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# **BHAGYANAGAR GAS LIMITED**

(A JOINT VENTURE OF HPCL & GAIL)

**MECHANICAL WORKS FOR DEVELOPMENT AND  
CONSTRUCTION OF CNG MOTHER STATIONS IN  
HYDERABAD GA**

**UNDER OPEN DOMESTIC  
COMPETITIVE BIDDING**

**Volume II of II**

**Bid Document No.:  
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Bhagyanagar Gas Ltd.  
Bhagyanagar  
Gas Limited


**Mechanical Works for development and construction of CNG  
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**SECTION – 07**

**SCOPE OF WORK & SPECIAL CONDITIONS  
OF CONTRACT**

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**Back ground:**

Bhagyanagar Gas Limited (BGL) is a City Gas Distribution (CGD) company authorized by the Petroleum and Natural Gas Regulatory Board (PNGRB) for the development, operation, and maintenance of City Gas Distribution networks in its authorized Geographical Areas, including Hyderabad GA.

BGL is now inviting tenders on Competitive Bidding basis for the below works under the same tender-

- a) Supply & installation, testing & commissioning for Mechanical piping & fittings Works, of Mother Station under Hyderabad GA
- b) Composite works (Mechanical, and instrumentation work). This part refers to Mechanical part i.e. Supply & installation, testing & commissioning of ‘Laying, fitting of “SS Tubes, Carbon steel pipes & flanges above ground level” for 02 no. of Mother stations in GA of Hyderabad.

The present document covers the technical specifications for the enquiry.

Any other mechanical-related works, whether explicitly mentioned or not but required for the safe, complete, and operational readiness of the CNG Mother Station, shall also be deemed to be included in the scope of the Civil Contractor.

**2.0 BRIEF SCOPE OF WORK OF CONTRACTOR  
FOR MOTHER STATIONS:**

The scope of work not limited to design, manufacture, supply, Inspection & testing at workshop, marking, packing, handling, and dispatch of Mechanical (SS, CS Piping system), as per P&ID’s, Piping GAD, Plot Layout & specifications.

The scope of work is broadly divided into the following:


Procurement, manufacturing, inspection, testing, supply, storage & preservation, Project Management, Construction management, overall quality control including Document Management. Construction, Installation, Erection and Testing, Pre-commissioning and Commissioning including supply of Manpower, Consumables, Non-sparking tools and tackles etc. Details of same shall be shared during execution, Project Close Out.

**GENERAL TERMS & CONDITIONS OF WORKS CONTRACT**

**1 PRELIMINARY**

1.1 This is a Contract for execution of job as defined in tender document at the specified location


1.2 The tenderer for the abovementioned item of work is the company/ proprietary concern/

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individual (as per details & address mentioned in the unpriced bid) and undersigned (digitally) is authorized to submit the bid on behalf of tenderer.

- 1.3 The terms and conditions mentioned hereunder are the terms and conditions of the Contract for the execution of the work mentioned under item 1.1 above.
- 1.4 It is the clear understanding between BHAGYANAGAR GAS LIMITED and the tenderer that in case the bid of tenderer is accepted by BHAGYANAGAR GAS LIMITED and an intimation to that effect is so issued and also a Procurement Order is on the tenderer this document shall form part of the Contract between the parties and terms and conditions hereunder would govern the parties interest.
- 1.5 Interpretation of Contract Documents: All documents forming part of the Contract are to be taken mutually explanatory. Should there be any discrepancy, inconsistency, error or omission in the contract, the decision of the Owner/Engineer- in-Charge/Site-in-Charge shall be the final and the contractor shall abide by the decision. The decision shall not be arbitrable. Works shown upon the drawings but not mentioned in the specification or described in the specifications without being shown on the drawings shall nevertheless be deemed to be included in the same manner as if they are shown in the drawings and described in the specifications.
- 1.6 Special conditions of Contract : The special conditions of contract, if any provided and whenever and wherever referred to shall be read in conjunction with General Terms and Conditions of contract, specifications, drawings, and any other documents forming part of this contract wherever the context so requires. Notwithstanding the subdivision of the documents into separate sections, parts volumes, every section, part or volume shall be deemed to be supplementary or complementary to each other and shall be read in whole. In case of any misunderstanding arising the same shall be referred to decision of the Owner/ Engineer- in-Charge/Site-in-Charge and their decision shall be final and binding and the decision shall not be arbitrable.

It is the clear understanding that wherever it is mentioned that the Contractor shall do/perform a work and/or provide facilities for the performance of the work, the doing or the performance or the providing of the facilities is at the cost and expenses of the Contractor not liable to be paid or reimbursed by the Owner.

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**1.7 The Order of Precedence of documents shall be as follows with document at level 1 having the highest precedence**

1. Contract Agreement
2. Detailed Letter of Acceptance along with its enclosures
3. Letter of Award / Fax of Acceptance
4. Job Specifications (specific to particular job only)
5. Drawings
6. Special Conditions of Contract
7. Technical Specifications
8. Instructions to Bidders
9. General Conditions of Contract
10. Other Documents

Any amendment / change order issued after signing of formal contract shall take precedence over respective clauses of the formal contract and its annexures

**2. DEFINITIONS**

In this contract unless otherwise specifically provided or defined and unless a contrary intention appears from the contract the following words and expressions are used in the following meanings;

- 2.1 The term "Agreement" wherever appearing in this document shall be read as "Contract".
- 2.2 The "competent Authority" for the purpose of this Contract shall be the **Managing Director** or any other person so appointed or authorised.
- 2.3 The "**Managing Director**" shall mean the Managing Director of BHAGYANAGAR GAS LIMITED or any person so appointed, nominated or designated and holding the office of Chairman & Managing Director.
- 2.4 The "**Change Order**" means an order given in writing by the Engineer-in-Charge or by Owner to effect additions to or deletion from or alterations into the Work.
- 2.5 The "**Construction Equipment**" means all appliances and equipment of whatsoever nature for the use in or for the execution, completion, operation or maintenance of the work except those intended to form part of the Permanent Work.
- 2.6 The "**Contract**" between the Owner and the Contractor shall mean and include all documents like enquiry, tender submitted by the contractor and the procurement order issued by the owner and other documents connected with the issue of the procurement order and orders, instruction, drawings, change orders, directions issued by the Owner/Engineer-in-Charge/Site-in-Charge for the execution, completion and commissioning of the works and the period of contract mentioned in the Contract including such periods of time extensions as may be granted by the owner at the request of the contractor and such period of time for which the work is continued by the contractor for purposes of completion of the work.
- 2.7 "**The Contractor**" means the person or the persons, firm or Company whose tender has been accepted by the Owner and includes the Contractor's legal heirs, representative, successor(s) and permitted assignees.



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- 2.8 The "**Drawings**" shall include maps, plans and tracings or prints thereof with any modifications approved in writing by the Engineer-in-Charge and such other drawings as may, from time to time, be furnished or approved in writing by the Engineer-in-Charge.
- 2.9 The "**Engineer-in-Charge or Site-in-Charge**" shall mean the person appointed or designated as such by the Owner and shall include those who are expressly authorised by the owner to act for and on its behalf.
- 2.10 "**The Owner**" means the **Bhagyanagar Gas Limited (BGL)** incorporated in India having its Registered office at **Basheerbagh, Hyderabad, Telangana** and Marketing office at the address mentioned for this purpose in the tender header or their successors or assignees.
- 2.11 The "**Permanent Work**" means and includes works which form a part of the work to be handed over to the Owner by the Contractor on completion of the contract.
- 2.12 The "**Project Manager**" shall mean the Project Manager of **BGL/ PMC**, or any person so appointed, nominated or designated.
- 2.13 The "**Site**" means the land on which the work is to be executed or carried out and such other place(s) for purpose of performing the Contract.
- 2.14 The "**Specifications**" shall mean the various technical and other specifications attached and referred to in the tender documents. It shall also include the latest editions, including all addenda/corrigenda or relevant Indian Standard Specifications and Bureau Of Indian Standards.
- 2.15 The "Sub-Contractor" means any person or firm or Company (other than the Contractor) to whom any part of the work has been entrusted by the Contractor with the prior written consent of the Owner/Engineer-in-Charge/Site-in-Charge and their legal heirs, representatives, successors and permitted assignees of such person, firm or Company.
- 2.16 The "Temporary Work" means and includes all such works which are a part of the contract for execution of the permanent work but does not form part of the permanent work confirming to practices, procedures applicable rules and regulations relevant in that behalf.
- 2.17 The "Tender" means the document submitted by a person or authority for carrying out the work and the Tenderer means a person or authority who submits the tender offering to carry out the work as per the terms and conditions.
- 2.18 The "Work" shall mean the works to be executed in accordance with the Contract or part thereof as the case may be and shall include extra, additional, altered or substituted works as maybe required for the purposes of completion of the work contemplated under the Contract.

### **3. SUBMISSION OF TENDER**

- 3.1 Before submitting the Tender, the Tenderer shall at their own cost and expenses visit the site, examine and satisfy as to the nature of the existing roads, means of communications, the character of the soil, state of land and of the excavations, the correct dimensions of the work facilities for procuring various construction and other material and their availability, and shall obtain information on all matters and conditions as they may feel necessary for the execution of the works as intended by the Owners and shall also satisfy of the availability of suitable water for construction of civil works and for drinking purpose and power required for fabrication work etc. Tenderer, whose tender may be accepted and with whom the Contract is entered into shall not be eligible and be able to make any

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claim on any of the said counts in what so ever manner for what so ever reasons at any point of time and such a claim shall not be raised as a dispute and shall not be arbitrable.

**A pre-bid meeting may be held as per the schedule mentioned in the tender.**

- 3.2 The Tenderer shall be deemed to have satisfied fully before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices quoted in the schedule of quantities which rates and prices shall except as otherwise provided cover all his obligations under the contract.
- 3.3 It must be clearly understood that the whole of the conditions and specifications are intended to be strictly enforced and that no work will be considered as extra work and allowed and paid for unless they are clearly outside the scope, spirit, meaning of the Contract and intent of the Owner and have been so ordered in writing by Owner and/or Engineer-in-Charge/Site-in-Charge, whose decision shall be final and binding.
- 3.4 Before filling the Tender the Contractor will check and satisfy all drawings and materials to be procured and the schedule of quantities by obtaining clarification from the Owner on all the items as may be desired by the Tenderer. No claim for any alleged loss or compensation will be entertained on this account, after submission of Tender by the Tenderer/Contractor and such a claim shall not be arbitrable.
- 3.5 Unless specifically provided for in the tender documents or any Special Conditions, no escalation in the Tender rates or prices quoted will be permitted throughout the period of contract or the period of actual completion of the job whichever is later on account of any variation in prices of materials or cost of labour or due to any other reasons. Claims on account of escalation shall not be arbitrable.
- 3.6 The quantities indicated in the Tender are approximate. The approved schedule of rates of the contract will be applicable for variations upto plus or minus 25% of the contract value. No revision of schedule of rates will be permitted for such variations in the contract value, including variations of individual quantities, addition of new items, alterations, additions/deletions or substitutions of items, as mentioned above. Quantities etc. mentioned and accepted in the joint measurement sheets shall alone be final and binding on the parties.
- 3.7 Owner reserve their right to award the contract to any tenderer and their decision in this regard shall be final. They also reserve their right to reject any or all tenders received. No disputes could be raised by any tenderer(s) whose tender has been rejected.
- 3.8 The Rates quoted by the Tenderer shall include Costs and expenses on all counts viz. cost of materials, transportation of machine(s), tools, equipments, labour, power, Administration charges, price escalations, profits, etc. except to the extent of the cost of material(s), if any, agreed to be supplied by Owner and mentioned specifically in that regard in condition of Contract, in which case, the cost of such material if taken for preparation of the Contractor's Bill(s) shall be deducted before making payment of the Bill(s) of the Contractor. The description given in the schedule of quantities shall unless otherwise stated be held to include wastage on materials, carriage and cartage, carrying in and return of empties, hoisting, setting, fitting and fixing in position and all other expenses necessary in and for the full and complete execution and completion of works and in accordance with good practice and recognised principles in that regard.




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- 3.9 Any person not complying with those rules etc. but submitting the tender in violation of such rules, after being so noticed shall be liable for the forfeiture of the Earnest Money Deposit made with the tender, termination of Contract and sufferance on account of forfeiture of Security Deposit and sufferance of damages arising as a result of termination of Contract.
- 3.10 Void
- 3.11 The prices quoted by the Tenderer shall be firm during the validity period of the bid and Tenderer agrees to keep the bid alive and valid during the said period. The Tenderers shall particularly take note of this factor before submitting their tender(s).
- 3.12 The works shall be carried out strictly as per approved specifications. Deviations, if any, shall have to be authorised by the Engineer-in-Charge/Site-in-Charge in writing prior to implementing deviations. The price benefit, if any, arising out of the accepted deviation shall be passed on to the Owner(i.e. BGL). The decision of Engineer- in-Charge shall be final in this matter.
- 3.13 The contractor shall make all arrangements at his own cost to transport the required materials outside and inside the working places and leaving the premises in a neat and tidy condition after completion of the job to the satisfaction of Owner. All materials except those agreed to be supplied by the Owner shall be supplied by the contractor at his own cost and the rates quoted by the Contractor should be inclusive of all royalties, rents, taxes, duties, statutory levies, if any, etc.
- 3.14 The Contractor shall not carry on any work other than the work under this Contract within the Owner's premises without prior permission in writing from the Engineer- in- Charge/Site-in-charge.
- 3.15 The Contractor shall be bound to follow and ensure compliance to all the safety and security regulations and other statutory rules applicable to the area. In the event of any damage or loss or sufferance caused due to non-observance of such rules and regulations, the contractor shall be solely responsible for the same and shall keep the Owner indemnified against all such losses and claims arising from the same.
- 3.16 At any time after acceptance of tender, the Owner reserves the right to add, amend or delete any work item, the bill of quantities at a later date or reduce the scope of work in the overall interest of the work by prior discussion and intimation to the Contractor. The decision of Owner, with reasons recorded therefor, shall be final and binding on both the Owner and the Contractor. The Contractor shall not have right to claim c o m p e n s a t i o n or damage etc. in that regard. The Owner reserves the right to split the work under this contract between two or more contractors without assigning any reasons.
- 3.17 Contractor shall not be entitled to sublet, sub contract or assign, the work under this Contract without the prior consent of the Owner obtained in writing.
- 3.18 All signatures in tender document shall be dated as well as all the pages of all sections of the tender documents shall be initialed at the lower position and signed, wherever required in the tender papers by the Tenderer or by a person holding Power of Attorney authorising

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him to sign on behalf of the tenderer before submission of tender.

- 3.19 The tender should be quoted in English, both in figures as well as in words. The rates and amounts tendered by the Tenderer in the Schedule of rates for each item and in such a way that insertion is not possible. The total tendered amount should also be indicated both in figures and words with the signature of tenderer.

If some discrepancies are found between the rates given in words and figures of the amount shown in the tender, the following procedure shall be applied :

- (a) When there is a difference between the rates in figures and words, the rate which corresponds to the amount worked out by the tenderer shall be taken as correct.
  - (b) When the rate quoted by the tenderer in figures and words tallies but the amount is incorrect, the rate quoted by the tenderer shall be taken as correct.
  - (c) When it is not possible to ascertain the correct rate in the manner prescribed above the rate as quoted in words shall be adopted.
- 3.20 All corrections and alterations in the entries of tender paper will be signed in full by the tenderer with date. No erasures or over writings are permissible.
- 3.21 Transfer of tender document by one intending tenderer to the another one is not permissible. The tenderer on whose name the tender has been sent only can quote.
- 3.22 The Tender submitted by a tenderer if found to be incomplete in any or all manner is liable to be rejected. The decision of the Owner in this regard is final and binding.

## DEPOSITS

a) **SECURITY DEPOSIT:**

The tenderer, with whom the contract is decided to be entered into and intimation is so given will have to make a security deposit of @10% of the annual total contract value in the form of account payee crossed demand draft drawn in favour of the Owner, within 30 days from the date of intimation of acceptance of their tender, failing which the Owner reserves the right to cancel the Contract and forfeit the EMD.

Composite Performance Bank Guarantee (CPBG) valid upto a period of 3 months beyond the expiry of defect liability period.

All the works shall be executed in strict conformity with the provisions of the contract documents and with such explanatory details, drawings, specifications and instructions as may be furnished from time to time to the Contractor by the Engineer-in-Charge/ Site-in-Charge, whether mentioned in the Contract or not. The Contractor shall be responsible for ensuring that works throughout are executed in the most proper and workman- like manner with the quality of material and workmanship in strict accordance with the specifications and to the entire satisfaction of the Engineer-in- Charge/Site-in-Charge.

The completion of work may entail working in monsoon also. The contractor must maintain the necessary work force as may be required during monsoon and plan to execute the job in such a way the entire project is completed within the contracted time schedule. No extra charges shall be payable for such work during monsoon. It shall be the responsibility of the contractor to keep the construction work site free from water during and off the monsoon period at his own cost



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and expenses.

For working on Sundays/Holidays, the contractor shall obtain the necessary permission from Engineer Incharge/Site Incharge in advance, no extra amount shall be payable by the owner on this account. The contractor shall be permitted to work beyond the normal hours with prior approval of Engineer-In-Charge/Site-In-Charge and the contractors quoted rate is inclusive of all such extended hours of working and no extra amount shall be payable by the owner on this account.

**5.a. SETTING OUT OF WORKS AND SITE INSTRUCTIONS**

- 5.a.1. The Engineer-in-Charge/Site-in-Charge shall furnish the Contractor with only the four corners of the work site and a level bench mark and the Contractor shall set out the works and shall provide an efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.
- 5.a.2. The Contractor shall provide, fix and be responsible for the maintenance of all necessary stakes, templates, level marks, profiles and other similar things and shall take all necessary precautions to prevent their removal or disturbance and shall be responsible for consequences of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The Contractor shall also be responsible for the maintenance of all existing survey marks, either existing or supplied and fixed by the Contractor. The work shall be set out to the satisfaction of the Engineer-in-Charge/Site-in-Charge. The approval thereof or joining in setting out the work shall not relieve the Contractor of his responsibility.
- 5.a.3. Before beginning the works, the Contractor shall, at his own cost, provide all necessary reference and level posts, pegs, bamboos, flags ranging rods, strings and other materials for proper layout of the work in accordance with the scheme, for bearing marks acceptable to the Engineer-in-Charge/Site-in-Charge. The Centre longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct marks at the centre to enable theodolite to be set over it. No work shall be started until all these points are checked and approved by the Engineer-in-Charge/Site-in-Charge in writing. But such approval shall not relieve the contractor of any of his responsibilities. The Contractor shall also provide all labour, materials and other facilities, as necessary, for the proper checking of layout and inspection of the points during construction.
- 5.a.4. Pillars bearing geodetic marks located at the sites of units of works under construction should be protected and fenced by the Contractor.
- 5.a.5. On completion of works, the contractor shall submit the geodetic documents according to which the work was carried out.
- 5.a.6. The Engineer-in-Charge/Site-in-Charge shall communicate or confirm his instructions to the contractor in respect of the executions of work in a "work site order book" maintained in the office having duplicate sheet and the authorised representative of the contractor shall confirm receipt of such instructions by signing the relevant entries in the book.
- 5.a.7. All instructions issued by the Engineer-in-Charge/Site-in-Charge shall be in writing. The Contractor shall be liable to carry out the instructions without fail.



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- 5.a.8. If the Contractor after receipt of written instruction from the Engineer-in-Charge/ Site-in-Charge requiring compliance within seven days fails to comply with such drawings or 'instructions' or both as the Engineer-in-Charge/Site-in-Charge may issue, owner may employ and pay other persons to execute any such work whatsoever that may be necessary to give effect to such drawings or 'instructions' and all cost and expenses incurred in connection therewith as certified by the Engineer-in-Charge/ Site-in-Charge shall be borne by the contractor or may be deducted from amounts due or that may become due to the contractor under the contract or may be recovered as a debt.
- 5.a.9. The Contractor shall be entirely and exclusively responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify effectually any errors or imperfections therein. Such rectifications shall be carried out by the Contractor, at his own cost.
- 5.a.10. In case any doubts arise in the mind of the Contractor in regard to any expressions, interpretations, statements, calculations of quantities, supply of material rates, etc. the contractor shall refer the same to the Site-in-Charge/ Engineer-in-Charge for his clarification, instructions, guidance or clearing of doubts. The decision of the Engineer-in-Charge/Site-in-Charge shall be final and the contractor shall be bound by such a decision.
- 5.a.11. "The Contractor shall take adequate precautions, to ensure that his operations do not create nuisance or misuse of the work space that shall cause unnecessary disturbance or inconvenience to others at the work site".
- 5.a.12. "All fossils, coins articles of value of antiquity and structure or other remains of geological or archaeological discovered on the site of works shall be declared to be the property of the Owner and Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such articles or thing and shall immediately inform the Owner/ Engineer-in-Charge/Site-in-Charge."
- 5.a.13. "Contractor will be entirely and exclusively responsible to provide and maintain at his expenses all lights, guards, fencing, etc. when and where even necessary or/as required by the Engineer-in-Charge/Site-in-Charge for the protection of works or safety and convenience to all the members employed at the site or general public."

**5.b. COMMENCEMENT OF WORK**

The contractor shall after paying the requisite security deposit, commence work within 15 days from the date of receipt of the intimation of intent from the EIC/ Owner informing that the contract is being awarded. The date of intimation shall be the date/day for counting the starting day/date and the ending day/date will be accordingly calculated. Penalty, if any, for the delay in execution shall be calculated accordingly.

Contractor should prepare detailed fortnightly construction programme for approval by the Engineer-in-Charge within one month of receipt of Letter Of Intent. The work shall be executed strictly as per such time schedule. The period of Contract includes the time required for

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testing, rectifications, if any, re-testing and completion of work in all respects to the entire satisfaction of the Engineer-in-Charge.

A Letter of Intent is an acceptance of offer by the Owner and it need not be accepted by the contractor. But the contractor should acknowledge a receipt of the purchase order within 07 days of mailing of Purchase Order and any delay in acknowledging the receipt will be a breach of contract and compensation for the loss caused by such breach will be recovered by the Owner by forfeiting earnest money deposit/bid bond.

**5.c. SUBLETTING OF WORK**

- 5.c.1. No part of the contract nor any share or interest thereof shall in any manner or degree be transferred, assigned or sublet, by the Contractor, directly or indirectly to any firm or corporation whatsoever, without the prior consent in writing of the Owner.
- 5.c.2. At the commencement of every month the Contractor shall furnish to the Engineer-in-charge/Site-in-Charge list of all sub-contractors or other persons or firms engaged by the Contractor.
- 5.c.3 The contract agreement will specify major items of supply or services for which the Contractor proposes to engage sub-Contractor/sub-Vendor. The contractor may from time to time propose any addition or deletion from any such list and will submit the proposals in this regard to the Engineer-in-charge/Designated officer-in-charge for approval well in advance so as not to impede the progress of work. Such approval of the Engineer-in-charge/Designated officer-in-charge will not relieve the contractor from any of his obligations, duties and responsibilities under the contract.
- 5.c.4. Notwithstanding any sub-letting with such approval as resaid and notwithstanding that the Engineer-in-Charge shall have received copies of any sub-contract, the Contractor shall be and shall remain solely to be responsible for the quality and proper and expeditious execution of the works and the performance of all the conditions of the contract in all respects as if such subletting or sub-contracting had not taken place and as if such work had been done directly by the Contractor.
- 5.c.5 Prior approval in writing of the Owner shall be obtained before any change is made in the constitution of the contractor/Contracting agency otherwise contract shall be deemed to have been allotted in contravention of clause entitled "sub-letting of works" and the same action may be taken and the same consequence shall ensue as provided in the clause of "sub- letting of works".

**5.d EXTENSION OF TIME**

- 1) If the Contractor anticipates that he will not be able to complete the work within the contractual delivery/ completion date (CDD), then the Contractor shall make a request for



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grant of time extension clearly specifying the reasons for which he seeks extension of time and demonstrating as to how these reasons were beyond the control of the contractor or attributable to the Owner. This request should be made well before the expiry of the Contractual Delivery/ Completion Date (CDD).

- 2) The concerned Competent authority of the Owner shall expeditiously decide upon the request for time extension and decide the levy of price reduction within a maximum period of 6 months from the CDD or date of receipt of the request, whichever is earlier.
- 3) Grant of any extension of time shall be by means of issuance of a Change Order.
- 4) void

**5.e. SUSPENSION OF WORKS**

5.e.1. Subject to the provisions of this contract, the contractor shall if ordered in writing by the Engineer- in-Charge/Site-in-Charge for reasons recorded suspend the works or any part thereof for such period and such time so ordered and shall not, after receiving such, proceed with the work therein ordered to suspended until he shall have received a written order to re-start. The Contractor shall be entitled to claim extension of time for that period of time the work was ordered to be suspended. Neither the Owner nor the Contractor shall be entitled to claim compensation or damages on account of such an extension of time.

5.e.2. In case of suspension of entire work, ordered in writing by Engineer-in- Charge/Site-in-Charge, for a period of 30 days, the Owner shall have the option to terminate the Contract as provided under the clause for termination. The Contractor shall not be at liberty to remove from the site of the works any plant or materials belonging to him and the Employer shall have lien upon all such plant and materials.

5.e.3. The contractor shall, in case of suspension have the right to raise a dispute and have the same arbitrated but however, shall not have the right to have the work stopped from further progress and completion either by the owner or through other contractor appointed by the owner.

**5.f. OWNER MAY DO PART OF WORK**

Notwithstanding anything contained elsewhere in this contract, the owner upon failure of the Contractor to comply with any instructions given in accordance with the provisions of this contract, may instead of Contract and undertaking charge of entire work, place additional labour force, tools, equipment and materials on such parts of the work, as the Owner may decide or engage another Contractor to carryout the balance of work. In such cases, the Owner shall have the right to deduct from the amounts payable to the Contractor the difference in cost of such work and materials with ten percent overhead added to cover all departmental charges. Should the total amount thereof exceed the amount due to the contractor, the Contractor shall pay the difference to the Owner within 15 days of making demand for payment failing which the Contractor shall be liable to pay interest at 24% p.a. on such amounts till the date of payment.

**5.g. INSPECTION OF WORKS**



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5.g.1. The Engineer-in-Charge/Site-in-Charge and Officers from Central or State Government will have full power and authority to inspect the works at any time wherever in progress, either on the site or at the Contractor's premises/workshops of any person, firm or corporation where work in connection with the contract may be in hand or where the materials are being or are to be supplied, and the Contractor shall afford or procure for the Engineer-in-Charge/Site-in-Charge every facility and assistance to carry out such inspection. The Contractor shall, at all times during the usual working hours and at all other times at which reasonable notice of the intention of the Engineer-in-Charge/Site-in-Charge or his representative to visit the works shall have been given to the Contractor, either himself be present to receive orders and instructions, or have a responsible agent, duly accredited in writing, present for the purpose. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the Contractor himself. The Contractor shall give not less than seven days notice in writing to the Engineer-in-Charge/Site-in-Charge before covering up or otherwise placing beyond reach of inspection and measurement any work in order that the same may be inspected and measured. In the event of breach of above, the same shall be uncovered at Contractor's expense for carrying out such measurement and/or inspection.

5.g.2. No material shall be removed and despatched by the Contractor from the site without the prior approval in writing of the Engineer-in-charge. The contractor is to provide at all times during the progress of the work and the maintenance period proper means of access with ladders, gangways, etc. and the necessary attendance to move and adapt as directed for inspection or measurements of the works by the Engineer-in-Charge/Site-in-Charge.

**5.h. SAMPLES**

5.h.1. The contractor shall furnish to the Engineer-in-charge/Site-in-Charge for approval when requested or required adequate samples of all materials and finishes to be used in the work.

5.h.2. Samples shall be furnished by the Contractor sufficiently in advance and before commencement of the work so as the Owner can carry out tests and examinations thereof and approve or reject the samples for use in the works. All material samples furnished and finally used/applied in actual work shall fully be of the same quality of the approved samples.

**5.i. TESTS FOR QUALITY OF WORK**

5.i.1. All workmanship shall be of the respective kinds described in the contract documents and in accordance with the instructions of the Engineer-in-Charge / Site-in-Charge and shall be subjected from time to time to such tests at Contractor's cost as the Engineer-in-Charge/Site-in-Charge may direct at the place of manufacture or fabrication or on the site or at all or any such places. The Contractor shall provide assistance, instruments, labour and materials as are normally required for examining, measuring and testing any workmanship as may be selected and required by the Engineer-in-Charge/Site-in-Charge.



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- 5.i.2. All the tests that will be necessary in connection with the execution of the work as decided by the Engineer-in-charge/Site-in-Charge shall be carried out at the contractors cost and expenses.
- 5.i.3. If any tests are required to be carried out in connection with the work or materials or workmanship to be supplied by the owner, such tests shall be carried out by the Contractor as per instructions of Engineer-in-Charge/Site-in-Charge and expenses for such tests, if any, incurred by the contractor shall be reimbursed by the Owner. The contractor should file his claim with the owner within 15 (fifteen) days of inspection/test and any claim made beyond that period shall lapse and be not payable.

**5.j. ALTERATIONS AND ADDITIONS TO SPECIFICATIONS, DESIGNS AND WORKS**

- 5.j.1. The Engineer-in-Charge/Site-in-Charge shall have powers to make any alterations, additions and/or substitutions to the schedule of quantities, the original specifications, drawings, designs and instructions that may become necessary or advisable or during the progress of the work and the Contractor shall be bound to carryout such altered/extra/new items of work in accordance with instructions which may be given to him in writing signed by the Engineer-in- Charge/Site- in-Charge. Such alterations, omissions, additions or substitutions shall not invalidate the contract. The altered, additional or substituted work which the Contractor may be directed to carryon in the manner as part of the work shall be carried out by the Contractor on the same conditions in all respects on which he has agreed to do the work. The time for completion of such altered added and/or substituted work may be extended for that part of the particular job. The rates for such additional altered or substituted work under this Clause shall, be worked out in accordance with the following provisions:
- 5.j.2. If the rates for the additional, altered or substituted work are specified in the contract for similar class of work, the Contractor is bound to carryout the additional, altered or substituted work at the same rates as are specified in the contract.
- 5.j.3. If the rates for the additional, altered or substituted work are not specifically provided in the contract for the work, the rates will be derived from the rates for similar class of work as are specified in the contract for the work. In the opinion of the Engineer-in- Charge/Site-in-Charge as to whether or not the rates can be reasonably so derived from the items in this contract, will be final and binding on the Contractor.
- 5.j.4. If the rates for the altered, additional or substituted work cannot be determined in the manner specified above, then the Contractor shall, within seven days of the date of receipt of order to carry out the work, inform the Engineer-in-Charge/ Site-in-Charge of the rate at which he intends to charge for such class of work, supported by analysis of the rate or rates claimed and the Engineer-In-Charge/ Site-in-Charge shall determine the rates on the basis of the prevailing market rates for both material and labour plus 10% to cover overhead and profit of labour rates and pay the Contractor accordingly. The opinion of the Engineer-in- Charge/Site-in-Charge as to current market rates of materials and the quantum of labour involved per unit of measurement will be final and binding on the contractor.
- 5.j.5. In case of any item of work for which there is no specification supplied by the Owner and is mentioned in the tender documents, such work shall be carried out in accordance



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with Indian Standard Specifications and if the Indian Standard Specifications do not cover the same, the work should be carried out as per standard Engineering Practice subject to the approval of the Engineer-in-Charge/ Site-in-Charge.

**5.k. PROVISIONAL ACCEPTANCE**

Acceptance of sections of the works for purposes of equipment erection, piping, electrical work and similar usages by the Owner and payment for such work or parts of work shall not constitute a waiver of any portion of this contract and shall not be construed so as to prevent the Engineer from requiring replacement of defective work that may become apparent after the said acceptance and also shall not absolve the Contractor of the obligations under this contract. It is made clear that such an acceptance does not indicate or denote or establish to the fact of execution of that work or the Contract until the work is completed in full in accordance with the provisions of this Contract.

**5.l. COMPLETION OF WORK AND COMPLETION CERTIFICATE**

As soon as the work is completed in all respects, the contractor shall give notice of such completion to the site in charge or the Owner and within thirty days of receipt of such notice the site in charge shall inspect the work and shall furnish the contractor with a certificate of completion indicating:

- a) defects, if any, to be rectified by the contractor
- b) items, if any, for which payment shall be made in reduced rates
- c) the date of completion.

**5.m. USE OF MATERIALS AND RETURN OF SURPLUS MATERIALS**

5.m.1. Notwithstanding anything contained to the contrary in any or all of the clauses of this contract, where any materials for the execution of the contract are procured with the assistance of Government either by issue from Government stocks or procurement made under orders or permits or licences issued by Government, the contractor shall use the said materials economically and solely for the purpose of the contract and shall not dispose them of without the permission of the Owner.

5.m.2. All surplus(serviceable) or unserviceable materials that may be left over after the completion of the contract or at its termination for any reason whatsoever, the Contractor shall deliver the said product to the Owner without any demur. The price to be paid to the Contractor, if not already paid either in full or in part, however, shall not exceed the amount mentioned in the Schedule of Rates for such material and in cases where such rates are not so mentioned, shall not exceed the CPWD scheduled rates. In the event of breach of the aforesaid condition the contractor shall become liable for contravention of the terms of the Contract.

5.m.3. The surplus (serviceable) and unserviceable products shall be determined by joint measurement. In case where joint measurement has failed to take place, the Owner may measure the same and determine the quantity.

5.m.4. It is made clear that the Owner shall not be liable to take stock and keep possession and pay for the surplus and unserviceable stocks and the Owner may direct the Contractor to take back such material brought by the Contractor and becoming surplus and which the Owner may decide to keep and not to pay for the same.



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**5.n. DEFECT LIABILITY PERIOD**

The contractor shall guarantee the work executed for a period of 12 months from the date of completion of the job. Any damage or defect that may arise or lie undiscovered at the time of completion of the job shall be rectified or replaced by the contractor at his own cost. The decision of the Engineer In-charge/Site-Incharge/Owner shall be the final in deciding whether the defect has to be rectified or replaced.

Equipment or spare parts replaced under warranty/guarantees shall have further warranty for a mutually agreed period from the date of acceptance.

The owner shall intimate the defects noticed in writing by a Registered or otherwise and the contractor within 15 days of receipt of the intimation shall start the rectification work and complete within the time specified by the owner failing which the owner will get the defects rectified by themselves or by any other contractor and the expenses incurred in getting the same done shall be paid by the Contractor under the provision of the Contract.

Thus, defect liability is applicable only in case of job/works contract (civil, mechanical, electrical, maintenance etc.) where any damage or defect may arise in future (i.e. within 12 months from the date of completion of job) or lie undiscovered at the time of completion of job.

In other words, in case of service contracts (like car hire etc.) where there is no question of damage or defect arising in future, the defect liability clause is not applicable.

Equipment or spare parts replaced under warranty/guarantees shall have further warranty for 12 months from the date of acceptance. However, in no case will the warranty exceed 24 months from the date of start of the original warranty.


**5.o. DAMAGE TO PROPERTY**

5.o.1. Contractor shall be responsible for making good to the satisfaction of the Owner any loss of and any damage to all structures and properties belonging to the Owner or being executed or procured by the Owner or of other agencies within the premises of the work of the Owner, if such loss or damage is due to fault and/or the negligence or willful acts or omission of the Contractor, his employees, agents, representatives or sub-contractors.

5.o.2. The Contractors shall indemnify and keep the Owner harmless of all claims for damage to Owner's property arising under or by reason of this contract.

**5.p. LIMITATION OF LIABILITY**

Notwithstanding anything contrary contained herein, the aggregate total liability of Seller, excluding his liability towards infringement of patent, trade mark or industrial design rights under the contract or otherwise shall be limited to 100% of value of Purchase order. However, neither party shall be liable to the other party for any indirect and consequential damages, loss of profits or loss of production.

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**5. DUTIES AND RESPONSIBILITIES OF CONTRACTOR**

**6. a. EMPLOYMENT LIABILITY TOWARDS WORKERS EMPLOYED BY THE CONTRACTOR**

6.a.1 The Contractor shall be solely and exclusively responsible for engaging or employing persons for the execution of work. All persons engaged by the contractor shall be on Contractor's payroll and paid by Contractor. All disputes or differences between the Contractor and his/their employees shall be settled by Contractor.

6.a.2. Owner has absolutely no liability whatsoever concerning the employees of the Contractor. The Contractor shall indemnify Owner against any loss or damage or liability arising out of or in the course of his/their employing persons or relation with his/their employees. The Contractor shall make regular and full payment of wages and on any complaint by any employee of the Contractor or his sub contractor regarding non-payment of wages, salaries or other dues, Owner reserves the right to make payments directly to such employees or sub- contractor of the Contractor and recover the amount in full from the bills of the Contractor and the contractor shall not claim any compensation or reimbursement thereof. The Contractor shall comply with the Minimum Wages Act applicable to the area of work site with regard to payment of wages to his employees and also to employees of his sub contractor.

6.a.3. The Contractor shall advise in writing or in such appropriate way to all of his employees and employees of sub-contractors and any other person engaged by him that their appointment/employment is not by the Owner but by the Contractor and that their present appointment is only in connection with the construction contract with Owner and that therefore, such an employment/appointment would not enable or make them eligible for any employment/appointment with the Owner either temporarily or/and permanent basis.

**6.b. NOTICE TO LOCAL BODIES**


The contractor shall comply with and give all notices required under any Government authority, instruction, rule or order made under any act of parliament, state laws or any regulations or by-laws of any local authority relating to the works.

**6.c. FIRST AID AND INDUSTRIAL INJURIES**

6.c.1 Contractor shall maintain first aid facility for his employees and those of his sub-contractors.

6.c.2. Contractor shall make arrangements for ambulance service and for the treatment of all types of injuries. Names and telephone numbers of those providing such services shall be furnished to Owner prior to start of construction and their name board shall be prominently displayed in Contractor's field office.


6.c.3. All industrial injuries shall be reported promptly to owner and a copy of contractor's

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report covering each personal injury requiring the attention of a physician shall be furnished to the Owner.

**6.d. SAFETY CODE**

- 6.d.1. The Contractor shall at his own expenses arrange for the Safety provisions as may be necessary for the execution of the work or as required by the Engineer-in-Charge in respect of all labours directly or indirectly employed for performance of the works and shall provide all facilities in connections therewith. In case the contractor fails to make arrangements and provide necessary facilities as aforesaid, the Owner shall be entitled to do so and recover the cost thereof from the Contractor.
- 6.d.2. From the commencement to the completion of the works, the contractor shall take full responsibility for the care thereof and of all the temporary works (defined as meaning all temporary works of every kind required in or for the execution, completion or maintenance of the works). In case damage, loss or injury shall happen to the works or to any part thereof or to temporary works or to any cause whatsoever repair at his (Contractor's) own cost and make good the same so that at the time of completion, the works shall be in good order and condition and in conformity in every respect with the requirement of the contract and Engineer-in-Charge's instructions.
- 6.d.3. In respect of all labour, directly or indirectly employed in the work for the performance of the Contractor's part of this agreement, the contractor shall at his own expense arrange for all the safety provisions as per relevant Safety Codes of C.P.W.D Bureau of Indian Standards, the Electricity Act/I.E. Rules. The Mines Act and such other Acts as applicable.
- 6.d.4. The Contractor shall observe and abide by all fire and safety regulations of the Owner. Before starting construction work, the Contractor shall consult with Owner's Safety Engineer or Engineer-in-Charge/Site-in-Charge and must make good to the satisfaction of the Owner any loss or damage due to fire to any portion of the work done or to be done under this agreement or to any of the Owner's existing property.
- 6.d.5. The Contractor will be fully responsible for complying with all relevant provisions of the Contract Labour Act and shall pay rates of Wages and observe hours of work/conditions of employment according to the rules in force from time to time.
- 6.d.6. The Contractor will be fully responsible for complying with the provision including documentation and submission of reports on the above to the concerned authorities and shall indemnify the Corporation from any such lapse for which the Government will be taking action against them.
- 6.d.7. Owner shall on a report having been made by an inspecting Office as defined in the Contract Labour Regulations have the power to deduct from the money due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker(s) by reasons of non-fulfillment of conditions of contract for the benefit of workers no-payment of wages or of deductions made from his or their wages which are not justified by the terms of contract or non observance of the said contractor's labour Regulation.

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**6.e. INSURANCE AND LABOUR**

Contractor shall at his own expense obtain and maintain an insurance policy with a Nationalised Insurance Company to the satisfaction of the Owner as provided hereunder.

**6.e.1. EMPLOYEES STATE INSURANCE ACT**

- i. The Contractor agrees to and does hereby accept full and exclusive liability for the compliance with all obligations imposed by Employees State Insurance Act, 1948, and the Contractor further agrees to defend indemnify and hold Owner harmless from any liability or penalty which may be imposed by the Central, State or local authority by reason of any asserted violation by Contractor, or sub-contractor of the Employees' State Insurance Act, 1948 and also from all claims, suits or proceedings that may be brought against the Owner arising under, growing out of or by reason of the work provided for by this contract whether brought by employees of the Contractor, by third parties or by Central or State Government authority or any political sub-division thereof.

- ii. The Contractor agrees to file with the Employees State Insurance Corporation, the Declaration forms and all forms which may be required in respect of the Contractor's or sub-contractor's employee whose aggregate emuneration is within the specified limit and who are employed in the work provided or those covered by ESI Act under any amendment to the Act from time to time.

The Contractor shall deduct and secure the agreement of the sub-contractor to deduct the employee's contribution as per the first schedule of the Employee's State Insurance Act from wages and affix the employee's contribution cards at wages payment intervals. The Contractor shall remit and secure the agreement of the sub contractor to remit to the State Bank of India, Employee's State Insurance Corporation Account, the Employee's contribution as required by the Act.

- ii. The Contractor agrees to maintain all records as required under the Act in respect of employees and payments and the Contractor shall secure the agreement of the sub contractor to maintain such records. Any expenses incurred for the contributions, making contribution or maintaining records shall be to the Contractor's or sub-contractor's account.

- iv. The Owner shall retain such sum as may be necessary from the total contract value until the Contractor shall furnish satisfactory proof that all contributions as required by the Employees State Insurance Act, 1948, have been paid.

**v. WORKMAN'S COMPENSATION AND EMPLOYEE'S LIABILITY INSURANCE**

Provide Insurance for all the Contractor's employees engaged in the performance of this contract. If any of the work is sublet, the Contractor shall ensure that the sub contractor provides workmen's compensation and Employer's Liability Insurance for the latter's employees who are not covered under the Contractor's insurance.



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vi. **AUTOMOBILE LIABILITY INSURANCE**

Contractor shall take out an Insurance to cover all risks to Owner for each of his vehicles plying on works of this contract and these insurances shall be valid for the total contract period. No extra payment will be made for this insurance. Owner shall not be liable for any damage or loss not made good by the Insurance Company, should such damage or loss result from unauthorised use of the vehicle. The provisions of the Motor Vehicle Act would apply.

vii. **FIRE INSURANCE**

Contractor shall within two weeks after award of contract insure the Works, Plant and Equipment and keep them insured until the final completion of the Contract against loss or damage by accident, fire or any other cause with an insurance company to be approved by the Employer/Consultant in the joint names of the Employer and the Contractor (name of the former being placed first in the Policy). Such Policy shall cover the property of the Employer only.

**6.e.2. ANY OTHER INSURANCE REQUIRED UNDER LAW OR REGULATION OR BY**

- i. Contractor shall also provide and maintain any and all other insurance which may be required under any law or regulations from time to time. He shall also carry and maintain any other insurance which may be required by the Owner.
- ii. The aforesaid insurance policy/policies shall provide that they shall not be cancelled till the Engineer-in-Charge has agreed to their cancellation.
- iii. The Contractor shall satisfy to the Engineer-in-Charge/Site-in-Charge from time to time that he has taken out all insurance policies referred to above and has paid the necessary premium for keeping the policies alive till the expiry of the defects liability period.
- iv. The contractor shall ensure that similar insurance policies are taken out by his sub-contractor (if any) and shall be responsible for any claims or losses to the Owner resulting from their failure to obtain adequate insurance protections in connection thereof. The contractor shall produce or cause to be produced by his sub-contractor (if any) as the case may be, the relevant policy or policies and premium receipts as and when required by the Engineer-in-Charge/Site-in-Charge.
- v. Contractor shall at his own expense cover all the workmen engaged under him under "Pradhan Mantri Surksha Bima Yojana (PMSBY)" and submit proof of the same to BGL.

**6.e.3. LABOUR AND LABOUR LAWS**

- i. The contractor shall at his own cost employ persons during the period of contract



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and the persons so appointed shall not be construed under any circumstances to be in the employment of the Owner.

- ii. All payments shall be made by the contractor to the labour employed by him in accordance with the various rules and regulations stated above. The contractor shall keep the Owner indemnified from any claims whatsoever inclusive of damages/costs or otherwise arising from injuries or alleged injuries to or death of a person employed by the contractor or damages or alleged damages to the property.
- iii. No labour below the age of eighteen years shall be employed on the work. The Contractor shall not pay less than what is provided under the provisions of the contract labour (Regulations and Abolition) Act, 1970 and the rules made thereunder and as may be amended from time to time. He shall pay the required deposit under the Act appropriate to the number of workman to be employed by him or through sub contractor and get himself registered under the Act. He shall produce the required Certificates to the Owner before commencement of the work. The Owner recognises only the Contractor and not his sub contractor under the provisions of the Act. The Contractor will have to submit daily a list of his workforce. He will also keep the wage register at the work site or/and produce the same to the Owner, whenever desired. A deposit may be taken by the Owner from the Contractor to be refunded only after the Owner is satisfied that all workmen employed by the Contractor have been fully paid for the period of work in Owner's premises at rates equal to or better than wages provided for under the Minimum Wages Act. The contractor shall be responsible and liable for any complaints that may arise in this regard and the consequences thereto.
- iv. The Contractor will comply with the provisions of the Employee's Provident Fund Act and the Family Pension Act as may be applicable and as amended from time to time.
- v. The Contractor will comply with the provisions of the payment of Gratuity Act, 1972, as may be applicable and as amended from time to time.
- vi. **IMPLEMENTATION OF APPRENTICES ACT, 1961**  
The Contractor shall comply with the provisions of the Apprentices Act, 1961 and the Rules and Orders issued thereunder from time to time. If he fails to do so, his failure will be a breach of the contract and the Engineer-in- Charge may, at his discretion, cancel the contract. The Contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provision of the Act.
- vii. **MODEL RULES FOR LABOUR WELFARE**

The Contractor shall at his own expenses comply with or cause be complied with Model rules for Labour Welfare as appended to those conditions or rules framed by the Government from time to time for the protection of health and for making sanitary



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arrangements for worker employed directly or indirectly on the works. In case the contractor fails to make arrangements as aforesaid the Engineer-in-Charge/Site-in-Charge shall be entitled to do so and recover the cost thereof from the contractor.

**6.f. DOCUMENTS CONCERNING WORKS**

- 6.f.1. All documents including drawings, blue prints, tracings, reproducible models, plans, specifications and copies, thereof furnished by the Owner as well as all drawings, tracings, reproducible, plans, specifications design calculations etc. prepared by the contractor for the purpose of execution of works covered in or connected with this contract shall be the property of the Owner and shall not be used by the contractor for any other work but are to be delivered to the Owner at the completion or otherwise of the contract.
- 6.f.2. The Contractor shall keep and maintain secrecy of the documents, drawings etc. issued to him for the execution of this contract and restrict access to such documents, drawings etc. and further the Contractor shall execute a SECRECY agreement from each or any person employed by the Contractor having access to such documents, drawings etc. The Contractor shall not issue drawings and documents to any other agency or individual without the written approval by the Engineer-in-Charge/Site- in-Charge.
- 6.f.3. Contractor will not give any information or document etc. concerning details of the work to the press or a news disseminating agency without prior written approval from Engineer-in-charge/Site-in-Charge. Contractor shall not take any pictures on site without written approval of Engineer-in-Charge/Site-in-Charge.

**6. PAYMENT OF CONTRACTOR'S BILLS**

- 7.1. Payments will be made against Running Accounts bills certified by the Owner's Engineer- in-Charge/Site-in-Charge within 30 days from the date of receipt of the bill.
- 7.2. Running Account Bills and the final bill shall be submitted by the Contractor together with the duly signed measurements sheet(s) to the Engineer-in-Charge/ Site-in-Charge of the Owner in quadruplicate for certification.

The Bills shall also be accompanied by quantity calculations in support of the quantities contained in the bill along with cement consumption statement, actual/theoretical, wherever applicable duly certified by the Engineer-in-Charge/ Site-in- Charge of the Owner.

- 7.3. All running account payments shall be regarded as on account payment(s) to be finally adjusted against the final bill payment. Payment of Running Account Bill(s) shall not determine or affect in any way the rights of the Owner under this Contract to make the final adjustments of the quantities of material, measurements of work and adjustments of amounts etc. in the final bill.
- 7.4. The final bill shall be submitted by the Contractor within one month of the date of



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completion of the work fully and completely in all respects. If the Contractor fails to submit the final bill accordingly Engineer-in-Charge/Site-in-Charge may make the measurement and determine the total amount payable for the work carried out by the Contractor and such a certification shall be final and binding on the Contractor. The Owner/Engineer-in-Charge/Site-in-Charge may take the assistance of an outside party for taking the measurement, the expenses of which shall be payable by the Contractor.

- 7.5. Payment of final bill shall be made within 30 days from the date of receipt of the certified bill by the Disbursement Section of the owner.
- 7.6. Wherever possible, payment shall be tendered to the contractor in electronic mode (e-payment) through any of the designated banks. The contractor will comply by furnishing full particulars of Bank account (mandate) to which the payments will be routed. Owner reserves the right to make payment in any alternate mode also.

**7.a. MEASUREMENT OF WORKS**

- 7.a.1. All measurements shall be in metric system. All the work will be jointly measured by the representative of the Engineer-in-Charge/Site-in-Charge and the Contractor or their authorised agent progressively. Such measurement will be recorded in the Measurement Book/Measurement Sheet by the Contractor or his authorised representative and signed in token of acceptance by the Owner or their authorised representative.
- 7.a.2. For the purpose of taking joint measurement, the Contractor/representative shall be bound to be present whenever required by the Engineer-in-Charge/Site-in-Charge. If, however, they are absent for any reasons whatsoever, the measurement will be taken by the Engineer-in-Charge/Site-in-Charge or his representative and the same would be deemed to be correct and binding on the Contractor.
- 7.a.3. In case of any dispute as to the mode of measurement for any item of work, the latest Indian Standard Specifications shall be followed. In case of any further dispute on the same the same shall be as per the certification of an outside qualified Engineer/ Consultant. Such a measurement shall be final and binding on the Owner and the Contractor.

**7.b. BILLING OF WORKS EXECUTED**

The Contractor will submit a bill in approved proforma in quadruplicate to the Engineer-in-Charge/Site-in-Charge of the work giving abstract and detailed measurement for the various items executed during a month, before the expiry of the first week of the succeeding month. The Engineer-in-Charge/Site-in-Charge shall take or cause to be taken the requisite measurements for the purpose of having the bill verified and/or checked before forwarding the same to the disbursement office of the Owner for further action in terms of the Contract and payment thereafter. The Engineer-in-Charge/Site-in-Charge shall verify the bills within 7 days of submission of the Bill by the Contractor.

**7.c. RETENTION MONEY**

5% of the total value of the Running Account and Final Bill will be deducted and retained by the Owner as retention money on account of any damage/defect liability that may arise for the



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period covered under the defect liability period clause of the Contract free of interest. Any damage or defect that may arise or lie undiscovered at the time of issue of completion certificate connected in any way with the equipment or materials supplied by contractor or in workmanship shall be rectified or replaced by the contractor at his own expense failing which the Owner shall be entitled to rectify the said damage/defect from the retention money. Any excess of expenditure incurred by the Owner on account of damage or defect shall be payable by the Contractor. The decision of the Owner in this behalf shall not be liable to be questioned but shall be final and binding on the Contractor.

Thus, deduction towards retention money is applicable only in case of job/works contracts (civil, mechanical, electrical, maintenance etc.) where any damage or defect may arise in future (i.e. within 12 months from the date of completion of job) or lie undiscovered at the time of issue of completion certificate.

**7.d. STATUTORY LEVIES**

7.d.1 The Contractor accepts full and exclusive liability for the payment of any and all taxes, duties, cess, levies and statutory payments payable under all or any of the statutes etc.

Variations of taxes and duties arising out of the amendments to the Central / State enactments, in respect of sale of goods / services covered under this bid shall be to BGL's account, so long as :

- They relate to the period after the opening of the price bid, but before the contracted completion period ( excluding permitted extensions due to delay on account of the contractors, if any) or the actual completion period, whichever is earlier; and
- The vendor furnishes documentary evidence of incurrence of such variations, in addition to the invoices/documents for claiming Cenvat /Input Tax credit, wherever applicable.

All contributions and taxes for unemployment compensation, insurance and old age pensions or annuities now or hereafter imposed by Central or State Governmental authorities which are imposed with respect to or covered by the wages, salaries or other compensations paid to the persons employed by the Contractor and the Contractor shall be responsible for the compliance with all obligations and restrictions imposed by the Labour Law or any other law affecting employer-employee relationship and the Contractor further agrees to comply and to secure the compliance of all sub-contractors with all applicable Central, State, Municipal and local laws, and regulations and requirements of any Central, State or Local Government agency or authority.

Contractor further agrees to defend, indemnify and hold harmless from any liability or penalty which may be imposed by the Central, State or Local authorities by reason of any violation by Contractor or sub-contractor of such laws, regulations or requirements and also from all claims, suits or proceedings that may be brought against the Owner arising under, growing out of, or by reasons of the work provided for by this contract by third parties, or by Central or State Government authority or any administrative sub-division thereof. The Contractor further agrees that in case any



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such demand is raised against the Owner, and Owner has no way but to pay and pays/makes payment of the same, the Owner shall have the right to deduct the same from the amounts due and payable to the Contractor. The Contractor shall not raise any demand or dispute in respect of the same but may have recourse to recover/receive from the concerned authorities on the basis of the Certificate of the Owner issued in that behalf.


- 7.d.2. The rates quoted should be inclusive of all taxes. However, wherever a tax to be deducted at source the same will be deducted from the bills of the Contractor and paid to the concerned authorities. The proof of such payments of tax on works contract will be furnished to the contractor.

The vendor shall comply with all the provisions of the GST Act/Rules/requirements like providing of tax invoices, payment of taxes to the authorities within the due dates, filing of returns within the due dates etc. to enable BGL to take Input Tax Credit. In case of imports, vendor shall provide import documents and invoice fulfilling the requirement of Customs Act and Rules. Vendor will be fully responsible for complying with the Customs provisions to enable BGL to take Input Tax Credit.

In case BGL is not able to take Input Tax Credit due to any noncompliance/default/negligence of the seller of goods/service provider, the same shall be recovered from the pending bills/dues (including security deposit, BG etc.)

Vendor shall be responsible to indemnify the Corporation for any loss, direct or implied accrued to the Corporation on account of supplier/service provider failure to discharge his statutory liabilities like paying taxes on time, filing appropriate returns within the prescribed time etc.

- 7.d.3. Income tax will be deducted at source as per rules at prevailing rates, unless certificate, if any, for deduction at lesser rate or nil deduction is submitted by the Contractor from appropriate authority.
- 7.d.4. The contractor shall provide accurate particulars of PAN number as required, under Section 206AA of Income Tax Act 1961.
- 7.d.5. The contractors having their 'tax residency status' outside India shall provide Tax Residency Certificate (TRC), issued by Government of the Country or the specified territory where the Contractor is a Resident. Rule 21AB of the Income Tax Rules, 1962 has prescribed the contents of a TRC. This would enable the Corporation to deduct tax at source by duly considering the 'treaty relief', if any, under Double Taxation Avoidance Agreement (DTAA) entered into between GOI and the respective country/specified territory in which the Contractors' 'tax residency status' is currently in force.
- 7.d.6. Anti-Profiteering Clause – GST Act anti-profiteering provisions mandates that any reduction in tax rates or benefits of input tax credits be passed on to the consumer by way of commensurate reduction in prices. Vendors to take note of the same and pass such benefits while quoting their price.

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**7.e. MATERIALS TO BE SUPPLIED BY CONTRACTOR**

- 7.e.1. The Contractor shall procure and provide the whole of the materials required for construction including tools, tackles, construction plant and equipment for the completion and maintenance of the works except the materials viz. steel and cement which may be agreed to be supplied as provided elsewhere in the contract. The contractor shall make arrangement for procuring such materials and for the transport thereof at their own cost and expenses.
- 7.e.2. The Owner may give necessary recommendation to the respective authority if so desired by the Contractor but assumes no responsibility of any nature. The Contractor shall procure materials of ISI stamp/certification and supplied by reputed suppliers borne on DGS&D list.
- 7.e.3. All materials procured should meet the specifications given in the tender document. The Engineer-in-charge may, at his discretion, ask for samples and test certificates for any batch of any materials procured. Before procuring, the Contractor should get the approval of Engineer-in-Charge/Site-in-Charge for any materials to be used for the works.
- 7.e.4. Manufacturer's certificate shall be submitted for all materials supplied by the Contractor. If, however, in the opinion of the Engineer-in-Charge/Site-in-Charge any tests are required to be conducted on the material supplied by the Contractor, these will be arranged by the Contractor promptly at his own cost.

**7.f. MATERIALS TO BE SUPPLIED BY THE OWNER**

- 7.f.1. Steel and Cement maybe supplied by the Owner to the contractor against payment by Contractor from either godown or from the site or within work premises itself and the contractor shall arrange for all transport to actual work site at no extra cost.
- 7.f.2. The contractor shall bear all the costs including loading and unloading, carting from issue points to work spot storage, unloading, custody and handling and stacking the same and return the surplus steel and cement to the Owner's storage point after completion of job.
- 7.f.3. The contractor will be fully accountable for the steel and cement received from the Owner and contractor will give acknowledgement/receipt for quantity of steel and cement received by him each time he uplifts cement from Owner's custody.
- 7.f.4. For all computation purposes, the theoretical cement consumption shall be considered as per CPWD standards.
- 7.f.5. Steel and Cement as received from the manufacturer/stockists will be issued to the contractor. Theoretical weight of cement in a bag will be considered as 50 Kg. Bags weighing upto 4% less shall be accepted by the contractor and considered as 50 Kg. per bag. Any shortage in the weight of any cement bag by more than 4% will be to the Owner's account only when pointed out by the Contractor and verified by Engineer-in-Charge/Site in Charge at the time of Contract or taking delivery.



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- 7.f.6. The contractor will be required to maintain a stock register for receipt, issuance and consumption of steel and cement at site. Cement will be stored in a warehouse at site. Requirement of cement on any day will be taken out of the warehouse. Cement issued shall be regulated on the basis of FIRST RECEIPT to go as FIRST ISSUE.
- 7.f.7. Empty cement bag shall be the property of the Contractor. Contractor shall be penalised for any excess/under consumption of cement. The penal rate will be twice the rate of issue of cement for this work.
- 7.f.8. All the running bills as well as the final bills will be accompanied by cement consumption statements giving the detailed working of the cement used, cement received and stock-on-hand.
- 7.f.9. The Contractor will be fully responsible for safe custody of cement once it is received by him and during transport. Owner will not entertain any claims of the contractor for theft, loss or damage to cement while in their custody.
- 7.f.10. The contractor shall not remove from the site any cement bags at any time.
- 7.f.11. The Contractor shall advise Engineer-in-charge/Site-in-charge in writing atleast 21 days before exhausting the Cement stocks already held by Contractor to ensure that such delays do not lead to interruptions in the progress of work.
- 7.f.12. Cement shall not be supplied by the Owner for manufacturing of mosaic tiles, precast cement jali and any other bought out items which consume cement and for temporary works.
- 7.f.13. Cement in bags and in good usable condition left over after the completion of work shall be returned by the contractor to the Owner. The Owner shall make payment to the Contractor at the supply rate for such stocks of cement they accept and receive. Any refused stock of cement shall be removed by the Contractor from the site at his cost and expenses within 15 days of completion of the work.

**7. PAYMENT OF CLAIMS AND DAMAGES**

- 8.1. Should the Owner have to pay money in respect of claims or demands as aforesaid the amount so paid and the costs incurred by the Owner shall be charged to and paid by the Contractor and the Contractor shall not be entitled to dispute or question the right of the Owner to make such payments notwithstanding the same may have been without his consent or authority or in law or otherwise to the contrary.
- 8.2. In every case in which by virtue of the provisions of Workmen's Compensation Act, 1923, or other Acts, the Owner is obliged to pay Compensation to a Workman employed by the Contractor in execution of the works, the Owner will recover from the Contractor the amount of compensation so paid and without prejudice to the rights of Owner under the said Act. Owner shall be at liberty to recover such amount or any



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part thereof by deducting it from the security deposit or from any sum due to the Contractor whether under this contract or otherwise. The Owner shall not be bound to contest any claim made under Section 12 sub section (1) of the said Act, except on the written request of the Contractor and upon his giving to the Owner full security for all costs for which the owner might become liable in consequence of contesting such claim.

**8.a. ACTION AND COMPENSATION IN CASE OF BAD WORK**


If it shall appear to the Engineer-in-Charge/Site-in-Charge that any work has been executed with bad, imperfect or unskilled workmanship, or with materials, or that any materials or articles provided by the Contractor for execution of the work are not of standards specified/inferior quality to that contracted for, or otherwise not in accordance with the contract, the CONTRACTOR shall on demand in writing from the Engineer-in-Charge/Site-in-Charge or his authorised representative specifying the work, materials or articles complained of, notwithstanding that the same may have been inadvertently passed, certified and paid for, forthwith rectify or remove and reconstruct the work so specified and at his own charge and cost and expenses and in the event of failure to do so within a period of 15 days of such intimation/information/knowledge, the Contractor shall be liable to pay compensation equivalent to the cost of reconstruction by the Owner. On expiry of 15 days period mentioned above, the Owner may by themselves or otherwise rectify or remove and re-execute the work or remove and replace with others, the materials or articles complained of as the case may be at the risk and expenses in all respects of the Contractor. The decision of the Engineer-in-Charge/ Site-in-Charge as to any question arising under this clause shall be final and conclusive and shall not be raised as a dispute or shall be arbitrable.

**8.b. INSPECTION AND AUDIT OF CONTRACT AND WORKS**

This project is subject to inspection by various Government agencies of Government of India. The contractor shall extend full cooperation to all the Government and other agencies in the inspection of the works, audit of the Contract and the documents of Contract Bills, measurements sheets etc. and examination of the records of works and make enquiries interrogation as they may deem fit, proper and necessary. Upon inspection etc. by such agencies if it is pointed out that the contract work has not been carried out according to the prescribed terms and conditions as laid down in the tender documents and if any recoveries are recommended, the same shall be recovered from the contractors running bills/final bill/from ordered/suggested Security Deposit/retention money. The Contractor shall not rise any dispute on any such account and the same shall not be arbitrable.

**8. CONTRACTOR TO INDEMNIFY THE OWNER**

The Contractor shall indemnify the Owner and every member, officer and employee of the Owner, also the Engineer-in-Charge/Site-in-Charge and his staff against all the actions, proceedings, claims, demands, costs, expenses, whatsoever arising out of or in connection with the works and all actions, proceedings, claims, demands, costs, expenses which may be made against the Owner for or in respect of or arising out of any failure by the Contractor in the performance of his obligations under the contract. The Contractor shall be liable for or in respect of or in consequence of any accident or injury to any workmen or other person in the employment of the Contractor or his sub contractor and Contractor shall indemnify and keep

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indemnified the Owner against all such damages, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

#### **9. Price reduction**

- i) In case of any delay in completion of the work beyond the CDD, the Owner shall be entitled to be paid Price Reduction by the Contractor. The price reduction shall be initially at the rate of 0.5% (half percent) of the total contract value for every week of the delay subject to a maximum of 5% of the total contract value. The price reduction shall be recovered by the Owner out of the amounts payable to the Contractor or from any Bank Guarantees or Deposits furnished by the Contractor or the Retention Money retained from the Bills of the Contractor, either under this contract or any other contract.
- ii) The Contractor shall be entitled to give an acceptable unconditional Bank Guarantee in lieu of such a deduction if Contractor desires any decision on a request for time extension.
- iii) Once a final decision is taken on the request of the Contractor or otherwise, the price reduction shall be applicable only on the basic cost of the contract and on each full completed week(s) of delay (and for part of the week, a pro-rata price reduction amount shall be applicable).
- iv) This final calculation of price reduction shall be only on the value of the unexecuted portion/quantity of work as on the CDD.
- v) Contractor agrees with the Owner, that the above represents a genuine pre- estimate of the damages which the Owner will suffer on account of delay in the performance of the work by Contractor. The Contractor further agrees that the price reduction amount is over and above any right which owner has to risk purchase under Clause 12.4 and any right to get the defects in the work rectified at the cost of the contractor.

#### **10. DEFECTS AFTER TAKING OVER OR TERMINATION OF WORK CONTRACT BY OWNER**

The Contractor shall remain responsible and liable to make good all losses or damages that may occur/appear to the work carried out under this Contract within a period of 12 months from date of issue of the Completion Certificate and/or the date of Owner taking over the work, whichever is earlier. The Contractor shall issue a Bank Guarantee to the Owner in the sum of 10% of the work entrusted in the Contract, from a bank from the list of banks whose bank guarantees are acceptable to the Owner (list enclosed) and if however, the Contractor fails to furnish such a Bank Guarantee the Owner shall have right to retain the Security Deposit and Retention Money to cover the 10% of the Guarantee amount under this clause and to return/refund the same after the expiry of the period of 12 months without any interest thereon. (Please refer to clause 4. Deposits)

#### **11. TERMINATION OF CONTRACT**

- 11.1 The owner may terminate the contract at any stage of the construction for reasons to be recorded in the letter of termination.



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- 11.2 The Owner inter alia may terminate the Contract for any or all of the following reasons that the contractor
- a) has abandoned the work/Contract.
  - b) has failed to commence the works, or has without any lawful excuse under these conditions suspended the work for 15 consecutive days.
  - c) has failed to remove materials from the site or to pull down and replace the work within 15 days after receiving from the Engineer written notice that the said materials or work were condemned and/or rejected by the Engineer under specified conditions.
  - d) has neglected or failed to observe and perform all or any of the terms acts, matters or things under this Contract to be observed and performed by the Contractor.
  - e) has to the detriment of good workmanship or in defiance of the Engineer's instructions to the contrary sub-let any part of the Contract.
  - f) has acted in any manner to the detrimental interest, reputation, dignity, name or prestige of the Owner.
  - g) has stopped attending to work without any prior notice and prior permission for a period of 15 days.
  - h) has become untraceable.
  - i) has without authority acted in violation of the terms and conditions of this contract and has committed breach of terms of the contract in best judgement of the owner.
  - j) has been declared insolvent/bankrupt.
  - k) in the event of sudden death of the Contractor.
- 11.3 The owner on termination of such contract shall have the right to appropriate the Security Deposit, Retention Money and invoke the Bank Guarantee furnished by the contractor and to appropriate the same towards the amounts due and payable by the contractor as per the conditions of Contract and return to the contractor excess money, if any, left over.
- 11.4 In case of Termination of the contract, Owner shall have the right to carry out the unexecuted portion of the work either by themselves or through any other contractor(s) at the risk and cost of the Contractor. In view of paucity of time, Owner shall have the right to place such unexecuted portion of the work on any nominated contractor(s). However, the overall liability of the Contractor shall be restricted to 100 % of the total contract value.
- 11.5 The contractor within or at the time fixed by the Owner shall depute his authorised representative for taking joint final measurements of the works executed thus far and submit the final bill for the work as per joint final measurement within 15 days of the date of joint final measurement. If the contractor fails to depute their representative for joint measurement, the owner shall take the measurement with their Engineer-in- Charge/Site-in-Charge or any other outside representatives. Such a measurement shall be final and binding on the Parties and shall not be questioned by the Contractor and no dispute can be raised by the Contractor on the same.
- 11.6 The Owner may enter upon and take possession of the works and all plant, tools, scaffoldings, sheds, machinery, power operated tools and steel, cement and other materials of the Contract at the site or around the site and use or employ the same for completion of the work or employ any other contractor or other person or persons to complete the works. The Contractor shall not in any way object or interrupt or do any act, matter or thing to prevent or hinder such actions, other Contractor or other persons employed for completing and finishing or



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using the materials and

plant for the works. When the works shall be completed or as soon thereafter the Engineer shall give a notice in writing to the Contractor to remove surplus materials and plant, if any, and belonging to the Contractor except as provided elsewhere in the Contract and should the Contractor fail to do so within a period of 15 days after receipt thereof the Owner may sell the same by public auction and shall give credit to the contractor for the amount realised. The Owner shall thereafter ascertain and certify in writing under his hand what (if anything) shall be due or payable to or by the Owner for the value of the plant and materials so taken possession and the expense or loss which the Owner shall have been put to in procuring the works, to be so completed, and the amount if any, owing to the Contractor and the amount which shall be so certified shall thereupon be paid by the Owner to the Contractor or by the Contractor to the Owner, as the case may, and the Certificate of the Owner shall be final and conclusive between the parties.

- 11.7 When the contract is terminated by the Owner for all or any of the reasons mentioned above the Contractor shall not have any right to claim compensation on account of such termination.

**12. FORCE MAJEURE**


Circumstances leading to force majeure

- (a) act of terrorism;
- (b) riot, war, invasion, act of foreign enemies, hostilities (whether war be declared or not), civil war, rebellion, revolution, insurrection of military or usurped power;
- (c) ionising radiation or contamination, radio activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive assembly or nuclear component;
- (d) epidemics, earthquakes, flood, fire, hurricanes, typhoons or other physical natural disaster, but excluding weather conditions regardless of severity; and
- (e) freight embargoes, strikes at national or state-wide level or industrial disputes at a national or state-wide level in any country where Works are performed, and which affect an essential portion of the Works but excluding any industrial dispute which is specific to the performance of the Works or the Contract.

For the avoidance of doubt, inclement weather, third party breach, delay in supply of materials (other than due to a nationwide transporters' strike) or commercial hardship shall not constitute a Force Majeure event.

- Notification of Force Majeure

Contractor shall notify within [10(ten)] days of becoming aware of or the date it ought to have become aware of the occurrence of an event of Force Majeure giving full particulars of the

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event of Force Majeure and the reasons for the event of Force Majeure preventing the Affected Party from, or delaying the Affected Party in performing its obligations under the Contract.

- Right of either party to terminate

If an event of Force Majeure occurs and its effect continues for a period of 180 (one hundred eighty days) or more in a continuous period of 365 (three hundred sixty-five) days after notice has been given under this clause, either Party may terminate the Contract by issuing a written notice of 30 (thirty) days to the other Party.

- Payment in case of termination due to Force Majeure

The Contract Price attributable to the Works performed as at the date of the commencement of the relevant event of Force Majeure.

The Contractor has no entitlement and Owner has no liability for:

- a) any costs, losses, expenses, damages or the payment of any part of the Contract Price during an event of Force Majeure; and
- b) any delay costs in any way incurred by the Contractor due to an event of Force Majeure.

Time extension for such cases will be worked out appropriately.


### 13. DISPUTE RESOLUTION

#### (A) Discussions and Resolution

- i) The parties shall attempt to resolve all dispute and difference arising out of or relating to this contract through negotiations in good faith. If any dispute or difference remains unresolved, then all such unresolved disputes or differences shall be referred to the Executive Director/SBU Head of BGL of the concerned department and the Director/ Owner / authorized Senior Official of the contractor/supplier for an amicable solution.
- ii) If any dispute or difference remains unsettled within sixty (60) days from the date on which either Party has served a written notice on the other Party making claims and for discussions, then the provisions of Part B (i.e. Conciliation) of this Clause shall apply.

#### (B) CONCILIATION

- (i) All disputes and differences covered under the Conciliation Rules, 2019 arising out of or relating to this contract including its performance or


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interpretation, shall be fully and finally settled through Conciliation as per the Conciliation Rules, of BGL, as amended from time to time.


- (ii) The Conciliation Rules of BGL and any modification thereof shall be binding upon the Parties
- (iii) The language of the conciliation shall be English;
- (iv) The governing law of this contract shall be of India.
- (v) In case the Conciliation fails, or if there are any disputes or differences which are not covered under Conciliation Rules, 2019, then the parties shall be free to take appropriate legal remedies for adjudication of their disputes.
- (vi) The Courts having jurisdiction over the place where the contract was performed, except for enforcement of decree/judgment, shall be the court having jurisdiction to adjudicate the disputes between the parties.

**14. GENERAL**

- 15.1. Materials required for the works whether brought by the or supplied by the Owner shall be stored by the contractor only at places approved by Engineer-in- Charge/Site-in- Charge. Storage and safe custody of the material shall be the responsibility of the Contractor.
- 15.2. Owner and/or Engineer-in-Charge/Site-in-Charge connected with the contract, shall be entitled at any time to inspect and examine any materials intended to be used in or on the works, either on the site or at factory or workshop or at other place(s) manufactured or at any places where these are laying or from which these are being obtained and the contractor shall give facilities as may be required for such inspection and examination.
- 15.3. In case of any class of work for which there is no such specification supplied by the owner as is mentioned in the tender documents, such work shall be carried out in accordance with Indian Standard Specifications and if the Indian Standard Specifications do not cover the same the work should be carried out as per standard Engineering practice subject to the approval of the Engineer-in-Charge/Site-in- Charge.
- 15.4. Should the work be suspended by reason of rain, strike, lockouts or other cause the contractor shall take all precautions necessary for the protection of the work and at his own expense shall make good any damages arising from any of these causes.
- 15.5. The contractor shall cover up and protect from injury from any cause all new work also for supplying all temporary doors, protection to windows and any other requisite protection for the whole of the works executed whether by himself or special tradesmen or sub- contractors and any damage caused must be made good by the contractors at his own expense.

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- 15.6 If the contractor has quoted the items under the deemed exports, then it will be the responsibility of the contractor to get all the benefits under deemed exports from the Government. The Owner's responsibility shall only be limited to the issuance of required certificates. The quotation will be unconditional and phrases like "subject to availability of deemed exports benefit" etc. will not find place in it.
15. Integrity Pact : Effective 1st September, 2007, all tenders and contracts shall comply with the requirements of the Integrity Pact (IP) if the value of such tenders or contracts is r 1crore & above. Failure to sign the Integrity Pact shall lead to outright rejection of bid.
16. Grievances of parties participating or intend to participate in the tender shall be addressed in writing to the officer designate of the Grievance Redressal Cell where the tenders have to be submitted within the stipulated period. Detailed mechanism of Grievance Redressal is available on the BGL website
17. The guidelines for Holiday Listing as adopted and available on BGL website shall be applicable to all tenders floated and all Purchase Orders/Contracts placed by BGL.

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**Section V: Special Conditions of Contract (SCC)**

*Note for Bidders: Following Special Conditions of Contract (SCC) shall apply for this procurement. These Special Conditions shall modify/ substitute/ supplement the corresponding (GCC / GTC ) clauses as indicated below. Whenever there is any conflict between the provision in the GCC/ GTC and that in the SCC, the provision contained in the SCC shall prevail.*

**Special Terms and Conditions – Works Contracts**

GCC Clause No.	Topic	To be Read as
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GTC 1.7	Order of Precedence	<p>The Order of Precedence of documents shall be as follows with document at level 1 having the highest precedence: -</p> <ol style="list-style-type: none"><li>1. Contract Agreement</li><li>2. Detailed SOR attached with Tender document</li><li>3. Detailed Letter of Acceptance along with its enclosures</li><li>4. Letter of Award / Fax of Acceptance</li><li>5. Job Specifications (specific to particular job only)</li><li>6. Drawings</li><li>7. TIS</li><li>8. NIT</li><li>9. Special Conditions of Contract / Purchase</li><li>10. Technical Specifications</li><li>11. AITB</li><li>12. Instructions to Bidders</li><li>13. General Conditions of Contract</li><li>14. Other Documents</li></ol> <p>Any amendment / change order issued after signing of formal contract shall take precedence over respective clauses of the formal contract and its annexures.</p>
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GTC 3.5	Escalation in tender rates	No change in the referred clause.
GTC 4a	Earnest Money Deposit	No change in the referred clause.
GTC 4b	Security Deposits	N As defined in AITB against ITB clause 13.2.4
GTC 5b	Commencement of Work	No change in the referred clause. 15 days from the date of intimation by EIC/ BGL/PMC.
GTC 5g	Inspection of Works	No change in the referred clause.
GTC 5n	Defect Liability Period	No change in the referred clause.
GTC 6e	Insurance and Labour	<p>The clause 6.e of General Terms and Conditions of Contract shall apply along with the following:</p> <p>Bidder shall carry out and maintain any and all Statutory Insurance(s) Requirements required under Indian laws and regulations, including Workmen Compensation Act/ Employee State Insurance/ Third Party Liabilities etc. and Insurances for their personnel engaged in performance of the work at Contractor's own cost.</p> <p>Irrespective of work acceptance, the responsibility to maintain adequate insurance coverage at all times during the period of Contract shall be that of Contractor alone. Contractor's failure in this regard shall not relieve him of any of his responsibilities and obligations under the contract.</p> <p>Contractor shall provide the Owner with a copy of all insurance policies and documents taken out by him in pursuance of the Contract. Such copies of documents shall be submitted to the Owner immediately upon the Contractor having taken such insurance coverage. Contractor shall also inform the Owner at least 60 (Sixty) days in advance regarding the expiry, cancellation and/or changes in any of such documents and ensure revalidation/renewal etc, as may be necessary well in time.</p>

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GTC 7c	Retention Money	No change in the referred clause.
GTC 7d	Statutory Levies, Taxes and Duties	No change in the referred clause.
GTC 10	Price Reduction / Liquidated Damages Clause	<p><b><u>Liquidated Damages Clause</u></b></p> <p>In case contractor fails to complete the work within the contract period as defined in Contract then unless such failure is due to force majeure as defined in Bid document, there will be reduction in contract price @ 0.5% for each week of delay or part thereof subject to maximum of 5% of contract price.</p>
GTC 6a2	EMPLOYMENT LIABILITIES OWARDS WORKERS EMPLOYED BY THE CONTRACTOR	In case of labour unrest/labour dispute arising out of non-implementation of any law, the responsibility shall solely lie with the CONTRACTOR and he shall remove/resolve the same satisfactorily at his cost and risk.
GTC 6a2	EMPLOYMENT LIABILITIES OWARDS WORKERS EMPLOYED BY THE CONTRACTOR	The CONTRACTOR shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labour and to preserve peace and protection of persons and property in the neighbourhood of the Works against such conduct
GTC 7 E 1	CONSTRUCTION EQUIPMENT, TOOLS & TACKLES	CONTRACTOR shall be solely responsible for making available for executing the WORK, all requisite CONSTRUCTION EQUIPMENTS, Special Aids, Barges, Cranes and the like, all Tools, Tackles and Testing Equipment and Appliances, including Customs of such equipment etc. as required. In case of Customs of the same the rates applicable for levying of Custom Duty on such Equipment, Tools, & Tackles and the duty drawback applicable thereon shall be ascertained by the CONTRACTOR from the concerned authorities of Government of India. It shall be clearly understood that OWNER shall not in any way be responsible for arranging to obtain Custom Clearance and/or payment of any duties and/or duty draw backs etc. for such equipment's so imported by the CONTRACTOR and the CONTRACTOR shall be fully responsible for all taxes, duties and documentation with regard to the same.

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GTC 7e & 7f	CEMENT & STEEL	In partial modification to Clause. 7.e and 7.f (GTC-WORK CONTRACT), unless until specified explicitly in the tender, supply of cement and steel shall be arranged by Contractor
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		and the cost of the same shall be deemed to be included in the quoted rates
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<b>Appendix to SCC</b>		
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1	<b>SCOPE OF WORK / SUPPLY</b>	<p>The scope of work covered in this Contract will be as described in particular job specifications,</p> <p>Technical specifications, Standard Specifications, Schedule of Rates etc. The scope of supply covered in this Contract will be as described in Particular Job Specifications, Technical Specifications, Standard Specifications, Schedule of Rates etc. It is however, explicitly understood that scope described is not limiting, in so far as the responsibilities of the contractor are concerned and shall include, inter alia, carrying out any and all works and providing any and all facilities as are required to complete the works in all respect.</p> <p>Materials to be supplied by the Owner on free issue basis, if any, under this Contract will be as described in tender document.</p>
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2	<b>OTHER REQUIREMENT</b>	<p>For specific requirements, Contractor shall refer to the Technical Specification. Status of all clearances required for the works shall be provided to the Successful Bidder or Contractor, should there be any other requirement for execution of works the same shall be obtained by the Contractor at its own cost and statutory payments shall be reimbursed by Owner based on documentary evidence.</p> <p>Contractor shall, at his own responsibility and cost, supply &amp; provide water, power and cement and other utilities for the entire job in the quantities and at the times required for performance of work under the contract. The contract price shall be deemed to include the costs towards the same. The owner/consultant shall not supply water, power, cement and other utilities. Contractor shall obtain transport permit for the access roads and other permits required for the execution of the works conforming to all the requirements of the Governing authorities.</p> <p>Contractor shall, if required by him, for the entire duration of the execution of the work make available near the site, land for construction of Contractor's office, Warehouse, Workshops</p>
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and for any purpose in connection with providing infrastructure required for the execution of the Contract. The Contractor shall at his own cost construct all temporary buildings/ portable cabin and provide suitable water supply and sanitary arrangement as required. On completion of the work undertaken by the Contractor, he shall remove all temporary works erected by him and have the site cleared as directed by Engineer-in-Charge. If the Contractor shall fail to comply with these requirements, the Engineer-in-Charge may at the expense of the Contractor remove such surplus and rubbish materials and dispose off the same as he deems fit and get the site cleared as aforesaid, and the Contractor shall forthwith pay the amount of all expenses so incurred and shall have no claims in respect of any such surplus material disposed of as aforesaid.

The CONTRACTOR shall not be permitted to enter on (other than for inspection purpose) or Take possession of site until instructed to do so by Owner / Consultant in writing. The portions of the site to be occupied by the CONTRACTOR shall be defined and/or marked on the site plan failing which these shall be indicated by Owner / Consultant at site and the operations beyond the areas, in respect of any land permitted by the Owner for the use of the CONTRACTOR for the purpose of or in connection with the Contract, the same shall be subject to the following and such other terms and condition as may be imposed by Owner. Such use or occupations shall not confer any right of tenancy of the land to the CONTRACTOR. The contractor shall submit fortnightly report covering all major activities indicating schedule / actual progress, near-misses, slippages & its reasons and catch up plan.

The CONTRACTOR shall have no right to put up any construction of its own of any nature or type at the Site except temporary constructions for storage of equipment's for the work under the Contract or as a resting place for the laborer (workmen) employed by it for the work provided that it obtains the requisite previous permission in writing from Owner /Consultant.

Owner may refuse such permission in its absolute discretion or grant conditional permission, as it may deem appropriate. Such construction will be erected at the CONTRACTOR's own



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		<p>cost. The CONTRACTOR shall at its own cost demolish all such constructions and remove the debris thereof. As also all its materials and equipment's and clean and level the site thereof before handing over the completed work to the Owner.</p> <p>The CONTRACTOR shall provide if necessary or if required for the site all temporary access thereof and shall alter adapt and maintain the same as required from time to time and shall take up and clear them away as and when no longer required and as and when ordered by Owner/ Consultant and make good all damages done at /to the site. The CONTRACTOR shall note that the final bill will not be certified for payment till the action as above is completed by the CONTRACTOR to the entire satisfaction of Owner / Consultant.</p> <p>All drawings, tracings, photo prints and writing (except letter) shall be the sole property of Owner and must be returned to them on completion of work. The drawings maintained on the site are to be carefully mounted on boards of appropriate size. They are to be protected from ravages from termites, ants, silverfish and other insects.</p> <p>The completion of the work may require working in the monsoon also. The CONTRACTOR must maintain labour force as may be required for the job and plan and execute the construction and erection according to the prescribed schedule. No extra rate will be considered for such work in monsoon. The time schedule includes monsoon window period also. Hence request for time extension due to monsoon shall not ordinarily be entertained by Owner.</p> <p>During the execution of the work CONTRACTOR shall check its work with drawings. The CONTRACTOR shall be responsible for all the errors in this connection and shall have to rectify all defects and / or error at its own cost failing which BGL reserves the rights to get the same rectified at the risk and cost of the CONTRACTOR.</p> <p>During inclement weather the CONTRACTOR shall suspend concreting and plastering for such time as Owner/ Consultant may direct and shall protect from injury all works in the course of erection.</p>
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		<p>Should the work be suspended by reason of rain, strike, lockouts or other cause the CONTRACTOR shall take all precautions necessary for the protection of the work at its own expense shall make good any damages arising from any such cause.</p> <p>All rubbish including muck and water, as it accumulates from time to time during the progress of the work shall be cleared through proper drainage arrangement so as not to hamper the progress of various other site works in progress.</p> <p>The CONTRACTOR shall provide suitable pillar with flat tops and build the same in concrete for temporary benchmarks. All the pegs for setting out the works and fixing the necessary levels required for the execution thereof shall if desired by Owner/Consultant likewise be built in masonry at such places and in such manner as the Owner may determine.</p> <p>The CONTRACTOR shall cover up and protect from injury due to any cause to all new work and any other requisite protection for the whole of the works executed whether by itself or special tradesman or sub- CONTRACTORS and any damage caused must be made good by the CONTRACTORS at its own expense.</p> <p>Cutting of trees shall not be permitted except in the case that tree is falling on the line of ROU/ROW. In such circumstances, details of such tree being cut shall be prepared and forest/ municipal authorities be informed, and necessary approval be obtained by contractor.</p>
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3	<b>BID PRICES</b>	<p>Price must be furnished in the Price Schedule format available online in e-tender portal of BGL. Quoted prices must be net of discount, if any. Conditional discounts, if offered by a bidder, shall not be considered for evaluation.</p> <p>Unless otherwise agreed to in the terms of the Work / Purchase Order, the price shall be firm and not subject to escalation for any reason whatsoever till the execution of entire order, even though it might be necessary for the order execution to take longer than the delivery period specified in the order.</p> <p>Price shall be exclusive of GST (CGST, SGST, IGST as applicable), Customs Duty and applicable cess, which are leviable by law on</p>
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		<p>sale of finished goods to Corporation. The nature and extent of such levies shall be shown separately.</p> <p>Quoted prices shall be inclusive of all testing and inspection requirements (including stage wise and final inspection by Owner/ Owner's Consultant for which no extra charges shall be paid) as specified in the bid document. It shall be contractor's sole responsibility to co-ordinate with all the stakeholders including vendors and expedite the equipment / package delivery to meet the project schedule. The Contractor's qualified QC engineer shall be present for all the Inspection activities along with Consultant / Owner at sub-vendors workshop / site.</p> <p>On award of contract, the bidder / contractor shall submit the detailed Inspection Categorization plan for all the packages / equipment's in the tendered works for Consultant / Owner's approval.</p> <p>In case the material gets rejected / does not fulfil acceptance criteria as per technical requirements then it shall be sole responsibility of the contractor to carry out rectification or arrange for replacement of part or full equipment / package as required, without any time and cost implication to the Owner / Consultant. Also in such an event, bidder shall be responsible for carrying out the re-inspections from consultant appointed TPIA at their own cost.</p> <p>Bidder's quoted prices shall be firm &amp; fixed till the completion of the works in all respects and</p> <p>no escalation in prices on any other account shall be admissible to the contractor. The quoted prices shall be deemed to include entire scope of work and all obligations and responsibilities to be carried out/ executed by the Bidder as per terms of bid document.</p> <p>The quoted base price shall be inclusive of Mandatory Spares, Pre-Commissioning &amp; Commissioning Spares, and Special Tools &amp; Tackles for Complete items as per technical specifications.</p> <p>It shall be the responsibility of the Bidder to duly enquire of their own and comply with all applicable laws, rules, regulations, orders and formalities applicable to GST, Customs Duty, Countervailing Duty etc. on the manufacture, sale and/or supply</p>
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		<p>of any material / services to Owner / Consultant. The Bidder shall keep the Owner / Consultant indemnified from and against any and all claims, demands, prosecutions, penalties, damages, demurrages and/or other levies whatsoever made or levied by any Court, Tribunal or the Customs or other Authorities with respect to any alleged breach, evasion or infraction of such duties, taxes, charges or levies or any breach or infraction of such laws, rules, regulations, orders or formalities concerning the same and from the consequence thereof.</p> <p>Price quoted by the bidder, shall remain Firm &amp; Fixed until complete execution of the Work / Purchase Order and shall not be subject to any variation, except statutory variation in taxes, duties &amp; levies pursuant to relevant provisions in Special Terms and Conditions of Contract. The Bidder's quoted price shall also remain Firm and Fixed on account of Foreign Exchange (FE) Variation, unless otherwise any specific provision is indicated in IFB document.</p> <p>The bidder shall quote the prices after careful analysis of cost involved for the performance of complete work considering all parts of the IFB documents. In case, any activity though specifically not covered but is required to complete the work as per scope of work, scope of supply, specifications, standards, drawings, GTC, STC or any other part of IFB Document, the prices quoted shall deemed to be inclusive of cost incurred for such activity(ies).</p> <p>Bidder to note and consider the following:</p> <p>a) Suppliers/Contractors shall arrange Road Permits/Waybills by themselves and comply with the statutory laws of the concerned state.</p> <p>b) In case as per state laws the issuance of Road Permit/Waybill is to be arranged by the buyer, BGL will arrange to issue Road Permit/Waybill. In case of imposition of any Tax the same shall be discharged by the buyer and the same will be adjusted against the payments due to vendors against their bills.</p> <p>Bidders shall quote their prices in Indian Rupees and only indicate the following in their offer:</p>
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		<p>Site work Prices, if applicable as per the scope of work mentioned in tender documents, shall be</p> <p>exclusive of Prevailing GST. All necessary taxes &amp; duties and registration, if required, for carrying out the site activities shall be done by the bidder and cost towards the same shall be included in quoted site work prices.</p> <p>GST Tax, payable extra on Site Work Services, as applicable.</p> <p>The entire work covered under this contract shall be treated as <b>"Works Contract"</b>.</p>
<p align="center">4</p>	<p align="center"><b>TIME OF COMPLETION</b></p>	<p>The work shall be executed strictly as per time Schedule mentioned elsewhere in the Bidding document. The period of completion given includes the time required for mobilization as well as testing, rectifications, if any, retesting and completion in all respects to the entire satisfaction of the Engineer-in-Charge.</p> <p>The work for each part shall commence concurrently.</p> <p>The Engineer-in-Charge and Contractor will prepare a joint program of execution of work. This program will take into account the time of completion mentioned above.</p> <p>Monthly/ weekly construction program will be drawn up by Engineer-in-Charge jointly with the Contractor based on availability of work fronts and the joint construction programs as per the above clause. The Contractor shall scrupulously adhere to these targets / programme by deploying adequate personnel, construction tools &amp; tackles and it shall also supply itself all materials within its scope of supply in good time to achieve the targets set out in the weekly and monthly programme. In all matters concerning the extent of targets set out in the weekly and achievements, the decision of the Engineer-in-Charge shall be final and binding on the Contractor.</p> <p>If the Contractor fails to achieve the targeted progress schedule of each month as mentioned in the IFB, the Owner at its option, may terminate the Contract as Contractor's default and get the work completed from other sources at Contractor's risk, consequence and cost.</p> <p>Contractor shall give every day report on category wise labour and equipment deployed along with the progress of work done</p>



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		<p>on previous day in the proforma prescribed by the Engineer-inCharge.</p> <p>The Contractor shall submit fortnightly report covering all major activities indicating schedule /actual progress, slippages &amp; its reasons and catch up plan.</p>
5	<b>COMPENSATION FOR IDLE TIME</b>	<p>The Owner shall make every reasonable effort to have free issue materials and right - of - use (ROU) available so as not to delay laying activities. No Idle time claim shall be entertained under any circumstances</p>
6	<b>WORK ON SUNDAYS, HOLIDAYS AND DURING NIGHT HOURS:</b>	<p>Contractor will be allowed to work on Sundays, holidays and during night hours only after obtaining prior written approval of Engineer-in-charge / Owner, but in no case at any extra cost or charges to the Owner for such work subject, however, to the statutory restrictions, if any, in respect thereof.</p>
7	<b>PROGRESS REPORTS:</b>	<p>All reports, progress charts etc. as required by Site Engineer or by the Owner shall be kept available at bidder's site office. The same shall be submitted to Site Engineer or the Owner as and when required without any charge to either the Site Engineer or Owner.</p>
8	<b>LABOUR AT SITE:</b>	<p>No labour shall be allowed to stay at site. The bidder shall obtain prior permission of the Owner</p> <p>for the watchman who will be required to stay at the site. The bidder shall arrange to provide due facilities to his labour at site. He will keep his temporary office, shed, etc. reasonably clean at all times</p>
9	<b>LABOUR RELATIONS</b>	<p>The following shall be appended as relevant clause of GTC-Works Contract.</p> <p>In case of labour unrest/labour dispute arising out of non-implementation of any law, the responsibility shall solely lie with the CONTRACTOR, and he shall remove/resolve the same satisfactorily at his cost and risk.</p> <p>The following shall be appended as sub clause no. 6.a.3 to clause no. 6.a of GTC-Works Contract.</p>



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		<p>The CONTRACTOR shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labour and to preserve peace and protection of persons and property in the neighbourhood of the Works against such conduct.</p>
10	<p><b>SITE FACILITIES:</b></p>	<p><b>Power Supply.</b> Contractor shall arrange at his own cost power supply distribution for the site. All works by the Contractor will be done as per Indian Electricity Act &amp; Rules framed there under and passed by the Engineer-in –charge. The temporary lines will be removed forthwith, after completion of the work or if there is any hindrance caused to other work due to the alignment of these lines, the Contractor will re-route or remove the temporary lines at his own cost. The Contract Price shall be deemed to include all costs towards all above.</p> <p><b>Water Supply.</b> The water required for construction and drinking shall be arranged by the Contractor at his own cost. The Contract Price shall be deemed to include all costs towards all above.</p> <p>Contractor shall be provided with some area within the site premises for Site Office / Fabrication Yard / Warehouse. Any additional area if required by Contractor for execution of the works shall be arranged by them at their own cost preferably at a location in close proximity to site. On completion of the relevant works undertaken by the Contractor, it shall remove all temporary works erected by it and have the site cleared as directed by Engineer-in-Charge. If the Contractor shall fail to comply with these requirements, the Engineer-in-Charge may at the expense of the Contractor remove such surplus and rubbish materials and dispose off the same as he deems fit and get the site cleared as aforesaid, and the Contractor shall forthwith pay the amount of all expenses so incurred and shall have no claims in respect of any such surplus material disposed of as aforesaid.</p> <p>Besides providing site facilities as per law of land, site camps with all related amenities shall be provided in line with the requirements of all Regulations/Acts and the Statutory</p>



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		<p>Authorities along with the following facilities at all work places where workmen are deployed / engaged by contractor:</p> <ul style="list-style-type: none"> <li>i) Arrangement for First Aid.</li> <li>ii) Arrangement for clean &amp; potable drinking water &amp; Tea, etc.</li> <li>iii) A creche where 10 or more women workers are having children below the age of 6 years.</li> <li>iv) Any other facility/utility as may be required under the Contract as per the existing legislation.</li> <li>v) Rest rooms / toilets for site staff / labour.</li> <li>vi) Proper Rest Facility with drinking water during lunch period.</li> </ul>
11	<b>COMPLIANCE WITH LAWS:</b>	<p>The Contractor shall abide by all applicable rules, regulations, statutes, laws, as amended from time to time governing the performance of works in India, including but not limited to the following:</p> <ul style="list-style-type: none"> <li>a. Indian Explosives Act, 1984.</li> <li>b. The Motor Vehicles Act, 1988.</li> <li>c. The Factories Act 1949.</li> <li>d. The Petroleum Act, 2002.</li> <li>e. Workman’s Compensation Act 1923.</li> <li>f. Static/Mobile Pressure Vessel Act,</li> <li>g. Indian Electricity Act,</li> <li>h. Indian Boiler Act, 1923.</li> <li>i. Water (Prevention &amp; Control Pollution) Act, 1974.</li> <li>j. Water (Prevention &amp; Control of Pollution) Cess Act-1977.</li> <li>k. The Air (Prevention &amp; Control of Pollution) Act-1981.</li> <li>l. The Radiation Protection Rules-1971</li> <li>m. The Indian Forest Act-1927.</li> <li>n. The Environment [Protection] Act 1986.</li> <li>o. The Environment (Protection) Rules-1986.</li> </ul>



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		<p>p. The Hazardous Wastes (Management &amp; Handling) Rules-1989.</p> <p>q. The Manufacture, Storage &amp; import of Hazardous Chemicals Rules-1989.</p> <p>r. Wildlife Act 1972 and Wildlife [Protection] Act 2006.</p> <p>s. Contract Labour (Regulation &amp; Abolition) Act 1970 &amp; the centre rules 1971 framed there under</p> <p>t. The Central Motor Vehicle Rule-1989.</p> <p>u. Payment of Wages Act 1936.</p> <p>v. Minimum Wages Act 1948.</p> <p>w. Employer's Liability Act 1938.</p> <p>x. Apprentices Act 1961.</p> <p>y. Industrial Disputes Act 1947.</p> <p>z. Merchant Maritime Act 1920</p> <p>aa. Building and other Construction workers Act 1996</p> <p>bb. Employees' State Insurance Act 1948</p> <p>cc. Employees' Provident Fund and Miscellaneous Provisions Act, 1952</p> <p>dd. Any other Statute, Act, Law as may be applicable.</p>
12	<b>PROVIDENT FUND</b>	<p>The Contractor shall strictly comply with the provisions of Employees Provident Fund Act and register themselves with RPFC before commencing work. The Contractor shall deposit Employees and Employers contributions to the RPFC every month. The Contractor shall furnish along with each running bill, the challan/ receipt for the payment made to the RPFC for the preceding months.</p>
13	<b>CONSTRUCTION EQUIPMENT, TOOLS &amp; TACKLES</b>	<p>Contractor shall be solely responsible for making available for executing the work, all requisite equipment, special aids, crane, tools, tackles and testing equipment and appliances suitable and required for the entire</p>



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		<p>job including the stations works for installation of both free issue material and contractor bought out items. Such equipment etc. shall have applicable safety/fitness certificates as applicable under Government Rules/Laws and shall be subject to examination and approval by Owner for the same being in first class operating condition. Any discrepancies pointed out by Owner shall be immediately got rectified, repaired or the equipment replaced altogether, by Contractor. Owner shall not in any way be responsible for providing any such equipment machinery, tools and tackles etc.</p> <p>The Contractor shall without prejudice to his overall responsibility to execute and complete the work as per specifications and time schedule, progressively arrange and deploy adequate equipment's and tools and tackles as per construction plan approved by Owner at construction site and augment the same as decided by the Engineer-in-Charge depending on the exigencies of the work so as to suit the construction schedule, without any additional cost to Owner.</p> <p>16.3 Total Stations, Theodolite for survey, Dumpy levels, plump bobs, prismatic compass, chain, steel and metallic tape as a minimum and all other surveying instruments found necessary for the works at all the stations shall be provided by the CONTRACTOR for the due performance of their contracts as instructed by Owner/ Consultant. Owner/ Consultant. will use any or all measure instruments or tools belonging to the CONTRACTOR as and when he chooses for checking the completed works as well as the work in progress.</p> <p>All scaffolding and ladders that may be necessary for taking measurements at site will be provided by the CONTRACTOR.</p> <p>Contractor shall provide minimum requirement of equipment's / Machinery as per Annexure 1 of STC.</p>
14	<b>CHANGE ORDERS</b>	<p>A change order will be initiated in case:</p> <p>The Owner directs the Contractor to include any addition to the scope of work not covered under this contract or deletes any part of the scope of the work under the contract.</p> <p>Contractor requests to delete any part of the work which will not adversely affect the operational</p>



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capabilities of the project and if agreed by the Owner and for which cost and time benefits shall be passed on to the Owner.

Any changes required by the Owner before giving their approval to detailed procedure or any other document relating to material procurement, layout plans etc for complying with the requirements of bidding document shall not be construed to be a change in the scope of work under the contract.

Any change order as above comprising an alteration which involves a change in the cost of the works (which sort of alteration is hereinafter called a "Variation") shall be the subject of an amendment to the contract by way of an increase or decrease in the contract price and adjustment of the Construction Schedule if any.

If the contract provides applicable rates for the valuation of the variation in question the contract price shall be increased or decreased in accordance with those rates. If the parties agree that the contract does not contain applicable rates then the parties shall negotiate a revision of the contract price which shall represent the change in cost of the works caused by the variations. Any change order must be duly approved by the Owner in writing.

If there is a difference of opinion between Contractor and Owner whether a particular work constitutes a change order or not, the matter shall be handled in accordance with the procedures as defined below.

Within 10 (Ten) working days of receiving the comments from the Owner on the documents submitted by the Contractor for approval, the Contractor's response in writing stating which item(s) is/are potential change (s), if applicable, will be submitted to the Owner.

**Procedure**

During execution of work if the Contractor observes that any new requirements which is not specific or intended in the bidding document has been indicated by Owner, they shall discuss the matter with Owner's representatives.



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		<p>In case such requirement arises from the side of the Contractor they would also discuss the matter with Owner's Representative.</p> <p>In either of the two cases above, the representatives of both the parties shall discuss the project requirement and mutually decide whether the project requirement constitutes a change order.</p> <p>If it is mutually agreed that the project requirement/Inquiry constitutes a "Change Order" then a joint memorandum will be prepared to confirm a "Change Order" and basic ideas of necessary agreed modifications.</p> <p>Contractor will study the work required in accordance with the Joint memorandum and assess subsequent schedule and cost effect if any.</p> <p>The results of this study would be discussed mutually to enable Owner to give a final decision whether Contractor should proceed with the Change Order or not, in the best interest of the Project.</p> <p>If Owner's representative accepts the change order in writing, then Contractor shall proceed with the work stipulated in the Change order. Time worked by all workmen employed and a statement showing the description and quantity of all materials and plant utilised for extra work shall be submitted to Owner. The Owner's representative shall sign and return to the Contractor the statement, as agreed. At the end of each month the Contractor shall deliver to the Owner's representative a priced statement of the labour, materials and plant used. Whenever any dispute arises as to cost allocation between the Contractor and the Owner, the voucher shall nevertheless be signed by the Owner as a record of time worked and materials used. List and vouchers so signed will be the subject of negotiations between the Owner and the Contractor regarding their costs allocation.</p> <p>In case, mutual agreement as above that is whether Project Requirement constitutes a Change order or not, is not reached, then Contractor, in the interest of the project, shall take up the implementation of the work, if advised in writing to do so by Owner's representative pending settlement between the two</p>
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		<p>parties to the effect whether the Project Requirement constitutes a change order or not as per the terms and conditions of Contract Documents.</p> <p>The time and cost effect in such a case shall be mutually verified for the purpose of record. Should it be established that the said work constitutes a Change Order, the same shall be compensated taking into account the records kept and in accordance with the contract.</p> <p>Should the amount of extra work/ change order, if any, which the Contractor may be required to perform under instructions from the Owner, fairly entitle the Contractor to extensions of time beyond the scheduled completion date for completion of either the whole of the works or for such extra work only, the Owner and the Contractor shall mutually discuss and decide the extension of time, if any to be granted to the Contractor.</p> <p>Contractor should bring into notice of Owner/Owner representative if any quantity exceeds from the quantity mentioned in SOR and take approval before further execution of any such quantity, failing to which contractor is not liable for any extra claim for the same and no change order will be issued in this regard.</p>
15	<p><b>CONSTRUCTION EQUIPMENT AND ORGANIZATION</b></p>	<p><b>CONSTRUCTION EQUIPMENT</b></p> <p>The CONTRACTOR shall without prejudice to his overall responsibility to execute and complete the work as per specifications and time schedule deploy construction equipment and tools &amp; tackles and augment the same as decided by the Engineer-in- Charge depending on the site requirement &amp; exigencies of the work so as to complete all works within the contracted time schedule and without any additional cost to OWNER.</p> <p>No construction equipment shall be supplied by the OWNER. CONTRACTOR to ensure deployment of suitable equipment and take all safety precautions during execution of work.</p> <p>CONTRACTOR shall be solely responsible for making available for executing the WORK, all requisite CONSTRUCTION EQUIPMENTS, Special Aids, Barges, Cranes and the like, all Tools, Tackles and Testing Equipment and Appliances, including</p>



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		<p>imports of such equipment etc. as required. In case of import of the same the rates applicable for levying of Custom Duty on such Equipment, Tools, &amp; Tackles and the duty drawback applicable thereon shall be ascertained by the CONTRACTOR from the concerned authorities of Government of India. It shall be clearly understood that OWNER shall not in any way be responsible for arranging to obtain Custom Clearance and/or payment of any duties and/or duty draw backs etc. for such equipment's so imported by the CONTRACTOR and the CONTRACTOR shall be fully responsible for all taxes, duties and documentation with regard to the same. Tenderer in his own interest may contact, for any clarifications in the matter, concerned agencies/Dept./Ministries of Govt. of India. All clarifications so obtained, and interpretations thereof shall be solely the responsibility of the CONTRACTOR.</p> <p><b><u>Schedule of Labor Rates</u></b></p> <p>Hiring / Recovery Rate for Deployment of Manpower attached as mentioned in clause no. 38 below shall be used for analysing rates for recovery for non- deployment of manpower.</p> <p><b><u>SITE ORGANISATION</u></b></p> <p>Subject to the provisions in the contract document and without prejudice to CONTRACTOR's liabilities and responsibilities to provide adequate qualified skilled, semiskilled and unskilled personnel on the work, CONTRACTOR shall deploy supervisory personnel as mentioned in tender documents and augment the same as decided by the Engineer-in-Charge depending upon the site requirement &amp; the exigencies of work so as to complete all works within the contracted time schedule and without any additional cost to OWNER.</p> <p>Qualification and experience of Key Supervisory Personnel to be deployed for this work shall be as mentioned in Special Terms and Conditions.</p>
16	<b>MEASUREMENT OF WORK</b>	Payments will be based on the actual measurements jointly taken by the Engineer-in-



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		Charge/Owner's representative and the Contractor. All payments will be made on the basis of actual measurements only
17	<b>PRICE REDUCTION FOR DELAY IN DELIVERY / LIQUIDATED DAMAGE</b>	<p>In partial modifications of the General terms and conditions of Works contract, in the event of delay beyond the Contractual progressive delivery dates for reasons not attributable to Owner and not constituting conditions of force majeure, it will be at Owner's discretion, without prejudice to his other rights under the contract, to accept delayed delivery at the prices reduced as per the following:</p> <p>Time allowed for carrying out the work as mentioned in bidding document shall be strictly adhered to by the Contractor. Work shall be carried out with all the diligence throughout the stipulated period of the contract.</p> <p>Value/Quantum of completed job as on the date of Contractual Delivery Date (CDD) shall be recorded jointly by the Contractor, Consultant/Owner.</p> <p>The price reduction for slippage shall be equal to 0.5% per week of delay or part thereof and on the undelivered portion of the contract price as on CDD. Total Price reduction shall be subject to ceiling of 5% of the undelivered portion of the contract price.</p> <p>Second Crop/additional compensations to be paid to landowners due to fault of vendor will be recovered from the vendor.</p>
18	<b>STATUTORY APPROVALS</b>	<p>The approval from any authority required as per statutory rules and regulations of Central/State Government/Local Bodies shall be the contractor's responsibility unless otherwise specified in the bid document. The application on behalf of the Owner for submission to relevant authorities along with copies of required certificates complete in all respects shall be prepared and submitted by the Contractor well ahead of time so that the actual construction/ commissioning of the work is not delayed for want of the approval/inspection by concerned authorities.</p> <p>The Contractor shall arrange the inspection of the works by the authorities and necessary coordination and liaison work in this</p>



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		<p>respect shall be the responsibility of the contractor. However statutory fees paid, if any, for all inspections and approvals to such authorities shall be reimbursed at actual by the Owner to the contractor on production of documentary evidence.</p> <p>Any change/ addition required to be made to meet the requirements of the statutory authorities shall be carried out by the contractor without additional cost to Owner. The inspection and acceptance of the work by statutory authorities shall however, not absolve the contractor from any of his responsibilities under this contract.</p>
19	<b>TESTS AND INSPECTION</b>	<p>The Contractor shall carry out various tests as enumerated in the technical specifications of the bidding document and the technical documents that will be furnished to him during the performance of the work.</p> <p>All the tests either on the field or at outside laboratories concerning the execution of the work and supply of materials by the Contractor shall be carried out by Contractor at his own cost.</p> <p>The work is subject to inspection at all times by the BGL/TE. The contractor shall carry out all instructions given during inspection and shall ensure that the work is being carried out according to the technical specifications of bid document, the technical documents and the relevant codes of practice will be furnished to him during the performance of the work.</p> <p>The Contractor shall provide for purposes of inspection access ladders, lighting and necessary instruments at his own cost.</p> <p>Any work not conforming to execution drawings, specifications or codes shall be rejected forthwith and the Contractor shall carryout the rectifications at his own cost.</p> <p>All results of inspection and tests will be recorded in the inspection reports, proforma of which will be approved by the Engineer-in-Charge. These reports shall form part of the completion documents.</p> <p>For materials supplied by Owner, Contractor shall carryout the tests, if required by the Engineer-in- Charge, and the Owner</p>



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		<p>shall reimburse the cost of such tests at actual to the Contractor on production of documentary evidence.</p> <p>Statutory fees paid to IBR authorities and for repeat tests and inspection due to failures, repairs etc. such reasons attributable to the Contractor shall be borne by the Contractor.</p> <p>Inspection and acceptance of work shall not relieve the Contractor from any of his responsibilities under this Contract.</p>
20	<p><b>INSPECTION OF SUPPLY ITEMS/ MATERIALS</b></p>	<p>All inspection and tests on bought out items/ materials shall be made as per the specifications forming part of this contract. Various stages of inspection and testing (for ingredients/ execution quality/ execution workmanship/ Post execution) shall be identified after receipt of Quality Assurance Program from the Contractor/Manufacturer.</p> <p>Inspection calls shall be given for associations of Owner/ Consultant's representative as per mutually agreed program in prescribed proforma with 15 days margin, giving details of equipment and attaching relevant test certificates and internal inspection report of the Contractor. All drawings, General Arrangement and other contract drawings, specifications, catalogues etc. pertaining to equipment offered for inspection shall be got approved from Owner/Consultant and copies shall be made available to Owner/Consultant beforehand for undertaking inspection.</p> <p>The Contractor shall ensure full and free access to the inspection engineer of Owner/Consultant at the Contractor's or their sub-contractor's premises at any time during contract period to facilitate him to carry out inspection and testing assignments.</p> <p>The Contractor/sub-contractor shall provide all instruments, tools, necessary testing and other inspection facilities to inspection engineer of Owner/Consultant free of cost for carrying out inspection.</p> <p>Where facilities for testing do not exist in the Contractor's/sub-contractor's laboratories, samples and test pieces shall be drawn by the Contractor/Subcontractor in presence of Inspection Engineer of Owner/Consultant and duly sealed by the later and sent for testing in NABL approved Test House or</p>



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		<p>any other testing laboratories approved by the Inspection Engineer at the Contractor's cost.</p> <p>It is sole responsibility of Contractor to ensure facilitation of Inspection for all the bought-out items &amp; timely completion of the delivery of such items to site locations without leading to impact the construction schedule.</p> <p>Any changes / re-inspection required to be carried out due to non-compliance to the technical requirements will be sole responsibility of the contractor. Contractor shall perform these actions without any time &amp; cost implications to Owner / Consultant.</p>
21	<b>TEST CERTIFICATES</b>	<p>Bidder shall be required to submit recent test certificates for the material being used in works from the recognized laboratories. These certificates should indicate all properties of the materials as required in relevant IS Standards or International Standards.</p> <p>Contractor shall also submit the test certificate with every batch of material supplied which will be approved by Engineer-in-Charge. In case any test is to be carried out, the same shall be got done at the discretion of the Owner/Consultant in the approved laboratory at the cost of contractor. No secured advance will be given for the materials not having test Certificates.</p>
22	<b>FINAL INSPECTION</b>	<p>After completion of all tests as per specification the whole work will be subject to a final</p> <p>inspection to ensure that job has been completed as per requirement. If any defects noticed in the work attributable to Contractor, the Contractor at his own cost shall attend and rectify these defects, as and when the owner brings them to his notice. The Owner/Consultant shall have the right to have these defects rectified at the risk and cost of the contractor if he fails to attend to these defects immediately.</p>
23	<b>HEALTH SAFETY AND ENVIRONMENT (HSE) MANAGEMENT</b>	<p>The Contractor, during entire duration of the Contract, shall adhere to HSE requirement as per HSE MANAGMENT Specifications provided in Tender Documents.</p> <p>The contractor shall engage qualified and experienced HSE Engineer at each location. The qualification and experience of</p>



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		such personnel shall not be less than what specified in Tender Documents
24	<b>COMPUTERIZED CONTRACTORS BILLING SYSTEM</b>	<p>Without prejudice to stipulation in Terms and Conditions of Works Contract, the Contractor should follow the printed / typed billing system.</p> <p>The bills will be prepared by the Contractor on their own PCs as per the standard formats and codification scheme proposed by Owner/Consultant. The Contractor will be provided with data entry format to capture the relevant billing data for subsequent processing. Contractor will submit these data to Owner/Consultant in an electronic media along with the hard copy of the bill, necessary enclosures and documents. The Contractor will also ensure the correctness and consistency of data so entered with the hard copy of the bill submitted for payment.</p> <p>Owner/Consultant will utilize these data for processing and verification of the Contractor's bill and payment.</p>
25	<b>INSURANCE FOR FREE ISSUE MATERIAL</b>	Not Applicable for this tender.
26	<b>MAKE OF MATERIAL</b>	<p>The materials required to be supplied by the Bidder under this Contract shall be procured only from Owner / Consultant approved vendors. Where the makes of materials are not indicated in the IFB, Bidder shall furnish the details (Past track record / credentials) of proposed makes and shall obtain prior approval of Owner / Consultant. Bidder shall not procure any item from vendors not approved by Consultant/ Owner.</p> <p>Bidder is also required to ensure that equipment qualification criteria, specified elsewhere in the bid document, are also simultaneously met.</p> <p>Bidder shall make an independent assessment of capability of all the vendors for timely deliveries of material / equipment. Any delays in deliveries by vendor(s) shall not be a cause of Schedule and cost implication.</p> <p>Non-acceptance of a particular proposed Makes /vendor due to any reasons whatsoever shall not be a cause of Schedule and cost implication to the Owner.</p>



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		<p>At any stage of the project, if it comes to the notice of Owner/ Consultant that Vendor has procured material / equipment, intentionally or unintentionally whatsoever, from an unapproved vendor and/or items not falling in approved range of vendor(s), the same shall be rejected forthwith and Vendor shall be liable to replace such material /plant / machinery without any Schedule and cost implication to the Owner.</p> <p>It is understood that should the name of Vendor be changed due to change in their Company or Corporate shareholding, Owner may accept such Vendors under its new name with prior approval.</p> <p>Any such approval shall however, not absolve the Vendor from any of his obligations under the contract; neither shall any such approval signify nominations or instruction to use such a vendor. All approved vendors are deemed to have been freely chosen by the VENDOR at his own risk.</p>
27	<p align="center"><b>SETTLEMENT OF DISPUTE BETWEEN TWO PSUS</b></p>	<p>In the event of any disputes or difference relating to the interpretation and application of the provisions of the contracts, such disputes or differences shall be referred by either party to the Arbitration in the Department of Public Enterprises nominated by the Secretary to the Govt. of India in charge of the Board of Public Enterprises, Govt. of India. The Arbitration and Conciliation of shall not be applicable to such arbitration. The award of the Arbitrator shall be binding upon the parties to the dispute, provided, however, any party aggrieved by such award may make a further reference for setting aside or revision of the award to the Law Secretary, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary cc the Special Additional Secretary when so authorized by the Law Secretary whose decision shall bind the parties finally and conclusively. The parties to the dispute will share equally the cost of arbitration as intimated by the Arbitrator.</p> <p>Since this is a Domestic tender hence Conciliation clause is applicable in place of Arbitration.</p>
28	<p align="center"><b>ADDITIONAL WORKS/ EXTRA WORKS</b></p>	<p>Owner reserves their right to execute any additional works/ extra works, during the execution of work, either by themselves or by appointing any other agency even though such works are incidental to and necessary for the completion</p>



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		of works awarded to the Contractor. In the event of such decisions taken by Owner, Contractor is required to extend necessary cooperation, and act as per the instructions of Engineer-in-Charge. No extra time/cost compensation will be made by Owner/Consultant.
29	<b>GUARANTEE</b>	<p>Contractor needs to replace/repair or reinstall free of cost any material/equipment supplied by him in case it fails to operate due to defective materials or workmanship as per requirements of this specification within Twelve (12) months from the date of issue of completion certificate and/or the date of Owner taking over the work, whichever is earlier, in line to General Terms and Condition of Work Contract thereby acceptance of the entire system by Owner.</p> <p>Contractor shall replace at his own cost if any item found defective or missing before handing over the system to Owner. The decision of Engineer-in-Charge/Owner shall be final and binding in this regard. The guarantee for such rectified/replaced item shall be for a period of 12 months from completion of such rectification/replacement.</p>
30	<b>LIMITATION OF LIABILITIES</b>	<p>The final payment by the Owner in pursuance of the contract terms shall not mean release of the Contractor from all his liabilities under the contract. The Contractor will be liable and committed under this contract to fulfil all his liabilities and responsibilities, till such time the Owner releases Contract Performance Guarantee.</p> <p>Contractor's over all liability towards execution of the Contract will not exceed 100% (One hundred Percent) of the total Contract Price without prejudice to any other rights Owner may have as per terms &amp; conditions of the Contract. Provided, this cap on liability of the Contractor shall not apply in case of loss or damage arising out of (i) negligence of the Contractor or any person engaged by the Contractor and or (ii) infringement of any intellectual property by Contractor or any person engaged by the Contractor and or (iii) statutory liability.</p>
31	<b>GOVERNMENT OF INDIA NOT LIABLE</b>	It is expressly understood and agreed by and between Bidder and M/s BHAGYANAGAR GAS LIMITED is entering into



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		<p>this agreement solely on its own behalf and not on behalf of any other person or entity. In particular, it is expressly understood and agreed that the Government of India is not a party to this agreement and has no liabilities, obligations or rights hereunder. It is expressly understood and agreed that M/s BHAGYANAGAR GAS LIMITED is an independent legal entity with power and authority to enter into contracts solely on its own behalf under the applicable Laws of India and general principles of Contract Law. The Bidder expressly agrees, acknowledges and understands that M/s BHAGYANAGAR GAS LIMITED is not an agent, representative or delegate of the Government of India. It is further understood and agreed that the Government of India is not and shall not be liable for any acts, omissions, commissions, breaches or other wrongs arising out of the contract. Accordingly, Bidder hereby expressly waives, releases and foregoes any and all actions or claims, including cross claims, impleader claims or counter claims against the Government of India arising out of this contract and covenants not to sue to Government of India as to any manner, claim, cause of action or thing whatsoever arising out of or under this agreement.</p>
32	<b>ISSUE OF OWNER SUPPLIED MATERIAL</b>	Not Applicable for this tender.
33	<b>LOCATION OF DUMPYARD / WAREHOUSE / STORAGE YARD</b>	Not Applicable for this tender.
34	<b>QUALITY ASSURANCE/ QUALITY CONTROL</b>	<p>Bidder shall include in his offer the Quality Assurance Program containing the overall quality management and procedures, which is required to be adhered to during the execution of contract. After the award of the contract detailed quality assurance program shall be prepared by the contractor for the execution of contract for various works, which will be mutually discussed and agreed to.</p> <p>The Contractor shall establish document and maintain an effective quality assurance system outlined in recognized codes.</p>



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		<p>Quality Assurance System plans/procedures of the Contractor shall be furnished in the form of a QA manual. This document should cover details of the personnel responsible for the Quality Assurance, plans or procedures to be followed for quality control in respect of Design, Engineering, Procurement, Supply, Installation, Testing and Commissioning. The quality assurance system should indicate organizational approach for quality control and quality assurance of the construction activities, at all stages of work at site as well as at manufacturer's works and dispatch of materials.</p> <p>The Owner/Consultant or their representative shall reserve the right to inspect/witness, review any or all stages of work at shop/site as deemed necessary for quality assurance.</p> <p>The contractor has to ensure the deployment of quality Assurance and Quality Control Engineer(s) depending upon the quantum of work. This QA/QC group shall be fully responsible to carry out the work as per standards and all code requirements. In case Engineer-in-charge feels that contractor's QA/QC Engineer(s) are incompetent or insufficient, contractor has to deploy other experienced Engineer(s) as per site requirement and to the full satisfaction of Engineer-In-Charge.</p> <p>In case contractor fails to follow the instructions of Engineer-in-charge with respect to above clauses, next payment due to him shall not be released unless and until he complies with the instructions to the full satisfaction of Engineer-in-charge.</p> <p>The Contractor shall adhere to the quality assurance system as provided in tender documents.</p> <p>Contractor shall provide all information and along with the consultant maintain C.T.E Registers. 38.9 The contractor shall engage a full time Quality Assurance/QC Engineer for each location as defined in tender document.</p> <p>Contractor shall use stage wise Checklist to ensure that all the construction activities are carried out complying with Specifications, Codes &amp; Standards, Typical formats of Checklist are as per Technical Specifications. These are attached separately with this Tender.</p>
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35	<b>MOBILIZATION ADVANCE</b>	NOT APPLICABLE FOR THIS TENDER
36	<b>DISTINCTION BETWEEN FOUNDATION AND SUPERSTRUCTURE</b>	<p>To distinguish between work in foundations and superstructures, the following criteria shall apply:</p> <p>For all Equipment pedestals, pipe racks, other foundation and R.C.C. Structures, work done up to 300 mm level above finished grade level will be taken as work in foundations and work above this level will be treated as work in superstructures and payments would be made accordingly.</p> <p>For Buildings only, all works upto level corresponding to finished floor level shall be treated as 'Work in foundation' and all works above the finished floor level shall be treated as "Work in superstructure".</p> <p>Irrespective of what has been stated above, all pavements, R.C.C. Retaining wall, all pipe sleepers and any similar item would be taken as work done in foundations irrespective of locations, nomenclature and levels given anywhere.</p> <p>Where not specifically pointed out all works in Cellars/ sumps, Tank Pads, Cable trenches, or such similar item would be taken as work in foundation.</p>
37	<b>SITE CLEANING</b>	<p>The Contractor shall clean and keep clean the work site from time to time to the satisfaction of the Engineer- in-Charge for easy access to work site and to ensure safe passage, movement and working.</p> <p>If the work involves dismantling of any existing structure in whole or in part, care shall be taken to limit the dismantling up to the exact point and/or lines as directed by the Engineer-in-Charge and any damage caused to the existing structure beyond the said line or point shall be repaired and restored to the original condition at the Contractor's cost and risks to the satisfaction of the Engineer-in-Charge, whose decision shall be final and binding upon the Contractor.</p> <p>The Contractor shall be the custodian of the dismantled materials till the Engineer-in-Charge takes charge thereof.</p> <p>The Contractor shall dispose of the unserviceable materials, debris etc. to any area as decided by the Engineer-in-Charge.</p>



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		<p>The Contractor shall sort out, clear and stack the serviceable materials obtained from the dismantling/renewal at places as directed by the Engineer-in-Charge.</p> <p>No extra payment shall be paid on the account of site cleaning.</p>													
		<p>Subject to the provisions in the contract document and without prejudice to Contractor's liabilities and responsibilities to provide adequate qualified skilled, semi-skilled and unskilled personnel on the work and augment the same as workout basis earned value method and decided by the Engineer-in-Charge depending upon the site requirement &amp; the exigencies of work so as to complete all works within the contracted time schedule and without any additional cost to OWNER. In case of any failure to augment resources as above Owner/Consultant reserve the right to deploy and deduct cost of such deployment from contractor's bills.</p> <p>42.2 Contractor shall mobilize the key personnel as detailed below. Contractor shall mobilize work force as per agreed schedule duly approved by Owner/ Consultant</p>													
38	SITE ORGANISATION	<table border="1"> <thead> <tr> <th>Sr. No.</th> <th>Category</th> <th>Nos. of Key Personnel (Minimum)</th> <th>Qualifications</th> <th>Experience</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Construction Manager</td> <td>1</td> <td>Degree / Diploma in Civil Engineering</td> <td>At least 5 years of experience for Degree holder or 7 years for Diploma holder in construction of relevant field.</td> </tr> </tbody> </table>	Sr. No.	Category	Nos. of Key Personnel (Minimum)	Qualifications	Experience	1.	Construction Manager	1	Degree / Diploma in Civil Engineering	At least 5 years of experience for Degree holder or 7 years for Diploma holder in construction of relevant field.			
		Sr. No.	Category	Nos. of Key Personnel (Minimum)	Qualifications	Experience									
1.	Construction Manager	1	Degree / Diploma in Civil Engineering	At least 5 years of experience for Degree holder or 7 years for Diploma holder in construction of relevant field.											



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		2.	QA / QC Engineer	1	Degree / Diploma in Mechanic al / Metallurg y Engineeri ng with ASNT	At least 3 years of experience for Degree holder or 5 years for Diploma holder in in Welding / Quality / NDT management in
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				Level-II in RT/UT	construction of relevant field.
		3.	Lead Planning / Billing Engineer	1	Degree / Diploma in Engineering/ Project Management At least 3 years of experience for Degree holder or 5 years for Diploma holder in executing projects in construction of pipelines in relevant field.
		4.	Safety Officer	1	Diploma in Industrial safety At least Diploma in Industrial Safety with minimum 3 years relevant Experience in Construction Safety.
<p><b>NOTE:</b></p> <p>1. The details of minimum manpower required to be mobilized by the execution contractor to complete the work within schedule is given above and is not exhaustive. Contractor is required to augment the above list with additional numbers/categories of workmen as required and directed by Engineer-In charge to complete the work within the completion time schedule and quoted price.</p> <p>2. The Manpower as identified above should have required qualification and adequate relevant experience.</p> <p>3. Contractor shall mobilize Construction Manager, QA/QC Engineer, Planning/ Billing Engineer and Safety Officer who will be the permanent employees of the Contractor and shall be available for the entire duration of job unless approved otherwise by BGL.</p>					



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		<p>4. Contractor shall mobilize the required manpower as per agreed schedule (month-wise) duly approved by BGL.</p> <p>5. Contractor shall submit bio-data of mandatory Key Supervisory Personnel meeting the requirement as above along with bid document. Contractor shall maintain record of actual mobilization of key personnel and work force and Joint record of mobilization will be maintained and offered to Owner/ Consultant for verification month-wise.</p> <p>In case of early mobilization or additional mobilization of manpower as compared to required manpower (based on approved schedule) to meet the schedule requirement, contractor shall not be entitled for any extra claim.</p> <p>Key personnel and manpower may be demobilized by the contractor on completion of work at site after written clearance of Engineer-in-charge. Price adjustment due to delayed mobilization or shortfall in mobilization of manpower shall be as below.</p> <p>a) The Key Supervisory Personnel as mentioned above shall be mobilized within 15 days of written instructions for mobilization given during Kick-off-meeting or by Engineer-in-charge based on front availability at site. In case of delay in mobilization or shortfall in Key personnel manpower, penal recovery shall be levied from 16th day onwards as per the recovery rates specified below till the date of mobilization of Key Supervisory personnel at site.</p> <p>b) All personnel of the contractor entering on work premises shall be properly and neatly dressed and shall wear uniform badges while working on premises of the Purchaser including work sites.</p> <p>c) In case Contract fails to depute required manpower, recovery will be made on contractor invoice at the following rate.</p>
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Sr. No.	Category	Rate Per Day of Normal Hours (In Rs.)
		2,500
1.	Construction Manager	2,500
2.	QA / QC Engineer	2000
3.	Lead Planning / Billing Engineer	2000
4.	Safety Officer	2000

39	<b>COMPLETION DOCUMENTS</b>	<p>Notwithstanding the provisions contained in standard specification, upon completion of work, the Contractor shall complete all of the related drawings and documents to the "AS BUILT" stage (including all vendor / sub-vendor drawings for bought out items), all Free-Issue-Material (FIM) documents and provide the Owner/Consultant, the following:</p> <ul style="list-style-type: none"> <li>i. One complete bound set of all original documents as mentioned but not limited to documents listed elsewhere in the bid document.</li> <li>ii. Three complete bound sets of documents as mentioned at (i) above, in original size and in 3 (three) pen drive.</li> <li>iii. Three complete bound sets of Contractor's specification including design calculations.</li> <li>iv. Three copies of Daily Progress Reports</li> <li>v. Three sets of all raw data collected / generated for and during execution of the entire job as specified in documents requirement.</li> <li>vi. Three sets of Closure report.</li> </ul> <p><b>Completion Documents</b></p> <p>The following documents shall be submitted in soft copy and hard binder by the Contractor in 3 (Three) sets, as a part of completion documents: ( as per the applicability of work)</p> <ul style="list-style-type: none"> <li>i. Welding Procedure Qualification Report.</li> <li>ii. Welder Qualification Report.</li> <li>iii. Radiographic Procedure Qualification.</li> <li>iv. Radiographic Report along with radiographs (Radiographs only with the original).</li> </ul>
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	<p>v. Batch Test Certificate from manufacturers for electrodes.</p> <p>vi. Pre-testing &amp; final Hydrostatic and other test results &amp; reports.</p> <p>vii. Electronic Geometry Pigging results &amp; reports as specified in technical document.</p> <p>viii. Pre-commissioning/ Commissioning checklist.</p> <p>ix. All other requirements as specified in the respective specifications.</p> <p>x. Approved Construction Drawing &amp; As built drawings.</p> <p>xi. Any other drawing/document/report specified elsewhere in the bidding document</p> <p>xii. No Claim / No Dues certificate by the contractor.</p> <p>xiii. Copies of deviation statement and order of extension of time, if granted.</p> <p>xiv. Copies of all documents related to statutory requirement i.e. Labour License, CAR Policy, Open Transit Policy, WCP, EPF, ESI Challans etc.</p> <p>xv. Any other contractual documents required on completion.</p> <p>xvi. Soft Copy of Pipe Book and Alignment Drawing, Isometric Drawing and other relevant documents.</p> <p>xvii. Test Certificate, Warrantee/Guarantee certificates and copies of Purchase Order with Prices blank from manufacturers for all supply material.</p> <p>xviii. All other requirements as specified in the respective specifications.</p> <p>xix. One set of reproducible on polyester film of construction drawing showing therein the execution of the work duly approved by the Engineer-in-Charge.</p> <p>Note: The Contractor shall be eligible to apply for issue of completion certificate after submission of completion documents as mentioned above.</p>
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40	<b>COORDINATION WITH OTHER AGENCIES</b>	Work shall be carried out in such a manner that the work of other agencies operating at the site is not hampered due to any action of the Contractor. Proper coordination with other agencies will be Contractor's responsibility. In case of any dispute, the decision of Engineer- in-Charge shall be final and binding on the Contractor.
41	<b>UNDERGROUND AND OVERHEAD STRUCTURES</b>	The information to possible extent regarding existing structures/ overhead lines, existing pipelines and utilities shall be informed to Contractor. Over and above Contractor may encounter other structures/ pipelines/ OFC etc., the Contractor is required to collect such information's on his own before commencing the work. The Contractor shall execute the work in such a manner that the said structures, utilities, pipelines etc. are not disturbed or damaged, and shall indemnify and keep indemnified the Owner from and against any destruction thereof or damages thereto.
42	<b>EXECUTION OF ELECTRICAL WORKS</b>	The Contractor shall engage an approved electrical agency for execution of electrical works so required for execution of the works under this Contract, holding valid electrical Contractor license. In case Contractor himself executes electrical works then he shall arrange valid electrical Contractor license before start of electrical works at site.
43	<b>RESPONSIBILITY OF CONTRACTOR</b>	It shall be the responsibility of the Contractor to obtain the approval for any revision and/or modifications decided by the Contractor from the Owner/ Engineer-in-charge before implementation. Also, such revisions and/or modifications if accepted/approved by the Owner/Engineer-in-charge shall be carried out at no extra cost to the Owner. Any changes required during and/or after approval for detailed construction drawings due to functional requirements or for efficient running of system keeping the basic parameters unchanged and which has not been indicated by the Contractor in the data/drawings furnished along with the offer will be carried out by the Contractor at no extra cost to the Owner.  All expenses towards mobilization at site and de-mobilization including bringing in equipment, clearing the site etc. shall be deemed to be included in the prices quoted and no separate payments on account of such expenses shall be entertained.



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		<p>It shall be entirely the Contractor's responsibility to provide, operate and maintain all necessary construction equipment, scaffoldings and safety gadgets, cranes and other lifting tackles, tools and appliances to perform the work in a workman like and efficient manner and complete all the jobs as per time schedules.</p> <p>Preparing approaches and working areas for the movement and operation of the cranes, levelling the areas for assembly and erection shall also be the responsibility of the Contractor. The Contractor shall acquaint himself with access availability, facilities such as railway siding, local labour etc. to provide suitable allowances in his quotation. The Contractor may have to build temporary access roads to aid his own work, which shall also be taken care while quoting for the work.</p> <p>The procurement and supply in sequence and at the appropriate time of all materials and consumables shall be entirely the Contractor's responsibility and his rates for execution of work will be inclusive of supply of all these items.</p> <p>Bidder shall note that any delays due to Sub-Vendor / Third Party appointed by contractor in Project execution &amp; completion shall be sole responsibility of the contractor.</p>
44	<b>GENERAL GUIDELINES DURING AND BEFORE ERECTION</b>	<p>Contractor shall be responsible for organizing the lifting of the equipment in the proper sequence, that orderly progress of the work is ensured and access routes for erecting the other equipment's are kept open.</p> <p>Orientation of all foundation, elevations, lengths and disposition of anchor bolts and diameter of holes in the supports saddles shall be checked by contractor, well in advance. Minor rectifications including chipping of foundations as the case may be, shall be carried out at no extra cost by the contractor after obtaining prior approval of the Engineer-in-Charge. The Contractor shall also be provided with the necessary structural drawings and piping layouts etc., wherever required for reference. During the structural member need to be dismantled, to facilitate the equipment erection, same shall be done by the contractor after ensuring proper stability of main structure with prior permission of Engineer-in-Charge. All such dismantled members shall be put</p>



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		<p>in position back after the completion of equipment erection to satisfaction of Engineer-in-Charge.</p> <p>During the performance of the work the Contractor at his own cost, shall keep structures, materials and equipment adequately braced by guys, struts or otherwise approved means which shall be supplied and installed by the Contractor as required till the installation work is satisfactorily completed. Such guys, shoring, bracing, strutting, planking supports etc. shall not interfere with the work of other agencies and shall not damage or cause distortion to other works executed by him or other agencies.</p> <p>Manufacturer's recommendations and detailed specifications for the installation of the various equipment and machines will be passed on to the contractor to the extent available during the performance of work. The requirements stipulated in these clauses shall be fulfilled by the Contractor.</p> <p>Various tolerances required as marked on the drawings and as per specifications and instructions of the Engineer-in-Charge, shall be maintained. Verticality shall be maintained. Verticality shall be verified with the Theodolite.</p>
45	<b>ERECTION OF EQUIPMENTS</b>	<p>Any erection which may be required, shall be carried out by Cranes of suitable capacity. Erection by derrick shall not be permissible. The contractor shall arrange the crane of suitable capacity required for erection and include cost for same in respective items without any liability on the part of Employer/Consultant.</p> <p>Bidder shall submit the indicative erection scheme for compressor/equipment and shall undertake the erection only after obtaining approval of erection scheme by Engineer-in-charge.</p> <p>Grouting of equipment's, anchor bolts, pockets and under base plates shall be carried out as per technical specifications.</p>
46	<b>REPAIR OF PIPE DEFECTS</b>	<p>Immediately prior to aligning pipe for welding, the bevelled ends of each joint of pipe and the area immediately adjacent thereto (at least 25mm from the edge on the inside and outside of the pipe) shall be thoroughly cleaned of paint, rust, mill scale, dirty or other foreign matter by use of power drive</p>



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		<p>wire buffing wheels, disc sanders, or by other methods approved by Employer/Consultant. This shall be done at no extra cost to Employer/Consultant.</p> <p>All damaged ends of pipe that are bent, cut or otherwise mutilated to such an extent that in the opinion of the Employer/Consultant, faulty alignment or unacceptable welding would result, shall be repaired or cut-off and re-bevelled to the correct angle with a bevelling machine of a type approved by Employer/Consultant. No compensation shall be allowed by reason of such recutting or bevelling, except when required because of the original bevel being damaged before the pipe is "taken over" by Contractor.</p> <p>Dents in bevels with a depth of less than 1 mm shall be removed by Contractor during cleaning and grinding, ahead of the welding in the field. Contractor shall re-bevel dented bevel ends with a depth between 1 and 3 mm. Dents over 3mm depth shall be repaired by cutting and re-bevelling</p>
47	<b>MECHANISED CONSTRUCTION</b>	<p>Contractor shall without prejudice to his overall responsibility to execute and complete the work as per specifications and time schedule adopt as far as practicable, mechanized construction techniques for major site activities. Contractor agrees that he will deploy the required numbers and types of the plant &amp; machinery applicable for different activities in consultation with the Engineer-in-charge during execution of works.</p> <p>Contractor further agrees that Contract price is inclusive of all the associated costs, which he may incur for actual mobilization, required in respect of use of mechanized construction techniques and that the Owner/Consultant in this regard shall not entertain any claim whatsoever in this regard.</p>
48	<b>CHECKING OF LEVELS</b>	<p>The Contractor shall be responsible for checking levels, orientation plan of all foundations, foundation bolts, etc., well in advance of taking up the actual erection work and bring to the notice of Engineer-in-Charge discrepancies, if any. In case of minor variations in levels etc. the Contractor shall carry out the necessary rectifications to the foundations within his quoted price.</p>



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		The Contractor shall also be responsible for checking with templates, wherever necessary, the disposition of foundation bolts with the corresponding bases of structure and shall effect rectifications, as directed, within his quoted rate.
49	<b>REGISTRATION OF THE CONTRACT WITH STATUTORY AUTHORITIES</b>	Before submission of their first invoice for Running payment, the Contractor shall register themselves and the contract at their own cost with the Reserve Bank of India, Income Tax, Sales Tax and such other statutory authorities, as may be required under the governing rules and regulations in India. The Contract Price shall be deemed to include all costs towards the same. The copies of all the related documents to all such registrations shall be submitted by the Contractor to Owner for their records and reference when-ever required during the tenure of the contract period
50	<b>AUDITS OF CONTRACT</b>	The project is subject to inspection by various audit/vigilance agencies of government of India/bgl., if any inspection of works is carried by such agencies, CONTRACTOR shall extend his full cooperation to these agencies in examining records, works etc. On inspection by such agencies, if it is pointed out that CONTRACTOR has not carried out work according to guidelines laid down in the tender document, immediate rectifications shall be taken up at no extra cost; and also if any recoveries against some items are pointed out therein, the same shall be recovered from CONTRACTOR's RA bills/final bill. The items under dispute shall not be paid in full till the job is completed to satisfaction of the inspection agency.
51	<b>SUBSEQUENT LEGISLATION</b>	All duties, taxes (on works Order/ trade tax/ turnover tax/etc. as applicable), fees, charges, expenses, etc. (except where otherwise expressly provided in the Order) as may be levied/ imposed in consequence of execution of the works or in relation there to or in connection therewith as per the Acts, Laws, Rules, Regulations in force shall be to contractor's account
52	<b>SINGLE POINT RESPONSIBILITY</b>	The entire work as per scope of work covered under this Order shall be awarded on Overall Lowest Cost Basis (L1) on single point responsibility basis.



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53	<b>WORK FRONT</b>	The work involved under this Order may include such works as have to be taken up and completed after other agencies have completed their jobs. The CONTRACTOR will be required and bound to take up and when the fronts are available for the same and no claim of any sort whatsoever shall be admissible to the CONTRACTOR on this account.
54	<b>TEMPORARY WORKS</b>	All Temporary and ancillary works including enabling works connected with the work shall be responsibility of the Contractor and the price quoted by them shall be deemed to have included the cost of such works which shall be removed by the contractor at his cost, immediately after completion of his work.
55	<b>DEFECTS AFTER TAKING OVER OR TERMINATION OF WORK CONTRACT BY OWNER</b>	The Contractor shall remain responsible and liable to make good all losses or damages that may occur/appear to the work carried out under this Contract within a period of 12 months from date of issue of the Completion Certificate and/or the date of Owner taking over the work, whichever is earlier. The Contractor shall issue a Bank Guarantee to the Owner in the sum of 10% of the work entrusted in the Contract, from any Scheduled bank (other than Co- operative Bank) acceptable to the Owner and if however, the Contractor fails to furnish such a Bank Guarantee the Owner shall have right to retain the Security Deposit and Retention Money to cover the 10% of the Guarantee amount under this clause and to return/refund the same after the expiry of the period of 12 months without any interest thereon.
56	<b>GRIEVANCE REDRESSAL MECHANISM</b>	There is a grievance redressal mechanism in BGL for vendors participating in the tender, the details of which are available on BGL's website <a href="http://www.bglgas.com">www.bglgas.com</a>
57	<b>ROYALTY</b>	<p>All royalties etc., as may be required for any entry permits, including right of way etc., to be arranged by Contractor shall be deemed to have been included in the quoted prices. Owner will not be able to obtain exemption from payment of royalty charges.</p> <p>Bidder's quoted rates shall include the royalty on different applicable items as per the prevailing State Government rates. Any increase in prevailing rate of royalty shall be borne by the Contractor at no extra cost to Owner.</p>



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		Documentary evidence to be furnished by Contractor along with the bills.
58	<b>EXCAVATION BY BLASTING</b>	Not applicable for this tender.
59	<b>BREACH OF CONTRACT</b>	In case of separate orders issued for various Parts or locations / Schedule(s) of the works in respect of Composite Works for MS, The Contractor shall be responsible for execution of all orders to the entire satisfaction of the Owner and breach in one order shall constitute as breach in the other order and accordingly appropriate action shall be taken as per stipulations of the order.
60	<b>CONTRACTOR'S STANDARD CONDITIONS</b>	Contractor's standard conditions if any shall not be applicable to the Contract.
61	<b>PATENTS, INFRINGEMENT &amp; INDEMNITY</b>	<p>Contractor shall protect and fully indemnify Owner from any claims for infringement of patents, copyright, trademark or the like.</p> <p>Contractor shall also protect and fully indemnify Owner from any claims from Contractor's workmen/employees, their heirs, dependents, representatives etc. Or from any other persons/persons or bodies/companies etc. for any act of commission or omission while executing the Contract.</p> <p>Contractor shall be responsible for compliance with requirements under the laws and shall protect and indemnify completely Owner from any claims/penalties arising out of any infringements.</p>
62	<b>IMPORT LICENCE</b>	Contractor shall arrange import of all materials required for permanent incorporation in the works in respect of Composite Works for MS as well as construction equipment as per the guidelines laid down by the Relevant Authorities. Owner/Consultant shall not provide import license.
63	<b>WITHHOLDING, ACCOUNTING AND TAX REQUIREMENTS</b>	Contractor agrees for withholding from wages and salaries of its agents, servants or employees all sums, required to be withheld by the laws of the Republic of India or any other agency having jurisdiction over the area where Contractor is conducting operations, and to pay the same promptly and directly when due to the proper authority. Contractor further agrees to comply with all accounting and reporting



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		requirements of any Nation having jurisdiction over the subject matter hereof and to conform to such laws and regulations and to pay the cost of such compliance. If requested, Contractor will furnish the evidence of payment of applicable taxes, in the country(ies) of the Contractor's and his sub-contractor(s) and expatriate employees.
64	<b>INTELLECTUAL PROPERTY</b>	Neither Owner/Consultant nor Contractor nor their personnel, agents nor any sub-contractor shall divulge to anyone (other than persons designated by the party disclosing the information) any information designated in writing as confidential and obtained from the disclosing party during the course of execution of the works so long as and to the extent that the information has not become part of the public domain. This obligation does not apply to information furnished or made known to the recipient of the information without restriction as to its use by third parties or which is demonstrated to be in recipient's possession at the time of disclosure by the disclosing party. Upon completion of the works or in the event of termination pursuant to the provisions of the Contract, Contractor shall immediately return to Owner/Consultant all drawings, plans, specifications and other documents supplied to the Contractor by or on behalf of Owner/Consultant or prepared by the Contractor solely for the purpose of the performance of the works, including all copies made thereof by the Contractor.
65	<b>DRAWINGS AND DOCUMENTS</b>	<p>The drawings accompanying the bid document (if any) are of indicative nature and issued for bidding purpose only. Purpose of these drawing is to enable the Bidder to make an offer in line with the requirements of the Owner. However no extra claim whatsoever, shall be entertained for variation in the "Approved for Construction" and "Tender drawings" regarding any changes/units. Construction shall be as per drawings/specifications issued/approved by the Engineer-in-Charge during the course of execution of work. Detailed construction drawings (wherever required) on the basis of which actual execution of work is to proceed will be prepared by the Contractor.</p> <p>The drawings and documents to be submitted by the Contractor to Owner after award of the LOA as per the requirements enlisted in the IFB shall be for Owner's review,</p>



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Gas Limited

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information and record. The Contractor shall ensure that drawings and documents submitted to Owner are accompanied by relevant calculations, data as required and essential for review of the document/ drawings.

All documents and drawings including those of Contractors' sub-vendor's manufacturer's etc. shall be submitted to Owner after having been fully vetted in detail, approved and co- opted by the Contractor & shall bear Contractor seal/ certifications to this effect. All documents/drawings & submissions made to Owner without compliance to this requirement will not be acceptable and the delay & liability owing to this shall be to the Contractor's account.

The Contractor shall, upon request of the Owner, submit all drawing and documents as envisaged herein to the Consultant. The Consultant shall review the drawings/ documents within 15 days from the date of submission provided the same are accompanied by relevant calculations, data as required and essential for review. Upon review of the submitted documents, Consultant may give their comments and ask for redesign/ resubmission after necessary rectifications/ modifications and the time frame of 15 days will be applicable for the same.

The review of documents and drawings by Owner/Consultant shall not absolve Contractor from its responsibility to meet the requirements of specifications, drawings etc. and liabilities for mistakes and deviations. Upon receiving the comments on the drawing/documents reviewed by Owner/Consultant, Contractor shall incorporate the comments as required and ensure compliance.

Copies of all detailed working drawing relating to the works shall be kept at the Contractors' office at the site and shall be made available to the Engineer-in-charge/ Owner/Consultant at any time during execution of the Contract. However no extra claim what so ever shall be entertained for any variation in the "approved/issued for construction drawings" and "tender drawings "regarding any changes/units unless otherwise agreed.

The Contractor shall rectify any inaccuracies, errors and or non-compliance of requirements envisaged in the Contract. Any delay occurring for reasons attributable to such



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		inaccuracies, error and or non-compliance shall not construe a reason for delay/ extension.
66	<b>HOUSE KEEPING</b>	<p>It is the responsibility of the Contractor to maintain general cleanliness and proper housekeeping at work site. Contractor shall organize disposal of excavated earth /garbage/ rubbish/ scrape, electrode butts etc. on day to day basis to identified disposal areas/safe areas as per Owner / Consultant.</p> <p>The CONTRACTOR shall dispose off the unserviceable materials, debris etc. to the earmarked area within / outside the work site as decided by the Owner / Consultant. No extra payment shall be paid on this account. Serviceable materials shall be stored in designate area separately after obtaining acknowledgement of duly authorized officer of Owner.</p>
67	<b>PROTECTION OF EXISTING FACILITIES</b>	<p>Contractor shall obtain all safety clearance (viz. excavation, hot/cold work permit).</p> <p>Contractor shall obtain plans and full details of all existing and planned underground services from Owner / Consultant and shall follow these plans closely at all times during the performance of work. Contractor shall be responsible for location and protection of all underground lines and structures at its own cost.</p> <p>Despite all precautions, should any damage to any structure / utility etc. at Site occur, the Contractor shall contact the Owner / Consultant / authority concerned and Contractor shall forthwith carry out repair at its expenses under the direction and to the satisfaction of Owner / Consultant and Owner / Consultant/concerned authority.</p> <p>Contractor shall take all precautions to ensure that no damage is caused to the existing pipelines, cables etc., at Site during construction. Existing structures, existing compound wall, tiling and other items damaged / disturbed during construction shall be repaired and restored to their original condition by Contractor after completion of relevant works to the complete satisfaction of Owner.</p> <p>If required, CONTRACTOR shall in consultation with Owner and Consultant and the concerned authorities, take adequate measures for strengthening the existing electric poles, cast</p>



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		<p>iron pipes, sewer lines, GI pipelines telephone poles etc. in the proximity of proposed City Gate Station. CONTRACTOR shall take adequate protective measures to prevent damage to these facilities during execution of above said work.</p> <p>Contractor shall have to adopt such method of construction as will be suitable for working at Site using the limited space available and without causing any damage to Site. Contractor shall be deemed to have taken cognizance of all such constraints, etc. while working at Site and Contractor shall not be entitled to claim any extra at a later stage.</p> <p>All the monuments, articles of value of antiquity and structure or other remains of geological or archaeological discovered on the site of works shall be declared to be the property of the Owner during the entire course of execution of work. Site Contractor shall take reasonable precautions to prevent these workmen or any other persons from removing or damaging any such articles or thing and shall immediately inform the Owner / Engineer-in-charge and thereafter hand them over immediately back to Owner in their existing condition, as per the instructions of Owner / Engineer-in-charge, at no extra cost to Owner.</p>
68	<b>CONSTRUCTION</b>	<p><b>RULES AND REGULATIONS</b></p> <p>CONTRACTOR shall observe in addition to Codes specified in respective specification, all Applicable Laws and shall be responsible for any extra costs arising from non-adherence with the same.</p> <p><b>PROCEDURES</b></p> <p>Contractor shall prepare and submit all the plans, procedures and documents to Consultant / Owner as specified in the Contract.</p> <p><b>CONSTRUCTION EXECUTION PLAN</b></p> <p>Contractor shall submit Construction Execution Plan to Consultant / Owner for review and approval while providing the Project Execution Strategy. The Construction Execution Plan shall detail the execution methodology of the Contractor</p>



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		<p>during execution of City Gate Station covering the following aspects as minimum:</p> <p>Contractor's Construction Execution Plan shall include:</p> <p>Contractor's man-power and its deployment schedule on monthly basis.</p> <p>Other plans of Contractor and procedures to be submitted at least 04 weeks prior to start of respective activity at site include the following as minimum:</p> <p>Temporary facilities, etc.</p> <p>Scaffolding Plan</p> <p>Heavy Transport &amp; Heavy Lifting Plan ( Rigging Plan)</p> <p>Pre-Fabrication Plan</p> <p>Hydro-test Plan</p> <p>Other activity plans (eg. Piping, equipment and steel structure erection plan etc)</p> <p>Monsoon Counter measures and preparation.</p> <p>Emergency Evacuation Procedure</p> <p>Storm Management Plan.</p>
69	<b>WORKING HOURS</b>	<p>Normal working Hours shall be from 09:00 am to 05:30 pm. However, the same may be extended by Owner/Consultant on request and need basis. However, working hours for work within the work site shall be governed by the work permits issued by Owner.</p> <p>Depending upon the requirement, Works Time Schedule / drawing programmes and the target set to complete the relevant work in time, the works may have to continue beyond normal working hours to the extent of round the clock also, for which no extra claim shall be entertained.</p>
70	<b>HYDROSTATIC TESTING</b>	<p>The Bidder as per the technical specification along with its Tender taking into account the Completion Period shall furnish the detailed procedure proposed for the hydrostatic testing. The necessary piping, pumps etc. shall be provided by the Contractor. The final disposal of water after testing shall be</p>



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		<p>Contractor's responsibility and should be in such a way that neither the traffic movement even pedestrians nor the standing crop in nearby fields gets affected. Suitable drains shall be provided for this purpose as directed by the Engineer-in-Charge within the Contract Price.</p> <p>The Contractor shall propose and obtain approval of Engineer-in-Charge based on drawings, availability of water for hydro testing and keeping in view other exigencies, if any before starting hydro testing work. The Contractor will carry out the hydrostatic test for approved number of test section including preparation for test and tie-ins, without any time and cost implication on this account to Owner/Consultant. Any increase or decrease in number of test sections will not have any cost implication to Owner / Consultant.</p>
71	<p><b>PROJECT PLANNING, SCHEDULING AND MONITORING SYSTEM</b></p>	<p>The following schedules/documents/reports shall be prepared and submitted by the Contractor for review/approval at various stages of the Contract.</p> <p>Work Time Schedule at the time of submitting the Tender and Project Schedule after the Award of Contract</p> <p>a) Works Time Schedule</p> <p>The Works Time Schedule submitted by the Bidder for the execution of work (including mobilization period) shall be developed keeping in mind the Completion Period and the provisions of the IFB.</p> <p>The Contractor is required to submit a Works Time Schedule in Primavera. The Works Time Schedule shall cover all aspects like sub-ordering, manufacturing and delivery, indicated in the Tender Documents. The Owner interface activities shall be clearly identified with their latest required dates. Owner reserves the right to disqualify the Bidder if the above Works Time Schedule submitted by the Bidder is not in line with the overall requirement of the Project.</p> <p>b) Scheduling &amp; Monitoring System</p> <p>The Bidders should describe their system of scheduling and monitoring the works in respect of execution of Composite</p>



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		<p>Works for MS, the extent of computerization, level of detailing, tracing methodology etc. with the name of computer package and sample outputs.</p> <p>c) Overall Project Schedule</p> <p>The Contractor shall submit within 1 week of LOA, a sufficiently detailed overall intended 'Project Schedule' in the activity network form, clearly indicating the major milestones, interrelationship/ interdependence between various activities together with analysis of critical path and floats.</p> <p>The intended 'Project Schedule' will be reviewed and approved by Engineer- in-Charge and the comments if any shall be incorporated in the network before issuing the same for implementation. The network thus finalized shall be referred as the 'Project Schedule' and form part of the Contract and the same shall not be revised without the prior permission from Engineer-in- Charge during the entire period of Contract.</p> <p>d) Progress Measurement Methodology</p> <p>The Contractor is required to submit within 1 week of award of LOA, the methodology of progress measurement of sub-ordering, manufacturing/ delivery, sub- contracting construction and commissioning works and the basis of computation of overall services/physical progress informed. Owner reserves the right to modify the methodology in part or in full.</p> <p>e) Functional Schedules</p> <p>The Contractor should prepare detailed functional schedules in line with network for functional monitoring and control and submit scheduled progress covers for each function viz. ordering, delivery and construction.</p>
72	<b>Project Review Meetings</b>	<p>The Contractor shall present the programme and status at various review meetings as required.</p> <p><b>Weekly Review Meeting</b></p> <p>Level of Participation Agenda</p>



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		<p>Contractor's / Consultant's construction Manager &amp; Job Engineers.</p> <p>a. Weekly programme v/s actual achieved in the past week &amp; programme for next week.</p> <p>b. Remedial Actions and hold up analysis.</p> <p>c. Client query/ approval.</p> <p>d. Status of HSE adherence / compliance</p> <p>Venue: Site Office</p> <p><b>Monthly Review Meeting</b></p> <p>Level of Participation Agenda</p> <p>Senior Officers of Owner/Consultant and Contractors.</p> <p>Progress Status/ Statistics</p> <p>a. Completion Outlook</p> <p>b. Major hold ups/slippages</p> <p>c. Assistance required</p> <p>d. Critical issues</p> <p>e. Client query/ approval</p> <p>f. Status of HSE adherence / compliance</p> <p><b>Progress Reporting Proforma</b></p> <p><b>A. Monthly Progress Report</b></p> <p>This report shall be submitted by the Contractor to Owner/Contractor on a monthly basis within 10 (ten) calendar days from cutoff date, as agreed upon covering overall scenarios of the Composite Works for MS. The report shall include, but not limited to the following:</p> <p>Brief Introduction of the work.</p> <p>a. Activities executed/ achievements during the month.</p> <p>b. Schedule versus actual percentage progress and progress curves for Detail Engg. Sub- ordering, manufacturing/delivery,</p>
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		<p>sub-contracting, construction, commissioning and overall and quantum wise status &amp; orders against schedule.</p> <p>c. Area of concern/ problem/ hold-ups, impacts and action plans.</p> <p>d. Resources deployment status.</p> <p>e. Annexures giving status summary for drawings, MRs, deliveries, sub-contracting and construction.</p> <p>f. Procurement status for items to be supplied by Contractor.</p> <p><b>B. Weekly Reports</b></p> <p>The report will be prepared and submitted by the Contractor to Owner/Consultant on weekly basis and will cover following items:</p> <p>a. Activities programmed and completed during the week.</p> <p>b. Resource deployed men and machines.</p> <p>c. Quantities achieved against target in construction</p> <p>d. Record of man-days lost.</p> <p>e. Construction percentage progress schedule and actual.</p> <p><b>C. Daily Reports</b></p> <p>a. Activity programme for the day</p> <p>b. Progress of the previous day and commutative progress.</p> <p>c. Manpower &amp; machinery deployed.</p> <p>D. Any other additional reports/ information as may be required by Engineer In Charge</p> <p><b>Progress Reports</b></p> <p>Contractor shall make every effort to keep the Owner adequately informed as to the progress of the works in respect of execution of work throughout the duration of the Contract.</p> <p>Contractor shall keep the Owner informed well in advance of the relevant Project Schedule so as to enable the Owner to arrange for requisite inspection to be carried out in such a manner as to minimize interference with progress of works. It</p>
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		<p>is imperative that close coordination be maintained with the Owner during all phases of Composite Works for MS.</p> <p>By the 10th (tenth) of each month, Contractor shall furnish the Owner a detailed report covering the progress as of the last day of the previous month. These reports will indicate actual and scheduled percentage of completion of construction as well as general comments of interest or the progress of various phases of execution of the work. The frequency of progress reporting by the Contractor shall be weekly.</p> <p>Once a week, Contractor shall submit a summary of the works accomplished during the preceding week in form of percentage completion of the various phases to the Owner.</p> <p>Progress reports shall be supplied by Contractor with documents such as chart, networks, photographs, test certificate etc. Such progress reports shall be in the form and size as may be required by the Owner and shall be submitted in at least 3 (three) copies.</p> <p>Contractor shall prepare daily progress report (DPR) in the desired format and submit it to Engineering-In-Charge along with schedule of next day to Engineer-In-Charge.</p>
73	<b>PIPES FOR WELDING QUALIFICATION</b>	<p>For the purpose of qualification of welding procedure, operators, Contractor may use the same pipes issued by Employer/Consultant. However, accounting of such pipes shall be done within the unaccountable wastage and scraps limit as defined in bidding document.</p> <p>The bare pipes for the purpose as above shall be issued within two week from the date of FOI/FOA. The contractor shall bear all cost towards lifting, carting from issue point to work site/Contractor's store, custody, handling, insurance and levies etc. and return of surplus/scrap materials to employer designated storage point. No separate payment shall be made for such expenditure.</p>
74	<b>SPARES</b>	<p>Contractor shall procure and supply all spare parts required during commissioning of the various items / materials supplied by him as enumerated in the Bidding Document. The quoted lumpsum prices shall be deemed to have been inclusive of all such provision of commissioning spares, required till</p>



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		<p>commissioning of such items. Contractor shall make available all the commissioning spares required at site at least 4 (four) weeks before start of commissioning. However, listed spares not used during commissioning shall be handed over to Employer at their designated place. Contractor shall also supply commissioning spares not listed but required during commissioning within the contracted price.</p> <p>In addition to above, special tools &amp; tackles required, if any, for operation &amp; maintenance shall also be supplied by the Contractor and the quoted prices shall be deemed to have been inclusive of all such provisions.</p>
75	<b>STORAGE FACILITIES</b>	<p>The Contractor shall store all materials / instruments required for calibration and testing of the instruments in suitable condition / environment conducive for the same at its own cost. The Contractor shall provide these facilities within the quoted rate.</p>
76	<b>WORK PERMIT</b>	<p>When Contractor is working at Site, Contractor shall note that Contractor would be required to obtain applicable hot work/ cold work permits on daily basis from the competent authority. Contractor shall also comply with all the conditions on the work permit / entry permits at no extra cost to Owner. Contractor shall be required to obtain police verification for obtaining work/entry permits to work inside the work site for all the employees and workers employed for the various works.</p> <p>The Contractor shall provide identity cards to all its staff/workmen who will be working inside the Site/Premises, The ID cards will have to be produced by the Contractors' workmen as and when demanded by the Owner's representatives or security personnel at Site/ Premises.</p> <p>Action where there is no specification:</p> <p>In case of any class of work for which there is no specification mentioned, the same shall be carried out in accordance with the latest edition of Indian Standard Specifications subject to the approval of the Owner.</p> <p>Typographical or Clerical Errors</p>



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		Owner clarifications regarding partially omitted particulars or typographical or clerical errors shall be final and binding on the Contractor.
77	<b>BUILDING AND OTHER CONSTRUCTION WORKER'S ACT</b>	<p>In order to govern welfare and working conditions of labourers engaged in construction activities, the Building and other Construction Workers' (Regulation of Employment and Conditions of Service "RE&amp;CS") Act, 1996 came into force. RE&amp;CS Act'1996 is applicable in respect of building and other construction work. Wherever applicable, The Contractor shall strictly comply with the following provisions pertaining to RE &amp;CS Act'1996.</p> <p>a. The Contractor shall be registered with the concerned authorities under the Building and Other Construction Workers' (RE&amp;CS) Act, 1996 or in case of non-registration; the CONTRACTOR shall obtain registration within one month of the award of LOA.</p> <p>b. The CONTRACTOR shall be responsible to comply with all provisions of the Building and Other Construction Workers' (RE&amp;CS) Act, 1996, the Building and Other Construction Workers' Welfare Cess Act, 1996, the Building and other Construction Workers' (RE&amp;CS) Rules, 1998 and the Building and Other Construction Workers Welfare Cess Rules, 1998.</p> <p>c. Cess as per the prevailing rate, shall be deducted at source from bills of the Contractor by the Engineer-In-Charge of the Contract and remitted to the "Secretary, Building and Other Construction Workers Welfare Board" of the concerned State. The Contractor shall be responsible to submit final assessment return of the cess amount to the assessing officer after adjusting the cess deducted at source.</p> <p>Before starting of work, the Contractor shall obtain a license from concerned authorities under the Contract Labour (Abolition and Regulation) Act, 1970, and furnish a copy of the same to the Engineer-in-Charge.</p> <p>Every worker engaged by the Contractor should be enrolled under the following scheme(s):</p> <p>i. Pradhan Mantri Jeevan Jyoti Bima Yojna (PMJJBY)</p>



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		<p>ii. Pradhan Mantri Suraksha Bima Yojna (PMSBY)</p> <p>Under the two schemes, applicable annual premium amount (presently Rs. 342/- per person) shall be considered by the prospective bidder while submitting the price bid. Proof of payment towards the above two scheme shall be submitted by the Contactor to EIC for verification of the same from time to time.</p>
78	<b>BUILDING AND OTHER CONSTRUCTION WORKERS (BOCW) WELFARE CESS</b>	<p>82.4.1 BOCW, if applicable, shall be paid extra at actual against the documentary proof of submission against payment of BOCW to relevant tax authorities.</p> <p>Notwithstanding the foregoing, Owner shall not bear any liability in respect of:</p> <p>a) Personal taxes on the personnel deployed by the Contractors, his sub-contractors and Agents, etc.</p> <p>b) The Corporate taxes in respect of Contractor and his Sub-contractors and other Agents, Indian or foreign based.”</p>
79	<b>GOVT. ACTS/ REGULATIONS</b>	<p>Any reference to the specific statutes/regulations in the IFB is only indicative, and it is entirely for the Bidder to ascertain the Applicable Laws.</p>
80	<b>SUBSTITUTION, WRONG SUPPLIES AND SHORT SUPPLIES</b>	<p>Unauthorized substitution or materials delivered in error, other than those mentioned in the Contract, or material of sub-standard quality or supplied in excess quantity (unless authorized by the buyer), shall be rejected and the rejected goods if any shall be returned to Contractor at Contractor 's cost and risk.</p>
81	<b>CEMENT &amp; STEEL</b>	<p>In partial modification to Clause. 7.e and 7.f of (GTC-WORK CONTRACT), unless until specified explicitly in the IFB, supply of cement and steel shall be arranged by Contractor and the cost of the same shall be deemed to be included in the quoted rates.</p>
82	<b>QUANTITY VARIATION FOR SUPPLY &amp; WORKS</b>	<p>Owner reserves the right, at the time of execution of Contract, to increase or decrease the quantity of goods for all items as specified in the IFB up to +/- 25% without any change in the unit prices (as well as lump sum prices, if any) and other terms and conditions. Bidder's quoted rates shall be valid for such quantity variation.</p>



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83	<b>RECOVERY OF FAILURE OF ITEMS FOR SUPPLY</b>	<p>In case the items supplied by the Contractor fails during fabrication and or erection due to manufacturing defect the Contractor shall become liable to replace the items without any additional cost to Owner and in a timely manner so as not to deviate from the Completion Period.</p> <p>The Contractor shall bear the landed cost for replacing the defective items, including all costs incurred up to delivery thereof at site, all duties, freight, insurance, labour, material, charges for cutting, removing, replacement, engineering and construction supervision charges of consultant, and relaying of defective part(s), including cost of incidental activities.</p>
84	<b>JURISDICTION</b>	The courts at Mumbai (India) shall have exclusive jurisdiction over all Disputes arising under or in connection with the CONTRACT.
85	<b>INTEGRITY PACT</b>	<p>Integrity Pact: All tenders and contracts shall comply with the requirements of the Integrity Pact (IP) if the value of such tenders or contracts exceed Rs.1 crore. Failure to sign the Integrity Pact shall lead to outright rejection of bid.</p> <p>The successful tenderer shall execute Integrity Pact with Owner as per the enclosed Draft Integrity Pact Agreement. Hard copy of the same duly filled signed, stamped by authorized person and witnessed to be forwarded along with EMD in physical condition so as to be received at Tractebel Office prior to bid due date and time.</p>
86	<b>EPMC CONSULTANT</b>	Notwithstanding anything contained elsewhere, Bidder acknowledges that the EPMC Consultant has been engaged by Owner for procurement assistance, tendering, evaluation of tenders and recommendation for placement of orders including expediting and inspection, and accordingly, the Bidder /Contractor shall be required to function in close co-ordination with the Consultant.
87	<b>PENALTIES</b>	<p>BGL shall have right to levy following penalties on the Contractor and deduct applicable amount from the Contractor's Running Bills:</p> <p>87.1 In case proper barricading, as per technical specification and instruction of EIC is not provided, the work shall be immediately suspended till such time proper barricading, as</p>



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		<p>per the technical specification is provided and penalty will be levied as per SCC clause "PENALTIES" 87.3.</p> <p>87.2 In case required numbers of safety equipment like Safety Harness belts, helmets, fluorescent jackets etc as per the Technical Specifications and Special conditions of the contract of the tender, could not be provided by the contractor during execution, work shall be suspended, and penalty will be levied as per SCC clause "PENALTIES" 87.3.</p> <p>87.3 Either of the case as in clause "PENALTIES" 87.1 &amp; 87.2 above shall attract penalty of <b>INR 1000.00</b> per instance. Any subsequent instance shall attract penalty of <b>INR 5000.00</b> per instance with a notice to contractor. Subsequent non-compliance within 5 days shall lead to a deduction of up-to 1% from RA bill at the discretion of the EIC and may also lead to blacklisting of the contractor for future jobs.</p> <p>87.4 In case of complete compliance of HSE norms throughout the contract period the contractor shall be issued a letter of appreciation by the Owner on recommendation by the consultant.</p> <p>87.5 In case required numbers of equipment, Tools &amp; Tackles, shuttering, vibrators, cubes auto level etc. as per the scope of work &amp; Technical Specifications, could not be provided by the contractor at the time of need, a notice shall be issued to the contractor by Engineer- In charge and <b>INR 1000/-per day</b> shall be levied as penalty till such time the equipment, Tools &amp; Tackles are made available for completion of the work.</p> <p>87.6 Failure to submit weekly &amp; monthly reports by 10th of every month, a penalty of <b>INR 500/- per instance per day</b> shall be levied till the time report is submitted to the Engineer-in Charge.</p> <p>87.7 Failure to adhere to the timelines of project as mutually decided before start of project by Engineer In Charge and contractor, shall invite a penalty of <b>INR 5000 per week</b> (provided the delay is attributable to the contractor) unless such failure is due to force majeure. The deduction will be made in RA bills. In case of delay beyond the validity of</p>
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		<p>purchase order, penalty of ½% per week shall be levied subjected to a maximum of 5% of total purchase order value.</p> <p>87.8 In case the contractor does not mobilize the required machines at site and fails to start the work within one week from the intimation received from Engineer-In charge adhering BGL safety standards. Owner at its sole discretion may get it executed from an alternate agency at the risk and cost of the contractor shall be borne by contractor. Also, an administrative charge @ 15% over and above the actual cost incurred shall be levied from contractor's bill. In case, no work is done, penalties will be deducted from CPBG.</p> <p>87.9 Delay in submission of test reports within 7 days of intimation by Engineer in-charge shall invite a penalty of INR1000 per instance.</p> <p>87.10 In case of installation of contractor's supplied material without inspection and prior approval EIC/sited in charge, <b>INR 5000/- per instance</b> shall be levied from the running bills.</p> <p>87.11 For non-execution / poor quality of restoration work till completion of the work in respective area, a penalty of INR 5000/- per week or part thereof shall be imposed on contractor till satisfactory execution &amp; acceptance by EIC following submission of NOC from respective Local Authority/statutory bodies. In addition to this, in case of any penalty imposed by statutory Authority / third party to Owner for non-execution/ poor quality of restoration, the same penalty shall be recovered from underground utilities.</p> <p>87.12 In case of non- compliance of statutory provisions penalty will be imposed by the owner as detailed below:</p> <p>a) Contractor's failure to submit RPFC/ ESI challans of previous month along with the bills during the validity of the contract, Owner shall deduct 5% (Five percent) of payable amount from the contractor's running bill and retain the same as a deposit. Such retained amount shall be refunded to contractor on production of RPFC challan/ receipt. In case of non-submission of challans for a particular month, a penalty of INR 5000 /- shall be imposed for that particular month.</p>
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		<p>b) Delay of more than 21 days from the date of PO / LOI in obtaining / submitting WC cover or taken for shorter duration will result into penalty of <b>INR 5000/- per week</b> or part thereof.</p> <p>c) Delay of more than 21 days from the date of PO / LOI in obtaining / submitting the required insurance policies as specified in the tender document will result into a penalty of <b>INR 5000/- per week</b> or part thereof.</p> <p>d) The contractor must obtain labour licence at the start of work at allotted site. Delay of more than 30 days from the date of PO / LOI in submitting the labour licence shall attract a penalty of <b>INR 5000/- per week</b> or part thereof.</p> <p>87.13 In case contractors sub-let his part or whole work, contractor shall be liable for a penalty of <b>INR 5000.00 per instance</b> on issuance of site memo. Any subsequent instance shall attract penalty of <b>INR 10,000.00</b> with a notice to contractor to remove the sub-contractor within 15 days. Subsequent non-compliance within 15 days shall lead to a deduction of penalty up to 1% of total executed work value from RA bill at the discretion of the EIC / Owner / Consultant and may also lead to blacklisting of the contractor for future jobs as per owner policy. The owner / Consultant may terminate the contract and the remaining work shall be carried out at the risk and cost of the contractor.</p>
88	<b>SAFETY CODE</b>	<p>The Contractor shall at his own expenses arrange for the Safety provisions as may be necessary for the execution of the work or as required by the Engineer-in-Charge in respect of all labours directly or indirectly employed for performance of the works and shall provide all facilities in connections therewith. In case the contractor fails to make arrangements and provide necessary facilities as aforesaid, the Owner shall be entitled but not bound to do so and recover the cost thereof from the Contractor.</p> <p>From the commencement to the completion of the works, the contractor shall take full responsibility for the care thereof and of all the temporary works (defined as meaning all temporary works of every kind required in or for the execution, completion or maintenance of the works). In case damage, loss or injury shall happen to the works or to any part thereof or to temporary works due to any cause whatsoever the contractor</p>



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		<p>shall repair at his (Contractor's) own cost and make good the same so that at the time of completion, the works shall be in good order and condition and in conformity in every respect with the requirement of the contract and Engineer-in Charge's instructions.</p> <p>In respect of all labour, directly or indirectly employed in the work for the performance of the Contractor's part of this agreement, the contractor shall at his own expense arrange for all the safety provisions as per relevant Safety Codes of C.P.W.D, Bureau of Indian Standards, the Electricity Act/I.E. Rules. The Mines Act and such other Acts as applicable.</p> <p>The Contractor shall observe and abide by all fire and safety regulations prescribed by the local government and/or the Owner. Before starting construction work, the Contractor shall consult the Owner's Safety Engineer or Engineer-in-Charge/Site-in-Charge and must make good to the satisfaction of the Owner any loss or damage due to fire to any portion of the work done or to be done under this agreement or to any of the Owner's existing property.</p> <p>The Contractor will be fully responsible for complying with all relevant provisions of the Contract Labour Act and shall pay rates of Wages and observe hours of work/conditions of employment according to the provisions under the applicable Law and rules in force from time to time.</p> <p>The Contractor will be fully responsible for complying with the provision including documentation and submission of reports on the above to the concerned authorities and does hereby indemnify the Owner from any such lapse for which the Government may take action against them.</p>
89	<b>CLOSING OF PO</b>	<p>Contractor to close the work order within Three (03 months, once the value is consumed or validity is expired (including time extensions for completion of scope of work, if required). In case contractor fails to close the work order within this period, Owner/PMC will short close the work order as per data available on the record. OWNER reserves the right to adjust any pending liability of the closed work order /contract from the any other running work order /contract.</p>



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43. DIRECT PAYMENTS TO SUB-VENDORS/ SUPPORTING AGENCIES OF MAIN CONTRACTOR
44. SUB-LETTING OF WORKS
45. BONUS FOR EARLY COMPLETION
46. PRADHAN MANTRI SURAKSHA BIMA YOJANA (PMSBY) AND PRADHAN MANTRI JEEVAN JYOTI BIMA YOJANA (PMJJBY)
47. FORCE MAJEURE (FOR COVID-19)



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1. GENERAL

- 1.0 Special conditions of contract (SCC) shall be read in conjunction with the General Conditions of Contract (GCC). Schedule of rates, specifications of work, drawings and any other document forming part of this contract wherever the context so requires.
- 1.1 Notwithstanding the sub-division of the document into these separate sections and volumes, every part of each with and into the contract so far as it may be practicable to do so.
- 1.2 Where any portion of the GCC is repugnant to or at variance with any provisions of the special conditions of contract, then unless a different intention appears, the provision(s) of the special conditions of contract shall be deemed to override the provision(s) of GCC only to the extent that such repugnancies of variations in the special conditions of contract are not possible of being reconciled with the provisions of GCC.
- 1.3 Wherever it is stated in this Bidding Document that such and such a supply is to be effected or such and such a work is to be carried out, it shall be understood that the same shall be effected/carried out by the contractor at his own cost, unless a different intention is specifically and expressly stated herein or otherwise explicit from the context. Contract value (also referred to as Contract price) shall be deemed to have included such cost.
- 1.4 The materials, design and workmanship shall satisfy the applicable relevant Indian Standards, the job specifications stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied. In the absence of any Standard/ Specifications/codes of practice for detailed specifications covering any part of the work covered in this Bidding on the contractor.
- 1.6 In partial modification to Clause No.21.0 of GCC-Works the following shall apply:
- In case of contradiction between Indian or other applicable Standards, General Conditions of Contract, Special Conditions of Contract, Specifications, drawings, Schedule of Rates, the following shall prevail in order of precedence:
- i) Letter of acceptance alongwith statement of Agreed variations.
  - ii) Fax / Letter of Intent / Fax of Acceptance
  - iii) Schedule of Rates as enclosures to letter of acceptance
  - iv) Particular Job Specifications
  - v) Drawings
  - vi) Technical / Material Specifications
  - vii) Special Conditions of Contract
  - viii) General Conditions of Contract
  - ix) Indian Standards
  - x) Other Applicable Standards
- 1.7 It will be contractor's responsibility to bring to the notice of Engineer-in-charge any



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irreconcilable conflict in the contract documents before starting the work(s) of making the supply with reference which the conflict exists.

In the absence of any specifications covering any material, design of work(s) in the same shall be performed / supplies / executed in accordance with Standards Engineering Practice as per the instructions / directions of the Engineer-in-charge, which will be binding on the Contractor.

- 1.8 The requirements of any statutory body and authority like Indian boiler regulation, Tariff Advisory Committee, Chief controller of Explosives, etc, shall govern where these are more stringent than the requirements specified above.
- 1.9 Owner's representative means authorized representative of Owner (i.e. M/s BHAGYANAGAR GAS LTD.) and / or Consultant (i.e. M/s LEPL).

2.0 THE WORK

2.1 Scope of work

The scope of work covered in this Contract will be as described in Annexure- 1 to SCC at Particular job specifications, Standard Specifications, Schedule of Rates etc.

2.2 Scope of Supply

The scope of supply covered in this Contract will be as described in Annexure-2 to SCC Particular Job Specifications, Standard Specifications, Schedule of Rates etc.

2.3 Time schedule

2.3.1 The work shall be executed strictly as per time schedule given in Annexure-3 to SCC. The period of completion given includes the time required for mobilization as well as testing, rectifications, if any, retesting, demobilization and completion in all respects to the satisfaction of the Engineer-in-Charge.

2.3.2 A joint program of execution of work will be prepared by the Engineer-in- Charge and Contractor. This program will take into account the time of completion mentioned in 2.3.1 above.

2.3.3 Monthly/Weekly execution program will be drawn up by the Engineer-in- Charge jointly with the Contractor based on availability of materials, work fronts and the joint program of execution as referred to above. The contractor shall scrupulously adhere to the Targets/Programs by deploying adequate personnel, Construction Equipment, Tools and Tackles and also by timely

supply of required materials coming within his scope of supply as per Contract. In all matters concerning the extent of target set out in the weekly/monthly program and the degree of achievement, the decision of the Engineer-in-Charge will be final



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and binding on the Contractor.

2.3.4 Contractor shall give every day category-wise labour and equipment deployment report alongwith the progress of work done on previous day in the proforma prescribed by the Engineer-in-Charge.

2.4 Measurement of Works

In addition to the provisions of Clause 88.1 of the General Conditions of Contract and associated provisions thereof, the provisions of Annexure – 4 to SCC shall apply.

2.5 Terms of Payment

Terms of Payment will be as specified in Annexure – 5 to SCC.

2.6 Temporary Works

All temporary works, ancillary works, enabling works, including dewatering of surface and subsoil water, temporary drains at the work site, preparing approaches to working areas, wherever required, for execution of the work, shall be the responsibility of Contractor.

2.7 Temporary Fencing

The Contractor shall, at his own costs and expenses, erect and maintain in good condition temporary fences and gates along the boundaries of the site assigned to him wherever required as per instruction of Engineer-in-charge. Wherever trenching is being done specially at crossing site near habitation and public movement. The contractor shall provide barricading as per sketch enclosed and provide proper night light as per requirement and to the satisfaction of EIC. The Contractor shall, except when authorized by the Engineer-in-Charge, confine his men, materials and plant etc. within the site of which he is given possession. The Contractor shall not use any part of the site for purpose not connected with the works unless prior written permission or consent of the Owner/Engineer-in-Charge has been obtained. Access to site shall be made only through the approved gateways. The Contractor shall maintain sufficient watchmen at site to the satisfaction of the Owner/Engineer- in-Charge.

2.8 Contractor's Temporary Structure

The Contractor may, at his own costs and expenses and subject to the approval of the Engineer-in-Charge and statutory authorities, construct offices, stores, workshop and remove the same as per the orders of the Engineer-in-Charge on completion of the contract. Whenever required the Contractor shall furnish such details of his temporary works as may be called for by the Owner/Engineer-in-Charge as to their safety and efficiency. The Owner/Engineer-in-Charge may direct those temporary works which he considers unsafe or, inefficient be removed and replaced in a satisfactory manner. The Contractor shall immediately follow Owner/Engineer-in-Charge's direction/instruction, on maintenance of all the equipments and he shall ensure that they are suitable for the work and is maintained



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in such a manner as to ensure their efficient working. The Owner/Engineer-in-Charge, may if they deem fit, direct the Contractor to remove from site any equipment which are not efficient and/or prejudicial to the quality of work to be replaced by equipment to their satisfaction. The Contractor shall immediately follow Owner/Engineer-in-Charge's direction/instruction.

2.9 Statutory Approvals

2.9.1 All associated activities required for obtaining necessary clearances, permissions, approvals, all licenses from all concerned authorities in respect of pipeline crossing & all related works shall be the responsibility of the Contractor and the cost of the same shall be deemed to have been included in the quoted prices.

The approval from any authority required as per statutory rules and regulations of Central/State Government shall be the Contractor's responsibility unless otherwise specified in the Bidding Document. The application on behalf of the Owner for submission to relevant authorities along with copies of required certificate complete in all respects shall be prepared and submitted by the Contractor well ahead of time so that the actual construction of the work is not delayed for want of the approval/inspection by concerned authorities. The inspection of the works by the authorities shall be arranged by the Contractor and necessary coordination and liaison work in this respect shall be the responsibility of the Contractor. However statutory fees paid, if any, for all inspections and approvals by such authorities shall be reimbursed at actual by the Owner to the Contractor on production of documentary evidence.

Any change/addition required to be made to meet the requirements of the statutory authorities shall be carried out by the Contractor free of charge. The inspection and acceptance of the work by statutory authorities shall however, not absolve the Contractor from any of his responsibilities under this Contract.

2.10 Quality Assurance

2.10.1 Bidder shall include in his offer the quality assurance programme containing the overall quality management and procedures, which is required to be adhered to during the execution of contract. After the award of contract detailed quality assurance program shall be prepared by the contractor for the execution of Contract for various works, which will be mutually discussed and agreed to.

2.10.2 The Contractor shall establish document and maintain an effective quality assurance system as outlined in recognized codes.

2.10.3 Quality Assurance System plans/procedures of the Contractor shall be furnished in the form of QA manual. This document should cover details of the personnel responsible for the quality assurance, plans or procedures to be followed for quality control in respect of Design, Engineering, Procurement, Supply, Installation, Testing and Commissioning.

The quality assurance system should indicate organizational approach for quality control and quality assurance of the construction activities, at all stages of work



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at site as well as at manufacturer's works and dispatch of materials.

- 2.10.4 The Employer/ consultant / Consultant or their representative shall reserve the right to inspect/witness, review any or all stages of work at shop/site as deemed necessary for quality assurance without any extra cost to Employer.
- 2.10.5 The Contractor has to ensure the deployment of quality Assurance and Quality Control Engineer(s) depending upon the quantum of work. This QA /QC group shall be fully responsible to carryout the work as per standards and all code requirements. In case Engineer- in-charge feels that contractor's QA/QC Engineer (s) are incompetent or insufficient, contractor has to deploy other experienced Engineer(s) as per site requirement and to the full satisfaction of engineer-in- charge.
- 2.10.6 In case contractor fails to follow the instructions of Engineer –in-charge with respect to above clauses, next payment due to him shall not be released unless until he complies with the instructions to the full satisfaction of Engineer –in –charge.
- 2.10.7 The contractor shall adhere to the quality assurance system as per LEPL specification enclosed in the bidding document as Annexure-6.
- 2.11 Notice and Licenses
- The Contractor shall at his costs and expenses give to the Municipal or Panchayat, Police and other authorities all notices etc., that may be required in law to be given and obtain all necessary permissions and licenses etc., for temporary obstructions, enclosures and pay all fees, taxes charges etc. which may be leviable by such authorities for that purpose. The Contractor shall make good any damage to the adjoining property whether public or private.
- 2.12 Working Hours
- Depending upon the requirements, time schedule/ drawn up programs and the target set to complete the job in time the works may have to continue beyond normal working hours to the extent of round the clock and on holidays also for which no extra claim shall be entertained.
- 2.13 Responsibility of Contractor
- Preparing approaches and working area for the movement and operation or the cranes, leveling the area for assembly and erection shall also be the responsibility of the Contractor. The Contractor shall acquaint himself with access availability, facilities such as railway siding, local labour etc.
- The procurement and supply in sequence and at the appropriate time of all materials and consumables covered under Contractor's scope of supply shall be entirely the Contractor's responsibility. Contractor shall not use any of the equipment or materials issued to him by Owner for temporary works, manufacturing erection aids etc. Misuse of materials will be seriously viewed and deduction at penal rates will be made from the Contractors bill for such quantities that are misused.



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Contract Price is deemed to be inclusive of all expenses towards above responsibilities.

2.14 Additional Works/Extra Works

Owner reserve their right to execute any additional works/ extra works, during the execution of Work, either by themselves or by appointing any other agency, even though such works are incidental to and necessary for the completion of works awarded to the Contractor. In the event of such decisions taken by Owner, Contractor is required to extend necessary cooperation and act as per the instructions of Engineer-in-Charge

2.15 Compensation for Idle Time

The owner shall make every reasonable effort to have the materials and working front available so as not to delay laying activities. No idle time claim shall be entertained under any circumstances.

2.17 Power and Water Connection

The Purchaser/Consultant will not provide any power and water during construction period. Contractor shall apply and obtain necessary power and water during connection from relevant authority and will pay its usage charge or arrange the same from the other sources.

3.0 CONSTRUCTION

OWNER reserves the right to inspect all phases of Contractor's operations to ensure conformity to the SPECIFICATIONS. Owner will have Engineers, Inspectors or other duly authorized representatives, made known to the Contractor present during progress of the WORK and such representatives shall have free access to the WORK at all times. The presence or absence of an Owner's representative does not relieve the Contractor of the responsibility for quality control in all phases of the WORK. In the event that any of the WORK being done by the Contractor or any Sub-Contractor is found by Owner's representatives to be unsatisfactory or not in accordance with the DRAWINGS, procedures and SPECIFICATIONS, the Contractor shall, upon verbal notice of such, revise the work in a manner to conform to the relevant DRAWINGS, procedures and SPECIFICATIONS.

3.1 Rules and Regulations

Contractor shall observe in addition to Codes specified in respective specification, all national and local laws, ordinances, rules and regulations and requirements pertaining to the work and shall be responsible for extra costs arising from violations of the same.

3.2 Procedures

Various procedures and method statements to be adopted by Contractor during the construction as required in the respective specifications shall be submitted to Engineer-in-Charge in due time for approval. No construction activity shall commence unless approved by Engineer-in-Charge in writing.



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3.3 Security

If the work being in protected area, entry into the work area shall be restricted and governed by issue of photo gate passes by the Security/CISF. The Contractor shall arrange to obtain through the Engineer-in-Charge, well in advance, all necessary entry permits/gate pass for his staff and labour and entry and exit of his men and materials shall be subject to vigorous check by the security staff. The Contractor shall not be eligible for any claim or extension of time whatsoever on this account. Also for domestic installation works, contractor shall provide Identity cards to their employees/workers to work inside the society / house premises.

3.4 Drawings and Documents

3.4.1 The drawings accompanying the bid document (if any) are of indicative nature and issued for bidding purpose only. Purpose of these drawing is to enable the bidder to make an offer in line with the requirements of the Employer/Consultant. However no extra claim whatsoever, shall be entertained for variation in the "Approved for Construction" and "Bid document drawings" regarding any changes/units. Construction shall be as per drawings/specifications issued/approved by the Engineer-in-Charge during the course of execution of work. Detailed construction drawings (wherever required) on the basis of which actual execution of work is to proceed will be prepared by the contractor.

3.4.2 The drawings and documents to be submitted by the Contractor to Employer/Consultant after award of the work as per the requirements enlisted in the bidding document shall be for Employer/Consultant's review, information and record. The Contractor shall ensure that drawings and documents submitted to Employer/Consultant are accompanied by relevant calculations, data as required and essential for review of the document/ drawings. LEPL shall review the drawings/ documents within two weeks from the date of submission provided the same are accompanied by relevant calculations, data as required and essential for review.

manufacturer's etc. shall be submitted to Employer/Consultant after having been fully vetted in detail, approved and co-opted by the Contractor & shall bear Contractor seal/ certifications to this effect. All documents/drawings & submissions made to Employer/Consultant without compliance to this requirement will not be acceptable and the delay & liability owing to this shall be to the Contractor's account.

3.4.4 The review of documents and drawings by Employer/Consultant shall not absolve Contractor from his responsibility to meet the requirements of specifications, drawings etc. and liabilities for mistakes and deviations. Upon receiving the comments on the drawing/documents reviewed by Employer/Consultant, Contractor shall incorporate the comments as required and ensure their compliance.

3.4.5 Copies of all detailed working drawing relating to the works shall be kept at the contractors' office at the site and shall be made available to the Engineer- in-charge/ Employer/Consultant at any time during execution of the contract. However no extra claim what so ever shall be entertained for any variation in the "approved/issued for construction drawings" and "tender drawings" regarding any changes/units unless otherwise agreed.



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3.4.6 The Contractor shall rectify any inaccuracies, errors and non-compliance to contractual requirements. Any delay occurring on this shall not construe a reason for delay/ extension.

3.5 DELETED.

3.6 Construction Equipment & Mechanization of Construction Activities

Contractor shall, without prejudice to his overall responsibility to execute and complete the Work as per specifications and time schedule, adopt as far as practicable, mechanized construction techniques for major site activities. However, Contractor agrees that he will deploy the required numbers and types of the part & machinery applicable for different activities in consultation with the Engineer-In-Charge during execution of works.

The Contractor shall mechanize the construction activities to the maximum extent by deploying all necessary construction equipment/machinery in adequate numbers and capacities.

Wherever Structural/Piping works are included in the scope, the Contractor's responsibilities shall include establishing and maintaining of a proper fabrication workshop with transportation facilities to site to carryout fabrication of steel structures, piping specials etc., preparing approaches working areas for the movement/operation of cranes and leveling the areas for assembly/erection to ensure effective mechanization on the works. The

Contractor shall acquaint himself with availability of access, facilities such as railway siding, local labour etc. and the Contractor may have to build temporary access roads to aid his work and the quoted and agreed rates shall be deemed to include the same. It may be noted that all fabrication work shall be carried out in fully mechanized workshops to reduce site fabrication to minimum.

Contractor may also ensure use of computer software for at least the following:

- (i) Billing
- (ii) Planning & Scheduling
- (iii) Progress Reporting
- (iv) Material Control & Warehousing
- (v) Safety Records
- (vi) Resource Deployment
- (vii) Communication

Contractor further agrees that Contract price is inclusive of all the associated costs) which he may incur for actual mobilization, required in respect of use of mechanized construction techniques and that the Owner/Consultant in this regard shall entertain no claim whatsoever.

3.7 Site Organization



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The Contractor shall provide all necessary superintendence during the design and execution of the Works and as long thereafter as the Engineer-in-Charge may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. Such superintendence shall be given by sufficient persons having adequate knowledge of the operations to be carried out including the methods and techniques required the hazards likely to be encountered and methods of preventing accident for the satisfactory and safe execution of the Work. The workmen deployed, by the Contractor should also possess the necessary license etc., if required under any law, rules and regulations.

Subject to the provisions in the Contract Document and without prejudice to Contractor's liabilities and responsibilities to provide adequate qualified and skilled personnel on the Work, Contractor shall augment the same as decided by the Engineer-in-Charge depending on the exigencies of Work.

### 3.7.1 SUPERVISION

All construction work will be carried out as per direction of EIC, and this will be the primary point of contact between the Contractor and BHAGYANAGAR GAS LTD. on site. All work will be issued and sanctioned through the EIC and site control exercised by site engineers. The Contractor shall ensure that technical quality standards are maintained, that construction is carried out cost effectively and that a good customer and public image is maintained for BHAGYANAGAR GAS LTD.

The Contractor will appoint his own supervisors of minimum number instructed by EIC. These personnel will be responsible to the SE for monitoring construction standards and for ensuring that all detailed technical requirements are met on each and every job which is undertaken. The Contractor's supervisor(s) will have day to day liaison with the SE, and will provide the SE with technical reports and audits, and other management information as is required on work progress and construction quality standards.

The Contractor's supervisor shall have mobile telephones or pagers to ensure that they can be contacted at all times. The Contractor will also nominate one person who can be contacted if necessary out of hours, for the duration of the works. The Contractor's supervisor will have access to transport at all times to allow them to visit sites and attend meetings with BHAGYANAGAR GAS LTD.as is required.

The normal day to day issue of work instructions, communication between BHAGYANAGAR GAS LTD.and the Contractor's supervisor and the SE. No deviation from the approved technical specification / issued construction drawings shall be undertaken without written approval of EIC.

### 3.8 Health Safety and Environment (HSE) Management

After the award of the contract, detailed Health, Safety and Environment (HSE) program to be followed for execution of contract under various divisions of works will be mutually discussed and agreed between Contractor, Client & PMC.



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The Contractor shall establish document and maintain an effective Health, Safety and Environment (HSE) management system.

In case contractor fails to follow the instructions of Engineer-in-charge with respect to above clauses, next payment due to him shall not be released unless until he complies with the instructions to the full satisfaction of Engineer-in-charge.

The Contractor shall adhere to the Health, Safety and Environment (HSE) management system as per BHAGYANAGAR GAS LTD. Specification and General Conditions of Contract.

It will be the Contractor's responsibility to acquaint his site staff and operatives of all current safety legislation, statutory requirements and BHAGYANAGAR GAS LTD.'s safety standards. In addition, and before any work takes place all the Contractor's operatives shall be given training in site safety by the trained person under supervision of BHAGYANAGAR GAS LTD. If the Contractor wishes to start any new operatives on site, he must first inform the SE, who will arrange for such training to be arranged.

3.9 General Guidelines During and Before Erection

3.9.1 The Contractor shall be responsible for organizing the lifting of the structural element, equipment in the proper sequence, that orderly progress of the work is ensured and access routes for erecting the other structures/ equipments are kept open.

3.9.2 During the performance of the work the Contractor at his own cost, shall keep structures, materials and equipment adequately braced by guys, struts or otherwise approved means which shall be Supplied and installed by the Contractor as required till the installation work is satisfactorily completed.

Such guys, shoring, bracing, strutting, planking supports etc. shall not interfere with the work of other agencies and shall not damage or cause distortion to other works executed by him or other agencies.

3.9.3 Manufacturer's recommendations and detailed specifications for the installation of the various equipment and machines shall be fulfilled by the Contractor.

3.9.4 Various tolerances required as marked on the drawings and as per specifications and instructions of the Engineer-in-Charge, shall be maintained.

Verticality shall be maintained. Verticality shall be verified with the Theodolite/advanced instruments,

3.10 Construction Photographs

The Owner desires to have two sets of monthly progress reports with photographs showing the progress of construction. Before utilizing any photograph for publicity,



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the Contractor shall obtain prior approval of the Owner.

3.11 Schedule of Labour

Schedule of Labour Rates attached as Annexure-9 to SCC shall be used for analysing rates for extra items.

Schedule of equipment rates attached as Annexure-9 to SCC shall be used for analysing rates for extra items.

3.11.1. Construction Equipment

Minimum construction equipment to be deployed is enclosed as Annexure-8 to SCC. However, Any other equipment required for completion of pipeline laying work but not specifically mentioned here, shall be deployed by contractor without any additional cost. The list of equipments mentioned in Annexure-8 is the minimum to be deployed by contractor and contractor shall ensure the availability at site of listed equipments in good working condition.

3.12 Specific Requirements

Specific requirements spelt out in various technical parts of the Bidding Document shall be followed by Contractor.

3.13 SITE CLEANING

3.13.1 The BIDDER shall take care for cleaning the working site from time to time for easy access to work site and also from safety point of view.

3.13.2 Working site should be always kept cleaned up to the entire satisfactions of the Engineer-in-charge.

Before handing over and work to owner, the BIDDER in addition to other formalities to be observed as detailed in the document shall clear the site to the entire satisfaction of Engineer-in-charge.

3.14 SURVEY OF WORK

Before the WORK or any part thereof are begun, the Contractor's agent and the Engineer-in-Charge's representative shall together survey the SITE and decide the tentative route considering all obstructions on which the pipeline is to be laid and on which measurements of the WORK are to be based. Such particulars shall be plotted by the BIDDER and trial pits started thereon.

The Contractor shall be entirely responsible for the correctness of every part of the WORK and shall rectify any errors or imperfections therein. Such rectifications shall be carried out by the Contractor at his own cost, when instructions are issued to this effect by the Engineer-in-Charge or his representative.

WORK shall be suspended for such times as necessary for checking lines and levels on



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any part of the WORK.

The Contractor shall at his own expense provide all assistance, which the Engineer-in-Charge may require for checking the setting out to WORKS.

Before commencement of any activity, Contractor's quality control set up duly approved by company must be available at site.

4.0 TESTS, INSPECTION AND COMPLETION

4.1 Tests and Inspection of Material under Contractor's Scope

Inspection and test prior to shipment of material and at final acceptance shall be as specified in Technical Specification. However, without prejudice to the provision of Technical Specification following shall hold good.

The Owner/Consultant or its representative shall have the right to inspect and or to test the material to conform their conformity to the specification.

If any inspected or tested material fail to conform the specification , the Owner/Consultant may reject them and the contractor shall either replace the rejected materials or make all the alteration necessary to meet the specification , free of cost to the purchaser/consultant.

The Purchaser / Consultant's right to inspect , test and where ever necessary reject the material after the material's arrival in the purchaser / consultant site shall in no way be limited to or waived by reason of the material having previously been inspected , tested and passed by the purchaser/ Consultant or their representative prior to the material shipment from the material supplier.

4.2 Tests and Inspection during execution

The Contractor shall carry out the various tests as enumerated in the technical specifications of this Bidding Document and technical documents that will be furnished to him during the performance of the work at no extra cost to the Owner.

All the tests either on the field or at outside laboratories concerning the execution of the work and supply of materials by the Contractor shall be carried out by Contractor at his own cost.

The work is subject to inspection at all times by the Engineer-in-Charge. The Contractor shall follow all instructions given during inspection and shall ensure that the work is being carried out according to the technical specifications of this Bidding Document, the technical documents that will be furnished to him during performance of work and the relevant codes of practice.

The Contractor shall provide for purposes of inspection access ladders, lighting equipment for testing, necessary instruments etc. at his own cost, low voltage lighting equipment for tray fixing and inspection work.



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Compressed air for carrying out works shall be arranged by the Contractor at his own cost.

For material supplied by Owner, Contractor shall carryout the tests, if required by the Engineer-in-Charge, and the cost of such tests shall be reimbursed by the Owner at actual to the Contractor on production of documentary evidence.

Contractor shall inspect carefully all equipment before receiving them from Owner for installation purposes. Any damage or defect noticed shall be brought to the notice of Engineer-in- Charge immediately.

All results of inspection and tests will be recorded in the inspection reports, proforma of which will be approved by the Engineer-in-Charge. These reports shall form part of the completion documents. Any work not conforming to execution drawings, specifications or codes shall be rejected and the Contractor shall carryout the rectifications at his own cost.

Inspection and acceptance of the work shall not relieve the Contractor from any of his responsibilities under this Contract.

4.3 Final Inspection during execution

After completion of all tests as per specification the whole work will be subject to a final inspection to ensure that job has been completed as per requirement. If any defect is noticed, the Contractor will be notified by the Engineer-in-Charge and he shall make good the defects at his own cost and risk with utmost speed. If, however, the Contractor fails to attend to these defects within a reasonable time (time period shall be fixed by the Engineer- in-Charge) then Engineer-in-Charge may have defects rectified at Contractor's cost.

When these works are carried out at the risk and cost of the Contractor, the Engineer-in-charge would recover the actual cost incurred towards labour, supervisions and material, consumables or otherwise, plus 100% towards overheads from any pending bill of the Contractor or the security deposit.

4.3 Documentation

4.3.1 As - Built Drawings

Notwithstanding the provisions contained in standard specifications, upon completion of commissioning, the BIDDER shall complete all of the related approved drawings along with bill of materials to the "AS BUILT" stage provide to a scale of 1:200 and submit to BHAGYANAGAR GAS LTD., the following:

- a) One complete set in reduced size (279 mm x 432 mm).
- b) One complete set of Soft Copy in CD of all original drawings.
- c) Four complete sets of approved prints in A2 / A3 sizes.

4.3.2 Completion Document



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The following documents shall be submitted in hard binder by the BIDDER in FOUR sets, as a part of completion documents: -

- a) Copies of the Inspection reports, Laying Graphs, HDD Profiles (IF ANY) and valve pit drawings (IF ANY).
- b) Pre testing, final Hydrostatic / pneumatic and other Test results and reports.
- c) Consumption statements of PE / GI certified by Owner's Site Engineer.
- d) Material Reconciliation, stores issue & return statements
- e) All other requirements as specified in the respective specifications.
- f) Completion Certificate issued by Owner's Site Engineer.
- g) No claim certificate by the BIDDER.
- h) Completion certificate for embedded and covered up works wherever applicable.
- i) Recovery statement, if any.
- j) Deviation statement.
- k) Statement for reconciliation of all the payments and recoveries made in the progress bills.
- l) Copies of deviation statement and order of extension of time, if granted.
- m) Any other contractual documents required on completion.

4.4 Statement of Final Bills-Issue of No Demand Certificate

The final bill of Contractor shall be accompanied by no-demand certificate from the following departments of the Owner:

- i) Administration & Personnel Department regarding vacation of land, housing accommodation, recovery of tents etc.
- ii) Fire and Safety Officer and CISF.

The Contractor shall obtain such no-demand certificates from the concerned authorities and furnish the same to the Engineer-in-Charge.

4.5 Issue and Reconciliation of Material

Refer Annexure-7 to SCC for details.



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4.8 GOVERNMENT OF INDIA NOT LIABLE

It is expressly understood and agreed by and between the Contractor and the Employer that the Employer is entering into this agreement solely on its own behalf and not on behalf of any other person or entity. In particular, it is expressly understood and agreed that the Government of India is not a party to this agreement and has no liabilities, obligations or rights there under. It is expressly understood and agreed that the Employer is an independent legal entity with power and authority to enter into contract, solely in its own behalf under the applicable laws of India and general principal of Contract Law. The Contractor expressly agrees, acknowledges and understands that the Employer is not an agent, representative or delegate of Govt. of India. It is further understood and agreed that the Govt. of India is not and shall not be liable for any acts, omissions, commissions, breaches or other wrongs arising out of the contract. Accordingly, contractor hereby expressly waives, releases and foregoes any and all actions or claims, including cross claims, impleader claims or counter claims against the Govt. of India arising out of this contract and covenants not to sue to Govt. of India as to any manner, claim, cause of action or thing whatsoever arising of or under this agreement.

5.0 REGISTRATION OF THE CONTRACT WITH STATUTORY AUTHORITIES  
(FOR FOREIGN BIDDER if applicable)

5.1 Within 30 days of execution of the Contract agreement, the Contractor shall register themselves and the Contract at their own cost with the Reserve Bank of India, Income Tax, Sales Tax and such other statutory authorities, as may be required under the rules and regulations governing in India. The Contract Price shall be deemed to include all costs towards the same. A copy of all documents related to all such registration shall be submitted to Employer for record.

6.0 LIMITATION OF LIABILITY

6.1 The final payment by the Employer in pursuance of the Contract terms shall not mean release of the Contractor from all of his liabilities under the Contract. The Contractor shall be liable and committed under this contract to fulfil all his liabilities and responsibilities, till the time of release of contract performance guarantee by the Employer.

6.2 Notwithstanding anything contrary contained herein, the aggregate total liability of Contractor under the Contract or otherwise shall be limited to 100% of Contract value. However, neither party shall be liable to the other party for any indirect and consequential damages, loss of profit or loss of production.

7.0 Void

8.0 DELETED

9.0 DELETED



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10. DELETED
11. DELETED
- 12.0 DELETED
- 13.0 VOID
- 14.0 DELETED
- 15 ISSUE OF CERTIFICATE- PERTAINING TO IMPORT
- 16.0 BHAGYANAGAR GAS LTD.shall not provide any kind of certificate.  
IMPORT LICENCE
- 16.1 Contractor shall arrange import of all materials required for permanent incorporation in the works as well as construction equipment as per the guidelines laid down by the Government of India. Employer shall not provide import license.
- 17.0 DELETED
- 18.0 INTELLECTUAL PROPERTY
- 18.1 Neither Employer nor Contractor nor their personnel, agents nor any sub- contractor shall divulge to any one (other than persons designated by the party disclosing the information) any information designated in writing as confidential and obtained from the disclosing party during the course of execution of the works so long as and to the extent that the information has not become part of the public domain. This obligation does not apply to information furnished or made known to the recipient of the information without restriction as to its use by third parties or which was in recipient's possession at the time of disclosure by the disclosing party. Upon completion of the works or in the event of termination pursuant to the provisions of the contract, Contractor shall immediately return to Employer/Consultant all drawings, plans, specifications and other documents supplied to the Contractor by or on behalf of Employer/Consultant or prepared by the Contractor solely for the purpose of the performance of the works, including all copies made thereof by the Contractor.
- 19.0 FIRM PRICE
- 19.1 The quoted prices shall be firm and shall not subjected to price escalation till the work is completed in all respects.
- 20.0 WORKS CONTRACT
- 20.1 The work covered under this contract shall be treated as "Works Contract".



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- 21.0 PROVIDENT FUND ACT
- 21.1 The Contractor shall strictly comply with the provisions of Employees Provident Fund Act and register themselves with RPFC before commencing work. The Contractor shall deposit Employees and Employers contributions to the RPFC every month. The Contractor shall furnish along with each running bill, the challan/ receipt for the payment made to the RPFC for the preceding months.
- 22.0 DELETED
- 23.0 TERMS OF PAYMENT
- 23.1 Basis and terms of payment for making “On Account Payment” shall be as set out in Annexure-5 to SCC.
- 24.0 DELETED
- 25.0 COORDINATION WITH OTHER AGENCIES
- 25.1 Work shall be carried out in such a manner that the work of other agencies operating at the site is not hampered due to any action of the Contractor. Proper coordination with other agencies will be Contractor's responsibility. In case of any dispute, the decision of Engineer-in-Charge shall be final and binding on the Contractor.
- 26.0 DELETED
- 27.0 ROYALTY
- 27.1 Contractor's quoted rate should include the royalty on different applicable items as per the prevailing Government rates. In case, Employer is able to obtain the exemption of Royalty from the State Government, the contractor shall pass on the same to Employer for all the items involving Royalty.
- 28.0 THE FACILITIES FOR WORKMEN
- 28.1 Following facilities are to be ensured at all work places where workmen are deployed/engaged by Contractor & any other, as required by law at the time of execution.
- Arrangement of first aid  
Arrangement for clean drinking water.  
Toilets  
Canteen where tea & snacks are available  
A crèche where 10 or more women workmen are having children below the age of 6 years.
- 29.0 DELETED



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- 30.0 PROJECT PLANNING, SCHEDULING AND MONITORING SYSTEM
- 33.1 The Contractor shall follow the specifications with respect to Project Planning, Scheduling and Monitoring system as giving in Bidding Document.
- 31.0 CHECKING OF LEVELS
- 31.1 The Contractor shall be responsible for checking levels, orientation plan of all foundations, foundation bolts, etc., well in advance of taking up the actual erection work and bring to the notice of Engineer-in-Charge discrepancies, if any. In case of minor variations in levels etc. the Contractor shall carry out the necessary rectifications to the foundations within his quoted price.
- 31.2 The Contractor shall also be responsible for checking with templates, wherever necessary, the disposition of foundation bolts with the corresponding bases of structure and shall effect rectifications, as directed, within his quoted rate.
- 32.0 STORAGE FACILITIES
- 32.1 The Contractor shall maintain wherever required an air-conditioned room for the storage of the instruments as well as for calibration and testing of the instruments at his own cost. The contractor shall provide these facilities with in the quoted price.
- 33.0 ABNORMALLY HIGH RATED ITEMS (AHR ITEMS)
- 33.1 Clause No. 20.0 of GCC-Works is modified to the following extent:
- 33.2 "In items rate contract where the quoted rates for the items exceed 50% of the owners/ estimated rates, such items will be considered as Abnormally High Rates Items (AHR) and payment of AHR items beyond the SOR stipulated quantities shall be made at the least of the following rates:
- i) Rates as per SOR, quoted by the Contractor.
  - ii) Rate of the item, which shall be derived as follows:
    - a) Based on rates of machine and labour as available from the contract (which includes contractor's supervision, profit, overheads and other expenses).
    - b) In case rates are not available in the contract, rates will be calculated based on prevailing market rates of machine, material and labour plus 15% to cover contractor's supervision profit, overhead & other expenses.
- 34.0 DELETED
35. DELETED



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36. COMPUTERIZED BILLS

Contractor shall submit computerized bills with duly printed GST Registration no. etc.

37. ORDER PLACEMENT OF BOUGHT OUT ITEMS

The contractor is required to place firm order for all bought out items of adequate quantity (including 1<sup>st</sup> lot in those cases where items are required to be procured in more than one lot, if so stated in SOR/ SCC) within 30 days from the date of placement of order, failing which owner reserves the right to procure the same at the risk & cost of the contractor. However the contractor shall always take prior approval of owner and consultant for items required to be procured.

Further lots (for those cases where items are required to be procured in more than one lot, if so stated in SOR/ SCC) shall be procured after suitable period so as to ensure adequate availability of material at site through out the execution period).

38. REQUIREMENTS FOR CONTRACTOR AT SITE

- 38.1 Contractor shall establish site office in the respective areas with adequate facilities like tables, chairs, telephone, and computer with mailing facility etc. for effective communication and documentation.
- 38.2 Contractor shall provide as and when required a wagon(s) suitable for soil removal, for the delivery or reinstatement materials and for the transport of pipe to and from site.
- 38.3 Contractor shall supply transport for their technical staff and operatives to move from site to site, and to move tools and equipment from site to site, this vehicle will also be fitted with a tow bar suitable for the towing of a mobile air compressor or pipe trailer.
- 38.4 Contractor shall make appropriate arrangements to ensure that their supervisor(s) are adequately mobile and can attend sites or meeting with BGL/ LEPL & other authorities or customers as required, without any undue delay.
- 38.5 Contractors shall provide cell phones to their supervisors for day to day communication with BHAGYANAGAR Gas/ BGL PMC and site representatives of BGL/ PMC.
- 38.6 The RCM/ site in-charge must be a permanent employee of the contractor having desired qualification and work experience, Any change in key persons working at site shall be informed to the Owner promptly.
- 38.7 Owner will not allow switching/ swapping of key personnel of any contractor working



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at site from one contractor to another during the continuity of the contract.

39. COMPLIANCE WITH LAWS

39.1 The Contractor shall abide by all applicable rules, regulations, statutes, laws governing the performance of works in India, including but not limited to the following:

- i) Contract Labour (Regulation & Abolition) Act 1970 & the centre rules, 1971 framed there under.
- ii) Payment of Wages Act.
- iii) Minimum Wages Act.
- iv) Employer's Liability Act.
- v) Factory Act.
- vi) Apprentices Act.
- vii) Workman's Compensation Act.
- viii) Industrial Dispute Act.
- ix) Environment Protection Act.
- x) Wild life Act.
- xi) Maritime Act.
- xii) Any other Statute, Act, Law as may be applicable.
- xiii) PNGRB Act.

40. NOTES TO SCHEDULE OF RATES (SOR)

- i) The SOR items would be operatable as per job requirement.
- ii) The quantities stated in SOR are tentative and may vary considerably on  $\pm$  side depending upon site condition, methodology adopted as per site requirement. The payment will be made as per actual certified Measurement at site and as instructed by EIC.
- iii) The scope as mentioned in the SOR is of indicative nature only and shall include all activities as detailed in the relevant clauses of the specifications attached and other relevant documents enclosed with tender.
- iv) Any other materials & activities not mentioned/covered in SOR , but otherwise required for satisfactory completion/safety of work as defined in tender has to be supplied /done by contractor with in the specified schedule at no extra cost to owner.
- v) Contractor shall be required to deploy adequate no. of plumbing teams to ensure domestic conversions expeditiously. In this regard, no. of independent teams shall be decided by Engineer-in-charge.

41.0 Insurance

All kind of Insurances including transit Insurance shall be borne & arranged by the bidder in line with clause no. 101 of GCC-Works. Price quoted in SOR shall be inclusive of this cost. Clause no. 16 of GCC-Goods, in this respect, shall stand superseded to this extent.



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- 42.0            **PRICE REDUCTION SCHEDULE**  
The Price reduction schedule shall be applicable as per clause no. 27 of GCC-Works. The Contract/order value shall exclude GST for the purpose of Price reduction schedule.
- 42.1.           PRS is the reduction in the consideration/contract value for the goods/services covered under this contract. In case of delay in supply/ execution of the contract, the supplier/contractor/service provider should raise invoice for reduced value as per Price Reduction Schedule Clause (PRS clause). If the supplier/contractor/ service provider has raised the invoice for the full value, then the supplier/contractor/service provider should issue Credit Note towards the applicable PRS amount with applicable taxes
- 42.2.           In such cases, if supplier/ contractor/ service provider fails to submit the invoice with reduced value or does not issue credit note as mentioned above, BHAGYANAGAR Gas will release the payment to supplier/ contractor/ service provider after giving the effect of the PRS clause with the corresponding reduction of taxes charged on vendor's invoice, to avoid delay in delivery/collection of material.
- 42.3            In case any financial implication arises on BHAGYANAGAR Gas due to issuance of invoice without reduction in price or non-issuance of Credit Note, the same shall be to the account of supplier/ contractor/ service provider. BHAGYANAGAR Gas shall be entitled to deduct /setoff / recover such GST amount (CGST & SGST/UTGST or IGST) together with penalties and interest, if any, against any amounts paid or becomes payable by  
  
BHAGYANAGAR Gas in future to the Supplier/Contractor under this contract or under any other contract.
- 43.0            **DIRECT PAYMENTS TO SUB-VENDORS/ SUPPORTING AGENCIES OF MAIN CONTRACTOR**  
  
Normally, the payment is to be made to vendor/ contractor only as per provision of contract. During execution, in case of financial constraints, BGL may make direct payment to their sub-vendor/ supporting agencies as an exception from the amounts due to the vendors/ contractors from any of their bills under process upon certification by EIC subject to receipt of such request from the vendor/ contractor. Further, the request for direct payments to the sub-vendor/ sub-contractor shall be considered in performance evaluation of such vendor/ contractor.
- 44.0            **SUB-LETTING OF WORKS**  
  
Pursuant to Clause No. 37 of GCC-Works:  
The contractor shall not, save with previous consent in writing of the Engineer-in-charge, sublet, transfer or assign the contract or any part thereof or



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interest therein or benefit or advantage thereof in any manner whatsoever. Provided, nevertheless, that any such consent shall not relieve the contractor from any obligation, duty or responsibility under the contract.  
However, subletting of WHOLE WORKS is prohibited. Vendor/ Contractor shall submit undertaking to this effect along with each invoice/ bill.

45.0 BONUS FOR EARLY COMPLETION

The Clause 27.3 of GCC-Works for Bonus for early completion shall not be applicable in this Contract.

46. PRADHAN MANTRI SURAKSHA BIMA YOJANA (PMSBY) AND PRADHAN MANTRI JEEVAN JYOTI BIMA YOJANA (PMJJBY)

Contractor shall ensure that all its personnel deployed under this contract have obtained additional insurance coverage under the Pradhan Mantri Suraksha Bima Yojana (PMSBY) and Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) through the participating banks and submit the proof of such insurance coverage to the satisfaction of BGL. The cost of the insurance premium amount for both the above schemes shall be borne by the contractor giving evidence/proof to BGL in this respect and the Contractor shall suitably consider the same in their bid.

Both the schemes are to be regulated continuously on yearly basis and the same should be renewed on each successive relevant date in subsequent years.

47. FORCE MAJEURE (FOR COVID-19)

Shall be as per Government of India Guide lines.



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ANNEXURES TO SCC

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Annexure-2	:	Scope of Supply
Annexure-3	:	Time Schedule
Annexure-4	:	Measurement of Work
Annexure-5	:	Terms of Payment
Annexure-6	:	Quality Assurance
Annexure-7	:	Conditions for issue & reconciliation of material
Annexure-8	:	Construction equipment to be deployed
Annexure-9	:	Schedule of Labour Rate
Annexure-10	:	Schedule of Equipment Hourly Rental Rate



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## **SCOPE OF WORK**

(ANNEXURE-1 TO SPECIAL CONDITIONS OF CONTRACT)

ANNEXURE-1 TO SCC

1.0 SCOPE OF WORK

Scope of work shall be as detailed in Particular Job Specification / Technical Vol II of II, Technical Specifications, Schedule of Rates & various other parts of this Bidding Document.



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## **SCOPE OF SUPPLY**

### **(ANNEXURE-2 TO SPECIAL CONDITIONS OF CONTRACT )**

#### ANNEXURE-2 TO SCC 1.0

#### SCOPE OF SUPPLY

##### 1.1 Owner's Scope of Supply (Free Issue Item)

Owner's scope of supply shall be as specified in Particular Job Specification, Technical Specifications, Schedule of Rates & various other parts of the Bidding Document.

In order to speed up the project Free Issue Materials shall be issued to the Contractor from the designated store(s) of BHAGYANAGAR Gas Ltd. Contractor shall be responsible for lifting the free issue materials from Owner's storage point(s) and transporting the same to work site(s) at his own cost.

Conditions for Issue and Reconciliation of Materials shall be as per Document enclosed as Annexure-7 to Special Conditions of Contract.

##### 1.2 Contractor's Scope of Supply

All materials except what is under Owner's scope of supply as mentioned in Clause No. 1.1 above, and required for successful completion of works in all respects shall be supplied by the Contractor and the cost of such supply shall be deemed to have been included in the quoted price without any additional liability on the part of Owner.



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**TIME SCHEDULE**

**(ANNEXURE-3 TO SPECIAL CONDITIONS OF CONTRACT)**

ANNEXURE-3 TO SCC

TIME SCHEDULE

Name of Work	Time of Completion	
MECHANICAL WORKS FOR DEVELOPMENT OR CONSTRUCTION OF CNG MOTHER STATION AT MLV-13 INDRESHAM & KATEDHAN IN HYDERABAD OF BHAGYANAGAR GAS LIMITED  (The time schedule is inclusive of mobilization period)	HYDERABAD	Contract validity period of 01 year from the date of LOI/FOA.  However, the execution of works shall be completed within 06 months from the date of Intimation by the EIC.

Note:

- 1) Mobilization period is 15 days from the date of BGL EIC/PMC intimation.
- 2) The time of completion shall be reckoned from the date of award of contract, which shall be the date of issue of letter/ Fax of Intent.
- 3) The time indicated is for completing all the works in all respects as per specifications, codes, drawings and instructions of Engineer-in-charge.
- 4) It should be noted that the period of construction given above includes preparation of drawings , procurement and supply of materials including their inspection & testing, mobilization at site, construction, laying, fabrication, erection inspection, testing, rectification (if any), pre-commissioning, commissioning and demobilization works etc. complete in all respects to the entire satisfaction of Owner/ Engineer-in- charge.
- 5) However execution period shall be 06 months from the date of EIC intimation to ensure the timely completion of the project.

\_\_\_\_\_  
(STAMP & SIGNATURE OF BIDDER)



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## **MEASUREMENT OF WORK**

### **(ANNEXURE-4 TO SPECIAL CONDITIONS OF CONTRACT – TECHNICAL)**

#### ANNEXURE-4 TO SCC

#### MEASUREMENT OF WORK

##### 1.0 GENERAL

- 1.1 The mode of measurement shall be as mentioned in relevant standard specification incorporated in the Bidding Document. Any other mode of measurements not covered in above specifications shall be followed in accordance with relevant BIS codes/ Schedule of Rates/ Specifications etc. and/ or as decided by Engineer-in- charge.
- 1.2 Payment will be made on the basis of joint measurements taken by Contractor and certified by Engineer-in-charge. Measurement shall be based on “Approved for Construction” drawings, to be the extent that the work conforms to the drawings and details are adequate.
- 1.3 Wherever work is executed based on instructions of Engineer-in-charge or details are not adequate in the drawings, physical measurements shall be taken by Contractor in the presence of Engineer-in-charge.
- 1.4 Measurements of weights shall be in metric tonnes corrected to the nearest Kilogram. Linear measurements shall be in meters corrected to the nearest centimeters.
- 1.5 The weights mentioned in the drawing or shipping list shall be the basis for payment. If mountings for panels etc. are packed separately, their erection weights shall include all mountings.
- 1.6 Welds, bolts, nuts, washers etc. shall not be measured. Rates for structural steel work shall be deemed to include the same.
- 1.7 No other payment either for temporary works connected with this Contractor for any other item such as weld, shims, packing plates etc. shall be made. Such items shall be deemed to have been included for in the rates quoted.
- 1.8 Measurement will be made for various items under schedule of rates on the following basis as indicated in the unit column.

- |      |        |   |           |
|------|--------|---|-----------|
| i)   | Weight | : | MT or Kg  |
| ii)  | Length | : | M (Meter) |
| iii) | Number | : | No.       |
| iv)  | Volume | : | Cu.M      |
| v)   | Area   | : | Sq.M      |



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**TERMS OF PAYMENT**

(ANNEXURE-5 TO SPECIAL CONDITIONS OF CONTRACT)



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ANNEXURE-5 TO SCC

1.0 TERMS OF PAYMENT

1.1 Advance

1.1.1 The Owner will not pay any advance in any circumstances.

1.2 The Payment terms shall be as follows:

The CONTRACTOR shall raise the RA bill on monthly basis and payment shall be made as per the following terms:

1.2.1 CIVIL / STRUCTURAL WORK

- a) 80% payment shall be released on Pro-Rata basis against submission of RA bill with GST and other requisite document duly certified by Engineer-In-Charge.
- b) 10% on completion of all the work and Certificate by Engineer-In -Charge
- c) Balance 10% on contract closure and submission of all documents as per contract.

1.2.2 MECHANICAL/ ELECTRICAL WORKS

- a) 80 % on Supply, fabrication, installation and testing with other requisite document duly certified by Engineer In-Charge.
- b) 10% on completion of all work and Certificate by Engineer-In -Charge
- c) Balance 10% on contract closure and submission of all documents as per contract.

1.2.3 PAYMENT METHODOLOGY

- a) The contractor shall raise GST invoices on monthly basis. Bidder shall enclose all relevant documents as per check list issued by BGL including during kick off meeting.
- b) The payments to the Contractor will be released within a period of 30 days from the date of receipt of the complete invoice as per the terms and conditions of the Contract.
- c) Employer will release payment through e-payments only as detailed in the Bidding Document.
- d) Further break-up of Lump-sum Prices, if deemed necessary for any progressive payment of individual item may be mutually arrived at between Engineer-in-Charge and the Contractor.
- e) All payments against running bills are advance against the work and shall not be taken as final acceptance of work / measurement carried out till the final bill.

1.2.4 PAYING AUTHORITY:

In charge- Finance ,  
BGL-HO, Hyderabad.



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**QUALITY ASSURANCE**

**(ANNEXURE-6 TO SPECIAL CONDITIONS OF CONTRACT)**

(For details- Refer our Technical Specification enclosed in Vol.-II of tender document.)



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**CONDITIONS FOR ISSUE AND RECONCILIATION  
OF MATERIAL**

(ANNEXURE-7 TO SPECIAL CONDITIONS OF CONTRACT)

ANNEXURE-7 TO SCC

1.0 CONDITIONS FOR ISSUE OF MATERIALS

Whenever any material is issued by Owner, following conditions for issue of material in addition to other conditions specified in the contract shall be applicable.

- 1.1 Necessary indents will have to be raised by the Contractor as per procedure laid down by the Engineer-in-charge from time to time, when he requires the above material for incorporation in permanent works.
- 1.2 Materials will be issued only for permanent works and not for temporary works, enabling works etc. unless specifically approved by the Engineer-in-charge and the same shall not be taken into account for the purpose of materials reconciliation.
- 1.3 The contractor shall bear all other cost including lifting, carting from issue points to work site/ contractor's store, custody and handling etc. and return of surplus/ serviceable scrap materials to Owner's storage points to be designated by the Engineer-in-charge etc. No separate payment for such expenditure will be made.
- 1.4 No material shall be allowed to be taken outside the plant without a gate pass.
- 1.5 The contractor shall be responsible for proper storage, preservation and watch & ward of the materials.
- 1.6 Reconciliation of Owner supplied materials
- 1.6.1 Every month, the contractor shall submit an account for all materials issued by Owner in the proforma prescribed by the Engineer-in-charge. On completion of the work the contractor shall submit "Material Appropriation Statement" for all materials issued by the Owner in the proforma prescribed by the Engineer-in-charge.

Waste materials like part lengths of pipes and other partly used items are the property of BHAGYANAGAR GAS LTD. and must be returned to the store with the appropriate documentation so that they can be considered as part of the material reconciliation.

\* In case supplied by Owner



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Unaccountable wastage/ scrap shall be at actual as per site assessment subject to maximum as stated above.

The percentage allowance shall be accounted on the basis of final measurement book.

- 1.6.2 All unused, scrap materials and salvageable materials shall be the property of the Owner and shall be returned by the Contractor category-wise at his cost to the Owner's designated store yard(s). In case the Contractor fails to do so/ or exceeds the limits of allowances specified above for scrap/ serviceable materials, then recovery for such quantities not returned as well as returned in excess of permitted limit by the Contractor will be done at the penal rate i.e. 125% of landed cost at the time of final bill/ closing of contract by Engineer-in-charge shall be effected from the Contractor's bill(s) or from any other dues of the Contractor to the Owner. Contractor shall be responsible for the adjustment/ weighment/ measurement of the surplus materials to be returned to the store. Contractor shall also be responsible for suitable segregation of returned materials into separate stacks of serviceable and scrap materials.
- 1.6.3 Wherever certain material is covered under Contractor's scope of supply whether part or in full for any item of work covered under SOR, no allowance towards wastage/ scrap etc. shall be accounted for during execution stage.



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**CONSTRUCTION EQUIPMENT TO BE DEPLOYED**

(ANNEXURE-8 TO SPECIAL CONDITIONS OF CONTRACT)



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ANNEXURE-8

CONSTRUCTION EQUIPMENT TO BE DEPLOYED



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Sl. No.	Description of Item	Minimum Qty. to be Deployed* for each city
i.	Electro-fusion machine with Bar Code and control box with leads	2
ii.	Moling Equipment	As and when required
iii.	PE Squeeze Tools for all diameter Pipes	2
iv.	Universal pipe scrapper 20mm, 32mm / hand scrappers for all diameters	4
v.	Tapping tools for PE service tees	2 sets of all size
vi.	PE pipe cutter/ Guillotine for all diameters	3
vii.	Gas detection equipment, wherever required	As and when required
viii.	Cable and pipe locator	As and when required
ix.	PE closure plugs/ test ends for 20mm / 32mm pipes	As required
x.	Towing heads	As required
xi.	Pipe alignment clamps, jointing of elbow, tee, top loading clamps for top tee	4
xii.	Pipe straightners, re-rounding tools of all pipe sizes	3
xiii.	Jumping Jack compactor	As and when required
xiv.	Roller for asphaltting	As and when required
xv.	Water tanker	As and when required
xvi.	Hammer Drill	3
xvii.	Portable Power Generator a) 5 kVA b) 3 kVA	2 2
viii.	Piston Drill	2 Gangs
xix.	Conversion Kit	2 Gangs as required
xx.	Pneumatic Test Pumps	2
xxi.	Die sets for thread preparation	2 per gang
xxii.	Soldier Torch	2
xiii.	Cleaning pads	6
xiv.	Cleaning Brush	6
xxv.	Lacquer and thinner	As Required



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xvi.	Safety Harness equipments with descent control	2
xvii.	Calibrated Pressure Gauge (0-6 Bar)	6

Notes:

1. Any other equipment required for completion of pipeline laying work but not specifically mentioned hereinabove, shall be deployed by contractor without any additional cost to Owner. Contractor shall deploy above mentioned equipments in good working condition.
2. Mobilization shall be considered complete only after equipments having quantity specifically mentioned hereinabove (in the min. qty. to be deployed column), are made available at site in good working condition as verified by EIC.
- \*) Number of equipment indicated hereinabove is a minimum requirement, however for completion of job, if additional equipment is required, same shall be deployed by the contractor at site without any additional cost to Owner.

\_\_\_\_\_  
(SIGNATURE OF BIDDER)



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**SCHEDULE OF LABOUR RATES**

(ANNEXURE-9 TO SPECIAL CONDITIONS OF CONTRACT)



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Gas Limited

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ANNEXURE -9 to SCC

SCHEDULE OF LABOUR RATES  
(FOR EXTRA WORKS)

Sl. Classification No. Personnel	Rates in INR for 8 hours	Rate per Hour for OT, Sunday & Holiday
	Standard Time (Rs)	In Rs
1. Engineer	1500/-	650
2. Surveyor Foreman	1200/-	430
3. Pipe Fitter	750/-	150
4. Pipe Welder	750/-	150
5. Gas Cutter	700/-	170
6. Grinder	700/-	170
7. Mason	520/-	120
8. Plumber	500/-	120
9. Carpenter	500/-	130
10. Painter	500/-	120
11. Electrician	600/-	150
12. Cable Jointer	780/-	190
13. Instrument Technician	1000/-	190
14. Rigger	400/-	110
15. Watchman/Helper	350/-	80
16. Concrete Mixer Operator	350/-	80
17. Heavy Machine Operator	700/-	170
18. Fusion Operation/ Jointer	500	120
19. Civil labour	450	60

(SIGNATURE OF BIDDER)

NOTES:-

Above rates are final and Tenderer is to sign only without deviation.



Bhagyanagar  
Gas Limited

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**EQUIPMENT HOURLY RENTAL RATES FOR EXTRA  
WORKS**

(ANNEXURE-10 TO SPECIAL CONDITIONS OF CONTRACT)



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ANNEXURE-10 TO SCC

EQUIPMENT HOURLY RENTAL RATES FOR EXTRA WORKS

SL. DESCRIPTION OF RATES FOR NO. EQUIPMENT INCLUDING	HOURLY RENTAL EXTRA WORKS  CONSUMABLES
1) Excavator/ JCB	Rs. 1000/-
2) Moling machine	Rs. 600/-
3) 3) Compressors 210 CFM	Rs. 1500/-
4) Dewatering Pumps	Rs. 600/-
5) Fusion Jointing Machine	Rs. 900/-
6) Power generators (5KVA)	Rs. 250/-
7) Gas cutting set with cylinders	Rs. 150/-
8) Trucks (small)	Rs. 400/-
9) Car/Jeep	Rs. 200/-
10) Tripod with 5 Tons Chain Pulley Block	Rs. 300/-
11) Tractor Compressor	Rs. 600/-

NOTES:-

- 1) Rates are final and Tenderer is to sign only without deviation.
- 2) In case of foreign bidder, Conversion rate applicable on one day prior to price bid Opening date published by the State Bank of India will be considered.
- 3) Rates are inclusive of operators / drivers as applicable
- 4) Rates are inclusive of contractor's overhead & profit
- 5) The recovery rate shall be the rates provided above plus 20%

\_\_\_\_\_  
(SIGNATURE OF BIDDER)

**Section VI: Schedule of Requirements**

**Background of Services**

**1) Background and Services; and impact on performance/ objectives;**

As per tender terms and conditions.

**2) Purpose and Service Outcomes Statement**

As per tender terms and conditions.

**3) Short Description and Scope of Services**

The scope involves Supply, Erection and Commissioning of Mechanical and Miscellaneous works for Mother Station (MS) for CNG & PNG facilities for CGD projects.

For detailed scope of work & specification, refer Technical Volume including Corrigendum (if any).

**4) Contract Duration / Contract Period**

As per tender terms and conditions

**5) Form of BOQ/ Contract**

SOR Type

**6) Deliverables/ Outcomes and Timelines(frequency) thereof:**

As per tender terms and conditions.

**7) Facilities and Utilities to be provided by the Employer to service provider at Site:**

As per tender terms and conditions.

**8) Institutional and organisational arrangement for Services**


As per tender terms and conditions.

**9) Statutory and contractual obligations to be complied with by the contractor**

As per tender terms and conditions.

**10) Insurances**

As per tender terms and conditions.

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### **Section VII: Performance Standards and Quality Assurance**

*Note for Bidders: Regarding this Schedule and its sub-schedules, Bidders shall submit the following forms, as relevant for the form of BOQ/ Contract, or if asked:*

- 1) *Form 4: Performance Standards and Quality Assurance - Compliance*



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**Technical Volume II of II**

Sl.No.	Description	Attached File	Set Value	Supporting Doc. Req'd
1	Technical Volume II of II		-	
2	Technical Volume II of II	Technical Volume II of II.pdf	-	



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**TECHNICAL DOCUMENTATION**

Technical Vol II of II, Rev. 0



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4	PTS	PIPING FABRICATION AND ERECTION	P.019141G 11077 M 008	0	12	18
5	PTS	STATION PIPE	P.019141G 11077 M 009	0	12	30
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**COMPOSITE WORKS PACKAGE (MECHANICAL WORKS) OF  
MOTHER STATIONS**

INTRODUCTION



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**1.0 INTRODUCTION**

Bhagyanagar Gas Limited (BGL) (hereinafter referred as Owner), is executing the City Gas Distribution project in Hyderabad GA.

VCS has been appointed as Project Management Consultant (hereinafter referred as PMC), by BGL for providing Design, Engineering & PMC services for a mentioned project.

BGL is now inviting tenders on Competitive Bidding basis for the below works under the same tender-

- a) Supply & installation, testing & commissioning for Mechanical piping & fittings Works, of Mother Station under Hyderabad GA
- b) Composite works (Mechanical, and instrumentation works). This part refers to Mechanical part i.e. Supply & installation, testing & commissioning of ‘Laying, fitting of “SS Tubes, Carbon steel pipes & flanges above ground level” for 02 no. of Mother stations in GA of Hyderabad.

The present document covers the technical specifications for the enquiry.

**2.0 BRIEF SCOPE OF WORK OF CONTRACTOR  
FOR MOTHER STATION**

The scope of work not limited to design, manufacture, supply, Inspection & testing at workshop, marking, packing, handling, and dispatch of Mechanical (SS, CS Piping system), as per P&ID’s, Piping GAD, Plot Layout & specifications.

The scope of work is broadly divided into the following:

Procurement, manufacturing, inspection, testing, supply, storage & preservation

Project Management, Construction management, overall quality control including Document Management.

Construction, Installation, Erection and Testing

Pre-commissioning and Commissioning including supply of Manpower, Consumables, Non-sparking tools and tackles etc. Details of same shall be shared during execution.

Project Close Out

**\*Note: Refer SOR for detailed scope of work.**

**3.0 FREE ISSUE MATERIAL FOR (MOTHER STATION):**

- 1. Cascades
- 2. Compressors
- 3. Dispenser
- 4. All CS Valves of size 4" and Above



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**PIPELINE VALVES**



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## PIPELINE VALVES

### INTRODUCTION

This Document (PTS - Particular Technical Specification for – PIPELINE VALVES) lists the Specification for Manufacturing of Ball Valves for City Gas Distribution Project in Hyderabad . Natural gas will be transported to residential, commercial, industrial (PNG) and automobile consumers (CNG) in the city.

The present specification can confirm, complete, or modify certain sections/paragraphs of said «General Technical Specification». The PTS will govern the requirements for all such sections.

### AMMENDMENT TO GTS 70000/740/402

#### 1. SCOPE

Add:

The present Particular Technical Specification relates to the manufacture of “Pipeline Ball Valves” (for above and underground) for City Gas Distribution Project for BHAGYANAGAR GAS LIMITED (BGL).

#### DEFINITIONS

Add:

<b>Purchaser</b>	shall mean Bhagyanagar Gas Limited,
<b>GTS</b>	means << General Technical Specification 70000/740/GTS/402 rev. 0 >> and all documents it refers to.
<b>PTS</b>	means the present <<Particular Technical specification P.019141 G11077 M005 >> and all its appendices, if any.
<b>Manufacturer</b>	means the Manufacturer of the valves as well as its sub-contractor(s).
<b>Control Authority</b>	Owner/Engineer or their Authorised Inspection Agency
<b>Inspection Agency or Third-Party Inspection Agency (TPIA)</b>	means the Inspection Agency to be appointed by the Manufacturer.
<b>Engineer/ Owner’s</b>	the entity of the purchaser or the company nominated by the purchaser.

#### 2. PRELIMINARY STATEMENT

Add:

- In case of conflict between the requirements in technical documents, the most stringent requirements shall apply.
- A valid copy of API 6D monogram/certificate shall be included in the offer.

Modify:

- For any control, test or examination required under the supervision of the Authorised Control authority (LOFC Intervention points included), the latter shall be informed in writing FIVE (5) working days in advance by the Manufacturer (Fifteen working days in case of supply of foreign origin) about place and

time with a copy to the Purchaser/Engineer. Wages and travel expenditure of the Authorised Control Authority are at the Purchaser's expenses.

- As the manufacturing is to be carried out under LOFC concept, the Manufacturer shall send for approval a List of Operation in Manufacturing and Control (see annex 1) to the Authorised Control Authority and Purchaser/Engineer, TEN (10) working days before manufacturing. This list shall be in conformity with the annex 1 to this document. Before starting any manufacturing, the Manufacturer shall be in possession of this approved document, filled in with all intervention points.

### 3. DESIGN AND CONSTRUCTION

#### 3.1 Design

##### 3.1.1 Welding ends

Add:

The valve manufacturer shall supply all butt weld valves with a welded pups/Transition piece at both ends which shall be considered as an integral part of the valve & hence such as strength test, hydrostatic test & Leak test should be done with pup-piece/transition piece weld on valve.

The chemical composition of the steel of the Pup/Transition piece meets the following requirements.

Maximum limit of chemical elements which may be used in material under this Particular Technical Specification.

	%maximum
C	0.230
Mn	1.60
Si	0.50
P	0.030
S	0.025
Nb	0.080
V	0.120
Mo	0.250
Nt	0.0150

Alternate alloy elements may be used but they shall be discussed with the user prior to delivery of the material. This table is not intended to represent the composition of any heat of steel, but merely to record the maximum permissible amounts of one element. The combination of elements of any heat must conform to the carbon equivalent, computed like following:

$$C.E. = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

and shall not exceed 0.43

For each heat the manufacturer shall analyse the following elements:

C, Mn, Si, P, S, Nb, V, Cr, Mo, Ni and Cu.

The intentional addition of elements other than those specified is not permitted unless agreed up by the purchaser.

In any case, for unintentional additions, the following limitations shall be respected:



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Cr ≤ 0.15%                      Mo ≤ 0.05%                      Cu ≤ 0.20%  
Ni ≤ 0.30%                      Co ≤ 0.01%                      Al ≤ 0.07%

The content of N total (Nt) may be up to 0.0150% and must be guaranteed by the manufacturer. If the manufacturer cannot give any guaranty of N content, he shall analyse this element.

The total content for Nb + V will be limited to 0.150%.

In grades X42 through X60 for each reduction of 0.01% below the maximum carbon content, an increase of 0.05% manganese above the specified maximum is permissible, up to a maximum of 1.70%.

The choice and use of alloying elements made from high strength low alloy steels to give the tensile properties of API 5L Gr. X52 (in table hereafter), is of the responsibility of the manufacturer.

Symbol	Yield Strength (min.)		Tensile Strength (min.)		Elongation in 2 in.
	Ksi	Mpa	Ksi	Mpa	Min. percent
<b>X52</b>	52	360	66	460	20
<b>X56</b>	56	390	71	490	20

The ratio of effective yield strength to effective tensile strength of the steel shall not exceed 0.90 for material of SMYS 60000 psi.

If the butt-welding end of the valve has a thickness and/or a steel grade not equal to the connecting pipe, butt-welding ends shall be in accordance with any of the suggestive figures given in Appendix I of ASME B 31.8 or an appropriate combination selected by the valve manufacturers to ensure that availability of uniform pig passage without sacrificing pressure-temperature design requirement.

Thickness of Pup Piece shall be determined by the Vendor as per Code requirements. The pipe end of the Pup Piece shall match the Material, diameter and thickness of line pipe where the valve is required to be welded. Table below indicate the size, thickness, material of the line pipe for various sizes of Ball valves:

Size of Ball valve (NB)	Material of construction	Thickness
4"	API 5L Gr. X52, PSL 2	6.4 mm
8"	API 5L Gr. X52, PSL 2	6.4 mm
10"	API 5L Gr. X-56, PSL 2	6.4 mm
12"	API 5L Gr. X-56, PSL 2	6.4 mm

The Valve Manufacturers shall submit all necessary details regarding welding of BW end of valve with Line pipe along with calculation for provided thickness for approval of Owner/Owner's representative.

**3.1.2 Design features**

Double piston effect: when the pressure is applied to one side, let us say upstream" side, and when upstream ball seat is leaking, transfer pressure shall have a positive shut-off effect on the downstream seat (acting, for instance, on the back face of this seat) and thus reinforcing the global tightness of the valve. *(Not applicable)*

**3.1.3 Vent, sealant etc. shall be adequately supported on the stem and body using clamps.**

**4. MATERIALS**

**4.2 Pressure Retaining Parts**

Modify clause no. 7.2.1 as below:

Bodies, including end flanges and welding ends (other than for field welding), bonnet and covers of valves shall be made in material conforming to API 6D spec. (or another material specification accepted by the Purchaser/Engineer) and be furnished with certificates EN 10204-3.2 stating the quality, the mechanical properties (yield strength, tensile strength, percent elongation, impact test value at the temperature specified under per Section 8.4.2) the chemical analysis, the manufacturing process and the marking (e.g. the heat number) of the steel. These certificates shall be added to the CMTR.

#### **4.3 Bonnet, Cover and Body Bolting**

Modify first paragraph as below:

Bonnet, flange cover and body bolting shall be in conformance to ASTM A320 Gr L7 or L7M or ASTM A193 grade B7 or B7M. Nuts shall conform to ASTM A194 Gr 7 or 7M or 2H. All bought out items shall be procured with certificates EN 10204-3.1 including Valve actuator. These certificates shall be added to CMTR.

#### **4.4 Sour Gas Service**

Not Applicable

### **5. FABRICATION AND TEST**

#### **5.1 Welding Fabrication**

Replace third point by:

The joints shall be furnished in accordance with the requirements of Section VIII of ASME Boiler and Pressure Vessel Code - Division 1 and Section IX.

Add:

Vendor shall provide detail instruction for carrying out welding; preheating etc and testing of weld joints between pipe and valves at site. Vendor shall depute his engineer for welding instruction at site

### **6. INSPECTION**

#### **6.1 Information**

Add:

In case of supply from foreign origin, the Manufacturer shall inform the Control Authority min. fifteen (15) working days in advance of any intervention required by this specification and shall send a copy of it to the Purchaser/Engineer (by fax).

Add:

#### **PACKING**

Ball valves are to be suitably packed, crated (seaworthy crate in the case of foreign vendors) and handled properly to prevent damages or deteriorations during transportation by sea (in the case foreign vendors) and road to the designated ware houses (as detailed in the commercial volume of the tender) of the owner and unloading of the valves and storage prior to installation.

Vendors shall submit drawings and details of the proposed packing / crating method clearly indicating the following:

1. Secure bolting arrangement of the ball valve to the robust base of the crate for packing.
2. Lateral staying arrangement to prevent movement of the valve inside the crate resulting damage during transportation and handling.



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3. Also all extended parts such as drain and vent piping shall be securely supported to the valve body to prevent damage during transportation and also subsequent installation and use in operations.

**7. PAINTING AND COATING**

Following coating specification shall be followed:

**Underground Valves:**

The external coating for underground valves shall be made of solvent free PUR / min. 1000 microns thickness in two layers as per code DIN 30677-2 (Type DIN 30677/2-PUR-50).

For repair it would be as per manufacturer's recommendations which have to be approved by Owner/Engineer.

**Aboveground Valves:**

The surface of the valve will be shot-blasted SA 2 1/2 (Swedish standard SIS 055900). Before painting, the valve shall be cleaned from grease and dirt. The painting shall be as per ISO12944-5-2007 (Table A-1) System No. A1.14 with durability C-5 (I) Very High Industrial.

The nature of the products shall be specified in the offer and shall guarantee a corrosion protection for a storage period in a shop for at least one year.

Painting in accordance with Purchaser/Engineer's specifications.

Painting and coating procedures shall be submitted for approval before manufacturing to the Control Authority and to the purchaser / engineer.

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**(MECHANICAL WORKS)**

PTS –LOADING, UNLOADING, TRANSPORTATION AND ERECTION OF  
MECHANICAL EQUIPMENT



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**LOADING, UNLOADING, TRANSPORTATION & ERECTION OF MECHANICAL EQUIPMENTS**

**1.0 SCOPE OF WORK**

1.1 Following Shall Constitute the Contractor's Scope of Work but Not Limited to as Given Herein

- i) Receiving of material from stores.
- ii) Loading of material/ equipment on a trailer / truck from BGL stores. Safe transportation to various sites.
- iii) Unloading, placement and alignment on foundation -on ground or above ground + 4.5 m at roof top (cascade only).
- iv) Transit Insurance of equipment from stores to site.
- v) All equipment transported shall be securely boarded and transported without causing any damage to equipment. Any damage caused during loading, transportation & unloading shall be recoverable from the contractor.
- vi) All the equipment shall be leak tested after erection as per instruction of engineering in charge and standard practice.

**2.0 EQUIPMENT WEIGHT & SIZES**

Sl. No.	Equipment	Size	Weight/ Unit Appx.
1.	Cascade 4500 L/3000L (water capacity)	5.5 M X 1.75M X 1.6M (H) approx. (size may vary for 9.0 T cascade)	6.0 T/9.0T

All excess, unutilized or defective materials and scrap shall be returned after duly accounting for, to the Owner's stores. Where materials are to be weighed before return, the Contractor shall be responsible for making necessary arrangements for weighing etc. The contractor shall not use scrapped or defective materials obtained during the course of construction for fabrication of temporary supports or other items without prior written permission of Engineer-in- Charge.

If the Contractor fails to return the surplus material aforesaid, the Owner will charge the Contractor for such un-returned material at penal rates, which will be deducted from whatever amount is due to the Contractor. In case any material issued by the Owner deteriorates during storage by the Contractor, new material will be issued to him if available at penal rates, but delay in procuring such materials will be at the Contractor's account only.

Contractor to arrange all equipment & tools such as cranes, winch, lifting hook etc and skilled & semiskilled manpower and consumables for erection of all the electro-mechanical equipment.



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**SUPPLY, ERECTION & COMMISSIONING OF MISCELLANEOUS ITEMS**

- 3.3.1 . Fire Fighting Equipment: Supply and installation of (at location indicated by EIC) the following fire-fighting equipment in various CNG stations
- 3.3.1.1:- 4.5kg capacity CO2 type fire extinguishers with steel cylinder with discharge valve conforming to IS:2878-1975. Extinguisher shall be painted with red enamel paint and hardware/bracket required for fixing to wall.
- 3.3.1.2 10kg capacity dry chemical powder (DCP) type fire extinguisher (Manufacturing code IS:13849) with extinguishers cabinet suitable for inverted operation and fabricated from MS sheet internally protected with anti corrosive treatment and hydraulically tested. Extinguishers shall be externally painted with red enamel paint.
- 3.3.1.3:- 75kg capacity trolley mounted dry chemical powder (DCP) type fire extinguisher (Manufacturing code IS:10658) suitable for inverted operation fabricated from MS sheet internally protected with anti corrosive treatment and hydraulically tested extinguishers externally painted with red enamel.
- 3.3.1.4 :- Fire buckets, 9ltrs. capacity, made of galvanized mild steel (as per IS:2546) including supplying & fixing of MS angle iron stand to accommodate 4nos. of Fire bucket sand first fill with sand/water all complete as per direction of Engineer In-charge. (Note: One set of Fire bucket consists of 4 buckets with stand)
- 3.3.2 Taking over the site from OWNER/ENGINEER-IN-CHARGE; carrying out pre- construction survey, making arrangement of safety, security, temporary water& electrical connections, traffic detour etc. setting out the piping GAD by laying out the plans at site.
- 3.3.3 Preparing QAP and taking approval from BGL including Welder's Qualification Test, Internal Test Plan, Hydrostatic Test Procedures, SS Tube & Yard Pipe testing & procedures.
- 3.3.4 To carry out all tests at work site, approved laboratory and place of manufacture/fabrication; provide all test certificates from manufacturers & supplier and offer inspection at all stages of procurement/construction.
- 3.3.5 To maintain and observe all statutory requirements with regards to labour laws, taxation laws, local statutory rules and insurance requirements.
- 3.3.6 To hand over clear site to OWNER/ENGINEER-IN-CHARGE after removing all debris subsequent to completed works as per scope.
- 3.3.7 To submit daily, weekly and monthly progress reports and to attend review meetings both at site and at project office and other discussions with Owner/ Statutory Authorities.
- 3.3.8 To transfer all Test Certificates, warranties/guarantees including maintenance/performance guarantees of various fittings/fixtures, equipment/material and indemnify consultant/OWNER of any liabilities of payments/ dues to its suppliers, manufacturers, agents etc.
- 3.3.9 Marking all as-built details on construction/fabrication drawings/data sheets issued by OWNER/ENGINEER-IN-CHARGE and submission of as-built details and drawings in six sets.



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**PIPING FABRICATION AND ERECTION**



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## **1.0 GENERAL**

This specification covers general requirements of fabrication and erection of aboveground and trench piping systems at site. The specification covers the scope of work of Contractor, basis of work to be carried out by the Contractor and standards, specifications, and normal practice to be followed during fabrication and erection by the Contractor.

## **2.0 SCOPE**

Scope of work of Contractor shall include the following:

- 2.1 Transportation of required piping materials, pipe support and all other necessary piping materials from OWNER/contractor's storage point to work site / shop including raising store requisitions for issue of materials in the prescribed format & maintaining an account of the materials received from Owner's stores.
- 2.1.1 Piping materials include the following but not limited to the same.
  - a. Station Pipes (Below 4'' as per PMS)
  - b. Flanges (All sizes, types & Pressure ratings).
  - c. Fittings (All sizes, types, and schedule)
  - d. Valves (sizes 2'' and below)
  - e. Gaskets (All sizes, types & Ratings)
  - f. Bolts, Nuts or M/C Bolts (All types)
  - g. Vent Cap (All Type and Size)
- 2.2 Shop & field fabrication and erection of piping in accordance with documents listed under Cl. 3.0 i.e 'BASIS OF WORK' including erection of all piping materials enumerated above.
- 2.3 Fabrication and erection of pipe supports like shoe, saddle, guide, stops, anchors, clips, cradles, hangers, turn buckles, supporting fixtures, bracket cantilevers, struts, tee posts including erection of spring supports and sway braces.
- 2.4 **Fabrication**
  - 2.4.1 Fabrication of piping materials like special radius bends, reducers, mitres etc.
  - 2.4.2 Fabrication of plain and threaded nipples from pipes as required during erection.
  - 2.4.3 Fabrication of swage nipples as and when required.
  - 2.4.4 Fabrication of odd angle elbow like 60°, 30° or any other angle from 90/45° elbows as and when required.
  - 2.4.5 Fabrication of flange, reducing flange, blind flange, spectacle blinds as and when required.
  - 2.4.6 Fabrication of stub-in connection with or without reinforcement.
  - 2.4.7 Grinding of edges of pipes, fittings, flanges etc. to match mating edges of uneven / different thickness wherever required.
- 2.5 Modifications like providing additional cleats, extension of stem of valve, locking arrangement of valves etc. as and when required.
- 2.6 Preparation of Isometrics, bill of materials, supporting details of all NON-IBR lines upto 2-1/2" within the unit battery limit and get subsequent approval from Engineer-in-Charge as and when called for.
- 2.7 Obtaining approval for drawings prepared by Contractor from statutory authority, if required.
- 2.8 Radiography, stress relieving, dye penetration, magnetic particle test etc. as required in specification.
- 2.9 Performing PMI using alloy analysers.
- 2.10 Casting of concrete pedestals and fabrication & erection of small structures for pipe supports including supply of necessary materials.

- 2.11 Providing insert plates from concrete structures and repair of platform gratings around pipe openings.
- 2.12 Making material reconciliation statement and return of Owner's supplied left over materials to Owner's store.
- 2.13 Flushing and testing of all piping systems as per standard specification for inspection, flushing and testing of piping systems.

**3.0 BASIS FOR WORK**

- 3.1 The complete piping work shall be carried out in accordance with the following
  - 3.1.1 "Approved for Construction" drawings and sketches issued by OWNER/PMC to the Contractor - Plans and/or Isometrics.
  - 3.1.2 Approved Process licensor's standards and specifications.
  - 3.1.3 Drawings, sketches and documents prepared by Contractor duly approved by Engineer-in-Charge/PMC (such as isometrics and offsite piping etc.)
  - 3.1.4 Construction job procedures prepared by Contractor and approved by OWNER/PMC.
  - 3.1.5 TEPL specifications/documents as below:
    - a. Process and Instrument Diagram.
    - b. Piping Materials Specification
    - c. Piping support standards.
    - d. Standard specification of NDT Requirement of Piping
    - e. Welding specification charts for piping classes.
    - f. Standard specification for Pressure Testing of Erected Piping System.
    - i. Welding specification for fabrication of piping
    - j. Any other specifications attached with Piping Material Specification or special condition of contract.
    - k. Procedure for storage, preservation, and positive identification of materials at Contractors works / stores.
  - 3.1.6 Applicable codes, standards, and regulations
    - a. ASME B 31.3 : Process Piping
    - b. PNGRB T4S :
    - c. OISD - 226 : Oil Industry Safety Directory for Natural Gas Transmission Pipeline and CGD Network
    - e. OISD-GDN-192 : Safety Practices During Construction
    - f. OISD - 179 : Oil Industry Safety Directory for Safety Requirements
    - g. ASME Sec. VIII : Rules for Construction of Pressure Vessels.
    - h. IBR Regulations
    - i. IS: 823 : Code for procedure for Manual Metal Arc Welding of Mild Steel (for structural steel).  
: Code for Sour Services material requirements.

- 3.2 Note: All codes referred shall be latest edition.  
Deviations

Where a deviation from the "Basis of Work" and approved job procedure described above is required or where the basis of work does not cover a particular situation, the matter shall be brought to the notice of

Engineer - in - Charge and the work carried out only after obtaining written approval from Engineer – in – Charge in each case.

#### **4.0 FABRICATION**

##### **4.1 Piping Material**

Pipe, pipe fittings, flanges, valves, gaskets, studs bolts etc. used in a given piping system shall be strictly as per the "Piping Material Specification" for the "Pipe Class" specified for that system. To ensure the above requirement, all piping material supplied by the Contractor shall have proper identification marks as per relevant standards / TEPL's specifications. Contractor shall provide identification marks on left over pipe lengths wherever marked up pipe lengths have been fabricated / erected.

##### **4.2 Fabrication**

- 4.2.1 All fabrication shall be carried out in accordance with piping general arrangement drawings, including this specification and codes as specified in section 3.0.
- 4.2.2 CONTRACTOR shall be responsible for working to the exact dimensions as per the approved drawings.
- 4.2.3 Flange bolt holes shall generally straddle the established centre lines unless other orientation is required and as called out in approved drawings.
- 4.2.4 Threading shall be NPT as per ANSI B 1.20.1. Threading shall preferably be done after bending, forging or heat treatment operation. However, if it is not possible, precaution shall be taken to protect threading against deformation. Thread shall be clean cut with no burrs or stripping. Dies shall be new, sharp, and properly designed for piping material. Ends shall be reamed to remove burrs.
- 4.2.5 All threaded joints shall be aligned properly. The pipe entering unions shall be true to centrelines so as to avoid forcing of union coupling during make up. Damaged threads shall be cut from the end of run and the pipe shall be rethreaded.
- 4.2.6 Immediately before testing the piping, all threads of pipe and fittings shall be thoroughly cleared of cuttings, fuel oil or other foreign matter. The male threads shall be sealed with thread sealant and the piping made up sufficiently for the thread to seize. Sealant shall be Teflon tape.
- 4.2.7 Seal welding of threaded connections when specified shall include the first block valve, cover all threads. The joint shall be cleaned of all cutting oil and other foreign material and made up dry to full thread engagement. Instrument threaded connections which are frequently subjected to testing and maintenance shall not be seal welded.
- 4.2.8 All threaded connections shall be protected from rusting by applying greases or oil when in operating condition.
- 4.2.9 When socket weld fittings or valves are used, pipe shall be spaced approximately 1/16" to avoid bottoming which could result in excessive weld stress.
- 4.2.10 where the ends of the piping components being welded have an internal surface misalignment exceeding 1.6mm, the wall of the component extending internally shall be trimmed by machining so that the adjoining internal surface will approximately flush.
- For the purpose of common understanding the construction job procedure, to be submitted by the contractor, shall include proposal for
- Maximizing prefabrication, inspection and testing at fabrication shop with minimum field joints.
  - Positive material identification, handling, storage & preservation.

##### **4.3 Dimensional Tolerances**

The Contractor shall be responsible for working to the dimensions shown on the approved drawings. However, the Contractor shall bear in mind that there may be variations between the dimensions shown in the drawing and those actually existing at site due to minor variations in the location of equipments, inserts, structures etc. To take care of these variations "Field Welds" shall be provided during piping fabrication. An

extra pipe length of 100 mm over and above the dimensions indicated in the drawing may be left on one side of the pipe at each of the field welds. During erection, the pipe end with extra length at each field weld, shall be cut to obtain the actual dimension occurring at site. Isometrics, if supplied may have the field welds marked on them. However, it is the responsibility of the Contractor to provide adequate number of field welds. In any case no extra claims will be entertained from the Contractor on this account. Wherever errors / omissions occur in drawings and Bills of Materials it shall be the Contractor's responsibility to notify the Engineer-in-Charge prior to fabrication or erection.

#### **4.4 Pipe Joints**

The piping class of each line specifies the type of pipe joints to be adopted. In general, joining of lines 2" and above in process and utility piping shall be accomplished by butt welds. Joining of lines 1-1/2" and below shall be by socket welding / butt welding / threaded joints as specified in "Piping Material Specifications". However, in piping 1-1/2" and below where socket welding/ threaded joints are specified butt - welds may be used with the approval of Engineer- in-Charge for pipe to pipe joining in long runs of piping.

Flange joints shall be used at connections to Vessels, Equipment's, Valves and where required for ease of erection and maintenance as indicated in drawings.

#### **4.5 Butt Welded and Socket Welded Piping**

End preparation, alignment and fit-up of pipe pieces to be welded, welding, pre-heat, post- heating and heat treatment shall be as described in the welding specification and NDT specification.

#### **4.6 Screwed Piping**

In general, Galvanized piping shall have threads as per IS: 554 or ANSI B 1.20.1 NPT as required to match threads on fittings, valves etc. All other piping shall have threads as per ANSI B 1.20.1, tapered unless specified otherwise.

Threads shall be clean cut, without any burrs or stripping and the ends shall be reamed. Threading of pipes shall be done preferably after bending, forging or heat-treating operations. If this is not possible, threads shall be gauge checked and chased after welding heat treatment etc.

During assembly of threaded joints, all threads of pipes and fittings shall be thoroughly cleaned of cuttings, dirt, oil or any other foreign matter. The male threads shall be coated with thread sealant and the joint tightened sufficiently for the threads to seize and give a leak proof joint.

Threaded joints to be seal-welded shall be cleaned of all foreign matter, including sealant and made up to full thread engagement before seal welding.

#### **4.7 Flange Connections**

All flange facings shall be true and perpendicular to the axis of pipe to which they are attached. Flanged bolt holes shall straddle the normal centrelines unless different orientation is shown in the drawing.

Wherever a spectacle blind is to be provided, drilling and tapping for the jack screws in the flange, shall be done before welding it to the pipe.

#### **4.8 Branch Connections**

Branch connections shall be as indicated in the piping material specifications. For end preparation, alignment, spacing, fit-up and welding of branch connections refer welding specifications. Templates shall be used wherever required to ensure accurate cutting and proper fit-up.

For all branch connections accomplished either by pipe to pipe connections or by using forged tees the rates quoted for piping shall be inclusive of this work.

Reinforcement pads shall be provided wherever indicated in drawings/ specifications etc.

#### **4.9 Bending**

Bending shall be as per ASME B31.3 except that corrugated or creased bends shall not be used.

Cold bends for lines 1-1/2" and below, with a bend radius of 5 times the nominal diameter shall be used as required in place of elbows wherever allowed by piping specifications. Bending of pipes 2" and above may be required in some cases.

The completed bend shall have a smooth surface, free from cracks, buckles, wrinkles, bulges, flat spots and other serious defects. They shall be true to dimensions. The flattening of a bend, as measured by the difference between the maximum and minimum diameters at any cross-section, shall not exceed 8% and 3% of the nominal outside diameter, for internal and external pressure respectively.

#### **4.10 Forging and forming**

Forging and forming of small-bore fittings, like reducing nipples for piping 1-1/2" and below, shall be as per ASME B 31.3.

**Mitre Bends and Fabricated Reducers not permitted.**

#### **4.11 Cutting and Trimming of Standard Fittings & Pipes**

Components like pipes, elbows, couplings, half-couplings etc. shall be cut / trimmed / edge prepared wherever required to meet fabrication and erection requirements, as per drawings and instructions of Engineer-in-Charge. Nipples as required shall be prepared from straight length piping.

#### **4.12 Galvanised Piping**

Galvanised carbon steel piping shall be completely cold worked, so as not to damage galvanised surfaces. This piping involves only threaded joints and additional external threading on pipes may be required to be done as per requirement.

#### **4.13 Jacketed Piping**

The Jacketing shall be done in accordance with standard specification as suggested in material specification or special condition of contract.

Pre-assembly of jacketed elements to the maximum extent possible shall be accomplished at shop by Contractor. Position of jump over and nozzles on the jacket pipes, fittings etc. shall be marked according to pipe disposition and those shall be prefabricated to avoid damaging of inner pipe and obstruction of jacket space. However, valves, flow glasses, in line instruments or even fittings shall be supplied as jacketed.

#### **4.14 Shop Fabrication / Prefabrication**

The purpose of shop fabrication or pre-fabrication is to minimise work during erection to the extent possible. Piping spool, after fabrication, shall be stacked with proper identification marks, so as facilitate their withdrawal at any time during erection. During this period all flange (gasket contact faces) and threads shall be adequately fabricated by coating with a removable rust preventive. Care shall also be taken to avoid any physical damage to flange faces and threads.

#### **4.15 Miscellaneous**

4.15.1 Contractor shall fabricate miscellaneous elements like flash pot, seal pot, sample cooler, supporting elements like turn buckles, extension of spindles and interlocking arrangement of valves, operating platforms as required by Engineer-in-Charge.

4.15.2 Spun Concrete Lining

The work of inside spun concrete lining of pipes and specials of diameter 3" and above shall be done as per Material specifications and special condition contract.

4.15.3 Fabrication of pipes from plate

Pipes shall be fabricated at site as and when required as per the specifications attached and the actual Piping Material Specification.

## **5.0 ERECTION**

### **5.1 Cleaning of Piping before Erection**

Before erection all prefabricated spool pieces, pipes, fittings etc. shall be cleaned inside and outside by suitable means. The cleaning process shall include removal of all foreign matter such as scale, sand, weld spatter chips etc. by wire brushes, cleaning tools etc. and blowing with compressed air/or flushing out with water. Special cleaning requirements for some services, if any shall be as specified in the piping material specification or isometric or line list.

### **5.2 Piping Routing**

No deviations from the piping route indicated in drawings shall be permitted without the consent of Engineer-in-Charge.

Pipe to pipe, pipe to structure / equipments distances / clearances as shown in the drawings shall be strictly followed as these clearances may be required for the free expansion of piping / equipment. No deviations from these clearances shall be permissible without the approval of Engineer-in-Charge.

In case of fouling of a line with other piping, structure, equipment etc. the matter shall be brought to the notice of Engineer-in-Charge and corrective action shall be taken as per his instructions.

### **5.3 Slopes**

Slopes specified for various lines in the drawings / P&ID shall be maintained by the Contractor. Corrective action shall be taken by the Contractor in consultation with Engineer-in-Charge wherever the Contractor is not able to maintain the specified slope.

### **5.4 Expansion Joints / Bellows**

Installation of Expansion Joints/Bellows shall be as follows:

All Expansion joints / Bellows shall be installed in accordance with the specification and installation drawings, supplied to the Contractor.

Upon receipt, the Contractor shall remove the Expansion Joints/ Bellows from the case(s) and check for any damage occurred during transit.

The Contractor shall bring to the notice of the Engineer-in-Charge any damage done to the bellows / corrugations, hinges, tie-rods, flanges / weld ends etc.

Each Expansion Joint / Bellow shall be blown free of dust / foreign matter with compressed air or cleaned with a piece of cloth.

For handling and installation of Expansion Joints, great care shall be taken while aligning. An Expansion Joints shall never be slinged from bellows corrugations / external shrouds, tie / rods, angles.

An Expansion Joints / Bellow shall preferably be slinged from the end pipes/ flanges or on the middle pipe.

Expansion Joints stop blocks shall be carefully removed after hydrostatic testing.

Angles welded to the flanges or weld ends shall be trimmed by saw as per manufacturer's instructions and the flanges or weld ends shall be ground smooth.

The pipe ends in which the Expansion Joint is to be installed shall be perfectly aligned or shall have specified lateral deflection as noted on the relevant drawings.

The pipe ends / flanges shall be spaced at a distance specified in the drawings.

The Expansion Joint shall be placed between the mating pipe ends / flanges and shall be tack welded/bolted. The mating pipes shall again be checked for correct alignment.

Butt-welding shall be carried out at each end of the expansion joint. For flanged

Expansion Joint, the mating flanges shall be bolted.

After the Expansion Joint is installed, the Contractor shall ensure that the mating pipes and Expansion Joints are in correct alignment and that the pipes are well supported and guided.

The Expansion Joint shall not have any lateral deflection. The Contractor shall maintain parallelism of restraining rings or bellows convolutions.

#### **Precautions**

- For carrying out welding, earthing lead shall not be attached with the Expansion Joint.
- The Expansion bellow shall be protected from arc weld spot and welding spatter.
- Hydrostatic Testing of the system having Expansion Joint shall be performed with shipping lugs in Position. These lugs shall be removed after testing and certification is over.

### **5.6 Flange Connections**

While fitting up mating flanges, care shall be exercised to properly align the pipes and to check the flanges for trueness, so that faces of the flanges can be pulled together, without inducing any stresses in the pipes and the equipment nozzles. Extra care shall be taken for flange connections to pumps, turbines, compressors, cold boxes, air coolers etc. The flange connections to these equipments shall be checked for misalignment, excessive gap etc. after the final alignment of the equipment is over. The joint shall be made up after obtaining approval of Engineer-in-Charge.

Temporary protective covers shall be retained on all flange connections of pumps, turbines, compressors and other similar equipments, until the piping is finally connected, so as to avoid any foreign material from entering these equipments.

The assembly of a flange joint shall be done in such a way that the gasket between these flange faces is uniformly compressed. To achieve these bolts shall be tightened in a proper sequence. All bolts shall extend completely through their nuts but not more than 1/4".

Steel to C.I. flange joints shall be made up with extreme care, tightening the bolts uniformly after bringing flange flush with gaskets with accurate pattern and lateral alignment.

### **5.7 Vents and Drains**

High point vents and low point drains shall be provided as per the instructions of Engineer-in- Charge, even if these are not shown in the drawings. The details of vents and drains shall be as per piping material specifications / job standards.

### **5.8 Valves**

Valves shall be installed with spindle / actuator orientation / position as shown in the layout drawings. In case of any difficulty in doing this or if the spindle orientation / position is not shown in the drawings, the Engineer-in-Charge shall be consulted, and work done as per his instructions. Care shall be exercised to ensure that globe valves, check valves, and other uni- directional valves are installed with the "Flow direction arrow "on the valve body pointing in the correct direction. If the direction of the arrow is not marked on such valves, this shall be done in the presence of Engineer-in-Charge before installation.

Fabrication of stem extensions, locking arrangements and interlocking arrangements of valves

(If called for), shall be carried out as per drawings / instructions of Engineer-in-Charge.

### **5.9 Instruments**

Installation of in-line instruments such as restriction orifices, control valves, safety valves, relief valves, rotameters, orifice flange assembly, venturi meters, flowmeters etc. shall form a part of piping erection work.

Fabrication and erection of piping upto first block valve / nozzle / flange for installation of offline Instruments for measurement of level, pressure, temperature, flow etc. shall also form part of piping construction work. The limits of piping and instrumentation work will be shown in drawings / standards / specifications. Orientations / locations of take-offs for temperature, pressure, flow, level connections etc. shown in drawings shall be maintained.

Flushing and testing of piping systems which include instruments mentioned above and the precautions to be taken are covered in flushing, testing and inspection of piping. Care shall be exercised, and adequate precautions taken to avoid damage and entry foreign matter into instruments during transportation, installation, testing etc.

#### **5.10 Line Mounted Equipment / Items**

Installation of line mounted items like filters, strainers, steam traps, air traps, desuperheaters, ejectors, samples coolers, mixers, flame arrestors, sight glasses etc. including their supporting arrangements shall form part of piping erection work.

#### **5.11 Bolts and Nuts**

The Contractor shall apply moly coat grease mixed with graphite powder (unless otherwise specified in piping classes) to all bolts and nuts during storage, after erection and wherever flange connections are broken and made-up for any purpose whatsoever. The grease and graphite powder shall be supplied by the Contractor within the rates for piping work.

#### **5.12 Pipe Supports**

Pipe supports are designed and located to effectively sustain the weight and thermal effects of the piping system and to prevent its vibrations. Location and design pipe support will be shown in drawing for lines 2" NB. However, any extra supports desired by Engineer-in-Charge shall also be installed.

No pipe shoe / cradle shall be offset unless specifically shown in the drawings.

Hanger rods shall be installed inclined in a direction opposite to the direction in which the pipe moves during expansion.

Present pins of all spring supports shall be removed only after hydrostatic testing and insulation is over. Springs shall be checked for the range of movement and adjusted if necessary, to obtain the correct positioning in cold condition. These shall be subsequently adjusted to hot setting in operating condition. The following points shall be checked after installation, with the Engineer-in-Charge and necessary confirmation in writing obtained certifying that:

- All restraints have been installed correctly.
- Clearances have been maintained as per support Drawings.
- Insulation does not restrict thermal expansion.
- All temporary tack welds provided during erection have been fully removed.
- All welded supports have been fully welded.

#### **6.0 WELDING**

Welding of pipelines shall be done as per applicable codes.

#### **7.0 ERECTION**

##### **7.1 Pre-fabrication and Field Assembly**

Extent of pre-fabrication shall be purely at the discretion of CONTRACTOR keeping in view the following: -

7.1.1 Field joint shall be decided by CONTRACTOR keeping in view the transportation of prefabricated pieces to site.

7.1.2 There can be some variations in the dimensions and level appearing in the arrangement drawings and those actually occurring at site due to minor variations in the location of equipments, structures, cut out etc. Adequate field joints shall be provided, permitting assembly and erection of pipe work without major modification.

7.2 Supporting Location and design of pipe supports shown in approved drawings and support drawings shall be strictly followed.

- 7.2.1 Supports shall be installed in such a way that they do not contribute to over stressing of a line.
- 7.2.2 Fabrication and erection of additional supporting elements and structural fixtures which in COMPANY's view are required for proper supporting of the system, shall be carried out by CONTRACTOR at no extra cost.
- 7.2.3 All temporary supports, elements required for alignment, erection and a ssembly shall be removed after completion of work.
- 7.3 Equipment hook-up
- 7.3.1 Prior to hook-up, the alignment and trueness of flange faces shall be checked to ensure that no undue stresses shall be induced in the system while hooking up.

## **8.0 INSPECTION**

- 8.1 CONTRACTOR shall provide all facilities/ assistance to OWNER for proper execution of their inspection without any extra charge.
- 8.2 All piping work shall be subjected to inspection by OWNER/PMC at any time during fabrication. CONTRACTOR shall furnish to OWNER detailed work programme sufficiently in advance, in order to enable OWNER to arrange for inspection.

## **9.0 PROTECTIVE COATING**

- 9.1 All above ground piping system shall be applied with protective coating in accordance with specification (as attached in the Tender document) for shop & field painting

## **10.0 FLUSHING**

Completed piping systems shall be flushed by CONTRACTOR with fresh water, to clean the pipe of all dirt, debris, and foreign material. CONTRACTOR shall prepare a procedure for flushing of the system for approval of OWNER/PMC. Flushing shall not be commenced without approval of flushing procedure.

- 10.1 CONTRACTOR shall perform all activities like dismantling and reinstalling of all strainers, in line instruments etc. before and after completion of flushing.
- 10.2 Flushing shall be considered as complete only after inspection and approval by Engineer-in-charge.
- 10.3 Disposal of muck and flushing media shall be arranged by CONTRACTOR as directed by OWNER/PMC, in such a manner that it does not spoil the adjacent installation. CONTRACTOR shall obtain OWNER/PMC approval regarding the place and method to be adopted for disposal of debris.
- 10.4 Record of flushing giving following details shall be submitted by CONTRACTOR to OWNER/PMC for its approval and records:
- Date of Flushing
  - Identification of line: flushed-line Number

## **11.0 HYDROSTATIC TESTING**

- 11.1 Completed piping system as approved by OWNER/PMC shall be hydrostatically tested in the presence of OWNER/PMC. The general requirements of hydrostatic testing shall be in accordance with codes specified in section 2.0.
- 11.2 CONTRACTOR shall prepare hydrostatic test procedure based on specified codes. The hydrostatic test shall

commence only after approval of procedure by OWNER/PMC.

- 11.3 Piping system shall be hydrostatically tested to a pressure corresponding to 1.5 times the design pressure.
- 11.4 Fresh water shall be used as test media. CONTRACTOR shall locate the source of water supply and arrange for transportation of water to test site. CONTRACTOR shall arrange at his own cost the water analysis and confirm that water is suitable for testing. In case any corrosion inhibitor is added, the same shall be done after approval of OWNER/PMC.
- 11.5 Lines repaired subsequent to hydrostatic test shall be retested using the same procedure as originally adopted. However, OWNER/PMC may waive such retest in case of minor repairs by taking precautionary measures to ensure sound construction.
- 11.6 All equipment and instruments used for hydrostatic test shall be approved by OWNER/PMC before start of tests.
- 11.7 Pressure gauges shall be installed online to measure test pressures. In case of longer lines two or more pressure gauges shall be installed as directed by Engineer-in-charge. One gauge shall be installed at the discharge of the pressurising pump. Pressure gauge used for hydrostatic testing shall be calibrated with dead weight tester in the presence of Engineer-in-charge. Range of pressure gauge shall generally be 1.5 times the test pressure.
- 11.8 Orifice plates and restriction orifices shall not be installed until hydrostatic testing is completed. Temporary gaskets shall be used during testing.
- 11.9 First block valve of pressure instruments shall be half open & plugged at the time of hydrostatic testing. Temperature connections shall be blanked off during testing.
- 11.10 All equipment in line instruments, relief valves shall be disconnected from piping system by means of blinds during testing. Control valves shall be replaced by spool pieces during testing.
- 11.11 High point vents and low point drain required for testing in addition to those marked in the drawings shall be provided by CONTRACTOR at his own cost.
- 11.12 All welded and screwed joints shall be kept clean for detecting leaks during testing.
- 11.13 Test pressure shall be maintained long enough to facilitate complete inspection of the system. Minimum duration of test shall be 6 hours unless otherwise specified. Pressurising equipment shall be isolated immediately after test pressure is attained.
- 11.14 After successful completion of hydrostatic testing, the piping system shall be dewatered. All lines shall be completely dried using compressed air. CONTRACTOR shall make his own arrangement for supply of compressed air. Drying of lines shall be considered complete on approval OWNER/PMC.
- 11.15 Test Records  
The records in duplicate shall be prepared and submitted by CONTRACTOR as below:
- a) Date of test
  - b) Identification of pipe tested - line number
  - c) Test pressure
  - d) Test results
  - e) Signature of CONTRACTOR
  - f) Approval signature by OWNER/ PMC.



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Mother Stations in Hyderabad GA**

Volume II  
of II

**Bid Document No: BGL/693/2025-26**

## **BHAGYANAGAR GAS LIMITED (BGL)**

### **COMPOSITE WORKS PACKAGE (MECHANICAL WORKS) OF MOTHER STATIONS IN HYDERABAD GA**

STATION PIPE



**Mechanical Works for development and construction of CNG  
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**1.0 SCOPE**

This Technical Specification covers the supply if applicable of line pipe used for Natural Gas transportation and distribution systems. It describes the general requirements, controls, tests, QA/QC examination and final acceptance criteria which need to be fulfilled.

**2.0 INSTRUCTION**

- 2.1 CONTRACTOR shall procure all the construction material from the vendor list mentioned in the tender documents.
- 2.2 Eventual interpretations and deviations to this specification by the Manufacturer shall be requested by writing in his offer with detailed justification and approved by the Owner before the eventual order to the Manufacturer. The latter is responsible and shall indemnify the Engineer-in-charge for any damage resulting from the non-respect of this obligation.
- 2.3 The specifications of the steel used by the material Manufacturer and all potential subcontractors will be described in the offer. After order, no change will be accepted except for justified "force majeure". In that case, the changes shall be supported by a technical file submitted to the Owner / Owner's representative for approval.
- 2.4 The Manufacturer shall provide a technical description of the manufacturing method that might influence the quality of the material.
- 2.5 When the order is placed, the Manufacturer shall promptly inform the Owner / Owner's representative about his subcontractor's names, addresses, phone numbers as well as sub-order numbers, extent and delivery terms. On this basis, the Manufacturer shall send a general planning including at least the raw material supply, the manufacturing stages testing, painting and packing/despatch. This planning shall be updated by the Manufacturer at least every month unless otherwise provided in the purchase order. A dispatcher/inspector delegated by the Owner / Owner's representative is entitled to follow, examine and verify the planning's relevance and effectiveness.
- 2.6 The Owner / Owner's representative keeps the right to audit the Manufacturers and subcontractor's manufacturing process and control methods. All costs form such an audit shall be borne by the Manufacturer except the wages and travel expenditures of the auditor(s) supported by the Owner / Owner's representative.
- 2.7 The manufacturing processes and the laboratories, in which destructive and non-destructive tests are carried out, shall be approved by the Owner / Owner's representative.
- 2.8 The Owner / Owner's representative shall have, at any time, free access to all parts of the Manufacturer's facilities and to those of all his subcontractors involved in the order manufacturing. All reasonable means shall be placed at the inspector(s)'s disposal to enable him to check that the product is being manufactured in accordance with this specification. All tests and inspections required in this specification shall be carried out, prior to shipment, in the Manufacturer's plant (or subcontractor's plant) and at the Manufacturer's expenses, unless otherwise provided in the order. The Owner / Owner's representative shall try not to interfere unnecessarily with other Manufacturer's works when running these tests and inspection.
- 2.9 A valid copy of the ISO 9001 certificate shall be included in the offer.
- 2.10 For any control, test or examination required under the supervision of the Third Party Inspection Agency the latter shall be informed in writing one (1) week in advance by the Manufacturer about place and time with a copy to the Owner / Owner's representative.
- 2.11 The Manufacturer shall send for approval a list of operation in manufacturing and control to the Third Party Inspection Agency and Owner / Owner's representative, one (1) week before manufacturing. This list shall be in conformity with the annex 1 to this document. Before starting any manufacturing, the Manufacturer shall be in possession of this approved document, filled in with all intervention points.
- 2.12 Material, even released by the TPIA and in which injurious defects are found after delivery, shall be rejected. The Manufacturer shall be notified, and the material replaced all costs involved, including wages and travel expenditure of the TPIA, Owner & Owner's representative shall be borne by the Manufacturer.

- 2.13 An approval of documents can never be considered as an acceptance of deviations or relaxation to requirements. A deviation is only possible after specific request to the Owner/Owner's representative.
- 2.14 The Owner/Owner's representative may verify the control equipment of the Manufacturer, its calibration, and the points at which it is located. If during the production certain problem arises, the Owner/Owner's representative may demand supplementary tests.

### **3.0 GENERAL**

- 3.1 This specification describes the pipe to be installed on transportation and distribution of natural gas.
- 3.2 This specification describes the examinations and upgrading tests to be performed on Carbon Steel pipes taken out of stock.
- 3.3 The present specification can conform, complete, or alter certain characteristic or tolerances of existing laws or specifications.
- 3.4 Before the order is placed, a Technical Audit could take place with Owner/Owner's representative.

### **4.0 CODES, NORMS AND STANDARDS**

Latest edition of following standards are applicable.

#### **4.1 ASME STANDARDS**

ASME B31.8	Gas transmission and distribution piping systems
ASME VIII, DIV-1	Boiler and Pressure Vessels code.
ASME B31.3	ASME code for process piping.
ASME B 16.25	Butt Welding Ends
ASME B 36.10	Welded and Seamless Wrought Steel Pipe

#### **4.2 ASTM STANDARDS**

TM A 106	Seamless and welded steel pipe for high temperature. Service
TM A 370	Mechanical testing of steel products
TM E 112	Standard methods for determining the average grain size.

#### **4.3 EN STANDARDS**

EN 10204	Metallic products: types of inspection documents
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#### **4.4 ISO STANDARDS**

ISO 9001	Quality Management Standards.
ISO 148	Determine the Impact strength of steel and energy absorbed by Charpy V-notch

In case of contradiction, the most stringent shall apply.

### **5.0 DESIGN AND CONSTRUCTION**

- 5.1 The pressure temperature ratings of the pipes are in accordance with ANSI B31.3 and B31.8 (see piping class which one is applicable); the dimension standard shall be conform to ANSI B 36.10.
- 5.2 The temperature and pressure range of line pipe shall be in accordance with the indicated values on the relevant piping specification. (Piping Specification – 1C1 and 3C1, as applicable).
- 5.3 Wall thickness shall meet the following requirements:

- The maximum allowable stress in the base material and in the weld shall be equal to fifty per cent of the minimum yield strength guaranteed by the specification of the steel used.

- 5.4 The specified pipe wall thickness/schedule and grade (with reference to the equivalent grade in ASTM spec.) with which the pipe is intended to be used is specified in the data sheet/piping class.
- 5.5 The design shall take into consideration performance requirements prescribed in paragraph 5.6.
- 5.6 All pipe under this specification shall be designed to withstand a field hydrostatic test pressure with noncorrosive water, after installation, during 24 hours at a following pressure level:

Minimum : P = 1.4 MOP

Maximum : Pressure 1.5 MOP

Where:

P = hydrostatic test pressure, bar

MOP = maximum operating pressure as indicated in relevant piping specifications.

The negative tolerance shall not exceed 12.5 %.

## **6.0 LENGTH OF PIPE**

- 6.1 Pipe Length shall be between 6.0m and 7.0m for single random and 10.0m to 12.0m for double random.
- 6.2 Overall length tolerance shall be (-) zero and (+) 1 pipe length to complete the required quantity.

## **7.0 MATERIALS**

- 7.1 The steel used in the manufacture of pipe shall be conform to the ASTM standard. The Manufacturer shall find the steel and grade in the present Particular Technical Specification.
- 7.2 The chemical composition of the steel meets the requirements shall be conform to the ASTM standard.
- 7.3 The steel used has tensile properties conforming to the requirements prescribed in the ASTM standard.
- 7.4 The ratio of yield strength to tensile strength shall not exceed 0.85.
- 7.5 The steel shall be fully killed, fine grain practice.
- 7.6 The steel used shall be suitable for field welding to other fittings, pipes, flanges, or valves manufactured under ASTM specifications A53, A105, A106, A234, A333, A350, A381, A420, A694, A707 or API standards specifications 5L, 6D, 605 or MSS standards SP-44, SP-72, SP-75 and EN10208-2.
- 7.7 If preheating of the material is required to ensure proper weldability under normal field conditions, the Manufacturer shall state so in the offer, specifying preheat requirements and if accepted by the purchaser this shall be permanently indicated on the pipe.
- 7.8 The Manufacturer of pipe must deliver a certificate EN 10204 3.1. Stating the quality, the mechanical properties (yield strength, tensile strength, percent elongation), the chemical analysis, the process of manufacture and the marking (for example the heat number of material) of the steel.
- A new chemical analysis (upgrading) shall be done on a specimen of pipe in presence of the TPIA; one per heat number, see par. 8.4.
  - Notch toughness properties Charpy V: the standard impact test temperature is 0°C. The average value per series of 3 tests specimen shall be equal to 35 J/cm<sup>2</sup>. The minimum value per test specimen shall be equal to 35 J/cm<sup>2</sup> this value may drop to 28 J/cm<sup>2</sup> per only one test specimen per series.
- 7.9 Chemical composition:  
For each heat the Manufacturer shall check a chemical analysis of the steel  
Check analysis: Carbon equivalent shall be computed by the following equation:

$$C.E.= C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

And shall not exceed 0.43.

## **8.0 PRELIMINARY CONDITIONS FOR UPGRADING TO 3.2 CERTIFICATE**

Before proceeding to any qualification tests, the pipes shall meet following requirements.

### **8.1 Material**

Carbon Steel piping to be supplied according to ASTM A 106 Gr. B.

### **8.2 Origin of pipes**

8.2.1 The origin of pipes shall be mentioned.

8.2.2 Owner/Owner's representative or/and the Third-Party Inspection Agency reserves the right to approve or refuse the origin of pipes.

### **8.3 Identification**

8.3.1 All pipes shall bear the original mill identification.

8.3.2 The marking shall be legible and shall include as a minimum:

- Manufacturer's name or brand.
- ASTM specification.
- Steel grade.
- Heat number or identification number traceable to the certificate.
- Size and schedule number.
- Process of manufacture.

### **8.4 Certification**

8.4.1 The pipes shall have been manufactured according to material - ASTM A 106 Gr. B.

8.4.2 A mill certificate according to EN 10204 3.1 shall be supplied and shall mention as a minimum:

- The ASTM specification and steel grade.
- The type of pipe manufacturing process.
- The heat and/or identification number.
- The type of heat treatment.
- The chemical analysis of the heat.
- The mechanical properties as required by the ASTM specification.

8.4.3 The marking on each pipe shall be checked for conformity with the Manufacturer certificate.

8.4.4 The content of the certificate shall be reviewed before upgrading take place for conformity with the applicable ASTM specification.

	TEST OF EXAMINATION	REFERENCE	NUMBER OF TESTS
By pipe  Manufacturer	Heat analysis	ASTM A 106, Cl.No. 8.1	Each heat of steel
	Tensile test	ASTM A 106 table 2 & 3, Cl. No. 10.1 & 20.1	5 % from each lot  On one pipe per lot
	Flattening test	ASTM A 106 Cl. No. 3.1 & 11.2 & 11.3 & 12.1	5 % from each lot  On one pipe per lot
	Hydrostatic test	ASTM A 106, Cl. No. 13	Each length
	Marking	ASTM A 106, Cl No 24 & table 5 ASTM A 530 Cl No 24	Each length Traceability to be guaranteed on test report
	Visual and dimensional examination	ASTM A 530, Cl No 26	All pipes of prepared lot

### 8.5 Preparation of pipes for qualification

All pipes shall be new, and the interior and exterior surfaces shall be free of dirt, sand, debris and rust.

The pipes shall be sorted per specification, per heat number and dimensions.

A lot of pipes prepared for qualification shall only contain pipes of the same:

- manufacturing process,
- diameter and schedule,
- indicated heat number,
- finishing treatment,

marked with piping class number and with the TPIA's identification stamp on both ends of each pipe.

### 9.0 UPGRADING TESTS

#### 9.1 Visual and dimensional examination

Before any other testing, each pipe length shall successfully undergo a visual and dimensional examination.

The good condition of the pipe shall be checked, particularly the external and internal surface aspects (cleanliness).

The dimensions shall be verified (thickness, diameters, out of roundness, straightness) and found to be within the tolerance of the specification.

For longitudinal pipes, all test required for the qualification of the welds and the HAZ will be redone specifically (tensile test).

## 9.2 Mechanical Testing

The mechanical properties shall be verified after acceptance of the pipes as pertaining from one same lot.

The procedure for mechanical testing needs to provide with the required quantities of pipes, as per material specification sheet (Log Book) and as per prepared lot, the necessary over lengths for removal of testing specimens.

These over lengths are in no way included in the material specification sheet (Log Book).

The nature of mechanical tests to be performed is specified in the applicable ASTM specification. Number of tests shall be as per ASTM A 106 specification. In addition, the requirements of the impact testing at 0°C shall be followed.

Location and removal of specimens from pipe to be carried-out according to ASTM specification.

Test specimens may only be cut after a marking transfer by the TPIA.

The following mechanical tests shall be performed on material of stock (with ASTM A106 Gr. B); the supervision of the TPIA delegate and the certificates shall be added to the CMTR.

## 9.3 Tension test

### Requirements

The material shall be conform with ASTM standard and the ratio of yield strength to tensile strength shall not exceed 0.85.

For pipes containing welds, the fracture must be happen outside of the weld. If there is a fracture in weld or HAZ, the tensile strength shall at least meet the requirements for tensile properties as per ASTM standards.

### Test specimen

The test specimen shall represent all pipes from the same lot.

### Number of tests

For pipes NPS 2 and greater the following number of test shall be performed:

- Base material : one tension test
- Weld (if any) : one tension test

### Test locations and orientations

For base material, test specimens shall be orientated transversally and if this orientation is not feasible, it shall be orientated longitudinally.

For welds, the test specimen shall be orientated transversally to the weld.

### Test method

Testing shall be performed in accordance with ASTM A 370 standard rectangular plate type 1-1/2" wide (Fig. 4-A370) or standard round (Fig. 5 or Fig. 6-A370). Yield strength shall be determined either by the 0.2 % offset or the 0.5 % extension under load (EUL) method.

### Retest

If the tension test specimen from any lot fails to conform to the requirements of the particular grade ordered, the Manufacturer may elect to make retests on two additional pieces from the same lot, each of which shall conform to the requirements specified in the ASTM standard. If one or both of the retests fail to conform to the requirements, the whole lot of that specimen will be rejected.

#### **9.4 Impact test**

##### Requirements

The standard impact test temperature is 0°C.

The average value of a set of 3 test specimens shall be equal to 35 J/cm<sup>2</sup>.

The minimum value per test specimen shall be equal to 35 J/cm<sup>2</sup>, but this value may drop to 28 J/cm<sup>2</sup> for only one test specimen per series.

##### Test specimen

The test specimen shall be machined from material obtained as in paragraph Test specimen for Tension test (par. 9.3).

Flattening of test specimens are not allowed.

##### Number of tests and orientation

Three test specimens shall constitute one test set.

For pipes NPS 2 and greater, the following number of tests shall be performed:

- Base material: 2 test sets, one set shall be orientated longitudinally and another one transversally.
- Weld: 1 test shall be orientated transversally.
- HAZ: 1 test shall be orientated transversally.

##### Test method

The notched bar impact test shall be made in accordance with ISO 148 - Charpy V - Notch.

If the wall thickness of the pipe or the coupon does not enable machining of full size specimens, the largest possible size must be used but not less than (10 x 5 mm). The axis of the notch shall be orientated through the wall thickness of the pipe.

#### **9.5 Retreatment**

If the result of the mechanical tests does not conform to the requirements specified in Cl. No. 9.3 & 9.4, the Manufacturer, with the acceptance of the Owner / Owner's Representative and the TPIA may retreat the pipes as applicable and repeat all the tests specified.

#### **9.6 Chemical analysis**

For each lot/item a new chemical analysis of the steel shall be done.

The chemical analysis shall be conform to the ASTM A 106 requirements.

The Carbon equivalent shall be computed by "check analysis": Cl. No. 7.9.

C.E. ≤ 0.43.

#### **9.7 UT testing**

After the mechanical testing, all pipes must be controlled with UT over all the surface, longitudinal seam weld and bevels.

- UT must be performed as per ASME code, section V, art. 23, SA - 388
- Acceptance criteria will be as follows:
  - for base material criteria:
  - ASME code, section VIII, division 1, UF-55 (angel probe will be used)

- for longitudinal seam welds:
- criteria : ASME code, section VIII, division 1, appendix 12

The following defects are unacceptable:

- Defects extending into the bevel provided the lamination is parallel to the surface and has a transverse dimension exceeding 6.35 mm.
- defects not parallel to the surface extending to the bevel

## **10.0 MARKING**

10.1 All pipes furnished under this specification shall be clearly identified on the O.D. with the following information marked with low stress die stamps or interrupted dot stamps as noted:

- Manufacturer's name or trademark.
- Heat code identity.
- Pipe number: The Pipe number shall be made up of six figures specified as follows: the item and its number specified in the purchase order.
- The monogram of the TPIA. This marking shall only be applied after complete approval of the Certified Material Test Report.

10.2 In addition to the above, for NPS 2" and larger, it shall also include the following information:

Grade symbol: the grade symbol must designate the material of the pipe conforming to ASTM code.

10.3 Marking must be done prior to final inspection.

## **11.0 INSPECTION AND CERTIFICATION**

a) Inspection and certification shall be done by the Quality Control department of the piping supplier and in presence of the TPIA' and apply to:

- Identification of pipes with respect to mill certificates.
- Visual and dimensional inspection.
- Sampling preparation for testing: stamping of specimens.
- Testing (destructive and non destructive).
- Hydrostatic test.
- Marking: all accepted pipe lengths shall be identified by TPIA's inspector.

b) Final certificate shall be of level DIN 50049.3.1. and shall include the results of all performed destructive, chemical check, hydrostatic test values and heat treatment data. This certificate shall be signed by the TPIA.

## **12.0 INSPECTION BY CONTROL OPERATIONS: L.O.C.**

Control and tests are carried out by the Pipe Supplier under his responsibility and at his cost.

In order to ensure that material is in accordance with the applicable standard specification and with this specification, Supplier shall follow a program of inspection as set in the L.O.C. (List of Operations for Control).

The intended intervention points of the TPIA and of Owner/Owner's Representative inspection are indicated in the L.O.C. form attached.

It is the responsibility of the Quality Control department to fill in the L.O.C. sheet with their intervention points.

Each operation step, after checking of execution, shall be signed by the responsible Q.C. Inspector, and countersigned respectively by the C.O. or Third-Party Inspection Agency.

Notification to the TPIA or to the Owner/Owner's Representative, for witnessing of testing operations, shall be done five working days, by fax, prior to the date scheduled to perform the test.



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Each pipe in which injurious defects are found after delivery shall be rejected. The vendor shall be notified. In this case, the pipe shall be replaced immediately. All costs involved, including wages and travel expenses of the TPIA and Owner/Owner's Representative shall be borne by the Manufacturer.


**13.0 CORROSION PROTECTION**

The corrosion protection will be applied by the vendor after final inspection by the inspection agency.

The corrosion protection shall be line sealed oil at the outside of the pipe.

This product shall meet the following criteria:

- Guarantee a corrosion protection for a storage period in open air for at least 6 months.
- Shall be easily removable by wire brushing or by grinding.
- Shall not produce toxic vapour or smoke when heated by blow torches or during welding.
- The vendor shall deliver the necessary quantity of product (tri-chlore-ethylene) to remove this oil.

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	<b>PTS – STATION PIPE</b>	<b>P.019141 G11077 M009</b>
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PIPING SUPPLIER		<u>LIST OF OPERATIONS FOR CONTROL</u>				Date:	
CUSTOMER		ORDER N°	PROJECT:	MAT. REQ.:			
SPECIFICATION: A 106		MATERIAL: Gr. B	PRODUCT:	DIA.:	SCH:		
OPER. N°	OPERATIONS	REFERENCE DOCUMENTS	INTERVENTION POINTS			REMARK	
			Q.C.		TPIA		
1	Verification of EN 10204 3.1 certificate and conformity of marking	ASTM A 106					
2	Sorting of pipe per lot and marking by TPIA	This tech. spec.					
3	Visual and dimensional examination	ASTM A 530					
4	Sampling preparation for product analysis and mechanical testing	ASTM A 106, Tech. Spec.					
5	Mechanical testing. Tensile test	Tech. Spec.					
6	Hydrostatic testing	Tech. Spec.					
7	UT testing	Tech. Spec.					
8	Marking + TPIA Stamping	Tech. Spec.					
9	Packing						
10	Review of documents						
Intervention points: H = HOLD point    W = WITNESS point    R = REVIEW point			PREPARED BY:	REV.			
			CHECKED BY:				
Code: Q.C. = Quality Control department    TPIA. = Third Party Inspection Agency							



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## **BHAGYANAGAR GAS LIMITED (BGL)**

### **COMPOSITE WORKS PACKAGE (MECHANICAL WORKS) OF MOTHER STATIONS IN HYDERABAD GA**

#### **QA AND QC**




**Mechanical Works for development and construction of CNG  
Mother Stations in Hyderabad GA**

**Bid Document No: BGL/693/2025-26**

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**1.0 PURPOSE**

The purpose of this document is for uniform understanding and implementation of quality management and quality control by contractor during construction to produce the product by combination of various activities and role of Owner/ Consultant in verification. The management of quality shall also cover co-ordination, review, approval audit and proper documentation of the works performed.

**2.0 SCOPE**

This document shall be applicable to all construction works to be executed by CONTRACTOR.

**3.0 RESPONSIBILITY**

It is CONTRACTOR’s prime responsibility to arrange/produce the product conforming to contract specifications and inspect all equipment, materials and works at various stages of execution as per the approved QA Plans. In addition, they have to coordinate directly with the OWNER/ Consultant and other involved agencies to give adequate confidence that the activities are performed as per agreed ITPs and necessary documentation are available. Verification by Owner/ Consultant or his representative at any stage shall not relieve CONTRACTOR of his responsibility towards quality of the product.

The CONTRACTOR shall comply with all statutory rules & regulations in force during execution of work and interface with such authorities as required.

**4.0 METHODOLOGY**

The management of construction quality control is divided into the following categories: -

- (1) Procurement of materials required for the construction work.
- (2) Execution of work
- (3) QA/QC Audits

**4.1 Procurement of Materials Required for the Construction Work**

The CONTRACTOR shall procure all the materials for CGS Station construction from the owner approved vendor list given in the tender document. Apart from the vendors detailed in the vendor list or items with no vendor list, the contractor may propose any other vendor having credentials for supply of respective items with the capability of the vendor to deliver the product in time with quality (for the same or higher size, pressure rating, schedule, capacity, etc as applicable) in the last 7 years in oil & gas applications (except for items meant for fire water service). In such cases the bidder shall provide supply records viz. copy of po, inspection reports, inspection release note, proven track record, experience details or any other documentary evidence to establish past supply, for owner’s review and approval, as applicable. The acceptance of the same is at the discretion of the owner and shall require approval of pipelines head office, CONTRACTOR shall submit the Quality Assurance Plans for all major items and carry out their procurement in line with the approved plans. The CONTRACTOR can either provide his own adequate qualified staff for inspection or employ a separate third-party inspection agency with prior approval to Owner to carry out these functions. Involvement of Engineer-In-Charge / Consultant in the quality control plan, if required, shall be defined during approval of the same.

**4.2 Execution of Work**

4.2.1 The QA plans for execution shall be developed by the CONTRACTOR. OWNER/ Consultant’s approval for the same shall be taken well before start of the work. The final Inspection & Test Plans (ITPs shall be developed by the CONTRACTOR as per contract specifications within fifteen (15) days after award of work for approval by OWNER/ Consultant. For the activities which are identified as Witness or Hold Point, specific inspection call shall be raised by the CONTRACTOR with OWNER/ Consultant in the requisite format well in advance.

4.2.2 CONTRACTOR shall be completely responsible for management of approved quality plans and OWNER/ Consultant involvement will be only of Surveillance in nature to randomly check the works at




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selective/critical junctures. Their role shall be to monitor that the CONTRACTOR is executing the quality plans as per the approved drawings, employing adequately qualified staff and other resources for various items of works. Any deviation to the specifications shall be brought to the notice of OWNER/ Consultant in prescribed formats by CONTRACTOR for approval.

- 4.2.3 Sub-Contracting of entire work is not allowed in this tender. CONTRACTOR may engage sub-contractor / Vendors for performance of part work in special conditions. CONTRACTOR shall be responsible for ensuring the implementation of approved QA plan, contract specifications and contract conditions through their sub-contractors to achieve the quality during all stages of construction. It shall be the responsibility of the CONTRACTOR to ensure proper coordination between his sub- contractor(s) and other agencies working at site.
- 4.2.4 The sub-contractor(s)/vendors selection shall be done after evaluation by the CONTRACTOR in line with contract requirements and shall be got approved by Owner/ Consultant before engaging them for the works.
- 4.2.5 Storage  
All the materials procured shall be stored/stacked as per the standard norms and as recommended in various clauses of relevant codes and contract document. The storage of material shall be such as to avoid damage to life/properties (physical and chemical) of the materials. The storage shall not cause deterioration, rusting, mix-up etc. and hamper the other related works in any way. CONTRACTOR shall submit his detailed warehouse plan for OWNER/ Consultant approval to manage the above in open/covered areas.  
The materials susceptible to fire shall be kept away in a separate protected place.  
In general, the materials shall be kept systematically in order of their class, batch number and identification number, so that they are accessible for the inspection by OWNER/ Consultant whenever required and to avoid the mix up in those materials.
- 4.2.6 Use  
The materials shall be stacked in such a way that the lot, which is procured first, will be consumed first. For materials which are having specific expiry date/ shelf life shall not be used beyond that date and shall be removed from site. Wherever there is any doubt about the change in properties of the materials, such materials shall be sent to reputed approved laboratory for testing and acceptance.
- 4.2.7 Inspection  
The CONTRACTOR shall be responsible for carrying out inspection of the materials brought at site and conducting tests/ checks (at site or in approved laboratories) at predefined frequencies as per contract. It is the responsibility of the CONTRACTOR to ensure that the materials used at site shall conform to relevant codes/ standards and Manufacturer Test Certificates are available for correlation as and when required. The CONTRACTOR shall maintain the records of all materials brought at site and tests conducted on them.
- 4.2.8 In process and final Inspection  
CONTRACTOR shall be responsible to arrange verification of products during in- process and final inspection. Relevant checks and tests shall be arranged for the works performed and records maintained. Tolerances achieved with respect to contract specification and execution drawings for various activities/processes shall be ascertained and submitted to OWNER/ Consultant for approval. Efforts shall be made to keep checks and controls in such a way that a non-conforming product is avoided. However, if in an isolated case, the tolerances are beyond the acceptable values given in the contract/execution drawings/codes, non-conformance resolution/Deviation permit need to be raised by the CONTRACTOR and got approved/resolved from OWNER/Consultant.
- 4.2.9 Any Observation on quality aspects, Owner/ Consultant shall raise OQA format (attached as Attachment-II) which has to be acknowledged & compliance to be done by the contractor within the agreed time period.
- 4.2.10 The contractor shall follow the requirements given for control of monitoring and measuring devices as per Attachment-III.

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### 4.3 Documentation

All the necessary documentation & records shall be maintained by CONTRACTOR till completion of project and handed over to OWNER/ Consultant in requisite copies as a part of completion documents. Wherever OWNER/ Consultant personnel were directly involved particularly in witness and hold point, the copies of the records shall also be provided to personnel on completing inspection of those activities. The documentation & records shall include the following as a minimum but not limited to:

1. Approved Quality Assurance Plan
2. Approved Inspection and Test Plans
3. Inspection and test documents covering:
  - A. Manufacturer Test Certificate
  - B. Material Receipt Report including Inspection Release Note, if applicable and Site Inspection and acceptance Report on quality and quantity of material
  - C. Site test/laboratory test Report reviewed by CONTRACTOR for acceptance vis-à-vis to contract/code requirements for materials/including PMI report at warehouse
  - D. In process Verification reports of CONTRACTOR representative and OWNER/ Consultant as applicable
  - E. Final verification report including any test checks done for compliance
  - F. As built vis-à-vis to contract/drawings including tolerances
  - G. As built for erection
  - H. Non conformance resolution raised by Contractor/Owner/ Consultant
  - I. Concession/Deviation approval by OWNER/ Consultant
  - J. Change order approval by OWNER/ Consultant in case there is variation from contract
  - K. QA/QC Audit Reports and compliance Reports thereof
  - L. Mechanical Completion formats

### 4.4 QA/QC Audits

During the execution of the works, CONTRACTOR shall carry out periodical Quality Audits at least quarterly in all areas of work. These audits will be conducted by a team of specialists in the respective areas. The auditors shall not be directly involved in the jobs being audited.

The CONTRACTOR shall prepare an Audit Plan and Procedure and submit the same to OWNER/ Consultant for approval.

A copy of the Audit Report containing the findings of the Audit team will be submitted to OWNER/ Consultant. After completion of rectification/modifications/corrective actions on the issues indicated in Audit Report, Compliance Report shall be submitted by the CONTRACTOR to OWNER/ Consultant for review.

Over and above the Contractor's Internal QA/QC Audits outlined above, OWNER/ Consultant shall also reserve the right to conduct QA/QC audits at the frequency decided by them. CONTRACTOR shall participate and provide full support to the Audit Team and furnish all documents / reports / records as desired by the Audit Team. The CONTRACTOR shall take all actions required to comply with the findings of the Audit Report and issue regular Compliance Reports for the same to OWNER/Consultant till all the findings of the Audit Report are fully complied.

In case major Non conformities are observed during execution of the works OWNER/ Consultant reserves the right to appoint an independent person/Third Party Agency to conduct QA/QC Systems Audit for full/part of the facilities being executed by the CONTRACTOR. This audit will be in addition to the audits described above and may be carried out intermittently/continuously for all or part of the facilities being executed by the CONTRACTOR. CONTRACTOR shall bear the total cost of such audits and shall participate & provide full support to the Audit Team and ensure compliance of the audit observations.



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**4.5 Waiver & Deviation**

Contractor shall strictly comply with specifications and no deviation shall be permitted. However, if the need for deviation arises under exceptional circumstances, such deviation shall be subject to the approval of Owner/Owner's representative and shall be submitted through Owner / Owner's representative in the prescribed "WAIVER /DEVIATION /EXCEPTION REQUEST" format. The WAIVER /DEVIATION / EXCEPTION REQUEST shall also indicate the cost benefit to the Owner.



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**ATTACHMENT –I : WAIVER / DEVIATION PERMIT**

Report No.: \_\_\_\_\_

Date: \_\_\_\_\_

**Waiver/Deviation Permit**

**(TO BE RAISED BY CONTRACTOR / VENDOR)**

**Project :**  
**Client :**  
**Consultant :**  
**Third Party Insp. :**  
**Order/Contract No. :**  
**Originator :**  
**Originator Ref. :**

S. No	Requirement as per Specification / Drawing	Description of Waiver / Deviation Sought	Remarks
1.			
2.			
3.			

**Why the Waiver / Deviation is required?**

**Contractual Implications if Waiver / Deviation is granted.**

**Time taken shall be** More / Less / No Change

**Cost of item shall be** More / Less / No Change

**(Detailed Break up of cost implication to be attached in a separate sheet)**

**Performance requirement shall be** Satisfied / Not Satisfied

Under present constraints, requested waiver / deviation is most optimum for the project and does not involve any safety and security hazard.



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<b>Date:</b>	<b>Signature of the Originator:</b>
	<b>Name &amp; Seal:</b>
<b>Recommended by Consultant (Site):</b>	
<b>Date:</b>	<b>Signature:</b>
	<b>Name &amp; Seal:</b>
<b>Justification by Consultant (HO) (When required):</b>	
<b>Date:</b>	<b>Signature:</b>
	<b>Name &amp; Seal:</b>
<b>Recommended by Owner (Site):</b>	
<b>Date:</b>	<b>Signature:</b>
	<b>Name &amp; Seal:</b>
<b>Recommended by TPIA (when required):</b>	
<b>Date:</b>	<b>Signature:</b>
	<b>Name: &amp; Seal</b>
<b>Final Approval by PM Owner:</b>	
<b>Date:</b>	<b>Signature:</b>
	<b>Name &amp; Seal:</b>




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**ATTACHMENT –II: FORMAT OBSERVATION ON QUALITY ASPECTS**

OBSERVATION ON QUALITY ASPECTS	
Job No:	No:
Name of Work:	Date of Issue:
FOI/LOA No:	
Issued To : M/s	
Location Of Work:	
Item Of Work:	
Details Of Observation( Deficiency)	Recommended Course Of Action
	Time Allowed For Correction
Issued By:	Received by:
Name:	Name:
Designation:	Signature:
Signature:	Date and Time:
Corrective Action Report By Contractor/Vendor:	
	Name:
Date:	Signature:
Distribution Before Resolution:	
RCM/QA Mgr (EPC):	
a) Verification Of Resolution By Issuer/OWNER(Site)/PMC(Site):	
	Name:
Date:	Signature:
Distribution After Resolution:	
RCM/QA Mgr (EPC):	

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**ATTACHMENT-III**

**REQUIREMENT FOR CONTROL OF MONITORING AND MEASURING DEVICES.**

Sl. No.	Description	Calibration requirements	Frequency	Remarks
<b>Civil-Survey</b>				
1.	Theodolite	To check for permanent adjustments by traversing and observing the closing error	once in a year or project duration whichever is earlier	Record to be maintained (See note below)
2.	Levels	To check by Backsight/ Foresight readings, the temporary adjustments of level	Every use	Record to be maintained (See note below)
3.	Steel measurement tapes	a. "Freemans" make or BIS approved make shall be used b. Mutilated, or broken tapes shall not be used c. Legible markings	----	---
4.	Cross staff	Same as 3b&3c above	---	---
5.	Distomat	Actual Physical Verification at Site	Before using first time at site	Records to be maintained
6.	Total Station	To check for permanent adjustments by traversing and observing the closing error, etc.	once in a year or project duration whichever is earlier	Record to be maintained (See note below)
<b>Civil Laboratory</b>				
1.	All balances-Mechanical	Check for zero error	Whenever used	---
2.	Weigh Batcher/Batching Plant	Calibration of scales	Once in three months	Records to be maintained
3.	Cube testing machine	Calibration certificate from manufacturers or from reputed calibrating agency.	As per manufacturer specification or once a year whichever is earlier	Records to be maintained
4.	Moisture Meter	Calibration of scales	6 months	Records to be maintained
<b>Mechanical/ Electrical/ Welding</b>				
1.	Pressure Gauges	Calibration certificate from reputed laboratories or calibrate by dead weight testers with standard weights	Once in 6 months	Records to be maintained
2.	Dial gauges	Check for Zero Error	Whenever used	---



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3.	Dead Weight Tester	Calibration from manufacturer or reputed calibrating agency and calibration certificate shall not be older than one month from the date of mobilization.	As per manufacturer's recommendation or once in a six month whichever is earlier.	Records (Calibration certificate) to be maintained
<b>Sl. No.</b>	<b>Description</b>	<b>Calibration requirements</b>	<b>Frequency</b>	<b>Remarks</b>
4.	Vernier caliper/ screw gauge	Check for Zero error	Whenever used	---
5.	Holiday tester	Calibration from manufacturer or reputed calibrating agency or by calibrating by zeep meter.	Once in 6 months	Records to be maintained
6.	Elcometer	Check with standard test films supplied by the manufactures	Before use	Records to be maintained
7.	Universal Testing Machine	Calibration Certificate from any reputed third party inspection agency. viz, CEIL, LRS, BV, ABS, DNV or IRS.	As per manufacturer's recommendation or once a year whichever is earlier	Records to be maintained
8.	Charpy V-notch Impact testing machine	Calibration Certificate from any reputed third party inspection agency. viz, CEIL, LRS, BV, ABS, DNV or IRS.	As per manufacturer's recommendation or once in a year whichever is earlier	Records to be maintained
9.	Hardness Testing Machine	Check with the standard test block supplied with the machine as per manufacturer's Recommendation	Before use	Records to be maintained
10.	Chemical Analysis, ex :PMI etc.	Check with the standard samples	Before use	Records to be maintained
11.	Various Digital and Analog meters	Calibration Certificate from reputed laboratories or the manufacturer	Once in Six Months or as per manufacturer's recommendation whichever is earlier.	Records to be maintained
12.	Variable current, voltage and resistance generators	Calibration Certificate from reputed laboratories	Once in Six months	Records to be maintained
13.	Temperature/ Pressure Recorders	Calibration from manufacturer or any reputed calibrating agency	Once in Six months	Records to be maintained
14.	Temperature gauges	Calibration Certificate from reputed laboratories	Once in Six months	To be discarded in case of damage or malfunctioning
15.	Thermocouples	Manufacturer's Certificate or Chemical Check	---	---
16.	Vibration probes	Calibration from reputed laboratory	Once in a year	To be discarded in case of damage or malfunctioning



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17.	Decibel-meter	Calibration from reputed laboratory	Once in a Year	- do-
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**Note:** If Error is found, it has to be sent to manufacturers or their agents for rectification and certification & reputed laboratory shall be NABL accredited for relevant testing.



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## **BHAGYANAGAR GAS LIMITED (BGL)**

### **COMPOSITE WORKS PACKAGE (MECHANICAL WORKS) OF MOTHER STATIONS IN HYDERABAD GA**

HEALTH, SAFETY & ENVIRONMENT



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### **1.0 SCOPE**

This specification establishes the Health, safety, and Environment (HSE) aspects to be complied with by the contractor during construction at site.

### **2.0 REFERENCES**

This document should be read in conjunction with following.

- 1) General Condition of Contract (GCC)
- 2) Special Condition of Contract (SCC)
- 3) Job Specifications
- 4) Relevant IS codes
- 5) Reporting Formats

### **3.0 RESPONSIBILITY & ORGANISATION**

Safety activities at site shall be under control of contractor's RCM. He shall be responsible for implementation of HSE provisions. The nominated or designated safety engineer/ officer shall assist and perform day to day HSE work as per his advice.

### **4.0 GENERAL REQUIREMENT**

- 4.1 The contractor should follow HSE policy of owner as applicable to construction site.
- 4.2 The contractor shall deploy a full time HSE engineer / officer to co-ordinate the site.
- 4.3 The HSE officer shall be duly qualified in Industrial Health & Safety management with an experience of 5 years.
- 4.4 The contractor shall ensure that HSE requirements are clearly understood & faithfully implemented at all level, at each site.
- 4.5 The contractor shall organize safety awareness programs regularly.
- 4.6 The contractor shall ensure his participation in the every HSE meeting called by owner/owner representative.
- 4.7 The contractors shall conduct daily toolbox talk.
- 4.8 The contractor shall submit Monthly HSE reports (Form attached in ANNEXURES).
- 4.9 The contractor shall provide all help and support to the injured person got injury at site during construction work and arrange compensation as per insurance policy / Act.
- 4.10 The contractor shall adhere consistently to all provisions of HSE. In case of non- compliance or continuous failure the owner/ owner representative may impose stoppage of work without any cost time implication to owner. A penalty amount of Rs 1000/-shall be imposed on the contractor for the serious HSE violation.
- 4.11 Three times of this penalty may count as a serious violation of contractor in line with HSE. This may affect to new work assignment/award of contractor.


### **5.0 ACCIDENT, INCIDENT AND NEAR-MISS REPORTING**

#### **Accident**

Unintended occurrence arising out of and in the course of employment of a person, which results into injury with or without damage to plant/equipment/materials.

#### **Incident**

means an unplanned and uncontrolled event which results in damage to plant or equipment or loss of

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material without causing any injury to persons, like fire, spill, leak, property damage etc.

**Near-miss**

An unexpected, unwanted event not causing loss, injury, or illness but which under slightly altered conditions can lead to an accident.

can be defined as “Any event which under slightly unfavorable circumstances, may have resulted in any of the following:

- Injury, fatal or otherwise or ill health to people
- Loss of property, damage to plant or materials
- Damage to the environment
- A business interruption”

Accident, Incident and Near miss reporting form listed in ANNEXURES

**6.0 HSE REQUIREMENTS AT SITE**

**6.1 Personnel Protective Equipment**

The contractors shall provide sufficient numbers of following personal protective equipment (PPEs) to workmen and supervisors/engineers to use them properly at work site.

Following five numbers of Personnel protective equipment are identified as MANDATORY for all.

Safety Helmet

Coverall

Safety shoes/footwear

Safety Glasses

Hand Gloves (as per job requirement)

Other PPEs are depends upon nature of job like

Arc Welding – Welding face shield

Grinding – Grinding face shield

Height work – Full Body harness (above 2 meters)

Ask site supervisor for proper use and selection of protective clothing / equipment for specialized jobs

**6.2 Welding**

Ensure that welding machine is in order and approved by site engineer.

Ensure that welding cables are in order.

Ensure that welding machine is properly earthed.

Remove all combustible material from welding area to avoid fire

Place a fire extinguisher nearby welding premises.

Ensure welding holder, cable and its lugs in good condition and use only industrial power socket and plugs (3 Pin) to avoid electricity risk.

Make sure that welding machine is provided with ON/OFF switch and is earthed /grounding.

Do not overload electrical appliances and cable, Shocked pin etc.

Ground the work piece separately from the welding return connection only.

### **6.3 Gas Cutting**

Check the cylinder and its valve or leakage and move out any leaking cylinder immediately.

Ensure that flash back arresters are installed with torch and NRV (Non return valve) on the gas cylinders side.

Ensure cylinders in vertical position (Cylinder trolley) and far away from fall of sparks and hot metal.

Check the regulator and torches that they are inspected prior to every use.

Check for leaks around regulators, hoses/fittings & nozzle with soap solution.

Check the entire hose length if it is cracked or worn out cut that length of hose or replace the hose.

Check that flash back arrester used for the purpose is of approved make/specification only.

Place a fire extinguisher nearby welding premises.

#### **Grinding Operation**

- Grinding wheels should be stored in dry place.
- After expiry date, grinding wheel must be condemned, broken into pieces.
- Power supply cable of adequate current carrying capacity shall be used and it should be in good workable condition without abrasions, cuts or puncture in outer insulation.
- Socket pin provided at supply end and on/off switch in working condition.
- Proper earthing of the body in case of metallic body.
- Wheel guard properly fitted in position.
- Machine body without any damage like crack etc.
- Moving part (wheel) must be properly fixed to the machine with the help of spanner.
- Grinding wheel must be of suitable size as per the speed of grinding machine.
- Grinding wheel without manufacturer's sticker showing size, speed and expiry date must be condemned.
- Don't use portable grinding machine as bench grinder.
- Don't fit over size wheel than recommended size by machine/wheel manufacturer.
- Don't grind small, unstable object without fixing it in the vice.
- Don't over press the grinding wheel against the job for fast removal of metal.
- Put OFF the main switch, while machine is not in use (tea break etc.)
- Don't chip off grinding/cutting wheel for achieving fast cutting rate.

### **6.4 PPEs:**

- Use of helmet, safety walking boot face shield or safety goggles (where face shield is not possible.) and hand gloves.
- The provision of edge protection (fall prevention of people and materials)
- Access and egress

### **6.5 Pipe Transportation and lowering**

- All drivers shall hold a valid driving license for the class of vehicle.

- Securing of the load shall be according to established and approved methods.
- All overhangs shall be made clearly visible and restricted to acceptable limits.
- Load shall be checked before moving off and after traveling a suitable distance.
- All vehicles used by Contractors shall be in worthy condition and in conformance to the Land Transport requirement.
- Use of certified side booms after 3<sup>rd</sup> Party inspection.
- Effective communication should be done among all involved personals.
- Signaling shall be done by authorized foreman only.
- Ensure appropriate measures are taken for overhead hazards.
- Persons are not allowed towards trench side / under the boom at the time of lowering.
- Co-ordination of lowering in by a single man only.
- Inspection of equipment before use.
- All personnel should stay clear of moving equipment.
- Use of certified lifting tools and tackles.

## **6.6 Pressure / Leak Testing**

### **Hydraulic and Pneumatic Test**

Access to the test area shall be limited to essential personnel only. before the test commences compliance is required with the following points:

Persons supervising pressure or leak tests must have sufficient knowledge and experience of testing to fully understand the hazards of the activity and the precaution, which must be taken

- Effective communication, including formal procedures, must be established between sites whenever the test envelope extends beyond one site, for example, pipelines.
- The area shall be cordoned off (using tape, shields, or barriers, etc) at an adequate distance from the equipment to be tested, as specified on the Permit to Work
- Warning signs shall be posted at access ways, at other strategic positions, and on the equipment to be tested (including the doors of test workshops or other designated areas)
- Pressuring equipment shall be provided with suitably calibrated pressure control / regulator devices.
- Pressuring equipment shall not be left unattended at any time during the test.
- Pressuring equipment shall be isolated from the equipment under test and where practicable disconnected, when the test pressure has been reached.
- Care must be taken to ensure that materials of construction have the required ductility at the test temperature to prevent brittle fracture.
- A safety valve should be fitted to the equipment/system being tested, set to relieve at a pressure that will prevent over pressurization
- Sufficient venting / draining points shall be provided in order to prevent trapping of pressurizing medium behind non-return valves, check valves, between isolation valves, or within dead legs of the pressure envelope
- The equipment/plant to be pressure tested must be subjected to thorough examination prior to testing. It may be necessary to 100% inspect all welds using visual, radiographic or other NDT techniques
- The gas supply must be isolated when test pressure has been achieved



## Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA

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- The pressure envelope must contain sufficient vents, to a safe location.
- De-pressurization after pneumatic testing must be gradual

### **6.7 Scaffolding and Ladder**

All working platform must be constructed with the specific requirement of job.

All portable ladders must be in good condition as per the site norms.

If the working platform is not permanent, then safety belt must be used.

- There shall be firm foundation for all scaffoldings. All scaffolding shall be made of sound material.
- Scaffolding material shall be inspected and used, only if found in good condition.
- Provide metal base plate is used under all upright or standard scaffoldings. Correct type of couplers shall be used for all connections.
- Plumb and level scaffoldings as erection proceeds, so that braces will fit without forcing. Fasten all braces securely.
- Working platforms shall be provided with guards. This should consist of top rail, mid rail, and toe board. The toe board shall be of minimum height 100 mm, while the mid rail and top rail shall be at heights of 600 mm and 1200 mm respectively.
- Do not use ladders or makeshift devices on top of scaffoldings to increase the height.
- Shall be placed at least 75 deg. to the floor.
- Ladder shall extend 3' to 4' above the point of Landing and topmost 3 rungs shall not be used.
- Ladder is checked visually for defects before every use.
- Ladders shall not be used in a horizontal position as runways or scaffoldings.
- Ladders shall not be placed in front of a door that opens toward the ladder unless the door is locked, blocked, or guarded.
- Fall arrestor to be used wherever applicable.

### **6.8 Work Permit Procedure**

For working at more than 1.5m height the permission must be obtained from site in-charge.

For doing any hot work in the fire risk areas the permission must be obtained from site in charge or safety officer.

For any Excavation work it must be ensured that there are no underground utilities like cables, Water pipeline etc.

For any work inside confined space, entry permit must be obtained from site engineer.

### **6.9 Barricades and Warning Signs**

- Area where work is being carried out above man height or below 1' ground depth must be barricaded. Follow the instruction of all types of warning signs like "NO SMOKING" "NO ENTRY" "DANGER" "Work at height"

### **6.10 Emergency Plan and Procedures**

- 1) All Contractor's employees should be aware of site Emergency control plan
- 2) Periodic drill to train employees for their awareness & information should be followed.



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**6.11 Road Safety Norms**

- 1) For roadside working site to be barricaded as per approved barricading norms given in drg. No. TEIND-STD-G-M-9001. Penalty clause for road safety & barricading shall be applicable as per relevant clause of commercial part of tender.
- 2) Only eligible driver can drive required vehicle inside site
- 3) Speed limit norms of site must be followed
- 4) No riding or travelling on the back of open-end vehicle, forklift or trailers should be done.

**6.12 Labour Welfare & Legal Requirement**

- 1) All mandatory provisions with regard to safety as prescribed under contract Labour (Abolition & Regulation) Act 1970 and Rules made there under are applicable.
- 2) Workmen compensation insurance and registration under ESI should be maintained.
- 3) Time to time, all rules and regulations suggested by safety committee of site must be followed and implemented

**6.13 Preventive measures for Project Sites from Covid -19**

To protect from COVID-19 infection it is important to identify the source or way of infection during the various activities to be performed at sites. The following table will help to take the preventive measure but must be reviewed at site if any change of activity or new activities are identified:

Sr. No.	Activities	Precautionary Measure
1	Workforce Mobilization	<ul style="list-style-type: none"><li>• All employees and workers should not come on same day. They should come in phase wise manner based on their job/activity or as per the Government/Company Directives dictate.</li></ul>



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2	Site Entry	<ul style="list-style-type: none"><li>• Thermal screening for all contractor employees and workers, all others permitted to enter the site must be done on daily basis and on each shift. If body temperature will be normal (less than or equal to 37 degree centigrade or 98.6-degree Fahrenheit), then individuals will be allowed to site.</li><li>• Nobody should be allowed to enter the site without mask and other PPE as required for construction activities.</li><li>• Aarogya setu app must be installed in all contractor employees and workers.</li></ul>
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Sr. No.	Activities	Precautionary Measure
3	Movement of construction equipment, machinery, and material	<ul style="list-style-type: none"><li>• All the materials, equipment, machinery, and vehicles coming to the sites should be disinfected on daily basis and after each shift.</li><li>• Disinfection tag should be pasted over the equipment and machinery to identify whether the same has been disinfected or not.</li></ul>



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4	Site construction activities	<ul style="list-style-type: none"><li>• Mask shall be worn by all the people all the time whilst working at site</li><li>• Usage of nitril gloves during paperwork or while moving at site for supervision &amp; inspection.</li><li>• Sanitising of Drawings/documents exchanged and no direct contact transfer</li><li>• Social distancing i.e. min 2 mtr. distance must be maintained even during the site activities. Activity should be planned accordingly, and risk assessed</li><li>• All the construction materials used by the construction people must be sanitize on daily basis.</li><li>• Adequate quantity of sanitizer must be provided at all work locations, meaning; accessible to workers so that they sanitize their hand as and when required.</li><li>• Make sure that staff, contractors and visitors have access to places where they can wash their hands with soap and water. Portable and moveable hand washing facility (soap and water) must be provided at site (readily accessible to worker)</li><li>• All visitors/vendors etc shall be indicted which shall include Covid-19 preparedness for that particular site</li><li>• Display posters promoting handwashing at all areas where people traverse on work locations.</li><li>• Avoid spitting. Gutka/tobacco and cigarette are</li></ul>
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Sr. No.	Activities	Precautionary Measure
		<p>strictly prohibited at the workplace.</p> <ul style="list-style-type: none"> <li>• PPE such as Helmet, shoe, goggles, earplug etc. must be disinfected on daily basis by the individual.</li> <li>• Coveralls must be washed on daily basis.</li> <li>• Discourage the sharing of personal belongings, food, water etc.</li> </ul>
5	Site Storage	<ul style="list-style-type: none"> <li>• Storage facility must be disinfected on daily basis.</li> <li>• Hand sanitizer must be provided near the storage area.</li> <li>• Use disposable hand gloves while handling the materials.</li> <li>• Avoid gathering near the store, give the requirement in advance or inform the store officer about the requirement to avoid waiting near the store.</li> <li>• Lock and key must be disinfected every day and after each shift.</li> </ul>
6	Workers meeting and training	<ul style="list-style-type: none"> <li>• Worker meetings such as toolbox talks and training keeping social distancing norms on safe procedure is an essential part for safe execution of all work-fronts. large gatherings of worker shall be avoided at all times</li> <li>• Training and/or meetings shall be conducted in small groups and at a distance of minimal. 6 ft. must be maintained between workers.</li> <li>• During meeting and/or training everybody must wear the mask.</li> <li>• Every meeting and/or training must be start with the do's and don'ts and symptoms related to COVID-19</li> </ul>



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7	Travelling (e.g. for leave, site transfer, daily commutation to site etc)	<ul style="list-style-type: none"><li>• Minimise the travel as much as possible.</li><li>• Thermal screening must be done, and self-declaration must be taken from the people returned from leave or transferred from another</li></ul>
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Sr. No.	Activities	Precautionary Measure
		<p>site</p> <ul style="list-style-type: none"><li>• Vehicle must be sanitised on daily basis</li><li>• Hand sanitizer must be provided inside the vehicle</li><li>• As per government directives more than 2 person including driver is not allowed in a CAR.</li><li>• Transport of the labours should be done through vehicle with capacity of no more than 40%</li><li>• Drivers Health card checklist must be checked, and daily self-declaration must be obtained from him.</li><li>• All drivers and/ passengers shall wear the appropriate face masks for the duration of the trip/s</li></ul>



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**ANNEXURE – A**

**RELEVANT IS-CODES FOR PERSONNEL PROTECTION**

IS : 2925 – 1984	:	Industrial Safety Helmets.
IS : 4770 – 1968	:	Rubber gloves for electrical purposes
IS : 6994 – 1973 (Part – I)	:	Industrial Safety Gloves (Leather & Cotton)
IS : 1989 – 1986 (Part – I & III)	:	Leather safety boots and shoes
IS : 3738 – 1975	:	Rubber knee boots
IS : 5557 – 1969	:	Industrial and Safety rubber knee boots
IS : 6519 – 1971	:	Code of practice for selection, care, and repair of Safety footwear
IS : 11226 – 1985	:	Leather Safety footwear having direct moulding sole
IS : 5983 – 1978	:	Eye protectors
IS : 9167 – 1979	:	Ear protectors.
IS : 3521 – 1983	:	Industrial Safety belts and harness

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**ANNEXURE – B**

FORMAT - 1.0

1.0: HEALTHY, SAFETY & ENVIRONMENT (HSE) PLAN

Project : .....

Contractor: .....

Date : .....

Owner: .....

(To be prepared & submitted by each Construction Agency)

Activity Description	Procedure/ W.I./ Guidelines	Code of Conformance	Performing Function			Audit Function
			Performance	Checker	Approver	Customer Review/ Audit Requirements

PREPARED BY

REVIEWED



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**MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (1/6)**

Project: \_\_\_\_\_ Contractor : \_\_\_\_\_

Date: \_\_\_\_\_ Owner : \_\_\_\_\_

Inspection By: \_\_\_\_\_

**Note: write 'NC' (Not Concern) wherever any of the items are not applicable**

Item	Yes	No	Remarks	Action
<b>HOUSEKEEPING</b>				
Waste containers provided and used				
Sanitary facilities adequate and Clean				
Passageways and Walkways Clear				
General neatness of working areas				
Proper Material Storage				
Wooden Boards properly stacked, and nails removed				
Cords, leads out of walk and traffic ways				
Scraps removed from the work site				
Other				
<b>PERSONNEL PROTECTIVE EQUIPMENT</b>				
Goggles: Shields				
Face protection				
Hearing protection				
Safety Shoes provided				
Hand protection				
Respiratory Masks etc.				
Safety Belts				
Safety Helmets				
Other				
<b>EXCAVATIONS / OPENINGS</b>				
Excavation permit				
Excavated earth kept away from edge				
Dewatering pump kept away from edge				
Safe access into excavated area				
Opening properly covered or barricaded				



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**MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (2/6)**

Item	Yes	No	Remark	Action
Welding Cutting				
Valid not work permit				
Flashback arrester provided for cylinders				
Power cable not crossing the welding cable				
Adequate earthing provided				
No combustible materials kept near welding & cutting works				
Gas cylinder chained upright & kept in trolleys				
Cables and hoses not obstructing				
Screens or shields used				
Flammable materials protected				
Fire extinguisher (s) accessible				
Other				
<b>SCAFFOLDING</b>				
Fully decked platform				
Guard and intermediate rails in place				
Toe boards in place & tied properly				



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**MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (3/6)**

Item	Yes	No	Remark	Action
<b>HOISTS, CRANES AND DERRICKS</b>				
Condition of cables and sheaves OK				
Condition of slings, chains, hooks and eyes OK				
Inspection and maintenance logs maintained				
Outriggers used				
Singh/ barricades provided				
Signals observed and understood				
Qualified operators				
Other				
<b>MACHINERY, TOOLS AND EQUIPMENT</b>				
Proper instruction				
Safety devices				
Proper cords				
Inspections and maintenance				
Other				
<b>VEHICLE AND TRAFFIC</b>				
Rules and regulations observed				
Inspection and maintenance				
Licensed drivers				
Others				



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**MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (4/6)**

Item	Yes	No	Remark	Action
<b>TEMPORARY FACILITIES</b>				
Emergency instruction posted				
Fire extinguishers provided				
Fire-aid equipment				
Secured against storm damage				
General nemeses				
In accordance with electrical requirements				
Other				
<b>Fire Prevention</b>				
Personnel instructed				
Fire extinguishers checked				
No smoking in prohibited areas				
Hydrants clear				
Other				
<b>ELECTRICAL</b>				
Proper wiring & earthing				
ELCB's provided				
Ground fault circuit interruptors				
Protection against damage				
Prevention of tripping hazards				
Proper electrical cable joints				
Light poles secured				
Clear way to power distribution board				
Proper rating of fuses				



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**MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (5/6)**

Item	Yes	No	Remark	Action
<b>HANDLING AND STORAGE OF MATERIALS</b>				
Properly stored or stacked				
Passageways clear				
Other				
<b>FLAMMABLE GASES AND LIQUIDS</b>				
Containers clearly identified				
Proper storage				
Fire extinguish HSEs nearby				
Other				
<b>WORKING AT HEIGHT</b>				
Erection plan				
Safety nets				
Safety belts tied properly				
Illumination				
No loose material at height				
No body under working area				
All openings covered				
Other				
<b>ENVIRONMENT</b>				
Chemical and other Effluents properly disposed				
Cleaning liquid of pipes disposed off properly				
Seawater used for hydrotesting disposed off as per agreed proceeding				
Lubricant Waste/ Engine oils properly disposed				
Waster from Canteen office, sanitation etc. disposed properly				
Disposal of surplus earth stripping materials, Oily rags and combustibile materials done properly				
Green belt protection.				



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**MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (6/6)**

Item	Yes	No	Remark	Action
<b>HEALTH CHECK</b>				
Hygienic conditions at labour camps OL				
Availability of First Aid facilities				
Proper sanitation at site, office and labour camps				
Arrangements of medical facility				
Measures for dealing with illness				
Availability of potable drinking waters for workmen & staff				
Provision of cretches for children				
<b>ERECTION</b>				
Slings/ D'shakle checked				
Signal Man				
Tag line for guiding the load				
Protecting the slings from sharp edges				
No loose materials at height				
Ladder & platform welding inspected				
No one under the suspended load				
Stay rope				
SWL				



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**MONTHLY HEALTH, SAFETY & ENVIRONMENTAL (HSE) REPORT  
(TO BE SUBMITTED BY EACH CONTRACTOR)**

Actual work start date: \_\_\_\_\_ For the month of: \_\_\_\_\_

Project: \_\_\_\_\_ Report No.: \_\_\_\_\_

Name of the Contractor: \_\_\_\_\_ Status as on: \_\_\_\_\_

Name of Work: \_\_\_\_\_ Name of Safety officer: \_\_\_\_\_

Item	This Month	Cumulative
Total strength (Staff – Workmen)		
Number of HSE meeting organised at site		
Number of HSE awareness programmes conducted at site		
Whether workmen compensation policy taken	Y/N	
Whether workmen compensation policy valid	Y/N	
Whether workmen registered under ESI Act	Y/N	
Number of Fatal Accident		
Number of Loss Time Accident (Other than Fatal)		
Other accident (non loss time)		
Total No. of accident		
Total man-hours worked		
Man-hour loss due to fire and accident		
Compensation cases raised with insurance		
Compensation cases resolved and paid to workmen		

Remark

Date: \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Safety Officer/RCM

(Signature and name)

To: OWNER .....1 COPY  
RCM/SITE-IN-CHARGE 1 COPY



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**SUPPLEMENTARY ACCIDENT, INCIDENT & NEAR MISS REPORT**

Project: \_\_\_\_\_ Supplementary to Report No.: \_\_\_\_\_

(Copy enclosed)

Site: \_\_\_\_\_ Date: \_\_\_\_\_

Contractor: \_\_\_\_\_

NAME OF THE INJURED.....  
FATHER'S NAME.....  
SUB-CONTRACTOR M/S.....  
DATE & TIME OF ACCIDENT.....  
LOCATION.....

BRIEF DESCRIPTION & CAUSE OF A ACCIDENT

NATURE OF INJURY / DAMAGE

COMMENTS FROM MEDICAL PRACTITIONER WHO ATTENDED THE VICITIM/INJURED

SUGGESTED IMPROVEMENT IN THE WORKING CONDITION IF ANY

LOSS OF MANHOURS AND IMPACT ON SITE WORKS

ANY OTHER COMMENT BY SAFETY OFFICER

Date : \_\_\_\_ / \_\_\_\_ / \_\_\_\_ / SIGNATURE OF CONTRACTOR WITH SEAL

To : OWNER..... 1 COPY  
: RCM/SITE-IN-CHARGE 1 COPY



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**ACCIDENT REPORT**

(To be submitted by Contractor after every accident within 2 hours of accident)

Report No. \_\_\_\_\_

Date: \_\_\_\_\_

Name of Site: \_\_\_\_\_

COTRACTOR \_\_\_\_\_

NAME OF THE INJURED .....

FATHER'S NAME.....

SUB-CONTRACTOR M/S.....

DATE & TIME OF ACCIDENT.....

LOCATION.....

BRIEF DESCRIPTION OF ACCIDENT

CAUSE OF ACCIDENT

NATURE OF INJURY / DAMAGE

MEDICAL AID PROVIDED / ACTIONS TAKEN

INTIMATION TO LOCAL AUTHORITIES

Date : \_\_\_\_ / \_\_\_\_ / \_\_\_\_

SIGNATURE OF CONTRACTOR WITH SEAL

To : OWNER ..... 1 COPY

: RCM/SITE-IN-CHARGE 1 COPY

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**BHAGYANAGAR GAS LIMITED (BGL)**

**COMPOSITE WORKS PACKAGE (MECHANICAL WORKS) OF  
MOTHER STATIONS IN HYDERABAD GA**

PTS – SS BALL VALVE



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### 1.0 GENERAL

BHAGYANAGAR GAS LIMITED (BGL), (hereinafter referred as Owner), has been authorised by PNGRB for setting up infrastructure and operation of City Gas Distribution Network for the Hyderabad GA. Natural gas will be transported to residential, commercial, industrial (PNG) and automobile consumers (CNG) in the city.

The present document covers the technical specifications for the procurement of "SS Ball valve"

This document shall be read in conjunction with schedule of rate (SOR), Material Requisition (MR), specification, standards, drawings and other documents forming a part of the tender document.

### 2.0 SCOPE OF SUPPLY

The scope of this specification include design, manufacture/ supply, inspection/ testing/ marking/ packaging/ handling and dispatch of SS Ball Valves as per relevant codes.

Purchaser reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms & conditions in the original order

### 3.0 CODES & STANDARDS

Applicable Codes and Standards to be followed are as under but not limited to the following:

MSS-SP-99 : Instrument valves

ANSI : Process Piping

In case of any conflict between this job specification and other document, the following order of precedence shall apply:

- Job Specification
- International Standards/ Codes Applicable.

Any discrepancy, ambiguity or conflict in or between any of the standards, specifications codes and the contract documents should be promptly referred to Purchaser / Purchaser's Representative for his decision, which shall be binding on the bidder.

### 4.0 MATERIALS

4.1 The valve body shall be made out of material conforming to ASTM A479 Type 316 or A351CF3M or equivalent Material.

4.2 Material of construction of ball shall conform to ASTM A276 Type 316.

4.3 Material of construction of seat springs shall be Alloy X-750 or equivalent.


### 5.0 DESIGN & MANUFACTURE

5.1 All ball valves shall be designed in conformance with the requirements of ASME B31.3, MSS-SP-99 and other applicable code and standards. Area classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC or Zone-1 Group-IIA/ IIB as per IS/ IEC specification or equivalent specification. all fittings shall be designed so that all parts/ components meet the requirements for the specified area classification

5.2 Valves shall be rated for a maximum working pressure of 6000 psig and shall be capable of operation between a temperature range of (-40) ° to 250°F

5.3 Valves shall have spring loaded PEEK seats allowing seal-ability over the full pressure range at any port and low operating torque over the full range of pressures and temperatures

5.4 Elastomeric seals, which require no packing adjustment, shall be used

 <p>Bhagyanagar Gas Limited</p>	<p><b>Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA</b></p> <p><b>Bid Document No: BGL/693/2025-26</b></p>	<p>Volume II of II</p>
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- 5.5 Valves stem shall be of Blow out proof design
- 5.6 Ball shall be blow out proof and trunnion mounted or floating.
- 5.7 Valves shall have positive wrench/ handle stops, Phenolic black wrench/ handle shall be provided. Wrench/ handle shall indicate the direction to flow. In the case of three way valves the stem/body shall also be provided with a visual indication of flow direction if the handle is removed.

**6.0 INSPECTION AND TESTING**

The valve manufacturer shall submit typical type test reports for the following test carrier out on similar valves

- i) Hydrostatic seat leak test shall be carried out with de-ionised water. There shall be no detectable set leakage at 1.1 times the rated pressure of the valve
- ii) Gas pressure test for seat and shell shall be carried out with nitrogen at 1000 psig. There shall be no detectable external leakage. Maximum allowable seat leakage shall be 0.1 atm-cc/min.

**7.0 OTHER REQUIREMENTS**

7.1 Manufacturer should confirm that valves are approved by Rail Road Commission of Texas, LP Gas Division under regulation for compressed natural gas or ANSI/ AGA NGV 3.1 1995, CAN/ CGA-12.3-M95 “Fuel Systems Components for Natural Gas Powered Vehicles” by “Canadian Standard Association”

7.2 Spares and Accessories

- i) If required, manufacturer shall furnish a list of recommended spares and accessories for valves required during start up and commissioning.
- ii) If required, manufacturer shall furnish a list of recommended spares and accessories required for two years of manual operation and maintenance of valves
- iii) Manufacturer shall quote for spares and accessories as per the material requisition

**8.0 TEST REPORTS & CERTIFICATES**

- 8.1 The manufacturer shall supply material compliance certificates.
- 8.2 The valve manufacturer shall provide test procedure and valve inspection and test report for type tests carried out on similar valves as per the requirements of clause 6.0

**9.0 MARKING, PACKING & SHIPMENT**

- 9.1 Heat code shall be marked on valve body to facilitate tractability
- 9.2 All the items shall be suitably wrapped and packaged to with stand rough handling during ocean shipment and inland journey
- 9.3 Each item shall be properly tagged and package separately to facilitate easy identification
- 9.4 All items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition

**10.0 DOCUMENTATION & TRAINING**

Prior to shipment, manufacturer shall submit following test certificates and documents

- i) Test certificate of chemical, mechanical testing
- ii) Manufacturers standard test reports
- iii) The procedure and certificates to be submitted as per the requirements of clause 7.0 of this specification
- iv) Manual for installation, erection, maintenance and operating instructions including a list of recommended spares for valves.
- v) Vendor shall provide complete training to Owner on installation of Ball valves at sites and other aspects



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like safety, operations & Maintenance, Repairing etc.

**11.0 GUARANTEE**

- 11.1 Manufacturer shall guarantee that the design, materials, manufacturing and testing of Ball Valves comply with the requirement of this specification and applicable codes and standards. Manufacturer shall replace all Valves which should result defective or fail during field pressure testing or fail to perform satisfactorily due to inadequate engineering, substandard material and workmanship at Manufacturer's end.
- 11.2 The manufacturer shall guarantee against any defect, failure or malfunctioning occurring during 12 months from the date of commissioning or 24 months from the date of supply whichever is earlier.



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	PAINTING	<b>P.019141 G11077 M012</b>
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**BHAGYANAGAR GAS LIMITED (BGL)**

**MECHANICAL, INSTRUMENTATION OF MOTHER STATIONS  
IN HYDERABAD GA**

PAINTING SYSTEM & COLOUR CODE FOR FINAL LAYER



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### 1.0 INTRODUCTION

This Document (PTS - Particular Technical Specification for Painting) lists the Specification for the project.

This present document covers the technical specification for the procurement of Painting used in high pressure natural gas transmission systems. It describes the general requirements, controls, tests, QA/QC examination and final acceptance criteria which need to be fulfilled.

In case of any conflict of Specification, PTS will supersede General Technical specification (GTS) and Data sheet will supersede PTS.

### 2.0 DEFINITIONS

Client / Owner	Shall mean BGL
Manufacturer	Means the Manufacturer of the Paint.
Contractor	The party which carries out all or part of Engineering, Procurement, Construction, Pre-commissioning & Commissioning of the project. It shall mean Pipe laying contractor in the present context.
Third Party Inspection Agency (TPIA)	Means the Inspection Agency to be appointed by the Pipe laying contractor
Consultant / Owner Representative	Shall means PMC/ BGL / The entity of the purchaser or the company nominated by the purchaser to design the natural gas transport or distribution system and to specify the equipment
PTS	Means the present <<Particular Technical Specification P.014902 G11077 M012>>and its entire appendix, if any.

### 3.0 COLOUR CODE SYSTEM

The colour codes for final layer of Station Pipe Work & Metering Shed shall be as under:

S. No.	DESCRIPTION	FINAL LAYER COLOUR SHADE	RAL CODE
1	Pipe Work	Yellow	RAL 1004
2	Piping Support	Grey	RAL 7043
3	Handrail	Orange	RAL 2003
4	Gas O/L Actuator	Blue	RAL 5015
5	Valve Handle/Wheel	Black	RAL 9005
6	All Valves	Grey	RAL 7038



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S. No.	DESCRIPTION	FINAL LAYER COLOUR SHADE	RAL CODE
7	IJ	Grey	RAL 7038
8	Filter	Grey	RAL 7038
9	Pig launcher & Receiver	Grey	RAL 7038
10	Bolts & Nuts	Grey	RAL 7038
11	Grating	Hot Galvanized	
12	Metering Station Shed		
12.1	Steel Frame	Beige	RAL 1018
12.2	Roof/ Vertical Shed	Grey	RAL 7030
12.3	Control Panel	Grey	RAL 7032

The recommended painting system should be of Category C5 – I Very high (Industrial) with high durability as specified in the Standard ISO 12944 Part 1 to 8. The proposed Painting system shall conform to Table A5 of ISO 12944 – 5 Standard.

Table A.5 — Paint systems for low-alloy carbon steel for corrosivity categories C5-I and C5-M

Substrate: Low-alloy carbon steel											
Surface preparation: For Sa 2½, from rust grade A, B or C only (see ISO 8501-1)											
System No.	Priming coat(s)				Subsequent coat(s)		Paint system		Expected durability		
	Binder	Type of primer <sup>a</sup>	No. of coats	NDFT <sup>b</sup> in µm	Binder type	No. of coats	NDFT <sup>b</sup> in µm	Low	Med	High	
<b>C5-I</b>											
A5I.01	EP, PUR	Misc.	1-2	120	AY, CR, PVC <sup>c</sup>	3-4	200				
A5I.02	EP, PUR	Misc.	1	80	EP, PUR	3-4	320				
A5I.03	EP, PUR	Misc.	1	150	EP, PUR	2	300				
A5I.04	EP, PUR, ESI <sup>d</sup>	Zn (R)	1	60 <sup>e</sup>	EP, PUR	3-4	240				
A5I.05	EP, PUR, ESI <sup>d</sup>	Zn (R)	1	60 <sup>e</sup>	EP, PUR	3-5	320				
A5I.06	EP, PUR, ESI <sup>d</sup>	Zn (R)	1	60 <sup>e</sup>	AY, CR, PVC <sup>c</sup>	4-5	320				
<b>C5-M</b>											
A5M.01	EP, PUR	Misc.	1	150	EP, PUR	2	300				
A5M.02	EP, PUR	Misc.	1	80	EP, PUR	3-4	320				
A5M.03	EP, PUR	Misc.	1	400	—	1	400				
A5M.04	EP, PUR	Misc.	1	250	EP, PUR	2	500				
A5M.05	EP, PUR, ESI <sup>d</sup>	Zn (R)	1	60 <sup>e</sup>	EP, PUR	4	240				
A5M.06	EP, PUR, ESI <sup>d</sup>	Zn (R)	1	60 <sup>e</sup>	EP, PUR	4-5	320				
A5M.07	EP, PUR, ESI <sup>d</sup>	Zn (R)	1	60 <sup>e</sup>	EPC	3-4	400				
A5M.08	EPC	Misc.	1	100	EPC	3	300				

Binder for priming coat(s)	Type	Water-borne possible	Binder for subsequent coat(s)	Type	Water-borne possible
EP = Epoxy	2-pack	X	EP = Epoxy	2-pack	X
EPC = Epoxy combination	2-pack		EPC = Epoxy combination	2-pack	
ESI = Ethyl silicate	1- or 2-pack	X	PUR = Polyurethane, aliphatic	1- or 2-pack	X
PUR = Polyurethane, aromatic or aliphatic	1- or 2-pack	X	CR = Chlorinated rubber	1-pack	
			AY = Acrylic	1-pack	X
			PVC = Poly(vinyl chloride)	1-pack	

<sup>a</sup> Zn (R) = Zinc-rich primer, see 5.2. Misc. = Primers with miscellaneous types of anticorrosive pigments.

<sup>b</sup> NDFT = Nominal dry film thickness. See 5.4 for further details.

<sup>c</sup> It is recommended that compatibility be checked with the paint manufacturer.

<sup>d</sup> It is recommended for ESI primers that one of the subsequent coats be used as a tie coat.

<sup>e</sup> It is also possible to work with an NDFT from 40 µm up to 80 µm provided the zinc-rich primer chosen is suitable for such an NDFT.



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**BHAGYANAGAR GAS LIMITED (BGL)  
(MECHANICAL, INSTRUMENTATION) OF MOTHER  
STATIONS IN HYDERABAD GA**

PTS – SS TUBES

		Issued for Tender			
<b>Rev.</b>	<b>Date</b>	<b>Description</b>	<b>Prepared by</b>	<b>Checked by</b>	<b>Approved by</b>




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 <p>Bhagyanagar Gas Limited</p>	<p><b>Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA</b></p> <p><b>Bid Document No: BGL/693/2025-26</b></p>	<p>Volume II of II</p>
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## 1.0 GENERAL

BHAGYANAGAR GAS LIMITED (BGL), (hereinafter referred as Owner), has been authorised by PNGRB for setting up infrastructure and operation of City Gas Distribution Network for the Hyderabad GA. Natural gas will be transported to residential, commercial, industrial (PNG) and automobile consumers (CNG) in the city.

The present document covers the technical specifications for the procurement of "SS Tubes"

This document shall be read in conjunction with schedule of rate (SOR), Material Requisition (MR), specification, standards, drawings and other documents forming a part of the tender document.

## 2.0 SCOPE OF SUPPLY

- 2.1 The scope of work not limited to manufacture, supply, Inspection & testing at workshop, marking, packing, handling and dispatch SS Tubes as per quantities given in MR and complying all the requirements as per ASTM A 269, ANSI B31.3.
- 2.2 All codes & Standards for manufacturing, testing, inspection etc. shall be of latest edition.
- 2.3 All tubes shall be designed as per applicable codes & standards.
- 2.4 All part/ component shall meet the requirement for the specified area's classification.
- 2.5 Area classification shall be Class-I, Division-I; Group-D as per NEC or Zone-I Group IIA/ IIB as per IS/ IEC Specification or equivalent specifications.

## 3.0 CODES & STANDARDS

Applicable Codes and Standards to be followed are as under but not limited to the following:

- ASTM A269 : Seamless and Welded Austenitic Stainless-steel tubing for general service  
 ASTM A450 : General requirements for carbon, ferritic alloy and austenitic alloy steel tubes

In case of any conflict between this job specification and other document, the following order of precedence shall apply:

- Job Specification
- International Standards/ Codes Applicable.

## 4.0 OTHER TECHNICAL REQUIREMENTS

The Contractor shall carry out the work in accordance with Specifications, Standards and ASME B 31.3 - Process Piping / ASME B 31.8 – Gas Transmission and Distribution Piping System, Oil Industry Safety Directorate (OISD) norms.

Any discrepancy, ambiguity or conflict in or between any of the standards, specifications codes and the contract documents should be promptly referred to Owner / Owner's Representative for his decision, which shall be binding on the bidder.

## 5.0 TECHNICAL SPECIFICATION

All the items shall be suitable for compressed natural gas service and meet following specifications.

- 5.1 Tube material shall be stainless steel as per ASTM A269 (Grade TP 316).
- 5.2 Tubing material shall have minimum molybdenum content 2.5%, carbon content of max. 0.030%
- 5.3 Tube shall be bright annealed.
- 5.4 Tube shall be seamless.

- 5.5 Tube hardness shall be less than Rb 80. Tubes shall be NACE MR 0175 certified for hardness. Hardness test shall be carried out on each tube.
- 5.6 10% lot shall be hydro tested as per requirement of ASTM A450 clause 22.3, at a hydro test pressure of 350 kg/cm<sup>2</sup>(g). However, it shall be ensured that the test pressure does not result in stresses exceeding the yield strength at test pressure.
- 5.7 The min. Strength & yield strength shall be verified by a means of tensile strength.
- 5.8 All S.S tubes shall be online 100% eddy current Tested as per ASTM A450.
- 5.9 Tolerance on outer diameter shall be  $\pm 0.005$ ".
- 5.10 Tube shall be of 6 meter in length with tolerance as per ASTM A269 (-0mm, +3.2mm)
- 5.11 Minimum thickness shall be as per following table:

<i>Tube OD</i>	<i>Minimum Wall Thickness</i>	<i>Maximum Allowable Working Pressure psig</i>
8mm	1mm	4800
10mm	1mm	4800
¾"	0.095"	4700
½"	0.083"	4700
1"	0.120"	4700

Note: Bidder to reconfirm maximum allowable working pressure for each tube size.

- 5.12 Following documents/ certificates to be submitted
- i) Chemical composition for heat
  - ii) Chemical composition for products
  - iii) Tensile test
  - iv) Hardness test
  - v) Flaring test
  - vi) Eddy current test
  - vi) Leak test
  - vii) Visual inspection and dimensional check
- 5.13 Tubing should be clearly marked with the specifications given in the inspection certificate with heat code, lot code, outer diameter and wall thickness with inspection certificate no.
- 5.14 Tubes should be supplied with both ends plugged with clean interior & each packing containing tubes shall carry the following stamped or written in indelible ink, manufacturer's name or trade mark, designation of tubes, lot no, etc.

## **6.0 INSPECTION AND TESTING**

- 6.1 Inspection shall be carried out as per tender technical specification, relevant Codes/ Standards and inspection Plan /QAP/ QCT. Vendor to prepare detailed QAP. Vendor to prepare detailed QAP and submit the same for approval to Purchaser/ Purchaser's representative.
- 6.2 Bidder/vendor furnish all the material test certificates, proof of approval/ license from specified authority as per specified authority as per specified standard, if relevant, internal test/ inspection reports as per tender technical specification and specified code for 100% material, at the time of final inspection of each supply lot of material.



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- 6.3 For any control test or examination required under the supervision of TPIA/ Purchaser/ Purchaser's representative

**7.0 PACKING & SHIPMENT**

- 7.1 All the items shall be suitably wrapped and packaged to with stand rough handling during ocean shipment and inland journey. Tubes should be supplied with both end plugged
- 7.2 The item shall be properly tagged and package separately to facilitate easy identification
- 7.3 Items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.

**8.0 DOCUMENTATION & TRAINING**

Following test certificates shall be furnished along with shipment

- Test certificate of visual, chemical, mechanical testing (incl. tensile, hardness, flaring, Eddy current and leak test)
- Manufacturers standard shop inspection & test report for all items
- The test report for specified tests
- Third party inspection report as applicable to meet the requirements of specified codes & standards as applicable
- Vendor shall provide complete training to Owner on installation of Tubes at sites and other aspects like safety, operations & Maintenance, Repairing etc.

**9.0 GUARANTEE**

- Manufacturer shall guarantee that the design, materials, manufacturing and testing of tubes conform to the requirement of this specification. Manufacturer shall replace all tubes free of costs which fail during field pressure testing or do not perform satisfactorily due to inadequate engineering, substandard material and poor workmanship at Manufacturer's end.
- The manufacturer shall guarantee against any defect, failure or malfunctioning occurring during 12 months from the date of commissioning or 24 months from the date of supply whichever is earlier.



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**2.0 TECHNICAL SPECIFICATION FOR  
SS FERRULE FITTINGS FOR  
CNG REFILLING STATIONS**



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**1.0 SCOPE OF WORK**

The scope of this specification covers the requirement of design, manufacture/ inspection/ testing at works/ marking/ packaging/ and supply of high-pressure SS Ferrule Fittings.

**2.0 CODES & STANDARD**

Items	Applicable Codes and Standards
Bar Stock	ASME SA-479-316 or DIN 4401 or BS:970-316-S31
Forging	ASME SA-182-316 or DIN 4401 or BS:970- 316-S31
Thread	NPT ANSI B 1.20.1

The latest editions of the following standards are referred to in this specification.

**3.0 PRECEDENCE**

In case of any conflict between this job specification and other document, the following order of precedence shall apply:

- 3.1 Job Specification.
- 3.2 International Standards/ Codes Applicable.

**4.0 DEVIATION**

Deviations if any required by Tenderer shall be separately furnished against each clause giving reasoning for each deviation. Tenderer to note that except the deviations furnished by them, Tenderer's offer shall be deemed to be in total conformity with the enquiry specifications.

**5.0 SPECIFICATION**

All the items shall be suitable for compressed Natural Gas service and meet following specifications.

**5.1 Materials**

5.1.1 Fittings shall be manufactured from the following materials:-

- i) Bar stock shall be as per BS: 970-316-S31, DIN 4401 or ASME 479-316 but with carbon content less than 0.05% to provide increased resistance to corrosion.
- ii) Forgings shall be as per BS: 970-316-S31, DIN 4401 or ASME SA- 182-316.

5.1.2 The fittings end connections shall be compatible to tube of hardness Rb80.

5.1.3 All component parts of the fittings shall be of the same material.

5.1.4 The ferrule material shall be able to withstand an atmosphere of Natural Gas, oil and moisture without rusting.



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**5.2 Design & Manufacture**

- 5.2.1 All fittings shall be designed in conformance with the requirements of ASME B31.3 and applicable standards. Area classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC or Zone-1 Group- IIA/IIB as per IS/ IEC specification or equivalent specification. All fittings shall be designed so that all parts/ components meet the requirements for the specified area classification.
- 5.2.2 The SS fittings shall be of flare less design and four piece construction, consisting of front and rear ferrules, nut and body suitable for use on SS tubes conforming to ASTM A269 TP316.
- 5.2.3 Fittings shall be rated for at least the design pressure as stipulated in the material requisition. The design of fittings shall ensure that they shall be capable of holding full tube burst pressure after only one and a quarter turn pull up of the nut.
- 5.2.4 The threaded ends of fittings shall be NPT as per ANSI B1.20.1.
- 5.2.5 The fittings shall hold the tube with collecting action producing a firm grip on the tube without substantially reducing the tube wall thickness.
- 5.2.6 Fittings shall not torque the tubing during original or subsequent make-up of the connection and should use geometry for inspection before and after makeup the fittings shall not require disassembly for inspection before or after makeup.
- 5.2.7 All tube fittings shall be gauge-able for sufficient pull up after one and a quarter turn. All tube fittings shall have a gauge-able shoulder and there will be no radius at the point where the shoulder meets the neck of the fitting body.
- 5.2.8 The gap inspection gauge shall be easily insert-able at finger tight position of nut. The gap inspection gauge shall not be insert-able between the nut and shoulder of the fitting after completing only one and a quarter turn pull up of the nut.
- 5.2.9 The tube seat counter bore in the body shall be faced flat 90° to the axis of the tubing to minimize tube expansion and subsequent galling.
- 5.2.10 The sealing and gripping power of the fitting shall be controlled such that the action between ferrules will overcome commercial variations in tubing wall thickness, hardness, diameter and installer skill.
- 5.2.11 The seal contact area of the fittings body shall have a machined finish of 32 Ra or better.
- 5.2.12 The fittings body shall have no machined stop or shoulder to preclude additional tightening in subsequent make-up.
- 5.2.13 Front Ferrule
- i) The front ferrule shall effect a long, smooth repeatable seal by contact with body and a grip hold on the tube surface.
  - ii) The front ferrule shall always remain in a sprung condition to compensate for thermal stresses and to accomplish repeated make and break

Rear Ferrule



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- i) The rear ferrule shall collect the tubing surface, improving the performance of the tubing in systems of high impulse or vibration.
- ii) The rear ferrule shall have a machine recess on the inside diameter and shall have complete surface hardening so as to substantially reduce the required pull up torque. Both the requirements i.e. complete surface hardness and machined recess shall be met for all rear ferrules.

5.2.15 Nuts shall have silver plated threads to act as a lubricating agent to avoid galling and to reduce tightening torque.

**5.3 Inspection and Testing**

5.3.1 The manufacturer shall submit typical type test reports for the following test carrier out on random samples of two ferrule fittings:-

- i) Hydraulic burst pressure test.
- ii) Helium leak test under 0.0002 PSIA negative pressure, leaks into assembly greater than 4.0 x 10<sup>-9</sup> atm-cc/sec being unacceptable.
- iii) Gas pressure test for 25 remarks at 5000 Psig. No leakage should be detectable even after 25 remarks.
- iv) Impulse & vibration testing by “rotary beam method” for 5,00,000 impulse cycles and 20million vibration cycles with no detectable leakage at full working pressure throughout till the end of the test.

**5.4 Test Reports and Certificates**

5.4.1 The manufacturer shall supply material compliance certificates conforming that the raw material for fittings conforms to the requirements of ASME Section-II and ASME Section-III sub section NB, NC and ND.

5.4.2 The manufacturer shall furnish test procedure and typical test reports of all tests conducted on fittings as per the requirements of clause 5.3.

**6.0 MARKETING, PACKING & SHIPMENT**

6.1 Heat code traceability number shall be stamped or etched on both body and nut of each fitting.

6.2 Replacement nuts and ferrules shall be packaged in a manner so as to allow safe and simple replacement.

6.3 All the items shall be suitably wrapped and packaged to with stand rough handling during ocean shipment and inland journey.

6.4 Item shall be properly tagged and packaged separately to facilitate easy identification.

6.5 Items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.

**7.0 DOCUMENTATION**

7.1 All documents shall be furnished in English language only.

7.2 At the time of bidding, bidder shall submit following documents:

- i) Reference list of previous supply for similar item, giving following details:



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- a) Name of the customer.
  - b) Specification of the item i.e., size and pressure & temperature rating.
  - c) Service
  - d) Quantity
  - e) Year of supply
- ii) Test procedure and typical certificates to be submitted as per clause 5.3 and 5.4 of this specification.
  - iii) Manufacturer Quality Control Plan and sampling plan.
  - iv) Copy of ISO:9000 certification for supplier/ manufacturer.

7.3 Following test certificates shall be furnished along-with shipment.

- i) Test certificate of chemical, mechanical testing.
- ii) Manufacturers standard shop inspection& test report.
- iii) The procedure and certificates to be submitted as per the requirements of clause 5.4 of this specification.

**8.0 GUARANTEE**

- 8.1 Manufacturer shall guarantee that the design, materials, manufacturing and testing of fittings comply with the requirement of this specification and applicable codes and standards. Manufacturer shall replace all fittings which should result defective or fail during field pressure testing or fail to perform satisfactorily due to inadequate engineering, substandard material and workmanship.
- 8.2 The manufacturer shall guarantee against any defect, failure or malfunctioning occurring during 12 months from the date of commissioning or 24 months from the date of supply whichever is earlier.



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**3.0 TECHNICAL SPECIFICATION FOR  
SS BALL VALVES FOR CNG REFILLING STATIONS**



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**1.0 SCOPE OF WORK**

- 1.1 The scope of this specification include design, manufacture/ supply, inspection/testing/ marking/packaging/handling and dispatch of SS Ball Valves as per relevant codes.
- 1.2 Purchaser reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms& conditions in the original order.

**2.0 CODES & STANDARD**

Items	Applicable Codes and Standards
Valves	MSS-SP-99

**3.0 PRECEDENCE**

- 3.1 In case of any conflict between this job specification and other document, the following order of precedence shall apply:
  - 3.1.1 Job Specification.
  - 3.1.2 International Standards/ Codes Applicable.

**4.0 DEVIATION**

Deviations if any required by Vendor shall be separately furnished against each clause giving reasoning for each deviation. Vendor to note that except the deviations furnished by them, Vendor's offer shall be deemed to be in total conformity with the enquiry specifications.

**5.0 MATERIALS**

- 5.1 The valve body shall be made out of material conforming to ASTM A479 Type 316.
- 5.2 Material of construction of ball shall conform to ASTM A276 Type 316.
- 5.3 Material of construction of seat springs shall be Alloy X-750.

**6.0 DESIGN & MANUFACTURE**

- 6.1 All ball valves shall be designed in conformance with the requirements of ASMEB31.3, MSS-SP-99and other applicable code and standards. Area Classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC or Zone-1Group-IIA/ IIB as per IS/ IEC specification or equivalent specification. All fittings shall be designed so that all parts/ components meet the requirements for the specified area classification.
- 6.2 Valves shall be rated for a maximum working pressure of 5000 psig and shall be capable of operation between a temperature range of (-40)° to 250°F.
- 6.3 Valves shall have spring loaded PEEK seats allowing seal-ability over the full pressure range at any port and low operating torque over the full range of pressures and temperatures.



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- 6.4 Elastomeric seals, which require no packing adjustment, shall be used.
- 6.5 Valves stem shall be of bottom loaded and blow out proof design.
- 6.6 Ball shall be blow out proof and turnnion mounted.
- 6.7 Valves shall have positive wrench/ handle stops, Phenolic black wrench/ handle shall be provided. Wrench/ handle shall indicate the direction to flow. In the case of three way valves the stem shall also provide th visual indication of flow direction if the handle is removed.

**7.0 INSPECTION AND TESTING**

- 7.1 The valve manufacturer shall submit typical type test reports for the following test carrier out on similar valves:-
- i) Hydrostatic seat leak test shall be carried out with de-ionized water. There shall be no detectable set leakage at 1.1 times the rated pressure of the valve.
  - ii) Gas pressure test for seat and shell shall be carried out with nitrogen at 1000 psig. There shall be no detectable external leakage. Maximum allowable seat leakage shall be 0.1 atm-cc/min.

**8.0 OTHER REQUIREMENTS**

- 8.1 Manufacturer should confirm that valves are approved by Rail Road Commission of Texas, LP Gas Division under regulation for compressed natural gas or ANSI/ AGA NGV 3.1 1995, CAN/ CGA-12.3-M95 “Fuel Systems Components for Natural Gas Powered Vehicles ”by “Canadian Standard Association”.
- 8.2 Spares and Accessories
- i) If required, manufacturer shall furnish a list of recommended spares and accessories for valves required during start up and commissioning.
  - ii) If required, manufacturer shall furnish a list of recommended spares and accessories required for two years of manual operation and maintenance of valves.
  - iii) Manufacturer shall quote for spares and accessories as per the material requisition.

**9.0 TEST REPORTS & CERTIFICATES**

- 9.1 The manufacturer shall supply material compliance certificates.
- 9.2 The valve manufacturer shall provide test procedure and valve inspection and test report for type tests carried out on similar valves as per the requirements of clause 7.0.

**10.0 MARKETING, PACKING & SHIPMENT**

- 10.1 Heat code shall be marked on valve body to facilitate tractability.
- 10.2 All the items shall be suitably wrapped and packaged to with stand rough handling during ocean shipment and inland journey.
- 10.3 Each item shall be properly tagged and packaged separately to facilitate easy identification.
- 10.4 ~~All items shall be wrapped and packaged in such-a-way that they can be preserved in original as new~~



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condition.

**11.0 DOCUMENTATION**

11.1 All documents shall be furnished in English language only.

11.2 At the time of bidding, bidder shall submit following documents:

i) Reference list of previous supply for similar item, giving following details:

- a) Name of the customer.
- b) Specification of the item i.e., size and pressure & temperature rating.
- c) Service
- d) Quantity
- e) Year of supply

ii) Test procedure and typical certificates to be submitted as per clause 5.3 and 5.4 of this specification.

iii) Copy of ISO: 9000 certification for supplier/ manufacturer.

iv) Manufacturer Quality Control Plan and sampling plan.

v) Technical descriptive catalogue of manufacturer.

vi) General arrangement/ assembly drawing of valve showing all features.

vii) Sectional drawing showing major parts with reference number and material specification.

11.3 Prior to shipment, manufacturer shall submit following test certificates and documents.

i) Test certificate of chemical, mechanical testing.

ii) Manufacturers standard shop inspection test.

iii) Manufacturers standard shop inspection and test reports.

iv) The procedure and certificates to be submitted as per the requirements of clause 8.0 of this specification.

v) Manual for installation, erection, maintenance and operating instructions including a list of recommended spares for valves.

**12.0 GUARANTEE**

12.1 Manufacturer shall guarantee that the design, materials, manufacturing and testing of fittings comply with the requirement of this specification and applicable codes and standards. Manufacturer shall replace all fittings which should result defective or fail during field pressure testing or fail to perform satisfactorily due to inadequate engineering, substandard material and workmanship.

12.2 The manufacturer shall guarantee against any defect, failure or malfunctioning occurring during 12 months from the date of commissioning or 24 months from the date of supply whichever is earlier.



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**4.0 TECHNICAL SPECIFICATION FOR  
THERMOPLASTIC HOSES FOR  
CNG REFILLING STATIONS**



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- 1.0 SCOPE OF WORK
- 2.0 CODE & STANDARD
- 3.0 PRECEDENCE
- 4.0 DEVIATION
- 5.0 SPECIFICATIONS
- 6.0 DESIGN & MANUFACTURE
- 7.0 INSPECTION AND TESTING
- 8.0 MARKETING , PACKING & SHIPMENT
- 9.0 DOCUMENTATION



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**1.0 SCOPE OF WORK**

- 1.1 The scope of this specification includes design, engineering, manufacturing, inspection/ testing, marking, packaging, handling and supply/ dispatch of Conductive Core Thermoplastic Flexible Hoses as per relevant codes.
- 1.2 Purchaser reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms & conditions in the original order.

**2.0 CODES & STANDARD**

Sr.No.	Description
1	1/2"IDHOSE Hose Length: 3 meter with Break way coupling Hose end to end Connections:1/2"OD Tube adaptor with nut & ferrule.
1A	Break away coupling for 1/2"ID HOSE Material-SS 316 Rated Pressure– 5000 PSI @70Deg.F Min. Flowrate– 2000SCFM Temperature–0Deg.F to400 Deg.F

Hose should conform to NFPA 52, AGA1-93 and ANSI / CSA NGV 4.2-2014 /CSA12.52-2014 and end connection shall conform to ASTMA276;ASTMA479,ASMESA479.

**3.0 PRECEDENCE**

In case of any conflict between this job specification and other document, most stringent shall apply.

**4.0 DEVIATION**

Deviations, if any, required by Vendor shall be separately furnished against each clause giving reasoning for each deviation. Vendor to not that except the deviations furnished by them, Vendor's offer shall be deemed to be in total conformity with the enquiry specifications.

**5.0 SPECIFICATIONS**

- a) The core material shall be non-metallic, flexible incomplete conformity with the relevant standard as mentioned above.
- b) Electrical conductivity shall comply with AGA1-93
- c) End connections shall be 316 stainless steel materials conforming to relevant design standard as specified above.

**6.0 DESIGN & MANUFACTURE**

- I. Hoses shall be designed in conformance with the requirements 52,AGA1-93 and ANSI / CSANGV 4.2-2014/CSA12.52-2014 and other applicable code sand standards. Area classification applicable for all items shall be Class-1,Division-1,Group-



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Dasper NEC or Zone-1 Group- HA/ HB as per IS/IEC specification or equivalent specification. All fittings shall be designed so that all parts/components meet the requirements for the specified area classification.

- II. End connections shall be designed in conformance with the requirement of ASTM A276;ASTMA479,ASMESA479.
- III. The whole assembly shall be rated for a working pressure of 5000 psi and shall be rated for temperature range of(-40)°to250°F.

**7.0 INSPECTION AND TESTING**

The manufacturer shall submit typical type test reports for the following test carried out:

- I. Hydrostatic test shall be carried out with de-ionized water. There shall be no detectable leakage at 1.5 times the rated pressure.
- II. Electrical conductivity test shall be carried out.
- III. Mechanical properties as a result of the test conducted and
- IV. Chemical analysis report

**7.1 TEST REPORTS & CERTIFICATES**

- I. The manufacturer shall supply material compliance certificates.
- II. Chemical Analysis report
- III. Mechanical properties test report
- IV. Hydrostatic test report
- V. Electrical conductivity test report
- VI. Warranty certificate

**8.0 MARKETING, PACKING & SHIPMENT**

- 8.1 Heat code shall be marked to facilitate tractability.
- 8.2 All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.
- 8.3 Each item shall be properly tagged and package separately to facilitate easy identification.
- 8.4 All items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.
- 8.5 Packing note shall carry easily identifiable name or code of the physical item

**9.0 DOCUMENTATION**

- 9.1 All documents shall be furnished in English language only.
- 9.2 At the time of bidding, bidder shall submit following documents:
  - I. Reference list of previous supply for similar item, giving following details:
    - a) Name of the customer.
    - b) Specification of the item i.e., size and pressure & temperature rating.
    - c) Service
    - d) Quantity
    - e) Year of supply
  - II. Test procedure and typical certificates to be submitted as per clause 5.3, 5.4 and 5.5 of this specification.
  - III. Copy of regulatory compliance document/certification for similar product supplied earlier.
  - IV. Manufacturer Quality Control Plan and sampling plan.
  - V. ~~Technical descriptive catalogue of manufacturer.~~



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- VI. General arrangement/ assembly drawing showing all features.
- VII. Sectional drawing showing major parts with reference number and material specification.
- 1.1 Prior to shipment, manufacturer shall submit one set of all the documents and test certificates as specified above. And one set of the same documents and certificates along with the material in addition to the following documents:
  - i. Manual for installation, erection, maintenance and operating instructions including a list of recommended spares.



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	PTS – FITTINGS AND FLANGES	<b>P.019141 G11077 M013</b>
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**BHAGYANAGAR GAS LIMITED (BGL)  
(MECHANICAL, INSTRUMENTATION WORKS) OF MOTHER  
STATIONS IN HYDERABAD GA**

FITTINGS AND FLANGES



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**1.0 GENERAL**

BHAGYANAGAR GAS LIMITED (hereinafter referred as Owner), is executing the City Gas Distribution project.

The fittings & flanges have to be delivered in accordance to the particular specification: Codes, Norms and standards (latest revision); but not limited to:

ANSI B16.5	Pipe flanges and flanged fittings
ANSI B16.9	Factory - made wrought steel butt welding fittings.
ANSI B 16.11	Forged steel fittings
ANSI B16.28	Wrought steel butt welding short radius elbows and returns
ANSI B31.3	ASME code for process piping.
ANSI B31.8	Gas transmission and distribution piping systems.
ANSI B36.10	Welded and seamless wrought steel pipe
ANSI B16.25	Butt Welding Ends
ASTM A 105/ A 105 M	Forging, carbon steel, for piping components.
ASTM A 203	Pressure vessel plates, alloy steel, nickels
ASTM A 234/ A 234 M	Piping, fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures
ASTM A 333	Seamless and welded steel pipe for low temperature
ASTM A 350/ A 350 M	Forging, carbon, and low alloy steel, requiring notch toughness testing for piping components.
ASTM A 370	Mechanical testing of steel products.
ASTM A 420/ A 420 M	Piping fittings of wrought carbon steel and alloy steel for low temperature service.



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ASTM E 112	Standard methods for determining the average grain size.
MSS SP 25	Standard marking system for valves, fittings, flanges, and unions.
MSS SP 55	Quality standard for steel castings for valves, flanges and fittings and other piping components (visual method).
MSS SP 75	Specification for high test wrought butt welding fittings. ASME Boiler and Pressure Vessel code.
MSS SP 44	Specification for Steel Pipeline Flanges
MSS SP 97	Specification for Forged Carbon steel branch outlet fittings – Socket, Threaded and Butt-Welding ends.
DIN 2413	Design of Steel Pressure Pipes
EN 10204	Type of Inspection documents
ISO 148	Metallic Material - Charpy Pendulum impact test
ISO 9001	Quality management standard

The present specification can confirm, complete, or alter certain characteristics or tolerances of existing laws or specifications.

In his offer, the manufacturer or vendor shall specify all proposed modifications or alternatives to the present specification. In all cases, each modification has to be submitted to the Owner/EPMC. All consequences after eventual order for non-compliance of this obligation are at the manufacturer's charge and responsibility.

A valid copy of the ISO 9001 certificate shall be included in the offer.

The Owner / EPMC keeps the right to audit the manufacturer's and their subcontractor's manufacturing process and control methods.

The manufacturer's specification of the steel, the manufacturing procedure itself and the laboratories in which testing takes place, shall be approved by the client/consultant.

The Owner/ EPMC may verify the control equipment of the manufacturer, its calibration and the points at which it is located. If during the control of the fittings certain problems arise the Owner/EPMC may demand supplementary tests at the cost of the manufacturer.

At all times while work on the contract of the Client is being performed, the inspector representing the Client shall have free entry to all parts of the manufacturer's facilities and those of all subcontractors, who are involved in the manufacturing of the fittings. All reasonable facilities shall be afforded to the inspector to satisfy him that the product is being furnished in accordance with these specifications. All tests and inspections called for by these specifications will be made in the manufacturer's plant prior to shipment and at the manufacturer's expense, unless otherwise, and shall be conducted as not to interfere unnecessarily with the operations of the manufacturer's plant. The manufacturer shall notify the Client prior to completion or shipment of all fittings requiring such inspection.

Eventual interpretations and deviations to this specification by the Manufacturer shall be requested by writing in his offer with detailed justification and approved by the Client/Consultant before eventual order to the Manufacturer. The latter is responsible and shall indemnify the Client/Consultant for any damage resulting from the non-compliance of this obligation.

An approval of documents can never be considered as an acceptance of deviations or relaxations to requirements. A deviation is only possible after specific request to the Client/Consultant.

### 1.1 Glossary

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<b>Client/Owner</b>	Shall mean the Purchaser of fitting & Flanges as mentioned in “Introduction” chapter.
<b>Manufacturer</b>	means the Manufacturer of the Fittings & Flanges
<b>PTS</b>	means the present Particular Technical Specification and all its appendices, if any.
<b>Third Party</b>	
<b>Inspection Agency (TPIA)</b>	means the Inspection Agency
<b>Consultant/Owner’s Representative/EPMC</b>	<b>shall</b> means BGL/PMC
<b>Representative</b>	The entity of the Client or the company nominated by the Client to design the natural gas transport or distribution system and to specify the equipment

**2.0 DESIGN AND CONSTRUCTION**

2.1 The pressure temperature ratings for tee, weldolets, elbows and flanges shall be calculated respectively in accordance with ANSI B31.8, DIN2413 and ANSI B16.5. For all other types of fittings (caps, reducers, nipple) ASME section VIII shall apply.

The standard dimension shall be in accordance

Flanges such as weld neck flanges and blind flanges shall conform to the requirements as follows - ASME B16.5 upto sizes DN 600 mm (24") excluding DN 550 mm (22"),

- MSS-SP-44 for sizes DN 550 mm (22").
- With ANSI B16.9 for the tees, reducers and elbows (except for short radius elbows which should be in accordance with ANSI B16.28)
- All Butt welded end fittings up to 16” such as tees, elbows, reducers, etc. shall conform to ASME B16.9. Socket weld and screwed end fittings shall conform to ASME B 16.11.
- All Butt welded end fitting above 16” such as tees, elbows, reducers, etc. shall be comply with the requirement of MSS-SP-75.

Fitting such as weldolets, sockolets, nipple, etc shall be manufactured in accordance with MSS-SP-97.

With ANSI B 16.9 for the caps,

With ANSI B 36.10 for the nipples,

And with ANSI B16.5 / MSS SP 44 for the flanges

2.2 The temperature and pressure range shall be as per the relevant piping specifications.

2.3 The wall thickness shall meet the following requirements:

2.3.1 The maximum allowable stress in the base material and in the weld shall be equal to forty per cent (40%) of the minimum yield strength guaranteed by the specification of the steel used.

2.3.2 The minimum wall thickness must be greater than the following:

- a. Thickness calculated in line with requirements given in ASME B 16.9 and cl. no. 2.7 of this specification.
- b. Nominal Thickness of pipe

- Thickness calculation is to be submitted to Owner/EPMC for prior approval before manufacturing.
- 2.3.3 If the fitting has yield strength lower than the yield strength of the pipe to which it is intended to be welded, the wall thickness in each zone of the fitting is at least equal to the largest value define "tr" of either.
- The specified pipe wall thickness times the ratio of the minimum yield strength guaranteed by the standard of the steel of the pipe and the minimum yield strength guaranteed by the standard of the steel of the fitting;
  - The absolute minimum thickness required by the applicable code(s).
- 2.3.4 The specified pipe wall thickness and grade (with reference to the equivalent grade in ASTM spec. or API 5L spec.) with which the fitting and flange is intended to be used is specified in the piping material specification.
- Fittings such as tees, elbows, reducers, etc. shall be either welded or seamless type. All welded fittings shall be subjected to heat treatment. All fittings (except weldolets) shall comply with The requirements of MSS-SP-75. Fittings such as weldolets etc. shall be manufactured in accordance with MSS- SP-97.
- Welded pipes used for fittings shall be LSAW type only.
- 2.3.5 The thickness at the welding end shall not exceed 1.5 times the nominal wall thickness of the pipe to be matched.
- 2.3.6 All the above requirements also apply to the welding ends of the flanges.
- 2.4 The manufacturer shall submit for approval to the Client and consultant the dimensional drawings, calculations, and the material part lists for all the types of fittings and flanges. All the documents must be identified with the Client's order number.
- 2.5 The design shall take into consideration performance requirements prescribed in paragraph 2.6.
- The design of tees, reducers or elbows must be established, by proof testing, in accordance with par. 2.7. The design of the other fittings must be established by mathematical analysis according to ASME code.
- 2.6 All fittings under this specification shall be designed to withstand a field hydrostatic test pressure with non corrosive water, after installation, during 24 hours at a following pressure level:
- Minimum:  $P = 1.5$  Design Pressure
- Where:
- $P$  = hydrostatic test pressure, bar
- Design Pressure = 49 barg.
- 2.7 Design Proof Test
- This applies to fitting only and not to flanges.
- 2.7.1 In addition to the requirements of par. 2.3.1 to 2.3.4 proof tests shall be made as evidence of the adequacy to the design references. Records of design or successful proof tests shall be available at the facility for inspection by the Client and copy shall be added to the Certified Material Test Report (CMTR, par. 9.2).
- 2.7.2 Unless otherwise agreed upon between manufacturer and Client, the only required proof test is a bursting strength test.
- 2.7.2.1 Prototype fittings, representatives of production (same size production fittings), selected for test shall be identified as to material, grade, and lot, including heat treatment. They shall be inspected for dimensional compliance to this standard.
- 2.7.2.2 Straight seamless or welded pipe sections, whose calculated bursting strength is at least as great as that calculated for the fittings, shall be welded to each end of the fitting to be tested. Any internal misalignment greater than 0.06 inch (1.6 mm) shall be reduced by taper boring at a slope not over 1:3. Length of pipe sections for closures shall be at least twice the pipe O.D. Shorter lengths may be used as follows:



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- 2.7.3 The assembly must withstand at least 110 % of the pressure computed in 2.7.5.
- 2.7.4 Minimum length of pipe shall be one pipe O.D. for sizes NPS 8" and smaller. Test fluid shall be water or other liquid used for hydrostatic testing.
- 2.7.5 Hydrostatic pressure shall be applied until the fitting ruptures. The actual test pressure prior to rupture must at least be equal to the adjusted proof test pressure defined as follows:

$$P (\text{adj.}) = P \times \frac{S(\text{act.})}{s}$$

where

P (adj.) = the adjusted proof test pressure, bar

P = the computed proof test pressure at burst of any part of the assembly, bar

S = minimum specified tensile strength of the pipe for which the fitting is intended to be used, N/mm<sup>2</sup>

S (act.) = the actual tensile strength of the material of the test fitting (determined on specimen representative of the test fitting), N/mm<sup>2</sup> The computed proof test pressure shall be determined as follows:

Which refers to the pipe which the fitting's marking identifies and, where

$$P = \frac{20S.t}{D}$$

Where

P = Computed bursting pressure of the pipe, bar

S = Minimum specified tensile strength of the pipe, N/mm<sup>2</sup>

t = Nominal pipe wall thickness, mm

D = Specified outside diameter of pipe, mm

- 2.7.6 A successful proof test on a identical prototype fitting, selected as required in subsection 2.7.2.1., may be used to qualify other fittings from the same lot of production.
- 2.7.7 Vendor shall produce test certificate for the burst test.
- 2.7.8 Test shall be witnessed & certified (3.2 certification) by TPIA.
- 2.8 Fitting dimensions

One of the principles of this standard is the maintenance of a fixed position for the welding ends with reference to the centreline of the fittings or the overall dimensions, as the case may be.

Dimensional standards will be in accordance with §2.1.

- 2.9 Fitting and Flanges Tolerances
- 2.9.1 Tolerances for welding ends, out-of-roundness at the welding ends and inside diameter at the bevel are shown hereafter. Other tolerances wall thickness are as per corresponding codes: ANSI B16.9 standard and for short radius elbows ANSI B16.28 standard.
- 2.9.2 Welding ends  
The welding end and bevel shall be in accordance with Figure 1 for wall thickness up to 20.0 mm ; for thicker walls, refer to Figure 2. The welding end land of the fitting & flanges shall be machined flat and shall not vary from the plane by more than 0.03 in (0.8 mm) at any point. If a fitting & flange has a thickness unequal to the pipe with which it is intended to be used, the welding end preparation at the joint has to conform with applicable I-5

of ASME B 31.8 Figure 3.

2.9.3 Out-of-roundness at the welding ends

The out-of-roundness, defined as the difference between the maximum and the minimum inside diameter at the welding ends shall not exceed 1 % of the specified inside diameter for sizes NPS 4 and smaller. Fittings & flanges NPS 4 and larger shall be machined true round.

2.10 Inside Diameter

The inside diameter at any place at end (bevel) shall be the following:

NPS	Tolerance of inside Øat end (mm)
1/2" – 24"	+ 1.6 - 0.4

(1) The tolerance refers to variation from nominal I.D. calculating by (O.D. nom. - 2 t nom.). (2) Flange Bore to match with I.D. of the pipe.

**3.0 MATERIALS**

3.1 The steel used in the manufacture of fittings & flanges shall be selected by the manufacturer and submitted for approval to the Client at the time of the offer. The manufacturer shall fill in the data sheet.

3.2 The chemical composition of the steel meets the requirements of Table 1.

3.3 The steel used has tensile properties conforming to the requirements prescribed in the ASTM standards.

3.4 The ratio of yield strength to tensile strength shall not exceed 0.90.

3.5 The material for fittings shall consist of blooms, billets, slabs, forging quality bar, plate, seamless or fusion welded tubular products with filler metal added.

3.6 The steel shall be fully killed, fine grain practice.

3.7 The steel used shall be suitable for field welding to other fittings, pipes, flanges, or valves manufactured under ASTM specifications A333, A350, A352, A381, A420, A694, A707 or API standards specifications 5L, 6D, 605 or MSS standards SP-44, SP-72, SP-75, EN 10208-2 in line with Piping Specification 6C1 attached with the tender document.

3.8 If preheating of the material is required to ensure proper weldability under normal field conditions, the manufacturer shall state so in the offer, specifying preheat requirements and if accepted by the Client this shall be permanently indicated on the fitting & flanges.

3.9 The Manufacturer must deliver a 3.2 certificate EN 10204, stating the quality, the mechanical properties (yield strength, tensile strength, percent elongation, impact test, chemical analysis, the process of manufacture and the marking (for example the heat number of material) of the steel.


3.10 Chemical Composition

3.10.1 For each heat the manufacturer shall check a chemical analysis of the steel (see Table 1).

3.10.2 Check analysis

Carbon equivalent shall be computed by the following equation:

$$C.E. = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

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And shall not exceed 0.43

**4.0 FABRICATION AND TEST**

For all forging materials, the specimen shall be taken from the integral part of the forging. The par.4.1 to 4.2 are only applicable on welded fittings.

4.1 Welding Fabrication

4.1.1 All welds and repair welds shall be performed according to written procedures. The welding procedure must be submitted for approval to the Owner/EPMC before any fabrication.

Only qualified & approved welders and welding operators shall be used in production.

4.1.2 The joints shall be furnished in accordance with the requirements of Section VIII of ASME Boiler and Pressure Vessel Code.

4.1.3 Machine welding shall be done by an electric process, preferably by submerged arc.

4.1.4 All butt welds shall have full penetration. Submerged arc machine welding shall be done with at least one pass from the inside, except when accessibility makes this impossible, then a manual or machine root bead may be employed provided that a visual inspection of the root bead is possible. Backing rings shall be not used.

4.1.5 Repair, chipping or grinding of welds shall be done in such a manner as not to gouge, groove, or reduce the original metal thickness by more than 6 1/2 % of nominal specified wall.

4.1.6 Except for bar in the tees, fillet welds shall not be permitted.

4.1.7 Welded-on braces, if used, should be removed before heat treatment and the weld spot shall be repaired and ground flush and smooth. However, when braces are required for heat treatment, they shall be cut out and the surface shall be ground flush and smooth after heat treatment. Except for bar in the tees, welding shall not be permitted after heat treatment. The ground areas shall be inspected by magnetic particle or liquid penetrant testing.

4.2 Welding Procedures

4.2.1 All welds, repair welds and repair by welding shall be performed according to written procedures. These welding procedures shall be qualified according to the requirements of the ASME Boiler and Pressure Vessel Code, Section IX.

The welding procedure tests are required on material which is on the high side of the chemistry specification.

The manufacturer shall maintain a weld record of the procedure and performance test results. The test coupons shall be submitted to the same fabrication and heat treatment as the actual fittings.

The welding procedure qualification must include an impact test set in the weld and in the HAZ with requirements of paragraph 5.1.2 and a macrographic examination described in paragraph 4.2.2. These tests shall be performed after eventual final heat treatment.

4.2.2 Macrographic examination: the etched surface of the macro test specimen viewed macroscopically must display the image of a well performed welded joint with sufficient penetration, free from linear defects and important inclusions. In case of doubt, the etched surface must be examined microscopically and additional macroscopical examinations of other areas may be required.

The macrographic examination will include hardness measurements in the weld and the HAZ. The hardness will not exceed the values measured on the parent metal by more than 80 points for the welds and 100 point for HAZ, with an absolute maximum of 350HV10.

The acceptance of inclusions can be decided upon with the NDE of the welded plates (see paragraph 6).

4.2.3 Transverse guided bend test

4.2.3.1. *Test method*

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Transverse weld test specimens shall be subjected to face and root guided bend tests. The specimens shall be approximately 1.5 in (38 mm) wide, at least 6 in (152 mm) long with the weld at the centre, and shall be machined in accordance with Figure 4. The face bend specimen shall be bent with the inside surface of the pipe against the plunger, and the root bend specimen with the outside surface against the plunger. The dimensions of the plunger for the bending jig shall be in accordance with Figure 5 and the other dimensions shall be substantially as shown in Figure 5.

The manufacturer shall use a "jig" based on this dimension or a smaller dimension at this option.

4.2.3.2. *Test specimen*

The weld bend test specimens, as described hereabove shall be cut from the coupon. The specimens may be taken from a fitting or from sample plates as described in par. 4.2.3.1.

4.2.3.3. *Acceptance criteria*

The bend test shall be acceptable if no cracks or other defects exceeding 0.12 in (3.2 mm) in any direction are present in the weld metal or between the weld metal and the fitting metal after the bending. Cracks which originate along the edges of the specimen during testing and which are less than 0.25 in (6.4 mm) measured in any direction, shall not be considered unless obvious defects are observed.

4.2.3.4. *Retest*

If either test fails to conform to specified requirements, the manufacturer may elect to make retests on two additional specimens from the same lot, each of which shall conform to the requirements specified hereabove. If any of these specimens fail to conform to the requirements, the welding procedure qualification test is not accepted.

(\*) A lot consists of all fittings/flanges from one heat of steel with same initial wall thickness, from the same furnace charge for final normalizing heat treatment, from the same shape and the same main pipe dimension.

4.2.4 Number of tests

The nature and number of tests are specified in the Table below and only one retest is allowed.

		Specification test	Number
Non destructive test		par. 6.	par. 6
X-ray and U.S. testing		par. 6	par.6
Destructive test		All specimens shall be taken transverse to the weld	
Tensile		par. 5.1.1.	2
Bend test	Face	par. 4.2.3.	2
	Root	par. 4.2.3	2
Impact	Weld	par. 5.1.2.	1 set of 3 specimens
	HAZ	par. 5.1.2.	1 set of 3 specimens
Macrographic examination		par. 4.2.2	1


4.3 Normalising Heat Treatment

Start & stop temperature chart shall be signed by TPIA, also power failure log shall be maintained.

4.3.1 After forming and welding, all fittings & flanges shall be heat treated by normalising. Normalising shall be carried out in such a way that the base material acquires a fine grained perlitic structure. If the manufacturer can give proof by qualified manufacturing procedure that after forming, the steel of the fitting & flanges has a homogeneous fine grained perlitic structure, he can ask for a derogation supported by technical file to the Client and TPIA.

The normalizing procedure requires the approval of the TPIA. Good care shall be taken to avoid direct contact of the flames with the material to be heated.

During the normalizing period, the temperature of the heat treatment lot shall be automatically recorded by a sufficient number of thermocouples attached to the material surface. The thermocouples shall be

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adequately protected against the influence of heat radiation. Temperature variations shall be within  $\pm 20^{\circ}\text{C}$ . The manufacturer shall furnish time temperature charts of each heat treatment lot. The fittings & flanges belonging to each treatment lot shall be specified on the charts. Temperature measurements by other means are permitted only if approved by the TPIA.

4.3.2 The fine grained perlitic structure of the steel shall be verified by at least one micrographic examination per lot (definition in §4.2.4), according to ASTM E 112. The grain size shall be in the range of 8 to 12.

4.3.3 The manufacturer shall include in the CMTR data of this treatment

**5.0 PHYSICAL TESTING**

5.1 Mechanical Tests

The following mechanical tests shall be performed by the vendor under the supervision of the TPIA and the certificates shall be added to the CMTR.

Test specimens may only be cut after a marking transfer by the Authorised TPIA. All the tests shall be performed after final heat treatment.

Certification requirements to comply with EN 10204 – 3.2 certificates shall issued by TPIA

5.1.1 Tension test

5.1.1.1. Requirements

The material shall be in conformance with the ASTM standards and the ratio of yield stress to tensile stress shall not exceed 0.90.

For fittings containing welds, the fracture must be outside of the weld. If there is a fracture in weld or HAZ, the tensile strength shall at least meet the requirements for tensile properties as per ASTM standards.

5.1.1.2. Test specimen

The test specimen shall represent all forgings from the same lot. Test specimens shall be taken from the fitting after final heat treatment or from a piece of pipe or plate of the same nominal thickness, same heat of steel from which the fitting is made and which has been heat treated in a lot with any of the fitting(s) it represents. For welded fittings, this coupon (piece of pipe or plate) shall contain a weld in prolongation of the weld of the fitting.

5.1.1.3. Number of tests

For fittings NPS 2 and greater the following number of test shall be performed:

Base material : one tension test

Weld : one tension test

5.1.1.4. Test locations and orientations

For welds, the test specimen shall be orientated transversally to the weld. For base material, test specimens shall be orientated transversally and if this orientation is not feasible, it shall be orientated longitudinally.

For flanges, the test location shall be in accordance with ASTM A350§6.1.3.

5.1.1.5. Test method

Testing shall be performed in accordance with ASTM A 370 standard rectangular plate type 1-1/2" wide (Fig. 4- A370) or standard round (Fig. 5 or Fig. 6-A370). Yield strength shall be determined either by the 0.2 % offset or the 0.5 % extension under load (EUL) method.

5.1.1.6. Retest

If the tension test specimen from any lot fails to conform to the requirements of the particular grade ordered, the manufacturer may elect to make retests on two additional pieces from the same lot. If one or both of the retests fail to conform to the requirements, the whole lot of that specimen will be rejected.

5.1.2 Impact test

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5.1.2.1. Requirements

For product, the Charpy V- Notch test shall be conducted as per following requirements:

Material	Impact Test Temperature	Energy Absorption Value (Minimum)
Carbon Steel Material	0 Deg C	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.

SMYS = Specified minimum yield strength.

5.1.2.2. Test specimen

The test specimen shall be machined from material obtained as in paragraph Test specimen for Tension test (par. 5.1.1.2.).

Flattening of test specimens are not allowed.

5.1.2.3. Number of tests and orientation

Three test specimens shall constitute one test set.

For fittings NPS 2 and greater, the following number of tests shall be performed :

Base material : 2 test sets, one set shall be orientated longitudinally and another one transversally.

Weld : 1 test shall be orientated transversally.

HAZ : 1 test shall be orientated transversally.

5.1.2.4. Test method

The notched bar impact test shall be made in accordance with ISO 148 - Charpy V - Notch.

If the wall thickness of the fitting or the coupon does not enable machining of full size specimens, the largest possible size must be used but not less than (10 x 5 mm). The axis of the notch shall be orientated through the wall thickness of the fitting.

5.1.3 Flattening test

This is not applicable to the flanges.

5.1.3.1. Requirements

Flatten to 1/3 original O.D. without cracks or breaks in the fitting, continue flattening until meeting opposite walls of the fitting.

No evidence of lamination of burnt metal may develop during entire test.

5.1.3.2. Test specimen

The test specimen represents all the fittings from the same heat of steel of the same shape and of the same main pipe dimension of the fittings.

5.1.3.3. Number of tests

For fittings size lower than 2" one flattening test shall be made per test specimen.

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### 5.1.4 Retreatment

If the result of the mechanical tests does not conform to the requirements specified in par. 5.1.3.1., the manufacturer, with the acceptance of the Owner/EPMC and the TPIA, may reheat treat the fittings as applicable and repeat all the tests specified.

### 5.2 Chemical Analysis

For each lot/item a new chemical analysis of the steel shall be done.

The chemical analysis shall conform to the ASTM requirements specified in the specification. The carbon equivalent shall be computed by "check analysis": see par. 3.10.2 with C.E.  $\leq 0.43$ . The reports shall be added to the CMTR reports and approved by the TPIA.

## 6.0 NON-DESTRUCTIVE EXAMINATIONS (NDE)

The following mechanical tests shall be performed by the vendor under the supervision of the TPIA and the certificates shall be added to the CMTR.

### 6.1.1 Radiography

All butt and repair welds shall be 100% radiographed in accordance with ASME section V - non destructive examination - article 2 - using fine grain film and lead screens. Acceptance criteria shall be as per ASME B 31.4 or ASME B 31.8 as applicable and API 1104. Radiography shall be performed after the final heat treatment.

### 6.1.2 U.S., Magnetic, Visual and Dimensional examination

#### 6.1.2.1. Non destructive examinations

In the presence of the TPIA, the manufacturer shall perform the following non destructive examinations on the fittings after the mechanical tests and according to an inspection procedure to be submitted for approval

For fitting with wall thickness larger than or equal to 6 mm, ultrasonic inspection on the whole surface (with angle probe and straight probe) to the maximum extent possible.

All finished wrought weld ends shall be 100% tested for lamination type defects by ultrasonic test. Any lamination larger than 6.35 mm shall not be acceptable.

When elbows of size  $> DN 450$  mm (18") are manufactured, the first elbow of each radius, diameter and wall thickness shall be ultrasonically checked for sufficient wall thickness in areas where a minimum wall thickness is to be expected. This shall be followed by random inspection of one out of every three elbows of the same radius, diameter and wall thickness.

Magnetic Particle or Liquid Penetrant Examination shall be performed on cold formed.

Butt welding tees with extruded outlets as per applicable material standard.

Welds, which cannot be inspected by radiographic methods, shall be checked by Ultrasonic or Magnetic particle methods. Acceptance criteria shall be as per ASME section VIII Appendix U and Appendix VI respectively.

Magnetic particle inspection on the whole external surface and the accessible internal surface.

#### 6.1.2.2. Ultrasonic inspection

Ultrasonic inspection of all welds and 25 mm of base material at each side of the weld shall be done.

#### 6.1.2.3. Visual examination

All fitting & flanges shall be visually examined.

#### 6.1.2.4. Test after machining

After machining, all the finished bevels shall be submitted to the following tests:

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- Magnetic particle or liquid penetrant
- For fitting and flanges with wall thickness larger than or equal to 6 mm, ultrasonic inspection on 25 mm of base material.
- 6.1.2.5. Dimensional examination
- For fittings up to NPS 6, the TPIA shall choose 10 % with a minimum of one piece per item of the order and these pieces shall be submitted to a dimensional examination.
- For fittings larger than NPS 6, all pieces shall be submitted to a dimensional examination
- All flanges shall be submitted to a dimensional examination.
- 6.1.3 Acceptance criteria of the different NDE
- 6.1.3.1. Visual examination
- The following defects are unacceptable:
- Undercuts exceeding 1 mm in depth and 25 mm in length.
- Undercuts of the outside weld which overlap undercuts of the inside weld.
- Lack of penetration.
- Continuous occurrence of under-cutting
- 6.1.3.2. Magnetic particle inspection
- Magnetic particle inspection on the external surface. ASME code, section VIII, division 1, appendix VI.
- 6.1.3.3. Ultrasonic inspection
- For the longitudinal welds: ASME code, section VIII, division 1, appendix 12.
- For welding ends, see § 6.1.3.5.
- For base material :
- Procedure: ASME code, section V, art. 23, SA-388.
- Criteria: ASME code, section VIII, division 1, UF-55 (angle probe will be used).
- 6.1.3.4. Radiographic examination
- For longitudinal seam welds :
- Criteria : ASME code, section VIII, division 1, UW 51
- For girth welds :
- Criteria: API standards 1104, section 6.0.
- 6.1.3.5. Magnetic particle or liquid penetrant on the finished bevel
- The following defects are unacceptable:
- Defects extending into the bevel provided the lamination is parallel to the surface and has a transverse dimension exceeding 6.35 mm.
- All defects not parallel to the surface extending into the bevel.

## **7.0 INSPECTION AND TESTING**

### **7.1 Information**

The manufacturer shall inform the TPIA MIN. 5 working days (15 in case of foreign supplier) in advance of any intervention required by this specification and shall send a copy (fax) of it to the Client/Consultant.



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Hydrostatic testing by the manufacturer is not required, but welding fittings shall be capable to withstand a field hydrostatic testing in accordance with par. 2.6.

7.2 Workmanship and Finish

7.3 Fittings & Flanges shall be free of injurious defects and shall have workmanlike finish.

7.4 Injurious defects are defined as those having a depth in excess of 6-1/2 % of specified nominal wall.

7.5 Machining and grinding of surface defects shall be treated as follows: sharp defects such as notches, scratches, scraps, seams, laps, tears, or slivers not deeper than 6-1/2 % of nominal wall thickness shall be removed by grinding. Repair of injurious defects by welding shall be permitted only after agreement by the Client and the TPIA, except that welding of injurious defects shall not be permitted when the depth of defects exceeds 33-1/3 % of the nominal wall thickness, or the length of repair exceeds 25 % of the specified diameter. Defects must be completely removed and welding performed by a welder qualified specifically for repair welding, as per par. 4.2.1. Such repair welding shall be ground flush with the surface and all welding shall be done before final heat treatment. Repair welding shall be done with low hydrogen electrodes in shielded metal arc welding, gas metal arc process or submerged arc process. In no case, repair welding or cracks nor repair or repairs is allowed. Repair welding will not be permitted for flanges.

7.6 Repair welding shall be done before the last heat treatment. Adjusting weld preparations, intended for field welding, by means of welding is not allowed. For "standard fitting" repair by welding is not permitted.

7.7 Repair welding on the welds & in the body shall be 100 % radiographed and U.S tested.

7.8 At the discretion of the TPIA, finished fittings & flanges shall be subject to rejection if surface imperfections acceptable under cl. no. 7.3 are not scattered but appear over an area in excess of what is considered as a workmanlike finish.

7.9 Rejection

Each fitting or flange in which injurious defects are found during inspection and after delivery shall be rejected. The manufacturer shall be notified. In this case, the fitting shall be replaced immediately. All the costs involved, including wages and travel expenses of the TPIA/Client/ Consultant shall be borne by the manufacturer.

### **8.0 MARKING**

8.1 All fittings and flanges furnished under this specification shall be clearly identified on the O.D. with the following information marked with low stress die stamps or interrupted dot stamps as noted (refer to MS SP25):

Manufacturer's name or trademark.

Heat code identity.

Fitting or flange number: the fitting or flange number shall be made up of six figures specified as follows: the item and his number specified in the purchase order.

The monogram of the Owner/EPMC. This marking shall only be applied after complete approval of the Certified Material Test Report (see par. 9.2.).

8.2 In addition to the above, for NPS 2" and larger, it shall also include the following information:

Grade symbol: the grade symbol must designate the material of the fitting or flange.

8.3 Marking must be done prior to final inspection.

### **9.0 DOCUMENTATION**

9.1 Before starting any control, the manufacturer shall submit for approval to the Third Party inspection agency and the Client/Consultant the following documents:

Detailed fabrication drawing and calculations.

Fabrication and control procedure

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List of Operations of Control (LOC) in accordance with PTS (if new -not if upgraded).

Material list.

Qualified welding procedures (if new -not if upgraded).

Welder's performances qualifications (if new -not if upgraded).

Heat treatment procedure-(if new -not if upgraded).

Non destructive testing procedures.

Each company dealing in the order by fabrication and/or control shall implement a LOC for all operations and interventions performed in its organization. They shall also be responsible for the implementation of the same by their subcontractors.

9.2 Certified Material Test Report

A Certified Material Test Report (CMTR) shall be furnished listing as built drawing and calculations, the LOC (see paragraph 9.1.), the proof test certificate, the base material certificate, the chemical check analysis. The certificate of the heat treatment, the mechanical tests, the non-destructive examination, the mechanical properties, the quality release note (see paragraph 9.3) and any special test required by the purchase order the fitting or flange individual number (see paragraph 8.1.1.) must be indicated in the CMTR to permit the correct traceability of each piece. The manufacturer shall furnish one copy of the CMTR to the TPIA and one original and one copy to the Client/Engineer.

9.3 IRN

After final approval of fittings/flanges and the acceptance of the CMTR, the Third Party inspection agency's delegate shall furnish to the Client/Consultant and to the manufacturer an Inspection Release Note (IRN). The manufacturer shall deliver one copy of the IRN with the fittings/flanges and one copy shall be included in the CMTR (see paragraph 9.2.)

All documents shall be in English language.

**10.0 CORROSION PROTECTION**

The corrosion protection will be applied by the manufacturer after final inspection by the TPIA. The product shall meet the following criteria:

- Guarantee a corrosion protection for a storage period in open air for at least 6 months.
- Shall be easily removable by wire brushing or by grinding.
- It shall not produce toxic vapour or smoke when heated by blow torches or during welding

**TABLE 1**

**CHEMICAL COMPOSITION FOR FITTINGS**

Maximum limit of chemical elements which may be used in material under this standard.

	% MAXIMUM
C	0.230
Mn	1.60
Si	0.50
P	0.030
S	0.025



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Nb	0.080
V	0.120
Mo	0.250
N <sub>t</sub>	0.0150

Alternate alloy elements may be used but they shall be discussed with the user prior to delivery of the material. This table is not intended to represent the composition of any heat of steel, but merely to record the maximum permissible amounts of one element. The combination of elements of any heat must conform to the carbon equivalent, subsection 3.10.2.

For each heat the manufacturer shall analyse the following elements: C, Mn, Si, P, S, Nb, V, Cr, Mo, Ni and Cu.

The intentional addition of elements other than those specified is not permitted unless agreed upon by the Client.

In any case, for unintentional additions, the following limitations shall be respected:

$$\text{Ni} \leq 0.30 \%$$

$$\text{Co} \leq 0.01 \%$$

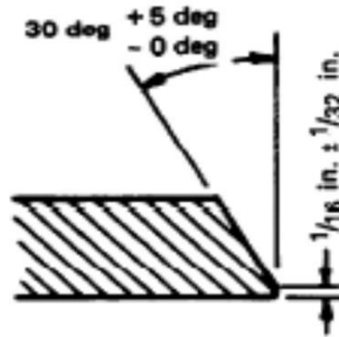
$$\text{Al} \leq 0.07 \%$$

The content of N total (N<sub>t</sub>) may be up to 0.0150 % and must be guaranteed by the manufacturer. If the manufacturer cannot give any guaranty of N content, he shall analyse this element.

The total content for Nb + V will be limited to 0.150 %.

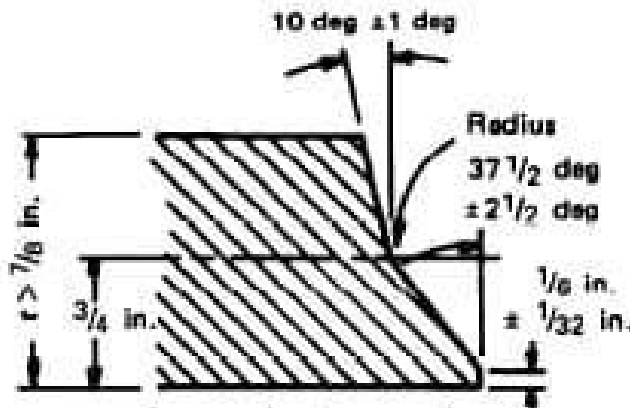
For each reduction of 0.01 % below the maximum carbon content, an increase of 0.05 % manganese above the specified maximum is permissible, up to a maximum of 1.70 %.

FIG. 1



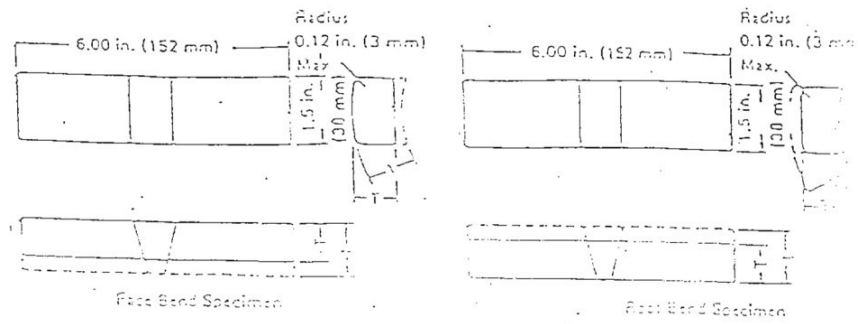
Fitting size 24" and smaller may be furnished with  $37^{\circ} \frac{1}{2}$  bevel at manufacturer's option. Recommended bevel for wall thickness (t) at end of fitting: 20 mm or less.

FIG. 2



Recommended bevel for wall thickness (t) at end of fitting, greater than 20 mm

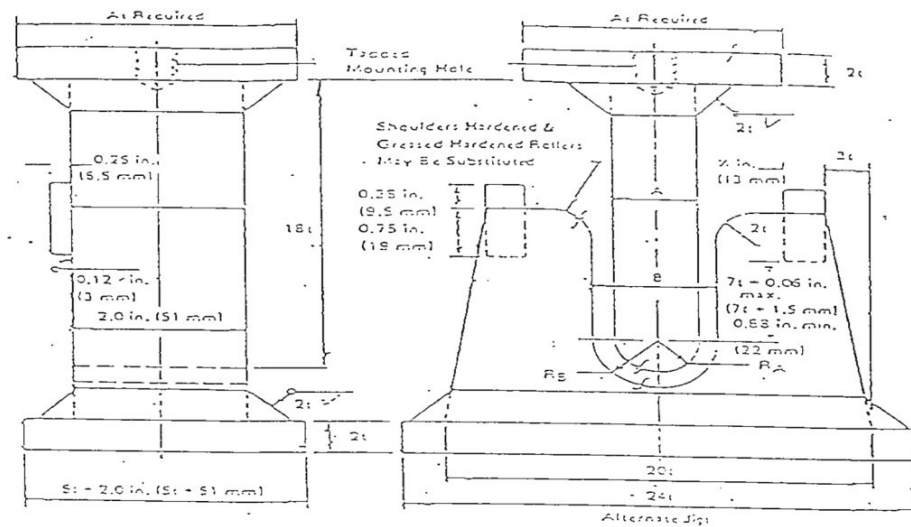
**FIG. 3**



TRANSVERSE FACE AND ROOT BEND TEST SPECIMENS

**FIG.5**

GUIDED-BEND TEST JIG DIMENSIONS

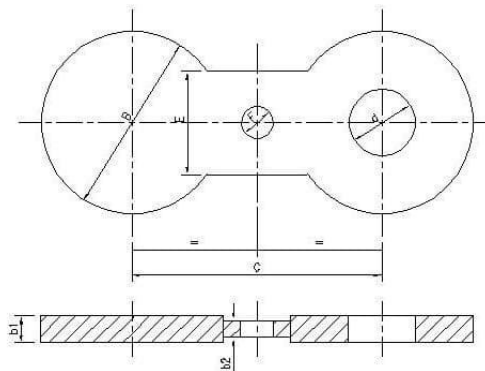


Radius of male member R <sub>A</sub> Radius of female member R <sub>B</sub> Width of male member, A Width of groove in female member, B	CLASS OF STEEL			
	Y52 and low-grade	Y56	Y60	Y70
1/2A	1/2A	1/2A	1/2A	1/2A
1/2B	1/2B	1/2B	1/2B	1/2B

t = specimen thickness

The manufacturer shall use a jig based on this dimension, or a smaller dimension at his option.

**FIG. 6**  
**SPECTACLE FLANGE**



Size NB (inch)	Class 150							Class 300							Class 600						
	B	d	C	E	b1	b2	F	B	d	C	E	b1	b2	F	B	d	C	E	b1	b2	F
1/2"	44	16.0	60	25	6.5	4	16	51	16.0	67	30	6.5	4	16	51	16.0	67	30	6.5	4	16
3/4"	54	22.0	70	30	6.5	4	16	63	22.0	83	35	6.5	4	16	63	22.0	83	35	6.5	4	16
1"	63	28.5	79	35	6.5	4	16	70	28.5	89	40	6.5	4	16	70	28.5	89	40	9.5	6	18
1 1/4"	73	35.0	89	40	6.5	4	16	79	35.0	98	45	6.5	4	16	79	35.0	98	50	9.5	6	18
1 1/2"	82	41.5	98	50	6.5	4	16	92	41.5	114	55	6.5	4	23	92	41.5	114	55	9.5	6	23
2"	101	54.0	121	50	6.5	4	19	108	54.0	127	28	6.5	4	16	108	54.0	127	28	9.5	6	18
2 1/2"	120	66.5	140	50	6.5	4	19	127	66.5	149	35	6.5	4	23	127	63.5	149	35	12.5	8	23
3"	133	79.5	152	60	6.5	4	19	146	79.5	168	40	9.5	6	23	146	79.5	168	40	16.0	10	23
3 1/2"	158	92.0	178	45	6.5	4	19	162	92.0	184	45	9.5	6	23	159	92.0	184	45	16.0	10	23
4"	171	108.0	191	50	6.5	4	19	178	108.0	200	50	12.5	8	23	190	105.0	216	55	16.0	10	23
5"	193	133.5	216	55	9.5	6	22	212	133.5	235	60	12.5	8	23	238	130.0	267	70	22.5	14	23
6"	218	159.0	241	60	9.5	6	22	247	159.0	270	45	16.0	8	23	263	155.5	292	45	25.5	16	23
8"	278	209.5	298	70	12.5	8	22	305	209.5	330	55	19.0	10	23	317	203.0	349	55	32.0	20	23
10"	336	260.5	362	65	16.0	8	26	359	260.5	387	45	25.5	14	23	390	257.0	432	45	38.0	24	23
12"	406	305.0	432	70	22.5	10	26	419	305.0	451	50	28.5	18	23	454	305.0	489	40	44.5	30	23
14"	441	338.5	476	70	25.5	14	29	476	338.5	514	45	32.0	20	23	489	336.5	527	40	51.0	36	23
16"	505	387.5	540	70	26.5	14	29	530	387.5	572	50	36.5	22	23	562	387.5	603	50	57.0	40	23
18"	540	438.0	578	70	25.5	14	32	587	438.0	629	45	41.5	24	23	609	438.0	654	55	63.0	50	23
20"	597	499.0	635	65	28.5	18	32	645	499.0	686	50	44.5	24	23	679	499.0	724	50	70.0	64	23
22"	657	548.0	692	65	35.0	20	35	702	548.0	743	50	44.5	24	23	730	540.0	778	55	70.0	64	23
24"	708	590.5	750	75	35.0	20	35	765	590.5	813	60	54.0	40	23	767	590.5	838	55	82.0	68	23
26"	762	641.5	806	70	51.0	32	35	822	641.5	878	50	73.0	60	23	851	641.5	915	50	101.0	85	23
28"	828	692.0	864	60	51.0	32	35	895	692.0	940	60	73.0	60	23	911	692.2	965	55	101.0	85	23
30"	870	743.0	914	65	54.0	34	35	940	743.0	997	60	85.0	70	23	959	743.0	1022	60	110.0	90	23
32"	936	794.0	978	65	54.0	34	41	1003	794.0	1054	65	85.0	70	23	1119	794.0	1060	60	110.0	90	23
34"	978	844.5	1029	55	57.0	34	41	1044	844.5	1105	70	98.0	80	23	1060	844.5	1130	65	117.0	100	23
36"	1035	895.5	1086	60	57.0	34	41	1105	895.5	1188	55	98.0	80	23	1117	895.5	1194	65	124.0	110	23



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**BHAGYANAGAR GAS LIMITED (BGL)**

**(MECHANICAL, INSTRUMENTATION WORKS) OF MOTHER  
STATIONS IN HYDERABAD GA**

INSULATING GASKET KIT



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# Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA

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## 1.0 INTRODUCTION

This Document (PTS - Particular Technical Specification for – Insulating Gaskets) lists the Specification for Manufacturing/Supplier of Insulating Gasket, for the project.

This present document covers the technical specification for the procurement of Insulating Gaskets used in high pressure natural gas transmission systems. It describes the general requirements, controls, tests, QA/QC examination and final acceptance criteria which need to be fulfilled.


## 2.0 DEFINITIONS

Client / Owner	Shall mean BHAGYANAGAR GAS LIMITED
Manufacturer	Means the Manufacturer of the Insulating Joint.
Laying Contractor/ Contractor	The party which carries out all or part of Engineering, Procurement, Construction, Pre-commissioning & Commissioning of the project. It shall mean Laying Contractor/Contractor in the present context.
Third Party Inspection Agency (TPIA)	Means the Inspection Agency to be appointed by the contractor
Consultant / Owner Representative	Shall means BGL/PMC / The entity of the purchaser or the company nominated by the purchaser to design the natural gas transport or distribution system and to specify the equipment
PTS	Means the present <<Particular Technical Specification P.019141 G11077 M014 >>and its entire appendix, if any.

## 3.0 TECHNICAL SPECIFICATION

3.1 The material of insulating gasket kit shall be as follows:

- i. Insulating Gaskets: It shall be machined glass reinforced epoxy (GRE) resin (G 10 or G11) with O-ring or spring energised seal made from rubber/PTFE.
- ii. Insulating Washer: - Material shall be GRE.
- iii. Insulating sleeve: - Material shall be GRE. Insulating length shall be two flange thickness including raised face, plus gasket, plus two insulating washers, plus one steel washer.
- iv. Steel machine cut washer: - It shall be zinc plated steel.

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- 3.2 One Insulating Gasket kit shall consist of Two (2) nos. of Flange, Stud Bolts, one (1) no. central insulating gasket, one (1) no. insulating sleeve per bolt, two (2) nos. insulating washer per bolt and two (2) nos. metallic washer per bolt.
- 3.3 Manufacturer shall guarantee that Insulating Gasket shall with stand test pressure equal to 1.5 times design pressure of Pipeline.
- 3.4 The dimensions of the gaskets shall be suitable for WNRf flange as per ASME B 16.5
- 3.5 The minimum thickness of insulating gasket shall be 3 mm.
- 3.6 Insulating gaskets shall have bolt holes punched out.
- 3.7 Asbestos shall not be used.
- 3.8 The insulating gaskets shall match flanges (Weld neck raised face & Blind face) to ASME 16.5
- 3.9 Packing size of Insulating Gaskets Kit to be mentioned to ensure uniformity in delivery conditions of the material being procured. Bidder shall submit the packaging details during offer and also complied with at the time of delivery.
- 3.10 Following electrical properties:
- Dielectric Strength (min.) = 550 VPM
  - Electrical Resistance = 25 Mega Ohm
- (When tested with 500-1000V DC megger).
- 3.11 Each kit shall be clearly marked with the size, rating, material specification etc.
- 3.12 Inspection shall be carried out as per Technical Specification.
- Owner Representative or Third-Party Inspection Agency appointed by Supplier shall carry out stage wise inspection during manufacturing / final inspection.
- Vendor shall furnish all the material test certificates, proof of approval / licence from specified authority as per specified standard, if relevant, internal test / inspection reports as per Owner Tech. Spec. & specified code for 100% material, at the time of final inspection of each supply lot of material.

#### **4.0 INSPECTION AND TESTING**

The manufacturer shall perform all inspections and tests as per the requirements of this specification and the applicable codes at his works prior to shipment. Such inspections and tests shall be, but not be limited to the following:

- 4.1 All the insulating gasket assemblies shall be visually inspected.
- 4.2 Insulating flange assembly shall be hydrostatically tested to a pressure equal to 1.5 times design Pressure in following manner.
- 5 minutes at a hydrotest pressure.
  - Reduce to Zero.
  - Repeat the above procedure twice

- 4.3 Insulating flange assembly shall be tested with air at 5 kg/cm<sup>2</sup> for 10 minutes. The tightness shall be checked by immersion or with a frothing agent. No leakage shall be accepted.
- 4.4 Dimensional checks shall be carried out as per Approved Drawings.
- 4.5 Chemical composition and mechanical properties shall be checked as per relevant material standards and this specification, for each heat of material used.
- 4.6 Each insulating gasket shall be tested for dielectric integrity at 5000 V A.C., 50 Hz for one minute and the leakage current before and after shall be equal. Testing time, voltage and leakage shall be recorded and certified. The test shall be carried out in dry conditions.
- 4.7 The insulation resistance of each insulating gasket assembly shall be at least 25 mega ohms when checked with 500V - 1000V D.C. This test shall be carried out in dry conditions.
- 4.8 Each Insulating Gasket Assembly shall be Dielectric Tested before and after hydrostatic Test.
- 4.9 Purchaser reserves the right to perform stage wise inspection and witness tests as indicated above at Manufacturer's Works prior to shipment. Manufacturer shall give reasonable notice of time and shall provide, without charge, reasonable access and facilities required for inspection by the Inspector. Inspections and tests performed/witnessed by the Inspector shall in no way relieve the Manufacturer of his obligation to perform the required inspection and tests.

For any control, test or examination required under the supervision of TPIA/Owner/Owner's representative, latter shall be informed in writing one (1) week in advance by vendor about inspection date and place along with production schedule.

Even after third party inspection, Owner reserves the right to select a sample of pipes randomly from each manufacturing batch & have these independently tested. Should the results of these tests fall outside the limits specified in Owner technical specification, then Owner reserves the right to reject all production supplied from the batch.

## **5.0 TEST CERTIFICATES**

Manufacturer shall submit following certificates to laying Contractor /owner/Owner's representative:

- a) Test certificates relevant to the chemical analysis and mechanical properties of the materials used for construction as per this specification and relevant standards.
- b) Test reports as per QAP
- c) Recorded and Certified Voltage and leakage

## **6.0 MARKING AND SHIPMENT**

### **6.1 Marking**

In addition to the marking required by the applicable standard, the following information shall be marked by cold stamping on the centering ring of each insulating gasket:

- a. The MANUFACTURER's name and trademark
- b. The diameter
- c. The rating

### **6.2 Packing**

The gaskets must be packed in sea-packing, which must be tight and meet the requirements of all stages of transport (rail, road, air, etc.).

## **7.0 DOCUMENTATION**

Within two weeks of placement of order, the manufacturer shall submit two copies of the drawings, documents and specifications for approval.



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Once the approval has been given by Owner/Owner's Representative. Any change in design, material method of manufacture shall be notified to Owner/Owner's Representative whose approval in writing of all changes shall be obtained before the manufacturing.

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**BHAGYANAGAR GAS LIMITED (BGL)  
( MECHANICAL, INSTRUMENTATION WORKS) OF  
MOTHER STATIONS IN HYDERABAD GA**



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### 1.0 GENERAL

BHAGYANAGAR GAS LIMITED (BGL), (hereinafter referred as Owner), has been authorised by PNGRB for setting up infrastructure and operation of City Gas Distribution Network for Hyderabad GA. Natural gas will be transported to residential, commercial, industrial (PNG) and automobile consumers (CNG) in the city.

The present document covers the technical specifications for the procurement of "SS Fittings"

This document shall be read in conjunction with schedule of rate (SOR), Material Requisition (MR), specification, standards, drawings and other documents forming a part of the tender document.

### 2.0 SCOPE OF SUPPLY

2.1 The scope of this specification covers the requirement of design, manufacture, inspection, testing at works/ marking/ packaging/ and supply of high pressure SS Fittings.

2.2 All codes & Standards for manufacturing, testing, inspection etc. shall be of latest edition.

### 3.0 CODES & STANDARDS

Applicable Codes and Standards to be followed are as under but not limited to the following:

Bar Stock	:	ASME SA-479-316 or DIN 4401 or BS:970-316-S31 Stainless Steel EN10088-3 – 1.4404+1D / (AISI 316L)
Forging	:	ASME SA-182-316 or DIN 4401 or BS:970-316-S31 Stainless Steel EN10088-3 – 1.4404+1D / (AISI 316L)
Thread	:	NPT ANSI B 1.20.1/ NPT ASME B1.20.1

In case of any conflict between this job specification and other document, the following order of precedence shall apply:

- Job Specification
- International Standards/ Codes Applicable.

Any discrepancy, ambiguity or conflict in or between any of the standards, specifications codes and the contract documents should be promptly referred to Owner / Owner's Representative for his decision, which shall be binding on the bidder.

### 4.0 TECHNICAL SPECIFICATION

All the items shall be suitable for compressed Natural Gas service and meet following specifications:

#### 4.1 Materials

4.1.1 Fittings shall be manufactured from the following materials:

- i) Bar stock shall be as per BS: 970-316-S31, DIN 4401 or ASME 479-316 but with carbon content less than 0.05% to provide increased resistance to corrosion
- ii) Forgings shall be as per BS: 970-316-S31, DIN 4401 or ASME SA- 182-316

4.1.2 The fittings end connections shall be compatible to tube of hardness  $\leq$ Rb80

4.1.3 All component parts of the fittings shall be of the same material.

4.1.4 The ferrule material shall be able to withstand an atmosphere of Natural Gas, oil and moisture without rusting.

#### 4.2 Design & Manufacture



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- 4.2.1 All fittings shall be designed in conformance with the requirements of ASME B31.3 and applicable standards. Area classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC or Zone-1 Group- IIA/ IIB as per IS/ IEC specification or equivalent specification. Fittings shall be designed so that all parts/ components meet the requirements for the specified area classification.
- 4.2.2 The SS fittings shall be of flareless design and four piece construction, consisting of front and rear ferrules, nut and body suitable for use on SS tubes conforming to ASTM A269 TP316.
- 4.2.3 Fittings shall be rated for at least the design pressure as stipulated in the material requisition. The design of fittings shall ensure that they shall be capable of holding full tube burst pressure after only one and a quarter turn pull up of the nut.
- 4.2.4 The threaded ends of fittings shall be NPT/METRIC as per ANSI B1.20.1/ NPT ASME B1.20.1
- 4.2.5 The fittings shall hold the tube with collecting action producing a firm grip on the tube without substantially reducing the tube wall thickness.
- 4.2.6 Fittings shall not torque the tubing during original or subsequent make-up of the connection and should use geometry for inspection before and after make up the fittings shall not require disassembly for inspection before or after makeup.
- 4.2.7 All tube fittings shall be guageable for sufficient pull up after one and a quarter turn or as per assembly instruction mentioned under point 4.2.3. All tube fittings shall have a guageable shoulder and there will be no radius at the point where the shoulder meets the neck of the fitting body.
- 4.2.8 The gap inspection gauge shall be easily insertable at finger tight position of nut. The gap inspection gauge shall not be insertable between the nut and shoulder of the fitting after completing only one and a quarter turn pull up of the nut.
- 4.2.9 The tube seat counter bore in the body shall be faced flat 90° to the axis of the tubing to minimize tube expansion and subsequent galling.
- 4.2.10 The sealing and gripping power of the fitting shall be controlled such that the action between ferrules will overcome commercial variations in tubing wall thickness, hardness, diameter and installer skill.
- 4.2.11 The seal contact areas of the fittings body shall have a machined finish.
- 4.2.12 The fittings body shall have no machined stop or shoulder to preclude additional tightening in subsequent make-up.
- 4.2.13 Front Ferrule
- i) The front ferrule shall effect a long, smooth repeatable seal by contact with body and a grip hold on the tube surface.
  - ii) The front ferrule shall always remain in a sprung condition to compensate for thermal stresses and to accomplish repeated make and break.
- 4.2.14 Rear Ferrule
- i) The rear ferrule shall collect the tubing surface, improving the performance of the tubing in systems of high impulse or vibration
  - ii) The rear ferrule shall have a machine recess on the inside diameter and shall have complete surface hardening so as to substantially reduce the required pull up torque. Both the requirements i.e. complete surface hardness and machined recess shall be met for all rear ferrules



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- 4.2.15 Nuts shall have silver plated threads to act as a lubricating agent to avoid galling and to reduce tightening torque.

**5.0 INSPECTION AND TESTING**

The manufacturer shall submit typical type test reports as per ASTM F 1387 standard for the following test carrier out on random samples of two ferrule fittings

- i) Hydraulic burst pressure test
- ii) Helium leak test under 0.0002 PSIA negative pressure, leaks into assembly greater than  $4.0 \times 10^{-9}$  atm-cc/sec being unacceptable
- iii) Gas pressure test for 25 remarks at 5000 Psig. No leakage should be detectable even after 25 remarks
- iv) Impulse & vibration testing by “rotary beam method” for 5,00,000 impulse cycles and 20 million vibration cycles with no detectable leakage at full working pressure throughout till the end of the test

**6.0 TEST REPORTS AND CERTIFICATES**

- 6.1 The manufacturer shall supply material compliance certificates conforming that the raw material for fittings conforms to the requirements of ASME Section-II and ASME Section-III sub section NB, NC and ND.
- 6.2 The manufacturer shall furnish test procedure and typical test reports of all tests conducted on fittings as per the requirements of clause 5

**7.0 MARKING, PACKING & SHIPMENT**

- 7.1 Heat code traceability number shall be stamped or etched on both body and nut of each fitting
- 7.2 Replacement nuts and ferrules shall be packaged in a manner so as to allow safe and simple replacement
- 7.3 All the items shall be suitably wrapped and packaged to with stand rough handling during ocean shipment and inland journey
- 7.4 Item shall be properly tagged and package separately to facilitate easy identification.
- 7.5 Items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.

**8.0 DOCUMENTATION & TRAINING**

Following test certificates shall be furnished along with shipment

- Test certificate of visual, chemical, mechanical testing (incl.tensile, hardness, flaring, Eddy current and leak test)
- Manufacturers standard test report for all items
- The test report for specified tests
- Third party inspection report as applicable to meet the requirements of specified codes & standards as applicable
- Vendor shall provide complete training to Owner on installation of Fittings at sites and other aspects like safety, operations & Maintenance, Repairing etc.

**9.0 GUARANTEE**

- 9.1 Manufacturer shall guarantee that the design, materials, manufacturing and testing of fittings comply with the requirement of this specification and applicable codes and standards. Manufacturer shall replace all the fittings which should result defective or fail during field pressure testing or fail to perform satisfactorily due to inadequate engineering, substandard material and workmanship at Manufacturer’s end.



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- 9.2 The manufacturer shall guarantee against any defect, failure or malfunctioning occurring during 12 months from the date of commissioning or 24 months from the date of supply whichever is earlier.



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**1. SCOPE**

This specification completes the description shown on individual piping material classes and covers the technical requirements for the fabrication, inspection, and shipment of spiral-wound gaskets, and ring joints used for pipeline and piping flanges.

**2. REFERENCE DOCUMENTS**

ASME B 31.8	Gas Transmission and Distribution Piping System.
ASME B 16.20	Metallic Gaskets for Pipe Flanges - Ring-Joints, Spiral-Wound, and Jacketed.
ASME B 16.5	Steel Pipe Flanges and Flanged Fittings.
ASME B 16.47	Large Diameter Steel Flanges (NPS 26 through NPS 60).
ASTM F 36	Standard Specification for Test Method for Compressibility and Recovery of Gasket Materials.
EN 10204	Metallic products - Type of inspection documents.

**3. DESCRIPTION OF THE MATERIALS**

3.1. General

All gaskets shall conform to the codes/standards and specifications given in the requisition. Vendor shall strictly comply with Purchase Requisition stipulations and no deviations shall be permitted.

Process of manufacture, dimensions and tolerances not specified in requisition shall be in accordance with the requirements of the manufacturer's standards.

Asbestos containing gaskets are prohibited.

Materials, dimensions, tolerances and markings shall comply with ASME B 16.20.

3.2. Spiral Wound Gaskets

The gaskets shall be in accordance with the standard ASME B16.20 and their spiral-wound portion shall be made from type 316 stainless steel (or higher grade, depending on the relevant piping material specification) strip.

Filler material for spiral wound gaskets shall not have any colour or dye.

GRAPHITE based fillers shall incorporate an adequate corrosion inhibitor in order to prevent from possible galvanic corrosion.

All spiral wound gaskets shall be supplied with Outer ring & Inner ring irrespective of their class, rating & Size unless otherwise specified.

The gaskets shall have an external centering ring and an inner ring.

Inner compression ring material shall be same as winding material. The outer rings are made of either coated carbon steel or of stainless steel.

Spiral wound gasket as per ASME B16.20 shall match flanges to ASME B16.5 up to 24" (except 22" size) and to ASME B16.47 (Series A) for 22" and above 24" unless specifically mentioned otherwise.

3.3. Metal Ring Joint

Hardness of metallic RTJ gaskets shall not exceed the values specified below unless otherwise specified.



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**Table 3-1: RTJ Hardness**

Ring Gasket Material Maximum	Max. Hardness (BHN)
Soft Iron	90
Carbon steel	120
5Cr½ Mo	130
18/8 Stainless Steel	135

3.4. *Face finish of metallic RTJ gaskets shall be 32 to 63 AARH.*

Ring joints may be either oval or octagonal. The dimensions of ring joints shall be in accordance with the standard ASME B16.20, and shall be specified to match with the relevant flanges standard.

**4. QUALITY CONTROL**

The inspection and tests necessary to confirm that the products meet the requirements of the standards, specifications, and requisitions, shall be carried out in the MANUFACTURER's plant by personnel of the plant. These specially qualified personnel shall be independent of the production department of the plant.

Products shall be guaranteed by an inspection certificate (conformity, material, etc.) that must accompany the supply. If the Manufacturer does not have the necessary means of examination, these tests may be carried out by an Inspection agency and at a place approved by the Company.

All inspection and testing shall be carried out as per standard & the QAP provided elsewhere in the bid.

All items shall be inspected and approved by Approved Third party inspector or any other agency authorized by owner.

4.1. Testing

Test reports shall be supplied for all mandatory tests for gaskets as per the standards specified in the requisition and the QAP.

Chemical composition and hardness of RTJ gaskets shall also be furnished in the form of test reports on samples.

For Spiral wound material following shall be furnished:

Manufacturer's test certificate for filler material and spiral material as per the relevant material specifications.

Manufacturer's test certificate for raw materials and tests for compressibility/ seal-ability & recovery as per the relevant material specifications.

PMI shall be performed as per standard and QAP.

**5. MANUFACTURER'S DOSSIER / FINAL DOCUMENTATION**

5.1. Certificate of conformity

The Manufacturer shall submit certificates of conformity to the standards specified by the requisitions for spiral-wound gaskets, and metal ring joints.

5.2. Material certificates

The Manufacturer shall submit material certificates in accordance with the requirements of the reference codes, standards and QAP.



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**6. PREPARATION FOR SHIPMENT**

6.1. Marking

6.2. Spiral-wound gaskets

In addition to the marking required by the standard ASME B16.20, the following information shall be marked by cold stamping on the centering ring of each spiral-wound gasket:

- a. The MANUFACTURER's name and trademark
- b. The diameter
- c. The rating

6.3. Metal ring joints

In addition to the marking required by the standard ASME B16.20, the outside surface of each ring shall include the following information which shall be marked by cold stamping:

- a. The MANUFACTURER's name and trademark
- b. The diameter
- c. The rating
- d. The ring number, followed by the identifying reference of the material.

6.4. Color Coding

Spiral-wound gaskets shall be marked with a color code that identifies the windings and filler materials as per ASME B 16.20.

6.5. Protection

Ring joint gaskets other than those made of stainless steel shall be covered by grease impregnated protecting strips.

Small diameter gaskets shall be grouped in cardboard boxes or plastic pouches and large diameter gaskets in rigid packing cases.

6.6. Packing

The gaskets must be packed in sea-packing, which must be tight and meet the requirements of all stages of transport (rail, road, air, etc.).

The gaskets of different types and sizes shall be place in separate shipping containers.

Each container shall clearly mark with size, rating, material specification and item code.

**Abbreviations:**

AARH	:	Average Arithmetic Root Height
BHN	:	Brinell Hardness Number
CS	:	Carbon Steel
MR	:	Material Requisition
PMI	:	Positive Material Identification
RTJ	:	Ring Type Joint
QAP	:	Quality Assurance Program

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(MECHANICAL, INSTRUMENTATION WORKS) OF MOTHER  
STATIONS IN HYDERABAD GA**

PTS – Thermoplastic Hoses



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### 1.0 GENERAL

BHAGYANAGAR GAS LIMITED (BGL), (hereinafter referred as Owner), has been authorised by PNGRB for setting up infrastructure and operation of City Gas Distribution Network for the Hyderabad GA. Natural gas will be transported to residential, commercial, industrial (PNG) and automobile consumers (CNG) in the city.

The present document covers the technical specifications for the procurement of "**Thermoplastic hose**"

This document shall be read in conjunction with schedule of rate (SOR), Material Requisition (MR), specification, standards, drawings and other documents forming a part of the tender document.

### 2.0 SCOPE OF SUPPLY

2.1 The scope of this specification covers the requirement of design, manufacture, inspection, testing at works/ marking/ packaging/ and supply of high pressure Conductive Core Thermoplastic Flexible Hoses as per relevant codes.

2.2 All codes & Standards for manufacturing, testing, inspection etc. shall be of latest edition.

### 3.0 CODES & STANDARDS

Sr. No.	Description
1	Hose Length: 3 meter with Breakaway coupling 3/8" ID HOSE Rated Pressure – 5000 PSI@ 70 Deg. F Min Hose end to end Connections: 3/8" OD Tube adaptor with nut & ferrule.
2	Breakaway coupling for 3/8" ID HOSE Material - SS316 Flow rate– 2000 SCFM

Hose should conform to NFPA 52, AGA1-93 and ANSI / CSA NGV 4.2-2014 / CSA 12.52-2014 and end connections shall conform to ASTM A276; ASTM A479, ASME SA479.

### 4.0 TECHNICAL SPECIFICATION

All the items shall be suitable for compressed Natural Gas service and meet following specifications:


#### 4.1 Materials

4.1.1 The core material shall be non-metallic, flexible in complete conformity with the relevant standard as mentioned above.

4.1.2 Electrical conductivity shall comply with AGA1-93

4.1.3 End connections shall be 316 stainless steel materials conforming to relevant design standard as specified above.

#### 4.2 Design & Manufacture

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4.2.1 Hoses shall be designed in conformance with the requirements 52, AGA1-93 and ANSI / CSA NGV 4.2-2014 / CSA 12.52-2014 and other applicable codes and standards. Area classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC or Zone-1 Group-HA/ HB as per IS/ IEC specification or equivalent specification. All fittings shall be designed so that all parts/ components meet the requirements for the specified area classification.

4.2.2 End connections shall be designed in conformance with the requirement of ASTM A276; ASTM A479, ASME SA479.

## 5.0 INSPECTION AND TESTING

The manufacturer shall submit typical type test reports for the following test carried out:

- i) Hydrostatic test shall be carried out with de-ionized water. There shall be no detectable leakage at 1.5 times the rated pressure.
- ii) Electrical conductivity test shall be carried out.
- iii) Mechanical properties as a result of the test conducted

## 6.0 TEST REPORTS AND CERTIFICATES

6.1 The manufacturer shall supply material compliance certificates.

6.2 Mechanical properties test report

6.3 Hydrostatic test report

6.4 Electrical conductivity test report

6.5 Warranty certificate

## 7.0 MARKING, PACKING & SHIPMENT

7.1 Heat code traceability number shall be stamped or etched.

7.2 All the items shall be suitably wrapped and packaged to with stand rough handling during ocean shipment and inland journey

7.3 Item shall be properly tagged and package separately to facilitate easy identification.

7.4 Items shall be wrapped and packaged in such-a-way that they can be preserved in original as new condition.

7.5 Packing note shall carry easily identifiable name or code of the physical item

## 8.0 DOCUMENTATION & TRAINING

Following test certificates shall be furnished along with shipment

- Test certificate of visual, chemical, mechanical testing (incl.tensile, hardness, flaring, Eddy current and leak test)
- Manufacturers standard test report for all items
- Third party inspection report as applicable to meet the requirements of specified codes & standards as applicable
- Copy of regulatory compliance document/certification for similar product supplied earlier.
- Manufacturer Quality Control Plan and sampling plan.
- Technical descriptive catalogue of manufacturer.
- General arrangement/ assembly drawing showing all features.
- Sectional drawing showing major parts with reference number and material specification.



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- Prior to shipment, manufacturer shall submit one set of all the documents and test certificates as specified above. And one set of the same documents and certificates along with the material in addition to Manual for installation, erection, maintenance and operating instructions including a list of recommended spares.
- Vendor shall provide complete training to Owner on installation of Tubes at sites and other aspects like safety, operations & Maintenance, Repairing etc.

**9.0**

**GUARANTEE**

- Manufacturer shall guarantee that the design, materials, manufacturing and testing of Hose conform to the requirement of this specification. Manufacturer shall replace all Hoses free of costs which fail during field pressure testing or do not perform satisfactorily due to inadequate engineering, substandard material and poor workmanship at Manufacturer's end.
- The manufacturer shall guarantee against any defect, failure or malfunctioning occurring during 12 months from the date of commissioning or 24 months from the date of supply whichever is earlier.



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## **BHAGYANAGAR GAS LIMITED (BGL)**

### **(MECHANICAL, INSTRUMENTATION WORKS) OF MOTHER STATION IN HYDERABAD GA**

**SS TUBE LAYING & MECHANICAL WORKS**



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### 1.0 GENERAL

BHAGYANAGAR GAS LIMITED (BGL), (hereinafter referred as Owner), has been authorised by PNGRB for setting up infrastructure and operation of City Gas Distribution Network for the GA of Haryana (Hyderabad districts). Natural gas will be transported to residential, commercial, industrial (PNG) and automobile consumers (CNG) in the city.

This document shall be read in conjunction with schedule of rate (SOR), specification, standards, drawings and other documents forming a part of the tender document.

### 2.0 OTHER TECHNICAL REQUIREMENTS

The Contractor shall carry out the work in accordance with Specifications, Standards and ASME B 31.3 - Process Piping / ASME B 31.8 – Gas Transmission and Distribution Piping System, Oil Industry Safety Directorate (OISD) norms.

Any discrepancy, ambiguity or conflict in or between any of the standards, specifications codes and the contract documents should be promptly referred to Owner / Owner's Representative for his decision, which shall be binding on the contractor.

### 3.0 SCOPE OF WORK

The scope of work includes supply, transportation, erection / construction, testing, pre-commissioning & commissioning including final documentation for associated works.

It shall be the sole responsibility of the Contractor to interface all such works so as to make the total system operational, trouble free and satisfactory as intended to the Owner.

All such works which are not indicated here below but are otherwise required to complete the work in all respects in accordance with codes, specifications, drawings, operation & maintenance manual and other requirements shall also form part of Contractor's scope of work. All works described below shall be performed in accordance with the applicable codes, specifications, drawings and other requirements of Tender and shall be subject to review by the Owner/Owner's Representative.

This document includes the details of work tendered, detailed scope of work and scope of material supply for the execution of composite work of CNG refuelling stations.

The scope of work is broadly divided into the following.

- Scope of supply
- Laying/Shifting of minor equipments.
- Construction/Installation and Erection
- Testing, Pre- Commissioning & Commissioning.
- Project Management

### 3.1 Detailed Scope of Work

#### 3.1.1 Tubing Work

3.1.1.1 Piping & Instrumentation Diagram (P&ID) for the CNG refueling stations, if required, to enable the Bidder to understand the various connection and details of tubing work involved may be handed over to successful bidder. The contractor shall carry out tubing works based on these drawings, reference specification / standards, documents etc. enclosed with this tender document and instruction of Owner / Owner's Representative and other provisions of Contract document.

3.1.1.2 The Contractor's Scope of Work for each CNG refueling station shall consist of but not limited to the following. Scope of Work indicated shall be read in conjunction with the schedule of rates, drawings, specification, standards and other documents forming a part of the Contract document.



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- 3.1.1.3 Providing all equipment, manpower, machinery, consumables for fabrication, installation, inspection, testing and pre-commissioning and assistance during commissioning; all types of safety tools, tackles, devices and apparatus, equipment etc. including ladders and scaffolding etc. complete as required including providing of all types of consumables, tools, tackles and facilities for inspection and interpretation of testing results by Owner/Owner's Representative personnel.
- 3.1.1.4 The fronts for execution of work may not be available at one go and shall be released in batches. Contractor shall make available their team along with all tools, tackles and vehicle for movement at any time.
- 3.1.1.5 Furnishing and mobilizing at site(s) of all construction equipment, tools and tackles, fully equipped and fully manned with other required support facilities etc. needed for successful execution of the works within 15 days after receipt of written notice from the Owner.
- 3.1.1.6 Supply of all materials as indicated in scope of supply.
- 3.1.1.7 "Taking over" of existing facilities required to be modified/dismantling from the Owner and carrying out necessary modifications / dismantling works including handing over of dismantled items to Owner. Owner will ensure that the facilities handed over to Contractor are safe for carrying out dismantling / modification works.
- 3.1.1.8 The contractor shall obtain necessary approvals, hot/cold work permits, and safety permits from the owner prior to starting of any cutting / dismantling/modification works on existing facilities. The contractor shall obtain work permits from respective control room in charge for works on operational existing facilities.
- 3.1.1.9 Fabrication works including modification, cutting/dismantling of existing operating facilities and hook-up of facilities shall be executed in a manner to ensure complete safety of the operating system and operating personnel.
- 3.1.1.10 "Receiving and taking over" of Owner supplied free issue materials from the designated places of issue, transportation including loading, unloading, handling from Owner's designated places of issue to Contractor's own stock yard(s) / work site(s) / work shop(s) including arranging all necessary intermediate storage areas(s) there of as required till the permanent installation of materials.
- 3.1.1.11 Procurement and supply of all materials and equipment that are included in the scope of supply of Contractor, transportation of all materials/equipment from manufacturer's works including loading, unloading, handling, storing and transportation to work site(s) / work shop(s) including arranging all necessary intermediate storage area(s) there of, as required.
- 3.1.1.12 Fabrication and installation of all tubing systems including hook-up of tubing with compressors, stationary type cascades, mobile type cascade facilities, dispensers etc. consisting of fabrication and installation of tubes, valves, fittings, hose and hose coupling etc.
- 3.1.1.13 Carrying out cutting, edge preparation wherever required, fit-up, bending wherever required.
- 3.1.1.14 Supply, fabrication and erection of tubing supports including extension of existing sleepers/supports wherever required. Box Clamps as per DIN 3015 Part-II shall be used for clamping for SS Tubes. Contractors are required to get the clamp sample approved from Owner after award of work.
- 3.1.1.15 Testing, pre-commissioning and assistance during commissioning activities of tubing system of all sizes as per specifications enclosed.
- 3.1.1.16 Installation and commissioning assistance works of Compressors, Dispensers and Cascades (stationary as well as mobile).
- 3.1.1.17 Painting of all tray/tube supports and all miscellaneous items with paints suitable for normal corrosive environment shall be done wherever touch up/repair of primer is required, high build epoxy zinc phosphate primer shall be used.
- 3.1.1.18 Final clean up and restoration of site, facilities etc. as per the requirement of Owner / Owner's Representative.
- 3.1.1.19 Co-ordination as required with other Agencies/Contractor(s) till the time the commissioning operations and handling over the CNG stations are complete.



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- 3.1.1.20 Preparation of fabrication drawings, if required for the purpose of fabrication during execution of work.
- 3.1.1.21 Preparation of detailed procedures for fabrication, installation, testing and pre – commissioning. These procedures shall be submitted to Owner / Owner’s Representative for review and approval.
- 3.1.1.22 Transportation of all surplus free issue material to Owner’s designated store after completion of works.
- 3.1.1.23 Any other works not specified listed herein but required for satisfactory completion/ operation/safety/ statutory/ maintenance of the works in all respects within specified schedule at no extra cost to Owner.

**4.0 SCOPE OF SUPPLY**

**4.1 Tubing**

**4.1.1 Contractors Scope of supply**

The procurement and supply, in sequence and at the appropriate time and place, including inspection and expediting of all materials and consumables required for completion of the work as defined in this tender document except the materials specifically listed under para 4.1.1 as Owner free issue material, shall be entirely the Contractor’s responsibility. The item rate quoted for the execution work shall be inclusive of supply of all these materials. All equipment, materials, components etc. shall be new and specifically purchased for this job from Owner approved vendors. Manufacturer’s certificate shall be submitted for review. As a minimum, such materials to be supplied by the contractor shall include, but not limited to the following :-

- 4.1.1.1 All temporary materials required for filling, pressurizing and dewatering in connection with testing including tubes, flanges, fittings, gaskets, bolts, nuts, clamps, etc. required for fabrication of test headers and all consumable.
- 4.1.1.2 All equipment and consumables required for testing like pumps, compressors, pressure and temperature gauges, test water and corrosion inhibitors for test water for hydrostatic testing, inert gas for purging etc.
- 4.1.1.3 All consumable required for all types of test.
- 4.1.1.4 All materials including consumables required for hook-up.
- 4.1.1.5 All steel materials such as structural steel, reinforcement steel, shims, wedges, packing plates, pipes, perforated trays, nuts and bolts etc. for all types of supports and foundation. (pipes supplied by Owner shall not be used for fabrication of supports/saddles etc.). all nuts and bolts washers, Box Clamps as per DIN 3015 Part 2, clips etc. as required for fabrication of support and other structural works. Tube/tray supports like MS plates, GI plates, flats, pipe etc.
- 4.1.1.6 Clamping of perforated trays/tubes with necessary accessories like bolts, supports etc., all bolts and nuts for supports, Box Clamps as per DIN 3015 Part 2 for tubes, anchor bolts of various sizes for fixing to concrete structure etc.
- 4.1.1.7 All types of painting materials including primers, paints, solvents, sand blasting materials, cleaning agents, compressed air etc.
- 4.1.1.8 Nitrogen for purging of tubing.
- 4.1.1.9 All materials required for grouting and concrete works etc.
- 4.1.1.10 All safety tools and tackles, devices, apparatus, equipment, etc. including ladders and scaffolding etc. complete as required.
- 4.1.1.11 Supply of 250 X 50mm wide MS galvanized perforated tray along with coupler plate (with nuts and bolts for above trays). All materials, equipment and manpower required during commissioning of tubing system.
- 4.1.1.12 Supply of SS-304 tubing for Air Line of ½” OD, 1.5 mm thk. along with required fittings and valves as per specifications enclosed.
- 4.1.1.13 Any other material not specifically listed herein, but required for the successful completion of the work.



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- 4.1.2 Storage of Materials
- 4.1.2.1 All materials shall be preserved against deterioration and corrosion due to poor or improper storage while under the custody of the contractor.
- 4.1.2.2 The contractor shall duly protect all materials for corrosion with appropriate preservatives like primer, lacquer, coating, grease etc.
- 4.1.2.3 Tubes shall be stacked according to the identification marks and stacks shall be arranged on sleepers / sand bags /racks at least 300 mm above ground.
- 4.1.2.4 The contractor shall check that valves, fittings etc are not subjected to corrosion from hydrostatic test water remaining in the tubing. Any such condition when detected should be brought to the notice of Owner / Owner's Representative and remedial measures taken as directed. Small and medium size tube fittings shall be stored in racks constructed for this purpose inside a covered godown.
- 4.1.2.5 Openings of equipment, machinery, valves etc shall be kept blocked/covered with blinds/caps/plugs to prevent entry of foreign matter.
- 4.1.2.6 As far as possible materials shall be transported to the site of erection only just prior to the actual erection and shall not be left around indefinitely. Instruction of Owner / Owner's Representative shall be followed strictly in this regard.
- 4.1.3 Laying, Testing & Commissioning of SS tubing
- 4.1.3.1 SS Tubes shall be clamped to the angles, trays at every 1500 mm using Box Clamps as per DIN 3015 Part-2. The practice of flattening tubes for clamping purpose is not allowed. In case of PVC covered tubes, any exposed portion and connection shall be neatly taped to appropriate thickness.
- 4.1.3.2 Perforated trays/angle shall be properly supported at a regular interval of max. 1500mm, wherever insert plates are not available, supports on concrete shall be fixed with a minimum of 10mm expansion bolts (Anchor fasteners). Trays shall be laid generally as per site conditions with the approval of Owner / Owner's Representative. Angle supports shall be fabricated from 50 mm x 50 mm x 6mm MS angles as minimum with a base plate of 200mmx 200mm x 6mm thk.
- 4.1.3.3 Modification and rectification of cascades and emergency modification work at stations like addition of new equipment in the existing set up shall also be included in the scope of Contractor. The rate indicated per meter shall be applicable.
- 4.1.3.4 Horizontal and vertical tubes shall be installed using levels and plumb bobs.
- 4.1.3.5 Tubes shall be bent using tube benders only and no hot bending is permitted.
- 4.1.3.6 Tubes shall be cut using pipe cutting devices. Hot cutting is not allowed.
- 4.1.3.7 Minor civil works like chipping of pavement and grouting on its pavements the supports and chipping and reinstating of the pavement, removal of sand from tube/pipe trenches etc.

**5.0 CONSTRUCTION/INSTALLATION AND ERECTION**

Work tendered as a part of this tender document pertains to works related to CNG refueling stations in geographical area.

- 5.1 Work Tendered
- 5.1.1 Work tendered shall consist of the following:-
- 5.1.1.1 Laying, Installation, testing and commissioning of SS tubes, fittings, valves and hoses complete with all supports.
- 5.1.1.2 Loading of various equipment from designated place(s) of issue, safe transportation, unloading at various stations in specified locations, but some of these equipment will have to be unloaded on ground at specified locations like from ground level to ground level at site, from ground level to 4.5 m ht., from ground level to 6.0 m ht., from ground level to 8.0 m ht., from 4.5 m ht. to ground level, from 6.0 m ht. to ground level and from 8.0 m ht. to ground level, but some of the units such as cascades of 3000WL/4500WL (water capacity)



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weight 6.5T/8.0T having 5.5 M X 1.75M X 1.6M (H) approx.. dimensions may have to be

erected on the roof top at 4.5m, 6.0 m and 8.0 m elevation above workshop / office area. In some cases only unloading of cascades shall have to be done at stores / sites. Any damage/lost/theft of owner issued materials during transportation from owner designated place to site/destination is responsibility of contractors. Contractors are required to take transit insurance/CAR policy as per requirement. Cost of purchasing of this policies shall be borne by the contractor.

- 5.1.1.3 The contractor shall be paid on SOR basis. Contractor shall execute the work and perform his obligations under the Contract and Owner shall pay the contractor for the measured quantity of each item of work actually carried out under the Contract.
- 5.1.1.4 Installation of all associated SS tubing for necessary hook-ups and modification / dismantling works wherever required.
- 5.1.1.5 Installation of Fittings etc. for necessary hook-up and modification works.
- 5.1.1.6 All associated and other mechanical works including works related to testing, commissioning assistance for SS tubing.
- 5.1.2 Loading, Unloading, Transportation & Erection of equipment  
Following shall also constitute the Contractor's scope of work but not limited to as given herein:
- 5.1.2.1 Unloading of material at store/site.
- 5.1.2.2 Receiving of materials from store/site.
- 5.1.2.3 Loading of material / equipment (like AVR, UPS, Battery etc.) on a trailer / truck from stores / site. (Equipment with weight up to 200 Kg, Equipment with weight range from 200 Kg to 500 Kg)
- 5.1.2.4 Safe transportation to various sites.
- 5.1.2.5 Unloading, placement and alignment of foundation on ground above ground +4.5 / 8.0 m at roof top (Cascade only).
- 5.1.2.6 Installing new base frame for dispenser, making holes by drill, providing anchor fastener, grouting etc., complete as per the direction of Owner / Owner's Representative.
- 5.1.2.7 Isolation and dismantling of existing equipment from foundation and shifting to ground as per direction of Owner / Owner's Representative.
- 5.1.2.8 All equipment transported shall be securely boarded and transported without causing any damage to equipment. Any damage caused during loading, transportation & unloading shall be recoverable from the contractor.
- 5.1.2.9 *Dismantling of SS tubes along with all accessories (all sizes).*
- 5.1.3 Installation procedure
- 5.1.3.1 Tube end preparation  
Cut the ends square with a hacksaw and a suitable guide. Tube cutters shall be suitable for cutting most tube materials but tend to work harden stainless steel.  
Burrs must be removed inside and outside for proper entry into fittings to prevent contamination and/or restricted flow. Preferably swagelock deburring tool shall be used.  
Remove all fittings, chips and grift before attachment of fittings.
- 5.1.3.2 Assembly  
Tube line fabrication must be accurate so that the tube end easily enters the fitting in proper alignment. Do not force an improperly fitted tube line into the fittings.  
Ensure that the tube end is bottomed against the shoulder in the fitting body. This is necessary to prevent movement of the tube while the nut forces the ferrule to grip the tube and to seal through any imperfection that may exist on the outside tube surface.

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Never permit the fitting body to rotate during tube end make-up, use two wrenches. Assemble port connectors to components first and hold with a wrench while making up the tube joint. All types of union bodies must be held while each of the tube ends is made up.

Always turn the nut in prescribed amount regardless of torque required. Fitting end plugs required only 1-1/4 turn from finger tight make up in all sizes.

5.1.3.3 Remake of fittings

A disassembles joint can be remade, simply by retightening the nut to the position of the original make up. For maximum number of remakes, mark the fitting and nut before disassembly. Before retightening, make sure the assembly has been inserted into the fitting until the ferrule(s) seats in the fitting. Retighten the nut by previous marks lining up. (A noticeable increase in mechanical resistance will be felt indicating the ferrule is being re-sprung into sealing position). Then swing the nut 1/12 turn (1/2 hex flat) past the original position.

**6.0 TESTING, PRE- COMMISSIONING & COMMISSIONING**

All expenses and cost for attending Tests/Inspections related to construction, bought out items etc. at laboratory or at vendors place for Owner/Owner's Representative shall be borne by the Contractor.

All work related to testing, acid cleaning, drying, pre-commissioning and commissioning of complete system shall be carried out as per specification and instruction of Owner/Owner's Representative.

Pre-Commissioning of complete system and commissioning with Nitrogen.

Assistance in Commissioning of complete system (with Compressors, Cascades and Dispensers) at operating pressure, including supply of materials (temporary, permanent or consumables), tools and tackles (including special tools & tackles) and manpower.

Contractor shall assist in commissioning the complete system. The system shall be tested with CNG in steps of 50 bar till a final pressure of 250 bar is achieved. At each increment of 50 bar, tubing shall be checked for any leakage. Contractor to supply manpower and equipment for the testing of the system. The testing may be delayed due to commissioning of the compressor, the contractor availability is required during the entire commissioning process of the station.

**7.0 PROJECT MANAGEMENT**

Planning, Scheduling and Monitoring of the entire project related activities.

Preparation of detailed project schedule and progress reports. Providing organization chart at construction site.

All necessary coordination and compliances as per general permissions from the authorities having jurisdiction during actual execution of work. Owner will provide general permission from authorities for construction at contractor's cost.

Co-ordinate all activities from concept to successful commissioning, with his own sub-contractors, site-workers, vendors, suppliers, Owner/Owner's Representative and Government agencies for specific clearances and approvals. Co-ordination and supervising the work of all sub-contractor(s), if any.

Quality Control of all the activities.

Attending Project Progress review meetings as per the requirements of the Owner.

**8.0 SAFETY**

The Contractor shall observe and maintain safe working practices in the storage and handling of cleaning fluids etc. and ensure smoking or naked flames are not permitted in the vicinity when these materials are being used.

Contractor shall obtain the work permit from concerned control room / authority to carry out the work at running CNG station.

Any accident causing injury to any person or damage to property or equipment shall be reported to the Owner / Owner's Representative.



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When the Owner / Owner's Representative determines that the work is being performed by the contractor in an unsafe manner, he may suspend the work until the contractor takes corrective action.

The contractor shall provide helmets and safety shoes to the workers. No worker shall be allowed without the minimum personnel protective equipments (PPE's) and safety appliances.

**9.0 DOCUMENTATION**

Preparation of As-built drawings / documents

Pipe books

Measurement sheets

Hydrostatic Test Reports / records

Inspection Reports

Vendor documents / records

Reconciliation statement

Project Records

Organization chart

Photographs

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**ANNEXURE – I**

**1. EQUIPMENT WEIGHT & SIZES**

Sl. No.	Equipment	Size	Weight (Approx.)
1	Cascades 3000WL/4500WL	5.5 M X 1.75M X 1.6M (H) approx.) for 4500WL dimensions may vary	6.5T / 9.0T
2	Car Dispenser	-	350 Kg
3	Bus Dispenser	-	300 Kg

**2. TOOL AND TACKLES REQUIRED**

Sl. No.	Description	Qty in Nos.
1	Tube Bender (all sizes)	2
2	Tube Deburring Tool (Swagelok / Parker)	2
3	Tube Cutting Guide (Swagelok / Parker)	2
4	Cutting blade of 25 TPI	Lot
5	Welding Machine with DG sets	1
6	Tube Cuter (Approved Make)	2
7	Gap inspection gauges (Approved Make)	2
8	Vehicle (car / jeep) dedicated	1

The Contractor to confirm the availability of the above for acceptance of the bid.

In addition, the contractor to employ only Approved make certified fitters to carryout the tubing wok.

**3. SCRAP AND EXCESS MATERIAL**

Every month the Contractor shall submit an account for all the materials issued to him by the Owner in the standard Performa prescribed for this purpose by the Owner / Owner's Representative.

On completion of the work, the contractor shall submit material reconciliation statements for all the materials issued by the Owner in the standards Performa. The following scrap allowances are permissible:

Item	Unaccountable	Scrap
Tube	1%	1% (Less than 0.3m)
Valves	0%	0%
Ferrule Fittings	0%	0%

All excess materials and scrap shall be returned after duly accounting for, to the Owner's stores. Where materials are to be weighed before return, the contractor shall be responsible for making necessary arrangements for weighing etc. The contractor shall not use scrap sections obtained during the course of construction for fabrication of temporary supports or other items without prior written permission of Owner / Owner's Representative.

If the contractor fails to return the surplus material aforesaid, the Owner will charge the contractor for such unreturned material at penal rates, which will be deducted from whatever amount is due to the contractor. In case any materials issued by the Owner deteriorates during storage by the contractor, new materials will be issued to him if available at penal rates, but delay in procuring such materials will be at the contractor's account only.



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	PTS – STEEL FASTNERS	<b>P.019141 G11077 M016</b>
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**BHAGYANAGAR GAS LIMITED (BGL)  
(MECHANICAL, INSTRUMENTATION WORKS) OF MOTHER  
STATIONS IN HYDERABAD GA**

STEEL FASTNERS



**Mechanical Works for development and construction of CNG  
Mother Stations in Hyderabad GA**

Volume II  
of II

**Bid Document No: BGL/693/2025-26**

	PTS – STEEL FASTNERS	<b>P.019141</b> <b>G11077</b> <b>M016</b>
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**1. GENERAL**

The process of manufacture, heat treatment, chemical & mechanical requirements and marking for all stud bolts, m/c bolts, Jack screws & nuts shall be in accordance with the codes/standards and specifications given in the requisition. The applicable identification symbol in accordance with the material specification shall be stamped on each bolt and nut. Vendor shall strictly comply with this specification & QAP and no deviations shall be permitted.

**2. REFERENCE DOCUMENTS**

Reference has been made in this specification to the latest edition (edition enforce at the time of issue of enquiry unless specified otherwise) of the following Codes, Standards and Specification.

ASME B31.8 : Gas Transmission and Distribution Piping Systems.

ASME B1.1 : Unified Inch Screw Threads (UN and UNR Thread Form)

ASMEB16.5 : Pipe Flanges and Flanged Fittings NPS ½" Through NPS 24 Metric/Inch Standard

ASME B18.2.1 : Square and Hexagonal Bolts and Screws (Inch Series)

ASME B18.2.2 : Square and Hexagonal Nuts (Inch Series)

ASTM A193 : Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.

ASTM A194 : Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Temperature or High Pressure Service, or Both.

ASTM A307 : Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

ASTM A320 : Standard Specification for Alloy-Steel and SS Bolting Materials for Low-Temperature service.

ASME 18.2.1 : Square and Hex Bolts and Screws (Inch Series)

ASME 18.2.2 : Square and Hex Nuts (Inch Series)



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ASME B16.5 : Pipe Flanges and Flanged Fittings up to 24"

ASME B16.47 : Large Diameter Steel Flanges (NPS 26 through NPS 60)

**3. SPECIFIC REQUIREMENT**

- 3.1. All bolting shall be as per ANSI B 18.2.1 for studs, M/c bolts and jackscrews and ANSI B18.2.2 for nuts and material.
- 3.2. Material of Stud Bolts shall be ASTM 320 Gr. L7
- 3.3. Material of Nuts shall be ASTM 194 Gr. 4 /Gr. 7
- 3.4. Threads shall be unified (UNC for 1" dia. and 8UN for > 1" dia.) as per ANSI B1.1 with class 2A fit for studs, M/c bolts and jackscrews and class 2B fit for nuts.
- 3.5. Stud bolts shall be threaded full length with two heavy hexagonal nuts. Length tolerance shall be in accordance with the requirement of table D2 of Annexure-D of ANSI B 16.5.
- 3.6. The nuts shall be double chamfered, semi-finished, heavy hexagonal type and shall be made by the hot forged process and stamped as per respective material specification.
- 3.7. Heads of jackscrews and m/c bolts shall be heavy hexagonal type. Jackscrew end shall be rounded.
- 3.8. Each size of studs & m/c bolts with nuts and jackscrews shall be supplied in separate containers marked with size and material specifications.
- 3.9. All items shall be inspected and approved (stage wise) by TPIA.
- 3.10. The heat treatment for stud bolts & nuts shall be as per code unless mentioned otherwise.
- 3.11. All austenitic stainless steel bolts, nuts, screws shall be supplied in solution annealed condition unless specified otherwise in the material specification.
- 3.12. Any additional requirements specified in the requisition shall be fully complied with.
- 3.13. When specified as galvanized, the studs, M/C bolts and nuts shall be 'hot dip zinc coated' in accordance with requirements of 'Class C' of 'ASTM A153'. As an alternative, electro-galvanizing as per IS 1573, 'Service Grade Number 2' is also acceptable.
- 3.14. All Stud Bolts of Bolt diameter size 1" and above shall be provided with three nuts irrespective of whatever has been specified elsewhere in the MR.



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- 3.15. Each stud bolt shall be supplied with matching two nuts and two washers
- 3.16. Bolts/Nuts shall be protected by non-corrosive oil or grease before dispatch to prevent rusting.

**4. TESTING**

- 4.1. Test reports shall be supplied for all mandatory tests as per the relevant material specifications.
- 4.2. Material test certificate shall also be furnished. (Heat Analysis, Product Analysis and Mechanical Requirement)
- 4.3. PMI shall be performed as per the scope and procedures defined in the Specification for PMI at Vendor's Works.
- 4.4. Stress Rupture Test as detailed in ASTM A453 shall be carried out for all ASTM A453 bolting material irrespective of the temperature.

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PIPELINE VALVES




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**1. SCOPE**

This General Technical Specification covers the supply of pipeline valves used in high pressure natural gas transport and distribution systems. It describes the general requirements, controls, tests, QA/QC, examination and final acceptance criteria which needs to be fulfilled.

This specification is general and is updated / amended by the Particular Technical Specification dedicated to the project.

**2. DEFINITIONS**

**Engineer** : The Entity of the Purchaser or the Company nominated by the Purchaser to design the natural gas transport or distribution system and to specify the equipment.

**Purchaser** : The Company which makes the purchase order.

**Control Authority** or **CA** : The Organisation put in place/requested by the Purchaser/Engineer to proceed to Quality Controls and Certification.

**Manufacturer** : Manufacturer who receive the purchase order

**3. PRELIMINARY STATEMENT**


The name of Control Organisation shall be mentioned in the purchase order.

Eventual interpretations and deviations to this specification by the Manufacturer shall be requested by writing in his offer with detailed justification and approved by the Purchaser/Engineer and the Control Authority before the eventual order to the Manufacturer. The latter is responsible and shall indemnify the Purchaser/Engineer for any damage resulting from the non-respect of this obligation.

The specifications of the steel used, the material Manufacturer and all potential subcontractors (such as forging plant, heat treatment, weld fabrication, ...) will be described in the offer. After order, no change will be accepted except for justified "force majeure". In that case, the asked changes shall be supported by a technical file submitted to the Purchaser/Engineer for approval.

The Manufacturer shall provide a technical description of the manufacturing method that might influence the quality of the material.

When the order is placed, the Manufacturer shall promptly inform the Purchaser/Engineer about his subcontractor's names, addresses, phone numbers as well as sub -order numbers, extent and delivery terms. On this basis, the Manufacturer shall send a general planning including at least the raw material supply, the manufacturing stages (machining, welding, part assembly, ...), testing , painting and packing/dispatching. This planning shall be updated by the Manufacturer at least every month unless otherwise provided in the purchase order. A Dispatcher/Inspector

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delegated by the Purchaser is entitled to follow, examine and verify the planning's' relevance and effectiveness.

The Purchaser keeps the right to audit the Manufacturers and subcontractor's manufacturing process and control methods. All costs form such an audit shall be borne by the Manufacturer except the wages and travel expenditures of the auditor(s) supported by the Purchaser.

The manufacturing processes and the laboratories, in which welding tests, destructive and non destructive tests are carried out, shall be approved by the Control Authority.

The Purchaser/Engineer and the Control Authority shall have, at any time, free access to all parts of the Manufacturer's facilities and to those of all his subcontractors involved in the order manufacturing. All reasonable means shall be placed at the inspector(s)'s disposal to enable him to check that the product is being manufactured in accordance with this specification. All tests and inspections required in this specification shall be carried out, prior to shipment, in the Manufacturer's plant (or subcontractor's plant) and at the Manufacturer's expenses, unless otherwise provided in the order. The Purchaser/Engineer and the Control Authority shall try not to interfere unnecessarily with other Manufacturer's works when running these tests and inspection.


A valid copy of the ISO 9001 certificate shall be included in the offer.

For any control, test or examination required under the supervision of the Control Authority (LOFC intervention points included), the latter shall be informed in writing FIFTEEN (15) working days in advance by the Manufacturer about place and time with a copy to the Purchaser/Engineer.

If manufacturing is to be carried out under LOFC concept, the Manufacturer shall send for approval a List of Operation in Manufacturing and Control to the Control Authority and Purchaser/Engineer, TEN (10) working days before manufacturing. This list shall be in conformity with the annex 1 to this document. Before starting any manufacturing, the Manufacturer shall be in possession of this approved document, filled in with all intervention points.

Material, even released by the Control Authority and in which injurious defects are found after delivery, shall be rejected. The Manufacturer shall be notified and the material replaced : all costs involved, including wages and travel expenditure of the Control Authority's representative, Purchaser and Engineer shall be borne by the Manufacturer.

An approval of documents can never be considered as an acceptance of deviations on relaxations to requirements. A deviation is only possible after specific request to the purchaser.

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**4. GENERAL**

- Valves are intended to be used in aboveground or underground, with cathodic protection services.

All particular conditions for each valve are described in attached data sheet and valve list.

All valves shall conform to API 6D spec. Whenever this specification and API 6D spec. conflict, this specification shall prevail.

Unless otherwise specified, pipeline valves covered by this specification are suitable for use in gas transmission and distribution systems, and in accordance with ASME B31.8.

**5. CODES, NORMS AND STANDARDS**

Latest edition of following standards are applicable.

- ASME STANDARDS

ASME B16.5                      Pipe flanges and flanged fittings

ASME B16.34                    Valves- flanged and butt welding end

ASME B31.8                      Gas transmission and distribution piping systems

- ASTM STANDARDS

ASTM A 53                        Pipe, steel, black and hot-dipped zinc coated welded and seamless

ASTM A 105/A 105 M            Forgings, carbon steel, for piping components


ASTM A 106                      Seamless carbon steel pipe for high temperature service

ASTM A 193/A 193 M            Alloy steel and stainless steel bolting materials for high temperature service


ASTM A 194/A 194 M            Carbon and alloy steel nuts for bolts for high temperature service

ASTM A 234/A 234 M            Piping, fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures

ASTM A 320/A 320 M            Alloy steel bolting materials for low temperature service

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ASTM A 333	Seamless & Steel Pipes for low temperature service
ASTM A 350/A 350 M	Forgings, carbon and low alloy steel, requiring notch toughness testing for piping components
ASTM A 370	Mechanical testing of steel products
ASTM A 381	Metal-arc-welded steel pipe for use with high-pressure transmission systems
ASTM A 420/A 420 M	Piping fittings of wrought carbon steel and alloy steel for low temperature service
ASTM A 694/A 694 M	Forgings, carbon and alloy steel, for pipe flanges, fittings, valves, and parts for high-pressure transmission service
ASTM A 707/A 707 M	Flanges, forged, carbon and alloy steel for low temperature service
<b>- API STANDARDS</b>	
API 5L	Specification for line pipe
API 6D	Specification for pipeline valves, end closures, connectors and swivels
API 6FA	Fire test for valves
API 605	Large diameter carbon steel flanges
<b>- MSS STANDARDS</b>	
MSS SP 6	Standard Finishes for Contact Faces of Pipe Flanges & Connecting – End Flanges of Valves and Fittings
MSS SP 25	Standard marking system for valves, fittings, flanges and unions
MSS SP 44	Steel pipeline flanges
MSS SP 54	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components Radiographic Examination Method
MSS SP 55	Quality standard for steel castings for valves, flanges and fittings and other piping components (visual method)

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MSS SP 72                      Ball valves with flanged or butt welding ends for general service

MSS SP 75                      Specification for high test wrought butt welding fittings

- ASME STANDARDS

ASME                              Boiler and Pressure Vessel code

- EN STANDARDS

EN 10204                        Metallic products : types of inspection documents

EN 10045/1                      Metallic products : Charpy impact test – test methods (V and U notches)

- ISO STANDARDS

ISO 148                            Acier – Essai de résilience Charpy (entaille V)

ISO 9001 :                        Quality management standard

- BRITISH STANDARDS

BS 5146                            Inspection and test of valves

BS 5351                            Steel ball valves for the petroleum, petrochemical and allied industries


- NACE STANDARDS

MR0175                            Sulphide Stress Cracking Resistant Metallic Materials for Oilfield Equipment.

**6. DESIGN AND CONSTRUCTION**

**6.1. RATINGS**

- 1) The pressure temperature ratings of flanged and butt welding end valves shall be in accordance with ASME B16.34.
- 2) The temperature and pressure ranges of valves shall be in accordance with the indicated values on the appropriated piping specification and valve data sheet.
- 3) Wall thickness for parts used for the welding connection with the line pipes shall meet the following requirements :

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- The maximum allowable stress in the material of the butt weld connection for butt welding end valves shall be equal to fifty per cent of the minimum yield strength guaranteed by the specification of the steel used.
  - The minimum wall thickness for butt welding connection must be greater than or equal to the largest value of either the calculated minimum thickness of butt welding connection or the nominal thickness of the pipe as indicated on data sheet.
  - If the butt welding connection has a yield strength lower than the yield strength of the pipe to which it is intended to be welded, the wall thickness in each zone of the butt welding connection is at least equal to the specified pipe wall thickness times the ratio of the minimum yield strength guaranteed by the specification of the steel of the pipe and the minimum yield strength guaranteed by the specification of the steel of the butt welding connection.
  - The specified pipe wall thickness and grade (with reference to the equivalent grade in API 5L spec. or ASTM spec.) with which the valve is intended to be used is specified in the data sheet/piping class.
- 4) The Manufacturer shall submit for approval to the Control Authority and to the Purchaser/Engineer the dimensional drawings, the calculation of the parts used for the welding connection to the pipeline and the material part list for all the types of valves. All these documents must be identified with the individual valve number according to attached valve list and shall be attached to the CMTR.
- 5) The design shall take into consideration performance requirements prescribed in the next paragraph.

All valves under this specification shall be designed to withstand a field hydrostatic test pressure with non corrosive water, after installation, during 24 hours when the gate, plug, ball or piston is partially or fully open at a pressure of 1.5 times the 38°C pressure rating gauged by ASME B16.34

During this test the closure element shall not be moved.

## 6.2. DESIGN

### 6.2.1. Face-to-face and end-to-end dimensions

Face-to-face and end-to-end dimensions for ball valves shall be in accordance with API spec. 6D.

Valves may be made to special dimension by agreement between the Manufacturer and the Purchaser.



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6.2.2. Welding ends

The connecting pipe outside diameter, wall thickness, specified minimum yield strength and material grade are mentioned in the relevant piping specification and valve data sheet.

Butt-welding ends shall be in accordance with figure 1 for wall thickness up to 20.0 mm; for thicker walls, refer to figure 2. The inside diameter at the welding end shall be equal to that of the pipe on which the valve shall be welded. If a welding end of a valve has a thickness not equal to the pipe with which it is intended to be used, the welding end preparation at the joint has to be in conformity with fig. 3.

The tolerance of the inside diameter at the bevel end shall be following :

NPS	Tolerance of inside diameter at bevel end (1) (mm)	
2" - 10"	+ 1.6	-0.4
12" - 48"	+ 2.4	-0.8

(1) Tolerance refers to variation from specified ID calculation by (OD spec. - 2t spec).

OD = outside diameter

t = wall thickness


The out-of roundness at a welding end, defined as the difference between the maximum and the minimum inside diameter at the welding pipe end shall not exceed 1% of the specified inside diameter.

The length of the butt end shall be sufficient to allow welding and heat treatment without damage of the internal parts of the valve. If Purchaser/Engineer accepts design which do not meet this requirement, than Manufacturer shall inform the Purchaser/Engineer about the precautions which needs to be fulfilled in order to guarantee that during welding of the butt welding ends no damage shall occur to the seat. These precautions shall be highlighted by the Manufacturer in the erection and installation instruction book.

6.2.3. End flanges

End flanges shall be furnished in the same class as the valve body with raised face or ring-joint face, as specified by the valve data sheet. Dimensions and tolerances (including drilling templates, flange facing, spot facing and back facing) shall conform to :

- ASME B16.5 standard for NPS 24" and smaller
- MSS SP-44 for NPS 26" to 60"
- MSS SP-6 for flange facing.

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6.2.4. Design features

All ball valves shall be full bore - to allow pigging - unless stipulated otherwise on the valve data sheet.

All trunnion mounted ball valves shall be fitted with following devices :

- Double block and bleed : design of a valve with two seating surfaces between which the cavity can be vented through a bleed connection and thus confirm the tightness of the valve, at least in closed position, when pressure is applied to any side or both sides of the valve.
- Double piston effect : when the pressure is applied to one side, let us say "upstream" side, and when upstream ball seat is leaking, transfer pressure shall have a positive shut-off effect on the downstream seat (acting, for instance, on the back face of this seat) and thus reinforcing the global tightness of the valve.
- Anti -static design : all ball valves shall be fitted with anti-static device conforming to BS 5351.
- Stem retention (anti blow-out) : In conformity with BS 5351 valve shall be designed with an anti blow-out stem so that the stem cannot be fully ejected by pressure inside the valve with the stem packing, gland retainer bolting removed.
- Secondary seat and stem sealing : all ball valves NPS 6" shall be fitted with a secondary stem sealing and all ball valves greater or equal to NPS 8" shall be fitted with a secondary seat and stem sealing. This system permits an injection of sealant and shall be fitted with an integral check valve. The number and the location of sealing points shall be on the Manufacturer's responsibility.

Purchaser is allowed to request the check of this system design and its operation, specially for modified or new valve model.


- A drain connection shall be located at the lowest part of the body cavity.

6.2.5. Auxiliary connections

The Manufacturer shall complete the valve data sheet with the size and allowable pressure for the following auxiliary piping connections.

a) Aboveground valves

- The drain shall be plugged.
- The vent/bleed connection for valves NPS 6" and above shall be equipped with one block valve plus one needle valve, each with anti blow-out stem. The block valve shall be of ball type. The needle valve shall have screwed connections, shall be preferably of angular pattern and shall be fitted with a special plug at the outlet : this plug shall be designed to relieve slowly the pressure without being ejected.

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- For valve size < NPS 6", the vent/bleed connection shall be equipped with this anti blow-out, depressurising plug only.
- Each secondary stem - and each secondary seat sealing device, when required (see § 6.2.4.), shall be fitted with a check valve integrated in the body plus a sealant fitting with built-in, spring loaded ball check valve, as mentioned in the valve data sheet.

b) Underground valves

- Vent/bleed connection shall be plugged and this functionality is by passed through the drain.
- Drain shall be fitted with a normally open block valve (ball type with anti blow-out stem) at the drain tap, piped to the upper part of the extension and ended by one ball valve plus one needle valve, each with anti blow-out stem.
- The needle valve shall have screwed connections, shall be preferably of angular pattern and shall be fixed with an anti blow-out, depressurising plug, at the outlet.
- Each stem and seat sealing connection, when required (see § 6.2.4) shall have a check valve integrated in the main valve body, a block valve (ball type with anti blow-out stem) closed to the body tap, shall be piped up to the upper part of the extension and equipped with a block valve (same type) plus a sealant fitting with built-in, spring loaded check valve, as mentioned in the valve data sheet.
- Valves and tubing shall be carefully fastened to the valve body and/or extension.

Valve bodies shall have tapped holes with a minimum effective threaded engagement at least equal to the nominal thread diameter. If body wall thickness is too thin, then unthreaded side of OEP/OET (One End Plain/One End Threaded) piece of pipe of a material compatible with the body, shall be welded to the valve body with full penetration or via a boss. Anyway, weld on threads is prohibited.


Material of auxiliary connections (pipe, tube, fittings, valve, ...) shall be, at the least of the same material quality as the main valve and can be in stainless steel series AISI 300.

6.2.6. Stem extension for underground valve

When a stem extension is required (see valve data sheet), the configuration and the length H shall be in accordance with this valve data sheet.

In this case and except otherwise specified in the purchase order, valves shall be fitted with drain and sealant extensions well fixed to the stem extension and clearly indicated in the as built design. The stem extension shall be fully watertight, but shall be provided with a means to prevent overpressure built up in the mechanism resulting from stem or bonnet seal leakage.

Valves, equipped with stem extension and/or actuator, shall be delivered completely equipped and mounted (in one piece).

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Underground actuated valves shall be provided with one identification plate on the valve body and one on the upper part of the extension.

6.2.7. Miscellaneous

Lifting lugs are required on all valves NPS 6" and larger. The lifting lugs shall be stamped with the safe working load. Number of lugs shall be sufficient for safe handling on site. Valve support : All valves greater than NPS 24" shall be equipped with supports to permit the installation of the valve in horizontal position directly on the floor. These supports shall be directly welded or fitted on the body of the valve.

6.2.8. Design review

The Manufacturer shall submit for approval to the Engineer/Purchaser and Control Authority the calculation for all bonnet, cover and body bolting for pressure retaining parts conforming to ASME B16.34.

6.3. OPERATION

6.3.1. Valve shall be operated by a hand-wheel, wrench, manual key or actuator.

Manual override devices shall be provided on all valves. Hand-wheels of electric actuators, shall be normally disengaged and shall automatically disengage when the actuator is operated.


6.3.2. The length of the wrench or diameter of the hand-wheel for direct or gear operated valves shall (after opening and closing a new valve at last three times) be such that a force not exceeding 350 N shall be required to operate the ball from either the open or closed position under the maximum differential pressure recommended by the Manufacturer.

For valves without stem extension equipped with a hand-wheel in vertical position, the maximum radius of the hand-wheel is equal to the distance between the centre line of the pipe and the centre of the hand-wheel minus 120 mm. In this case no extruding lugs on hand-wheel are permitted, and provision for by-pass valve shall be kept.

6.3.3. Hand-wheel shall be marked to indicate the direction of closing.

6.3.4. Hand-wheels and wrenches shall be fitted in such a way that whilst held securely they can be removed and replaced where necessary.

6.3.5. All ball valves shall be provided with a mark on the stem to show the position of the ball in order to enable a good regulation of the actuator without seeing the ball. Exception can be made for valves with gear boxes for underground service.

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6.3.6. Ball manual direct operated valves shall be fitted out with fully open and fully closed stops. These stops shall be well fixed to the body of the valve in order to withstand many extreme opening and closing actions. These stops shall be easily removable. Ball gear operated valves shall be fitted out with fully open and fully closed stops shall be adjusted and fixed on the gear box.

6.3.7. The Manufacturer shall advise the maximum operating torque or force which can be sustained without causing permanent damage anywhere in the drive train from the actuator to the obturator. The Manufacturer shall also provide the torque graph : torque value in function of opening angle of the ball and pressure.

Deflection in the extended drive train must be limited so that the closing position contact reflects exactly the real position of the obturator.

6.3.8. Maximum rated differential pressure (MRDP)

The MRDP is the maximum difference between the valve upstream and downstream pressure at which the obturator (closure member) may be operated (opening). The Manufacturer shall specify this value and shall mark it on the valve name plate.

For the specification of different types of actuator refer to the concerned GTS/740/403.

## 7. **MATERIALS**

### 7.1. **STEEL USED**

The steel used in the valve Manufacturing shall be selected by the Manufacturer and filled in data sheet form


This list shall be submitted for approval to the purchaser/Engineer at the time of the offer. This list shall be added to the CMTR.

### 7.2. **PRESSURE RETAINING PARTS**

For pressure retaining parts the following requirements must be fulfilled

7.2.1. Bodies, including end flanges and welding ends (other than for field welding), bonnet and covers of valves shall be made in material conforming to API 6D spec. (or another material specification accepted by the Purchaser/Engineer) and be furnished with certificates EN 10204-3.1. B stating the quality, the mechanical properties (yield strength, tensile strength, percent elongation, impact test value at the temperature specified under per Section 8.4.2), the chemical analysis, the manufacturing process and the marking (e.g. the heat number) of the steel. These certificates shall be added to the CMTR.

For the valves with butt welding end, for the part on which the line pipe shall be welded, see paragraph 7.2.4. and 8.4.

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7.2.2. Notch toughness properties

The impact test temperature conditions and temperature are defined under Section 8.4.2.

7.2.3. The carbon content of parts involved in welding operation (except for those parts which shall be used for the welding connection with the line pipes) shall be restricted as follows :

- maximum percentage of carbon : 0.230

- $C + \frac{Mn}{6} \leq 0.41$


7.2.4. For parts used for the welding connection with the line pipes the following supplementary requirements must be fulfilled :

- The chemical composition of the steel meets the requirements of table 1. The choice and use of alloying elements made from high strength low alloy steels to give the tensile properties prescribed in table 2 shall be made by the Manufacturer and included and reported to identify the type of steel.
- For each heat, the Manufacturer shall analyse the following elements : C, Mn, Si, P, S, Nb, V, Cr, Mo, Ni and Cu.
- The carbon equivalent shall be computed by the following equation :

$$C.E. = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

and shall not exceed 0.45.

- The steel used shall be fully killed, fine grain practice.
- The steel used shall be suitable for field welding to pipes, flanges or fittings manufactured under ASTM A53, A105, A106, A234, A333, A350, A381, A420, A694, A707 or API 5L, 605 or MSS SP-44, SP-72, SP-75, EN10208-2.
- The steel used has tensile properties conforming to requirements prescribed in table 2 and capable of meeting the valve design.
- The ratio of yield strength to tensile strength shall not exceed 0.85.
- Mechanical tests as prescribed in section 8.4. shall be performed after final heat treatment.

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7.3. BONNET, COVER AND BODY BOLTING

Bonnet flange cover, and body bolting shall be conform to ASTM A320 Gr L7 or L7M or ASTM A193 grade B7 or B7M. Nuts shall be conform to ASTM A194 Gr 7 or 7M or 2H. For NPS greater than 4", they must be supplied with certificates EN 10204-3.1.C. and for NPS 4" and smaller with certificates EN 10204.3.1.B. These certificates shall be added to CMTR.

Bolt design shall be done to withstand safety all stresses occurring under operating conditions, calculations shall be submitted for approval.

Materials shall be compatible in order to avoid galvanic corrosion and shall not be susceptible to hydrogen embrittlement or stress corrosion cracking. Manufacturer must take into account that the materials shall be eventually cathodic protected.

7.4. NON-METALLIC PARTS

Non-metallic parts and elements, which usually include such items as packing, injectable material and lubricants, shall be suitable for the service and must be defined in the offer.

7.5. OTHER PARTS

Metal parts, which usually include such items as yokes, yoke nuts, stems, glands, gland bushing, gates, balls, plugs, discs, pistons, hand-wheel, gearing and motor drive attachments, shall be of material suitable for the service and must be defined in the offer.

7.6. SOUR GAS SERVICE


When sour gas service or NACE is specified, all process wetted, pressure containing parts and bolting shall meet the requirements of NACE MR0175.

**8. FABRICATION AND TEST**

Prior to manufacturing a meeting shall be organised between Manufacturer, Purchasing agent, Engineer and Control Authority.

8.1. WELDING FABRICATION

- 1) Welds and repair welds shall be performed according to written procedures. The welding procedure must be submitted for approval to the Control Authority before any fabrication and/or repair.
- 2) Only welders and welder operators who are qualified shall be used in production.
- 3) The joints shall be furnished in accordance with the requirements of Section VIII of ASME Boiler and Pressure Vessel Code - Division 1.

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- 4) The machine welding shall be done by an electric process, preferably by submerged arc.
- 5) Repair by welding is prohibited on forged material.

## 8.2. WELDING PROCEDURES

- 8.2.1. All welds, repair welds and repair by welding shall be performed according to written procedures. These welding procedures shall be qualified according to the requirements of the ASME Boiler and Pressure Vessel Code, Section IX.

The welding procedure tests are required on material which is on the high side of the chemistry specification.

The Manufacturer shall maintain a weld record of the procedure and performance test results.

For the tensile test, the rupture of the specimen must take place in the unaffected parent material.

The welding procedure qualification must include an impact test set in the weld and in the HAZ with requirements of paragraph 8.4.2. and a macrographic examination described in paragraph 8.2.2. These tests shall be performed after eventual final heat treatment. If weld thickness is higher than 25 mm, even covered by the PQR, additional impact test shall be performed on the test specimens taken in weld thickness layers.


- 8.2.2. Macrographic examination : the etched surface of the macro test specimen viewed macroscopically must display the image of a well performed welded joint with sufficient penetration, free from linear defects and important inclusions. In case of doubt, the etched surface must be examined microscopically and additional macroscopic examinations of other areas may be required.

The macrographic examination will include hardness measurements in the weld and the HAZ. The hardness will not exceed the values measured on the parent metal by more than 80 points for the welds and 100 point for HAZ, with an absolute maximum of 350HV10.

The acceptance of inclusions can be decided upon with the NDE of the welded plates (see paragraph 8.5.).

- 8.2.3. Additional requirements for "Sour Gas". Qualified welding procedure shall guarantee a good geometry without stress concentration and shall be realised according to NACE MR 0175 (max. 1% Ni in welding consumables).

On the macro, series of hardness tests shall be performed in the base metal, weld and Heat affected zone; results shall be maximum 248HV10.

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8.3. HEAT TREATMENT

8.3.1. After hot working and before re-heating for normalising heat treatment, forging or casting shall be allowed to cool substantially below the transformation range. All forging or casting shall be heat treated by normalising. Normalising shall be carried out in such a way that the base material acquires a fine grained perlitic structure.

8.3.2. Heat treatment of welds : the rules of ASME VIII Div. 1 are applicable. If a required treatment is not feasible (seat damage, etc, ...), special agreement must be obtained from Purchaser/Engineer and Control Authority ACA, after the Manufacturer has proved good quality of welds.

8.3.3. The Manufacturer shall include in the CMTR data of this heat treatment.

8.4. MECHANICAL TESTS ON THE PARTS USED FOR WELDING CONNECTION WITH THE LINE PIPES

The following mechanical tests shall be performed on these parts after final heat treatment under the supervision of the Control Authority's delegate and the certificates shall be added to the CMTR.

Test specimens may only be cut after a marking transfer by the Control Authority.

8.4.1. Tensile testing

Requirements :

The material shall be in conformity with table 2. The ratio of yield strength to tensile strength shall not exceed 0.85.

Test specimen :

The test specimen represents any part of the same shape, the same heat of steel and the same heat treatment lot.


Number of test : one

Test location and orientation :

The test specimen shall be orientated transversally to direction of lamination and if this orientation is not feasible, it shall be orientated longitudinally. For castings only one orientation is applicable.

Test method :

Testing shall be performed in accordance with ASTM A370 standard rectangular plate type 1 1/2" wide (fig. 4 - A370) or standard round (fig. 5 or fig. 6 - A370).

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Yield strength shall be determined either by the 0.2 % offset or the 0.5 % extension under load (EUL) method. If another material are accepted by the Purchaser, the test method will be as specified in the material specification.

8.4.2. Impact test

Requirements :

The standard impact test temperature is -20°C, except if otherwise stated in the "Material Requisition" or particular Technical Specification. The average value of a set of 3 test specimens shall be equal to 35 J/cm<sup>2</sup>. The minimum value per test specimen shall be equal to 35 J/cm<sup>2</sup> but this value may drop to 28 J/cm<sup>2</sup> for only one test specimen per series.

- Test specimen :

The test specimen represents any part of the same shape, the same heat of steel and the same heat treatment lot.

- Number of tests :

2 test sets (3 test specimens constitute one test set). For castings only 1 test set.

- Test location and orientation :

1 set shall be orientated longitudinally and another one transversally. For castings only one orientation is applicable.

- Test method :

The notched bar impact test shall be performed in accordance with ISO 148 or A370-Charpy V - Notch.

If the wall thickness of these parts or the coupon does not enable machining of full size specimens, the largest possible size must be used but not less than (10 x 5) mm. The axis of the notch shall be orientated through the wall thickness of these parts. If the weld thickness is > 25 mm, several specimen sets shall be taken in the weld thickness with min one (1) set per 12.5 mm of thickness, the specimen sets shall be selected in agreement with the Purchaser/Engineer and Authorised Control Authority.

8.5. NON DESTRUCTIVE EXAMINATION (NDE)

The following NDE will be performed after the final heat treatment and before coating.

8.5.1. List of NDE

- All butt welds shall be examined by a radiographic examination. If the thickness exceeds 15 mm or if the radiographic examination is not feasible than welds are only examined by ultrasonic examination to the largest extent possible.



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The radiographic examination shall be executed in accordance with ASME Boiler and Pressure Vessel Code, section V, art. 2 - using fine grain film and lead screens.

- Butt welding ends on cast bodies shall be examined before fabrication welding end, by radiography in accordance to MSS-SP-54 and over a width of 70 mm.
- 25 mm of base material at each side of each weld and each weld shall be 100 % ultrasonically examined.

The ultrasonic examination shall be executed in accordance with ASME Boiler and Pressure Vessel Code, section 5, art. 5.

- Body for all valves NPS 6" and greater shall be tested by magnetic particle examination in conformity with ASME Boiler and Pressure Vessel Code, section V, art. 7.
  - All valves shall be visually examined.
  - All valves shall be dimensionally examined.
  - For butt welding end valves after machining, the finished bevel end pipe used for field welding shall be submitted to the following tests :
    - ◆ Magnetic (ASME V Art. 7) or liquid penetrant (ASME V Art. 6).
    - ◆ Ultrasonic inspection (ASME V Art. 5) or radiographic examination (ASME V Art. 2) on 25 mm of base material.
    - ◆ Visual and dimensional examination.
  - If any repair by welding is performed, the concerned parts shall be completely re-examined.

**8.5.2. Additional NDE requirement for "SOUR Gas"**

A series of hardness test on surfaces in contact with the fluid shall be performed to NACE MR 0175. Results shall be 22 HRC or 248 HV 10 max.


**8.5.3. Acceptance criteria of the different NDE**

- Radiographic examination :

ASME Boiler and Pressure Vessel Code, section VIII, division 1, UW 51 for forged steel

ASME Boiler and Pressure Vessel Code, section VIII, division 1, appendix 7 for casted steel. The control will done on width of 70mm with.

On the first 40mm A1,B1,C1 acceptable, D, E, F and G are rejected.

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Between 40mm and 70mm, A2, B3, C3 acceptables; D, E, F, G are rejected.

- Ultrasonic inspection of weldings and HAZ:

ASME Boiler and Pressure Vessel Code, section VIII, division 1, Appendix 12.

- Magnetic particle inspection of the body:

ASME Boiler and Pressure Vessel Code, section VIII, division 1, Appendix 6.

For casted pieces refer to Appendix 7.

- Visual examination

MSS-SP-55.

- Magnetic particle or liquid penetrant of the finished bevel:

The following defects are unacceptable :


- Defects extending into the bevel provided the lamination is parallel to the surface and has a transverse dimension exceeding 6.35 mm.
- All defects not parallel to the surface extending into the bevel.

All the NDE (except radiographic examination) shall be performed under the supervision of the control authority's delegate and the certificates shall be added to the CMTR.

## 8.6. PRESSURE TESTING

### 8.6.1. General requirements

- Each valve shall be tested by the Manufacturer under the supervision of the Control Authority after final completion of all welding and all heat treatment operations.
- Hydrostatic and air seat test shall be performed after an acceptable shell test.
- Fluid for shell and hydrostatic seat tests shall be liquid as water (which may contain a corrosion inhibitor), kerosene, or other fluid with a viscosity not greater than that of water. Temperature of the test fluid shall not exceed 50°C.
- Valves shall be substantially relieved of air when tested with liquid.
- Valves shall be shell tested prior to painting.
- Valve test fixture loads applied to valve ends shall be limited to those required to effectively seal the valve ends.
- Pressure testing certificates shall be included in the CMTR.

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- Drain, the sealant and the bleed valve shall be included in all pressure tests.
- If any supplementary welding, repair by welding or treatment are performed, valve shall be completely re-tested.

8.6.2. Shell test

- Each valve shall be given a shell test at the gauge pressure not less than 1.5 times the 38°C rating gauged by ASME B16.34, rounded off to the next higher 1 bar increment.
- Shell test shall be conducted with the valve in a partially open position and with the valve ends closed.

- *Drain lines and valves*

Shall be either included in the hydrostatic shell test, or tested separately.

- Duration of the shell test

NPS up to 18" shall not be less than 15 minutes.

NPS 20" and larger shall not be less than 30 minutes.

- Visual leakage or harmful inelastic deformation are not accepted.

8.6.3. Hydrostatic seat test

- Each valve shall be given a hydrostatic seat test at the gauge pressure not less than 1.1 times the 38°C rating gauged by ASME B16.34, rounded off to the next higher 1 bar increment.

- Seat closure testing shall be performed with seat surfaces free of sealant, grease or other foreign material that aids in sealing except as provided hereafter :

- When necessary to prevent damage during valve actuation, a light oil of viscosity not greater than that of kerosene may be applied to sealing surface.

- When valve primary design is based on the presence of a sealant material (lubricated plug valve), the sealant material may be in place.

- For valve of the double seating type such as gate, plug and ball valve, the test pressure shall be applied successively to each end of the closed valve and leakage to opposite end checked. Provision shall be taken before, for de energising the self relieving pressure system.

- For soft seated valves there shall be no visible leakage - for metal seated valves the leakage rate shall not exceed 0.006 ml per minute and per mm of nominal pipe size (ND).



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- For double block and bleed valve the following tests shall be performed :  
Close valve, open body vent, apply seat test pressure to both ends of the valve.  
Close valve, open body vent, apply seat test pressure to one end of the valve, release pressure and repeat test for the other end of the valve.
- For double piston effect valve the following test shall be performed :  
Release pressure, close valve, open body vent, apply seat test pressure through the body vent.
- For other valve type, the test pressure shall be applied across the closure member in the direction producing the most adverse seating conditions. For example, a globe valve shall be tested with pressure under the disc. A check valve, globe valve or other valve type designed, sold and marked as a one-way valve, requires a closure test only in the appropriate direction.
- The duration of the hydrostatic seat test shall not be less than 5 minutes for each end.
- Visual leakage or harmful inelastic deformation are not accepted.

**8.6.4. External leak testing**

Under the supervision of the Control Authority's delegate, the Manufacturer shall check the external leak tightness of body, stem and all external taps. This shall be done with soap suds at an inner pressure of 6 bar. For underground valves, this test shall include piping, fittings and valves of the auxiliary lines for drain, vent/bleed and sealant connections.

**8.6.5. Air seat test**


- Each valve shall be given an air seat test at 6 bar.
- This test shall be performed in the same manner as hydrostatic seat test.
- The duration of this test shall not be less than 5 minutes for each end.
- No signs of leakage are accepted.

**8.6.6. Procedure**

Procedure of all pressure tests shall be included in the offer.

**8.6.7. After tests**

After test, any auxiliary connections shall not be removed, and auxiliary piping shall be cleaned and dried, especially the sealant piping.

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8.7. OPERATIONAL TORQUE TEST

For valves operated with an actuator the Manufacturer shall perform an operational torque test at full rated differential pressure and at ambient temperature. The procedure must be included in the offer. The certificates shall be included in the CMTR.

8.8. FIRE TEST

The Manufacturer shall supply valves qualified by fire testing as specified in API 6FA and this certificate shall be added to the CMTR.

8.9. ANTI-STATIC DEVICE TESTING

If requested in the purchase order, all ball valves shall be submitted of to an anti-static electricity testing in accordance with BS 5146 and this certificate shall be added to the CMTR.

8.10. VISUAL AND DIMENSIONAL EXAMINATION

All valves shall be visually and dimensionally examined, according to API 1104 and MSS-SP-55.

9. MARKING

9.1.1. All valves supplied under this specification shall be clearly identified on the body, on the identification plate and on the valve flange edge.

9.1.2. Body markings

The following markings shall be cast, stamped, forged or engraved on the body of the valve :

c) Manufacturer's name or trademark.


Individual tag number according to attached valves list.

The monogram of the Control Authority. This marking shall only be applied after complete approval of the CMTR.

Flow direction on unidirectional valve.

9.1.3. Permanently attached identification plate markings

On minimum the following markings shall be shown on permanently attached identification plates :

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- a) Manufacturer's name or trademark.
- b) Individual valve fabrication number (serial number).
- c) Individual tag number.
- d) The maximum operating pressure;
- e) The min and maximum operating temperatures
- f) Body material designation (conforming MSS SP-25).
- g) Rating designation (conforming ASME B16.34).
- h) Valve trim identification (conforming MSS SP-25).
- i) Nominal valve size.
- j) Monogram of the Control Authority.

**10. INSPECTION**

**10.1. INFORMATION**


The Manufacturer shall inform the Control Authority min. five (5) working days in advance of any intervention required by this specification and shall send a copy of it to the Purchaser/Engineer (by fax).

**10.2. DOCUMENTS**

Before starting any fabrication, the Manufacturer shall submit for approval to the Control Authority and the Purchaser/Engineer the following documents :

- Detailed fabrication drawing and calculations.
- Fabrication and control procedure.
- Qualified welding procedures;
- Welders performances qualifications;
- NDT procedures;
- List of Operations in Fabrication and Control (LOFC) in accordance with annex 1.

Each company dealing in the order by fabrication and/or control shall implement a LOFC for all operations and interventions performed in its organisation. They shall also be responsible for the implementation of the same by their subcontractors.

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10.3. CERTIFIED MATERIAL TEST REPORT

A Certified Material Test Report (CMTR) shall be furnished listing as built drawings and calculations, the LOFC (see paragraph 10.2.), the base material certificate, the chemical check analysis of the welding ends. The certificate of the heat treatment, the mechanical test, the non-destructive examination, the pressure testing, the operational torque test, the quality release note (see paragraph 10.4.) and any special test required by the purchase order. The valve individual number (see paragraph 9.1.2.) must be indicated in the CMTR to permit the correct traceability of each valve. The Manufacturer shall furnish one copy of the CMTR to the Control Authority's delegate and one original and one copy to the Purchaser/Engineer.

10.4. QRN

After final approval of valves and the acceptance of the CMTR, the control authority's delegate shall furnish to the Purchaser/Engineer and to the Manufacturer a Quality Release Note (QRN). The Manufacturer shall deliver one copy of the QRN with the valves and one copy shall be included in the CMTR (see paragraph 10.3.).

10.5. REPAIR

Defects in material may only be repaired provided written acceptance by the contracting parties and the Control Authority has first been obtained.

This written acceptance must be given case per case. Defective material, that cannot be satisfactory repaired or repaired without written approval shall be definitively rejected.

10.6. REJECTION

Each valve in which injurious defects are found after delivery shall be rejected. The Manufacturer shall be notified. In this case, the valve shall be replaced immediately. All the costs involved, including wages and travel expenses of the Control Authority's delegate shall be borne by the Manufacturer.

11. **PAINTING AND COATING**

The surface of the valve will be shot-blasted SA 2 1/2 (Swedish standard SIS 055900). Before painting, the valve shall be cleaned from grease and dirt. The painting shall consist of a primer coating (30 - 40 µm) and a finish coating (30 - 40 µm).

The nature of the products shall be specified in the offer and shall guarantee a corrosion protection for a storage period in a shop for at least one year.

Painting in accordance with Purchaser/Engineer's specifications.

Painting and coating procedures shall be submitted for approval before manufacturing to the authorized Control authority and to the purchaser / engineer.



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For underground valves the Manufacturer shall propose an adequate protection at the time of offer. This adequate protection shall be in accordance with the Purchaser/Engineer's specification.

**TABLE 1**

**CHEMICAL COMPOSITION FOR WELDING END OF VALVES**

Maximum limit of chemical elements which may be used in material under this standard.


	% Maximum
C	0.230
Mn	1.60
Si	0.50
P	0.030
S	0.025
Nb	0.080
V	0.120
Mo	0.250
N <sub>t</sub>	0.0150

Alternate alloy elements may be used but they shall be discussed with the user prior to delivery of the material. This table is not intended to represent the composition of any heat of steel, but merely to record the maximum permissible amounts of one element. The combination of elements of any heat must conform to the carbon equivalent, subsection 3.2.4.3.

For each heat the Manufacturer shall analyse the following elements : C,

Mn, Si, P, S, Nb, V, Cr, Mo, Ni and Cu.

The intentional addition of elements other than those specified is not permitted unless agreed upon by the Purchaser.

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In any case, for unintentional additions, the following limitations shall be respected :

Cr  $\leq$  0.15 %    Mo  $\leq$  0.05 %    Cu  $\leq$  0.20 %

Ni  $\leq$  0.30 %    Co  $\leq$  0.01 %    Al  $\leq$  0.07 %

The content of N total (N<sub>t</sub>) may be up to 0.0150 % and Must be guaranteed by the Manufacturer. If the Manufacturer cannot give any guaranty of N content, he shall analyse this element.

The total content for Nb + V will be limited to 0.150 %.

In grades X42 through X60 for each reduction of 0.01 % below the maximum carbon content, an increase of 0.05 % manganese above the specified maximum is permissible, up to a maximum of 1.70 %.

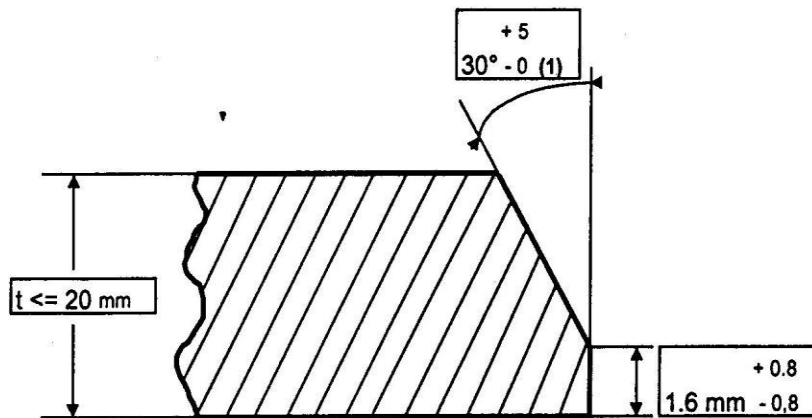
**TABLE 2**

**TENSILE REQUIREMENTS OF THE WELDING END OF VALVES**

CLASS SYMBOL	FIELD STRENGTH (min)		TENSILE STRENGTH (min)		ELONGATION in 2" min. %
	KSI	MPa	KSI	MPa	
B	35	241	60	413	25
X42	42	289	60	413	25
X46	46	317	63	434	25
X52	52	358	66	455	25
X60	60	413	75	517	20

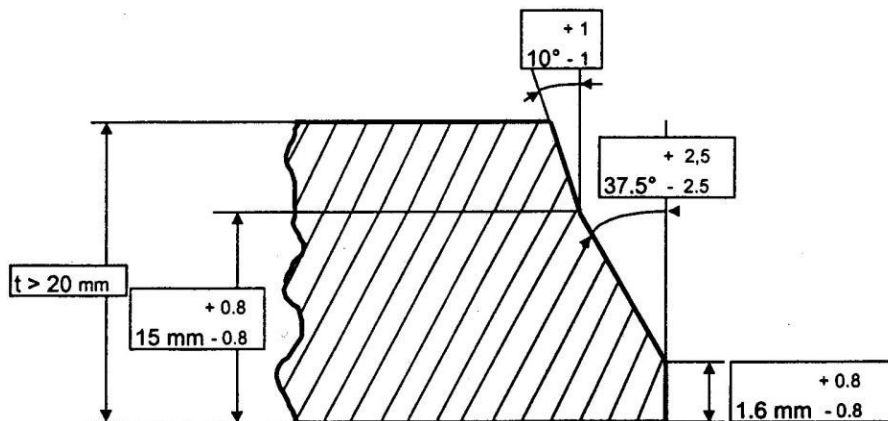
The ratio of effective yield strength to effective tensile strength of the steel shall not exceed 0.85.

**Figure 1**



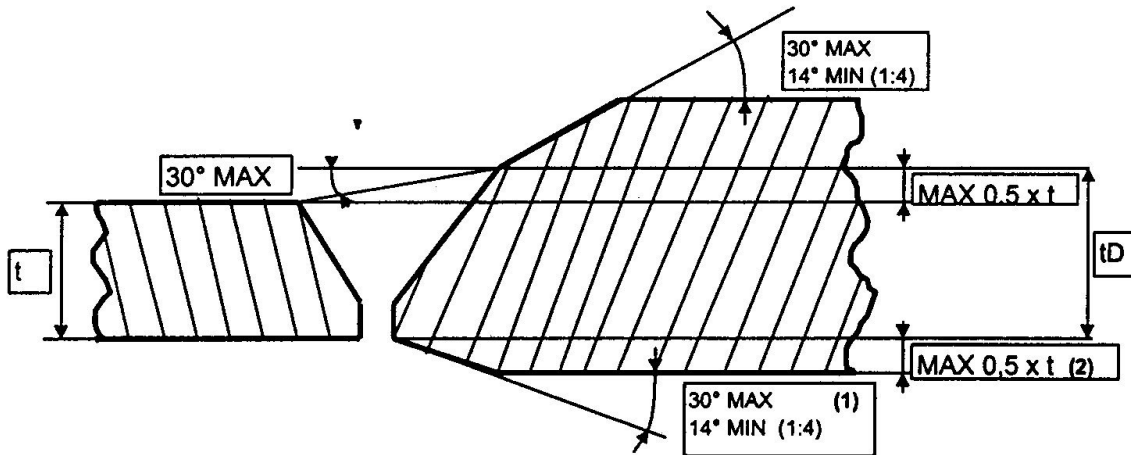
(1): welding end, size 24" and smaller may be furnished with  $37.5^\circ \pm 2.5$  bevel at manufacturer option.

**Figure 2**



**Figure 3**

**ACCEPTABLE DESIGN FOR UNEQUAL WALL THICKNESS AT WELDING END OF VALVE**




**Notes**

- (1) No minimum when materials joined have equal yield strength.
- (2) Dimension to be limited to a minimum.

When the minimum specified yield strengths of the sections to be joined are unequal :

- the deposited weld metal shall have mechanical properties at least equal to those of the section of the higher strength.
- tD shall be equal to at least t times the ratio of min. specified yield strength of pipe by those of welding end of valve.

- $tD \geq t \times \frac{\text{Min. Yield strength guaranteed by the standard of the steel of the pipe}}{\text{Min. yield strength guaranteed by the standard of the steel of the welding end of the valve}}$

 <p>Bhagyanagar Gas Ltd. Bhagyanagar Gas Limited</p>	<p><b>Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA</b></p> <p><b>Bid Document No: BGL/693/2025-26</b></p>	<p>Volume II of II</p>
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**ANNEX 1**

**LOFC (LIST OF OPERATIONS OF FABRICATIONS AND CONTROLS)**

Each LOFC must contain the following information as a minimum (all clearly marked and separated) :

- k) Company name and references relating to the order.
- l) All technical and other information required in order to define the items covered.

The area of application will be limited to that item or those considered as in fabrication and control.

- m) A numerical sequence of operations with description will be built-up in a logical way of work progress.

- The first operation will be the control of the incoming material(s) and documents.
  - The last operation will be the control of the CMTR.

The following operations have to be included (not limited to) :

- Each fabrication step.
  - Each step which calls for own quality control (eventually QA).
  - Each applicable examination as part of this specification.
  - Document controls - stamping and final documentation.

- n) Each operation will be followed by the applicable specification or procedure number (with the latest revision).

- o) Columns to be provided for possible interventions of :

- the Manufacturer's fabrication control,
  - the Manufacturer's quality control (eventually QA),
  - Control Authority,
  - the Purchaser/Engineer,

and place of intervention if not by the Manufacturer.

The interventions will be indicated per operation with H or W and/or R.

H = hold point

No further steps may be undertaken before the intervention of the appointed responsible takes place.



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W = witness point

The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

R = point for which a control report or a recording has to be made.

The Manufacturer will fill in his own H, W and R points. The Control Authority and the Purchaser/Engineer will do the same in their designated columns, but this will not implicate a relaxation or wearing of the requirements of the Manufacturer's controls.

Each intervention has to be signed and dated by the person acting as controller. Only the original documents will be presented for this purpose.

- p) One column to be provided for report or record numbers (points marked R) and one for the review of these documents by the Control Authority.
- q) Two extra columns may give reference to a non-conformity report if any and to the resolution given to it.

Completion of the LOFC does not automatically give rise to a release of the material or it must be stipulated otherwise in the contract.

\* \* \*



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		PIPING SPECIFICATION		P.019141 G 11076 M001 ( 3C1 )	
				SHEET 1 OF 6	
BASIC PIPING SPECIFICATION DATAS		MAXIMUM DESIGN CONDITIONS			
		TEMPERATURE ° C		PRESSURE bar g	
PRIMARY FLANGE RATING	300#-RF	CARBON STEEL	- 20 to 65	NG	49.00
				AG	49.00
BASIC MATERIAL	CARBON STEEL				
CORROSION ALLOWACE	1.6 mm				
X-RAYS	100%				
SIZE RANGE	1/2"-16"				
CODE	ANSI B 31.8				
FLUIDS					



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		PIPING SPECIFICATIONS					SPECIFICATION NO P.019141 G 11076 M001 (3C1)
							SHEET 2 OF 6
ITEM	SHORT CODE	SIZE FROM- THRU	END CONNECTION	RATING AND/OR SCHED.	DIMENSION STANDARD	MATERIAL	REMARKS
PIPES	P	1/2" - 1 1/2"	PE-SEAMLESS	SCH 80	ANSI B36.10	ASTM A 106 Gr. B	SEAMLESS
		2" - 3"	BE-ANSI B16.25	SCH 80	ANSI B36.10	ASTM A 106 Gr. B	SEAMLESS
		4" - 8"	BE-ANSI B16.25	6.4 mm	API 5L	API 5L X 52	HFW / SMLS
		10" - 12"	BE-ANSI B16.25	6.4 mm	API 5L	API 5L X 56	HFW / SMLS/ LSAW
		16"	BE-ANSI B16.25	7.1 mm	API 5L	API 5L X 56	HFW / SMLS/ LSAW
ELBOWS 90 LR	E	1/2" - 1 1/2"	SW	CLASS 3000	ASME B16.11	ASTM A105	SEAMLESS
		2" - 3"	BE-ASME B16.25	SCH 80	ASME B16.9	ASTM A234 Gr. WPB	SEAMLESS
		4" - 8"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 52 or ASTM A860 WPHY 52	
		10" - 16"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 56 or ASTM A860 WPHY 60	
ELBOWS 45 LR	E45	1/2" - 1 1/2"	SW - ASME B16.25	CLASS 3000	ASME B16.11	ASTM A105	SEAMLESS
		2" - 3"	BE-ASME B16.25	SCH 80	ASME B16.9	ASTM A234 Gr. WPB	SEAMLESS
		4" - 8"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 52 or ASTM A860 WPHY 52	
		10" - 16"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 56 or ASTM A860 WPHY 60	
REDUCERS CONCENTRIC	RCO	1/2" - 1 1/2"	SW - ASME B16.25	CLASS 3000	ASME B16.11	ASTM A105	SEAMLESS
		2" - 3"	BE-ASME B16.25	SCH 80	ASME B16.9	ASTM A234 Gr. WPB	SEAMLESS
		4" - 8"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 52 or ASTM A860 WPHY 52	
		10" - 16"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 56 or ASTM A860 WPHY 60	
REDUCERS ECCENTRIC	REC	1/2" - 1 1/2"	SW - ASME B16.25	CLASS 3000	ASME B16.11	ASTM A105	SEAMLESS
		2" - 3"	BE-ASME B16.25	SCH 80	ASME B16.9	ASTM A234 Gr. WPB	SEAMLESS
		4" - 8"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 52 or ASTM A860 WPHY 52	
		10" - 16"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 56 or ASTM A860 WPHY 60	
TEES EQUAL	T	1/2" - 1 1/2"	SW - ASME B16.25	CLASS 3000	ASME B16.11	ASTM A105	SEAMLESS
		2" - 3"	BE-ASME B16.25	SCH 80	ASME B16.9	ASTM A234 Gr. WPB	SEAMLESS
		4" - 8"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 52 or ASTM A860 WPHY 52	
		10" - 16"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 56 or ASTM A860 WPHY 60	
TEES RED	TR	1/2" - 1 1/2"	SW - ASME B16.25	CLASS 3000	ASME B16.11	ASTM A105	SEAMLESS
		2" - 3"	BE-ASME B16.25	SCH 80	ASME B16.9	ASTM A234 Gr. WPB	For Branch Size, Please refer to the Chart given in Sheet 6 of this Document.
		4" - 8"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 52 or ASTM A860 WPHY 52	
		10" - 16"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 56 or ASTM A860 WPHY 60	
SOCKOLETS	SOL	1/2" - 1 1/2"	SW - ANSI B16.25	CLASS 3000	MSS-SP-97	ASTM A 105	
THREDOLETS	TOL	1/2" - 1 1/2"	THREADED AS PER ASME B 1.1	CLASS 3000	MSS-SP-97	ASTM A 105	Thredolet shall only be used for Temperature measuring equipments
WELDOLETS	WEL	2" - 8"	BW - ANSI B16.25	STD	MSS-SP-97	ASTM A 105	
CAPS	CAP	1/2" - 1 1/2"	SW	SEE PIPE	ANSI B16.9	ASTM A 105	SEAMLESS
		2"	BE-ASME B16.25	SCH 80	ASME B16.9	ASTM A234 Gr. WPB	
		4" - 8"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 52 or ASTM A860 WPHY 52	
		10" - 18"	BW - ANSI B16.25	SEE PIPE	ANSI B16.9	API 5L X 56 or ASTM A860 WPHY 60	
NIPPLES	NBEP	1/2" - 1.1/2"	BOTH ENDS PLAIN	80	ANSI B36.10	ASTM A 106 Gr. B	SEAMLESS-LG=100mm
	NOET	1/2" - 1.1/2"	ONE END THRD-MNPT	80	ANSI B36.10	ASTM A 106 Gr. B	SEAMLESS-LG=100mm
	NBET	1/2" - 1.1/2"	BOTH ENDS THRD-MNPT	80	ANSI B36.10	ASTM A 106 Gr. B	SEAMLESS-LG=100mm
FULL COUPLINGS THRD	CF	1/2" - 1.1/2"	FNPT ANSI B1-20-1	3000#	ANSI B16.11	ASTM A 105	SEAMLESS
CAPS THRD	C2	1/2" - 1.1/2"	FNPT ANSI B1-20-1	3000#	ANSI B16.11	ASTM A 105	SEAMLESS
PLUGS THRD	PL	1/2" - 1.1/2"	MNPT ANSI B1-20-1	3000#	ANSI B16.11	ASTM A 105	SEAMLESS



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			PIPING SPECIFICATIONS				SPECIFICATION NO P.019141 G 11076 M001 (3C1)
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ITEM	SHORT CODE	SIZE FROM-THRU	END CONNECTION	RATING AND/OR SCHED.	DIMENSION STANDARD	MATERIAL	REMARKS
WN FLANGES	FLG	1/2" - 1 1/2"	SW	300# SWRF, TO MATCH SCH 80 PIPE	ASME B16.5	ASTM A105	SERRATED FINISH
		2"	BW - ASME B16.25	300# WNRF, TO MATCH SCH STD PIPE	ASME B16.5	ASTM A105	
		4" - 8"	BW - ASME B16.25	300# WNRF, TO MATCH SCH STD PIPE	ASME B16.5	ASTM A 694 F 52	
		10" - 16"	BW - ASME B16.25	300# WNRF, TO MATCH SCH STD PIPE	ASME B16.5	ASTM A 694 F 60	
ORIFICE FLANGES	FRO	1/2" - 1 1/2"	SW	300# SWRF, TO MATCH SCH 80 PIPE	ASME B16.36	ASTM A105	SERRATED FINISH
		2"	BW - ASME B16.25	300# WNRF, TO MATCH SCH STD PIPE	ASME B16.36	ASTM A105	
		4" - 8"	BW - ASME B16.25	300# WNRF, TO MATCH SCH STD PIPE	ASME B16.36	ASTM A 694 F 52	
		10" - 16"	BW - ASME B16.25	300# WNRF, TO MATCH SCH STD PIPE	ASME B16.36	ASTM A 694 F 60	
BLIND FLANGE	FBL	1" - 16"	FLGD	300# RF	ANSI B16.5	ASTM A 105	SERRATED FINISH
SPECTACLE BLINDS	SPB	1" - 16"		300# RF	ASME B16.48	ASTM A 105	
RESTRICTION ORIFICES	ROF	All Size		300# RF	ASME B16.36	ASTM A 105	
BOLT	BOL	All Sizes	-	-	ASME / B16.5 / ASME B 18.2.1	ASTM A193 Gr. B7 (HOT DIP GALVANISED, 80 - 100 MICRON)	THREADS AS PER ASME B1.1
NUT	NUT	All Sizes	-	-	ASME B 18.2.2	ASTM A194 GR 2H (HOT DIP GALVANISED, 80 - 100 MICRON)	THREADS AS PER ASME B1.1
GASKET SPIRAL WOUND	GSK	All Sizes	-	300# RF	ASME B 16.20	3.2MM Thick Spiral Wound 316L with CS Outer ring and 316L inner ring and graphite filler.	



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ITEM	SHORT CODE	SIZE FROM-THRU	END CONNECTION	RATING AND/OR SCHED.	DIMENSION STANDARD	MATERIAL	REMARKS
BALL VALVE (See Note 4)	VBA	1/2" - 1 1/2"	SW	800#	ASME B16.10	BODY : ASTM A105	WRENCH OPERATED.
					ISO EN 17292	BALL : ASTM A182 GR.F316 SEAT : RPTFE	ANTI-STATIC FIRE SAFE
		2" - 4"	FLGD RF:ASME B16.5 or BW :ASME B16.25	300 #	ASME B16.10	BODY : ASTM A216 GR WCB	WRENCH OPERATED.
					API-6D	BALL : ASTM A182 Gr. F316 SEAT : AISI4140+ 75 microns ENP / AISI410	ANTI-STATIC FIRE SAFE
		6" - 16"	FLGD RF:ASME B16.5 or BW :ASME B16.25	300#	ASME B16.10	BODY : ASTM A216 GR WCB	ANTI-STATIC
					API-6D	BALL : ASTM A182 Gr. F316 SEAT : AISI4140+ 75 microns ENP / AISI410	FIRE SAFE GEAR OPERATED - MANUAL / ACTUATED - AS INDICATED IN DATA SHEET
GLOBE VALVE	VGL	1/2" - 1 1/2"	SW: ASME B16.25	800#	ASME B16.10	BODY : ASTM A 105	HANDWHEEL
					ISO 15761	DISC / RING : 13% CR. / SS304L	
						STEM : 13% CR. STEEL (NO CASTING)	
		2" - 4"	FLGD RF:ASME B16.5 or BW: ASME B16.25	300#	ASME B16.10	BODY : ASTM A216 GR WCB	HANDWHEEL
					BS 1873	DISC / RING : 13% CR. / SS304L	
						STEM : 13% CR. STEEL (NO CASTING)	
		6" - 16"	FLGD RF:ASME B16.5 or BW: ASME B16.25	300#	ASME B16.10	BODY : ASTM A216 GR WCB	HANDWHEEL
					BS 1873	DISC / RING : 13% CR. / SS304L	
						STEM : 13% CR. STEEL (NO CASTING)	
SWING CHECK VALVE	VCH	1/2" - 11/2"	SW: ASME B16.25	800#	ASME B16.10	BODY : ASTM A 105	
						DISC / RING : 13% CR. / SS304L	
						HINGE PIN : 13% CR. STEEL (NO CASTING)	
		2 1/2" - 16"	FLGD RF:ASME B16.5 or BW: ASME B16.25	300#	ASME B16.10	BODY : ASTM A216 GR WCB	
					API-6D	DISC / RING : 13% CR. / SS304L	
						HINGE PIN : 13% CR. STEEL (NO CASTING)	



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**Mechanical Works for development and construction of CNG  
Mother Stations in Hyderabad GA**

Volume II  
of II

**Bid Document No: BGL/693/2025-26**

## **BHAGYANAGAR GAS LIMITED (BGL)**

### **CNG STATION WORKS**

### **SS TUBE LAYING & MECHANICAL WORKS**

### **AT VARIOUS LOCATIONS**

TECHNICAL SPECIFICATION FOR SS TUBES, SS VALVES & SS FITTINGS  
FOR INSTRUMENTS AIR LINE



**Mechanical Works for development and construction of CNG  
Mother Stations in Hyderabad GA**

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	<b>INSTALLATION, TESTING AND CALIBRATION OF INSTRUMENTATION AND CONTROL SYSTEM</b>	

**1.0 SCOPE**

- 1.1 The purpose of this specification is to define the general requirements for the installation, installation materials, testing and calibration of instruments and control system.
- 1.2 The work shall be carried out in accordance with the codes, standards and recommended practice listed in this specification and in accordance with local Statutory regulations'.
- 1.3 For installation of instruments and control system, of the new material where quality is of the prescribed standards and which is in every way fit for its intended purpose shall be used.
- 1.4 Unless otherwise specified all the materials shall be indicated in this specification except where it is not compatible with fluids being handled. In such cases the selection of the material shall be approved by Owner/PMC.
- 1.5 Only the best trade practices shall be used. All the work shall be carried out in a neat, workman like manner and to the satisfaction of Owner/PMC.

**2.0 STANDARDS OF MATERIALS**

- 2.1 Instrument process piping / tubing up to and including the first block valve and 'in-line' instrument equipment shall conform to the line class or vessel rating concerned instrument piping or tubing after the first lock valve may use alternate materials consistent with service conditions. In general, they shall conform to the following specification as a minimum.
  - 2.1.1 Stainless tubes shall be fully annealed and cold drawn seam less as per ASTM A 269 TP304 with size 1/2"OD x 0.083" WT (wall thickness).
  - 2.1.2 Monel tubing shall be fully annealed seamless as per ASTM B165 with size 1/2" OD x 0.35"WT.
  - 2.1.3 Carbon steel pipe shall be 1/2" seamless and shall be as per ASTM A106 Gr B min of SCH 80 & dimensions as per ANSI B36.10.
  - 2.1.5 Instrument air supply piping from the main instrument air header shall be galvanised heavy class pipes to IS 1239.
- 2.2 Individual pneumatic signal and air supply tubing shall conform to the following specifications:
  - 2.2.1 Stainless tubes shall be used in general and shall be fully annealed and cold drawn seamless as per ASTM A269 TP 304 with 6mmOD x 1mmWT.
  - 2.2.2 Copper tubing where specified shall be seamless 6mmOD x 1.0mmWT soft annealed as per ASTM 868.74a cd No. 122 (DHP) sheathed with PVC 1.0mm thick coloured Black.
- 2.3 All fittings shall be as a minimum of 100 rating except for tube fittings. The fittings shall have threading as per B2.1 and socket weld connections as per B 16.11. These shall conform to the following specifications in general.
  - 2.3.1 Tube fittings shall be flare type compression fittings Swagelok or equivalents make double ferrule and pressure seat type.  
All tube fittings in impulse lines shall be rated to 5000 PSIG at 38 degree C.
  - 2.3.2 Carbon steel pipe fittings shall be forged as per ASTM A105 stainless steel pipe fittings shall be as per ASTM -182 Grf 316L
- 2.4 Valve shall have normally Globe body and shall be fabricated out of Bar-stock and rated to min. of 1500. These shall be screwed bonnet type with 13% GSS trim and plug shall be integral with the stem. Face to face dimensions shall be approx. 80mm. End connections shall be socket weld to ANSI 16.11 and threaded to B2.1
- 2.5 Multibore tubing shall have a maximum 19 single polyethylene tubes, 6mmOD x 1mm numbered for easy identification. The bundle shall be marked with inner and outer fire resistance PVC sheath. They shall carry a pair of telephone wire 0.6mm diameter flexible.

- 2.6 Single pair and multi pair extension cables for Thermocouples shall be matched and calibrated in accordance with ISA MC 96.1. Conductor size shall be AWG for single pair and 20 A for Multipair.  
The cable shall be armoured, each twisted pair shall be individually shielded with aluminium Mylar tape and a tinned copper drain wire. The wires and the cable shall be colour coded as per ISA recommended practices.
- 2.7 Instrument Electrical cables shall conform to the following specificationsZ:
- 2.7.1 Instrument electronic signal cables single pair/ Multipair shall have copper conductor, twisted in pair and individually shielded with Aluminium Mylar tape with drain wire. In multipair cables, each pair shall be armoured with inner and cut PVC sheath. Minimum conductor size shall be 1.5 mm<sup>2</sup>.
- 2.7.2 Control Cables for control signal, alarms actuating devices and solenoid valves of the interlock and shutdown valves shall generally be 1.5 mm<sup>2</sup> copper conductors armoured with inner and cut PVC sheath.
- 2.7.3 All power supply cables shall have copper/Aluminium conductor depending upon the conductor size. The cables shall be armoured with inner and cut PVC sheath. The cables shall be sized adequately. Minimum conductor size shall be 2.5 mm<sup>2</sup>.
- 2.7.4 2-core armoured cable shall be used for illuminator on level gauges.
- 2.7.5 The material and construction of all electrical cables shall conform to IS- 1554 Part I or appropriate equivalent code and standard

### **3.0 INSTALLATION OF INSTRUMENTS**

#### **3.1 Instrument Mounting**

- 3.1.1 No instrument shall be installed in such a way that it bends for support on the impulse piping or electrical connection on it.
- 3.1.2 Pressure gauges and temperature indicator shall normally be mounted directly on line. However direct on line mounting shall be avoided where vibrations are likely to be present.
- 3.1.3 Local mounted instruments shall be mounted on brackets, panels or placed on a suitable pedestal. Transmitters shall be mounted on 2" pipe supports where practical. Instruments to be mounted on steel columns, masonry structure etc. These shall not be mounted on heating equipments, pipelines and structures.
- 3.1.4 Blind transmitters shall be mounted at 130mm above graded platform. Local controllers, indicating transmitters and indicating instruments shall be mounted at approximately 1500 mm.
- 3.1.5 All the instruments shall be accessible from grade, ladder or platform etc. Pressures gauges and other local indicating instruments shall be readable from grade or operating level and if used for manual control shall be visible from the related valve.  
All the instruments shall be located such that they don't impede the process operation.
- 3.1.6 Local mounted instruments which are not available in weather proof housing shall be mounted inside a weather proof case.
- 3.1.7 Items such as pilot valves, solenoid valves etc. shall be located local to its point of application or near to the device being actuated by them.
- 3.1.8 For blind transmitters output meters shall be mounted on instrument supports.
- 3.1.9 Filter regulators shall be mounted on the instrument supports below pneumatic transmitter or on the control valve yoke.
- 3.1.10 Instruments or instrument lines shall not be supported on hand rails, in general.
- 3.1.11 The use of process piping to support instrument lines shall be avoided as far as possible.
- 3.1.12 The instrument impulse piping shall be kept as short as possible.
- 3.1.13 Instruments and impulse lines shall be protected against mechanical damage.

- 3.1.14 In case of capillary tube instruments, capillary tube is to be supported and protected against mechanical damage.
- 3.1.15 Orifice meters shall not be installed on the top of orifice fittings. On horizontal lines orifice pressure taps shall be located as follows
- a) On top for air and gas service
  - b) Horizontal for liquid and condensable vapour service.

**3.2 Instrument Piping & Tubing.**

- 3.2.1 Impulse Piping/tubing
- 3.2.1.1 The primary instrument block valves for all instruments shall be as per piping specifications.
- 3.2.1.2 3- Valve manifold in general shall be integral type. For pressure gauges, 2-valve manifolds shall also be acceptable instead of isolation valve, drain valve and pipe fittings.
- 3.2.1.3 Differential or static pressure sensing lines shall not exceed 6 mtrs. (20 feet) in general for direct connected or locally mounted instruments.
- 3.2.1.4 All impulse lines shall be run with a slope not less than 1 in 12 except where otherwise specified. Direction of slope is to be downward from the process for liquid service and upward from the process for gas service.
- 3.2.1.5 Tubing shall be joined by compression fittings.
- 3.2.1.6 Piping shall be joined by pipe fittings/flanges as per the piping specifications.
- 3.2.1.7 All instruments pipes and tubes shall run in horizontal and vertical planes only and shall run with minimum number of changes in direction, consistent with good engineering practices and neat appearance.
- 3.2.1.8 Tubing shall be bent with correct size tube bender as far as possible to avoid use of fittings. Hot bending shall be totally avoided.
- Tube cutter shall always be used to cut tubing. The use of short lengths of tubing in long runs shall be avoided in order to avoid the fittings.
- 3.2.1.9 All tubing shall run in such a manner as to give the maximum protection against mechanical damage. Tubing runs shall be grouped together and clamped.
- 3.2.1.10 Tubing shall be arranged so that the unions can be tightened without distorting lines.
- 3.2.1.11 Instrument tubing or piping shall not run on trays intended for cables and shall not share the same transit.
- 3.2.1.12 No pipe or tube shall be left with mechanical strain on them.
- 3.2.1.13 A mechanical ferrule seater shall be used on tubing for 140 kg/cm<sup>2</sup> (2000 psi) or more.
- 3.2.1.14 Pipe bushings shall not be used.
- 3.2.1.15 Pipe plugs shall be fabricated out of bar stock and shall have hex-head.
- 3.2.2 Air/Signal Tubing
- 3.2.2.1 Signal Transmission tubes shall be laid on perforated trays prefabricated out of min 2.5 mm. thick steel plates. The width of the tray shall be selected as per the number of tubes to be laid.
- 3.2.2.2 Where tubing is run in permanent enclosures, it should be ensured that entry and exit of such enclosures is clean and smooth.
- 3.2.2.3 Tubing run in permanent enclosures shall not have joints, except at special junctions boxes provided for this purpose.
- 3.2.2.4 Where permanent enclosures are left with space for instrument tubing to be laid at some later date, a galvanised pull wire of adequate size shall be left in the tray.
- 3.2.2.5 Where the length of transmission tubing exceeds 60 mtrs (200ft) necessity of installing signal booster



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- relays shall be considered.
- 3.2.2.6 In case of 'Skidded' equipment or vessels with instrumentation, where off- skid alarms shutdown or control functions are provided the signal tubes shall be terminated on the control bulk head near the skid boundary.
- 3.2.3 All threaded pipe joints shall be joined after applying Teflon tape. It should be applied in a manner to ensure that the tape does not spill over the end of the male fitting. No other pipe joining compound shall be used except on high temperature service where graphite sealing compounds shall be used.
- 3.2.4 All reasonable precautions shall be taken to prevent foreign materials entering pipe lines or tubing before and during erection.
- 3.2.5 Pipes and tubes installed but not connected, shall have the ends clad in approved fashion to prevent the entry of foreign material. For a period upto one week adhesive tape may be used, for longer periods, caps or plugs shall be used.
- 3.2.6 Piping/Tubing supports
- 3.2.6.1 Piping and tubing shall be adequately supported and fixed at a distance not exceeding that in the following table:

Table - 1

Single tubing/Piping	Max. distance between supports
3/8" OD or less	Continuous
1/2" to 3/4" Nom. size	2 meters (6ft.)
3/4" to 1" Nom. size	3 meters (9ft.)
Multitube bundle	3 meters (9ft)

- 3.2.6.2 All field mounted instrument air tubing shall be supported with galvanised steel angles or channels of minimum 1/8" thickness fabricated to present neat appearance.
- 3.2.6.3 All instruments tubing supports shall be galvanised prior to installation
- 3.2.6.4 Trays shall be properly supported either from any rigid steel structure or concrete member. In case of non-availability of above, a suitable support shall be fabricated.

**3.3 Instrument Air Supply Distribution**

- 3.3.1 Piping material for instrument main and branched air headers upto the isolation valve at each take-off from main or branch header shall conform to piping specification.
- 3.3.2 The air header size shall be established in accordance with the table below, unless otherwise specified, for a header pressure of 4 to 8.5 kg/cm<sup>2</sup>

Table – 2

number of users	Nominal pipe size Max.
upto 5	1/2"
upto 10	3/4"
upto 25	1"
upto 80	1-
1/2" upto 150	2"
upto 500	3"

- 3.2.3 All take off for branch lines are to be from the top of the main header with block valves equal in size to the branch line. All low point shall have a 1/2" valve installed as a drain and blow down point.



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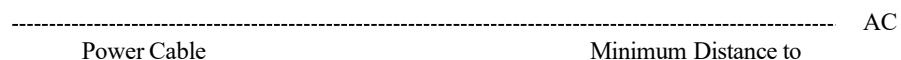
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- 3.3.4 A minimum size of ½” pipe shall be run to the instrument with a ½” valve for each user. Tubing from the isolation valve to the instrument shall be 6.0 mm.
- 3.2.5 Union shall be provided at convenient location in the air header.
- 3.3.6 Filter regulator shall be provided for individual field mounted consumer and shall be complete with an output gauge.
- 3.3.7 In case of skid mounted equipment or vessels which incorporate instrumentation requiring pneumatic supply, on skid supply piping shall terminate at the skid boundary location and size of the supply connections shall be noted on the vendor approval drawings.

**3.4 Installation of multitude and Multicore cables.**

- 3.4.1 Multicore/ Multitube cables shall generally be installed on trays or ducts and properly clamped. At bends minimum radius shall be maintained as per cable manufacturer’s standards
- 3.4.2 All cables shall be rigidly supported on structural steel and masonry. Drilling of steel member should normally be avoided. However, if the drilling of steel must be resorted to, it must be drilled where minimum of weakening of structure will result cables shall be support at every 500 mm. At every vertical drop these shall be clamped at more frequent intervals max of 300 mm.
- 3.4.3 Directly buried cables shall be laid underground in excavated cable trenches. Trenches shall have sufficient depth and width to accommodate all cables correctly spaced and arranged with a view of heat dissipation and economy of design construction of trenches laying of cables and filling up of trenches shall be as per relevant standard.
- 3.4.4 Each underground cable shall be provided with identifying tag of load securely fastened every 30 M of its underground length with at least one tag at each end before the cable enters the ground. Before cables are placed, the trench bottom shall be filled with a layer of sand. The cables shall be covered with 150 mm of sand on the top of the largest dia. cable tube and sand shall be lightly pressed. A protective covering of 75 mm thick second class red bricks shall be laid flat and the balance portion of the trench shall be filled with soil, compacted and levelled.
- 3.4.5 At each road crossing and other places where cables enter pipe sleeves, adequate bed of sand shall be given so that the cables don’t slack and get damaged by pipe ends after back filling.
- 3.4.6 At the entry into concrete blocks loops shall be provided at either end to prevent any damage to cable.
- 3.4.7 The cable entry to control room shall be suitably filled and sealed after laying of cables so as to achieve a positive sealing against the entry of gas/water.
- 3.4.8 All wiring, tubing, cables, Junctions boxes and auxiliary equivalent shall be suitably identified as per applicable codes and practices. All piping and tubing shall be tagged with slip-on or clip on wire marker at both ends.
- 3.4.9 Cables jointing are not permitted. Cables shall be cut after the exact site measurements at the cable drums shall be so selected before cutting the lengths as to avoid any unnecessary wastage.
- 3.4.10 Low signal cables like alarms, analysers cables, special cables for turbine meter, thermocouple compensating cables etc. shall be layed separated from power supply cables in ducts/trenches/trays.
- 3.4.11 Electric signal lines for electronic transmitters to receive and to final control element shall be continuously shielded with the shield grounded at the same point as the signal circuit generally at the control instrument.
- 3.4.12 Separate junction boxes shall be used for intrinsically sage cables.
- 3.4.13 Different intrinsically safe system e.g., systems having different rounds shall not be run in the same multicore cable, in general.

Recommended minimum separation distance between twisted pair signal leads and AC Power Lines





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Signal Lead

Voltage (Volts)	Current (Am)	in (cm)
0 to 125	0 to 10	12" (30)
125 to 250	0 to 50	15" (38)
250 to 440	0 to 200	18" (46)
5KV & Up	200 Amp. & Up	24" (61)

Different intrinsically safe circuits e.g., circuits having different voltage levels, of the same intrinsically safe system shall not be run in the same cable unless each conductor insulation is at least 0.25mm or no hazard can result from interconnection.

- 3.4.14 Separation between power cables and signal cables shall be as per API 550 Part I Section VII. Cable in intrinsically safe circuits shall preferably be not run in the same tray where-- on intrinsically safe circuits cables are being run. If these are being run in the same tray, a metallic earthed separately shall be provided.
- 3.4.15 For temperature controllers, single pair thermocouple extension cable or cable for resistance thermometer shall be layed directly from the element to the transducer in the control room without intermediate terminal blocks.
- 3.4.16 In case of skid mounted equipment or equipment which incorporates skid instrumentation like alarms, shutdown or control function shall terminate signals or control junction box near skid boundary for connection of off skid equipment.
- 3.4.17 No wire shall be terminated or left with mechanical strain within any conductor.
- 3.4.18 Splices shall be made only at terminals, in instruments or approval equipment/ junction boxes using lugs and screwed connections. No intermediate splices shall be made in cable trays or in conduct. Number of junction boxes in any cable path shall be limited to only one.

**3.5 Installation of Zener barriers**

- 3.5.1 Zener barriers shall be installed in the circuit to make the system intrinsically safe provided:
  - a) There is no energy storage system in excess to the minimum permitted by the barrier design on the hazardous side of the barrier. The same shall be met by taking intrinsically safe transmitters and selecting the cable electrical parameters like inductance L/R ratio & capacitance in accordance with the maximum parameters given in barrier specifications.
  - b) No power source exceeding the voltage rating of Zener barrier shall be connected on safe side of the Zener barrier.
  - c) No outside power source including other intrinsically safe circuits shall be connected to the hazardous side of the barrier
- 3.5.2 Zener barriers shall be located as close as possible to the field wiring entry point in the control room.
- 3.5.3 Single barrier are bolted directly to copper bus bar and multiple barriers on the barrier mounting plates. Copper bus or barriers mounting plates shall be isolated from the panel frame.
- 3.5.4 The signal ground system for intrinsically safe system shall be separate from power ground system and shall be connected to the signal ground reference point. The maximum resistance allocable between the farthest point on intrinsically safe barrier ground bus and signal ground reference point shall be less than 1 ohm.

- 3.5.5 Field wires shall directly terminate at the barriers and not through intermediate terminals.
- 3.6 Installation of Analyser / Gas Chromatograph
- 3.6.1 Installation of all analyser shall be in general, as per APIP 550 Part II.
- 3.6.2 The analyser housing at its installation shall meet all safety requirements as per classifications.
- 3.6.3 Sampled process fluid, if not returned to the process shall be disposed to a safe location. Piping shall be provided so that vapours can be vented to a safe location and liquids shall be drained in a clean and orderly fashion to a safe place. Toxic vapours shall not be vented to atmosphere.
- 3.6.4 Analyser shall be located as near to the sampling point as possible.
- 3.6.5 Analyser equipment must be protected from the following:
- Hot equipment
  - Severe ambient temperature changes
  - Shock
  - Mechanical damage
  - Vibration
- 3.6.6 If a separate vent for the analyser is used, the location of that vent shall be in area of minimum air Turbulence. If the vents of different analysers are vented into a common vent, a back pressure regulator shall be used.
- 3.6.7 Vent piping shall be designed to prevent condensate from accumulation in low point and obstruct a free vent flow.

### **3.7 Ducts, Trays and Supports**

- 3.7.1 Main cable duct shall be of bottom open type with flat/angle --- construction with side sheet and top cover of 3.2 mm thickness.
- 3.7.2 The ducts and trays shall be properly supported at regular intervals. Wherever insert plates are not available, support on concrete structure or ceiling shall be fixed with a minimum of 10 mm expansion bolts Angle supports for ducts shall be fabricated from minimum of 40 mm angle.
- 3.7.3 All supports shall be neatly cut with hacksaw only and not with gas cutting. Free ends of angle supports shall not have sharp ends and shall be properly rounded off.
- 3.7.4 Ducts and supports shall be painted with one coat of Red oxide Zinc chromate primer conforming to IS-2074 after cleaning to remove scale and then painted with 2 coats of final enamel paint as given below:
- Duct - Dark admirately Grey as per IS0632.
  - Supports - Black.

### **3.8 Instrument Steam Tracing**

- 3.8.1 Steam for Tracking of instruments shall be taken from main steam header take of valve through carbon steel pipes supported at regular intervals.
- 3.8.2 Steam tracing around individual instrument shall be by copper tube of 1/8" diameter.
- 3.8.3 Piping or tubing for steam tracing shall be installed in such a way as to avoid condensate pockets.
- 3.8.4 After steam tracing, the line is connected to drain funnel through steam trap.

### **3.9 Identification of Lines and Instruments**

- 3.9.1 All site mounted instruments, junction boxes, air headers, tubing and wiring terminations shall be labelled or tagged.
- 3.9.2 Instruments shall be furnished with stainless steel name tags containing Tag no., manufacturer's name, and model no. serial number. ~~This tag number shall be approximately 3"x1" size and shall be attached to the~~

instruments with -- gauge stainless steel wire.

3.9.3 Unused cable entries in junction boxes and field instruments are to be plugged.

#### **4.0 TESTING**

##### **4.1 Instrument Impulse Piping/Tubing**

4.1.1 All process impulse lines shall be disconnected both from the instrument and vessel/piping end and flushed with water.

4.1.2 After thorough flushing the impulse line shall be isolated from the instruments and pressurised hydraulically to 1.5 times the maximum working pressure corrected for ambient temperature. They shall then be isolated from the pressure source and the pressure reading on a test pressure gauge shall not fall at a rate exceeding one psig/hour.

In case no isolation valve is provided near the instrument, impulse piping/tubing shall be pressurised along with the instrument to the maximum pressure of scale in case of pressure transmitter and max. Operating pressure in case of differential pressure instrument with equalising valve open

4.1.3 In special conditions where hydro- testing is not permissible due to service requirements, testing shall be carried out by using compressed air/nitrogen.

4.1.4 The external displacer type instruments and cage type level switches shall be tested to 1.5 times the operating pressure using air/nitrogen after thorough flushing.

##### **4.2 Instrument Air Lines/Signal Tubing**

4.2.1 Instrument air lines/signal tubing shall not be hydrostatically tested.

4.2.2 Instrument air tubing shall be disconnected upstream of all filter regulators and blown down to remove water, slag and mill scale, from lines at  $7.0 \text{ kg/cm}^2 \text{ G}$  for fifteen minutes.

Air filter shall be taken in line and tubing shall be disconnected at instrument end, and blown for 3 minutes to remove traces of dirt.

4.2.3 Testing of instrument air shall be carried out with instrument air at  $7 \text{ kg/cm}^2 \text{ G}$  upto the upstream of the filter regulator after thorough flushing. All lines shall be checked with soap solution and bubbler unit for possible leak at joints.

4.2.4 All signal tubing shall be checked with  $1.5 \text{ kg/cm}^2$  after proper flushing. After pressuring, source shall be cut off and rate of fall in pressure shall be less than IPSL for each 100 feet of tubing for a test period of 2 minutes as per instrument society of American RP 7.1 'Pneumatic Control Circuit Pressure Test'

##### **4.3 Cables**

4.3.1 All wiring shall be checked to ensure that it is correctly connected and properly grounded.

4.3.2 All cables shall be checked for continuity proper connection and insulation testing.

Insulation test shall be carried out on all wiring with a certified magger after disconnecting the cables at both ends.

4.4 All the results of the above mentioned testing shall be recorded and submitted for check.

4.5 All the in line instruments like orifice plates, turbine meters, Rotameters, Target meters, vortex meters, control valves, safety valves etc. shall be removed and spool pieces shall be provided prior to the flushing of the lines.

## **5.0 CALIBRATION OF INSTRUMENTS**

5.1 All instruments shall be calibrated strictly as per manufacturer's instructions prior to the installation. In addition to calibration of instruments, setting of safety devices like process switches, safety valves etc. and simulation testing of all interlock and shutdown system shall be carried out.

5.2 In general, all tests shall simulate, as closely as possible, design process condition by the use of manometers, potentiometers, deadweight testers, test pressure gauges etc. Pour point calibration shall refer to the input signal to an instrument equivalent to 0, 25, 50, 75, 100% of instrument range upscale (rising) and 75, 50, 25, 0% of instrument (downscale) (falling).

All instruments unless otherwise noted shall be calibrated in upscale and downscale direction and if necessary, adjusted until their accuracies conform to those limits state by the manufacturer.

Upon completion of these tests, the instruments shall be drained, completely.

5.3 Temperature Instruments

5.3.1 Temperature Gauges Filled type and Bi metallic dial type Thermometers shall be four point bench checked for proper operation and calibration using a temperature bath prior to installation.

5.3.2 Temperature Elements and Temperature Transmitters.

Temperature Elements and Transmitter shall be four point bench calibrated using a temperature bath precision meter or precision gauge prior to installation.

5.4 Pressure Instruments

5.4.1 Pressure Gauges

5.4.1.1 Direct connected bourdon type pressure gauges shall be dead weight tested or tested against a test gauges prior to installation.

5.4.1.2 Receiver type pressure gauges shall be four points calibrated using a precision gauge and precision air regulator.

5.4.1.3 Pressure and Differential Pressure Transmitters.

Pressure and differential pressure transmitters shall be four points calibrated using a hydraulic or dead weight tester or a precision pneumatic calibrator prior to the installation. A precision output meter or gauge shall be used to monitor the output.

5.5.1 Orifice plates shall be checked visually for the name plate and for an upstream sharp edge. Bore dia. shall be checked for compliance with the specification.

5.5.2 Differential pressure type of flow instruments shall be four points calibrated using precision pneumatic calibrator or a manometer and precision regulator. A precision output meter or gauge shall be used to monitor the output of the transmitter.

5.5.3 a) Rotameters shall be installed as received. A check shall be made to confirm that shipping stops have been removed and float has been installed.

b) Where rotameters have transmitting mechanism, the float shall be raised and lowered mechanically and output shall be checked. Vendor calibration data/ curve shall be checked.

c) A check shall be conducted with plumb for a vertical installation

5.5.4 Turbine meters, Annubar, positive displacement meters, vortex meter, ultrasonic flow meter, etc. shall be installed as received.

5.5.5 Target meters shall be checked for calibration using calibration weights. Output shall be monitored using precision output meter.

5.6 Level Instruments

- 5.6.1 Level Gauge Glasses  
Gauge glasses shall be installed as received installation of illuminators, frost protectors and other accessories shall be checked.
- 5.6.2 Displacer Type, Level Transmitter
- Displacer type level transmitter shall be checked by raising and lowering mechanically the displacement and checking the pilot or transmitter action. Check transmitter with out put gauge or meter for smooth and full output change.
  - A check shall be conducted with plumb for a vertical installation.
- 5.6.3 Differential pressure type level transmitter Differential pressure type level transmitter shall be calibrated with pneumatic calibrator at four points prior to installation. A precision meter or gauge shall be used to monitor the output of the transmitter.
- 5.6.4 Tank level gauges
- a) Tank level gauges shall be checked by raising and lowering mechanically the displacer and checking the indicator on the gauge board.
  - b) Check for proper liquid seal prior to installation in case of liquid seal tank gauges.
  - c) In case of servo type gauges, the displacer is hoisted from the tank into the calibration chamber.
- 5.7 Control Valves, shutdown valves and self actuated valves**
- 5.7.1 All diaphragm and piston operated control valve shall be stroked pneumatically using a pressure regulator and pressure gauge against the spring range specified on the name plate of the valve.
- 5.7.2 Mechanical seating and travel of the valve stem shall be checked against the side indicator and the name plate
- 5.7.3 Valve positioned shall be calibrated with the control valve in accordance with the name plate data and specifications with the help of pneumatic calibrator or gauge with precision regulator. Zero position or fully close position of the valve shall be a live zero i.e., the plug shall be just off the seat at the minimum setting.
- 5.7.4 Volume bottles, where used shall be checked for proper filling. The signal line shall be bled to zero pressure and failure action shall be confirmed.
- 5.7.5 Control valve accessories such as handwheels, boosters, relays etc. shall be checked operationally. Declutch able handwheel shall be operable both with and without an air signal to the diaphragm.
- 5.7.6 Self actuated control valves shall be installed as received, checking inlet and outlet points and name plate data. Regulators with external pressure connections shall be inspected for proper installation.
- 5.7.7 Butterfly shall be checked carefully to see that the vane moves freely into the upstream and down stream piping. Proper vane movement to stroke shall be confirmed.
- 5.7.8 All control valves and regulators shall be removed from the line prior to flushing and during hydro testing.
- 5.8 Safety Relief Valves
- 5.8.1 Safety relief valves shall be installed as received after carefully checking the name plate data. Pilots, if used, shall be checked carefully for installation on the proper safety valve.
- 5.8.2 Valves, which are installed in such a manner as to permit on line testing, shall be pressure tested after installation to determine proper operation and setting. Compressed air or nitrogen shall be used for testing of safety relief valves.
- 5.9 Switches
- 5.9.1 Level Switches shall be actuated mechanically for switch operation but shall not be calibrated for level setting.
- 5.9.2 Pressure switches shall be calibrated using hydropic or dead weight tester or precision air regulator

and gauge. The setting/trip point shall be checked using a continuity tester.

- 5.9.3 Temperature switches shall be calibrated using a temperature both prior to installation and set to the required alarm/ trip point using a continuity tester.
- 5.10 Receiver Instruments
- 5.10.1 Receiver Indicator/Recorders
- 5.10.1.1 Pneumatic indicators/ Recorders shall be calibrated using pneumatic calibrator/ precision pressure regulator and gauge.
- 5.10.1.2 Electronics indicators/ Recorders shall be calibrated using a current generator and a precision meter.
- 5.10.1.3 Chart drive assembly shall be checked for proper operation.
- 5.10.2 Controllers
- 5.10.2.1 Proper balancing of the controller shall be checked as per the manufacturers catalogues
- 5.10.2.2 Controllers shall be checked for manual and Auto operation and Transfer. The transfer from manual to Auto and vice versa shall be bumpless and smooth.
- 5.10.3.1 Manual loader station Output of the manual loader shall be checked with a precision meter.
- 5.10.4.1 Multipoint Temperature Recorders Each point shall be calibrated using a temperature simulator/ decade box for RTD / voltage generator and precision meter for the thermocouples.
- 5.10.4.2 Point synchronisation shall be checked.
- 5.10.5 Pneumatic receiver switches shall be calibrated using precision air regulator and gauge. The setting/alarm/trip point shall be checked using continuity tester.
- 5.10.6 Trip Amplifiers Trip amplifiers shall be calibrated using a temperature simulators or voltage generator and precision meter for thermocouple or Resistance box for RTD's. The required setting/ alarm point/ trip point shall be checked using a continuity tester.
- 5.10.7 Receiver Switch module Receiver switch modules shall be calibrated using a current source and a precision meter. The required setting/alarm/trip point shall be checked using a continuity tester.
- 5.10.8 Alarm and Annunciator system
- 5.10.8.1 Alarm and annunciator system shall be checked for visual and audio alarm operation using dummy signals. Full alarm sequence of each alarm point shall be checked.
- 5.10.8.2 Each point shall be checked for proper engraving.
- 5.10.9 Shutdown System
- 5.10.9.1 Operation of final actuating elements shall be checked for proper operation using dummy signals.
- 5.10.9.2 All timers, push buttons and switches shall also be checked for their proper operation.
- 5.11 Analytical Instruments
- 5.11.1 Check the full analyser system including sample handling system for leakage.
- 5.11.2 Check the full sample handling system for its proper operation. Calibrate and check completely all analysers using zero and span samples as per vendor catalogues.
- 5.10.4.1 Multipoint Temperature Recorders  
Each point shall be calibrated using a temperature simulator/ decade box for RTD / voltage generator and precision meter for the thermocouples.
- 5.10.4.2 Point synchronisation shall be checked

- 5.10.5 Pneumatic receiver switches shall be calibrated using precision air regulator and gauge. The setting/alarm/trip point shall be checked using continuity tester.
- 5.10.6 Trip Amplifiers Trip amplifiers shall be calibrated using a temperature simulators or voltage generator and precision meter for thermocouple or Resistance box for RTD's. The required setting/ alarm point/ trip point shall be checked using a continuity tester.
- 5.10.7 Receiver Switch module Receiver switch modules shall be calibrated using a current source and a precision meter. The required setting/alarm/trip point shall be checked using a continuity tester.
- 5.10.8 Alarm and Annunciator system
- 5.10.8.1 Alarm and annunciator system shall be checked for visual and audio alarm operation using dummy signals. Full alarm sequence of each alarm point shall be checked.
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- 5.11 Analytical Instruments
- 5.11.1 Check the full analyser system including sample handling system for leakage.
- 5.11.2 Check the full sample handling system for its proper operation. Calibrate and check completely all analysers using zero and span samples as per vendor catalogues.
- 5.12 Flow computer / Volume corrector
- 5.12.1 Corrected flow values shall be checked for various D.C. inputs and pressure and temperature variations for upscale and downscale ranges.
- 5.13 The list of test and calibration instruments with traceability certificates shall be submitted to MECON for approval before carrying out the tests / calibration of instruments at site.
- 5.14 The formats / description of tests / calibration of all instruments shall be submitted to MECON for approval.
- 5.15 Daily / weekly reports shall be submitted during execution of work at site



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## **SPECIFICATION**

### **FOR INSTRUMENT TUBING**



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- 5.0 REJECTION**

**1.0 GENERAL**

**1.1 Scope**

1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, testing and shipping of Instrument Tubing which includes the following types:-

- a) SS tubes
- b) Copper tubes

1.1.2 The related standards referred to herein and mentioned below shall be of the latest edition prior to the date of Purchaser's enquiry:

ASTM A 269	-	Specification for seamless and welded ferritic stainless steel tubing for general services.
ASTM B 251	-	Specification for general requirements for wrought seamless copper and copper alloy tube.
ASTM B 251M	-	Specification for general requirements for wrought seamless copper and copper alloy tube (Metric)
ASTM B 68	-	Specification for seamless copper tube, bright annealed.
ASTM B 68M	-	Specification for seamless copper tube, bright annealed. (Metric)

1.1.3 In the event of any conflict between these specifications, data sheets, related standards, codes, etc., the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question.

**1.2 Bids**

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of tube which shall provide the following information:

- a) All the details regarding the type, construction, materials etc. of the items.
- b) Overall dimensions in mm.

1.2.2 All the units of measurement and material specifications for various parts in the vendor's specification sheets shall be to same standards as in purchaser's data sheets.

1.2.3 Vendor shall attach a list of items, type wise, summing up all the deviations from this specification and purchaser's data sheets if there are any. Also vendor shall provide reasons for these deviations.

1.2.4 Vendor shall enclose catalogues giving detailed technical specifications and other information for each type of tube in the bid

1.2.5 Vendor's quotation, catalogues, drawings etc. shall be in English language.

**1.3 Drawings, Data and Certification**

Detailed drawings, data, catalogues and manuals etc. required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducible and prints shall be despatched to the address mentioned, adhering to the time limits indicated.

## **2.0 CONSTRUCTION**

### **2.1 Stainless Steel Tubes**

- 2.1.1 SS tubes of the tubes shall be Rockwell RB 70-70. Tubes shall be free from scratches and to be suitable for bending.
- 2.1.3 Tube wall thickness shall be 0.083" for 1/2" OD.
- 2.1.4 Maximum working pressure shall be  $153.0 \text{ kg/cm}^2$  at  $38^\circ \text{C}$  for 1/2" OD Tube, unless otherwise specified and  $80.0 \text{ kg/cm}^2$  at  $38^\circ \text{C}$  for 6mm OD tube.
- 2.1.5 Tubes shall be supplied in minimum length of 6 metres without brazing in between.
- 2.1.6 Dimensional tolerances shall be as per ASTM A 269.
- 2.1.7 The following shall be marked on the tube:
- Name of manufacturer
  - Type and material grade of tube
  - Tube O.D. and wall thickness

### **2.2 Copper Tubes**

#### **2.2.1 Copper Tubes (PVC Jacket)**

- 2.2.1.1 The tube shall be soft annealed copper with 6mm OD and a wall thickness o 1.0 mm as per ASTM B 68M Copper No.C12200.
- 2.2.1.2 The tube shall be jacketed with black PVC. The jacket thickness shall be 1.6mm. The PVC jacket shall confirm to ASTM D-1047.
- 2.2.1.3 The tube ends shall be plugged prior to transportation.
- 2.2.1.4 The tube shall be of continuous length without any brazing in between for 100 metres length.
- 2.2.1.5 Minimum length of single tube shall be 100 metres.
- 2.2.1.6 The dimensional tolerances shall be as per ASTM B 251M

#### **2.2.2 Bare Copper Tubes (For Steam Tracing)**

- 2.2.2.1 The tube shall be soft annealed copper with 3/8" OD or 6mm OD with a wall thickness of 1.0 mm as per ASTM B68 copper No.C12200.
- 2.2.2.2 The tube ends shall be plugged prior to transportation.
- 2.2.2.3 The tube shall be of continuous length without any brazing in between for 100 metres length.
- 2.2.2.4 Minimum length of tube shall be 100 metres.
- 2.2.2.5 The dimensional tolerances shall be as per ASTM B 251.

## **3.0 TESTING**

- 3.1 The following tests shall be done for SS tubes.
- Hardness test
  - Hydrostatic test at  $153.0 \text{ kg/cm}^2$  at  $38^\circ \text{C}$  for 1/2" tube and at  $80.0 \text{ kg/cm}^2$  at  $38^\circ \text{C}$  for 6mm tube, unless otherwise specified.
- 3.2 PVC jacketed copper tubes shall be tested at  $7.0 \text{ kg/cm}^2$  g with dry air for leak check.
- 3.3 Bare copper tubes shall be hydrostatically tested at  $80.0 \text{ kg/cm}^2$  g at  $38^\circ \text{C}$ .



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3.4 Final test before delivery shall include ball test to ensure clear opening of the tube for copper tubes. The O.D of the ball shall be minimum 1mm for 6mm O.D tube and 2mm for 3/8" tube.

**4.0 SHIPPING**

4.1 The tubes shall be plugged at both ends to avoid entry of foreign matter. The tubes shall be packed carefully so as to avoid damage during transport.

**5.0 REJECTION**

Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected

## **SPECIFICATION**

### **FOR INSTRUMENT TUBE FITTINGS**



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- 1.0 GENERAL**
- 2.0 CONSTRUCTION**
- 3.0 TESTING**
- 4.0 SHIPPING**
- 5.0 REJECTION**

## **1.0 GENERAL**

### 1.1 Scope

1.1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, testing and shipping of instrument tube fittings which includes the following types:-

- a) SS compression fittings (SS tube)
- b) Brass compression fittings (copper tube)

1.1.2 The related standards referred to herein and mentioned below shall be of the latest edition prior to the date of Purchase's enquiry:

- ANSI B 2.1 - Pipe Threads
- B16.11 - Forged steelfittings-socket welding and threaded.
- IS:319 - Specification for free cutting brass bars, rods and sections.
- ISA RP 42.1 - Nomenclature for instrument tubing - fittings.

1.1.3 In the event of any conflict between these specifications, data sheets, related standards, codes etc., the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question.

### 1.2 Bids

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of tube fittings which shall provide the following information:

- a) All the details regarding the type, construction, materials, etc. of the items.
- b) Overall dimensions in mm.

1.2.2 All the units of measurement and material specifications for various parts in the vendor's specification sheets shall be to same standards as in purchaser's data sheets.

1.2.3 Vendor shall attach a list of items, typewise, summing up all the deviations from this specification and purchaser's data sheets if there are any. Also vendor shall provide reasons for these deviations.

1.2.4 Vendor shall enclose catalogues giving detailed technical specifications and other information for each type of fitting in the bid.

1.2.5 Vendor's quotation, catalogues, drawings, etc. shall be in English language.

### 1.3 Drawings, Data and Certification

Detailed drawings, data, catalogues and manuals etc., required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducibles and points shall be despatched to the address mentioned, adhering to the time limits indicated.

## **2.0 CONSTRUCTION**

### 2.1 SS Tube fittings:

2.1.1 Nomenclature of all tube fittings shall be as per ISA RP 42.1.

- 2.1.2 Fittings shall be flareless compression type and of three piece construction with ferrule, nut and body suitable for use on SS tubes conforming to ASTM A 269 TP304, hardness not exceeding RB80.
- 2.1.3 All parts shall be of SS 316.
- 2.1.4 Hardness of the ferrules shall be in the range of RB 85-90 so as to ensure a minimum hardness difference of 5 to 10 between tube and fittings, for better sealing.
- 2.1.5 Nuts and ferrules of particular size shall be interchangeable for each type.
- 2.1.6 Spanner hold shall be metric.
- 2.1.7 Threaded ends of fittings shall be NPT as per ANSI B 2.1.
- 2.1.8 Copper Tube Fittings
- 2.2.1 Nomenclature of all tube fittings shall be as per ISA 42.1.
- 2.2.2 Fittings shall be of flareless compression type and of three-piece construction consisting of ferrule, nut and body suitable for use on copper tubes conforming to ASTM B 68/B 68M hardness not exceeding RB 50.
- 2.2.3 All parts shall be manufactured from Brass as per IS 319 barstock and Nickel plated.
- 2.2.4 For better grip, vendor shall maintain hardness difference between tube & ferrule and indicate the same along with the offer.
- 2.2.5 Nuts & ferrules of particular size shall be interchangeable for each type.
- 2.2.6 Threaded ends of fittings shall be NPT as per ANSI B 2.1.
- 2.2.7 Spanner hold shall be metric.
- 2.2.8 Vendor shall ensure that the ferrules and nuts supplied for fittings shall be suitable for sample tube which shall be supplied during manufacture.

### **3.0 TESTING**

- 3.1 Random samples of SS tube fittings shall be hydrostatically tested as follows:-  
For 6 mm fittings at 80.0 kg/cm<sup>2</sup>, 1/2" fittings at 153.0 kg/cm<sup>2</sup> at 38<sup>o</sup>c unless otherwise specified.
- 3.2 Random samples of brass compression fittings shall be hydrostatically tested as follows:-  
For 1/4" fittings, at 10 kg./cm<sup>2</sup>, 3/8" at 80.0 Kg/cm<sup>2</sup> and all at 38<sup>o</sup>C.

### **4.0 SHIPPING**

- 4.1 All thread/ends shall be protected with plastic caps to prevent damage/entry of foreign matter.

### **5.0 REJECTION**

Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected



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## **SPECIFICATION**

### **FOR INSTRUMENT VALVES AND MANIFOLDS**



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- 1.0 GENERAL**
- 2.0 CONSTRUCTION**
- 3.0 TESTING**
- 4.0 SHIPPING**
- 5.0 REJECTION**

## **1.0 GENERAL**

### 1.1 Scope

1.1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, testing and shipping of Instrument Valves & Manifolds which includes the following types:-

- a) Miniature instrument valves
- b) Instrument valve manifolds
- c) Instrument air valves

1.1.2 The related standards referred to herein and mentioned below shall be of the latest edition prior to the date of Purchaser's enquiry:

- ANSI B 2.1 - Pipe threads  
ANSI B 16.11 - Forged steel fittings-socket welding and threaded.

1.1.3 In the event of any conflict between these specifications, data sheets related standards, codes etc, the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question.

### 1.2 Bids

1.2.1 Vendor's quotation shall include a detailed specification sheet for each type of Valves & Manifolds which shall provide the following information:

- a) All the details regarding the type, construction, materials etc. of the items.
- b) Overall dimensions in mm.

1.2.2 All the units of measurement and material specifications for various parts in the vendor's specification sheets shall be to same standards as in purchaser's data sheets.

1.2.3 Vendor shall attach a list of items, typewise, summing up all the deviations from this specification and purchaser's data sheets if there are any. Also vendor shall provide reasons for these in the bid.

1.2.4 Vendor's quotation, catalogues, drawings etc. shall be in English language.

### 1.3 Drawing, Data & Certification

Detailed drawings, data, catalogues and manual etc. required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducible and prints shall be despatched to the address mentioned, adhering to the time limits indicated.

## **2.0 CONSTRUCTION**

### 2.1 Instrument Valves (Miniature)

2.1.1 The instrument valves shall be globe pattern-needle valves forged/ bar stock with inside screwed bonnet.

2.1.2 Body and trim material shall be 304 SS unless otherwise specified.

2.1.3 The valve body rating shall be 3000 lbs unless specified in piping material specification which shall govern in case it is specified

2.1.4 The end connection shall be 1/2" NPTF to ANSI B2.1.

2.1.5 The packing material shall be teflon unless otherwise specified.

2.1.6 The hand wheel material shall be carbon steel zinc plated.

2.1.7 Flow direction shall be marked on the body.

- 2.1.8 The valve dimension shall be as follows:
- a) End to end dimensions 76 mm (approximately).
  - b) Height in fully open condition - 135mm maximum.
- 2.2 VALVE MANIFOLDS
- 2.2.1 3-Valve & 5-Valve manifolds:
- 2.2.1.1 3-Valve manifold shall be designed for direct coupling to differential pressure transmitters having 2 bolt flanges with 54 mm (2-1/8") centre to centre connections and 41.3 mm (1-5/8") bolt to bolt distance. The manifold shall contain two main block valves and an equalizing by-pass valve. The valves shall be needle valves. They shall use self aligning 316SS ball seats.
- 2.2.1.2 5-Valve manifold shall contain two main line block valves and a combination double block and bleed for the bypass line.
- 2.2.1.3 The manifold shall be suitable for mounting directly on the station (2" pipe).
- 2.2.1.4 All bonnets shall have teflon packing unless otherwise specified.
- 2.2.1.5 The material of construction shall be 316 SS unless otherwise specified.
- 2.2.1.6 The material of construction shall be 316SS unless otherwise specified.
- 2.2.1.7 The flanges shall be integral part of the block.
- 2.2.1.8 The process connection shall be 1/2" NPTF to ANSI B2.1
- 2.2.1.9 The manifolds shall be supplied alongwith mounting accessories. The bolts and nuts shall be alloy steel as per ASTM A 193 Gr B ASTM A 194 GR 2H respectively. Rings shall be teflon and other accessories shall be cadmium plated.
- 2.2.1.10 Vendor shall furnish the material certificate for body.
- 2.2.2 3 Way 2 Valve Manifold for pressure gauges.
- 2.2.2.1 The manifold shall be designed for use with pressure gauges.
- 2.2.2.2 The valve shall be a ball valve.
- 2.2.2.3 The body shall be either straight or angle as specified in data sheets.
- 2.2.2.4 The body and trim material shall be 316SS, packing material shall be teflon unless otherwise specified.
- 2.2.2.5 The inlet connection shall be 3/4" plain end (female) for socket weld as per ANSI B 16.11.
- 2.2.2.6 The gauge connections shall be with union nut & tail piece threaded 1/2" NPT (F).
- 2.2.2.7 The drain connection shall 1/2"NPTF.
- 2.3 Instrument Air Isolation Valves
- 2.3.1 The valves shall be full bore ball valves.
- 2.3.2 Body material shall be Nickel or Cadmium plated carbon steel.
- 2.3.3 Trim material shall be 316SS.
- 2.3.4 The end connection shall be 1/2" NPTF to ANSI B2.1 unless otherwise specified.
- 2.3.5 The packing material shall be teflon.
- 2.3.6 The handle/wrench material shall be cadmium or nickel plated carbon steel.
- 2.3.7 The valve body rating shall be ANSI 800 lb
- 2.3.8 End to end dimensions shall be 70mm (approximately).



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**3.0 TESTING**

- 3.1 The instrument valves (miniature) shall be hydrostatically tested at  $200\text{kg/cm}^2\text{g}$  at  $38^{\circ}\text{C}$ .
- 3.2 All manifolds (3 valves, 5 valves and 3 ways, 2 valves) shall be hydrostatically tested at  $200\text{ kg/cm}^2$  at  $38\text{C}$ .
- 3.3 The instrument air valves shall be hydrostatically tested at  $15.0\text{ kg/cm}^2\text{g}$  at  $38^{\circ}\text{C}$  and at  $10.5\text{ kg/cm}^2\text{g}$  with dry air.

**4.0 SHIPPING**

- 4.1 All threads/ends shall be protected with plastic caps to prevent damage/entry of foreign matter.

**5.0 REJECTION**

Vendor shall make his offer in detail, with respect to every item of the purchaser's specifications. Any offer not conforming to this shall be summarily rejected.



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<b>BHAGYANAGAR GAS LIMITED</b> City Gas Distribution project	<b>MANUAL BALL VALVES ABOVEGROUND SERVICES SIZE - 2" AND ABOVE DATA SHEET</b>	<b>DATA SHEET No.</b> P.019141 G11087 M001 (VBA-3C1)
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**I. PROCESS DATA :**

- PIPE CLASS	:	3C1	- CORROSION ALLOWANCE	:	1.6 mm
- FLUID	:	Natural Gas			
- FLUID SYMBOL	:	NG			
<b><u>OPERATING CONDITION</u></b>					
TEMPERATURE (°C)	:	10 - 50			
PRESSURE (Barg)	:	19 - 45			
<b><u>DESIGN CONDITION</u></b>					
TEMPERATURE (°C)	:	0 - 65			
PRESSURE (Barg)	:	49			

**II. VALVE DATA :**

- APPLICABLE SPECIFICATION	:	PTS - Pipeline valves			
- CONSTRUCTION DESIGN	:	API 6D			
- PIPE CLASS	:	3C1			
- RATING	:	300#			
- VALVE BORE	:	Full Bore			
- TYPE	:	2" - 4" - FLOATING BALL 6" & ABOVE - TRUNNION MOUNTED - DOUBLE BLOCK AND BLEED			
- END CONNECTION	:	BW/Flange End			
- BODY MATERIAL	:	ASTM A 216 GR. WCB / ASTM A 234 GR. WPB			
- BALL MATERIAL	:	(ASTM A 216 GR. WCB / ASTM A 234 GR. WPB) + MINIMUM 75 MICRONS ENP			
- BODY SEAT RINGS	:	AISI 4140 + MINIMUM 75 MICRONS ENP COATING / AISI 410			
- SEAT SEAL	:	VITON / DEVLON			
- STEM	:	AISI 4140 + MINIMUM 75 MICRONS ENP COATING / AISI 410			
- STEM SEALS	:	VITON / PTFE			
- STUD BOLTS/NUTS	:	ASTM A 193 Gr. B7 / ASTM A 194 GR. 2H			
- PRIMARY SEAT	:	METAL TO METAL			
- SECONDARY SEAT	:	DEVLOK / RPTFE or Equivalent			
- FIRE SAFE	:	YES (Bidder to submit documentry proof)			
- ANTISTATIC	:	YES			
- ANTI-BLOW OUT	:	YES			
- EXTENSION STEM	:	NO			
<b><u>PUPS (Applicable only for BW end)</u></b>					
LENGTH	:	Min. 150 mm for size upto 8" & Minimum 250 mm for size greater than 10"			
MATERIAL OF CONSTRUCTION	:	for 2" TO 8" size - API 5L GR.-X52 PSL2 for 10" TO 16" size - API 5L GR.-X56 PSL2			
THICKNESS	:	See PMS			
<b><u>PAINTING (Refer Annexure II of PTS)</u></b>					
Surface preparation	:	SA 2.5			



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Primer	:	30 - 40 µm	See Para.11 of PTS- PIPELINE VALVES & Painting
Finish	:	30 - 40 µm	System & Colour Code for Final Layer (P.019141
Final Paint DFT	:	300 µm (min.)	G11077 M005 & P.019141 G11077 M012)
- <b>INSULATION</b>	:	NO	

12.08.2021	0	AHR	SSA	SSM	ISSUED FOR PROCUREMENT	
DATE	REV	PREP	CHK	APP	DESCRIPTION	



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BHAGYANAGAR GAS LIMITED City Gas Distribution Project	MANUAL BALL VALVES ABOVEGROUND SERVICES SIZE - BELOW 2" DATA SHEET	DATA SHEET No. P.019141 G 11087 M003 (VBA-3C1)
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**I GENERAL**

- VALVE MANUFACTURER -
- ACTUATOR MANUFACTURER NA

**II VALVE DESIGN CONDITIONS**

- CORROSION ALLOWANCE 1.6 mm
- SERVICE Gas
- DESIGN PRESSURE (Barg) 49
- TEMPERATURE (°C) 0 to 65

**III. CONNECTING PIPE DETAILS**

- MATERIAL See PMS
- DIAMETER (OD) See PMS
- THICKNESS See PMS

**IV. VALVE CONSTRUCTION DESIGN :**

- APPLICABLE SPECIFICATION PTS - Pipeline valves
- CONSTRUCTION DESIGN ISO EN 17292
- PIPE CLASS 3C1
- RATING 800 #
- INSTALLATION ABOVE GROUND
- VALVE BORE AS per M.R.
- VALVE BODY FULLY WELDED / BOLTED
- TYPE FLOATING BALL
- VALVE OPERATION WRENCHED OPERATED
- END CONNECTION SW,
- FACE FINISH (Flanged End) 125 AARH

**V VALVE MATERIAL SPECIFICATION**

*PART  
DESCRIPTI  
ON*

- BODY

- BALL

- SEAT

- STEM

- GASKET  
&  
PACKIN  
G

- TRIM

- LENGTH OF EXTENSION STEM

- PUPS (Applicable only for BW end) As per MR

Length : 100 MM

Material of Construction : ASTM A 106

Thickness : SCH. 80

- PAINTING

Surface preparation : SA 2.5

Primer : Type of Paint, Total DFT shall be as per paint system no. chosen from Table 5, ISO 12944-5 for highly corrosive environment, Final Shade shall be as per Painting Specification no. P.019141G11077 M012

Finish :

Final Paint DFT : 300 µm (min.)

- INSULATION NO

DATE	REV	PREP BY	CHECK BY	APPR BY	DESCRIPTION



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<i>SPECIFIED MATERIAL</i>	<i>OFFERED MATERIAL</i>
ASTM A 105	*
ASTM A182 GR.F316	*
RPTFE WITH SECONDARY METAL TO METAL	*
ASTM A182 GR.F316	*
GRAPHITE	*
ASTM A 182 F6	*
Not Applicable	



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<b>BHAGYANAGAR GAS LIMITED City Gas Distribution Project in UP &amp; UK Cluster GA's</b>	<b>MANUAL BALL VALVES ABOVEGROUND SERVICES SIZE - BELOW 2" DATA SHEET</b>	<b>DATA SHEET No. P.019141 G 11087 M003 (VBA-3C1)</b>
		<b>Page 2 of 2</b>

**VI TEST**

- HYDROSTATIC SHELL TEST :

Test pressure	:	1.5 x Design Pressure	Test Medium :	Water
Test Duration	:	15 mins.		

- HYDROSTATIC SEAT TEST :

Test pressure	:	1.1 x Design Pressure	Test Medium :	Water
Test Duration	:	5 mins.		

- PNEUMATIC SEAT TEST :

Test pressure	:	6 barg	Test Medium :	Air
Test Duration	:	5 mins.		

- FUNCTIONAL TEST :

Test pressure	:	3 Opening / Closing		
	:	Atmospheric & Maximum differential pressure		

- EXTERNAL LEAK TEST :

at inner pressure of 6 barg with soap suds to check external leak of Body, Stem and all external taps.

- TORQUE TEST :

Yes

- ANTISTATIC TEST :

BS 5146

- VISUAL AND DIMENSIONAL  
EXAMINATION TEST:

55 / API 1104	:	MSS-SP-
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- FIRE TEST :

API 6FA

**IV QUALITY CONTROL**

: See quality control table for valves

- **MATERIAL CERTIFICATES  
PARTS OF**

: ALL PRESSURE RETAINING AND PRESSURE CONTROLLING  
VALVES SHALL BE SUPPLIED WITH EN 10204 - 3.1  
CERTIFICATES.

- **ALL TEST CERTIFICATES  
PHYSICAL**

: TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC,  
IMPACT, CHEMICAL, PAINTING ETC.

**NOTES:-**

- Unless otherwise stated, all tests will be witnessed by the purchaser/control authority.

19.07.2022	0	SSA	MS	SSM	Issued for Procurement
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<b>BHAGYANAGAR GAS LIMITED</b> City Gas Distribution project IN HYDERABAD GA	<b>MANUAL GLOBE VALVES</b> <b>ABOVEGROUND SERVICE</b> <b>SIZE 2" AND ABOVE</b> <b>DATA SHEET</b>	DATA SHEET NO. P.019141 G11087 M002A  (VGA-3C1)  Page 1 of 2
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**I. PROCESS DATA**

- PIPE CLASS : 3C1 - CORROSION ALLOWANCE : 1.6 mm
- FLUID : Natural Gas
- Fluid Symbol : NG
- OPERATING CONDITIONS
  - Pressure (barg) : 15-35
  - Temperature (°C) : 10 - 50
- DESIGN CONDITIONS
  - Pressure (barg) : 49
  - Temperature (°C) : 0 to 65

**II. VALVE DATA**

- CONSTRUCTION DESIGN : BS 1873
- TYPE : HIGH RESISTANCE TO VIBRATIONS AND HIGH DIFFERENTIAL PRESSURE  
: BILINEAR OR EQUAL %  
: Uni-Directional  
: GLAND TYPE-BOLTED BONNET-NON ROTATING STEM
- PATTERN : STRAIGHT THROUGH GLOBE
- END CONNECTION : Refer MR
- FACE TO FACE : ANSI B16.10
- BODY MATERIAL : ASTM A 216 GR. WCB / ASTM A 234 GR. WPB
- DISC MATERIAL : 13% CR. STEEL / SS304L
- SEAT : 13% CR. STEEL / SS304L
- TRIM : 13% CR. STEEL / SS304L
- STEM : 13% CR. STEEL / SS304L
- GASKET : GRAPHITE
- PACKING : GRAPHITE
- OPERATOR : HANDWHEEL OPERATED
- PAINTING
  - Surface preparation : SA 2.5
  - Primer : Type of Paint, Total DFT shall be as per paint system no. chosen from Table 5, ISO 12944-5 for highly corrosive environment, Final Shade shall be as per Painting Specification no. P.019141G11077 M012
  - Finish : environment, Final Shade shall be as per Painting Specification no. P.019141G11077 M012
  - Final Paint DFT : 300 µm (min.)
- INSULATION : No

19.07.20212	0	AHR	SSA	SSM	Issued for Tender
<b>DATE</b>	<b>REV</b>	<b>PREPARED BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>	<b>DESCRIPTION</b>



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<b>BHAGYANAGAR GAS LIMITED</b> City Gas Distribution project	<b>MANUAL GLOBE VALVES</b> <b>ABOVEGROUND SERVICE</b> <b>SIZE LESS THAN 2"</b> <b>DATA SHEET</b>	DATA SHEET NO. P.019141 G11087 M002
		(VGA-3C1) Page 1 of 2

**I. PROCESS DATA**

- PIPE CLASS : 3C1 - CORROSION ALLOWANCE : 1.6 mm
- FLUID : Natural Gas
- Fluid Symbol : NG
- OPERATING CONDITIONS
  - Pressure (barg) : 15-35
  - Temperature (°C) : 10 - 50
- DESIGN CONDITIONS
  - Pressure (barg) : 49
  - Temperature (°C) : 0 to 65

**II. VALVE DATA**

- CONSTRUCTION DESIGN : ISO 15761
- TYPE : HIGH RESISTANCE TO VIBRATIONS AND HIGH DIFFERENTIAL PRESSURE  
: BILINEAR OR EQUAL %  
: Uni-Directional  
: GLAND TYPE-BOLTED BONNET-NON ROTATING STEM
- PATTERN : STRAIGHT THROUGH GLOBE
- END CONNECTION : SW
- FACE TO FACE : ANSI B16.10
- BODY MATERIAL : ASTM A 105
- DISC MATERIAL : 13% CR. STEEL/ SS304L
- SEAT : 13% CR. STEEL/ SS304L
- TRIM : 13% CR. STEEL/ SS304L
- STEM : 13% CR. STEEL/ SS304L
- GASKET : GRAPHITE
- PACKING : GRAPHITE
- OPERATOR : HANDWHEEL OPERATED
- PAINTING
  - Surface preparation : SA 2.5
  - Primer : Type of Paint, Total DFT shall be as per paint system no. chosen from Table 5, ISO 12944-5 for highly corrosive environment, Final Shade shall be as per Painting Specification no. P.019141G11077 M012
  - Finish : environment, Final Shade shall be as per Painting Specification no. P.019141G11077 M012
  - Final Paint DFT : 300 µm (min.)
- INSULATION : No

12.08.2021	0	AHR	SSA	SSM	Issued for Tender
<b>DATE</b>	<b>REV</b>	<b>PREPARED BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>	<b>DESCRIPTION</b>



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<b>BHAGYANAGAR GAS LIMITED</b> City Gas Distribution project UP & UK Cluster GA's	<b>MANUAL GLOBE VALVES</b> <b>ABOVEGROUND SERVICE</b> <b>SIZE LESS THAN 2"</b> <b>DATA SHEET</b>	DATA SHEET NO. P.019141 G11087 M002
		(VGA-3C1) Page 2 of 2

**III. VALVE INSPECTION AND TESTING**

- SHELL TEST : SEE API 598 / BS 6755
- BACKSEAT TEST : SEE API 598 / BS 6755
- LOW -PRESSURE CLOSURE TEST : SEE API 598 / BS 6755
- HIGH-PRESSURE CLOSURE TEST : SEE API 598 / BS 6755
- VISUAL EXAMINATION OF CASTINGS : SEE API 598 / BS 6755
- HIGH-PRESSURE PNEUMATIC SHELL TEST : SEE API 598 / BS 6755

NOTE : Unless otherwise stated, all tests will be witnessed by the purchaser.

**IV. QUALITY CONTROL**

(See Quality Control Table for CS valves)

- MATERIAL CERTIFICATES ALL PRESSURE RETAINING AND PRESSURE CONTROLLING PARTS OF VALVES SHALL BE SUPPLIED WITH EN 10204 - 3.1 CERTIFICATES.
- ALL NECESSARY CERTIFICATES TEST CERTIFICATES INCLUDING, FIRE SAFE, ANTISTATIC, PHYSICAL IMPACT, CHEMICAL, PAINTING ETC.

19.07.2022	0	AHR	SSA	SSM	Issued for Tender
<b>DATE</b>	<b>REV</b>	<b>PREPARED BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>	<b>DESCRIPTION</b>



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PRESSURE RELIEF VALVE						
UNITS: Flow<> Liquid- m <sup>3</sup> /hr Gas- Sm <sup>3</sup> /hr Steam- kg/hr Pressure-> kg/cm <sup>2</sup> G Temperature<> oC Level/Length<> mm						
General	1	Tag No.	Quantity			*
	2	Line No.	Schedule			*
	3	Vessel No.			*	
	4	Safety / Relief			Safety relief	
Valve	5	Full Nozzle Full Lift/Mod. Nozzle			Full nozzle full lift	
	6	Bonnet type			Closed	
	7	Conv./Bellows/Pilot Operated			Conventional	
	8	Inlet Conn.	Size & Rating			*
	9		Facing & Finish			*
	10	Outlet Conn.	Size & Rating			*
	11		Facing & Finish			*
	12	Cap Over Adj. Bolt			Yes	
	13		Screwed / Bolted			Bolted
	14	Lifting Gear - Type				
Material	15	Test Gag			Yes	
	16					
	17					
	18	Body and Bonnet			A351 CF8M	
	19	Nozzle and Disc			SS316	
	20	Spring			SS304	
Options	21	Bellows			--	
	22					
	23					
	24	Resilient Seat Seal			--	
Basis	25					
	26					
	27	Code			API	
Service conditions	28					
	29					
	30	Fluid	State	Natural Gas		Gas
	31	Corrosive Constituent				
	32	Required Flow Capacity				
	33	Mol.Wt.	S.G. at Rel. Temp			
	34	Oper. Pressure	Normal			
	35	Oper. Temp.	Rel. Temp.			
	36	Valve Discharges to			Atmosphere	
	37	Back Press.	Const. Or Variable			Variable
	38	Set Pressure				
	39	Cold Bend Test Pressure				
	40	% Over Pressure	% Blow Down	21%		
	41	Cp/Cv	Compressibility Factor			
Orifice	42	Viscosity @ Rel. Temp.	mPas(cP)			
	43	Vess. Wall Temp.	Surf.Area-m2			
	44					
	45	Calculated Area cm2			*	
	46	Sel. Area cm2	Orifice Design			*
	47	No. of Valves Reqd. for capacity			*	
	48	Tota Area - cm2			*	
	49	Actual Flow Capacity			*	
	50					
	51	Model No.			*	
52	IBR Certification			No		
53						
54						

NOTES:  
\*1 : Venodr to furnish

DEVIATION

NO DEVIATION

VENDOR'S SIGNATURE WITH SEAL

Document No.	P.019141 G11087 M003					
Sheet 1 of 1	CLIENT:					
	PROJECT: City Gas Distribution project					
		0	12.08.2021	AHR	SHD	SSM
	VENDOR:	REV.	DATE	PREP	CHKD	APPD



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		QUALITY ASSURANCE PLAN BALL VALVES SIZE BELOW 2 INCH				QAP No. : P.019141 G11013 M002		
						Date: 27.09.2024	Revision: 0	
						Prepared : AML		
						Checked : GGA		
						Approved : SSM		
Sl. Nos.	ACTIVITY	GTS / PTS	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.				Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
<b>CONTROL BEFORE MANUFACTURING</b>								
1	- list of operation in manufacturing and control	3	ASME B16.34  Relavant Standard	specification		Perform	review point	review point
	- material part list	6.1.		specification		Perform	review point	review point
	- dimensional drawings	6.1.		specification		Perform	review point	review point
	- calculation butt welding ends	6.1. / 6.2.2.		specification		Perform	review point	review point
	- calculation of body bolting, Bonnet, Cover (For Pressure Retaining Parts)	6.2.8.		specification,		Perform	review point	review point
	- Fixation of Operation Methodology	6.3		specification, Data Sheet		Perform	review point	review point
	- qualified welding procedures/welders performances qualification record	8.1, 8.2, 10.2		specification		Perform	review point	review point
	- heat treatment procedure	8.3		specification		Perform	review point	review point
	- non destructive testing procedures	8.5		specification		Perform	review point	review point
	- pressure test procedure	8.6.6		specification		Perform	review point	review point
- painting procedure	11	specification		Perform	review point	review point		
<b>2 CONTROL ON RECEIPT OF MATERIAL</b>								
2A	<b>Valve BODY:</b>	7	ISO EN 17292 / Relavant Standard					
	Casting/Forging			GTS / PTS	certif. 3.1	Perform	review point	review point
	Chemical Testing, <b>Carbon Equivalent</b>			GTS / PTS	certif. 3.1	Perform	review point	review point
	Heat Treatment							
	Mechanical tests ( YS, TS, % EL, Ys/ TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA)			GTS / PTS	certif. 3.1	Perform	review point	review point
Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans) (Remark : marking transfer by TPIA)			- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.1	Perform	review point	review point	



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UT of Forging Body (100%)	-	ASME B 16.34	ASME B 16.34, App IV	certif. 3.1	Perform	review point	review point
Radiography Test of Casting Body (100%)	-	ASME B 16.34	ASME B 16.34	certif. 3.1	Perform	review point	review point
Wet magnetic Particle Examination (100% External & accessible Internal)	-	ASME B 16.34	ASME B 16.34	certif. 3.1	Perform	review point	review point
<b>FLANGES:</b>							
Chemical Testing, <b>Carbon Equivalent</b>			GTS / PTS	certif. 3.1	Perform	review point	review point
Heat Treatment		Relavant Standard	GTS / PTS	certif. 3.1	Perform	review point	review point
Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA)		ASTM A370	GTS / PTS City Gas Distribution	certif. 3.1	Perform	review point	review point

Sl. Nos.	ACTIVITY	GTS / PTS chap.	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
						Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
<b>QUALITY ASSURANCE PLAN</b>						QAP No. : P.019141 G11013 M002		
<b>BALL VALVES</b>						Date: 27.09.2024 Revision: 0		
<b>SIZE BELOW 2 INCH</b>						Prepared : AML		
						Checked : GGA		
						Approved : SSM		
2B	Charpy-test at 0°C and as per Material requirement 2 test sets (1 long/1 trans.) (Remark : marking transfer by TPIA)	-	ASTM A370	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.1	Perform	review point	review point
	UT of Forging Body (100%)	-	ASME B 16.34	ASME B 16.34, App IV	certif. 3.1	Perform	review point	review point
	Wet magnetic Particle Examination (100% External & accessible Internal)		ASME B 16.34	ASME B 16.34	certif. 3.1	Perform	review point	review point
	<b>LATERAL CONNECTIONS:</b>						review point	
	Chemical Testing, <b>Carbon Equivalent</b>			GTS / PTS	certif. 3.1	Perform	review point	review point
	Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA)		ASTM A370	GTS / PTS	certif. 3.1	Perform	review point	review point




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2C	Charpy-test at 0°C and as per Material requirement 2 test sets (1 long/ 1 trans.) (Remark : marking transfer by TPIA)	7	ASTM A370	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.1	Perform	review point	review point
	UT of Forging Body (100%)	-	ASME B 16.34	ASME B 16.34, App IV	certif. 3.1	Perform	review point	review point
	Radiography Test of Casting Body (100%)	-	ASME B 16.34	ASME B 16.34	certif. 3.1	Perform	review point	review point
	Wet magnetic Particle Examination (100% External & accessible Internal)	-	ASME B 16.34	ASME B 16.34	certif. 3.1	Perform	review point	review point
2D	<b>EXTENSION PIPE PIECES AS PER DATA SHEET</b>	7		GTS / PTS	certif. 3.1	Perform	review point	review point
	<b>Chemical Test, Carbon Equivalent</b>						review point	
	Mechanical tests (Remark : marking transfer by TPIA)		ASTM A370				review point	
	Charpy-test at 0°C and as per Material requirement 2 test sets (1 long/ 1 trans.) (Remark : marking transfer by TPIA)		ASTM A370				- at 0°C, for Base - 40J/cm <sup>2</sup> (Avg.), 32J/cm <sup>2</sup> (Ind.), - at 0°C, for Weld/HAZ - 27J/cm <sup>2</sup> (Avg.), 22J/cm <sup>2</sup> (Ind.)	
<b>BALL / OBTURATOR (Note -7):</b>								
Chemical Testing, Carbon Equivalent			GTS / PTS	certif. 3.1	Perform	review point	review point	

 <b>Bhayanagar Gas Limited</b>	<b>Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA</b>  <b>Bid Document No: BGL/693/2025-26</b>	<b>Volume II of II</b>
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		<b>QUALITY ASSURANCE PLAN BALL VALVES SIZE BELOW 2 INCH</b>				QAP No. : P.019141 G11013 M002		
						Date: 27.09.2024	Revision: 0	
		Prepared : AML						
		Checked : GGA						
		Approved : SSM						
Sl. Nos.	ACTIVITY	GTS / PTS	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.				Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
2E	- Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness of Base ENP Coating etc) (Remark : marking transfer by TPIA)	7	Relavant Standard	GTS / PTS	certif. 3.1	Perform	review point	review point




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		QUALITY ASSURANCE PLAN BALL VALVES SIZE BELOW 2 INCH				QAP No. : P.019141 G11013 M002 Date: 27.09.2024 Revision: 0 Prepared : AML Checked : GGA Approved : SSM		
Sl. Nos.	ACTIVITY	GTS / PTS	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.				Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
	UT of Forging Body (100%) OR		ASME B 16.34	ASME B 16.34, App IV	certif. 3.1	Perform	review point	review point
	Radiography Test of Casting Body (100%)		ASME B 16.34	ASME B 16.34	certif. 3.1	Perform	review point	review point
2F	<b>SEAT:</b> - Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA), - Chemical tests, Carbon equivalent	7	Relavant Standard	GTS / PTS	certif. 3.1	Perform	review point	review point
	Wet magnetic Particle Examination (All accessible area)	-	ASME B 16.34	ASME B 16.34	certif. 3.1	Perform	review point	review point
2G	<b>STEM:</b> -Chemical Testing, Carbon equivalent	7		GTS / PTS	certif. 3.1	Perform	review point	review point
	-Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness of Base and ENP coating etc) (Remark : marking transfer by TPIA)		ASTM A370	GTS / PTS	certif. 3.1	Perform	review point	review point
	UT of Forging Body (100%)	-	ASME B 16.34	ASME B 16.34, App IV	certif. 3.1	Perform	review point	review point
	Wet magnetic Particle Examination (All accessible area)	-	ASME B 16.34	ASME B 16.34	certif. 3.1	Perform	review point	review point
2H	<b>STUDS/NUTS (With Xylan Coating)</b> -Chemical Testing, Carbon Equivalent	7		GTS / PTS				
	- Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA)		ASTM A370	GTS / PTS	certif. 3.1	Perform	review point	review point
				GTS / PTS	certif. 3.1	Perform	review point	review point
2I	<b>VENT/BLEED PLUG:</b> - "Chemical test,"Mechanical tests	7	Relavant Standard	GTS / PTS	certif. 3.1	Perform	review point	review point
				GTS / PTS				
2J	<b>DRAIN: OPEN BLOCK VALVE AT DRAIN TAP:</b>	7		GTS / PTS	certif. 3.1	Perform	review point	review point

 <b>Bhayanagar Gas Limited</b>	<h2 style="margin: 0;">Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA</h2> <h3 style="margin: 0;">Bid Document No: BGL/693/2025-26</h3>	<b>Volume II of II</b>
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	- 'Chemical test, mechanical tests		Relavant Standard	GTS / PTS				
<b>2K</b>	<b><u>DRAIN: UPPER BALL VALVE &amp; NEEDLE VALVE:</u></b>	7		GTS / PTS	certif. 3.1	Perform	review point	review point
	- 'Chemical Test, Mechanical tests		Relavant Standard	GTS / PTS				
<b>2L</b>	<b><u>STEM &amp; SEAT SEALING CONNECTION :</u></b>	7		GTS / PTS	certif. 3.1	Perform	review point	review point
	- Chemical Test, Mechanical tests		Relavant Standard	GTS / PTS				
<b>2M</b>	<b><u>OTHER VALVE PARTS INCLUDING PIPE PUP PIECE</u></b>	7		GTS / PTS	certif. 3.1	Perform	review point	review point
	- Mechanical and Chemical tests		Relavant Standard	GTS / PTS				
				GTS / PTS				

	<b>QUALITY ASSURANCE PLAN BALL VALVES SIZE BELOW 2 INCH</b>	QAP No. : P.019141 G11013 M002 Date: 27.09.2024      Revision: 0 Prepared : AML Checked : GGA Approved : SSM
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Sl. Nos.	ACTIVITY	GTS / PTS chap.	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
						Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
<b>3</b>	<b>FABRICATION AND TESTS</b>							
3.1	<b>Welds and repair welds shall be performed according to written qualified procedures</b>	8.1 - 8.2	ASME IX + spec. / API 6D + GTS / PTS	ASME IX + spec.	Welding Procedure Specification (WPS)	Perform	review point	review & approval point
3.1.1	Heat treatment fully welded valve and test pieces	8.3	ASME VIII Div.1 / API 6D + GTS / PTS	ASME VIII Div.1	review CTT/TT curves	Perform	review report	review report
3.1.2	Mechanical tests (Remark : marking transfer by TPIA)	8.4.1	ASTM A370	GTS / PTS	certif. 3.1	Perform	review point	review report
3.1.3	Charpy-test at 0°C and as per Material requirement 2 test sets (1 long/1 trans.) (Remark : marking transfer by TPIA)	8.4.2	ASTM A370	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.1	Perform	review point	review report
3.3	(if feasible) RT on butt welds	8.5.1	ASME SECT V art. 2 / API 6D + GTS / PTS	ASME SECT. VIII, div.1, UW 51.	(RT-Test report)	Perform	review point	review point
	(if not feasible & thk. > 15mm) UT on butt welds	8.5.1	ASME SECT V art. 5 / API 6D + GTS / PTS	ASME SECT. VIII, div.1, App.12	UT-Test report	Perform	review point	review point



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3.4	Butt welding ends on cast bodies shall be examined before fabrication welding end by radiography (Over a width of 70mm)(not applicable for forged bodies)	8.5.1	ASME SECT V art. 2 / API 6D + GTS / PTS	MSS-SP-55	(RT-Test report)	Perform	review point	review point
3.5	UT on 25 mm of base mat. (at each side) and each weld(100%)	8.5.1	ASME SECT V art. 5 / API 6D + GTS / PTS	ASME SECT. VIII, dic.1, App.12	UT-Test report	Perform	review point	review point
3.6	Magnetic Particulate Examination on valve body 10 % valves < 6" 100% valves ≥ 6"	8.5.1	ASME SECT V art. 7 / API 6D + GTS / PTS	ASME SECT. VIII App.6	MPE-Test report	Perform	review point	review point
3.7	Visual examination	8.5.1	Sec 8 proc.7 / API 6D + GTS / PTS	MSS-SP-55	report	Perform	review point	review point
3.8	Dimensional examination	8.5.1	Sec 8 proc.24 / API 6D + GTS / PTS	DWG **	report	Perform	review point	review point
4	<b>Finished bevel end pipe used for field welding :</b>							
4.1	Magnetic Particle Examination / Liquid Penetrant Examination	8.5.1	ASME SECT V art. 7 ASME SECT V art. 6 / API 6D + GTS / PTS	unacceptable defects : defects not parallel to the surface extending into the bevel + defect extending into the bevel provided the lamination is parallel to the surface and has a transverse dimension exceeding 6.35 mm	MPE/ LPE-Test report	Perform	review point	review point
4.2	UT inspection on 50 mm of base material	8.5.1	ASME SECT V art. 5 / API 6D + GTS / PTS	ASME SECT. VIII, div.1, App.12	UT-Test report	Perform	review point	review point
4.3	RT inspection on 50 mm of base material	8.5.1	ASME SECT V art. 5 / API 6D + GTS / PTS	ASME SECT. VIII, div.1, App.12	UT-Test report	Perform	review point	review point
4.4	Visual and dimensional examination	8.5.1	Sec 8 proc.7 / API 6D + GTS / PTS	MSS-SP-55 +DWG**	report	Perform	review point	review point
5	<b>FINAL INSPECTION TEST</b>							

Sl. Nos.	ACTIVITY	GTS / PTS		Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.					Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
5.1	Hydrostatic Shell Test	8.6.2		API 6D + GTS / PTS	@ 1.5 x Design Pr., 30 Min(NPS>18") / 15 Min(NPS<16"),	certif. 3.1	Perform	review point	witness point
5.2	Hydrostatic Seat Test	8.6.3		API 6D + GTS / PTS	@ 1.1 x Design Pr., 5 Min.	certif. 3.1	Perform	review point	witness point
5.3	Pneumatic Test (with nitrogen) ( Shell & Seat)	8.6.5		GTS / PTS	@ 95 barg for 5 min.	certif. 3.1	Perform	review point	witness point
5.4	External leak testing (with Soup suds)	8.6.4		GTS / PTS	@ 6 bar	certif. 3.1	Perform	review point	witness point

QAP No. : P.019141 G11013 M002  
Date: 27.09.2024 Revision: 0  
Prepared : AML  
Checked : GGA  
Approved : SSM



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5.5	Air seat test	8.6.5	GTS / PTS	@ 7 bar, 5 Min.	certif. 3.1	Perform	review point	witness point
5.7	Functional Test (10 Opening / Closing with Operator mounted on the valve at 95 barg)	x	API 6D/API 598 + GTS / PTS	API 6D/ API 599	certif. 3.1	Perform	review point	witness point
5.8	Antistatic Test	x	BS 5351 + GTS / PTS	BS 5351 + specification	certif. 3.1	Perform	review point	witness point
5.9	Operational torque Test	8.7	API 6D		report	Perform	review point	witness point
5.10	Fire Safe Test	8.8	API 6FA	API6FA	report	Perform	review point	review report
5.11	Visual examination	8.10	Sec 8 proc.7 / API 6D + GTS / PTS	MSS-SP-55 / GTS / PTS	report	Perform	review point	review report
5.12	Dimensional examination	8.10	Sec 8 proc.24 / API 6D + GTS / PTS	DWG **	report	Perform	review point	review report
6	Marking	9	section 9 of specification / API 6D + GTS / PTS	section 9 specification	report	Perform	review point	review report
6.1	Inspector's stamp	9.1.2	section 9 of specification / API 6D + GTS / PTS	section 9 specification			review point	review report
7	Painting And Coating	11	SIS055900	SA2.5, Cl.11 of Specification	report	Perform	review point	review report
8	Control of all certificates & Final Certificate	10	section 10 of specification	section 10 of specification	certif. 3.1	Perform	review point	review report

**LEGENDS:**

<b>RT:</b> Radiographic test	<b>PT:</b> Liquid penetrant test	<b>MT:</b> Magnetic particle test	<b>TPIA:</b> Third Party Inspection Agency; .	<b>Control Authority :</b> Owner / Owner's representatives
<b>P:</b> Performed	<b>R:</b> Review	<b>W:</b> Witness	<b>RW:</b> Random Witness	

**Hold point** = No further steps may be undertaken before the intervention of the appointed responsible takes place.

**Witness point** = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

- Note:**
- The above testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure and that the product also comply to the additional requirements as per Technical specifications and data sheets.
  - The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Owner/Owner's representative.
  - Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval.
  - TPIA along with Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. submitted by supplier.
  - For All Forging Materials, The Specimen Shall Be Taken From The Integral Part of The Forging.
  - Heat treatment start and stop temperature chart shall be witnessed & signed by TPIA. Power failure log book / sheet shall be maintained
  - TPIA shall ensure that Ball and Stem are Electroless Nickel Plated (ENP) with minimum thickness of 75 microns as per data sheet requirement.
  - Contractor in coordination with Supplier/Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organise Inspection.
  - Certification requirements shall comply with European Standard EN 10204 (latest edition)
  - In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable.



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		QUALITY ASSURANCE PLAN BALL VALVES SIZE 2 INCH AND ABOVE				QAP No. : P.019141 G11013 M002		
						Date: 26.09.2024	Revision: 0	
						Prepared : AML		
						Checked : GGA		
						Approved : SSM		
Sl. Nos.	ACTIVITY	GTS / PTS	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.				Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
<b>CONTROL BEFORE MANUFACTURING</b>								
1	- list of operation in manufacturing and control	3	ASME B16.34  Relavant Standard	specification		Perform	review point	review point
	- material part list	6.1.		specification		Perform	review point	review point
	- dimensional drawings	6.1.		specification		Perform	review point	review point
	- calculation butt welding ends	6.1. / 6.2.2.		specification		Perform	review point	review point
	- calculation of body bolting, Bonnet, Cover (For Pressure Retaining Parts)	6.2.8.		specification,		Perform	review point	review point
	- Fixation of Operation Methodology	6.3		specification, Data Sheet		Perform	review point	review point
	- qualified welding procedures/welders performances qualification record	8.1, 8.2, 10.2		specification		Perform	review point	review point
	- heat treatment procedure	8.3		specification		Perform	review point	review point
	- non destructive testing procedures	8.5		specification		Perform	review point	review point
	- pressure test procedure	8.6.6		specification		Perform	review point	review point
- painting procedure	11	specification		Perform	review point	review point		
<b>2 CONTROL ON RECEIPT OF MATERIAL</b>								
2A	<b>Valve BODY:</b>	7	API 6D / Relavant Standard					
	Casting/Forging			GTS / PTS	certif. 3.2	Perform	witness point	review point
	Chemical Testing, <b>Carbon Equivalent</b>			GTS / PTS	certif. 3.2	Perform	witness point	review point
	Heat Treatment							
	Mechanical tests ( YS, TS, % EL, Ys/ TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA)			GTS / PTS	certif. 3.2	Perform	witness point	review point
Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans) (Remark : marking transfer by TPIA)				certif. 3.2	Perform	witness point	review point	
				- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.				



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UT of Forging Body (100%)	-	ASME B 16.34	ASME B 16.34, App IV	certif. 3.2	Perform	witness point	review point
Radiography Test of Casting Body (100%)	-	ASME B 16.34	ASME B 16.34	certif. 3.2	Perform	review point	review point
Wet magnetic Particle Examination (100% External & accessible Internal)	-	ASME B 16.34	ASME B 16.34	certif. 3.2	Perform	witness point	review point
<b>FLANGES:</b>							
Chemical Testing, <b>Carbon Equivalent</b>			GTS / PTS	certif. 3.2	Perform	witness point	review point
Heat Treatment		Relavant Standard	GTS / PTS	certif. 3.2	Perform	witness point	review point
Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA)		ASTM A370	GTS / PTS City Gas Distribution	certif. 3.2	Perform	witness point	review point

Sl. Nos.	ACTIVITY	GTS / PTS chap.	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
						Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
<b>QUALITY ASSURANCE PLAN</b>						QAP No. : P.019141 G11013 M002		
<b>BALL VALVES</b>						Date: 26.09.2024 Revision: 0		
<b>SIZE 2 INCH AND ABOVE</b>						Prepared : AML		
						Checked : GGA		
						Approved : SSM		
<b>2B</b>	Charpy-test at 0°C and as per Material requirement 2 test sets (1 long/1 trans.) (Remark : marking transfer by TPIA)	-	ASTM A370	- At 0°C <b>Minimum Average Absorbed Energy</b> shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C <b>Minimum Individual Energy value</b> shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.2	Perform	witness point	review point
	UT of Forging Body (100%)	-	ASME B 16.34	ASME B 16.34, App IV	certif. 3.2	Perform	witness point	review point
	Wet magnetic Particle Examination (100% External & accessible Internal)		ASME B 16.34	ASME B 16.34	certif. 3.2	Perform	witness point	review point
	<b>LATERAL CONNECTIONS:</b>							
	Chemical Testing, <b>Carbon Equivalent</b>			GTS / PTS	certif. 3.2	Perform	witness point	review point
	Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA)		ASTM A370	GTS / PTS	certif. 3.2	Perform	witness point	review point



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2C	Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA)	7	ASTM A370	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.2	Perform	witness point	review point
	UT of Forging Body (100%)	-	ASME B 16.34	ASME B 16.34, App IV	certif. 3.2	Perform	witness point	review point
	Radiography Test of Casting Body (100%)	-	ASME B 16.34	ASME B 16.34	certif. 3.2	Perform	review point	review point
	Wet magnetic Particle Examination (100% External & accessible Internal)	-	ASME B 16.34	ASME B 16.34	certif. 3.2	Perform	witness point	review point
2D	<u>EXTENSION PIPE PIECES AS PER DATA SHEET</u>	7		GTS / PTS	certif. 3.2	Perform	witness point	review point
	Chemical Test, Carbon Equivalent						witness point	
	Mechanical tests (Remark : marking transfer by TPIA)		ASTM A370				witness point	
	Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA)		ASTM A370	- at 0°C, for Base - 40J/cm <sup>2</sup> (Avg.), 32J/cm <sup>2</sup> (Ind.), - at 0°C, for Weld/HAZ - 27J/cm <sup>2</sup> (Avg.), 22J/cm <sup>2</sup> (Ind.)	certif. 3.2	Perform	witness point	review point
	<u>BALL / OBTURATOR (Note -7):</u>							
	Chemical Testing, Carbon Equivalent			GTS / PTS	certif. 3.2	Perform	witness point	review point



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		QUALITY ASSURANCE PLAN BALL VALVES SIZE 2 INCH AND ABOVE				QAP No. : P.019141 G11013 M002		
						Date: 26.09.2024	Revision: 0	
						Prepared : AML		
						Checked : GGA		
						Approved : SSM		
Sl. Nos.	ACTIVITY	GTS / PTS	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.				Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
2E	- Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness of Base ENP Coating etc) (Remark : marking transfer by TPIA)	7	Relavant Standard	GTS / PTS	certif. 3.2	Perform	witness point	review point




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		QUALITY ASSURANCE PLAN BALL VALVES SIZE 2 INCH AND ABOVE				QAP No. : P.019141 G11013 M002 Date: 26.09.2024 Revision: 0 Prepared : AML Checked : GGA Approved : SSM		
Sl. Nos.	ACTIVITY	GTS / PTS	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.				Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
	UT of Forging Body (100%) OR		ASME B 16.34	ASME B 16.34, App IV	certif. 3.2	Perform	witness point	review point
	Radiography Test of Casting Body (100%)		ASME B 16.34	ASME B 16.34	certif. 3.2	Perform	review point	review point
2F	<b>SEAT:</b> - Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA), - Chemical tests, Carbon equivalent	7	Relavant Standard	GTS / PTS	certif. 3.2	Perform	Mechanical-witness point Chemical-review point	review point
	Wet magnetic Particle Examination (All accessible area)	-	ASME B 16.34	ASME B 16.34	certif. 3.2	Perform	witness point	review point
	<b>STEM:</b> -Chemical Testing, Carbon equivalent	7		GTS / PTS	certif. 3.1	Perform	review point	review point
2G	-Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness of Base and ENP coating etc) (Remark : marking transfer by TPIA)		ASTM A370	GTS / PTS	certif. 3.2	Perform	witness point	review point
	UT of Forging Body (100%)	-	ASME B 16.34	ASME B 16.34, App IV	certif. 3.2	Perform	witness point	review point
	Wet magnetic Particle Examination (All accessible area)	-	ASME B 16.34	ASME B 16.34	certif. 3.2	Perform	witness point	review point
2H	<b>STUDS/NUTS (With Xylan Coating)</b> -Chemical Testing, Carbon Equivalent	7		GTS / PTS	certif. 3.1	Perform	review point	review point
	- Mechanical tests ( YS, TS, % EL, Ys / TS ratio, Micro / Macro, hardness etc) (Remark : marking transfer by TPIA)		ASTM A370	GTS / PTS	certif. 3.2	Perform	witness point	review point
	<b>VENT/BLEED PLUG:</b> - Chemical test, Mechanical tests	7	Relavant Standard	GTS / PTS	certif. 3.1	Perform	review point	review point
2I	<b>DRAIN: OPEN BLOCK VALVE AT DRAIN TAP:</b> - Chemical test, mechanical tests	7	Relavant Standard	GTS / PTS	certif. 3.1	Perform	review point	review point
2K	<b>DRAIN: UPPER BALL VALVE &amp; NEEDLE VALVE:</b> - Chemical Test, Mechanical tests	7	Relavant Standard	GTS / PTS	certif. 3.1	Perform	review point	review point
	<b>STEM &amp; SEAT SEALING CONNECTION :</b> - Chemical Test, Mechanical tests	7	Relavant Standard	GTS / PTS	certif. 3.1	Perform	review point	review point

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2M	<b><u>OTHER VALVE PARTS INCLUDING PIPE PUP PIECE</u></b>	7		GTS / PTS	certif. 3.1	Perform	review point	review point
	- Mechanical and Chemical tests		Relavant Standard	GTS / PTS				
				GTS / PTS				



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**QUALITY ASSURANCE PLAN BALL VALVES**  
**SIZE 2 INCH AND ABOVE**

QAP No. : P.019141 G11013 M002

Date: 26.09.2024

Revision: 0

Prepared : AML

Checked : GGA

Approved : SSM

SL Nos.	ACTIVITY	GTS / PTS chap.	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
						Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
<b>3</b>	<b>FABRICATION AND TESTS</b>							
3.1	<b>Welds and repair welds shall be performed according to written qualified procedures</b>	8.1 - 8.2	ASME IX + spec. / API 6D + GTS / PTS	ASME IX + spec.	Welding Procedure Specification (WPS)	Perform	witness point (For new proposed WPS) Review(For already qualified)	review & approval point
3.1.1	Heat treatment fully welded valve and test pieces	8.3	ASME VIII Div.1 / API 6D + GTS / PTS	ASME VIII Div.1	review CTT/TT curves	Perform	review report	review report
3.1.2	Mechanical tests (Remark : marking transfer by TPIA)	8.4.1	ASTM A370	GTS / PTS	certif. 3.2	Perform	witness point	review report
3.1.3	Charpy-test at 0°C and as per Material requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA)	8.4.2	ASTM A370	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.2	Perform	witness point	review report
3.3	(if feasible) RT on butt welds	8.5.1	ASME SECT V art. 2 / API 6D + GTS / PTS	ASME SECT. VIII, div.1, UW 51.	(RT-Test report)	Perform	review point	review point
	(if not feasible & thk. > 15mm) UT on butt welds	8.5.1	ASME SECT V art. 5 / API 6D + GTS / PTS	ASME SECT. VIII, div.1, App.12	UT-Test report	Perform	witness point	review point
3.4	Butt welding ends on cast bodies shall be examined before fabrication welding end by radiography (Over a width of 70mm)(not applicable for forged bodies)	8.5.1	ASME SECT V art. 2 / API 6D + GTS / PTS	MSS-SP-55	(RT-Test report)	Perform	witness point	review point
3.5	UT on 25 mm of base mat. (at each side) and each weld(100%)	8.5.1	ASME SECT V art. 5 / API 6D + GTS / PTS	ASME SECT. VIII, dic.1, App.12	UT-Test report	Perform	witness point	review point
3.6	Magnetic Particulate Examination on valve body 10 % valves < 6" 100% valves ≥ 6"	8.5.1	ASME SECT V art. 7 / API 6D + GTS / PTS	ASME SECT. VIII App.6	MPE-Test report	Perform	witness point	review point
3.7	Visual examination	8.5.1	Sec 8 proc.7 / API 6D + GTS / PTS	MSS-SP-55	report	Perform	witness point	review point
3.8	Dimensional examination	8.5.1	Sec 8 proc.24 / API 6D + GTS / PTS	DWG **	report	Perform	witness point	review point
<b>4</b>	<b>Finished bevel end pipe used for field welding :</b>							
4.1	Magnetic Particle Examination / Liquid Penetrant Examination	8.5.1	ASME SECT V art. 7 ASME SECT V art. 6 / API 6D + GTS / PTS	unacceptable defects : defects not parallel to the surface extending into the bevel + defect extending into the bevel provided the lamination is parallel to the surface and has a transverse dimension exceeding 6.35 mm	MPE/ LPE-Test report	Perform	witness point	review point



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4.2	UT inspection on 50 mm of base material	8.5.1	ASME SECT V art. 5 / API 6D + GTS / PTS	ASME SECT. VIII, div.1, App.12	UT-Test report	Perform	witness point	review point
4.3	RT inspection on 50 mm of base material	8.5.1	ASME SECT V art. 5 / API 6D + GTS / PTS	ASME SECT. VIII, div.1, App.12	UT-Test report	Perform	Review point	review point
4.4	Visual and dimensional examination	8.5.1	Sec 8 proc.7 / API 6D + GTS / PTS	MSS-SP-55 +DWG**	report	Perform	witness point	review point
5	<b>FINAL INSPECTION TEST</b>			City Gas Distribution				



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		QUALITY ASSURANCE PLAN BALL VALVES SIZE 2 INCH AND ABOVE				QAP No. : P.019141 G11013 M002 Date: 26.09.2024      Revision: 0 Prepared : AML Checked : GGA Approved : SSM		
Sl. Nos.	ACTIVITY	GTS / PTS	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.				Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
5.1	Hydrostatic Shell Test	8.6.2	API 6D + GTS / PTS	@ 1.5 x Design Pr., 30 Min(NPS>18") / 15 Min(NPS<16").	certif. 3.2	Perform	witness point	witness point
5.2	Hydrostatic Seat Test	8.6.3	API 6D + GTS / PTS	@ 1.1 x Design Pr., 5 Min.	certif. 3.2	Perform	witness point	witness point
5.3	Pneumatic Test (with nitrogen) ( Shell & Seat)	8.6.5	GTS / PTS	@ 95 barg for 5 min.	certif. 3.2	Perform	witness point	witness point
5.4	External leak testing (with Soup suds)	8.6.4	GTS / PTS	@ 6 bar	certif. 3.2	Perform	witness point	witness point
5.5	Air seat test	8.6.5	GTS / PTS	@ 7 bar, 5 Min.	certif. 3.2	Perform	witness point	witness point
5.6	Double Block and Bleed Test	x	API 6D/API 598 + GTS / PTS	API 6D/ API 598	certif. 3.2	Perform	witness point	witness point
5.7	Functional Test (10 Opening / Closing with Operator mounted on the valve at 95 barg)	x	API 6D/API 598 + GTS / PTS	API 6D/ API 599	certif. 3.2	Perform	witness point	witness point
5.8	Antistatic Test	x	BS 5351 + GTS / PTS	BS 5351 + specification	certif. 3.2	Perform	witness point	witness point
5.9	Operational torque Test	8.7	API 6D		report	Perform	witness point	witness point
5.10	Fire Safe Test	8.8	API 6FA	API6FA	report	Perform	review report	review report
5.11	Visual examination	8.10	Sec 8 proc.7 / API 6D + GTS / PTS	MSS-SP-55 / GTS / PTS	report	Perform	witness point	review report
5.12	Dimensional examination	8.10	Sec 8 proc.24 / API 6D + GTS / PTS	DWG **	report	Perform	witness point	review report
6	Marking	9	section 9 of specification / API 6D + GTS / PTS	section 9 specification	report	Perform	witness point	review report
6.1	Inspector's stamp	9.1.2	section 9 of specification / API 6D + GTS / PTS	section 9 specification			hold point	review report
7	Painting And Coating	11	SIS055900	SA2.5, Cl.11 of Specification	report	Perform	witness point	review report
8	Control of all certificates & Final Certificate	10	section 10 of specification	section 10 of specification	certif. 3.2	Perform	hold point	review report
<b>LEGENDS:</b>								
	RT: Radiographic test	PT:Liquid penetrant test	MT: Magnetic particle test	TPIA: Third Party Inspection Agency; .	Control Authority : Owner / Owner's representatives			
	P: Performed	R:Review	W: Witness	RW: Random Witness				
<b>Hold point</b> = No further steps may be undertaken before the intervention of the appointed responsible takes place.								
<b>Witness point</b> = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.								



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- Note:**
- 1 The above testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure and that the product also comply to the additional requirements as per Technical specifications and data sheets.
  - 2 The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Owner/Owner's representative.
  - 3 Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval.
  - 4 TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above.
  - 5 TPIA along with Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc.submitted by supplier.
  - 6 For All Forging Materials, The Specimen Shall Be Taken From The Integral Part of The Forging.
  - 7 Heat treatment start and stop temperature chart shall be witnessed & signed by TPIA. Power failure log book / sheet shall be maintained
  - 8 TPIA shall ensure that Ball and Stem are Electroless Nickel Plated (ENP) with minimum thickness of 75 microns as per data sheet requirement.
  - 9 Contractor in coordination with Supplier/Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organise Inspection.
  - 10 Certification requirements shall comply with European Standard EN 10204 (latest edition)
  - 11 In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable.




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Sl. Nos.	ACTIVITY	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
					Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
<b>QUALITY ASSURANCE PLAN GLOBE SIZE 2" AND ABOVE</b>					<b>QAP No</b>	P.019141 G11013 M003	
					<b>Date</b>	26.09.2024	
					<b>Prepared by</b>	AML	Checked :GGA
					<b>Approved by</b>	SSM	
					<b>Client</b>	BGL	
					<b>Consultant</b>	TEPL	
1	<b>CONTROL BEFORE MANUFACTURING</b>						
	- list of operation in manufacturing and control	As per tender specification / data Sheet / Ref Std.	As per tender specification / data Sheet / Ref Std.		Perform	review point	review point
	- material part list				Perform	review point	review point
	- dimensional drawings				Perform	review point	review point
	- calculation butt welding ends				Perform	review point	review point
	- calculation of body bolting, Bonnet, Cover (For Pressure Retaining Parts)	ASME B16.34	specification,		Perform	review point	review point
	- Fixation of Operation Methodology		specification, Data Sheet		Perform	review point	review point
	- qualified welding procedures/welders performances qualification record		specification		Perform	review point	review point
	- heat treatment procedure		specification		Perform	review point	review point
	- non destructive testing procedures		specification		Perform	review point	review point
- pressure test procedure		specification		Perform	review point	review point	
- painting procedure		specification		Perform	review point	review point	
2	<b>CONTROL ON RECEIPT OF MATERIAL</b>						
2.1	<b>Casts</b>						
2.1.1	<b>Non Destructive Testing</b>						
	Radiography Testing - 100%: each type / size / rating	ASME V, Art. 2	ASME VIII-1, App. 7 ASME B31.3(Latest), Table 341.3.2A, Severe Cyclic cond.	certif. 3.1	Perform	review point	review point
	Penetrant Testing - 100%: each type / size / rating	ASME V, Art. 6 - ASTM E-165	ASME VIII-1, App. 7 & 8	certif. 3.2	Perform	Witness point	review point
	Magnetic Particle Testing - (alternative for PT)	ASME V, Art. 7	ASME VIII-1, App. 6 & 7	certif. 3.2	Perform	Witness point	review point
2.1.2	Chemical analysis, Carbon Equivalent (each heat and product)	Referred API / ASTM	Referred API / ASTM	certif. 3.2	Perform	Witness point	review point
2.1.3	Mechanical tests (YS, UTS, YS/UTS, %EL, RA, Bend, Micro / macro, hardness etc. as applicable) - on samples taken from mill. (Remark : marking transfer by TPIA)	Referred API / ASTM	Referred API / ASTM	certif. 3.2	Perform	Witness point	Witness point

 <b>Bhayanagar Gas Limited</b>	<b>Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA</b>  <b>Bid Document No: BGL/693/2025-26</b>	<b>Volume II of II</b>
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2.1.4	Charpy Impact test - 2 test sets (1 Longitudinal & 1 Transverse) (Remark : marking transfer by TPIA)	ASTM A-370	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.2	Perform	Witness point	Witness point
2.2	<b>Forgings</b>						
	<b>Non Destructive Testing</b>						
	Penetrant Testing - 10%: on Disc / Wedge & Stem after final machining	ASME V, Art. 6	ASME VIII-1, App. 8	certif. 3.2	Perform	Witness point	review point

Sl. Nos.	ACTIVITY	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
					Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
<b>QUALITY ASSURANCE PLAN GLOBE SIZE 2" AND ABOVE</b>					QAP No	P.019141 G11013 M003	
					Date	26.09.2024	
					Prepared by	AML	Checked :GGA
					Approved by	SSM	
					Client	BGL	
					Consultant	TEPL	
2.2.1	Ultrasonic Testing - 100%: on Body & Bonnet	ASME B 16.34, App. IV / ASME Sec V Art 5	ASME B 16.34, App. IV / ASME Sec V Div. 1 UF 55	certif. 3.2	Perform	Witness point	review point
	Magnetic Particle Testing - 100% on pressure retaining parts	ASME V, Art. 7	ASME VIII-1, App. 6	certif. 3.2	Perform	Witness point	review point
2.2.2	Chemical analysis, Carbon Equivalent (each heat and product)	Referred API / ASTM	Referred API / ASTM	certif. 3.2	Perform	Witness point	review point
2.2.3	Mechanical tests (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) - on samples taken from mill. (Remark : marking transfer by TPIA)	Referred API / ASTM	Referred API / ASTM	certif. 3.2	Perform	Witness point	review point
2.2.4	Charpy Impact test - 2 test sets (1 Longitudinal & 1 Transverse) (Remark : marking transfer by TPIA)	ASTM A-370	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.2	Perform	Witness point	review point
2.3	<b>Plate:</b> Cover, Disc, Seat Ring Flap, Arm (Chemical & Mechanical Properties)	As per Approved Procedure / Purchase Specification	As per Approved Procedure / Purchase Specification	certif. 3.2	Perform	Witness point	review point

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<b>2.4</b>	<b>Bolting/ Fasteners</b>						
2.4.1	Penetrant Testing (on each batch after final machining)	ASME V, Art. 6	ASME VIII-1, App. 8	certif. 3.1	Perform	review point	review point
2.4.2	Heat Treatment (on each Heat Treatment batch)	Referred ASTM	Referred ASTM	certif. 3.1	Perform	review point	review point
2.4.3	Chemical analysis, Carbon Equivalent (each heat and product)	Referred API / ASTM	Referred API / ASTM	certif. 3.2	Perform	Witness point	review point
2.4.4	Mechanical tests (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) - on samples taken from mill. (Remark : marking transfer by TPIA)	Referred API / ASTM	Referred API / ASTM	certif. 3.2	Perform	Witness point	review point
2.4.5	Charpy Impact test as per Material specification requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA)	ASTM A-370	As per material specification	certif. 3.2	Perform	Witness point	Random Witness point
2.5	Actuators (If Applicable)	Compliance to purchase order	Purchase Specification	report	Perform	review point	review point
2.6	BW ends - each piece.	100 % RT ASME V, Art. 2	ASME B31.3(1990), Table 341.3.2A, severe cyclic cond.	report	Perform	review point	review point
2.7	Welds & weld repairs - each piece	100 % RT ASME V, Art. 2 & ASME IX	ASME B31.3(1990), Table 341.3.2A, severe cyclic cond.	report	Perform	review point	review point
3	<b>FINAL INSPECTION TEST</b>						

		<b>QUALITY ASSURANCE PLAN GLOBE SIZE 2" AND ABOVE</b>		QAP No	P.019141 G11013 M003			
				Date	26.09.2024			
				Prepared by	AML	Checked	:GGA	
				Approved by	SSM			
				Client	BGL			
				Consultant	TEPL			
Sl. Nos.	ACTIVITY	Applied standard e/o Procedure	Acceptance criteria	Document type	<b>Scope of Inspection</b>			
					Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority	
3.1	Hydrostatic Shell Test (duration minimum 15 min)			certif. 3.2	Perform	Witness point	Witness point	
3.2	Hydrostatic Seat Test (duration minimum 30 min)			certif. 3.2	Perform	Witness point	Witness point	
3.3	Hydrostatic Back Seat Test (duration minimum 30 min)			certif. 3.2	Perform	Witness point	Witness point	
3.4	Pneumatic Shell & Seat Test (at 7 Bar with Nitrogen)			certif. 3.2	Perform	Witness point	Witness point	
3.5	Air seat test (duration minimum 5 min)			certif. 3.2	Perform	Witness point	Witness point	



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3.6	Helium Leak Test (duration minimum 30 min)	BS 1873 / API 598 / ASME B16.34 / ASTM A-530 & Data Sheet	BS 1873 / API 598 / ASME B16.34 / ASTM A-530 & Data Sheet	certif. 3.2	Perform	Witness point	Witness point
3.7	Cyclic Pressure Test - 1 per valve per size ( 6" & above) ( 10 Open Close - Open Cycles with Maximum differential Pressure)			certif. 3.2	Perform	Witness point	Witness point
3.8	Torque Test			certif. 3.2	Perform	Witness point	Random Witness point
3.9	High Pressure Closure Test & Low Pressure Closure Test (3 Opening & Closure at Atmospheric & Maximum differential pressure)			report	Perform	Witness point	Random Witness point
3.1	Cyclic Pressure Test - 1 Valve per size (6" & above) (10 Open - Close - Open cycles with Maximum differential pressure)			report	Perform	Witness point	Random Witness point
3.11	Fire safe tested (Type Test) (Certificates of previously conducted tests shall be submitted)	API 6FA / API 607 / BS 5146 / OCMA	API 6FA / API 607 / BS 5146 / OCMA	report	Perform	review report	review report
3.12	Actuator Functional Test (If applicable)	Open, Close time, Torque, Limit setting	Functioning in Hydrostatic Test	report	Perform	Witness point	Witness point
3.13	Visual & Dimensional examination	ASME Sec-V, Art. 9	Referred ANSI dimensions	report	Perform	review report	review report
4	Surface Preparation, Painting & Preservation	As per Approved procedure	As per Approved procedure		Perform	Witness point	review report
5.1	Marking	As per Approved procedure	As per Approved procedure	X	Perform	review report	review report
5.2	Inspector's stamp	-	-	X	Perform	hold point	review report
6	Control of all certificates & Final Certificate	-	-	certif. 3.2	Perform	hold point	review report

**LEGENDS:**

**RT:** Radiographic test  
**P:** Performed

**PT:** Liquid penetrant test  
**R:** Review

**MT:** Magnetic particle test  
**W:** Witness

**TPIA:** Third Party Inspection Agency; .


**Control Authority :** Owner/Engineer or their Authorized Inspection Agency

**Hold point** = No further steps may be undertaken before the intervention of the appointed responsible takes place.

**Witness point** = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

- Notes:**
- The Above Testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure and that the product also comply to the additional requirements as per Technical specifications and data sheets. TPJA shall issue the EN10204 3.2 Certification for the Final Product. Welding & Welder Qualification "W" for Customer/CA. Heat treatment as per Specification.
  - The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Owner/Owner's representative and TPJA.

<b>QUALITY ASSURANCE PLAN GLOBE SIZE 2" AND ABOVE</b>	<b>QAP No</b>	P.019141 G11013 M003	
	<b>Date</b>	26.09.2024	
	<b>Prepared by</b>	AML	Checked :GGA
	<b>Approved by</b>	SSM	
	<b>Client</b>	BGL	
	<b>Consultant</b>	TEPL	
<b>Scope of Inspection</b>			

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SL Nos.	ACTIVITY	Applied standard e/o Procedure	Acceptance criteria	Document type	Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
3	Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval.						
4	TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above.						
5	TPIA along with Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. submitted by supplier.						
6	TPIA shall also Review the Test certificates submitted by the Actuator manufacturer.						
7	Contractor shall in coordination with Supplier/Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organize Inspection.						
8	Certification requirements shall comply with European Standard EN 10204 (latest edition)						
9	All bought out items will be procured with 3.2 Certificates.						
10	For All Forging / Casting Materials, The Specimen Shall Be Taken From The Integral Part of The Forging / Casting						
11	Heat treatment start and stop temperature chart shall be Witnessed & signed by TPIA. Power failure log book / sheet shall be maintained						
12	In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable.						



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Sl. Nos.	ACTIVITY	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection			
					Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority	
<b>QUALITY ASSURANCE PLAN GLOBE SIZE BELOW 2 INCH</b>					<b>QAP No</b>	<b>P.019141 G11013 M003</b>		
					<b>Date</b>	<b>26.09.2024</b>		
					<b>Prepared by</b>	<b>AHR</b>	<b>Checked :SSA</b>	
					<b>Approved by</b>	<b>SSM</b>		
					<b>Client</b>	<b>BGL</b>		
					<b>Consultant</b>	<b>TEPL</b>		
1	<b>CONTROL BEFORE MANUFACTURING</b>							
	- list of operation in manufacturing and control	As per tender specification / data Sheet / Ref Std.	As per tender specification / data Sheet / Ref Std.		Perform	review point	review point	
	- material part list				Perform	review point	review point	
	- dimensional drawings				Perform	review point	review point	
	- calculation butt welding ends				Perform	review point	review point	
	- calculation of body bolting, Bonnet, Cover (For Pressure Retaining Parts)	ASME B16.34	specification,	Perform	review point	review point		
	- Fixation of Operation Methodology		specification, Data Sheet	Perform	review point	review point		
	- qualified welding procedures/welders performances qualification record		specification	Perform	review point	review point		
	- heat treatment procedure		specification	Perform	review point	review point		
	- non destructive testing procedures		specification	Perform	review point	review point		
- pressure test procedure		specification	Perform	review point	review point			
- painting procedure		specification	Perform	review point	review point			
2	<b>CONTROL ON RECEIPT OF MATERIAL</b>							
2.1	<b>Casts</b>							
2.1.1	<b>Non Destructive Testing</b>							
	Radiography Testing - 100%: each type / size / rating	ASME V, Art. 2	ASME VIII-1, App. 7 ASME B31.3(Latest), Table 341.3.2A, Severe Cyclic cond.	certif. 3.1	Perform	review point	review point	
	Penetrant Testing - 100%: each type / size / rating	ASME V, Art. 6 - ASTM E-165	ASME VIII-1, App. 7 & 8	certif. 3.1	Perform	review point	review point	
	Magnetic Particle Testing - (alternative for PT)	ASME V, Art. 7	ASME VIII-1, App. 6 & 7	certif. 3.1	Perform	review point	review point	
2.1.2	Chemical analysis, Carbon Equivalent (each heat and product)	Referred API / ASTM	Referred API / ASTM	certif. 3.1	Perform	review point	review point	
2.1.3	Mechanical tests (YS, UTS, YS/UTS, %EL, RA, Bend, Micro / macro, hardness etc. as applicable) - on samples taken from mill. (Remark : marking transfer by TPIA)	Referred API / ASTM	Referred API / ASTM	certif. 3.1	Perform	review point	review point	



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2.1.4	Charpy Impact test - 2 test sets (1 Longitudinal & 1 Transverse) (Remark : marking transfer by TPIA)	ASTM A-370	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.1	Perform	review point	review point
2.2	<b>Forgings</b>						
	<b>Non Destructive Testing</b>						
	Penetrant Testing - 10%: on Disc / Wedge & Stem after final machining	ASME V, Art. 6	ASME VIII-1, App. 8	certif. 3.1	Perform	review point	review point

Sl. Nos.	ACTIVITY	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
					Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
<b>QUALITY ASSURANCE PLAN GLOBE SIZE BELOW 2 INCH</b>					<b>QAP No</b>	P.019141 G11013 M003	
					<b>Date</b>	26.09.2024	
					<b>Prepared by</b>	AHR	Checked :SSA
					<b>Approved by</b>	SSM	
					<b>Client</b>	BGL	
					<b>Consultant</b>	TEPL	
2.2.1	Ultrasonic Testing - 100%: on Body & Bonnet	ASME B 16.34, App. IV / ASME Sec V Art 5	ASME B 16.34, App. IV / ASME Sec V Div. 1 UF 55	certif. 3.1	Perform	review point	review point
	Magnetic Particle Testing - 100% on pressure retaining parts	ASME V, Art. 7	ASME VIII-1, App. 6	certif. 3.1	Perform	review point	review point
2.2.2	Chemical analysis, Carbon Equivalent (each heat and product)	Referred API / ASTM	Referred API / ASTM	certif. 3.1	Perform	review point	review point
2.2.3	Mechanical tests (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) - on samples taken from mill. (Remark : marking transfer by TPIA)	Referred API / ASTM	Referred API / ASTM	certif. 3.1	Perform	review point	review point
2.2.4	Charpy Impact test - 2 test sets (1 Longitudinal & 1 Transverse) (Remark : marking transfer by TPIA)	ASTM A-370	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.1	Perform	review point	review point
2.3	<b>Plate:</b> Cover, Disc, Seat Ring Flap, Arm (Chemical & Mechanical Properties)	As per Approved Procedure / Purchase Specification	As per Approved Procedure / Purchase Specification	certif. 3.1	Perform	review point	review point



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2.4	Bolting/ Fasteners						
2.4.1	Penetrant Testing (on each batch after final machining)	ASME V, Art. 6	ASME VIII-1, App. 8	certif. 3.1	Perform	review point	review point
2.4.2	Heat Treatment (on each Heat Treatment batch)	Referred ASTM	Referred ASTM	certif. 3.1	Perform	review point	review point
2.4.3	Chemical analysis, Carbon Equivalent (each heat and product)	Referred API / ASTM	Referred API / ASTM	certif. 3.1	Perform	review point	review point
2.4.4	Mechanical tests (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable) - on samples taken from mill. (Remark : marking transfer by TPIA)	Referred API / ASTM	Referred API / ASTM	certif. 3.1	Perform	review point	review point
2.4.5	Charpy Impact test as per Material specification requirement 2 test sets (1 long./1 trans.) (Remark : marking transfer by TPIA)	ASTM A-370	As per material specification	certif. 3.1	Perform	review point	Random review point
2.5	Actuators (If Applicable)	Compliance to purchase order	Purchase Specification	report	Perform	review point	review point
2.6	BW ends - each piece.	100 % RT ASME V, Art. 2	ASME B31.3(1990), Table 341.3.2A, severe cyclic cond.	report	Perform	review point	review point
2.7	Welds & weld repairs - each piece	100 % RT ASME V, Art. 2 & ASME IX	ASME B31.3(1990), Table 341.3.2A, severe cyclic cond.	report	Perform	review point	review point
3	<b>FINAL INSPECTION TEST</b>						

Sl. Nos.	ACTIVITY	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
					Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
3.1	Hydrostatic Shell Test (duration minimum 15 min)			certif. 3.1	Perform	review point	review point
3.2	Hydrostatic Seat Test (duration minimum 30 min)			certif. 3.1	Perform	review point	review point
3.3	Hydrostatic Back Seat Test (duration minimum 30 min)			certif. 3.1	Perform	review point	review point
3.4	Pneumatic Shell & Seat Test (at 7 Bar with Nitrogen)			certif. 3.1	Perform	review point	review point
3.5	Air seat test (duration minimum 5 min)			certif. 3.1	Perform	review point	review point

QUALITY ASSURANCE PLAN GLOBE SIZE BELOW 2 INCH	
QAP No	P.019141 G11013 M003
Date	26.09.2024
Prepared by	AHR
Checked	:SSA
Approved by	SSM
Client	BGL
Consultant	TEPL



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3.6	Helium Leak Test (duration minimum 30 min)	BS 1873 / API 598 / ASME B16.34 / ASTM A-530 & Data Sheet	BS 1873 / API 598 / ASME B16.34 / ASTM A-530 & Data Sheet	certif. 3.1	Perform	review point	review point
3.7	Cyclic Pressure Test - 1 per valve per size ( 6" & above) ( 10 Open Close - Open Cycles with Maximum differential Pressure)			certif. 3.1	Perform	review point	review point
3.8	Torque Test			certif. 3.1	Perform	review point	Random review point
3.9	High Pressure Closure Test & Low Pressure Closure Test (3 Opening & Closure at Atmospheric & Maximum differential pressure)			report	Perform	review point	Random review point
3.1	Cyclic Pressure Test - 1 Valve per size (6" & above) (10 Open - Close - Open cycles with Maximum differential pressure)			report	Perform	review point	Random review point
3.11	Fire safe tested (Type Test) (Certificates of previously conducted tests shall be submitted)	API 6FA / API 607 / BS 5146 / OCMA	API 6FA / API 607 / BS 5146 / OCMA	report	Perform	review report	review report
3.12	Actuator Functional Test (If applicable)	Open, Close time, Torque, Limit setting	Functioning in Hydrostatic Test	report	Perform	review point	review point
3.13	Visual & Dimensional examination	ASME Sec-V, Art. 9	Referred ANSI dimensions	report	Perform	review report	review report
4	Surface Preparation, Painting & Preservation	As per Approved procedure	As per Approved procedure		Perform	review point	review report
5.1	Marking	As per Approved procedure	As per Approved procedure	X	Perform	review report	review report
5.2	Inspector's stamp	-	-	X	Perform	review report	review report
6	Control of all certificates & Final Certificate	-	-	certif. 3.1	Perform	review report	review report

**LEGENDS:**


RT: Radiographic test      PT: Liquid penetrant test      MT: Magnetic particle test      TPIA: Third Party Inspection Agency; .  
P: Performed      R: Review      W: Witness      **Control Authority** : Owner/Engineer or their Authorized Inspection Agency

**Hold point** = No further steps may be undertaken before the intervention of the appointed responsible takes place.

review point = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.

- Notes:**
- The Above Testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure and that the product also comply to the additional requirements as per Technical specifications and data sheets. TPIA shall issue the EN10204 3.1 Certification for the Final Product. Welding & Welder Qualification "W" for Customer/CA. Heat treatment as per Specification.
  - The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Owner/Owner's representative and TPIA.

<b>QUALITY ASSURANCE PLAN GLOBE SIZE BELOW 2 INCH</b>	<b>QAP No</b>	P.019141 G11013 M003	
	<b>Date</b>	26.09.2024	
	<b>Prepared by</b>	AHR	Checked :SSA
	<b>Approved by</b>	SSM	
	<b>Client</b>	BGL	
	<b>Consultant</b>	TEPL	
<b>Scope of Inspection</b>			

 <b>Bhayanagar Gas Limited</b>	<b>Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA</b>  <b>Bid Document No: BGL/693/2025-26</b>	<b>Volume II of II</b>
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SL Nos.	ACTIVITY	Applied standard e/o Procedure	Acceptance criteria	Document type	Manufacturer	TPIA (By Manufacturer / Contractor)	Control Authority
3	Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval.						
4	TPIA along with Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. submitted by supplier.						
5	Contractor shall in coordination with Supplier/Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organize Inspection.						
6	Certification requirements shall comply with European Standard EN 10204 (latest edition)						
7	For All Forging / Casting Materials, The Specimen Shall Be Taken From The Integral Part of The Forging / Casting						
8	Heat treatment start and stop temperature chart shall be Witnessed & signed by TPIA. Power failure log book / sheet shall be maintained						
9	In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable.						



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		QUALITY ASSURANCE PLAN SKID FABRICATIONS							P.019141 G11013 M004			
Sr.No	Description	Characteristic	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
									M	TPIA	Owner	
<b>1</b>	<b>Incoming Material for skid spool fabrication</b>											
1.1	Pipe	As per Specification	Major	laboratory + Dimensional	1 piece per pipe size	A106 Gr. B (Seamless)	/A106 Gr. B (Seamless)	Mfr / lab cert.	P	W	W/R	
1.2	Pipe Fittings	As per Specification	Minor	laboratory	Per heat	ASTM A105	ASTM A105	Mfr / lab cert.	P	W	W/R	
			Major	laboratory	Per heat	ASTM A105	ASTM A105	Mfr / lab cert.	P	W	W/R	
			Minor	Visual	10%	ANSI B16.9	ANSI B16.9	Mfr cert.	P	W	W/R	
1.3	Flanges	As per Specification	Minor	laboratory	100%	ASTM A105	ASTM A105	lab cert.	P	W	W/R	
			Major	laboratory	Per heat	ASTM A105	ASTM A105	Mfr / lab cert.	P	W	W/R	
			Minor	Visual	10%	ANSI 16.5	ANSI 16.5	Mfr cert.	P	W	W/R	
1.4	Stud and Bolts/ gaskets	Chemical, physical and impact test	Minor	Visual +10% Dimensional	Random selection one piece/size	ASME Sec II and ANSI B1.1	ASME Sec II and ANSI B1.1	Mfr cert.	P	R	W/R	
1.5	Structure	Dimensional	Minor	Visual + Dimensional	100%	as per IS 2062	as per IS 2062	Mfr cert.	P	W	W/R	Fabricator W/S
<b>2</b>	<b>Welding, NDT &amp; Testing for skid Piping fabrication</b>											
2.1	WPS/WQP/PQR	Welders Qualification & Welding Procedure	Major	Welders Qualification & Welding Procedure	100%	Approved WPS/WQR/PQR	ASME Sec.IX	WPS/WQP/PQR	P	R	W/R	
2.2	UT or DPT of Non Radiography for Joints	DPT after Final Welding	Major	DPT on other than butt weld joints + UT Report	100%	DPT Report + UT Report	ASME + Sec. V	DPT Report + UT Report	P	10%W	W/R	UT / DPT Report 100% Review
2.3	Radiography Test	Radiography after Final Welding	Major	100% Process Piping	100%	Radiography Report	ASME Sec.VIII/Div.1 & ASME Sec. V	Radiography Report	P	* R	* W/R	* Film to be Reviewed
2.4	Hydro Test for Interconnecting Pipe spools (with 0.2% Inhibitor)	Hydro Test at 1.4 times the Design Pressure	Major	Strength	100%	GA Drawing and hydro test procedure	ASME B 31.8, IGE/TD/13. No Leakage	Hydro Test Report	P	W	W/R	
2.5	Internal Cleaning of Pipe Spools after Hydro Test.	Internal Surface Finish	Major	Visual	100%	Internal Report	Internal Report	Internal Report	P	R	W/R	
2.6	Surface Preparation and Painting of Skid	Surface Preparation and Painting	Major	Visual + DFT Measurement	100%	Approved Painting Specification	Approved Painting Specification	Inspection Report	P	W	W/R	Random DFT Measurement Witness
2.7	Pneumatic Leak Test for skid	Pneumatic Leak Test at 7.7 Bar for 30 min.	Major	leakage	100%	GA Drawing and Pneumatic test procedure attached	ASME B 31.8, IGE/TD/13. No Leakage	Pneumatic Report	P	W	W/R	
2.8	Final Inspection of Assembled Skid with all Instruments	Tender Specs.	Major	Visual	100%	GA Drawing + P&ID	Approved Specification	Internal Report	P	W	W/R	
2.9	Skid Preservation with N2 purging	N2 Purging - 2Kg/cm2g Preservation-0.3Kg/cm2g	Major	Visual	100%	GA & N2 Drg.+Preservation Procedure	No Leakage	Internal Report	P	R	W/R	
2.10	Necessary Protection during Transportation		Major	Visual	100%	Protection Procedure	Protection Procedure	Internal Report	P	R	W/R	




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		QUALITY ASSURANCE PLAN SKID FABRICATION						P.019141 G11013 M004				
Sr.No	Description	Characteristic	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
									M	TPIA	Owner	
<b>3</b>	<b>Incoming Material Identification of Bought out Items</b>											
3.1	Ball Valve	As per specifications	Major	As per specifications	As per specifications	As per specifications	Approved Specification	MFR's TC	P	W/R	W/R	
3.2	Globe Valve / Check valve	As per specifications	Major	As per specifications	As per specifications	As per specifications	Approved Data Sheet	MFR's TC	P	W/R	W/R	
3.3	Pressure Safety Valve	As per attached QAP	Major	As per attached QAP	100%	As per attached QAP	Approved Data Sheet	MFR's TC	P	W/R	W/R	
3.4	Pressure & Temperature Transmitter/Level Gauge, DPT,LT etc	As per attached QAP	Major	As per attached QAP	As per attached QAP	Vendor's QAP	Approved Data Sheet	MFR's TC	P	W/R	W/R	
3.5	Mass Flow Meter/RPD Flow meter and USM/Turbine meter with meter run & flow profiler.	Dimensional Drawing	Major	Dimensional, Visual, Model Operation of Orifice Assembly	100%	Vendor's Manual	Approved Data Sheet	MFR's TC	P	R	W/R	
3.6	Panel / FC/EVC	Physical / Electrical	Major	Continuity check	100%	Loop Diagram, Panel GA	Approved Data Sheet	MFR's TC	P	W	W/R	
3.7	Natural Gas Filter	As per specifications	Major	As per specifications	As per specifications	As per specifications	Approved Data Sheet	MFR's TC	P	W/R	W/R	
3.8	Slam Shut Valve + Regulators	As per attached QAP	Major	As per attached QAP	As per attached QAP	As per attached QAP	Approved Data Sheet	MFR's TC	P	W/R	W/R	
3.9	SS Fittings	As per specifications	Major	As per specifications	As per specifications	As per specifications	Approved Data Sheet	MFR's TC	P	W/R	W/R	
3.10	Pressure Gauge/Temperature Gauge/DPG	As per attached QAP	Major	Calibration, Dimensional, Range Model & Visual	100%	Approved Data Sheet	Approved Data Sheet	MFR's TC	P	W/R	W/R	


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3.11	Cable	Test Reports	Major	MTC, Visual & Dimensional	100%	MTC's, tender Specification	Approved Data Sheet	MFR's TC	P	W/R	W/R	
3.12	Junction Box & Cable Gland	Visual & Dimensional Review of Certificates	Major	Visual & Dimensional	100%	Approved P&ID and GA Drawing	Approved P&ID and GA Drawing	MFR's TC	P	R	W/R	

	<b>QUALITY ASSURANCE PLAN SKID FABRICATION</b>	<b>P.019141 G11013 M004</b>
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Sr.No	Description	Characteristic	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
									M	TPIA	Owner	
<b>4 Final Inspection</b>												
4.1	Factory Acceptance Test (Panel)	FAT as per Submitted FAT Manual	Major	FAT Procedure	100%	Approved FAT Manual	Approved FAT Manual	Inspection Report	P	W	W/R	
4.2	Completeness + Inspection Release Certificate (IRC)	---	Major	Visual + Dimensions	100%	Approved Bill of Material	Approved Bill of Material	Inspection Report	P	W	W/R	
<b>5 Packing and Shipping Control</b>												
5.1	Dispatch	---	Major	Verification of Documentation	100%	Verification of Documentation	Verification of Documentation	Dispatch Clearance by Client	---	R	W/R	
5.2	Name Plate Verification	Name Plate Verification	---	Name Plate Verification	100%	Approved Drawing	Approved Drawing	Approved Drawing	---	R	W/R	
<b>6 Site Acceptance Test</b>												
6.1	Pneumatic Leak Test for Skid Assembly	Pneumatic Leak Test at 7.7 Bar for 30 min.	Major	Strength	100%	Approved P&ID and GA Drawing	No Leakage	Inspection Report	---	W	W/R	
6.2	Site Acceptance Test	SAT as per submitted SAT Manual	Major	SAT Procedure	100%	Approved SAT Manual & FDS	Approved SAT Manual & FDS	Inspection Report	---	W	W/R	
<b>7 Final Documentation</b>												
7.1	Design and Calculation, Material TC, Calibration, Inspection and Test Report, As Built GA Drawing and P&ID	As per Tender Copy	Major	Verification of Documentation	100%	Approved Specification & As per Tender Doc.	Approved Specification & As per Tender Doc.	Vendor Document Report	---	R	W/R	

<b>Legend</b>			
M	Manufacturer	P	Perform
C	Client/Owner	R	Review
TPIA	Third Party Inspection Agency appointed by bidder.	W	Witness
		W/R	Witness of Test & Review of Certificates & Documents as per QAP

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**Bought-out items may be procured under 3.1 certification. However, TPIA carrying out the final inspection of the skid will review all 3.1 certification of bought-out items and include the details in the final inspection report.**

**NOTE**

- 1 Review of existing WPS/PQR by TPIA for suitability . If not suitable, Testing has to be carried out under witness of TPIA
- 2 EPMC / Owner's Inspection shall not be a Hold Point.



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**QUALITY ASSURANCE PLAN  
FLANGES**

**P.019141  
G11013  
M005**

S.No.	ACTIVITY	PTS	Frequency	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.					Manufacturer	TPIA	Client / Consultant
<b>0</b>	<b>CONTROL BEFORE MANUFACTURING</b>								
	- list of operation in manufacturing and control	9.1	1 per purchase order		specification		Perform	review point	review point
	- Fabrication and Control procedure	9.1			specification		Perform	review point	review point
	- material part list	9.1; 2 and 3			specification		Perform	review point	review point
	- dimensional drawings	9.2; 2			specification		Perform	review point	review point
	- heat treatment procedure	2, 4, 5, 6 & 7			specification		Perform	review point	review point
	- non destructive testing procedures	6			specification		Perform	review point	review point
	- painting procedure	As per PTS			specification		Perform	review point	review point
<b>1</b>	<b>BASE MATERIAL</b>								
1.1	<b>Mechanical tests</b> (remark : marking transfer by TPIA)								
	Tensile tests (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable)	5.1.1	1 per lot*		PTS / Mat. Spec.	certif. 3.2	Perform	hold point	review report
	Charpy Impact test at temp. as per Mat. Spec.	5.1.2	1 per lot* (1 set of 3 specimen per temp. range)		PTS / Mat. Spec.	certif. 3.2	Perform	hold point	review report
1.2	<b>CHEMICAL COMPOSITION</b>								
	Check chemical analysis	3.10	1 per heat		PTS-Table1		Perform	review report	review report
<b>2</b>	<b>FABRICATION AND TESTS</b>								
2.1.	Heat treatment (Loading & Unloading shall be witnessed by TPIA, Power failure log shall be maintained)	4.3	all fittings	T/T Graph	PTS	certif. 3.2	Perform	Witness Point (Loading & Unloading)	review report
	- time temperature chart	4.3.1	1 per furnace charge			report	Perform	review report	review report
	- micrographic examination	4.3.2	1 per lot*	ASTM E 112	Grain size : range 8 to 12	certif. 3.2	Perform	hold point	review report
2.2.	<b>Mechanical tests</b> (remark : marking transfer by TPIA)					certif. 3.2	Perform	hold point	review report
2.2.1	- Tension test for flanges (YS, UTS, YS/UTS, %EL, RA, Bend etc. as applicable)	4.2.4 & 5.1.1	1 sample per lot of HT per Raw material Heat	ASTM A 350 § 6.1.3 + E/R <= 0.85 / PTS	PTS & Mat. Spec.	certif. 3.2	Perform	hold point	review report



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2.2.2	-	Charpy Impact test for flanges (Longitudinal & Transverse)	4.2.4 & 5.1.2	2 sets of 3 specimens per lot of HT per RM Heat	ISO 148 - Charpy V-Notch	- At 0°C Minimum Average Absorbed Energy shall be SMYS (Mpa)/10, with a minimum of 27 J, for the transverse direction. - At 0°C Minimum Individual Energy value shall not be less than 80 % of the Minimum required average value, for the transverse direction.	certif. 3.2	Perform	hold point	review report
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**QUALITY ASSURANCE PLAN  
FLANGES**

**P.019141  
G11013  
M005**

S.No.	ACTIVITY	PTS	Frequency	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.					Manufacturer	TPIA	Client / Consultant
<b>3</b>	<b>NON DESTRUCTIVE EXAMINATIONS (NDE)</b>								
3.1	Radiographic examination	6.1.1 and 6.1.3.4	All butt welds	ASME Section-V	Girth welds : API 1104 section 6.0	certif. 3.2	Perform	witness point	review report
3.2	Ultrasonic inspection	6.1.2.1, 6.1.2.2, 6.1.2.4, 6.1.3.3	100%	ASME Section-V, Art-23, SA-388	ASME section VIII division1 UF-55	certif. 3.2	Perform	witness point	review report
3.3	Magnetic particle inspection	6.1.2.1, 6.1.2.4, 6.1.3.2, 6.1.3.5,	100%	ASME Section-V	ASME section VIII division1 appendix 6	certif. 3.2	Perform	witness point	review report
3.4	After machining								
	- Magnetic particle or liquid penetrant of the bevels	6.1.2.4, 6.1.3.5,	all finished bevels	ASME Section-V	PTS § 5.3.3.5.	certif. 3.2	Perform	witness point	review report
	- Ultrasonic inspection of 25 mm of base material	6.1.2.1, 6.1.2.2, 6.1.2.4, 6.1.3.3	wall thickness ≥ 6 mm all finished bevels	ASME Section-V	PTS § 5.3.3.5.	certif. 3.2	Perform	witness point	review report
3.5	Visual examination	6.1.2.3 & 6.1.3.1	100%		PTS	certif. 3.2	Perform	hold point	review report
3.6	Dimensional examination	6.1.2.5	10% NPS ≤ 6" 100% NPS > 6"		PTS	certif. 3.2	Perform	witness point	review report
<b>4</b>	<b>FINAL INSPECTION TEST</b>								
4.1	Marking	8	all				Perform	witness point	review report
4.2	Inspector's stamp	8.1.1	all			certif. 3.2	Perform	hold point	review report
4.3	Documentation	9	-	PTS & P.O.	PTS & P.O.	certif. 3.2	Perform	hold point	review report

\* LOT - A lot consists of all fittings from one heat of steel with same initial wall thickness, from the same furnace charge for final normalizing heat treatment, from the same shape and the same main pipe dimension.



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<b>LEGEND:</b>					
RT : Radiographic test	PT : Liquid penetrant test	MT : Magnetic particle test	HT : Heat treatment	VT : Visual test	RM : Raw Material
R : Review	W : Witness	P : Performed	TPIA : Third Party Inspection Agency;	SMYS : Specified Minimum Yield Strength;	
<b>Hold point</b> = No further steps may be undertaken before the intervention of the appointed responsible takes place.					
<b>Witness point</b> = The appointed responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not.					
<b>Note:</b>					
1 The Above Testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure that the product also comply to the additional requirements as per Technical specifications and data sheets.					
2 The supplier shall submit their own detailed QAP prepared on the basis of the above for approval of Owner/EPMC and TPIA, for each size. Impact test at -20 deg C shall be conducted in addition to respective material requirement.					
3 Supplier shall submit Calibration certificates of all Instruments/Equipment to be used for Inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval.					
4 TPIA will have Right to Inspect minimum 10% of all manufacturing activities on each day or as specified above. Owner reserves the right to inspect any quantity of item at any time during execution.					
5 TPIA along with Owner/EPMC shall review/approve all the documents related to QAP/Quality manuals/Drawings etc.submitted by supplier.					
6 Manufacturer shall in coordination with Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/EPMC and TPIA to organise Inspection.					
7 Certification requirements shall comply with European Standard EN 10204 (latest edition)-3.2 issued by TPIA and Vendor.					
8 Heat treatment start and stop temperature chart shall be witnessed & signed by TPIA. Power failure log book / sheet shall be maintained					
9 For All Forging Materials, The Specimen Shall Be Taken From The Integral Part of The Forging.					

		<b>QUALITY ASSURANCE PLAN FLANGES</b>					<b>P.019141 G11013 M005</b>		
S.No.	ACTIVITY	PTS	Frequency	Applied standard e/o Procedure	Acceptance criteria	Document type	Scope of Inspection		
		chap.					Manufacturer	TPIA	Client / Consultant
10	Certification requirements shall comply with European Standard EN 10204 (latest edition)								
11	In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable.								



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		QUALITY CONTROL TABLE INSULATING GASKET				QCT No. : P.019141 G11013 M006		REMARKS
						Date: 26.09.2024	Revision: 0	
				Prepared : AML				
				Checked : GGA				
				Approved : SSM				
S. No	DESCRIPTION	QUANTUM OF CHECK	CHARACTERISTICS	ACCEPTANCE CRITERIA	DOCUMENTATION	INSPECTION		
						MANUF.	TPIA / CA	
<b>1</b>	<b>Raw Material Inspection</b>							
1.1	Insulating Gaskets	1 sample per heat	PHYSICAL , CHEMICAL	PTS / Data sheet	Test report	H	R	
1.2	Insulating Washer							
1.3	Insulating Sleeve							
1.4	Machine Cut Washer							
<b>2</b>	<b>Final Inspection</b>							
2.1	Raw Material		PHYSICAL , CHEMICAL	PTS / Data sheet	Test report	P	W	
2.2	Hydrotest and Pneumatic Test	Each Batch	PTS	PTS / Data sheet / Approved Procedure	Inspection report	P	W	
2.3	Visual & Dimensional check	100%	Measurement	PTS / Data sheet	Inspection report	P	R	
2.4	Marking	Each Batch	PTS	PTS / Data sheet / Approved Procedure	Inspection report	P	R	
2.5	Packing	Each Batch	PTS	PTS / Data sheet / Approved Procedure	Inspection report	P	R	
2.6	Documentation		PO / PTS	PTS / Data sheet	Inspection report	P	W	

**LEGEN** R - Review, W - Witness, RW - Random Witness, H - Hold, P - Perform, TPIA - Third Party Inspection Agency, CA - Control Authority ( Owner / owner's representative ) ,  
**DS:** P.O. - Purchase order

**Notes: -**

- 1 The Above Testing and acceptance criteria are minimum requirements, however, manufacturer shall ensure that the product shall also comply to the additional requirements as per Particular Technical specifications(PTS)
- 2 The testing of Flange and Stud Bolts shall be as per QCT Flanges (P.013313 D 11013 141) and QCT Fastners (P.013313 D 11013 143) respectively.
- 3 The supplier shall submit their own detailed QAP prepared on the basis of above / Technical specification for approval of Owner/Owner's representative.
- 4 Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc.submitted by supplier.
- 5 Contractor in coordination with Supplier/Sub vendor shall issue detailed Production and Inspection schedule indicating the dates and the locations to facilitate Owner/Owner's representative and TPIA to organise Inspection.
- 6 Special manufacturing procedures have to be specially approved or only previously approved procedures have to be used, in case of conflict between specifications more stringent condition shall be applicable.
- 7 Owner / Owner's representative including TPIA will have the right to inspect any activity of manufacturing at any time.
- 8 All reference Codes/ Standards, Documents, P.O. Copies shall be arranged by vendor / supplier for reference of TPIA/CA at the time of Inspection
- 9 At the time of deleviery of material in stores, vendor will submit copy of all related document of inspection along with release note & MTC.



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QUALITY CONTROL TABLE FASTENERS							QCT No. : P.019141 G11013 M007		
							Date: 26.09.2024	Revision: 0	
							Prepared : AML		
							Checked : GGA		
							Approved : SSM		
SR. NO	COMPONENTS & OPERATIONS	TYPES OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	INSPECTION		
							VENDOR	TPIA (By Manufacturer / Contractor)	CONTROL AUTHORITY
<b>1</b>	<b>RAW MATERIAL</b>								
	1. RAW MATERIAL	1. VISUAL INSPECTION, MARKING & CORRELATION WITH MANUFACTURE TEST CERTIFICATE)	100%	ASTM A 320 L7 / A 194 GR4/GR7	ASTM A 320 L7 / A 194 GR4/GR7	MTC 3.1	R	W	R
		2. CHEMICAL COMPOSITION	PER HEAT	ASTM A 320 L7 / A 194 GR4/GR7	ASTM A 320 L7 / A 194 GR4/GR7	MTC / LAB TEST REPORT 3.1	R	R	R
		3. MECHANICAL PROPERTIES	PER HEAT	ASTM A 320 L7 / A 194 GR4/GR7	ASTM A 320 L7 / A 194 GR4/GR7	INSPECTION REPORT 3.1	R	R	R
		4. PMI CHECK	100%	ASTM A 320 L7 / A 194 GR4/GR7	ASTM A 320 L7 / A 194 GR4/GR7	INSPECTION REPORT 3.2	P	W	R
<b>2</b>	<b>INPROCESS INSPECTION.</b>								
	1. MFG. OF BOLT & NUT	1.CUTTING , GRINDING, FORGING, THREADING ETC.	100%	VENDOR DRG./ ASTM A 320 L7 / A 194 GR4/GR7/ ASME B18.2.1&2.2	VENDOR DRG./ ASTM A 320 L7 / A 194 GR4/GR7/ ASME B18.2.1&2.2	DIMENSION REPORT 3.1	P	R	R
		2. PRODUCT DIMENSIONS	100%	VENDOR DRG./ ASTM A 320 L7 / A 194 GR4/GR7/ ASME B18.2.1&2.2	VENDOR DRG./ ASTM A 320 L7 / A 194 GR4/GR7/ ASME B18.2.1&2.2	DIMENSION REPORT 3.1	P	R	R
	2. HEAT TREATMENT	1. HEAT TREATMENT CYCLE (TEMP. / TIME CHART)	100%	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	ASTM A 370 / A 194 GR4/GR7/ SPECIFICATION.	HT GRAPH / INSPECTION REPORT 3.1	P	R	R
	3. STAMPING OF SAMPLE FOR TESTING	1. STAMPING OF TEST SAMPLE	100%	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	INSPECTION REPORT 3.2	P	W	R
	4. MECHANICAL TESTING	1. TENSILE TESTING (TS,YS,EL%)	ONE / HEAT/LOT	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	INSPECTION REPORT 3.2	P	W	R
		2. PROOF LOAD TEST	ONE / HEAT/LOT	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	INSPECTION REPORT 3.2	P	W	R
		3. HARDNESS TESTING	5 % / HEAT/LOT	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	INSPECTION REPORT 3.2	P	W	R
		4. IMPACT TEST AT - 101° C	ONE / HEAT/LOT	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	AVG 27J & IND 20J / SPECIFICATION.	INSPECTION REPORT 3.2	P	W	R
	5. PRODUCT CHEMICAL CHECK ANALYSIS	1. CHEMICAL ANALYSIS	ONE / HEAT/LOT	ASTM A 370 / A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	A 320 L7 / A 194 GR4 / GR7 / SPECIFICATION.	INSPECTION REPORT 3.1	P	R	R
		2. PMI TEST	5 % / HEAT/LOT	A 320 L7 / A 194 GR4/GR7/ SPECIFICATION.	A 320 L7 / A 194 GR4 / GR7 / SPECIFICATION.	INSPECTION REPORT 3.2	P	W	R
<b>3</b>	<b>FINAL INSPECTION</b>								
	1.FINAL INSPECTION	1.VISUAL \STAMPING\MARKING\ COLOR CODING.	100%	SPECIFICATION/ ASTM A 320 L7/ A194 GR4/GR7	SPECIFICATION/ ASTM A 320 L7/ A194 GR4/GR7	INSPECTION REPORT 3.2	P	100% W	R
		2. DIMENSIONS	100%	APPRD. DRG./ ASTM A 320 L7 / A194 GR4/GR7	APPRD. DRG./ ASTM A 320 L7 / A194 GR4/GR7	INSPECTION REPORT 3.2	P	10% W	R
<b>4</b>	<b>FINAL DOCUMENTS</b>								
	1. FINAL DOCUMENTS	1. QAP / PO / MTC / IR / COMPLIANCE CERTIFICATES	100%	AS PER SPECIFICATION / AS PER APPR. DRG. & QAP	AS PER SPECIFICATION / AS PER APPR. DRG. & QAP	COMPLIANCE CERTIFICATE	P	R	R
		2. INSPECTION RELEASE NOTE	100%	AS PER SPECIFICATION / AS PER APPR. DRG. & QAP	AS PER SPECIFICATION / AS PER APPR. DRG. & QAP	COMPLIANCE CERTIFICATE	H	P	R



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<b>Legend:</b>	P-Perform, R-Review, W-Witness, H-Hold, TPIA: Third Party Inspection Agency, Control Authority : Owner / Owner's representatives.
<b>NOTE :</b>	1. TPIA SHALL ISSUE 3.2 CERTIFICATE AS PER BS EN 10204
	2. MATERIAL & TYPE SHALL BE AS PER SPECIFICATIONS / DATA SHEET
	3. START & STOP TEMP. CHART SHALL BE SIGNED BY TPIA, ALSO POWER FAILURE LOG SHALL BE MAINTAINED.
	4. SAMPLE FROM ANY ONE LOT/HEAT SHALL BE TESTED BY CLIENT UNDER THEIR WITNESS AT ANY NABL ACCREDITED LAB.
	5. IN CASE OF CONFLICT BETWEEN PURCHASE SPECIFICATION, CONTRACT DOCUMENTS AND QAP, MORE STRINGENT CONDITIONS SHALL BE APPLICABLE.



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Sr.No	Name of ITEM/Package	Recommended Vendor List
1	<b>COALESCENT FILTER / REGULATORS</b>	ASEA BROWN BOVERI LTD.
2	COALESCENT FILTER / REGULATORS	BLUE STAR LTD
3	COALESCENT FILTER / REGULATORS	PLACKA INSTRUMENTS & CONTROLS PVT. LTD
4	COALESCENT FILTER / REGULATORS	SHAH PNEUMATICS
5	COALESCENT FILTER / REGULATORS	SHAVO NORGREN (I) PVT. LTD
6	COALESCENT FILTER / REGULATORS	PARKER
7	COALESCENT FILTER / REGULATORS	WEH
8	COALESCENT FILTER / REGULATORS	V AUTOMAT & INSTRUMENTS PVT. LTD.
9	COALESCENT FILTER / REGULATORS	VELJAN HYDRAIR PVT. LTD.
10	COALESCENT FILTER / REGULATORS	COMPAC NEWZEALAND
11	COALESCENT FILTER / REGULATORS	GASOREX
12	COALESCENT FILTER / REGULATORS	OEM
13	<b>PRESSURE RELIEF VALVE</b>	ALSTHOM FLUIDS SAPAG
14	PRESSURE RELIEF VALVE	ANDERSON GREENWOOD CROSBY
15	PRESSURE RELIEF VALVE	BHEL (TRICHY )
16	PRESSURE RELIEF VALVE	DRESSER INC.
17	PRESSURE RELIEF VALVE	FUKUI SEISAKUSHO CO. LTD.
18	PRESSURE RELIEF VALVE	INSTRUMENTATION LTD. (PALGHAT)
19	PRESSURE RELIEF VALVE	NAKAKITA SEISAKUSHO CO LTD.
20	PRESSURE RELIEF VALVE	PARCOL SPA
21	PRESSURE RELIEF VALVE	SAFETY SYSTEMS UR LTD.
22	PRESSURE RELIEF VALVE	SARASIN RSBD
23	PRESSURE RELIEF VALVE	SEBIN VALVES INDIA PVT. LTD.
24	PRESSURE RELIEF VALVE	TAI MILANO SPA
25	PRESSURE RELIEF VALVE	TYCO SANMAR LTD.
26	PRESSURE RELIEF VALVE	TYCO VALVES & CONTROLS INDIA PVT. LTD
27	PRESSURE RELIEF VALVE	SWAGELOK
28	PRESSURE RELIEF VALVE	PARKER
29	PRESSURE RELIEF VALVE	COMPAC NEWZEALAND
30	PRESSURE RELIEF VALVE	ASPRO
31	PRESSURE RELIEF VALVE	NUOVO PIGNONE SPA (ITALY)
32	PRESSURE RELIEF VALVE	FARINOSLA
33	PRESSURE RELIEF VALVE	FAINGER LASER
34	PRESSURE RELIEF VALVE	MERCER
35	PRESSURE RELIEF VALVE	FISHER ROSEMOUNT (EMERSON)
36	PRESSURE RELIEF VALVE	OFE & OE GROUP KEYSTONE VALVES PVT. LTD
37	PRESSURE RELIEF VALVE	HALOL
38	PRESSURE RELIEF VALVE	M/s Nirmal
39	PRESSURE RELIEF VALVE (PRV)	FMC SANMAR LTD.
40	PRESSURE RELIEF VALVE (PRV)	PROTEGO INDIA PVT. LTD.



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41	PRESSURE RELIEF VALVE (PRV)	L&T VALVES LTD.
42	PRESSURE RELIEF VALVE (PRV)	MEKASTER (FORMERLY SEBIM) VALVES INDIA PVT. LTD.
43	PRESSURE RELIEF VALVE (PRV)	RMG REGAL + MESSTECH GMBH, GERMANY
44	PRESSURE RELIEF VALVE (PRV)	TYCO VALVES
45	<b>HOSES</b>	PARKER
46	HOSES	EATON
47	HOSES	SWAGELOK

Sr.No	Name of ITEM/Package	Recommended Vendor List
48	HOSES	TRANSFER OIL
49	HOSES	M/s. ZEC S.p.A Italy
50	<b>BREAKAWAY COUPLING</b>	OPW
51	BREAKAWAY COUPLING	STAUBLI
52	BREAKAWAY COUPLING	WEH
53	BREAKAWAY COUPLING	PARKER
54	BREAKAWAY COUPLING	OASIS
55	<b>FLAMEPROOF GLANDS</b>	COMET/OEM MAKE
56	<b>SURGE PROTECTOR</b>	PHONEX
57	SURGE PROTECTOR	MTL
58	SURGE PROTECTOR	P&F
59	SURGE PROTECTOR	OEM MAKE
60	SURGE PROTECTOR	MEGGITT AVIONICS
61	SURGE PROTECTOR	GENERAL MONITORS/ MSA
62	SURGE PROTECTOR	SPECTREX
63	SURGE PROTECTOR	DETRONICS
64	SURGE PROTECTOR	HONEYWELL
65	SURGE PROTECTOR	NET SAFETY
66	SURGE PROTECTOR	CROW ON
67	SURGE PROTECTOR	SIEGER
68	SURGE PROTECTOR	ISOLATORS
69	SURGE PROTECTOR	BARRIERS
70	SURGE PROTECTOR	ESP
71	SURGE PROTECTOR	Schneider
72	SURGE PROTECTOR	ASPRO
73	<b>NGV NOZZLES</b>	OPW
74	NGV NOZZLES	WEH
75	NGV NOZZLES	STAUBLI
76	NGV NOZZLES	PARKER
77	NGV NOZZLES	COMPAC
78	NGV NOZZLES	SHEREX
79	NGV NOZZLES	OASIS
80	<b>STATION PIPE</b>	MAHARASHTRA SEAMLESS LTD.
81	STATION PIPE	INDIAN SEAMLESS METAL TUBES
82	STATION PIPE	SURYA GLOBAL STEEL & TUBES
83	STATION PIPE	INTERFORGE



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84	STATION PIPE	HEAVY METAL & TUBES LTD.
85	STATION PIPE	JINDAL SAW LTD.
86	STATION PIPE	MAHA LAKSHMI SEAMLESS LTD.
87	STATION PIPE	RATANAMANI METAL TUBES LTD.
88	<b>BALL VALVES</b>	FLOW CHEM
89	BALL VALVES	L&T VALVES LIMITED
90	BALL VALVES	MICROFINISH VALVES PVT. LTD.
91	BALL VALVES	STEEL STRONG VALVES (I) PVT LTD.
92	BALL VALVES	OSWAL INDUSTRIES LTD.
93	BALL VALVES	NILON VALVES PVT LTD.
94	BALL VALVES	PETRO VALVES PVT. LTD.

Sr.No	Name of ITEM/Package	Recommended Vendor List
95	BALL VALVES	ZED VALVES CO. PVT LTD.
96	BALL VALVES	HAWA ENGINEERING LTD. INDIA
97	BALL VALVES	GM ENGINEERING
98	BALL VALVES	LEADER VALVES LTD.
99	BALL VALVES	VIRGO VLAVES
100	BALL VALVES	AUDCO
101	BALL VALVES	ROTEX
102	BALL VALVES	TUBEFIT
103	<b>INSULATING JOINTS</b>	IGP ENGINEERS PVT. LTD., CHENNAI, TAMIL NADU, INDIA
104	INSULATING JOINTS	ADVANCE ELECTRONICS SYSTEM, GUJARAT, INDIA
105	INSULATING JOINTS	NUPROS INC. GUJRAT
106	INSULATING JOINTS	VEE KAY VIKRAM & CO. LLP, AHMEDABAD - 380054 ,GUJARAT, INDIA
107	<b>GLOBE VALVES</b>	NSSL
108	GLOBE VALVES	OSWAL INDUSTRIES LTD.
109	GLOBE VALVES	L&T VALVES LIMITED
110	GLOBE VALVES	ZED VALVES CO. PVT LTD.
111	GLOBE VALVES	STEEL STRONG VALVES (I) PVT LTD.
112	GLOBE VALVES	LEADER VALVES LTD.
113	GLOBE VALVES	NILON VALVES PVT LTD.
114	GLOBE VALVES	NITON VALVES PVT. LTD.
115	GLOBE VALVES	PETRO VALVES PVT. LTD.
116	GLOBE VALVES	FLOWCHEM INDUSTRIES
117	GLOBE VALVES	GM ENGINEERING
118	GLOBE VALVES	WEIR BDK VALVES
119	<b>CHECK VALVES</b>	ECONO VALVES PVT. LTD.
120	CHECK VALVES	L&T VALVES LTD.
121	CHECK VALVES	OSWAL INDUSTRIES LTD
122	CHECK VALVES	NILON VALVES PVT LTD.
123	CHECK VALVES	WEIR BDK VALVES
124	CHECK VALVES	FLOWCHEM INDUSTRIES
125	CHECK VALVES	NSSL LIMITED
126	CHECK VALVES	LEADER VALVES LTD.



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127	CHECK VALVES	NITON VALVES IND. PVT. LTD.
128	<b>TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES</b>	<b>SWAGELOK</b>
129	TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES	PARKER
130	TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES	COMPAC
131	TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES	
132	TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES	
133	TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES	
134	TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES	OASIS
135	TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES	SSP
136	TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES	DK-LOK
137	TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES	OASIS
138	<b>INSTRUMENT SS FITTINGS/ VALVES</b>	SWAGELOK
139	INSTRUMENT SS FITTINGS/ VALVES	PARKER
140	INSTRUMENT SS FITTINGS/ VALVES	DK-LOK
141	INSTRUMENT SS FITTINGS/ VALVES	HYLOK

Sr.No	Name of ITEM/Package	Recommended Vendor List
142	INSTRUMENT SS FITTINGS/ VALVES	DKLOK
143	INSTRUMENT SS FITTINGS/ VALVES	
144	INSTRUMENT SS FITTINGS/ VALVES	SSP
145	INSTRUMENT SS FITTINGS/ VALVES	
146	INSTRUMENT SS FITTINGS/ VALVES	ABAC
147	INSTRUMENT SS FITTINGS/ VALVES	STAUFF
148	INSTRUMENT SS FITTINGS/ VALVES	M/s Fluid Controls
149	INSTRUMENT SS FITTINGS/ VALVES	
150	INSTRUMENT SS FITTINGS/ VALVES	-
151	<b>SS TUBING</b>	SANDVIK
152	SS TUBING	
153	SS TUBING	TUBACEX
154	SS TUBING	PARKER
155	SS TUBING	RATANAMANI
156	SS TUBING	
157	<b>PIPE FITTINGS ( SEAMLESS / WELDED)</b>	TEEKAY TUBE
158	PIPE FITTINGS ( SEAMLESS / WELDED)	AMFORGE INDUSTRIES
159	PIPE FITTINGS ( SEAMLESS / WELDED)	PIPEFIT ENGINEERS PVT. LTD.
160	PIPE FITTINGS ( SEAMLESS / WELDED)	C D ENGINEERING CO. GHAZIABAD
161	PIPE FITTINGS ( SEAMLESS / WELDED)	CHW FORGE PVT LTD., GHAZIABAD
162	PIPE FITTINGS ( SEAMLESS / WELDED)	SANGHVI FORGING & ENGINEERING, VADODARA
163	PIPE FITTINGS ( SEAMLESS / WELDED)	GOOD LUCK ENGINEERING CO. / GOOD LUCK INDIA LTD., GHAZIABAD
164	PIPE FITTINGS ( SEAMLESS / WELDED)	UTSAH ENGINEERING PVT. LTD, GHAZIABAD
165	PIPE FITTINGS ( SEAMLESS / WELDED)	JINDAL FORGINGS PVT LTD
166	PIPE FITTINGS ( SEAMLESS / WELDED)	SHAKTI FORGE INDUSTRIES
167	PIPE FITTINGS ( SEAMLESS / WELDED)	A.M. ENGINEERS
168	PIPE FITTINGS ( SEAMLESS / WELDED)	KUNJ FORGING (P) LTD GHAZIABAD
169	PIPE FITTINGS ( SEAMLESS / WELDED)	VIVIAL FORGE (P) LTD.



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170	PIPE FITTINGS ( SEAMLESS / WELDED)	PIPEFIT ENGINEERS PVT. LTD.
171	PIPE FITTINGS ( SEAMLESS / WELDED)	UNITED FORGE INDUSTRIES
172	PIPE FITTINGS ( SEAMLESS / WELDED)	SKY FORGE PVT. LTD.
173	PIPE FITTINGS ( SEAMLESS / WELDED)	SAWAN ENGINEERS PVT. LTD.
174	PIPE FITTINGS ( SEAMLESS / WELDED)	DEE PIPING SYSTEM (EARLIER DEE DEVELOPMENT ENGINEERS PVT. LTD.)
175	PIPE FITTINGS ( SEAMLESS / WELDED)	SIDDHARTH & GAUTAM INDIA
176	PIPE FITTINGS ( SEAMLESS / WELDED)	M.S. FITTINGS MANUFACTURING COMPANY PVT. LTD.
177	PIPE FITTINGS ( SEAMLESS / WELDED)	GUJRAT INFRA PIPES PVT. LTD.
178	PIPE FITTINGS ( SEAMLESS / WELDED)	TOPAZ PIPING INDUSTRIES
179	PIPE FITTINGS ( SEAMLESS / WELDED)	COMMERCIAL SUPPLYING AGENCY, MUMBAI
180	PIPE FITTINGS ( SEAMLESS / WELDED)	EBY INDUSTRIES, MUMBAI
181	<b>PIPE FITTINGS (FORGED)</b>	SIDDHARTH & GAUTAM
182	PIPE FITTINGS (FORGED)	C D ENGINEERING CO. GHAZIABAD
183	PIPE FITTINGS (FORGED)	CHW FORGE PVT LTD., GHAZIABAD
184	PIPE FITTINGS (FORGED)	SANGHVI FORGING & ENGINEERING, VADODARA
185	PIPE FITTINGS (FORGED)	AMFORGE INDUSTRIES
186	PIPE FITTINGS (FORGED)	GOOD LUCK ENGINEERING CO. /GOOD LUCK INDIA LTD., GHAZIABAD
187	PIPE FITTINGS (FORGED)	UTSAH ENGINEERING PVT. LTD, GHAZIABAD
188	PIPE FITTINGS (FORGED)	JINDAL FORGINGS PVT LTD

Sr.No	Name of ITEM/Package	Recommended Vendor List
189	PIPE FITTINGS (FORGED)	SHAKTI FORGE INDUSTRIES
190	PIPE FITTINGS (FORGED)	A.M. ENGINEERS
191	PIPE FITTINGS (FORGED)	KUNJ FORGING (P) LTD GHAZIABAD
192	PIPE FITTINGS (FORGED)	VIVIAL FORGE (P) LTD.
193	PIPE FITTINGS (FORGED)	PIPEFIT ENGINEERS PVT. LTD.
194	PIPE FITTINGS (FORGED)	UNITED FORGE INDUSTRIES
195	PIPE FITTINGS (FORGED)	SKY FORGE PVT. LTD.
196	PIPE FITTINGS (FORGED)	DEE PIPING SYSTEM (EARLIER DEE DEVELOPMENT ENGINEERS PVT. LTD.)
197	<b>FLOW TEES</b>	TECHNOGORGE- ITALY (INTERNATIONAL PIPING GROUP)
198	FLOW TEES	PIPEFIT ENGINEERS PVT. LTD.
199	FLOW TEES	VIVIAL FORGE PVT LTD
200	FLOW TEES	UNITED FORGE PVT LTD
201	FLOW TEES	MULTITEX FILTRATIONS
202	FLOW TEES	SAWAN ENGINEERS PVT. LTD.
203	<b>FLANGES</b>	ECHJAY INDUSTRIES PVT. LTD.
204	FLANGES	CD INDUSTRIES
205	FLANGES	CHW FORGE (CHOUDHARY HAMMER WORKS)
206	FLANGES	METAL FORGINS (P) LTD.
207	FLANGES	PUNJAB STEEL WORKS
208	FLANGES	AMFORGE INDUSTRIES
209	FLANGES	JAV FORGINGS PVT. LTD.
210	FLANGES	C D ENGINEERING CO.
211	FLANGES	GOOD LUCK ENGINEERING CO. /



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212	FLANGES	GOOD LUCK INDIA LTD., GHAZIABAD
213	FLANGES	UTSAH ENGINEERING PVT. LTD, GHAZIABAD
214	FLANGES	JINDAL FORGINGS PVT LTD
215	FLANGES	SHAKTI FORGE INDUSTRIES
216	FLANGES	A.M. ENGINEERS
217	FLANGES	KUNJ FORGING (P) LTD GHAZIABAD
218	FLANGES	VIVIAL FORGE (P) LTD.
219	FLANGES	J K FORGINGS
220	FLANGES	SANGHVI FORGING & ENGINEERING LTD.
221	FLANGES	PIPEFIT ENGINEERS PVT. LTD.
222	FLANGES	SAWAN ENGINEERS PVT. LTD.
223	<b>WELDING ELECTRODE</b>	FOR MAINLINE- LINCOLN / BOHLER MAKE
224	WELDING ELECTRODE	FOR TERMINAL / STATION PIPING- LINCOLN/D&H
225	WELDING ELECTRODE	FOR Mainline/Terminal/Station Piping- M/s. ITW HOBART
226	<b>NDT AGENCIES</b>	NDT SERVICES, AHMEDABAD
227	NDT AGENCIES	RTD , MUMBAI
228	NDT AGENCIES	SIEVERT, MUMBAI
229	NDT AGENCIES	X-TECH - VIZAG
230	NDT AGENCIES	GEECY INDUSTRIAL SERVICES PVT. LTD. MUMBAI
231	<b>FASTENERS</b>	MULTI FASTENERS PVT. LTD.
232	FASTENERS	PRECISION ENGINEERING INDUSTRIES
233	FASTENERS	PRECISION AUTO ENGINEERS
234	FASTENERS	NITIN FASTENERS
235	FASTENERS	DEEPAK FASTENERS LTD.

Sr.No	Name of ITEM/Package	Recommended Vendor List
236	FASTENERS	FIX FIT FASTING MFG. PVT. LTD.
237	FASTENERS	PACIFIC FORGING & FASTNERS PVT LTD., MUMBAI
238	FASTENERS	MULTI FASTNERS PVT LTD., VADODARA
239	FASTENERS	AEP COMPANY, ANAND
240	FASTENERS	HARDWIN FASTENERS PVT LTD., MUMBAI
241	FASTENERS	SYNDICATE ENGINEERING INDUSTRIES, MUMBAI
242	FASTENERS	PIONEER NUTS AND BOLTS PVT. LTD., LUDHIANA
243	FASTENERS	MULTI THREAD FASTENERS, VADODARA
244	FASTENERS	PRESIDENT ENGINEERING WORKS, MUMBAI
245	FASTENERS	UDHERA FASTNERS LTD. LUDHIANA
246	FASTENERS	NEXO INDUSTRIES LIMITED, LUDHIANA
247	FASTENERS	CONSOL ENGINEERING & FASTENERS INDUSTRIES, HOWRAH
248	FASTENERS	NIREKA ENGG CO. PVT. LTD.
249	<b>GASKETS</b>	GOODRICH GASKETS. PVT. LTD.
250	GASKETS	IGP ENGINEERS PVT. LTD., CHENNAI, TAMIL NADU, INDIA
251	GASKETS	MADRAS INDUSTRIAL PRODUCTS
252	GASKETS	BANCO PRODUCTS (P) LTD.
253	GASKETS	UNI KLINGER LIMITED, NEW DELHI
254	GASKETS	GASKET INDIA PRIVATE LTD., CHENNAI



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255	GASKETS	STARFLEX SEALING INDIA PVT. LTD.
256	<b>HEAT SHRINKABLE SLEEVES</b>	SHRI NARAYAN IMPAC INDIA LLP (SNI) (HSS and HDD Sleeves )
257	HEAT SHRINKABLE SLEEVES	DENSO GMBH
258	HEAT SHRINKABLE SLEEVES	SEAL FOR LIFE INDUSTRIES HTLP-80 (HSS) & DIREX SLEEVE (HDD)
259	HEAT SHRINKABLE SLEEVES	CYG CHANGTONG NEW MATERIAL CO. LTD., CHINA
260	<b>COLD APPLIED TAPES</b>	BERRY PLASTICS CORPORATION, BELGIUM- COVALENCE BRAND
261	COLD APPLIED TAPES	DENSO GMBH
262	COLD APPLIED TAPES	CANUSA-CPS A DIVISION OF SHAWCOR INC.
263	<b>PUR (TAR-FREE) COATING</b>	DENSO GMBH
264	PUR (TAR-FREE) COATING	BERRY PLASTICS CORPORATION, OMAN/ HOUSTON- POWERCRETE BRAND
265	<b>CASING END CLOSURE</b>	RAYCHEM RPG LIMITED
266	CASING END CLOSURE	SEAL FOR LIFE INDUSTRIES
267	CASING END CLOSURE	RACI, ITALY
268	<b>ROCKSHIELD</b>	RAYCHEM RPG LIMITED
269	ROCKSHIELD	SEAL FOR LIFE
270	ROCKSHIELD	DENSO GMBH
271	<b>SPACER / INSULATOR</b>	RAYCHEM RPG LIMITED
272	SPACER / INSULATOR	MALON TECHNICAL PRODUCTS
273	SPACER / INSULATOR	ADVANCE PRODUCTS & SYSTEM INC.
274	SPACER / INSULATOR	RACI, ITALY
275	<b>WARNING MAT</b>	AMBICA PLASTIC INDUSTRIES
276	WARNING MAT	SPARCO MULTIPLAST PVT. LTD.
277	WARNING MAT	SHRI VIJAY WIRE PVT. LTD.
278	WARNING MAT	SINGHAL INDUSTRIES PVT LTD
279	WARNING MAT	BINA ENTERPRISE
280	<b>GI PIPES</b>	TATA BSL LTD
281	GI PIPES	SWASTIK PIPE LTD.
282	GI PIPES	JINDAL INDUSTRIES LTD.

Sr.No	Name of ITEM/Package	Recommended Vendor List
283	GI PIPES	VISHAL PIPES LTD.
284	GI PIPES	INDUS TUBES LTD.
285	GI PIPES	ADVANCE STEEL TUBES LTD.
286	GI PIPES	SURYA ROSHNI LIMITED
287	GI PIPES	RAMA STEEL TUBES
288	GI PIPES	P S STEEL TUBES
289	GI PIPES	M/s Goodluck India Ltd
290	<b>GI FITTINGS</b>	SARIN INDUSTRIES LTD.
291	GI FITTINGS	JUPITER METAL INDUSTRIES LTD.
292	GI FITTINGS	JAINSONS INDUSTRIES LTD.
293	GI FITTINGS	JINAN MEIDE
294	GI FITTINGS	GREEN MALLEABLE PVT LTD
295	GI FITTINGS	RAJNESH MALLEABLE LTD., DELHI
296	GI FITTINGS	INDUSTRIAL VALVES & COMPONENTS, DELHI
297	GI FITTINGS	EXCEL METAL & ENGINEERING INDUSTRIES,MUMBAI



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298	GI FITTINGS	MODERN STORES & ENGINEERING CONCERN, KOLKATA
299	GI FITTINGS	CHOKHAWALA DISTRIBUTORS (FOR JINAN MEIDE)
300	<b>FORGED FITTINGS</b>	JAINSONS INDUSTRIES LTD JALANDHAR
301	FORGED FITTINGS	MODERN STORES & ENGINEERING CONCERN, KOLKATA
302	FORGED FITTINGS	BHARAT FORGE & PRESS INDUSTRIES BARODA
303	FORGED FITTINGS	B M METERS PVT LTD, JALANDHAR
304	<b>ISOLATION BALL VALVE &amp; APPLIANCE VALVE</b>	ENOLOGAS BONOMI S.P.A.
305	ISOLATION BALL VALVE & APPLIANCE VALVE	NINGBO ZHIQING INDUSTRIAL CO. LIMITED
306	ISOLATION BALL VALVE & APPLIANCE VALVE	ZHEJIANG VALOGIN TECHNOLOGY CO. LTD.
307	ISOLATION BALL VALVE & APPLIANCE VALVE	UMESH ENTERPRISES
308	ISOLATION BALL VALVE & APPLIANCE VALVE	PARKER HANNIFIN S.P.A.
309	ISOLATION BALL VALVE & APPLIANCE VALVE	CHANDAN ENTERPRISES
310	ISOLATION BALL VALVE & APPLIANCE VALVE	ZHEJIANG YIFAN TECHNOLOGY CO., LTD.
311	<b>PE (FITTING/VALVES/TRANSITION FITTINGS)</b>	GEORG FISCHER PIPING SYSTEM
312	PE (FITTING/VALVES/TRANSITION FITTINGS)	KIMPLAS PIPING SYSTEMS
313	PE (FITTING/VALVES/TRANSITION FITTINGS)	INNOGAZ & M/S FRIALEN OF M/S ALIAXIS UTILITIES & INDUSTRY PVT. LTD. (FORMERLY GLYNWED PIPE SYSTEMS)
314	PE (FITTING/VALVES/TRANSITION FITTINGS)	RMG AUTOMETERS GAS TECHNOLOGIES
315	PE (FITTING/VALVES/TRANSITION FITTINGS)	FRIATECH AG, GERMANY (REPRESENTED BY SHERMAN SALES IN INDIA)
316	PE (FITTING/VALVES/TRANSITION FITTINGS)	AL-AZIZ PLASTICS (P) LTD.
317	<b>STEEL REINFORCED RUBBER HOSE (TYPE-4)</b>	SUPER SEAL FLEXIBLE HOSE LTD.
318	STEEL REINFORCED RUBBER HOSE (TYPE-4)	SURAKSHA PRODUCTS PVT. LTD.
319	STEEL REINFORCED RUBBER HOSE (TYPE-4)	VANSH INDUSTRIES
320	STEEL REINFORCED RUBBER HOSE (TYPE-4)	T & L GASES
321	<b>CORRUGATED FLEXIBLE METAL HOSE (ANACONDA)</b>	KPC FLEX TUBES
322	CORRUGATED FLEXIBLE METAL HOSE (ANACONDA)	VESTAS HOSE DIVISION
323	CORRUGATED FLEXIBLE METAL HOSE (ANACONDA)	ALFA HOSES & BELLOWS MFG. CO.
324	CORRUGATED FLEXIBLE METAL HOSE (ANACONDA)	ALPHA FLEXI TUBES
325	CORRUGATED FLEXIBLE METAL HOSE (ANACONDA)	CHANDAN ENTERPRISES
326	CORRUGATED FLEXIBLE METAL HOSE (ANACONDA)	VIKRAM & CO.
327	<b>MDPE PIPE</b>	HARI UDYOG PVT. LTD
328	MDPE PIPE	JAIN IRRIGATION SYSTEMS LTD.

Sr.No	Name of ITEM/Package	Recommended Vendor List
329	MDPE PIPE	ORI PLAST LTD.
330	MDPE PIPE	VISHAKHA IRRIGATION PVT. LTD.
331	MDPE PIPE	DURALINE INDIAN PVT. LTD.
332	MDPE PIPE	KRITI INDUSTRIES (I) LTD., INDORE
333	MDPE PIPE	VEEKAY PLAST
334	MDPE PIPE	M/s Venuka Polymers Pvt. Ltd
335	<b>COPPER TUBES &amp; FITTINGS</b>	RAJCO METAL
336	COPPER TUBES & FITTINGS	MEHTA TUBES
337	COPPER TUBES & FITTINGS	JAY BANAS METALS PVT. LTD
338	COPPER TUBES & FITTINGS	PARAS INDUSTRIES LTD. (ONLY FOR FITTINGS)



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339	COPPER TUBES & FITTINGS	CHANDAN ENTERPRISE
340	COPPER TUBES & FITTINGS	JANYA EXTRUSIONS PVT LTD.
341	<b>BRASS FITTINGS</b>	PARAS INDUSTRIES LTD.
342	BRASS FITTINGS	CHANDAN ENTERPRISES
343	BRASS FITTINGS	PARAS INDUSTRIES LTD.
344	BRASS FITTINGS	OM BRASS ENTERPRISES
345	BRASS FITTINGS	CHOKHAWALA DISTRIBUTORS
346	<b>THIRD PARTY INSPECTION AGENCY</b>	AMERICAN BUREAU SERVICES
347	THIRD PARTY INSPECTION AGENCY	TECHNISCHE ULIERWACHUNGS VEREIN (TUV)
348	THIRD PARTY INSPECTION AGENCY	DNV-GL
349	THIRD PARTY INSPECTION AGENCY	MS EDLIPSE ENGINEERING GLOBAL PVT. LTD
350	THIRD PARTY INSPECTION AGENCY	INTERNATIONAL CERTIFICATION SERVICES PVT LTD
351	THIRD PARTY INSPECTION AGENCY	BUREAU VERITAS
352	THIRD PARTY INSPECTION AGENCY	CERTIFICATION ENGINEERS INTERNATIONALLIMITED (CEIL)
353	THIRD PARTY INSPECTION AGENCY	LLOYD REGISTER OF INDUSTRIAL SERVICES
354	THIRD PARTY INSPECTION AGENCY	SGS
355	THIRD PARTY INSPECTION AGENCY	TUV INDIA PVT. LTD. (TUV - NORD)
356	THIRD PARTY INSPECTION AGENCY	TUV-SUD SOUTH ASIA
357	THIRD PARTY INSPECTION AGENCY	M/s. Industrial Inspection & Verification Services (I) Pvt. Ltd
358	THIRD PARTY INSPECTION AGENCY	M/s Hertz Inspection Services pvt. Ltd
359	<b>HDPE Pipe</b>	DURALINE INDIA
360	HDPE Pipe	JAIN IRRIGATION SYSTEMS LIMITED
361	HDPE Pipe	KRITI INDUSTRIES INDIA LTD.
362	HDPE Pipe	ORIPLAST LTD.
363	HDPE Pipe	VEE KAY PLAST
364	HDPE Pipe	VISHAKHA IRRIGATION PVT. LTD.
365	HDPE Pipe	HARI PLAST
366	HDPE Pipe	CLIMAX SYNTHETICS (P) LTD., VADODRA
367	HDPE Pipe	SANGIR PLASTICS (P) LTD., MUMBAI
368	HDPE Pipe	HIMALYAN PIPE INDUSTRIES, SOLAN
369	HDPE Pipe	DUTRON POLYMERS LTD.
370	HDPE Pipe	PARIXIT IRRIGATION LIMITED
371	HDPE Pipe	VEEKAY PLAST
372	<b>HDPE DUCT FOR OFC</b>	JAIN IRRIGATION SYSTEM LTD
373	HDPE DUCT FOR OFC	KIRTI INDUSTRIES
374	HDPE DUCT FOR OFC	ORIPLAST
375	HDPE DUCT FOR OFC	DURA-LINE

Sr.No	Name of ITEM/Package	Recommended Vendor List
376	HDPE DUCT FOR OFC	VEEKAY PLAST
377	HDPE DUCT FOR OFC	VEDANTA POLYMER PVT LTD
378	HDPE DUCT FOR OFC	HARIPLAST
379	HDPE DUCT FOR OFC	PARIXIT INDUSTRIES LTD
380	HDPE DUCT FOR OFC	PENNWALT AGRU PLASTIC LT
381	<b>CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)</b>	HEAVY METAL & TUBES LTD., MEHSANA



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382	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	ISMT LIMITED
383	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	JINDAL SAW LTD.
384	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	MAHARASHTRA SEAMLESS LIMITED
385	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	MAHALAXMI METAL CORPORATION
386	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	SAINEST TUBES PVT. LTD.
387	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	RATNADEEP METAL & TUBES LTD.
388	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	JFE STEEL CORPORATION
389	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	MANNESMANN S.A.
390	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	ARCELORMITTAL TUBULAR PRODUCTS ROMAN SA
391	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	SUMITOMO METAL IND.LTD
392	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	NIPPON METAL INDUSTRY CO
393	CARBON STEEL PIPE (ASTM A106 Gr. B , A333 Gr.6 Station Pipe)	TENARIS
394	<b>CARBON STEEL PIPES (API 5L GRADE - PSL2)</b>	RATNAMANI METALS & TUBES LTD. - FOR UP TO 18" ERW PIPES & SAW PIPES OF 18" & ABOVE.
395	CARBON STEEL PIPES (API 5L GRADE - PSL 2)	TATA BHUSHAN STEEL LIMITED- FOR UP TO 18" ERW PIPES
396	CARBON STEEL PIPES (API 5L GRADE - PSL 2)	JINDAL INDIA LTD - FOR UP TO 18" ERW PIPES
397	CARBON STEEL PIPES (API 5L GRADE - PSL 2)	JINDAL SAW – FOR 16" & ABOVE SAW PIPES
398	CARBON STEEL PIPES (API 5L GRADE - PSL 2)	SURYA ROSHINI LTD-- FOR UP TO 16" ERW PIPES & SAW PIPES OF 18" & ABOVE
399	CARBON STEEL PIPES (API 5L GRADE - PSL 2)	MAHARASHTRA SEAMLESS LIMITED - SEAMLESS PIPES, ERW PIPES,
400	CARBON STEEL PIPES (API 5L GRADE - PSL 2)	WELSPUN CORP LTD - ERW PIPES & SAW PIPES
401	<b>QUICK CONNECT BODY &amp; STEM</b>	PARKER (double shut off valve type)
402	QUICK CONNECT BODY & STEM	SWAGELOK ( double shut off valve type)
403	<b>QUICK CONNECT BODY &amp; STEM</b>	PSL LTD.
404	QUICK CONNECT BODY & STEM	JINDAL SAW LIMITED
405	<b>HOT INDUCTION BEND</b>	WELSPUN GUJRAT STAHAL ROHERN LTD
406	HOT INDUCTION BEND	SAWAN ENGINEERS PVT LTD
407	HOT INDUCTION BEND	FABRICOM
408	HOT INDUCTION BEND	LALIT ROHR FITTINGS PVT LTD
409	<b>FLAME ARRESTOR</b>	FLUIDYNE INSTRUMENTS PVT. LTD.
410	FLAME ARRESTOR	PROTEGO India Pvt. Ltd.
411	FLAME ARRESTOR	NIRMAL INDUSTRIAL CONTROLS PVT. LTD.
412	FLAME ARRESTOR	SUPER SAFETY SERVICES
413	FLAME ARRESTOR	A PLUS PROJECTS & TECHNOLOGY (P) LTD.
414	<b>ON OFF SS BALL/NEEDLE /NON RETURN VALVE FOR CNG APPLICATION</b>	PARKER
415	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	SWAGELOK
416	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	ABAC
417	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	SPIRAX SARCO
418	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	WORCESTER
419	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	WAREE / BAUMER
420	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	STAUFF
421	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	SSP
422	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	L&T

Sr.No	Name of ITEM/Package	Recommended Vendor List
423	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	SANKEY CONTROLS
424	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	ROTEX



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425	ON OFF SS BALL/NEEDLE /NON RETURN VALVE	AUDCO
426	<b>SPLIT TEES FOR HOT TAPPING</b>	TD WILLIAMSON
427	SPLIT TEES FOR HOT TAPPING	ADVANTICA
428	SPLIT TEES FOR HOT TAPPING	FURMANITE INTERNATIONAL LTD - UK
429	<b>QUICK OPENING END CLOSURE</b>	FORAIN SRL, ITALY
430	QUICK OPENING END CLOSURE	G.D.ENGINEERING
431	QUICK OPENING END CLOSURE	PERRY EQUIPMENT CORPORATION
432	QUICK OPENING END CLOSURE	PIPELINE ENGINEERING
433	QUICK OPENING END CLOSURE	SIIRTEC NIGI S.P.A
434	QUICK OPENING END CLOSURE	GROUPE GENOYER (PHOCEEENNE)
435	QUICK OPENING END CLOSURE	ROSEN GROUP
436	QUICK OPENING END CLOSURE	TD WILLIAMSON
437	<b>PIG SIGNALLER / PIG ALERTS</b>	G.D.ENGINEERING
438	PIG SIGNALLER / PIG ALERTS	FORAIN S.R.L
439	PIG SIGNALLER / PIG ALERTS	TD WILLIAMSON
440	PIG SIGNALLER / PIG ALERTS	GROUPE GENOYER (PHOCEEENNE)
441	<b>EGP/ INTELLIGENT PIGGING</b>	ROSEN GROUP
442	EGP/ INTELLIGENT PIGGING	PIPELINE ENGINEERING
443	EGP/ INTELLIGENT PIGGING	SPETSNEFTEGAZ NPO JSC (NGKS), RUSSIA
444	EGP/ INTELLIGENT PIGGING	TD WILLIAMSON
445	<b>VACCUM DRYING</b>	CORRTECH INTERNATIONAL PVT. LTD.
446	VACCUM DRYING	TOTALINE, AUSTRALIA
447	<b>PAINTS FOR INTERNAL COATING</b>	DUPONT, INDIA
448	PAINTS FOR INTERNAL COATING	PERFORMANCE COATING GMBH
449	PAINTS FOR INTERNAL COATING	COPAN
450	<b>FIRE EXTINGUISHER</b>	SAFEX FIRE SERVICES
451	FIRE EXTINGUISHER	BRIJBASI HI-TECH UDYOG
452	FIRE EXTINGUISHER	NITIN FIRE PROTECTION INDUSTRIES LTD.
453	FIRE EXTINGUISHER	SUPERMEX EQUIPMENTS
454	FIRE EXTINGUISHER	KOOVERJI DEVSHI & CO.
455	<b>HIRE HYDRANT, MONITORS, DELUGE VALVES &amp; NOZZLES</b>	MINIMAX
456	HIRE HYDRANT, MONITORS, DELUGE VALVES & NOZZLES	VIJAY FIRE
457	HIRE HYDRANT, MONITORS, DELUGE VALVES & NOZZLES	NEWAGE
458	HIRE HYDRANT, MONITORS, DELUGE VALVES & NOZZLES	ZENITH
459	HIRE HYDRANT, MONITORS, DELUGE VALVES & NOZZLES	NITIN FIRE PROTECTION INDUSTRIES LTD.
460	<b>HOSES &amp; HOSES ACCESSORIES</b>	GAYATRI INDUSTRIAL CORPORATION
461	HOSES & HOSES ACCESSORIES	ROYAL INDIA CORPORATION
462	HOSES & HOSES ACCESSORIES	BRIJBASI HI-TECH UDYOG
463	HOSES & HOSES ACCESSORIES	NITIN FIRE PROTECTION INDUSTRIES LTD.
464	HOSES & HOSES ACCESSORIES	ZAVERCHAND MARKETING PVT. LTD.
465	HOSES & HOSES ACCESSORIES	NEWAGE
466	HOSES & HOSES ACCESSORIES	SIMPLEX RUBBER PRODUCTS
467	<b>CONTRACTORS FOR HDD WORK</b>	CHERINGTON ASIA (INDIA) PVT. LTD.
468	CONTRACTORS FOR HDD WORK	ESSAR CONSTRUCTION LTD.
469	CONTRACTORS FOR HDD WORK	MERSING CONSTRUCTION AND ENGINEERING SDN BHD., SELANGOR (MALAYSIA)



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470	CONTRACTORS FOR HDD WORK	HERRENKNECHT (ASIA) LTD. (THAILAND)
471	CONTRACTORS FOR HDD WORK	MID EAST PIPELINE
472	CONTRACTORS FOR HDD WORK	N.R. PATEL & CO.,
473	CONTRACTORS FOR HDD WORK	TRENCHLESS
474	<b>CONTRACTORS FOR VACCUM DRYING</b>	CORRTECH INTERNATIONAL PVT. LTD.
475	CONTRACTORS FOR VACCUM DRYING	TOTALINE, AUSTRALIA
476	<b>PAINTS FOR OUTER SURFACE</b>	ASIAN PAINTS LTD.
477	PAINTS FOR OUTER SURFACE	SIGMA PAINTS S.A. LTD.
478	PAINTS FOR OUTER SURFACE	BERGER PAINTS INDIA LTD.
479	PAINTS FOR OUTER SURFACE	KANSAI NEROLAC PAINTS LTD.
480	<b>VITREOUS CHINA SANITARYWARE</b>	PARRYWARE
481	VITREOUS CHINA SANITARYWARE	HINDUSTAN
482	VITREOUS CHINA SANITARYWARE	CERA
483	<b>STAINLESS STEEL SINKS</b>	AMC
484	STAINLESS STEEL SINKS	NEELKANTH
485	<b>C.P FITTINGS</b>	PARCO
486	C.P FITTINGS	GEM
487	<b>C.P ACCESSORIES, WASTE FITTINGS</b>	ESS
488	C.P ACCESSORIES, WASTE FITTINGS	LOTUS
489	C.P ACCESSORIES, WASTE FITTINGS	ORIENT
490	<b>PVC PIPES</b>	SUPREME
491	PVC PIPES	PRINCE
492	<b>COMPOSITE PIPES &amp; FITTINGS</b>	KITEC
493	<b>GUN METAL VALVES AND LOCKS</b>	LEADER
494	GUN METAL VALVES AND LOCKS	ZOLOTE
495	<b>CI DOUBLE FLANGED SLUICE VALVES, NON</b>	KIRLOSKAR
496	<b>STONE WARE PIPE AND GULLY TRAPS</b>	PERFECT
497	<b>WATER TANKS</b>	SINTEX
498	<b>ALUMINIUM HARDWARE</b>	EARIBIHARI
499	<b>GLASS</b>	MODIGUARD
500	GLASS	ATUL
501	<b>ALUMINIUM DOOR/WINDOW SECTION</b>	HINDALCO
502	ALUMINIUM DOOR/WINDOW SECTION	ULTRATECH CEMENTS
503	<b>CEMENT</b>	AMBUJA
504	CEMENT	ACC
505	CEMENT	BIRLA
506	<b>PAINTS</b>	ASIAN
507	PAINTS	BERGER
508	PAINTS	NEROLAC
509	PAINTS	SHALIMAR
510	PAINTS	BOMBAY
511	<b>CERAMIC/VITRIFIED/VITREOUS TILES</b>	KAJARIA
512	CERAMIC/VITRIFIED/VITREOUS TILES	JOHNSON



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513	CERAMIC/VITRIFIED/VITREOUS TILES	SOMANY
514	STRUCTURAL STEEL	SAIL
515	<b>REINFORCEMENT STEEL</b>	TISCO
516	REINFORCEMENT STEEL	SAIL

Sr.No	Name of ITEM/Package	Recommended Vendor List
517	<b>MIXED METAL OXIDE (MMO) ANODES</b>	TITANOR COMPONENTS LTD., GOA
518	<b>SPARK GAP ARRESTOR / SURGE DIVERTER</b>	DHEN, GERMANY
519	SPARK GAP ARRESTOR / SURGE DIVERTER	MC MILLER
520	SPARK GAP ARRESTOR / SURGE DIVERTER	DAIRY LAND ELECTRICAL INDUSTRIES
521	<b>CU/CUSO4 REFERENCE CELLS</b>	MC MILLER, USA
522	CU/CUSO4 REFERENCE CELLS	BORIN, USA
523	CU/CUSO4 REFERENCE CELLS	KRICK
524	<b>THERMIT WELD MATERIAL</b>	ERICO EUROPA
525	<b>PETROLEUM COKE BREEZE</b>	GOA CARBON , GOA
526	PETROLEUM COKE BREEZE	INDIA CARBON, DURGAPUR(WB)
527	<b>MG/ZN ANODE</b>	CORTECH INTERNATIONAL PVT. LTD.
528	MG/ZN ANODE	TITANOR COMPONENT LTD., GOA
529	MG/ZN ANODE	SCIENTIFIC METAL ENGINEERS KARAIKUDI
530	<b>PIN BRAZING</b>	BAC
531	PIN BRAZING	SAFETRACK
532	<b>CABLE LUGS</b>	ISMAIL, RANCHI
533	CABLE LUGS	DOWELS, MUMBAI
534	<b>CABLE GLANDS</b>	FLEXPRO ELECTRICAL PVT. LTD., MUMBAI
535	CABLE GLANDS	FLAMEPROOF EQUIPMENT PVT. LTD., MUMBAI
536	CABLE GLANDS	BALIGA LIGHTING EQUIPMENT LTD., CHENNAI
537	<b>BACKFILL</b>	INDIA CARBON
538	BACKFILL	GOA CARBON
539	<b>POLARIZATION CELL</b>	MC MILLER
540	POLARIZATION CELL	KRIK ENGINEERING
541	JUNCTION BOX	FLEXPRO
542	JUNCTION BOX	FELP CONTROL GEARS
543	<b>TEST STATION/ JUNCTION BOX (WEATHERPROOF)</b>	UNDTs
544	TEST STATION/ JUNCTION BOX (WEATHERPROOF)	CORRTECH INTERNATIONAL
545	TEST STATION/ JUNCTION BOX (WEATHERPROOF)	CCS, MUMBAI
546	TEST STATION/ JUNCTION BOX (WEATHERPROOF)	RAYCHEM RPG PVT LTD
547	<b>MIXED METAL OXIDE (MMO) ANODES</b>	TITANOR COMPONENTS LTD., GOA
548	<b>SOLID STATE DECOUPLER</b>	KRISTRON SYSTEMS
549	SOLID STATE DECOUPLER	DEHN GERMANY
550	SOLID STATE DECOUPLER	RUSTROL, USA
551	SOLID STATE DECOUPLER	DAIRYLAND ELECTRICALS, USA
552	<b>GAS OVER OIL ACTUATORS</b>	BIFFI ITALIA S.R.L, ITALY
553	GAS OVER OIL ACTUATORS	ROTORK FLUID SYTEM S.R.L
554	GAS OVER OIL ACTUATORS	SHAFFER ACTUATORS



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555	GAS OVER OIL ACTUATORS	SCHUCK
556	GAS OVER OIL ACTUATORS	BETTIS CORPORATION (EMERSON GROUP)
557	GAS OVER OIL ACTUATORS	LEEDEN
558	GAS OVER OIL ACTUATORS	NELES
559	<b>AIR FILTER REGULATORS</b>	ASEA BROWN BOVERI LTD.
560	AIR FILTER REGULATORS	BLUE STAR LTD
561	AIR FILTER REGULATORS	DIVYA CONTROL ELEMENTS PVT. LTD.
562	AIR FILTER REGULATORS	PLACKA INSTRUMENTS & CONTROLS PVT. LTD
563	AIR FILTER REGULATORS	SHAH PNEUMATICS

Sr.No	Name of ITEM/Package	Recommended Vendor List
564	AIR FILTER REGULATORS	SHAVO NORGREN (I) PVT. LTD
565	AIR FILTER REGULATORS	VELJAN HYDRAIR PVT. LTD.
566	AIR FILTER REGULATORS	PARKER
567	AIR FILTER REGULATORS	SWAGELOK
568	AIR FILTER REGULATORS	VANAZ ENGINEERS LIMITED
569	PRESSURE RELIEF/SAFETY VALVE	ANDERSON GREENWOOD CROSBY
570	PRESSURE RELIEF/SAFETY VALVE	BHEL (TRICHY )
571	PRESSURE RELIEF/SAFETY VALVE	ASPRO
572	PRESSURE RELIEF/SAFETY VALVE	DRESSER INC.
573	PRESSURE RELIEF/SAFETY VALVE	FUKUI SEISAKUSHO CO. LTD.
574	PRESSURE RELIEF/SAFETY VALVE	INSTRUMENTATION LTD. (PALGHAT)
575	PRESSURE RELIEF/SAFETY VALVE	NAKAKITA SEISAKUSHO CO LTD.
576	PRESSURE RELIEF/SAFETY VALVE	NUOVO PIGNONE SPA (ITALY)
577	PRESSURE RELIEF/SAFETY VALVE	PARCOL SPA
578	PRESSURE RELIEF/SAFETY VALVE	SAFETY SYSTEMS UR LTD.
579	PRESSURE RELIEF/SAFETY VALVE	SARASIN RSBD
580	PRESSURE RELIEF/SAFETY VALVE	SEBIN VALVES INDIA PVT. LTD.
581	PRESSURE RELIEF/SAFETY VALVE	TAI MILANO SPA
582	PRESSURE RELIEF/SAFETY VALVE	TYCO SANMAR LTD.
583	PRESSURE RELIEF/SAFETY VALVE	TYCO VALVES & CONTROLS INDIA PVT. LTD
584	PRESSURE RELIEF/SAFETY VALVE	FARINOSLA
585	PRESSURE RELIEF/SAFETY VALVE	FAINGER LASER
586	PRESSURE RELIEF/SAFETY VALVE	MERCER
587	PRESSURE RELIEF/SAFETY VALVE	FISHER ROSEMOUNT (EMERSON)
588	PRESSURE RELIEF/SAFETY VALVE	OFE & OE GROUP KEYSTONE VALVES PVT. LTD
589	PRESSURE RELIEF/SAFETY VALVE	BARODA SEBIM VALVES PVT. LTD.
590	PRESSURE RELIEF/SAFETY VALVE	HALOL
591	<b>SUCTION &amp; DISCHARGE FILTER</b>	BEKO FILTER
592	SUCTION & DISCHARGE FILTER	ULTRA FILTER
593	SUCTION & DISCHARGE FILTER	FILTRATION AND SEPERATION TECHNOLOGY
594	SUCTION & DISCHARGE FILTER	FILTRATION TECHNIQUE
595	SUCTION & DISCHARGE FILTER	PARKER
596	<b>CARTRIDGE FILTERS</b>	BEKO FILTER
597	CARTRIDGE FILTERS	FILTRATION & SEPERATION TECHNOLOGY



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598	CARTRIDGE FILTERS	ULTRA FILTER
599	CARTRIDGE FILTERS	FILTRATION TECHNIQUE
600	CARTRIDGE FILTERS	ZANDER GMBH (GERMANY)
601	CARTRIDGE FILTERS	GRAND PRIX FAB (PVT.) LTD., NEW DELHI
602	CARTRIDGE FILTERS	MULTITEX FILTRATION ENERGY PVT. LTD.,
603	<b>AIR COMPRESSOR</b>	C (IR)
604	AIR COMPRESSOR	ELGI
605	AIR COMPRESSOR	ANESTA IWATA MOTHERSON
606	AIR COMPRESSOR	CHICAGO PNEUMATICS
607	AIR COMPRESSOR	ATLAS COPCO/INGERSOL RAND
608	<b>CO2 CYLINDER VALVE WITH ACTUATORFOR CO2 FLODDING SYSTEM</b>	GINGEKERR
609	CO2 CYLINDER VALVE WITH ACTUATORFOR CO2 FLODDING SYSTEM	CEODUEX (ROTAREX)
610	CO2 CYLINDER VALVE WITH ACTUATORFOR CO2 FLODDING SYSTEM	KIDDE

Sr.No	Name of ITEM/Package	Recommended Vendor List
611	CO2 CYLINDER VALVE WITH ACTUATORFOR CO2 FLODDING SYSTEM	FIKE
612	CO2 CYLINDER VALVE WITH ACTUATORFOR CO2 FLODDING SYSTEM	ANSUL
613	CO2 CYLINDER VALVE WITH ACTUATORFOR CO2 FLODDING SYSTEM	LPG
614	CO2 CYLINDER VALVE WITH ACTUATORFOR CO2 FLODDING SYSTEM	VTI
615	CO2 CYLINDER VALVE WITH ACTUATORFOR CO2 FLODDING SYSTEM	ROTEX
616	CO2 CYLINDER VALVE WITH ACTUATORFOR CO2 FLODDING SYSTEM	KEW
617	<b>FLP SWITCH</b>	BALIGA
618	FLP SWITCH	FCG
619	FLP SWITCH	FPE
620	FLP SWITCH	FLEXPRO
621	<b>SWITCHES/FUSES/CONTRACTORS</b>	L&T
622	SWITCHES/FUSES/CONTRACTORS	GEC
623	SWITCHES/FUSES/CONTRACTORS	SIEMENS
624	RTDs	ALTOP
625	<b>PLUG VALVE</b>	AIR & NORDSTROM VALVES INC
626	PLUG VALVE	XOMOX
627	PLUG VALVE	SANMAR INDIA LTD, NEW DELHI
628	PLUG VALVE	AIR & NORDSTROM VALVES INC
629	PLUG VALVE	SERCK AUDCO VALVES
630	PLUG VALVE	SUMITOMO CORPORATION
631	PLUG VALVE	FISHER XOMOX SANMAR
632	PLUG VALVE	L&T (AUDCO INDIA LTD, CHENNAI)
633	PLUG VALVE	PARKER
634	PLUG VALVE	STAUFF
635	<b>GAS ENGINE</b>	CUMMINS
636	GAS ENGINE	CATERPILLAR
637	<b>PRESSURE RELIEF/SAFETY VALVE</b>	SWAGELOK
638	PRESSURE RELIEF/SAFETY VALVE	PARKER
639	PRESSURE RELIEF/SAFETY VALVE	STAUFF
640	PRESSURE RELIEF/SAFETY VALVE	M/s Nirmal



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641	<b>PRESSURE SAFETY VALVE</b>	BESTOBELL / HEROSE / AUDCO VALVES / FORBES MARSHALL
642	<b>AIR COMPRESSOR</b>	EMTEX
643	AIR COMPRESSOR	KPCL
644	<b>COMPRESSOR MAIN MOTOR</b>	CROMPTON GREAVES
645	COMPRESSOR MAIN MOTOR	SIEMENS
646	COMPRESSOR MAIN MOTOR	WEG
647	COMPRESSOR MAIN MOTOR	ABB
648	COMPRESSOR MAIN MOTOR	LHP
649	COMPRESSOR MAIN MOTOR	KIRLOSKAR
650	COMPRESSOR MAIN MOTOR	BHARAT BIJLEE
651	<b>MAIN MOTOR VFD STARTER</b>	SIEMENS
652	MAIN MOTOR VFD STARTER	SCHNEIDER
653	MAIN MOTOR VFD STARTER	FUJI
654	MAIN MOTOR VFD STARTER	ABB
655	<b>SOFT STARTER</b>	SIEMENS
656	SOFT STARTER	SCHNEIDER
657	SOFT STARTER	ABB

Sr.No	Name of ITEM/Package	Recommended Vendor List
658	SOFT STARTER	FUJI
659	<b>INSTRUMENTATION</b>	
660	<b>FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)</b>	ABB AUTOMATION LTD.
661	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	FISHER ROSEMOUNT SINGAPORE PTE LTD.
662	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	FUJI ELECTRIC CO. LTD.
663	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	HONEYWELL INC.
664	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	HONEYWELL
665	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	YOKOGAWA ELECTRIC CORPORATION
666	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	YOKOGAWA BLUE STAR LTD.
667	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	ASHCROFT
668	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	MURPHY
669	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	WIKA
670	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	DRUCK
671	FIELD INSTRUMENTS TRANSMITTERS (P, DP, F,L,T)	WAREE
672	<b>CORIOLIS MASS FLOW METERS</b>	EMERSON PROCESS MANAGEMENT
673	CORIOLIS MASS FLOW METERS	COMPAC,NEW ZELAND
674	CORIOLIS MASS FLOW METERS	ENDRESS & HAUSER CMBH & COMPANY
675	THERMAL MASS FLOW METER	MAGNETROL
676	THERMAL MASS FLOW METER	PROCESS CONTROL DEVICES (PCD)
677	<b>PRESSURE GAUGES</b>	AN INSTRUMENTS PVT. LTD.
678	PRESSURE GAUGES	ALTOP
679	PRESSURE GAUGES	GENERAL INSTRUMENTS CONSORTIUM
680	PRESSURE GAUGES	WAAREE INSTRUMNETS CONSORTIUM
681	PRESSURE GAUGES	GENERAL INSTRUMENTS CONSORTIUM
682	PRESSURE GAUGES	MANOMETER (INDIA) PVT. LTD.



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683	PRESSURE GAUGES	WIKA INSTRUMENTS INDIA PVT. LTD.
684	PRESSURE GAUGES	DRUCK
685	PRESSURE GAUGES	BADOTHERM PROCESS INSTRUMENTS B. V.
686	PRESSURE GAUGES	BOURDON HAENNI S.A
687	PRESSURE GAUGES	BRITISH ROTOTHERM CO. LTD
688	PRESSURE GAUGES	BUDENBERG GUAGE CO. LTD.
689	PRESSURE GAUGES	DRESSER INC.
690	PRESSURE GAUGES	NAGANO KEIKI SEISAKUSHO LTD.
691	PRESSURE GAUGES	BAUMER
692	PRESSURE GAUGES	WALCHANDNAGER INDUSTRIES LTD.
693	PRESSURE GAUGES	WIKA ALEXANDER WIEGAND & CO GMBH
694	PRESSURE GAUGES	ASHCROFT /PRECISON MASS
695	PRESSURE GAUGES	H. GURU
696	<b>TEMPERATURE GAUGE WITH THERMOWELL</b>	PRECISON MASS
697	TEMPERATURE GAUGE WITH THERMOWELL	AN INSTRUMENTS PVT. LTD.
698	TEMPERATURE GAUGE WITH THERMOWELL	GENERAL INSTRUMENTS LTD
699	TEMPERATURE GAUGE WITH THERMOWELL	WIKA INSTRUMENTS INDIA PVT. LTD.
700	TEMPERATURE GAUGE WITH THERMOWELL	BAUMER TECHNOLOGIES INDIA
701	TEMPERATURE GAUGE WITH THERMOWELL	ALTO INDUSTRIES
702	<b>RTD WITH THERMOWELL AND SKIN TYPE</b>	A.N.INSTRUMENTS
703	RTD WITH THERMOWELL AND SKIN TYPE	GENERAL INSTRUMENTS PVT LTD
704	RTD WITH THERMOWELL AND SKIN TYPE	NAGMAN SENSORS PVT LTD

Sr.No	Name of ITEM/Package	Recommended Vendor List
705	RTD WITH THERMOWELL AND SKIN TYPE	PYRO ELECTRIC INSTRUMENTS
706	RTD WITH THERMOWELL AND SKIN TYPE	WIKA
707	RTD WITH THERMOWELL AND SKIN TYPE	WAREE
708	RTD WITH THERMOWELL AND SKIN TYPE	BAUMER
709	RTD WITH THERMOWELL AND SKIN TYPE	ALTOP
710	RTD WITH THERMOWELL AND SKIN TYPE	TEMPSENS INSTRUMENTS INDIA PVT LTD, INDIA
711	RTD WITH THERMOWELL AND SKIN TYPE	THERMO ELECTRIC COMPANY INDIA PVT. LTD, INDIA
712	RTD WITH THERMOWELL AND SKIN TYPE	TECHNO INSTRUMENTS, INDIA
713	RTD WITH THERMOWELL AND SKIN TYPE	TM TECNOMATIC SPA, ITALY
714	RTD WITH THERMOWELL AND SKIN TYPE	THERMAL INSTRUMENT (I) P LTD
715	<b>PRESSURE/DIFFERENTIAL /TEMP SWITCH</b>	SWITZER
716	PRESSURE/DIFFERENTIAL /TEMP SWITCH	DELTA
717	PRESSURE/DIFFERENTIAL /TEMP SWITCH	UNITED ELECTRIC
718	PRESSURE/DIFFERENTIAL /TEMP SWITCH	SOR
719	PRESSURE/DIFFERENTIAL /TEMP SWITCH	GAUGE BOURDON
720	PRESSURE/DIFFERENTIAL /TEMP SWITCH	DRESSER
721	PRESSURE/DIFFERENTIAL /TEMP SWITCH	INFOS
722	<b>ULTRASONIC FLOW METER</b>	DANIEL MEASUREMENT AND CONTROLS PVT LTD ( EMERSON)
723	ULTRASONIC FLOW METER	SICK , INDIA
724	ULTRASONIC FLOW METER	RMG,



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725	ULTRASONIC FLOW METER	ELSTER- HONEYWELL
726	ULTRASONIC FLOW METER	KROHNE
727	ULTRASONIC FLOW METER	ENDRESS & HAUSER (E&H)
728	ULTRASONIC FLOW METER	FLEXIM
729	ULTRASONIC FLOW METER	GE
730	<b>RPD Meter</b>	DRESSER
731	RPD Meter	ROMET
732	RPD Meter	ELSTER-HONEYWELL
733	RPD Meter	RMG REGEL + MESSTECHNIL GmbH
734	RPD Meter	ITRON
735	RPD Meter	RAYCHEM RPG LTD
736	RPD Meter	CAMERON
737	RPD Meter	FMG
738	<b>TURBIN FLOW METER</b>	DRESSER
739	TURBIN FLOW METER	ROCKWIN
740	TURBIN FLOW METER	ELSTER-HONEYWELL
741	TURBIN FLOW METER	RMG REGEL + MESSTECHNIL GmbH
742	TURBIN FLOW METER	DANIEL/EMERSON
743	TURBIN FLOW METER	ITRON
744	TURBIN FLOW METER	VEMTECH
745	<b>FLOW COMPUTER</b>	DANIEL/EMERSON
746	FLOW COMPUTER	OMNI
747	FLOW COMPUTER	FMC
748	FLOW COMPUTER	HONEYWELL
749	FLOW COMPUTER	ELSTER
750	FLOW COMPUTER	SCHNEIDER

Sr.No	Name of ITEM/Package	Recommended Vendor List
751	FLOW COMPUTER	ABB
752	<b>ELECTRONIC VOLUME CONVERTER</b>	PLUM
753	ELECTRONIC VOLUME CONVERTER	ELGAS
754	<b>SELF ACTUATED PR. CONTROL VALVE</b>	DANIEL INDUSTRIES INC
755	SELF ACTUATED PR. CONTROL VALVE	DRESSER PRODUITS INDUSTRIES
756	SELF ACTUATED PR. CONTROL VALVE	ESME VALVES LTD.
757	SELF ACTUATED PR. CONTROL VALVE	FISHER ROSEMOUNT SINGAPORE PTE LTD.
758	SELF ACTUATED PR. CONTROL VALVE	FISHER EXMOX SANMAR LIMITED
759	SELF ACTUATED PR. CONTROL VALVE	GORTER CONTROLS B.V.
760	SELF ACTUATED PR. CONTROL VALVE	INSTROMET INTERNATIONAL NV
761	SELF ACTUATED PR. CONTROL VALVE	KEYE & MACDONALD INC
762	SELF ACTUATED PR. CONTROL VALVE	NUOVO PIGNONE SPA (ITALY)
763	SELF ACTUATED PR. CONTROL VALVE	PIETRO FIORENTINI SPA
764	SELF ACTUATED PR. CONTROL VALVE	RICHARDS INDUSTRIES (FORMERLY TRELOAR)
765	SELF ACTUATED PR. CONTROL VALVE	RMG REGEL + MESSTECHNIK GMBH



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766	SELF ACTUATED PR. CONTROL VALVE	COMPAC INDUSTRIES LTD., NZL.
767	SELF ACTUATED PR. CONTROL VALVE	ASPRO
768	SELF ACTUATED PR. CONTROL VALVE	VANAZ
769	SELF ACTUATED PR. CONTROL VALVE	NIRMAL INDUSTRIES LIMITED
770	<b>SOLENOID VALVES</b>	ALCON ALEXANDER CONTROLS LIMITED
771	SOLENOID VALVES	JEFFERSONS
772	SOLENOID VALVES	ASCO (INDIA) LIMITED
773	SOLENOID VALVES	ASCO JOUCOMATIC LTD.
774	SOLENOID VALVES	ASCO JOUCOMATIC SA
775	SOLENOID VALVES	PARKER HANNIFIN, USA
776	SOLENOID VALVES	AVCON CONTROLS PVT. LTD.
777	SOLENOID VALVES	BARKSDALE INC.
778	SOLENOID VALVES	BLUE STAR LTD.
779	SOLENOID VALVES	HERION WERKE
780	SOLENOID VALVES	SCHRADER SCOVILL DUNCAN LIMITED
781	SOLENOID VALVES	SEITZ AG
782	SOLENOID VALVES	COMPAC NEW ZEALAND
783	SOLENOID VALVES	ROTEX AUTOMATION LIMITED
784	SOLENOID VALVES	OPERATED VALVES ASCO
785	SOLENOID VALVES	HABONIM VASS
786	SOLENOID VALVES	FESTO
787	SOLENOID VALVES	MICROMECHANICA
788	<b>SPECIAL CONTROL VALVES</b>	FISHER ROSEMOUNT SIGAPORE PTE. LTD.
789	SPECIAL CONTROL VALVES	FLOWSERVE PTE. LTD. (FORMERLY DURIRON)
790	SPECIAL CONTROL VALVES	HOPKINSONS LIMITED
791	SPECIAL CONTROL VALVES	METSO AUTOMATION PTE LTD. (FORMERLY NELES)
792	SPECIAL CONTROL VALVES	NUOVO PIGNONE SPA (ITALY
793	SPECIAL CONTROL VALVES	SPX VALVES & CONTROLS (FORMERLY DEXURIK )
794	SPECIAL CONTROL VALVES	COMPAC IND. LTD. NZL
795	<b>REGULATORS</b>	COMPAC IND. LTD.
796	REGULATORS	FISHER ROSEMOUNT SIGAPORE PTE. LTD

Sr.No	Name of ITEM/Package	Recommended Vendor List
797	REGULATORS	FLOWSERVE PTE. LTD. (FORMERLY DURIRON)
798	REGULATORS	SWAGELOK
799	REGULATORS	PARKER
800	REGULATORS	COMPAC
801	REGULATORS	HAMLET
802	REGULATORS	HYLOCK
803	REGULATORS	DK-LOK
804	REGULATORS	SEALEXCEL
805	REGULATORS	SSP
806	REGULATORS	OASIS
807	<b>GAS DETECTOR SYSTEM</b>	DETRONICS



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808	GAS DETECTOR SYSTEM	HONEYWELL
809	GAS DETECTOR SYSTEM	NET SAFETY
810	GAS DETECTOR SYSTEM	GENERAL MONITORS/ MSA
811	GAS DETECTOR SYSTEM	CROW ON
812	GAS DETECTOR SYSTEM	SIEGER
813	GAS DETECTOR SYSTEM	ESP SAFETY
814	GAS DETECTOR SYSTEM	SENSITRON
815	GAS DETECTOR SYSTEM	ROSEMOUNT EARLIER KNOWN AS NET SEFETY
816	GAS DETECTOR SYSTEM	DRAEGER SAFETY
817	GAS DETECTOR SYSTEM	EMERSON PROCESS MANAGEMENT INDIA PVT LTD
818	GAS DETECTOR SYSTEM	RESPO PRODUCTS
819	GAS DETECTOR SYSTEM	DET-TRONICS
820	<b>FIRE DETECTION/ALARM SYSTEM</b>	APOIIO
821	FIRE DETECTION/ALARM SYSTEM	AGNI PVT LTD
822	FIRE DETECTION/ALARM SYSTEM	ASES/IRIS
823	FIRE DETECTION/ALARM SYSTEM	HONEYWELL
824	FIRE DETECTION/ALARM SYSTEM	RAVEL
825	FIRE DETECTION/ALARM SYSTEM	NEW FIRE ENGINEERS (P) LTD, INDIA
826	<b>FLAME DETECTOR/ SURGE PROTECTORS</b>	GENERAL MONITORS/ MSA
827	FLAME DETECTOR/ SURGE PROTECTORS	SPECTREX
828	FLAME DETECTOR/ SURGE PROTECTORS	DETRONICS
829	FLAME DETECTOR/ SURGE PROTECTORS	HONEYWELL
830	FLAME DETECTOR/ SURGE PROTECTORS	NET SAFETY
831	FLAME DETECTOR/ SURGE PROTECTORS	CROW ON
832	FLAME DETECTOR/ SURGE PROTECTORS	SIEGER
833	FLAME DETECTOR/ SURGE PROTECTORS	ESP SAFETY
834	<b>SURGE PROTECTORS/BARRIER/ISOLATORS/SIGNAL MULTIPLYER</b>	PHOENIX
835	SURGE PROTECTORS/BARRIER/ISOLATORS/SIGNAL MULTIPLYER	P&F
836	SURGE PROTECTORS/BARRIER/ISOLATORS/SIGNAL MULTIPLYER	MTL
837	SURGE PROTECTORS/BARRIER/ISOLATORS/SIGNAL MULTIPLYER	HANS TURCK GMBH & CO. KG INDIA / GERMANY
838	<b>RELAYS</b>	OMRON
839	RELAYS	OEN
840	RELAYS	JYOTI
841	RELAYS	PHOENIX
842	<b>PLC/RTU</b>	ALLEN BRADLEY

Sr.No	Name of ITEM/Package	Recommended Vendor List
843	PLC/RTU	GE FANUC
844	PLC/RTU	BRISTOL BABCOCK INC.
845	PLC/RTU	HONEYWELL
846	PLC/RTU	SCHNIEDER
847	PLC/RTU	ABB
848	PLC/RTU	SIEMENS



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849	PLC/RTU	EMERSON
850	PLC/RTU	SYNERGY
851	PLC/RTU	INVENSYS
852	PLC/RTU	ELECTRONIC CORPORATION OF INDIA
853	PLC/RTU	M/s. Phoenix Contact India Pvt Ltd
854	<b>MCT</b>	NEIMEX
855	MCT	SIGNET INTERNATIONAL
856	MCT	G.K Gmbh, GERMANY
857	MCT	ROTEX
858	<b>OFC</b>	FINOLEX CABLE
859	OFC	BIRLA ERICSSION OPTICAL LTD
860	OFC	RPG CABLE LTD
861	OFC	TAMILNADU TELECOMMUNICATION LTD
862	OFC	U M Cables
863	OFC	HIMACHAL FUTURISTIC COMMUNICATION LTD
864	OFC	STERLITE INDUSTRIESLTD
865	OFC	KEC INTERNATIONAL LTD,INDIA
866	<b>ELECTRONIC MARKER AND LOCATOR</b>	3M
867	ELECTRONIC MARKER AND LOCATOR	MOELLER
868	<b>FIBER TERMINAL CLOSER (FTC)</b>	RAYCHEM
869	FIBER TERMINAL CLOSER (FTC)	3M
870	FIBER TERMINAL CLOSER (FTC)	SIEMENS
871	FIBER TERMINAL CLOSER (FTC)	F&G
872	FIBER TERMINAL CLOSER (FTC)	KEPTEL
873	FIBER TERMINAL CLOSER (FTC)	ALCOA FUJIKURLA LTD
874	<b>INSTRUMENT PANEL</b>	RITTAL
875	INSTRUMENT PANEL	ACCUSONIC CONTROLS PVT LTD, INDIA
876	INSTRUMENT PANEL	INSTRUMENTATION LTD, INDIA
877	INSTRUMENT PANEL	INDUSTRIAL CONTROLS & APPLIANCES PVT LTD,INDIA
878	INSTRUMENT PANEL	POSITRONICS PVT LTD,INDIA
879	INSTRUMENT PANEL	RADHA KRISHNA CONTROLS,INDIA
880	INSTRUMENT PANEL	ICA SOLUTIONS LTD, U.K
881	INSTRUMENT PANEL	PYROTECH CONTROLS, INDIA
882	INSTRUMENT PANEL	ENCLOTEK, INDIA
883	INSTRUMENT PANEL	CONTROL SYSTEM ENGINEERS
884	INSTRUMENT PANEL	IRIS AUTOMATION PVT. LTD.
885	<b>JUNCTION BOX</b>	BALIGA LIGHTING EQUIPMENT (P) LTD, INDIA
886	JUNCTION BOX	FLEXPRO ELECTRICALS PVT.LTD ,INDIA
887	JUNCTION BOX	FLAMEPROOF EQUIPMENT PVT.LTD, INDIA
888	JUNCTION BOX	FCG POWER INDUSTRIES PVT. LTD,INDIA
889	JUNCTION BOX	FCG FLAMEPROOF CONTROL GEARS PVT. LTD, INDIA

Sr.No	Name of ITEM/Package	Recommended Vendor List
890	JUNCTION BOX	SUDHIR SWITCHGEARS PVT.LTD, INDIA
891	JUNCTION BOX	EXPROTECTA



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892	<b>CABLE GLAND/PLUGS</b>	BALIGA LIGHTING EQUIPMENTS PVT. LTD, INDIA
893	CABLE GLAND/PLUGS	COMET BRASS PRODUCTS , INDIA
894	CABLE GLAND/PLUGS	COMET INDUSTRIES, INDIA
895	CABLE GLAND/PLUGS	FLEXPRO ELECTRICALS PVT.LTD,INDIA
896	CABLE GLAND/PLUGS	FLAMEPROOF EQUIPMENTS (P) LTD, INDIA
897	CABLE GLAND/PLUGS	FCG POWER INDUSTRIES PVT.LTD, INDIA
898	CABLE GLAND/PLUGS	FCG FLAMEPROOF CONTROL GEARS PVT LTD, INDIA
899	CABLE GLAND/PLUGS	STANDARD METAL INDUSTRIES,INDIA
900	CABLE GLAND/PLUGS	SUDHIR SWITCHGEARS PVT.LTD, INDIA
901	CABLE GLAND/PLUGS	KAYSONS TECHNO EQUIPMENT P LTD.
902	CABLE GLAND/PLUGS	STANDARD METAL INDUSTRIES
903	<b>INSTRUMENT CABLES</b>	CORDS CABLES INDUSTRIES
904	INSTRUMENT CABLES	ASSOCIATED CABLES
905	INSTRUMENT CABLES	INCAB
906	INSTRUMENT CABLES	UNIVERSAL CABLES LTS/OEM Cables
907	INSTRUMENT CABLES	ASEAN
908	INSTRUMENT CABLES	CCI
909	INSTRUMENT CABLES	FORT GLOSTER
910	INSTRUMENT CABLES	FINOLEX
911	INSTRUMENT CABLES	KEI
912	INSTRUMENT CABLES	POLYCAB
913	INSTRUMENT CABLES	HAVELLS
914	INSTRUMENT CABLES	THERMO CABLES LTD, INDIA
915	INSTRUMENT CABLES	UDEY PYROCABLES PVT.LTD, INDIA
916	INSTRUMENT CABLES	SUYOG ELECTRICALS LTD, INDIA
917	<b>TELECOM SYSTEM</b>	COMMTEL NETWORK
918	TELECOM SYSTEM	ECI TELECOM LTD
919	TELECOM SYSTEM	FIBCOM INDIA LTD
920	TELECOM SYSTEM	TEJAS NETWORK LTD
921	TELECOM SYSTEM	ABB LTD
922	<b>LANSWITCH/ROUTER/FIRE WALL</b>	3COM
923	LANSWITCH/ROUTER/FIRE WALL	CISCO
924	LANSWITCH/ROUTER/FIRE WALL	NORTEL
925	LANSWITCH/ROUTER/FIRE WALL	DELL
926	LANSWITCH/ROUTER/FIRE WALL	CHECK POINT
927	LANSWITCH/ROUTER/FIRE WALL	PALO ALTO
928	LANSWITCH/ROUTER/FIRE WALL	IBM
929	<b>CCTV</b>	PELCO
930	CCTV	AXIS
931	CCTV	SAMSUNG
932	CCTV	PANASONIC
933	CCTV	HONEYWELL
934	CCTV	CP PLUS
935	<b>CORROSIVE MONITORING SYSTEM (CMS)</b>	CAPROCO, UK
936	CORROSIVE MONITORING SYSTEM (CMS)	CORRPRO, SHARJA



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937	CORROSIVE MONITORING SYSTEM (CMS)	METAL SAMPLES, USA
938	CORROSIVE MONITORING SYSTEM (CMS)	CORMON, UK
939	CORROSIVE MONITORING SYSTEM (CMS)	ATEL, ITALY
940	CORROSIVE MONITORING SYSTEM (CMS)	KOROSI SPECINDO
941	<b>VIBRATION SWITCH</b>	MURPHY
942	VIBRATION SWITCH	METRIX
943	VIBRATION SWITCH	ROBERTSHAW CONTROL
944	<b>TELEPHONES/EPABX SYSTEM</b>	ALCATEL
945	TELEPHONES/EPABX SYSTEM	AVAYA
946	TELEPHONES/EPABX SYSTEM	ERICSSION
947	TELEPHONES/EPABX SYSTEM	SIEMENS
948	TELEPHONES/EPABX SYSTEM	PANASONIC
949	TELEPHONES/EPABX SYSTEM	TATA
950	TELEPHONES/EPABX SYSTEM	SAMSUNG
951	<b>PRESSURE SWITCHES</b>	ASCO JOUCOMATIC LTD,UK, C/O ASCO (INDIA) LTD, INDIA
952	PRESSURE SWITCHES	DAG PROCESS INSTRUMENTS PVT LTD, INDIA
953	PRESSURE SWITCHES	DELTA CONTROLS LTD, UK
954	PRESSURE SWITCHES	INDFOS INDUSTRIES LIMITED, INDIA
955	PRESSURE SWITCHES	KAUSTUBHA UDYOG, INDIA
956	PRESSURE SWITCHES	PYROPRESS ENGG CO LTD, UK
957	PRESSURE SWITCHES	ROBERTSHAW CONTROLS CO, USA
958	PRESSURE SWITCHES	REGULATEURS GEORGIN S.A, FRANCE
959	PRESSURE SWITCHES	SWITZER INSTRUMENT LTD, INDIA
960	PRESSURE SWITCHES	SOR INC, USA
961	PRESSURE SWITCHES	SIRCO CONTROLS LIMITED, UK
962	PRESSURE SWITCHES	UNITED ELECTRIC CONTROLS CO, USA, C/O UNITED
963	PRESSURE SWITCHES	ELECTRIC CONTROLS CO., INDIA
964	PRESSURE SWITCHES	INDFOS,ASHCROFT
965	<b>LEVEL GAUGE GLASSES &amp; COCKS</b>	BLISS ANAND PVT LTD, INDIA
966	LEVEL GAUGE GLASSES & COCKS	CHEMTROLS SAMIL (INDIA) PVT LTD, INDIA
967	LEVEL GAUGE GLASSES & COCKS	CESARE BONNETTI S.P.A., ITALY, C/O BONETTI WAAREE (I) PVT.
968	LEVEL GAUGE GLASSES & COCKS	GAUGES BURDON (I) PVT. LTD.( GENERAL INSTRUMENTS)
969	LEVEL GAUGE GLASSES & COCKS	JERGUSON GAUGE & VALVE,USA
970	LEVEL GAUGE GLASSES & COCKS	KLINGER SPA, ITALY
971	LEVEL GAUGE GLASSES & COCKS	LEVCON INSTRUMENTS PVT LTD,INDIA
972	LEVEL GAUGE GLASSES & COCKS	NIHON KLINGAGE CO LTD, JAPAN
973	LEVEL GAUGE GLASSES & COCKS	PRATOLINA INSTRUMENTS PVT LTD, INDIA
974	LEVEL GAUGE GLASSES & COCKS	SIGMA INSTRUMENTS CO, INDIA
975	LEVEL GAUGE GLASSES & COCKS	NISAN SCIENTIFIC PROCESS EQUIP. P LTD
976	LEVEL GAUGE GLASSES & COCKS	PUNE TECHTROL PVT LTD
977	LEVEL GAUGE GLASSES & COCKS	PRATOLINA INSTRUMENTS PVT LTD
978	<b>LEVEL INSTRUMENT</b>	ABB INC,USA, C/O ABB LTD, INDIA



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979	LEVEL INSTRUMENT	EMERSON PROCESS MANAGEMENT INDIA PVT LTD, INDIA
980	LEVEL INSTRUMENT	ENDRESS+HAUSER (I) PVT. LTD, INDIA
981	LEVEL INSTRUMENT	KROHNE MESSTECHNIK GMBH & CO KG, GERMANY
982	LEVEL INSTRUMENT	L & J TECHNOLOGIES, USA, C/O L&J TECHNOLOGIES INC,

Sr.No	Name of ITEM/Package	Recommended Vendor List
983	LEVEL INSTRUMENT	MAGNETROL INTERNATIONAL
984	LEVEL INSTRUMENT	VEGA GRIESHABER KG, GERMANY, C/O VEGA INDIA LEVEL AND PRESSURE MGMT PVT. LTD, INDIA
985	<b>Panel mounted 24 V DC Power supply</b>	SITOP, INDIA
986	Panel mounted 24 V DC Power supply	PHEONIX, INDIA
987	Panel mounted 24 V DC Power supply	WAGO
988	Panel mounted 24 V DC Power supply	COSEL
989	<b>CABLE – FIRE ALARM &amp; COMMUNICATION CABLES</b>	CORDS CABLE INDUSTRIES LTD.
990	CABLE – FIRE ALARM & COMMUNICATION CABLES	CMI
991	CABLE – FIRE ALARM & COMMUNICATION CABLES	DELTON CABLES LTD.
992	CABLE – FIRE ALARM & COMMUNICATION CABLES	ELKAY TELELINKS
993	CABLE – FIRE ALARM & COMMUNICATION CABLES	KEI INDUSTRIES LTD.
994	CABLE – FIRE ALARM & COMMUNICATION CABLES	RELIANCE ENGINEERS LTD.
995	<b>CABLE – LT POWER &amp; CONTROL(XPLE)</b>	CORDS CABLE INDUSTRIES LTD.
996	CABLE – LT POWER & CONTROL(XPLE)	UNIVERSAL CABLE LTD.
997	CABLE – LT POWER & CONTROL(XPLE)	KEI INDUSTRIES LTD.
998	CABLE – LT POWER & CONTROL(XPLE)	HAVELLS
999	CABLE – LT POWER & CONTROL(XPLE)	DELTON
1000	CABLE – LT POWER & CONTROL(XPLE)	ELKAY TELELINKS
1001	CABLE – LT POWER & CONTROL(XPLE)	EVERSHINE ELECTRICALS
1002	CABLE – LT POWER & CONTROL(XPLE)	ECKO
1003	CABLE – LT POWER & CONTROL(XPLE)	RAVIN
1004	CABLE – LT POWER & CONTROL(XPLE)	RALLISON
1005	CABLE – LT POWER & CONTROL(XPLE)	SUYOG
1006	CABLE – LT POWER & CONTROL(XPLE)	NETCO
1007	CABLE – LT POWER & CONTROL(XPLE)	UNIFLEX
1008	CABLE – LT POWER & CONTROL(XPLE)	PARAMOUNT
1009	CABLE – LT POWER & CONTROL(XPLE)	GLOSTER
1010	CABLE – LT POWER & CONTROL(XPLE)	ASSOCIATED CABLES PVT. LTD.
1011	CABLE – LT POWER & CONTROL(XPLE)	CMI
1012	CABLE – LT POWER & CONTROL(XPLE)	GEMSCAB
1013	CABLE – LT POWER & CONTROL(XPLE)	INDUSTRIAL CABLES
1014	CABLE – LT POWER & CONTROL(XPLE)	NICCO
1015	CABLE – LT POWER & CONTROL(XPLE)	POLYCAB
1016	CABLE – LT POWER & CONTROL(XPLE)	TORRENT
1017	CABLE – LT POWER & CONTROL(XPLE)	FASCO GUARDON
1018	CABLE – LT POWER & CONTROL(XPLE)	Swadeshi Cable



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1019	<b>CABLE – GLAND</b>	BALIGA
1020	CABLE – GLAND	COMET
1021	CABLE – GLAND	FLEXPRO
1022	CABLE – GLAND	FLAMEPROOF
1023	CABLE – GLAND	FCG
1024	CABLE – GLAND	ELECTRO WERKE
1025	CABLE – GLAND	DOWELS
1026	CABLE – GLAND	CCI
1027	CABLE – GLAND	IVECO GUARDPLUS
1028	<b>CABLE – LUGS</b>	DOWELS

Sr.No	Name of ITEM/Package	Recommended Vendor List
1029	CABLE – LUGS	JAINSON
1030	CABLE – LUGS	ISMAL
1031	CABLE – LUGS	IVECO GUARDPLUS
1032	CABLE – LUGS	Guardplus
1033	<b>CABLE – TRAY</b>	ERCON COMPOSITES
1034	CABLE – TRAY	YAMUNA POWER & INFRASTRUCTURE LTD.
1035	CABLE – TRAY	IVECO RENO
1036	<b>EARTHING MATERIALS</b>	RUKMANI ELECTRICAL & COMPONENTS PVT LTD.
1037	EARTHING MATERIALS	INDIANA GRATING PVT LTD.
1038	EARTHING MATERIALS	JEF TECHNO SOLUTIONS PVT LTD
1039	EARTHING MATERIALS	IVECO-RENO
1040	<b>FLAME PROOF LDB'S/ JB,S/CONTROL STATION/ SWITCHES</b>	FCG
1041	FLAME PROOF LDB'S/ JB,S/CONTROL STATION/ SWITCHES	SUDHIR
1042	FLAME PROOF LDB'S/ JB,S/CONTROL STATION/ SWITCHES	PROMPT ENGINEERING WORKS
1043	FLAME PROOF LDB'S/ JB,S/CONTROL STATION/ SWITCHES	FLAME PROOF EQUIPMENTS PVT. LTD.
1044	FLAME PROOF LDB'S/ JB,S/CONTROL STATION/ SWITCHES	BALIGA LIGHTING EQUIPMENTS PVT. LTD.
1045	FLAME PROOF LDB'S/ JB,S/CONTROL STATION/ SWITCHES	FLEXPRO ELECTRICALS PVT. LTD.
1046	FLAME PROOF LDB'S/ JB,S/CONTROL STATION/ SWITCHES	ERGON
1047	FLAME PROOF LDB'S/ JB,S/CONTROL STATION/ SWITCHES	Equipments Pvt. Ltd
1048	<b>LIGHTING FIXTURES</b>	GE LIGHTING PVT. LTD.
1049	LIGHTING FIXTURES	BAJAJ ELECTRICALS LTD.
1050	LIGHTING FIXTURES	CROMPTON GREAVES LTD.
1051	LIGHTING FIXTURES	PHILIPS INDIA LTD.
1052	LIGHTING FIXTURES	HAVELL'S
1053	<b>LIGHTING FIXTURES (FLAMEPROOF)</b>	BAJAJ ELECTRICALS LTD.
1054	LIGHTING FIXTURES (FLAMEPROOF)	BALIGA LIGHTING EQUIPMENT PVT. LTD.
1055	LIGHTING FIXTURES (FLAMEPROOF)	CROMPTON GREAVES LTD.
1056	LIGHTING FIXTURES (FLAMEPROOF)	CEAG FLAMEPROOF CONTROLGEAR PVT. LTD.
1057	LIGHTING FIXTURES (FLAMEPROOF)	FLEXPRO ELECTRICALS PVT. LTD.
1058	LIGHTING FIXTURES (FLAMEPROOF)	PHILIPS INDIA LTD.
1059	LIGHTING FIXTURES (FLAMEPROOF)	SUDHIR SWITCHGEARS PVT. LTD.
1060	LIGHTING FIXTURES (FLAMEPROOF)	FCG



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1061	<b>GI-OCTOGONAL POLE</b>	BAJAJ
1062	GI-OCTOGONAL POLE	TRANSRAIL
1063	GI-OCTOGONAL POLE	WIPRO
1064	GI-OCTOGONAL POLE	IVECO ROSHNI
1065	<b>LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB</b>	ABB
1066	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	BCH
1067	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	C&S
1068	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	ELECMECH SWITCHGEAR & INSTRUMENTATION
1069	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	KMG ATOZ
1070	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	L&T
1071	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	PYROTECH ELECTRONICS PVT. LTD.
1072	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	RISHA CONTROL ENGINEERS PVT. LTD.
1073	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	SIEMENS LTD.
1074	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	TRICOLITE ELECTRICAL INDUSTRIES
1075	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	UNILEC ENGINEERS LTD.

Sr.No	Name of ITEM/Package	Recommended Vendor List
1076	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	VIDYUT CONTROL INDIA PVT. LTD.
1077	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	CONTROL AND SCHEMATIC
1078	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	ZENITH ENGINEERING
1079	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	NATURGY CONTRA
1080	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	EXPERT ENGINEERS
1081	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	SYNERGY SYSTEMS
1082	LOW VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB	M/S SHOREY E SOLUTION
1083	<b>MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB</b>	ABB
1084	MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB	HAGGER
1085	MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB	HAVELL'S INDIA LTD.
1086	MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB	INDO ASIAN FUSEGEAR LTD.
1087	MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB	LEGRAND
1088	MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB	MDS SWITCHGEAR LTD.
1089	MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB	SCHNEIDER
1090	MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB	SIEMENS LTD.
1091	MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB	HPL
1092	<b>MOULDED CASE CIRCUIT BREAKER (MCCBS)</b>	ABB
1093	MOULDED CASE CIRCUIT BREAKER (MCCBS)	ANDREW YULE
1094	MOULDED CASE CIRCUIT BREAKER (MCCBS)	LARSEN & TOUBRO
1095	MOULDED CASE CIRCUIT BREAKER (MCCBS)	SCHNEIDER
1096	MOULDED CASE CIRCUIT BREAKER (MCCBS)	SIEMENS
1097	MOULDED CASE CIRCUIT BREAKER (MCCBS)	CONTROL & SWITCHGEAR
1098	<b>INDICATING METERS</b>	ABB
1099	INDICATING METERS	AMCO
1100	INDICATING METERS	AE
1101	INDICATING METERS	ALSTOM LTD.
1102	INDICATING METERS	CONZERV/SCHNEIDER
1103	INDICATING METERS	ELECON MEASUREMENT PVT. LTD.



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1104	INDICATING METERS	HPL ELECTRIC & POWER PVT. LTD.
1105	INDICATING METERS	MECO INSTRUMENTS LTD.
1106	INDICATING METERS	MINILEC
1107	INDICATING METERS	RISHABH INSTRUMENTS PVT. LTD.
1108	INDICATING METERS	TRINITY ENERGY SYSTEM
1109	INDICATING METERS	KAYCEE
1110	INDICATING METERS	SALZER
1111	<b>CONTRACTORS – AC POWER</b>	ANDREW YULE
1112	CONTRACTORS – AC POWER	ABB
1113	CONTRACTORS – AC POWER	BHEL
1114	CONTRACTORS – AC POWER	C&S
1115	CONTRACTORS – AC POWER	HAVELL'S
1116	CONTRACTORS – AC POWER	L&T
1117	CONTRACTORS – AC POWER	SCHNEIDER
1118	CONTRACTORS – AC POWER	SIEMENS LTD.
1119	CONTRACTORS – AC POWER	TELEMECHANIQUE
1120	<b>CONTROL TRANSFORMER</b>	AE
1121	CONTROL TRANSFORMER	INDUSHREE
1122	CONTROL TRANSFORMER	INTRA VIDYUT
1123	CONTROL TRANSFORMER	KALPA ELECTRIKALS

Sr.No	Name of ITEM/Package	Recommended Vendor List
1124	CONTROL TRANSFORMER	TRANSPower INDUSTRIES LTD.
1125	CONTROL TRANSFORMER	SIEMENS
1126	<b>INDICATING LAMPS</b>	ALSTOM LTD.
1127	INDICATING LAMPS	BCH
1128	INDICATING LAMPS	L&T
1129	INDICATING LAMPS	SIEMENS LTD.
1130	INDICATING LAMPS	VAISHNO ELECTRICALS
1131	<b>PROTECTION RELAYS – THERMAL</b>	BCH
1132	PROTECTION RELAYS – THERMAL	L&T LTD.
1133	PROTECTION RELAYS – THERMAL	SIEMENS LTD.
1134	PROTECTION RELAYS – THERMAL	TELEMENCHANIQUE & CONTROLS (INDIA) LTD.
1135	<b>PUSH BUTTONS</b>	BCH
1136	PUSH BUTTONS	ALSTOM LTD.
1137	PUSH BUTTONS	L&T
1138	PUSH BUTTONS	SIEMENS LTD.
1139	PUSH BUTTONS	TELEMENCHANIQUE & CONTROLS (INDIA) LTD.
1140	PUSH BUTTONS	VAISHNO ELECTRICALS
1141	<b>SWITCHES – CONTROL</b>	BCH
1142	SWITCHES – CONTROL	EASUM REYROLLE RELAYS & DEVICES LTD.
1143	SWITCHES – CONTROL	ALSTOM
1144	SWITCHES – CONTROL	KAYCEE INDUSTRIES LTD.
1145	SWITCHES – CONTROL	L&T
1146	SWITCHES – CONTROL	SIEMENS LTD.



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1147	<b>SWITCHES – 5/15A PIANO/ PLATE, SWITCH SOCKET</b>	ANCHOR ELECTRONICS & ELECTRICALS PVT. LTD.
1148	SWITCHES – 5/15A PIANO/ PLATE, SWITCH SOCKET	KINGAL ELECTRICALS PVT. LTD.
1149	SWITCHES – 5/15A PIANO/ PLATE, SWITCH SOCKET	NORTH-WEST SWITCHGEAR LTD.
1150	<b>SWITCH SOCKET OUTLETS (INDUSTRIAL)</b>	ALSTOM LTD.
1151	SWITCH SOCKET OUTLETS (INDUSTRIAL)	BEST & CROMPTION ENGINEERING LTD.
1152	SWITCH SOCKET OUTLETS (INDUSTRIAL)	BCH
1153	SWITCH SOCKET OUTLETS (INDUSTRIAL)	CROMPTON GREAVES LTD.
1154	SWITCH SOCKET OUTLETS (INDUSTRIAL)	ESSEN ENGINEERING COMPANY PVT. LTD.
1155	<b>TERMINALS BLOCKS</b>	CONNECTWELL
1156	TERMINALS BLOCKS	CONTROLS & SWITCHGEAR CO. LTD.
1157	TERMINALS BLOCKS	ELMEX CONTROLS PVT. LTD.
1158	TERMINALS BLOCKS	ESSEN ENGINEERING CO. PVT. LTD.
1159	<b>UPS SYSTEM AND INVERTER</b>	VERTIV (EARLIER DB POWER & EMERSON)
1160	UPS SYSTEM AND INVERTER	APLAB
1161	UPS SYSTEM AND INVERTER	KELTRON
1162	UPS SYSTEM AND INVERTER	HI-REL
1163	UPS SYSTEM AND INVERTER	DUBAS
1164	UPS SYSTEM AND INVERTER	TOSHIBA CORPORATION
1165	UPS SYSTEM AND INVERTER	FUZI ELECTRIC CO LTD
1166	UPS SYSTEM AND INVERTER	SYNERGY SYSTEMS
1167	UPS SYSTEM AND INVERTER	IVECO PLUS
1168	UPS SYSTEM AND INVERTER	BPE
1169	UPS SYSTEM AND INVERTER	M/S SHOREY E SOLUTION
1170	<b>BATTERIES</b>	AMCO BATTERIES LTD.

Sr.No	Name of ITEM/Package	Recommended Vendor List
1171	BATTERIES	HBLNIFE POWER SYSTEMS LTD.
1172	BATTERIES	EXIDE INDUSTRIES LTD
1173	BATTERIES	AMARA RAJA
1174	BATTERIES	ERGON GREEN
1175	<b>CHANGE OVER SWITCH</b>	CGM
1176	CHANGE OVER SWITCH	L&T
1177	CHANGE OVER SWITCH	SIEMENS
1178	<b>SOLAR STREET LIGHTING</b>	TATA BP SOLAR (I) LTD.
1179	SOLAR STREET LIGHTING	REIL, JAIPUR.
1180	SOLAR STREET LIGHTING	CEIL, SAHIBABAD.
1181	SOLAR STREET LIGHTING	HBL POWER
1182	SOLAR STREET LIGHTING	NATURGY GREENS
1183	<b>AVR AND STABLISERS</b>	JINDAL
1184	AVR AND STABLISERS	ERGON POWER
1185	<b>CHEMICAL/PLATE/G.I. EARTHINGS/G.I. PATTI/LCV EARTHING SYSTEM</b>	IVECO RENO
1186	CHEMICAL/PLATE/G.I. EARTHINGS/G.I. PATTI/LCV EARTHING SYSTEM	JEF TECH EARTHINGS
1187	CHEMICAL/PLATE/G.I. EARTHINGS/G.I. PATTI/LCV EARTHING SYSTEM	INDIANA GRATINGS
1188	<b>GEG SET</b>	CHROMA-ATOR
1189	GEG SET	MAHINDRA



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1190	GEG SET	KIRLOSKAR
1191	<b>TRANSFORMER</b>	ABB
1192	TRANSFORMER	GE
1193	TRANSFORMER	CROMPTON GREAVES
1194	TRANSFORMER	SIEMENS
1195	TRANSFORMER	TRANSFORMERS & RECTIFIERS INDIA LTD
1196	TRANSFORMER	KIRLOSKAR ELECTRIC
1197	TRANSFORMER	GUJARAT TRANSFORMER
1198	TRANSFORMER	KOTSONS PVT LTD
1199	<b>AIR CONDITIONING SYSTEM</b>	CARRIER
1200	AIR CONDITIONING SYSTEM	HITACHI
1201	AIR CONDITIONING SYSTEM	DAIKIN
1202	AIR CONDITIONING SYSTEM	BLUE STAR
1203	AIR CONDITIONING SYSTEM	VOLTAS
1204	<b>VENTILATION FAN</b>	ADVANCE VENTILATION PVT LTD.
1205	VENTILATION FAN	CB DOCTOR INDIA PVT.LTD.
1206	VENTILATION FAN	SK SYSTEMS PRIVATE LIMITED
1207	VENTILATION FAN	SARALA (Suburban Industrial Works)
1208	<b>VENTILATION INTAKE LOUVER, BACK DRAFT DAMPER</b>	ADVANCE VENTILATION PVT LTD.
1209	VENTILATION INTAKE LOUVER, BACK DRAFT DAMPER	RUSKIN TITUS INDIA PVT. LIMITED
1210	<b>LNG STORAGE TANK</b>	INOX
1211	LNG STORAGE TANK	VRV
1212	LNG STORAGE TANK	CHART
1213	LNG STORAGE TANK	TAYLOR WHARTON
1214	LNG STORAGE TANK	CRYOGAS
1215	LNG STORAGE TANK	New Field Industrial Equipment Pvt Ltd
1216	<b>MANUAL CRYOGENIC GLOBE /CHECK VALVE</b>	BESTOBELL
1217	MANUAL CRYOGENIC GLOBE /CHECK VALVE	HEROSE

Sr.No	Name of ITEM/Package	Recommended Vendor List
1218	<b>EP OPERATED CRYOGENIC VALVES</b>	HEROSE
1219	EP OPERATED CRYOGENIC VALVES	HABONIM
1220	EP OPERATED CRYOGENIC VALVES	BESTOBELL
1221	EP OPERATED CRYOGENIC VALVES	MECAINOX
1222	<b>ESD VALVES</b>	BESTOBELL
1223	ESD VALVES	HEROSE
1224	ESD VALVES	MECAINOX
1225	<b>INSTRUMENT VALVES FITTING, TUBE FITTINGS &amp; AIR MANIFOLD</b>	SWAGelok
1226	INSTRUMENT VALVES FITTING, TUBE FITTINGS & AIR MANIFOLD	PARKER
1227	<b>LEVEL GAUGE</b>	WIKA
1228	LEVEL GAUGE	CHEMTROL
1229	LEVEL GAUGE	KRONE
1230	<b>CRYO REGULATOR &amp; PRESSURE REGULATOR</b>	SAMSON
1231	CRYO REGULATOR & PRESSURE REGULATOR	CASH
1232	CRYO REGULATOR & PRESSURE REGULATOR	



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1233	CRYO REGULATOR & PRESSURE REGULATOR	BESTOBELL REGO
1234	<b>PRESSURE CONTROL REGULATOR</b>	NIRMAL INDIA
1235	PRESSURE CONTROL REGULATOR	PIETRO FIORENTIN
1236	PRESSURE CONTROL REGULATOR	REGO
1237	<b>SAFETY VALVE</b>	HEROSE
1238	SAFETY VALVE	LESSER
1239	SAFETY VALVE	ROCKWOOD
1240	<b>THERMAL RELIEF VALVE</b>	HEROSE
1241	THERMAL RELIEF VALVE	REGO
1242	<b>PRESSURE GAUGE &amp; DIFFERENTIAL PRESSURE GAUGES</b>	WIKA
1243	PRESSURE GAUGE & DIFFERENTIAL PRESSURE GAUGES	GENERAL INSTRUMENT
1244	PRESSURE GAUGE & DIFFERENTIAL PRESSURE GAUGES	WAREE INSTRUMENTS LTD
1245	PRESSURE GAUGE & DIFFERENTIAL PRESSURE GAUGES	A.N. INSTRUMENTS PVT. LTD
1246	<b>TEMPERATURE ELEMENTT</b>	GENERAL INSTRUMENT
1247	TEMPERATURE ELEMENTT	TEMPSEN
1248	TEMPERATURE ELEMENTT	PYROELECTRIC
1249	<b>PRESSURE/ DIFFERENTIAL PRESSURE /TEMPERATURE TRANSMITTER</b>	EMERSON
1250	PRESSURE/ DIFFERENTIAL PRESSURE /TEMPERATURE TRANSMITTER	SIEMENS
1251	PRESSURE/ DIFFERENTIAL PRESSURE /TEMPERATURE TRANSMITTER	YOKOGAWA
1252	PRESSURE/ DIFFERENTIAL PRESSURE /TEMPERATURE TRANSMITTER	HONEYWELL
1253	<b>JUNCTION BOX</b>	BALIGA
1254	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.
1255	JUNCTION BOX	EXPROTECTA ELECTRICALS
1256	<b>FIRE &amp; GAS DETECTION SYSTEM</b>	DETECTION ELECTRONIC
1257	FIRE & GAS DETECTION SYSTEM	HONEYWELL
1258	FIRE & GAS DETECTION SYSTEM	TYCO
1259	FIRE & GAS DETECTION SYSTEM	CHEMTROL ENGINEERING
1260	<b>PLC SYSTEM HARDWARE WITH COMPLETE CONTROL PANEL</b>	ALLEN BRADLEY
1261	PLC SYSTEM HARDWARE WITH COMPLETE CONTROL PANEL	SIEMENS
1262	PLC SYSTEM HARDWARE WITH COMPLETE CONTROL PANEL	HONEYWELL
1263	PLC SYSTEM HARDWARE WITH COMPLETE CONTROL PANEL	YOKOGAWA
1264	<b>CONTROL CONSOLE</b>	EVAN

Sr.No	Name of ITEM/Package	Recommended Vendor List
1265	CONTROL CONSOLE	PYROTECH
1266	<b>SCADA</b>	HONEYWELL
1267	SCADA	YOKOGAWA
1268	SCADA	SIEMENS
1269	SCADA	ALLEN BRADLEY
1270	<b>MASS FLOW METER</b>	EMERSON
1271	MASS FLOW METER	E&H
1272	MASS FLOW METER	SICK
1273	<b>USM METER</b>	Daniel/ Insromet International/ Krohne
1274	USM METER	Insromet International



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1275	USM METER	Krohne
1276	<b>LAN SWITCH</b>	CISCO
1277	LAN SWITCH	NORTEL
1278	LAN SWITCH	MOXA
1279	<b>LASER JET COLOUR PRINTER</b>	HP
1280	LASER JET COLOUR PRINTER	Canon
1281	LASER JET COLOUR PRINTER	Epson
1282	<b>ZENER BARRIERS/ISOLATORS</b>	MTL
1283	ZENER BARRIERS/ISOLATORS	P & F
1284	<b>POWER SUPPLY UNIT</b>	ELNOVA
1285	POWER SUPPLY UNIT	APLAB
1286	<b>SERVER &amp; HMI</b>	DELL
1287	SERVER & HMI	HP
1288	<b>PRIORITY PANEL</b>	PARKER
1289	PRIORITY PANEL	TULSA
1290	<b>LEL NG GAS DETECTOR /DETECTION SYSTEM</b>	CROWCON DETECTION INSTRUMENTS LTD
1291	LEL NG GAS DETECTOR /DETECTION SYSTEM	DETECTION INSTRUMENTS (I) PVT LTD
1292	LEL NG GAS DETECTOR /DETECTION SYSTEM	DETECTOR ELECTRONICS CORPORATION
1293	LEL NG GAS DETECTOR /DETECTION SYSTEM	DRAGER SAFETY AG & CO.
1294	LEL NG GAS DETECTOR /DETECTION SYSTEM	KGAA MSA MINESAFETY APPLIANCES
1295	LEL NG GAS DETECTOR /DETECTION SYSTEM	OLDHAM FRANCE S.A. HO
1296	LEL NG GAS DETECTOR /DETECTION SYSTEM	HONEYWELL
1297	<b>EMERGENCY STOP PUSH BUTTON STATION NEAR TANK</b>	BALIGA/KAYSON/SUDHIR
1298	<b>ELECTRICAL CABLES</b>	M/S ASSOCIATED CABLES/
1299	ELECTRICAL CABLES	M/S DELTON CABLES LTD, INDIA /
1300	ELECTRICAL CABLES	M/S KEI INDUSTRIES LTD INDIA /
1301	ELECTRICAL CABLES	M/S - CORDS CABLE INDUSTRIES LTD, INDIA
1302	ELECTRICAL CABLES	M/S POLYCAB WIRES PVT LTD, INDIA
1303	ELECTRICAL CABLES	T. C. COMMUNICATION PVT. LTD., DELHI
1304	ELECTRICAL CABLES	M/S SUYOG
1305	ELECTRICAL CABLES	M/S THERMO CABLES
1306	<b>CONTROL &amp; INSTRUMENT CABLES</b>	KEI
1307	CONTROL & INSTRUMENT CABLES	CORDS
1308	CONTROL & INSTRUMENT CABLES	POLYCAB
1309	CONTROL & INSTRUMENT CABLES	DELTON
1310	<b>CRYOGENIC PUMP CENTRIFUGAL / SUBMERGED</b>	CRYOSTAR
1311	CRYOGENIC PUMP CENTRIFUGAL / SUBMERGED	ACD NIKISSO

Sr.No	Name of ITEM/Package	Recommended Vendor List
1312	CRYOGENIC PUMP CENTRIFUGAL / SUBMERGED	VANZETTI
1313	CRYOGENIC PUMP CENTRIFUGAL / SUBMERGED	CRYOMECH
1314	CRYOGENIC PUMP CENTRIFUGAL / SUBMERGED	ICL
1315	<b>LNG DISPENSER</b>	CRYOSTAR
1316	LNG DISPENSER	ACD NIKISSO



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1317	LNG DISPENSER	CRYOGAS
1318	LNG DISPENSER	INOX
1319	<b>CNG DISPENSER</b>	TULSA
1320	CNG DISPENSER	PARKER
1321	<b>MOTOR</b>	ABB
1322	MOTOR	SIEMENS
1323	MOTOR	CGL
1324	MOTOR	BBL
1325	MOTOR	MARATHON
1326	<b>VFD</b>	ABB
1327	VFD	SIEMENS
1328	VFD	HITACHI
1329	VFD	SCHNEIDER
1330	<b>FIRE PUMP</b>	LUBI
1331	FIRE PUMP	KIRLOSKAR
1332	FIRE PUMP	WILO
1333	FIRE PUMP	FLOWMORE
1334	FIRE PUMP	VARAT PUMPS
1335	<b>HYDRANT VALVE / WATER MONITOR / HOSE BOX / FIRE HOSE / BRIGADE INLET / BRANCH PIPE</b>	NEWAGE
1336	HYDRANT VALVE / WATER MONITOR / HOSE BOX / FIRE HOSE / BRIGADE INLET / BRANCH PIPE	SBJ
1337	HYDRANT VALVE / WATER MONITOR / HOSE BOX / FIRE HOSE / BRIGADE INLET / BRANCH PIPE	WINCO
1338	HYDRANT VALVE / WATER MONITOR / HOSE BOX / FIRE HOSE / BRIGADE INLET / BRANCH PIPE	VIMAL FIRE
1339	HYDRANT VALVE / WATER MONITOR / HOSE BOX / FIRE HOSE / BRIGADE INLET / BRANCH PIPE	SUKAN
1340	HYDRANT VALVE / WATER MONITOR / HOSE BOX / FIRE HOSE / BRIGADE INLET / BRANCH PIPE	SUPREMEX
1341	HYDRANT VALVE / WATER MONITOR / HOSE BOX / FIRE HOSE / BRIGADE INLET / BRANCH PIPE	UNITED FIRE
1342	<b>FIRE EXTINGUISHERS</b>	MINIMAX
1343	FIRE EXTINGUISHERS	CEASE FIRE
1344	FIRE EXTINGUISHERS	KANEX
1345	FIRE EXTINGUISHERS	SUPREMEX
1346	<b>FIRE WATER PIPES (MS)</b>	TATA
1347	FIRE WATER PIPES (MS)	JINDAL
1348	FIRE WATER PIPES (MS)	SURYA ROSHNI
1349	FIRE WATER PIPES (MS)	WELSPUN
1350	FIRE WATER PIPES (MS)	RATNAMANI
1351	FIRE WATER PIPES (MS)	MAHARASHTRA SEAMLESS
1352	FIRE WATER PIPES (MS)	SWASTIK

Sr.No	Name of ITEM/Package	Recommended Vendor List
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1353	FIRE WATER PIPES (MS)	ESSAR
1354	FIRE WATER PIPES (MS)	GOODLUCK
1355	<b>OS &amp; Y GATE VALVES</b>	KARTAR
1356	OS & Y GATE VALVES	KIRLOSKAR
1357	OS & Y GATE VALVES	HD FIRE
1358	OS & Y GATE VALVES	L&T
1359	OS & Y GATE VALVES	OSWAL
1360	<b>BUTTERFLY VALVES (FIRE SERVICE)</b>	TYCO / INTERVALVE / L&T / FOURESS / AV VALVES / ADVANCE / DELVAL / LEADER
1361	BUTTERFLY VALVES (FIRE SERVICE)	INTERVALVE
1362	BUTTERFLY VALVES (FIRE SERVICE)	L&T
1363	BUTTERFLY VALVES (FIRE SERVICE)	FOURESS
1364	BUTTERFLY VALVES (FIRE SERVICE)	AV VALVES
1365	BUTTERFLY VALVES (FIRE SERVICE)	ADVANCE
1366	BUTTERFLY VALVES (FIRE SERVICE)	DELVAL
1367	BUTTERFLY VALVES (FIRE SERVICE)	LEADER
1368	<b>NON-RETURN VALVES (FIRE SERVICE)</b>	TYCO
1369	NON-RETURN VALVES (FIRE SERVICE)	L&T
1370	NON-RETURN VALVES (FIRE SERVICE)	WEIR BDK
1371	NON-RETURN VALVES (FIRE SERVICE)	OSWAL
1372	NON-RETURN VALVES (FIRE SERVICE)	FLOTEK
1373	NON-RETURN VALVES (FIRE SERVICE)	STEEL STRONG
1374	NON-RETURN VALVES (FIRE SERVICE)	FLUIDLINE
1375	<b>STRAINERS (FIRE SERVICE)</b>	SANT
1376	STRAINERS (FIRE SERVICE)	TELEFLOW
1377	STRAINERS (FIRE SERVICE)	FLAIR
1378	STRAINERS (FIRE SERVICE)	VENUS
1379	STRAINERS (FIRE SERVICE)	LEADER
1380	<b>FIRE PUMP TEST METER</b>	TYCO
1381	FIRE PUMP TEST METER	RAPIDROP
1382	<b>PIPE FITTINGS (FIRE SERVICE)</b>	UNIK
1383	PIPE FITTINGS (FIRE SERVICE)	ZOLOTO
1384	PIPE FITTINGS (FIRE SERVICE)	VENUS
1385	PIPE FITTINGS (FIRE SERVICE)	FITWELL
1386	PIPE FITTINGS (FIRE SERVICE)	WELDFIT
1387	PIPE FITTINGS (FIRE SERVICE)	JK FORGE
1388	PIPE FITTINGS (FIRE SERVICE)	OMEGA
1389	PIPE FITTINGS (FIRE SERVICE)	HB
1390	PIPE FITTINGS (FIRE SERVICE)	DRP-M
1391	PIPE FITTINGS (FIRE SERVICE)	GREENLINE
1392	PIPE FITTINGS (FIRE SERVICE)	HARDIK FORGING
1393	PIPE FITTINGS (FIRE SERVICE)	METRO METAL
1394	<b>LEVEL GAUGE FOR FIRE WATER APPLICATION</b>	LEVCON
1395	LEVEL GAUGE FOR FIRE WATER APPLICATION	SIGMA
1396	LEVEL GAUGE FOR FIRE WATER APPLICATION	CHEMTROL
1397	LEVEL GAUGE FOR FIRE WATER APPLICATION	DK INSTRUMENT
1398	LEVEL GAUGE FOR FIRE WATER APPLICATION	V AUTOMAT
1399	<b>FLOW DIVERTER</b>	BESTOBELL



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Sr.No	Name of ITEM/Package	Recommended Vendor List
1400	FLOW DIVERTER	REGO
1401	<b>CONTROL ROOM EQUIPMENT CONTROL PANEL &amp; ACCESSORIES</b>	M/S KELTRON CONTROLS LTD
1402	CONTROL ROOM EQUIPMENT CONTROL PANEL & ACCESSORIES	M/S ITTAL
1403	CONTROL ROOM EQUIPMENT CONTROL PANEL & ACCESSORIES	M/S PYROTECH
1404	CONTROL ROOM EQUIPMENT CONTROL PANEL & ACCESSORIES	M/S POSITRONICS PVT. LTD.
1405	CONTROL ROOM EQUIPMENT CONTROL PANEL & ACCESSORIES	RITTAL
1406	CONTROL ROOM EQUIPMENT CONTROL PANEL & ACCESSORIES	PYROTECH CONTROLS
1407	<b>INDICATORS</b>	M/S ABB
1408	INDICATORS	M/S EUROTHERN
1409	INDICATORS	M/S TATA HONEYWELL
1410	INDICATORS	M/S MASIBUS
1411	<b>LIGHTING FIXTURES (NORMAL)</b>	HAVELLS INDIA/ GE LIGHTING PVT. LTD/ PHILIPS INDIA LTD/ BAJAJ ELECTRICALS LTD/ CROMPTON GREAVES LTD
1412	LIGHTING FIXTURES (NORMAL)	GE LIGHTING PVT. LTD
1413	LIGHTING FIXTURES (NORMAL)	PHILIPS INDIA LTD
1414	LIGHTING FIXTURES (NORMAL)	BAJAJ ELECTRICALS LTD
1415	LIGHTING FIXTURES (NORMAL)	CROMPTON GREAVES LTD
1416	<b>DIESEL ENGINE</b>	CUMMIN
1417	DIESEL ENGINE	GREAVES
1418	DIESEL ENGINE	EICHER
1419	DIESEL ENGINE	KOEL
1420	<b>VAPORIZER</b>	CRYOGAS
1421	VAPORIZER	INOX
1422	VAPORIZER	VRV
1423	VAPORIZER	ACD NIKISSO
1424	<b>DEWATERING PUMP</b>	CROMPTON
1425	DEWATERING PUMP	KIRLOSKAR
1426	DEWATERING PUMP	LUBI
1427	DEWATERING PUMP	VARAT PUMPS
1428	<b>STEEL PLATES</b>	Arcelor Mittal, Romania/ France/ Germany
1429	STEEL PLATES	Azovstahl, Ukraine
1430	STEEL PLATES	Nippon Steel Corporation, Japan [Formerly known as Nippon Steel & Sumitomo Metal Corp. (NSSMC)]
1431	STEEL PLATES	Baoshan Iron & Steel Co. Ltd., Shanghai, China
1432	STEEL PLATES	Dillinger, Germany
1433	STEEL PLATES	Essar Steel, India
1434	STEEL PLATES	Ilva (Riva Group), Italy
1435	STEEL PLATES	JFE Steel, Japan
1436	STEEL PLATES	Jindal Steel & Power Ltd. (upto 20.6 mm)
1437	STEEL PLATES	JSW Steel, USA
1438	STEEL PLATES	Mannesmann Salzgitter Roehrenwerke, Germany
1439	STEEL PLATES	POSCO, South Korea
1440	STEEL PLATES	SAIL, Rourkela Steel Plant (up to 23.8 mm)
1441	STEEL PLATES	Usiminas, Brazil



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1442	STEEL PLATES	Voestalpine, Austria
1443	STEEL PLATES	Welspun PCMD, India
1444	<b>STEEL COILS</b>	AHMSA (Altos Hornos De Mexico), Mexico
1445	STEEL COILS	Angang Steel Co.Ltd., China

Sr.No	Name of ITEM/Package	Recommended Vendor List
1446	STEEL COILS	Anyang Iron & Steel Group Co.Ltd. China
1447	STEEL COILS	Arcelor Mittal,France/ Germany
1448	STEEL COILS	Baoshan Iron & Steel Co. Ltd., Shanghai, China
1449	STEEL COILS	Benxi Iron & Steel, China
1450	STEEL COILS	Erdemir, Turkey
1451	STEEL COILS	Essar Steel, India
1452	STEEL COILS	Hadeed Saudi Iron & Steel Co., Saudi Arabia/ UAE
1453	STEEL COILS	HBIS Hebei Iron & Steel Group Co.Ltd, China
1454	STEEL COILS	Hunan Valin Lianyuan Steel Co. Ltd. China (Arcelor Mittal Group)
1455	STEEL COILS	Hyundai Steel, South Korea
1456	STEEL COILS	Jiangsu Shagang (Group), China
1457	STEEL COILS	Jinan Iron & Steel Co. Ltd., China
1458	STEEL COILS	JSW steel limited, Dolvi (earlier Ispat (upto X-70, WT-11.7mm)
1459	STEEL COILS	JSW, Bellary India
1460	STEEL COILS	Lloyd Steel, India (upto X-70, WT-11.7mm)
1461	STEEL COILS	Maanshan Iron & Steel Co. Ltd., China
1462	STEEL COILS	Megasteel, Malaysia (upto X-70, WT-10.3mm)
1463	STEEL COILS	POSCO, South Korea
1464	STEEL COILS	SAIL, Bokaro (uptoX-70, WT-11.1mm)
1465	STEEL COILS	Shou-gang Qian Iron & Steel Co. Ltd., China
1466	STEEL COILS	ThyssenKrupp, Germany
1467	STEEL COILS	TISCO (Group) Co. Ltd, China
1468	STEEL COILS	US Steel Kosice, Slovak Republic
1469	STEEL COILS	Wuhan Iron & Steel, China
1470	STEEL COILS	Tata Steel Ltd., Jamshedpur (upto API 5L X-60 & WT upto 9.35 mm)
1471	STEEL COILS	Tata Steel Ltd., Kalinganagar (upto API 5L X-70 & WT upto 16.0 mm)
1472	STEEL COILS	Tata Steel BSL Ltd., Meramandali (upto API 5L X-70 & WT upto 12.7 mm)
1473	<b>TEMPORARY CATHODIC PROTECTION</b>	
1474	CATHODIC PROTECTION AGENCY	Corrtech , Ahemdabad
1475	CATHODIC PROTECTION AGENCY	Corrosion Technology Services Pvt. Ltd., Mumbai
1476	CATHODIC PROTECTION AGENCY	Sark EPC, Ahmedadbad
1477	CATHODIC PROTECTION AGENCY	UNDTs, Noida
1478	CATHODIC PROTECTION AGENCY	Mitcorr, Baroda
1479	CATHODIC PROTECTION AGENCY	BSS Tech, Mumbai
1480	CATHODIC PROTECTION AGENCY	Vijaya Engineering
1481	CATHODIC PROTECTION AGENCY	Universal Corrosion Prevention India , Kolkata
1482	CATHODIC PROTECTION AGENCY	AMR Engineering Products , Mumbai
1483	CATHODIC PROTECTION AGENCY	Himoya Corrosion Technology , Kolkata



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1484	CATHODIC PROTECTION AGENCY	Consultech ,Baroda
1485	CATHODIC PROTECTION AGENCY	M.Tech Engineers , Surat
1486	CATHODIC PROTECTION AGENCY	Cortigo Technologies Pvt. Ltd , Ahmedabad
1487	CATHODIC PROTECTION AGENCY	AA Projects Cathodic Protection
1488	<b>JUNCTION BOXES (CLASSIFIED TYPE)</b>	Flame Proof Equipment Pvt. Ltd.(FEPL), Bombay
1489	JUNCTION BOXES (CLASSIFIED TYPE)	Baliga Lighting, Chennai
1490	JUNCTION BOXES (CLASSIFIED TYPE)	CEAG Flame Proof Control Gears, Bombay
1491	JUNCTION BOXES (CLASSIFIED TYPE)	Flexpro Electricals, Navsari, Gujarat
1492	JUNCTION BOXES (CLASSIFIED TYPE)	Sudhir Switchgear

Sr.No	Name of ITEM/Package	Recommended Vendor List
1493	JUNCTION BOXES (CLASSIFIED TYPE)	FCG flame proof control gears P. Ltd., Daman
1494	JUNCTION BOXES (CLASSIFIED TYPE)	Pepperl & Fuchs manufacturing (I) Pvt. Ltd.,Kanchipuram
1495	JUNCTION BOXES (CLASSIFIED TYPE)	Kaysons Techno equipments Pvt. Ltd., India
1496	JUNCTION BOXES (CLASSIFIED TYPE)	R Stahl Pvt. Ltd. Kanchipuram
1497	JUNCTION BOXES/ TEST STATION (NON- CLASSIFIED TYPE)	Kristron systems, Mumbai
1498	JUNCTION BOXES/ TEST STATION (NON- CLASSIFIED TYPE)	Raychem RPG Pvt Limited
1499	JUNCTION BOXES/ TEST STATION (NON- CLASSIFIED TYPE)	Corrttech International Pvt Ltd
1500	JUNCTION BOXES/ TEST STATION (NON- CLASSIFIED TYPE)	Sukrit Industries Ahemdabad
1501	JUNCTION BOXES/ TEST STATION (NON- CLASSIFIED TYPE)	Silverline Integrity Services
1502	JUNCTION BOXES/ TEST STATION (NON- CLASSIFIED TYPE)	UNDTs
1503	JUNCTION BOXES/ TEST STATION (NON- CLASSIFIED TYPE)	SARK EPC
1504	<b>CABLES</b>	Netco Cable
1505	CABLES	KEI
1506	CABLES	Fort Gloster
1507	CABLES	Polycab
1508	CABLES	Universal
1509	CABLES	CCI
1510	CABLES	CMIL
1511	CABLES	Suyog Electricals
1512	CABLES	Victor cables
1513	CABLES	Finolex cables
1514	CABLES	Asian Cables
1515	CABLES	Radiant Cables
1516	CABLES	Icon cables
1517	CABLES	Gemscab
1518	CABLES	Torrent
1519	CABLES	Nicco
1520	CABLES	KEC International
1521	CABLES	Uniflex
1522	CABLES	Havells
1523	CABLES	Crystal Cable Corporation
1524	CABLES	Ravin
1525	<b>PORTABLE/ PERMANENT REFERENCE ELECTRODES</b>	Permacell/Harco, USA
1526	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Borin Manufacturer, USA



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1527	PORTABLE/ PERMANENT REFERENCE ELECTRODES	M.C.Miller, USA
1528	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Tinker & Rasor, USA
1529	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Ceranoda Technologies, USA
1530	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Telpro USA
1531	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Gruppo De nora, Goa
1532	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Oranzio De nora, Italy
1533	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Silvion, UK
1534	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Harco, USA
1535	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Electrochemical devices, USA
1536	<b>SURGE DIVERTOR (EX-d type)</b>	Dehn (Germany)
1537	SURGE DIVERTOR (EX-d type)	OBO Betterman (Germany)
1538	<b>SOLID STATE POLARISTATION CELL</b>	Dairyland
1539	SOLID STATE POLARISTATION CELL	Metricorr, Denmark

Sr.No	Name of ITEM/Package	Recommended Vendor List
1540	SOLID STATE POLARISTATION CELL	Rustrol
1541	SOLID STATE POLARISTATION CELL	Dehn, Germany
1542	SOLID STATE POLARISTATION CELL	Kristron Systems, Mumbai
1543	SOLID STATE POLARISTATION CELL	Corrpro system
1544	SOLID STATE POLARISTATION CELL	Caltech
1545	<b>THERMIT WELDS</b>	Erico, USA
1546	THERMIT WELDS	Thermoweld, USA
1547	THERMIT WELDS	Erico, Europe
1548	THERMIT WELDS	Bac, UK
1549	<b>PINBRAZING</b>	Safe Track
1550	PINBRAZING	Bac, UK
1551	<b>MAGNESIUM &amp; ZINC ANODES</b>	Sargam Metal , Chennai
1552	MAGNESIUM & ZINC ANODES	Scientific Metal, Chennai
1553	MAGNESIUM & ZINC ANODES	Shakti enterprises, Ahemdabad
1554	MAGNESIUM & ZINC ANODES	PSL Holding Pvt. Ltd., Mumbai
1555	MAGNESIUM & ZINC ANODES	Cathodic Controls, Bangalore
1556	MAGNESIUM & ZINC ANODES	Impalloy International
1557	MAGNESIUM & ZINC ANODES	Electro protection services, India
1558	MAGNESIUM & ZINC ANODES	Cathodic Control Company Pvt. Ltd., India
1559	MAGNESIUM & ZINC ANODES	Nippon Corrosion, Japan
1560	MAGNESIUM & ZINC ANODES	AFIC, KSA
1561	MAGNESIUM & ZINC ANODES	Platt Bros. and Company, USA
1562	MAGNESIUM & ZINC ANODES	Impalloy International, UK
1563	MAGNESIUM & ZINC ANODES	Corrpro International, Canada
1564	MAGNESIUM & ZINC ANODES	Nakabohtec, Japan
1565	MAGNESIUM & ZINC ANODES	Metal Founder, Mumbai
1566	MAGNESIUM & ZINC ANODES	Corrosion Matters, Hyderabad
1567	<b>ANODE BACKFILL MATERIAL</b>	Goa carbon, Goa
1568	ANODE BACKFILL MATERIAL	India Carbon, Kolkata
1569	ANODE BACKFILL MATERIAL	Petrocarbon & Chemical Company, Kolkata



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1570	ANODE BACKFILL MATERIAL	Loresco, USA
1571	<b>PERMANENT CATHODIC PROTECTION SYSTEM</b>	Corrtech , Ahemdabad
1572	PERMANENT CATHODIC PROTECTION SYSTEM	Corrosion Technology Services Pvt. Ltd., Mumbai
1573	PERMANENT CATHODIC PROTECTION SYSTEM	Sark EPC, Ahmedadbad
1574	PERMANENT CATHODIC PROTECTION SYSTEM	UNDTs, Noida
1575	PERMANENT CATHODIC PROTECTION SYSTEM	Mitcorr, Baroda
1576	PERMANENT CATHODIC PROTECTION SYSTEM	BSS Tech, Mumbai
1577	PERMANENT CATHODIC PROTECTION SYSTEM	Vijaya Engineering
1578	PERMANENT CATHODIC PROTECTION SYSTEM	Cortigo Technologies Pvt. Ltd., Ahmedabad
1579	<b>TRANSFORMER- RECTIFIER UNITS</b>	Raychem RPG Pvt Ltd.(Canara Electric), Mumbai
1580	TRANSFORMER- RECTIFIER UNITS	Kristron Systems Mumbai
1581	TRANSFORMER- RECTIFIER UNITS	Cathodic Control Co Pvt. Ltd,
1582	TRANSFORMER- RECTIFIER UNITS	Golconda Corrosion Control Pvt. Ltd., India
1583	TRANSFORMER- RECTIFIER UNITS	Hind Rectifiers Ltd., India
1584	<b>JUNCTION BOXES (CLASSIFIED TYPE)</b>	Flame Proof Equipment Pvt. Ltd.(FEPL), Bombay
1585	JUNCTION BOXES (CLASSIFIED TYPE)	Baliga Lighting, Chennai
1586	JUNCTION BOXES (CLASSIFIED TYPE)	Ceag Flame Proof Control Gears, Bombay

Sr.No	Name of ITEM/Package	Recommended Vendor List
1587	JUNCTION BOXES (CLASSIFIED TYPE)	Flexpro Electricals, Navsari, Gujarat
1588	JUNCTION BOXES (CLASSIFIED TYPE)	Sudhir Switchgear
1589	JUNCTION BOXES (CLASSIFIED TYPE)	FCG flame proof control gears P. Ltd., Daman
1590	JUNCTION BOXES (CLASSIFIED TYPE)	Pepperl & Fuchs manufacturing (I) Pvt. Ltd.,Kanchipuram
1591	JUNCTION BOXES (CLASSIFIED TYPE)	Kaysons Techno equipments Pvt. Ltd., India
1592	JUNCTION BOXES (CLASSIFIED TYPE)	R Stahl Pvt. Ltd. Kanchipuram
1593	<b>JUNCTION BOXES/ Test Stations (NON- CLASSIFIED TYPE)</b>	Kristron systems, Mumbai
1594	JUNCTION BOXES/ Test Stations (NON- CLASSIFIED TYPE)	Raychem RPG Pvt Limited
1595	JUNCTION BOXES/ Test Stations (NON- CLASSIFIED TYPE)	Corrtech International Pvt Ltd
1596	JUNCTION BOXES/ Test Stations (NON- CLASSIFIED TYPE)	Sukrit Industries Ahemdabad
1597	JUNCTION BOXES/ Test Stations (NON- CLASSIFIED TYPE)	Silverline Integrity Services
1598	JUNCTION BOXES/ Test Stations (NON- CLASSIFIED TYPE)	UNDTs
1599	JUNCTION BOXES/ Test Stations (NON- CLASSIFIED TYPE)	SARK EPC
1600	<b>CABLES</b>	Netco Cable
1601	CABLES	KEI
1602	CABLES	Fort Gloster
1603	CABLES	Polycab
1604	CABLES	Universal
1605	CABLES	Cable Corporation of India
1606	CABLES	CMIL
1607	CABLES	Suyog Electricals
1608	CABLES	Victor cables
1609	CABLES	Finolex cables
1610	CABLES	Asian Cables
1611	CABLES	Radiant Cables
1612	CABLES	Icon cables



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1613	CABLES	Gemscab
1614	CABLES	Torrent
1615	CABLES	Nicco
1616	CABLES	KEC International
1617	CABLES	Uniflex
1618	CABLES	Havells
1619	CABLES	Crystal Cable Corporation
1620	CABLES	Ravin
1621	<b>PORTABLE/ PERMANENT REFERENCE ELECTRODES</b>	Permacell/Harco, USA
1622	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Borin Manufacturer, USA
1623	PORTABLE/ PERMANENT REFERENCE ELECTRODES	M.C.Miller, USA
1624	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Tinker & Rasor, USA
1625	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Ceranoda Technologies, USA
1626	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Telpro USA
1627	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Gruppo De nora, Goa
1628	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Oranzio De nora, Italy
1629	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Silvion, UK
1630	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Harco, USA
1631	PORTABLE/ PERMANENT REFERENCE ELECTRODES	Electrochemical devices, USA
1632	<b>SURGE DIVERTOR (EX-d)</b>	Dehn (Germany)
1633	SURGE DIVERTOR (EX-d)	OBO Betterman (Germany)

Sr.No	Name of ITEM/Package	Recommended Vendor List
1634	<b>AC CORROSION COUPON</b>	MC Miller
1635	AC CORROSION COUPON	Farwest Corrosion
1636	<b>THERMIT WELDS</b>	Erico, USA
1637	THERMIT WELDS	Thermoweld, USA
1638	THERMIT WELDS	Erico, Europe
1639	THERMIT WELDS	Bac, UK
1640	<b>PINBRAZING</b>	Safe Track, Sweden
1641	PINBRAZING	Bac, UK
1642	<b>ER PROBE</b>	Rose Corrosion Service, UK
1643	ER PROBE	Metal Samples. USA
1644	ER PROBE	Roharbak Cosasco, USA
1645	ER PROBE	Caproco, UK
1646	ER PROBE	Korosi Specindo, Indonesia
1647	<b>MMO WIRE ANODE</b>	Titanor Components Ltd., Goa
1648	MMO WIRE ANODE	Oranzio De Nora, Italy
1649	MMO WIRE ANODE	Eltech System, USA
1650	MMO WIRE ANODE	Ceranode Technologies, USA
1651	MMO WIRE ANODE	Matcor, USA
1652	MMO WIRE ANODE	Covalence, USA
1653	MMO WIRE ANODE	Berry Plastics
1654	MMO WIRE ANODE	Gruppo De nora, Goa
1655	MMO WIRE ANODE	Telpro USA



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1656	<b>MMO TUBULAR /STRIP/RIBBON ANODE</b>	Titanor Components Ltd., Goa
1657	MMO TUBULAR /STRIP/RIBBON ANODE	Oranzio De Nora, Italy
1658	MMO TUBULAR /STRIP/RIBBON ANODE	Magnetocheme, Holland
1659	MMO TUBULAR /STRIP/RIBBON ANODE	Actel Ltd., UK
1660	MMO TUBULAR /STRIP/RIBBON ANODE	Eltech System, USA
1661	MMO TUBULAR /STRIP/RIBBON ANODE	Ceranode Technologies, USA
1662	MMO TUBULAR /STRIP/RIBBON ANODE	Matcor, USA
1663	MMO TUBULAR /STRIP/RIBBON ANODE	Gruppo De nora, Goa
1664	MMO TUBULAR /STRIP/RIBBON ANODE	Cathodic Control Co Pvt. Ltd, India
1665	MMO TUBULAR /STRIP/RIBBON ANODE	Electro Protection Services India P Ltd
1666	MMO TUBULAR /STRIP/RIBBON ANODE	Emirates Techno Casting, UAE
1667	MMO TUBULAR /STRIP/RIBBON ANODE	Corrosion Matters, Hyderabad
1668	<b>SOLID STATE POLARISATION CELL</b>	Dairyland
1669	SOLID STATE POLARISATION CELL	Metricorr, Denmark
1670	SOLID STATE POLARISATION CELL	Rustrol
1671	SOLID STATE POLARISATION CELL	Dehn, Germany
1672	SOLID STATE POLARISATION CELL	Kristron Systems, Mumbai
1673	SOLID STATE POLARISATION CELL	Corrpro system
1674	<b>HEAT SHRINK CAP FOR ANODE TO CABLE JOINT</b>	Raychem, USA
1675	HEAT SHRINK CAP FOR ANODE TO CABLE JOINT	Matcor, USA
1676	<b>MAGNESIUM &amp; ZINC ANODE'S</b>	Sargam Metal , Chennai
1677	MAGNESIUM & ZINC ANODE'S	Scientific Metal, Chennai
1678	MAGNESIUM & ZINC ANODE'S	Shakti enterprises, Ahemdabad
1679	MAGNESIUM & ZINC ANODE'S	PSL Holding Pvt. Ltd., Mumbai

Sr.No	Name of ITEM/Package	Recommended Vendor List
1680	MAGNESIUM & ZINC ANODE'S	Cathodic Controls, Bangalore
1681	MAGNESIUM & ZINC ANODE'S	Impalloy International
1682	MAGNESIUM & ZINC ANODE'S	Electro protection services, India
1683	MAGNESIUM & ZINC ANODE'S	Cathodic Control Company Pvt. Ltd., India
1684	MAGNESIUM & ZINC ANODE'S	Nippon Corrosion, Japan
1685	MAGNESIUM & ZINC ANODE'S	AFIC, KSA
1686	MAGNESIUM & ZINC ANODE'S	Platt Bros. and Company, USA
1687	MAGNESIUM & ZINC ANODE'S	Impalloy International, UK
1688	MAGNESIUM & ZINC ANODE'S	Corrpro International, Canada
1689	MAGNESIUM & ZINC ANODE'S	Nakabohtec, Japan
1690	MAGNESIUM & ZINC ANODE'S	Metal Founder, Mumbai
1691	MAGNESIUM & ZINC ANODE'S	Corrosion Matters, Hyderabad
1692	<b>ANODE BACKFILL MATERIAL</b>	Goa carbon, Goa
1693	ANODE BACKFILL MATERIAL	India Carbon, Kolkata
1694	ANODE BACKFILL MATERIAL	Petrocarbon & Chemical Company, Kolkata
1695	ANODE BACKFILL MATERIAL	Loresco, USA
1696	<b>INSTRUMENTS, TOOLS AND SPARES</b>	



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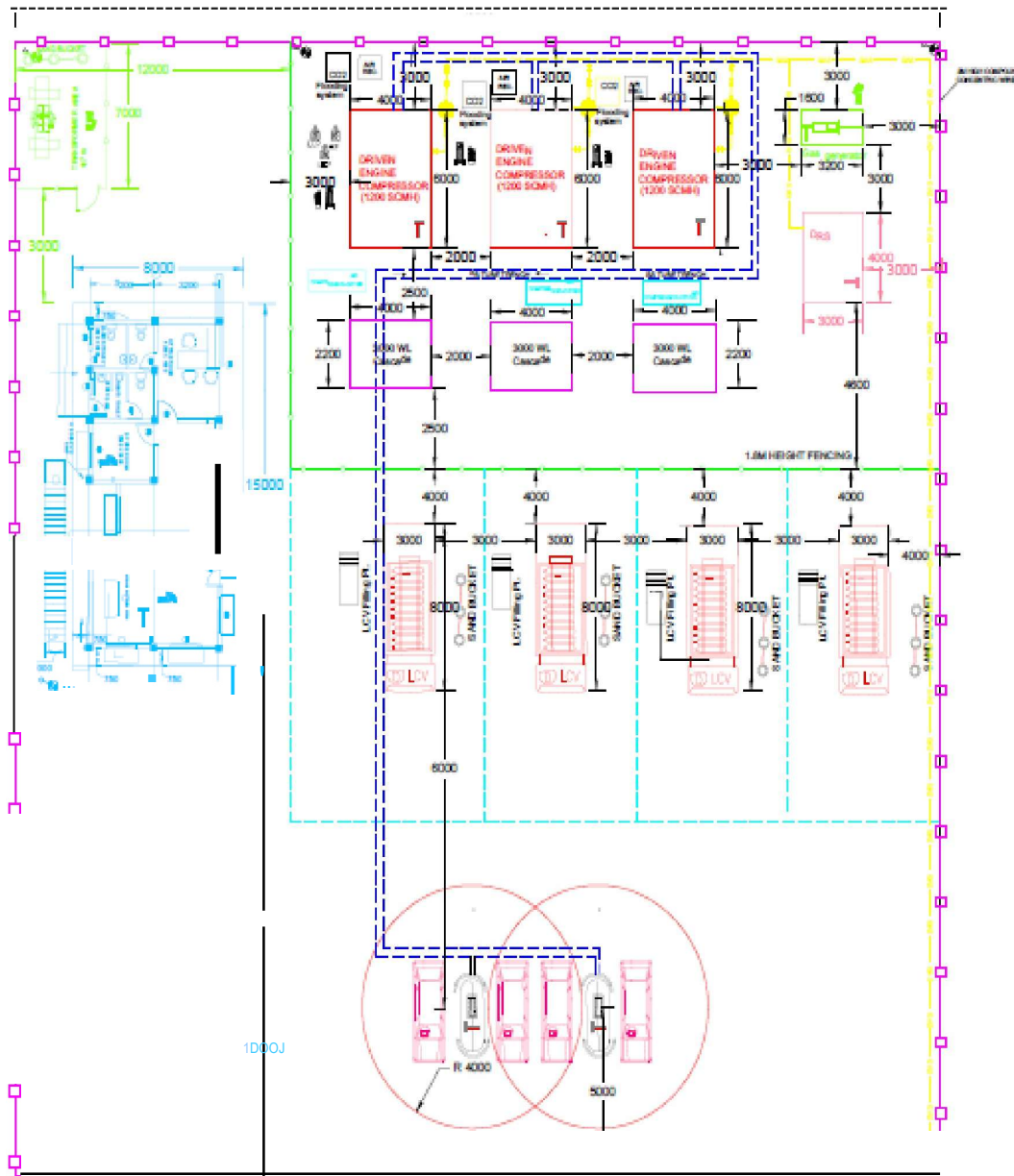
1697	HAND HELD DATA LOGGER	ECD, Mumbai
1698	HAND HELD DATA LOGGER	M C Miller, USA
1699	HAND HELD DATA LOGGER	Cath-tech
1700	<b>GSM BASED DIGITAL DATA LOGGER</b>	Raychem, USA
1701	GSM BASED DIGITAL DATA LOGGER	M C Miller, USA
1702	GSM BASED DIGITAL DATA LOGGER	Kriston, Mumbai
1703	<b>CORROSION VOLTMETER</b>	Rishabh
1704	CORROSION VOLTMETER	MECO
1705	CORROSION VOLTMETER	Fluke
1706	CORROSION VOLTMETER	Yokogawa
1707	<b>MULTI-COMBINATION METER</b>	Rishabh
1708	MULTI-COMBINATION METER	MECO
1709	MULTI-COMBINATION METER	Fluke
1710	<b>CPL SURVEY DATA LOGGER</b>	MC Miller
1711	CPL SURVEY DATA LOGGER	Roger
1712	<b>DCVG SURVEY KIT</b>	DCVG
1713	<b>HOLIDAY DETECTOR</b>	Associate Electronics
1714	<b>PIPE LOCATOR</b>	Radio Detection
1715	PIPE LOCATOR	Vivax
1716	<b>ELCOMETER FOR COATING THICKNESS MEASUREMENT</b>	Olympus
1717	<b>4 PIN SOIL RESISTIVITY METER</b>	Tinkor & Rasor
1718	4 PIN SOIL RESISTIVITY METER	Nillson
1719	4 PIN SOIL RESISTIVITY METER	Fluke
1720	<b>SINCORDER</b>	MC Miller
1721	<b>CP SOFTWARE( FOR REMOTE MONITORING)</b>	Kristron
1722	<b>ELECTRICIAN TOOL BOX WITH TOOL SET</b>	Taparia
1723	ELECTRICIAN TOOL BOX WITH TOOL SET	Stanley
1724	<b>CAT /CAT A FRAME SURVEY EQUIPMENT</b>	Radio Detection
1725	CAT /CAT A FRAME SURVEY EQUIPMENT	Vivax
1726	<b>AC/DC INTERFRENCE SURVEY AGENCY</b>	Jeff Techno Solutions Pvt. Ltd.

Sr.No	Name of ITEM/Package	Recommended Vendor List
1727	AC/DC INTERFRENCE SURVEY AGENCY	Dehn India Pvt. Ltd.

1. Any other vendor(s) apart from as mentioned above may be accepted subject to approval by Owner/Owners representative on submission of refusal letter from the existing approved vendor, non-responsiveness of existing approved vendor, existing approved vendor not complying with the project delivery schedule etc. Evidence of such reasons must be provided with the request and based on past track record (PTR). PTR document shall be submitted by the contractor for review. PTR must contain at least 3 nos. past executed purchase order copy.

2. For the vendors of items not covered in above vendor list, but required for completion of project successfully, supplier shall take approval form Owner/Owners representative for the same during project execution. Bidder shall submit the required certifications, documents, PTR and Performance letters from clients for the same.

3. Refer approved vendor list for applicable items of the subject tender.



**Tentative Layout of Mother stations**

Note : The drawings, layouts, and sketches provided in the tender documents are indicative in nature and are intended only for general understanding of the scope of work. The actual layouts and drawings shall be finalized based on site conditions and execution requirements, duly approved by the Engineer-in-Charge. Payment shall be made based on the actual quantities executed at site, measured jointly, and shall be in accordance with the applicable Schedule of Rates (SOR).



Bhagyanagar  
Gas Limited

**Mechanical Works for development and construction of CNG  
Mother Stations in Hyderabad GA**

**Bid Document No: BGL/693/2025-26**

Volume II  
of II

**SECTION : 08**

**SCHEDULE OF RATES**

Schedule of Rates (SOR)						
Tender Name: Mechanical Works for development and construction of CNG Mother Stations in Hyderabad GA						
Tender No.: BGL/693/2025-26						
Name of the Bidder:						
ITEM NO.	DESCRIPTION	UOM	UNIT RATE - INCLUSIVE OF ALL TAXES AND DUTIES, LEVIES, FREIGHT, INSURANCE INCLUDING TRANSPORTATION OF FREE ISSUE MATERIALS AS DEFINED IN BID DOCUMENT (EXCLUDING GST)	QTY	GST	TOTAL RATE - INCLUSIVE OF ALL TAXES AND DUTIES, LEVIES, FREIGHT, INSURANCE INCLUDING TRANSPORTATION OF FREE ISSUE MATERIALS AS DEFINED IN BID DOCUMENT (INCLUDING GST)
<b>PART A - Indresham</b>						
<b>A MECHANICAL</b>						
Pipeline laying / installation of above ground pipeline						
Welding of pipes with Pipes/fittings/flanges/Valves :-						
Receiving and taking over of all free issue materials from company's designated place of issue, handling including lifting, transportation from Owners and / or contractors storage point to work site / workshop as applicable for fabrication or / and to work site for field fabrication and erection for all piping items supplied by COMPANY / CONTRACTOR.						
Fabrication including cutting, edge preparation, inclusive of grinding the edges of pipes, fittings, flanges, etc. to match with grinding to match with the matching edges of nozzles / different thickness wherever required fit - up bending, preheating wherever required, welding, repair welding etc. pipe fittings like elbows, tees, reducers, weldolet, socketlets, etc. vent and drain point connection etc. including providing stub - in connection, fabricated fittings and reinforcement pads etc. as required. Carrying out Non-destructive testing of all weld joints and repair welds as per specification & instruction of EIC.						
10	4" NB	Number (NO)	1,485.00	28.00	18%	49,064.40
20	2" NB	Number (NO)	779.00	30.00	18%	27,576.60
30	1.5" NB	Number (NO)	719.00	4.00	18%	3,393.68
40	1" NB	Number (NO)	658.00	4.00	18%	3,105.76
50	0.75" NB	Number (NO)	393.00	20.00	18%	9,274.80
Note: 1. The above SOR item shall be carried out only when instructed by Engineer in Charge; 2. Size wise Unit rate is for welding with all schedule thickness, pipe fittings, valves etc.as required.						
<b>Erection &amp; Testing:</b>						
Complete work of erection, painting, testing and making ready for further commissioning / start - up carbon steel piping and fittings of all sizes and ratings including supply & installation of, all fittings like elbow, tees, reducers, socketlets, nipples, flanges, blind flanges, spectacle blind flanges, valves, pipes of sizes 2" NB and below and of all ratings including supply of all consumables, equipment, manpower and other resources and execution of but not limited to the following works in accordance with relevant specifications, drawings, scope of work and instruction of Owner/ Owner's Representative and as per all provisions of the contract document.						
Erection of pipes of all types and thickness over sleepers, overhead on rack and at all elevations, connecting with equipment nozzle, aligning and installation for all types of valves, all online instruments and fittings of all sizes of elbow, reducers, tees, flanges blind flange, spectacle blind flanges, branch connection / tapping, vents and drains, required for process and hydro testing, tapping for pressure gauges thermowells sample connections, etc.						
Painting of entire system (including all pipes and accessories) as per specification, including supply of approved paints and primers, preparation of surface and application of primer and paint, identification lettering/numbering, color coding, etc. as specified including rub-down & touch up of shop primer or scraping of shop primer wherever required by COMPANY and providing scaffolding for all heights etc. Cleaning and flushing by water / compressed air, testing of the system including hydrostatic, pneumatic and any other type of testing as specified, draining, drying by compressed air / other methods approved by COMPANY.						
Cleaning and flushing by water/ compressed air, testing of the system including hydrostatic, pneumatic and any other type of testing as specified, draining, drying by compressed air/ other methods as approved by Owner.						
Completion of all such work in all respect as per scope of work and as per drawings specifications and instructions of the COMPANY and keeping in the system ready in all respects for further commissioning and start up.						
Hooking up with other system piping at battery limit. Preparation of isometric, fabrication drgs. Bill of materials as per specifications, drawings and instruction of Owner/Owner's Representative						
60	4" NB	Meter (M)	719.00	20	18%	16,968.40
70	2" NB (Including supply of pipe, fittings, flanges, valves and other items required).	Meter (M)	1,042.00	20	18%	24,591.20
80	1.5" NB (Including supply of pipe, fittings, flanges, valves and other items required).	Meter (M)	974.00	5	18%	5,746.60
90	1" NB (Including supply of pipe, fittings, flanges, valves and other items required).	Meter (M)	905.00	5	18%	5,339.50
100	0.75" NB (Including supply of pipe, fittings, flanges, valves and other items required).	Meter (M)	546.00	5	18%	3,221.40
Note: 1. Bolts, nuts, washer, U-clamps, gaskets, Weldolet, Socketlet etc. of all size and rating required for piping facilities shall be procured and supplied by the contractor within the rate quoted. These items shall not be separately measured and paid. 2. Supply of all materials (Pipe, valves, fittings, flanges etc) of size below 4" shall be in contractor's scope, cost of the same shall be included in the unit rate. 3. 4" and above (Pipe fittings & flanges etc ), material supply is also in the contractor's scope. It shall be paid separately under relevant SOR item on actual basis. 4. Measurement of Erection & Testing in metre will include pipes, fittings , flanges , valves, gaskets and all components coming along the measured length in meter. 5. Valves of size 4" and above shall be free issued by client.						
<b>Supply of major items as per specification enclosed in tender</b>						
<b>Supply of Long Radius Elbow (R = 1.5D), Rating 300 #</b>						
4" NB, Material : API 5L X 52 / ASTM A 860 WPHY 52, min. thk. 6.4 mm						
110	90 Degree	Number (NO)	1,550.00	2	18%	3,658.00
120	45 Degree	Number (NO)	1,243.00	2	18%	2,933.48
<b>Supply of Reducing Tee, Rating 300 #</b>						
4" x 2", Material : API 5L X 52 / ASTM A 860 WPHY 52, min. thk. 6.4 mm x Sch 80						
130	Reducer, Rating 300#	Number (NO)	1,626.00	5	18%	9,593.40
4" x 2", Material : API 5L X 52 / ASTM A 860 WPHY 52, min. thk. 6.4mm x Sch. 80						
140	Flanges (WNRF), Rating 300 #	Number (NO)	1,595.00	5	18%	9,410.50
4" (Material : ASTM A 694 F 52)						
150	Station pipe -Seamless	Number (NO)	1,744.00	2	18%	4,115.84
4" (Material : ASTM A 106 Gr.B, 6.4 mm thk)						
160	SUPPLY OF RAIN CAP	Meter (M)	1,656.00	50	18%	97,704.00
Supply and Installation of Non Sparking type Rain Cap (material - brass) including all necessary fabrication works, including providing all necessary equipment's, labour, materials, consumables and inputs other than Owner supplied materials and performing all works as per drawings, data sheet, specifications enclosed with the Contract and directions of Engineer-in-Charge.						
170	2" Rain Cap for Vent.	Number (NO)	3,167.00	3	18%	11,211.18
<b>Nitrogen Supply</b>						
180	Supply of Nitrogen with cylinder for localized purging, Hook up of pipeline and piping.	Cubic meter (M3)	562.00	5	18%	3,315.80
<b>SUPPLY OF SS FITTINGS</b>						
<b>Quick Connect Body &amp; Stem</b>						
190	End connection: 3/8" Tube OD, for stem & 1/2"NPT (F) for body Material : SS316, Rated pressure : 5000 PSI @ 70°F Temperature: 0°F to 400°F ( Parker make only)	Nos.	10,708.00	4	18%	50,541.76
<b>Plug</b>						
200	Size : 1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,500.00	5	18%	8,850.00
210	Size : 3/4" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	601.00	5	18%	709.18
220	Size : 1/2" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	584.00	3	18%	2,067.36
<b>Cups</b>						
230	Size : 1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	5,400.00	5	18%	31,860.00
240	Size : 3/4" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	721.00	5	18%	4,253.90
250	Size : 1/2" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	667.00	3	18%	2,361.18

	<b>Union</b>							
266	Size : 1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	5,400.00	25	18%	6,372.00		1,59,300.00
270	Size : ½" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,736.00	25	18%	2,048.48		51,212.00
280	Size : ¾" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,042.00	5	18%	1,229.56		6,147.80
	<b>Reducing Union</b>							
290	Tube OD 1" x Tube OD ¾", Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	5,400.00	15	18%	6,372.00		95,580.00
300	Tube OD ¾" x Tube OD ½", Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,988.00	4	18%	2,345.84		9,383.36
	<b>Equal Tee</b>							
310	Size: 1" OD x 1" OD x 1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	12,500.00	5	18%	14,750.00		73,750.00
320	Size: ¾" OD x ¾" OD x ½" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	3,903.00	10	18%	4,603.54		46,055.40
330	Size: ½" OD x ½" OD x 1/2" OD x 1/2" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	2,117.00	2	18%	2,498.06		4,996.12
	<b>Reducing Union Tee</b>							
340	¾" OD x ½" OD x ½" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	5,421.00	2	18%	6,396.78		12,793.56
	<b>Tube End Connection</b>							
350	½" Tube End & ½" OD with Ferrule Fitting, SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,082.00	5	18%	1,276.76		6,383.80
	<b>Nut</b>							
360	1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,450.00	5	18%	1,711.00		8,555.00
370	¾" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	620.00	10	18%	731.60		7,316.00
380	½" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	441.00	5	18%	520.38		2,601.90
	<b>Back Ferrule</b>							
390	1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	750.00	10	18%	885.00		8,850.00
400	¾" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	173.00	20	18%	204.14		4,082.80
410	½" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	162.00	5	18%	191.16		955.80
	<b>Front Ferrule</b>							
420	1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	750.00	10	18%	885.00		8,850.00
430	¾" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	179.00	20	18%	211.22		4,224.40
440	½" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	173.00	5	18%	204.14		1,020.70
	<b>THERMOPLASTIC HOSE</b>							
450	1/2" ID Conductive Core Thermoplastic Hose of 5.0m length for CNG Service with break away coupling along with Quick connect body & stem (End connections) ½" Tube OD for stem & ½" NPT (F) for body, Material : SS316, Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F) One end of the hose shall be 1/2" OD tube and other end of the hose shall be 3/4" OD Supply and assembling of all necessary fittings with the hose for making the end connections as indicated above are in the scope of contractor.	Nos.	65,000.00	4	18%	76,700.00		3,06,800.00
	<b>NRV</b>							
460	¾" NRV, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	10,829.00	6	18%	12,778.22		76,669.32
	<b>SS TUBES</b>							
470	1" OD X 0.095" min Wall thk., Material SS 316 Seamless Tube as per ASTM A213/269 GRADE TP316L	RM	3,250.00	150	18%	3,835.00		5,75,250.00
480	¾" OD X 0.120" min Wall thk., Material SS 316 Seamless Tube as per ASTM A213/269 GRADE TP316L	RM	1,299.00	220	18%	1,532.82		3,37,220.40
490	½" OD X 0.083" min Wall thk., Material SS 316 Seamless Tube as per ASTM A213/269 GRADE TP316L	RM	1,040.00	30	18%	1,227.20		36,816.00
	<b>SS Ball Valves</b>							
500	2-Way Trunnion Floating Normal Bore Ball Valve ¾" (Rated pressure : 6000 PSI @ 70°F Temperature : 0°F to 400°F) with additional 1 set of Nuts, Backs & Front Ferrule etc.	Nos.	19,420.00	30	18%	22,915.60		6,87,468.00
510	2-Way Trunnion Floating Normal Bore Ball Valve ½" (Rated pressure : 6000 PSI @ 70°F Temperature : 0°F to 400°F) with additional 1 set of Nuts, Backs & Front Ferrule etc.	Nos.	18,735.00	5	18%	22,107.30		1,10,536.50
520	3-Way Trunnion Mounted, Reducer Bore Ball Valve ½" OD end Connection and ½" NPT (F) bottom end connection (Rated pressure : 6000 PSI @ 70°F Temperature : 0°F to 400°F) with additional 1 set of Nuts, Backs & Front Ferrule etc.	Nos.	30,729.00	5	18%	36,260.22		1,81,301.10
	<b>Laying, testing and commissioning of SS tubes, SS fittings and SS valves as per Technical Specification, Typical P &amp; ID, Drawings, scope of work including handling, lifting, transportation from stores to CNG stations and as per the instruction of Engineer In charge.</b>							
	<b>Tubes shall be clamped using clamps at a gap of 1 Meter, clamps shall be supplied by the bidder as per tender terms and conditions.</b>							
530	1" OD X 0.120" min Wall thk., SS Tube	RUNNING METER (RM)	650.00	150	18%	767.00		1,15,050.00
540	¾" OD X 0.095" min Wall thk., SS Tube	RUNNING METER (RM)	340.00	175	18%	401.20		70,210.00
550	½" OD X 0.083" min Wall thk., SS Tube	RUNNING METER (RM)	339.00	30	18%	400.02		12,000.60
	<b>Supply, laying, testing and commissioning of SS 304 Tubes including all isolation valves, reducers &amp; fittings etc. as per Technical Specification, Typical schematic drg. for Ins. air line of CNG station and scope of work, including handling, storage, lifting, transportation upto CNG stations.</b>							
	<b>Tubes shall be clamped using SS U-clamps at a gap of 1 Meter, clamps shall be supplied by the bidder.</b>							
560	½" OD X 0.083" min Wall thk., SS Tube	RUNNING METER (RM)	1,033.00	50	18%	1,218.94		60,947.00
	<b>SECTION-B : ERECTION OF MECH. EQUIPMENT</b>							
	<b>Handling (including lifting and transportation from Client's store in Shamprpt) and erecting in position, the following equipment on the foundation at Ground/ upto 4.5 Mtr height. Contractor's scope shall include supply of all material and accessories including but not limited to any fixtures, clamps, gasket, nut bolts, etc. :</b>							
570	Cascade 4500 L or 3000 L water capacity, Erection at Ground/ upto 4.5 Mtr height	Number (NO)	22,162.00	3	18%	26,151.16		78,453.48
580	<b>Transportation with loading, unloading i.e. "Receiving and taking over" of "free issue" Compressors/Dispenser/cascade or any other item (complete package including all parts) from BGL store/site to BGL Store/other site.</b> <b>Loading , Handling and transportation from designated place of issue to unloading and placing of the package at BGL site/store as per instruction of EIC.</b> <b>This is including arranging all equipments, trailers, trucks &amp; manpower along with all associated works not indicated herein but required to complete the work as per Scope of Work, Provision of Contract &amp; instructions of Engineer InCharge.</b> <b>This SOR line item shall be executed for any equipment to be shifted as per instructions of EIC/BGL.</b>	Per Ton Per KM	34.00	7000	18%	40.12		2,80,840.00
	<b>Fire Fighting Equipment</b>							
590	Supply and placement of DCP - 9 kg	Number (NO)	2,760.00	20	18%	3,256.80		65,136.00
600	Supply and placement of DCP - 75 kg	Number (NO)	20,197.00	5	18%	23,832.46		1,19,162.30
610	Supply and placement of DCP - 5 kg	Number (NO)	3,790.00	5	18%	4,472.20		22,361.00
620	Supply and placement of Co2 Fire extinguisher - 2 kg	Number (NO)	3,397.00	5	18%	4,008.46		20,042.30
630	Supply and placement of Co2 Fire extinguisher - 4.5 kg	Number (NO)	4,600.00	5	18%	5,428.00		27,140.00
640	Supply and placement of Co2 Fire extinguisher - 6.8 kg	Number (NO)	6,919.00	5	18%	8,164.42		40,822.10
650	Supply and installation of Sand bucket (Set of 4 buckets)	Number (NO)	1,695.00	4	18%	2,000.10		8,000.40
660	Wind socks	Number (NO)	1,368.00	2	18%	1,614.24		3,228.48
	<b>Supply SS316 impulse tubes &amp; fittings</b>							
670	1/2" OD x 0.065" thick SS316 Tube	Mtrs	1,510.00	3	18%	1,781.80		5,345.40
680	1/2" NPT x 1/2" OD Male connector	Number (NO)	936.00	3	18%	1,104.48		3,313.44
690	1/2" SS316 Ball valve	Number (NO)	16,413.00	1	18%	19,367.34		19,367.34
700	100 mm GI nipple	Number (NO)	340.00	1	18%	401.20		401.20
710	1/2" OD Plug	Number (NO)	936.00	1	18%	1,104.48		1,104.48
	<b>Supply of Erection material</b>							
720	2" Seamless Pipe Sch 40, height 2 mtrs for PG as per Hook up drawing	Number (NO)	2,831.00	3	18%	3,340.58		10,021.74
730	4" Seamless Pipe Sch 40, height 4 mtrs CCTV as per Hook up drawing	Number (NO)	5,660.00	7	18%	6,678.80		46,751.60
740	Instrument sunshades made from 2mm thick Metallic, supplied with mounting clamp (epoxy coated) suitable for a 2" instrument stand.	Number (NO)	3,743.00	3	18%	4,416.74		13,250.22
750	<b>Supply, fabrication and erection of all types of pipe supports like clamps, saddle, guide stops, cradles, turn buckles, anchors, T posts, stockade/ trellis and pipe bridle for overhead piping, frames for canopy, approach ladders and platforms, crossover, cable tray supports, etc. including painting as per specification labour and supervision &amp; complete work as per drawings, specifications and instruction of Engineer-in-charge. (Bolts, nuts, washers, Uclamps etc. for supporting shall be supplied by the Contractor within the rates quoted. These items will not be measured and paid separately). HDPE/ rubber sheet is to be provided between support &amp; pipe wherever required., The work is to be completed in all respect as per scope of work and specification.</b>	MT						4,07,100.00
	<b>Sub total including GST for Indresham (A)</b>		1,15,000.00	3	18%	1,35,700.00		46,47,873.68
	<b>Part B - Katedan</b>							

A MECHANICAL						
<b>Pipeline laying / installation of above ground pipeline</b>						
<b>Welding of pipes with Pipes/Fittings/Flanges/Valves :-</b>						
Receiving and taking over of all free issue materials from company's designated place of issue, handling including lifting, transportation from Owners and / or contractors storage point to work site / workshop as applicable for fabrication or / and to work site for field fabrication and erection for all piping items supplied by COMPANY / CONTRACTOR.						
Fabrication including cutting, edge preparation, inclusive of grinding the edges of pipes, fittings, flanges, etc. to match with grinding to match with the matching edges of uneven / different thickness wherever required fit - up bending, preheating wherever required, welding, repair welding etc. pipe fittings like elbows, tees, reducers, weldolet, socketlets, etc. vent and drain point connection etc. including providing stub - in connection, fabricated fittings and reinforcement pads etc. as required. Carrying out Non-destructive testing of all weld joints and repair welds as per specification & instruction of EIC.						
10	4" NB	Number (NO)	1,485.00	28.00	18%	49,064.40
20	2" NB	Number (NO)	779.00	30.00	18%	27,576.60
30	1.5" NB	Number (NO)	719.00	4.00	18%	3,393.68
40	1" NB	Number (NO)	658.00	4.00	18%	3,105.76
50	0.75" NB	Number (NO)	393.00	20.00	18%	9,274.80
Note: 1. The above SOR item shall be carried out only when instructed by Engineer In-charge; 2. Size wise Unit rate is for welding with all schedule/thickness, pipe fittings, valves etc as required.						
<b>Erection &amp; Testing:</b>						
Complete work of erection, painting, testing and making ready for further commissioning / start - up carbon steel piping and fittings of all sizes and ratings including supply & installation of, all fittings like elbow, tees, reducers, swages, weldolet, socketlets, nipples, flanges, blind flanges, spectacle blind flanges, valves, pipes of sizes 2" NB & below and of all ratings including supply of all consumables, equipment, manpower and other resources and execution of but not limited to the following works in accordance with relevant specifications, drawings, scope of work and instruction of Owner/ Owner's Representative and as per all provisions of the contract document.						
Erection of pipes of all types and thickness over sleepers, overhead on rack and at all elevations, connecting with equipment nozzle, aligning and installation for all types of valves, all online instruments and fittings of all sizes of elbow, reducers, tees, flanges blind flange, spectacle blind flanges, branch connection / tapping, vents and drains, required for process and hydro testing, tapping for pressure gauges thermowells sample connections, etc.						
Painting of entire system (including all pipes and accessories) as per specification, including supply of approved paints and primers, preparation of surface and application of primer and paint, identification lettering/numbering, color coding, etc. as specified including rub down & touch up of shop primer or scraping of shop primer wherever required by COMPANY and providing scaffolding for all heights etc. Cleaning and flushing by water/ compressed air, testing of the system including hydrostatic, pneumatic and any other type of testing as specified, draining, drying by compressed air / other methods approved by COMPANY.						
Cleaning and flushing by water/ compressed air, testing of the system including hydrostatic, pneumatic and any other type of testing as specified, draining, drying by compressed air/ other methods as approved by Owner.						
Completion of all such work in all respect as per scope of work and as per drawings specifications and instructions of the COMPANY and keeping in the system ready in all respects for further commissioning and start up.						
Hooking up with other system piping at battery limit. Preparation of isometric, fabrication dgs. Bill of materials as per specifications, drawings and instruction of Owner/Owner's Representative						
60	4" NB	Meter (M)	719.00	20	18%	16,968.40
70	2" NB (Including supply of pipe, fittings, flanges, valves and other items required).	Meter (M)	1,042.00	20	18%	24,591.20
80	1.5" NB (Including supply of pipe, fittings, flanges, valves and other items required).	Meter (M)	974.00	5	18%	5,746.60
90	1" NB (Including supply of pipe, fittings, flanges, valves and other items required).	Meter (M)	905.00	5	18%	5,339.50
100	0.75" NB (Including supply of pipe, fittings, flanges, valves and other items required).	Meter (M)	546.00	5	18%	3,221.40
Note: 1. Bolts, nuts, washer, U-clamps, gaskets, Weldolet, Socketlet etc. of all size and rating required for piping facilities shall be procured and supplied by the contractor within the rate quoted. These items shall not be separately measured and paid. 2. Supply of all materials (Pipe, valves, fittings, flanges etc) of size below 4" shall be in contractor's scope, cost of the same shall be included in the unit rate. 3. 4" and above (Pipe fittings & flanges etc), material supply is also in the contractor's scope. It shall be paid separately under relevant SOR item on actual basis. 4. Measurement of Erection & Testing in metre will include pipes, fittings, flanges, valves, gaskets and all components coming along the measured length in meter. 5. Valves of size 4" and above shall be free issued by client.						
<b>Supply of major items as per specification enclosed in tender</b>						
<b>Supply of Long Radius Elbow (R = 1.5D), Rating 300 #</b>						
<b>4" NB, Material : API 5L X 52 / ASTM A 860 WPHY 52, min. thk. 6.4 mm</b>						
110	90 Degree	Number (NO)	1,550.00	2	18%	3,658.00
120	45 Degree	Number (NO)	1,243.00	2	18%	2,934.48
<b>Supply of Reducing Tee, Rating 300 #</b>						
130	4" x 2", Material : API 5L X 52 / ASTM A 860 WPHY 52, min. thk. 6.4 mm x Sch 80	Number (NO)	1,626.00	5	18%	9,593.40
<b>Reducer, Rating 300#</b>						
140	4" X 2", Material : API 5L X 52 / ASTM A 860 WPHY 52, min. thk. 6.4mm x Sch. 80	Number (NO)	1,595.00	5	18%	9,410.50
<b>Flanges (WNRF), Rating 300 #</b>						
150	4" (Material : ASTM A 694 F 52)	Number (NO)	1,744.00	2	18%	4,115.84
<b>Station pipe - Seamless</b>						
160	4" (Material : ASTM A 106 Gr.B, 6.4 mm thk)	Meter (M)	1,656.00	50	18%	97,704.00
<b>SUPPLY OF RAIN CAP</b>						
Supply and Installation of Non Sparking type Rain Cap (material - brass) including all necessary fabrication works, including providing all necessary equipment's, labour, materials, consumables and inputs other than Owner supplied materials and performing all works as per drawings, data sheet, specifications enclosed with the Contract and directions of Engineer-in-Charge.						
170	2" Rain Cap for Vent.	Number (NO)	3,167.00	3	18%	11,211.18
<b>Nitrogen Supply</b>						
180	Supply of Nitrogen with cylinder for localized purging. Hook up of pipeline and piping.	Cubic meter	562.00	5	18%	3,315.80
<b>SS TUBING</b>						
<b>SUPPLY OF SS FITTINGS</b>						
<b>Quick Connect Body &amp; Stem</b>						
190	End connection: 1/2" Tube OD, for stem & 1/2" NPT (F) for body Material : SS316, Rated pressure : 5000 PSI @ 70°F Temperature: 0°F to 400°F ( Parker make only)	Nos.	10,708.00	4	18%	50,541.76
<b>Plug</b>						
200	Size : 1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,500.00	5	18%	8,850.00
210	Size : 3/4" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	601.00	5	18%	3,545.90
220	Size : 1/2" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	584.00	3	18%	2,067.36
<b>Caps</b>						
230	Size : 1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	5,400.00	5	18%	31,860.00
240	Size : 3/2" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	721.00	5	18%	4,253.90
250	Size : 1/2" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	667.00	3	18%	2,361.18
<b>Union</b>						
260	Size : 1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	5,400.00	25	18%	1,59,300.00
270	Size : 3/2" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,756.00	25	18%	51,212.00
280	Size : 1/2" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,042.00	5	18%	6,147.80
<b>Reducing Union</b>						
290	Tube OD 1" x Tube OD 3/2", Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	5,400.00	15	18%	95,580.00
300	Tube OD 3/4" x Tube OD 1/2", Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,988.00	4	18%	9,383.36
<b>Equal Tee</b>						
310	Size: 1" OD x 1" OD x 1" OD, Material : SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	12,500.00	5	18%	73,750.00
320	Size: 3/2" OD x 3/2" OD x 3/2" OD, Material : SS316 ( Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	3,903.00	10	18%	46,055.40

330	Size:1/2" OD x 1/2" OD x 1/2" OD, Material : SS316 ( Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	2,117.00	2	18%	2,498.06	4,996.12
<b>Reducing Union Tee</b>							
340	3/4" OD x 3/4" OD x 3/4" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	5,421.00	2	18%	6,396.78	12,793.56
<b>Tube End Connection</b>							
350	1/2" Tube End & 3/4" OD with Ferrule Fitting, SS316 (Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,082.00	5	18%	1,276.76	6,383.80
<b>Nut</b>							
360	1" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	1,450.00	5	18%	1,711.00	8,555.00
370	3/4" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	620.00	10	18%	731.60	7,316.00
380	3/2" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	441.00	5	18%	520.38	2,601.90
<b>Back Ferrule</b>							
390	1" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	750.00	10	18%	885.00	8,850.00
400	3/4" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	173.00	20	18%	204.14	4,082.80
410	1/2" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	162.00	5	18%	191.16	955.80
<b>Front Ferrule</b>							
420	1" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	750.00	10	18%	885.00	8,850.00
430	3/4" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	179.00	20	18%	211.22	4,224.40
440	1/2" OD, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	173.00	5	18%	204.14	1,020.70
<b>THERMOPLASTIC HOSE</b>							
450	1/2" ID Conductive Core Thermoplastic Hose of 5.0m length for CNG Service with break away coupling along with Quick connect body & stem (End connections: 1/2" Tube OD for stem & 3/4" NPT (F) for body, Material : SS316, Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F) One end of the hose shall be 1/2" OD tube and other end of the hose shall be 3/4" OD Supply and assembling of all necessary fittings with the hose for making the end connections as indicated above are in the scope of contractor.	Nos.	65,000.00	4	18%	76,700.00	3,068,000.00
<b>NRV</b>							
460	3/4" NRV, Material : SS316(Rated pressure : 5000 PSI @ 70°F Temperature : 0°F to 400°F)	Nos.	10,829.00	6	18%	12,778.22	76,669.32
<b>SS TUBES</b>							
470	1"OD X 0.095" min Wall thk., Material SS 316 Seamless Tube as per ASTM A213/269 GRADE TP316L	RM	3,250.00	150	18%	3,835.00	5,752,500.00
480	3/4"OD X 0.120" min Wall thk., Material SS 316 Seamless Tube as per ASTM A213/269 GRADE TP316L	RM	1,299.00	220	18%	1,532.82	3,372,204.00
490	1/2"OD X 0.083" min Wall thk., Material SS 316 Seamless Tube as per ASTM A213/269 GRADE TP316L	RM	1,040.00	30	18%	1,227.20	36,816.00
<b>SS Ball Valves</b>							
500	2-Way Trunion Floating Normal Bore Ball Valve 3/4"(Rated pressure : 6000 PSI @ 70°F Temperature : 0°F to 400°F) with additional 1 set of Nuts, Backs & Front Ferrule etc.	Nos.	19,420.00	30	18%	22,915.60	6,874,680.00
510	2-Way Trunion Floating Normal Bore Ball Valve 1/2"(Rated pressure : 6000 PSI @ 70°F Temperature : 0°F to 400°F) with additional 1 set of Nuts, Backs & Front Ferrule etc.	Nos.	18,735.00	5	18%	22,107.30	1,10,536.50
520	3-Way Trunion Mounted, Reducer Bore Ball Valve 1/2" OD end Connection and 3/4" NPT (F) bottom end connection(Rated pressure : 6000 PSI @ 70°F Temperature : 0°F to 400°F) with additional 1 set of Nuts, Backs & Front Ferrule etc.	Nos.	30,729.00	5	18%	36,260.22	1,81,301.10
<b>Laying, testing and commissioning of SS tubes, SS fittings and SS valves as per Technical Specification, Typical P &amp; ID, Drawings, scope of work including handling, lifting, transportation from stores to CNG stations and as per the instruction of Engineer In charge.</b>							
<b>Tubes shall be clamped using clamps at a gap of 1 Meter, clamps shall be supplied by the bidder as per tender terms and conditions.</b>							
530	1"OD X 0.120"min Wall thk., SS Tube	RUNNING METER (RM)	650.00	150	18%	767.00	1,15,050.00
540	3/4"OD X 0.095" min Wall thk., SS Tube	RUNNING METER (RM)	340.00	175	18%	401.20	70,210.00
550	1/2"OD X 0.083" min Wall thk., SS Tube	RUNNING METER (RM)	339.00	30	18%	400.02	12,000.60
<b>Supply, laying, testing and commissioning of SS 304 Tubes including all isolation valves, reducers &amp; fittings etc.as per Technical Specification, Typical schematic drg. for Ins. air line of CNG station and scope of work. including handling, storage,lifting, transportation upto CNG stations.</b>							
<b>Tubes shall be clamped using SS U-clamps at a gap of 1 Meter, clamps shall be supplied by the bidder.</b>							
560	1/2"OD X 0.083" min Wall thk., SS Tube	RUNNING METER (RM)	1,033.00	50	18%	1,218.94	60,947.00
<b>SECTION-B : ERECTION OF MECH EQUIPMENT</b>							
<b>Handling (including lifting and transportation from Client's store in Shamirpet) and erecting in position, the following equipment on the foundation at Ground/ upto 4.5 Mtr height. Contractor's scope shall include supply of all material and accessories including but not limited to any fixtures, clamps, gasket, nut bolts, etc. :</b>							
570	Cascade 4500 L or 3000 L water capacity, Erection at Ground/ upto 4.5 Mtr height	Number (NO)	22,162.00	3	18%	26,151.16	78,453.48
<b>Transportation with loading, unloading i.e. "Receiving and taking over" of "free issue" Compressors/Dispenser/cascade or any other item (complete package including all parts) from BGL store/ site to BGL Store/ other site.</b>							
<b>Loading , Handling and transportation from designated place of issue to unloading and placing of the package at BGL site/store as per instruction of EIC.</b>							
580	This is including arranging all equipments, trailers, trucks & manpower along with all associated works not indicated herein but required to complete the work as per Scope of Work, Provision of Contract & instructions of Engineer InCharge. This SOR line item shall be executed for any equipment to be shifted as per instructions of EIC/BGL.	Per Ton Per KM	34.00	7000	18%	40.12	2,80,840.00
<b>Fire Fighting Equipment</b>							
590	Supply and placement of DCP - 9 kg	Number (NO)	2,760.00	20	18%	3,256.80	65,136.00
600	Supply and placement of DCP - 75 kg	Number (NO)	20,197.00	5	18%	23,832.46	1,19,162.30
610	Supply and placement of DCP - 5 kg	Number (NO)	3,790.00	5	18%	4,472.20	22,361.00
620	Supply and placement of Co2 Fire extinguisher - 2 kg	Number (NO)	3,397.00	5	18%	4,008.46	20,042.30
630	Supply and placement of Co2 Fire extinguisher - 4.5 kg	Number (NO)	4,600.00	5	18%	5,428.00	27,140.00
640	Supply and placement of Co2 Fire extinguisher - 6.8 kg	Number (NO)	6,919.00	5	18%	8,164.42	40,822.10
650	Supply and installation of Sand bucket (Set of 4 buckets)	Number (NO)	1,695.00	4	18%	2,000.10	8,000.40
660	Wind socks	Number (NO)	1,368.00	2	18%	1,614.24	3,228.48
<b>Supply SS316 impulse tubes &amp; fittings</b>							
670	1/2" OD x 0.065"thick SS316 Tube	Mtrs	1,510.00	3	18%	1,781.80	5,345.40
680	1/2" NPT x 1/2" OD Male connector	Number (NO)	936.00	3	18%	1,104.48	3,313.44
690	1/2" SS316 Ball valve	Number (NO)	16,413.00	1	18%	19,367.34	19,367.34
700	100 mm GI nipple	Number (NO)	340.00	1	18%	401.20	401.20
710	1/2" OD Plug	Number (NO)	936.00	1	18%	1,104.48	1,104.48
<b>Supply of Erection material</b>							
720	2" Seamless Pipe Sch 40, height 2 mtrs. for PG as per Hook up drawing	Number (NO)	2,831.00	3	18%	3,340.58	10,021.74
730	4" Seamless Pipe Sch 40, height 4 mtrs CCTV as per Hook up drawing	Number (NO)	5,660.00	7	18%	6,678.80	46,751.60
740	Instrument sunshades made from 2mm thick Metallic, supplied with mounting clamp (epoxy coated) suitable for a 2" instrument stand.	Number (NO)	3,743.00	3	18%	4,416.74	13,250.22
750	Supply, fabrication and erection of all types of pipe supports like clamps, saddle, guide steps, cradles, turn buckles, anchors, T-posts, stockade/ treble and pipe bridge for overhead piping; frames for canopy, approach ladders and platforms, crossover, cable tray supports, etc. including painting as per specification labour and supervision & complete work as per drawings, specifications and instruction of Engineer-in-charge. (Bolts, nuts, washers, Uclamps etc. for supporting shall be supplied by the Contractor within the rates quoted. These items will not be measured and paid separately). HDPE/ rubber sheet is to be provided/between support & pipe wherever required.. The work is to be completed in all respect as per scope of work and specification.	MT	1,15,000.00	3	18%	1,35,700.00	4,07,100.00
<b>Sub total including GST for Katrand (B)</b>							46,47,873.68
<b>Total including GST (A+B)</b>							92,95,747.36
<b>Percentage to be quoted by the bidder(%)</b>							-
<b>Total amount including GST</b>							92,95,747.36



Bhagyanagar  
Gas Limited

**Mechanical Works for development and construction of  
CNG Mother Stations in Hyderabad GA**

**Bid Document No: BGL/693/2025-26**

Volume II  
of II

**SECTION: 09**  
**DRAWING**

1

2

3

4

A

B

C

D

E

NOTES

# TYPICAL CABLE TRAY INSTALLATION DETAILS

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT		
TYPICAL CABLE TRAY INSTALLATION DETAILS		
Size	Scale	Sheet
A3	NTS	01 of 62
Drawing No.		Rev.
GGNG-E-20714-3010		0

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A

B

C

D

E

## NOTES

## NOTES :

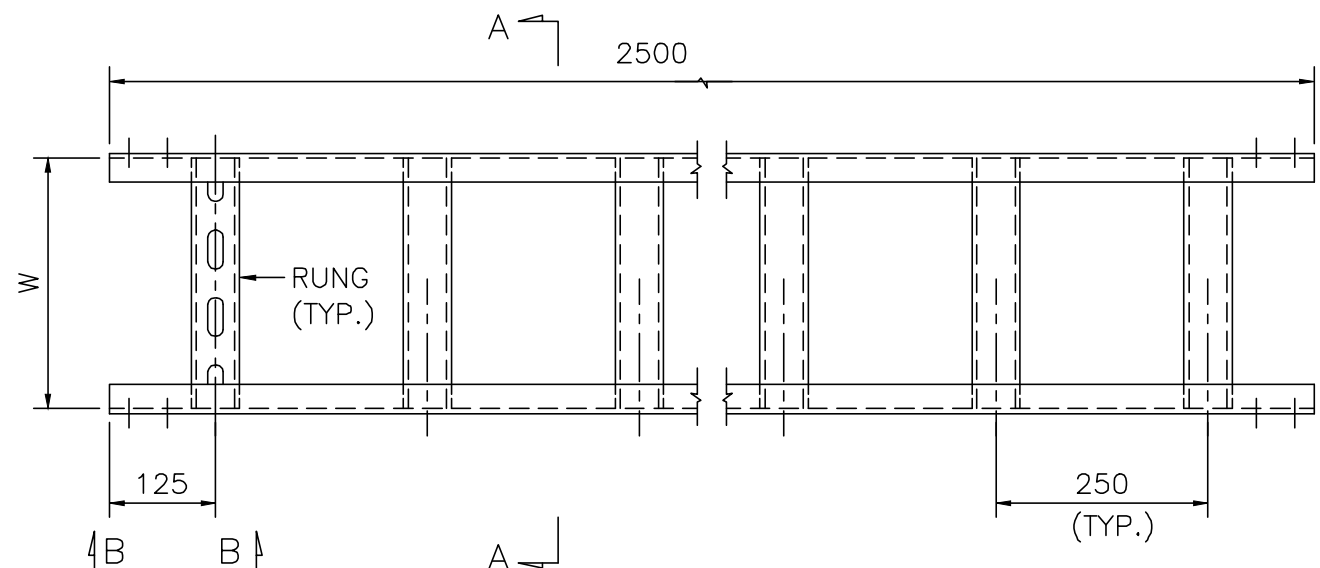
- 1- IN THE FOLLOWING SHEETS, EXACT DIMENSIONS X, Y, Z FOR CABLE SUPPORTS SHOULD BE DETERMINED ON SITE ACCORDING TO THE LOCATION,INSTALLATION DRAWING DONE FOR BUILDINGS AND AREAS.
- 2- THESE ERECTION DETAILS COULD BE ADAPTED ACCORDING TO NEEDS ON SITE.
- 3- THIS DOCUMENT IS A GUIDE LINE FOR CABLE TRAY INSTALLATION CONTRACTOR TO HELP HIM IN THE DEFINITION OF ITS SCOPE OF DESIGN AND SUPPLY.
- 4- MATERIAL SHOWN IN THIS DOCUMENT CAN BE ADAPTED BY CABLE TRAY INSTALLATION CONTRACTOR

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS						
	Size	Scale	Sheet			
	A3	NTS	02 of 62			
	Drawing No.					Rev.
	GGNG-E-20714-3010					0

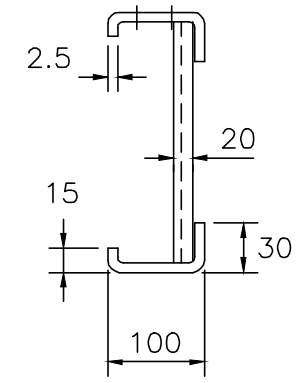
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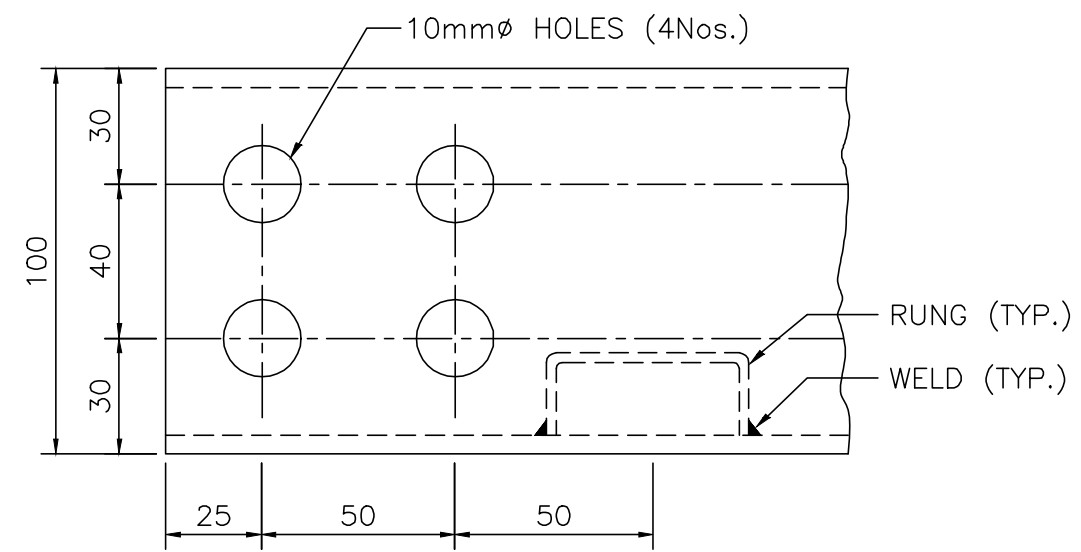
- 1. ALL DIMENSIONS ARE IN MM.
- 2. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
- 3. THE MATERIAL DIMENSIONAL DETAILS SHOWN ARE TYPICAL FOR GS STRESS.
- 4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRED HARDWARE.
- 5. CABLE TRAYS SHALL DESIGN FOR 3000mm SUPPORT SPAN UNLESS NOTED OTHERWISE FOR SPECIFIED TRAY LOADING.



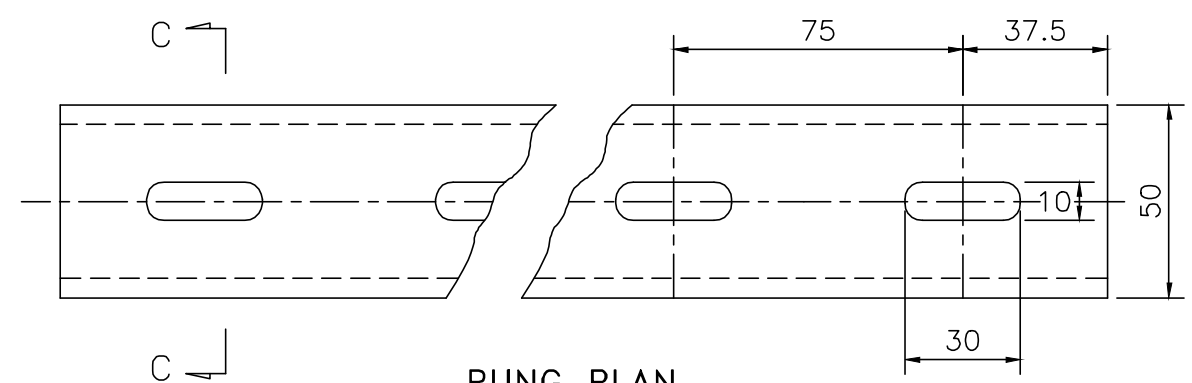
PLAN



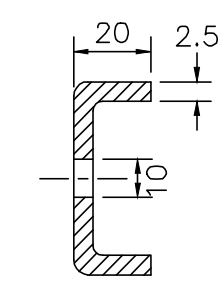
SECTION 'A-A'



SECTION 'B-B'



RUNG PLAN



SECTION 'C-C'

MATERIAL - 12 GAUGE (2.5MM) M.S.SHEET/G.S/AL/FRP (AS PER BOQ)  
 INSIDE TRAY WIDTH (W) - 150,300,450,600,800MM (AS PER BOQ)

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

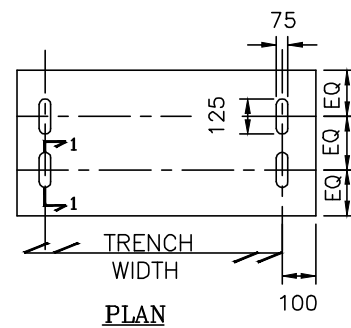
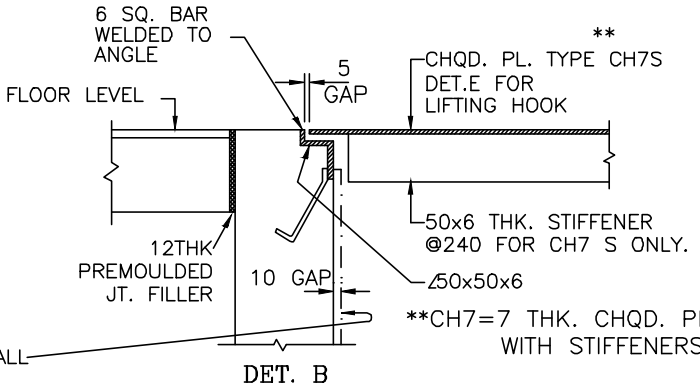
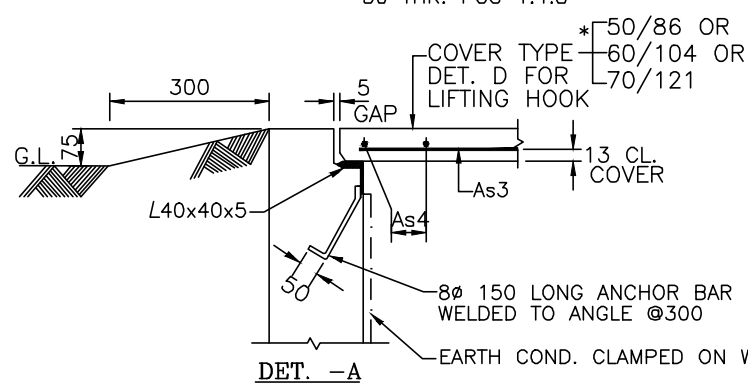
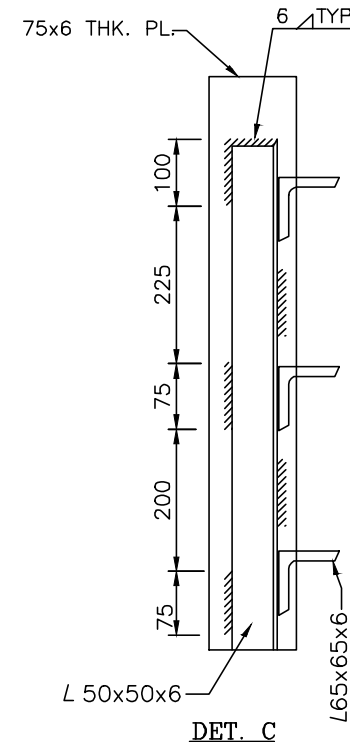
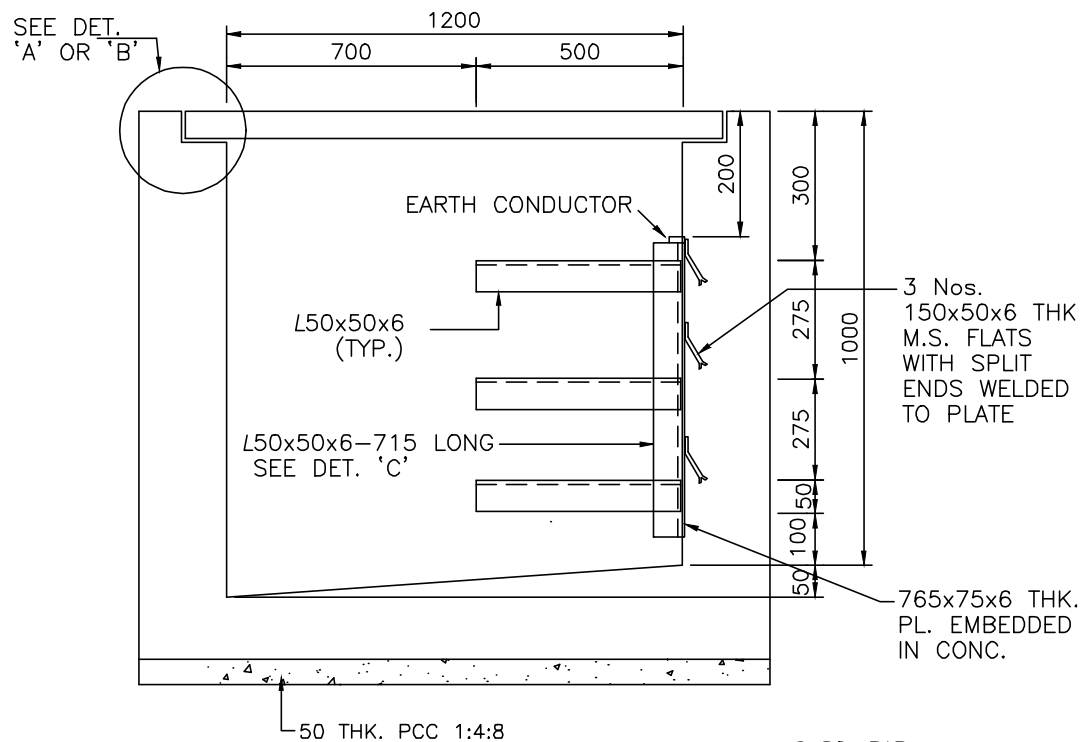
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
 LADDER TYPE CABLE TRAY

Size	Scale	Sheet
A3	NTS	03 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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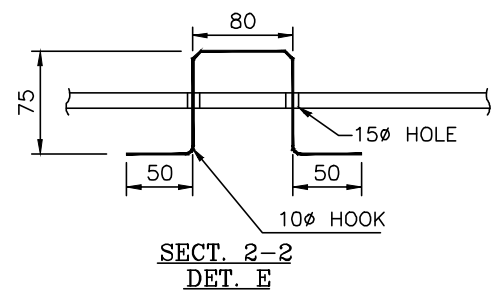
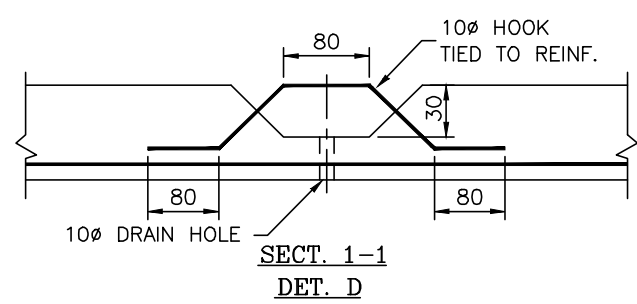
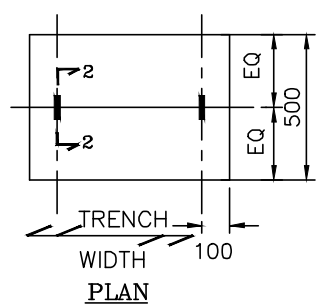
NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



R C COVER TYPE	THICKNESS mm.	As3	As4
50/86	50	7-6ø	9-6ø
60/86	60	6-8ø	7-8ø
70/181	70	5-8ø	7-8ø

\* 60/104 MEANS 60mm. THK.x86 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.

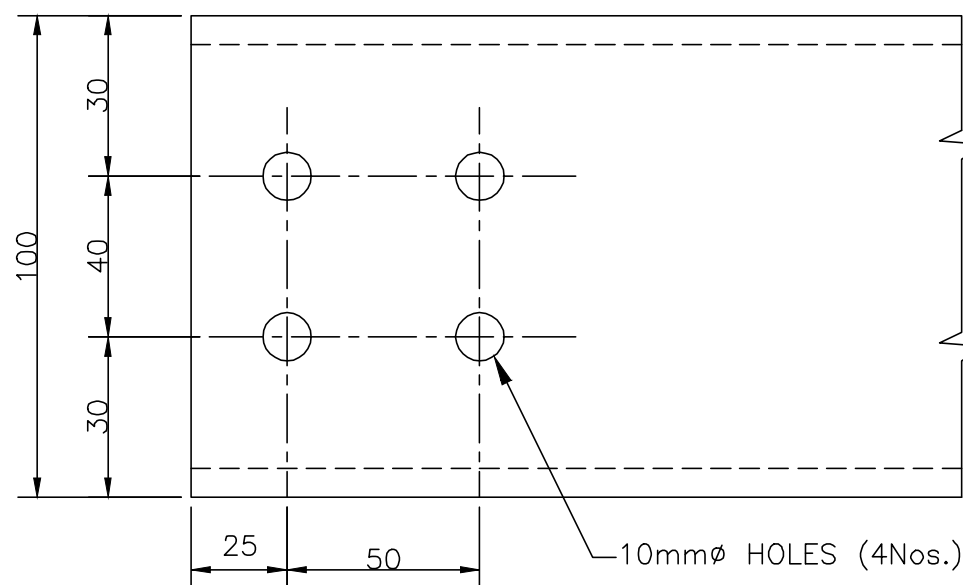
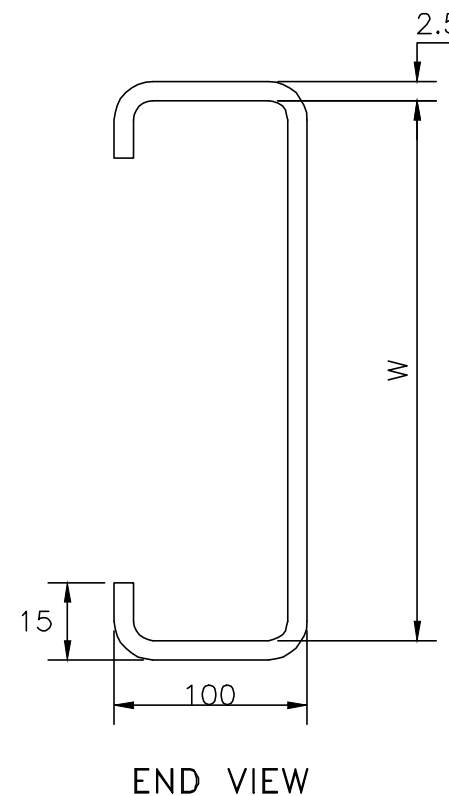
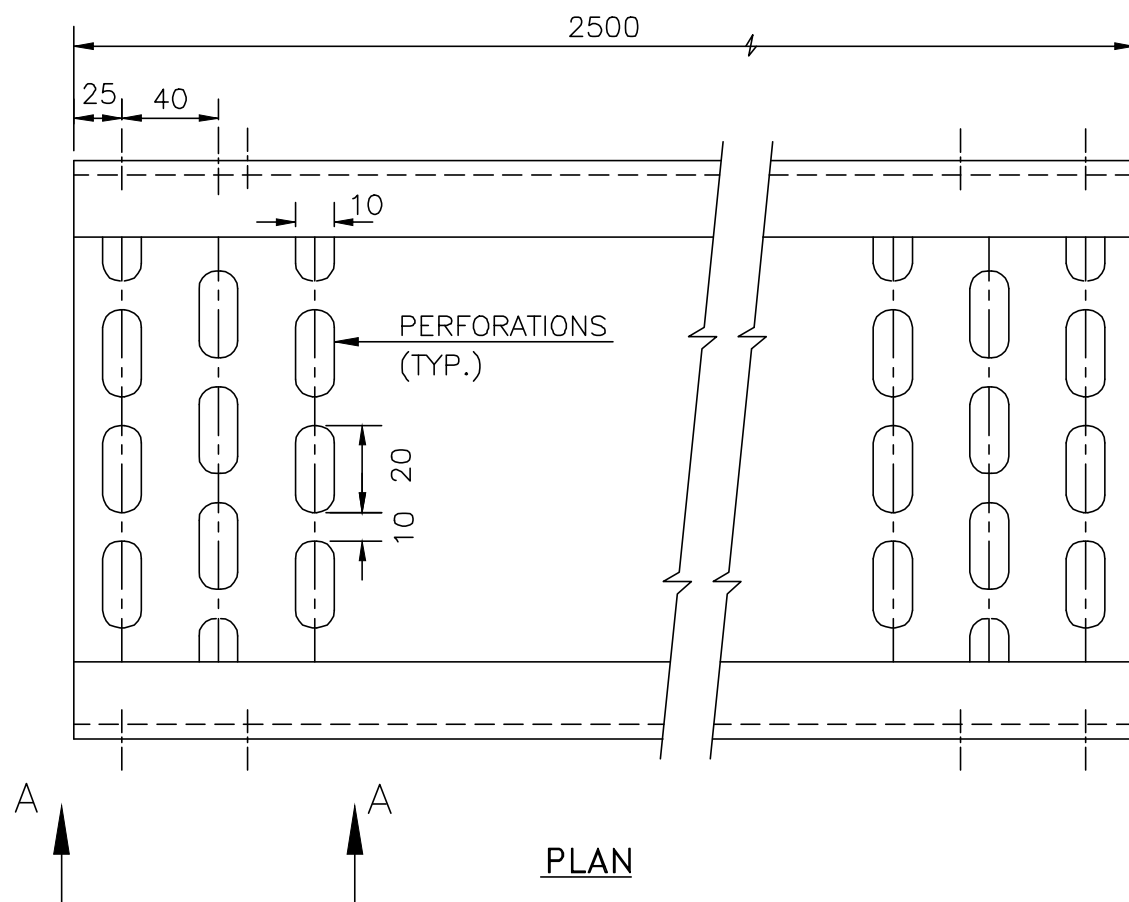


0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS CABLE TRENCH TYPE						
Size	Scale	Sheet				
A3	NTS	04 of 62				
Drawing No. GGNG-E-20714-3010			Rev.		0	

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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
- 3. THE MATERIAL DIMENSIONAL DETAILS SHOWN ARE TYPICAL FOR GS STRESS.
- 4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRED HARDWARE.
- 5. CABLE TRAYS SHALL DESIGN FOR 3000mm SUPPORT SPAN UNLESS NOTED OTHERWISE FOR SPECIFIED TRAY LOADING.



INSIDE WIDTH (W) - 100,150,300,450,600,800MM (AS PER BOQ)  
 MATERIAL - 12 GAUGE (2.5MM) M.S.SHEET/G.S./AL/FRP (AS PER BOQ)

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

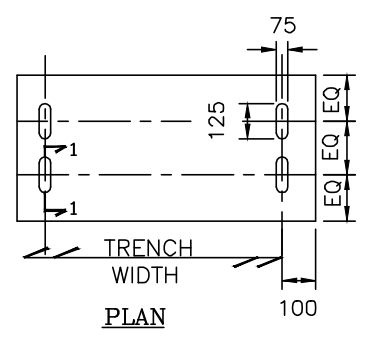
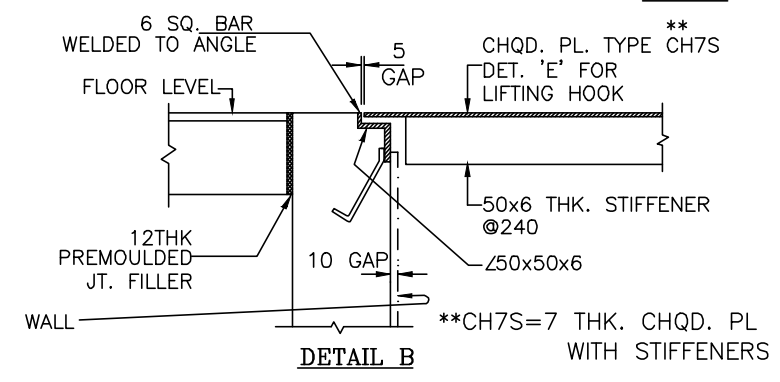
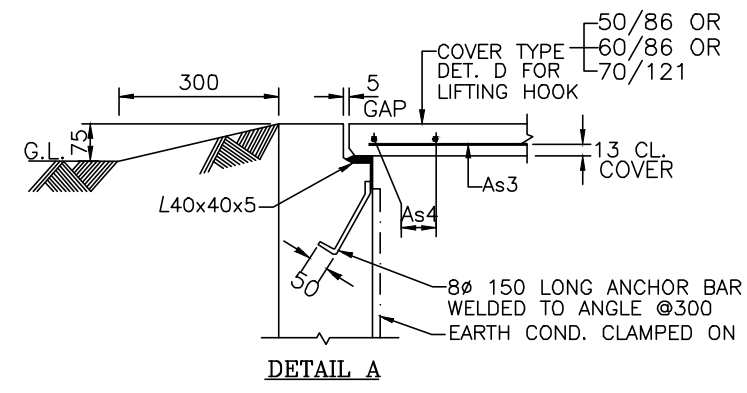
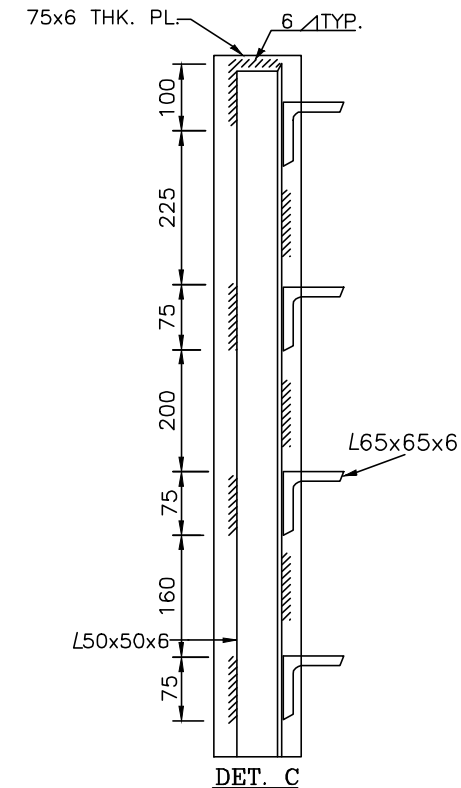
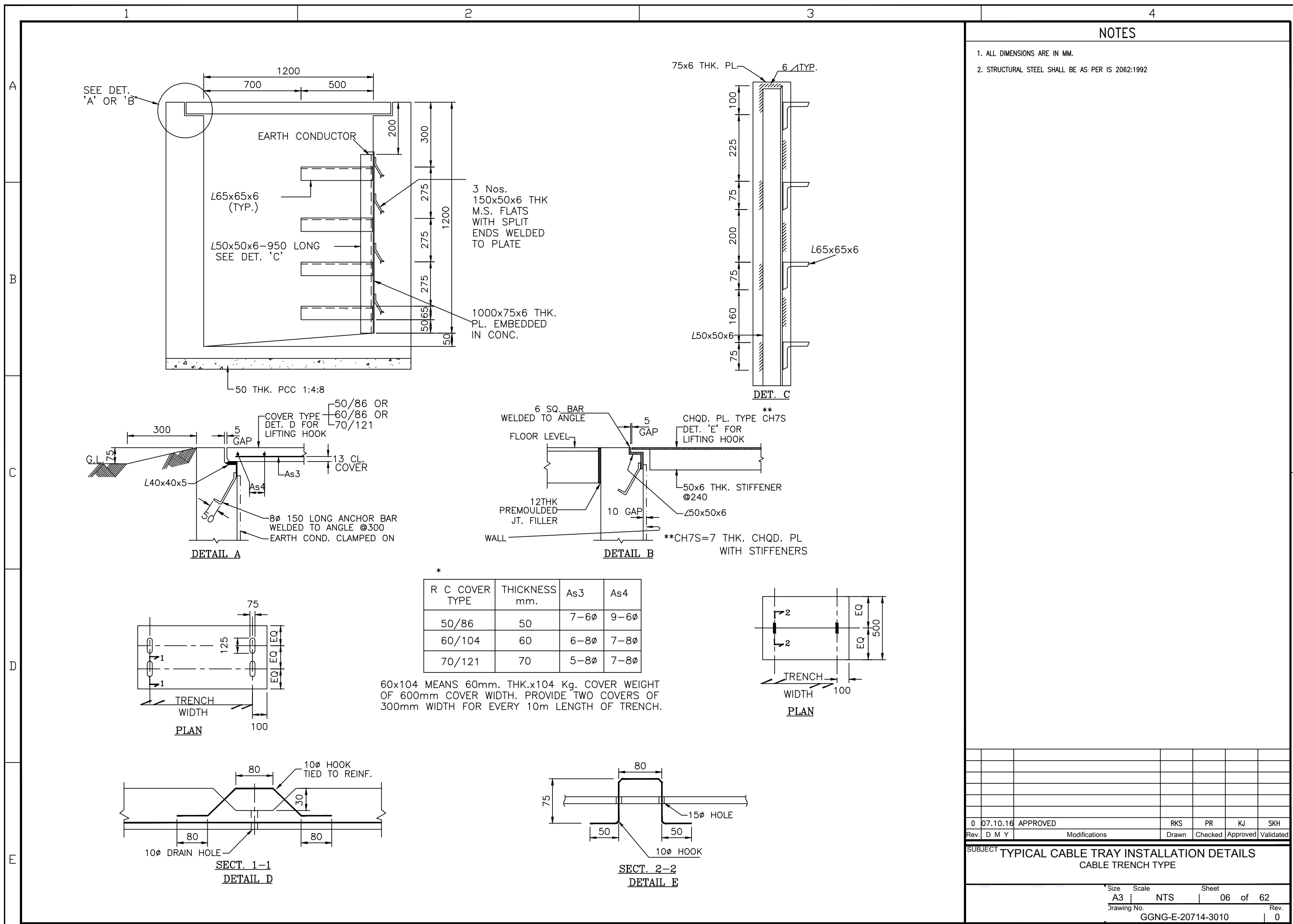
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
 PERFORATED TYPE CABLE TRAY

Size	Scale	Sheet
A3	NTS	05 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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NOTES

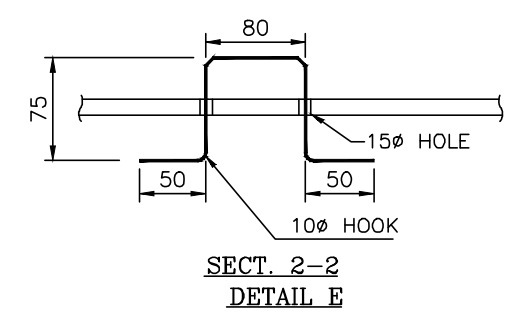
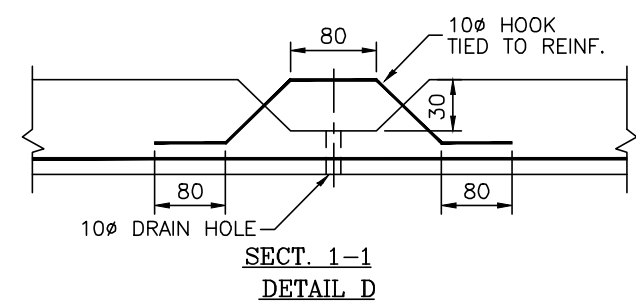
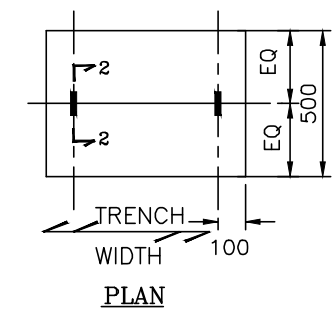
1. ALL DIMENSIONS ARE IN MM.
2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



\*

R C COVER TYPE	THICKNESS mm.	As3	As4
50/86	50	7-6φ	9-6φ
60/104	60	6-8φ	7-8φ
70/121	70	5-8φ	7-8φ

60x104 MEANS 60mm. THK.x104 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



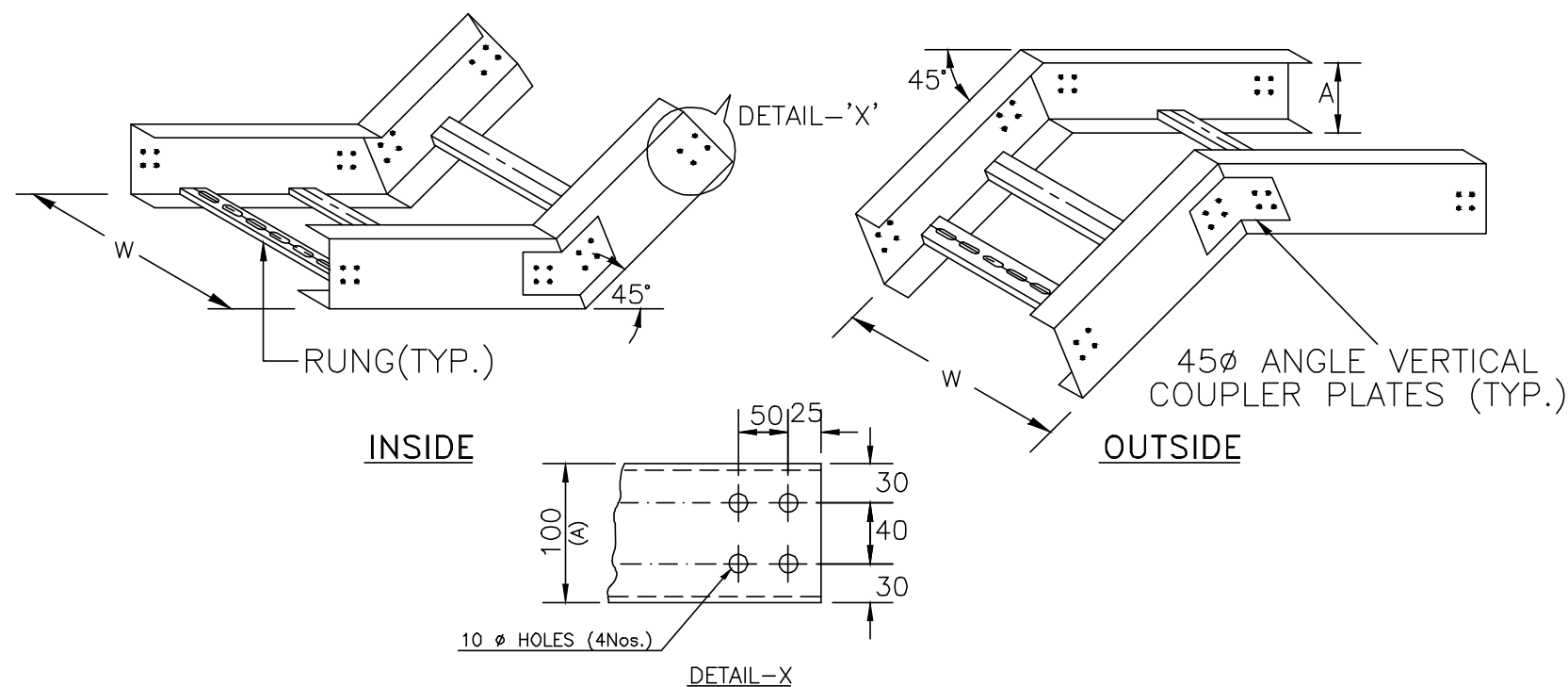
0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS CABLE TRENCH TYPE						
Size	Scale	Sheet				
A3	NTS	06 of 62				
Drawing No. GGNG-E-20714-3010						Rev. 0

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NOTES

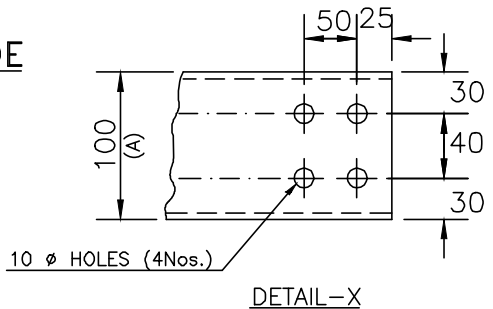
- 1. ALL DIMENSIONS ARE IN MM.
- 2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER BOQ)
- 3. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
- 4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRED HARDWARE.
- 5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES & HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.

45° DIRECT VERTICAL ELBOW



INSIDE

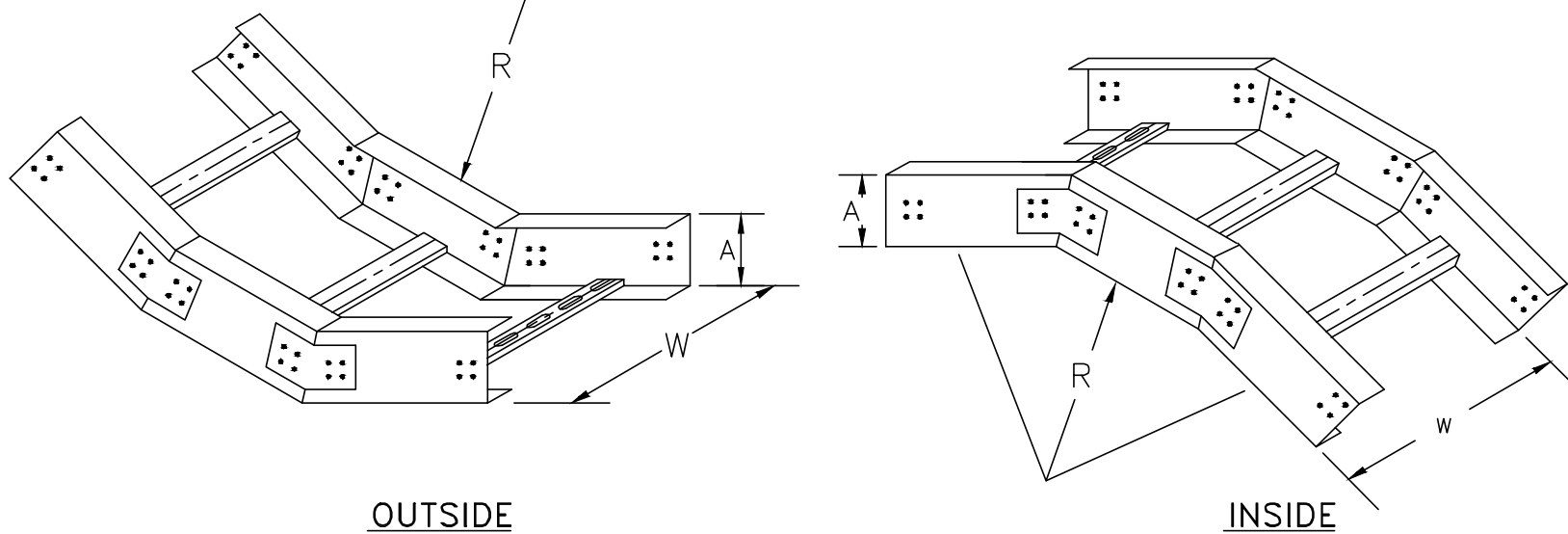
OUTSIDE



10 Ø HOLES (4Nos.)

DETAIL-X

45° VERTICAL RADIUS ELBOW



OUTSIDE

INSIDE

- (W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER BOQ)
- (A) DEPTH OF TRAY - 100MM UNLESS NOTED
- (R) BENDING RADIUS (AS PER BOQ)

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

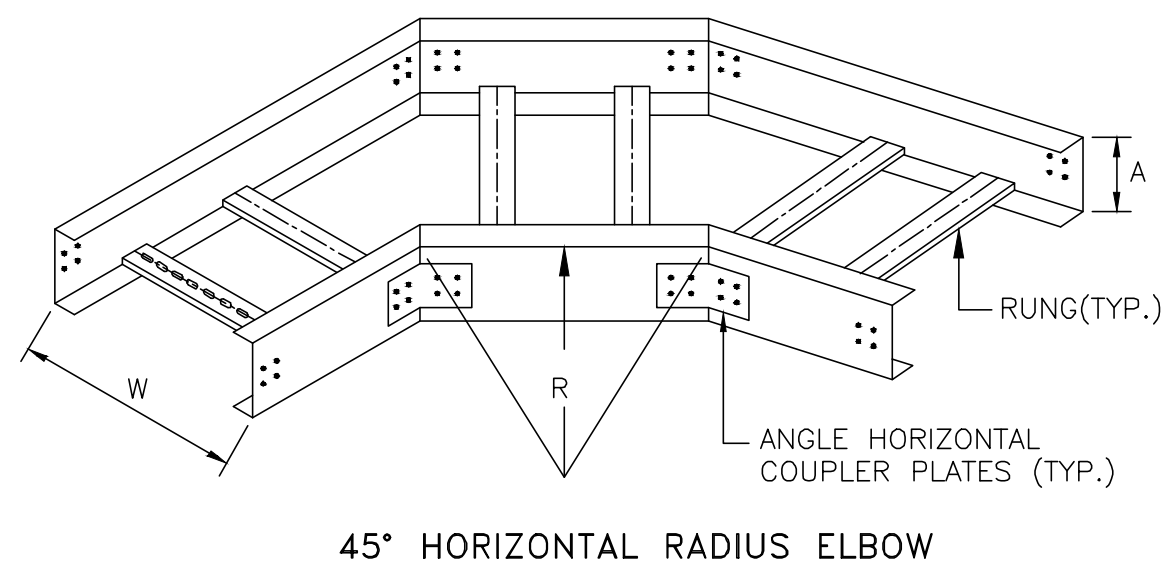
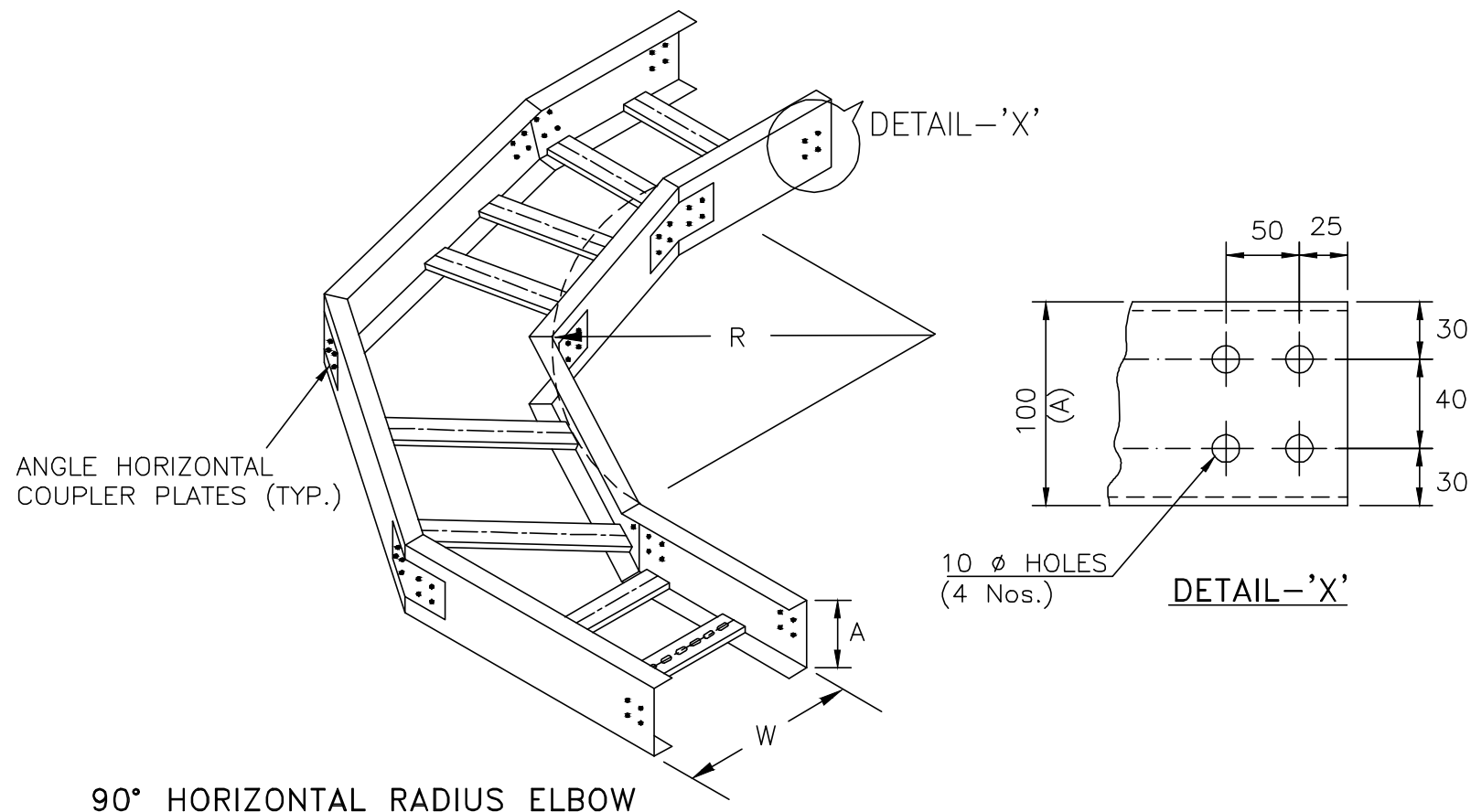
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY ACCESSORIES

Size	Scale	Sheet
A3	NTS	07 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER BOQ)
- 3. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
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- 5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES & HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.



(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER BOQ)  
 (A) DEPTH OF TRAY - 100MM UNLESS NOTED  
 (R) BENDING RADIUS (AS PER BOQ)

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

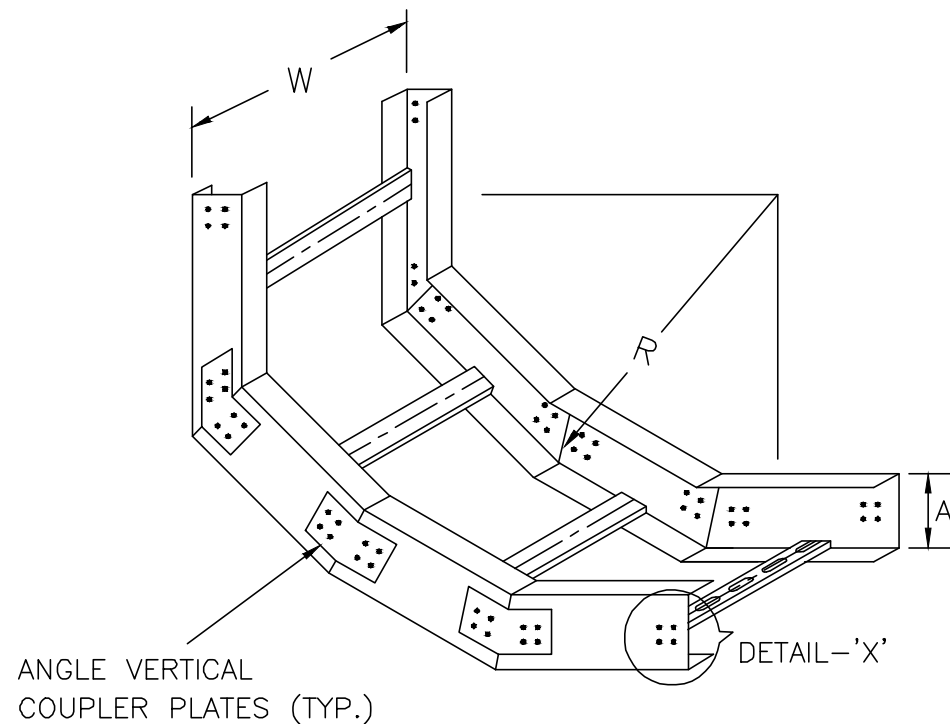
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS CABLE TRAY ACCESSORIES						
Size	Scale	Sheet				
A3	NTS	08 of 62				
Drawing No.			Rev.			
GGNG-E-20714-3010			0			

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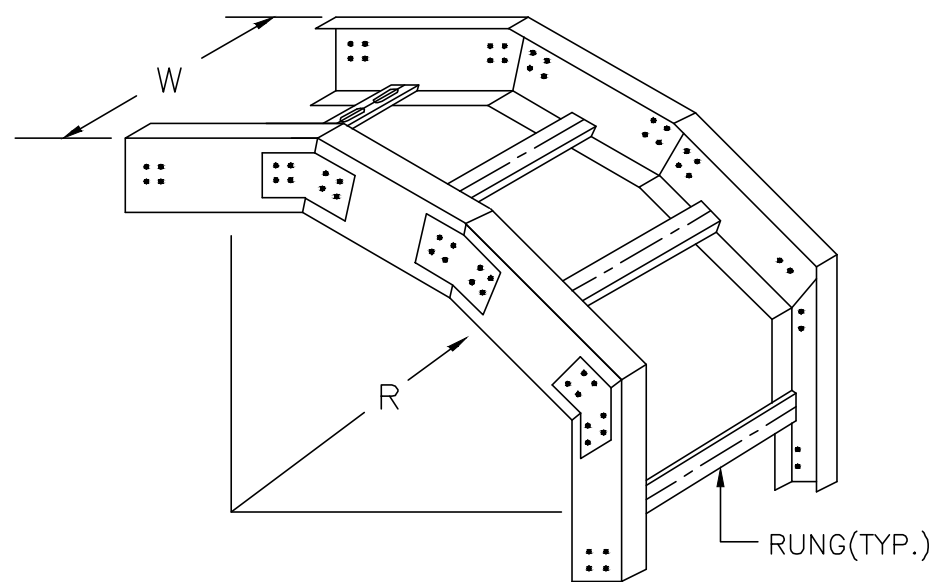
NOTES

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- 5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES & HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.

90° VERTICAL RADIUS ELBOW

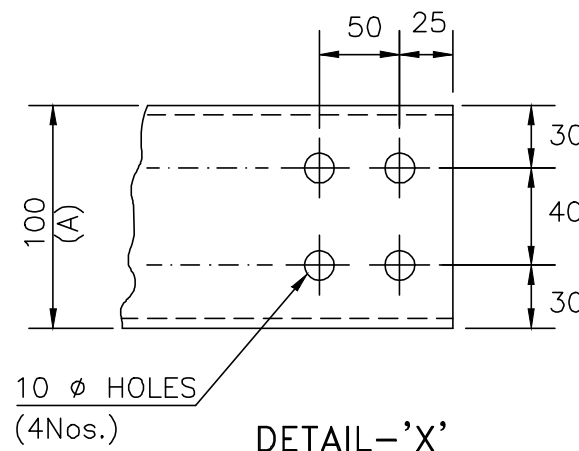


INSIDE



OUTSIDE

- (W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER BOQ).
- (A) DEPTH OF TRAY - 100MM UNLESS NOTED.
- (R) BENDING RADIUS (AS PER BOQ).



10 Ø HOLES (4Nos.)

DETAIL - 'X'

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

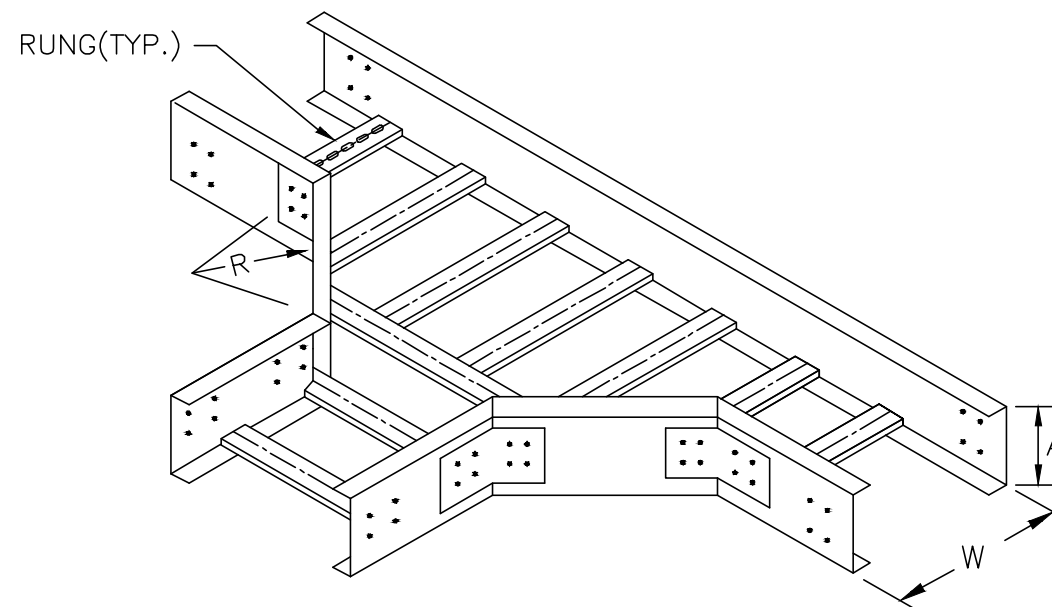
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY ACCESSORIES

Size	Scale	Sheet
A3	NTS	09 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

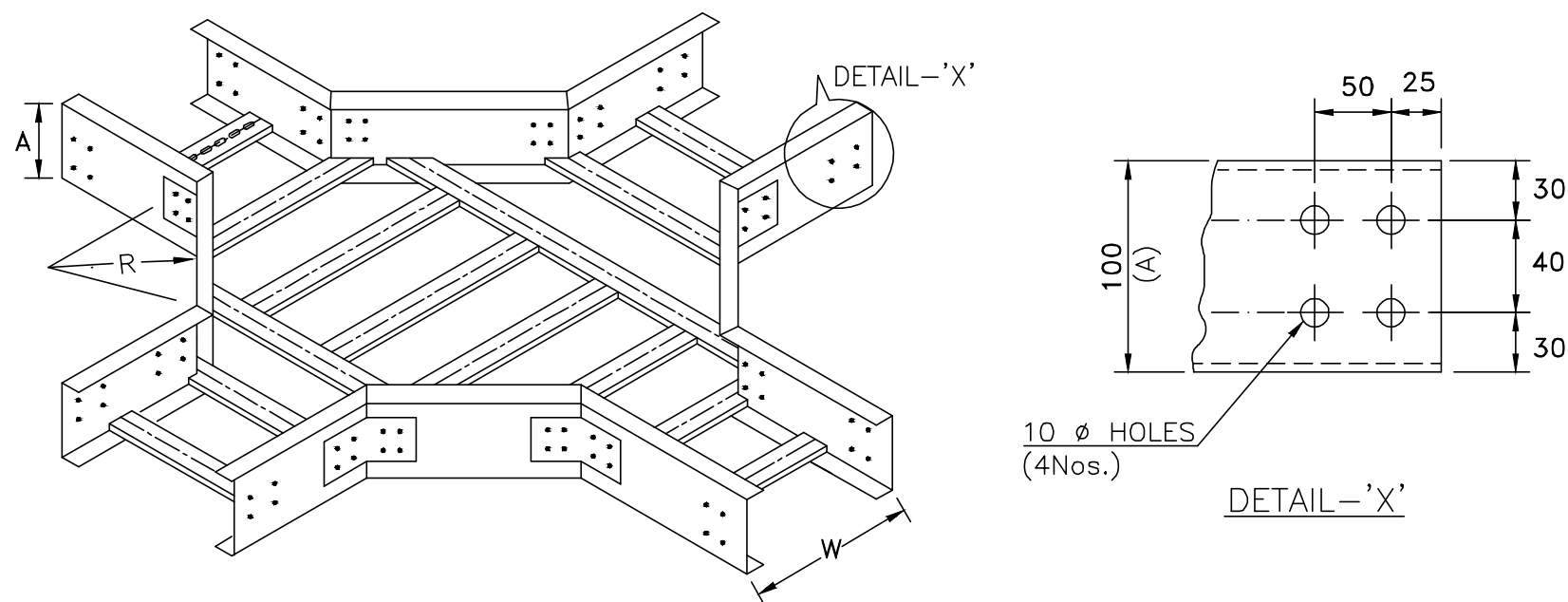
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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER BOQ)
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- 4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRED HARDWARE.
- 5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES & HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.



HORIZONTAL RADIUS TEE



HORIZONTAL RADIUS CROSS

- (W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER BOQ)
- (A) DEPTH OF TRAY - 100MM UNLESS NOTED
- (R) BENDING RADIUS (AS PER BOQ)

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

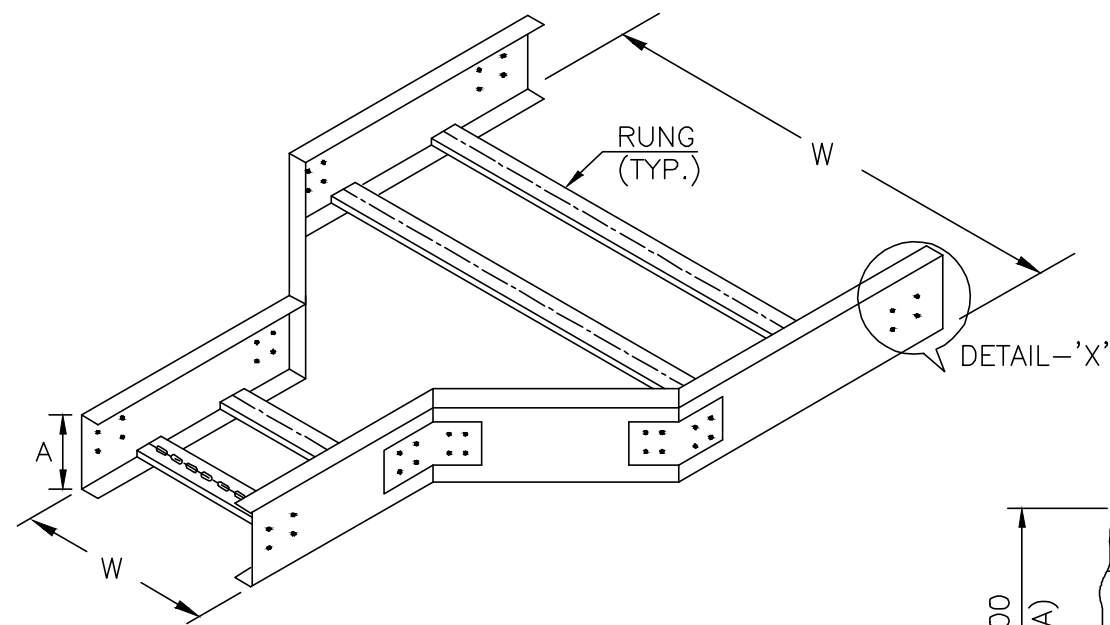
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY ACCESSORIES

Size	Scale	Sheet
A3	NTS	10 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

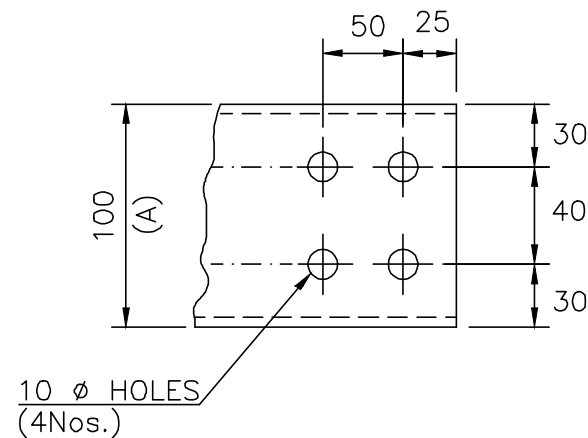
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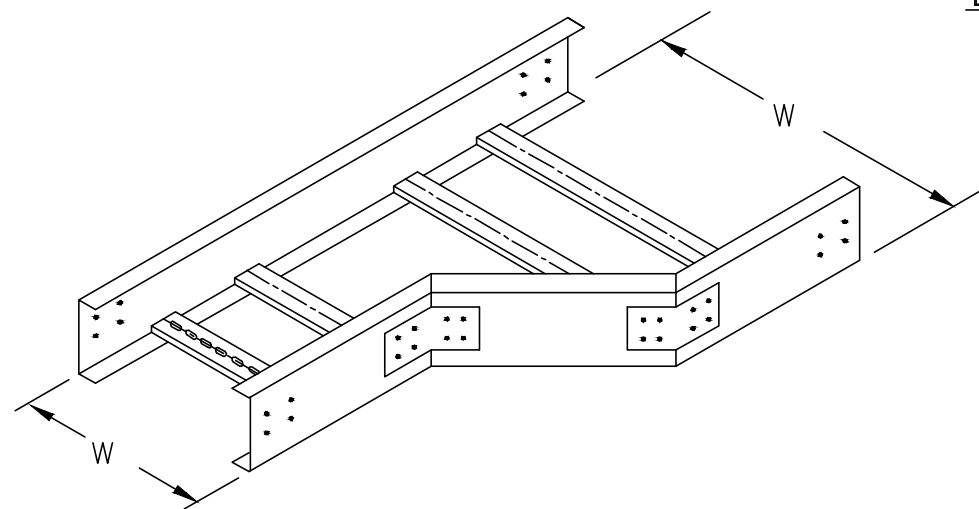
- 1. ALL DIMENSIONS ARE IN MM.
- 2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER BOQ)
- 3. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
- 4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRED HARDWARE.
- 5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES & HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.



STRAIGHT REDUCER



DETAIL-'X'



RIGHT TO LEFT HAND REDUCER

(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER BOQ)

(A) DEPTH OF TRAY - 100MM UNLESS NOTED

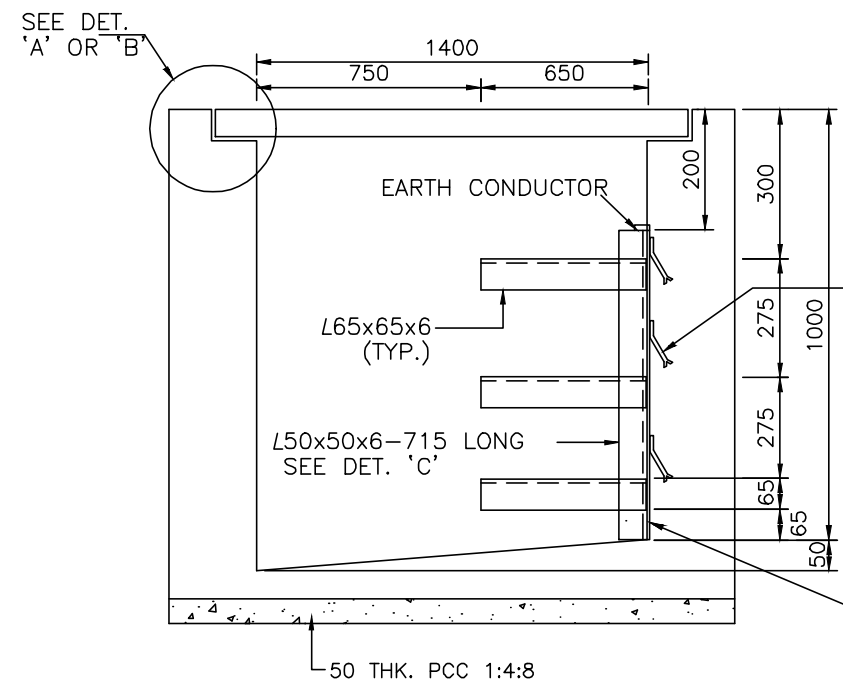
0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY ACCESSORIES

Size	Scale	Sheet
A3	NTS	11 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

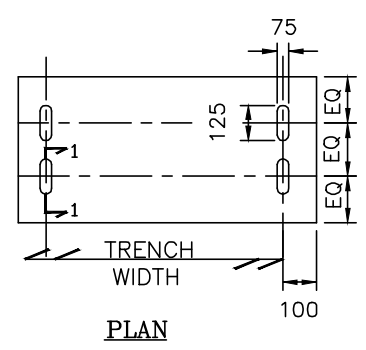
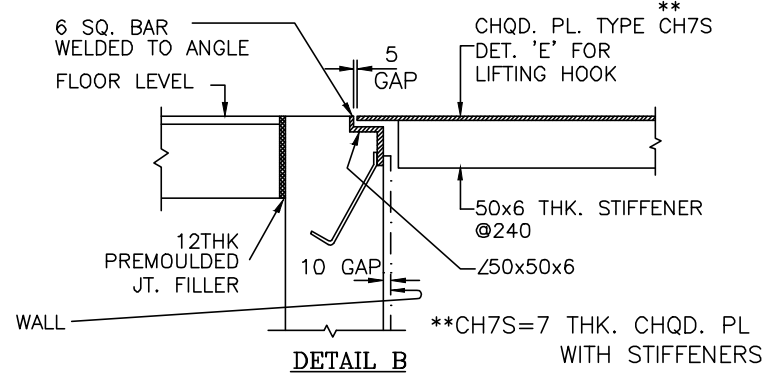
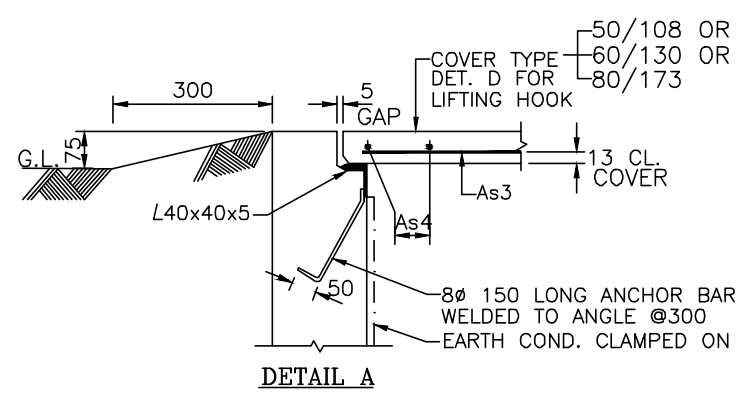
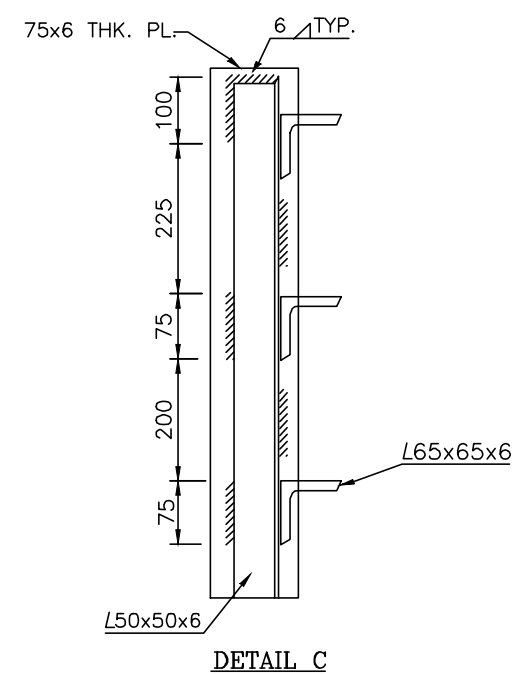
NOTES

1. ALL DIMENSIONS ARE IN MM.
2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



3 Nos. 150x50x6 THK M.S. FLATS WITH SPLIT ENDS WELDED TO PLATE

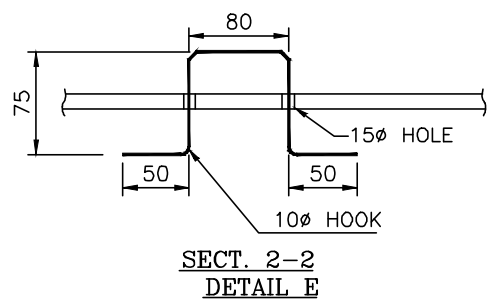
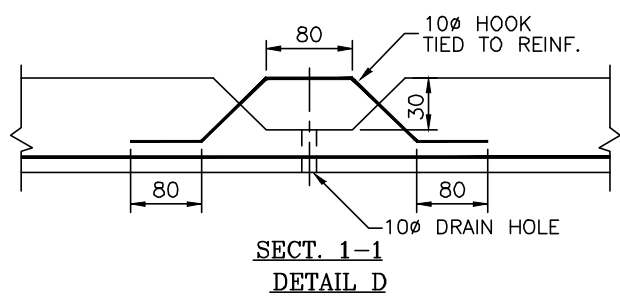
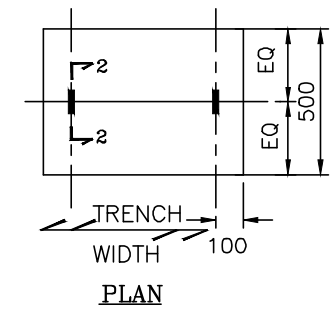
765x75x6 THK. PL. EMBEDDED IN CONC.



\*

R C COVER TYPE	THICKNESS mm.	As3	As4
50/108	50	7-6ø	9-6ø
60/130	60	6-8ø	7-8ø
80/173	80	5-8ø	7-8ø

60x130 MEANS 60mm. THK.x130 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

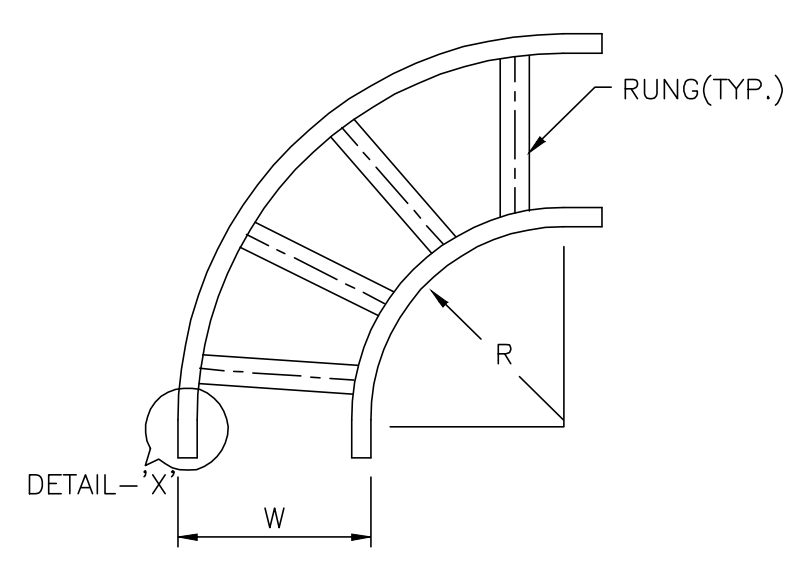
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRENCH TYPE

Size	Scale	Sheet
A3	NTS	12 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

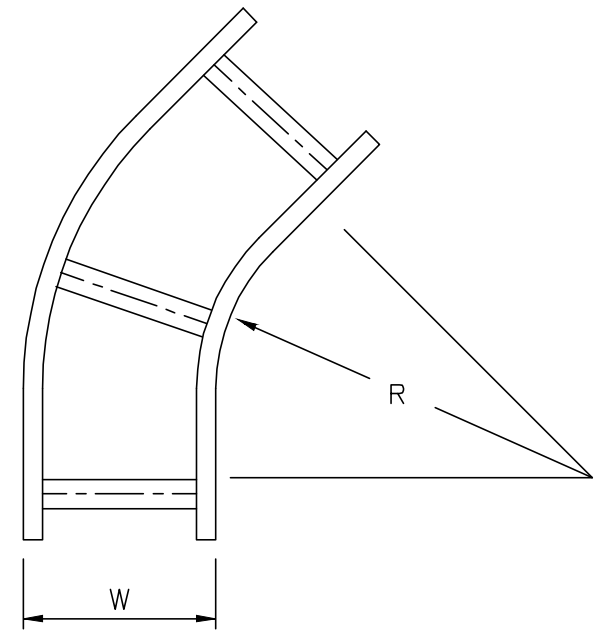
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NOTES

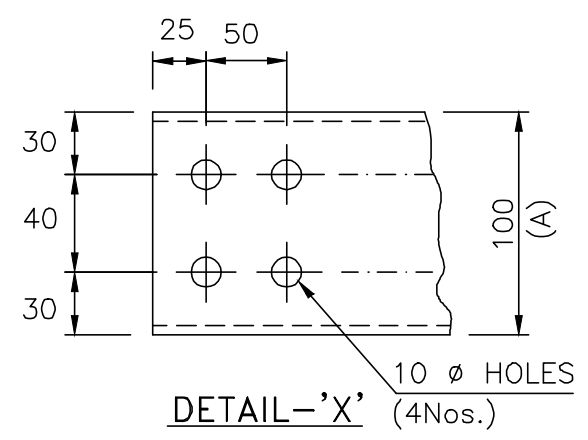
- 1. ALL DIMENSIONS ARE IN MM.
- 2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER BOQ)
- 3. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
- 4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRED HARDWARE.
- 5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES & HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.



90° HORIZONTAL RADIUS ELBOW

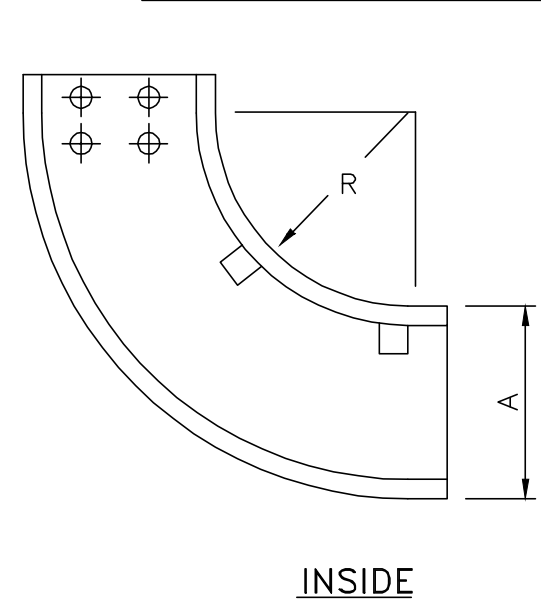


45° HORIZONTAL RADIUS ELBOW

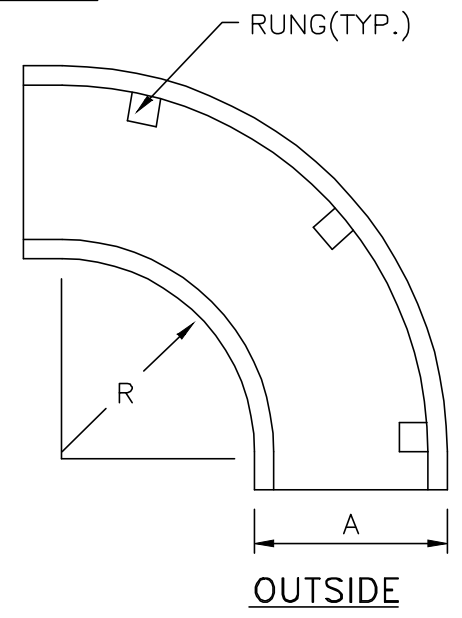


(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER BOQ)  
 (A) DEPTH OF TRAY - 100MM UNLESS NOTED  
 (R) BENDING RADIUS (AS PER BOQ)

90° VERTICAL MOULDED RADIUS ELBOW



INSIDE



OUTSIDE

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

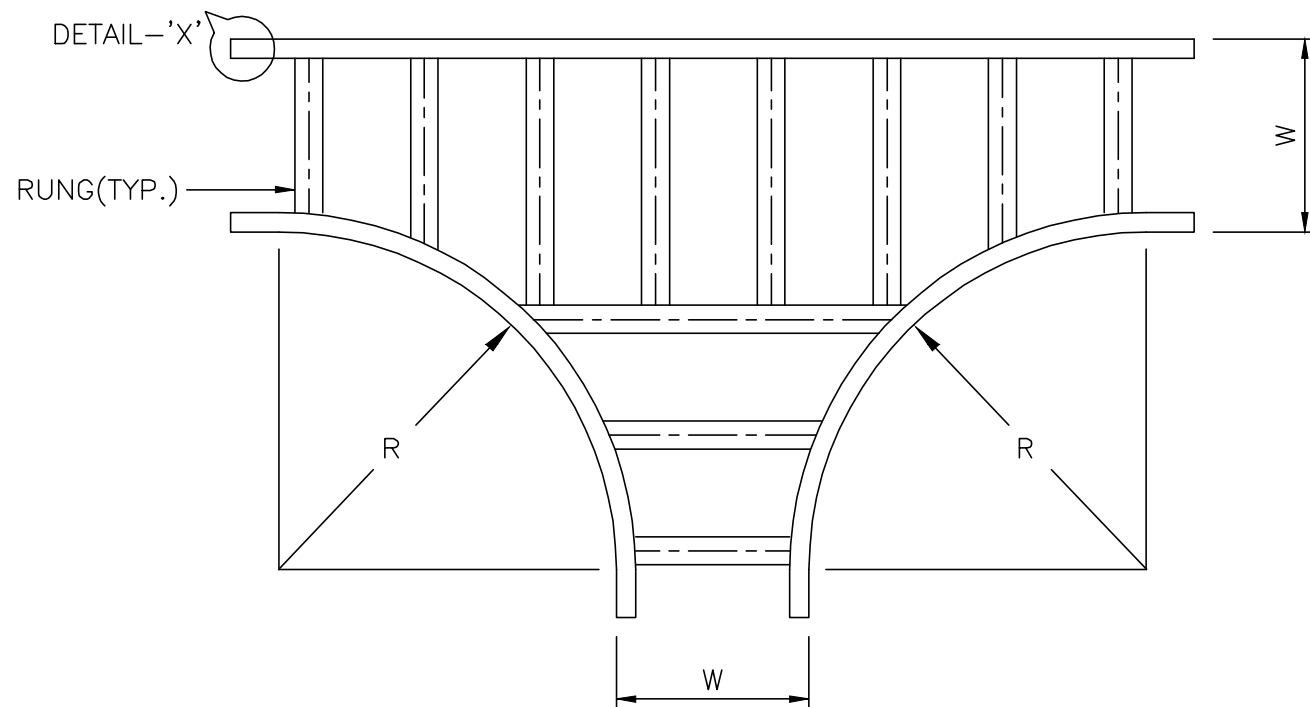
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
 CABLE TRAY ACCESSORIES (FRP)

Size	Scale	Sheet
A3	NTS	13 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

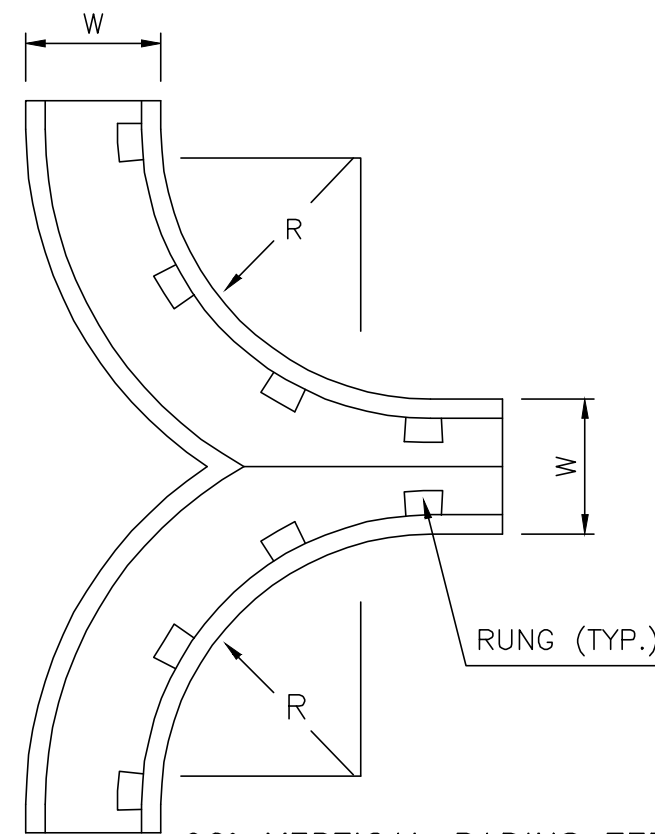
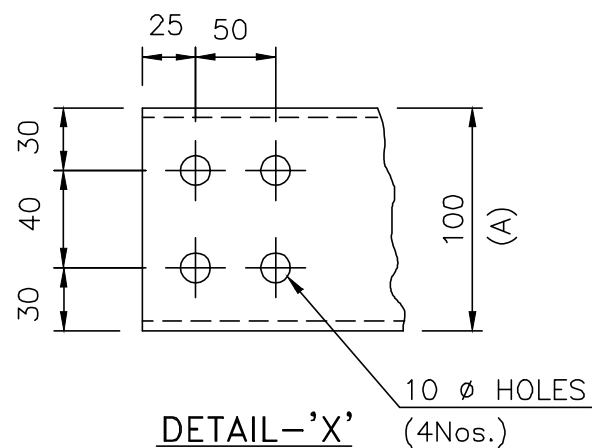
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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S./AL/FRP (AS PER BOQ)
- 3. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
- 4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRED HARDWARE.
- 5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES & HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.



HORIZONTAL RADIUS TEE



90° VERTICAL RADIUS TEE

- (W) - INSIDE WIDTH OF TRAY-150,300,450,600,800MM (AS PER BOQ)
- (A) - DEPTH OF TRAY-100MM UNLESS NOTED
- (R) - BENDING RADIUS (AS PER BOQ)

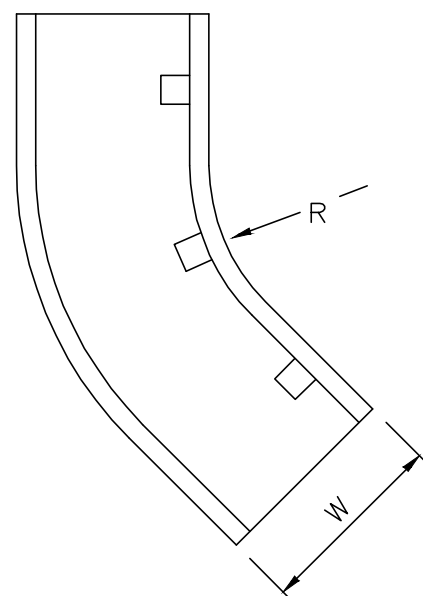
0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY ACCESSORIES

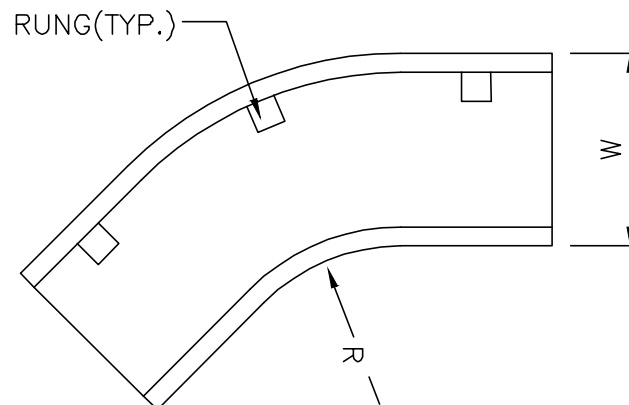
Size	Scale	Sheet
A3	NTS	14 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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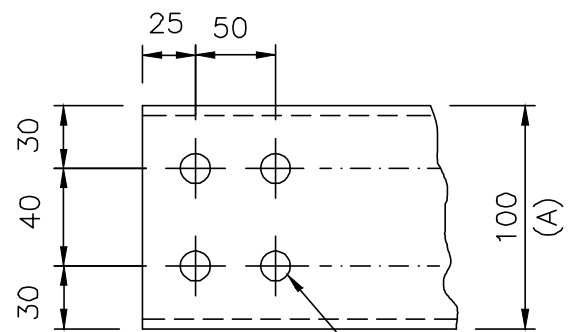
### 45° VERTICAL RADIUS ELBOW



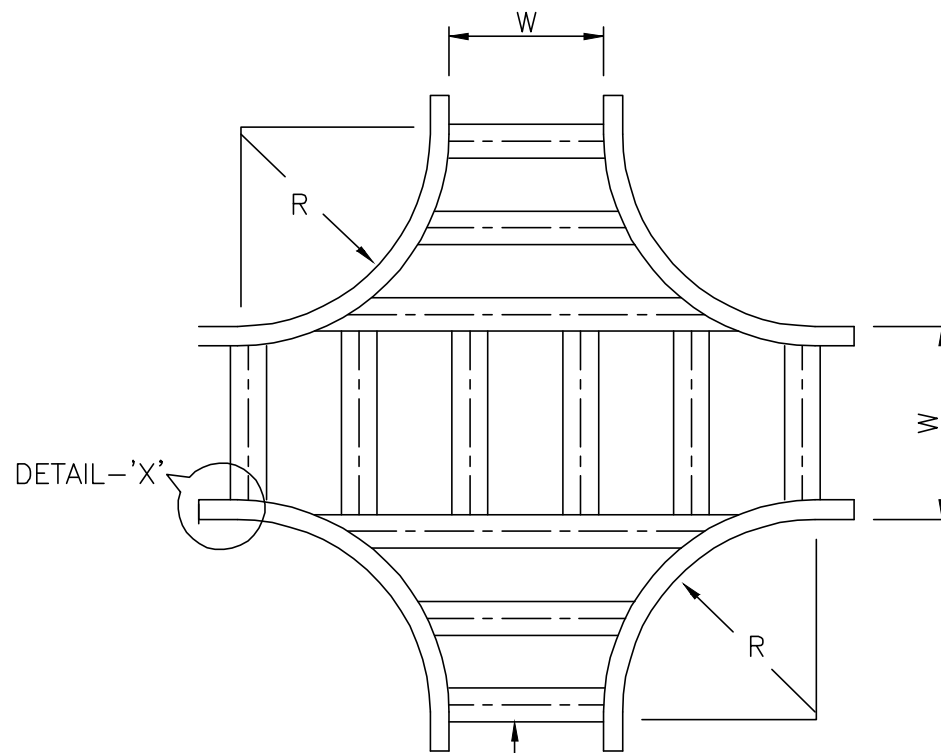
INSIDE



OUTSIDE



10  $\phi$  HOLES  
(4Nos.)  
DETAIL - 'X'



HORIZONTAL RADIUS CROSS

### NOTES

1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER BOQ)
3. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRED HARDWARE.
5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES & HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.

(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER BOQ)

(A) DEPTH OF TRAY - 100MM UNLESS NOTED

(R) BENDING RADIUS (AS PER BOQ)

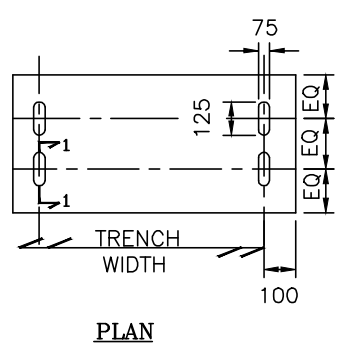
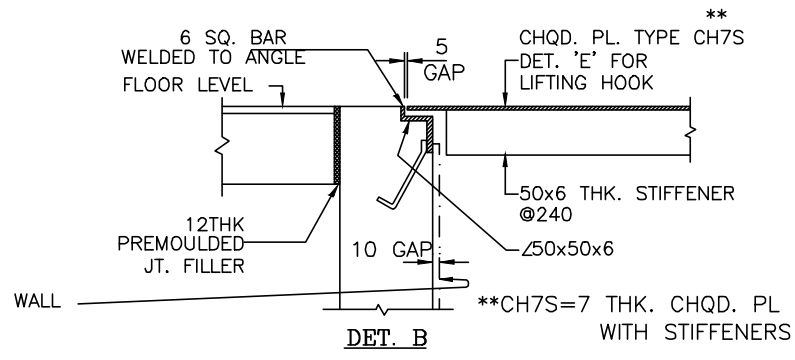
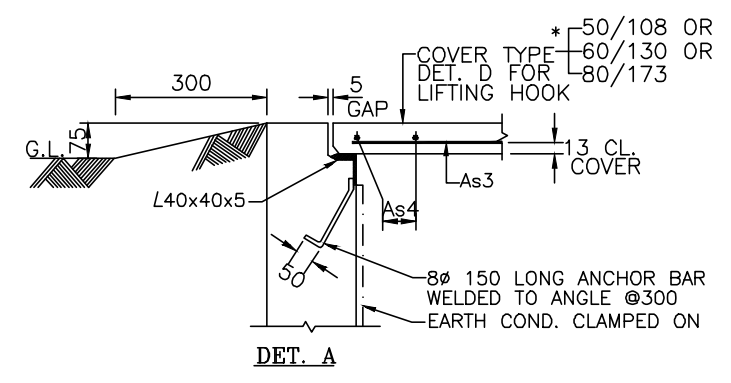
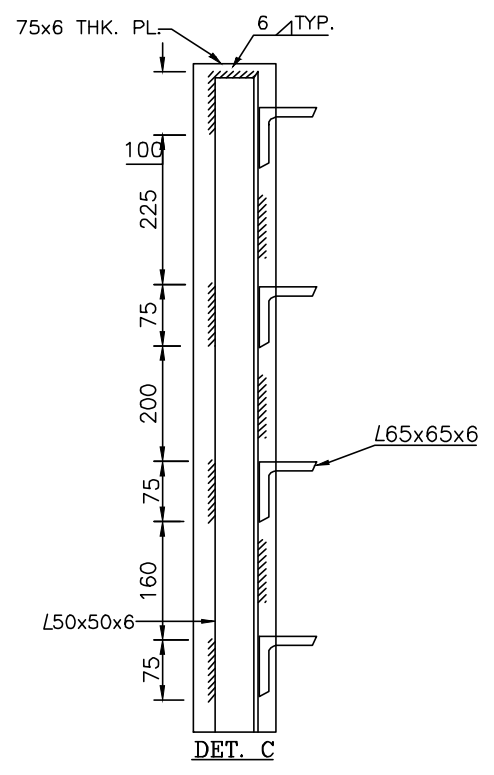
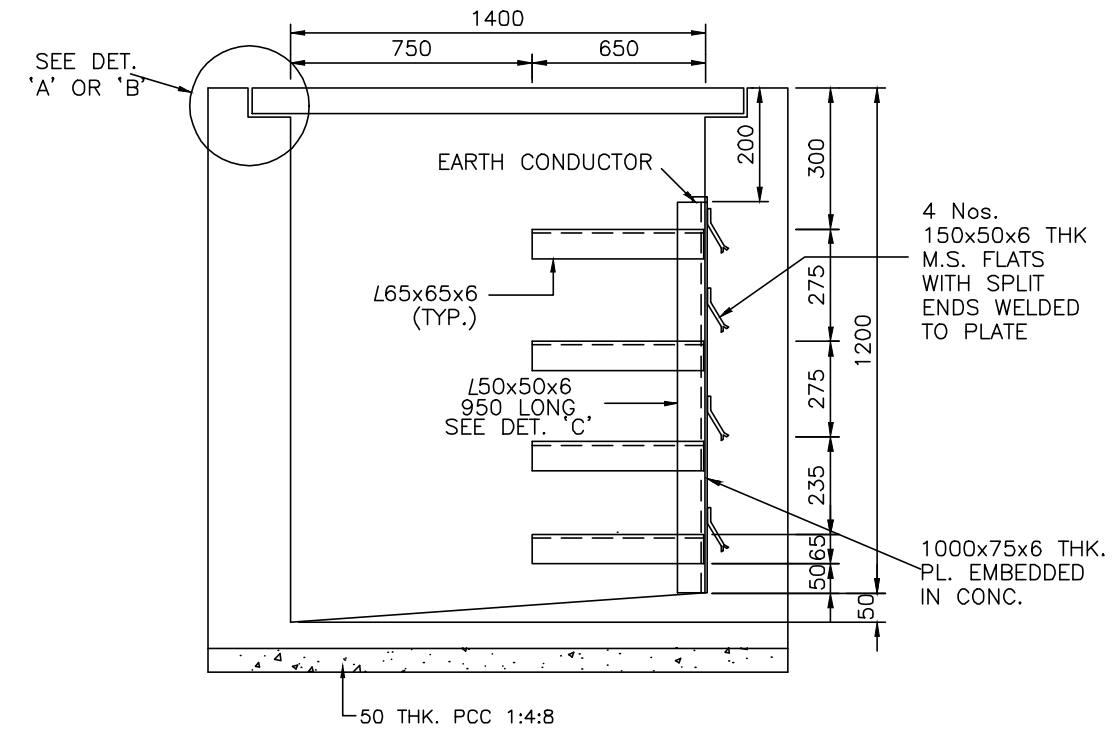
0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY ACCESSORIES

Size	Scale	Sheet
A3	NTS	15 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

NOTES

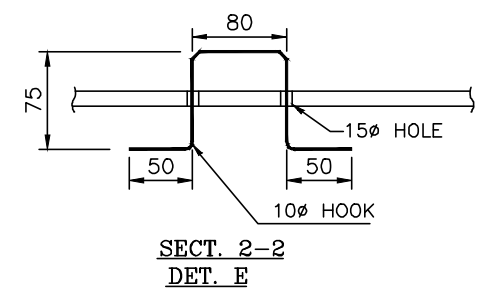
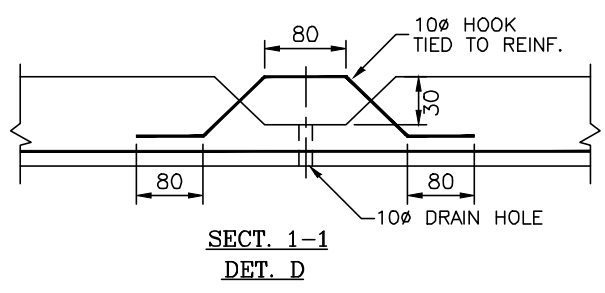
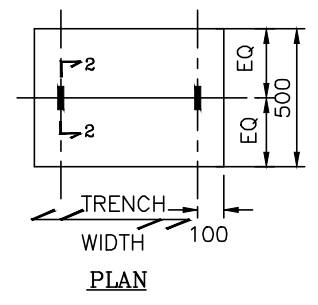
- 1. ALL DIMENSIONS ARE IN MM.
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992.



\*

R C COVER TYPE	THICKNESS mm.	As3	As4
50/108	50	7-6 $\phi$	9-6 $\phi$
60/130	60	6-8 $\phi$	8-8 $\phi$
80/173	80	5-8 $\phi$	8-8 $\phi$

60x130 MEANS 60mm. THK.x130 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.

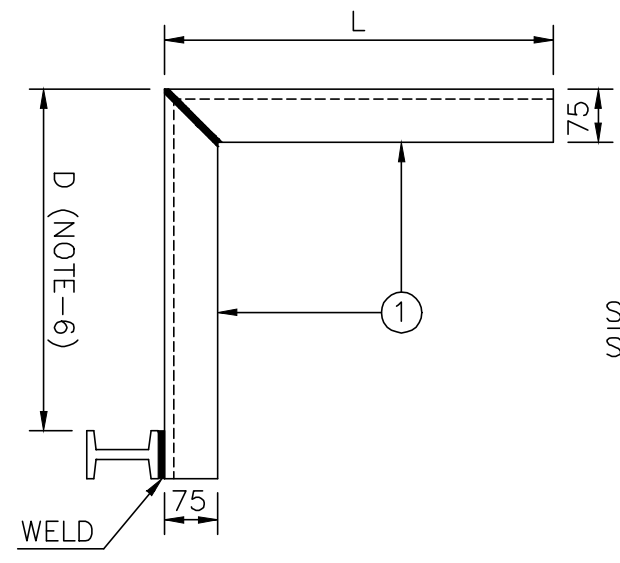


0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS CABLE TRENCH TYPE						
Size	Scale	Sheet				
A3	NTS	16	of	62		
Drawing No.			Rev.			
GGNG-E-20714-3010			0			

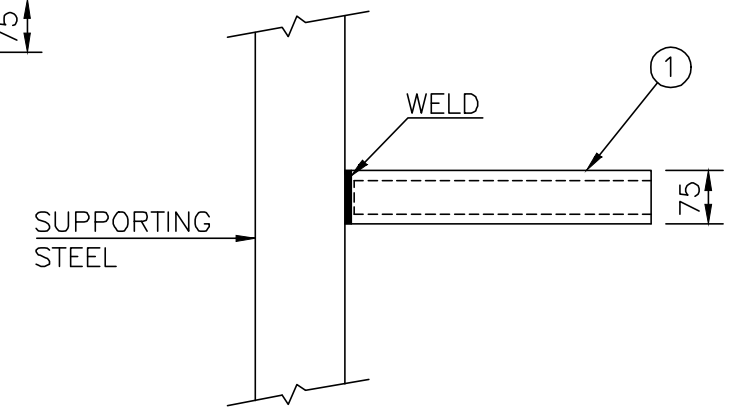
A  
B  
C  
D  
E

NOTES

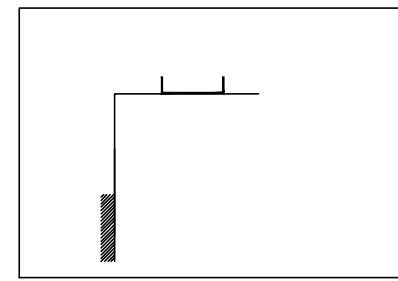
- 1. ALL DIMENSIONS ARE IN MM.
- 2. FULL LENGTH FILLET WELD WITH RETURNED ENDS TO BE MINIMUM 4MM.
- 3. ISMC 75 SHALL BE AS PER IS 2062: 1992.
- 4. WELDING SHALL BE DONE AS PER IS 816: 1969.
- 5. DIMENSION 'D' TO SUIT ELEVATION OF TRAY AS GIVEN ON CABLE TRAY LAYOUT DRAWING.



ELEVATION



PLAN



TYPE-2A

TABLE-1

TRAY WIDTH	L	REMARKS
100	250	
150	300	

TABLE-2

ITEM NO	DESCRIPTION	LENGTH	QTY No.	REMARKS
①	ISMC 75	D + L	1	FOR 'L' REF.TABLE-1

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

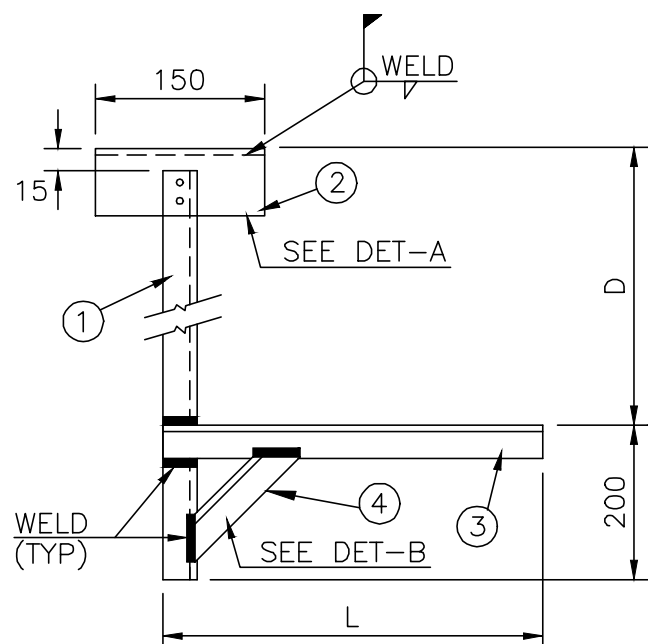
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY CEILING MOUNTED SINGLE SUPPORT

Size	Scale	Sheet
A3	NTS	17 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

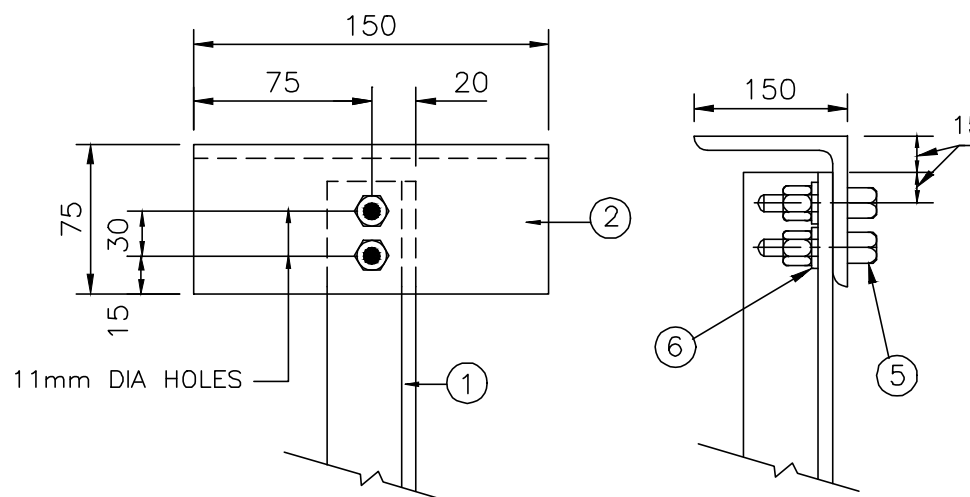
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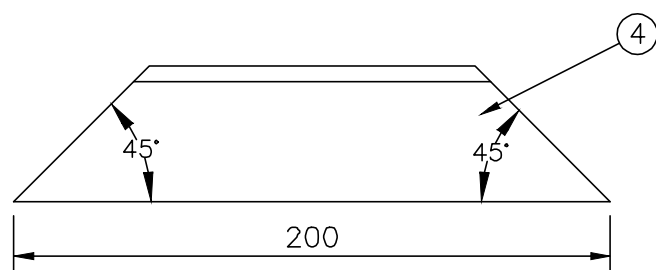
1. ALL DIMENSIONS ARE IN MM.
2. FULL LENGTH FILLET WELD WITH RETURNED ENDS TO BE MINIMUM 4MM.
3. DIMENSION 'D' TO SUIT ELEVATION OF THE TRAY AS GIVEN ON CABLE TRAY LAYOUT DRAWING.
4. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.
5. NUTS AND BOLTS SHALL BE AS PER IS 1363 (PART-1,2,3): 1992/IS 1367(PART-5): 1980.
6. WASHERS SHALL BE AS PER IS 2016: 1967.



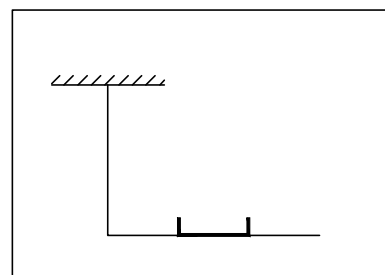
ELEVATION



DETAIL-A



DETAIL-B



TYPE-2B

TABLE-1

TRAY WIDTH	L	REMARKS
100	200	
150	250	
300	400	
450	550	
600	700	

TABLE-2

ITEM NO	DESCRIPTION	LENGTH MM	QTY No.	REMARKS
①	ISA 50x50x6	D+200	1	FOR 'D' REF.NOTE.4
②	ISA 75x50x6	150	1	
③	ISA 50x50x6	L	1	FOR 'L' REF.TABLE-1
④	ISA 50x50x6	200	1	ONLY FOR 600MM TRAY
⑤	BOLT/NUT(M10)	30	2	
⑥	SPRING WASHER (M10)	-	2	

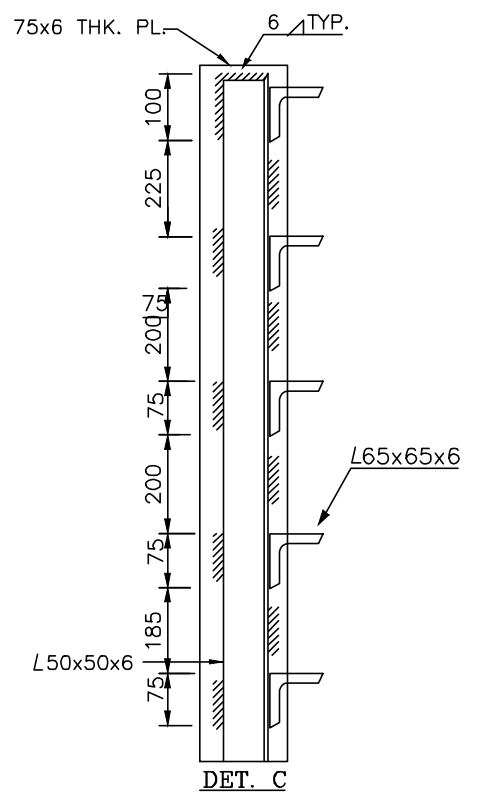
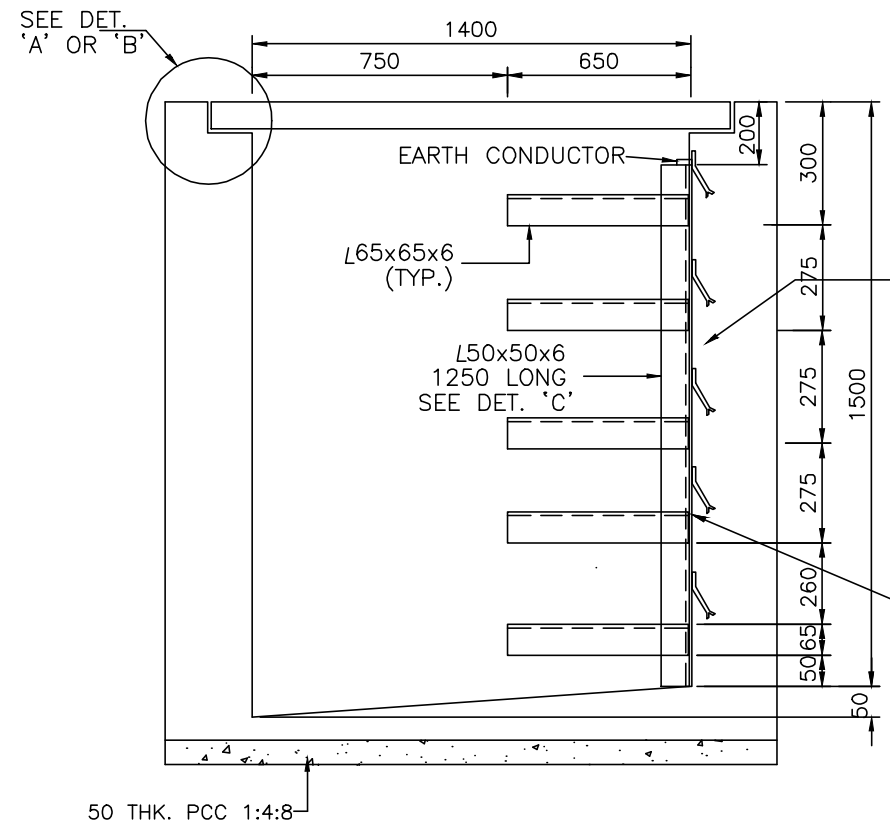
0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY CEILING MOUNTED SINGLE SUPPORT

Size	Scale	Sheet
A3	NTS	18 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

NOTES

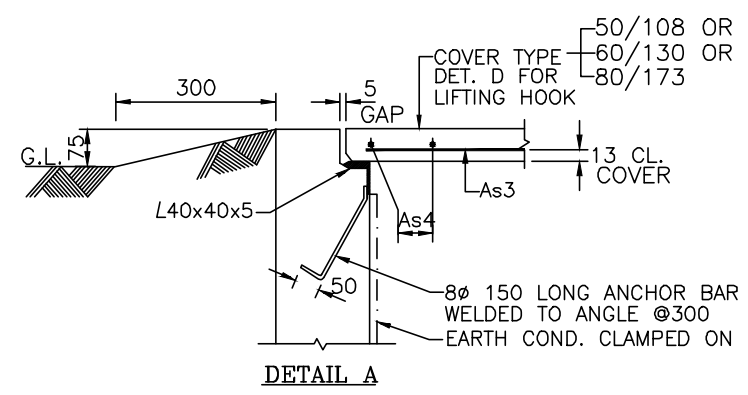
- 1. ALL DIMENSIONS ARE IN MM.
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



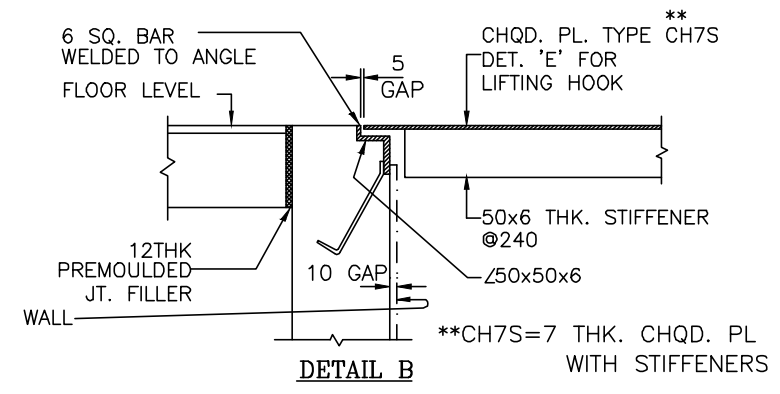
5 Nos.  
150x50x6 THK  
M.S. FLATS  
WITH SPLIT  
ENDS WELDED  
TO PLATE

1300x75x6 THK.  
PL. EMBEDDED  
IN CONC.

50 THK. PCC 1:4:8



DETAIL A

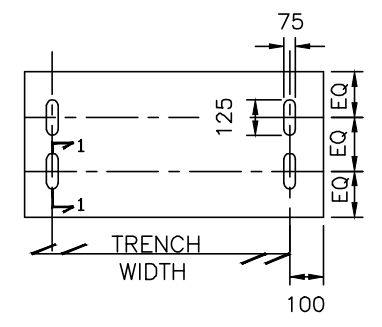


DETAIL B

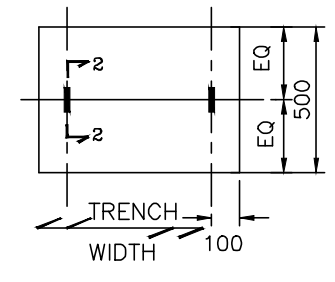
\*

R C COVER TYPE	THICKNESS mm.	As3	As4
50/108	50	7-6ø	10-6ø
60/130	60	6-8ø	8-8ø
80/173	80	5-8ø	8-8ø

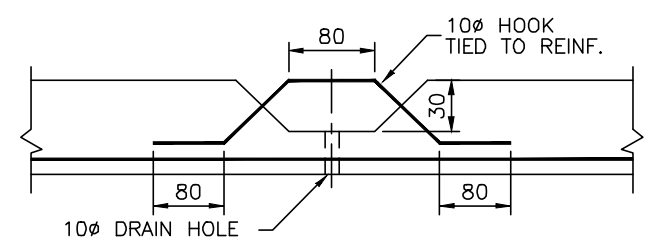
60x130 MEANS 60mm. THK.x130 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



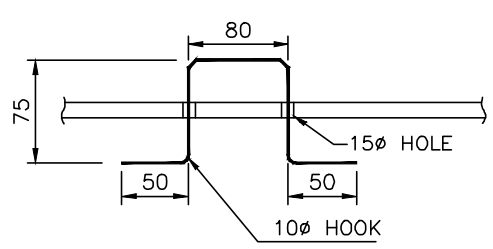
PLAN



PLAN



SECT. 1-1  
DETAIL D



SECT. 2-2  
DETAIL E

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRENCH TYPE - 1415

Size	Scale	Sheet
A3	NTS	19 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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NOTES

1. ALL DIMENSIONS ARE IN MM.
2. BOLT SIZE M10x90 SHALL BE USED FOR TOTAL WEIGHT (INCLUDING CABLES, CABLE TRAY ACCESSORIES) UP TO 200 Kgs/METER AND M10x150 SHALL BE USED FOR TOTAL WEIGHT ABOVE 200 Kgs/METER AND UP TO 500 Kgs/METER.
3. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.
4. WELDING SHALL BE DONE AS PER IS 816: 1969.

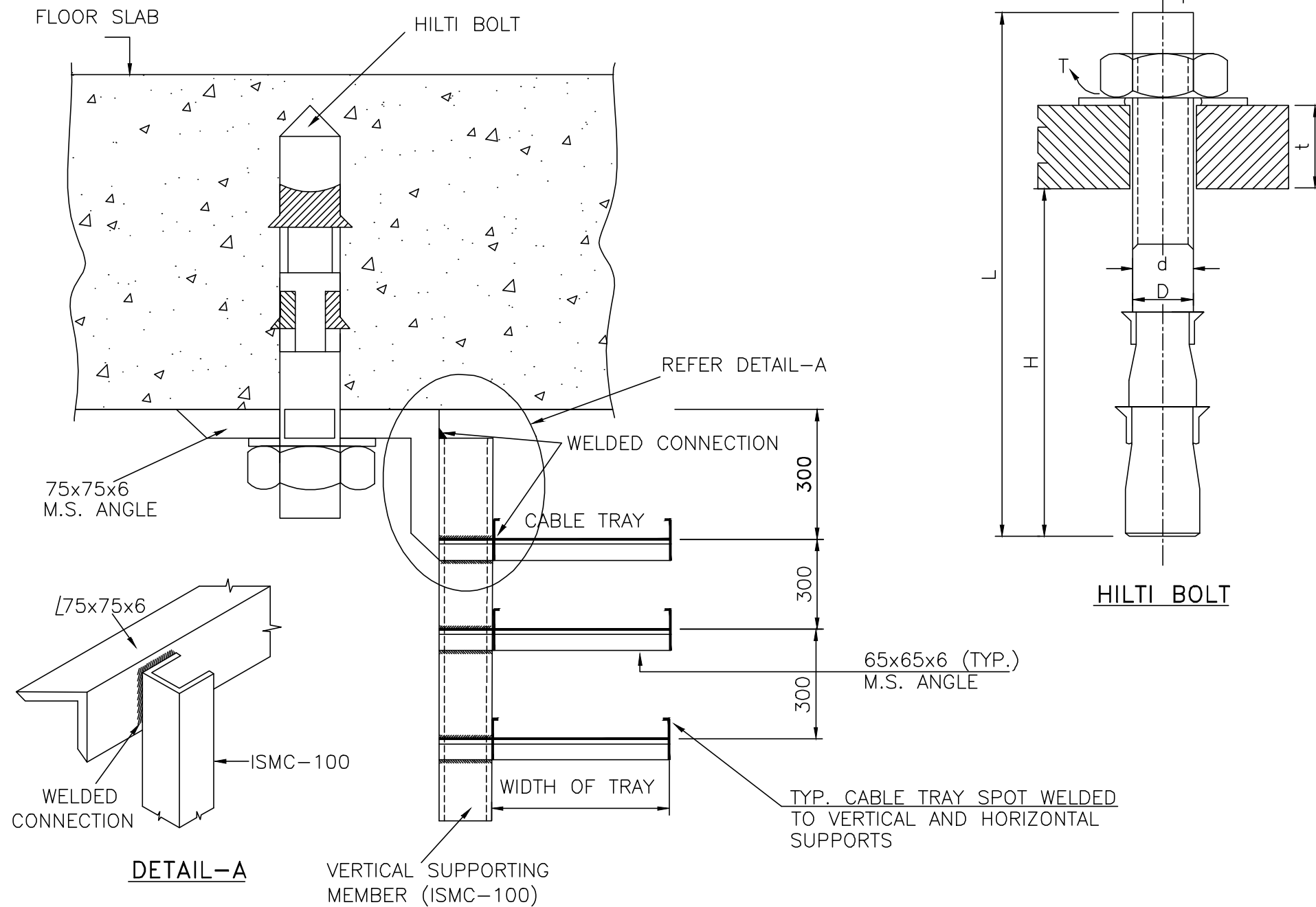
A

B

C

D

E



HILTI BOLT DETAILS

SIZE	BOLT DIA (D) mm	BOLT LENGTH (L) mm	DRILL DIA (d) mm	DEPTH OF HOLE (H) mm	FIXING HEIGHT (t) mm	MAXIMUM PULLOUT LOAD (P) Kg	TORQUE AT SF-4 (T) Kg.f.m.
M10x90	10(3/8")	90	10	45	25	1620	0.81
M10x150	12(1/2")	150	13	80	40	2700	1.62

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

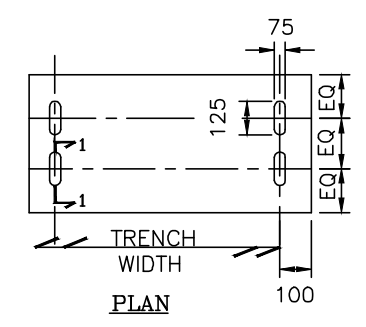
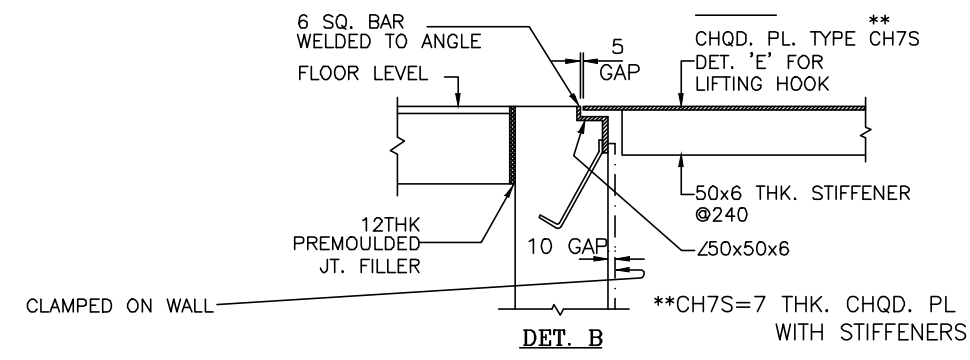
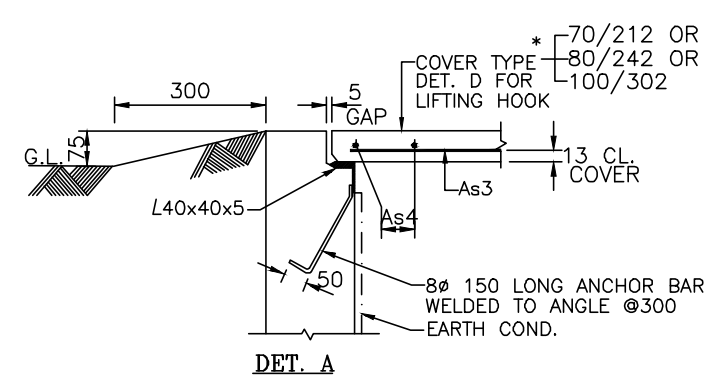
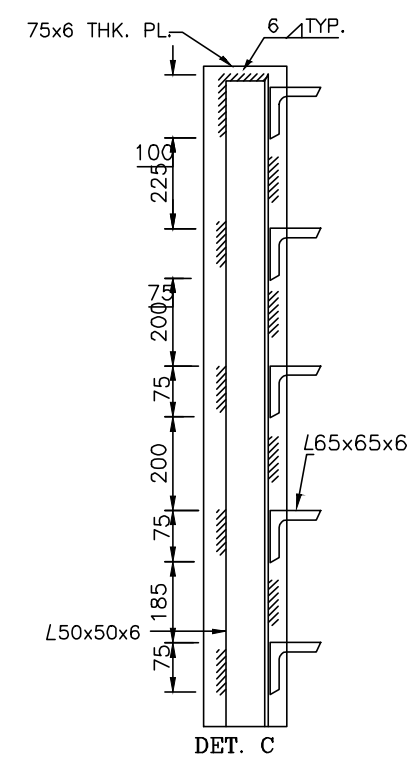
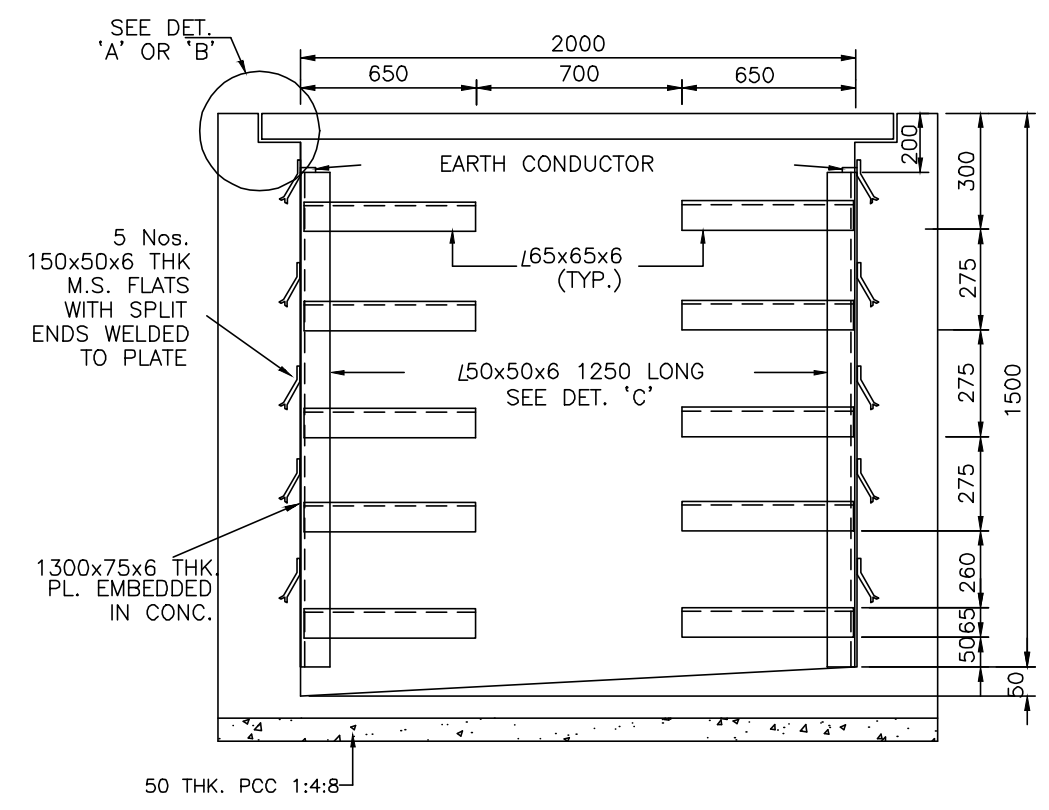
SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMH (TYPE-A2)

Size	Scale	Sheet
A3	NTS	20 of 62
Drawing No.	GGNG-E-20714-3010	
Rev.	0	

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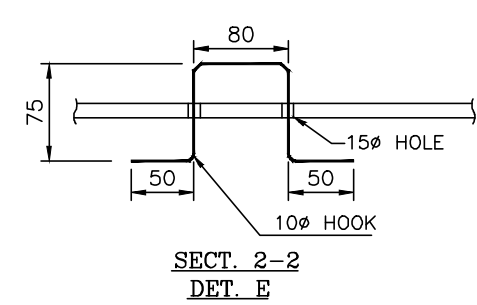
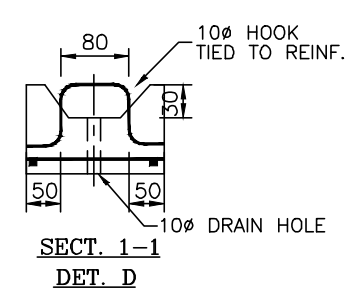
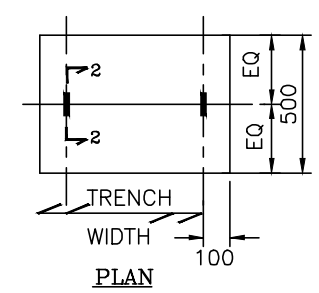
### NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992.



R C COVER TYPE	THICKNESS mm.	As3	As4
70/212	70	5-8 $\phi$	11-8 $\phi$
80/242	80	5-8 $\phi$	11-8 $\phi$
100/302	100	6-8 $\phi$	11-8 $\phi$

\* 70x130 MEANS 70mm. THK.x212 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10.0m LENGTH OF TRENCH.

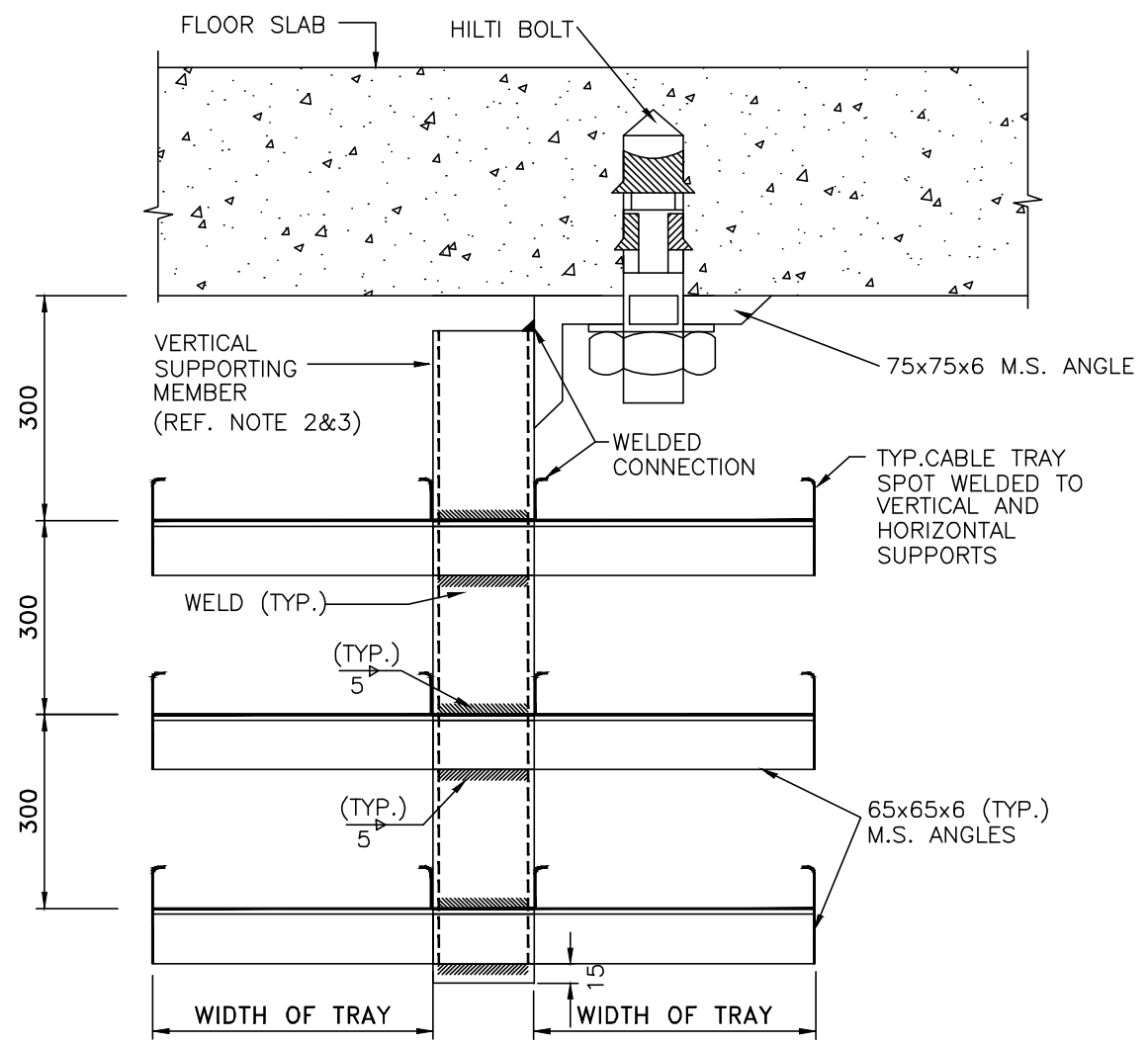


0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS CABLE TRENCH TYPE - 2015						
Size	Scale	Sheet				
A3	NTS	21 of 62				
Drawing No. GGNG-E-20714-3010			Rev. 0			

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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. ISMC 75 UP TO TWO TIERS.
- 3. ISMC 100 FOR MORE THAN TWO TIERS.
- 4. BOLT SIZE M10x90 SHALL BE USED FOR TOTAL WEIGHT (INCLUDING CABLES, CABLE TRAY ACCESSORIES) UP TO 200 Kgs/METER AND M10x150 SHALL BE USED FOR TOTAL WEIGHT ABOVE 200 Kgs/METER AND UP TO 500 Kgs/METER.
- 5. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.
- 6. WELDING SHALL BE DONE AS PER IS 816: 1969.



DRAWING TYPICAL FOR CTMH-T3

HILTI BOLT DETAILS

SIZE	BOLT DIA (D) mm	BOLT LENGTH (L) mm	DRILL DIA (d) mm	DEPTH OF HOLE (H) mm	FIXING HEIGHT (t) mm	MAXIMUM PULLOUT LOAD (P) Kg	TORQUE AT SF-4 (T) Kg.f.m.
M10x90	10(3/8")	90	10	45	25	1620	0.81
M10x150	12(1/2")	150	13	80	40	2700	1.62

SL.NO.	TYPE OF MOUNTING	NO. OF TIERS
1	CTMH-T1	1
2	CTMH-T2	2
3	CTMH-T3	3
4	CTMH-T4	4

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

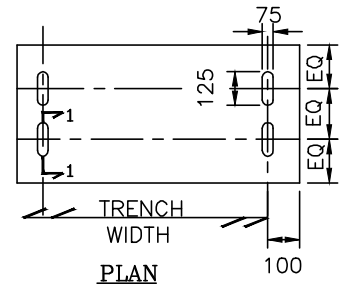
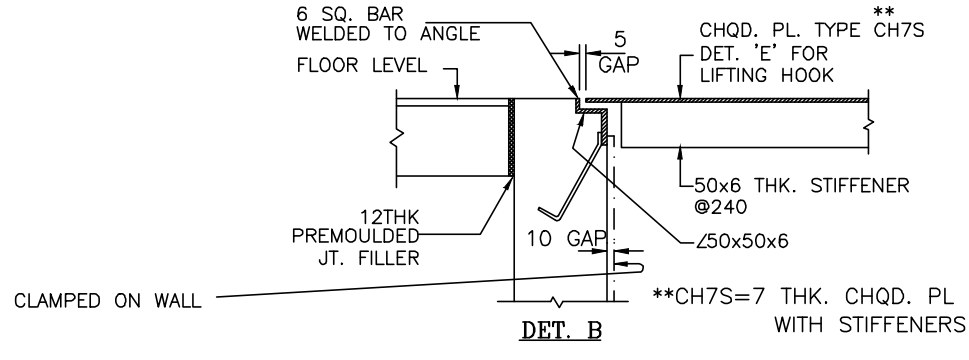
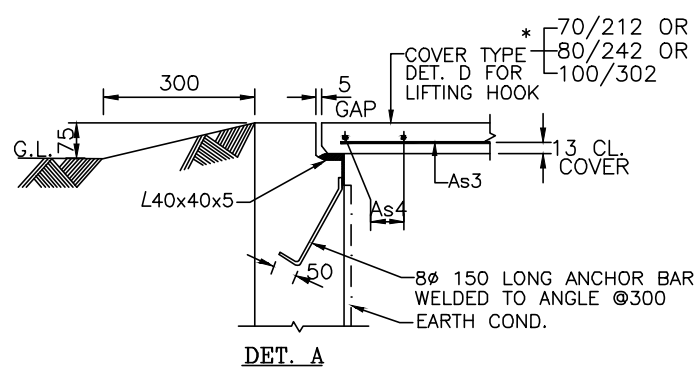
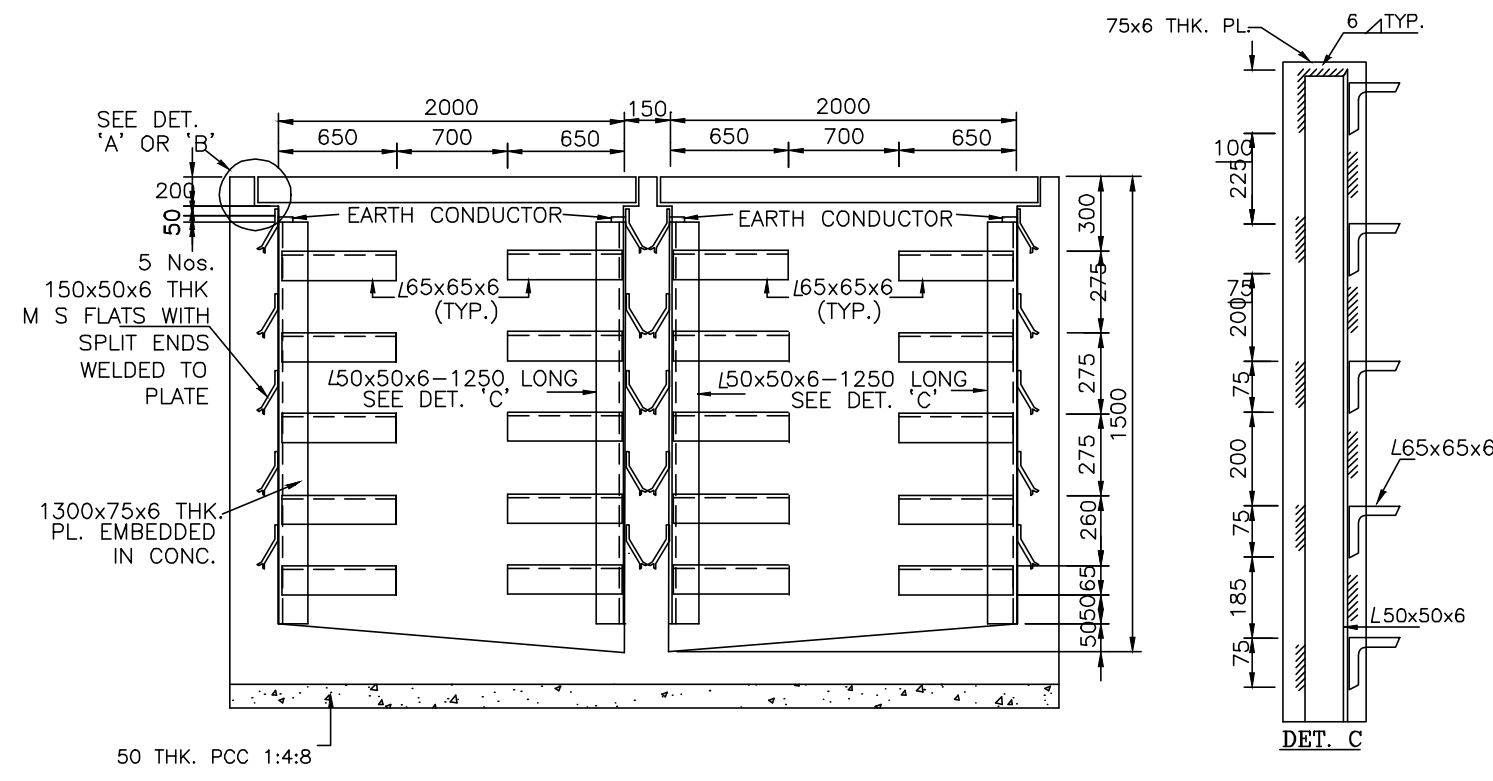
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMH (TYPE-B2)

Size	Scale	Sheet
A3	NTS	22 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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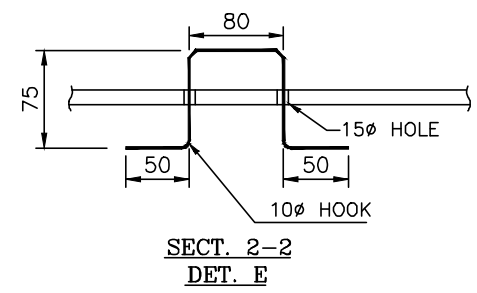
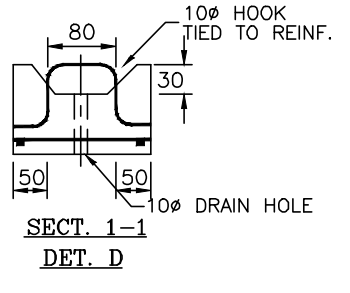
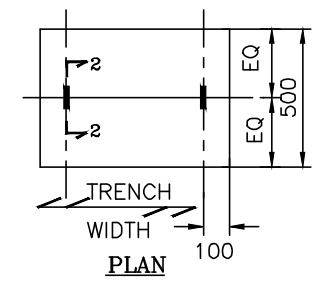
NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992.



R C COVER TYPE	THICKNESS mm.	As3	As4
70/212	70	5-8ø	11-8ø
80/242	80	5-8ø	11-8ø
100/302	100	6-8ø	11-8ø

\* 70x212 MEANS 70mm. THK.x212 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRENCH TYPE 2/2013

Size	Scale	Sheet
A3	NTS	23 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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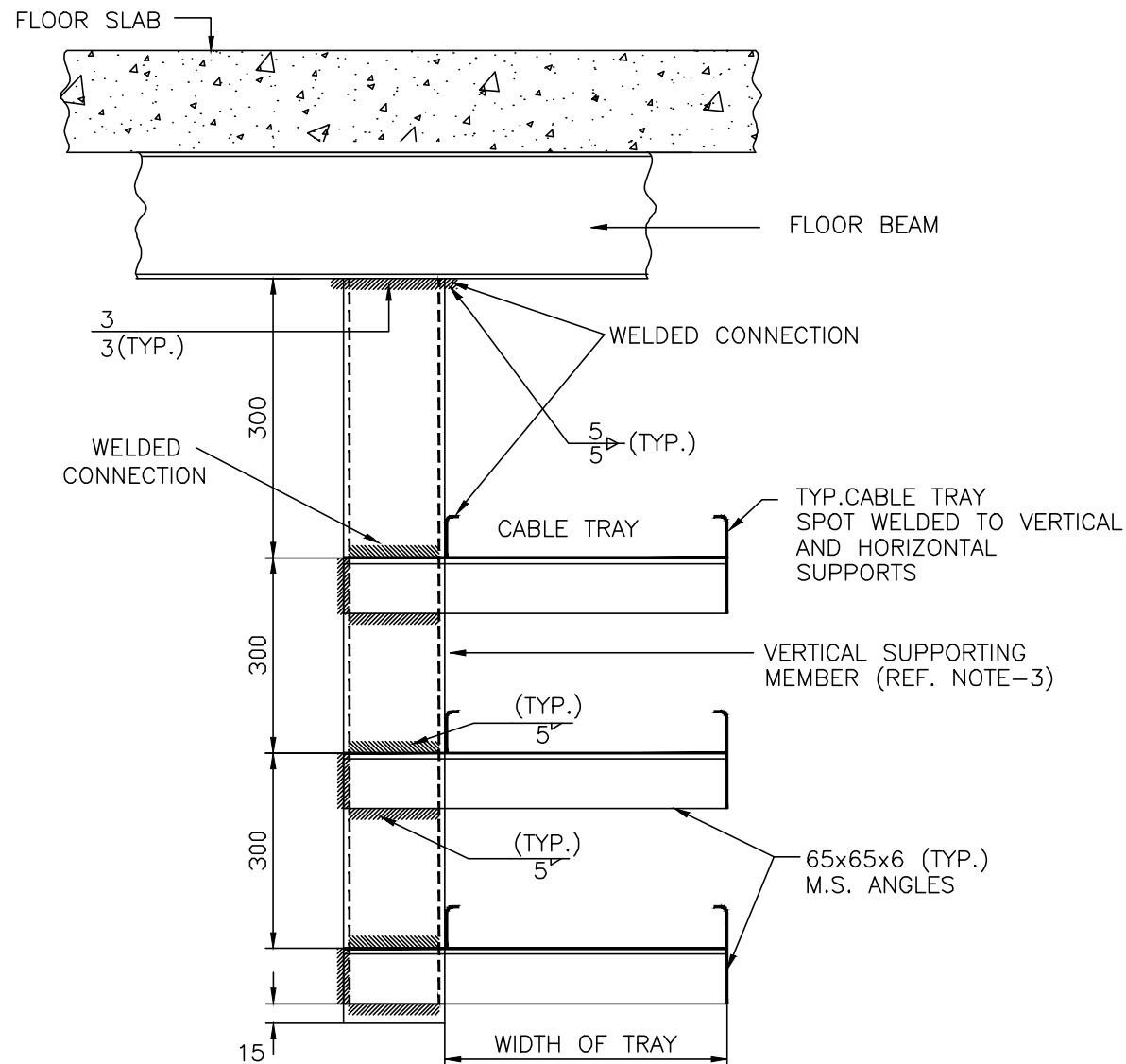
A

B

C

D

E



DRAWING TYPICAL FOR CTMH-T3

SL.NO.	TYPE OF MOUNTING	NO. OF TIERS
1	CTMH-T1	1
2	CTMH-T2	2
3	CTMH-T3	3
4	CTMH-T4	4

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. 75x75x6 M.S. ANGLE FOR ONE TIER.
3. ISMC 100 FOR MORE THAN ONE TIER.
4. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992.
5. WELDING SHALL BE DONE AS PER IS 816: 1969.

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMH (TYPE-C)

Size	Scale	Sheet
A3	NTS	24 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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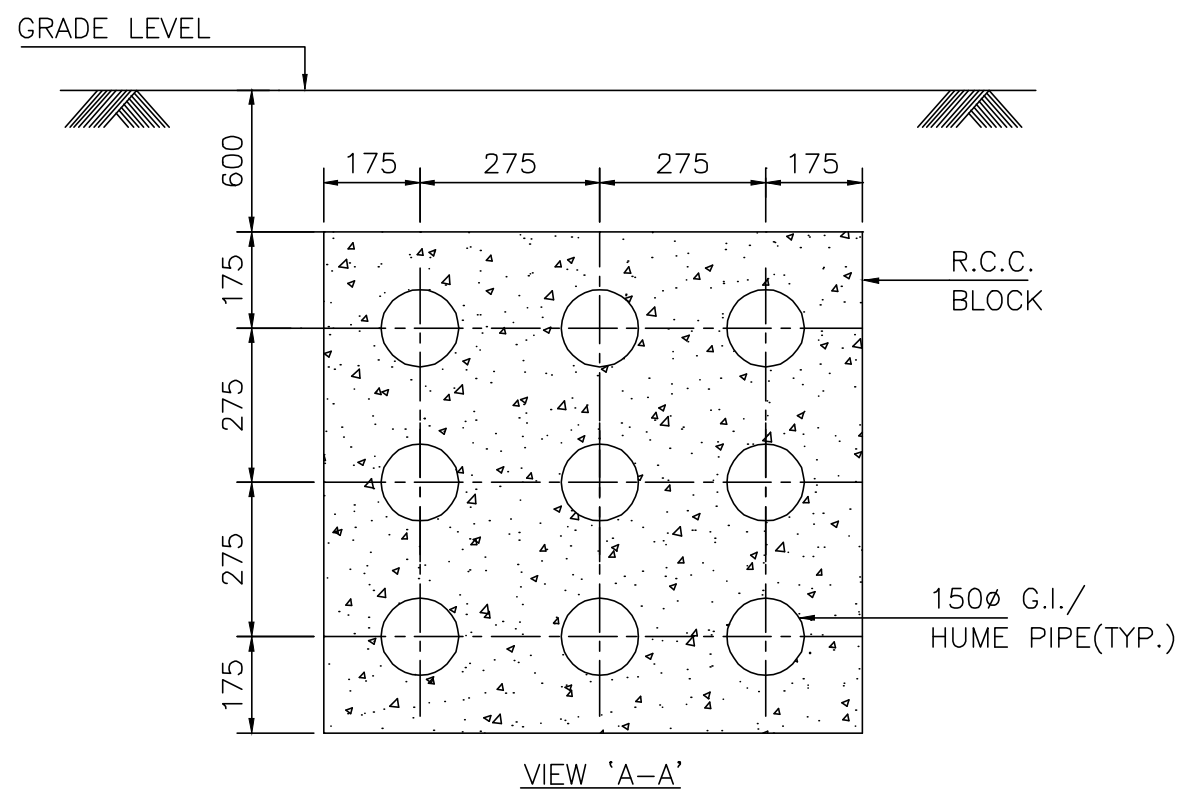
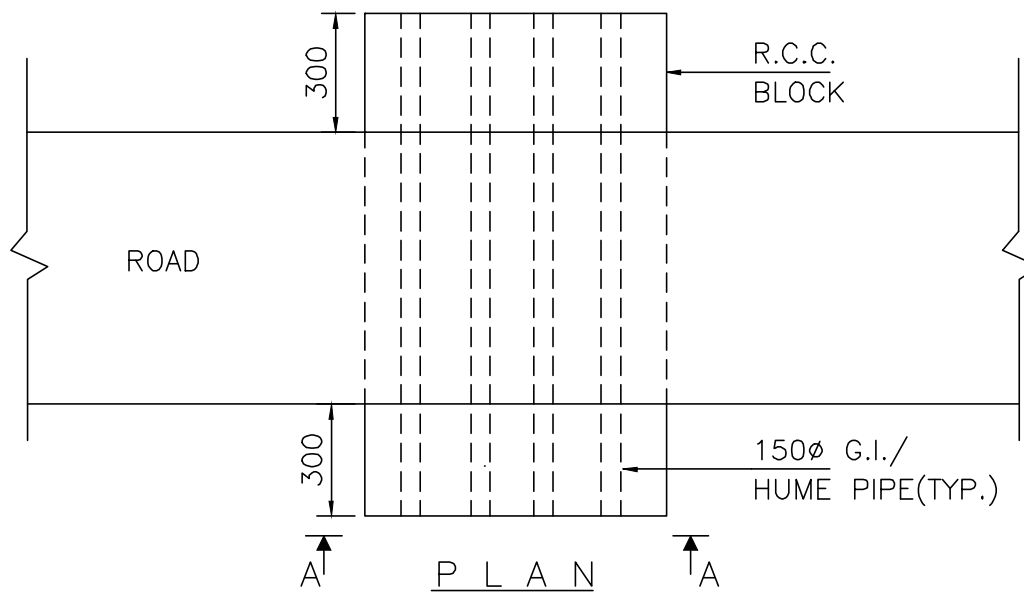
C

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### NOTES

1. ALL DIMENSIONS ARE IN MM.
2. R.C.C. BLOCK SHALL BE PROVIDED AT A MINIMUM DEPTH OF 600mm FROM THE GRADE LEVEL AND SHALL BE EXTENDED BY 300mm ON EITHER SIDES OF THE ROAD UNLESS OTHERWISE SPECIFIED.
3. G.I./HUME PIPE SIZES INDICATED ARE FOR INFORMATION ONLY AND EXACT SIZE AS PER PROJECT REQUIREMENT SHALL BE ADOPTED.



0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

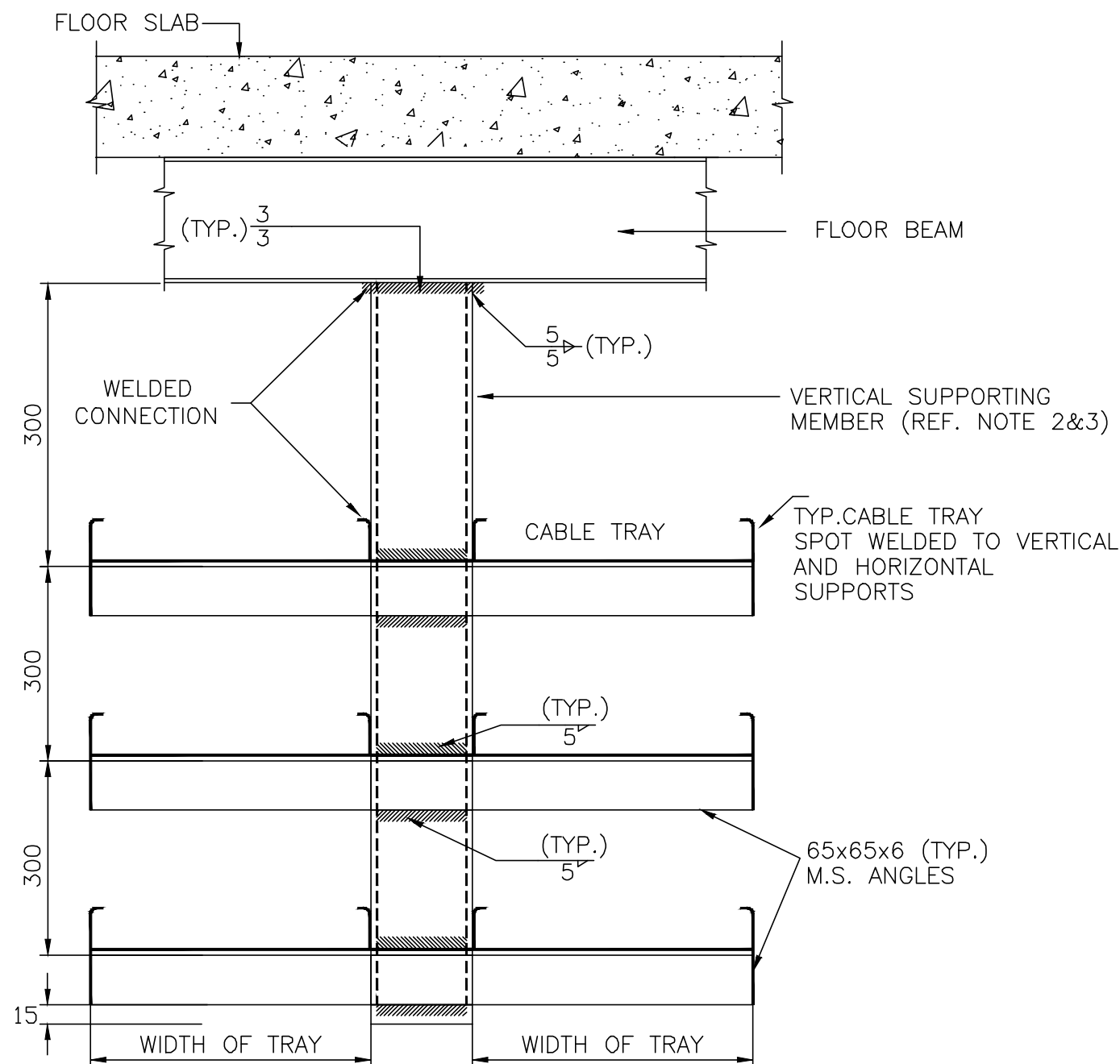
SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE INSTALLATION PRACTICE BELOW/CROSSING ROAD

Size	Scale	Sheet
A3	NTS	25 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. 75x75x6 M.S. ANGLE FOR ONE TIER.
- 3. ISMC 100 FOR MORE THAN TWO TIERS.
- 4. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.
- 5. WELDING SHALL BE DONE AS PER IS 816: 1969.



DRAWING TYPICAL FOR CTMH-T3

SR.NO.	TYPE OF MOUNTING	NO. OF TIERS
1	CTMH-T1	1
2	CTMH-T2	2
3	CTMH-T3	3
4	CTMH-T4	4

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMH (TYPE-D)

Size	Scale	Sheet
A3	NTS	26 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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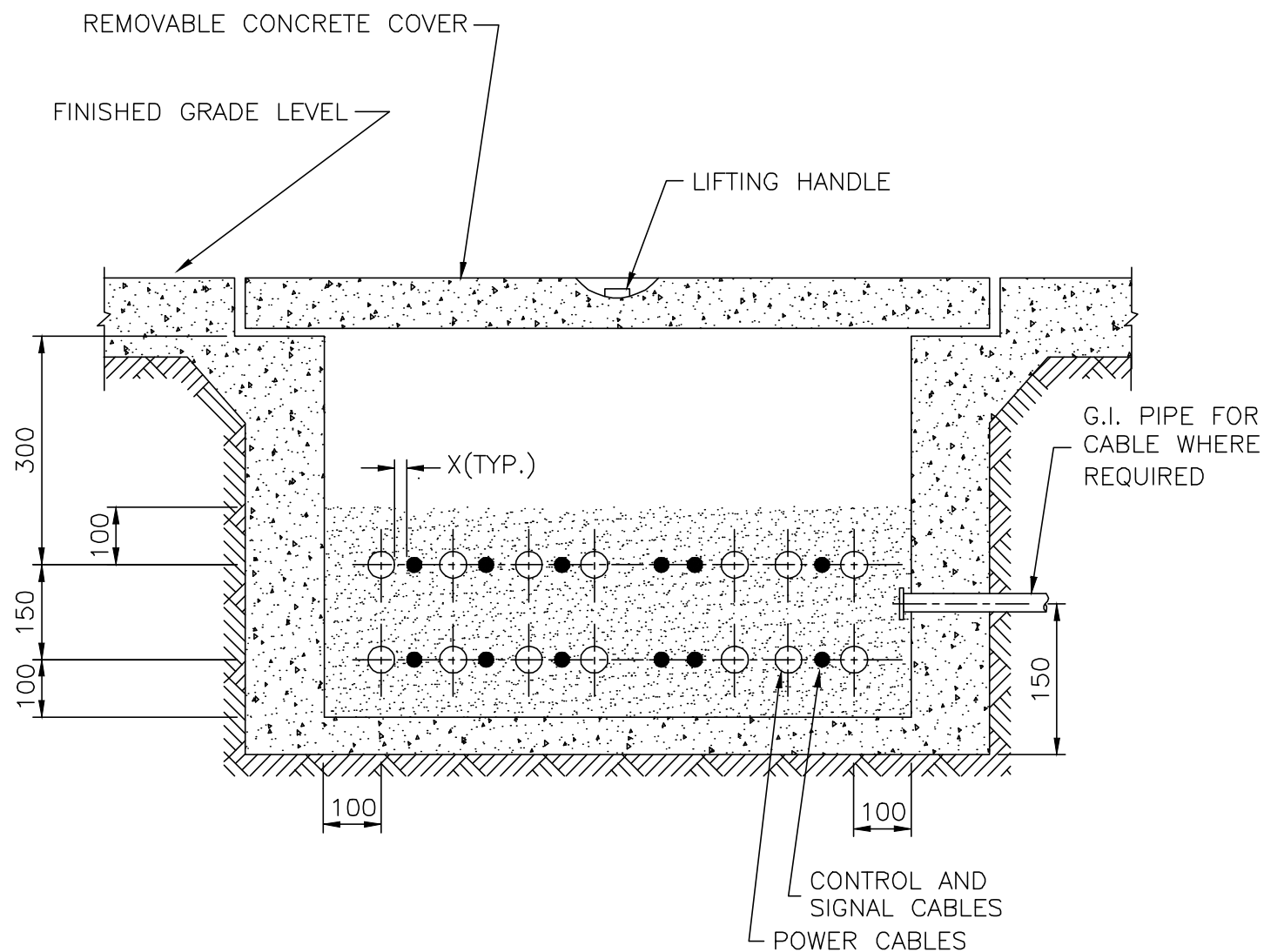
C

D

E

NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. LEAVE SPACE FOR LATER ADDITION OF AT LEAST 2 CABLES AND 15% AVERAGE SPARE SPACE REGARDLESS OF FUTURE EXTENSION.



X - OVERAL DIAMETER OF THE BIGGER OF THE TWO CABLES

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLES DIRECTLY BURRIED IN TRENCH (IN PAVED AREA)

Size	Scale	Sheet
A3	NTS	27 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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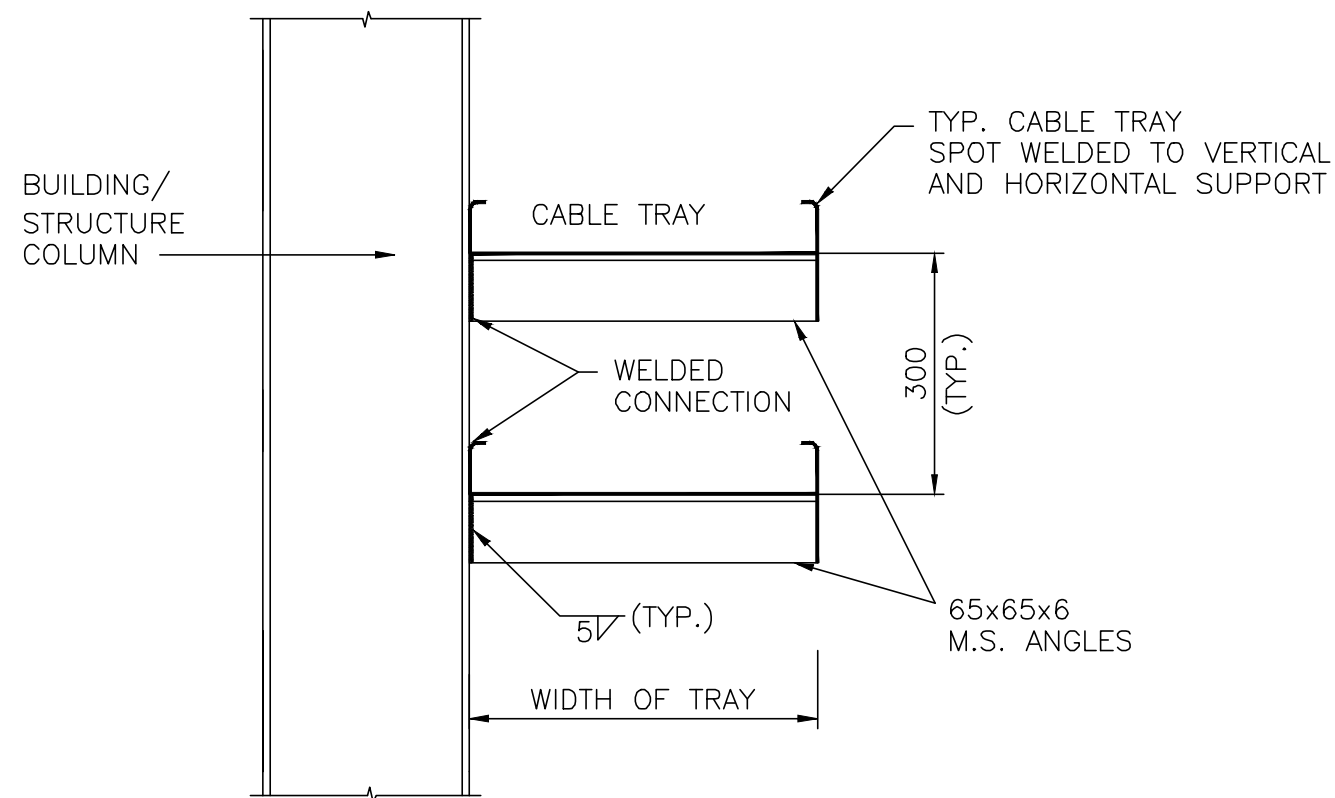
A

B

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E



DRAWING TYPICAL FOR CTMH-T2

SR.NO.	TYPE OF MOUNTING	NO. OF TIERS
1	CTMH-T1	1
2	CTMH-T2	2
3	CTMH-T3	3
4	CTMH-T4	4

NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.
- 3. WELDING SHALL BE DONE AS PER IS 816: 1969.

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

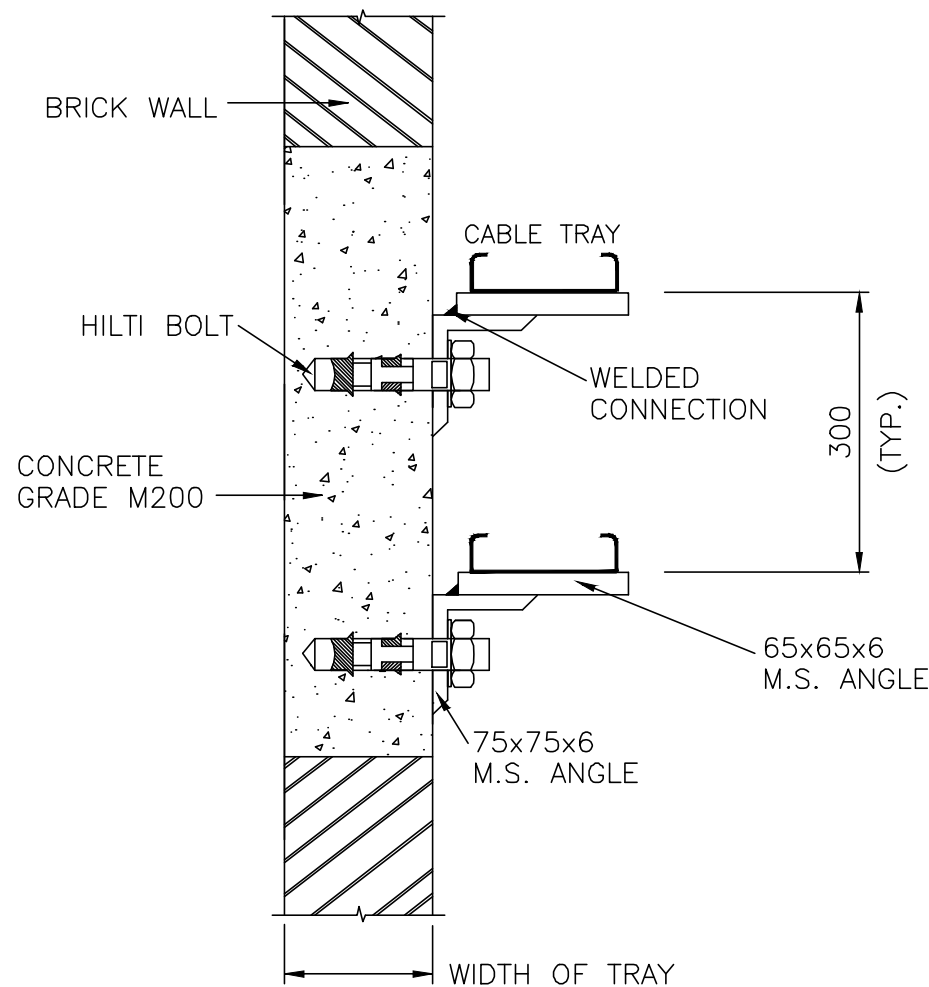
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMH (TYPE-E)

Size	Scale	Sheet
A3	NTS	28 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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NOTES

1. ALL DIMENSIONS ARE IN MM.
2. BOLT SIZE M10x90 SHALL BE USED FOR TOTAL WEIGHT (INCLUDING CABLES, CABLE TRAY ACCESSORIES) UP TO 200 Kgs/METER AND M10x150 SHALL BE USED FOR TOTAL WEIGHT ABOVE 200 Kgs/METER AND UP TO 500 Kgs/METER.
3. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.
4. WELDING SHALL BE DONE AS PER IS 816: 1969.



DRAWING TYPICAL FOR CTMH-T2

HILTI BOLT DETAILS

SIZE	BOLT DIA (D) mm	BOLT LENGTH (L) mm	DRILL DIA (d) mm	DEPTH OF HOLE (H) mm	FIXING HEIGHT (t) mm	MAXIMUM PULLOUT LOAD (P) Kg	TORQUE AT SF-4 (T) Kg.f.m.
M10x90	10(3/8")	90	10	45	25	1620	0.81
M10x150	12(1/2")	150	13	80	40	2700	1.62

SL. NO.	TYPE OF MOUNTING	NO. OF TIERS
1	CTMH-T1	1
2	CTMH-T2	2

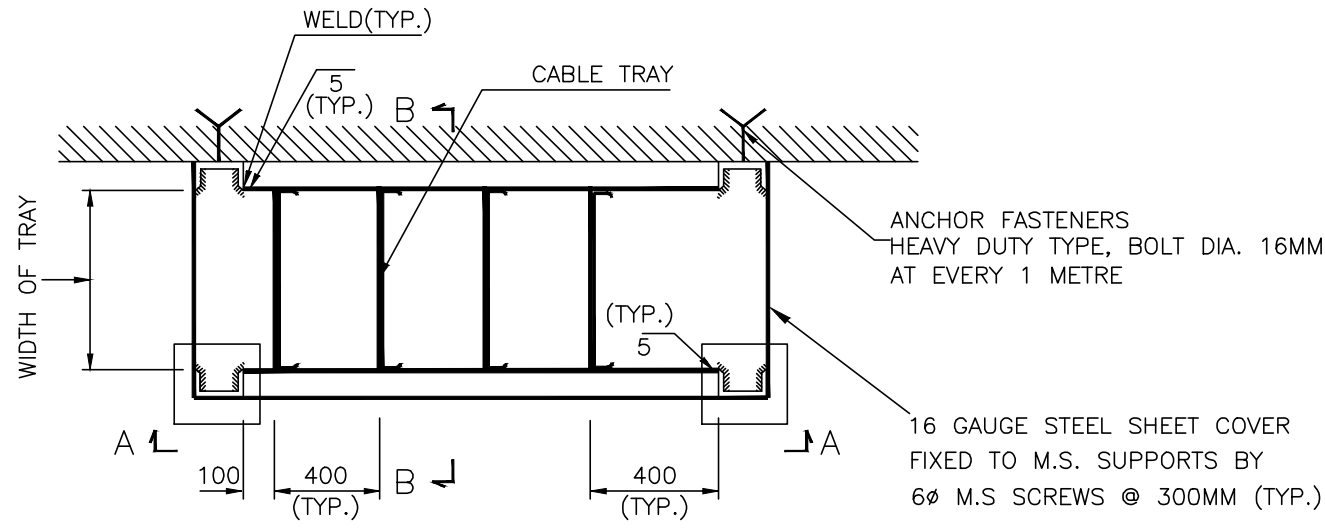
0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMH (TYPE-F2)

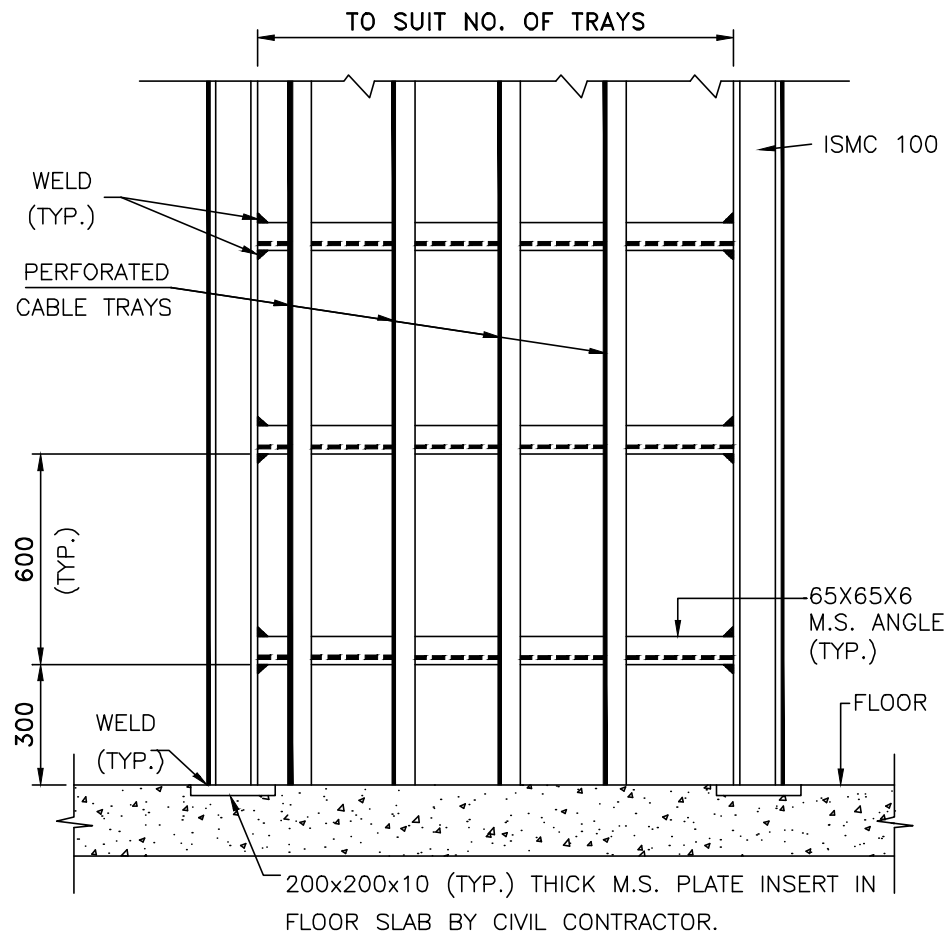
Size	Scale	Sheet
A3	NTS	29 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

NOTES

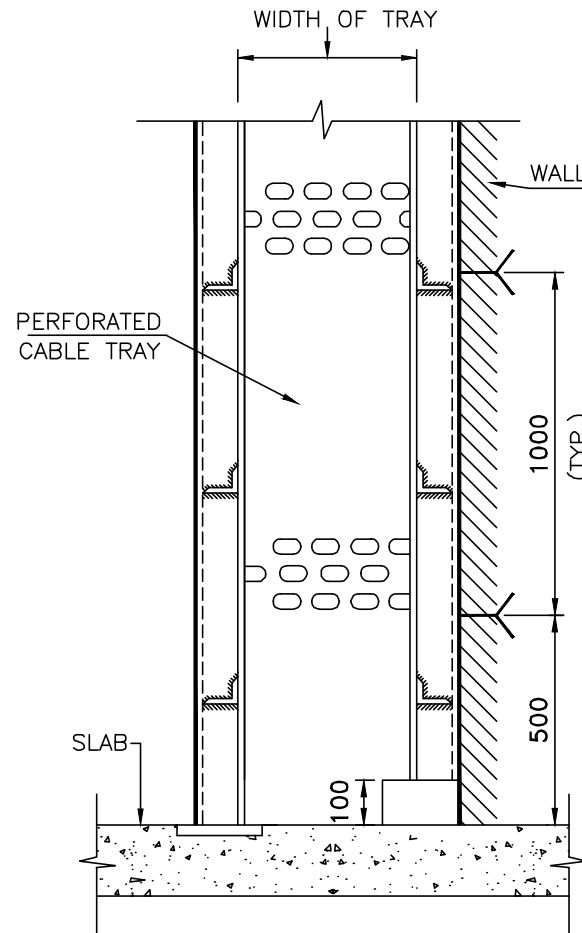
- 1. ALL DIMENSIONS ARE IN MM.
- 2. NUMBER OF TRAYS WILL BE AS PER REQUIREMENT.
- 3. FOR OUTDOOR USE, THE VERTICAL SUPPORTS TO BE SUITABLY GROUTED IN CONCRETE FOUNDATION OR WELDED TO AVAILABLE STEEL STRUCTURES.
- 4. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.
- 5. WELDING SHALL BE DONE AS PER IS 816: 1969.



PLAN



SECTION A-A



SECTION B-B

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMV (TYPE-A)

Size	Scale	Sheet
A3	NTS	30 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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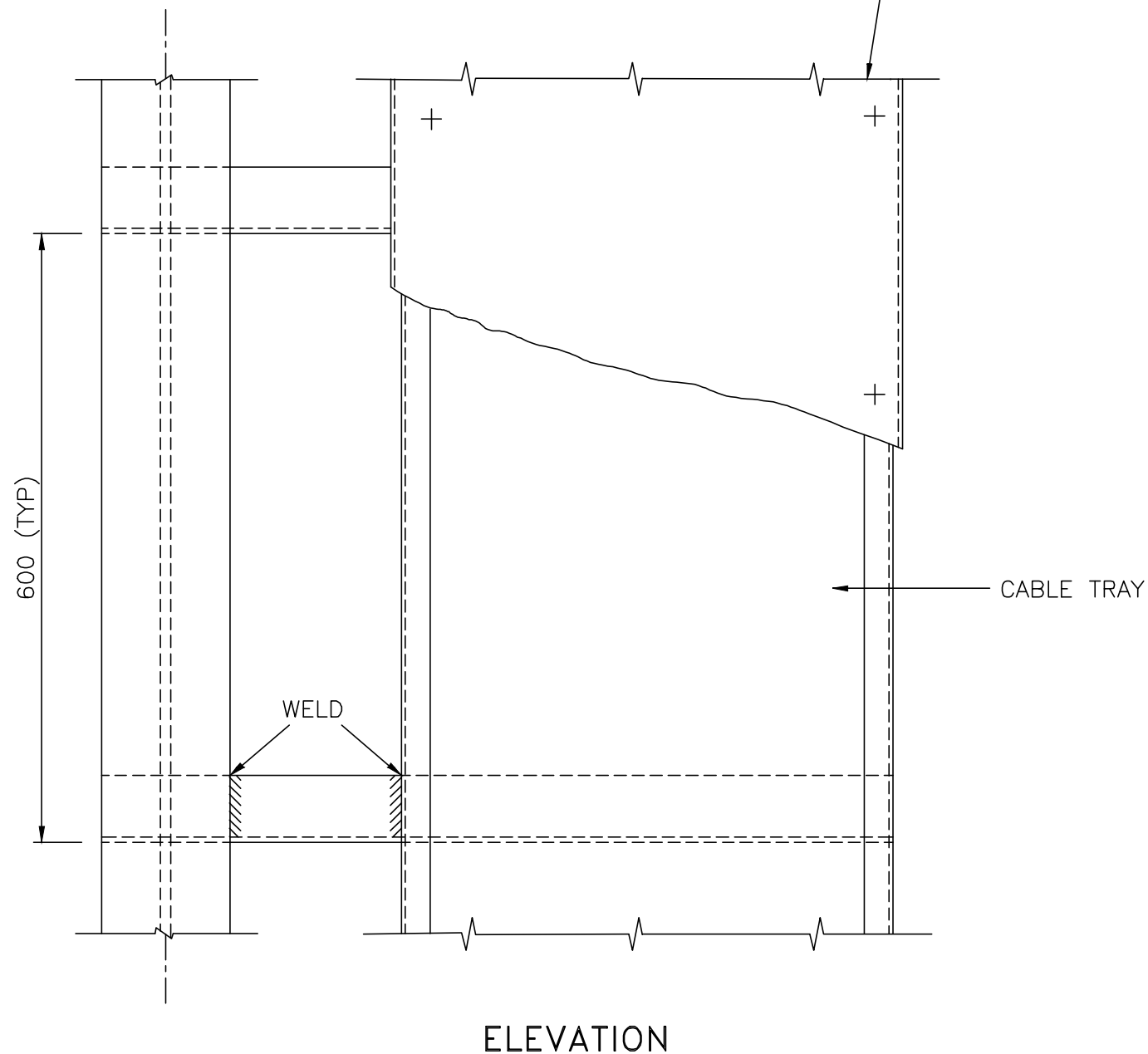
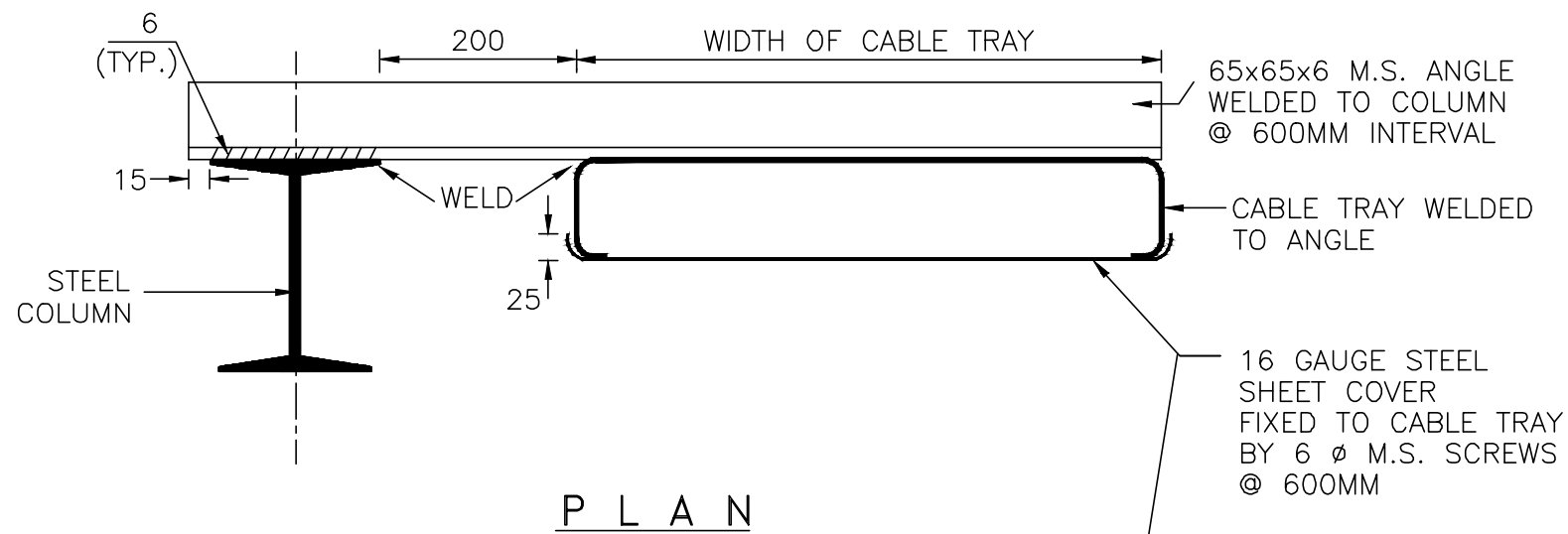
A

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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

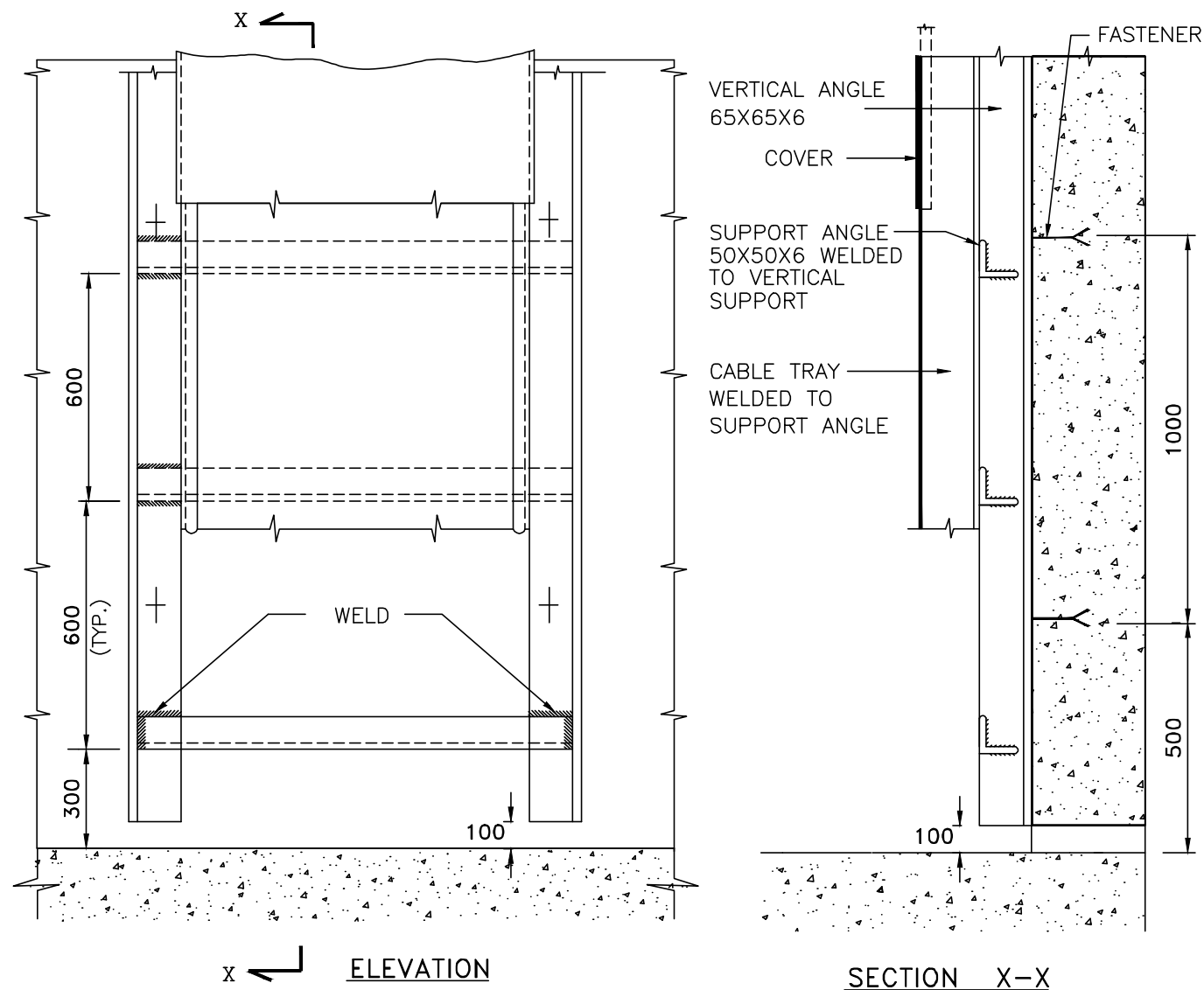
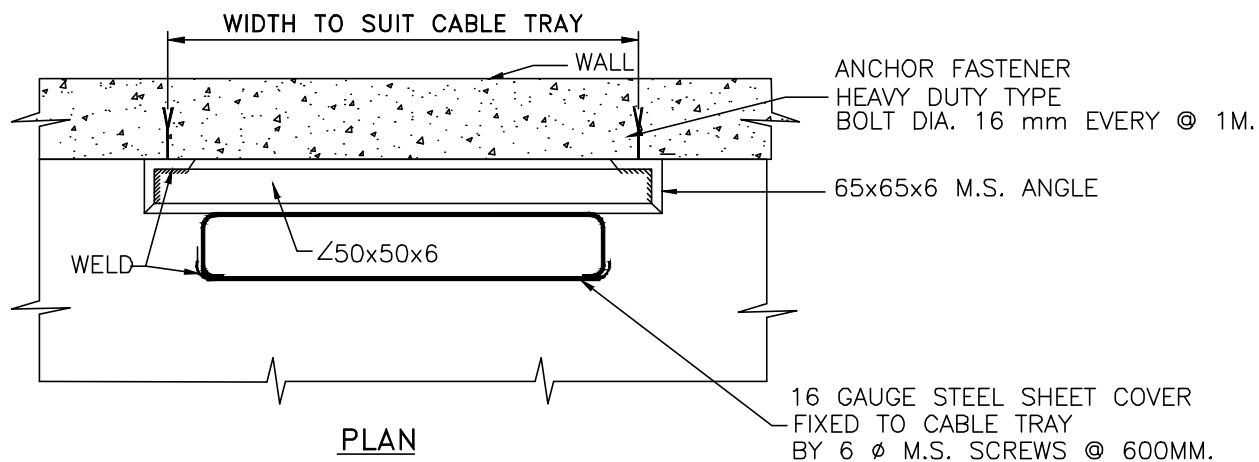
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMV (TYPE-B)

Size	Scale	Sheet
A3	NTS	31 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. NUMBER OF TRAYS WILL BE AS PER REQUIREMENT.
- 3. FOR OUTDOOR USE, THE VERTICAL SUPPORTS TO BE SUITABLY GROUTED IN CONCRETE FOUNDATION OR WELDED TO AVAILABLE STEEL STRUCTURES.
- 4. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.
- 5. WELDING SHALL BE DONE AS PER IS 816: 1969.



0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMV (TYPE-C)

Size	Scale	Sheet
A3	NTS	32 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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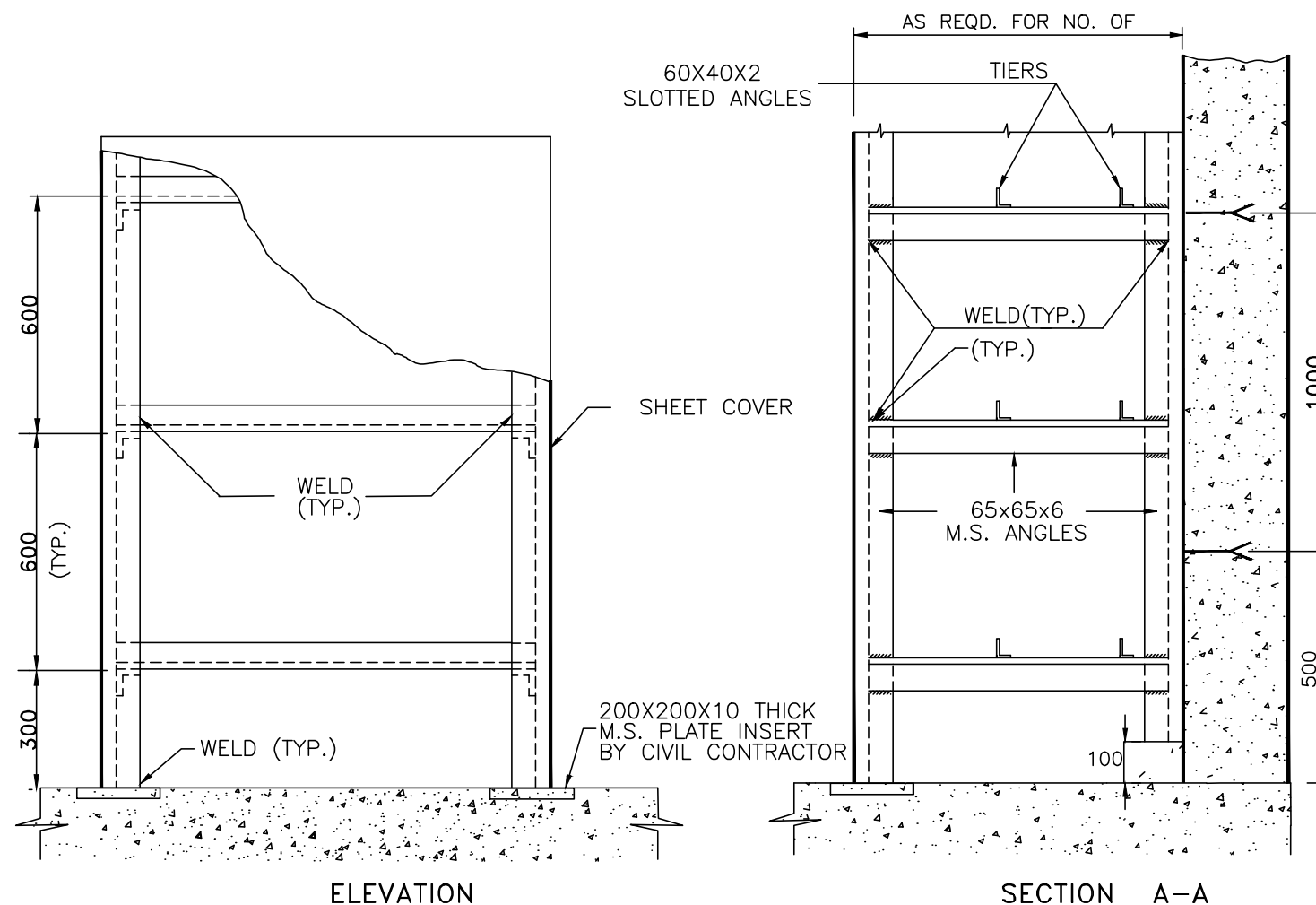
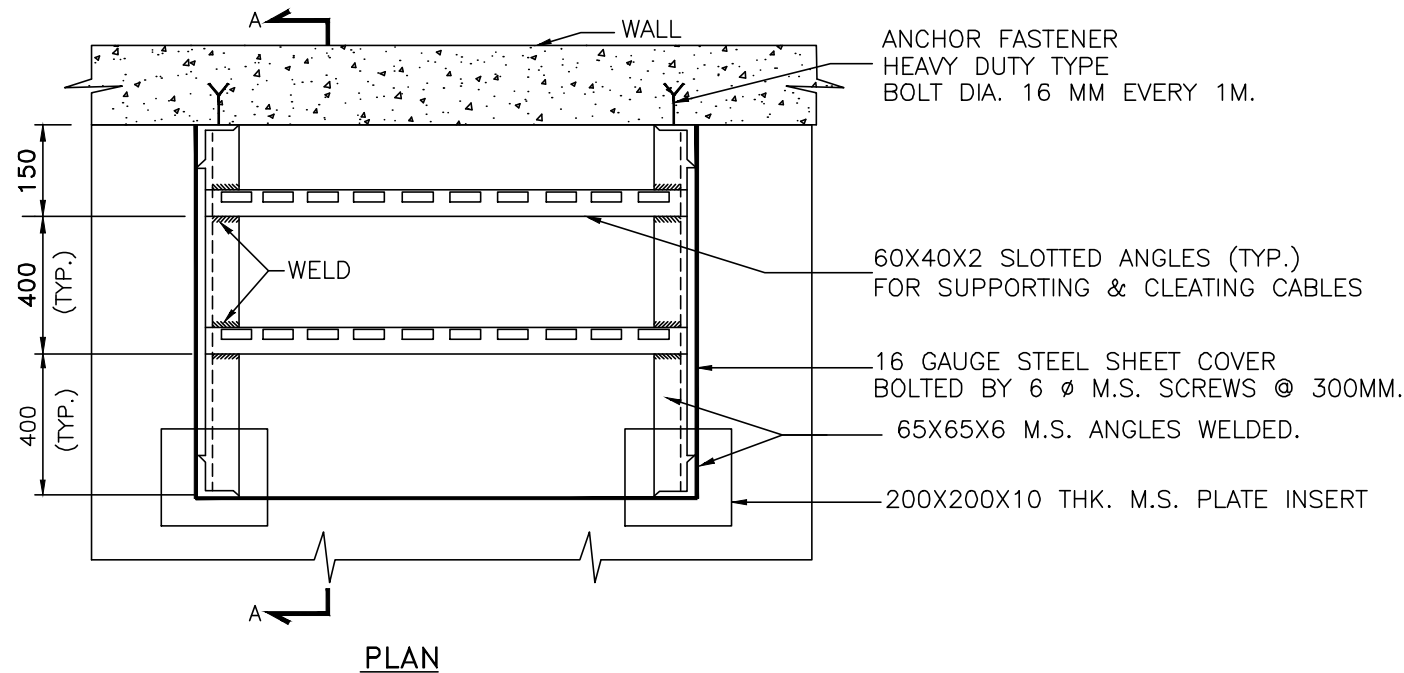
C

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### NOTES

1. ALL DIMENSIONS ARE IN MM.
2. NUMBER OF TRAYS WILL BE AS PER REQUIREMENT.
3. FOR OUTDOOR USE, THE VERTICAL SUPPORTS TO BE SUITABLY GROUTED IN CONCRETE FOUNDATION OR WELDED TO AVAILABLE STEEL STRUCTURES.
4. STRUCTURAL STEEL SHALL BE AS PER IS 2062: 1992.
5. WELDING SHALL BE DONE AS PER IS 816: 1969.



0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAY MOUNTING ARRANGEMENT CTMV (TYPE-D)

Size	Scale	Sheet
A3	NTS	33 of 62
Drawing No.	GGNG-E-20714-3010	
Rev.	0	

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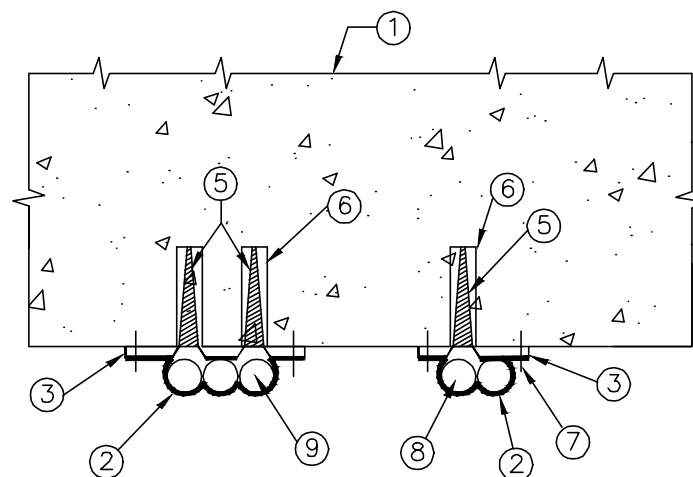
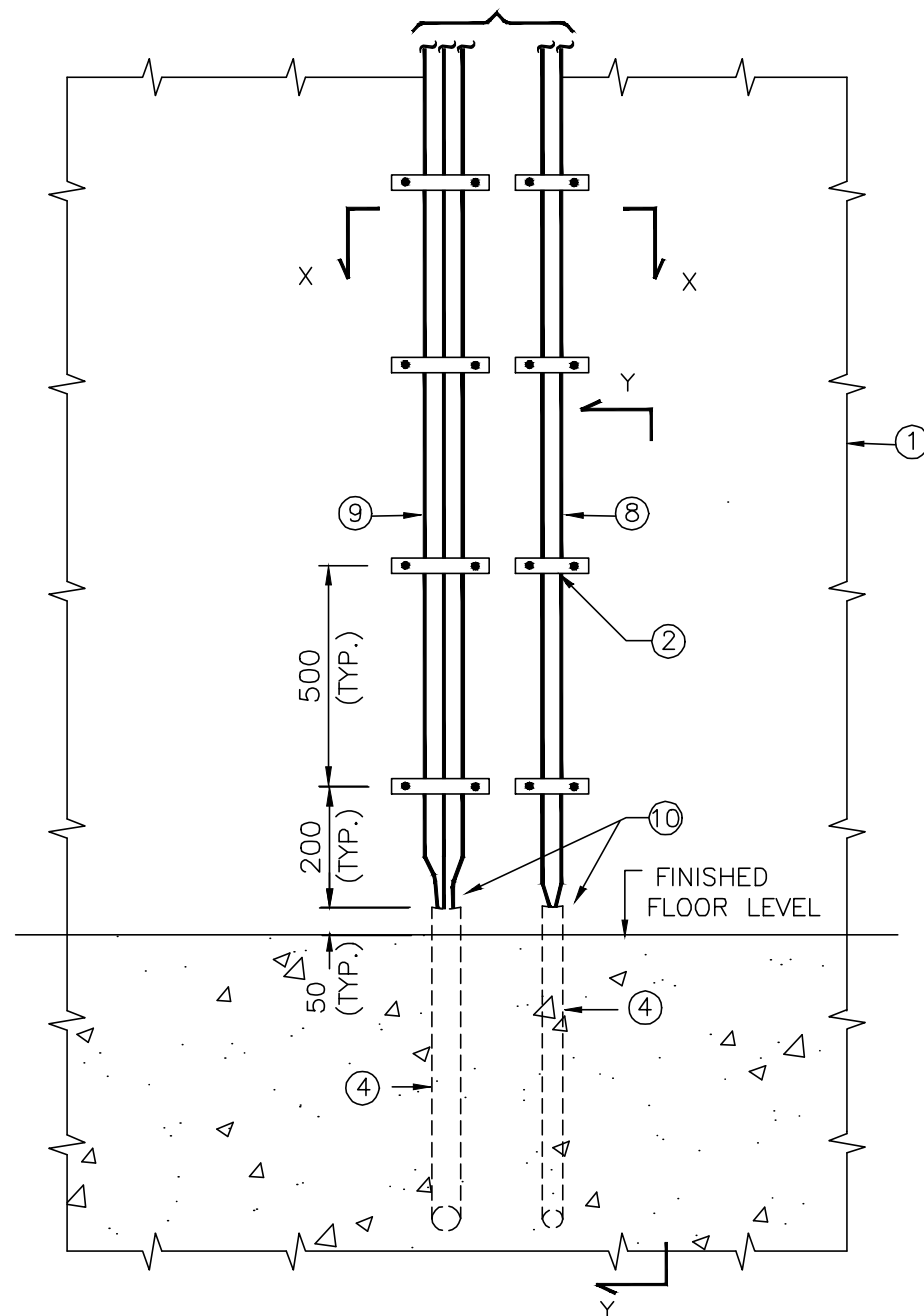
B

C

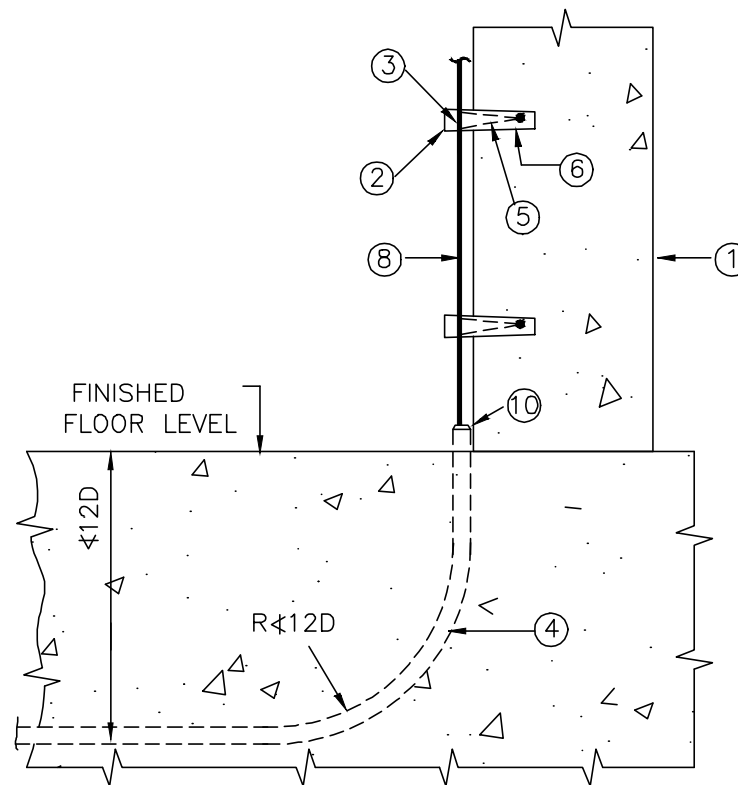
D

E

TO CABLE TRAY/EQUIPMENT



SECTION X-X



SECTION Y-Y

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. MAXIMUM 3 No. CABLES SHALL BE CLAMPED WITH ONE SADDLE. SEPARATE SADDLE SHALL BE USED FOR MORE THAN 3 CABLES.
3. POWER AND CONTROL CABLES SHALL BE CLAMPED SEPARATELY.
4. THE CONDUIT SHALL BE EXTENDED UP TO 2500 ABOVE THE FLOOR LEVEL IN CASE OF UNARMORED CABLES.

LEGEND

- ① WALL/RCC STRUCTURE
- ② G.I. SADDLE
- ③ G.I. SPACER
- ④ G.I. CONDUIT
- ⑤ 6 $\phi$ , 35 LONG G.I. SCREW
- ⑥ RAWL PLUG
- ⑦ 3 $\phi$ , 5 LONG G.I. M/C SCREW
- ⑧ CONTROL CABLE
- ⑨ POWER CABLE (LESS THAN 3Cx70MM<sup>2</sup>)
- ⑩ WATER PROOF SEALING
- D - NORMAL DIAMETER OF CONDUIT

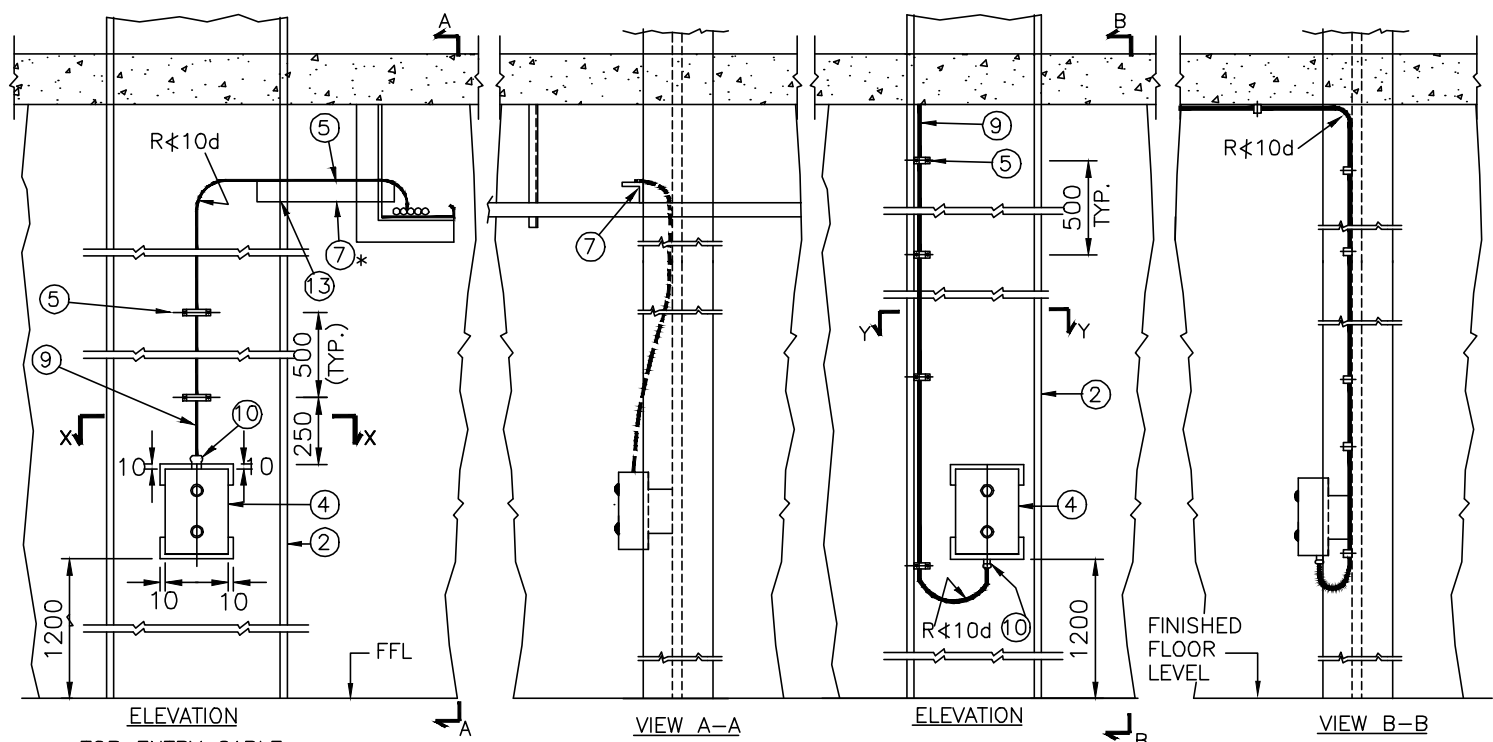
0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
 CABLE INSTALLATION PRACTICE ALONG WALL/RCC  
 STRUCTURE (CABLE SIZE <3CX70mm)

Size	Scale	Sheet
A3	NTS	34 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

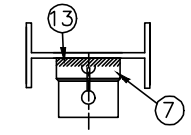
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NOTES



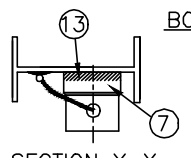
ELEVATION TOP ENTRY CABLE

(ONLY FOR INDOOR & WHEN THERE IS NO LIKELIHOOD OF ANY LIQUID SPILLAGE)



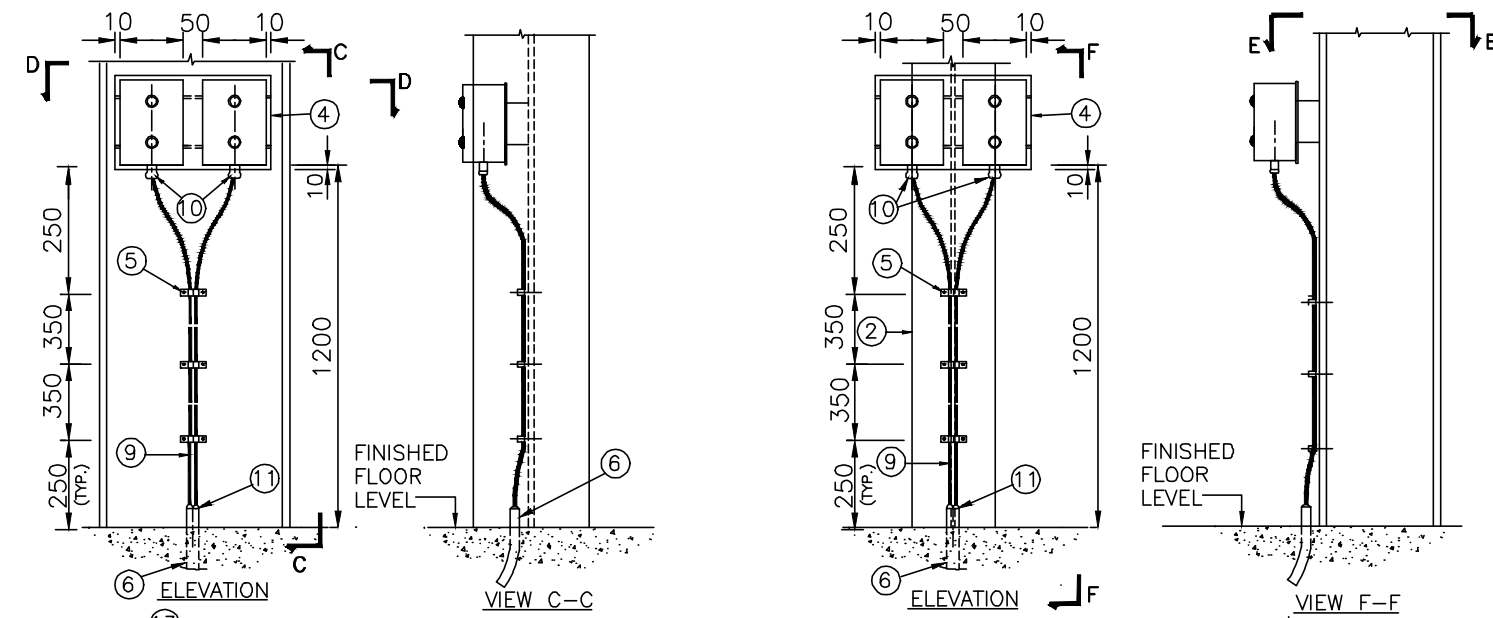
SECTION X-X

ELEVATION BOTTOM ENTRY CABLE



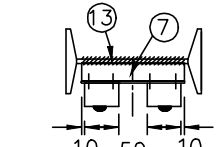
SECTION Y-Y

\* ITEM 7 TO BE WELDED TO COLUMN AND CABLE TRAY



ELEVATION

FINISHED FLOOR LEVEL

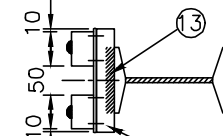


VIEW D-D

VIEW C-C

ELEVATION

FINISHED FLOOR LEVEL



VIEW E-E

TYPICAL TWO P.B. STATIONS

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
 INSTALLATION OF P.B. STATION AND CABLE  
 (MOUNTED OF STEEL COLUMAN)

Size	Scale	Sheet
A3	NTS	35 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

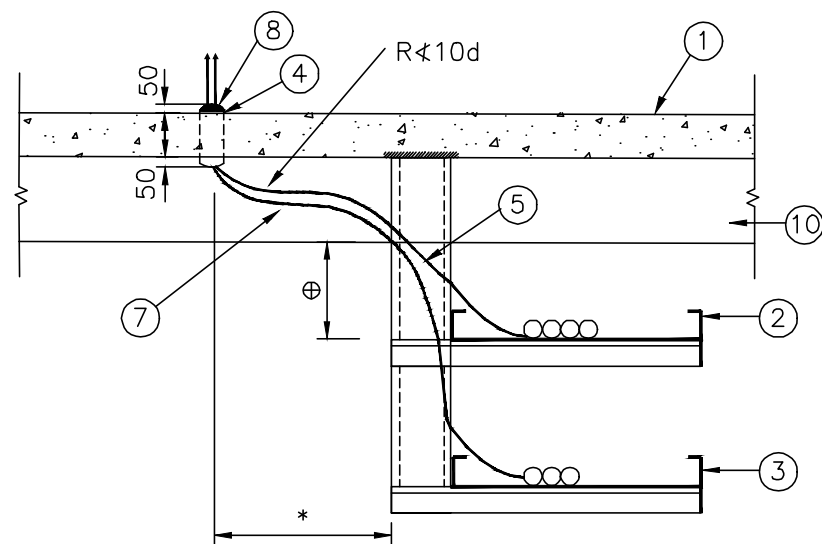
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NOTES

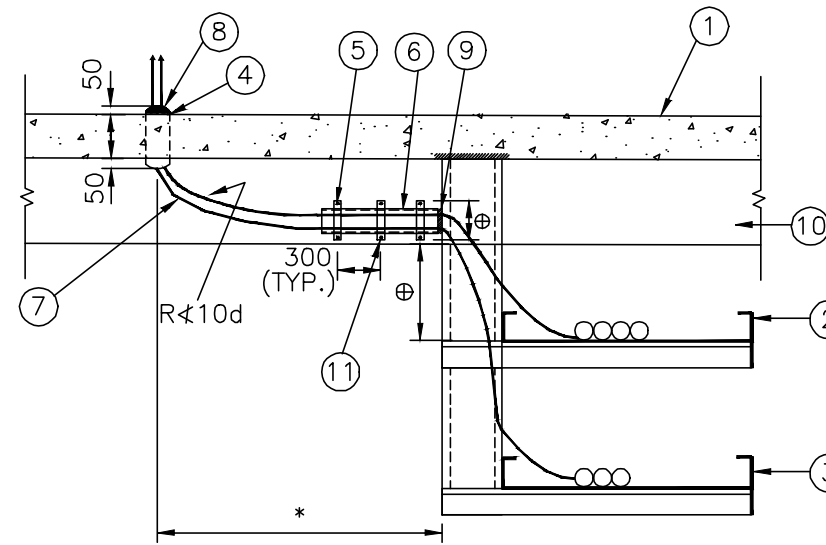
1. ALL DIMENSIONS ARE IN MM.
2. POWER AND CONTROL CABLES SHALL BE CLAMPED SEPERATELY.
3. G.I. PIPE INSERT SHALL BE INSTALLED NEAR THE EQUIPMENT SUCH THAT THE CABLE COULD BE RAISED STRAIGHT TO THE EQUIPMENT CABLE GLAND /BOX WITHOUT ANT OFFSET.
4. ALL EMBEDDED PIPE INSERTS SHALL HAVE MINIMUM 50 LONG THREADED PROJECTION BEYOND THE EMBEDDED PART.
5. THE DIMENSION MARKED THUS  $\oplus$  SHALL BE DECIDED AT SITE. (PREFERABLY THIS SHALL NOT EXCEED 500mm).
7. CABLE SHALL BE CLAMPED SUBJECT TO MINIMUM BENDING RADIUS.
8. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992.
9. WELDING SHALL BE DONE AS PER IS 816:1969.

LEGEND

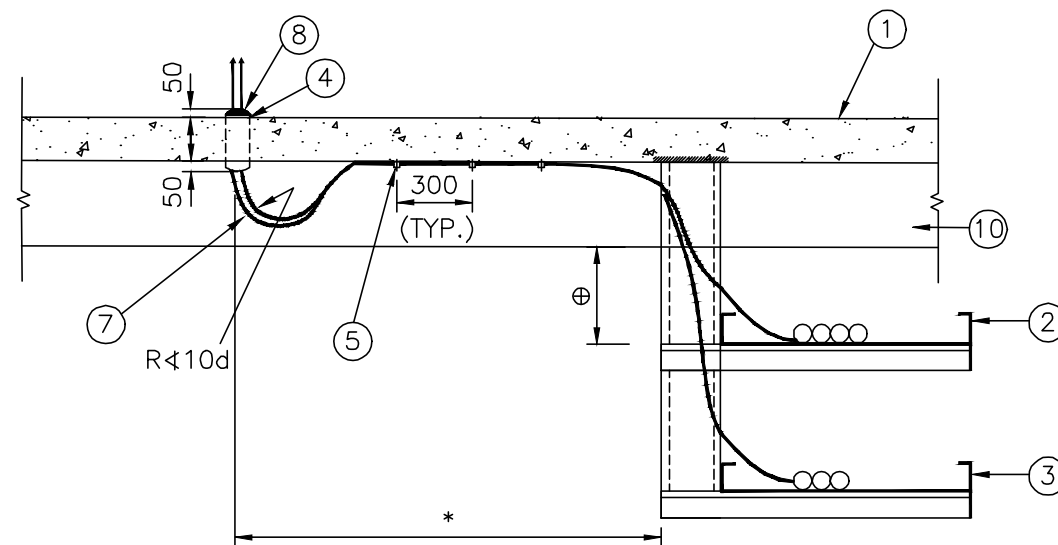
- ① FLOOR SLAB
  - ② POWER CABLE TRAY
  - ③ CONTROL CABLE TRAY
  - ④ G.I. PIPE INSERT
  - ⑤ SADDLE AND SPACER
  - ⑥ 50x50x6 M.S. ANGLE
  - ⑦ CABLE
  - ⑧ FIRE PROOF/WATER PROOF SEALING
  - ⑨ WELD
  - ⑩ BEAM
  - ⑪ 25 WIDE x 3 THICK M.S. FLAT WELDED TO ITEM-6
- d - OVERALL DIA. OF CABLE



CABLE TRAY NEAR PIPE INSERT  
 (\* = APPROX. 500)



CABLE TRAY AWAY FROM PIPE INSERT  
 (\* > 1200)



CABLE TRAY FAR AWAY FROM PIPE INSERT  
 (\* > 1200)

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT			
TYPICAL CABLE TRAY INSTALLATION DETAILS			
CABLE INSTALLATION PRACTICE TO			
EQUIPMENTS INSTALLED ON UPPER FLOOR			
Size	Scale	Sheet	
A3	NTS	36 of 62	
Drawing No.			Rev.
GGNG-E-20714-3010			0

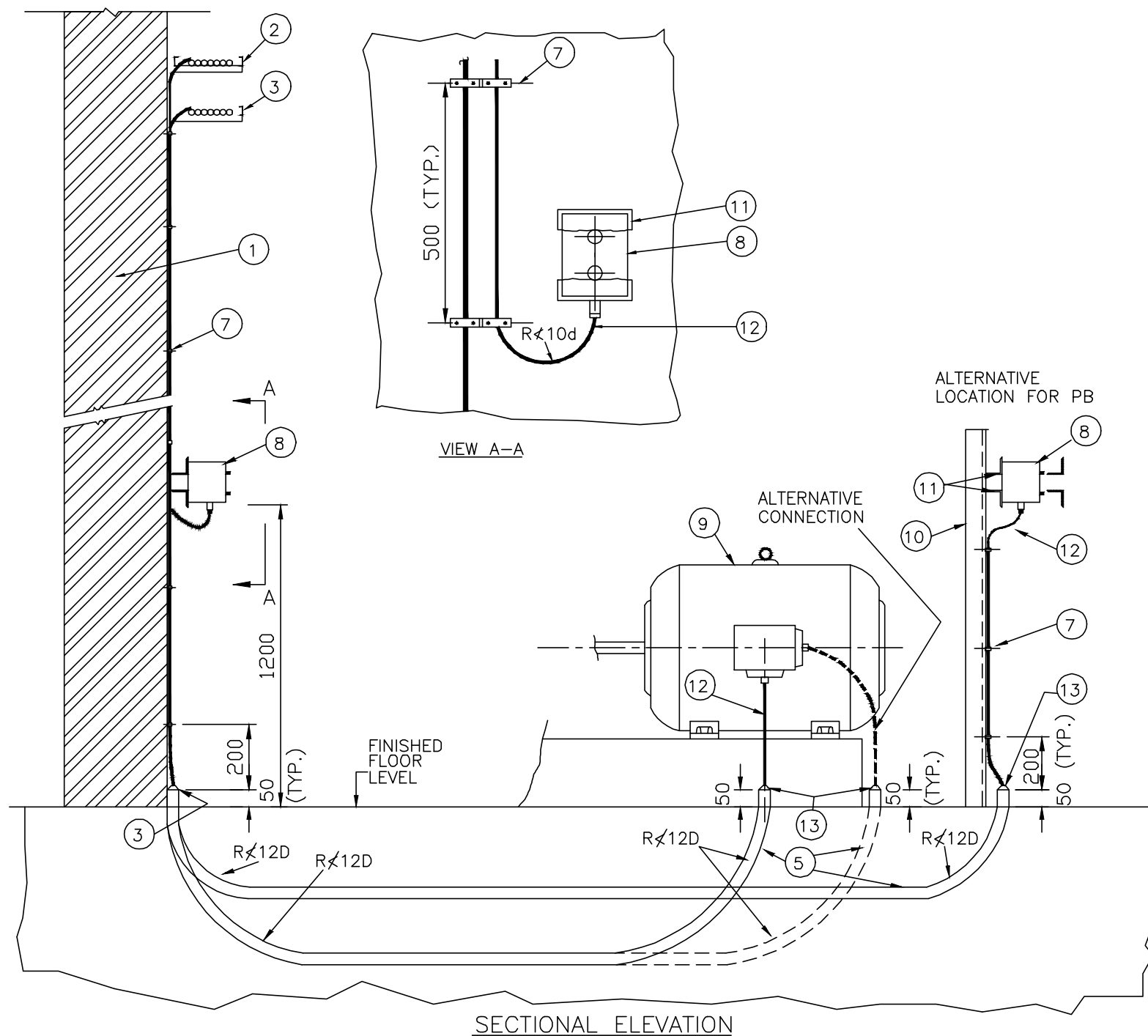
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NOTES

1. ALL DIMENSIONS ARE IN MM.
2. POWER AND CONTROL CABLES SHALL BE CLAMPED SEPARATELY.
3. THE CONDUIT/PIPE INSERT SHALL BE INSTALLED SUCH THAT CABLE CAN BE RAISED STRAIGHT TO THE EQUIPMENT CABLE GLAND/BOX WITHOUT ANY OFFSET.
4. CABLE SHALL BE CLAMPED/BENT SUBJECT TO MINIMUM BENDING RADIUS.
5. SEPARATE SPACE HEATER CABLE WHERE REQUIRED, SHALL BE LAID ALONG WITH THE POWER CABLE IN THE SAME CONDUIT, IF THE VOLTAGE GRADES OF THE TWO CABLES ARE SAME. OTHERWISE SEPARATE CONDUIT SHALL BE PROVIDED.
6. UNARMoured CABLES SHALL HAVE MECHANICAL PROTECTION UPTO 2500 ABOVE FLOOR LEVEL.
7. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992.
8. CONDUITS AND ACCESSORIES SHALL CONFORM TO IS 1653:1972/IS 3837:1976.

LEGEND

- ① WALL/STEEL COLUMN
  - ② POWER CABLE TRAY/RACK
  - ③ CONTROL CABLE TRAY/RACK
  - ④ CABLE TRENCH
  - ⑤ G.I. CONDUIT
  - ⑥ G.I. PIPE INSERT
  - ⑦ SADDLE AND SPACER
  - ⑧ P.B. STATION
  - ⑨ MOTOR
  - ⑩ ISMC-100
  - ⑪ 50x50x6 M.S. ANGLE
  - ⑫ CABLE IDENTIFICATION TAG
  - ⑬ WATER PROOF/FIRE PROOF SEALING
- d OVERALL DIA. OF CABLE  
D NOMINAL DIA. OF CONDUIT



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E

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

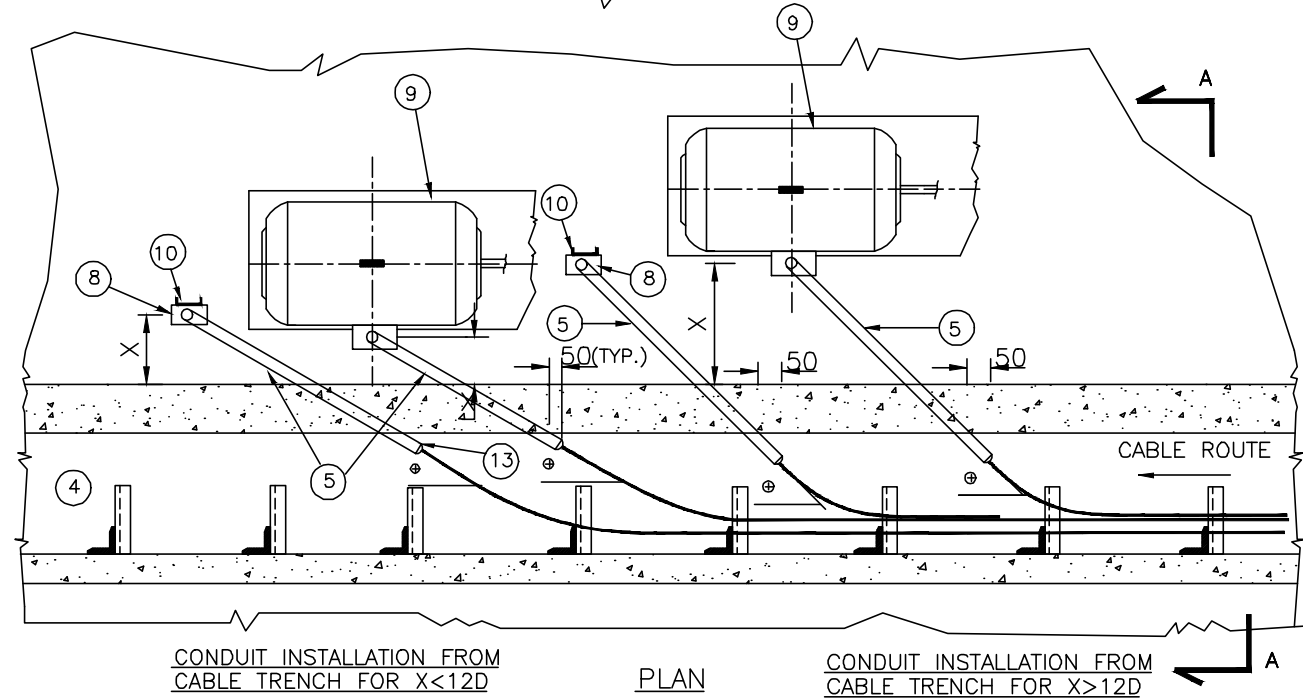
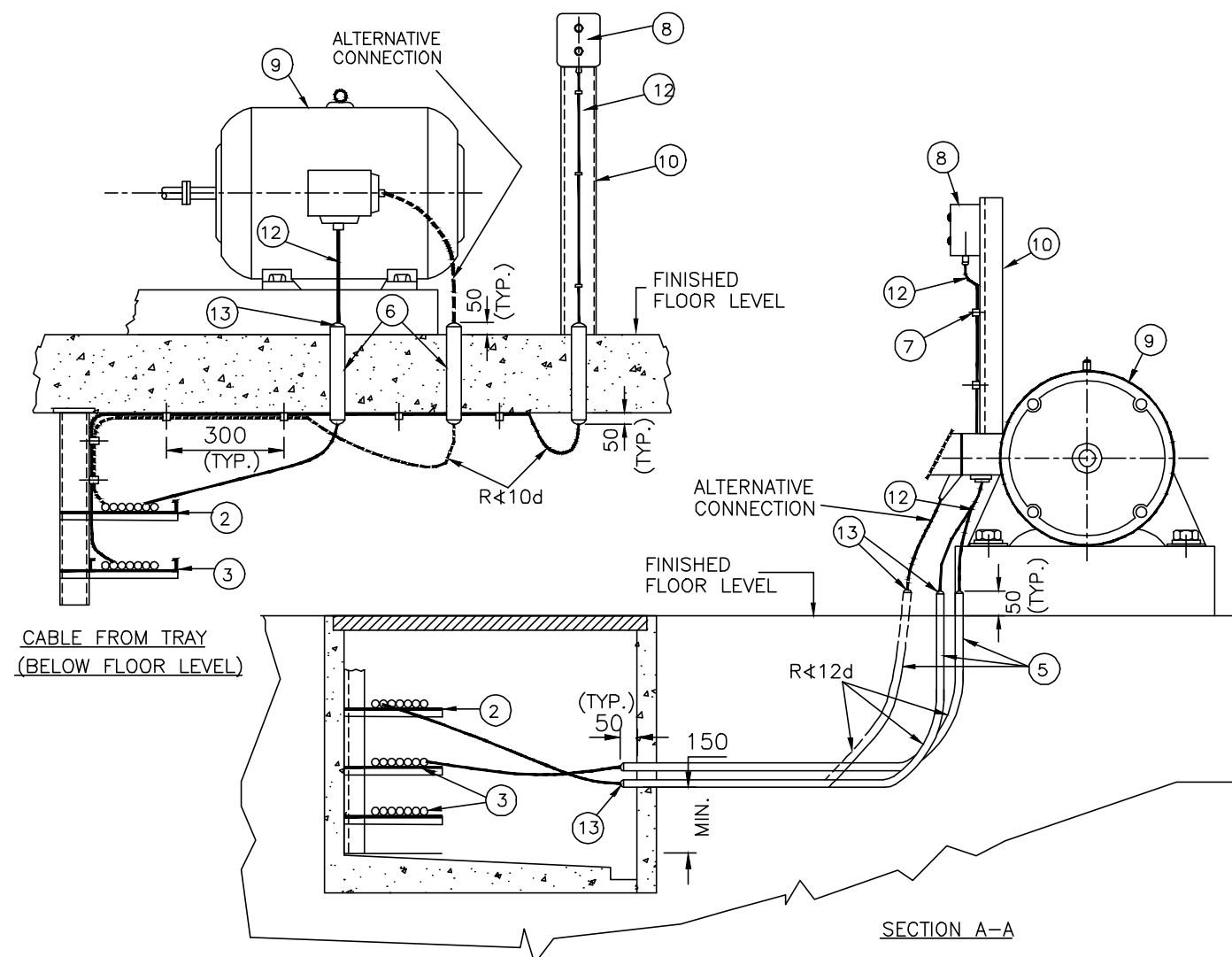
SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE INSTALLATION PRACTICE TO MOTOR AND P.B.

Size	Scale	Sheet
A3	NTS	37 of 62
Drawing No.	Rev.	
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NOTES

- 1. FOR NOTES AND LEGEND REFER SHEET 37 OF 62.
- 2. THE ANGLE MARKED THUS  $\oplus$  SHALL BE DECIDED BY SITE ENGINEER/INSTALLATION CONTRACTOR TO SUIT SITE CONDITION.



CONDUIT INSTALLATION FROM CABLE TRENCH FOR X<12D

PLAN

CONDUIT INSTALLATION FROM CABLE TRENCH FOR X>12D

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE INSTALLATION PRACTICE TO MOTOR AND P.B.

Size	Scale	Sheet
A3	NTS	38 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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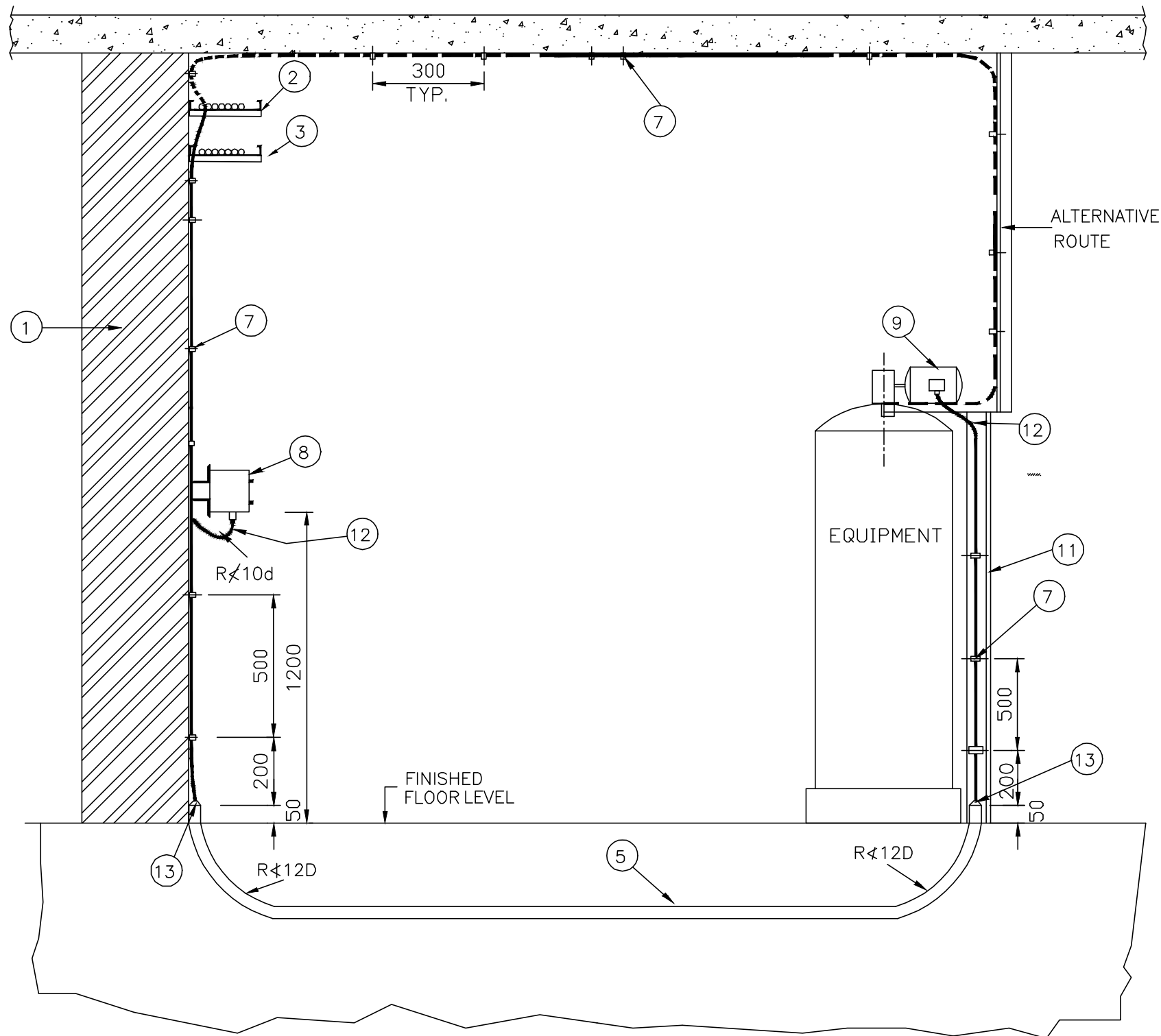
A

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TYPICAL MOTOR MOUNTED ON EQUIPMENT

NOTES

- 1. FOR NOTES AND LEGEND REFER SHEET 37 OF 62.
- 2. 50x50x6 M.S. ANGLE SUPPORT FOR CABLE CLAMPING SHALL BE INSTALLED WITHOUT OBSTRUCTING THE PASSAGE AND ACCESSIBILITY, FOR MAINTENANCE OF EQUIPMENT. PREFERABLY THE SUPPORT SHALL BE REMOVABLE TYPE.

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE INSTALLATION PRACTICE TO MOTOR AND P.B.

Size	Scale	Sheet
A3	NTS	39 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

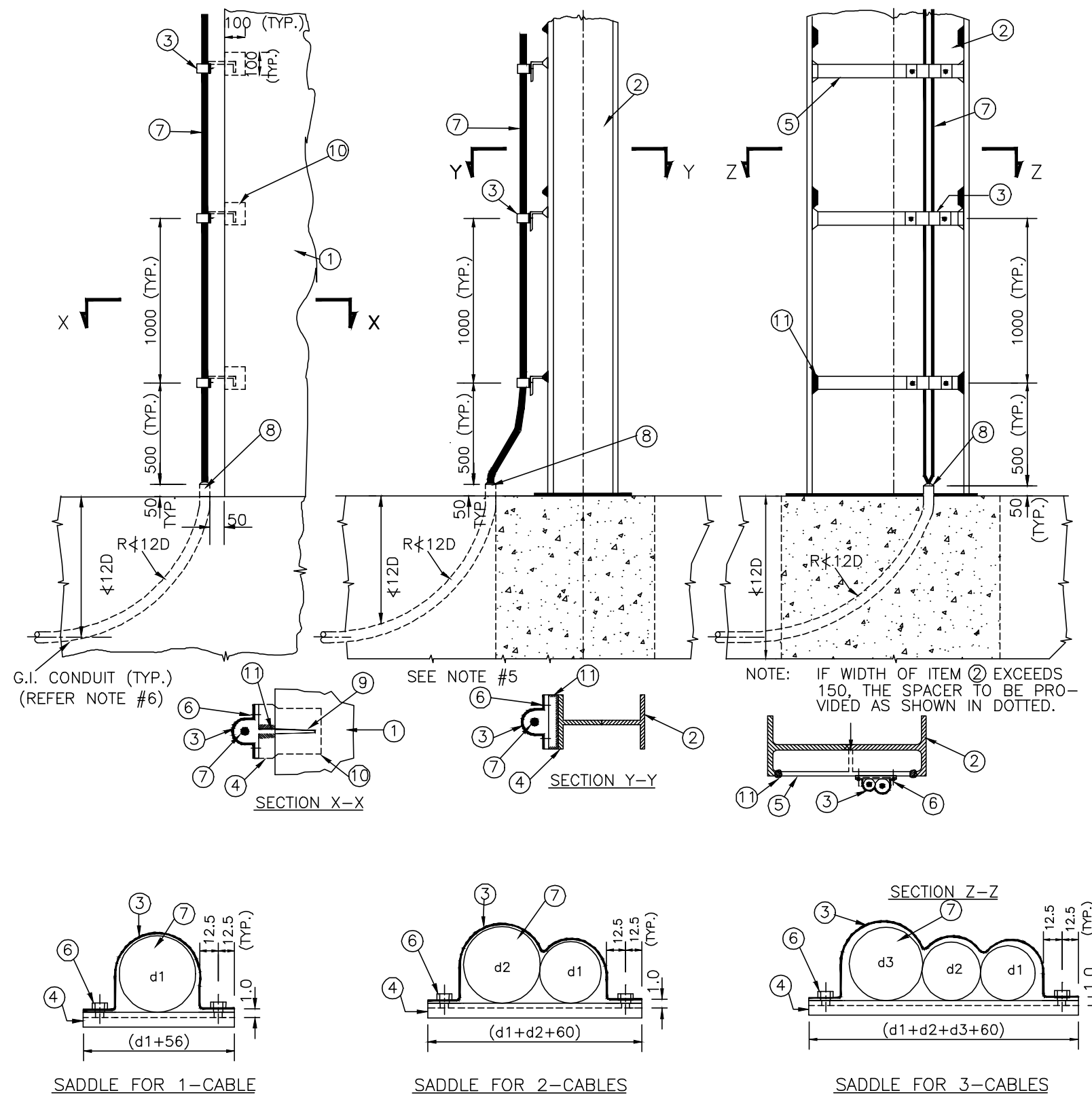
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### NOTES

1. ALL DIMENSIONS ARE IN MM.
2. MAXIMUM 3NO. POWER CABLES SHALL BE CLAMPED TOGETHER.
3. CABLES OF DIFFERENT VOLTAGES SHALL BE CLAMPED SEPARATELY.
4. SINGLE CORE POWER CABLES SHALL BE CLAMPED IN TREFOIL FORMATION.
5. 2Nos. ANCHOR BARS SHALL BE USED FOR EACH ANGLE SPACER HAVING LENGTH MORE THAN 100.
6. THE CONDUIT SHALL BE EXTENDED UPTO 2500 ABOVE THE FLOOR LEVEL IN CASE OF UNARMoured CABLES.
7. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992.
8. NUTS AND BOLTS SHALL BE AS PER IS 1363(PART-1,2,3):1992/ IS 1367(PART-5):1980.
9. WASHERS SHALL BE AS PER IS 2016:1967.
10. WELDING SHALL BE DONE AS PER IS 816:1969.

### LEGEND

- ① WALL
  - ② STEEL COLUMN
  - ③ SADDLE FABRICATED FROM 25x3 G.I. FLAT (50x50x6 M.S. ANGLE) SPACER
  - ④ SPACER (25x6 M.S. FLAT)
  - ⑤ 8ø,25LONG G.I. BOLT, NUT AND WASHER.
  - ⑥ POWER CABLE (3Cx70mm AND ABOVE)
  - ⑦ WATER PROOF SEALING
  - ⑧ 8ø,150 LONG M.S. ANCHOR BAR
  - ⑨ M 150 CONCRETE
  - ⑩ WELD
- d1, d2... OVERALL DIAMETER OF CABLES.  
D-NOMINAL DIAMETER OF CONDUIT.



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Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS CABLE INSTALLATION PRACTICE FOR POWER CABLES (3CX70mm AND ABOVE)								
Size		Scale		Sheet				
A3		NTS		40 of 62				
Drawing No. GGNG-E-20714-3010							Rev. 0	

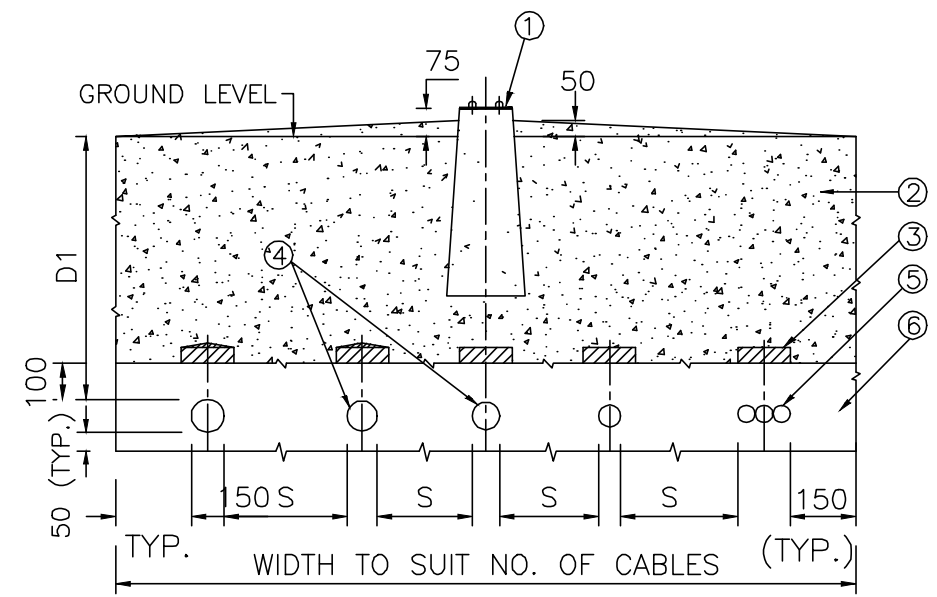
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### NOTES

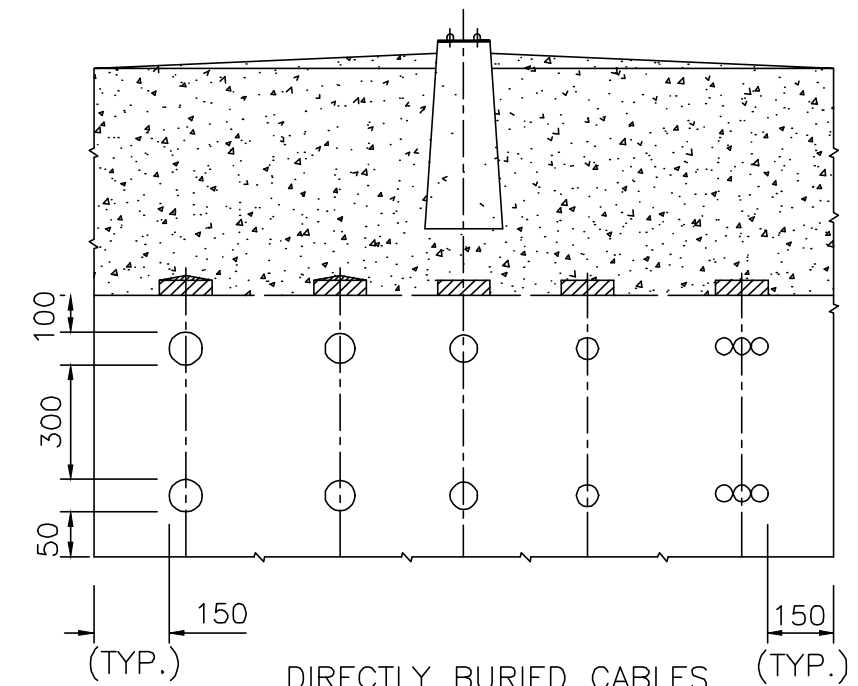
1. ALL DIMENSIONS ARE IN MM.
2. SINGLE CORE CABLES SHALL BE RUN IN TREFOIL FORMATION AND SHALL BE BOUND BY PLASTIC TAPES OR 3 DIA NYLON CORD EVERY 750MM.
3. CABLE IDENTIFICATION TAG SHALL BE TIED AT BOTH ENDS OF THE CABLE AND ALSO AT AN INTERVAL OF 15 METRES.
4. IF THE MINIMUM CLEARANCE AS INDICATED IN THE ABOVE TABLE FOR CABLES OF DIFFERENT CLASSES ARE NOT FEASIBLE, BRICK BARRIERS SHALL BE USED BETWEEN ADJACENT CABLES.
5. G.I./HUME PIPE SHALL BE PROVIDED FOR ROAD CROSSING AT A MINIMUM DEPTH OF 600 FROM THE GRADE LEVEL UNLESS OTHERWISE SPECIFIED.

### LEGEND

- ① CABLE ROUTE MARKER
- ② EARTH BACK FILLED & RAMMED
- ③ PROTECTIVE COVERS, AS PER APPENDIX-C OF IS:1255
  - a) EARTHENWARE FOR LOW VOLTAGE CABLES.
  - b) RCC FOR HIGH VOLTAGE CABLES, WITH HOLE AT EACH END TO TIE THEM TO EACH OTHER WITH G.I. WIRE.
- ④ POWER CABLE
- ⑤ CONTROL CABLE
- ⑥ FINE SAND/RIDDLED SOIL COMPACTED.



DIRECTLY BURIED CABLES IN SINGLE LAYER



DIRECTLY BURIED CABLES IN TWO LAYERS

DIMENSIONS (MIN.)	1100V GRADE CABLES	FOR 3.3KV TO 11KV	22KV & 33KV
D1	750	900	1050
S	⊗ d — BETWEEN CABLES OF SAME CLASS *300mm — BETWEEN CABLES OF DIFFERENT CLASS *400mm — BETWEEN 1/C POWER CABLE AND COMMUNICATION CABLE *300mm — BETWEEN MULTICORE POWER CABLE AND COMMUNICATION CABLE		

⊗ d — OVERALL DIAMETER OF THE BIGGER OF THE TWO CABLES  
 \* — SPACING SHALL BE KEPT BOTH HORIZONTALLY & VERTICALLY

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Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS  
 INSTALLATION PRACTICE FOR DIRECTLY BURIED CABLES

Size	Scale	Sheet
A3	NTS	41 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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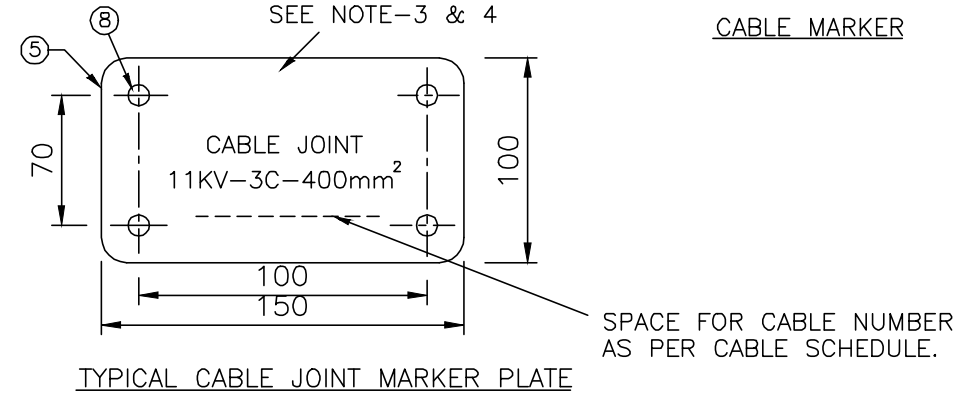
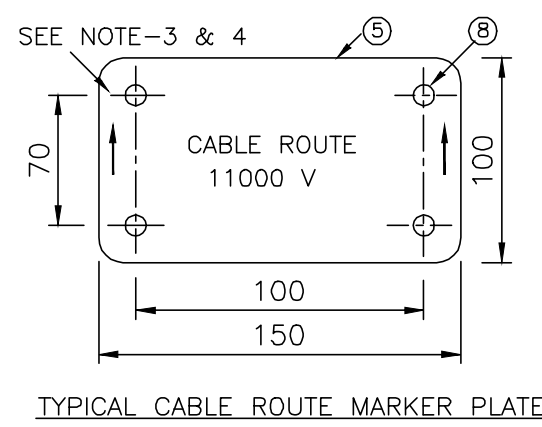
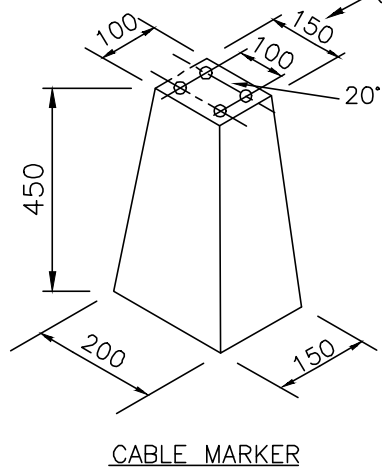
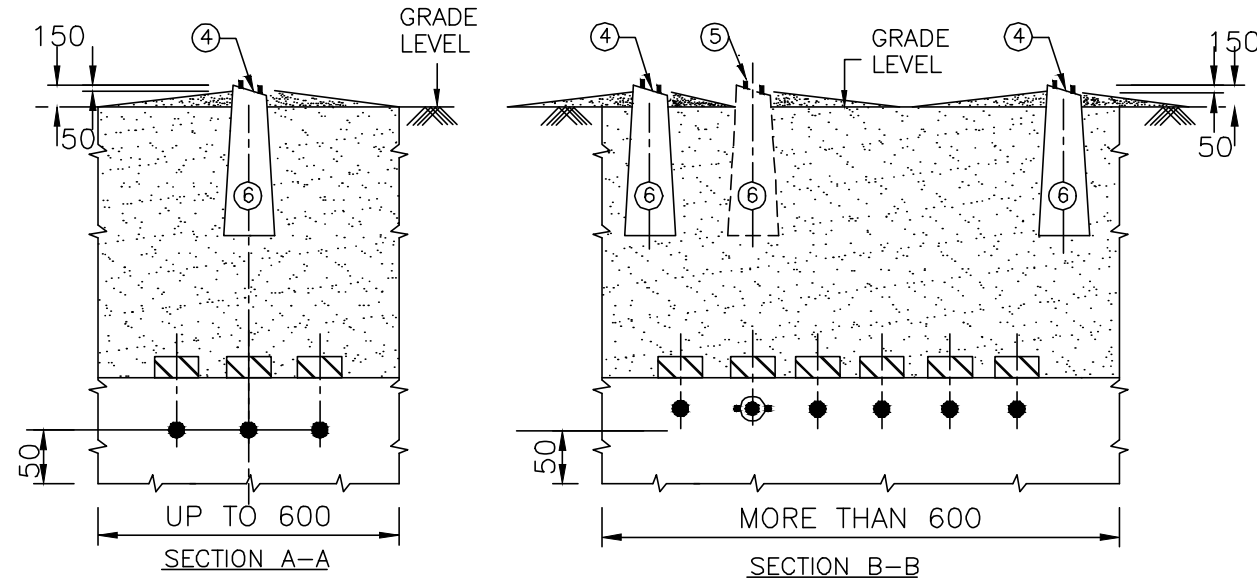
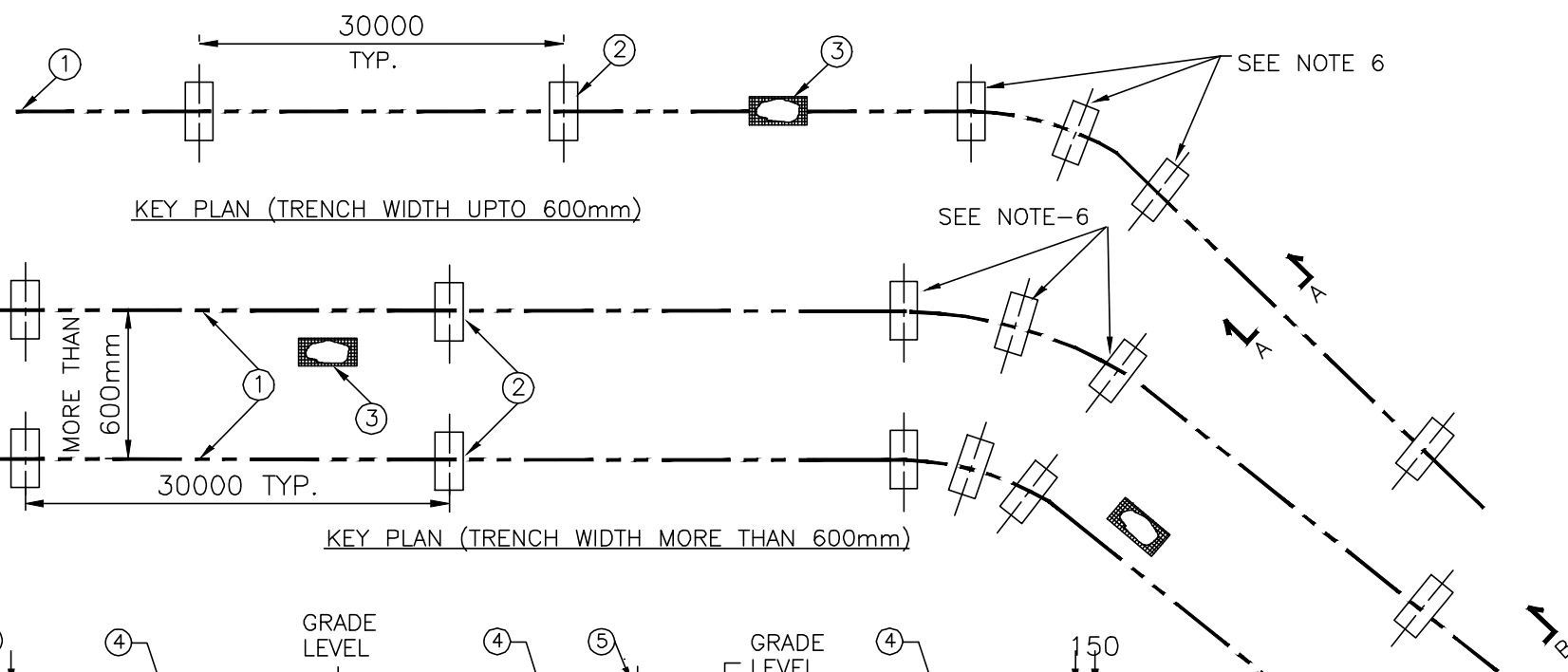
A

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### NOTES

1. ALL DIMENSIONS ARE IN MM.
2. FOR NOTES AND OTHER DETAILS REFER SHEET 41 OF 62.
3. a) VOLTAGE OF HIGHEST GRADE CABLE SHALL BE CAST ON THE CABLE ROUTE MARKER PLATE.  
b) VOLTAGE, NUMBER OF CORES, SIZE AND IDENTIFICATION NUMBER OF THE CABLE SHALL BE CAST ON THE CABLE JOINT MARKER PLATE.
4. RAISED LETTERS AND ARROWS SHALL BE CAST ON 10 THICK CAST IRON PLATE (ARROW INDICATES THE ROUTE OF CABLES).
5. CABLE MARKER AS ABOVE SHALL BE AVOIDED ON ROADS. ONLY A TILE SHOWING DETAILS, SHALL BE USED AS MARKER.
6. TYPICAL CABLE ROUTE MARKER AS ABOVE IS SHOWN FOR BEND. ACTUAL PLACEMENT OF ROUTE MARKER SHALL BE DECIDED AT SITE BY SITE ENGINEER/CABLE INSTALLATION CONTRACTOR.
7. THE CABLE MARKER PLATE SHALL BE FIXED BY 4NO. SUITABLE G.I. NUTS.

### LEGEND

- ① CABLE ROUTE
- ② CABLE ROUTE MARKER
- ③ CABLE JOINT MARKER
- ④ CABLE ROUTE MARKER PLATE (C.I.)
- ⑤ CABLE JOINT MARKER PLATE (C.I.)
- ⑥ M-150 CONCRETE BLOCK
- ⑦ 10 $\phi$ , 25 PROJ. G.I. STUD
- ⑧ 12 $\phi$  HOLE

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

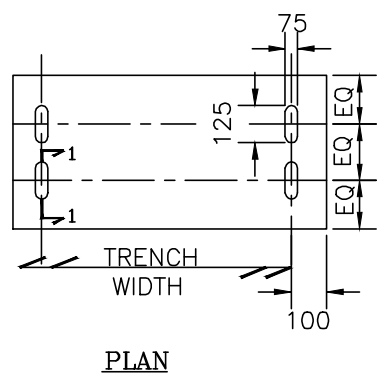
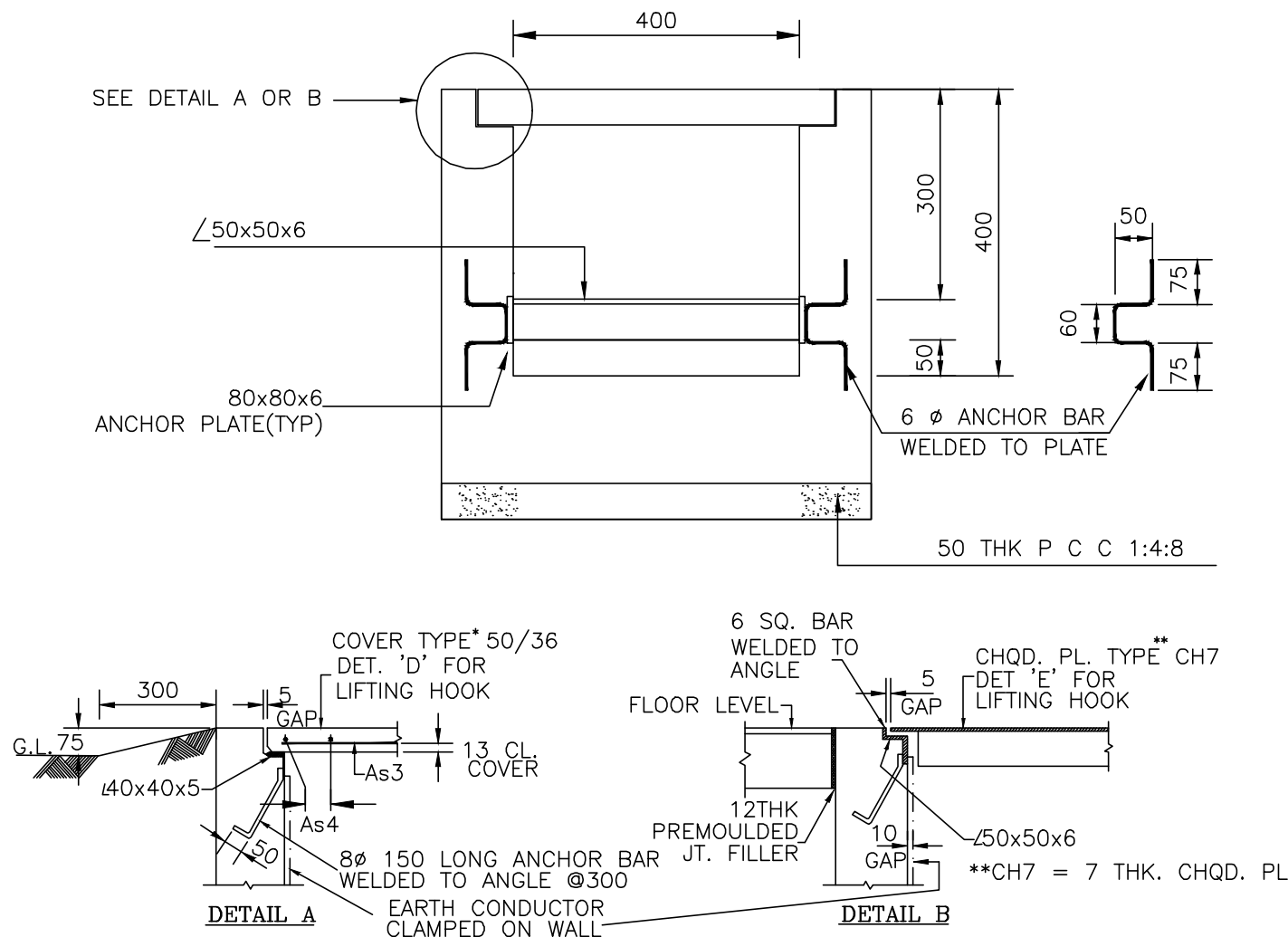
SUBJECT: TYPICAL CABLE TRAY INSTALLATION DETAILS  
INSTALLATION PRACTICE FOR DIRECTLY BURIED CABLES

Size	Scale	Sheet
A3	NTS	42 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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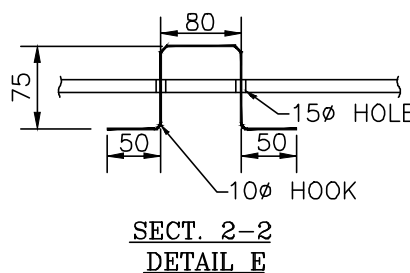
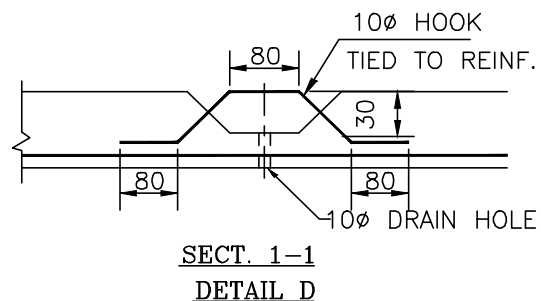
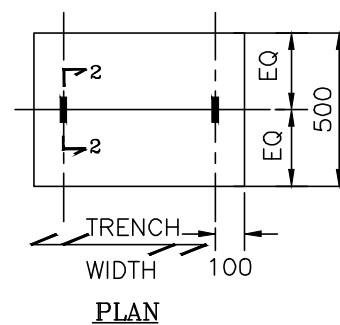
NOTES

- 1. ALL DIMENSIONS ARE IN MM
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



R C COVER TYPE	THICKNESS mm.	As3	As4
50/36	50	7-6∅	4-6∅

\* 50/36 MEANS 50mm. THK.x36 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.

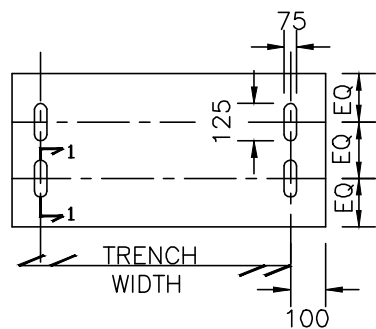
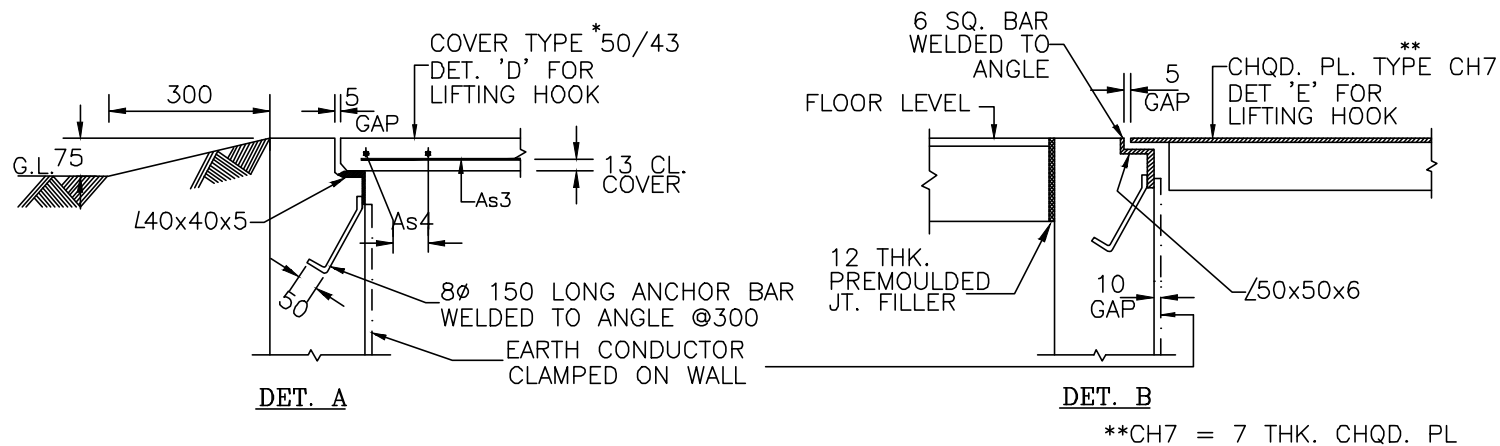
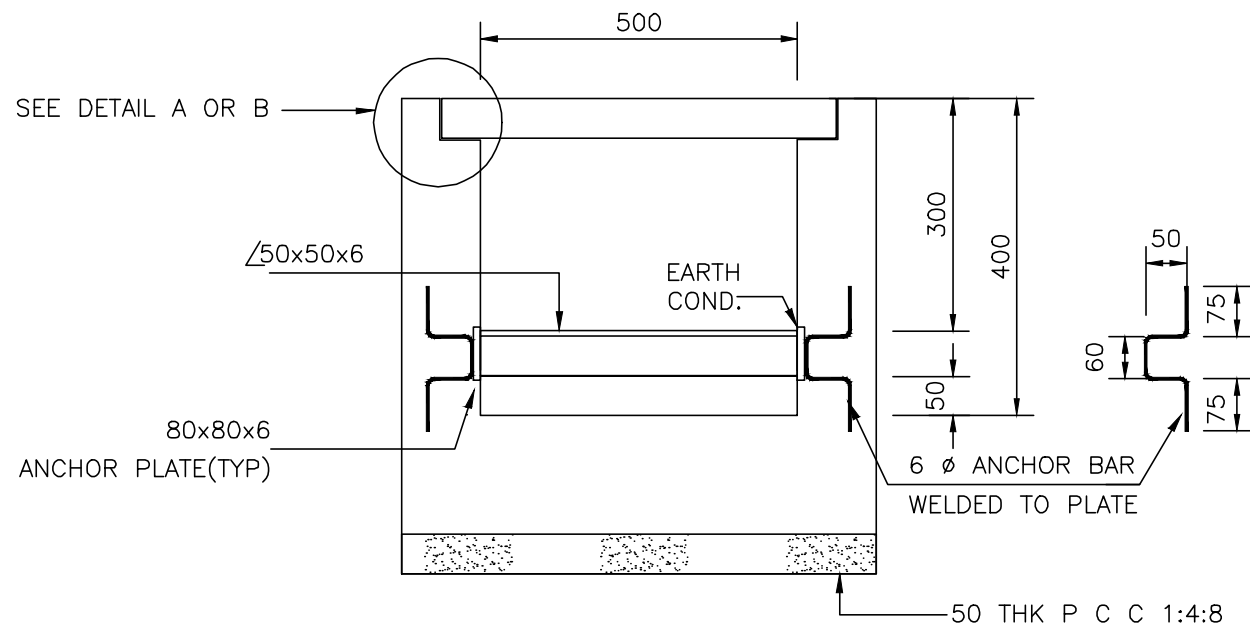


0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT							TYPICAL CABLE TRAY INSTALLATION DETAILS	
							CABLE TRENCH TYPE - 0404	
		Size	Scale	Sheet				
		A3	NTS	43 of 62				
		Drawing No.		Rev.				
		GGNG-E-20714-3010		0				

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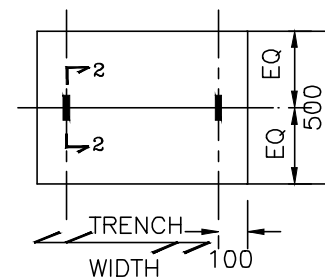
- 1. ALL DIMENSIONS ARE IN MM
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



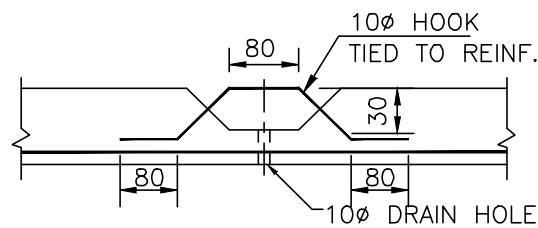
PLAN

R C COVER TYPE	THICKNESS mm.	As3	As4
50/72	50	7-6∅	7-6∅
50/36	50	7-6∅	4-6∅

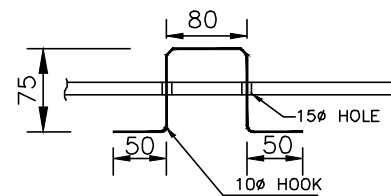
\* 50/36 MEANS 50mm. THK.x36 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



PLAN



SECT. 1-1  
DET. D



SECT. 2-2  
DET. E

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

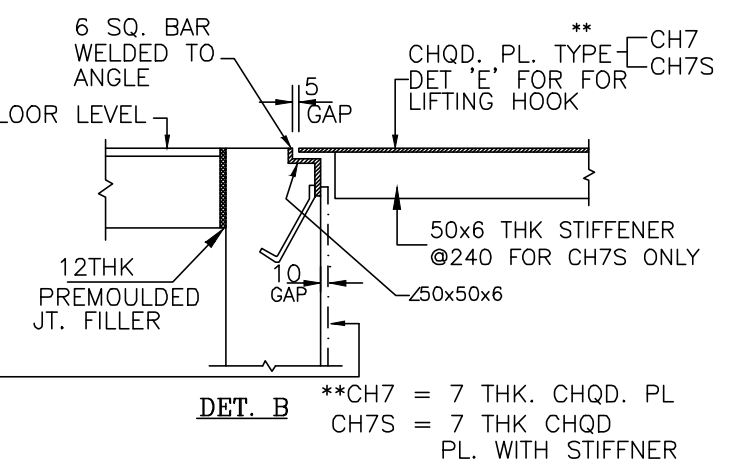
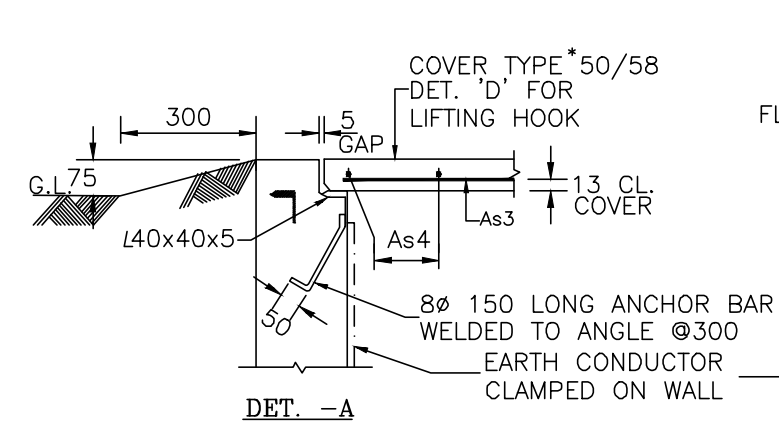
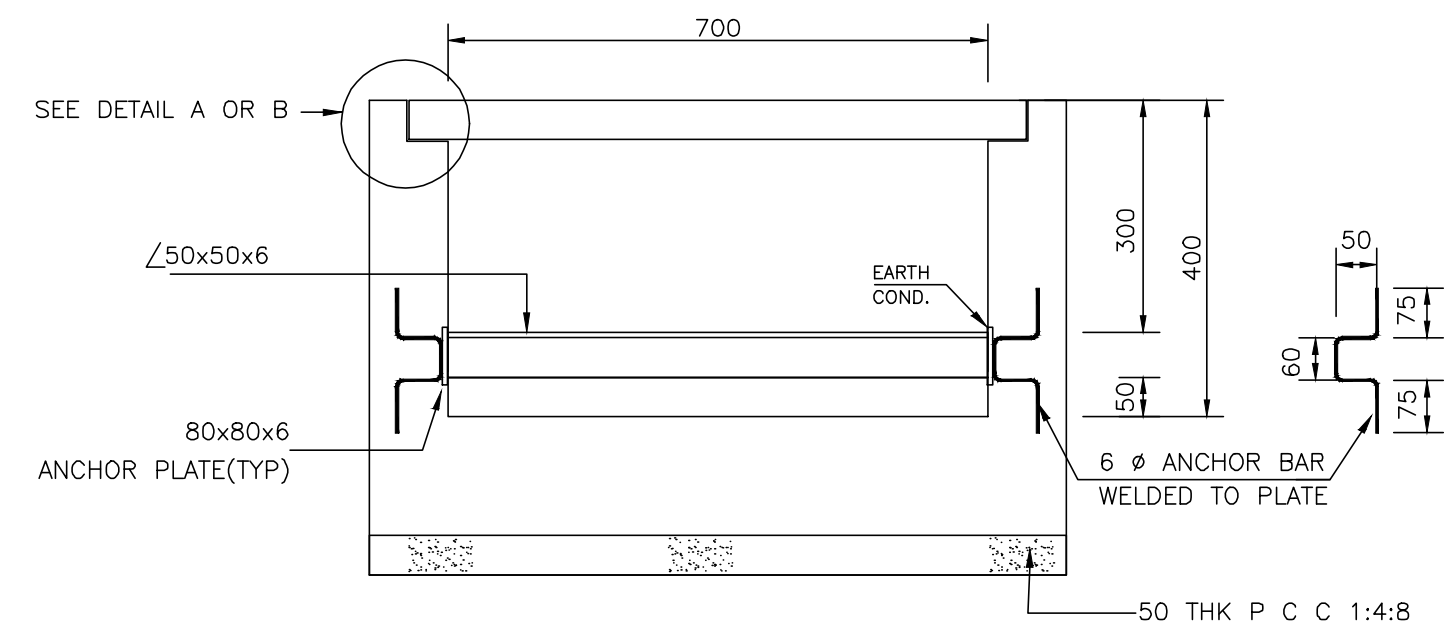
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRENCH TYPE - 0504

Size	Scale	Sheet
A3	NTS	44 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

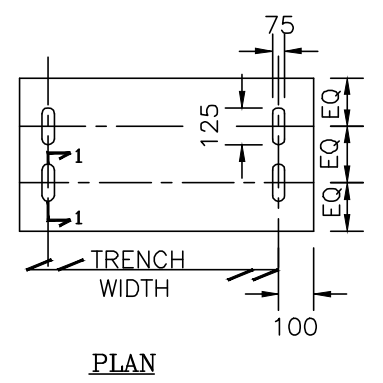
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NOTES

- 1. ALL DIMENSIONS ARE IN MM
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



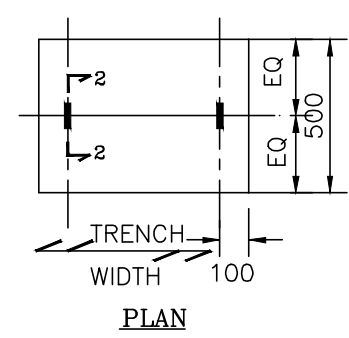
\*\*CH7 = 7 THK. CHQD. PL.  
CH7S = 7 THK CHQD. PL. WITH STIFFNER



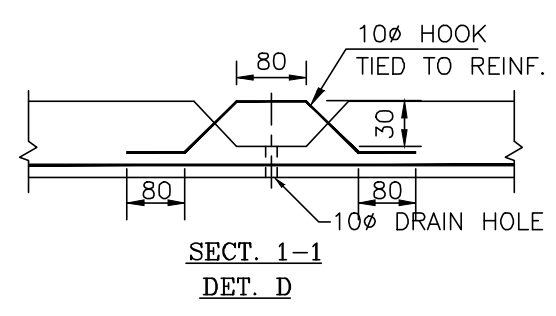
PLAN

R C COVER TYPE	THICKNESS mm.	As3	As4
50/58	50	7-6φ	7-6φ

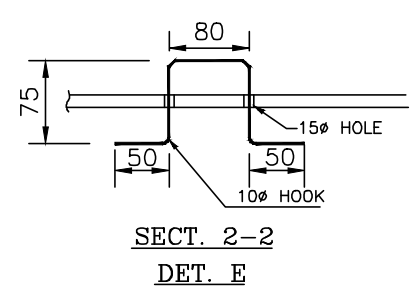
\* 50/58 MEANS 50mm. THK.x58 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



PLAN



SECT. 1-1  
DET. D



SECT. 2-2  
DET. E

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

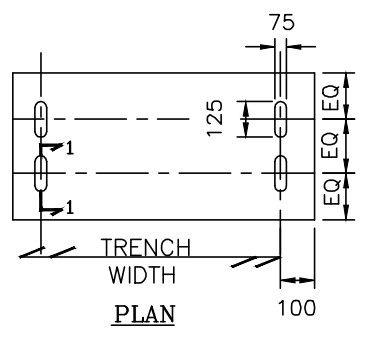
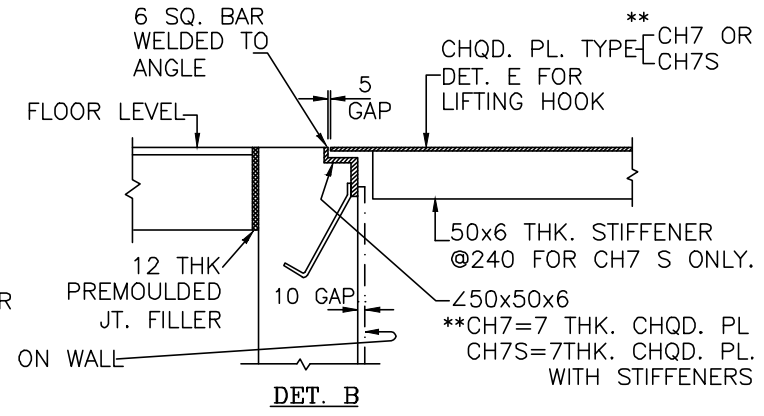
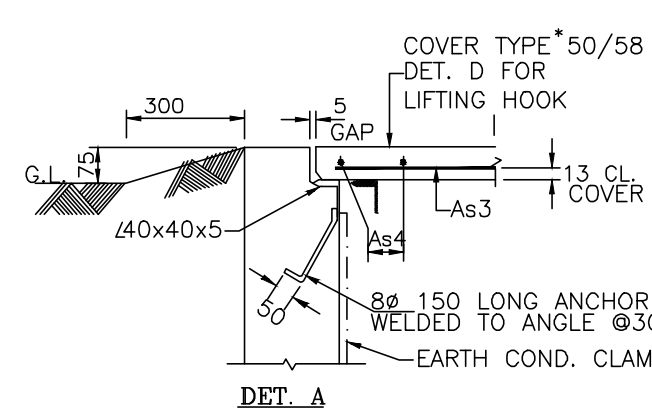
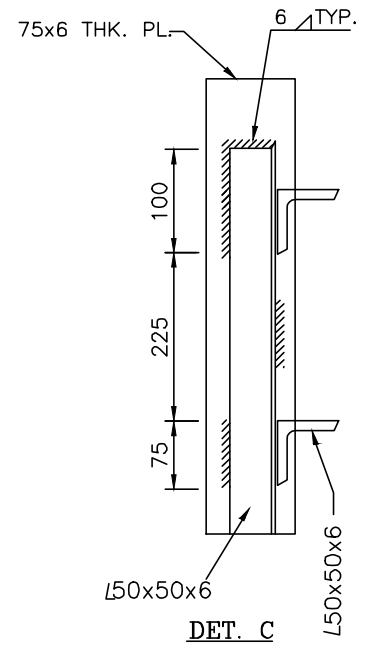
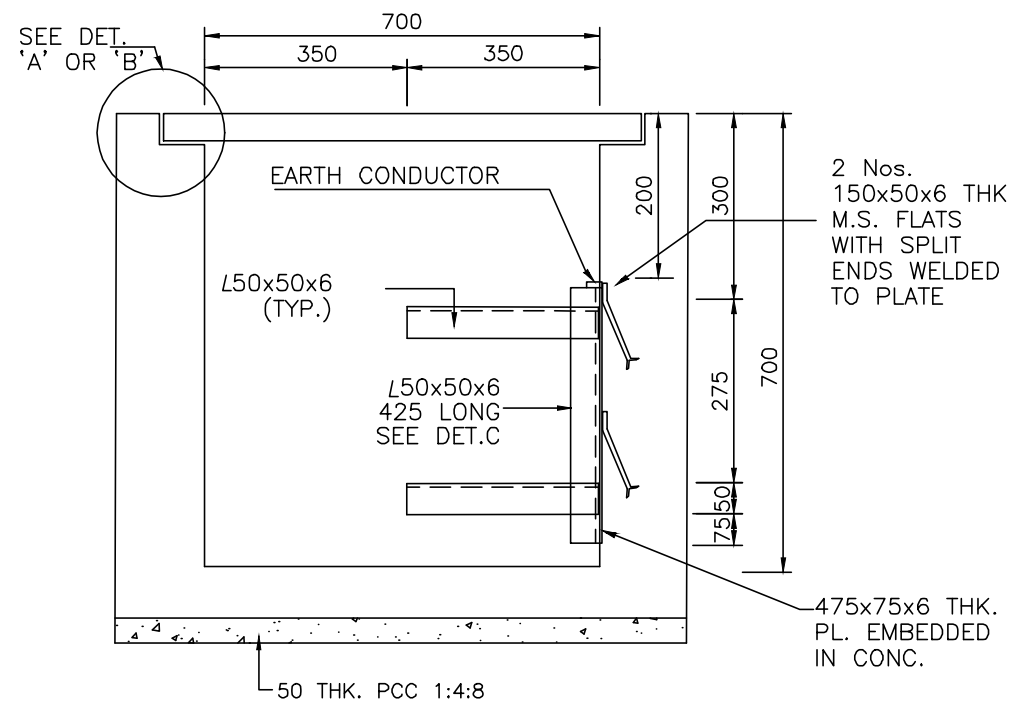
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRENCH TYPE - 0704

Size	Scale	Sheet
A3	NTS	45 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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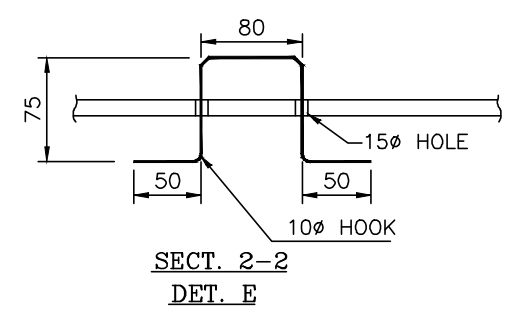
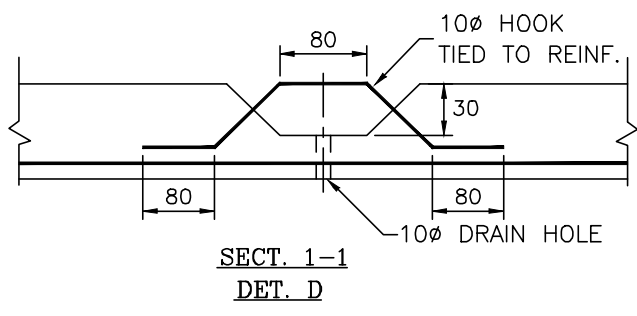
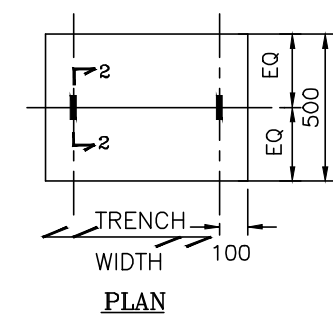
- 1. ALL DIMENSIONS ARE IN MM.
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



\*

R C COVER TYPE	THICKNESS mm.	As3	As4
50/58	50	7-6 $\phi$	6-6 $\phi$

50x58 MEANS 50mm. THK.x58 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.

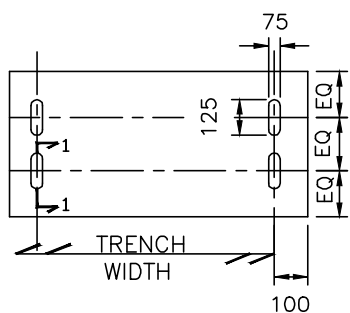
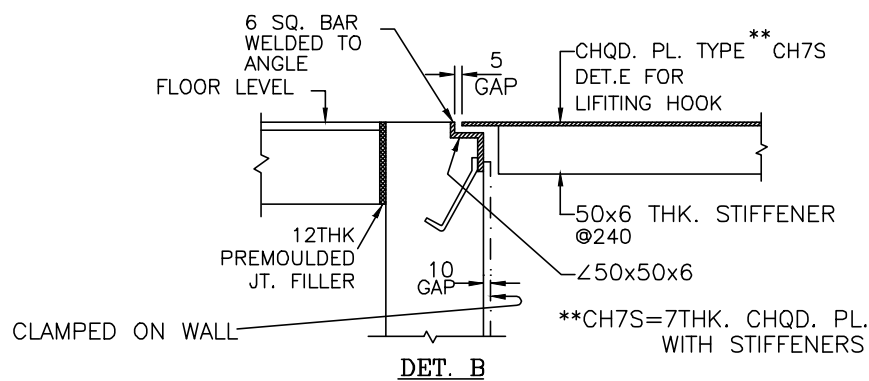
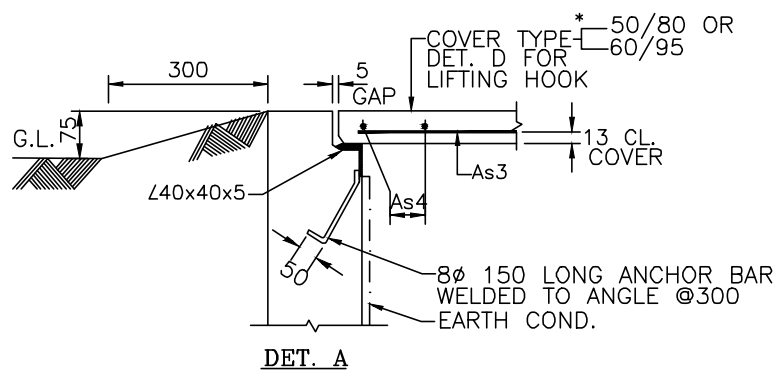
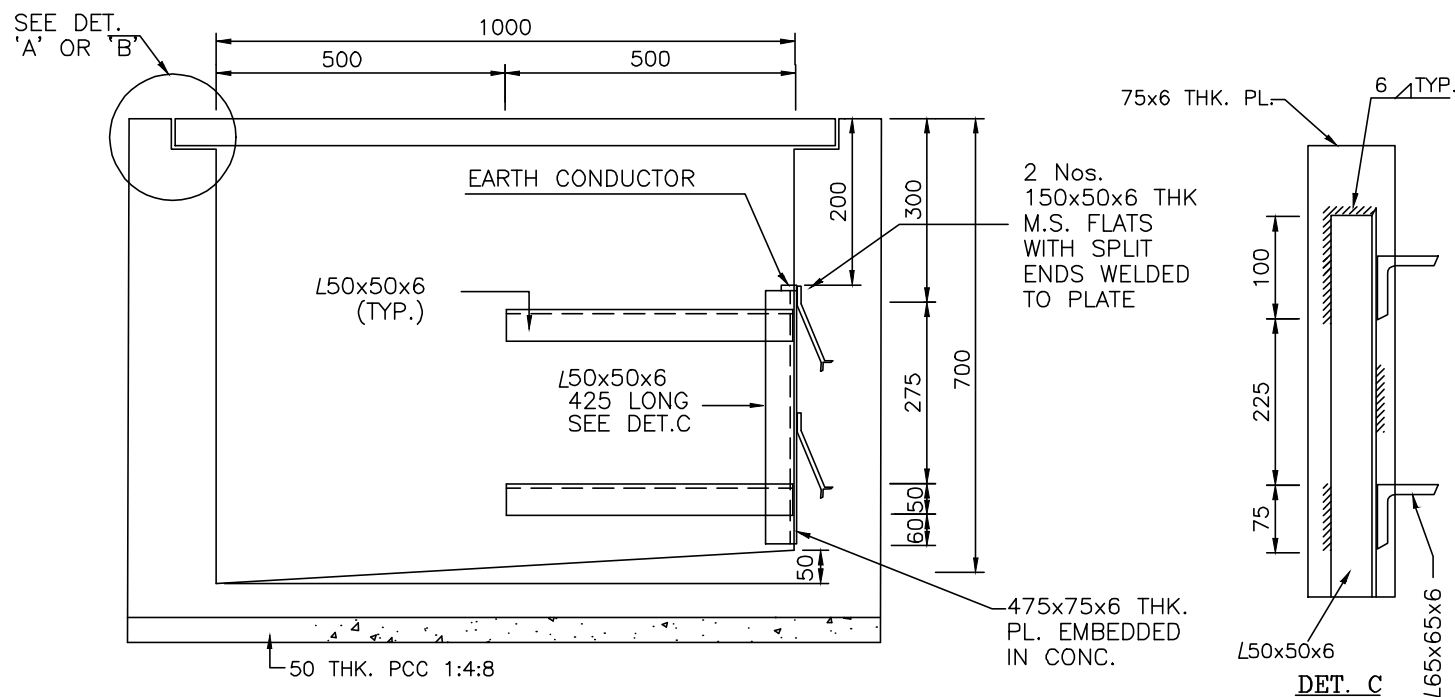


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Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS CABLE TRENCH TYPE - 0707						
Size	Scale	Sheet				
A3	NTS	46 of 62				
Drawing No.			Rev.			
GGNG-E-20714-3010			0			

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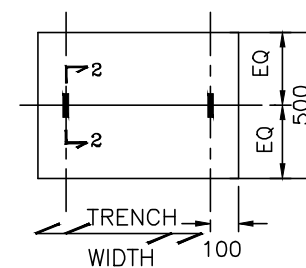
- 1. ALL DIMENSIONS ARE IN MM.
- 2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



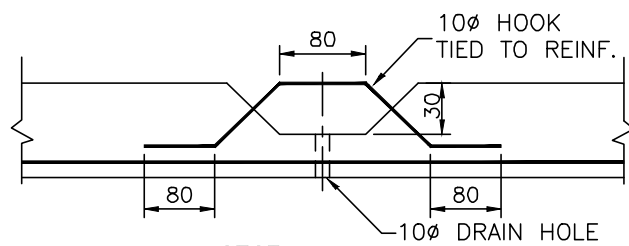
PLAN

R C COVER TYPE	THICKNESS mm.	As3	As4
50/80	50	7-6 $\phi$	6-6 $\phi$
60/95	60	7-8 $\phi$	6-8 $\phi$

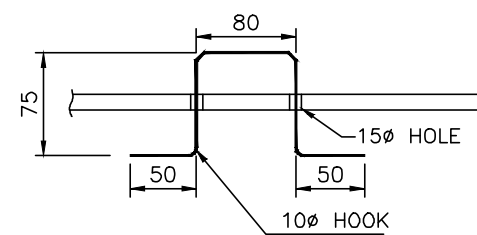
\* 60x95 MEANS 60mm. THK.x95 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



PLAN



SECT. 1-1  
DET. D



SECT. 2-2  
DET. E

0	07.10.16	APPROVED	RKS	PR	KJ	SKH	
Rev.	D	M	Y	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRENCH TYPE - 1007

Size	Scale	Sheet
A3	NTS	47 of 62
Drawing No.	GGNG-E-20714-3010	
Rev.	0	

NOTES

THE FOLLOWING TIGHTENING TORQUES SHALL BE USED FOR NUTS AND BOLTS USED FOR SUPPORTS, CABLE TRAY OR ACCESSORIES ASSEMBLY.

Metric size (mm)	Recommended Torque (Nm)
M8	12 Nm.
M10	25 Nm.
M12	45 Nm.
M16	100 Nm.

AS THE ABOVE VALUES CAN SLIGHTLY CHANGE FROM ONE CABLE TRAY MANUFACTURER TO ANOTHER, CABLE TRAY INSTALLATION CONTRACTOR TO CHECK THESE VALUES WITH MANUFACTURER DATA.

### TIGHTENING TORQUES

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS TIGHTENING TORQUES								
Size		Scale		Sheet				
A3		NTS		48 of 62				
Drawing No. GGNG-E-20714-3010							Rev.	
							0	

1

2

3

4

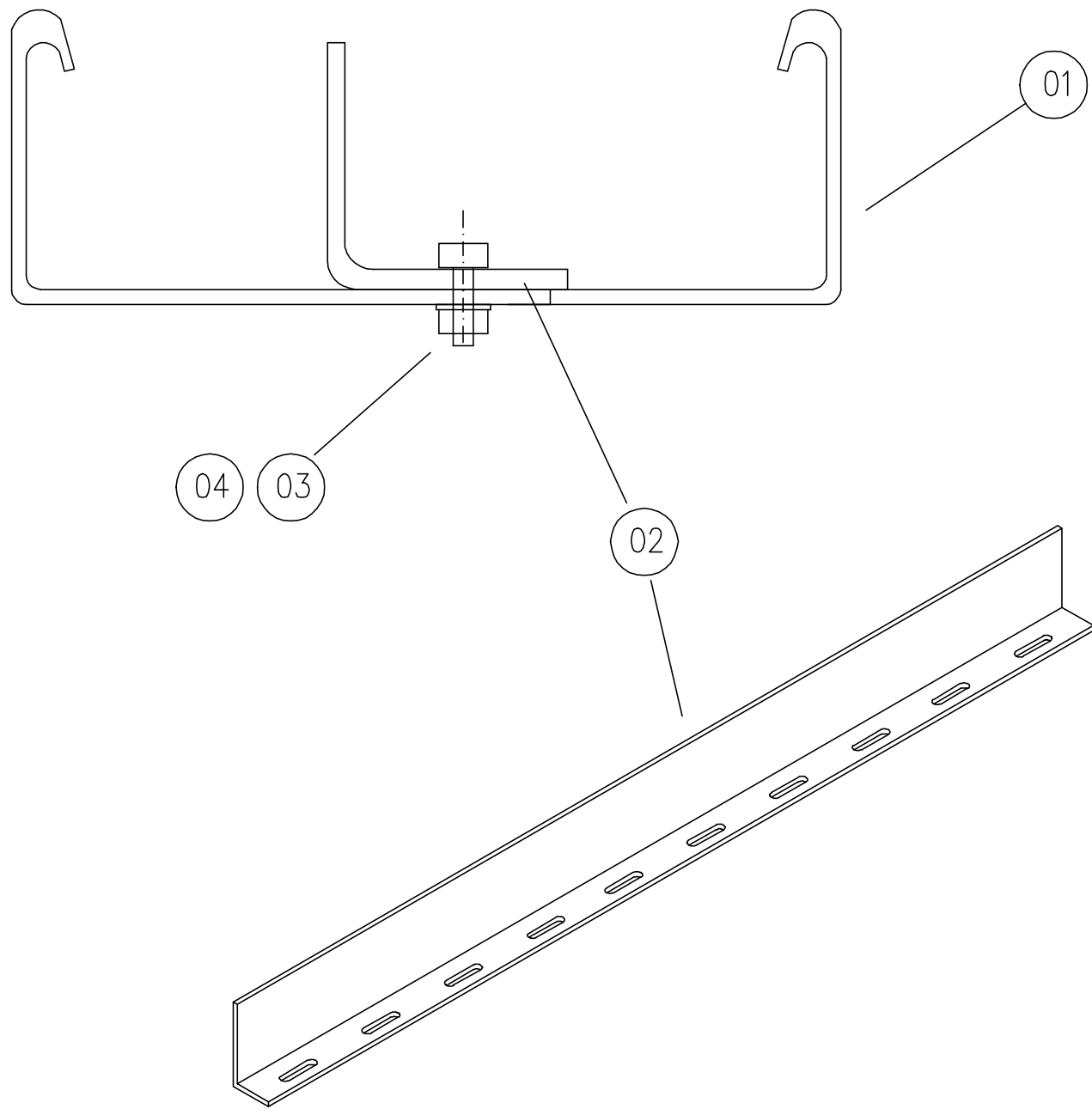
A

B

C

D

E



CABLE TRAY W=100mm / H=50mm

04	NUT M6 WITH STOP BASE
03	SCREW M6x16
02	SEPARATOR
01	CABLE LADDER
DESIGNATION	

### SEPARATOR FOR CABLE TRAY

#### NOTES

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS SEPARATOR FOR CABLE TRAY								
Size		Scale		Sheet				
A3		NTS		49 of 62				
Drawing No.							Rev.	
GGNG-E-20714-3010							0	

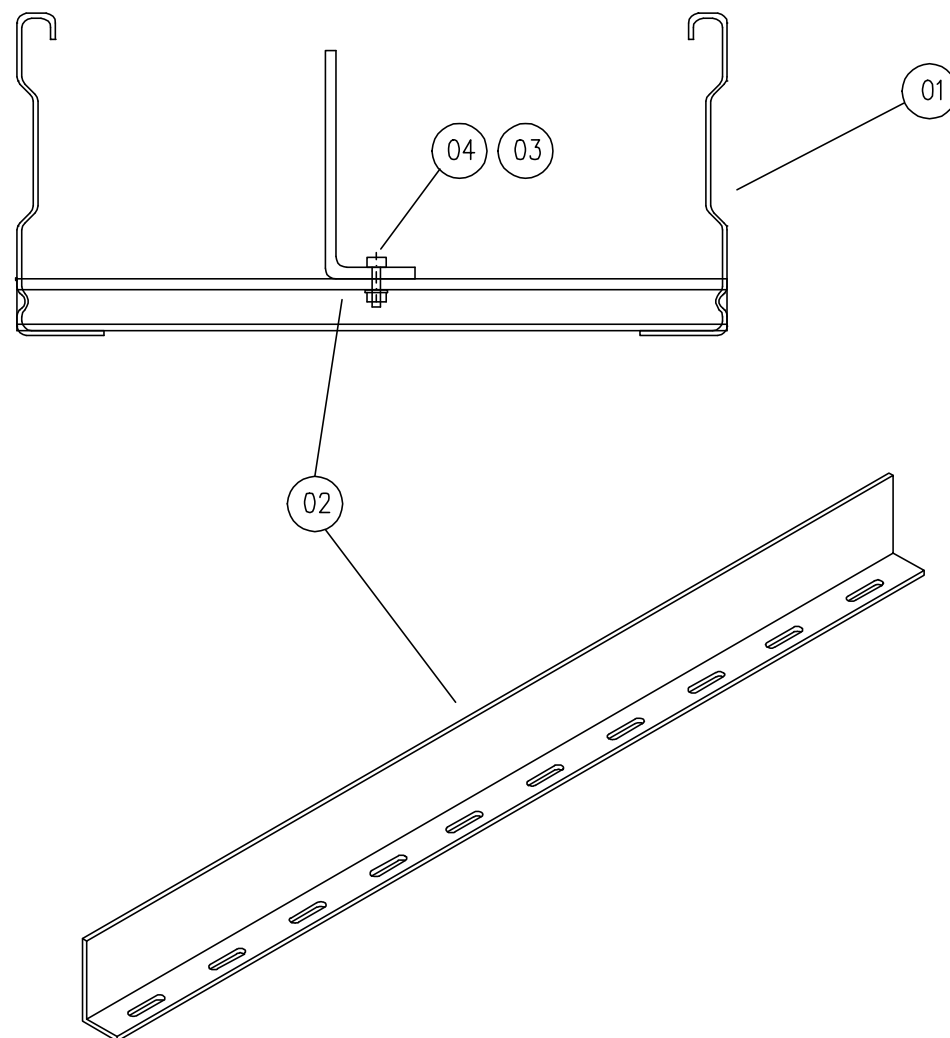
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CABLES LADDER	W=300mm / H=100mm
CABLES LADDER	W=600mm / H=100mm

04	NUT M6 WITH STOP BASE
03	SCREW M6x16
02	SEPARATOR H 68mm
01	CABLE LADDER H 100mm
DESIGNATION	

**CABLES LADDER SEPARATOR**

NOTES

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLES LADDER SEPARATOR

Size	A3	Scale	NTS	Sheet	50	of	62	
Drawing No.	GGNG-E-20714-3010						Rev.	0

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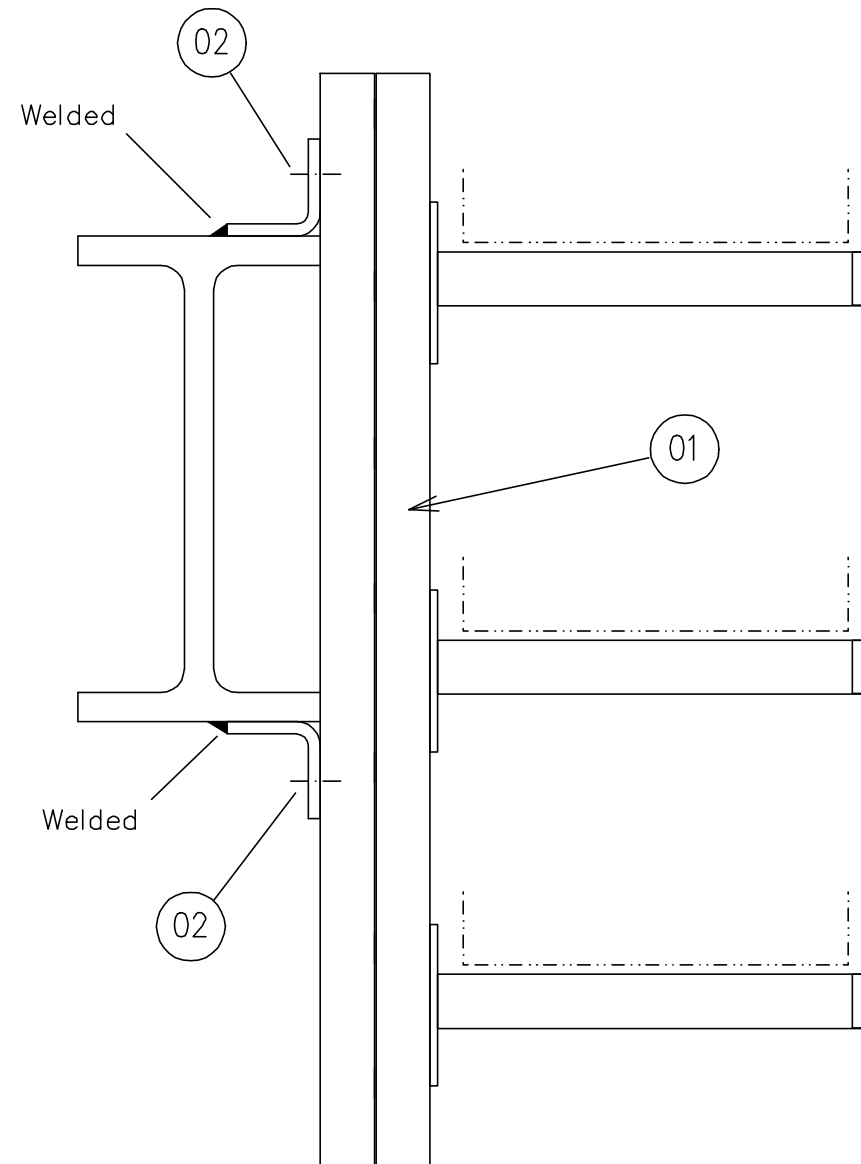
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NOTES



02	BOLT M10x30
01	DOUBLE CHANNEL 82x41
	DESIGNATION

**SUPPORT TYPE FIXING ON  
GROUND AND CEILING**

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
SUPPORT TYPE FIXING ON GROUND AND CEILING

Size	Scale	Sheet
A3	NTS	51 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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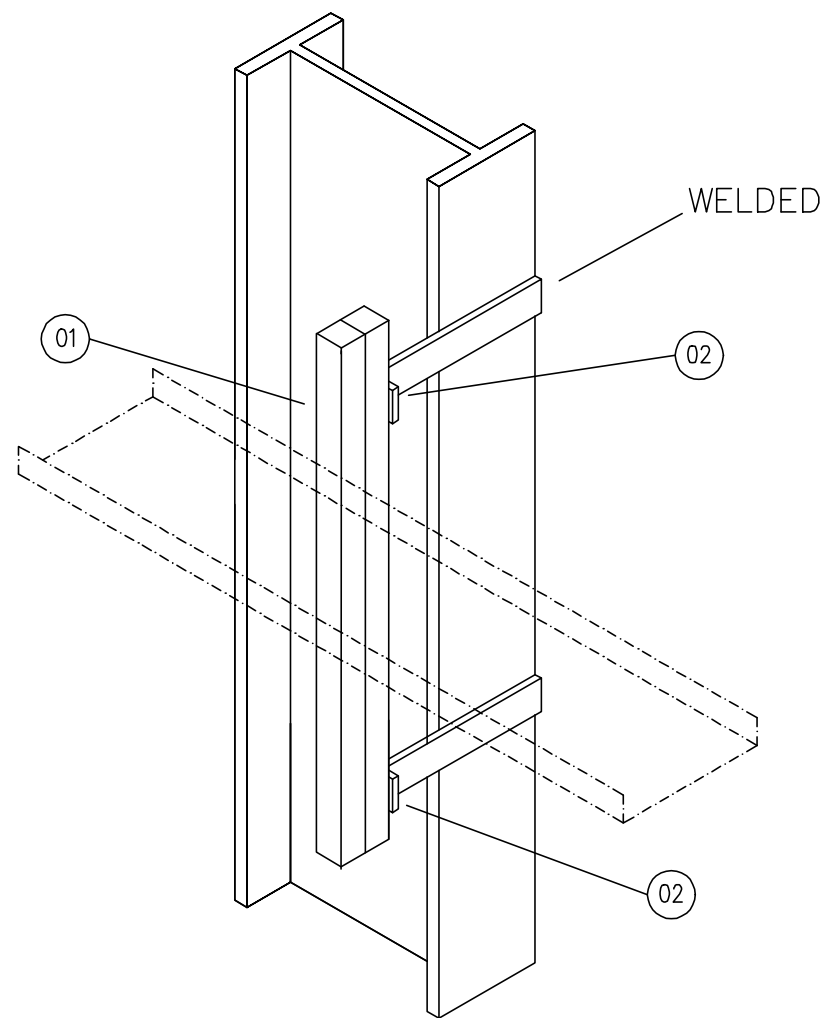
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VERTICAL OR HORIZONTAL MOUNTING  
ACCORDING TO DRAWING.

02	BOLT M10x30
01	DOUBLE CHANEL 82x41
	DESIGNATION

### SUPPORT TYPE FIXING ON GROUND AND CEILING

#### NOTES

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
SUPPORT TYPE FIXING ON GROUND AND CEILING

Size	Scale	Sheet
A3	NTS	52 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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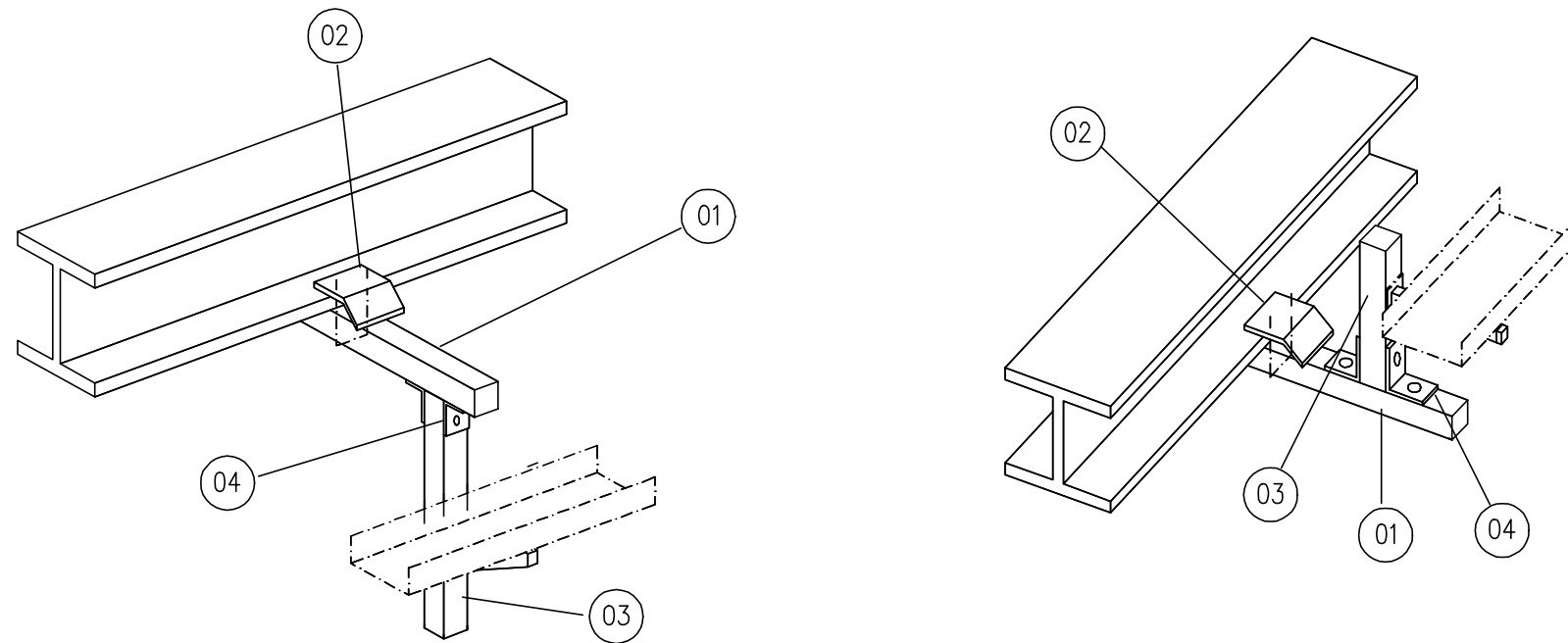
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NOTES

04	TWO HOLE CORNER ANGLE	
03	SIMPLE CHANNEL U 41x41	
02	BEAM CLAMPS FOR U 41x41	SUPPLIED WITH 1 U BOLT
01	SIMPLE CHANNEL U 41x41	
	DESIGNATION	REMARKS

**SUPPORT TYPE  
MOUNTING UNDER BEAM**

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
SUPPORT TYPE MOUNTING UNDER BEAM

Size	Scale	Sheet
A3	NTS	53 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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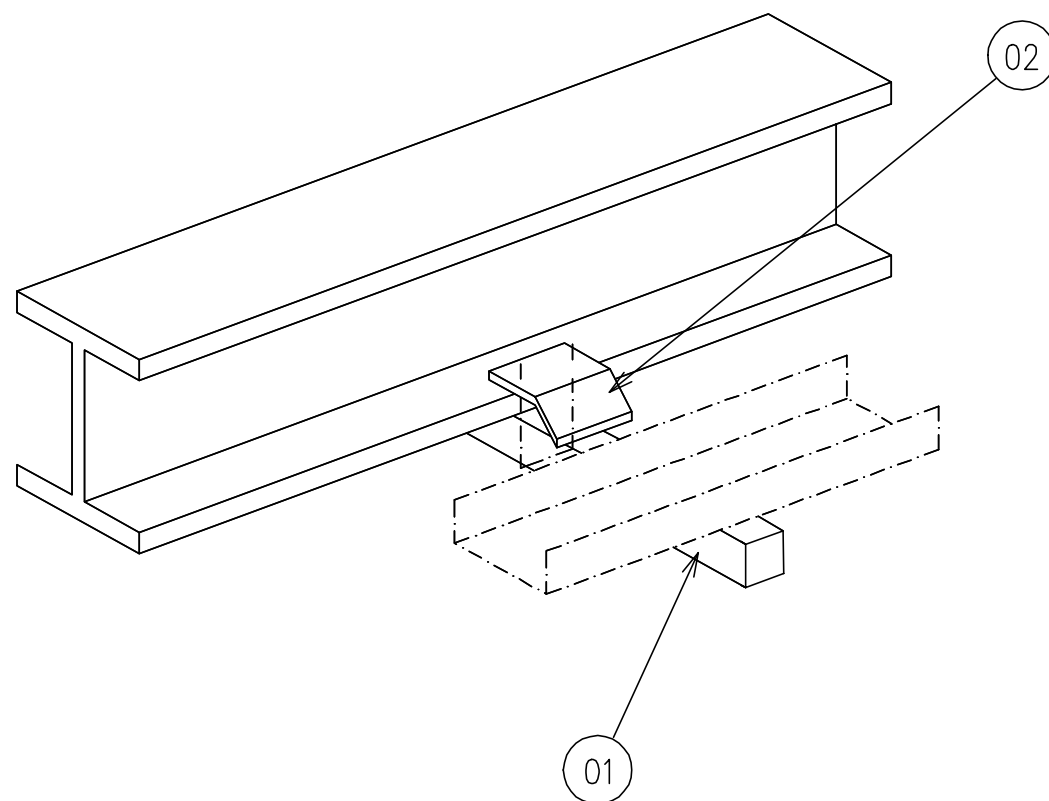
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NOTES



VERTICAL OR HORIZONTAL MOUNTING ACCORDING TO DRAWING.

02	BEAM CLAMPS FOR U 41x41	SUPPLIED WITH 1 U BOLT
01	SIMPLE CHANNEL U 41x41	
	DESIGNATION	REMARKS

**SUPPORT TYPE MOUNTING ON BEAM**


0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
SUPPORT TYPE MOUNTING ON BEAM

Size	Scale	Sheet
A3	NTS	54 of 62
Drawing No.	Rev.	
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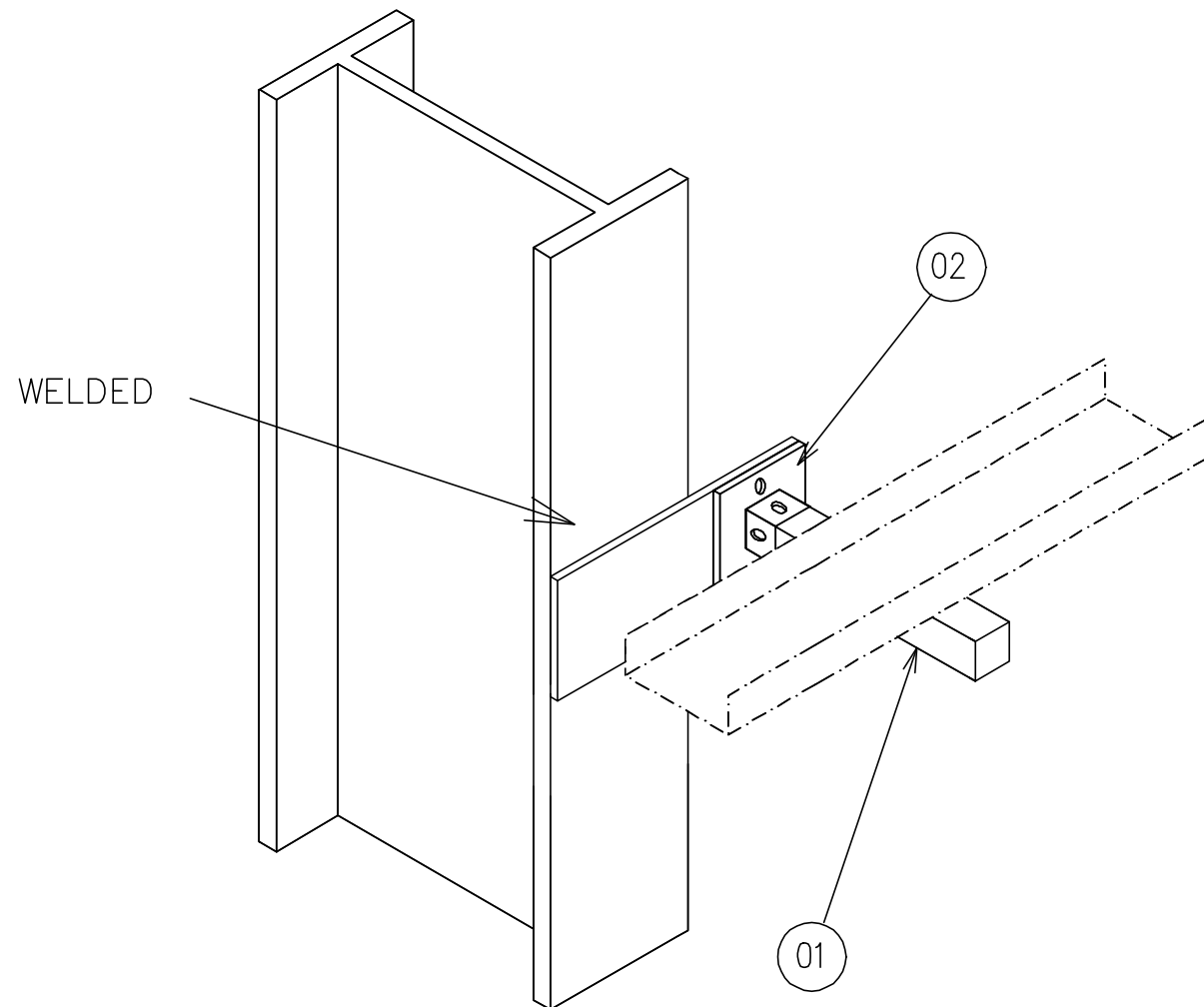
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VERTICAL OR HORIZONTAL MOUNTING  
ACCORDING TO DRAWING.

02	HEAD POST BASE	WELDED
01	SINGLE CHANNEL U 41x41	
	DESIGNATION	

### SUPPORT TYPE MOUNTING ON BEAM

#### NOTES

0	07.10.16	APPROVED	RKS	PR	KJ	SKH			
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated	
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS SUPPORT TYPE MOUNTING ON BEAM									
			Size	Scale	Sheet				
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			Drawing No.	GGNG-E-20714-3010			Rev.	0	

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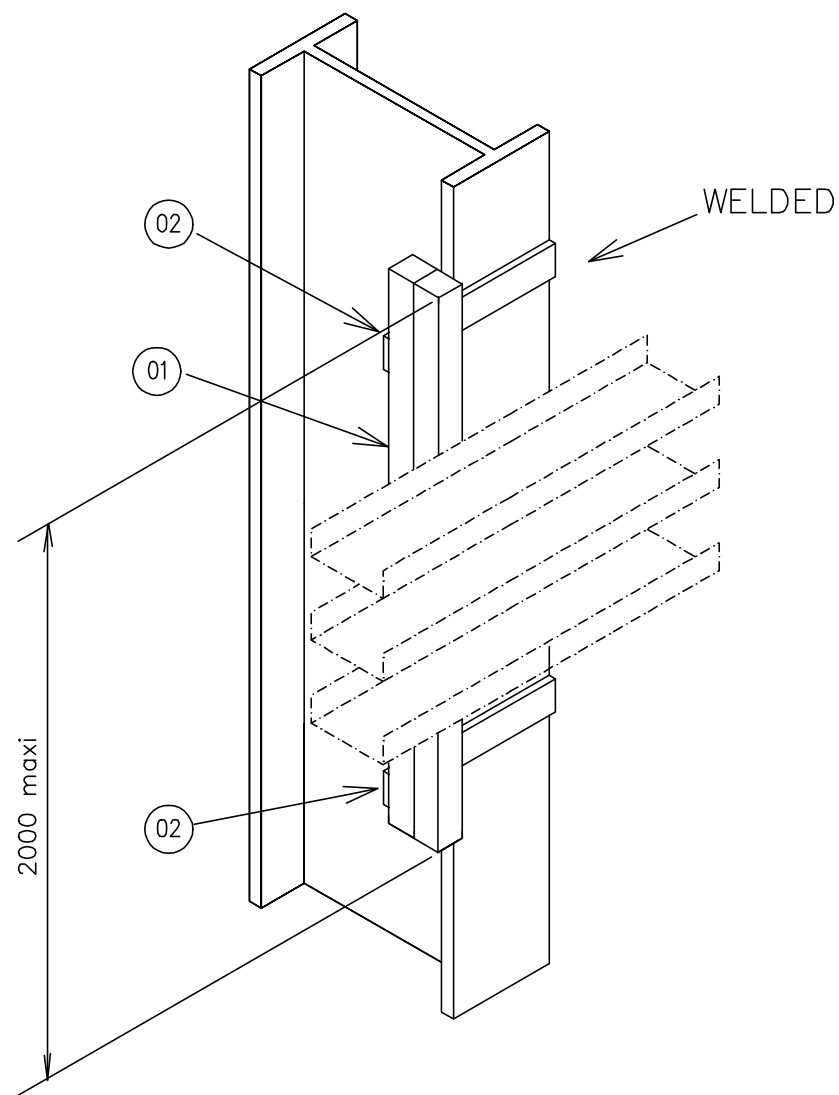
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NOTES



VERTICAL OR HORIZONTAL MOUNTING ACCORDING TO DRAWING.

02	BOLT M10x30
01	DOUBLE CHANEL 82x41
	DESIGNATION

**SUPPORT TYPE FIXING ON GROUND AND CEILING**

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS SUPPORT TYPE FIXING ON GROUND AND CEILING

Size	Scale	Sheet
A3	NTS	56 of 62
Drawing No.		Rev.
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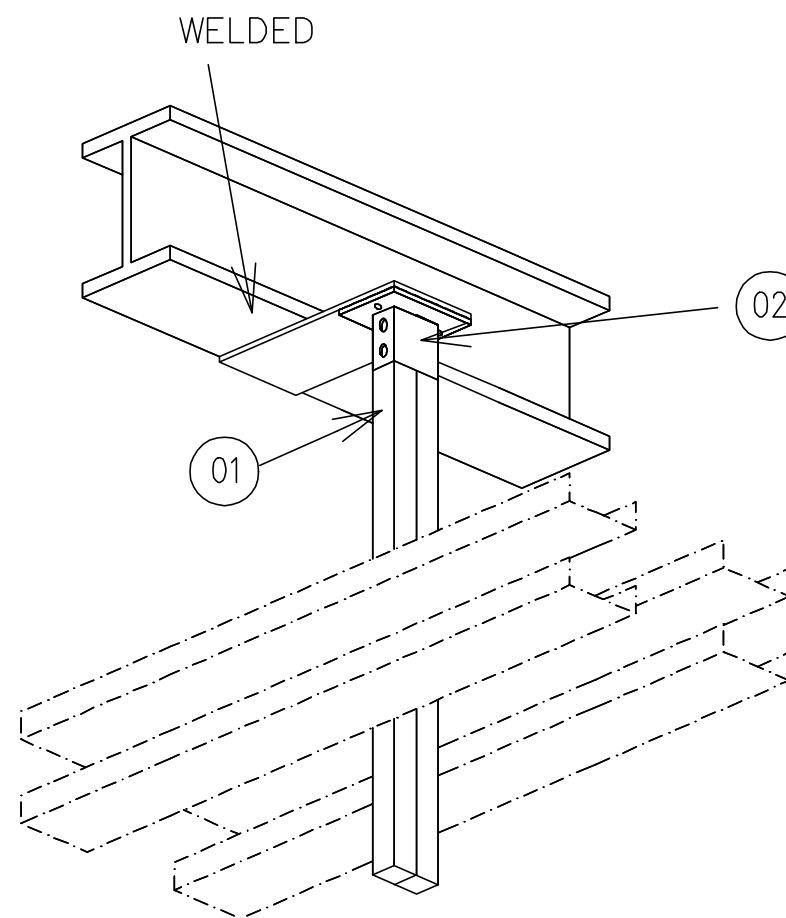
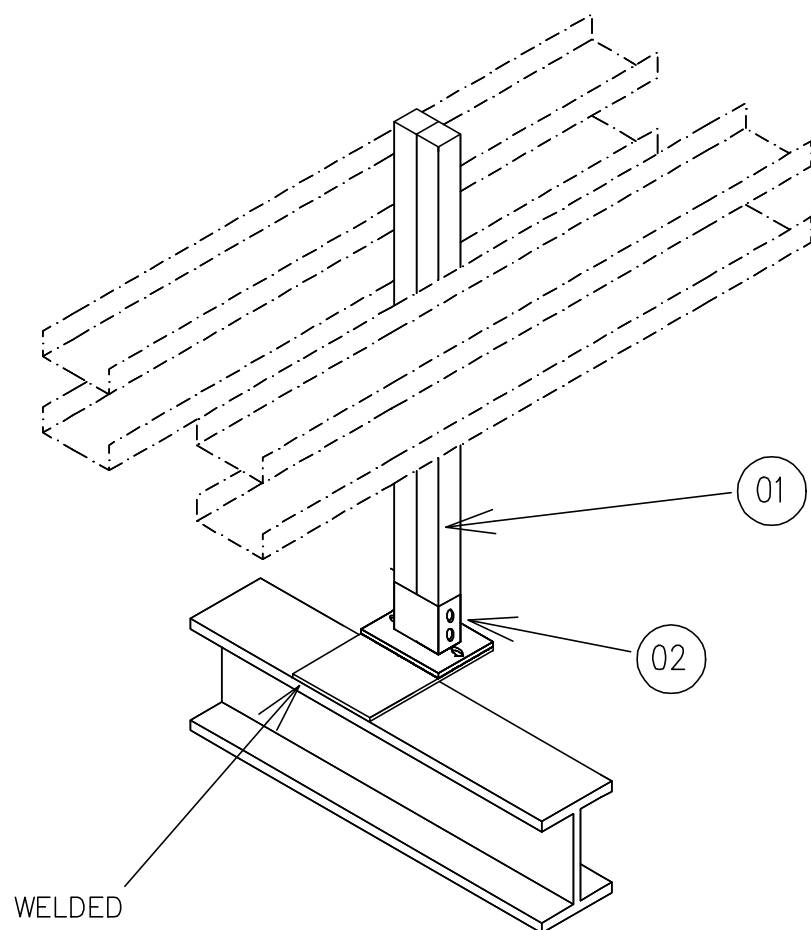
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NOTES



02	DOUBLE HEAD POST BASE	BOLTED
01	DOUBLE CHANNEL U 82x41	
	DESIGNATION	

**SUPPORT TYPE FIXING ON  
GROUND AND CEILING**

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT			
TYPICAL CABLE TRAY INSTALLATION DETAILS SUPPORT TYPE FIXING ON GROUND AND CEILING			
Size	Scale	Sheet	
A3	NTS	57 of 62	
Drawing No.			Rev.
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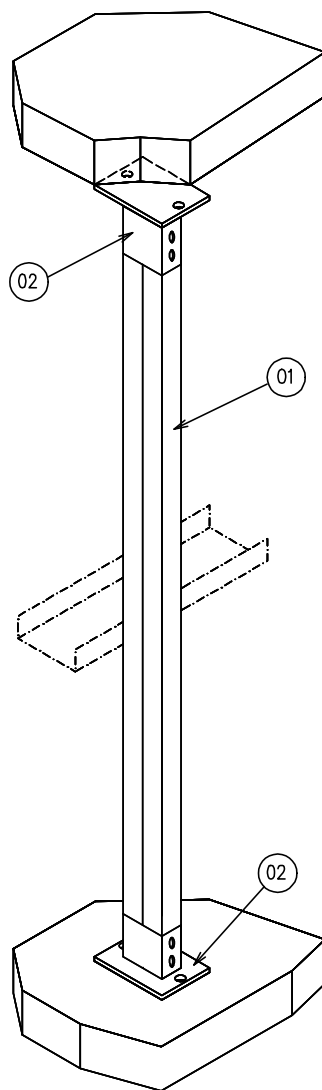
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02	DOUBLE HEAD POST BASE	BOLTED
01	DOUBLE CHANNEL U 82x41	
	DESIGNATION	

**SUPPORT TYPE 65 FIXING ON  
GROUND AND CEILING**

NOTES

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
SUPPORT TYPE 65 FIXING ON GROUND AND CEILING

Size	Scale	Sheet
A3	NTS	58 of 62
Drawing No.	Rev.	
GGNG-E-20714-3010	0	

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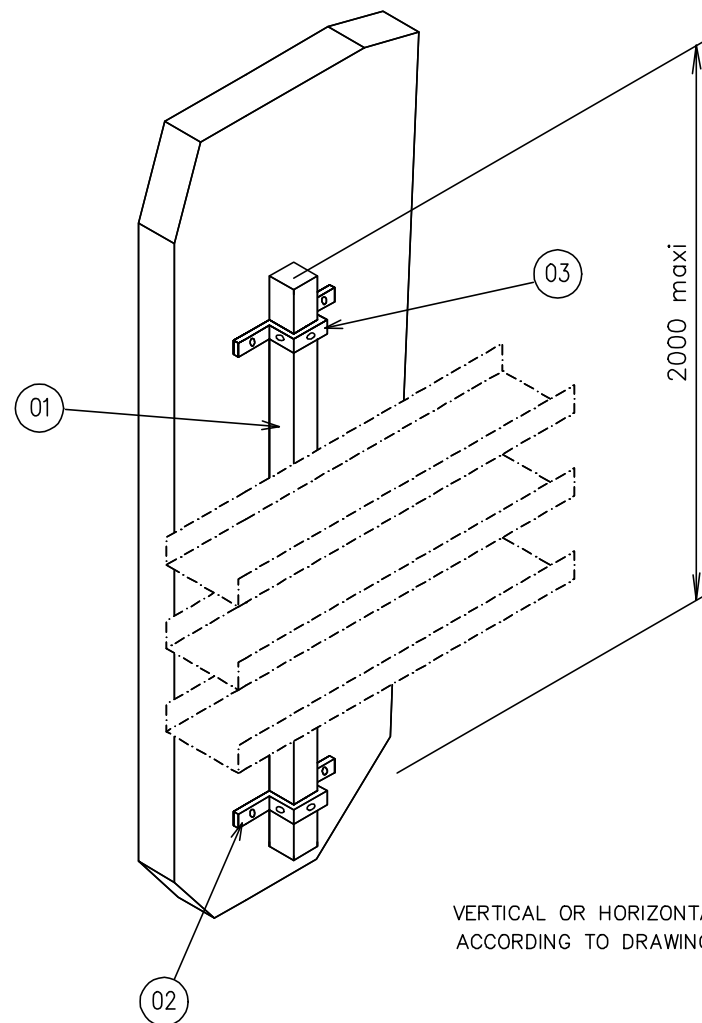
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NOTES



VERTICAL OR HORIZONTAL MOUNTING ACCORDING TO DRAWING.

03	OMEGA SHAPE FITTING FOR U 42 x41
02	EXPANSION STUD ANCHOR
01	SINGLE CHANNEL U 41x41
	DESIGNATION

**SUPPORT TYPE FIXING ON  
SINGLE CHANNEL U 41x41 ON CONCRETE**

0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT								
TYPICAL CABLE TRAY INSTALLATION DETAILS								
SUPPORT TYPE FIXING ON SINGLE CHANNEL								
U41x41 ON CONCRETE								
	Size	Scale		Sheet				
	A3	NTS		59	of	62		
	Drawing No.				Rev.			
	GGNG-E-20714-3010				0			

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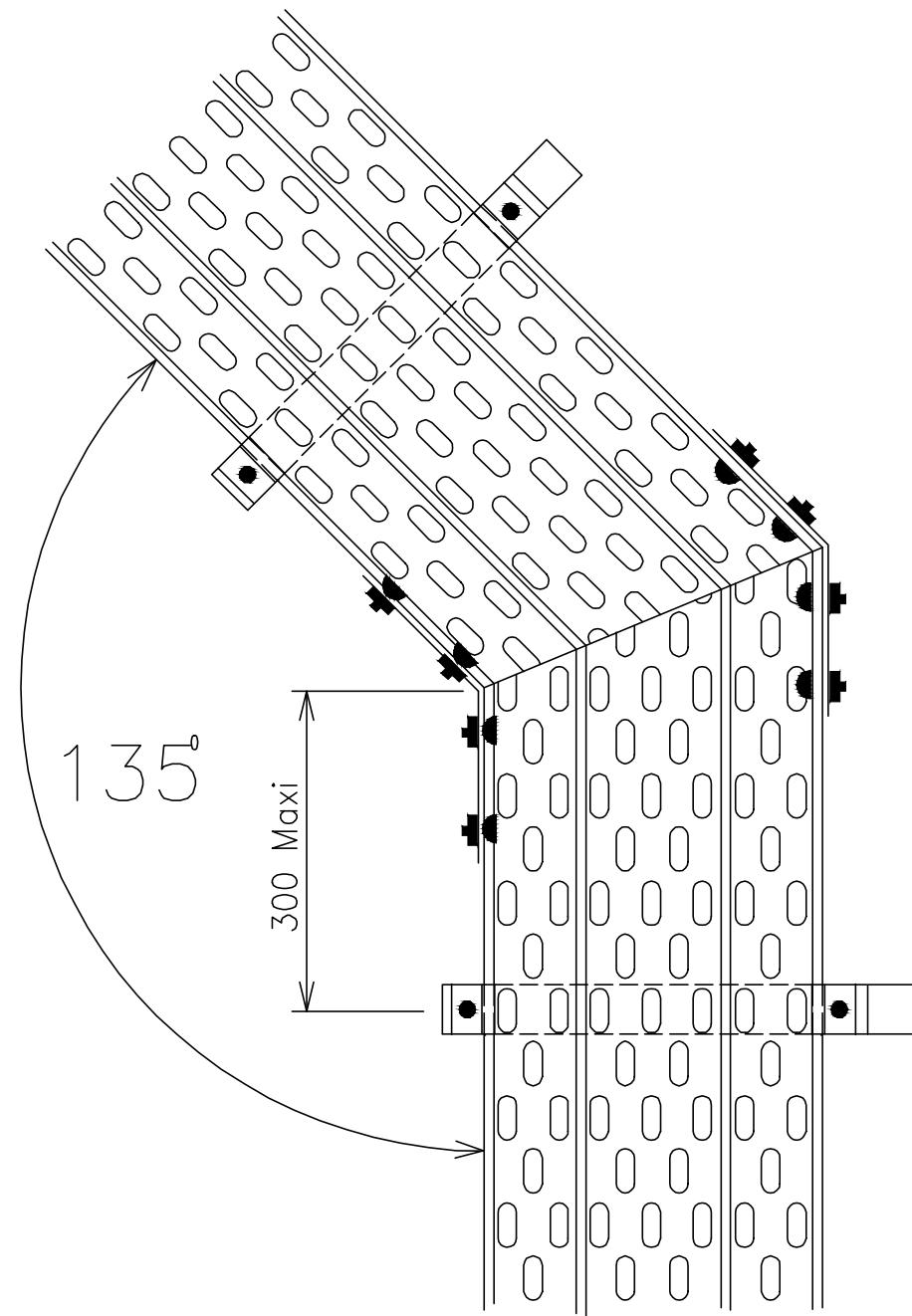
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**CABLE TRAYS 135° ANGLE**

**NOTES**

0	07.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS						
CABLE TRAYS 135 ANGLE						
	Size	Scale		Sheet		
	A3	NTS		60 of 62		
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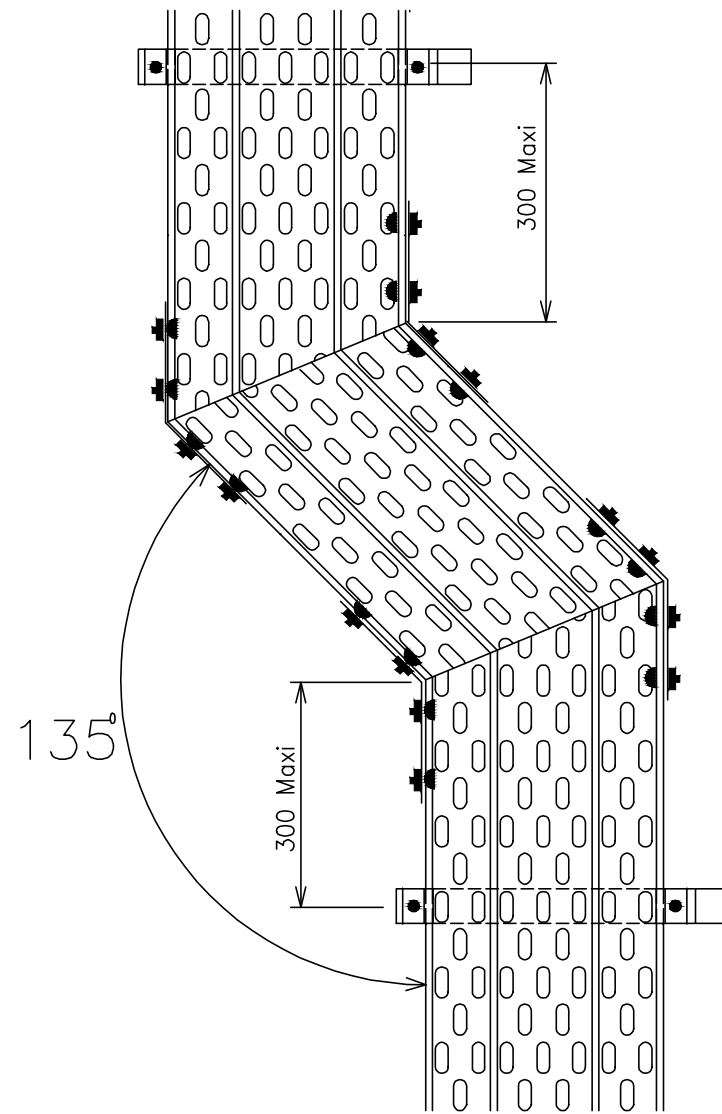
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NOTES



CABLE TRAYS 135° ANGLE


0	07.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE TRAYS 135 ANGLE

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A3	NTS	61 of 62
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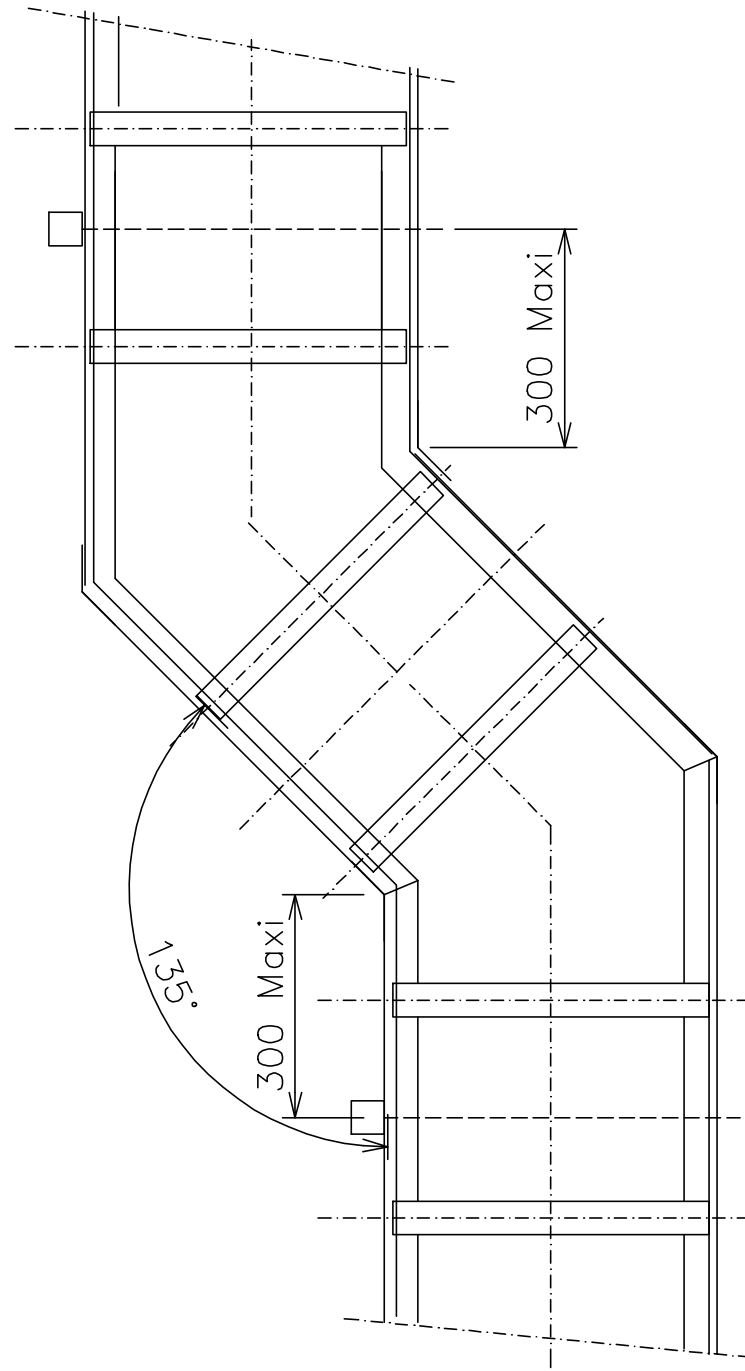
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**CABLE LADDER 135° ANGLE**

NOTES

0	07.10.16	APPROVED		RKS	PR	KJ	SKH	
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL CABLE TRAY INSTALLATION DETAILS  
CABLE LADDER 135 ANGLE

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GGNG-E-20714-3010		0

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# TYPICAL EARTHING INSTALLATION DETAILS

0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS						
Size		Scale		Sheet		
A3		NTS		01 of 23		
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GGNG-E-20715-0812						0

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GENERAL NOTES

NOTES

1. ALL DIMENSIONS ARE GIVEN IN MM.( UNLESS OTHERWISE SPECIFIED).
2. ALL GROUNDING CONDUCTORS SURROUNDING THE BUILDINGS SHALL BE LOCATED ABOUT 1.5M(1500MM) FROM WALLS, COLUMN PEDESTALS AND FENCES.
3. ALL JOINTS UNDERGROUND SHALL BE PROTECTED AGAINST CORROSION BY DENSO TAPE(OR EQUIVALENT).
4. TIGHTENING TORQUES ARE GIVEN IN THE FOLLOWING TABLE:

Tightening torques ( in m.kg )	
Diameter of screw	Class 5.8 steel screw
M 10	2.86
M 12	4.94
M 14	7.8
M 16	11.83
M 20	26

5. METALLIC FENCES AROUND TRANSFORMER AREA AND LONG METALLIC OBJECTS SHALL BE CONNECTED TO THE GROUNDING SYSTEM IN AT LEAST TWO INTERVALS NOT EXCEEDING 50 METERS.  
 PLASTIC COVERED CHAIN LINK FENCES SHALL BE CONSIDERED IN THE SAME WAY AS BARE METALLIC FENCES, SO THAT SUPPORT POSTS, STAYS AND ANTI-CLIMBING FITTINGS SHALL BE BANDED ACCORDING TO ABOVE TWO METHODS.
6. PVC PIPES SHALL BE SET IN CONCRETE CASING UNLESS OTHERWISE SPECIFIED.
7. PVC PIPES ARE HEAVY DUTY TYPE.
8. ALL ARC WELDS SHALL BE PROTECTED AGAINST CORROSION.
9. ELECTRICAL EQUIPMENT LIKE MV/LV SWITCHGEAR, DB, CONTROL PANEL WILL BE EARTHED TO THE EARTHING CONDUCTOR RUNNING ALONG THE EDGE OF THE NEARBY CABLE TRAY, WHETHER AVAILABLE.
10. ALL NON CURRENT CARRYING METALLIC EQUIPMENT SUCH AS TANKS, METAL STRUCTURE SUCH HAS HAND RAIL, STRUCTURAL COLUMNS SHALL BE GROUNDED WITH MIN ON GROUND CONDUCTOR. AND TWO NUMBERS IN CASE LOCATED IN HAZARDOUS AREA.
11. A TEST LINK SHALL BE PROVIDED IN EACH EARTH PIT.
12. EARTH PIT FOR LIGHTNING PROTECTION DOWN CONDUCTOR SHALL BE SEPARATE DOWN CONDUCTORS FROM LIGHTNING ARRESTOR TO EARTH PIT SHALL BE RUN BY SHORTEST ROUTE LENGTH.
13. AL ELECTRICAL EQUIPMENT WITH 3-PHASE SUPPLY EG. SWITCHGEAR, POWER AND MOTOR CONTROL CENTERS, INVERTER PANEL, POWER LIGHTING DB, MOTOR WELDING RECEPTACLES. ETC SHALL BE GROUNDED BY TWO SEPARATE GROUND CONNECTIONS.
14. NEUTRAL POINT OF TRANSFORMER SECONDARY SHALL BE GROUNDED WITH TWO SEPARATE AND DISTINCT EARTH PIT. TRANSFORMER BODY SHALL BE GROUNDED BY TWO SEPARATE AND DIAGONALLY OPPOSITE CONNECTIONS TO MAIN GROUND GRID.
15. STATIC GROUND CONNECTIONS SHALL BE MADE ACROSS FLANGED JOINTS OF PIPELINES IDENTIFIED FOR STATIC CHARGE IN ALL AREAS.
16. DCS/PLC GROUND BUS BAR SHALL BE CONNECTED TO DCS GROUNDING ELECTRODE BY TWO SEPARATE PVC INSULATED COPPER CONDUCTORS.
17. ALL FLAME PROOF ELECTRICAL EQUIPMENT INCLUDING LIGHTING FIXTURES AND PUSH BUTTON STATION SHALL BE GROUNDED AT TWO POINTS.

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Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

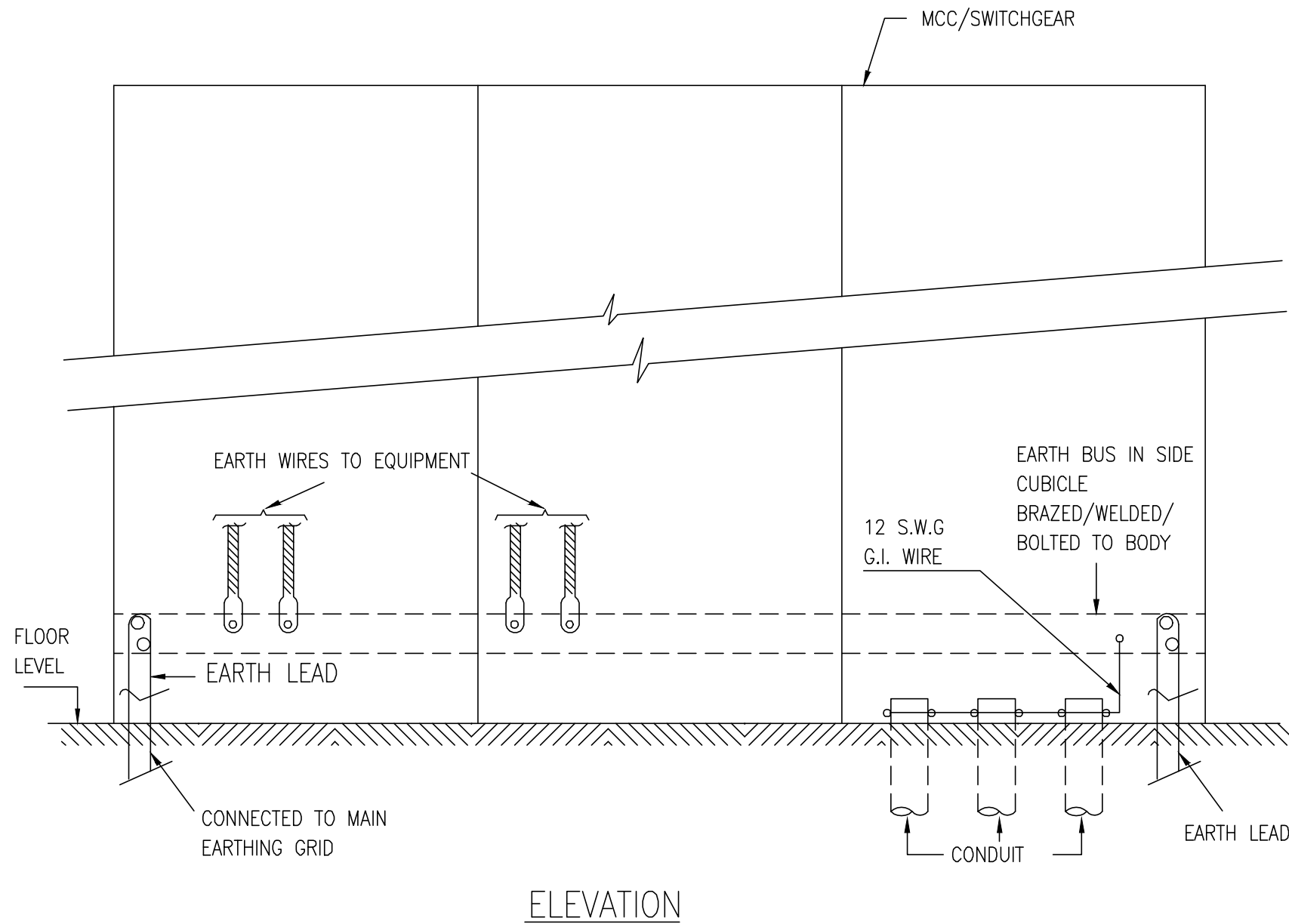
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Size	Scale	Sheet	
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NOTES

NOTES

- 1. CONNECTION BETWEEN EARTH BUS IN MCC/SWITCHGEAR AND EARTH LEAD SHALL BE WITH MINIMUM TWO BOLTS.



ELEVATION

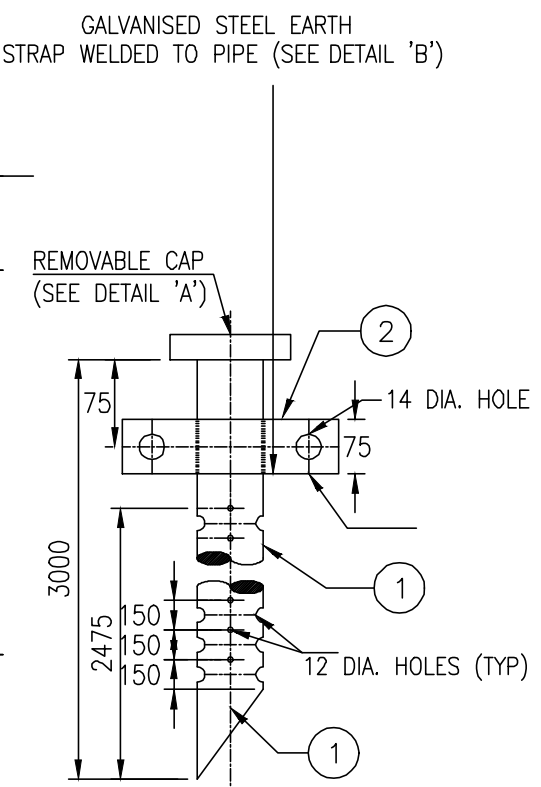
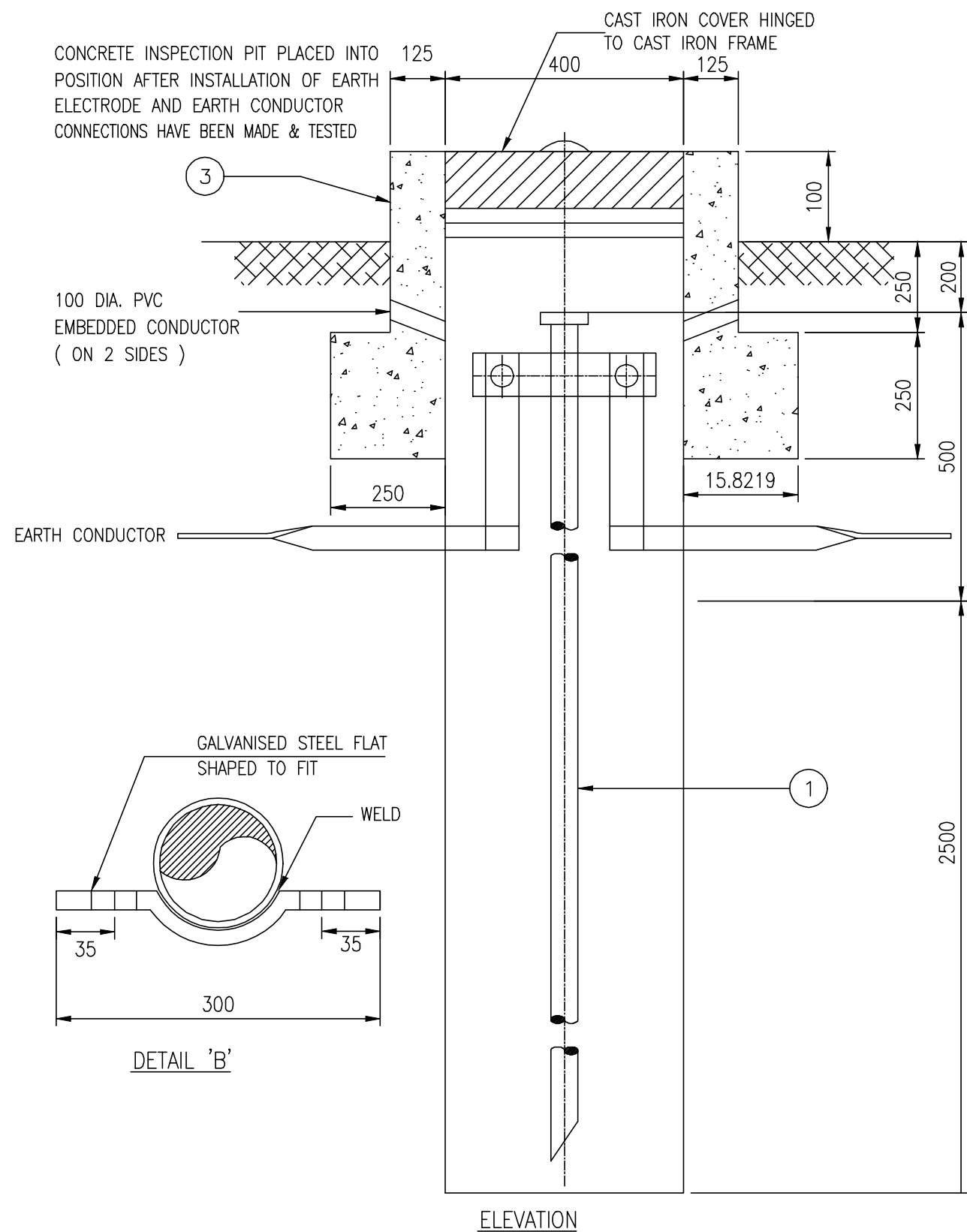
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Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
M.C.C. & METAL CLAD SWITCHGEAR

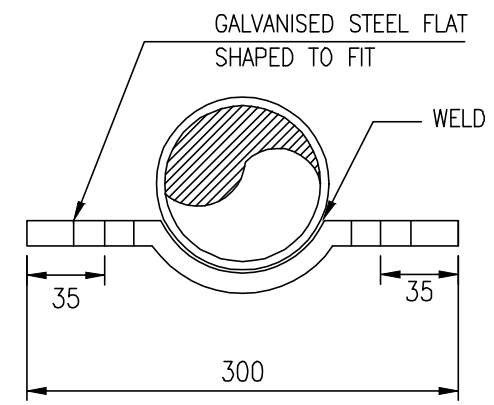
Size	Scale	Sheet
A3	NTS	03 of 23
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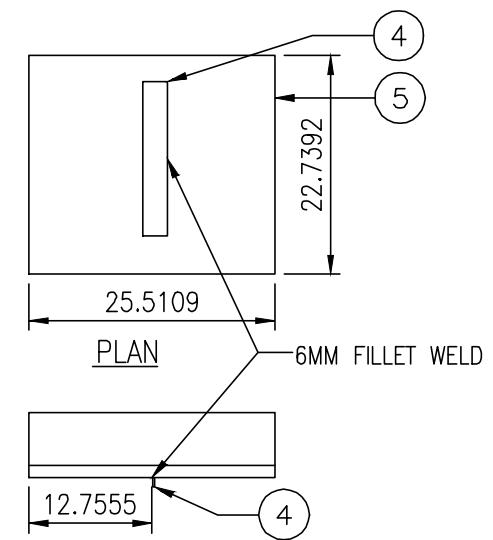
- 1. ALL DIMENSION AREA IN MILLIMETER (mm).
- 2. ALL STEEL WORK SHALL BE HOT DIP GALVANISED.
- 3. INSPECTION PITS SHALL BE INSTALLED FLASH WITH SURROUNDING GRADE WITHIN PAVED AREAS.
- 4. UNLESS OTHERWISE SPECIFIED, ALL THE MATERIALS ARE IN CONTRACTORS SCOPE OF SUPPLY.



ELEVATION



DETAIL 'B'



PLAN

ELEVATION

TYPICAL ARRANGEMENT OF PIPE ELECTRODE

- LEGEND**
- ① 100mm DIAMETER MEDIUM DUTY GALVANISED STEEL PIPE (CLASS 'B')
  - ② GALVANISED MS FLAT (DETAIL 'B')
  - ③ CONCRETE INSPECTION COVER
  - ④ 90x50x6 GALVANISED MS ANGLE (DETAIL 'A')
  - ⑤ 130x130x6 GALVANISED MS PLATE (DETAIL 'A')

0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

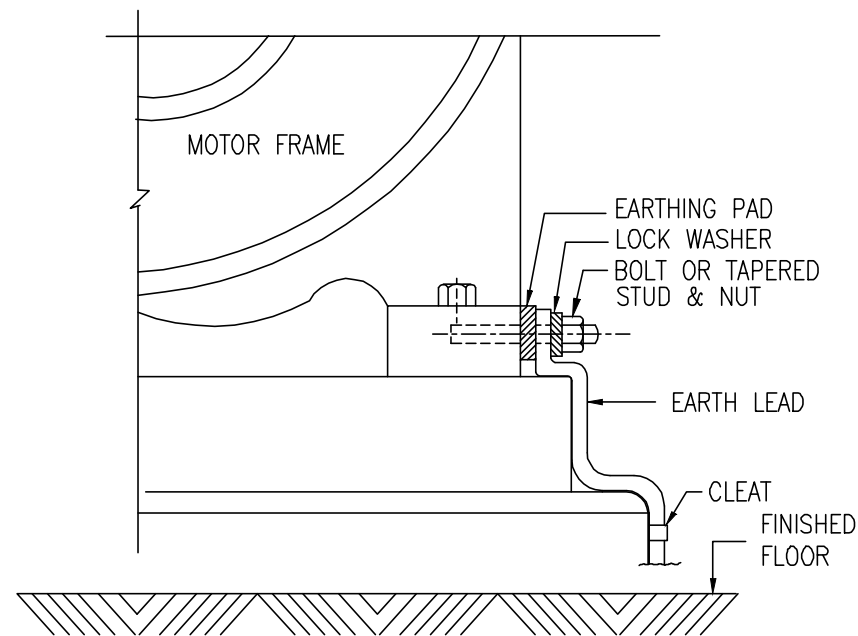
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
PIPE/ROD ELECTRODE

Size	Scale	Sheet
A3	NTS	04 of 23
Drawing No.	Rev.	
GGNG-E-20715-0812	0	

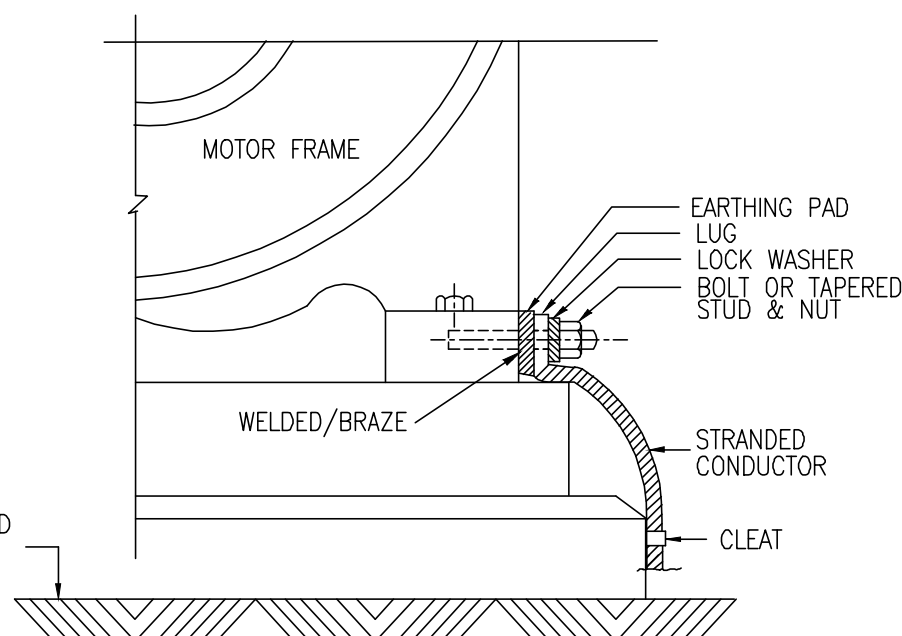
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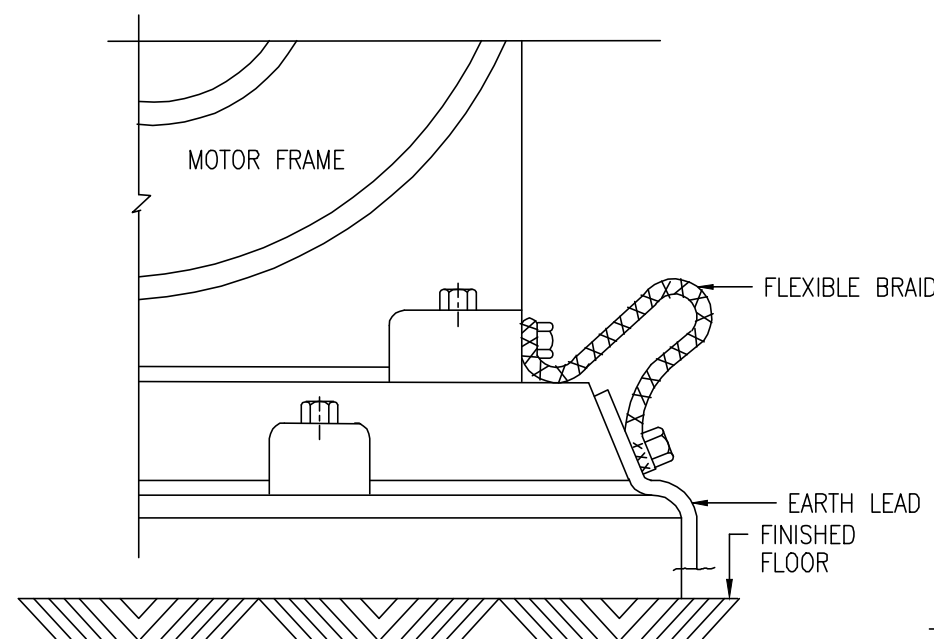
- 1. NUTS AND BOLTS SHALL BE AS PER IS: 1363(PART-1,2,3):1992/ IS 1367(PART-5):1980.
- 2. WASHERS SHALL BE AS PER IS 2016:1967.



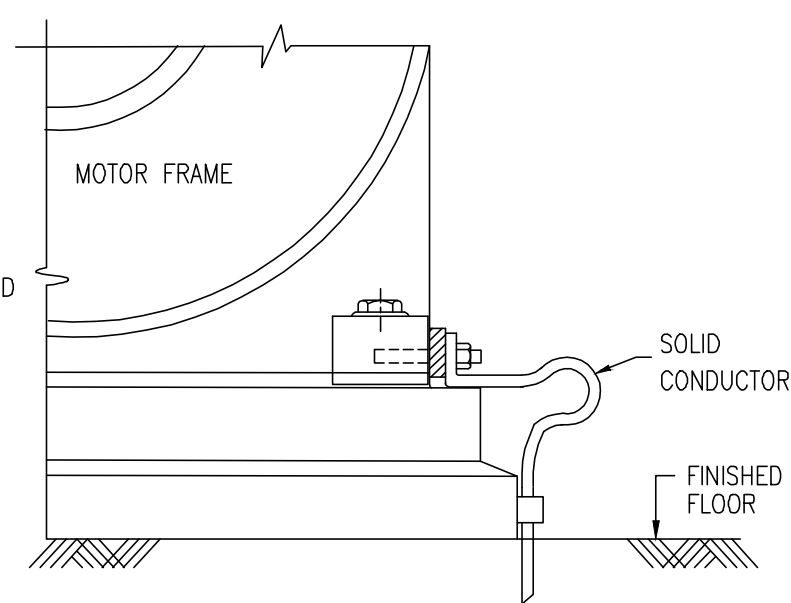
TYPE I CONNECTION FOR FLAT CONDUCTOR



TYPE II CONNECTION FOR STRANDED CONDUCTOR



TYPE III CONNECTION FOR FLAT/STRANDED CONDUCTOR FOR MOTORS IN SLIDING BASE



TYPE IV CONNECTION FOR SMALL MOTORS WHEN STRANDED CONDUCTORS IS NOT AVAILABLE

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Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
MOTOR FRAME EARTHING

Size	Scale	Sheet
A3	NTS	05 of 23
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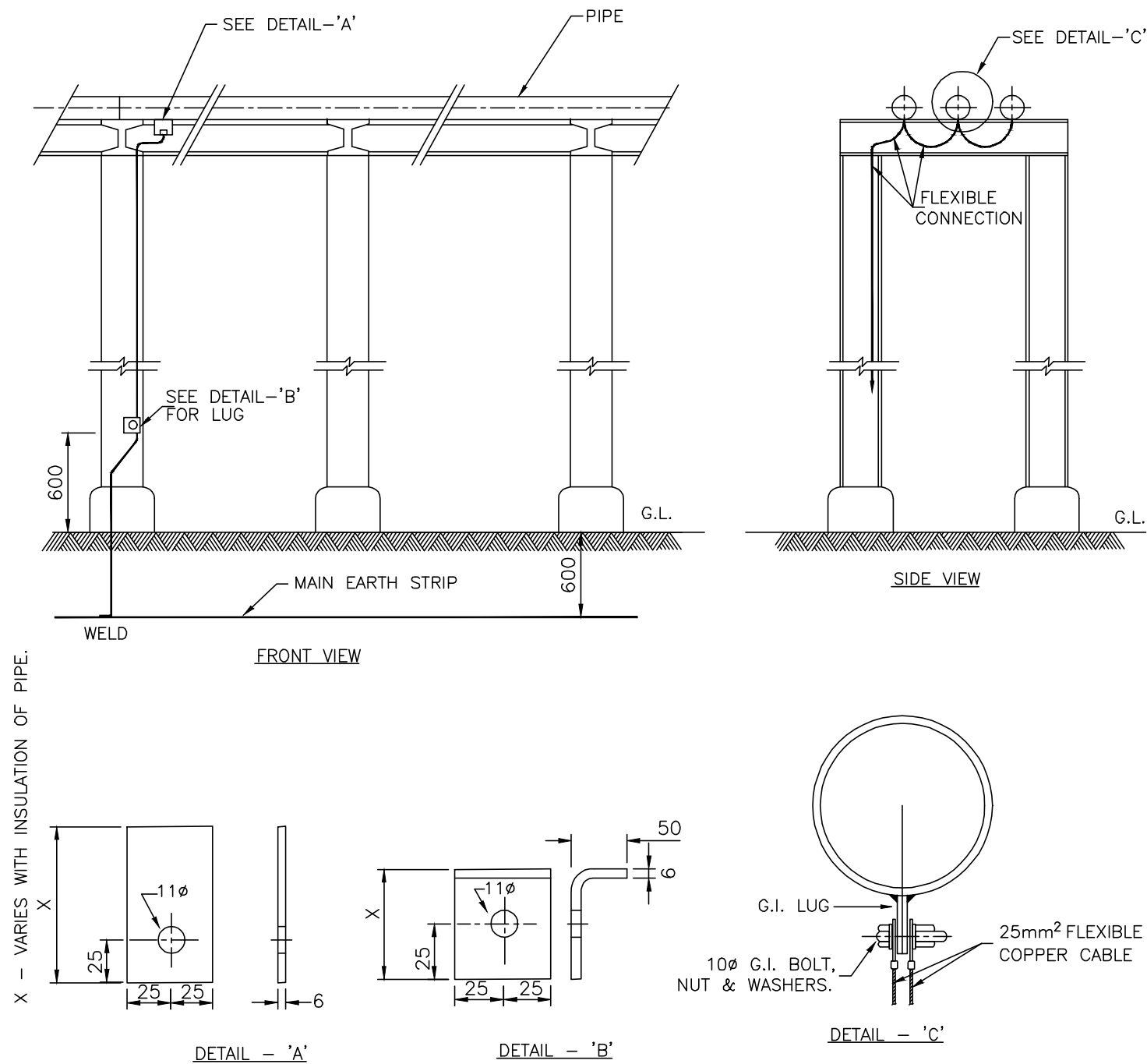
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NOTES

1. ALL DIMENSIONS ARE IN MM.
2. THE PIPE LINES SHALL BE BONDED AND EARTHED AT THE ENTRY AND EXIT POINTS OF BATTERY LIMIT UNLESS OTHERWISE SPECIFIED.
3. NUTS/BOLTS SHALL BE AS PER IS 1363(PART-1,2,3):1992/ IS 1367(PART5):1980.
4. WASHERS SHALL BE AS PER IS 2016:1967.

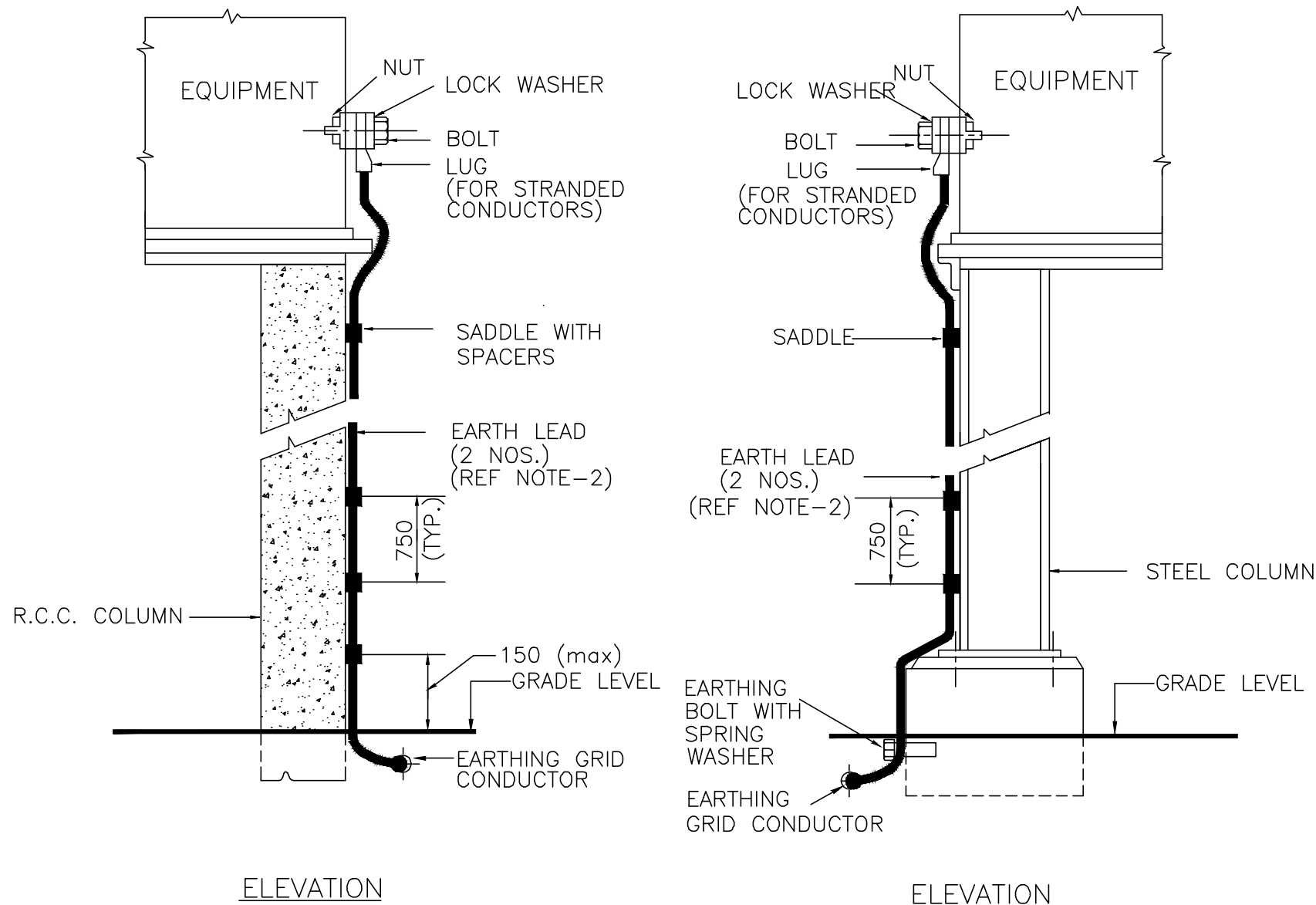
0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
EARTHING OF PIPES ON RACK

Size	Scale	Sheet
A3	NTS	06 of 23
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NOTES

1. ALL DIMENSIONS ARE IN MM.
2. THE EARTH LEADS FOR THE SAME EQUIPMENT SHALL BE LAID ON TWO DIFFERENT COLUMNS, HOWEVER, IF THE EQUIPMENT IS SUPPORTED ON ONLY ONE COLUMN THE LEADS TO BE RUN ON OPPOSITE FACES OF THE SAME.
3. IF FLAT CONDUCTOR IS USED THE SAME TO BE SUITABLY DRILLED FOR CONNECTION TO THE EQUIPMENT EARTHING TERMINAL STUD.
4. THE CONDUCTOR CAN ALTERNATIVELY BE WELDED TO STEEL STRUCTURE AT 1000MM INTERVAL.
5. THE CONNECTION BETWEEN CONDUCTOR AND LUG SHALL BE CRIMPED TYPE.
6. NUTS AND BOLTS SHALL BE AS PER IS: 1363(PART-1,2,3):1992/ IS 1367(PART-5):1980.
7. WASHERS SHALL BE AS PER IS 2016:1967.



0	13.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

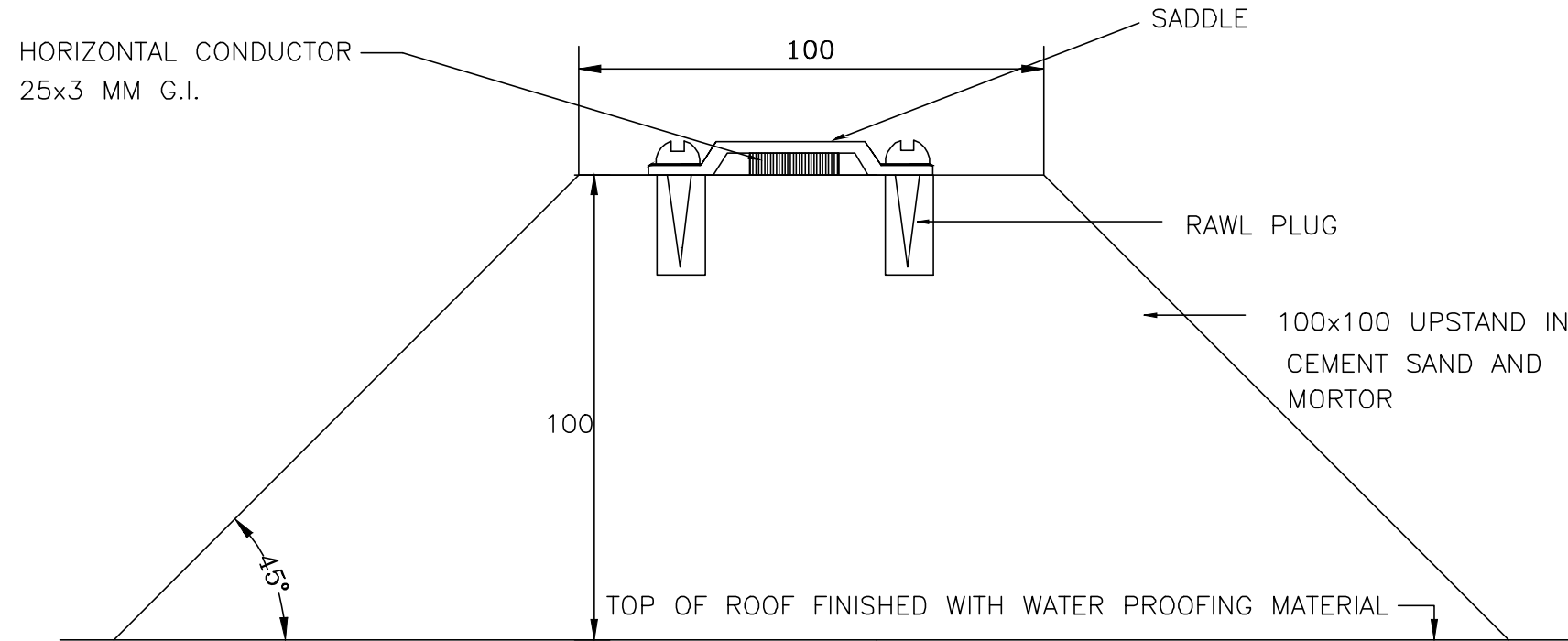
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
EQUIPMENT ON R C C / STEEL COLUMN

Size	Scale	Sheet
A3	NTS	07 of 23
Drawing No.	Rev.	
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NOTES

1. ALL DIMENSIONS ARE IN MM.



TYPICAL DETAILS OF CLEATING HORIZONTAL CONDUCTOR  
OVER WATER PROOFING

0	13.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

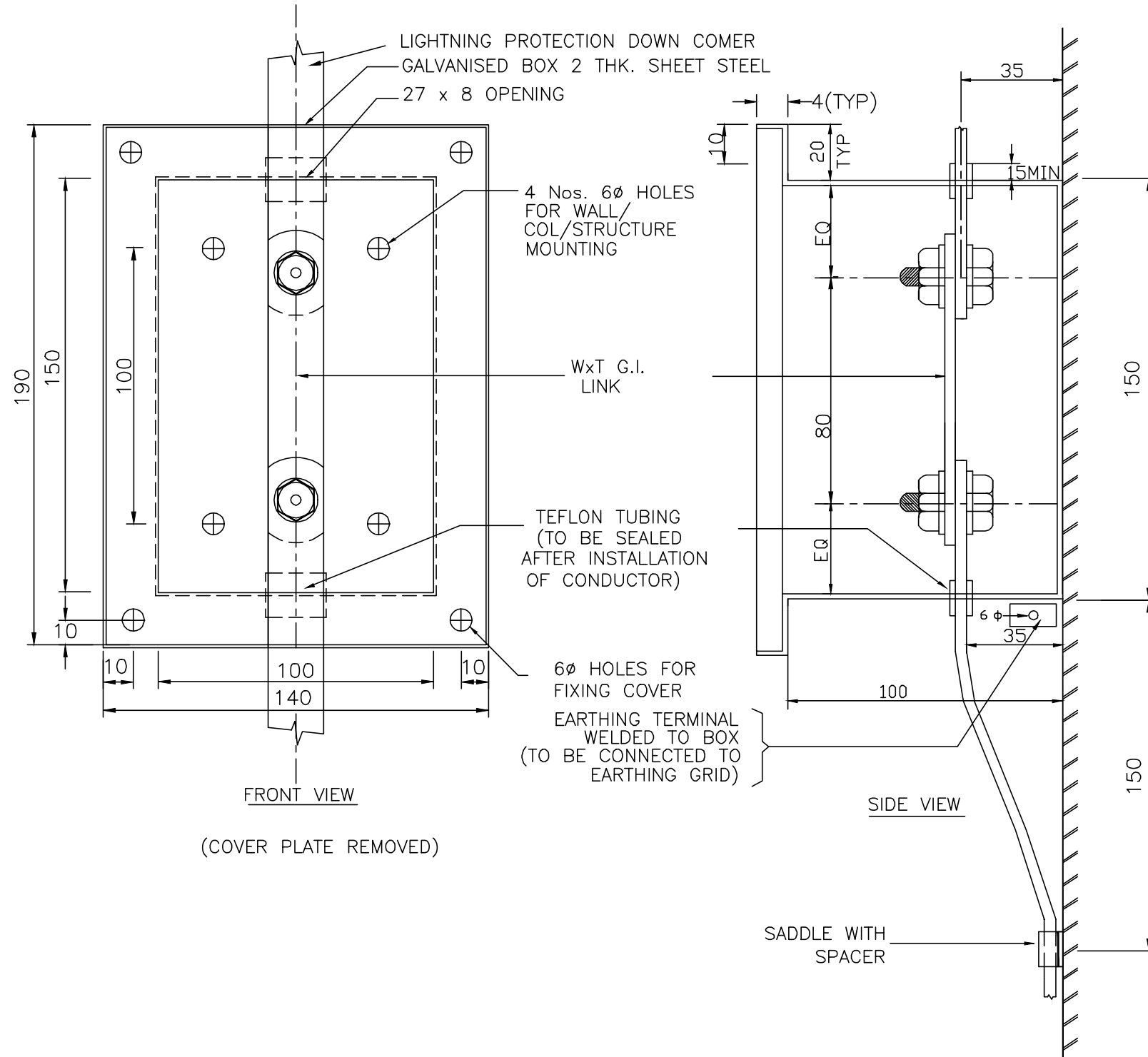
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
CLEATING EARTHING / LIGHTNING CONDUCTOR

Size	Scale	Sheet
A3	NTS	08 of 23
Drawing No.	Rev.	
GGNG-E-20715-0812	0	

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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. THE DOWN COMER ENTRY AND EXIT POINTS IN THE BOX TO BE MADE WATER TIGHT AFTER LAYING OF CONDUCTOR.
- 3. THE TEST LINK SHALL BE OF SAME WIDTH AND THICKNESS AS THE DOWN COMER. THE NUTS BOLTS AND WASHERS TO BE OF G.I.
- 4. NUTS AND BOLTS SHALL BE AS PER IS: 1363(PART-1,2,3):1992/ IS 1367(PART-5):1980.
- 5. WASHERS SHALL BE AS PER IS 2016:1967.



0	13.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

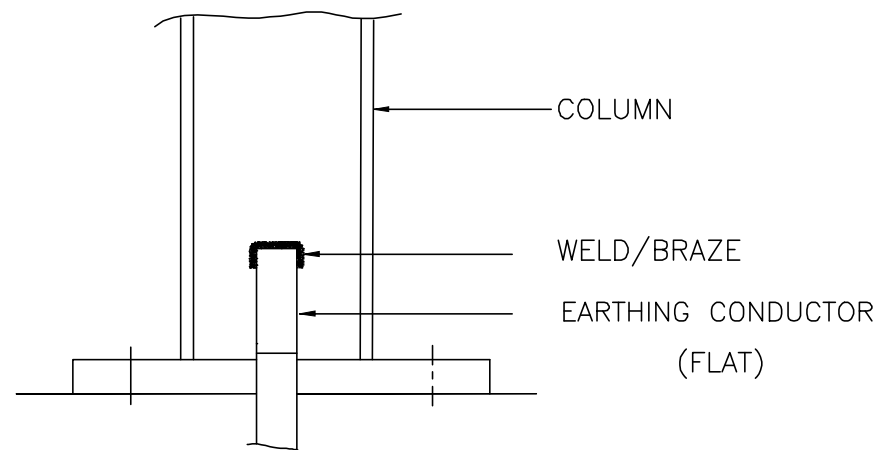
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
LIGHTNING PROTECTION DOWN COMER TEST LINK

Size	Scale	Sheet
A3	NTS	09 of 23
Drawing No.	Rev.	
GGNG-E-20715-0812	0	

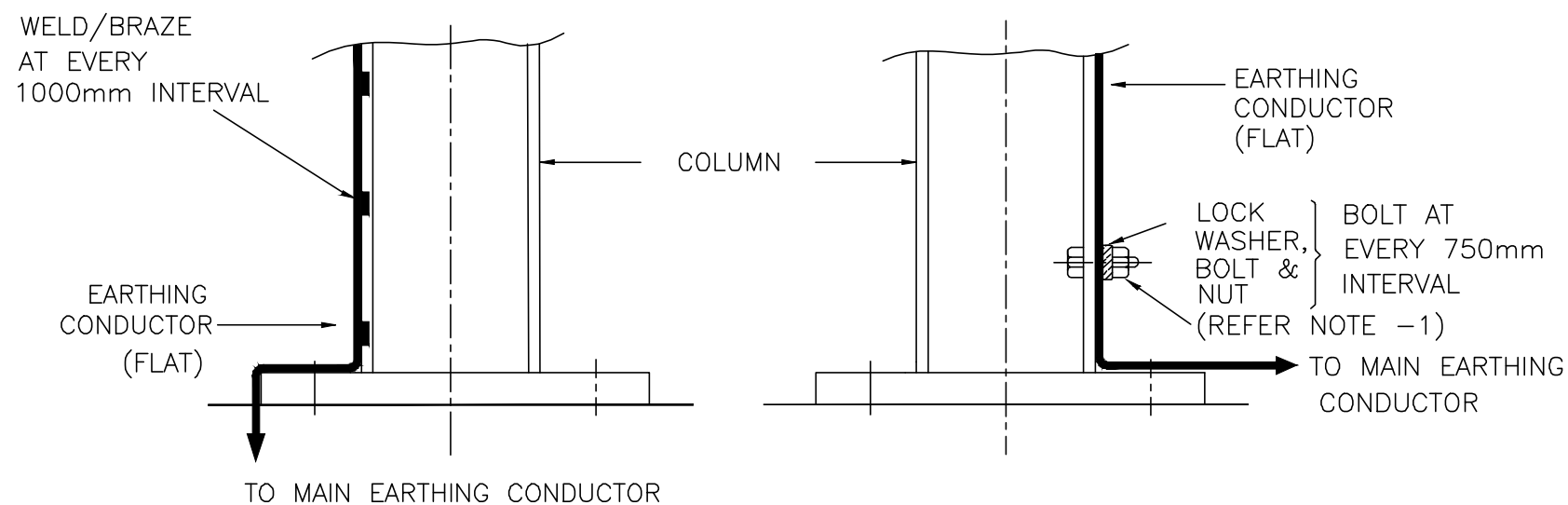
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NOTES

- 1. IT IS PREFERABLE TO HAVE A RUN ON WEB SO THAT PROJECTIONS OF NUT/BOLTS ARE AVOIDED.
- 2. NUTS AND BOLTS SHALL BE AS PER IS: 1363(PART-1,2,3):1992/ IS 1367(PART-5):1980.
- 3. WASHERS SHALL BE AS PER IS 2016:1967.



(i) STEEL COLUMN EARTHING



(ii) FLAT EARTHING CONDUCTOR RUNNING ALONG STEEL COLUMN

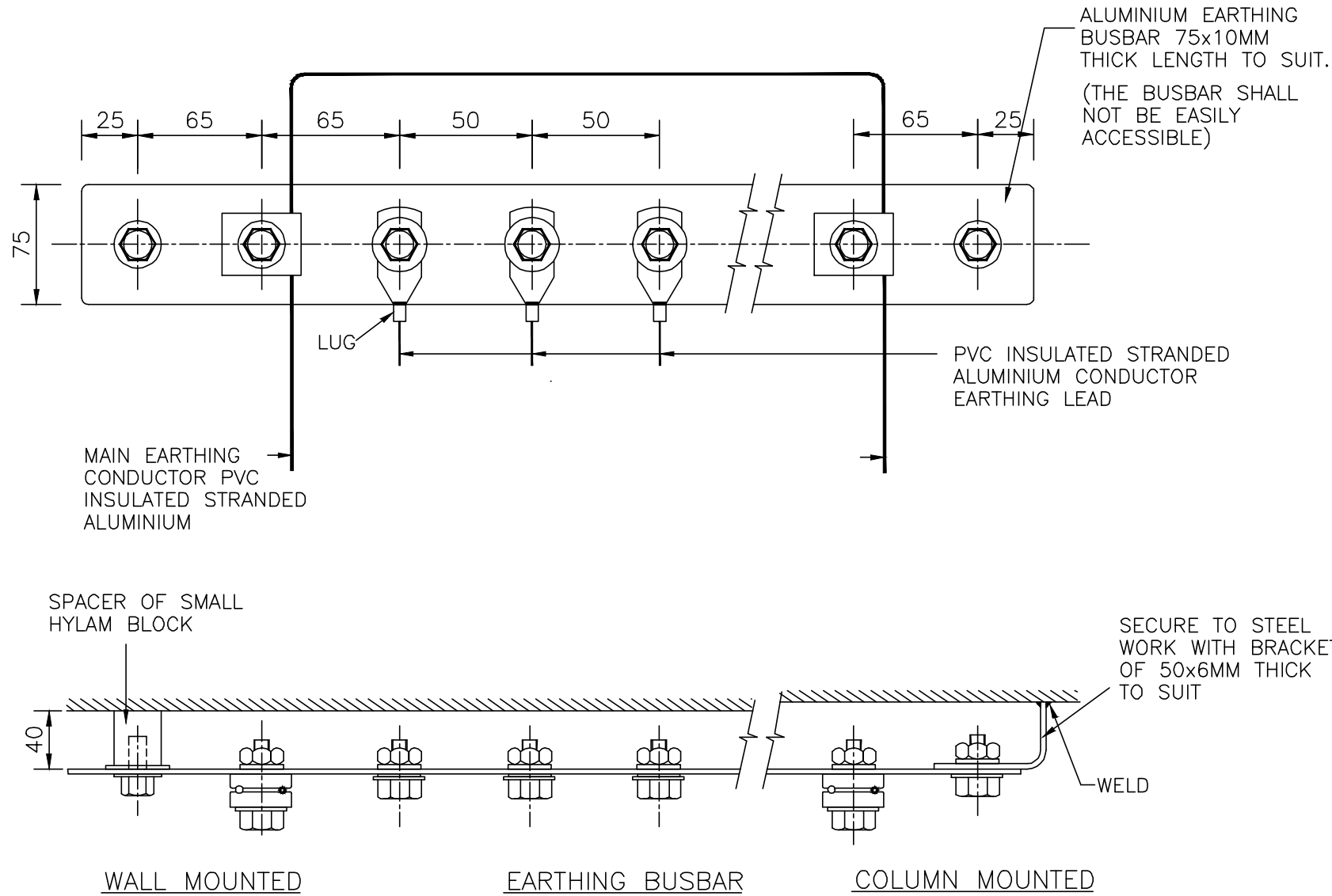
0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
EARTHING DETAILS STEEL COLUMNS

Size	Scale	Sheet
A3	NTS	10 of 23
Drawing No.	Rev.	
GGNG-E-20715-0812	0	

NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. LUG DIMENSIONS TO SUIT VARIOUS CONDUCTOR SIZES USED.
- 3. FIELD TO ENCASE BUS IN BOX WHEN IN CORROSIVE ATMOSPHERE.
- 4. NUTS AND BOLTS SHALL BE AS PER IS: 1363(PART-1,2,3):1992/ IS 1367(PART-5):1980.
- 5. WASHERS SHALL BE AS PER IS 2016:1967.



MATERIALS

- 1. LUGS. . . . . ALUMINIUM (REFER NOTE # 2)
- 2. NUTS, BOLTS & WASHERS ..... G.I.

0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

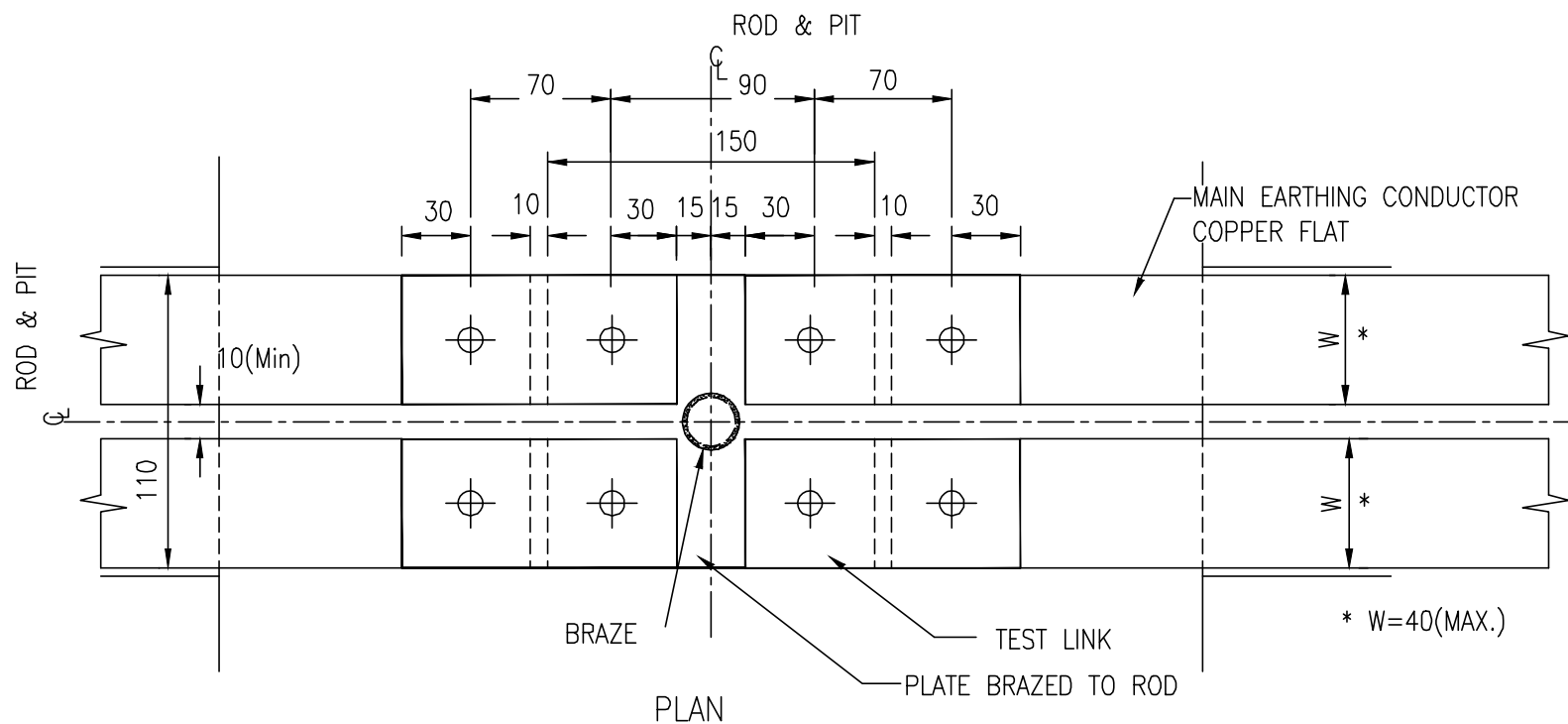
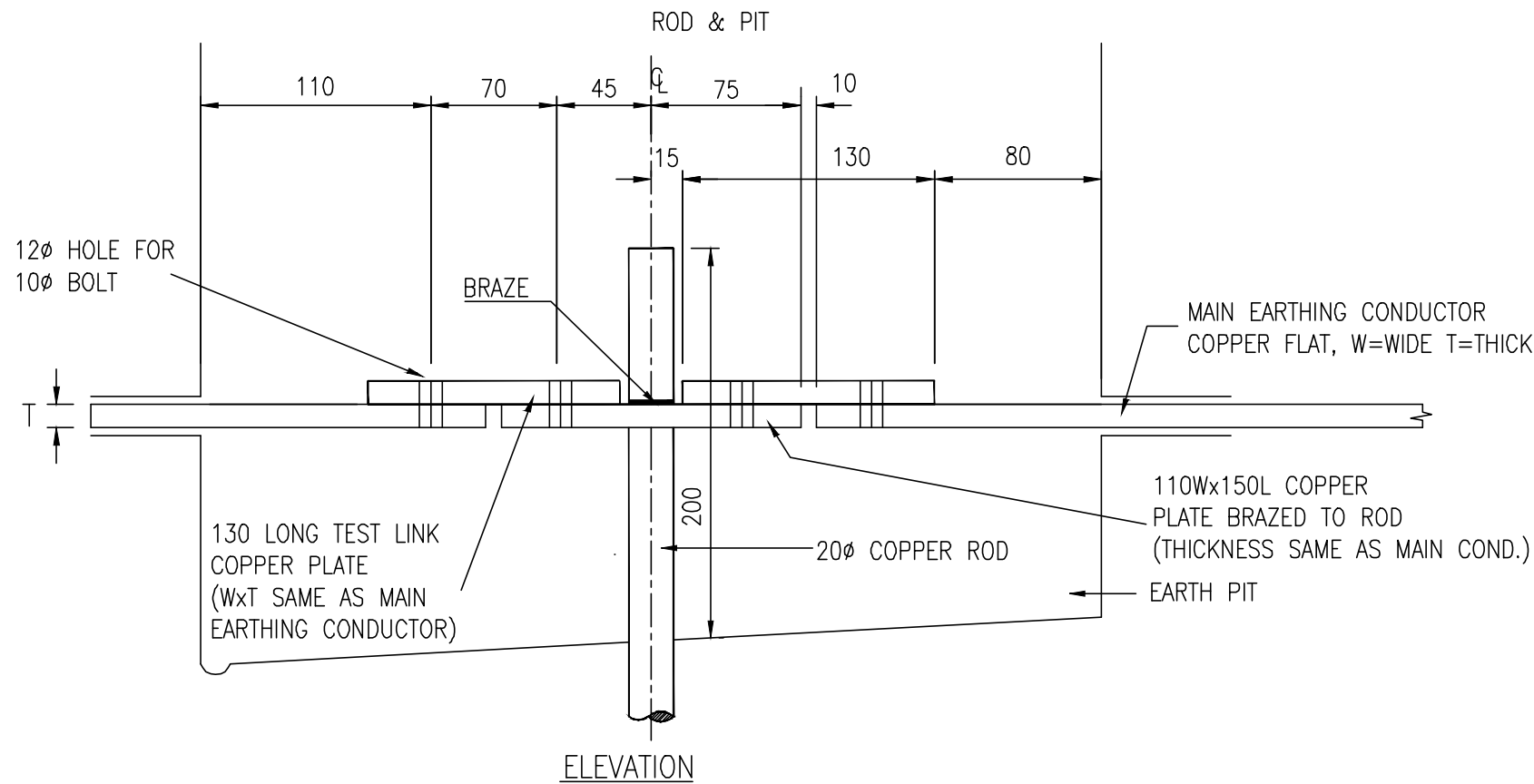
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS BUSBARS WALL/COLUMN MOUNTED

Size	Scale	Sheet
A3	NTS	11 of 23
Drawing No.	Rev.	
GGNG-E-20715-0812	0	

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NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. ALL NUTS, BOLTS & WASHERS SHALL BE OF HIGH SILICON BRONZE ALLOY.
- 3. EXCEPT DIMENSIONS OF MAIN EARTHING CONDUCTOR, ALL OTHER DIMENSIONS SHALL REMAIN FIRM.
- 4. THE ARRANGEMENT IS TYPICAL FOR CONNECTING FOUR CONDUCTORS ON COPPER ROD ELECTRODE. ACTUAL NO. OF CONNECTIONS TO BE DECIDED AT SITE.
- 5. NUTS AND BOLTS SHALL BE AS PER IS: 1363(PART-1,2,3):1992/ IS 1367(PART-5):1980.
- 6. WASHERS SHALL BE AS PER IS 2016:1967.



0	13.10.16	APPROVED	RKS	PR	KJ	SKH
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SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
ROD ELECTRODE CONNECTION DETAILS (FLAT CONDUCTOR)

Size	Scale	Sheet
A3	NTS	12 of 23
Drawing No.	Rev.	
GGNG-E-20715-0812	0	

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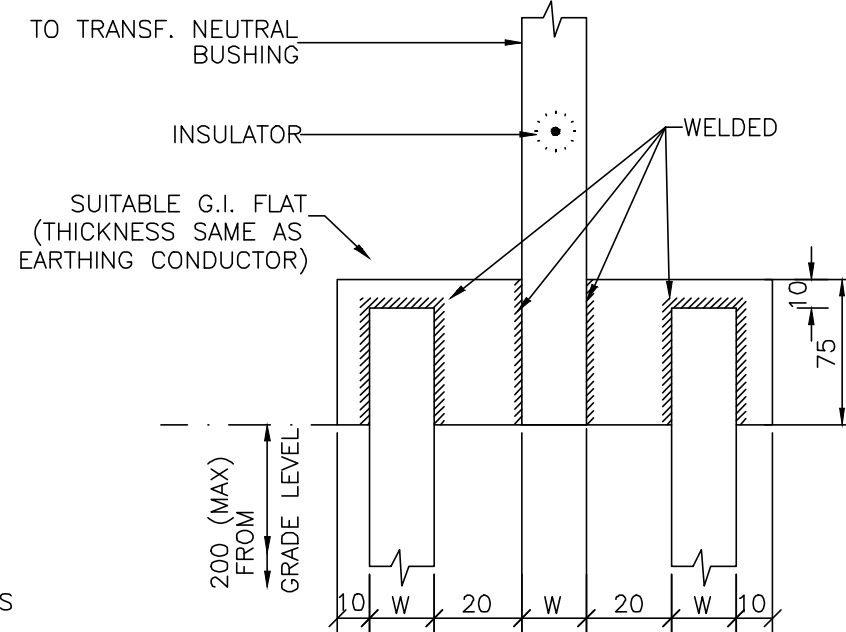
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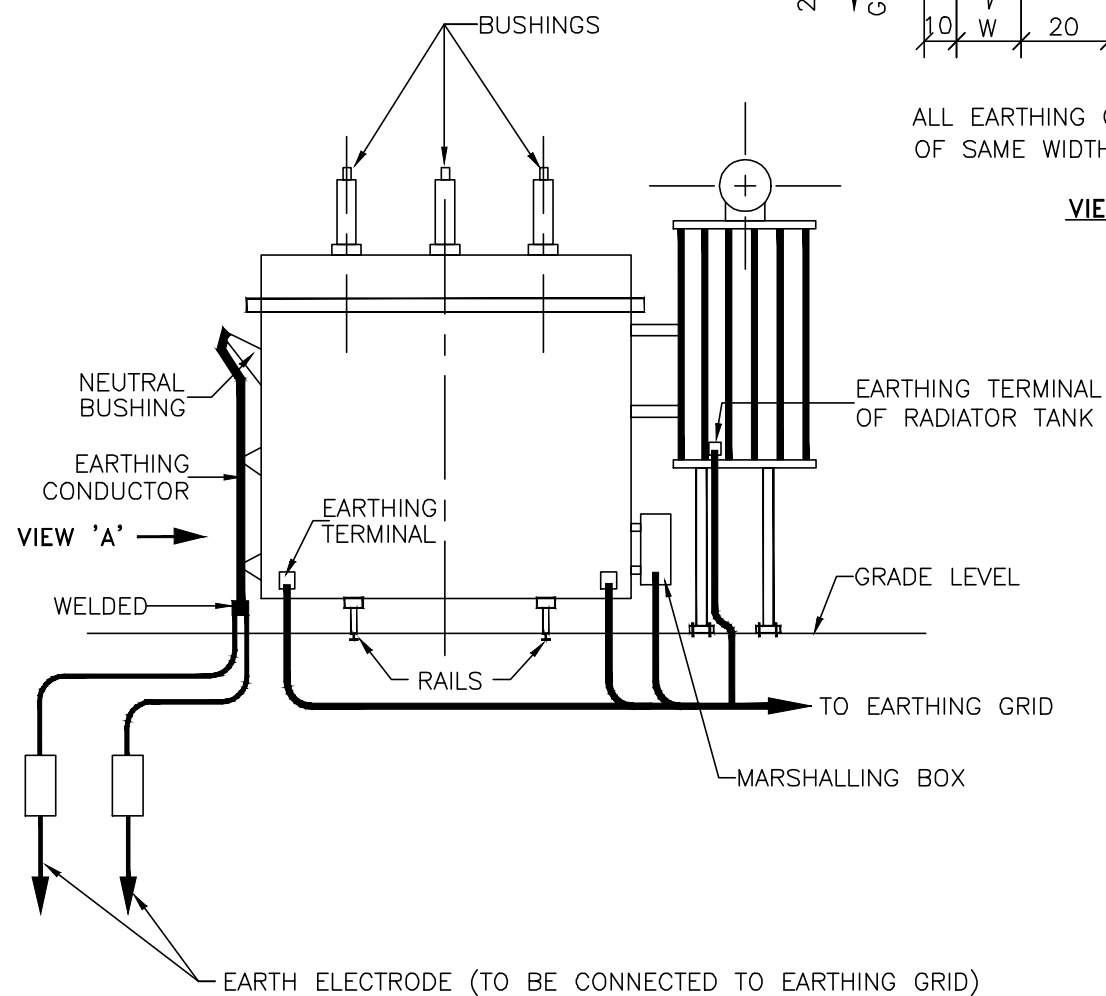
NOTES

- 1. ALL DIMENSIONS ARE IN MM.
- 2. WELDING SHALL BE DONE AS PER IS 816:1969.
- 3. THE TRANSFORMER NEUTRAL SHALL BE CONNECTED TO TWO ELECTRODES LOCATED APPROX 6M APART IN EARTH TEST PIT. THE CONNECTION BETWEEN TRANSFORMER NEUTRAL AND EACH ELECTRODE SHALL BE MADE BY SEPARATE CONDUCTORS.



ALL EARTHING CONDUCTORS TO BE OF SAME WIDTH & THICKNESS.

VIEW 'A'



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Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
TRANSFORMER EARTHING

Size	Scale	Sheet
A3	NTS	13 of 23
Drawing No.	Rev.	
GGNG-E-20715-0812	0	

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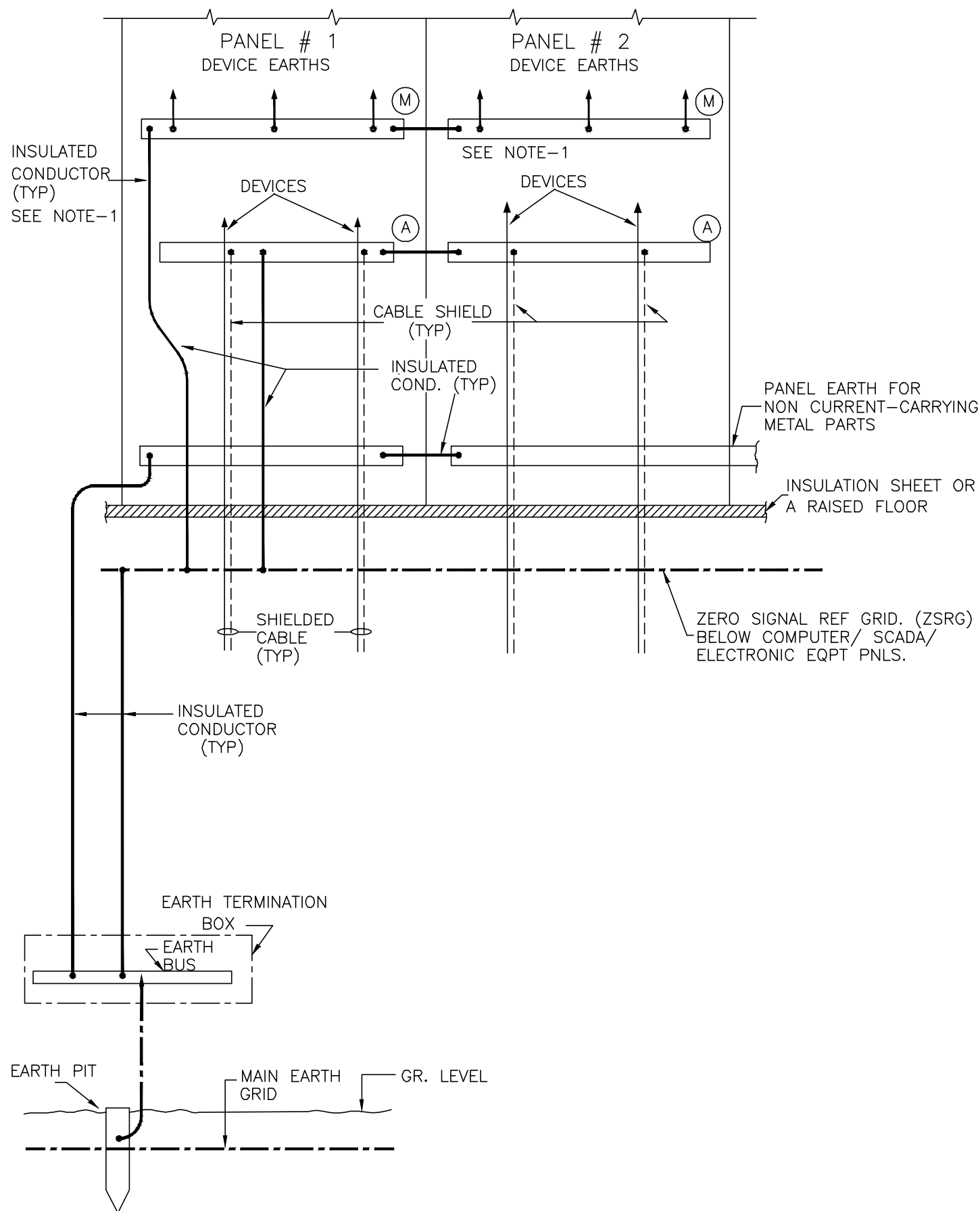
A

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NOTES

- 1 EARTH BUSES (A) & (M) MAY BE COMBINED INTO ONE BUS IF TWO SEPARATE BUSES ARE NOT SPECIFIED BY VENDORS
- 2 IF ZSRG IS NOT PROVIDED THE (A) & (M) BUSES ARE BROUGHT BY INSULATED CONDUCTORS TO THE EARTHBUS IN THE EARTH TERMINATION BOX. ONLY ONE EARTHING CONNECTION SHOULD BE PROVIDED FROM THIS EARTH BUS TO EARTH PIT PROVIDED IN THE MAIN EARTHING GRID.

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SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
COMPUTER/INSTRUMENTATION EQUIPMENT

Size	Scale	Sheet
A3	NTS	14 of 23
Drawing No.	Rev.	
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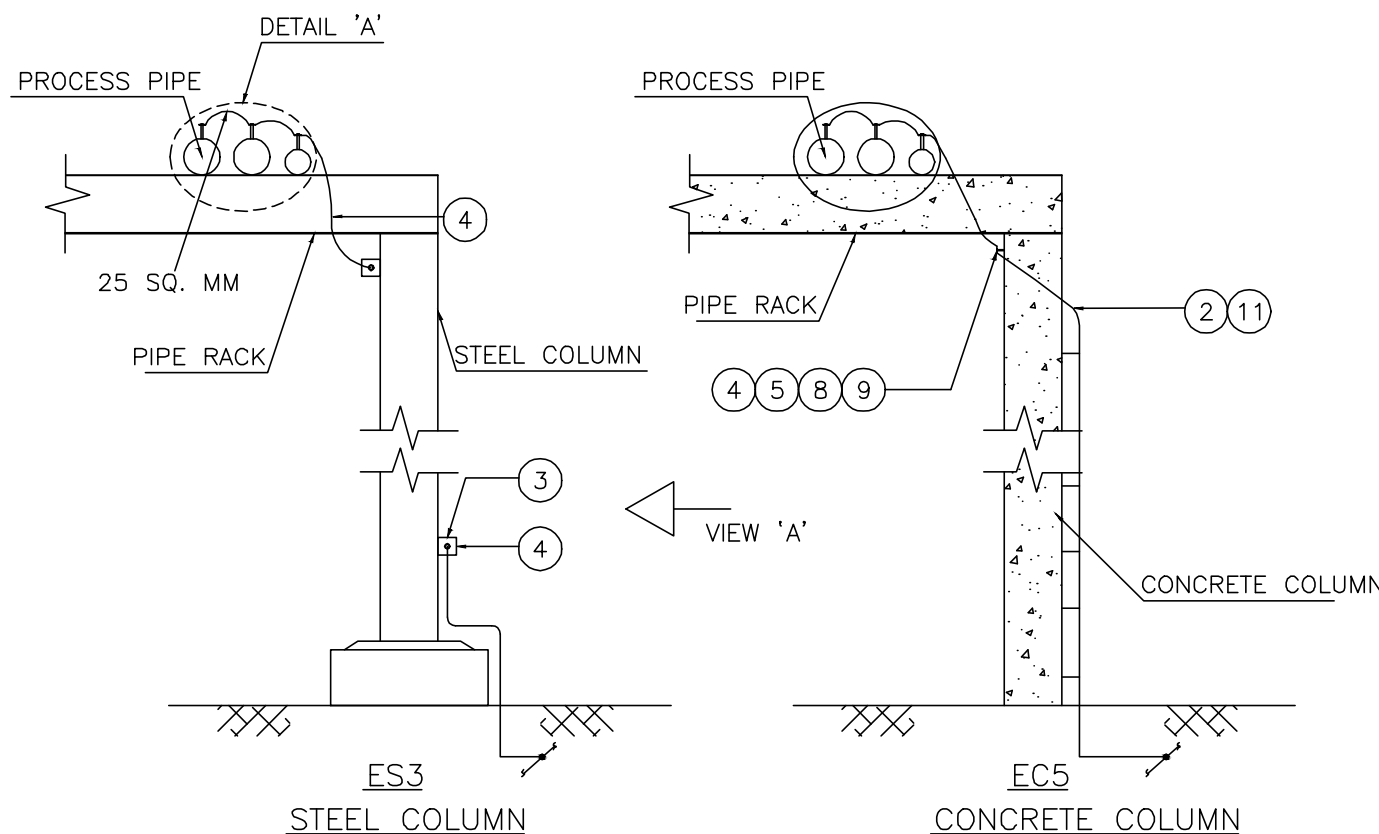
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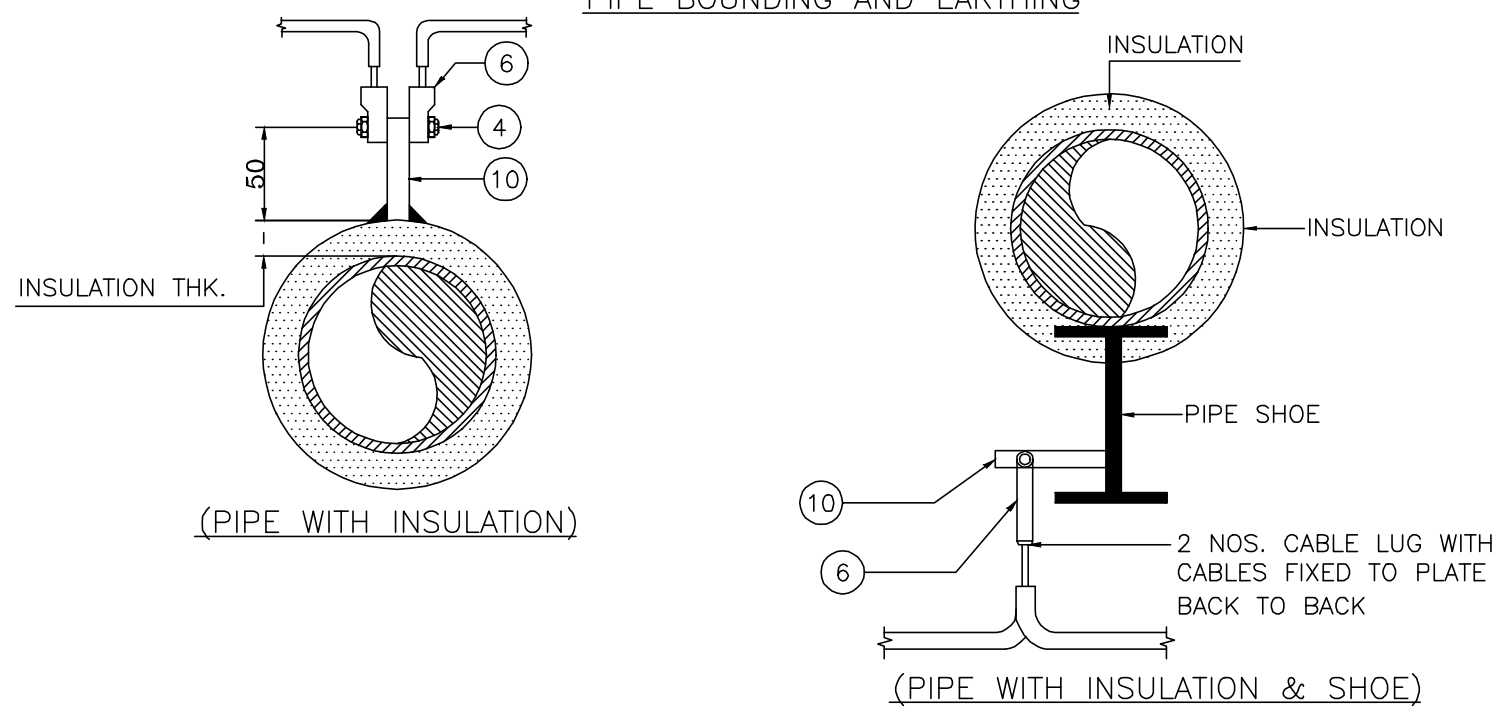
1. ALL DIMENSION INDICATED ARE IN MM UNLESS OTHERWISE SPECIFIED

LEGEND

- ① EARTHING STRIP GI
- ② SADDLE WITH CLAMP (HOT DIP GALV.)
- ③ EARTHING LUG (100x75x5mm THK.)
- ④ NUT, BOLT & SPRING WASHER
- ⑤ EARTH BUS 75x10mm, 400mm LONG
- ⑥ TERMINAL LUG (25 SQ.MM)
- ⑦ EARTHING CONDUCTOR (25AQ.MM)
- ⑧ 12mm DIA. SPACING PIPE(50mm LONG)
- ⑨ ANCHOR BOLT M8x100mm LONG WITH NUT WASHER & SPRING WASHER
- ⑩ 50 X 8 G.I STRIP WITH 1 NO. 10 DIA HOLE, LENGHT TO SUIT INSULATION
- ⑪ EXPANSION ANCHOR BOLT WITH FLATE WASHER (M6x40mm)



PIPE BOUNDING AND EARTHING



0	13.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
EQUIPMENT ON R C C / STEEL COLUMN

Size	Scale	Sheet
A3	NTS	15 of 23
Drawing No.	Rev.	
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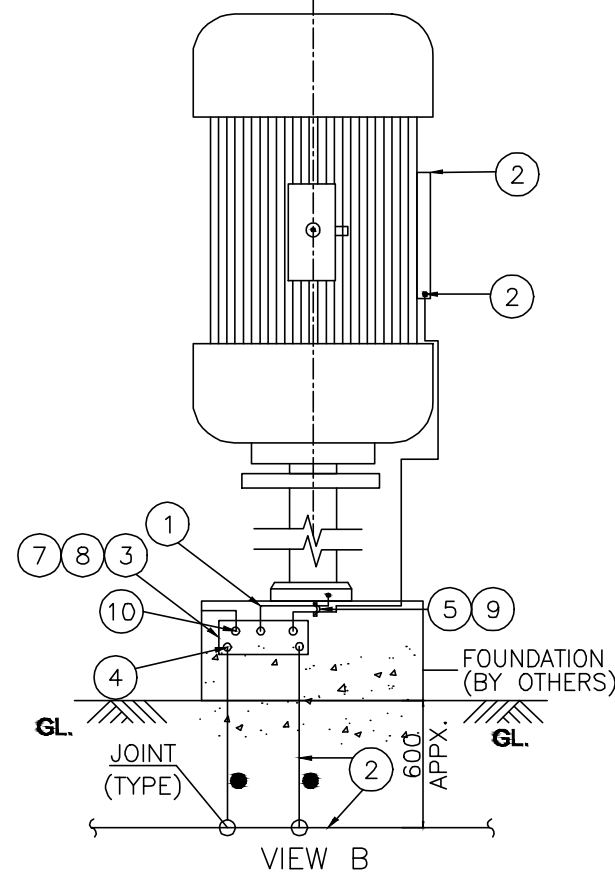
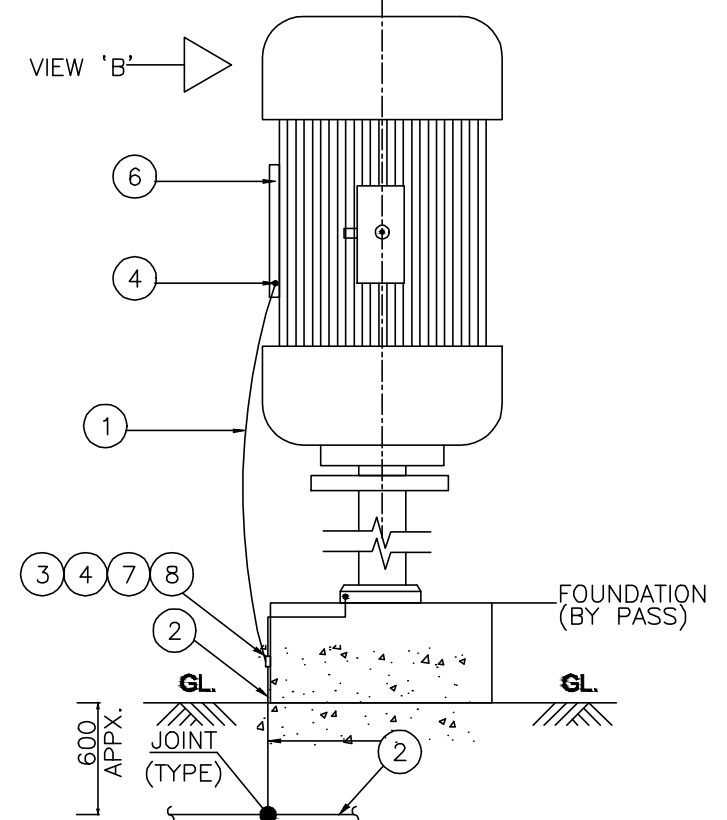
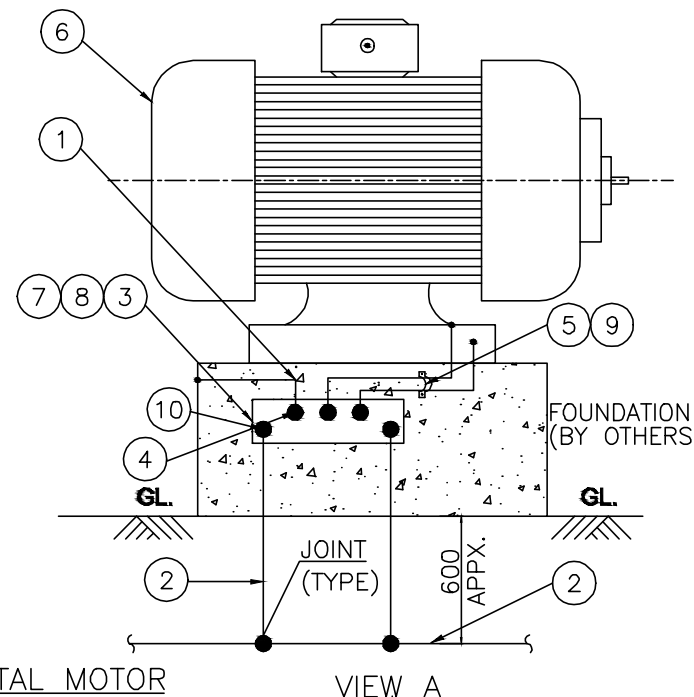
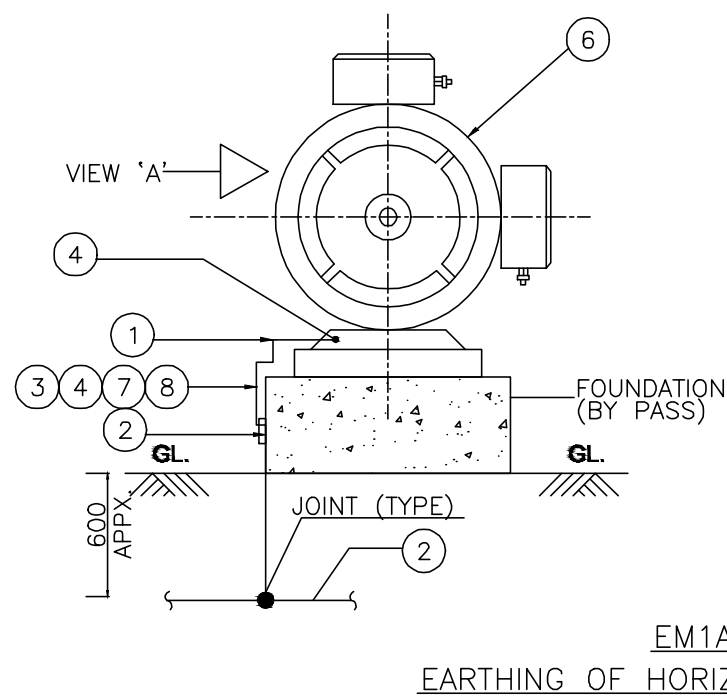
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NOTES

1. ALL DIMENSION INDICATED ARE IN MM UNLESS OTHERWISE SPECIFIED.

LEGEND

- ① EARTHING CONDUCTOR
- ② EARTHING STRIP
- ③ EARTH BUS
- ④ TERMINAL LUG WITH NUT , BOLT & SPRING WASHER
- ⑤ SADDLE WITH CLAMP
- ⑥ MOTOR
- ⑦ 12mm DIA. SPACING PIPE (50mm LONG)
- ⑧ ANCHOR BOLT DIA 8mm, 100mm LONG WITH NUT,SPRING WASHER & PLAIN WASHER
- ⑨ EXPANSION ANCHOR NBOLT WITH FLATWASHER (M6x40mm)
- ⑩ NUT, BOLT & SPRING WASHER (M8)



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SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
EARTHING OF HORIZONTAL MOTOR

Size	Scale	Sheet
A3	NTS	16 of 23
Drawing No.	Rev.	
GGNG-E-20715-0812	0	

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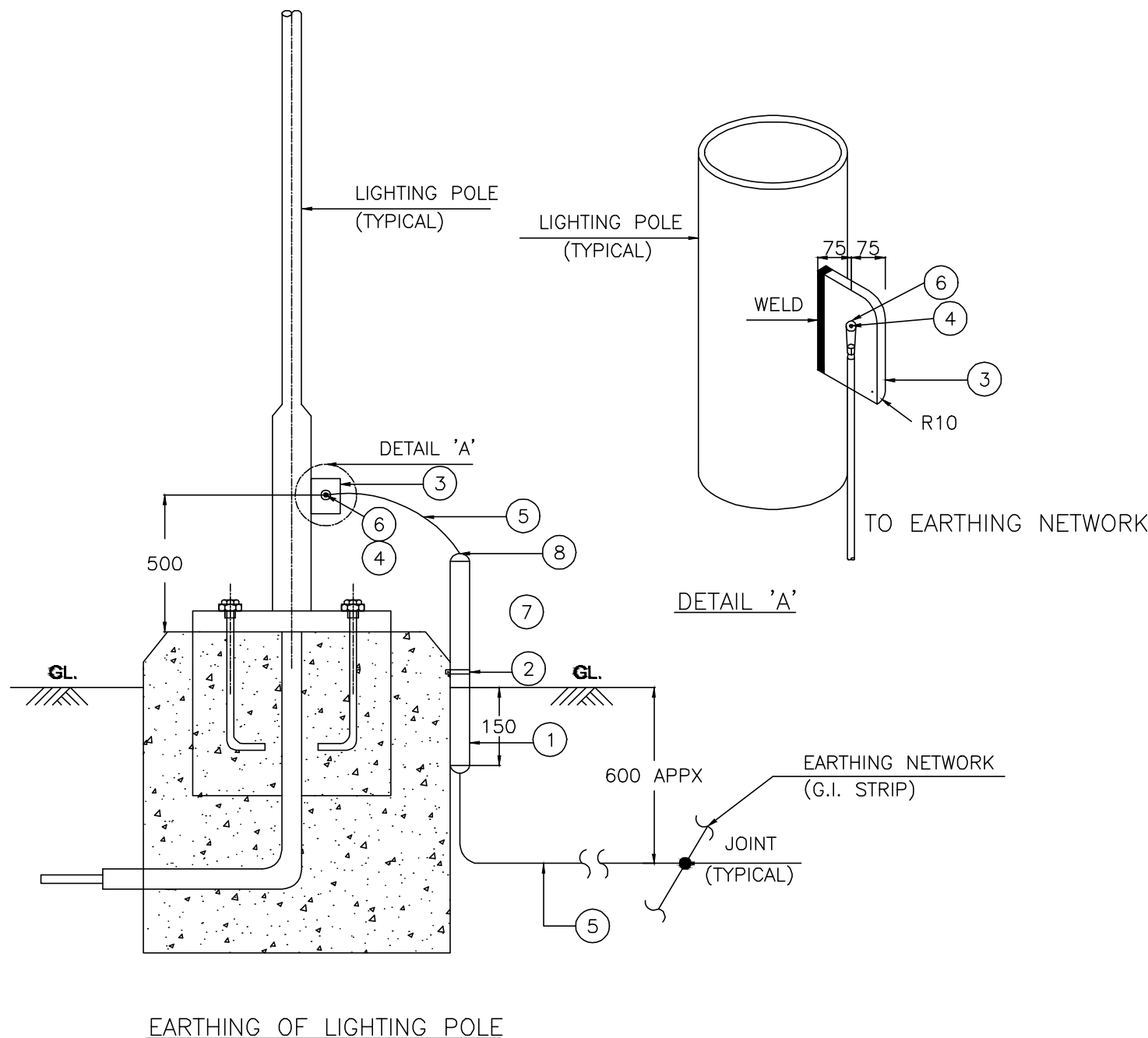
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NOTES

1. ALL DIMENSION INDICATED ARE IN MM UNLESS OTHERWISE SPECIFIED.



LEGEND

- ① CONDUIT (GI)
- ② CONDUIT CLAMP (HOT DIP GALV)
- ③ EARTHING LUG (100x75x5mm THK)
- ④ NUT, BOLT & SPRING WASHER (M8)
- ⑤ EARTHING CONDUCTOR (25 sq.mm)
- ⑥ TERMINAL LUG (25 sq.mm)
- ⑦ EXPANSION ANCHOR BOLT WITH FLATEWASHER (M6x400mm)
- ⑧ SEALING MATERIAL

0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
STANDARD EARTHING DETAILS FOR LIGHING POLE

Size	Scale	Sheet
A3	NTS	17 of 23
Drawing No.	Rev.	
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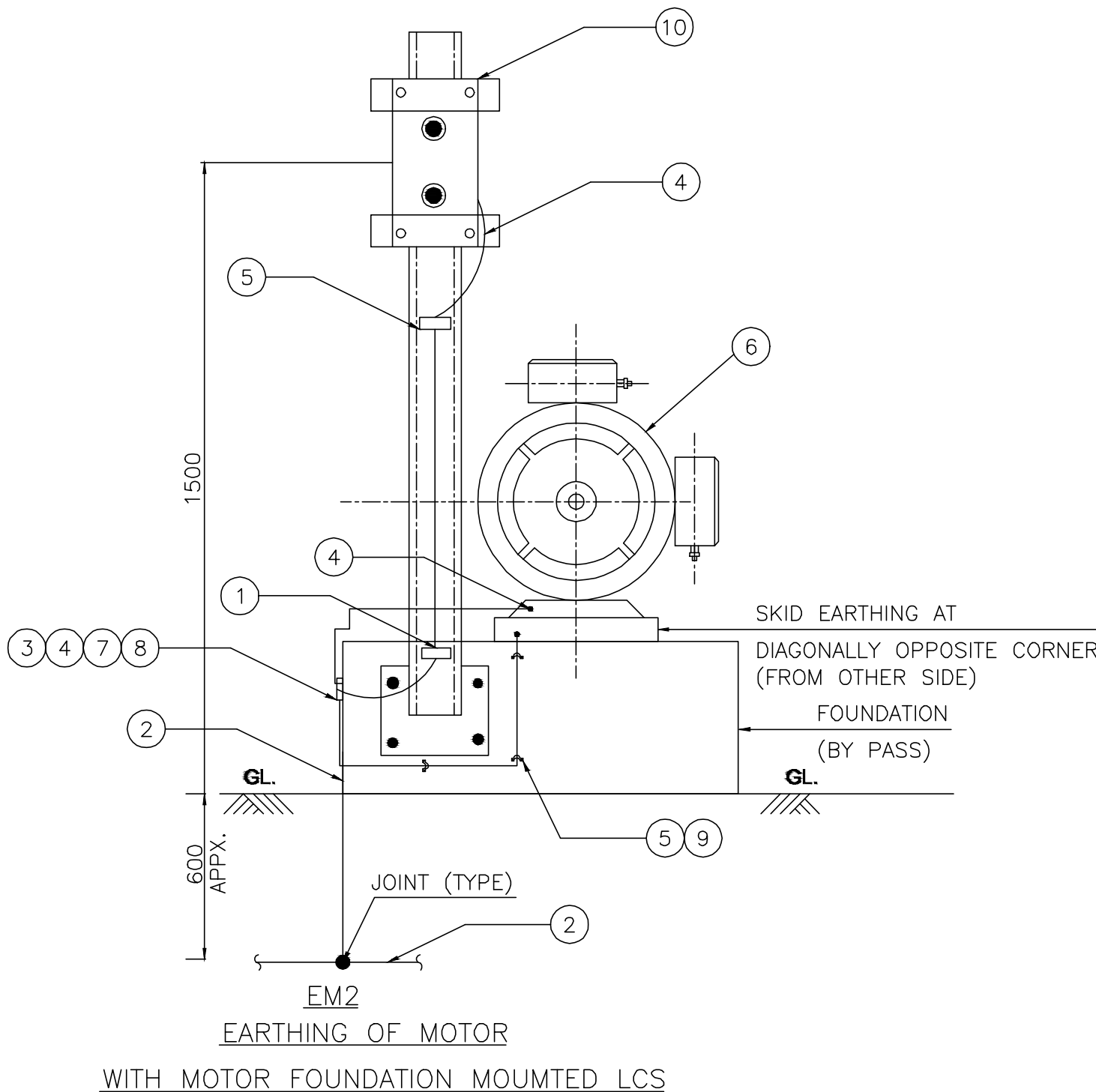
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NOTES

1. ALL DIMENSION INDICATED ARE IN MM UNLESS OTHERWISE SPECIFIED.

LEGEND

- ① EARTHING CONDUCTOR
- ② EARTHING STRIP GI
- ③ EARTH BUS GI
- ④ TERMINAL LUG WITH NUT , BOLT & SPRING WASHER
- ⑤ SADDLE WITH CLAMP
- ⑥ MOTOR
- ⑦ 12mm DIA. SPACING PIPE (50mm LONG)
- ⑧ ANCHOR BOLT DIA 8mm, 100mm LONG WITH NUT,SPRING WASHER & PLAIN WASHER
- ⑨ EXPANSION ANCHOR NBOLT WITH FLATWASHER (M6x40mm)
- ⑩ LOCAL CONTROL STATION



SKID EARTHING AT  
DIAGONALLY OPPOSITE CORNER  
(FROM OTHER SIDE)  
FOUNDATION  
(BY PASS)

EM2  
EARTHING OF MOTOR  
WITH MOTOR FOUNDATION MOUNTED LCS

0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT TYPICAL EARTHING INSTALLATION DETAILS  
EARTHING OF MOTOR WITH MOTOR FOUNDATION MOUNTED LCS

Size	Scale	Sheet
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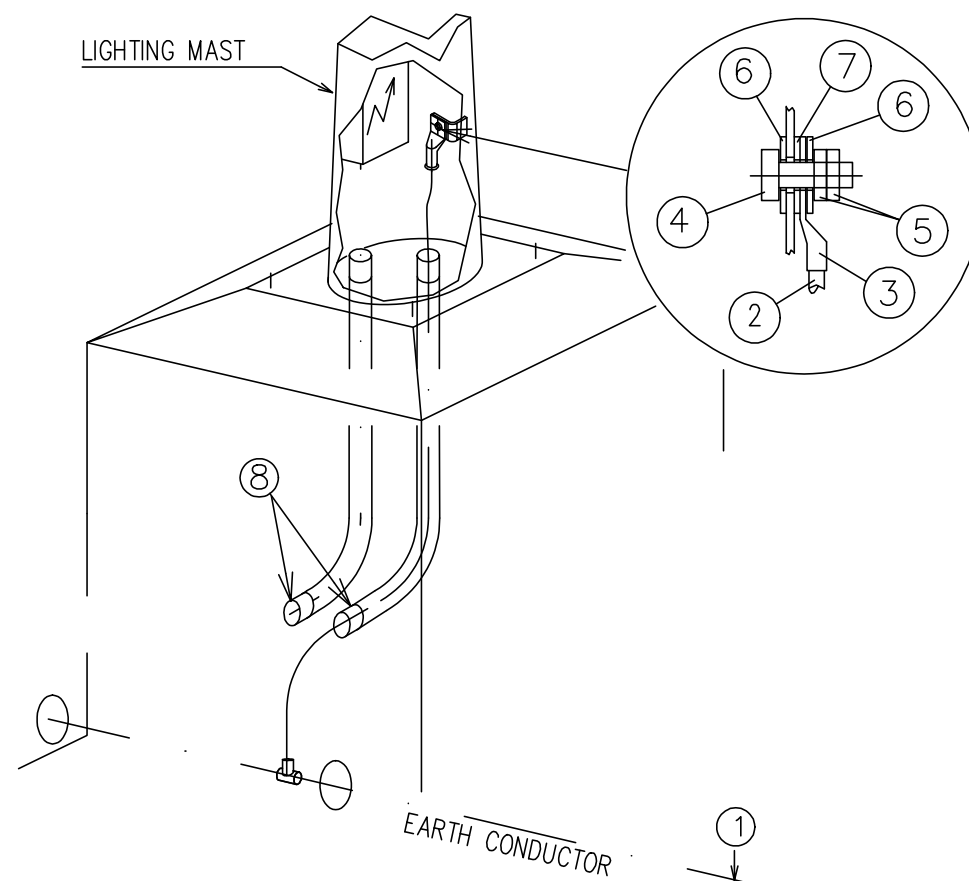
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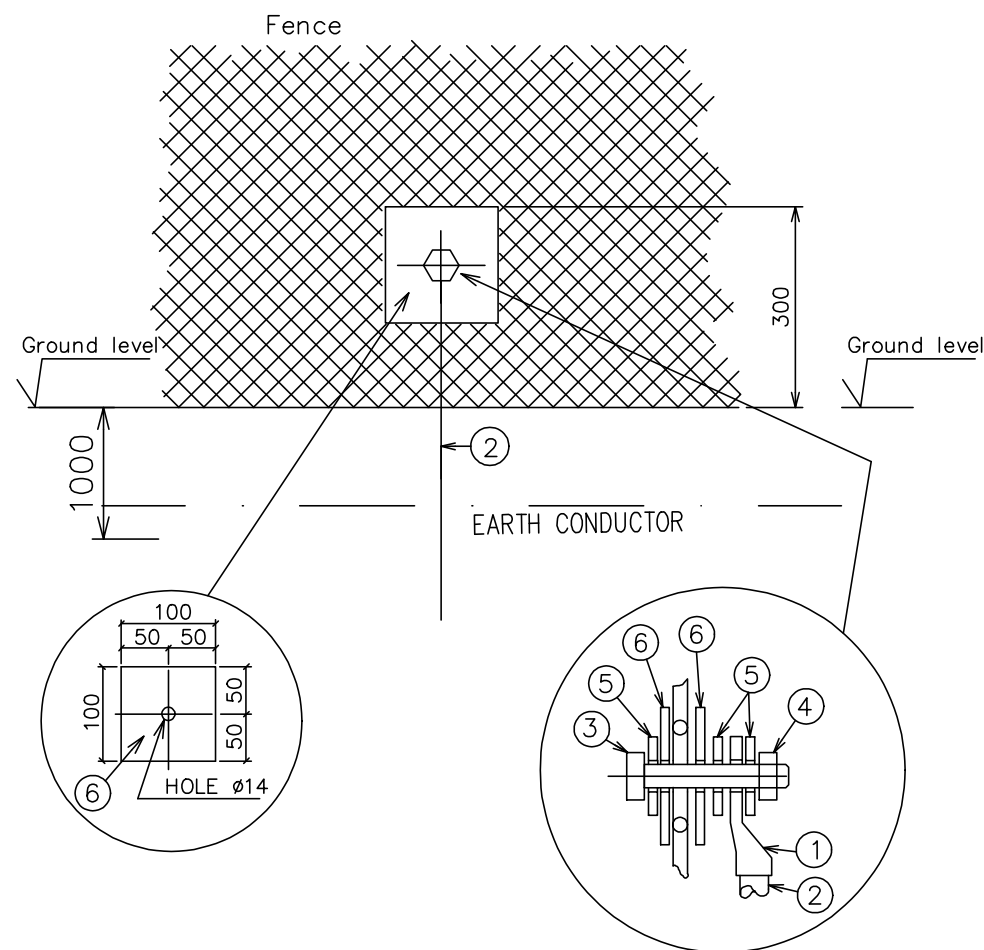


⑧	PIPE $\phi$ 80mm	PVC		SUPPLY BY CIVIL WORK
⑦	BIMETALLIC WASHER M12	CU/AL		SUPPLY BY LIGHTING SUB-CONTRACTOR
⑥	CONTACT WASHER	STEEL	Zn8/B/Fe	SUPPLY BY LIGHTING SUB-CONTRACTOR
⑤	NUT	STEEL	Zn8/B/Fe	SUPPLY BY LIGHTING SUB-CONTRACTOR
④	SCREW	STEEL	Zn8/B/Fe	SUPPLY BY LIGHTING SUB-CONTRACTOR
③	TERMINAL	COPPER	Tinned	SUPPLY BY LIGHTING SUB-CONTRACTOR
②	PROTECTIVE CONDUCTOR	COPPER	Annealed	1x25 Sq.mm
①	EARTHING CONDUCTOR	G.I. FLAT	Annealed	65x8mm
N°	DESIGNATION	MATTER	SURF. TREAT.	OBSERVATION

TYPICAL DETAIL OF LIGHTING MAST EARTHING

0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT			
TYPICAL EARTHING INSTALLATION DETAILS			
LIGHTING MAST EARTHING			
Size	Scale	Sheet	
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For metallic fence for inside facility like transformer yard the earthing conductor will be bonded to the main buried earthing network.

⑥	ALUMINIUM FLAT 100x5	ALUMINIUM		Manufactur. on site
⑤	BIMETALLIC WASHER M12	CU /AL		
④	NUT H M12	STEEL	Zn8/B/Fe	
③	SCREW H M12 x 40	STEEL	Zn8/B/Fe	
②	PROTECTIVE CONDUCTOR	COPPER	Annealed	S= 50 Sqmm/ L=3m
①	CRIMPING LUG 70-12.5	COPPER	Tinned	
N*	DESIGNATION	MATTER	SURF. TREAT.	OBSERVATION

DETAIL OF FENCE EARTHING

0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS OF FENCE EARTHING						
Size		Scale	Sheet			
A3		NTS	20 of 23			
Drawing No.			Rev.			
GGNG-E-20715-0812			0			

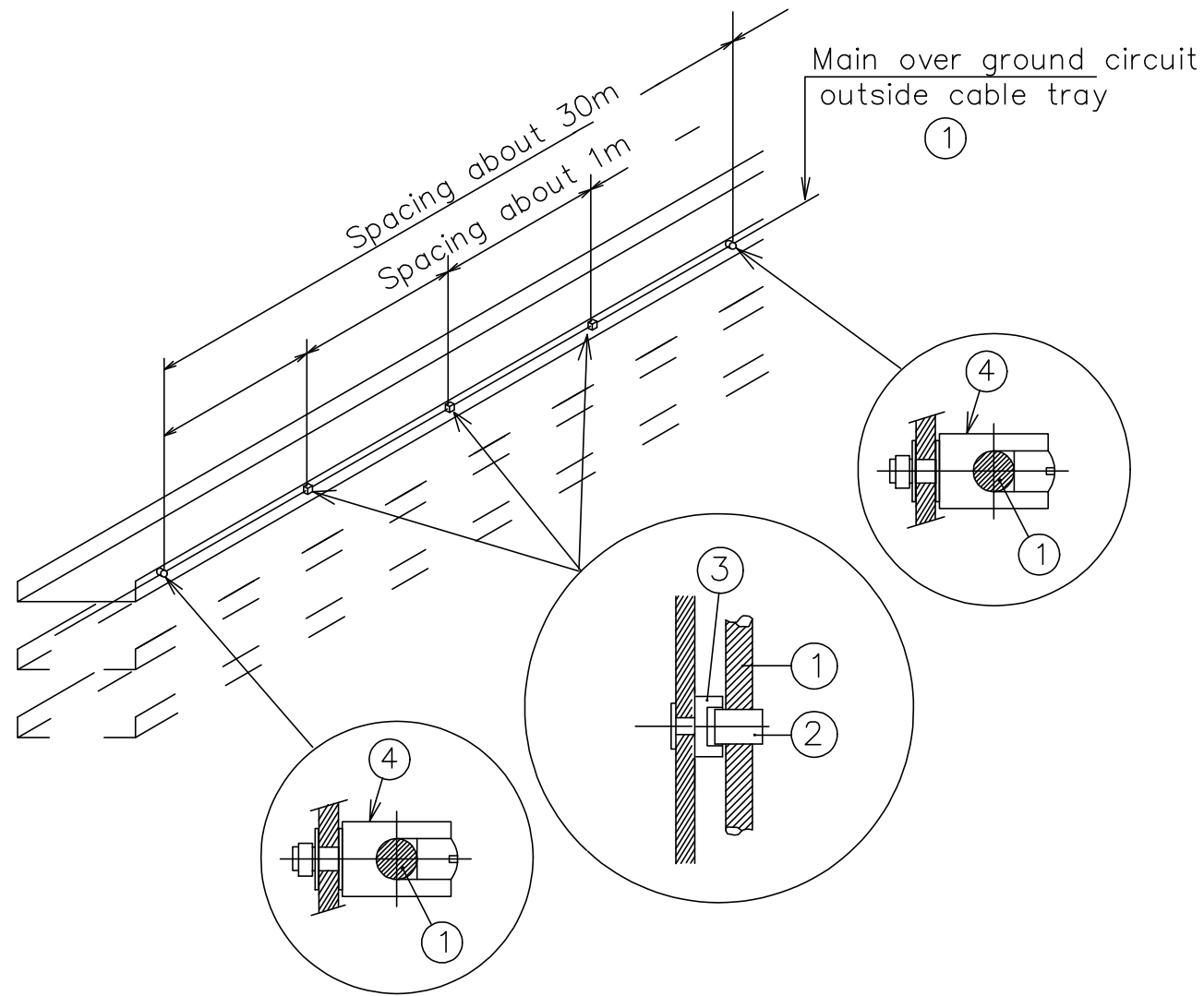
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④	EARTHING CLIP	Brass		
③	BASE FOR CABLE TIE	Polyamide		
②	CABLE TIE	Polyamide		
①	PROTECTIVE CONDUCTOR	GI	Annealed	
N°	DESIGNATION	MATTER	SURF. TREAT.	OBSERVATION

TYPICAL DETAIL OF SINGLE ROW CABLE TRAY EARTHING

NOTES

0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS OF CABLE TRAY EARTHING						
Size		Scale	Sheet			
A3		NTS	21 of 23			
Drawing No.			Rev.			
GGNG-E-20715-0812			0			

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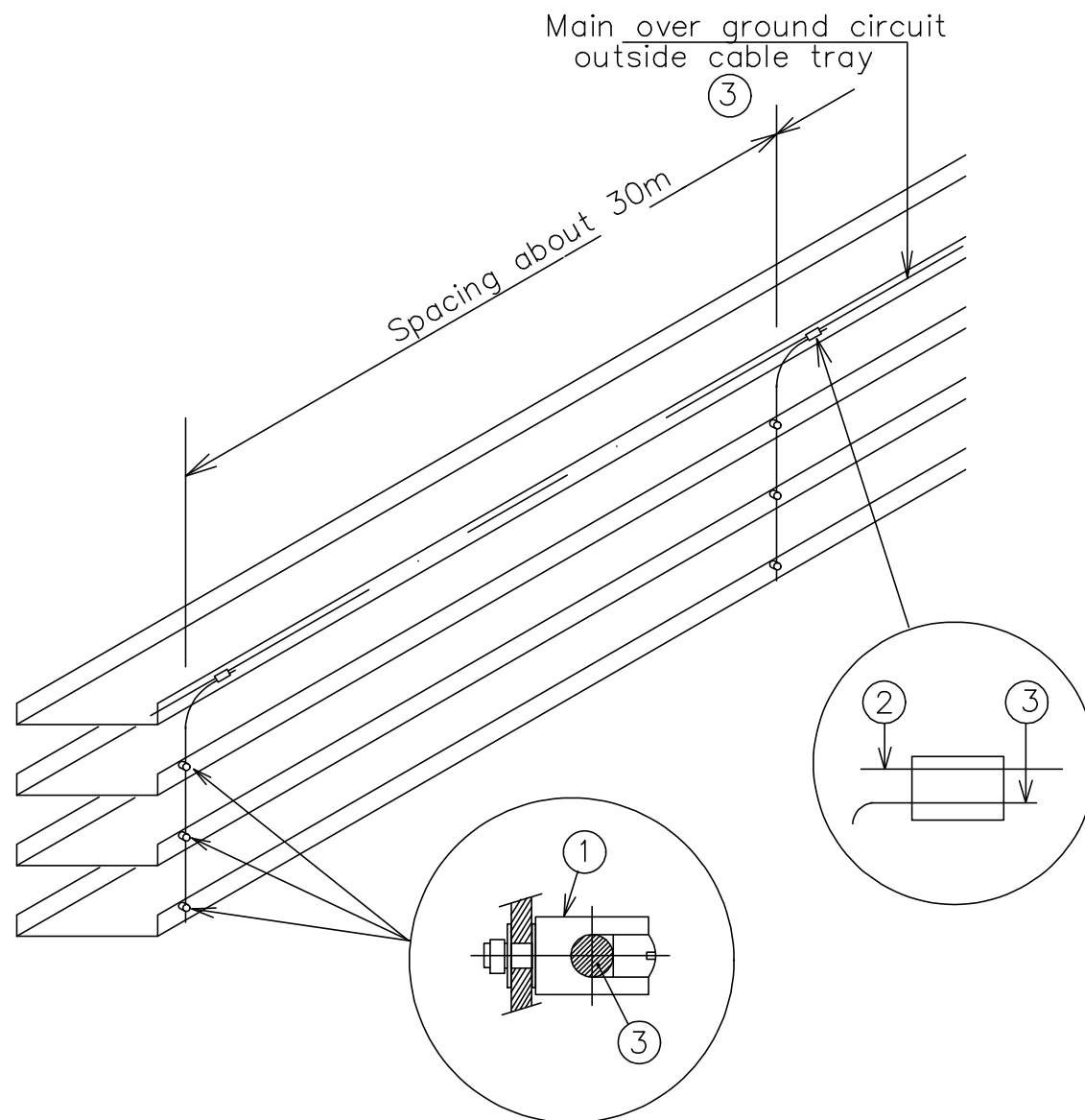
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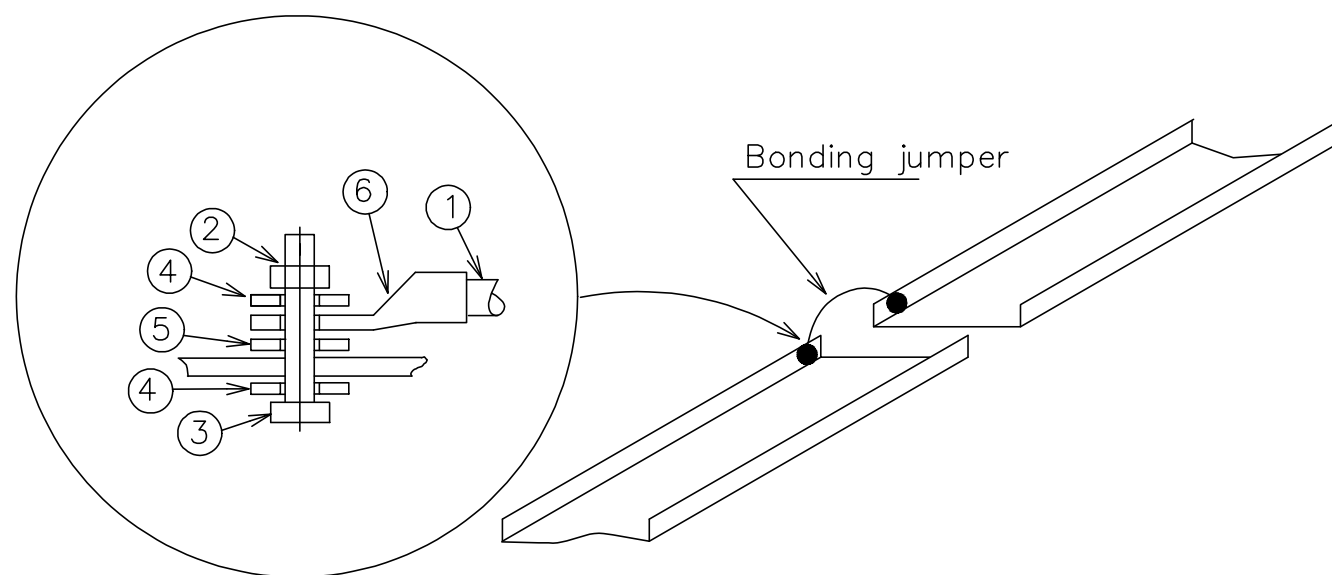


③	PROTECTIVE CONDUCTOR	GI	Annealed	65x8
②	PROTECTIVE CONDUCTOR	GI	Annealed	65x8
①	EARTHING CLIP	BRASS		According to number of cable trays
N°	DESIGNATION	MATTER	SURF. TREAT.	OBSERVATION

TYPICAL DETAIL OF MULTIPLE ROW CABLE TRAY EARTHING

NOTES

0	13.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS OF MULTIPLE ROW CABLE TRAY EARTHING						
Size		Scale		Sheet		
A3		NTS		22 of 23		
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6	CRIMPING LUG 50-12	COPPER	Tinned	S= 50 Sqmm
5	BIMETALLIC PLATE	CU/AL		
4	BIMETALLIC WASHER M12	CU/AL		
3	SCREW H M12-40	STEEL	Zn8/ B/ Fe	
2	NUT H M12	STEEL	Zn8/ B/ Fe	
1	PROTECTIVE CONDUCTOR	COPPER	Annealed	S=50 Sqmm
N°	DESIGNATION	MATTER	SURF. TREAT.	OBSERVATION

TYPICAL DETAIL OF EXPANSION JOINT OF MAIN CABLE TRAY EARTHING

0	13.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated
SUBJECT TYPICAL EARTHING INSTALLATION DETAILS OF EXPANSION JOINT OF MAIN CABLE TRAY EARTHING								
Size		Scale		Sheet				
A3		NTS		23 of 23				
Drawing No.							Rev.	
GGNG-E-20715-0812							0	

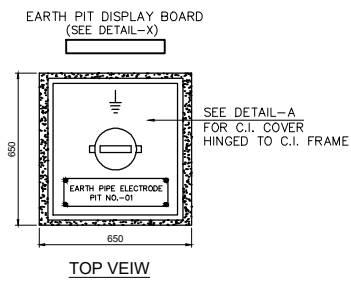
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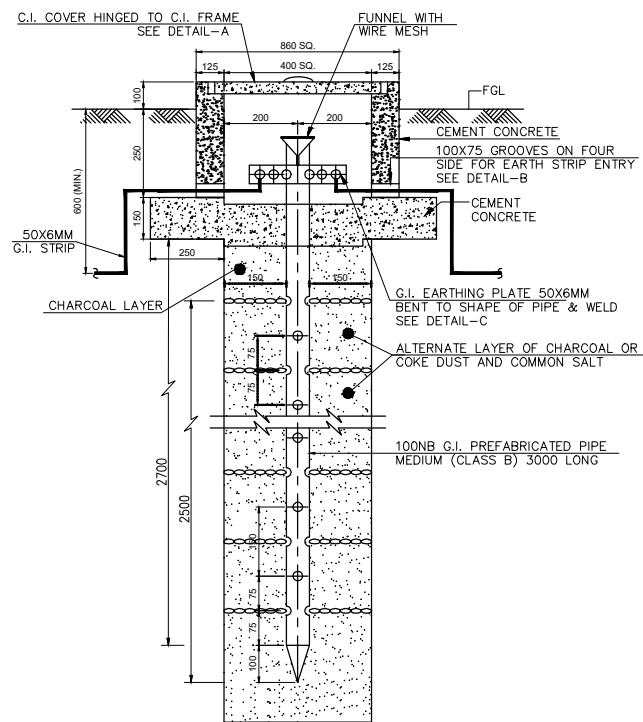
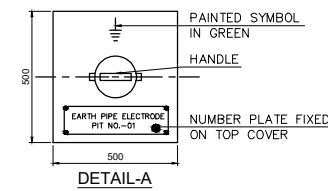
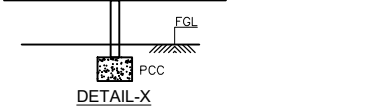
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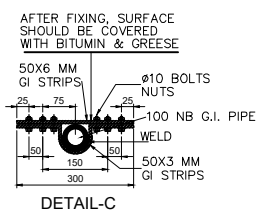
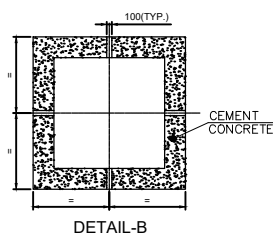
**EARTH PIT DETAILS WITH G.I. PIPE ELECTRODE**



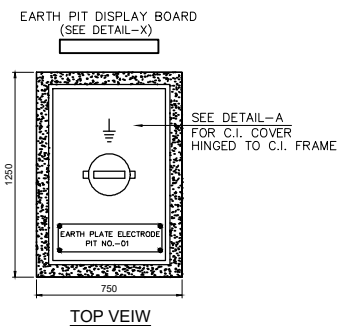
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 EARTH PIT TYPE: EPG  
 DATE OF TESTING: XX/XX/XXXX  
 TEST VALUES: XX  
 NEXT DUE DATE: XX/XX/XXXX



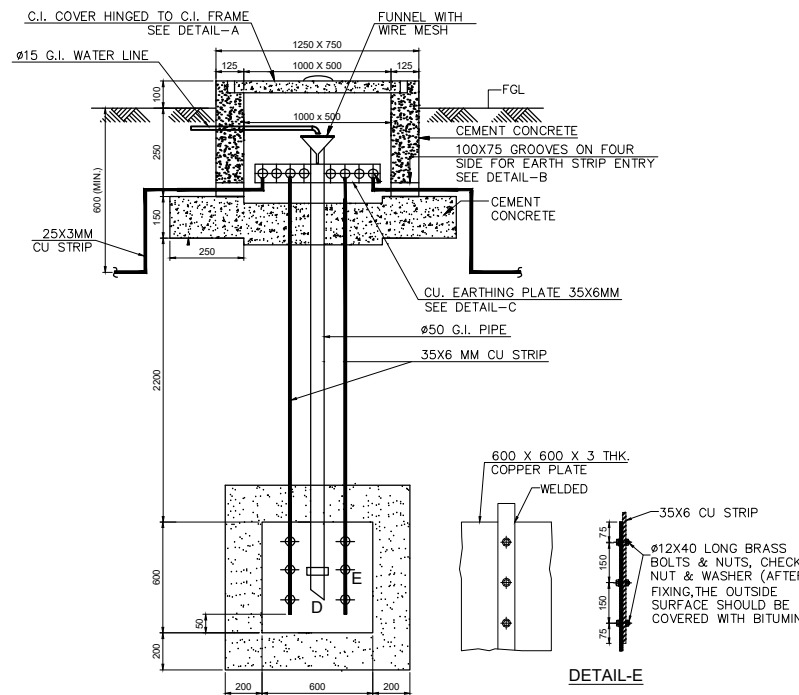
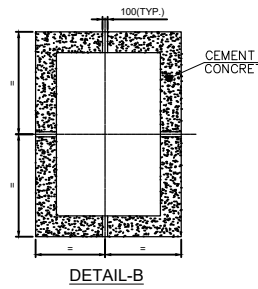
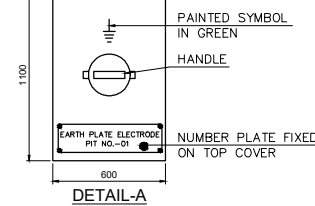
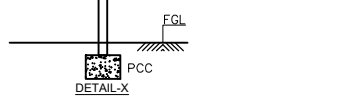
TYPICAL ARRANGEMENT FOR G.I. PIPE ELECTRODE



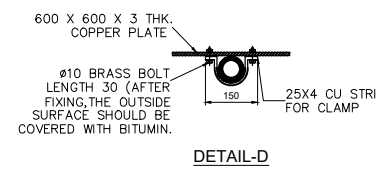
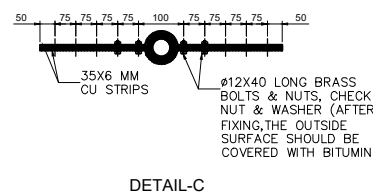
**EARTH PIT DETAILS WITH COPPER PLATE ELECTRODE**



EARTH PIT NO: XX  
 EARTH PIT TYPE: EPE  
 DATE OF TESTING: XX/XX/XXXX  
 TEST VALUES: XX  
 NEXT DUE DATE: XX/XX/XXXX



TYPICAL ARRANGEMENT FOR COPPER PLATE ELECTRODE



**NOTES**

- 1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- 2 FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE.
3. THE PIPE ASSEMBLY SHALL BE HOT DIP GALVANISED AFTER FABRICATION.

0	22.01.24	APPROVED	RKA	KB	DMY	VG
---	----------	----------	-----	----	-----	----

SUBJECT

TYPICAL EARTH PIT DETAILS

Size	Scale	Sheet
A3	NTS	01 of 01
Drawing No.	Rev.	
GGNG-E-20713-3001	0	

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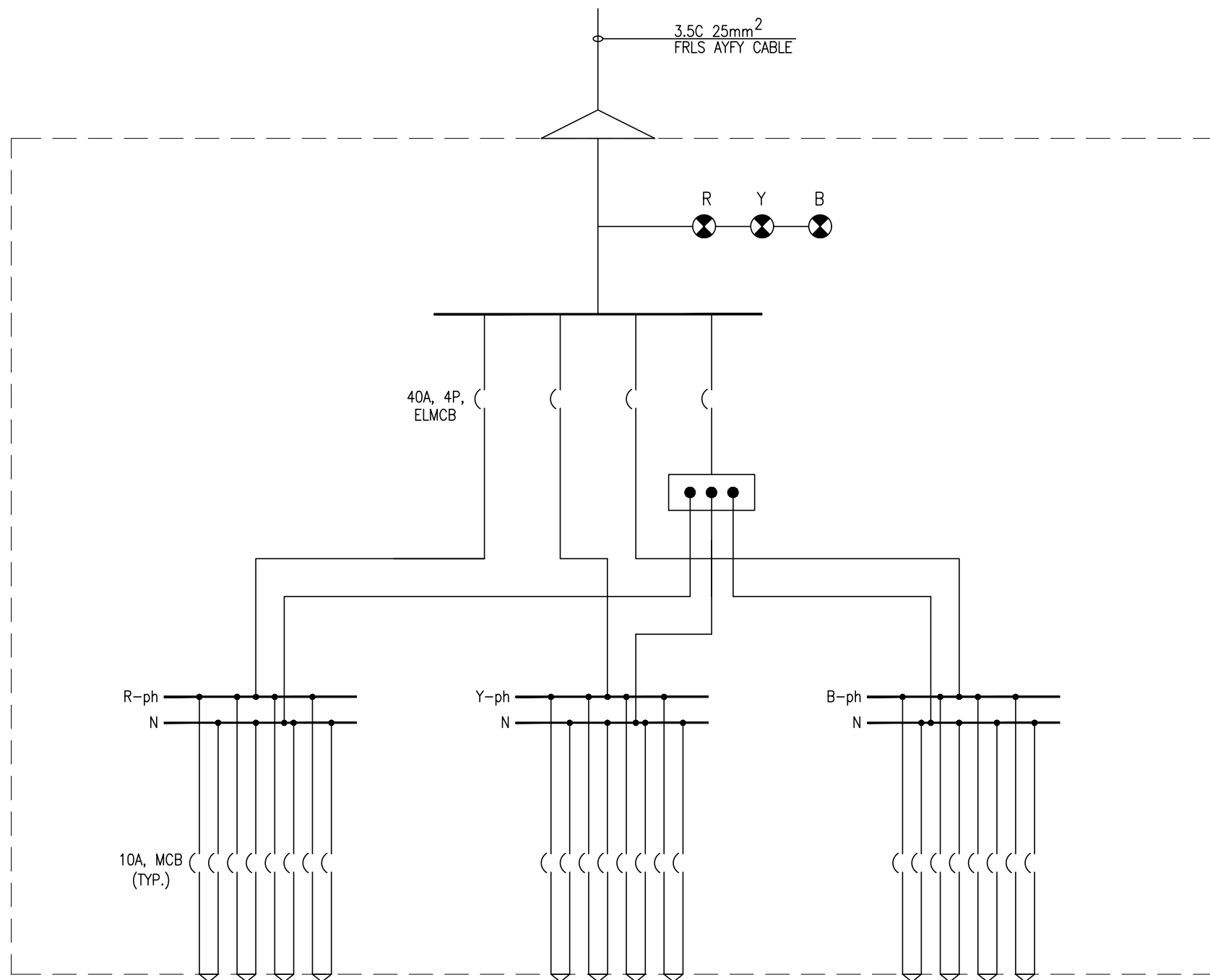
LEGEND:



MCB



INDICATION LAMP




0	06.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT **WIRING DIAGRAM FOR INDOOR LIGHTING  
SUB DISTRIBUTION BOARD**

Size	Scale	Sheet
A3	NTS	01 of 01
Drawing No.	Rev.	
GGNG-E-20713-3002	0	

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1

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A

B

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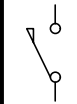
LEGEND:



MCB



INDICATION LAMP



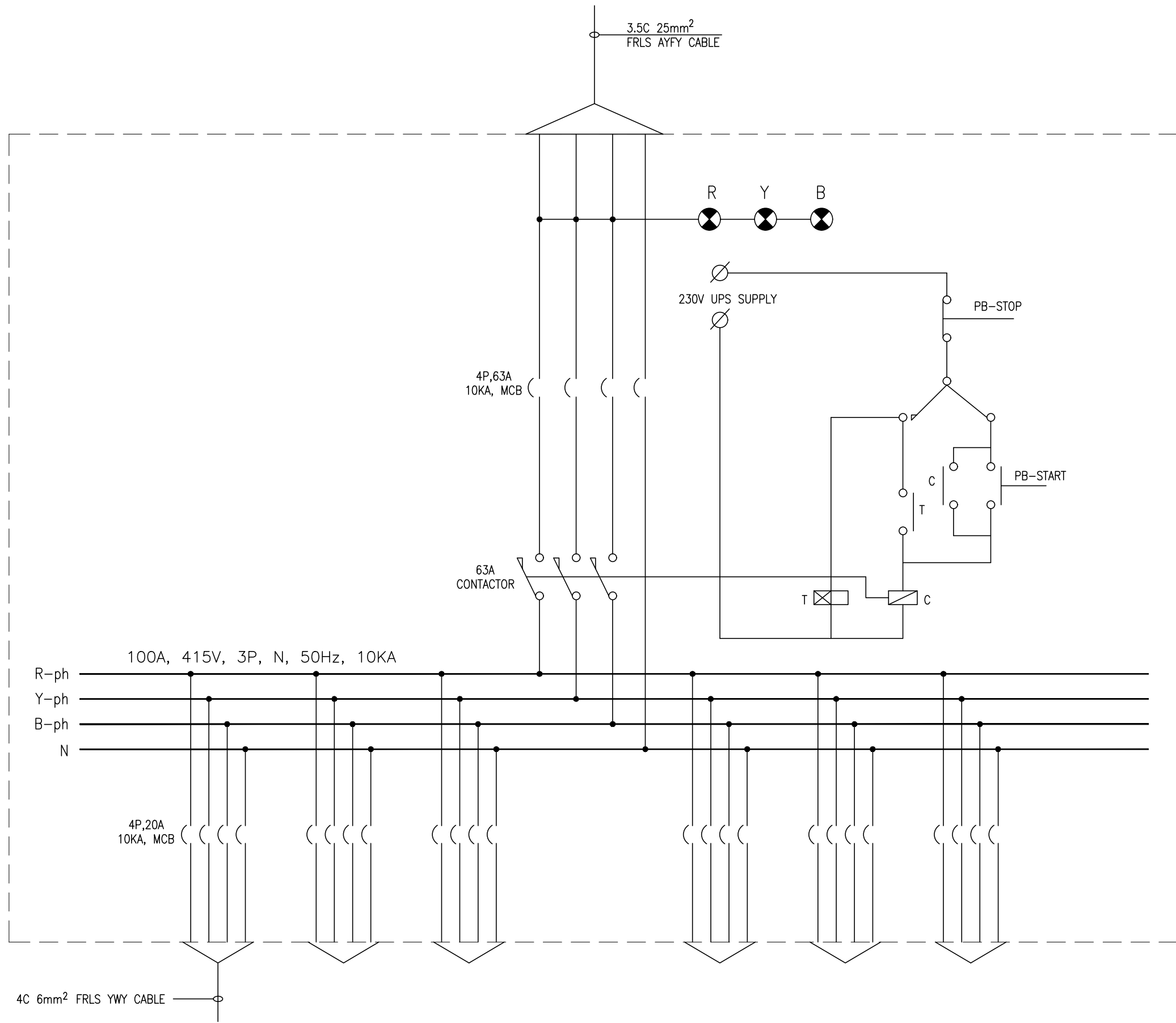
CONTACTOR



CONTACTOR



TIMER



0	06.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT WIRING DIAGRAM FOR OUTDOOR LIGHTING  
SUB DISTRIBUTION BOARD

Size	Scale	Sheet
A3	NTS	01 of 01
Drawing No.	Rev.	
GGNG-E-20713-3003	0	

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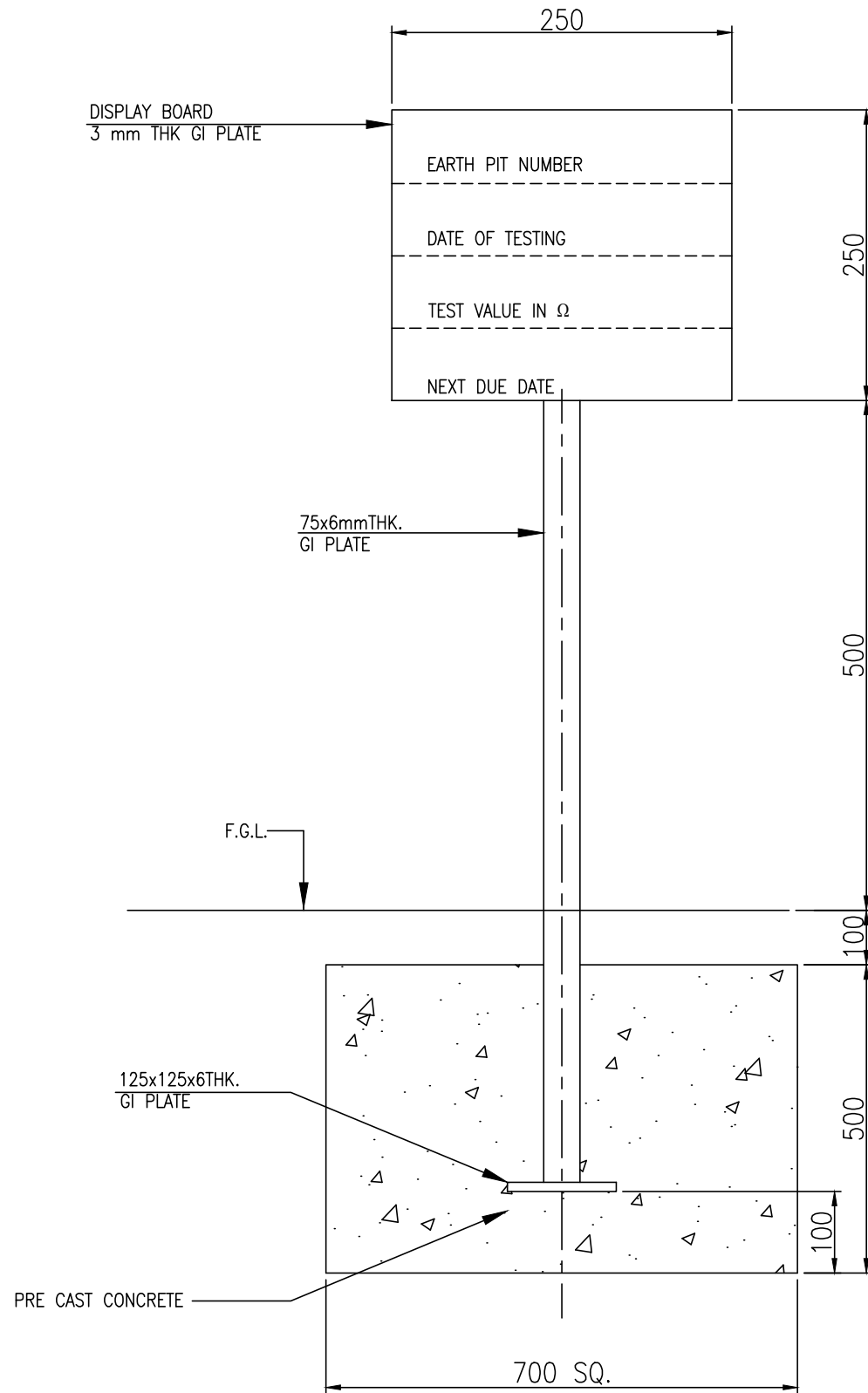
A

B

C

D

E



### NOTES

- 1 ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED.
- 2 FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE.
- 3 TEXT TO BE WRITTEN ON THE BOARD WITH BLACK ENAMEL PAINT AND FIGURE TO BE WRITTEN WITH RED ENAMEL PAINT.

0	06.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT		DISPLAY BOARD FOR EARTH PIT			
Size	Scale	Sheet			
A3	NTS	01 of 01			
Drawing No.		Rev.			
GGNG-E-20713-3004		0			

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1

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A

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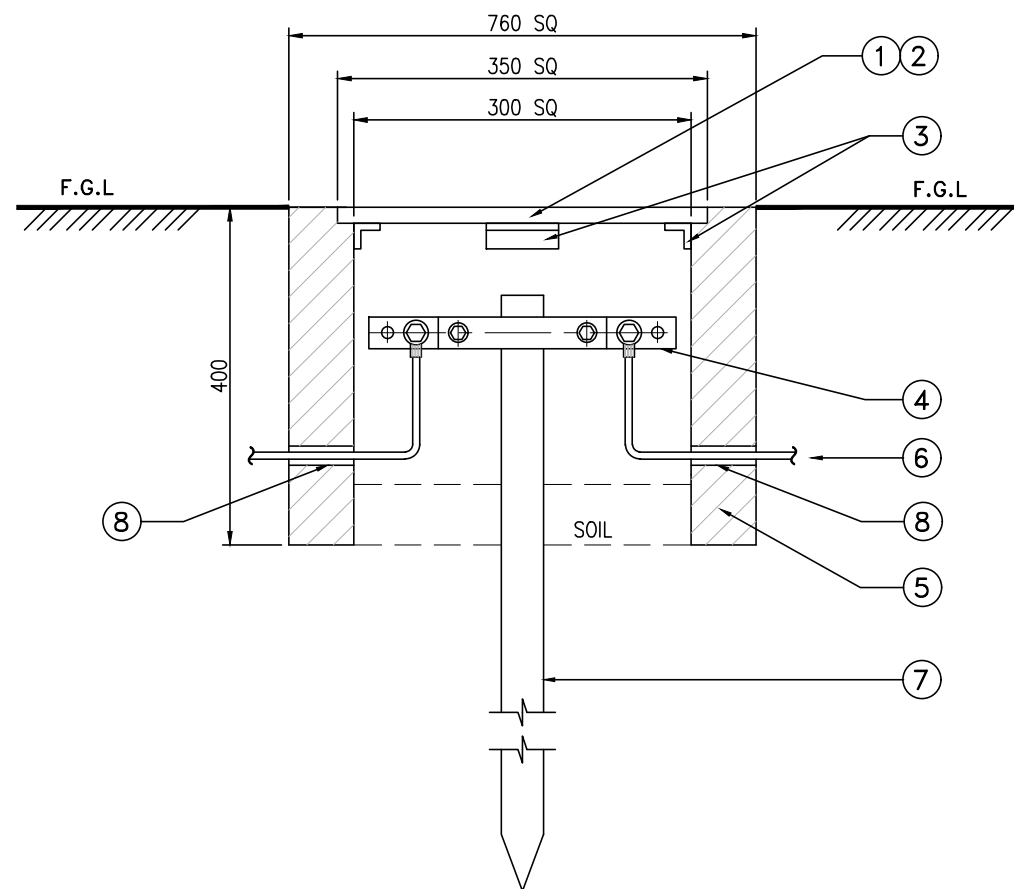
C

D

E

### NOTES

- 1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- 2 FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE.
- 3 EARTH RODS TO BE PROVIDED WITH A CLAMP TYPE EARTH BAR, WHICH ENSURES CONTINUITY OF MAIN EARTH RING EVEN WHEN REMOVED FROM EARTH ROD.



(TOP VIEW)  
CLAMP TYPE EARTH BAR

TAG	MATERIAL DESCRIPTION	CODMAT	QTY.	UNIT
1	STEEL COVER (6 THICK WITH 12 DIA LIFTING HOLE)		1	U
2	MARKED BY WELDING WITH EARTH SYMBOL		-	-
3	SECURING ANGLE IRON WELDED TO COVER		+	M
4	CLAMP TYPE EARTH BAR WITH HARDWARE & ACCESSORIES (NOTE1)		1	U
5	BRICK WORK		+	U
6	PLANT EARTH RING		*	M
7	20mm DIA. EARTH ROD (COPPER CLAD STEEL ROD)		3	M
8	PIPE CONDUIT 1 1/4" PVC HEAVY DUTY		1	M

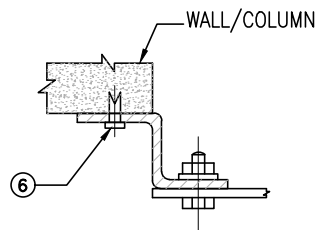
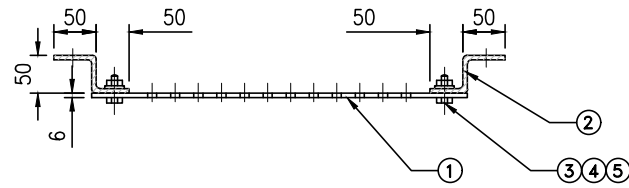
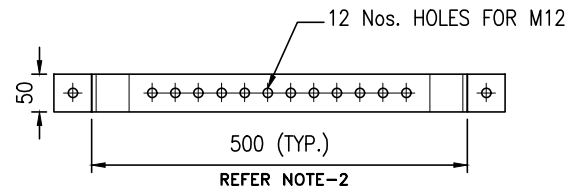
- + DECIDED AS PER REQUIREMENT
- \* QUANTITY AS REQUIRED

0	06.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

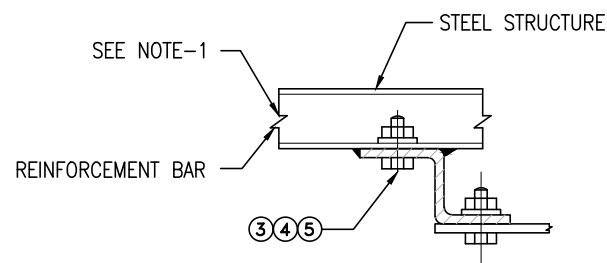
SUBJECT TYPICAL EARTHING PIT DETAIL

Size	Scale	Sheet
A3	NTS	01 of 0
Drawing No.	Rev.	
GGNG-E-20713-3005	0	

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MOUNTING TYPE-1



MOUNTING TYPE-2

**NOTES**

- 1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- 2 FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE.
- 3 EARTH BUS SHALL BE INSTALLED AT CONVENIENT LOCATION NEAR GROUP OF EQUIPMENT PRECISE LOCATION OF GROUND BUS SHALL BE DECIDED BY AS PER SITE CONDITION.
- 4 LENGHT OF BUS TO SUIT AT SITE CONDITION.

TAG	MATERIAL DESCRIPTION	CODMAT	QTY.	UNIT
1	EARTH BUS 50x6 mm THK. COPPER		*	U
2	MOUNTING BRACKET		1	U
3	BOLT M12 - MS GALVANISED		2	U
4	NUTS (HEXAGONAL HEAD) - GALVANISED		2	U
5	PLAIN WASHER - GALVANISED		1	U
6	ANCHOR BOLT		4	U

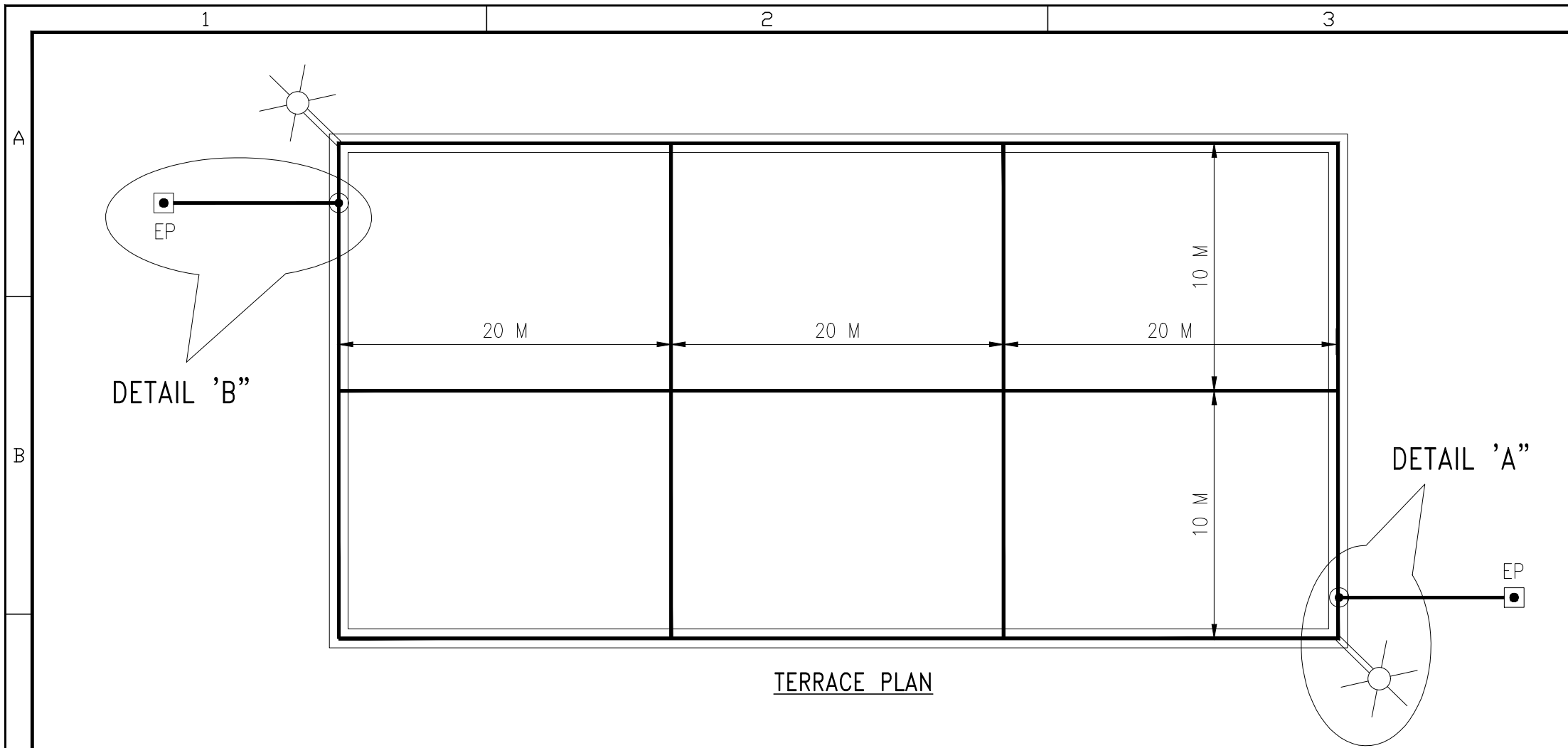
\* QUANTITY AS REQUIRED

0	06.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT **TYPICAL EARTHING BUS DETAILS**

Size	A3	Scale	NTS	Sheet	01 of 01
Drawing No.	GGNG-E-20713-3006			Rev.	0

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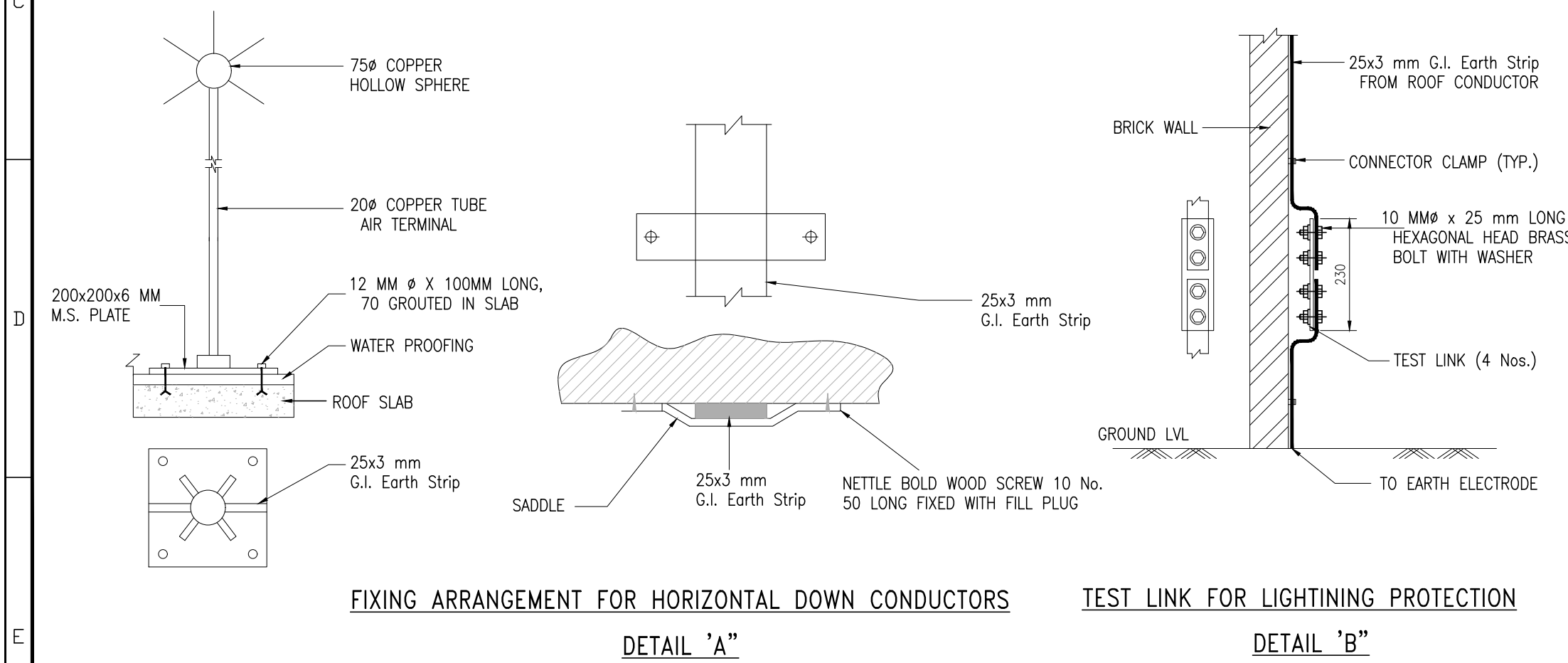
TERRACE PLAN

NOTES

- 1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- 2 FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE.
- 3 G.I. SADDLE TO BE FIXED FOR HORIZONTAL DOWN CONDUCTOR AT THE INTERVAL OF 750mm.

LEGEND

S.No.	SYMBOL DESCRIPTION	SYMBOL
1	25x3 mm G.I. EARTH STRIP	—
2	25x3 mm DOWN CONDUCTOR	●
3	LIGHTNING ARRESTOR (VERTICAL AIR TERMINAL)	☼
4	EARTH PIT	EP □



FIXING ARRANGEMENT FOR HORIZONTAL DOWN CONDUCTORS

DETAIL 'A'

TEST LINK FOR LIGHTNING PROTECTION

DETAIL 'B'

0	06.10.16	APPROVED	RKS	PR	KJ	SKH
Rev.	D M Y	Modifications	Drawn	Checked	Approved	Validated

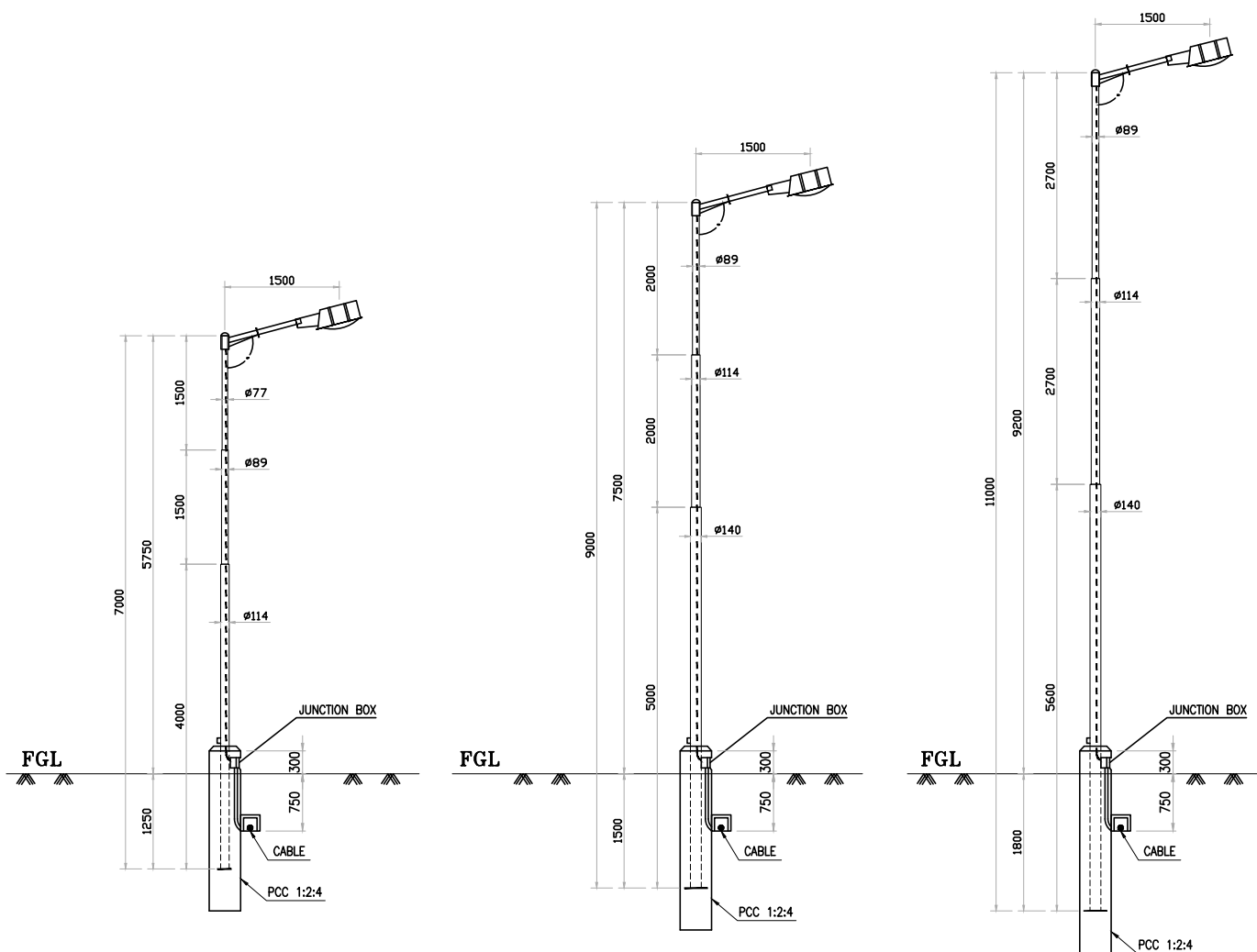
SUBJECT TYP. LIGHTNING PROTECTION DETAIL FOR CONTROL ROOM BUILDING

Size	Scale	Sheet
A3	NTS	01 of 01
Drawing No.	Rev.	
GGNG-E-20713-3007	0	

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NOTES

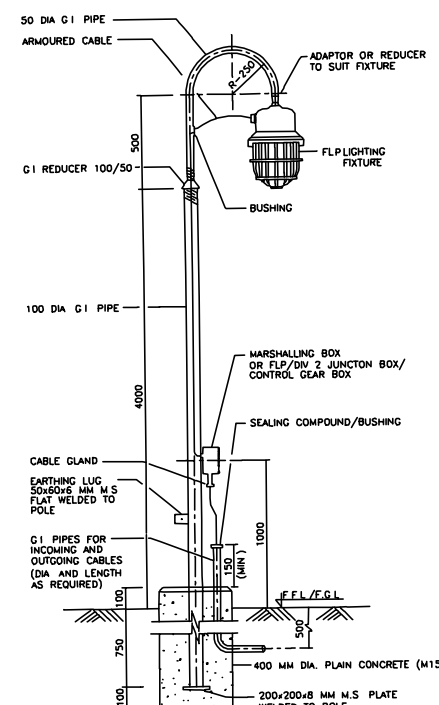
- 1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- 2 FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE.
- 3 THE LIGHTING POLE SHALL BE ACCORDING TO IS:2713.



7M HEIGH POLE TYPE-(410 SP-3)

9M HEIGH POLE TYPE-(410 SP-30)

11M HEIGH POLE TYPE-(410 SP-50)



4.5M HEIGH FLP WELL GLASS LIGHTING FIXTURE  
SUITABLE FOR HAZARDOUS AREA (ZONE 1/ZONE 2)

0	06.10.16	APPROVED	RKS	PR	KJ	SKH		
Rev.	D	M	Y	Modifications	Drawn	Checked	Approved	Validated

SUBJECT		LIGHTING POLES DETAILS			
Size	Scale	Sheet			
A3	NTS	01 of 01			
Drawing No.		Rev.			
GGNG-E-20713-3009		0			

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# **STANDARD DRAWINGS**

SPECTACLE BLIND  
FLANGE

DRAWING NO.

SD-PI-001

SHEET NO.

1 OF 1

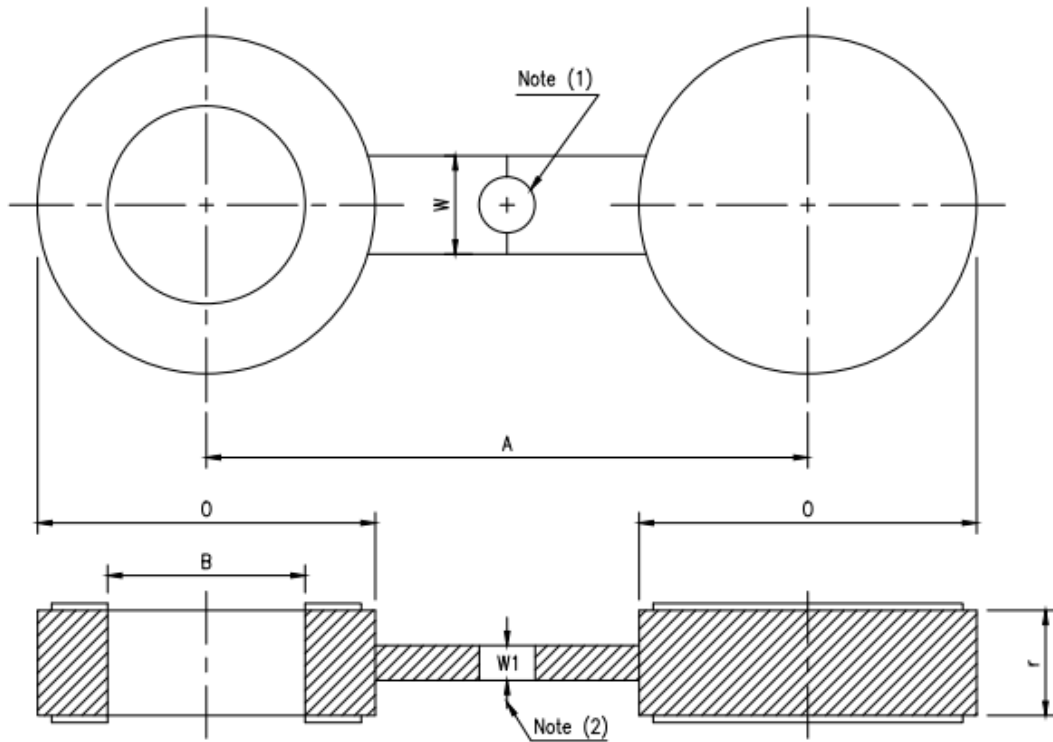


TABLE-4 DIMENSIONS OF CLASS 600 RAISED FACE FIGURE 8 BLANKS

NPS	INSIDE DIAMETER B, in.	OUTSIDE DIAMETER O, in.	CENTERLINE DIMENSION A, in.	THICKNESS r, in.	WEB WIDTH W, in.
1/2	0.62	2.00	2.62	0.25	1.50
3/4	0.82	2.50	3.25	0.25	1.50
1	1.05	2.75	3.50	0.25	2.25
1 1/4	1.44	3.12	3.98	0.38	2.25
1 1/2	1.68	3.62	4.50	0.38	2.62
2	2.16	4.25	5.00	0.38	2.25
2 1/2	2.64	5.00	5.88	0.50	2.62
3	3.26	5.75	6.62	0.50	2.62
3 1/2	3.76	6.25	7.25	0.62	3.00
4	4.26	7.50	8.50	0.62	3.00
5	5.30	9.38	10.50	0.75	3.38
6	6.36	10.38	11.50	0.88	3.38
8	8.33	12.50	13.75	1.12	3.75
10	10.42	15.62	17.00	1.38	4.12
12	12.39	17.88	19.25	1.62	4.12
14	13.62	19.25	20.75	1.75	4.50
16	16.62	22.12	23.75	2.00	4.88
18	17.62	24.00	25.75	2.12	5.25
20	19.58	26.75	28.50	2.50	5.25
24	23.50	31.00	33.00	2.88	6.00

NOTES:

- (1) Hole size (where required due to bolt spacing) shall be the same as the flange bolt hole, and located such that it will not interfere with bolting between two flanges.  
 (2) The thickness of the web (or tie bar) dimension  $W_1$  shall be 0.25 in. minimum.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

ANCHOR FOR BARE PIPE  
 SIZE 2" THRU 24"  
 TYPE-G5 (FOR OFFSITE)

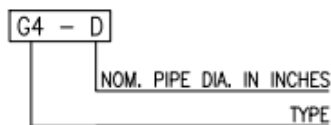
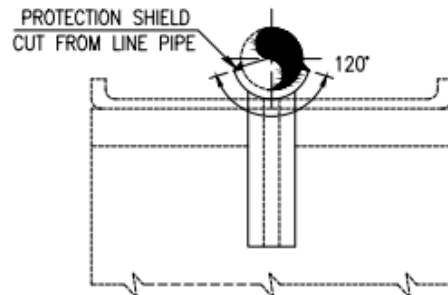
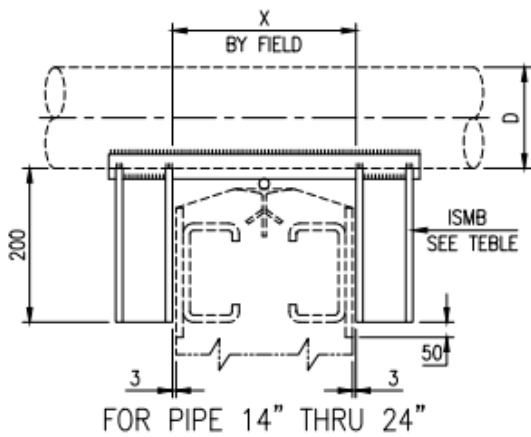
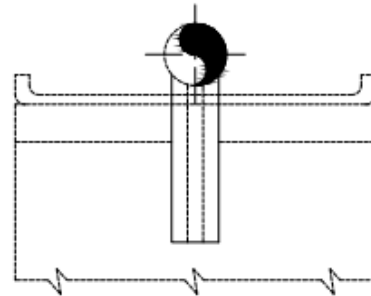
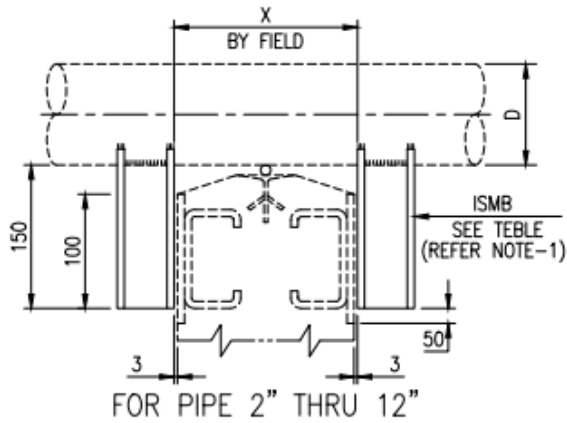
DRAWING NO.

SD-PI-002

SHEET NO.

1 OF 1

D	8	10	12	14	16	18	20	24
I BEAM	150			200			250	



SYMBOL

NOTE:-

- FOR SUPPORTING DETAILS FOR PIPE SIZE 2" THRU 6", REFER STD. 00004-PL-PI-STD-009

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

CROSS GUIDE FOR BARE  
PIPE SIZE 2" THRU 24"  
TYPE-G4 ( OFFSITE)

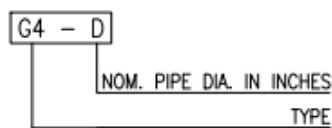
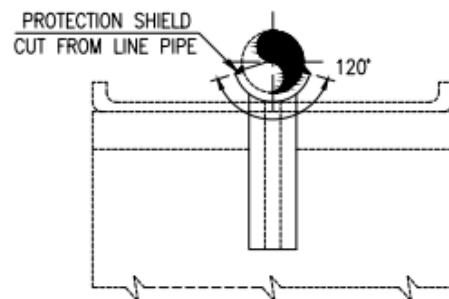
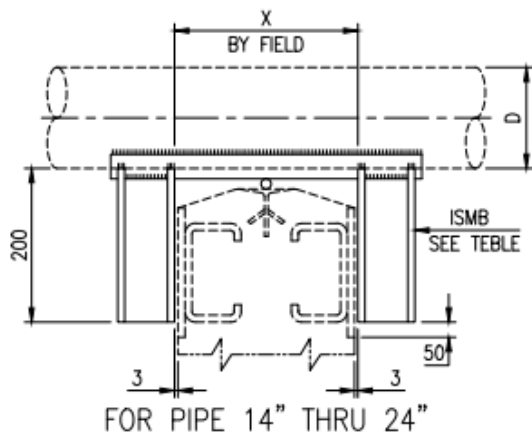
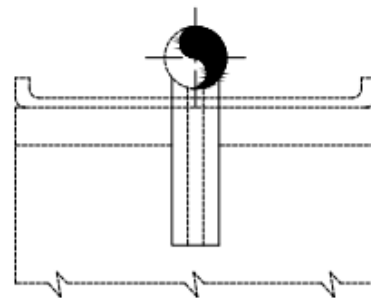
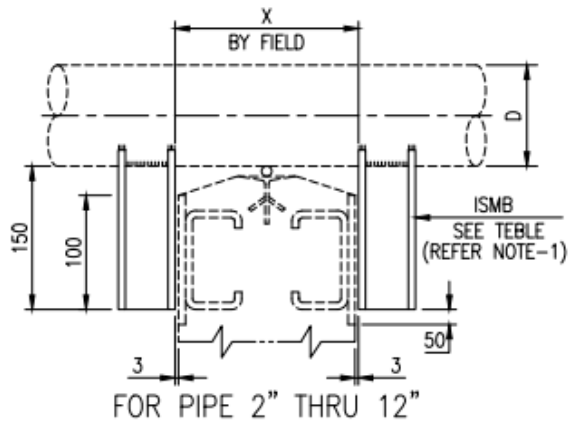
DRAWING NO.

SD-PI-003

SHEET NO.

1 OF 1

D	8	10	12	14	16	18	20	24
I BEAM	150			200			250	



SYMBOL

NOTE:-

- FOR SUPPORTING DETAILS FOR PIPE SIZE 2" THRU 6", REFER STD. STD.00004-PL-PI-STD-009

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

CROSS GUIDE FOR BARE  
PIPE SIZE 2" THRU 24"  
TYPE-G3

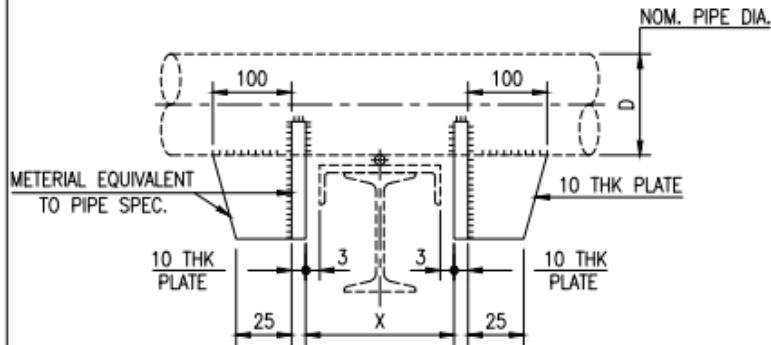
DRAWING NO.

SD-PI-004

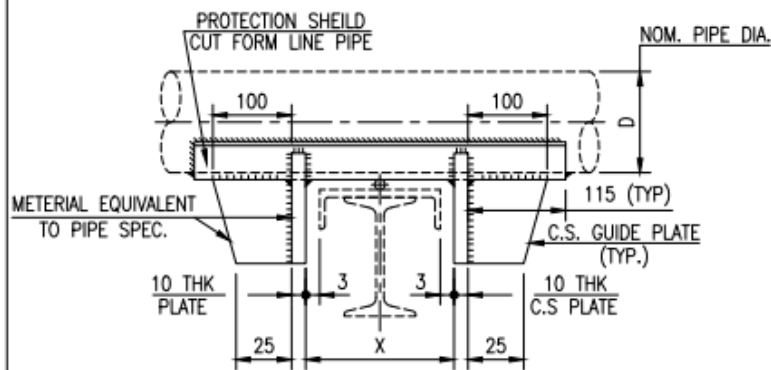
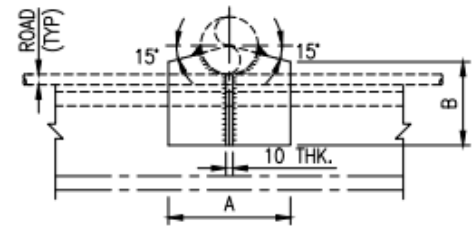
SHEET NO.

1 OF 1

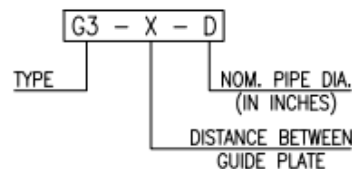
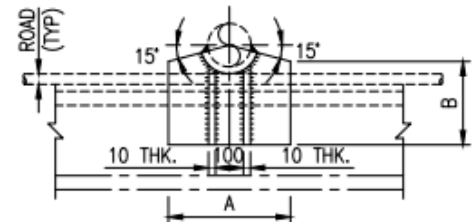
CROSS GUIDE													
D	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	22"	24"
A	100	130	154	208	280	314	364	396	446	498	548	598	650
B	67	78	86	106	131	145	163	175	193	212	231	248	268



CROSS GUIDE 2" THRU 12"



CROSS GUIDE 14" THRU 24"



SYMBOL

NOTE:-

1. PROTECTION SHIELD SHALL BE CUT FROM LINE PIPE.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

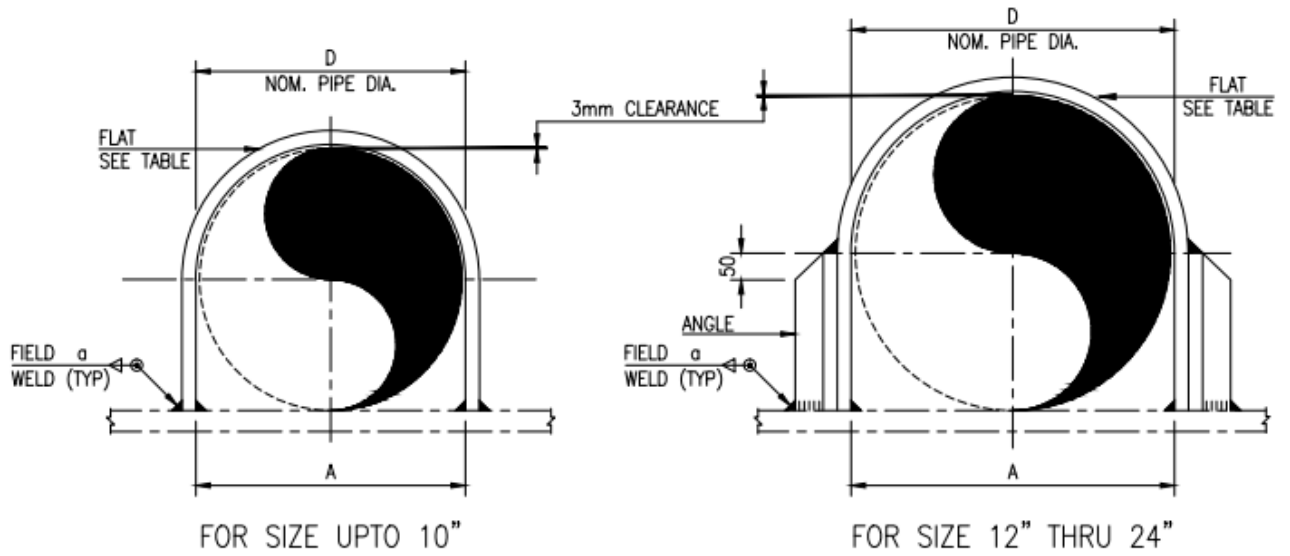
GUIDE SUPPORT FOR BARE PIPE  
 SIZE 1/2" THRU 24" TYPE-G1

DRAWING NO.

SD-PI-005

SHEET NO.

1 OF 1



D	A	$\alpha$	FLAT SIZE	ANGLE SIZE
1/2"	26	6	40 x 6	-
3/4"	33			
1"	40			
1 1/4"	48			
1 1/2"	55			
2"	65			
2 1/2"	80			
3"	95	10	50 x 10	-
3 1/2"	107			
4"	120			
5"	146			
6"	174			
8"	225	10	65 x 12	75x75x10
10"	278			
12"	328			
14"	362	10	75 x 12	90x90x10
16"	412			
18"	463			
20"	515			
24"	616			

G1 - D  
 TYPE \_\_\_\_\_ NOM. PIPE DIA. (INCH)  
 SYMBOL

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

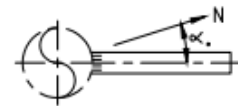
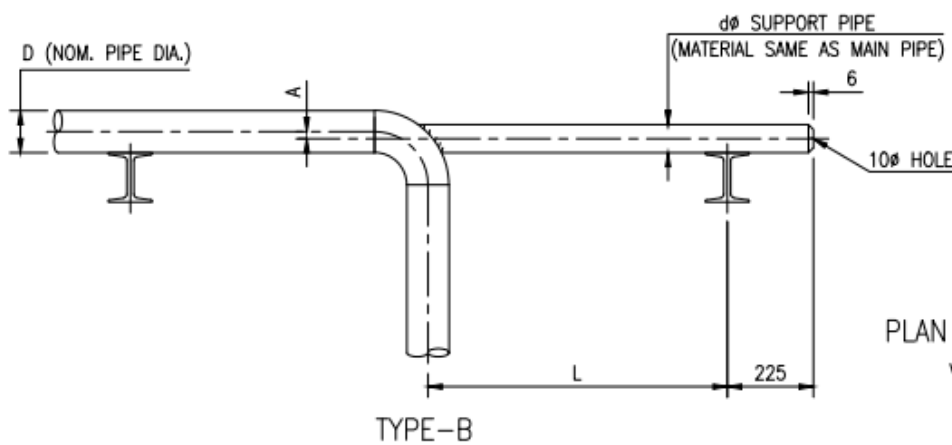
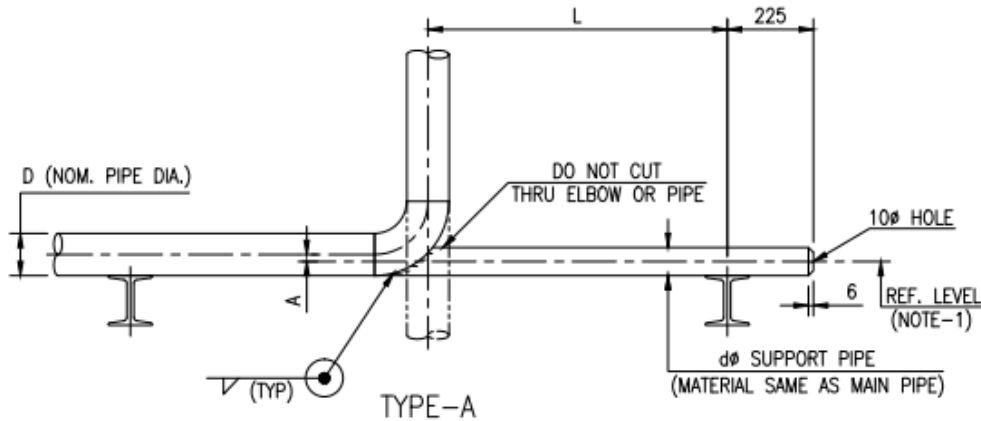
DUMMY PIPE SUPPORT FOR  
BARE PIPE SIZE 2" THRU 24"  
TYPE-B-39

DRAWING NO.

SD-PI-006

SHEET NO.

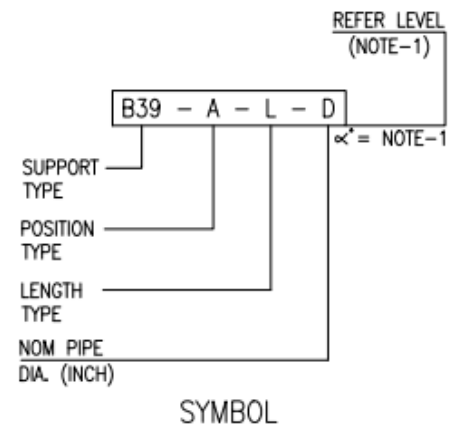
1 OF 1



PLAN FOR SUPPORT ON  
VERTICAL PIPE

FOR L, 1500 OR LESS		
D	d (NOTE 2)	A
2"	2"-SCH.40	-
3"	2"-SCH.40	15
4"	3"-SCH.40	13
6"	3"-SCH.40	40
8"	4"-SCH.40	52
10"	6"-SCH.40	52
12"	6"-SCH.40	78
14"	8"-SCH.40	68
16"	8"-SCH.40	94
18"	8"-SCH.40	119
20"	10"-SCH.40	118
24"	10"-SCH.40	168

FOR L, OVER 1500		
D	d (NOTE 2)	A
2"	2"-SCH.40	-
3"	2"-SCH.40	15
4"	3"-SCH.40	13
6"	4"-SCH.40	27
8"	6"-SCH.40	25
10"	8"-SCH.40	27
12"	8"-SCH.40	52
14"	10"-SCH.40	41
16"	10"-SCH.40	67
18"	10"-SCH.40	92
20"	12"-SCH.40	92
24"	12"-SCH.40	143



NOTES:-

1. REF. LEVEL &  $\alpha$  TO BE GIVEN IN CASE SUPPORT IS WELDED TO VERTICAL PIPE.
2. IN CASE SIZE AND/OR SCH. OF SUPPORT PIPE (d) LISTED IN THE TABLE IS NOT AVAILABLE USE NEXT HIGHER SIZE AND/OR NEAREST EQUIVALENT THICKNESS AVAILABLE.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

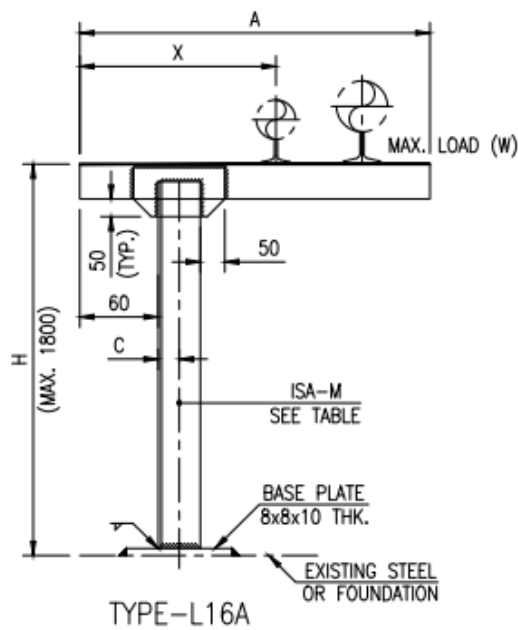
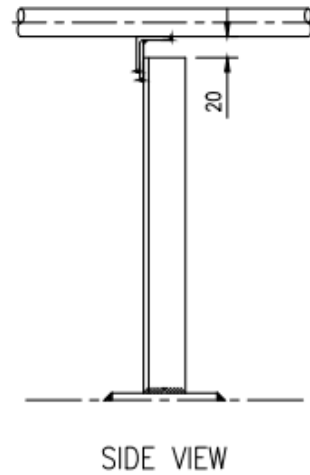
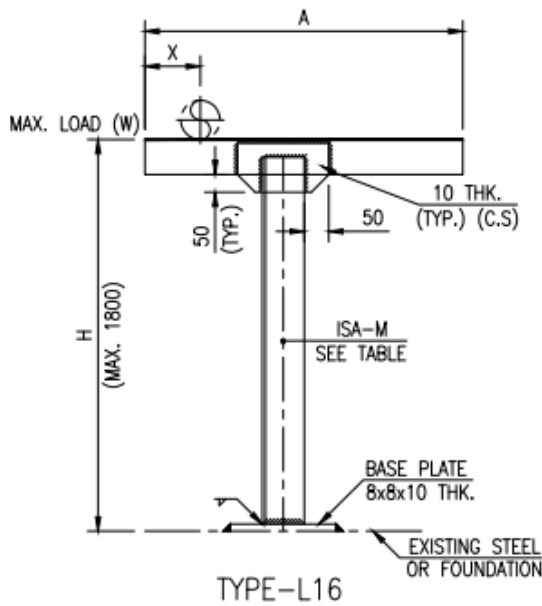
LOW SUPPORT STANCHION  
TYPE-L16 AND L-16A

DRAWING NO.

SD-PI-007

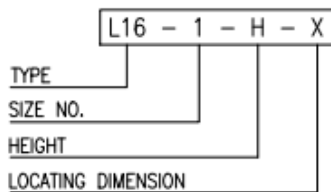
SHEET NO.

1 OF 1



NOTE:-

- DO NOT USE FOR ANCHORING THE PIPE.



SYMBOL

SIZE NO.	MAX. LOAD (W) Kg.	M	A	B	C
1	500	ISA 80x80x8	600	150	45
2	800	ISA 100x100x10	700	150	60
3	1500	ISA 130x130x12	800	150	80

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

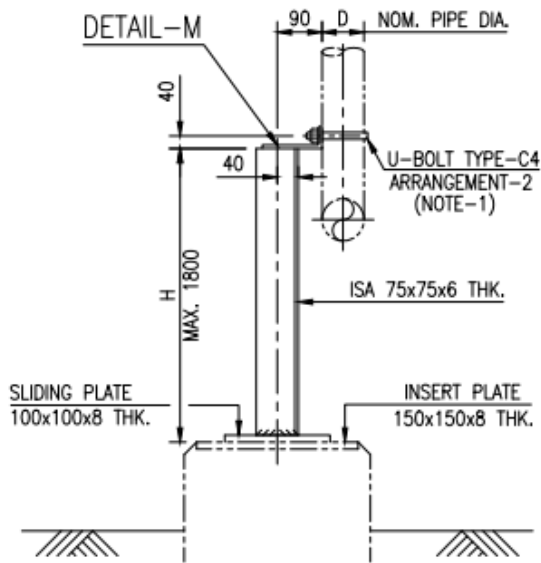
LOW SUPPORT SLIDING AND  
FIXED FOR PIPE SIZE 3/4"  
THRU 1.1/2" TYPE L-15

DRAWING NO.

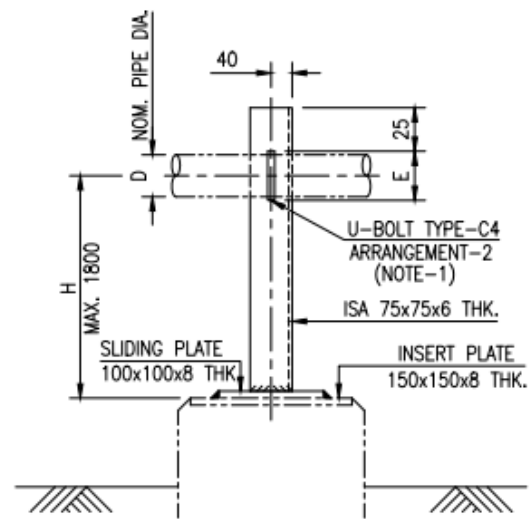
SD-PI-008

SHEET NO.

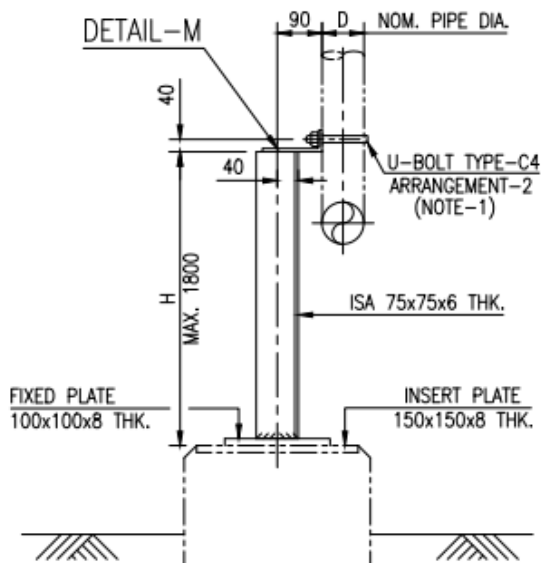
1 OF 1



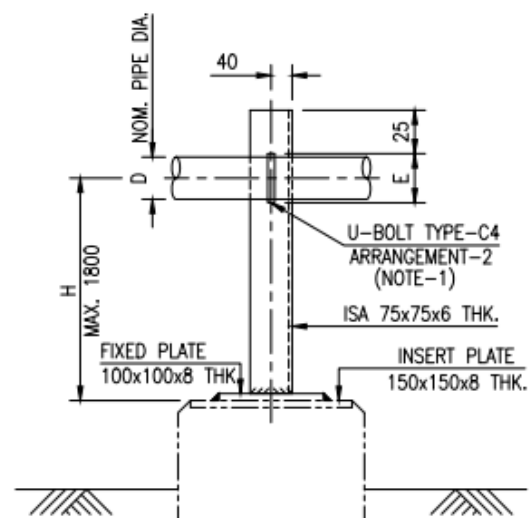
ARRANGEMENT TYPE-1  
(SLIDING)



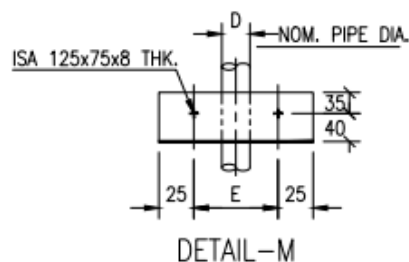
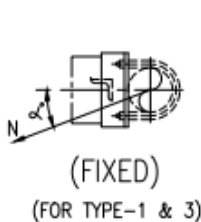
ARRANGEMENT TYPE-2  
(SLIDING)



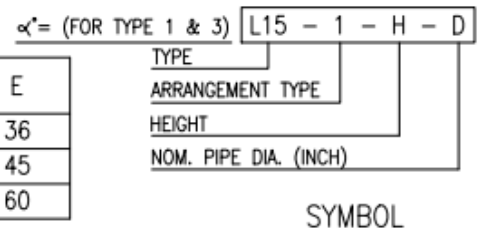
ARRANGEMENT TYPE-3  
(FIXED)



ARRANGEMENT TYPE-4  
(FIXED)



D	E
3/4"	36
1"	45
1 1/2"	60



0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

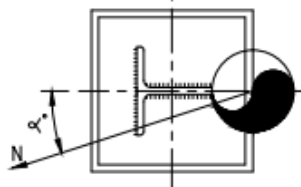
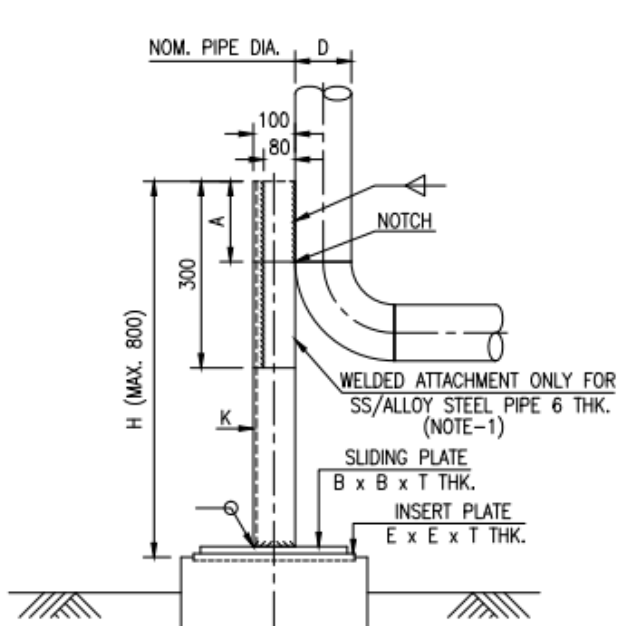
LOW SUPPORT SLIDING FOR  
BARE & INSULATED PIPE  
SIZE 2" THRU 24" TYPE-L6

DRAWING NO.

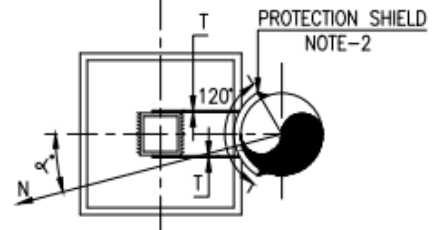
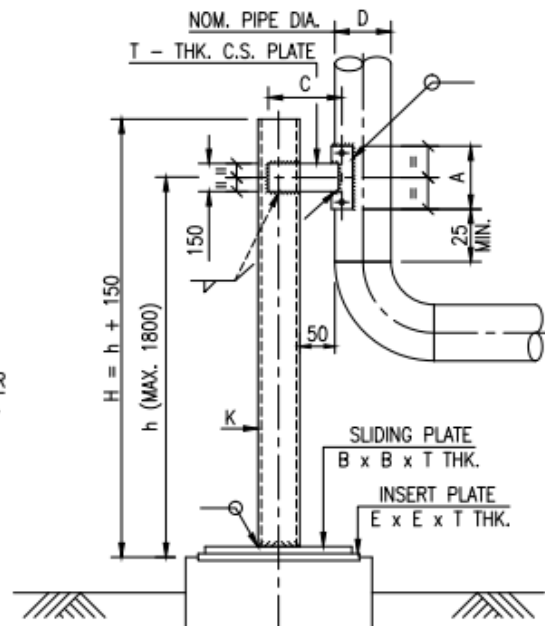
SD-PI-009

SHEET NO.

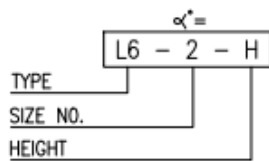
1 OF 1



FOR PIPE SIZES 2" THRU 4"



FOR PIPE SIZES 6" THRU 24"



SYMBOL

NOTES:-

1. MATERIAL FOR WELDED ATTACHMENT SHALL BE EQUIVALENT TO PIPE MATERIAL.
2. PROTECTION SHIELD IS TO BE CUT FROM LINE PIPE.

SIZE NO.	D	K	A	T	C	E	B
1	2" TO 4"	CUT FROM ISMB 200	200	10	-	250	150
2	6" TO 10"	ISMC-125 2 NOS.	200	12	150	300	200
3	12" TO 24"	ISMC-225 2 NOS.	300	12	230	400	300

FOR TEMP. UP TO 400 °C ONLY

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

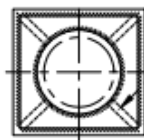
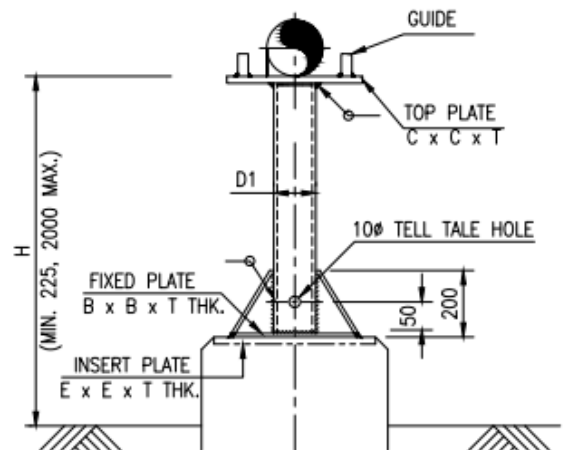
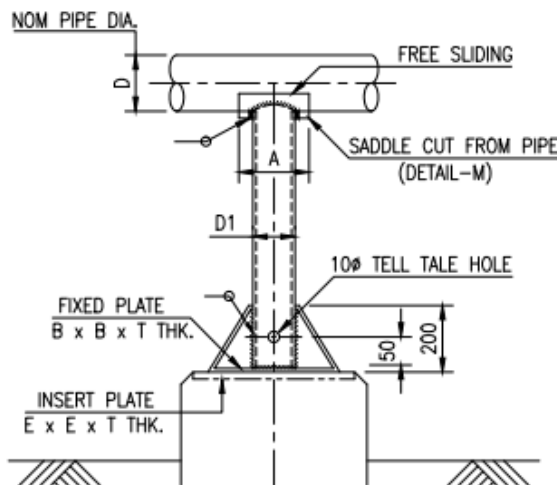
LOW SUPPORT SLIDING FOR BARE  
PIPE SIZE 3/4" THRU 36"  
TYPE-L5 & L5A

DRAWING NO.

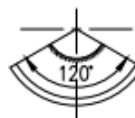
SD-PI-010

SHEET NO.

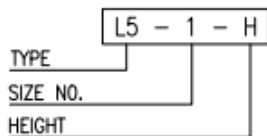
1 OF 1



10 THK. PLATE TO BE  
WELDED WHEN H EXCEEDS 1000



DETAIL-M



SYMBOL



SYMBOL

SIZE NO.	D	A	D1 (NOTE-1)	C	B	E	T
1	3/4"	2" NB x 100 Lg.	2" HEAVY IS :1239	150	150	200	12
	1"						
	1.1/2"	3" NB x 100 Lg.		200			
	2"						
2	3"	6" NB x 150 Lg.	2" HEAVY IS :1239	200	150	200	12
	4"						
3	6"	10" NB x 250 Lg.	3" HEAVY IS :1239	300	200	250	16
	8"						
4	10"	14" NB x 350 Lg.	4" HEAVY IS :1239	350	200	250	16
	12"						
5	14"	18" NB x 350 Lg.	6" HEAVY IS :1239	400	250	300	20
	16"						
6	18"	20" NB x 350 Lg.	8" SCH. 40	400	300	350	20
	20"						
7	24"	24" NB x 350 Lg.	10" SCH. 40	450	350	400	20
	26"						
8	30"	30" NB x 350 Lg.	12" SCH. 40	550	400	500	20
	36"						

NOTES:-

1. IN CASE SIZE AND/OR SCH. OF SUPPORT PIPE (D) LISTED IN THE TABLE IS NOT AVAILABLE, USE NEXT HIGHER SIZE AND/OR NEAREST EQUIVALENT THICKNESS AVAILABLE.
2. MATERIAL FOR SUPPORT PIPE & PLATE SHALL BE CARBON STEEL.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

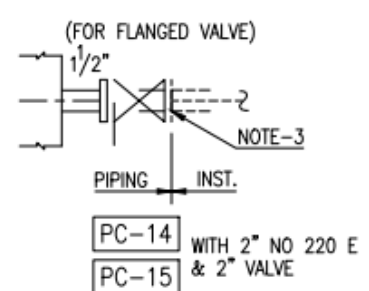
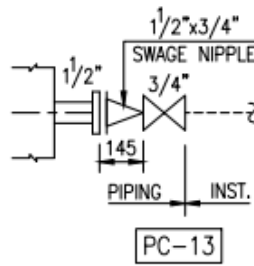
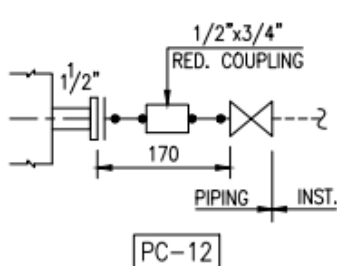
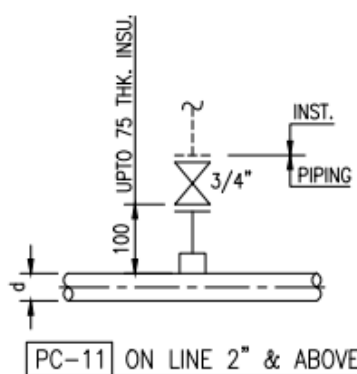
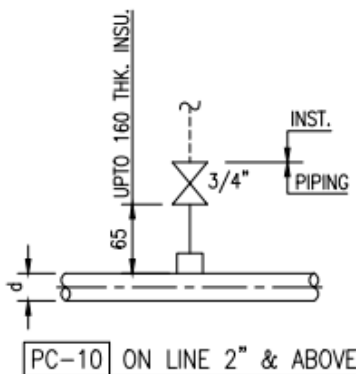
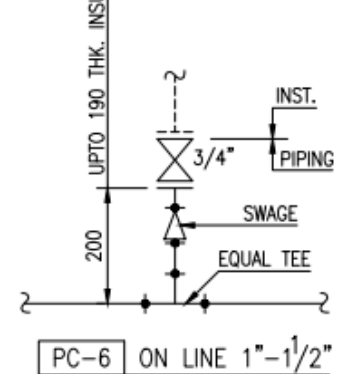
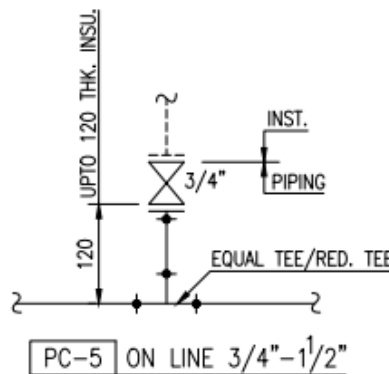
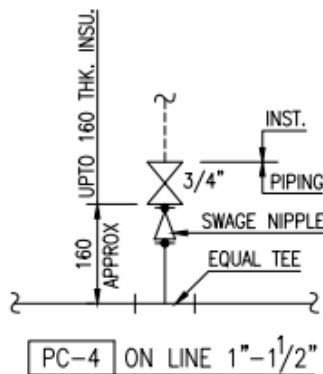
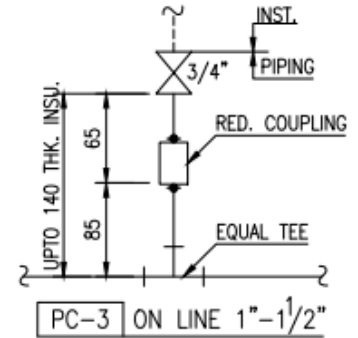
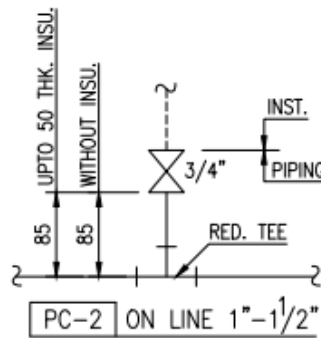
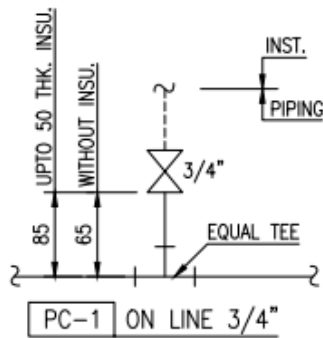
PRESSURE TAPPINGS  
(PA, PG, PC, PT, PIC ETC.)

DRAWING NO.

SD-PI-011

SHEET NO.

1 OF 1



ON VESSELS / COLUMNS

NOTES:-

1. THE INDICATED DIMENSIONS ARE MINIMUM WHICH ALSO COVER INSULATION TO THE EXTENT SHOWN ABOVE. IN HIGHER THICKNESS OF INSULATION THAN INDICATED, THE DIFFERENCE SHALL BE ADDED IN THE DIMENSIONS SHOWN ABOVE ACCORDINGLY.
2. PRESSURE TAPPING SHALL BE PROVIDED WITH GATE, GLOBE OR PLUG VALVE (FLGD. SW. OR SCR'D) WITH TEE (EQ. OR RED.) HALF COUPLING (.W. OR SCR'D) OR STUB-IN AS PER PIPING SPECIFICATION.
3. IN CASE OF FLGD. VALVES BOLTING & GASKET ON BOTH SIDES OF VALVE SHALL BE IN PIPING SCOPE.
4. IN CASE OF TAPPING PROVIDED OTHER THAN INDICATED IN THIS STD FOR LAYOUT REASONS DETAILED DIMENSIONS WILL BE CALLED FOR OR CARRIED OUT.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

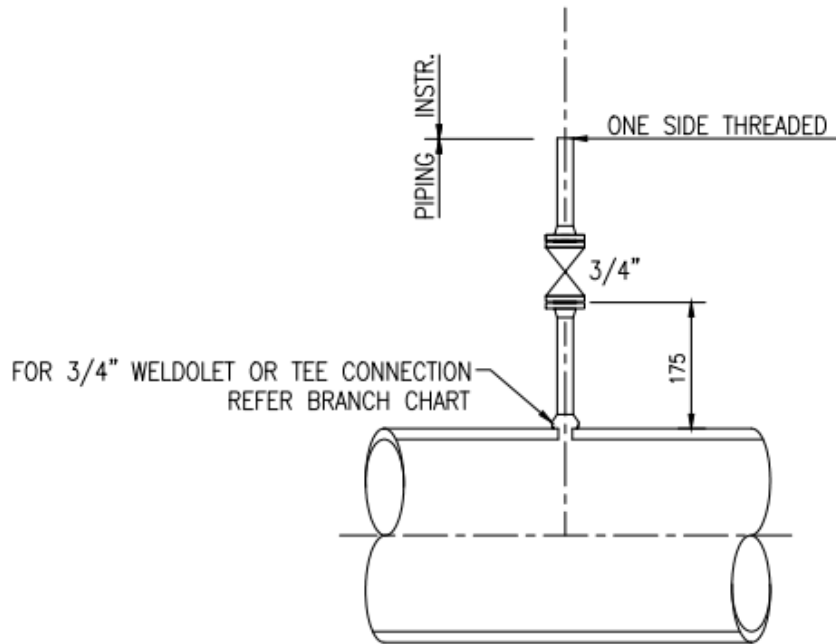
DETAIL OF PRESSURE  
CONNECTIONS ABOVE GROUND  
PIPE

DRAWING NO.

SD-PI-012

SHEET NO.

1 OF 1



0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

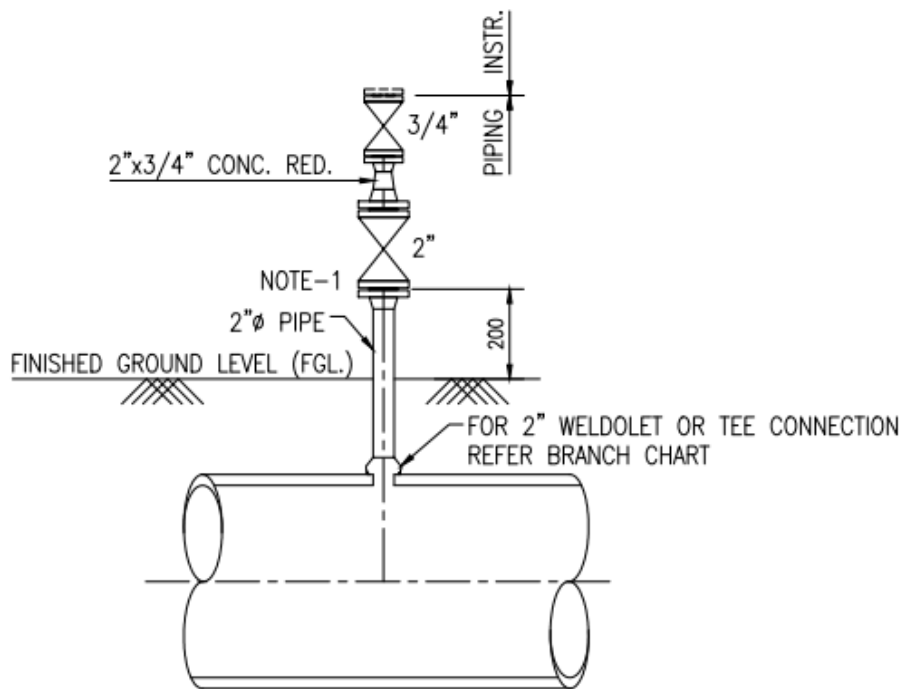
DETAIL OF PRESSURE CONNECTIONS  
UNDER GROUND PIPE

DRAWING NO.

SD-PI-013

SHEET NO.

1 OF 1



NOTE:

1 INSULATION GASKET SHALL BE INSTALLED.

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REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

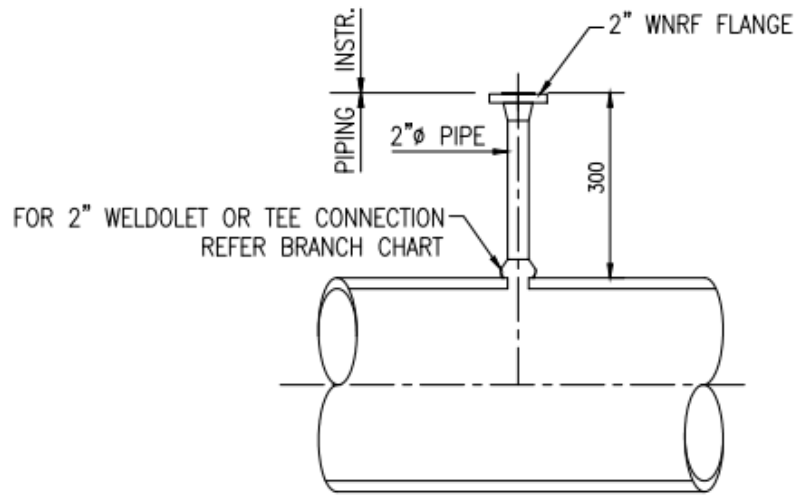
DETAIL OF TEMPERATURE CONNECTIONS  
ABOVE GROUND PIPE

DRAWING NO.

SD-PI-014

SHEET NO.

1 OF 1



0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

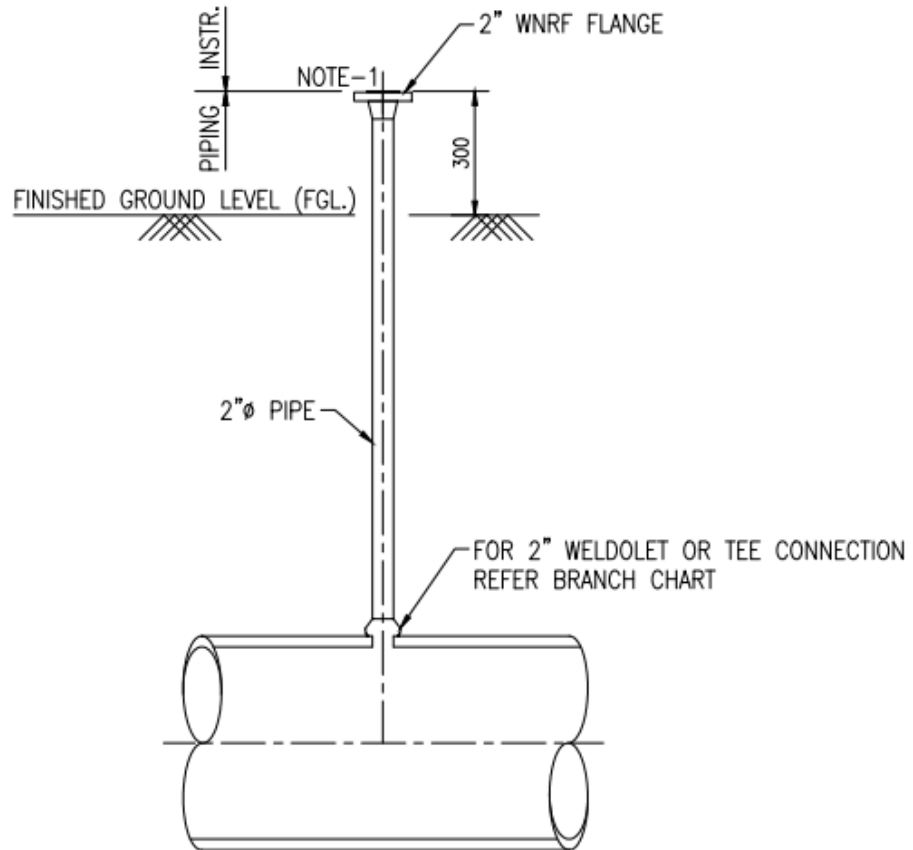
DETAIL OF TEMPERATURE  
CONNECTIONS UNDER GROUND  
PIPE

DRAWING NO.

SD-PI-015

SHEET NO.

1 OF 1



NOTE:

- 1 INSULATION GASKET SHALL BE INSTALLED.

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REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

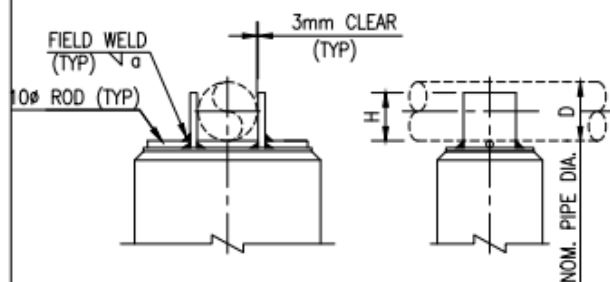
GUIDE SUPPORT FOR BARE PIPE  
(SIZE 1/2" TO 24") TYPE G2

DRAWING NO.

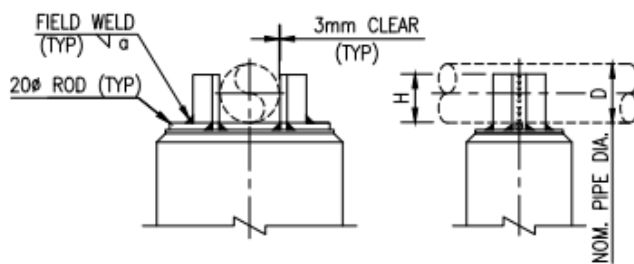
SD-PI-016

SHEET NO.

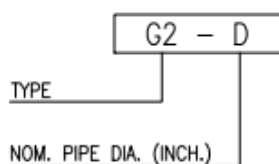
1 OF 1



FOR SIZES UPTO 4"



FOR SIZES 6" THRU 24"



SYMBOL

D	H	α	METERIAL
2" & SMALLER	40	6	FLAT 60 x 10
3" TO 4"	70	6	FLAT 75 x 10
6" TO 8"	130	6	2 NOS. ISA 50 x 50 x 6
10" TO 18"	230	10	2 NOS. ISA 75 x 75 x 10
20" TO 24"	350	10	2 NOS. ISA 90 x 90 x 10

NOTES:-

GUIDE ANGLES SHOULD BE SUITABLY TRIMMED WHEREVER THESE OBSTRUCT ADJOINING GUIDE ANGLES.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

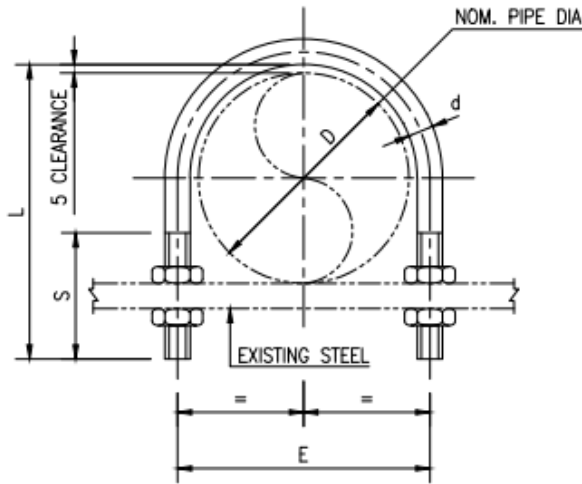
U-BOLT FOR BARE PIPE  
(SIZE 1/2" TO 24")

DRAWING NO.

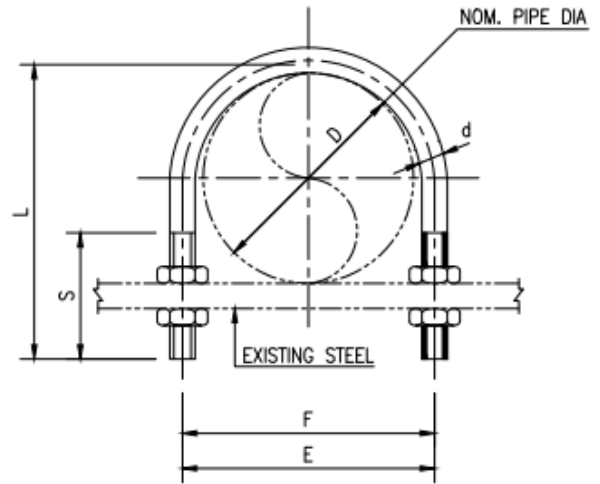
SD-PI-017

SHEET NO.

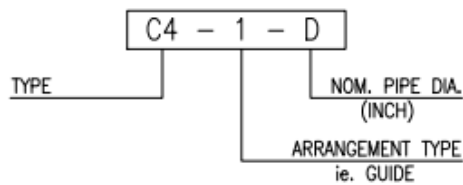
1 OF 1



GUIDE  
ARRANGEMENT TYPE-1  
(1/2" TO 24")



FIXED  
ARRANGEMENT TYPE-2  
(1/2" TO 1 1/2")



SYMBOL

D	O.D. (mm)	'U' CLAMP				
		L	E	S	d	F
1/2"	21	65	30	50	6	24
3/4"	27	70	36	50	6	30
1"	33	75	45	55	8	37
1 1/2"	48	90	60	55	8	52
2"	60	105	72	60	8	64
3"	89	145	106	80	12	94
4"	114	170	130	80	12	119
6"	168	240	190	100	16	173
8"	219	290	242	100	16	226
10"	273	345	296	100	16	280
12"	324	420	351	130	20	331
14"	356	450	382	130	20	362
16"	408	500	435	130	20	414
18"	457	565	490	140	24	465
20"	508	620	540	140	24	515
24"	610	720	645	140	24	620

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

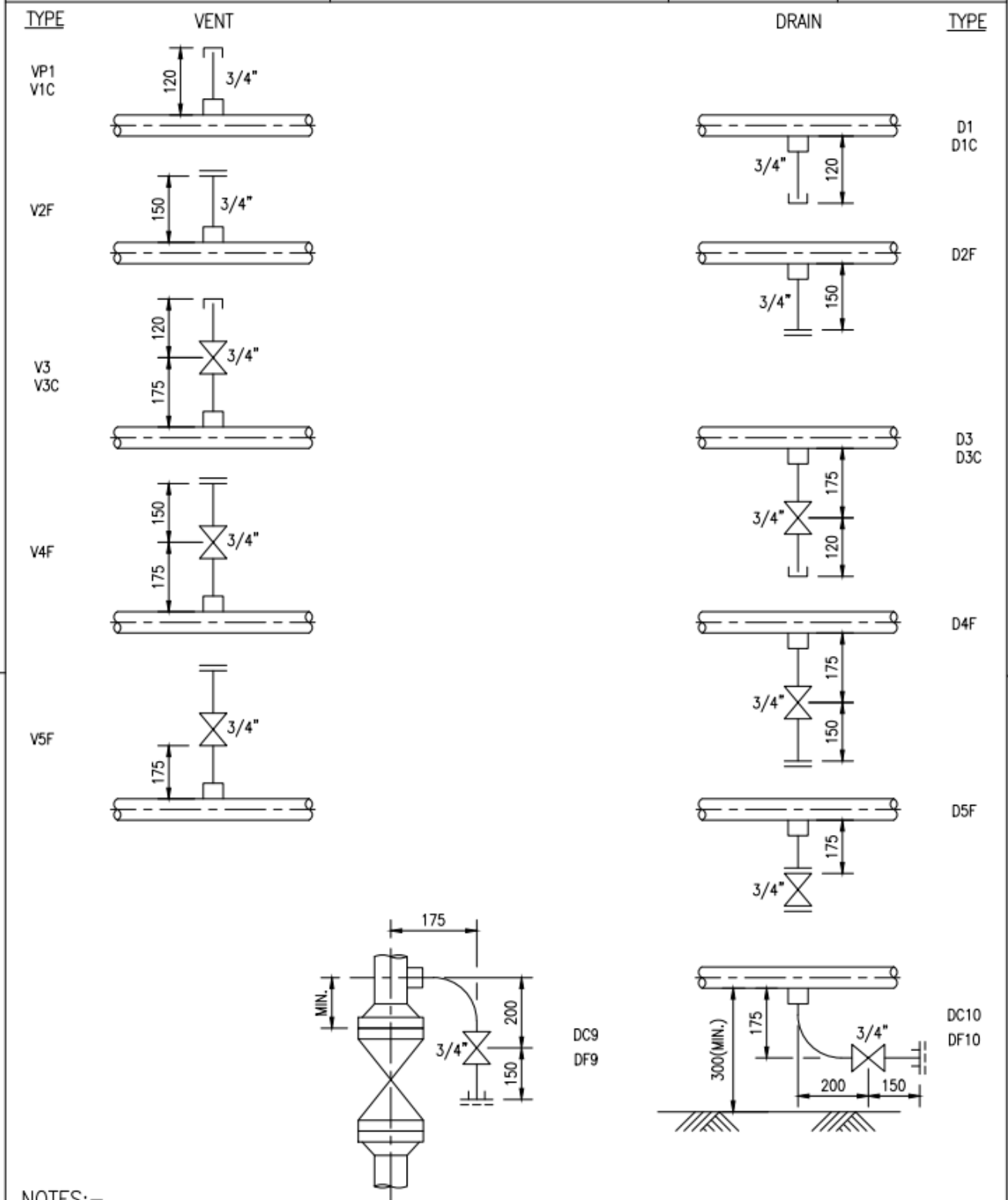
VENTS AND DRAINS  
(ON LINES 2" AND ABOVE)

DRAWING NO.

SD-PI-018

SHEET NO.

1 OF 1



NOTES:-

1. DELETED.
2. VENTS & DRAINS SHALL BE PROVIDED WITH GATE, GLOBE OR PLUG VALVE (FLG'D.) WITH HALF COUPLING. OR STUB IN, WITH CAP OR FLANGE & BLIND FLANGE AS PER PIPING SPECIFICATIONS.
3. DELETED.
4. LEGEND : V = VENT; D = DRAIN; C = CAP; F = FLANGE; P = PLUG.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

VENTS AND DRAINS  
(ON LINES 1 1/2" AND BELOW)

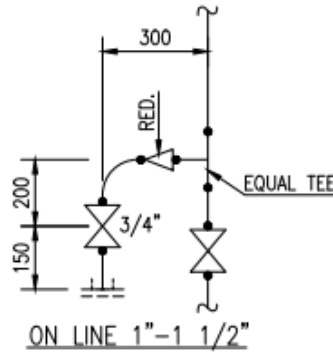
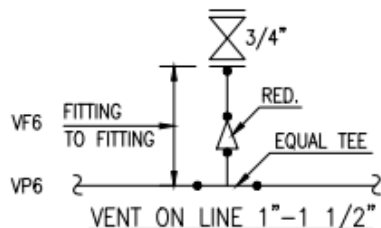
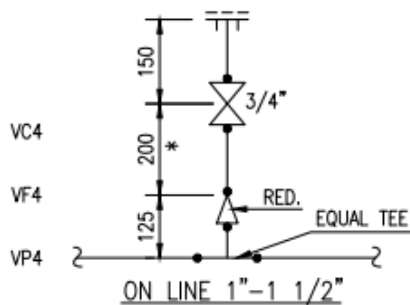
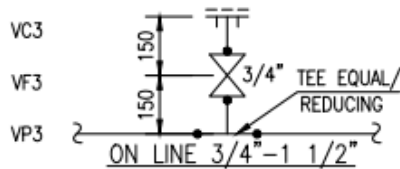
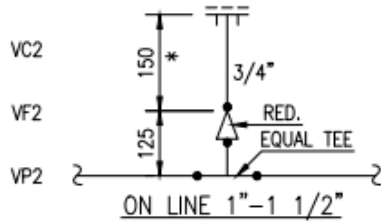
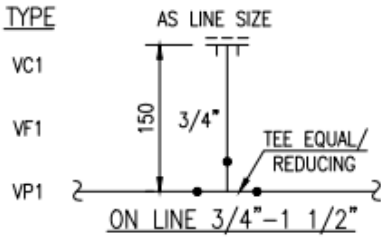
DRAWING NO.

SD-PI-019

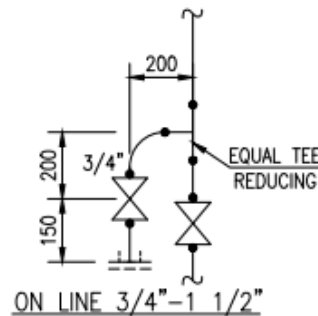
SHEET NO.

1 OF 1

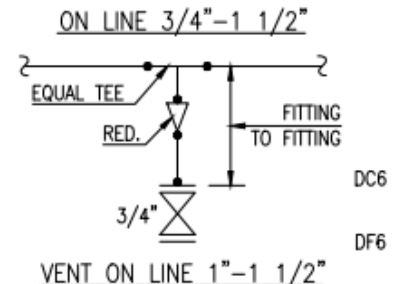
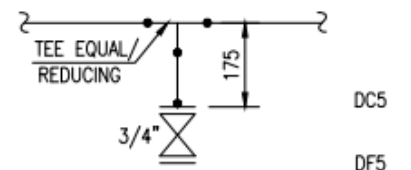
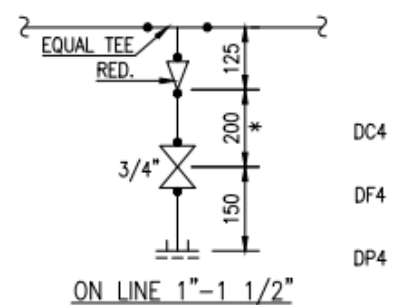
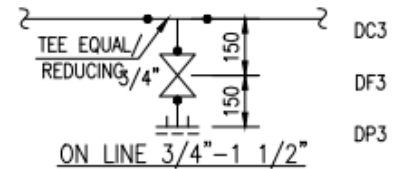
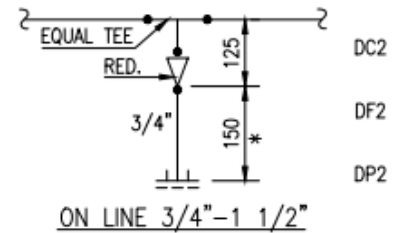
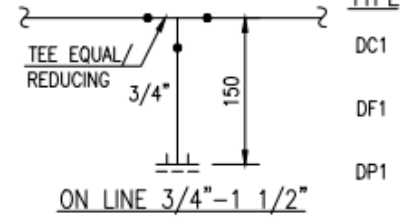
TYPE



DC7  
DF7  
DP7



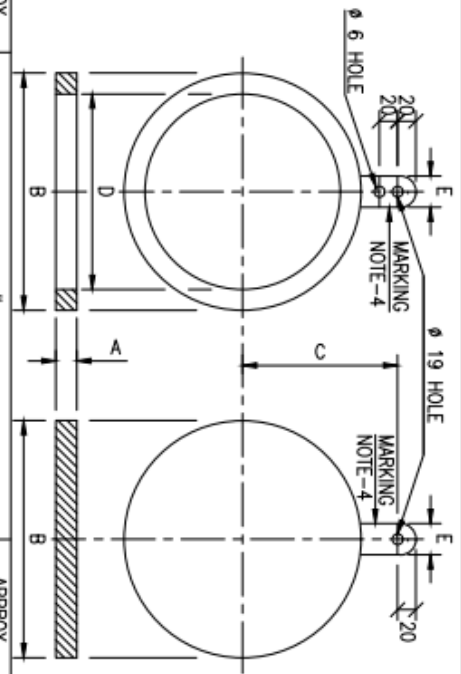
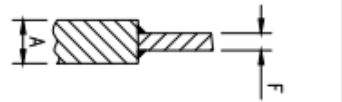
DC8  
DF8  
DP8



NOTES:-

1. DIMENSIONS ARE VALID FOR 50mm(MAX) INSULATION THICKNESS, INCREASE DIMENSIONS AS REQUIRED, DIMENSIONS MARKED '\*' ARE MAXIMUM AND MAY BE REDUCED TO SUIT.
2. VENTS & DRAINS SHALL BE PROVIDED WITH GATE, GLOBE OR PLUG VALVE (FLGD.) WITH TEE (EQUAL OR REDUCING), HALF COUPLING OR STUB IN, CAP OR PLUG FLANGE AND BLIND FLANGE AS PER PIPING SPECIFICATION.  
LEGEND : V = VENT; D = DRAIN; C = CAP; F = FLANGE; RED. = REDUCER, COUPLING OR SOCKET; P = PLUG.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



- NOTES:-
1. PROVIDE CONCENTRIC SERRATED FINISH ON BOTH SIDES WITH GROOVES 0.8 mm APART AND DEPTH APPROX 0.4 mm.
  2. DIMENSIONS ARE FOR FLANGES TO ANSI B16.5 FOR SIZE UP TO 24" & MSS-SP-44 FOR SIZE ABOVE 24" FOR FLANGES TO API 605 CALCULATE DIMN.
  3. THE DIA METER RATING AND MATERIAL SPECIFICATION SHALL BE MARKED ON WELDED FIXED PLATE.
  4. MATERIAL AS PER PIPE CLASS.

PIPE SIZE INCH	150# FF						300# FF						600# FF												
	A	B	C	D	E	F	BLIND WT KGS	SPEC	A	B	C	D	E	F	BLIND WT KGS	SPEC	A	B	C	D	E	F	BLIND WT KGS	SPEC	PIPE SIZE INCH
1"	5	62	105	29	25	4	0.2	0.1	5	70	115	29	25	4	0.2	0.1	5	70	125	29	25	4	0.28	0.15	1"
1/2"	5	82	115	43	25	4	0.3	0.2	5	92	125	43	25	4	0.4	0.3	7	92	125	43	25	4	0.5	0.35	1/2"
2"	7	102	125	55	25	4	0.4	0.3	7	108	130	55	25	4	0.6	0.4	10	108	130	55	25	4	0.75	0.5	2"
2 1/2"	7	121	140	65	25	4	0.8	0.6	10	127	150	65	25	6	1.1	0.7	15	127	150	65	25	6	1.2	0.9	2 1/2"
3"	7	134	150	80	40	4	0.9	0.7	10	146	155	80	40	6	1.7	1.0	15	146	155	80	40	6	2.0	1.2	3"
4"	8	170	165	106	40	6	1.8	1.0	13	178	180	106	40	6	2.1	1.2	18	190	180	106	40	6	3.7	2.4	4"
6"	11	218	190	157	40	6	3.7	1.5	18	248	210	157	40	6	7.2	3.8	24	263	225	157	40	8	11.0	6.2	6"
8"	15	275	220	207	40	6	7.5	2.7	21	305	240	207	40	8	13.5	6.3	30	314	260	207	40	10	19.5	10.0	8"
10"	18	335	250	260	40	8	13.0	4.3	26	358	270	260	40	10	22.5	8.8	37	397	300	260	40	10	37.0	19.0	10"
12"	19	405	290	312	40	8	22.0	8.0	30	418	310	312	40	10	35.0	13.8	43	454	325	312	40	15	57.0	27.5	12"
14"	22	445	320	342	40	10	28.0	12.5	34	480	340	342	40	15	52.0	23.5	48	448	350	342	40	15	71.0	33.0	14"
16"	26	510	350	393	40	10	42.0	15.0	38	536	375	393	40	15	70.0	30.0	54	560	390	393	40	20	110	55	16"
18"	29	545	370	445	40	10	53.0	17.0	43	592	400	445	40	20	100	42.0	62	608	415	445	40	20	140	65	18"
20"	30	600	400	496	40	15	70.0	20.0	48	650	440	496	40	20	128	49.0	67	678	450	496	40	20	190	83	20"
24"	37	710	450	597	50	15	120	52.0	57	772	510	597	50	20	210	74.0	81	785	515	597	50	25	307	125	24"
TOLERANCE	± 0.3	± 0.5		± 0.5	± 1.0				± 0.3	± 0.5		± 0.5	± 1.0				± 0.3	± 0.5		± 0.5	± 1.0				TOLERANCE

SPACERS BLINDS		DRAWING NO.	
0	10.05.17	150# , 300# & 600# FF	SD-P1-021
NO.	DATE	REVISED WITH TENDER	REV.
		US	DK
		DRN	CHND
		APPD	APPD

**SYMBOLS OF PIPING  
ELEMENTS ON DRAWINGS**

DRAWING NO.

SD-PI-023

SHEET NO.

1 OF 4

DESCRIPTION	FLANGED	SCREWED	WELDED (NOTE-1)	SOCKET WELD
90° ELBOW				
ELBOW (TURNED UP)				
ELBOW (TURNED DOWN)				
MITERED BEND 90°				
MITERED BEND 45°				
45° ELBOW				
45° ELBOW (TURNED UP)				
45° ELBOW (TURNED DOWN)				
TEE EQUAL/UNEQUAL				
TEE (OUTLET UP)				
TEE (OUTLET DOWN)				
CROSS				
CONCENTRIC REDUCER				
ECCENTRIC REDUCER				
DEAD END				
LATERAL				
SIGHT GLASS				
UNION				
HALF COUPLING				
FULL COUPLING				
HOSE COUPLING				

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

**SYMBOLS OF PIPING  
ELEMENTS ON DRAWINGS**

DRAWING NO.

SD-PI-023

SHEET NO.

2 OF 4

DESCRIPTION	FLANGED	SCREWED	WELDED (NOTE-1)	SOCKET WELD
GATE VALVE (PLAN)				
GATE VALVE (ELEVATION)				
GLOBE VALVE (PLAN)				
GLOBE VALVE (ELEVATION)				
ANGLE VALVE (PLAN)				
ANGLE VALVE (ELEVATION)				
CHECK VALVE (PLAN OR ELEVATION)				
ANGLE STOP CHECK VALVE (PLAN)				
ANGLE STOP CHECK VALVE (ELEVATION)				
PLUG VALVE (PLAN)				
PLUG VALVE (ELEVATION)				
BALL VALVE (PLAN)				
BALL VALVE (ELEVATION)				
NEEDLE VALVE (PLAN OR ELEVATION)				
RELIEF VALVE (PLAN)				
RELIEF VALVE (ELEVATION)				
CONTROL VALVE GLOBE TYPE(PLAN)				
CONTROL VALVE GLOBE TYPE(ELEVATION)				
CONTROL VALVE BUTTERFLY TYPE(PLAN)				
CONTROL VALVE BUTTERFLY TYPE(ELEV.)				
SOLENOID OPERATED VALVE(PLAN OR ELEV.)				

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

**SYMBOLS OF PIPING  
ELEMENTS ON DRAWINGS**

DRAWING NO.

SD-PI-023

SHEET NO.

3 OF 4

DESCRIPTION	FLANGED	SCREWED	WELDED (NOTE-1)	SOCKET WELD
BUTTERFLY VALVE (PLAN OR ELEVATION)				
DIAPHRAGM VALVE (PLAN OR ELEVATION)				
3-WAY PLUG VALVE (PLAN OR ELEVATION)				
4-WAY PLUG VALVE (PLAN OR ELEVATION)				
EXPANSION JOINT				
ANGLE CONTROL VALVE				
CHAIN OPERATING VALVE				
GEAR OPERATED VALVE (BEVEL GEAR)PLAN				
GEAR OPERATED VALVE (SPUR GEAR)PLAN				
MOTOR OPERATING VALVE				
STEAM TRAP				
Y-STRAINER				

DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL
SLIP ON FLANGE		STUB - IN (WITH OR WITHOUT RENIF)	
WELDNECK FLANGE			
SCREWED FLANGE		STUB - IN (SADDLE RENIF)	
SOCKET WELD FLANGE			
SPACER		STUB - IN WITH RENIF (IN PLAN)	
SPACER BLIND			
SPECTALE FIG. 8 (BLIND)		INSULATED (LINES 12" AND BELOW)	
SPECTALE FIG. 8 (OPEN)			

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

**SYMBOLS OF PIPING  
ELEMENTS ON DRAWINGS**

DRAWING NO.

SD-PI-023

SHEET NO.

3 OF 4


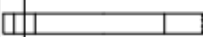









DESCRIPTION	FLANGED	SCREWED	WELDED (NOTE-1)	SOCKET WELD
BUTTERFLY VALVE (PLAN OR ELEVATION)				
DIAPHRAGM VALVE (PLAN OR ELEVATION)				
3-WAY PLUG VALVE (PLAN OR ELEVATION)				
4-WAY PLUG VALVE (PLAN OR ELEVATION)				
EXPANSION JOINT				
ANGLE CONTROL VALVE				
CHAIN OPERATING VALVE				
GEAR OPERATED VALVE (BEVEL GEAR)PLAN				
GEAR OPERATED VALVE (SPUR GEAR)PLAN				
MOTOR OPERATING VALVE				
STEAM TRAP				
Y-STRAINER				

DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL
SLIP ON FLANGE		STUB - IN (WITH OR WITHOUT RENIF)	
WELDNECK FLANGE			
SCREWED FLANGE		STUB - IN (SADDLE RENIF)	
SOCKET WELD FLANGE			
SPACER		STUB - IN WITH RENIF (IN PLAN)	
SPACER BLIND			
SPECTALE FIG. 8 (BLIND)		INSULATED (LINES 12" AND BELOW)	
SPECTALE FIG. 8 (OPEN)			

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

**GASKET THICKNESS**

DRAWING NO.  
SD-PI-024  
SHEET NO. 1 OF 1

TYPICAL CROSS SECTION	DESCRIPTION		THICKNESS OF GASKET	COMPRESSED THICKNESS (NOTE -1)
	FLAT RING FOR RAISED FACE FLANGE	COMPRESSED ASBESTOS FOR SYNTHETIC RUBBER	2.0	2.0
	FULL FACE FOR FLAT FACE FLANGES			
	SPIRAL WOUND METAL FLAT RING GASKET, NON METALLIC FILTER, AND A STEEL SOLID RING TYPE CENTERING DEVICE- FOR RAISED FACE FLANGES.		4.4	3.0
	FLAT METAL JACKETED GASKET, NON METALLIC FILTER COMPLETELY ENCLOSED WITHIN A FULLY ANNEALED DOUBLE METAL JACKET-FORRAISED FACE FLANGES		3.0	2.0
	CORRUGATED METAL JACKETED GASKET, NON METALLIC FILTER, COMPLETELY ENCLOSED WITHIN A FULLY ANNEALED DOUBLE METAL CORRUGATED JACKET- FOR RAISED FACE FLANGES.		3.2	1.0
	CORRUGATED METAL GASKET-FULLY ANNEALED CORRUGATED METAL WITH FILTER MATERIAL CEMENTED TO THE CORRUGATIONS ON BOTH FACES -FOR RAISED FACE FLANGES		3.2	1.0
	SOLID METAL FLAT RING FOR SMALL TONGUE AND GROOVE FLANGES.		AS SPECIFIED	
	SOLID METAL FLAT RING FOR LARGE TONGUE AND GROOVE FLANGES.		AS SPECIFIED	
	SOLID METAL OCTAGONAL RING FOR R.T.J FLANGES	DIMENSIONS SHALL BE AS PER ASME B 16.20(NOTE-2)		
	SOLID METAL OVAL RING FOR R.T.J FLANGES	DIMENSIONS SHALL BE AS PER ASME B 16.20(NOTE-2)		
	FULLY ANEALED CORRUGATED METAL FOR RAISED FACE FLANGES.		3.2	1.0

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

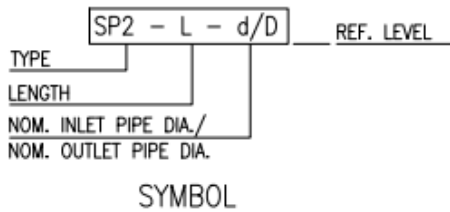
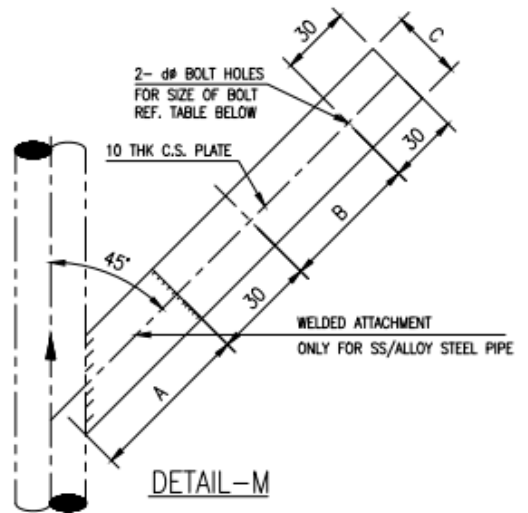
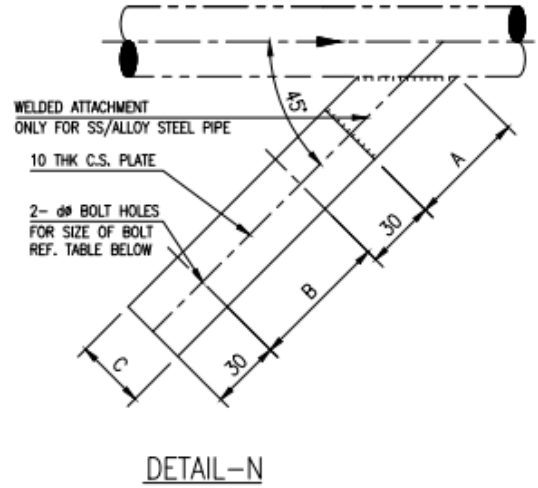
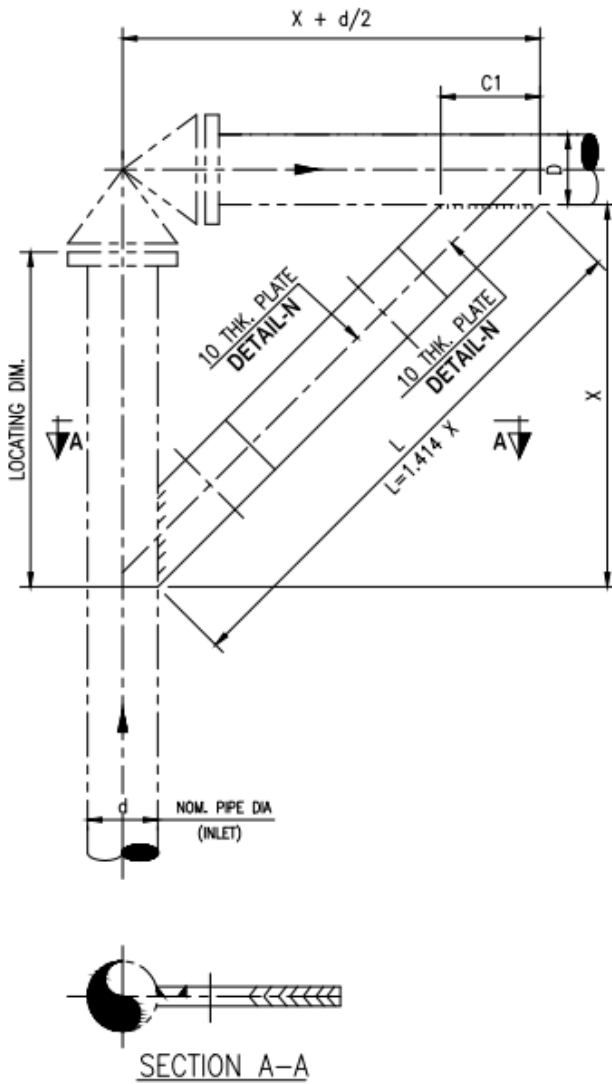
**SUPPORTING ARRANGEMENT  
FOR ANGLE AND RELIEF VALVES  
TYPE-SP2**

DRAWING NO.

SD-PI-025

SHEET NO.

1 OF 1



**NOTES:-**

- MATERIAL FOR WELDED ATTACHMENT SHALL BE EQUIVALENT TO PIPE MATERIAL.

D	BOLT SIZE dø	A	C	B MIN.	C1	D1
1" TO 4"	M12 X 50	75	50	150	71	14
6" TO 12"	M16 X 50	100	75	200	106	18

FOR TEMP. UP TO 400 °C ONLY

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

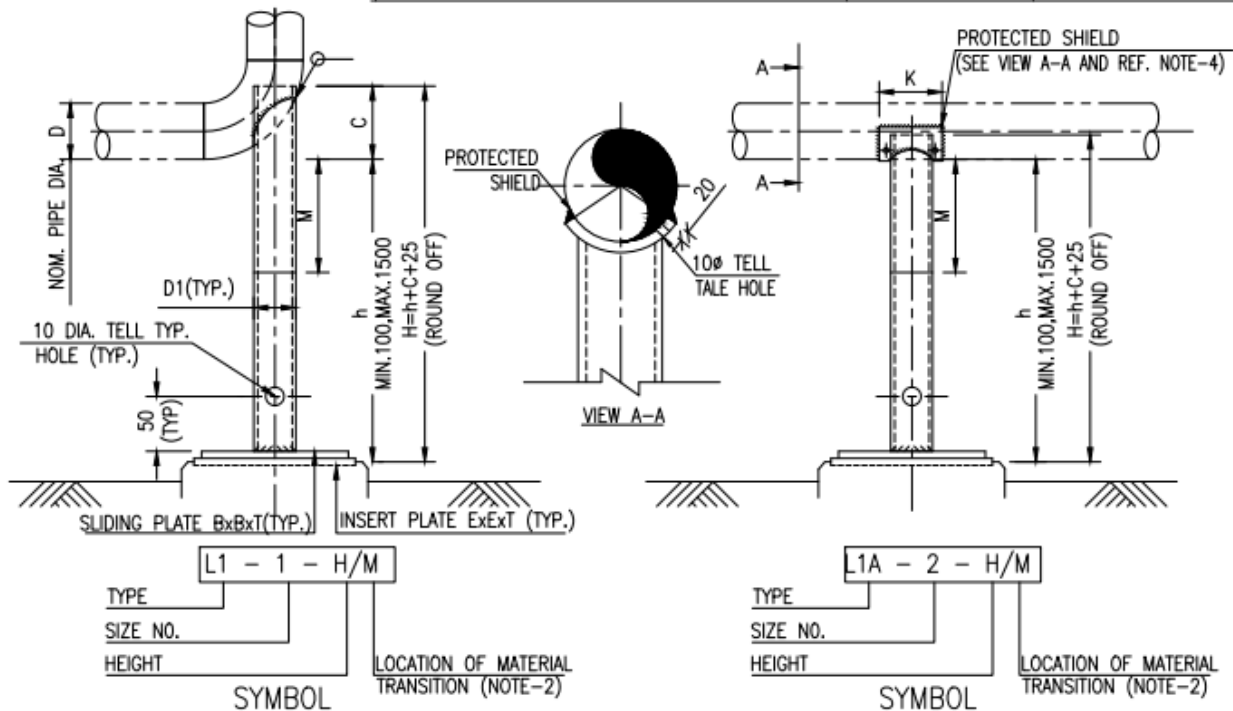
LOW SUPPORT SLIDING FOR BARE  
& INSULATED PIPE SIZE 2"  
THRU 36" TYPE-L1 AND L1A

DRAWING NO.

SD-PI-026

SHEET NO.

1 OF 1



SIZE NO.	D	D1 (NOTE-3)	B	T	C (NOTE-5)	E	K (NOTE-4)
1	2"	2" S40/10S	150	10	70	250	160
	3"				115		
2	4"	3" S40/10S	200	10	137	300	190
	6"				174		
3	8"	4" S40/10S	200	12	205	300	215
	10"				262		
	12"				287		
4	14"	6" S40/10S	250	12	388	350	270
	16"				418		
5	18"	8" S40/10S	300	12	454	400	320
6	20"	10" S40/10S	350	12	554	450	375
	24"				615		
7	26"	12" S40/10S	400	16	675	500	425
	30"				800		
	36"				950		

NOTES:-

- INSERT AND SLIDING PLATE MATERIAL SHALL BE CARBON STEEL WHERE DESIGN TEMP. IS  $>345^{\circ}\text{C}$  WITH  $h < 200\text{MM}$ , SLIDING PLATE MATERIAL SHALL BE EQUIVALENT TO PIPE MATERIAL.
- DIMENSION "M" LOCATES THE POINT OF MATERIAL TRANSITION ON THE SUPPORT. THE STUB MATERIAL SHALL BE EQUIVALENT TO THAT OF LINE PIPE AND THE LOWER SUPPORT PIPE SHALL BE CARBON STEEL. MINIMUM VALUE OF M SHALL BE "INSULATION THICKNESS+25MM".  
A. FOR CARBON STEEL(CS) LINE PIPE, THE ENTIRE SUPPORT PIPE SHALL BE CS, THAT IS  $M=0$ .  
B. FOR ALLOY STEEL(AS) OR STAINLESS STEEL(SS) LINE -PIPE, SUPPORT PIPE SHALL CONSIST OF THE FOLLOWING-  
-FOR  $h$  LESS THAN OR EQUAL TO 500MM, ENTIRE SUPPORT PIPE MATERIAL SHALL BE EQUIVALENT TO THAT OF LINE PIPE, THAT IS  $M=h$ .  
-FOR  $h$  GREATER THAN 500MM, SUPPORT PIPE SHALL BE COMPOSITE WITH  $M$ =INSULATION THK.+25MM OR 100MM, WHICHEVER IS GREATER.
- IN CASE SIZE AND/OR SCH. OF SUPPORT PIPE (D1) LISTED IN THE TABLE IS NOT AVAILABE USE NEXT HIGHER SIZE AND/OR NEAREST HIGHER THICKNESS AVAILABLE.
- PROTECTION SHIELD (LENGTH=KMM) CUT FROM LINE-PIPE OR EQUIVALANT PLATE SHALL BE PROVIDED ON HORIZONTAL LINE AS FOLLOWS-  
A. FOR 150# AND 300# CLASS PIPEING  
CS AND AS LINES - 10" AND ABOVE  
SS LINES - 2" AND ABOVE  
B. FOR 600# AND HIGHER CLASS PIPING  
CS, AS AND SS LINES - 10" AND ABOVE
- DIMENSION "C" IS TO BE MODIFIED IF OTHER THAN 1.5 D RADIUS ELBOWS ARE USED.
- IN CASE CALCULATED  $h$  EXCEEDS THE MAX. VALUE, PEDESTAL SHALL BE RAISED ACCORDINGLY.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

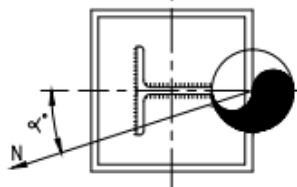
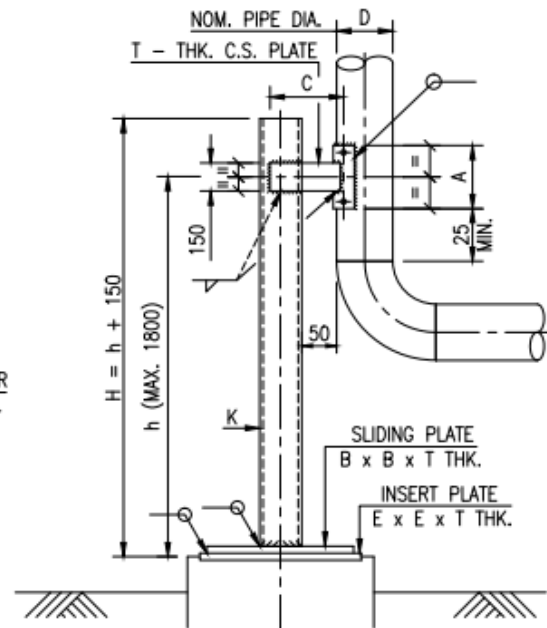
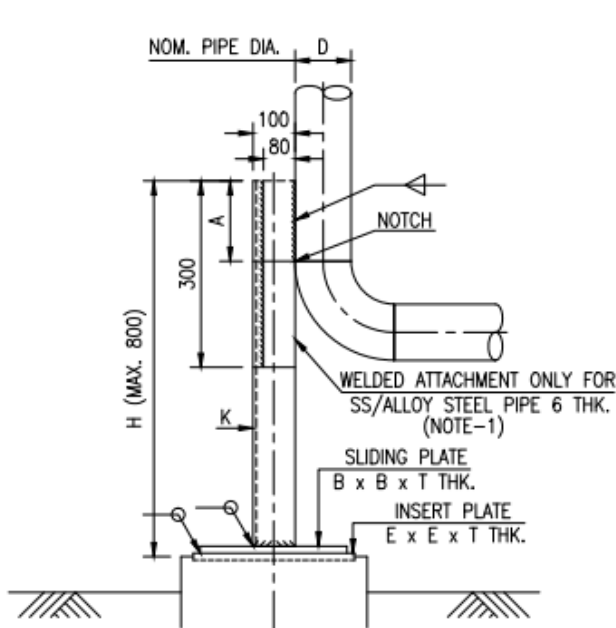
LOW SUPPORT FIXED FOR BARE  
& INSULATED PIPE SIZE 2"  
THRU 24" TYPE-L6

DRAWING NO.

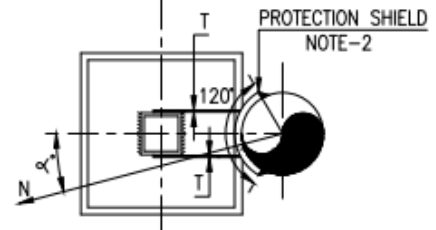
SD-PI-027

SHEET NO.

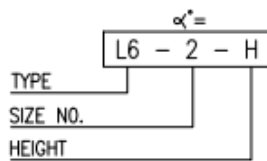
1 OF 1



FOR PIPE SIZES 2" THRU 4"



FOR PIPE SIZES 6" THRU 24"



SYMBOL

NOTES:-

1. MATERIAL FOR WELDED ATTACHMENT SHALL BE EQUIVALENT TO PIPE MATERIAL.
2. PROTECTION SHIELD IS TO BE CUT FROM LINE PIPE.

SIZE NO.	D	K	A	T	C	E	B
1	2" TO 4"	CUT FROM ISMB 200	200	10	-	250	150
2	6" TO 10"	ISMC-125 2 NOS.	200	12	150	300	200
3	12" TO 24"	ISMC-225 2 NOS.	300	12	230	400	300

FOR TEMP. UP TO 400 °C ONLY

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

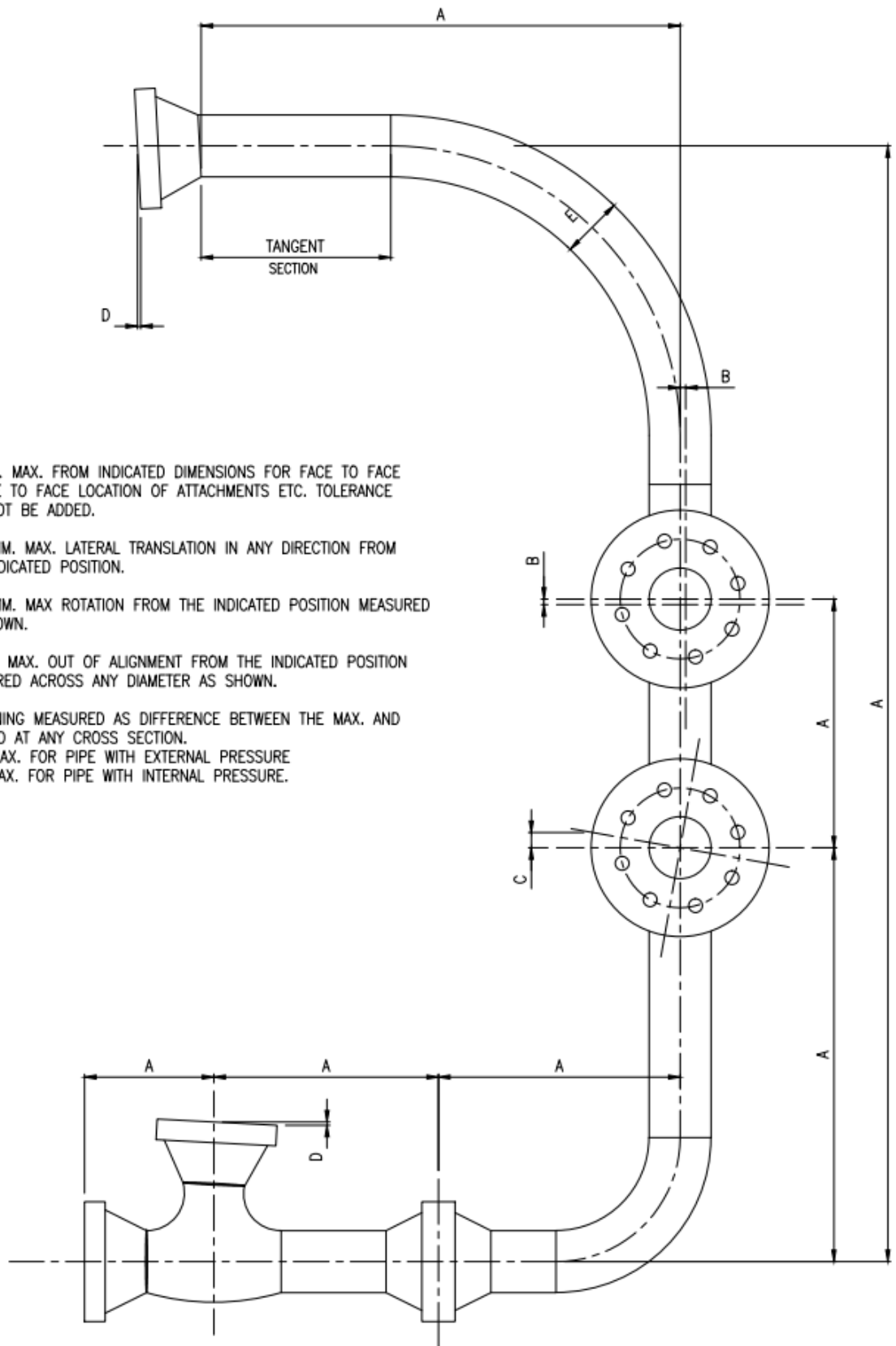
TOLERANCES  
FOR FABRICATION

DRAWING NO.

SD-PI-028

SHEET NO.

1 OF 1



- A  $\pm 3$  MM. MAX. FROM INDICATED DIMENSIONS FOR FACE TO FACE CENTRE TO FACE LOCATION OF ATTACHMENTS ETC. TOLERANCE CAN NOT BE ADDED.
- B  $\pm 1.5$  MM. MAX. LATERAL TRANSLATION IN ANY DIRECTION FROM THE INDICATED POSITION.
- C  $\pm 1.5$  MM. MAX ROTATION FROM THE INDICATED POSITION MEASURED AS SHOWN.
- D  $\pm 1$  MM MAX. OUT OF ALIGNMENT FROM THE INDICATED POSITION MEASURED ACROSS ANY DIAMETER AS SHOWN.
- E FLATTENING MEASURED AS DIFFERENCE BETWEEN THE MAX. AND MIN. OD AT ANY CROSS SECTION.  
 $-3\%$  MAX. FOR PIPE WITH EXTERNAL PRESSURE  
 $8\%$  MAX. FOR PIPE WITH INTERNAL PRESSURE.

0	10.05.17	ISSUED FOR STANDARD	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD




ABBREVIATIONS

DRAWING NO.

SD-PI-029

SHEET NO.

1 OF 1

M&F	MALE & FEMALE	SO	SLIP ON
MI	MALLEABLE IRON	SOL	SOCKOLET
MOLY OR MO	MOLYBDENUM	SP. GR	SPECIFIC GRAVITY
MR	MATERIAL REQUISITION	SR	SHORT RADIUS
MTO	MATERIAL TAKE OFF	SS	STAINLESS STEEL
MS	MILD STEEL	ST	STEAM TRAP
MSS	MANUFACTURER'S STANDARD SOCIETY	STN	STATION
MH	MAN HLOE	STM	STEAM
NPT	NATIONAL PIPE THREAD	STD	STANDARD
NPSH	NET POSITIVE SUCTION HEAD	SW	SOCKET WELD
NIP	NIPPLE	SWG	SWAGE NIPPLE / STD WIRE GAGE
OD	OUTSIDE DIAMETER	STA	STEAM TRAP ASSEMBLY
PC.MK	PIECE MARK	TOG	TOP OF GRATING
PE	PLAIN END	TEMP.	TEMPERATURE
PL	PLATE	TOL	THREADOLET
PLTF	PLATFORM	T&C	THREADED & COUPLED
P.S	PIPE SUPPORT	THRD	THREADED
PSE	PLAIN SMALL END	T&G	TONGUE & GROOVE
PRESS.	PRESSURE	TBE	THREADED BOTH ENDS
PSI	POUNDS PER SQUARE INCH	TLE	THREADED LARGE END
POE	PLAIN ONE END	TSE	THREADED SMALL END
PSIG	POUNDS PER SQUARE INCH GAUGE	TOS	TOP OF STEEL
RAD OR R	RADIUS	TOE	THREADED ONE END
RED.	REDUCER	TYP	TYPICAL
RF	RAISED FACE	VC	VENT CONNECTION
R/L	RANDOM LENGTH	VERT.	VERTICAL
REF.	REFERENCE	WP	WORKING PRESSURE, WORKING POINT
RPM	REVOLUTIONS PER MINUTE		INVERT LEVEL OF PIPE
RTJ	RING TYPE JOINT		BOTTOM LEVEL OF THE PIPE
SH	SPRING HANGER		CENTRELINE ELEVATION OF PIPE
SHT	SHEET	WN	WELD NECK
SCH	SCHEDULE	WT	WEIGHT
SCRD	SCREWED	WOL	WELDOLET
S	SAMPLE CONNECTION	WLD	WELD
SG	SIGHT GLASS	XS	EXTRA STRONG
SC	SAMPLE COOLER	XXS	DOUBLE EXTRA STRONG
SMLS	SEAMLESS		

**NOTE:**

1. FOR ABBREVIATIONS RELATED TO CIVIL ENGINEERING/UNDERGROUND PIPING WORK, REFER CIVIL ENGINEERING STANDARD.

0	10.05.17	ISSUED WITH TENDER	US	DK	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD

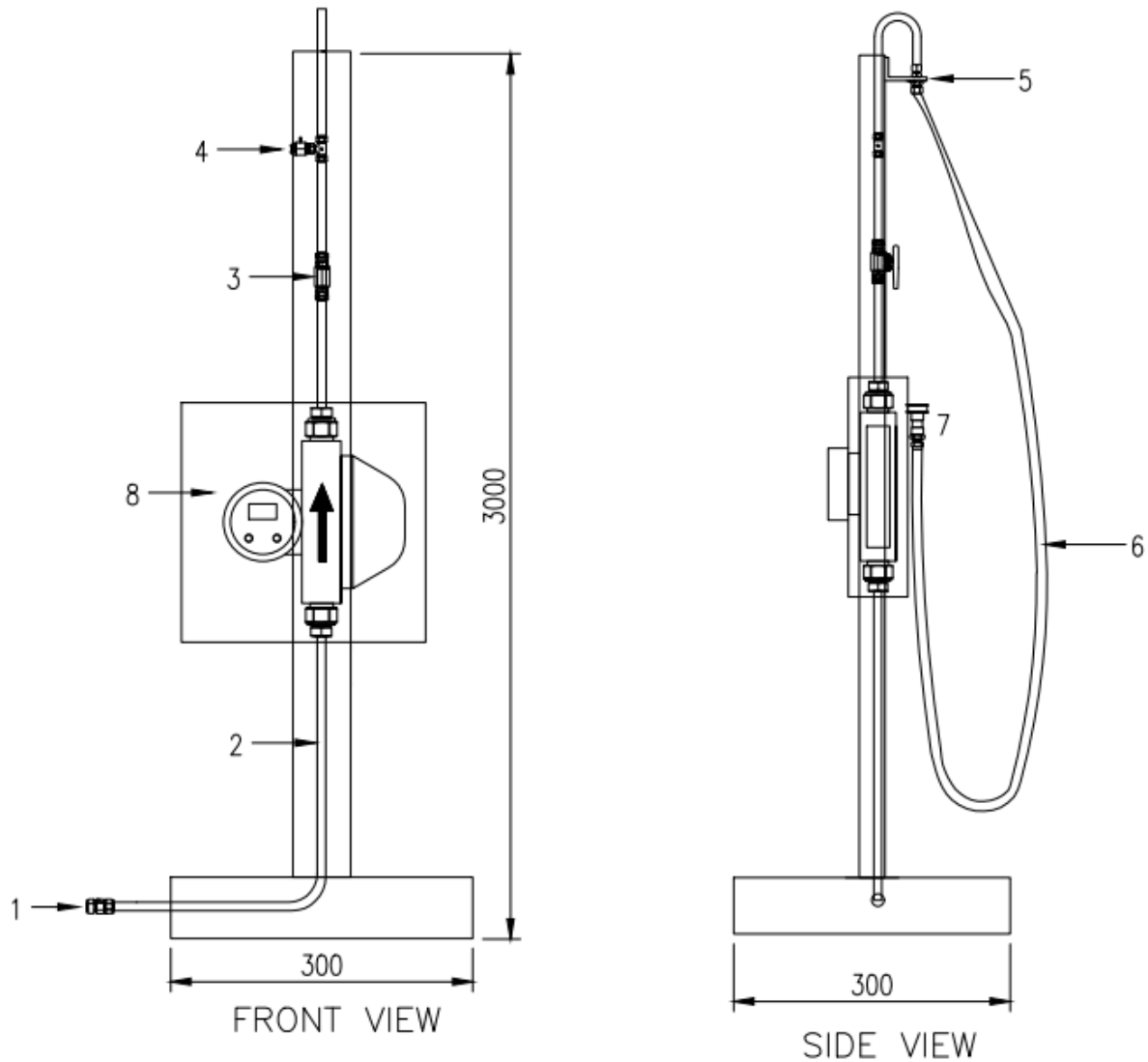
LCV LOADING POST  
WITH FLOW METER

DRAWING NO.

SD-ME-001

SHEET NO.

1 OF 1



S.NO.	PART NAME	MATERIAL	MAKE/MODEL
1	UNION 3/4" OD	SS 316	SWAGELOK/PARKER/ DK LOK
2	TUBE 3/4" OD	A 269/213 TP316	SANDVIK/TUBACEX
3	TWO WAY BALL VALVE 3/4" OD	SS 316	SWAGELOK/PARKER/ DK LOK
4	BLEED VALVE 1/4" NPTM	SS 316	SWAGELOK/PARKER/ DK LOK
5	BULKHEAD UNION 3/4" OD	SS 316	SWAGELOK/PARKER/ DK LOK
6	FILL HOSE 1/2" ID, LENGTH-4Mtr. (SS BRAIDED STAINLESS STEEL)	5000 PSIG	SWAGELOK/TUBACEX/ETON
7	QRC 1/2" NPTF	SS 316	SWAGELOK/PARKER/ DK LOK
8	FLOW METER WITH INTEGRATED DISPLAY (COROLIS TYPE) 0-100 Kg/min.	-	MICRO MOTION / E&H

**NOTES :**

1. ALL DIMENSIONS IN MM.
2. THIS DWG. IS INDICATIVE ONLY, VENDOR TO FURNISH FINAL DWG. BASED ON ARRANGEMENT FOR CNG FILLING FOR APPROVAL POST ORDER.
3. HOSE SHOULD CONFIRM TO NFPA52/CSA NGV 4.2-2014/CSA12.52-2014.

0	24.09.19	ISSUED FOR REVIEW	DK	RR	AD
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD



**LIST OF ATTACHMENT  
CIVIL-STRUCTURAL AND ARCHITECTURAL**

**CONTENTS**

1.0 LIST OF ATTACHMENTS.....3  
2.0 STANDARD DRAWINGS .....3  
3.0 SPECIFICATIONS.....6  
4.0 PROJECT SPECIFIC DRAWINGS.....4

## 1.0 LIST OF ATTACHMENTS

Contractor shall carry out all works strictly in accordance with the drawings/documents/specifications indicated in subsequent paragraphs.

## 2.0 STANDARD DRAWINGS

Sr. No	Standard Drawings Number	Description	Sheet	Rev No
1		Detail of Road Curves and Crossing	1	3
2		Chain Link Fencing	2	3
3		Detail Of Soak Pit	1	3
4		Detail Of Septic Tank	1	3
5		Standard section of storm water drains	1	3
6		Trench Sand Bedding	1	3
7		Concrete Bedding & Encasement for Pipes	1	3
8		Pipe Culvert for Storm Water Drainage	1	3
9		Rain Water Harvesting Pit	1	3
10		Cross Section of Road	3	3
11		Sand trap ( for tank farm)	1	3
12		Man Holes (SWS) type-1 for depth < 1M( $\phi$ <300)	1	3
13		Man Holes type-2 sanitary waste system for depth <2M( $\phi$ ≤500)	1	3
14		Details of masonry dyke and fire wall (tank farm)	1	3
15		Brick masonry compound wall	1	3
16		Tank pad details with stone ring wall (for tank height up to 10.0m)	1	3
17		Brick footpath	1	3
18		RCC pavement details	1	3
19		Concrete trapezoidal storm water drain (height (h)<3.0m)	1	3
20		Steps on earthen dykes and road	1	3

Sr. No	Standard Drawings Number	Description	Sheet	Rev No
		embankments		
21		Area plan for Topo survey	1	3
22		Standard Typ. Details of Cable Trench	1	3
23		R.C.C Flooring Details(Type I & II)	2	3
24		Handrail On Steel Platform	1	3
25		Sliding T- Support	2	3
26		Small operating platforms on grade/ RCC elevation structure	3	3
27		Standard Grating Details	3	3
28		Pipe sleeper Crossover	3	3
29		Miscellaneous Details	1	3
30		Details of Steel Ladder	3	3
31		Metal Insert Plates	7	3
32		Cantilever Pipe Support	1	3
33		Standard for Ring wall foundation for storage tanks (liquid temp. up to 190° c)	4	3
34		Standard for detail of Pedestal for stair / ladder	1	3
35		Details of Block foundation for transformers (up to 2000 KVA rating)	1	3
36		Details for M.S. rungs for conc. structures	1	3
37		Steel stairs	6	3
38		Reinforcement details at circular cut-out in slab	1	3
39		Reinforcement details at sq. / rect. cut-out in slab	1	3
40		Standard lugs	1	3
41		Box culvert Type I,II,III & IV	1	3
42		Typical grating support.	1	3
43		Typical Chequered Plate Support	1	3

<b>Sr. No</b>	<b>Standard Drawings Number</b>	<b>Description</b>	<b>Sheet</b>	<b>Rev No</b>
44		M.S. anchor bolt assemblies	4	3
45		RCC pipe support	1	3
46		Standard for Detail of False Flooring	3	3
47		Wash Basin Fixing Detail	1	3
48		European Type W.C. Fixing Detail	1	3
49		Urinal Fixing Detail	1	3
50		Standard for Detail of Glazed Aluminum Doors	2	3
51		Wooden Flush Door	1	3
52		Glazed Aluminum Window	1	3
53		False Ceiling	1	3
54		Standard for Detail of Hung Gate	4	3
55		Standard for Detail of Steel Door (Pressed Steel Single Shutter)	2	3
56		Typ. Plinth protection	1	3
57		Aluminum sliding window	1	3
58		Aluminum ventilator	1	3
59		Standard for Detail of Barbed wire fencing(With angle Iron post)	1	3

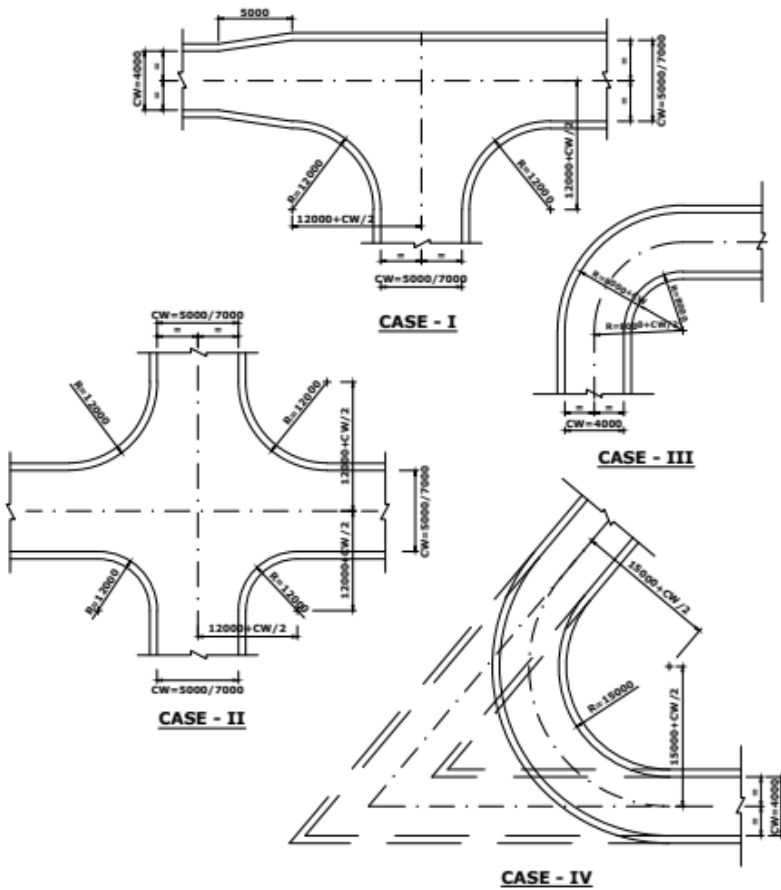
### 3.0 SPECIFICATIONS

Sr. No	Specification Number	Description	Sheet	Rev no
1		Topographic survey of stations	09	3
2		Earthwork in site grading	09	3
3		Earthwork for underground piping	08	3
4		Roads and flexible pavements (up to WBM layer)	12	3
5		Concrete pavement	11	3
6		Flexible pavement with bitumen premix carpet	09	3
7		RCC pipe culverts & ERC crossing etc.	06	3
8		Tank pads	08	3
9		Gravel filling	06	3
10		Misc. civil & structural works for underground services	07	3
11		Plumbing & drainage	09	3
12		Chain link fencing	08	3
13		General scope	05	3
14		Materials	17	3
15		Earth work in foundations	13	3
16		Plain and reinforced cement concrete	35	3
17		Structural steel works	26	3
18		Steel works (tubular hollow sections)	14	3
19		Miscellaneous steel works	13	3
20		Brick masonry	09	3
21		Stone masonry	10	3
22		Demolition & dismantling	08	3
23		Miscellaneous items	09	3

Sr. No	Specification Number	Description	Sheet	Rev no
24		Soil investigations	35	3
25		Driven cast-in-situ piles	09	3
26		Construction and installation of RCC bored cast-in-situ piles	09	3
27		Testing of concrete piles	13	3
28		Floor finishing	19	3
29		Wood work	08	3
30		Steel aluminum doors, windows and ventilators	09	3
31		Plastering & Pointing	10	3
32		Roof Treatment	05	3
33		White washing, Colour washing, distempering, painting and polishing	15	3
34		Roofing	10	3
35		False ceiling, false flooring, under deck insulation & partitioning	12	3
36		Acid proof tile lining	06	3
37		Inspection and Test Plan (ITP) for Civil Structural & Architectural Works	31	3

STANDARD DRAWING FOR  
OF ROAD CURVES  
AND CROSSINGS

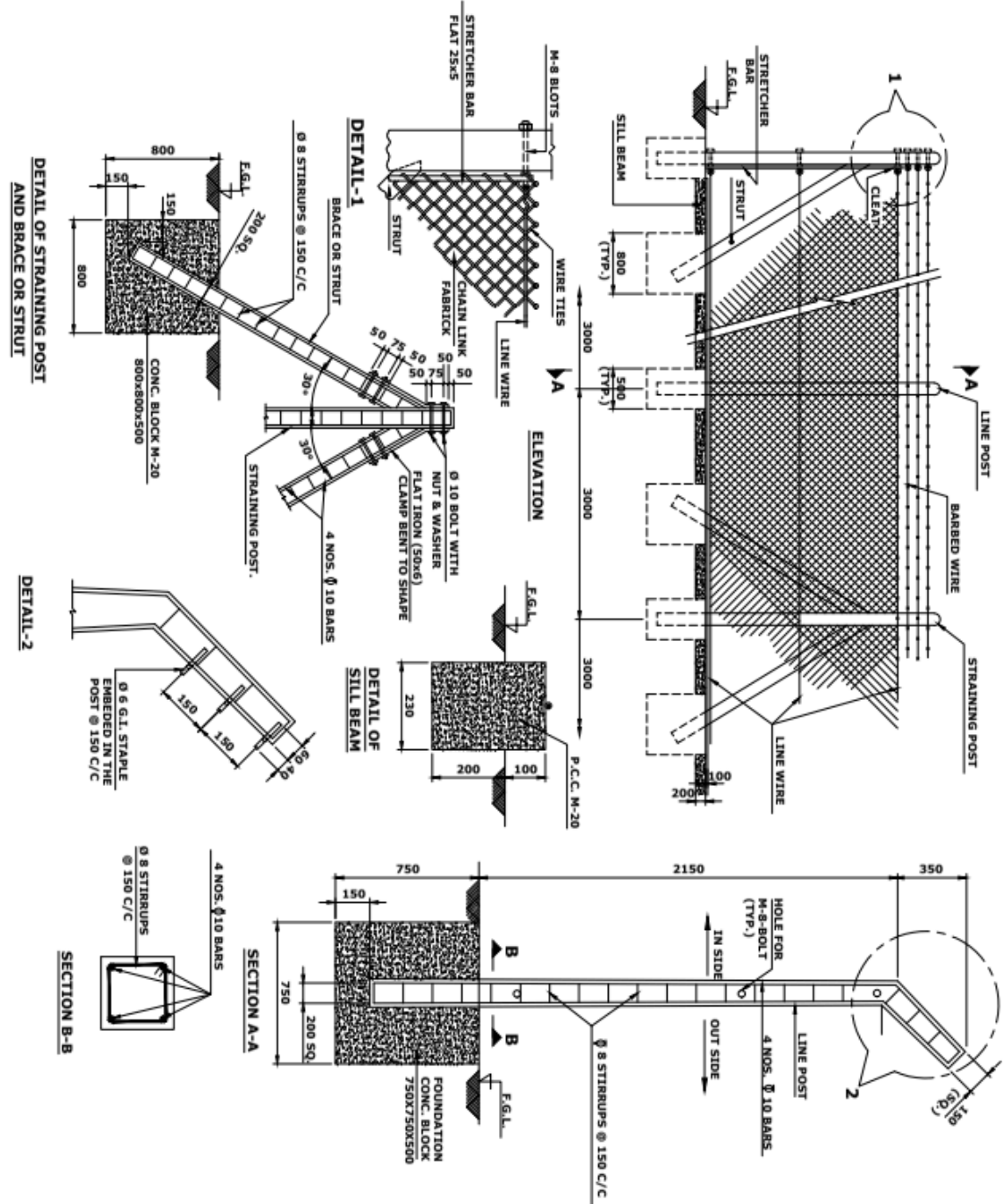
STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.		03	A4
1 OF 1			



**NOTES:-**

1. ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE MENTIONED.
2. MINIMUM RADIUS OF CURVES FOR ROADS WITH CW=4.0m
3. MINIMUM RADIUS OF CURVES FOR ROADS WITH CW>4.0m SHALL BE 12m.
4. RADIUS OF CURVES FOR APPROACH ROADS TO BUILDINGS AND OTHERS AREAS MAY BE REDUCED AS PER SERVICES REQUIRMENTS.
5. FOR ROAD CURVES WITH ACUTE ANGLE TURNING. THE MINIMUM RADIUS SHALL BE 15m AND ANGLE NOT LESS THAN 50°.

6. RADIUS OF CURVES AND CROSSING WHEN DIFFERENT FROM THOSE GIVEN IN THIS STANDARD TO MEET ANY SPECIAL REQUIRMENT SHALL BE SO MARKED IN THE AREA DRAWINGS.



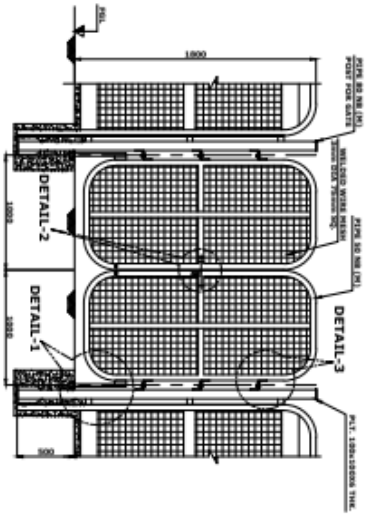
**NOTES:-**

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. THE GALVANISED STEEL BARBED WIRE AT TO IS:2728 SHALL HAVE LINE WIRE OF Ø 2.5 MM POINT WIRE OF Ø 2.0 MM & MINIMUM WEIGHT OF COMPLETE BARBED WIRE SHALL BE 108gm/m WITH 75 MM DISTANCE BETWEEN TWO BARS.
3. LINE POST SHALL BE PLACED AT 3.0 M C/C.
4. STRUT SHALL BE PROVIDED AT EVERY 15 TH. POST LAST BUT ONE END POST & CORNER POST ON BOTH SIDE & END POST ON ONE SIDE ONLY.
5. REINF. STEEL SHOWN THUS (SHALL CONFORM TO IS:1786 LATEST & REINF. STEEL SHOWN THUS Ø SHALL CONFORM TO GRADE Fe 415 (MIN.) LATEST.
6. STRAINING BOLTS SHALL BE PROVIDED AT THE END POST & AT PLACES AS DIRECTED BY ENGINEER INCHARGE.
7. SIZE OF STRAINING POST SHALL BE SAME AS THAT OF LINE POST.
8. GRADE OF CONC. SHALL BE AS FOLLOWS:  

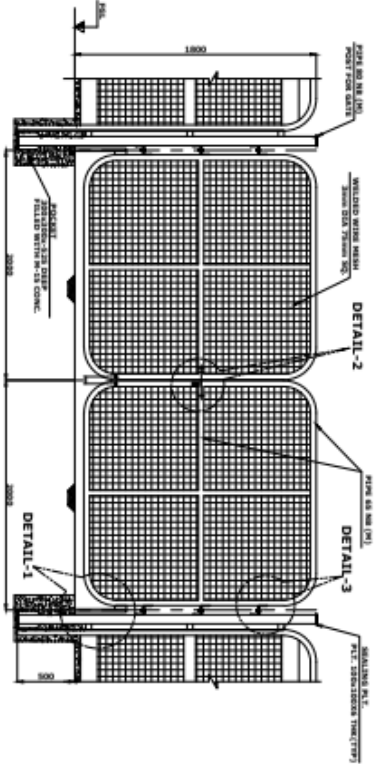
MODERATE SOIL SEVERE/	AGGRASSIVE SOIL
I) LINE & STRAINING POSTS	RCC M25
II) FOUNDATION BLOCKS	RCC M30
III) STILL BEAM	PCC M20
IV) BRACE OR STRUT	PCC M20
	RCC M25
	RCC M30
9. MANUFACTURE OF CONC. POSTS SHALL CONFORM TO IS:4996.
10. THE CHAIN LINK FABRIC SHALL CONFORM TO IS:1721.
11. STRETCHER BAR SHALL BE HOT DIP GALVANISED.
12. SUITABLE INSERTS SHALL BE PROVIDED ON THE TOP OF THE STILL BEAM TO THE BOTTOM LINE WIRE WITH THE STILL BEAM.

TYPE-1

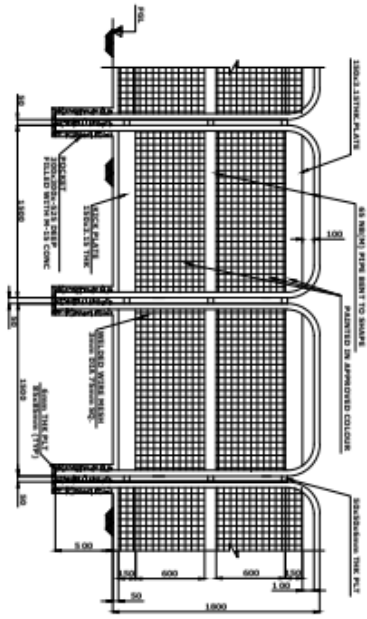
DETAIL OF CHAIN LINK FENCING (WITH CONC. POST)



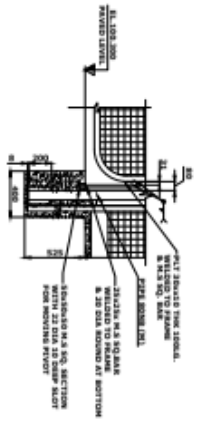
2.0 WIDE GATE DETAIL  
2100 HIGH



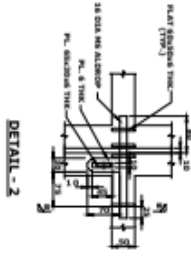
4.0 WIDE GATE DETAIL



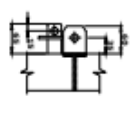
TYPICAL FENCING DETAIL



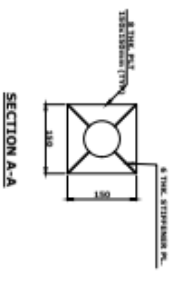
DETAIL - 1



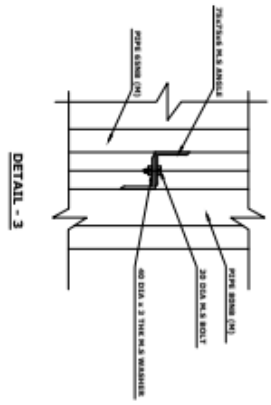
DETAIL - 2



SECTION B-B



SECTION A-A



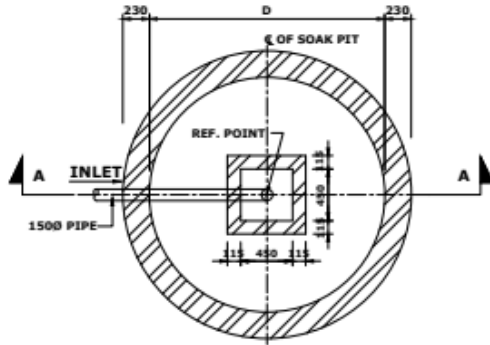
DETAIL - 3

- NOTES-
1. ALL DIMENSIONS AND LEVELS ARE IN INCH. (UNLESS MENTIONED OTHERWISE)
  2. ALL DIMENSIONS ARE TO FACE UNLESS NOTED OTHERWISE
  3. ALL DIMENSIONS ARE TO FACE UNLESS NOTED OTHERWISE
  4. FABRICATION SHALL BE DONE IN ACCORDANCE TO A.S. 1000-2007
  5. ALL WELDS SHALL BE SPAN FILLET WELD UNLESS OTHERWISE STATED.
  6. ALL SHOT JOINTS SHALL BE COMPLETELY WELDED WITH CONTINUOUS
  7. FABRICATION OF ALL MEMBERS TO BE DONE AFTER FULL SCALE SHOP LAYOUT BEFORE CUTTING MEMBERS.
  8. LAYOUT BEFORE CUTTING MEMBERS OF CHAIN LINK FENCING AND GATE SHALL BE DONE AFTER FULL SCALE SHOP LAYOUT BEFORE CUTTING MEMBERS.

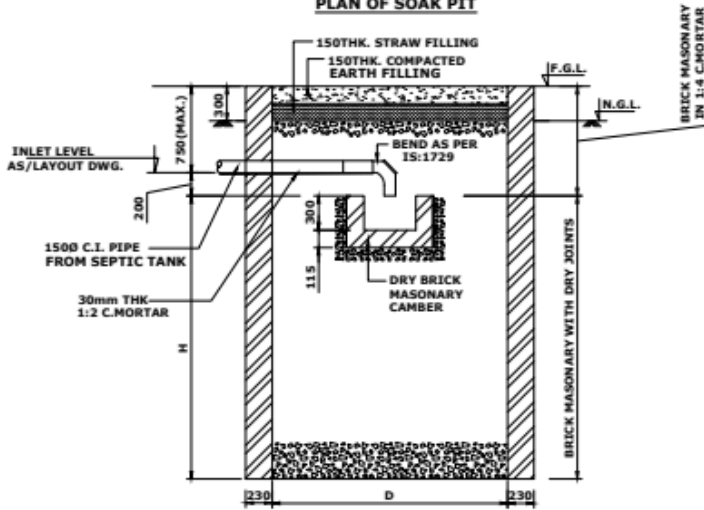
DETAIL OF CHAIN LINK  
FENCING & GATE (WITH STEEL POST)

TYPE-II

STANDARD DRAWING FOR DETAIL OF SOAKPIT		STANDARD DRAWING NO.	REV.	SIZE
		SHEET NO.	1 OF 1	03 A4



PLAN OF SOAK PIT



SECTION A-A

TABLE

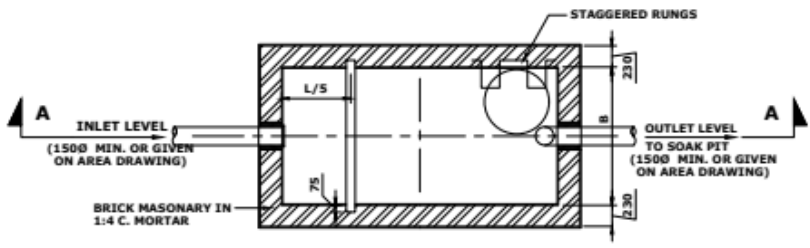
TYPE	NO. OF USERS	DEPTH IN METERS	DIA IN METERS	AREA OF ABSORPTION
1	10	2.5	2.5	24.53
2	25	5.0	3.25	59.35
3	50	7.0	3.6	89.30
4	100	10.0	5.0	196.25

NOTES:-

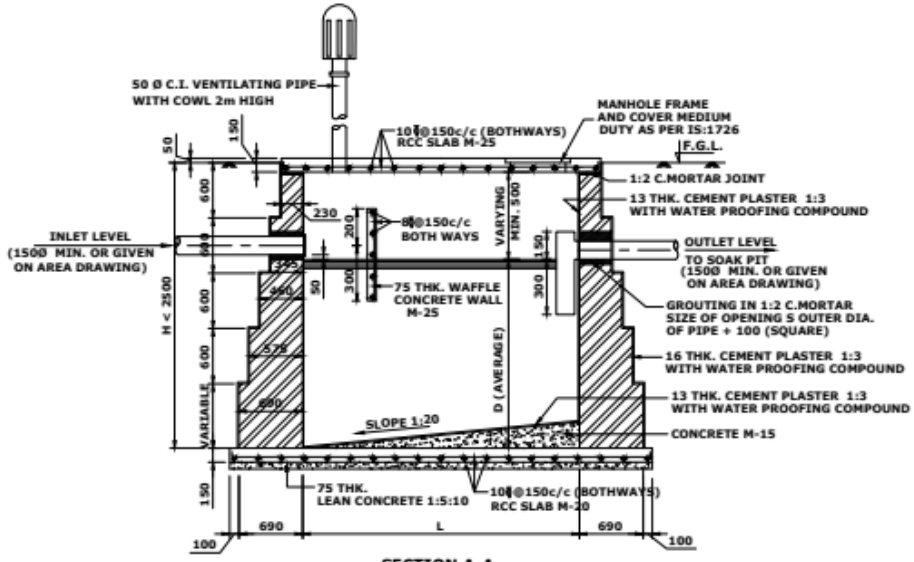
1. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS AND CO-ORDINATES WHICH ARE IN METERS.
2. THE FILLING OF BRICK BATS IN SOAKPIT SHALL BE DONE SIMULTANEOUSLY WITH CONST. OF BRICK WALLS AS WORK PROGRESS.
3. C.I. PIPE SHALL CONFORM TO IS: 3486.
4. DEPTH AND DIA CAN BE SUITABLY ADJUSTED TO GIVE THE ABSORPTIVE AREA DEPENDING UPON THE SUB SOIL WATER TABLE.
5. BOTTOM OF THE SOAKPIT SHOULD NOT BE LESS THAN 600mm ABOVE THE SUB SOIL WATER.

STANDARD DRAWING FOR  
DETAIL OF SEPTIC TANK

STANDARD DRAWING NO.	REV.	SIZE
SHEET NO.	1 OF 1	03 A4



PLAN OF SEPTIC TANK



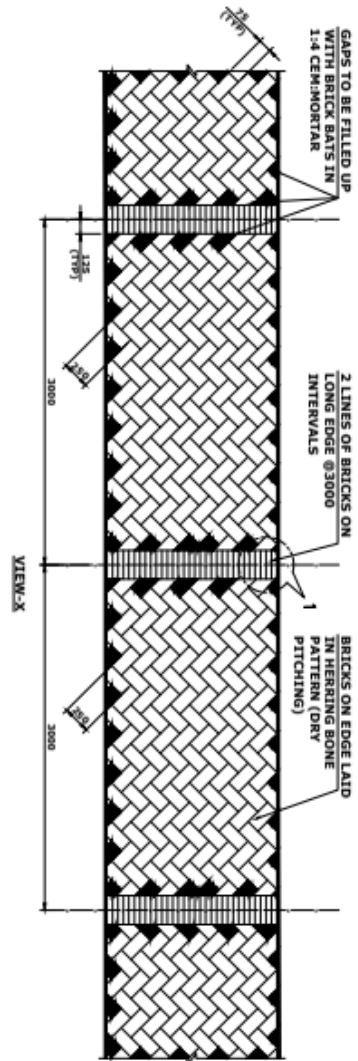
SECTION A-A

RECOMMENDED DIMENSIONS OF SEPTIC TANK

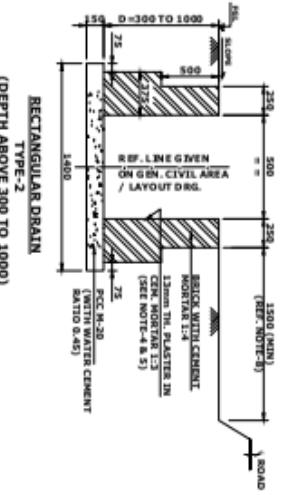
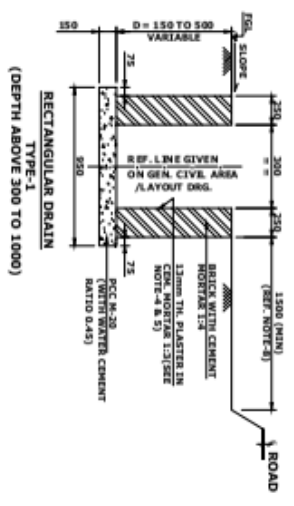
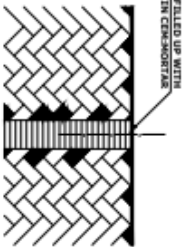
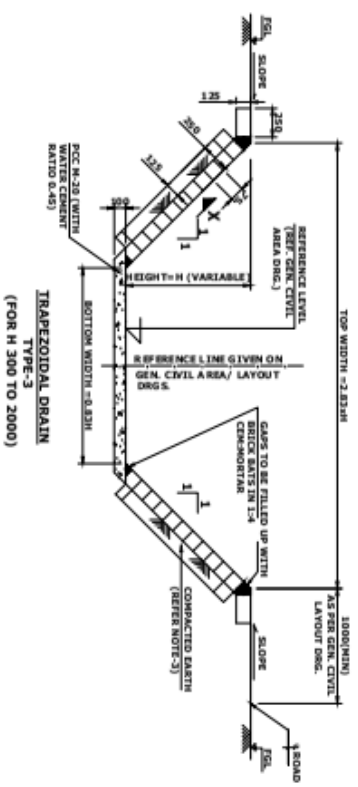
TYPE	NO. OF USERS	LENGTH (L)	BREADTH (B)	LIQUID DEPTH (D)
1	10	2000	900	1000
2	20	2300	1100	1300
3	30	4000	1400	1300
4	50	4750	1700	1500

NOTES:-

1. ALL DIMENSIONS ARE IN MM. & LEVEL IN METRES.
2. FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE.
3. CLEAR COVER TO MAIN REINF. SHALL BE: (a) SLAB = 30 mm
4. Ø DENOTES HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe 415 (MIN.) CONFORMING TO IS -1786 .
5. DESLUDGING SHALL BE DONE PERIODICALLY EVERY YEAR PREFERABLY BY A PORTABLE NON CLDG. PUMP.



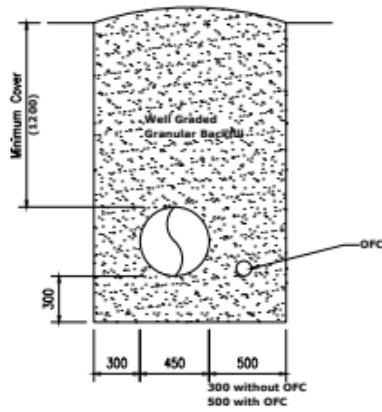
- NOTES:-
1. ALL DIMENSIONS ARE IN MM, UNLESS NOTED OTHERWISE.
  2. (a) THIS STD. IS APPLICABLE FOR OFFSITE AREAS ONLY.
  - (b) WHEREVER TYPE 1 & 2 DRAINS ARE LAID IN EXPANSIVE SOIL, A LAYER OF MINIMUM 250mm THICK SAND SHALL BE PROVIDED BELOW AND AROUND THE SIDES OF DRAIN.
  - (c) TRAPEZOIDAL DRAIN (TYPE-3) IS NOT SUITABLE FOR AREAS WITH EXPANSIVE SOIL AND SANDY SOIL.
  3. BRICK PITCHING SHALL BE DONE ONLY AFTER THE SIDES OF DRAIN ARE CUT, COMPACTED TO 90% OF MAX. LABORATORY DRY DENSITY AND DRESSED TO THE REQUIRED SLOPE.
  4. 13mm THK. PLASTER IN CEM. MORTAR 1:3 SHALL BE PROVIDED ON BENDS UP TO A DISTANCE OF 1.5M ON EITHER SIDE OF THE BEND FOR ALL DRAINS. FLUSH CEMENT POINTING IN CEMENT MORTAR 1:3 SHALL BE DONE AT OTHER PLACES.
  5. INTERNAL PLASTER OF SAME SPECIFICATION AS SHOWN IN NOTE-4 IN RECTANGULAR DRAIN TYPE-1 & 2 SHALL BE DONE ONLY FOR THE PORTION OF DRAIN LOCATED NEAR BUILDING.
  6. EXACT THICKNESS OF BRICK MASONRY WORK SHALL BE ACCORDING TO THE SIZE OF LOCALLY AVAILABLE BRICK HERE BRICK SIZE IS CONSIDERED AS 250x125x75.
  7. THIS STANDARD DRG. SHALL BE VALID WHERE WATER TABLE IS UP TO FGL.
  8. 1500 mm (MIN) HAS BEEN KEPT TO AVOID THE IMPACT OF SURCHARGE PRESSURE OF ROAD EMBANKMENT OF THE WALL OF THE DRAIN.



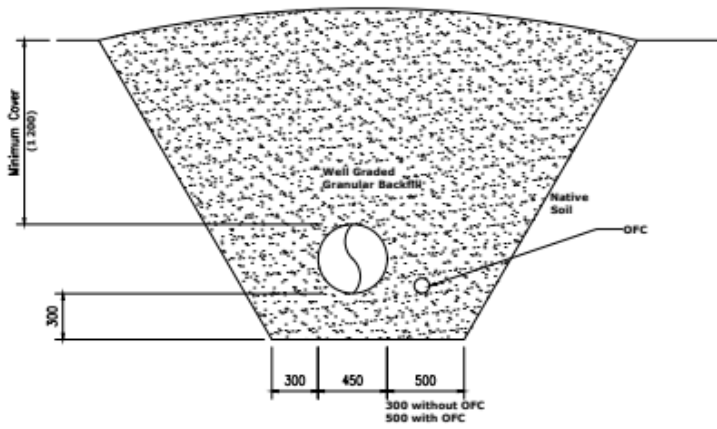
STANDARD SECTION OF STORM WATER DRAINS

STANDARD FOR TRENCH SAND BEDDING	STANDARD DRAWING NO.		REV.	SIZE
	-----		03	A4
	SHEET NO.	1 OF 1		

For Rocky Strata / Gravel Area :



For Clay Soil :



STANDARD DRAWING FOR  
CONCRETE BEDDING AND  
ENCASMENT FOR PIPES

STANDARD DRAWING NO.

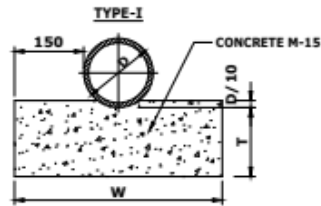
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SHEET NO.

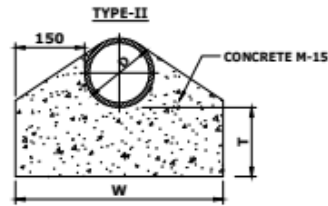
1 OF 1

03

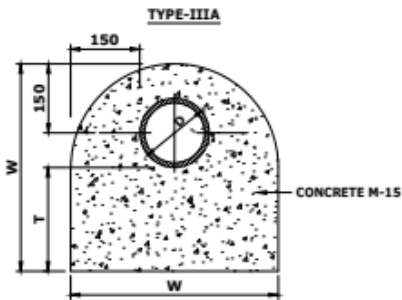
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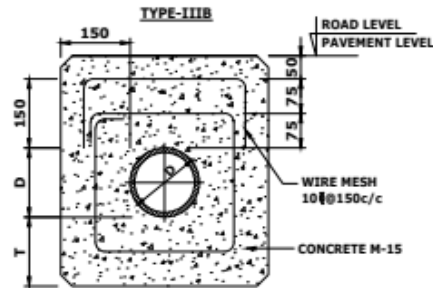
**SECTION ELEVATION OF BEDDING**  
(FOR C.S PIPE SEWER WHERE SUPPORT IS REQUIRED)



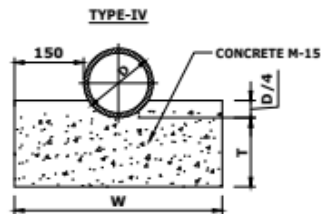
**SECTION ELEVATION OF HAUNCHING**  
(FOR HDPE, SW PIPE SEWERS)



**SECTION ELEVATION SURROUND OR ENCASING**  
(FOR SEWERS UNDER ROADS COVER > 600mm)



**SECTION ELEVATION SURROUND OR ENCASING**  
(FOR SLEEVES/PIPES CULVERTS UNDER ROADS FOR COVER < 600mm)



**SECTION ELEVATION CONCRETE GRADE BEDDING**  
(FOR SEWERS - CONCRETE PIPE)

**LEGEND**

D = EXTERNAL DIA OF PIPE  
W = D+300  
T = 100 FOR PIPES UNDER 150 NOMINAL DIA.  
T = 150 FOR PIPES OF 150 NOMINAL DIA AND ABOVE.

**NOTES:-**

- BEDDING:- WHERE BEDDING IS USED, THE CONCRETE SHALL BE BROUGHT UP TO ATLEAST TO THE INVERT LEVEL OF THE PIPE TO FORM A CRADLE & TO AVOID LINE CONTACT BETWEEN THE PIPE AND BED.
- HAUNCHING:- THE FULL WIDTH OF THE BED SHALL BE CARRIED TO THE LEVEL OF THE HORIZONTAL DIAMETER OF THE PIPE AND SPLAYS FROM THIS LEVEL CARRIED ON BOTH SIDES OF THE PIPE TO MEET THE PIPE BARREL TANGENTIALLY.
- SURROUNDED OR ENCASING TYPE-IIIa:- THE SURROUND OR ENCASING SHALL BE SIMILAR TO HAUNCHING UP TO THE HORIZONTAL DIA OF THE PIPE & THE PORTION OVER THIS SHALL BE FINISHED IN A SEMI-CIRCULAR FORM TO GIVE A UNIFORM ENCASING FOR THE TOP HALF OF THE PIPE.  
TYPE-IIIb:- IT IS SIMILAR TO TYPE-IIIa ABOVE EXCEPT THAT THE TOP PORTION OVER THIS SHALL BE FINISHED RECTANGULAR AS SHOWN AND THE SECTION PROVIDED WITH REINFORCEMENT AS PER REQUIREMENTS.
- CONCRETE CRADLE BEDDING:- IS THE METHOD OF BEDDING PIPES IN WHICH THE LOWER PART OF THE PIPE EXTERIOR IS BEDDED IN CRADLE CONSTRUCTION OF CONCRETE WITH DIMENSION AS SHOWN.
- CONCRETE WORK SHALL BE CONFORM TO IS: 456.

STANDARD DRAWING FOR  
PIPE CULVERT FOR STORM  
WATER DRAINAGE

STANDARD DRAWING NO.

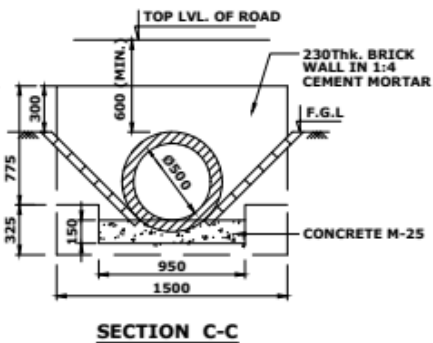
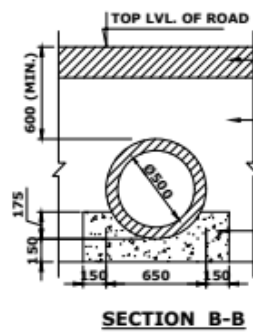
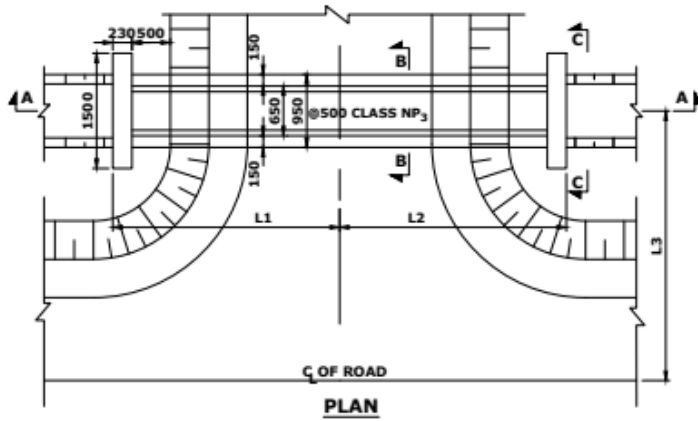
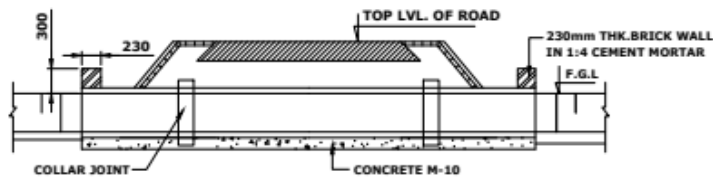
REV. SIZE

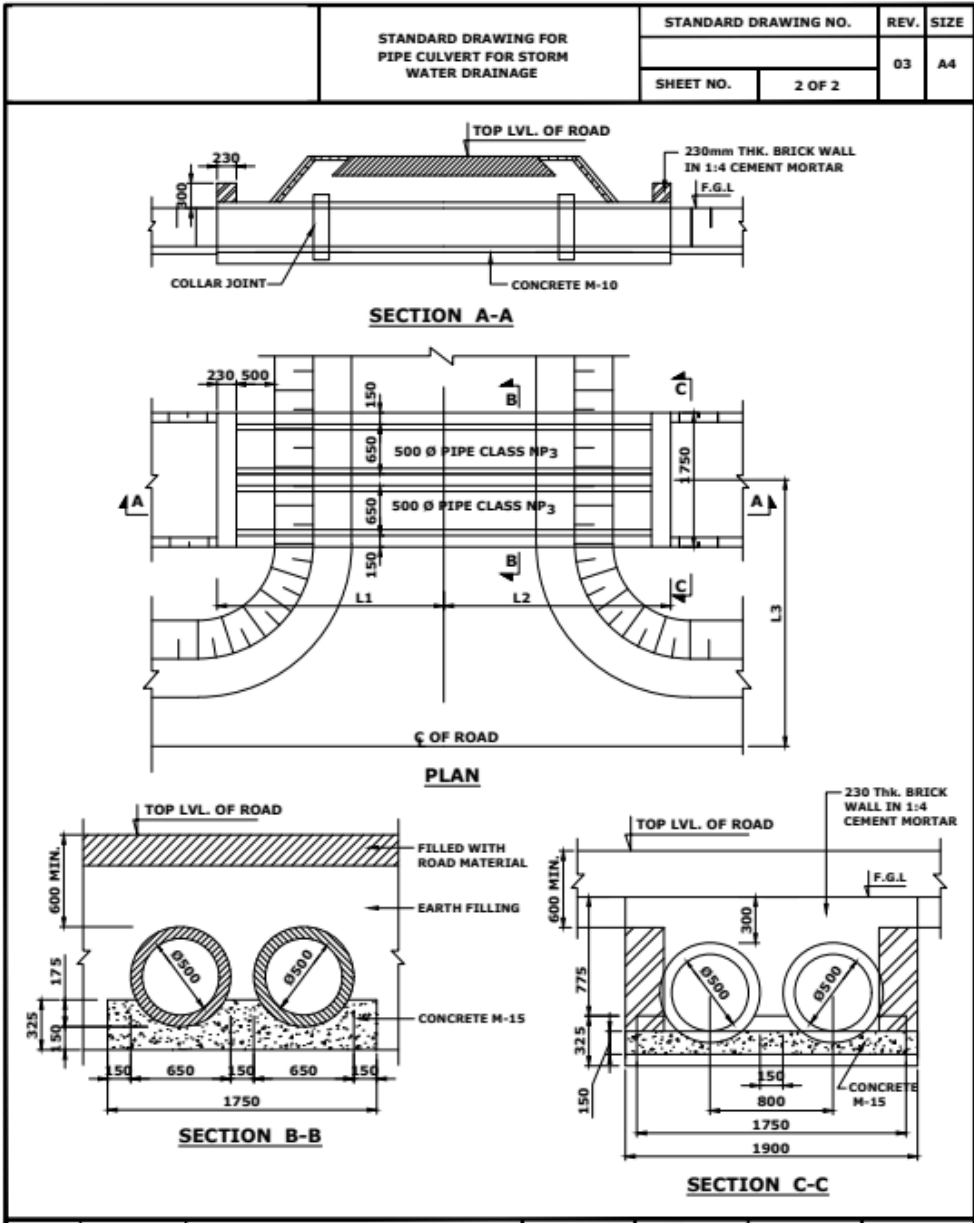
SHEET NO.

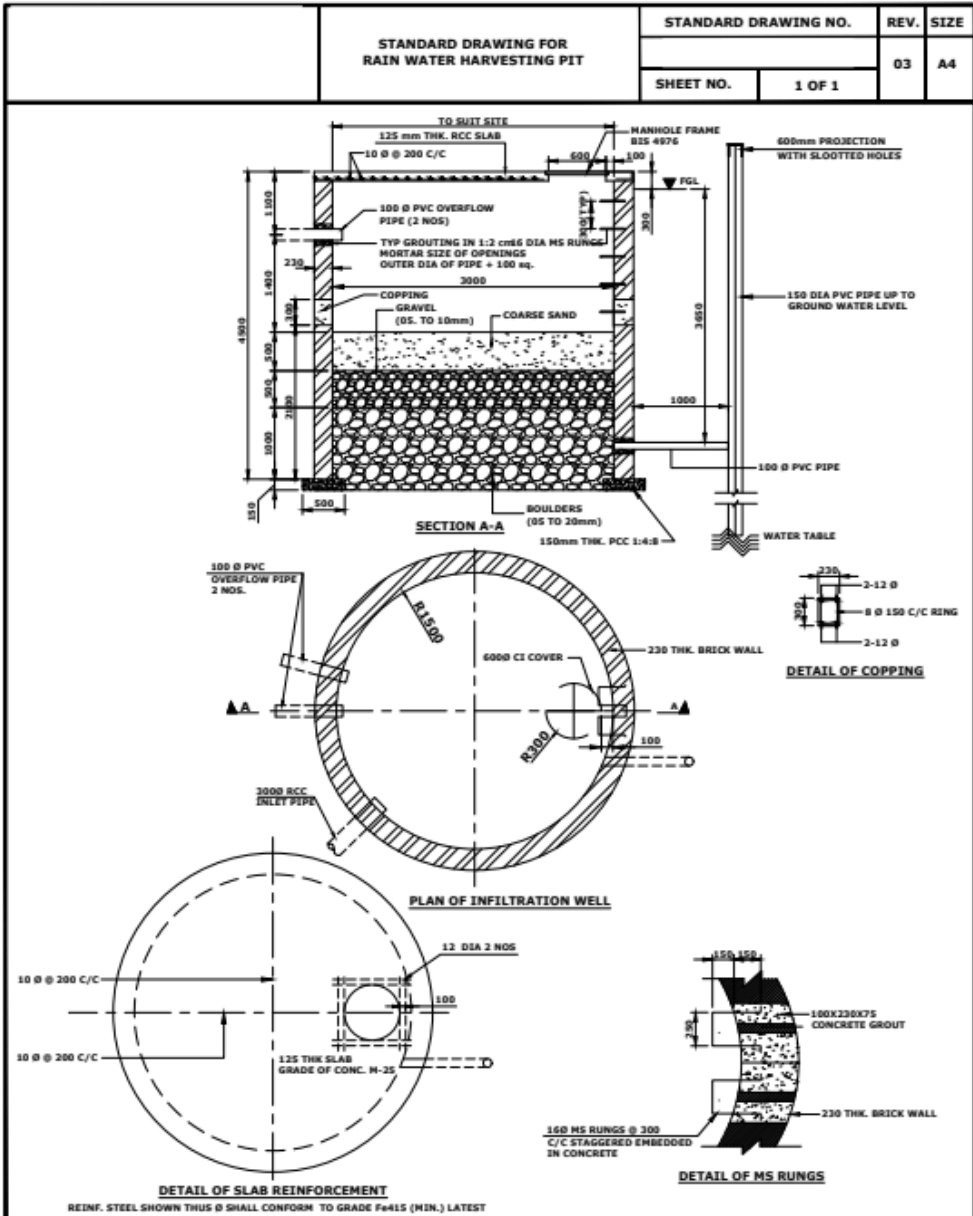
1 OF 2

03

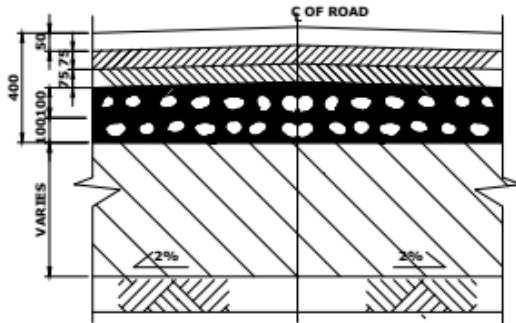
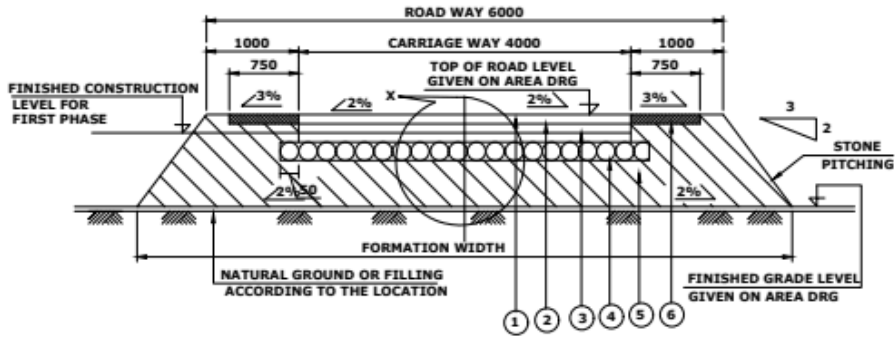
A4







STANDARD DRAWING FOR CROSS SECTION OF ROAD (6.0 M WIDE)	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	1 OF 3		03 A4



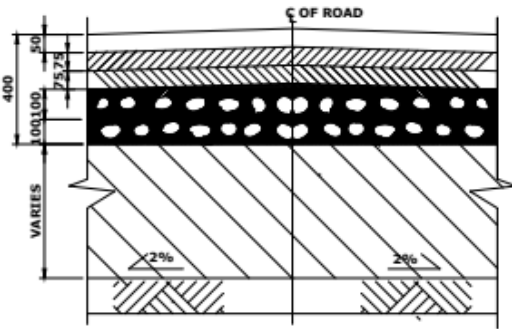
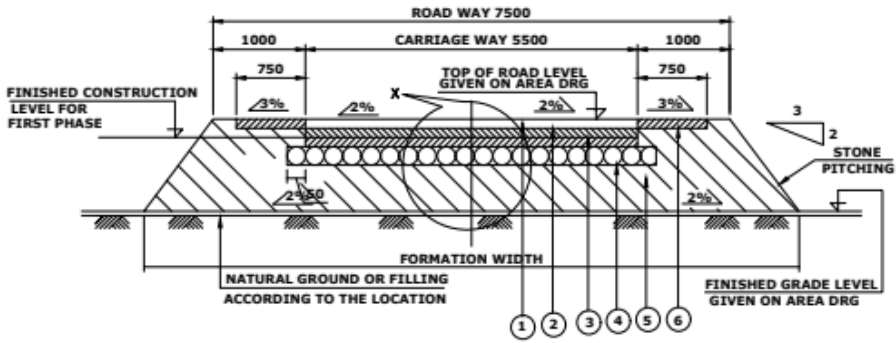
**DETAIL - X**

**LEGEND**

1. PREMIX BITUMENOUS CARPET WITH SEAL COAT.
2. SECOND LAYER WATER BOUND MACADAM COURSE WITH GRADE-II AGGREGATE.
3. FIRST LAYER WATER BOUND MACADAM COURSE WITH GRADE-II AGGREGATE.
4. SUB BASE COURSE TWO LAYERS OF WBM WITH GRADE-I AGGREGATE.
5. APPROVED MATERIAL FROM SITE COMPACTED TO 90% OF MAXIMUM LAB. DRY DENSITY AS IS 2720 PART VIII.
6. 75mm THK. WATER BOUND MACADAM COURSE WITH GRADE-II AGGREGATE.

STANDARD DRAWING FOR  
CROSS SECTION OF ROAD  
(7.5 M WIDE)

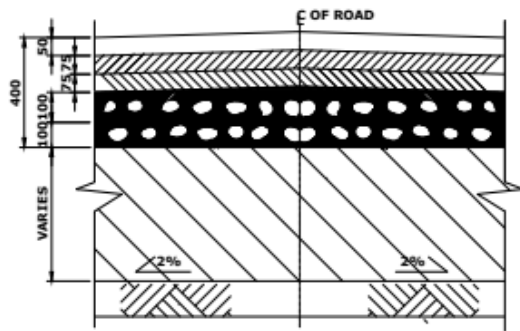
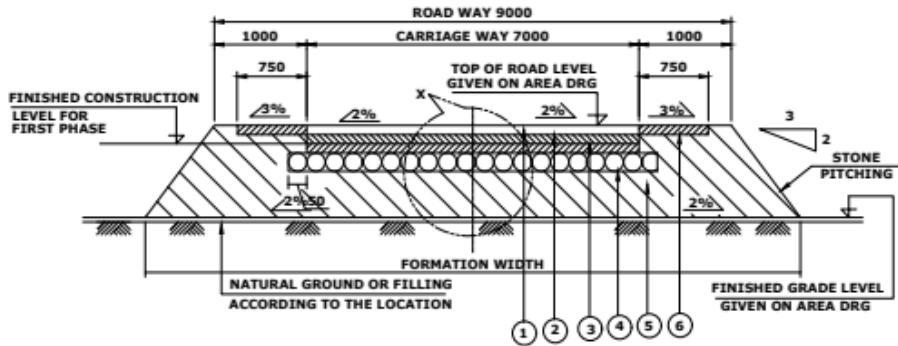
STANDARD DRAWING NO.		REV.	SIZE
		03	A4
SHEET NO.	2 OF 3		



**DETAIL - X**

STANDARD DRAWING FOR  
CROSS SECTION OF ROAD  
(9.0 M WIDE)

STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.	3 OF 3	03	A4



DETAIL - X

STANDARD DRAWING FOR  
SAND TRAP  
(FOR TANK FARM)

STANDARD DRAWING NO.

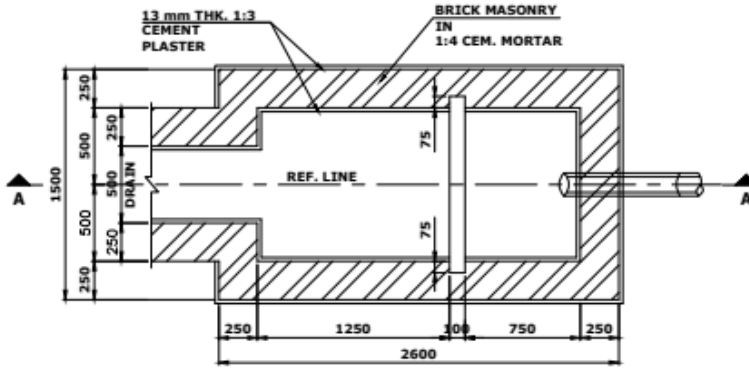
REV. SIZE

SHEET NO.

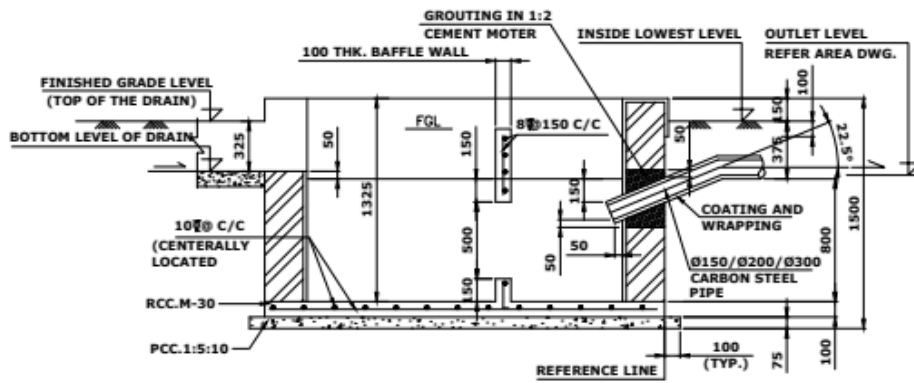
1 OF 1

03

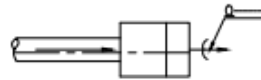
A4



PLAN



SECTION A-A

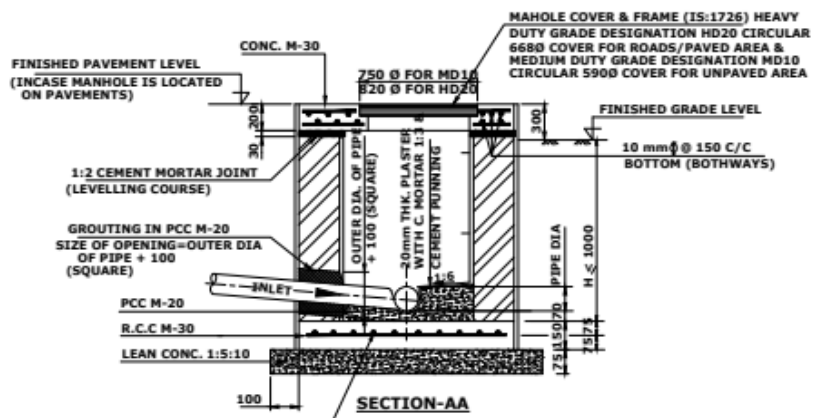
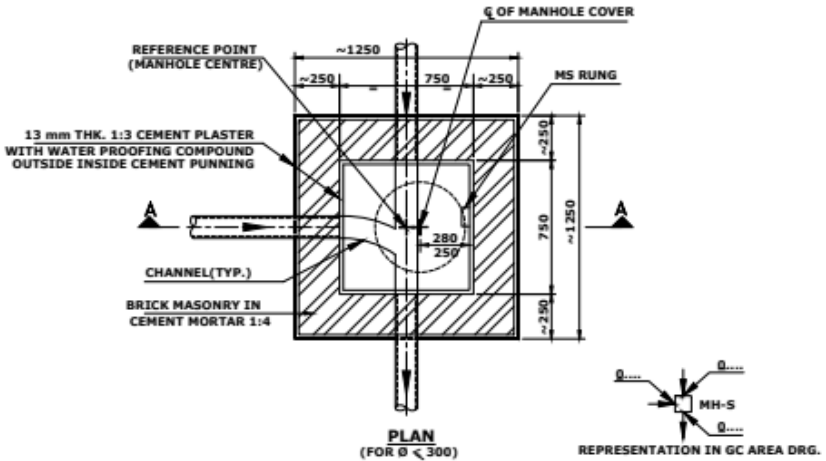


REPRESENTATION IN AREA DRG.

NOTES :-

1. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. EXACT THICKNESS OF BRICK MASONRY SHALL BE ACCORDING TO THE SIZE OF LOCALLY AVAILABLE BRICK. HERE BRICK SIZE IS CONSIDERED AS 250x125x75.

STANDARD DRAWING FOR MANHOLE(SWS) TYPE-1 FOR DEPTH <1M. (Ø<300)	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	1 OF 1		03 A4



- NOTES:**
1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
  2. ALL REINFORCEMENT SHALL BE OF GRADE Fe415 CONFORMING TO IS:1786.
  3. EXACT THICKNESS OF BRICK MASONRY SHALL BE ACCORDING TO SIZE OF LOCALLY AVAILABLE BRICKS.
  4. FOR AGGRESSIVE SOIL CONCRETE GRADE M-35 SHALL BE PROVIDED

STANDARD DRAWING FOR  
**MANNHOLE TYPE-2**  
 (SANITARY WASTE SYSTEM)  
 FOR DEPTH<2( $\phi < 500$ )

STANDARD DRAWING NO.

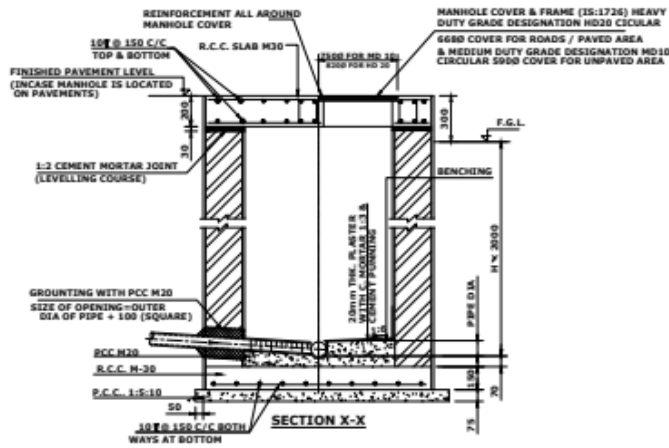
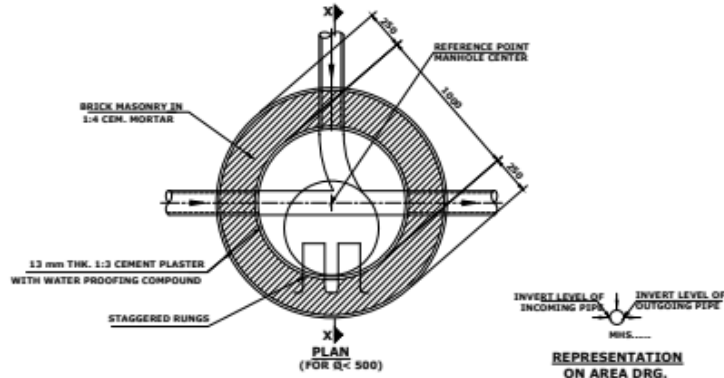
REV. SIZE

SHEET NO.

1 OF 1

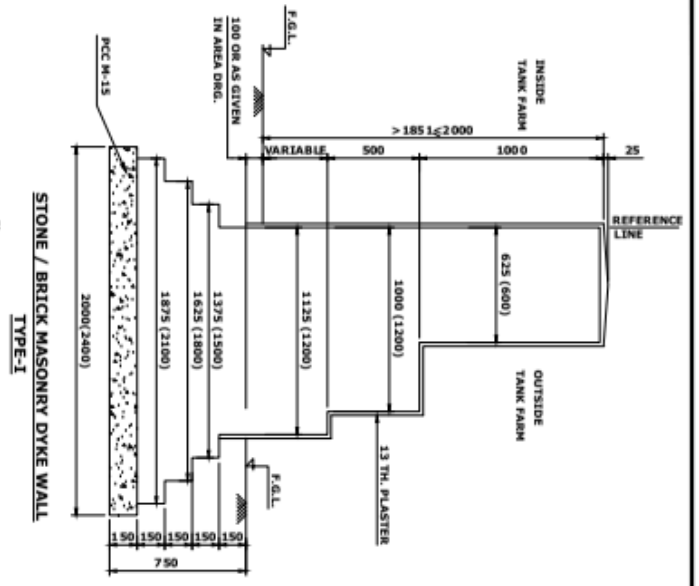
03

A4

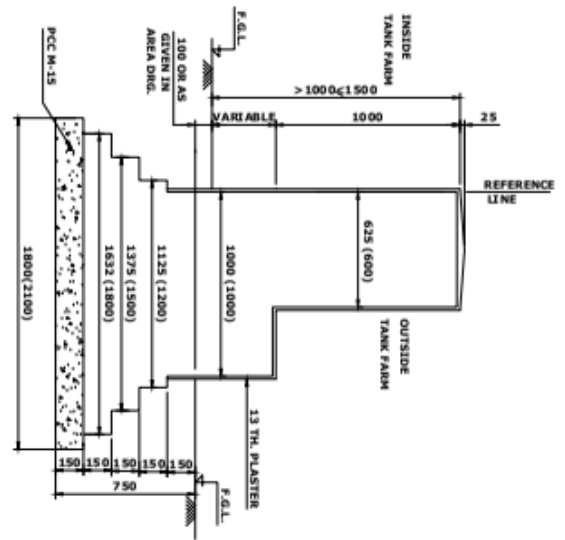


**NOTE:**

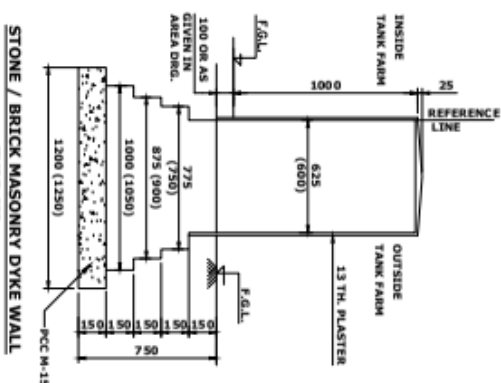
1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE
2. ALL REINFORCEMENT SHALL BE OF GRADE Fe 415 (MIN.) CONFORMING TO IS:1786
3. BAR BENDING SHALL CONFORM TO IS:2502.
4. TOP SLAB SHALL BE CAST-IN-SITU AND REINFORCEMENT ON WALL SIDE OF MANNHOLE OPENING SHALL BE ADJUSTED AT SITE.
5. THE BRICKS SHALL CONFORM TO IS:1077 (CLASS 5.0 MINIMUM).
6. EXACT THICKNESS OF BRICK MASONRY WALL SHALL BE AS PER LOCATION AVAILABLE BRICK (HERE WALL THICKNESS HAS BEEN GIVEN AS PER BRICKS SIZE 250x125x75).
7. FOR AGGRESSIVE SOIL CONCRETE GRADE M-35 SHALL BE PROVIDE.



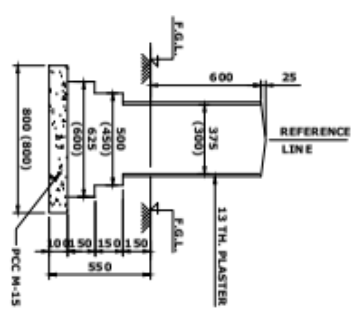
STONE / BRICK MASONRY DYKE WALL  
TYPE-I



STONE / BRICK MASONRY DYKE WALL  
TYPE-II



STONE / BRICK MASONRY DYKE WALL  
TYPE-III



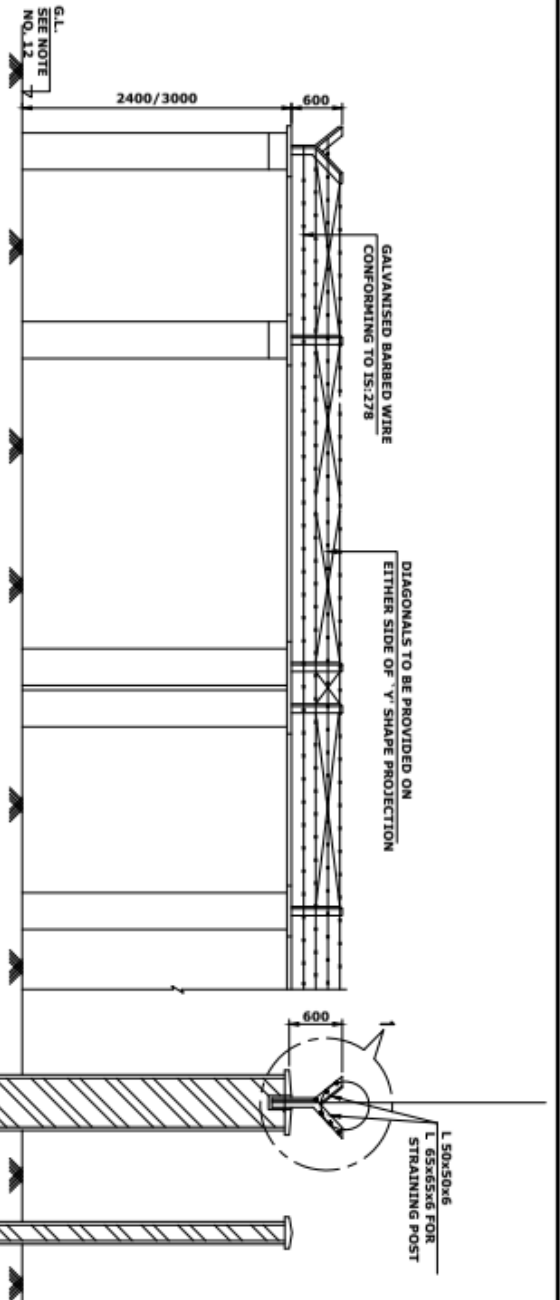
STONE / BRICK MASONRY FIRE WALL

**NOTES :-**

**DESIGN CONDITIONS:**

1. ALL DIMENSIONS ARE IN MILLIMETER.
2. DYKE AND FIRE WALL IS DESIGNED TO RETAIN LIQUID ON ONE SIDE OF WALL, IT SHALL BE ENSURED THAT EARTH IS TO BE RETAINED ON EITHER SIDE OF WALL BELOW F.G.L FOR STABILITY.
3. WALL FOOTINGS ARE DESIGNED FOR A MINIMUM SAFE BEARING CAPACITY OF 7.5T/m<sup>2</sup> (NET) FOR DYKE WALLS AND 5.0 T/m<sup>2</sup> (NET) FOR FIRE WALLS.
4. DIMENSIONS GIVEN WITHIN BRACKETS ARE FOR STONE MASONRY DYKE WALLS AND FIRE WALLS
5. BRICK MASONRY WALLS SHALL BE PLASTERED WITH 13MM THICK 1:3 CEMENT MORTAR ON SIDES & TOP AND STONE MASONRY WALLS SHALL BE FLUSH POINTED IN 1:3 CEMENT MORTAR.
6. BRICK MASONRY AND STONE MASONRY SHALL BE DONE IN 1:4 CEMENT MORTAR
7. EXACT THICKNESS OF BRICK MASONRY WALL SHALL BE AS PER LOCALLY AVAILABLE BRICKS. (HERE WALL THICKNESS HAS BEEN GIVEN AS PER BRICK SIZE OF 250X125X75).
8. THE BRICKS OF CLASS 5.0 (MINIMUM) SHALL BE USED.

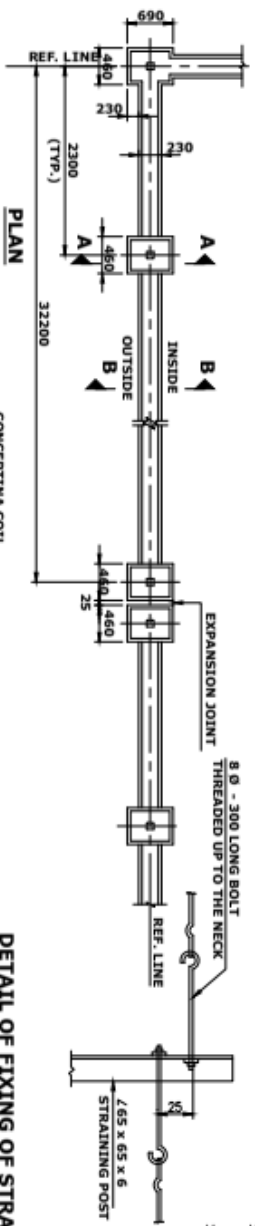
DETAILS OF MASONRY DYKE AND  
FIRE WALL (TANK FARM)



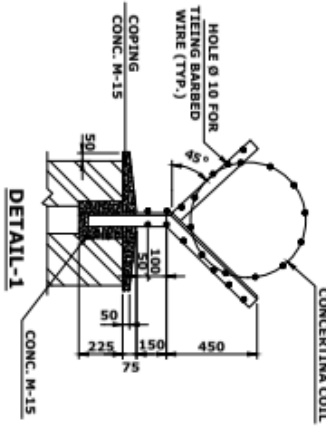
**NOTES:-**

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. CEMENT MORTAR FOR BRICK MASONRY AND PLASTER SHALL BE 1:6 ( 1 CEMENT : 6 SAND )
3. PLASTER SHALL BE 13 mm THK. ON EVEN SURFACE AND 16 THK. ON UNEVEN SURFACE.
4. POCKETS FOR ANGLE IRON MEMBERS SHALL BE 150x150 IN PLAN AND OF 3 BRICK COURSE IN DEPTH AND SHALL BE GROUTED WITH CONC. M-15
5. GALVANISED BARBED WIRE SHALL CONFORM TO IS:278.
6. STRAINING BOLT SHALL BE PROVIDED AT EVERY 90th APPX.
7. EXPANSION JOINTS SHALL PROVIDE A CONTINUOUS VERTICAL SEPARATION THROUGH THE FULL THICKNESS OF MASONRY WALL EXTENDING FROM TOP OF WALL TO BASE CONCRETE.
8. NECESSARY STEPS SHALL BE GIVEN IN THE HEIGHT OF THE WALL SO THAT THE HEIGHT OF WALL IS NOT LESS THAN 3050 MM ABOVE G.L. AT ANY POINT.
9. EARTH AVAILABLE FROM THE EXCAVATION OF FOUNDATION SHALL BE FILLED 2.5 M ON EITHER SIDE TO THE FINISHED GRADE LEVEL AND COMPACTED WITH PROPER SLOPE FOR DRAINAGE OF WATER AWAY FROM THE WALL.
10. WEEP HOLES SHALL BE PROVIDED IN THE COMPOUND WALL WHEREVER REQUIRED AT SUITABLE LOCATION DIRECTED BY ENGINEER-IN-CHARGE.
11. FOR FOUNDATION DETAILS REFER RELEVANT STRL. DRG.

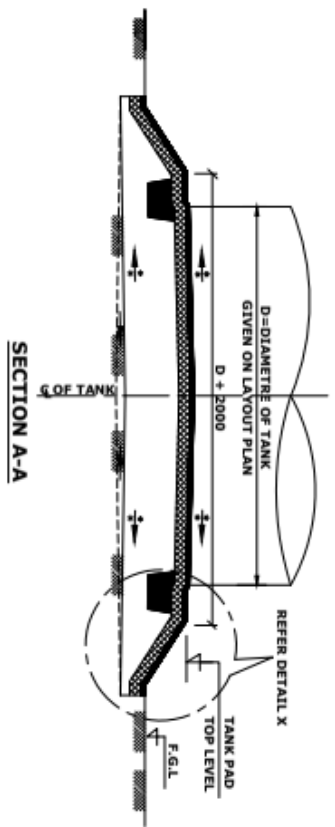
(ALL BARBED WIRE ROWS NOT SHOWN)



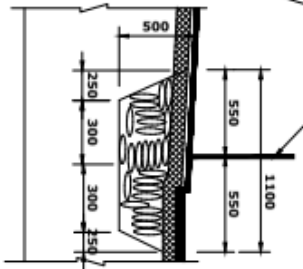
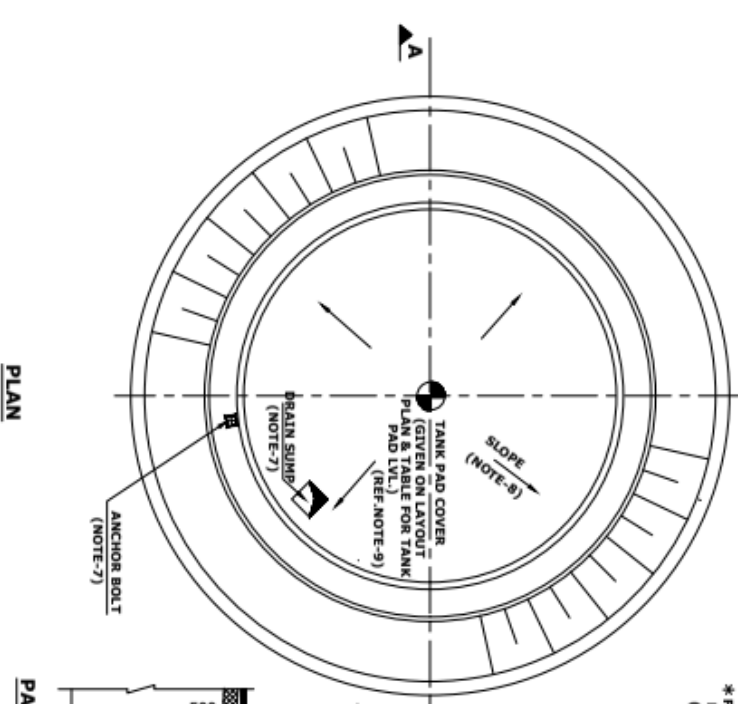
**DETAIL OF FIXING OF STRAINING BOLT WITH STRAINING POST**



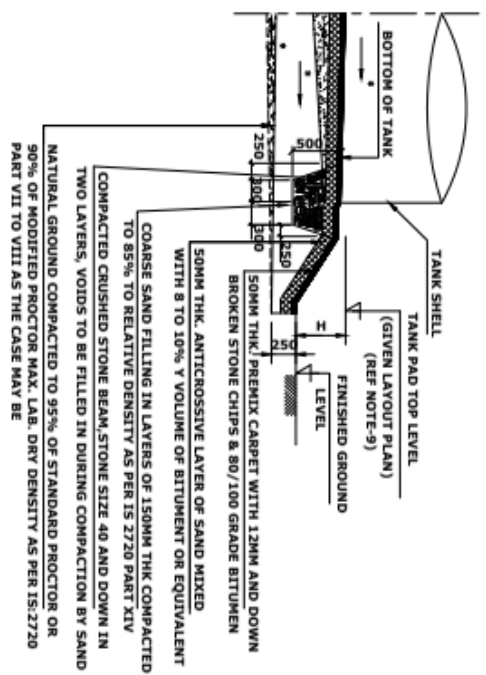
BRICK MASONRY COMPOUND WALL



\* FOR SLOPE AND DIRECTION REFER TANK DATA SHEET (REFER NOTE NO. 8)



TANK PAD DETAILS WITH STONE RING WALL (FOR TANK HEIGHT UPTO 10.0M)



**NOTES:-**

1. ALL DIMENSIONS ARE IN MM & ALL LEVELS ARE IN METRES UNLESS OTHERWISE SPECIFIED
2. THIS FOUNDATION IS VALID FOR TANK HEIGHT UPTO 10.0M
3. SOIL STRATUM AT EXCAVATION LEVELS FOR TANKS PADS SHALL BE THOROUGHLY EXAMINED BEFORE STARTING THE FILLING FOR TANK PADS. INCASE LOOSE SOILS ARE MET WITH OR DRY DENSITY OF SOIL POOR, IT SHALL BE COMPACTED TO 95% OF STANDARD PROCTOR OR 90% OF MODIFIED PROCTOR DENSITY AS PER IS:2720 PART VII OR VIII AS THE CASE MAY BE & TESTED TO THE SATISFACTION OF ENGINEER IN CHARGE
4. SAND USED FOR FILLING SHALL BE APPROVED BY ENGINEER IN CHARGE. USE OF DUST LINE SAND IS PROHIBITED. SAND FILLING SHALL BE IN 150 THK. LAYERS. EACH SHALL BE THOROUGHLY COMPACTED TO 85% RELATIVE DENSITY AS PER IS:2720 PART XIV
5. ANTICORROSIVE LAYER OVER SAND FILLING CONSISTS OF SIFTED DRY SAND HAVING 1.5 EFFECTIVE SIZE MIXED WITH BINDING MATERIAL 8 TO 10% BY VOLUME OF BITUMEN OR EQUIVALENT
6. PREMIX CARPET SHALL BE LAID AFTER INSULATION OF TANK AND AS PER INSTRUCTIONS OF THE ENGINEER IN CHARGE
7. FOR SIZE AND LOCATION OF ANCHOR BOLTS AND DRAIN SUMP REFER RELEVANT TANK DATA SHEET
8. INWARD/OUTWARD SLOPE OF TANK PAD TOP SHALL BE VARIETED WITH RELEVANT TANK DATA SHEET.
9. THE TANK PAD LEVEL SHALL BE GIVEN AS 'TO BE CONSTRUCTED' AND ALSO AS 'FINAL TANK PAD LEVEL AFTER SETTLEMENT DURING HYDROTEST'. THE DIFFERENCE BETWEEN TWO LEVELS BEING THE EXPECTED SETTLEMENT

STANDARD DRAWING FOR  
BRICK FOOTPATH

STANDARD DRAWING NO.

REV.

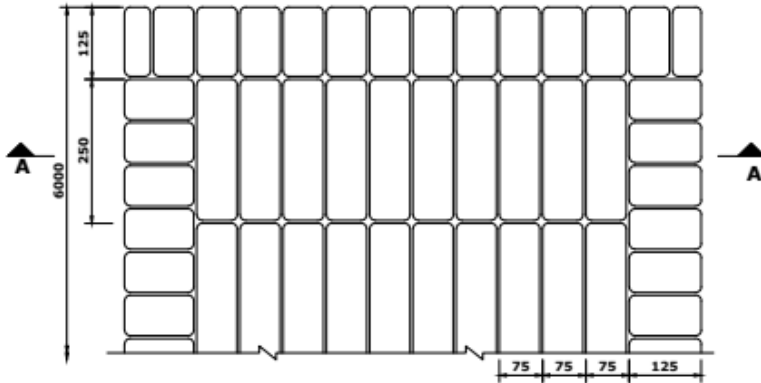
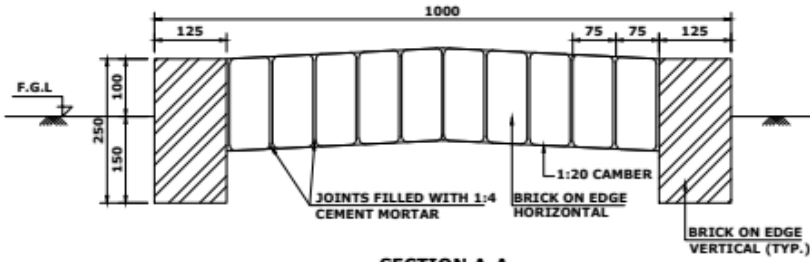
SIZE

SHEET NO.

1 OF 1

03

A4

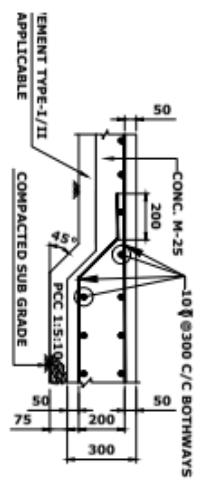
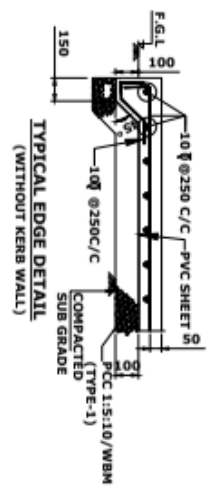
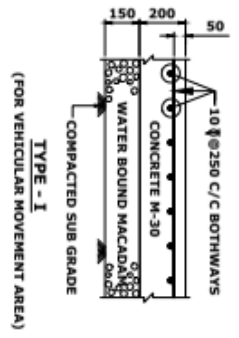


**NOTES:-**

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. AFTER EVERY 6000 LENGTH OF FOOTPATH A BREAK OF 100 mm WIDTH SHALL BE LEFT UNPAVED TO ALLOW THE SURFACE DRAINAGE.

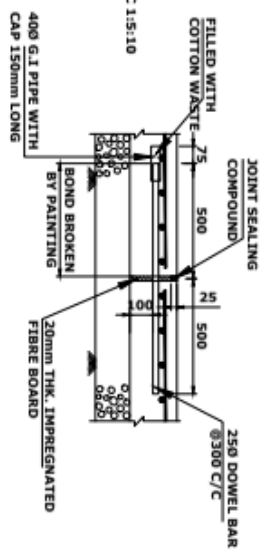
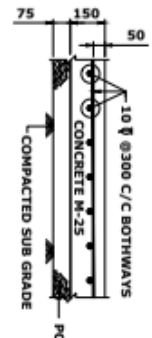
**LEGEND:-**

F.G.L = FINISH GRADE LEVEL

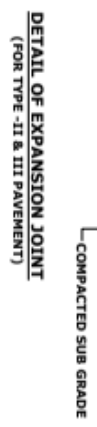


**TYPICAL DETAIL OF JOINT SEALING**  
AROUND FOUNDATION

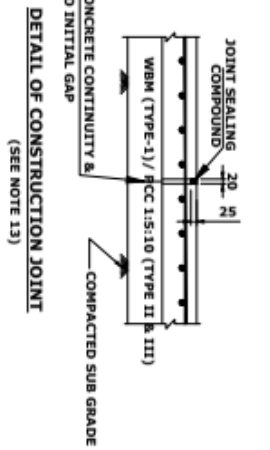
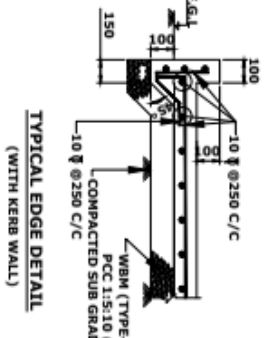
**TYPICAL DETAIL OF JOINT SEALING**  
AROUND FOUNDATION



**DETAIL OF EXPANSION JOINT**  
(FOR TYPE - I PAVEMENT)



**DETAIL OF EXPANSION JOINT**  
(FOR TYPE - II & III PAVEMENT)



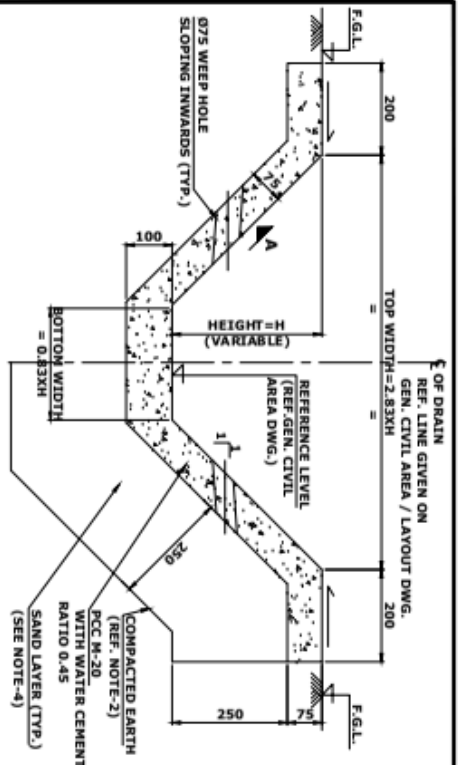
**DETAIL OF CONSTRUCTION JOINT**  
(SEE NOTE 13)

RCC PAVEMENT DETAILS

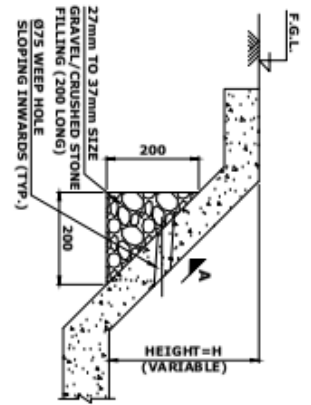
**NOTES:-**

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CONCRETE SHALL BE CONFIRM TO IS:456.
3. Ø DENOTES HIGH YIELD DEFORMED BARS OF GRADE Fe415 (MIN.) CONFORMING TO IS:1786. UNLESS OTHERWISE SPECIFIED.
4. JOINT SEALING COMPOUND IN PAVING AND AROUND EQUIPMENT FOUNDATIONS SHALL CONFIRM TO IS:1834 TYPE-B.
5. EXPANSION AND SEALING JOINT FILLER MATERIAL SHALL BE FILLERS OF BITUMEN PERFORMED FIBRES IMPREGNATED FIBRE, CONFIRMING TO IS:1838, PART-1.
6. CONCRETE PAVING SHALL BE SLOPED STEEPEST TO 1:100 UNLESS OTHERWISE SHOWN IN DETAIL ENGINEERING DRAWING. SLOPE OF THE SUB GRADE SHALL BE PREPARED TO MATCH WITH SLOPE OF PAVEMENT.
7. SUB GRADE BELOW PAVEMENT SHALL BE THOROUGHLY COMPACTED TO 95% OF LAB DRY DENSITY AS PER IS:2720, PART VIII.
8. CAST IN-SITU CONCRETE FOR PAVEMENT SHALL BE LAID IN ALTERNATE PANELS OF SIZES AS DEFINED IN THIS STANDARD DRAWING HOWEVER, THE PANEL SIZE SHALL BE ADJUSTED AROUND COLUMNS & FOUNDATION
9. EXPANSION JOINTS SHALL BE SPACED AT 14.0M (MAX.) FOR TYPE-I PAVEMENT & 13M C/C (MAX.) FOR TYPE-II PAVEMENTS.
10. EXPANSION JOINTS SHALL BE SPACED AT 15 M C/C & CONSTRUCTION JOINTS SHALL BE SPACED AT 7.5M C/C (MAXIMUM) FOR TYPE-III PAVEMENTS.
11. THIS STANDARD NOT VALID FOR CAUSTIC HANDLING AREAS.
12. LIMITATION OF SINGLE AXLE LOAD ON RCC PAVEMENT:  
FOR TYPE-I PAVEMENT : MAX. UP TO 12.0 TONNE  
FOR TYPE-II PAVEMENT : MAX. UP TO 6.0 TONNE  
(FOR SMALL VEHICLES LIKE FORK LIFT)
13. CONSTRUCTION JOINTS MAY BE PROVIDED IN CASE PANEL SIZE IS LESS THAN THE REQUIREMENT OF EXPANSION SUIT SITE REQUIREMENTS.
14. FOR PIPE SUPPORT DETAILS COMING IN THICKENED PAVEMENT AREA REFER RELEVANT PIPING GAD / PIPING STANDARDS.

GEO-TECHNICAL RECOMMENDATION SHALL BE FOLLOWED FOR SUBGRADE TREATMENT FOR PAVEMENTS IN BLACK COTTON SOIL AREAS/JOB SPECIFIC REQUIREMENT

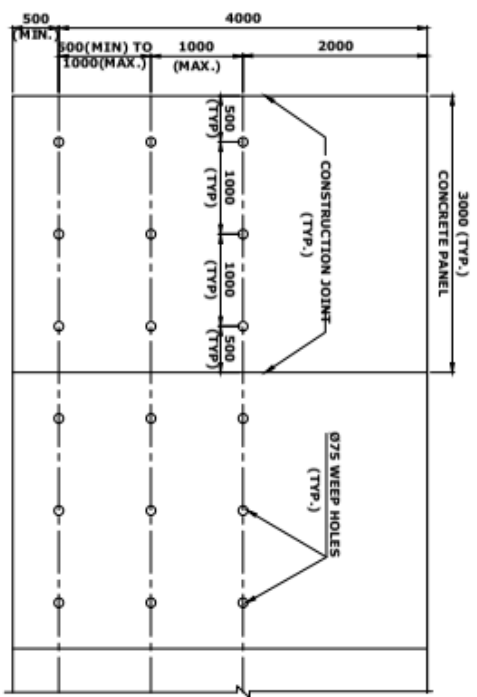


TRAPEZOIDAL DRAIN

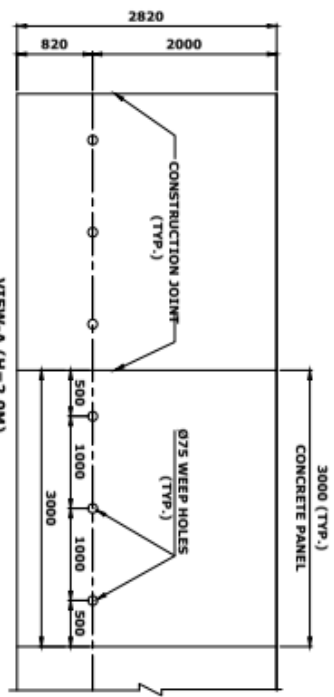


DETAIL OF WEEP HOLE

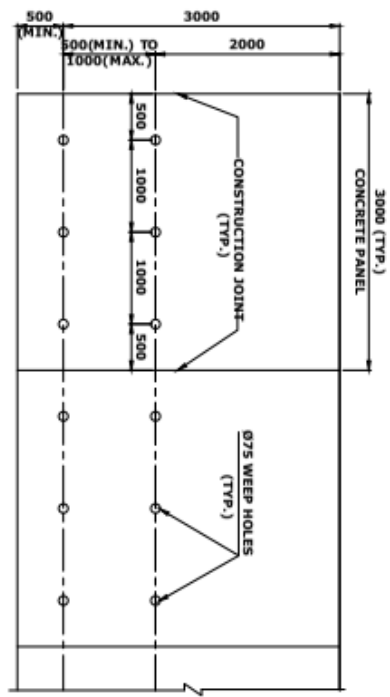
- NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
  2. CONCRETE LINING SHALL BE DONE AFTER THE SIDES OF DRAIN ARE CUT, COMPACTED TO 90% OF MAX. LABORATORY DRY DENSITY AND DRESSED TO THE REQUIRED SLOPE.
  3. CONCRETING ON THE SIDE SLOPES SHALL BE DONE IN PANELS OF 3.0 METER LENGTH.
  4. WHEREVER CONCRETE TRAPEZOIDAL DRAIN IS LAID IN EXPANSIVE/ BLACK COTTON SOIL, A LAYER OF 250 mm THICK SAND SHALL BE PROVIDED BELOW AND AROUND THE SIDE OF DRAIN.
  5. NO WEEP HOLES SHALL BE PROVIDED UPTO 1.5M HEIGHT (H) I.e. 2.0 (APPROX.) INCLINED PART OF THE DRAIN FROM FGL TO ELIMINATE POLLUTION IN THE DRAIN DUE TO CONTAMINATED SUB-SURFACE FLOW.
  6. THE VIEW OF INCLINED PART OF DRAIN ARE SHOWN HERE AS A GUIDELINE FOR THE LOCATION OF WEEP HOLES AND FOR THE PANELS OF CONCRETING. HOWEVER, FOR DEPTHS OTHER THAN SHOWN HERE, THE GUIDELINE SHALL REMAIN SAME.



VIEW-A (H=>2.5M TO 3.0M)  
(INCLINED PART OF THE DRAIN)



VIEW-A (H=2.0M)  
(INCLINED PART OF THE DRAIN)

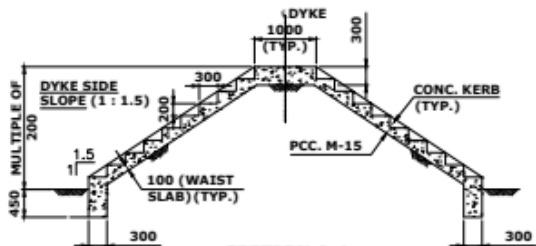


VIEW-A (H=>2.0M TO 2.50M)  
(INCLINED PART OF THE DRAIN)

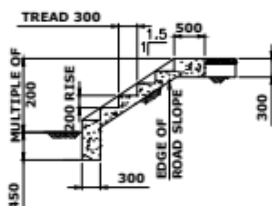
CONCRETE TRAPEZOIDAL  
STORM WATER DRAIN  
(HEIGHT (H)<3.0M)

STEPS ON EARTHEN DYKES  
AND ROAD EMBANKMENTS

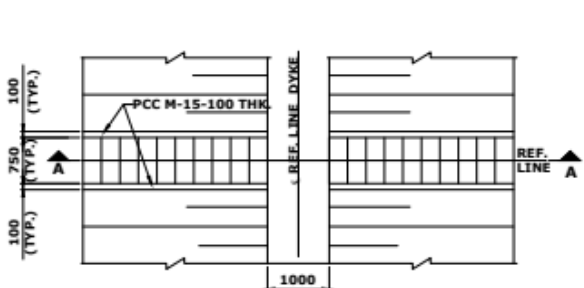
STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.		03	A4
1 OF 1			



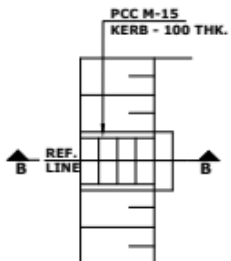
SECTION A-A



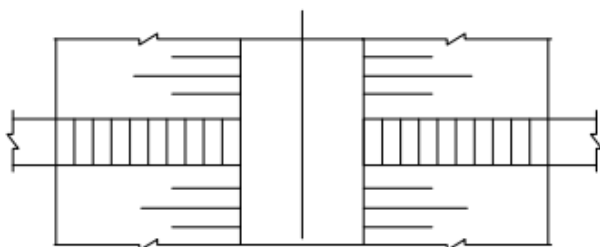
SECTION B-B



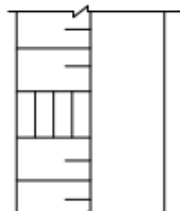
PLAN  
(FOR EARTHEN DYKES)



PLAN  
(FOR ROAD EMBANKMENT)



REPRESENTATION ON AREA DRG.  
(FOR EARTHEN DYKES)

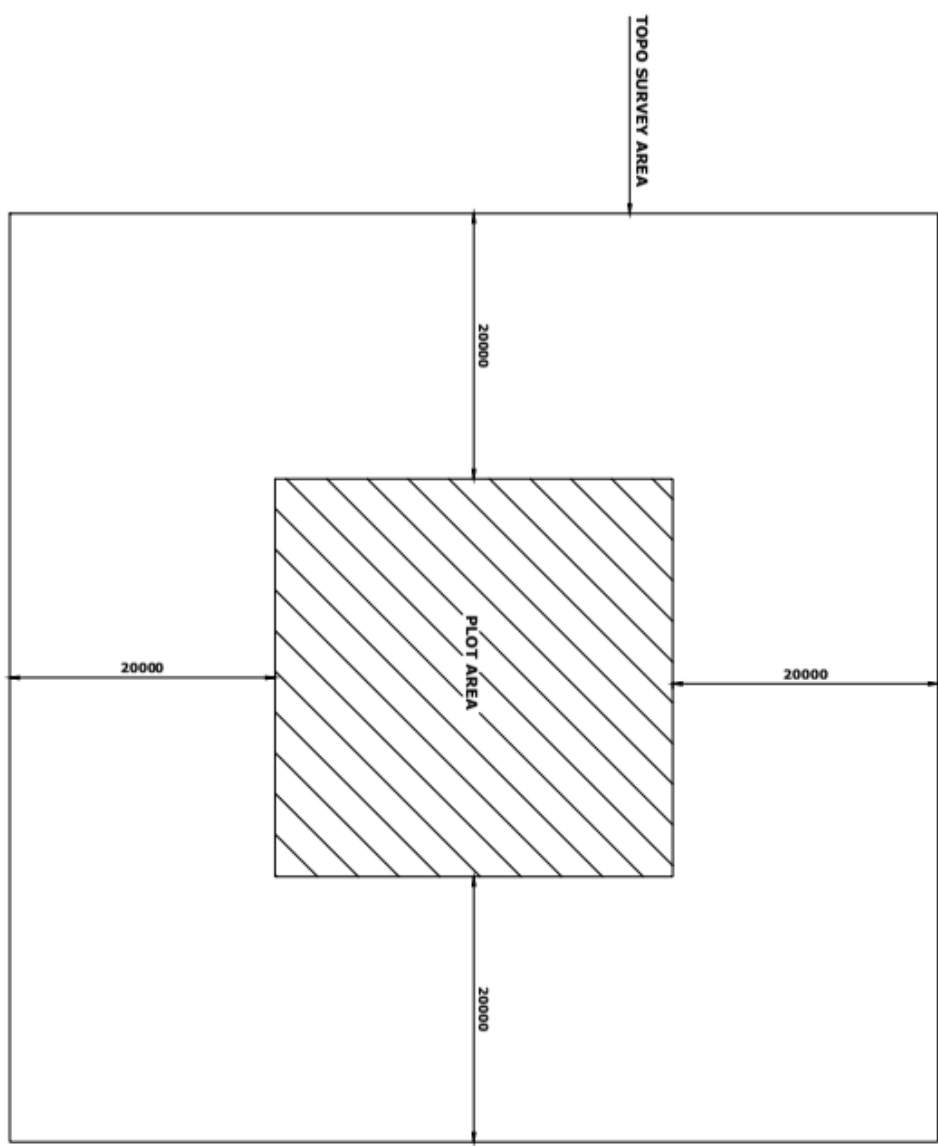


REPRESENTATION ON AREA DRG.  
(FOR ROADS)

NOTES :-

1. ALL HANDRAIL AND UPRIGHT SHALL BE AS PER RESPECTIVE TYPE.

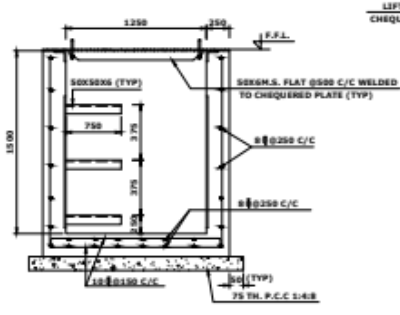
**NOTES:-**  
1. ALL DIMENSION ARE IN MM AND CO-ORDINATES AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.



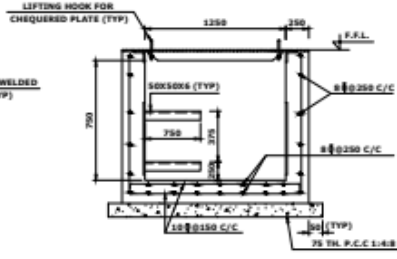
AREA PLAN FOR TOPO SURVEY

AREA PLAN FOR TOPO SURVEY

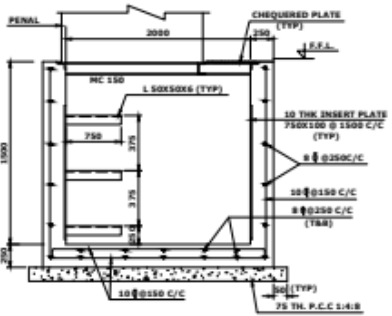
<b>STANDARD TYP.DETAILS OF CABLE TRENCH</b>	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	1 OF 1	03	A4



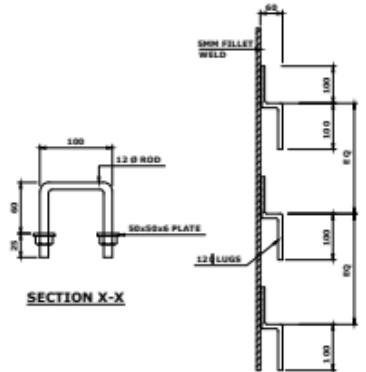
**R/F DETAIL OF CABLE TRENCH SECTION**



**R/F DETAIL OF CABLE TRENCH SECTION**

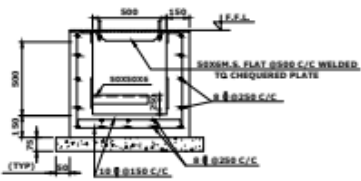


**SUPPORTING PANELS**

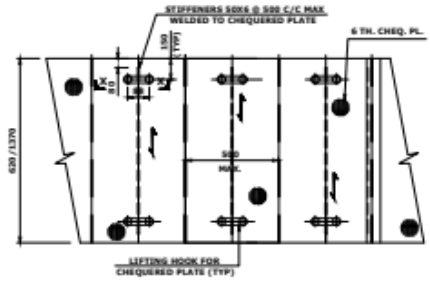


**SECTION X-X**

**TYP. DETAIL OF INSERT PLATE**

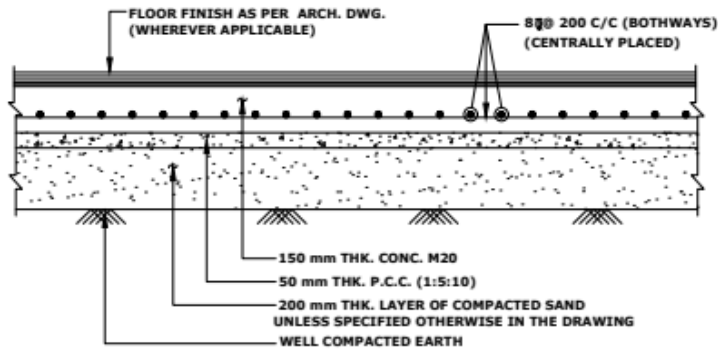


**R/F DETAIL OF CABLE TRENCH SECTION**



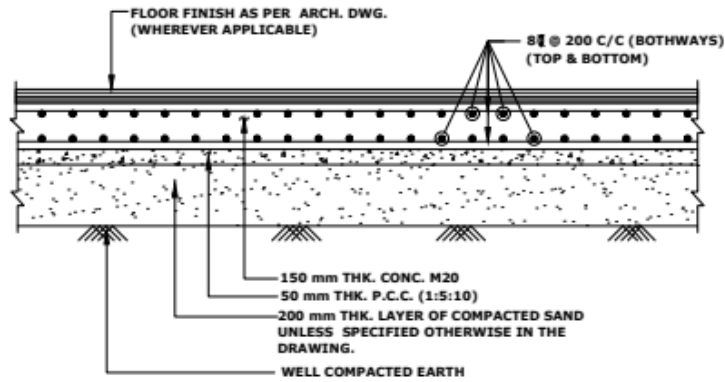
**DETAIL OF CHEQUERED PLATE**

	R.C.C FLOORING DETAILS	STANDARD DRAWING NO.		REV.	SIZE
				03	A4
		SHEET NO.	1 OF 2		



**TYPE-I**

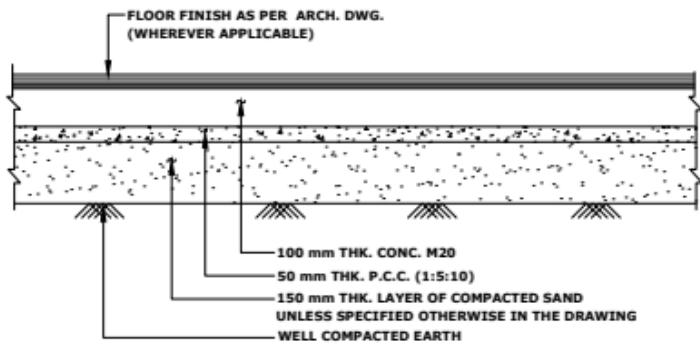
(FOR PLANT BUILDINGS, SUB-STATION, CONTROL ROOM, PUMP HOUSE,  
UTILITY COMPRESSOR HOUSE, PARKING AREA, STORE &  
PORCH)



**TYPE-II**

(FOR WAREHOUSE, WORKSHOP, CEMENT GODOWN, FIRE STATION  
& PROCESS COMPRESSOR HOUSE)

R.C.C FLOORING DETAILS	STANDARD DRAWING NO.	REV.	SIZE
	SHEET NO.	2 OF 2	03 A4



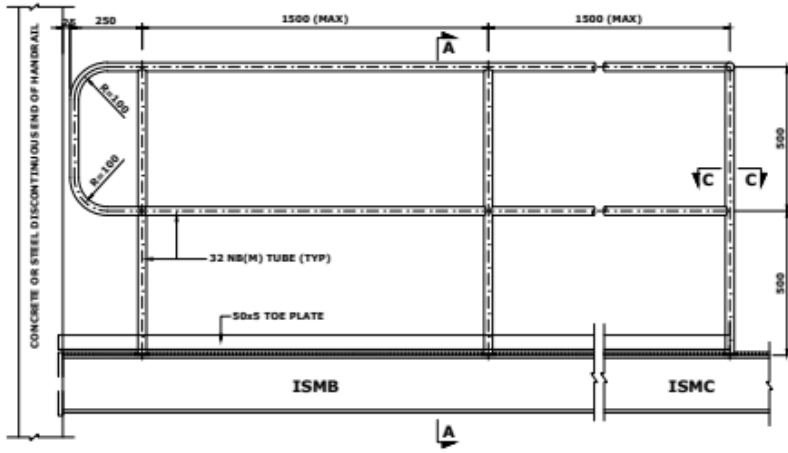
**TYPE-III**

(FOR NON-PLANT BUILDINGS, ADMINISTRATION, LABORATORY, CANTEEN, TIME OFFICE, SITE OFFICE ETC.,)

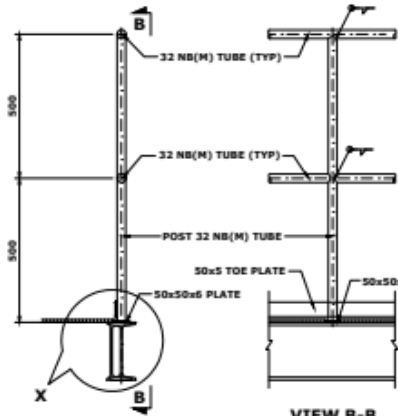
**NOTES:-**

1. ALL DIMENSIONS ARE IN mm
2. STRUCTURAL CONCRETE SLAB SHALL BE CAST IN ALTERNATE PANELS AND NO DIMENSION OF THE PANEL SHALL EXCEED 4.5 m

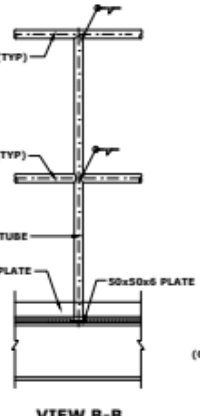
STANDARD FOR HANDRAIL ON STEEL PLATFORM	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	1 OF 1	03	A4



**HORIZONTAL HANDRAIL ON STEEL PLATFORM**



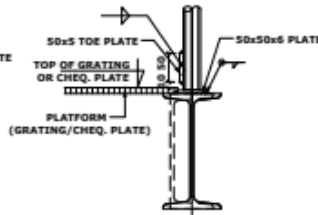
**SECTION A-A**



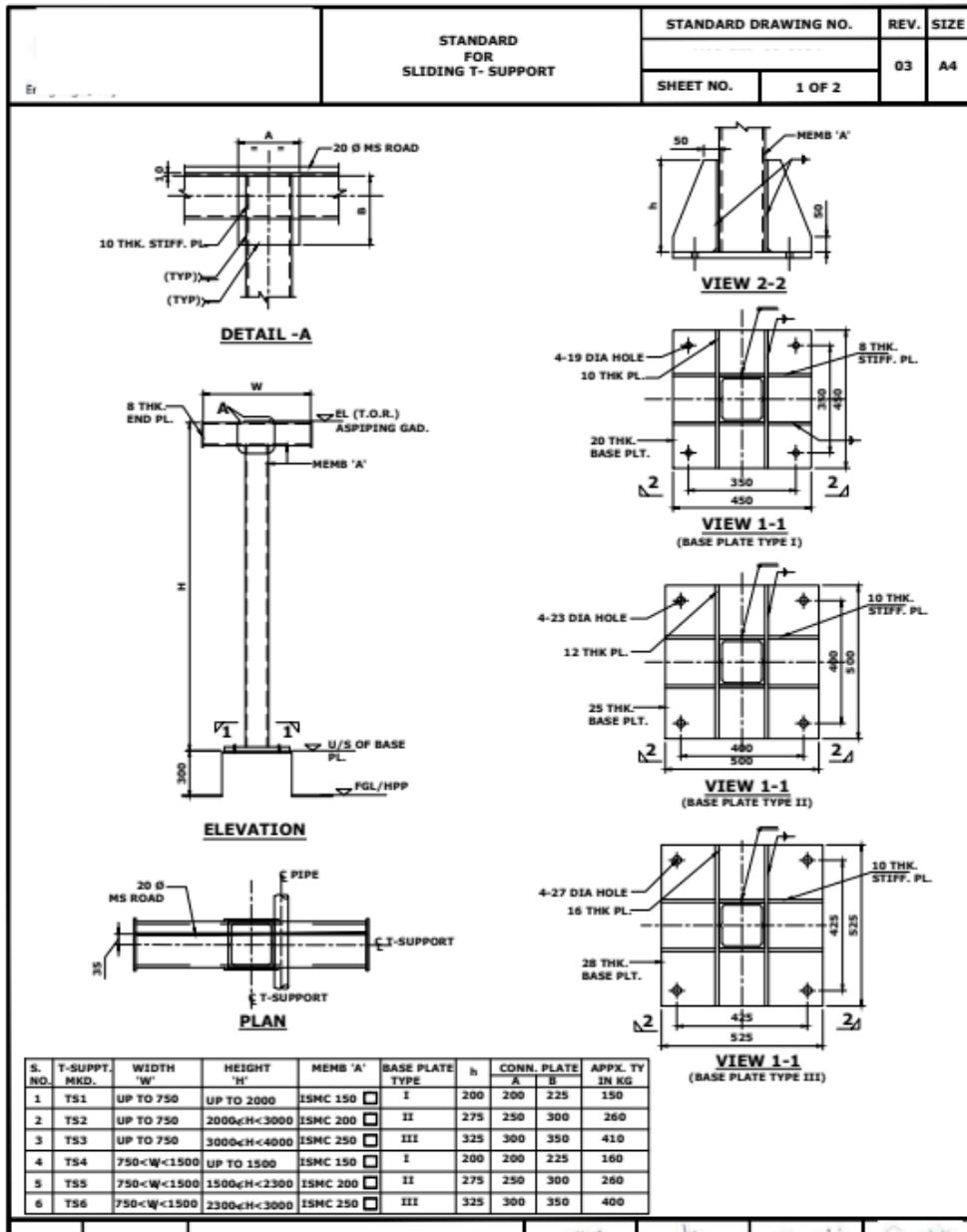
**VIEW B-B**

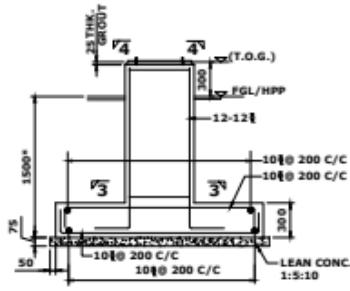


**VIEW C-C  
(AT CORNER)**

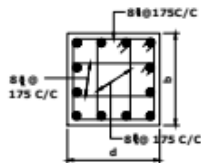


**DETAIL X**

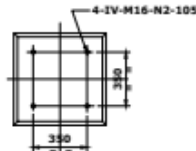




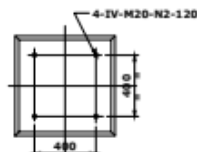
**ELEVATION**



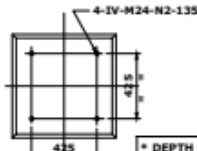
**SECTION 3-3**



**VIEW -4-4**  
(FOR SUPPORT TS1 & TS4)

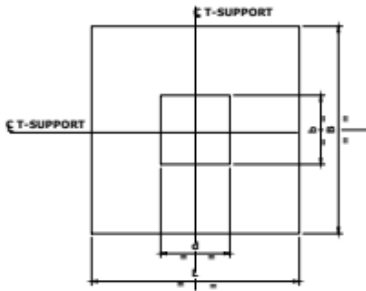


**VIEW -4-4**  
(FOR SUPPORT TS2 & TS5)



**VIEW -4-4**  
(FOR SUPPORT TS3 & TS6)

\* DEPTH OF FDN. CAN BE INCREASED TO CLEAR U/G PIPING IF ANY.



**FDN. PLAN**

**NOTES :-**

1. FOLLOWING LOADS HAVE BEEN CONSIDERED IN DESIGN:
  - a) VERTICAL LOAD = 1.0 MT FOR 750 WIDTH  
= 2.0 MT FOR 1500 WIDTH
  - b) WIND INTENSITY = 150 Kg/sqm
  - c) WIND ON 18" PIPE HAS BEEN CONSIDERED
  - d) PIPE FRICTION COEFFICIENT IN BOTH DIRECTION = 0.30

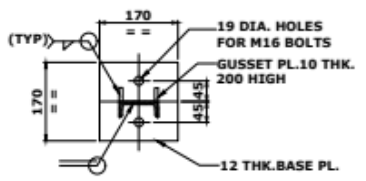
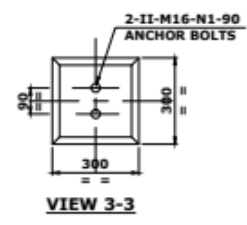
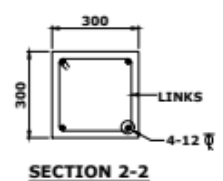
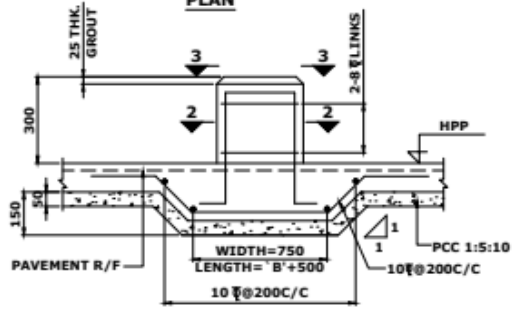
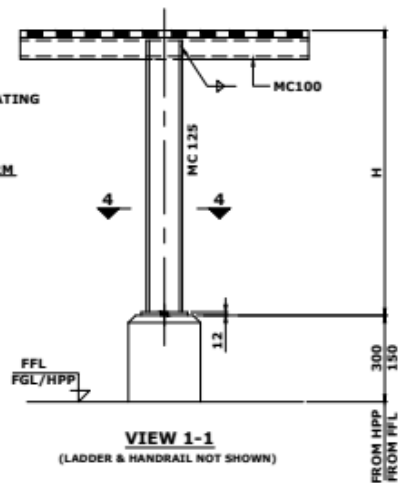
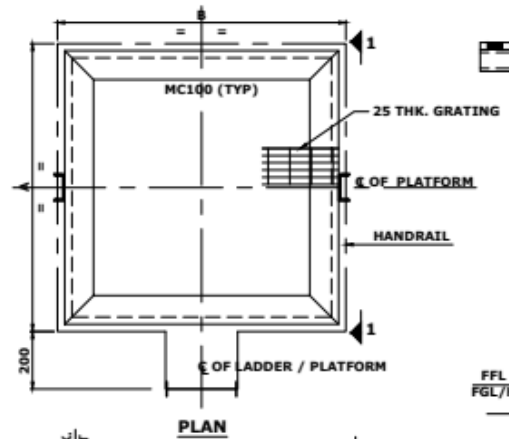
S. NO.	T-SUPPT. MKD.	PED SIZE		5.0 < S.B.C < 10.0 T/sqm		10.0 < S.B.C < 15.0 T/sqm		S.B.C > 15.0 T/sqm				
		d	b	L	B	QTY IN m <sup>3</sup>	L	B	QTY IN m <sup>3</sup>	L	B	QTY IN m <sup>3</sup>
1	TS1	600	600	1800	1800	1.51	1600	1600	1.31	1500	1800	1.22
2	TS2	650	650	2000	2000	1.83	1750	1750	1.55	1600	1600	1.40
3	TS3	675	675	2250	2250	2.20	1800	1800	1.66	1800	1800	1.66
4	TS4	600	600	2000	2000	1.74	1750	1750	1.46	1600	1600	1.31
5	TS5	650	650	2250	2250	2.15	1800	1800	1.60	1700	1700	1.50
6	TS6	675	675	2250	2250	2.20	1900	1900	1.77	1900	1900	1.77

	SMALL OPERATING PLATFORMS ON GRADE/RCC ELEVATION STRUCTURE	STANDARD DRAWING NO.		REV.	SIZE
		-----		03	A4
		SHEET NO.	1 OF 3		

**NOTES:-**

1. THIS STANDARD COVERS DETAILS OF OPERATING PLATFORM ON GRADE, OR ON ELEVATED R.C.C. STRUCTURE FOR A MAXIMUM HEIGHT OF 2300mm ABOVE FGL AND/OR 2150mm ABOVE FFL.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. STRUCTURAL STEEL SHALL CONFORM TO IS:2062 GRADE-A.
4. GRADE OF CONCRETE SHALL BE AS MENTIONED IN GENERAL NOTES FOR CONCRETE WORKS FOR THE PROJECT.
5. R/F BARS SHALL BE COLD WORKED STEEL HIGH STRENGTH DEFORMED BARS OF GRADE Fe415 CONFORMING TO IS:1786.
6. CONCRETE & STEEL WORKS SHALL BE AS PER GENERAL NOTES OF THE PROJECT.
7. THE LOCATION AND ORIENTATION OF PLATFORMS SHALL BE AS PER PIPING GAD.
8. IF NOT GALVANIZED GRATING SHALL BE WELDED ALONG THE LINE OF SUPPORT. GALVANIZED GRATING SHALL BE CLAMPED.
9. UP TO H> 2000 HANDRAIL SHALL BE TYPE-IV HANDRAIL FOR OTHER PLATFORMS SHALL BE TYPE-VII. TOP RAIL OF HANDRAIL SHALL BE 32 NB (M) PIPE.
10. ALL GUSSET PLATES SHALL BE 8mm THICK, UNLESS NOTED OTHERWISE.
11. ALL CONNECTIONS SHALL BE WELDED USING 6mm THICK FILLET WELDS. CONNECTIONS AT CORNER LOCATIONS SHALL BE WITH SUITABLE CLEAT ANGLE.
12. FOUNDATIONS SHOWN IN THIS STANDARD ARE VALID UP TO S.B.C. OF 5.00 T/M<sup>2</sup> AT FOUNDATION LEVEL.
13. CONSTRUCTION JOINTS IN PAVEMENT SHALL BE SUITABLY LOCATED AT SITE IN CASE THICKNESS PAVEMENT IS ADOPTED FOR PLATFORM FOUNDATIONS.
14. GROUT SHALL BE 1:2 CEMENT SAND MORTAR TYPE.

SMALL OPERATING PLATFORMS ON GRADE/RCC ELEVATION STRUCTURE	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	2 OF 3	03	A4



750 <math>\leq A < \leq 1000</math>
750 <math>\leq B < \leq 1000</math>
750 <math>\leq H < \leq 1000</math>

**TYP. DETAILS OF PLATFORMS**

SMALL OPERATING PLATFORMS  
ON GRADE/RCC ELEVATION  
STRUCTURE

STANDARD DRAWING NO.

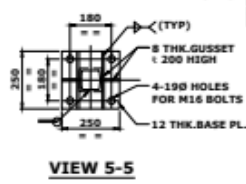
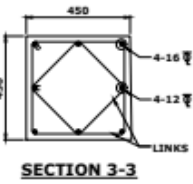
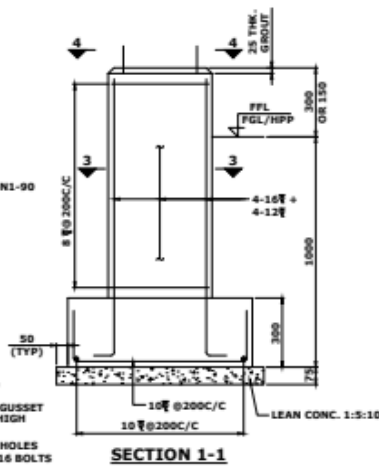
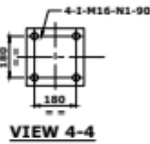
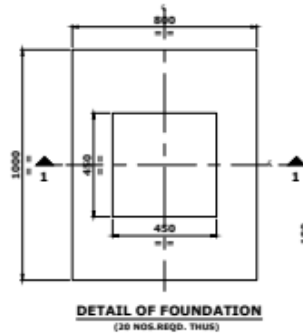
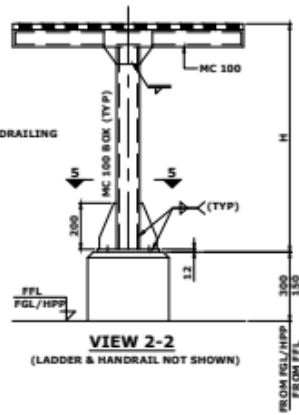
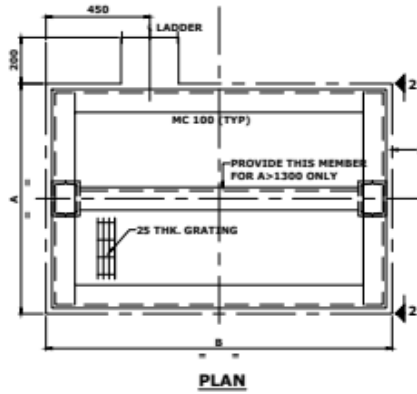
REV. SIZE

SHEET NO.

3 OF 3

03

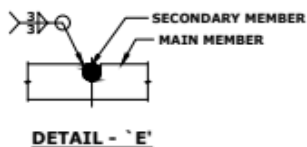
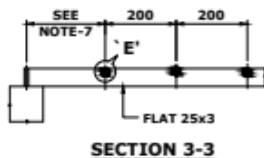
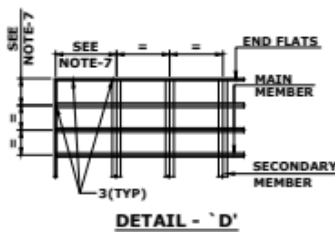
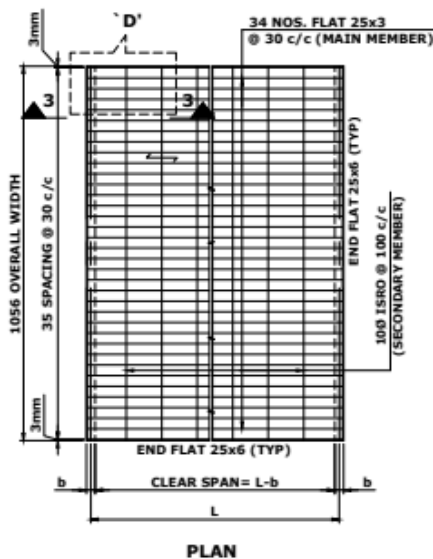
A4



1000 <math>\leq A < 1500</math>  
1000 <math>\leq B < 2500</math>  
1000 <math>\leq H < 2000</math>

TYP. DETAILS OF PLATFORMS FOR

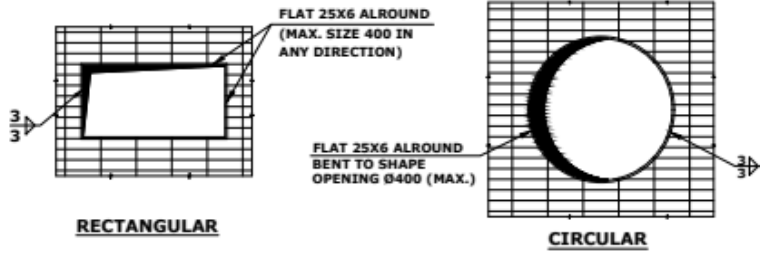




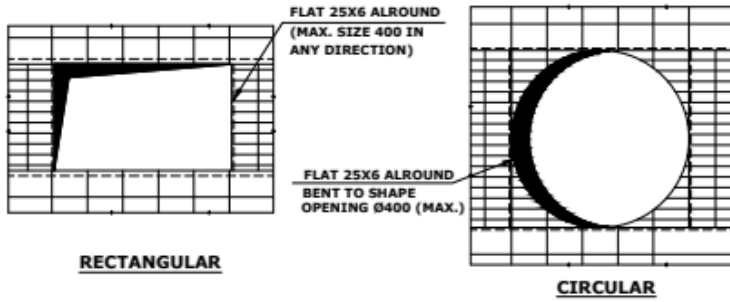
**GRATING**

WEIGHT OF GRATING IN kg/m <sup>2</sup>				PROPERTIES WIDTH - 1056			APPLICATION	NOTES
25X6	25X3	100 ISRO	TOTAL	Lxx cm <sup>4</sup>	Zxx cm <sup>3</sup>	MR kgm		
4.6	18.8	5.4	28.8	14.84	11.87	195.94	EQUIPMENT PLATFORM STAIRCASE PUMP HOUSE CROSS OVER	REFER SHT. 1 OF 3

STANDARD GRATING DETAILS	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	3 OF 3	03	A4

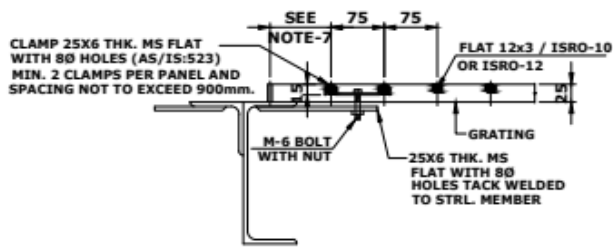


**(MAXIMUM SIZE OF OPENING 400 mm)**



**(SIZE OF OPENING GREATER THAN 400 mm)**

**TYPICAL DETAIL OF GRATING STRENGTHENING AT OPENINGS**

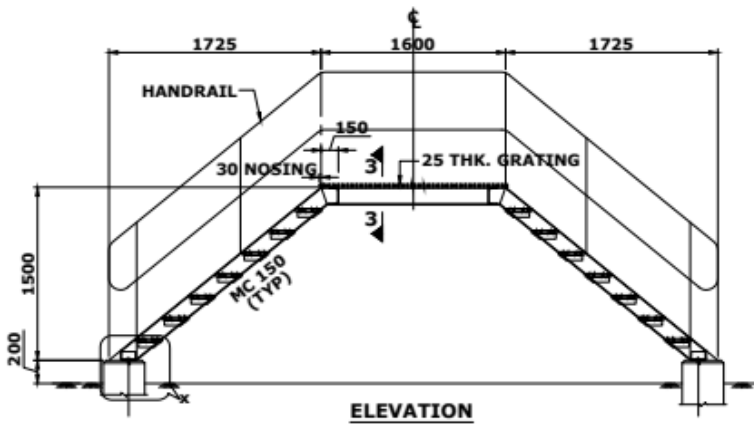


**FIXING DETAIL FOR REMOVABLE GRATING PANELS WITH CLAMPS**

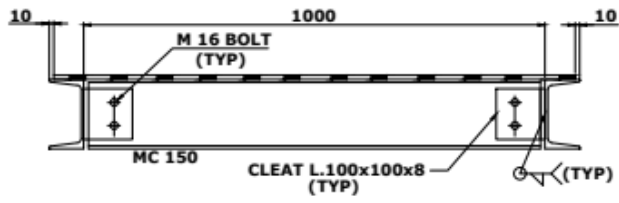
(SEE NOTE - 9)

	PIPE SLEEPER CROSSOVER	STANDARD DRAWING NO.		REV.	SIZE
				03	A4
		SHEET NO.	1 OF 3		
<p><b>NOTES :-</b></p> <ol style="list-style-type: none"> <li>1. ALL DIMENSIONS ARE IN MILLIMETERS</li> <li>2. THE LOADING CONSIDER ARE :-               <ol style="list-style-type: none"> <li>a) LIVE LOAD = 2.0 KN/m<sup>2</sup> ON CROSSOVER</li> <li>b) SELF WEIGHT OF MEMBER INCLUDING GRATINGS</li> </ol> </li> <li>3. ALL STRUCTURE STEEL SHALL CONFORM TO IS: 2062 GRADE-A</li> <li>4. GRADE OF CONCRETE SHALL BE AS MENTIONED IN GENERAL NOTES FOR CONCRETE WORKS, FOR THE PROJECT</li> <li>5. R/F BARS SHALL BE COLD WORKED STEEL HIGH STRENGTH DEFORMED BARS OF GRADE Fe 415 (MIN.) CONFORMING TO IS: 1786</li> <li>6. CONCRETE AND STEEL WORK SHALL BE AS PER GENERAL NOTES FOR THE PROJECT.</li> <li>7. LOCATION AND ORIENTATION OF PLATFORMS SHALL BE AS PER PIPING GAD.</li> <li>8. STAIRCASE DETAIL AS PER VPC-STD-CS-6047.</li> <li>9. STAIRCASE ON EACH SIDE OF CROSSOVER SHALL HAVE INCLINATION OF 41° TO HORIZONTAL, WITH RISERS NOT EXCEEDING 200mm.</li> <li>10. GRATING SHALL BE AS PER VPC-STD-CS-6036.</li> <li>11. UPTO&gt; 2000 HANDRAIL SHALL BE AS PER VPC-STD-CS-6033.</li> <li>12. GUSSET PLATES SHALL BE 8mm. THICK UNLESS NOTED OTHERWISE.</li> <li>13. ANCHOR BOLTS SHALL BE AS PER VPC-STD-CS-6054.</li> <li>14. PIPE SLEEPERS HAVE BEEN ASSUMED TO BE 500mm. (MAXIMUM) ABOVE GRADE AND WITH A MAXIMUM LENGTH OF 5000mm SYMMETRICALLY LOCATED WITH RESPECT TO CENTRE LINE THUS REQUIRING SINGLE SPAN CROSSOVERS.</li> </ol>					

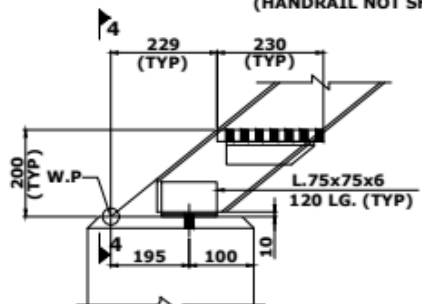
	PIPE SLEEPER CROSSOVER	STANDARD DRAWING NO.		REV.	SIZE
		SHEET NO.	2 OF 3		03



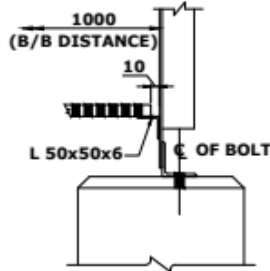
**ELEVATION**



**SEC. 3-3**  
(HANDRAIL NOT SHOWN)

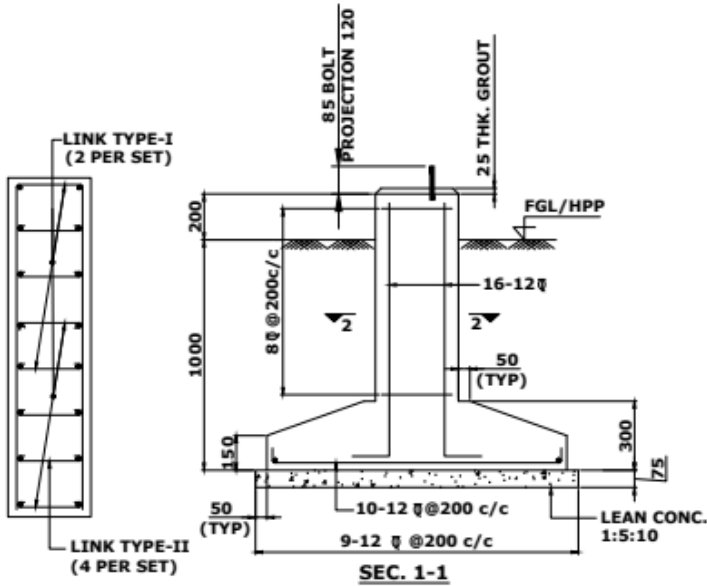


**DETAIL X FOR**  
**MC 150 STRINGER**



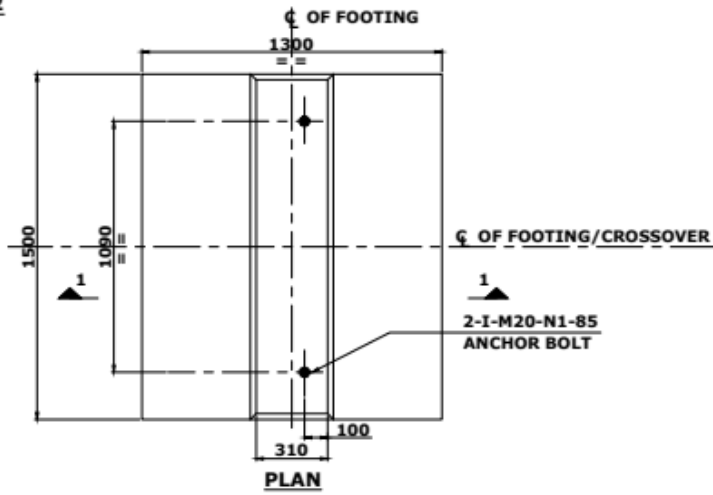
**VIEW 4-4**

PIPE SLEEPER CROSSOVER	STANDARD DRAWING NO.		REV.	SIZE
	1		03	A4
	SHEET NO.	3 OF 3		



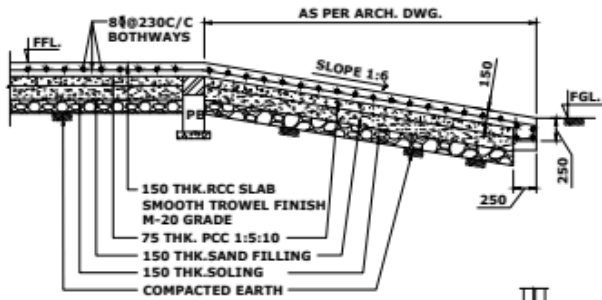
**SEC. 1-1**

**SEC. 2-2**

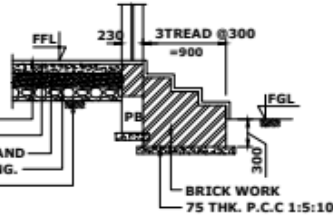


**PLAN**

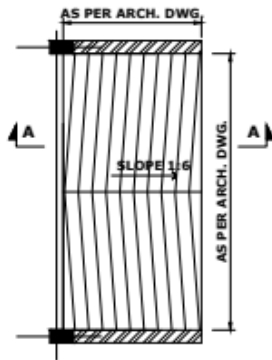
E	STANDARD FOR MISCELLANEOUS DETAILS	STANDARD DRAWING NO.		REV.	SIZE
		SHEET NO.	1 OF 1	03	A4



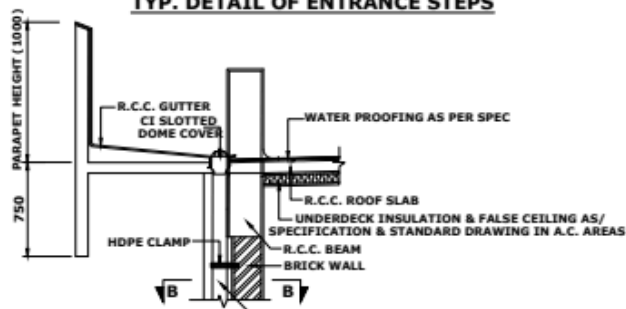
**SECTION A-A**



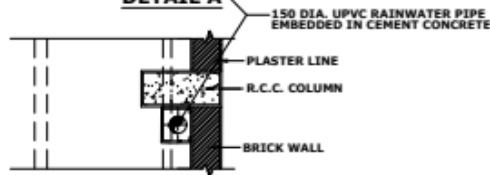
**TYP. DETAIL OF ENTRANCE STEPS**



**PLAN OF RAMP**

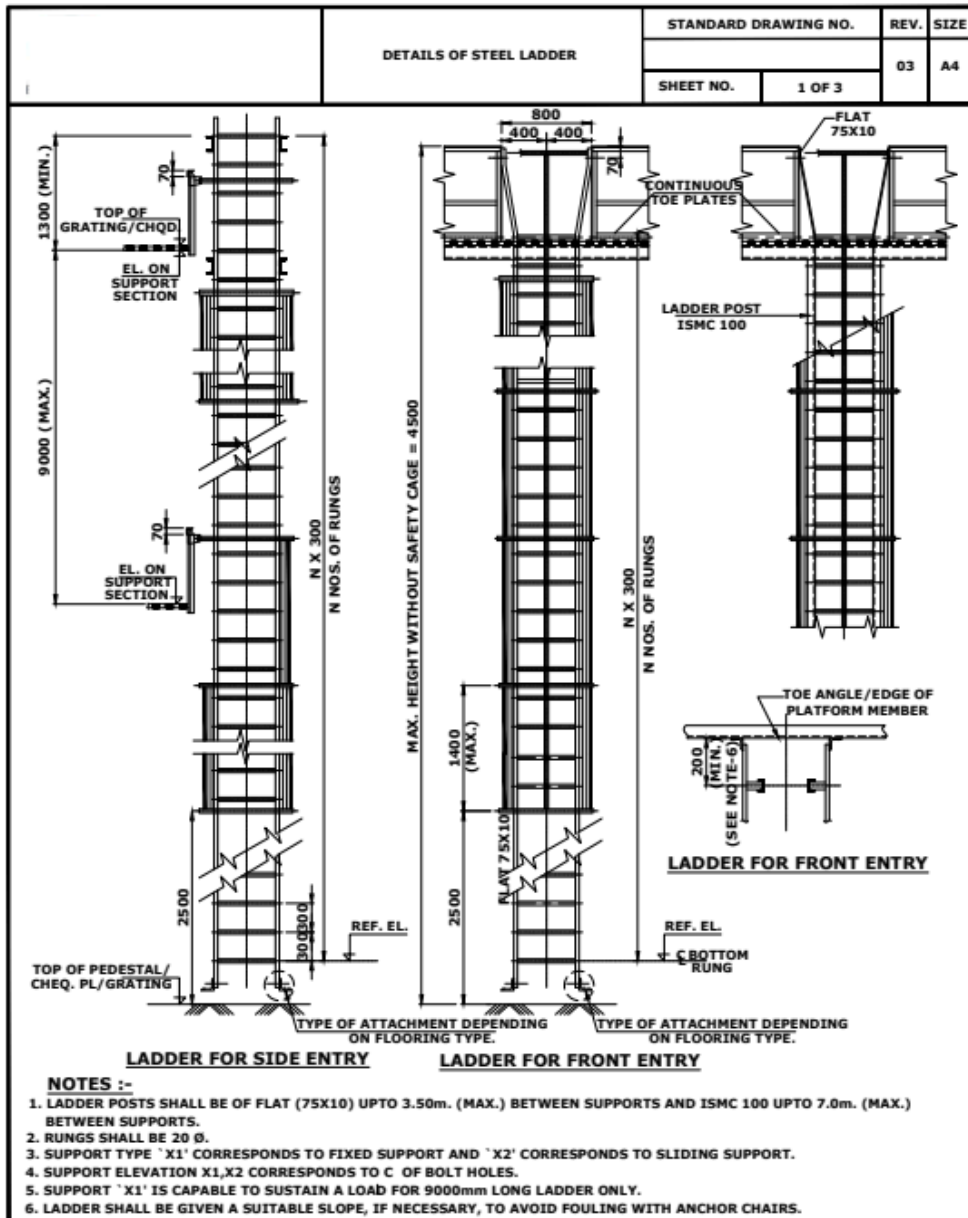


**DETAIL A**



**SECTION B-B**

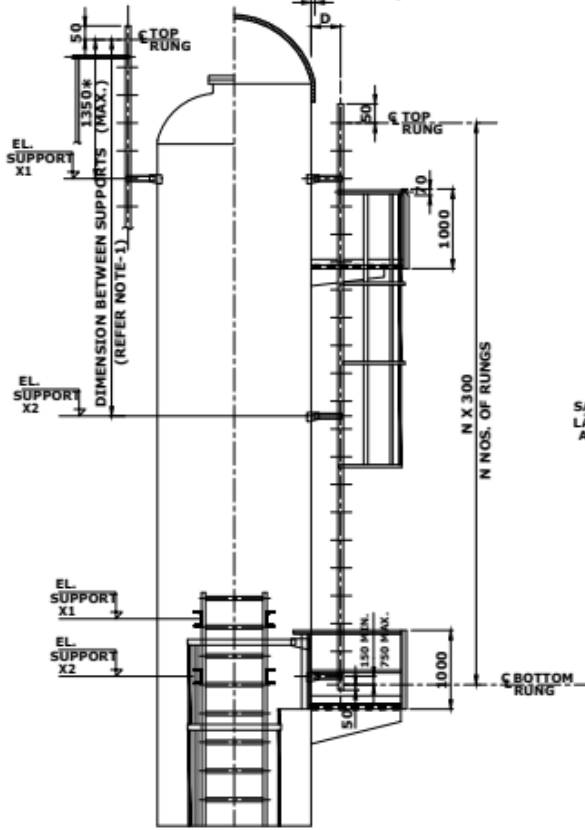
**TYP. DETAIL OF RAIN DOWNTAKE**



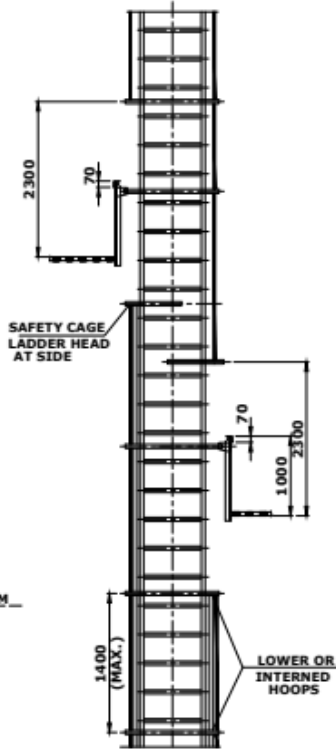
DETAILS OF STEEL LADDER

STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.		03	A4
2 OF 3			

'e' INSULATION THICKNESS (50 mm UNLESS NOTED OTHERWISE)



LADDER FOR SIDE ENTRY



LADDER FOR SIDE ENTRY

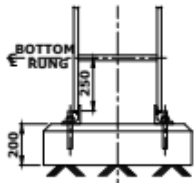
VESSEL DIA (mm)	DISTANCE 'D' (mm)
UPTO 800	200 + e
> 800 < 3200	260 + e
> 3200 < 8000	275 + e

\*MC100 SHALL BE ADOPTED FOR DISTANCE MORE THAN 1350 UPTO 2000

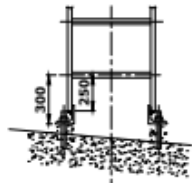
<b>DETAILS OF STEEL LADDER</b>	STANDARD DRAWING NO.	REV.	SIZE
	SHEET NO.	3 OF 3	

03  
A4

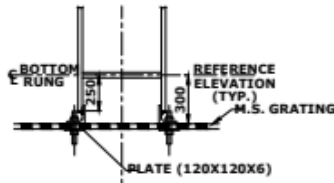
TYPE OF ATTACHMENT	NATURE OF SUPPORT SECTION	REMARKS
A1, A2	SITE WITHOUT PAVING	
B1, B2	CONCRETE FLOOR	A1, B1, C1, D1 : FIXED TYPE
C1, C2, D1, D2	CHEQUERED PLATE / GRATING FLOORING	A2, B2, C2, D2 : SLIDING TYPE



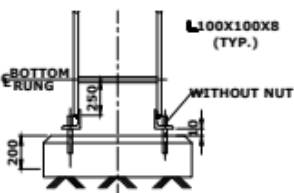
**TYPE - A1**



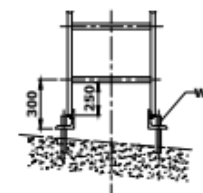
**TYPE - B1**



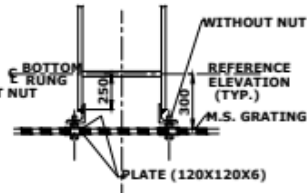
**TYPE - C1**



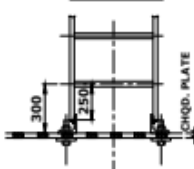
**TYPE - A2**



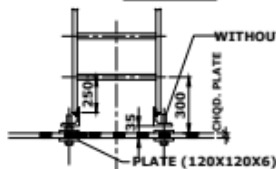
**TYPE - B2**



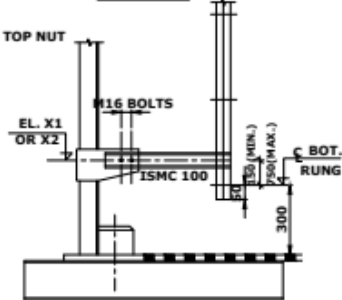
**TYPE - C2**



**TYPE - D1**



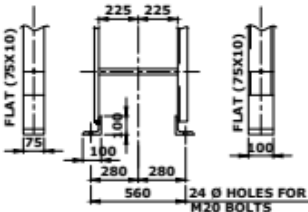
**TYPE - D2**



**TYPE - E**  
(FREE)

**NOTE :-**  
IN CASE OF TOWERS BOTTOM RUNG SHALL  
BE 300 mm FROM FGL / HPP

**TYPE OF ATTACHMENT AT BASE**

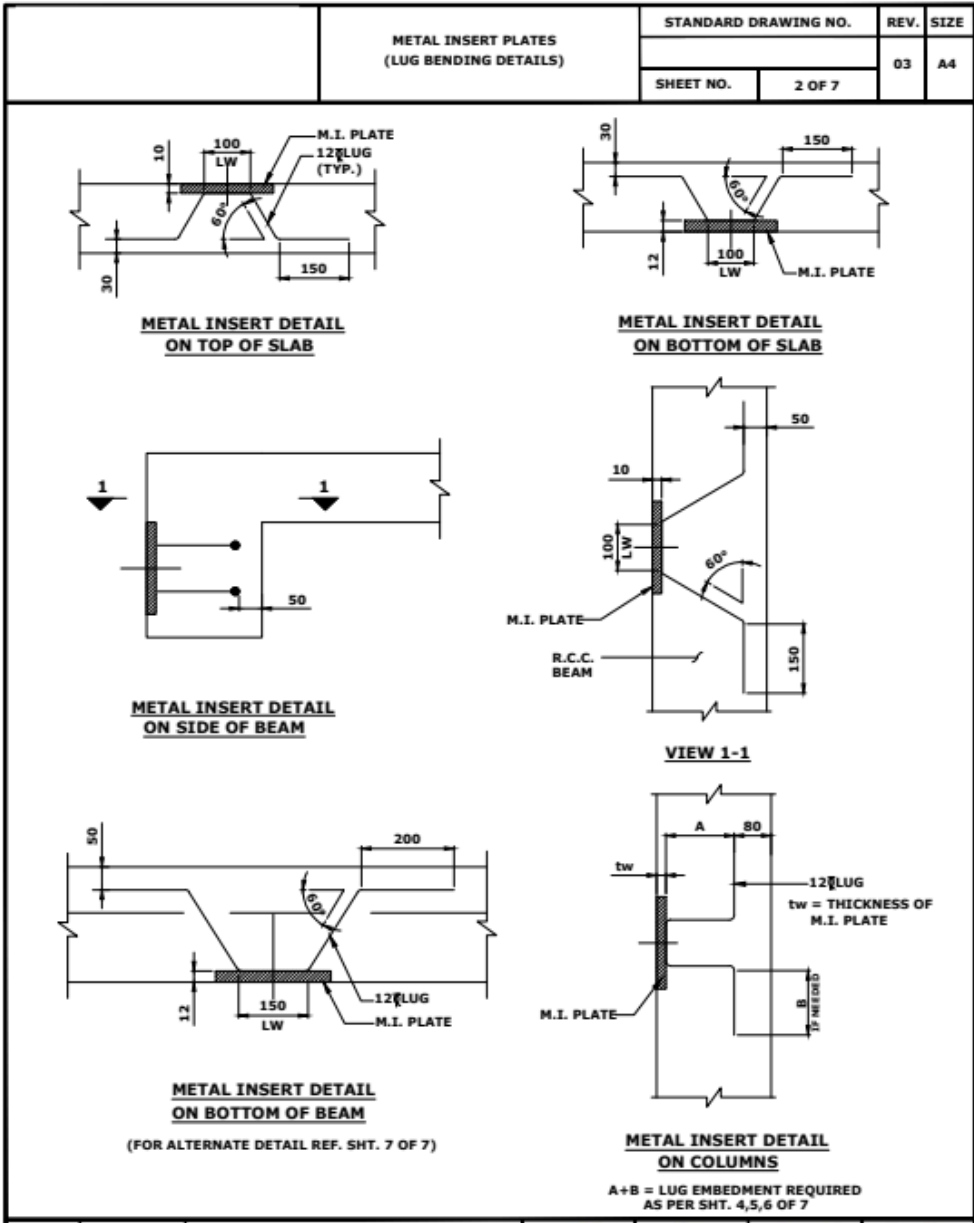


**LADDER BOTTOM DETAILS**

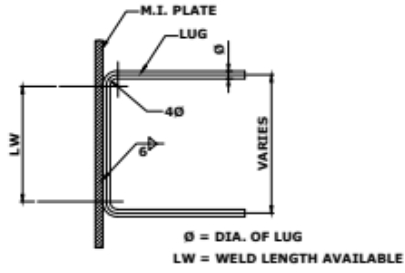
	METAL INSERT PLATES	STANDARD DRAWING NO.		REV.	SIZE
				03	A4
		SHEET NO.	1 OF 7		

**GENERAL NOTES:-**

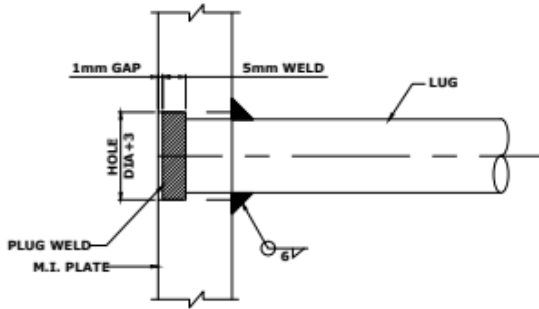
1. ALL LUGS SHALL BE OF HIGH STRENGTH DEFORMED BARS OF GRADE Fe415 CONFORMING TO IS:1786 (WITH GUARANTEED WELDABILITY) AND SHALL BE CONNECTED TO METAL INSERT PLATES BY 6 mm FILLET WELDS AS SHOWN IN SKETCHES.
2. METAL INSERT PLATES SHALL BE CONFORMING TO IS:2062 (GR-A).
3. METAL INSERT PLATES MARKED ON DRAWING REFER AS UNDER
  - IP -(A) @ (C)
  - IP = INSERT PLATE
  - A = TYPE OF INSERT PLATE
  - C = ELEVATION OF INSERT PLATE (TOP EDGE)
 e.g IP-R9a @ EL.110.300 MEANS INSERT TYPE R9a AT EL.110.300.
4. METAL INSERT PLATES SHALL BE KEPT FLUSH WITH CONCRETE SURFACE.
5. THE LONGER SIDE OF METAL INSERT PLATE SHALL BE KEPT VERTICAL UNLESS SHOWN OTHERWISE.
6. METAL INSERT PLATE ON COLUMN OR BEAM SHALL BE KEPT SYMMETRICAL ABOUT C OF COLUMN OR BEAM, UNLESS SHOWN OTHERWISE.



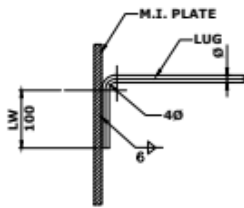
	METAL INSERT PLATES	STANDARD DRAWING NO.	REV.	SIZE	
		-----		03	A4
		SHEET NO.	3 OF 7		



**BENDING DIMENSIONS FOR 12mm & 16mm LUGS**  
(FOR SPACING OF LUGS  $\geq$  190)  
(NOT APPLICABLE FOR S1, S2 & R1)



**WELD DETAIL OF 12mm & 16mm LUGS WITH M.I. PLATE**  
(FOR SPACING OF LUGS  $<$  190)  
(VALID FOR S1, S2 & R1)



**BENDING DIMENSIONS FOR 12mm & 16mm LUGS**  
(VALID FOR R9, R10, R12, R13, R14, PS11 & PS12)

METAL INSERT PLATES (S/R DESIGNATES)		STANDARD DRAWING NO.		REV.	SIZE
		SHEET NO.		03	A4

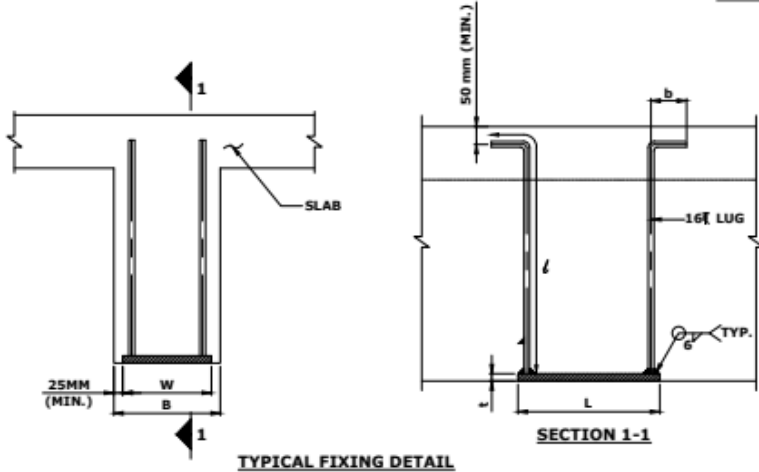
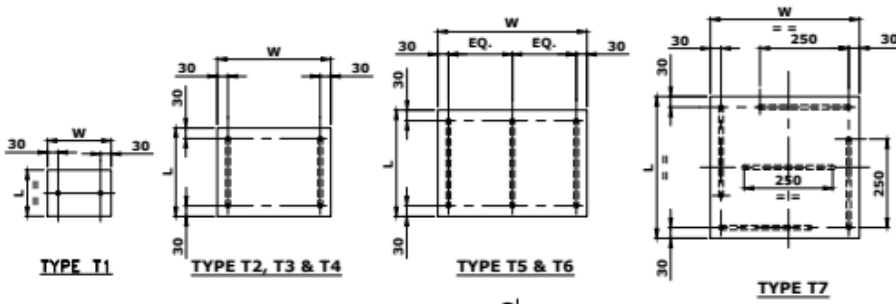
S. NO.	TYPE OF INSERT	DIA OF LUGS	THK. OF INSERT	DETAILS OF INSERT PLATE		S. NO.	TYPE OF INSERT	DIA OF LUGS	THK. OF INSERT	DETAILS OF INSERT PLATE	
				PLAN	CROSS SECTION					PLAN	CROSS SECTION
1.	S1a	12	12			7.	S7a	12	12		
	S1b	16	16				S7b	16	16		
2.	S2a	12	12			8.	R1a	12	12		
	S2b	16	16				R1b	16	16		
3.	S3a	12	12			9.	R2a	12	12		
	S3b	16	16				R2b	16	16		
4.	S4a	12	12			10.	R3a	12	12		
	S4b	16	16				R3b	16	16		
5.	S5a	12	12			11.	R4a	12	12		
	S5b	16	16				R4b	16	16		
6.	S6a	12	12			12.	R5a	12	12		
	S6b	16	16				R5b	16	16		

METAL INSERT PLATES (R DESIGNATES)		STANDARD DRAWING NO.		REV.	SIZE
		SHEET NO.		03	A4

S. NO.	TYPE OF INSERT	DIA. OF LUGS	THK. OF INSERT	DETAILS OF INSERT PLATE		S. NO.	TYPE OF INSERT	DIA. OF LUGS	THK. OF INSERT	DETAILS OF INSERT PLATE	
				PLAN	CROSS SECTION					PLAN	CROSS SECTION
13.	R6a	12	12			R11a	12	12			
	R6b	16	16			R11b	16	16			
14.	R7a	12	12			R12a	12	12			
	R7b	16	16			R12b	16	16			
15.	R8a	12	12			R13a	12	12			
	R8b	16	16			R13b	16	16			
16.	R9a	12	12			R14a	12	12			
	R9b	16	16			R14b	16	16			
17.	R10a	12	12								
	R10b	16	16								

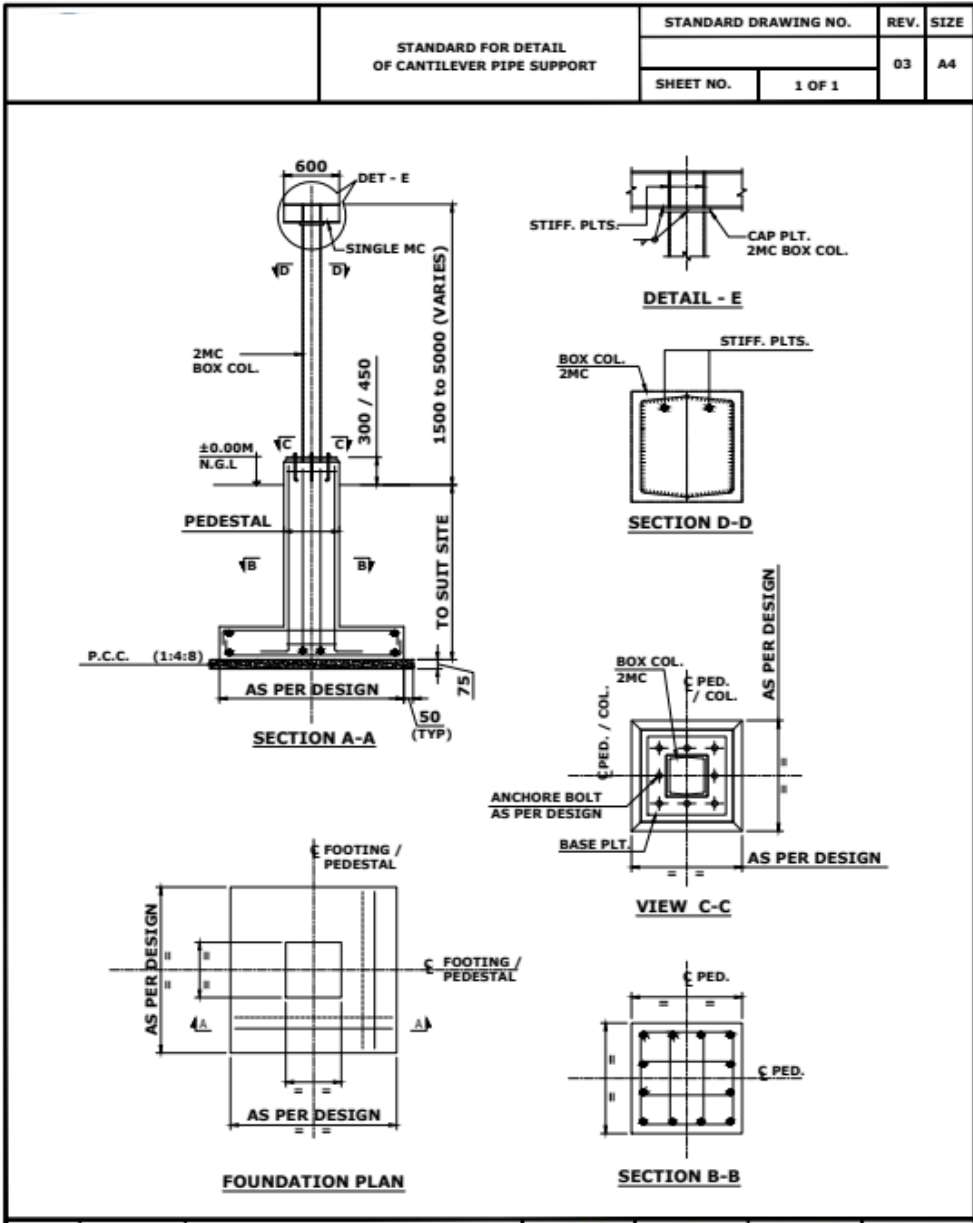
				METAL INSERT PLATES (PS DESIGNATES)		STANDARD DRAWING NO.		REV.	SIZE
								03	A4
						SHEET NO.	6 OF 7		
S. NO.	TYPE OF INSERT	DIA. OF LUGS	THK. OF INSERT	DETAILS OF INSERT PLATE					
				PLAN			CROSS SECTION		
1.	PS1	12	12				 250(TYP.) FOR 12 LUGS 300(TYP.) FOR 16 LUGS		
	PS2	16	16	<b>SIZE 150x150</b>					
2.	PS3	12	12						
	PS4	16	16	<b>SIZE 225x225</b>					
3.	PS5	12	12						
	PS6	16	16	<b>SIZE 300x300</b>					
4.	PS7	12	12						
	PS8	16	16	<b>SIZE 400x400</b>					
5.	PS9	12	12						
	PS10	16	16	<b>SIZE 450x450</b>					
6.	PS11	12	12						
	PS12	16	16	<b>SIZE 500x500</b>					

	STANDARD FOR DETAIL OF METAL INSERT PLATES (PS DESIGNATES)	STANDARD DRAWING NO.		REV.	SIZE
		SHEET NO. 7 OF 7		03	A4



**TYPICAL FIXING DETAIL**

S.NO.	TYPE OF INSERT	WIDTH OF BEAM 'B' (mm)	MAXIMUM WIDTH OF PLATE 'W' (mm)	LENGTH OF PLATE 'L' (mm)	MAXIMUM 'b' (mm)	THICKNESS OF PLATE 't' (mm)	TOTAL ANCHORAGE LENGTH 'ℓ' (mm)
1.	T1	230	180	180	110	16	350
2.	T2	300	220	250	110	20	350
3.	T3	350	270	250	110	20	350
4.	T4	400	320	250	110	20	350
5.	T5	450	370	300	110	32	350
6.	T6	500	420	300	110	32	350
7.	T7	500	420	400	110	32	350



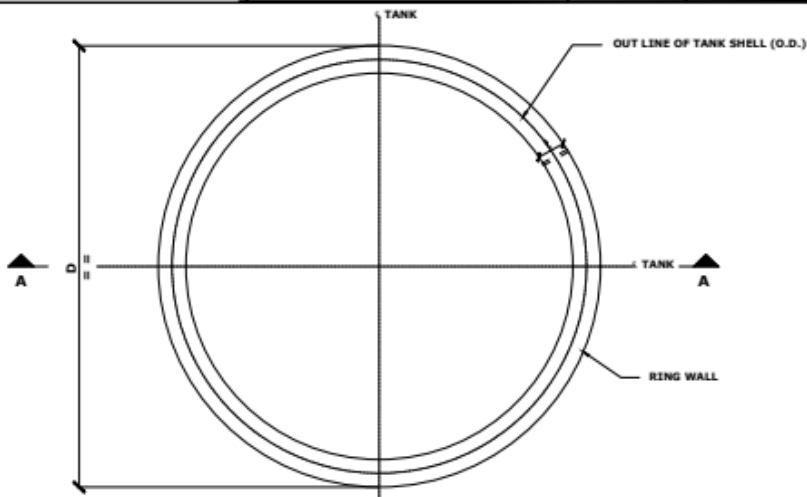
	STANDARD FOR DETAIL OF RING WALL FOUNDATION FOR STORAGE TANKS (LIQUID TEMP. UPTO 190° C)	STANDARD DRAWING NO.		REV.	SIZE
		SHEET NO.	1 OF 4	03	A4

**NOTES:-**

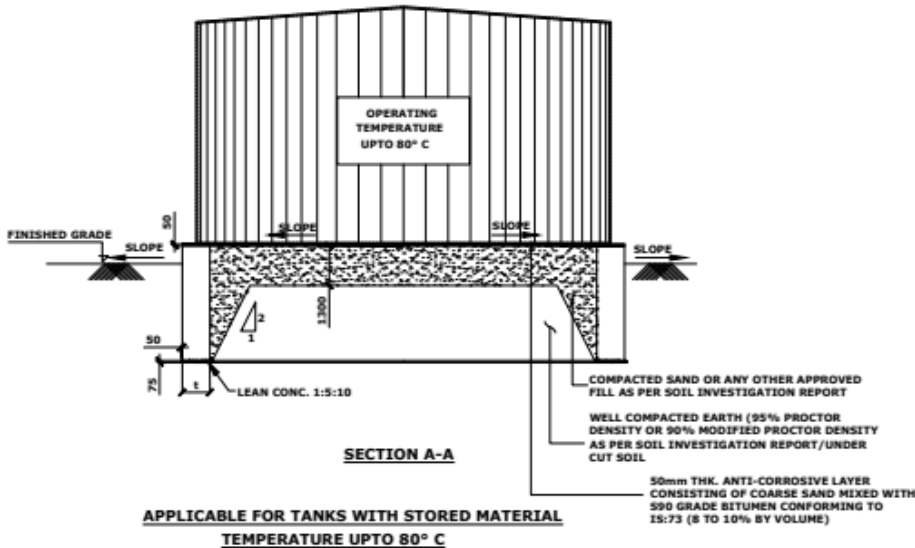
1. ALL DIMENSIONS ARE IN mm.
2. JOB SPECIFIC DRAWING SHALL BE REFERRED FOR THE FOLLOWING :-
  - RING BEAM DETAILS INCLUDING TOP & BOTTOM LEVEL.
  - ANCHOR BOLT LOCATION AND DETAILS.
  - DRAIN LOCATION AND OTHER DETAILS.
  - SPECIFIC REQUIREMENT ON GROUND TREATMENT.
3. SLOPE OF TOP OF SAND FILL AND ANTI-CORROSIVE LAYER SHALL MATCH WITH TANK BOTTOM.

**THIS STANDARD IS NOT APPLICABLE FOR ACID / CAUSTIC / PRESSURISED TANKS AS WELL AS FOR TANKS WHERE STRESS RELIEVING IN POSITION IS ENVISAGED.**

<b>STANDARD FOR DETAIL OF RING WALL FOUNDATION FOR STORAGE TANKS (LIQUID TEMP. UPTO 190° C)</b>	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	2 OF 4	03	A4



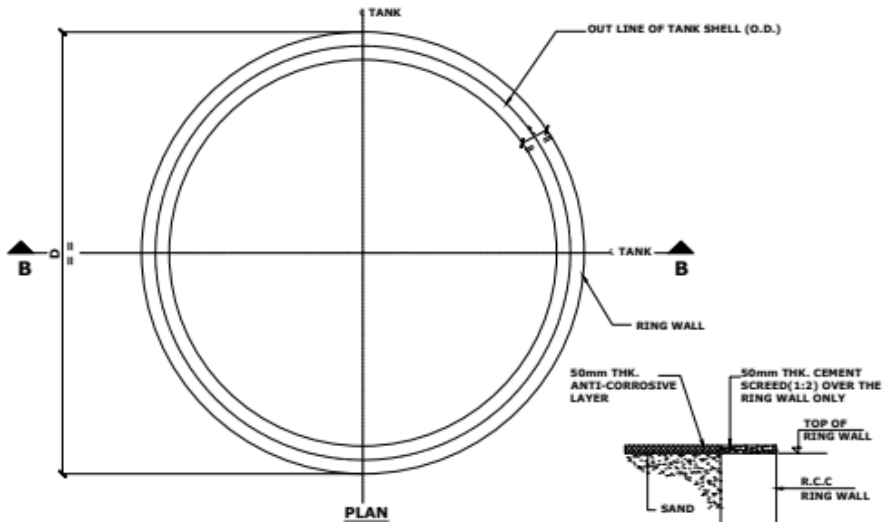
**PLAN**



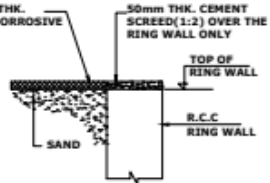
**SECTION A-A**

**APPLICABLE FOR TANKS WITH STORED MATERIAL  
TEMPERATURE UPTO 80° C**

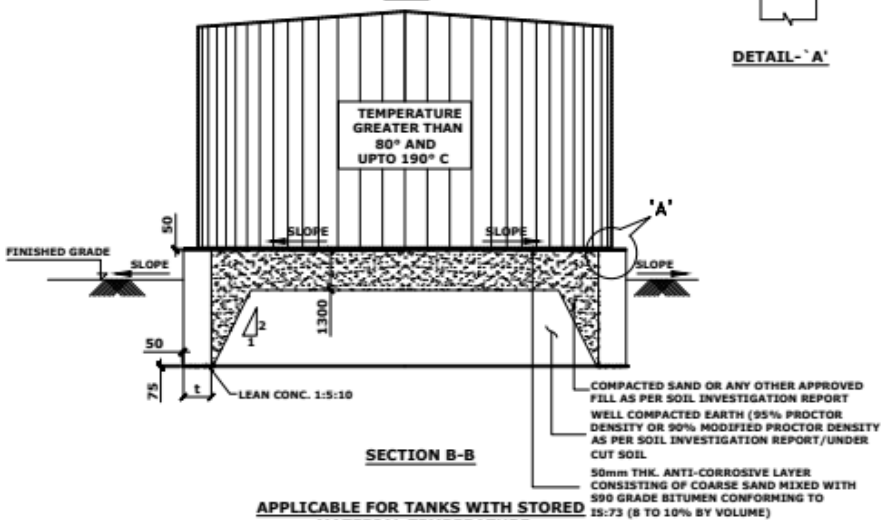
STANDARD FOR DETAIL OF RING WALL FOUNDATION FOR STORAGE TANKS (LIQUID TEMP. UPTO 190° C)		STANDARD DRAWING NO.	REV.	SIZE
SHEET NO.	3 OF 4		03	A4



PLAN



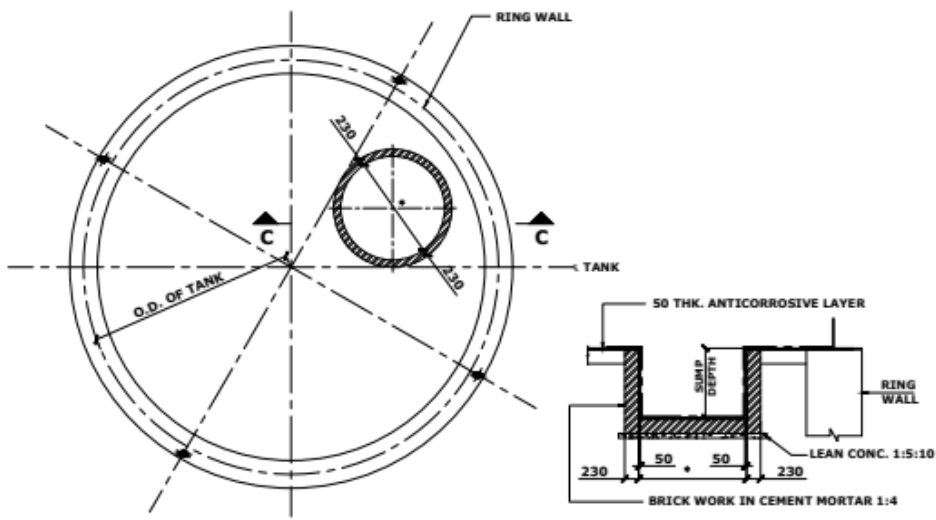
DETAIL - 'A'



SECTION B-B

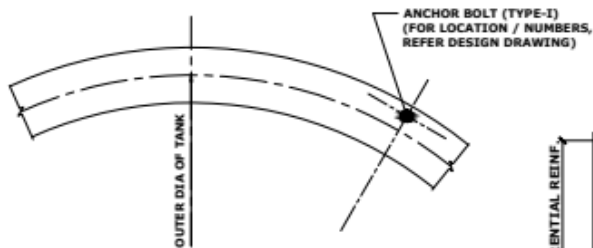
**APPLICABLE FOR TANKS WITH STORED  
MATERIAL TEMPERATURE  
GREATER THAN 80° C AND UPTO 190° C**

E	STANDARD FOR DETAIL OF RING WALL FOUNDATION FOR STORAGE TANKS (LIQUID TEMP. UPTO 190° C)	STANDARD DRAWING NO.		REV.	SIZE
		SHEET NO.		03	A4
		4 OF 4			

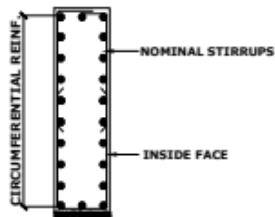


**TYPICAL DETAIL FOR DRAIN PIT**  
(FOR ORIENTATION AND LOCATION REFER TANK DATA)

**SECTION C-C**  
\* = DIMENSION AS PER TANK DATA SHEET

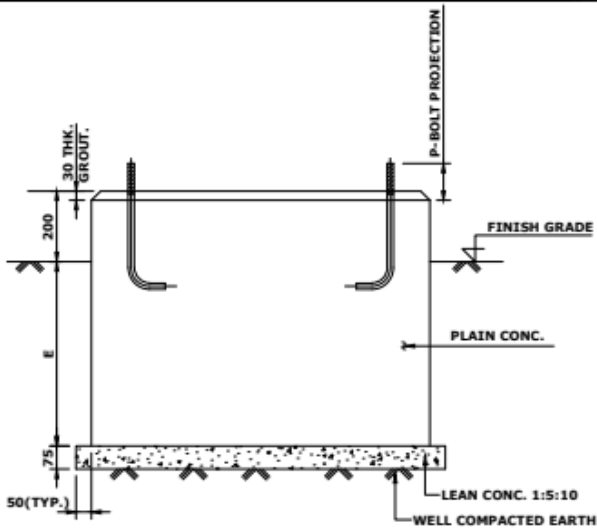


**TYP. DET. OF RING WALL AT ANCHOR BOLT LOCATION**

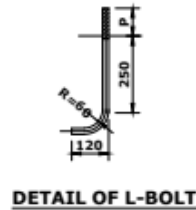


**TYP. DETAIL OF REINF.**

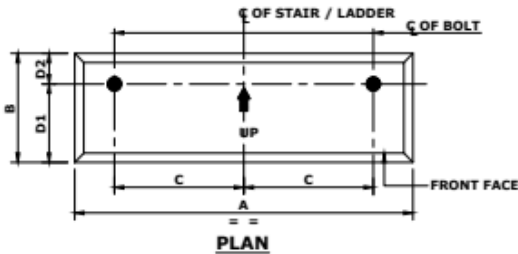
STANDARD FOR DETAIL OF PEDESTAL FOR STAIR / LADDER	STANDARD DRAWING NO.	REV.	SIZE
	SHEET NO.	1 OF 1	03 A4



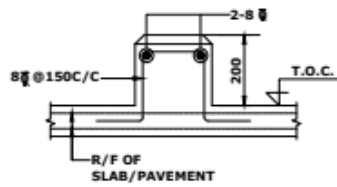
**PEDESTAL FOR UNPAVED AREA**



**DETAIL OF L-BOLT**



**PLAN**

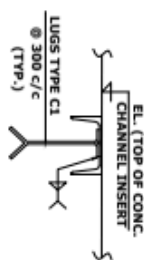
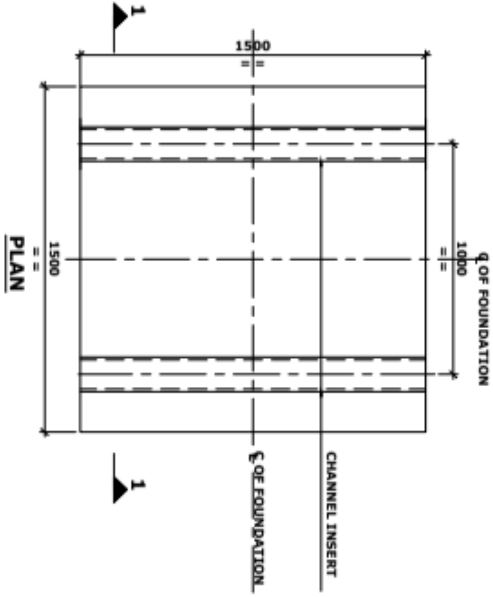
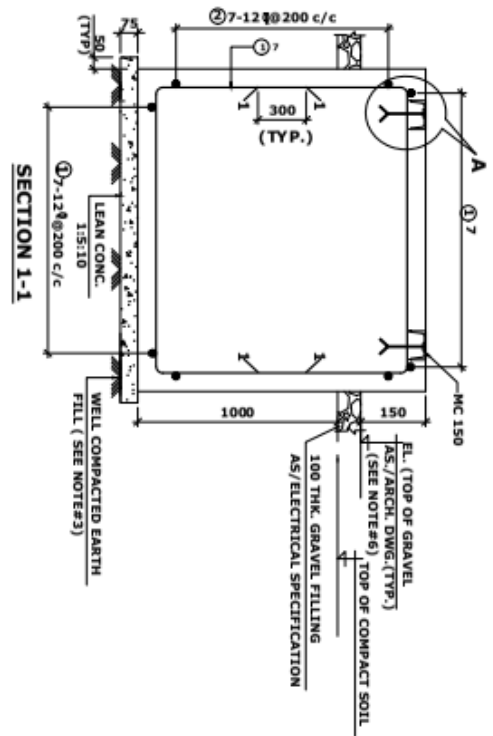


**PEDESTAL ON CONC. PAVEMENT/R.C.C.SLAB**

S.NO.	ITEM	WIDTH	A	B	C	D1	D2	P	E	NUT	REMARKS
1	LADDER	450	750	300	280	200	100	90	500	SINGLE	
2	STAIR	750	1100	310	421	160	150	90	600	SINGLE	FOR STRINGER BEAM MC150
3	STAIR	750	1100	355	421	255	100	90	600	SINGLE	FOR STRINGER BEAM MC200

**NOTES :-**

1. IN CASE OF PEDESTAL OVER PILE CAP/RCC FOUNDATION, DIMENSION E TO SUIT ACCORDINGLY BUT NOT TO EXCEED VALUES GIVEN IN ABOVE TABLE.
2. CONCRETE GRADE SHALL BE AS PER GENERAL NOTES OF THE PROJECT BUT NOT LOWER THEN M25.
3. M20 L-BOLT AS PER DETAIL GIVEN ABOVE SHALL BE PROVIDED.
4. BOLTS SHALL BE TURNED FROM MILD STEEL BARS CONFORMING TO IS:2062 GRADE-A.
5. HEXAGONAL NUTS AND WASHERS SHALL CONFORM TO IS:1363 AND IS:3138.
6. THREADING SHALL BE COARSE AND CONFORM TO IS:1367 AND IS 4218.



FOR LOCATION & LAYOUT OF TRANSFORMER FDN. REFER RELEVANT ELECTRICAL DRGS.

**NOTES:**

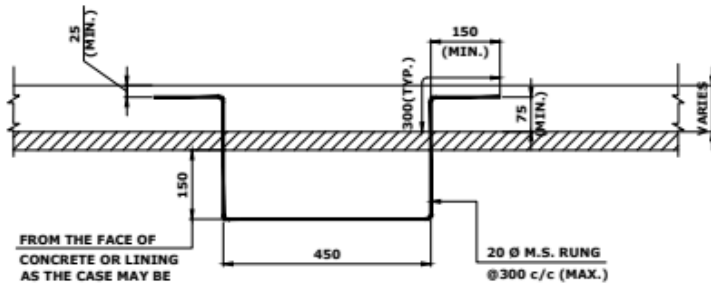
1. CONCRETE GRADE SHALL BE AS PER GENERAL NOTES OF THE PROJECT BUT NOT LOWER THAN M25.
2. R/F SHALL BE HIGH YIELD STRENGTH DEFORMED BARS CONFORMING TO IS:1786 GRADE Fe 415 (MIN.)
3. FOUNDATION SHALL REST ON WELL COMPACTED EARTH FILL AS/ SPECIFICATIONS.
4. SUITABLE END STOPPERS SHALL BE PROVIDED (BY OTHERS) AT CHANNEL ENDS AFTER THE INSTALLATION OF TRANSFORMER.
5. SBC OF SOIL CONSIDERED IS 5 MT/m<sup>2</sup> AND A MAXIMUM EQUIPMENT WEIGHT OF 6.5 MT.
6. TOP OF COMPACTED SOIL FILL SHALL BE 50mm ABOVE THE TOP OF APPROACH ROAD LEVEL.

TYPE	BAR MARK	Ψ	A	B	C	CUT LENGTH (mm)	NOS. REQD.	TOTAL LENGTH (mm)	UNIT WT. IN Kg./m	QUANTITIES FOR ONE SET				REMARKS
										HYD. BARS (kg.)	CONC. 15:10 (m <sup>3</sup> )	STRL. CONC. (m <sup>3</sup> )	STRL. STEEL (kg.)	
①	12	1400	750	750	2825	28	79100	0.89	108.00	0.34	3.00	50.00		
②	12	1400	850	850	3025	14	42350	0.89						

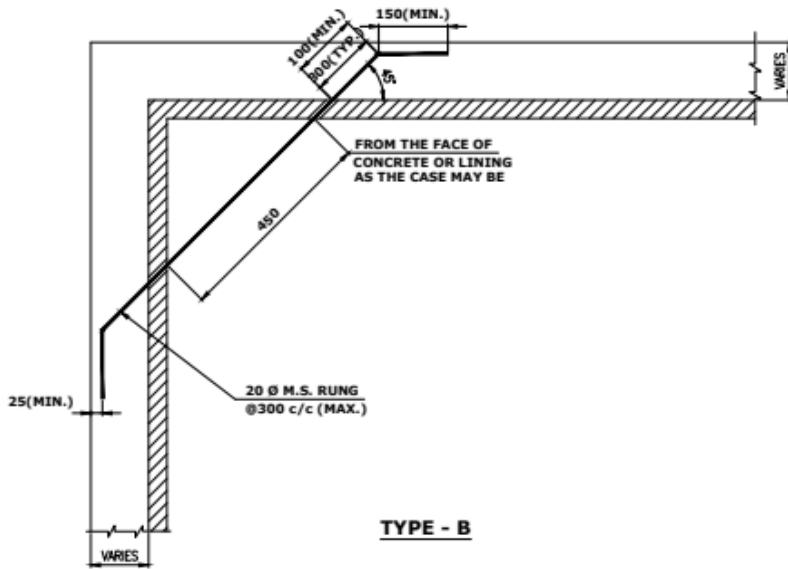
STANDARD FOR DETAIL OF BLOCK FOUNDATION FOR TRANSFORMERS (UPTO 2000KVA RATING)

STANDARD FOR DETAIL  
OF M.S. RUNGS FOR CONC. STRUCTURES

STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.	1 OF 1	03	A4



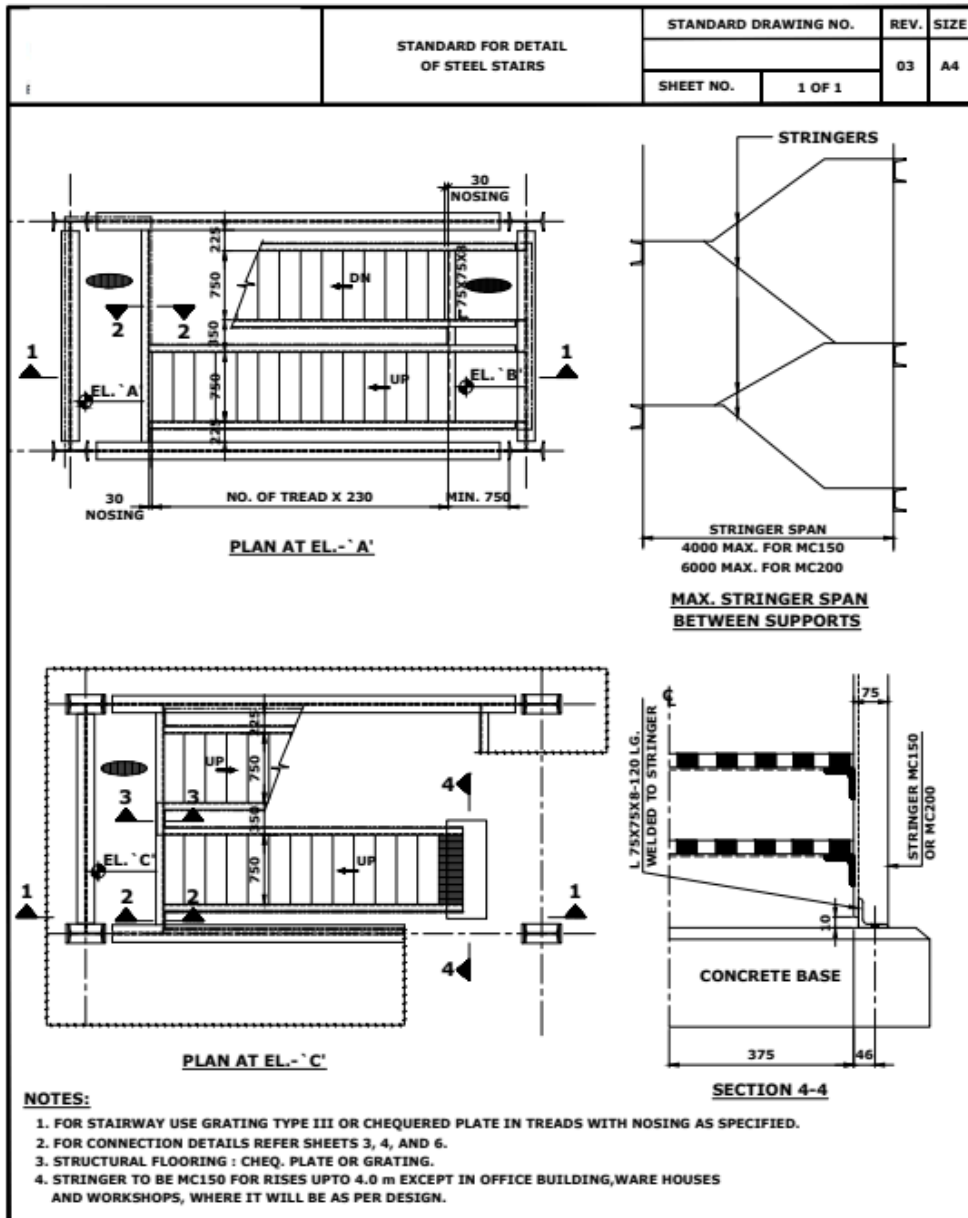
**TYPE - A**



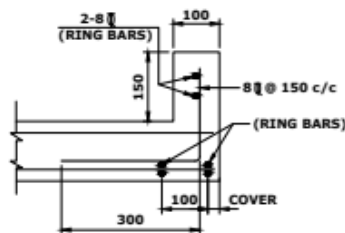
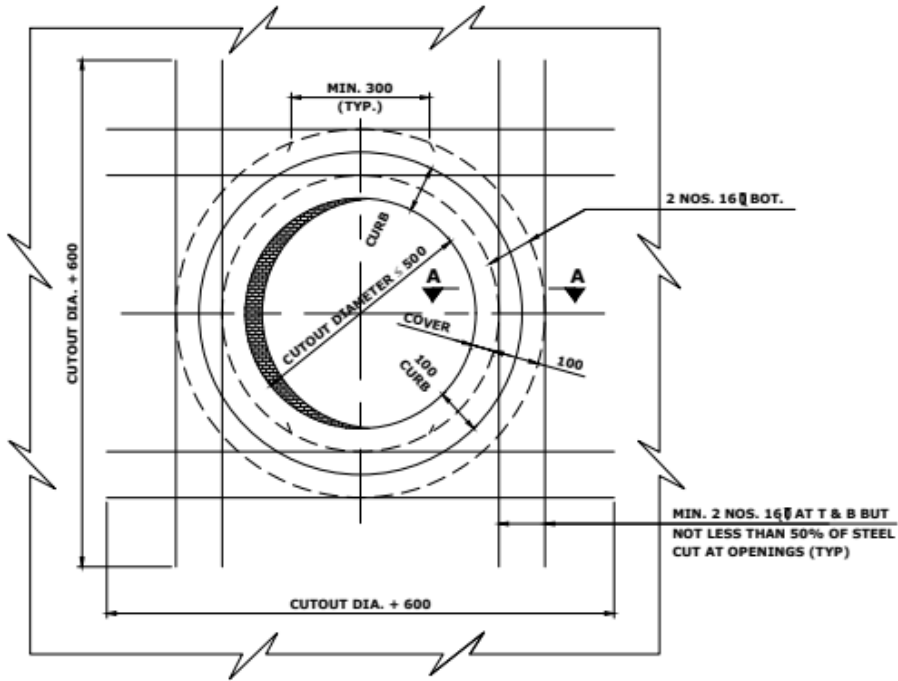
**TYPE - B**

**NOTES :-**

1. ALL DIMENSIONS ARE IN mm.
2. FIRST RUNG SHALL BE AT 300mm FROM TOP.



STANDARD FOR DETAIL OF REINFORCEMENT AT CIRCULAR CUT-OUT IN SLAB	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	1 OF 1	03	A4

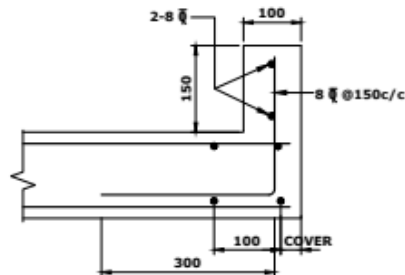
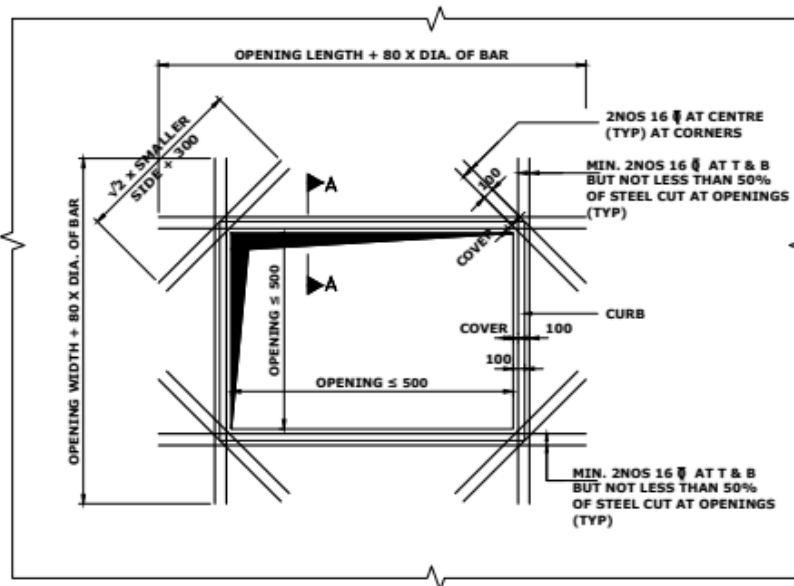


**SECTION: A-A**

**NOTES :-**

1. ALL DIMENSIONS ARE IN mm.
2. ALL THE BARS SHALL BE EFFECTIVELY TIED WITH THE MAIN REINFORCEMENT BARS CUT OR SPLAYED NEAR THE OPENING AS PER THE DIRECTION OF THE ENGINEER-IN-CHARGE.
3. THIS DETAIL APPLIES TO SLABS UPTO 200 THK.
4. OMIT CURB WHERE SPECIFICALLY STATED ON DRAWINGS.

	STANDARD FOR DETAIL OF REINFORCEMENT AT SQ. / RECT. CUT-OUT IN SLAB	STANDARD DRAWING NO.		REV.	SIZE
		SHEET NO.	1 OF 1	03	A4

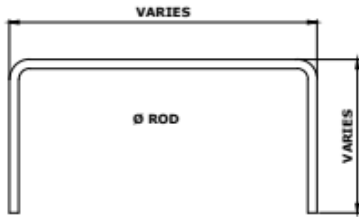


**SECTION: A-A**

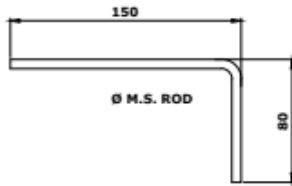
**NOTES:-**

1. ALL DIMENSIONS ARE IN mm.
2. EXTRA BARS MAY BE OMITTED IF A BEAM IS PROVIDED AT THE RELEVANT EDGE.
3. CORNER BAR MAY BE OMITTED IF TWO BEAMS MEET AT THE RELEVANT CORNER.
4. ALL THE BARS MENTIONED ABOVE SHALL BE EFFECTIVELY TIED WITH THE MAIN REINFORCEMENT BARS CUT OR SPLAYED NEAR OPENING AS DIRECTED BY ENGINEER-IN-CHARGE.
5. OMIT CURB WHERE SPECIFICALLY STATED ON DRAWING.
6. THIS DETAIL APPLIES TO SLABS UPTO 200 THK.

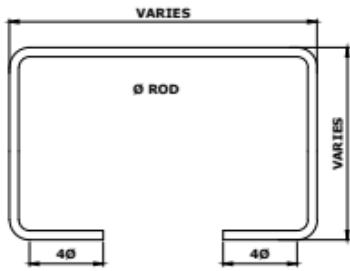
STANDARD FOR DETAIL OF LUGS	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	1 OF 1	03	A4



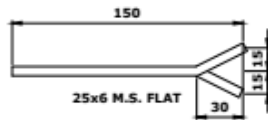
**TYPE-`A1`**



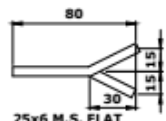
**TYPE-`B`**



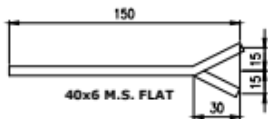
**TYPE-`A2`**



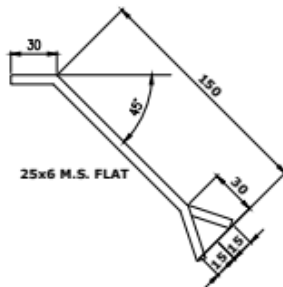
**TYPE-`C1`**



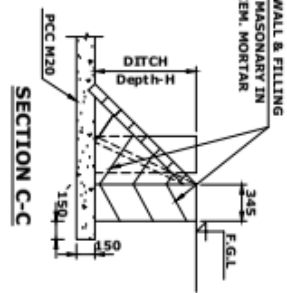
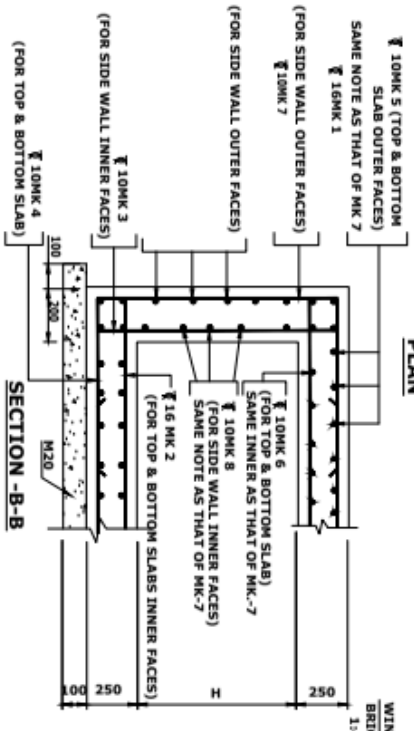
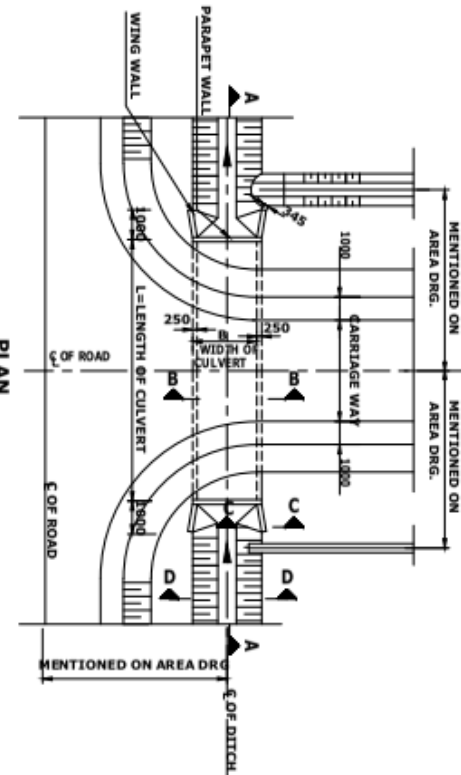
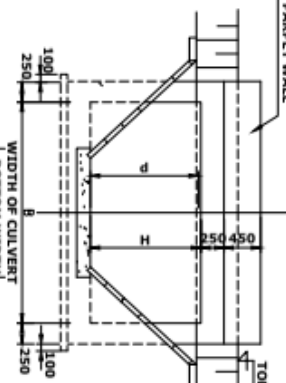
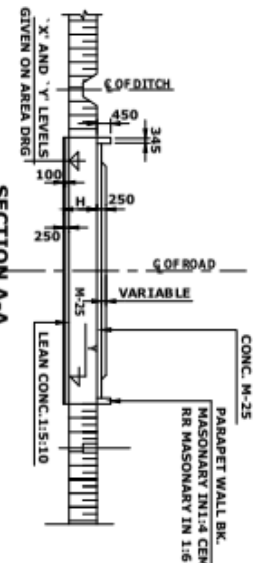
**TYPE-`C3`**



**TYPE-`C2`**



**TYPE-`C4`**



- NOTES:-**
1. ALL DIMENSIONS ARE IN MM EXCEPT LEVELS WHICH ARE IN METRES.
  2. BOX CULVERT ARE DESIGNED FOR I.R.C CLASS 'A' & CLASS 'AA' LOADING.
  3. ALL REINFORCEMENT SHOWN THUS SHALL BE OF COLD TWISTED, DEFORMED BARS CONFORMING TO IS 1786-LATEST.
  4. BARS BENDING SHALL CONFORM TO IS 2502
  5. REINFORCEMENT CONCRETE SHALL BE M-25 CONFORMING TO IS : 456 LATEST
  6. ALL BRICK WORK SHALL BE IN 1:4 CEMENT MORTAR AS PER IS : 2212
  7. OVERLAP FOR BARS SHALL BE 50D AND SHALL BE STAGGERED.
  8. FOR AGGRESSIVE SOIL PCC M20 AND RCC M25 SHALL BE USED.

**STANDARD DIMENSIONS OF BOX CULVERT WITH BILLS OF MATERIAL**

TYPE	WIDTH DEPTH (BXH)	PER METRE LENGTH OF CULVERT		WING WALL & PARAPET PER CULVERT	
		WEIGHT OF REINFORCEMENT	CONC. 1:5:10	CONC. 1:4:8	BR.WALL IN 1:3 CEM PLASTER 1:4 MORTAR -TER 13mm THK.
I	1700X850	16.0, 1.1T	0.21M <sup>3</sup>	1.53M <sup>3</sup>	0.25M <sup>3</sup>
II	2000X1000	16.0, 1.6T	0.27M <sup>3</sup>	1.75M <sup>3</sup>	0.25M <sup>3</sup>
III	2200X1100	16.0, 1.29T	0.291M <sup>3</sup>	1.90M <sup>3</sup>	0.25M <sup>3</sup>
IV	2600X1300	16.0, 1.44T	0.33M <sup>3</sup>	2.20M <sup>3</sup>	0.25M <sup>3</sup>

**REINFORCEMENT BENDING SCHEDULE**

MARK	TYPE OF CULVERT	STEEL DIA & SPACING	MARK 2 3 4		CUT LENGTH
			A	B	
MK-1	I	016 150C/C	1250	725	2704
	II	016 125C/C	1400	850	3004
	III	016 100C/C	1500	930	3264
	IV	016 100C/C	1700	1070	3744
MK-2	I	016 150C/C	2100	2100	2100
	II	016 125C/C	2400	2400	2400
	III	016 100C/C	2600	2600	2600
	IV	016 100C/C	3000	3000	3000
MK-3	I	010 200C/C	1250	1250	1250
	II	010 200C/C	1400	1400	1400
	III	010 200C/C	1500	1500	1500
	IV	010 200C/C	1700	1700	1700
MK-4	I	010 200C/C	2100	2100	2100
	II	010 200C/C	2400	2400	2400
	III	010 200C/C	2600	2600	2600
	IV	010 200C/C	3000	3000	3000
MK-5	I	010 200C/C	BARS OF VARYING LENGTH		
	II	010 200C/C	BARS OF VARYING LENGTH		
	III	010 200C/C	BARS OF VARYING LENGTH		
	IV	010 200C/C	BARS OF VARYING LENGTH		

STANDARD FOR DETAIL OF BOX CULVERT TYPE-I,II,III & IV

STANDARD FOR DETAIL  
OF TYPICAL GRATING SPORT.

STANDARD DRAWING NO.

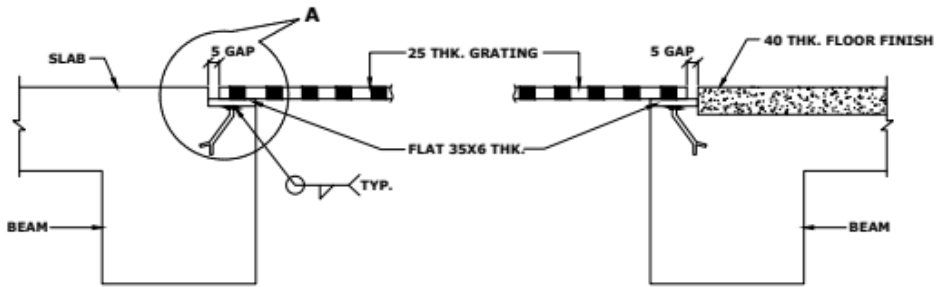
REV.

SIZE

SHEET NO. 1 OF 1

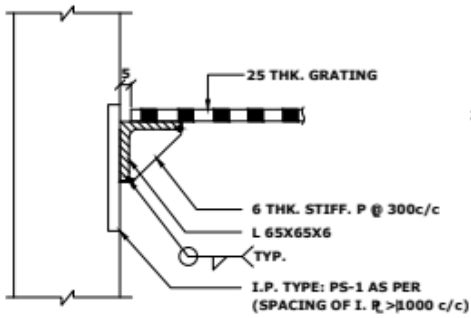
03

A4

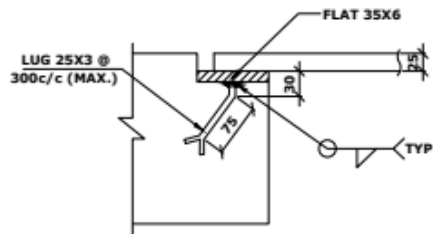


**GRATING SUPPORT OVER BEAM  
WITHOUT FLOOR FINISH**

**GRATING SUPPORT OVER BEAM  
WITH FLOOR FINISH**



**GRATING SUPPORT ON WALL/COLUMN**

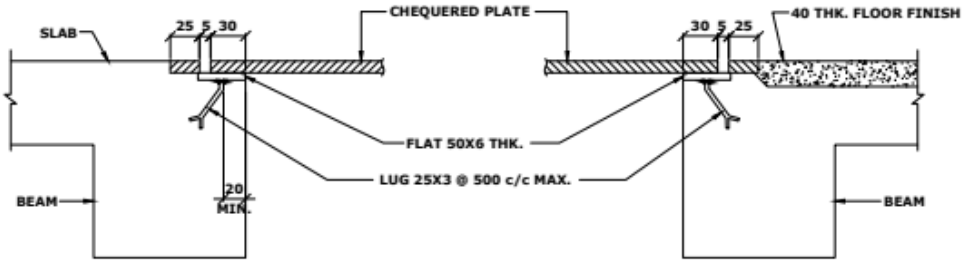


**DETAIL 'A'**

**NOTES:**

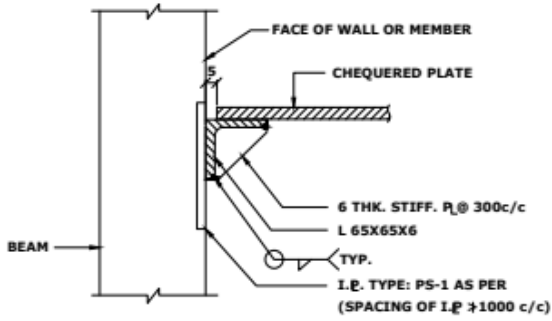
1. M.S. LUGS SHALL BE SUITABLY BENT IF CONCRETE THICKNESS IS LESS THAN THE LENGTH OF LUGS OR LUGS INTERFERE WITH R/F BARS.
2. ALL DIMENSIONS ARE IN mm.

STANDARD FOR DETAIL TYPICAL CHEQUERED PLATE SUPPORT.	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.		03	A4
	1 OF 1			



**CHQD. R SUPPORT OVER BEAM  
WITHOUT FLOOR FINISH**

**CHQD. P<sub>1</sub> SUPPORT OVER BEAM  
WITH FLOOR FINISH**



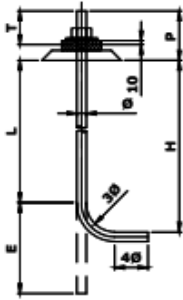
**GRATING SUPPORT ON WALL/COLUMN**

**NOTES:**

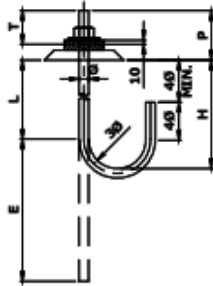
1. M.S. LUGS SHALL BE SUITABLY BENT IF CONCRETE THICKNESS IS LESS THAN THE LENGTH OF LUGS OR LUGS INTERFERE WITH R/F BARS.
2. ALL DIMENSIONS ARE IN mm.

M.S. ANCHOR BOLT ASSEMBLIES		STANDARD DRAWING NO.	REV.	SIZE
		SHEET NO. 1 OF 4		03 A4

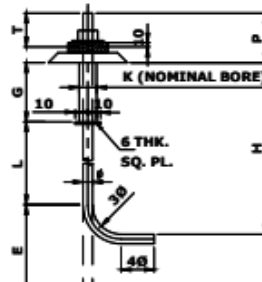
GRADE OF CONC.	BOLT TYPE	DIMENSIONS MM	BOLT DIA ( Ø ) IN MM											
			10	12	16	18	20	22	24	27	30	33	36	39
M25	I & III	L	200	250	400	600	450	550	550	650	700	800	850	950
		E	95	115	155	170	190	210	230	255	285	315	345	370
		H	230	286	448	454	510	616	622	731	790	899	958	1067
		TYPE-III	380	436	598	604	810	916	922	1181	1240	1349	1408	1517
	II & IV	L	150	150	250	250	300	350	350	450	500	550	600	650
		E	150	180	240	270	300	330	360	405	450	495	540	585
		H	180	186	298	304	360	416	422	531	590	649	708	767
		TYPE-IV	330	336	440	454	660	716	722	981	1040	1099	1158	1217
M30	I & III	L	180	220	315	335	390	445	470	550	600	680	735	815
		E	95	115	155	170	190	210	230	255	285	315	345	370
		H	210	260	365	390	450	515	545	635	690	780	845	935
		TYPE-III	360	410	515	540	750	815	845	1085	1140	1230	1295	1385
	II & IV	L	150	150	200	200	250	275	300	350	375	425	450	500
		E	150	180	240	270	300	330	360	405	450	495	540	585
		H	180	190	250	255	310	345	375	435	465	525	560	620
		TYPE-IV	330	340	400	405	610	645	675	885	915	975	1010	1070



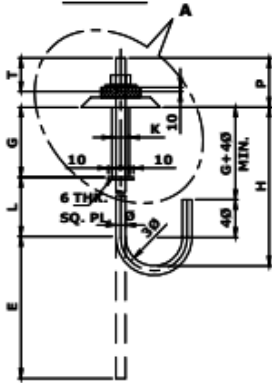
**TYPE-I**



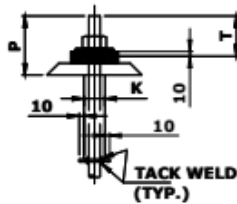
**TYPE-II**



**TYPE-III**



**TYPE-IV**



**DETAIL-A (TYP.)**

M.S. ANCHOR BOLT ASSEMBLIES

STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.		03	A4
2 OF 4			

GRADE OF CONC.	BOLT TYPE	DIMENSIONS MM		BOLT DIA ( Ø ) IN MM																							
		SLEEVE	THREADED (T) LENGTH	10	12	16	18	20	22	24	27	30	33	36	39	42	45	48	52	56	60	64	68	72			
M25&M30	III & IV	G		150	150	150	150	300	300	300	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450		
		K		50	50	50	50	50	50	50	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80		
	I TO IV		SINGLE NUT	40	45	55	60	65	70	75	80	90	95	100													
	IX & XII		DOUBLE NUT	50	60	70	75	80	90	95	105	110	120	130	140												
M25	V	G		150	150	200	200	300	300	300	450	450	450	550	600	650	700	750	800	900	900	1000	1000	1000			
		H		210	222	234	291	398	410	417	580	585	598	608	772	786	841	905	975	1035	1150	1171	1281	1350			
	V & VI		W	80	80	90	100	100	130	130	140	150	170	180	200	210	220	230	260	270	290	320	330	350			
		L3		10	12	16	16	20	20	25	25	28	32	36	36	40	45	50	56	56	63	63	63	63			
M30	VII	L						350	400	400	500	550	600	750	950	1050	1100	1150	1500	1750	1900	2100	2300	2300			
		L																									
	VIII	C																									
		C																									
	V	G		150	150	150	200	300	300	300	450	450	450	550	600	650	700	750	800	900	900	1000	1000				
		H		210	225	235	290	400	410	415	580	585	600	610	675	690	745	805	875	955	1050	1075	1185	1300			
	V & VI		W	80	80	90	100	100	100	100	110	110	140	160	200	210	220	230	260	270	290	320	330	350			
		L3		10	12	16	16	20	20	25	25	28	32	36	36	40	45	50	56	56	63	63	63	63			
	VII	L						275	325	325	375	425	500	600	750	850	975	1000	1075	1225	1375	1525	1675	1850			
		L																									
	VIII	C																									
		C																									

M.S. ANCHOR BOLT ASSEMBLIES

STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.		03	A4
3 OF 4			

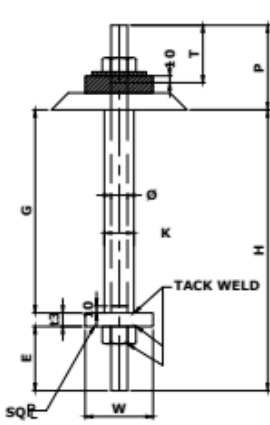
GRADE OF CONC.	BOLT TYPE	DIMENSIONS MM	BOLT DIA. (Ø) IN MM																				
			10	12	16	18	22	24	27	30	33	36	39	42	45	48	52	56	60	64	68	72	
M 25&M30	V & VI	E	50	60	70	75	80	90	95	105	110	120	130	140	150	155	165	180	190	200	215	225	240
	V, VI, & VII	K	50	50	50	50	50	80	80	80	80	80	80	100	100	100	100	125	125	150	150	150	150
M 25&M30	VII & VIII	THREADED (T)	40	45	55	60	60	65	70	75	80	80	95	100	105	110	120	125	135	140	150	160	165
	VII & VIII	LENGTH	50	60	70	75	80	90	95	105	110	120	130	140	150	155	165	180	190	200	215	225	240
M 25	VII & VIII	CS	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	VII & VIII	G	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
M 30	IX	L	80	100	150	170	200																
	XI	L	18	20	310	335	385	435	465	535	590	660	720										
M 30		L	15	15	150	200	225	250	275	300	350	375	425	450									

NOTES :-

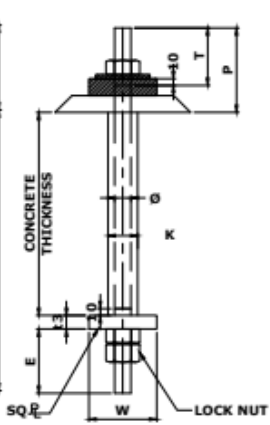
- BOLTS SHALL BE MARKED ON THE DRAWING AS UNDER :
  - A B C D P
  - PROJECTION ABOVE CONCRETE
  - SINGLE NUT (N1) OR DOUBLE NUT (N2)
  - DIAMETER OF BOLT
  - TYPE OF BOLT
  - NO OF BOLTS
- 4.9- 6-IV-M27-M1-200
- BOLTS SHALL BE TURNED FROM M.S. ROUNDS CONFORMING TO IS 2062
- NUTS AND WASHERS SHALL CONFORM TO IS:1363 AND IS 3138.
- THREADED SHALL BE COARSE CONFORMING TO IS:1367 AND IS 4218
- ANCHOR BOLTS SHALL BE SET ACCURATELY AND HELD IN POSITION BY TEMPLATE BEFORE CONCRETING.
- SLAVEE SHALL BE M.S. TUBES (MEDIUM) AS PER IS:1239.
- WITH BOLTS AND SLAVEE FOR BOLT TYPE III, IV, VII AND VIII.
- SLAVEE SHALL BE M.S. TUBES (MEDIUM) AS PER IS:1239.
- REFER DESIGN DRAWINGS FOR PROJECTION (P) OF BOLT ABOVE TOP OF CONCRETE.
- ANCHOR BOLTS SHALL BE TEMPERED BEFORE MACHINING IF MADE BY FORGING. THE FORGING TEMPERATURE SHALL BE A ABOVE 900° C BUT LOWER THAN SUPER HEATING TEMPERA TURE.

<b>M.S. ANCHOR BOLT ASSEMBLIES</b>		STANDARD DRAWING NO.		REV.	SIZE
		SHEET NO.		03	A4

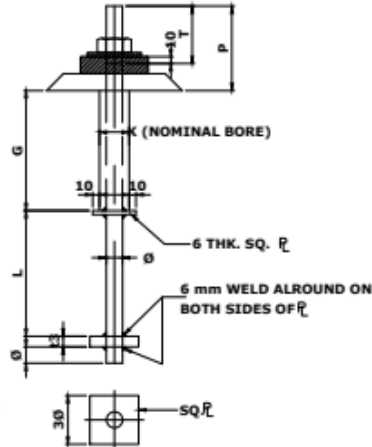
4 OF 4



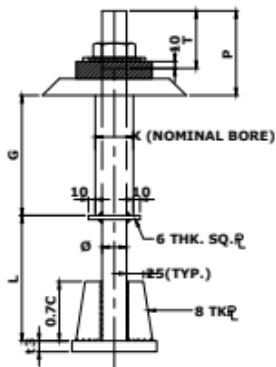
**TYPE-V**



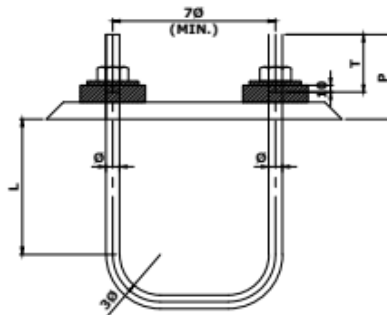
**TYPE-VI**



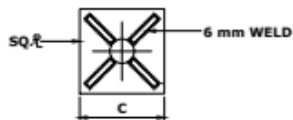
**TYPE-VII**



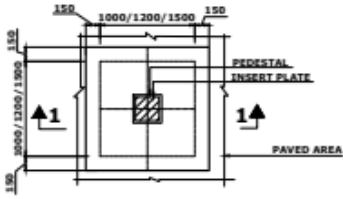
**TYPE-VIII**



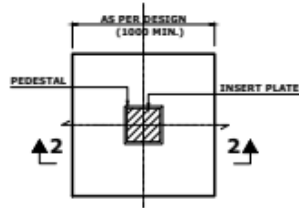
**TYPE-IX**



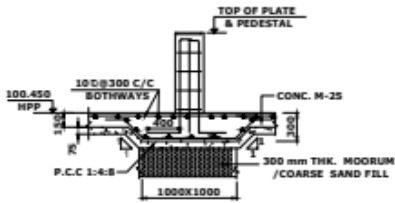
STANDARD FOR DETAIL OF RCC PIPE SUPPORT	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	1 OF 1	03	A4



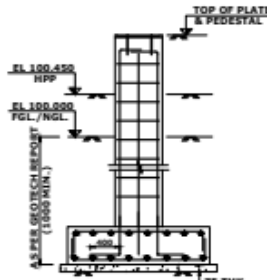
**FOUNDATION PLAN**  
**(FOUNDATION LOAD LESS THAN 8 KN)**



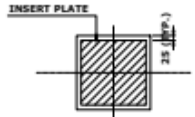
**FOUNDATION PLAN**  
**(FOUNDATION LOAD > 8 KN AND < 15 KN)**



**SECTION 1-1**

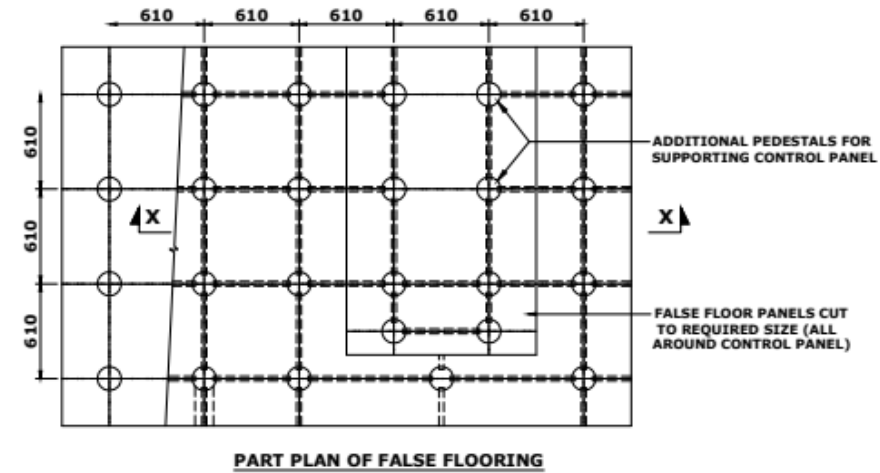
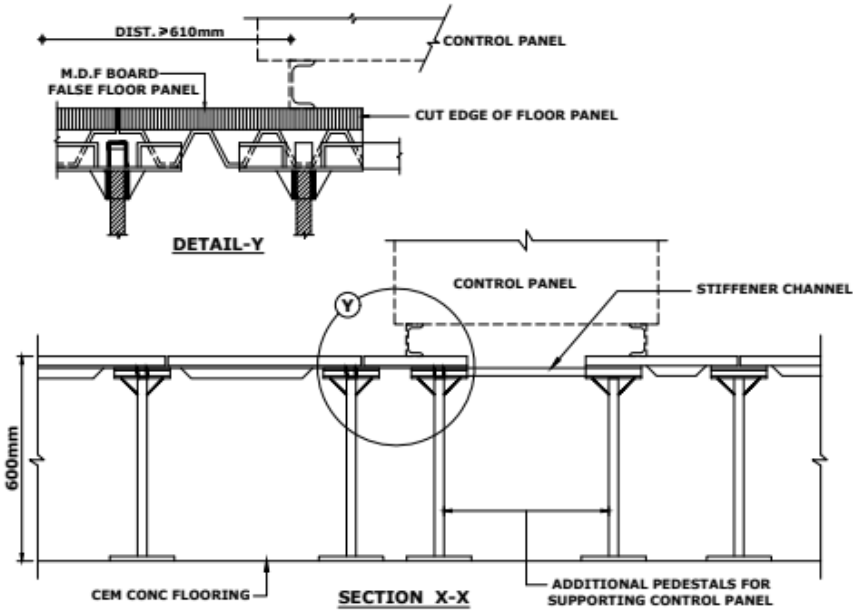


**SECTION 2-2**



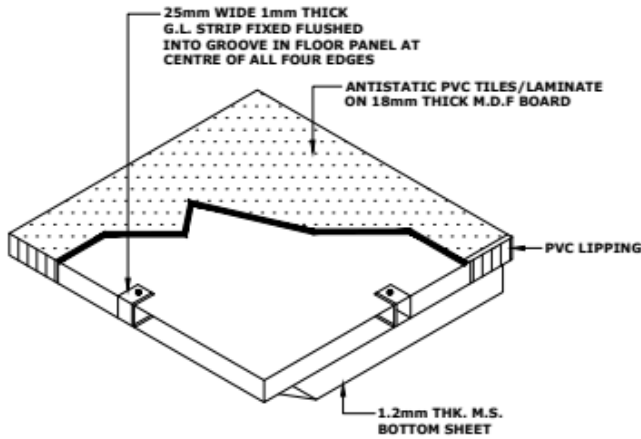
**PEDESTAL PLAN**

STANDARD FOR DETAIL OF FALSE FLOORING	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.		03	A4
	1 OF 3			

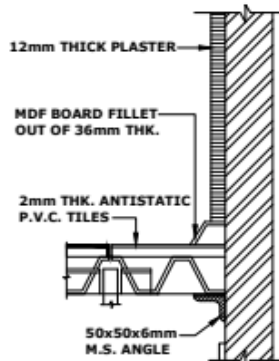


**PART PLAN OF FALSE FLOORING**

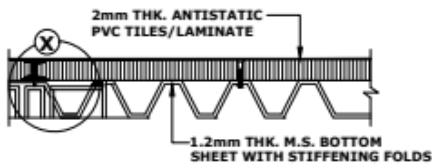
<b>STANDARD FOR DETAIL OF FALSE FLOORING</b>	STANDARD DRAWING NO.		REV.	SIZE
			03	A4
	SHEET NO.	2 OF 3		



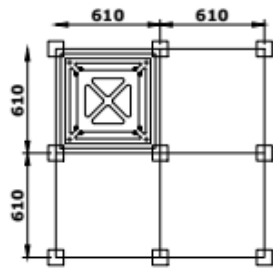
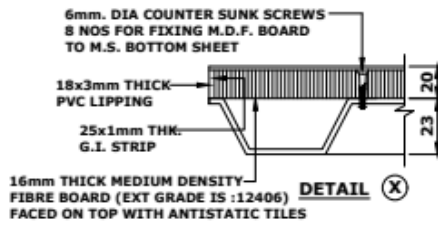
**ISOMETRIC VIEW OF A PANEL**



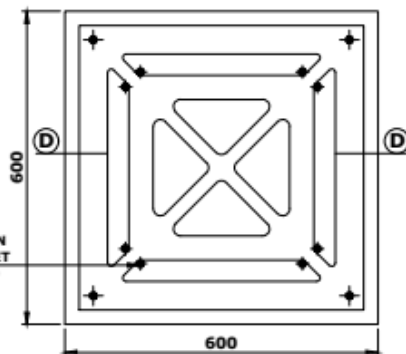
**DET. OF JUNCTION WITH THE WALL**



**SECTION D-D**

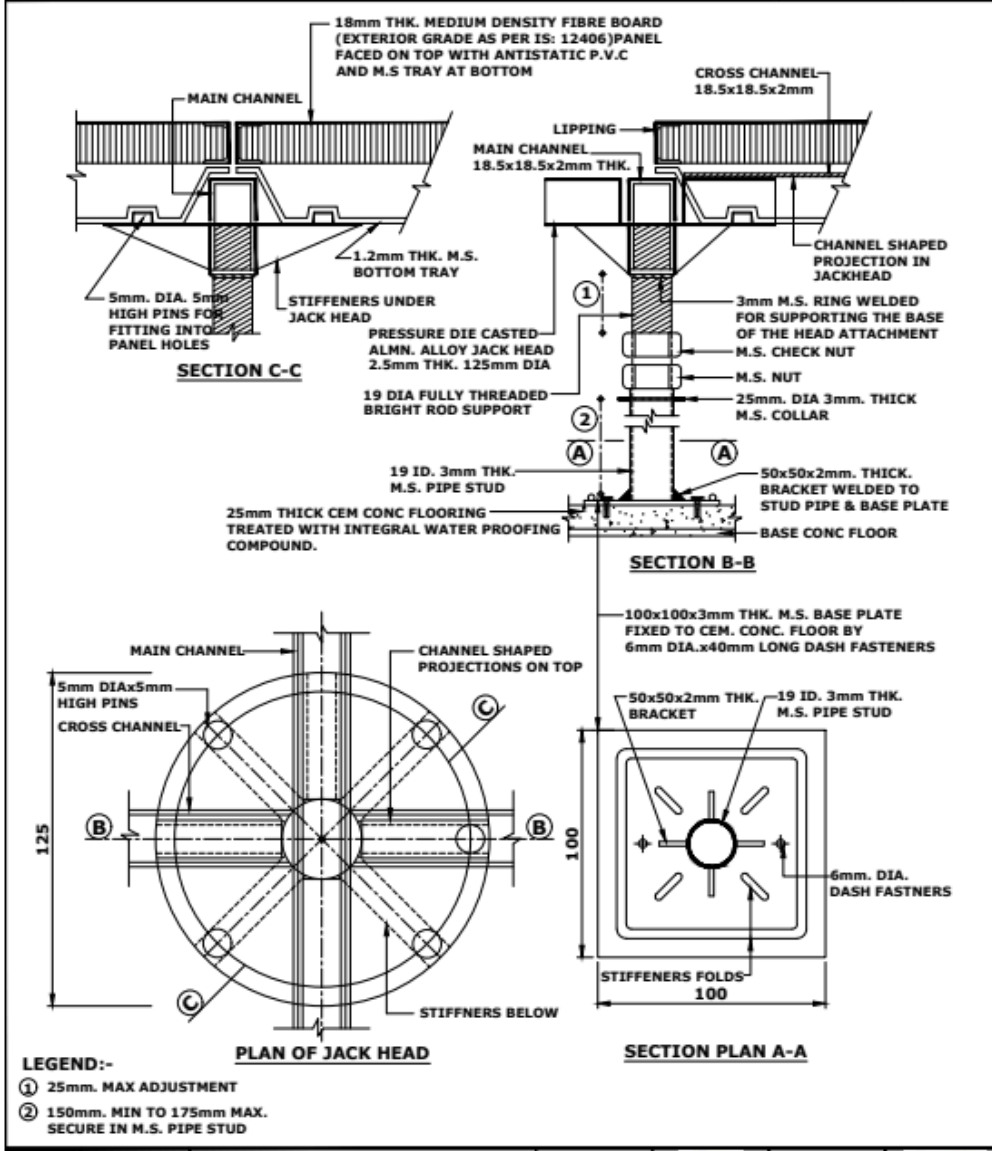


**PART OF GRID PLAN**

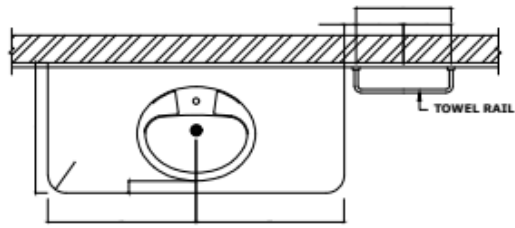


**PLAN OF FLOOR PANEL**

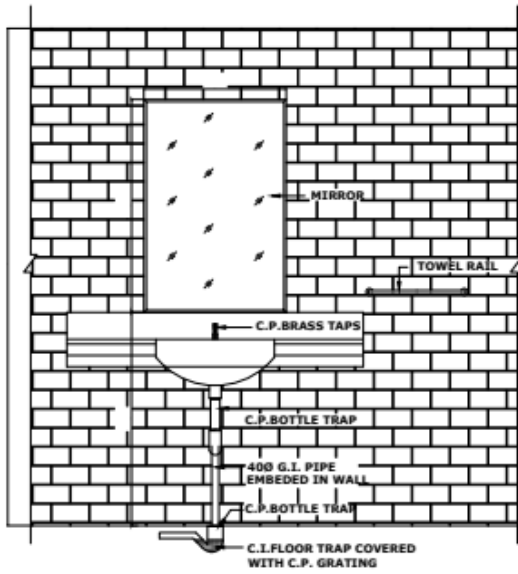
STANDARD FOR DETAIL OF FALSE FLOORING	STANDARD DRAWING NO.		REV.	SIZE
			03	A4
	SHEET NO.	3 OF 3		



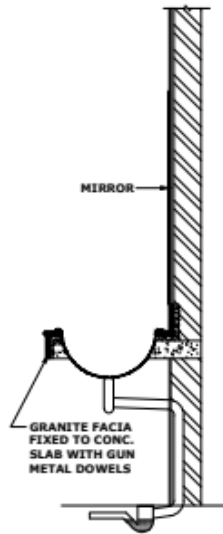
E	STANDARD FOR DETAIL OF WASH BASIN FIXING DETAIL	STANDARD DRAWING NO.		REV.	SIZE
				03	A4
		SHEET NO.	1 OF 1		



**PLAN**

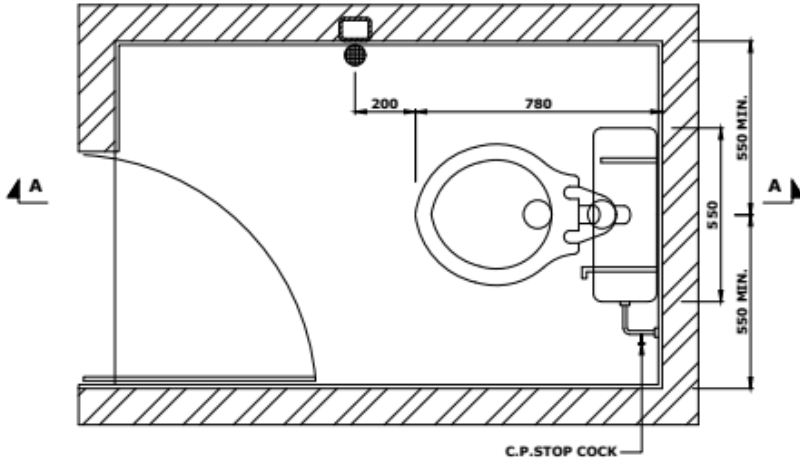


**ELEVATION**

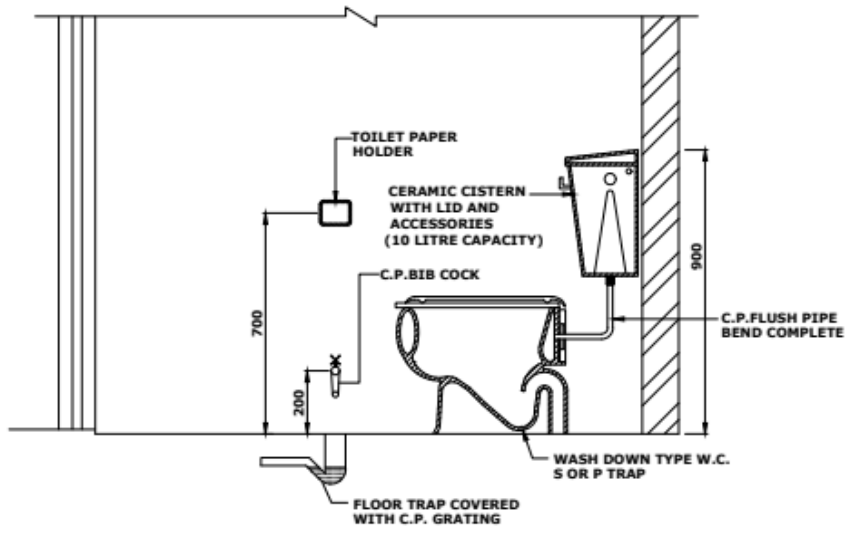


**SECTION**

E	STANDARD FOR DETAIL OF EUROPEAN TYPE W.C. FIXING DETAIL	STANDARD DRAWING NO.		REV.	SIZE
				03	A4
		SHEET NO.	1 OF 1		

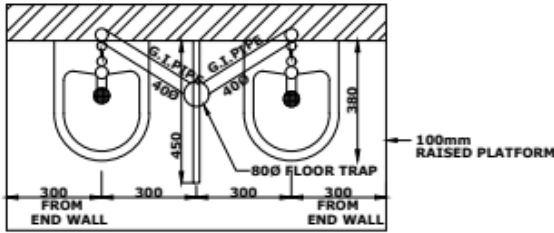


**PLAN**

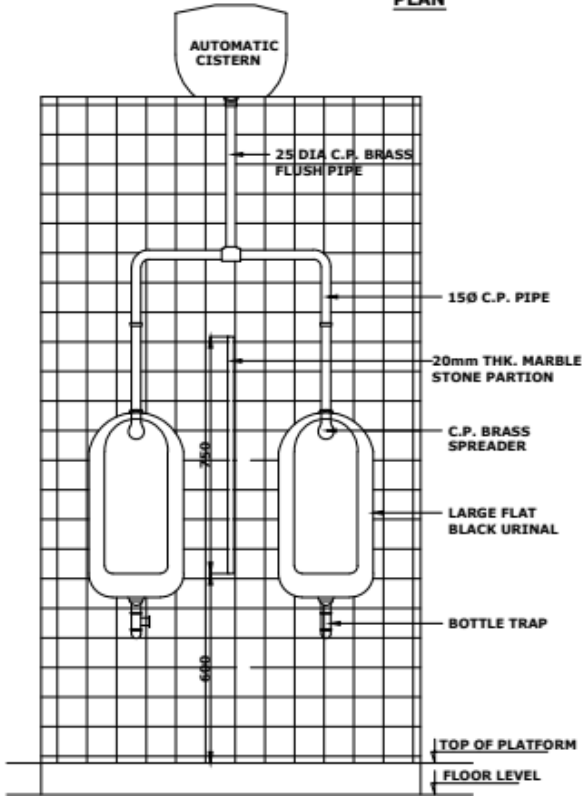


**SECTION A-A**

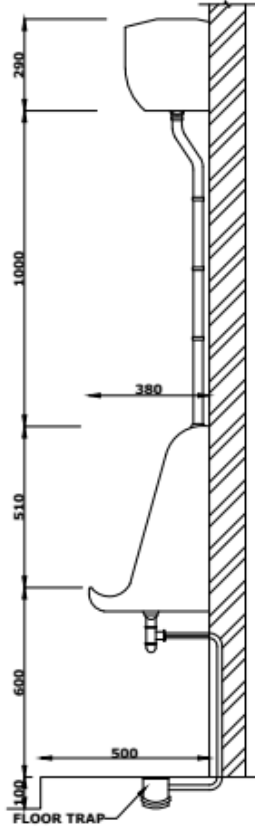
STANDARD FOR DETAIL OF URINAL FIXING DETAIL	STANDARD DRAWING NO.		REV.	SIZE
	1		03	A4
	SHEET NO.	1 OF 1		



**PLAN**



**ELEVATION**



**SIDE ELEVATION**

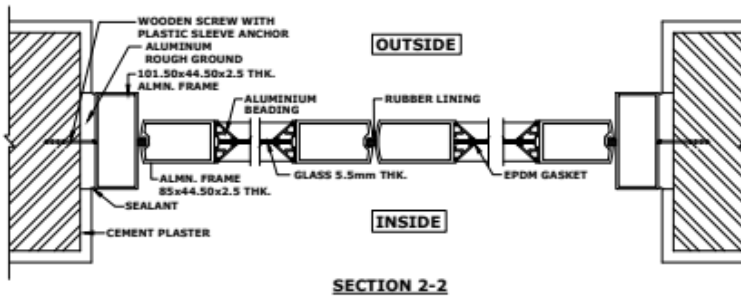
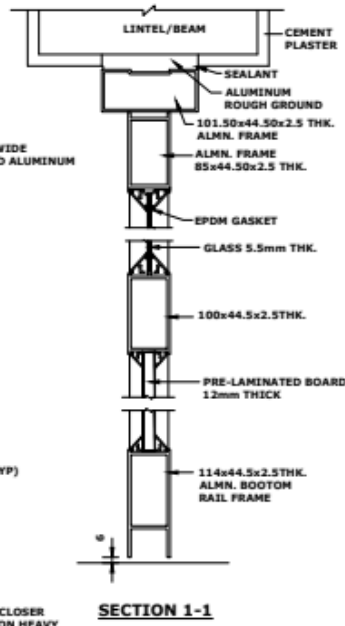
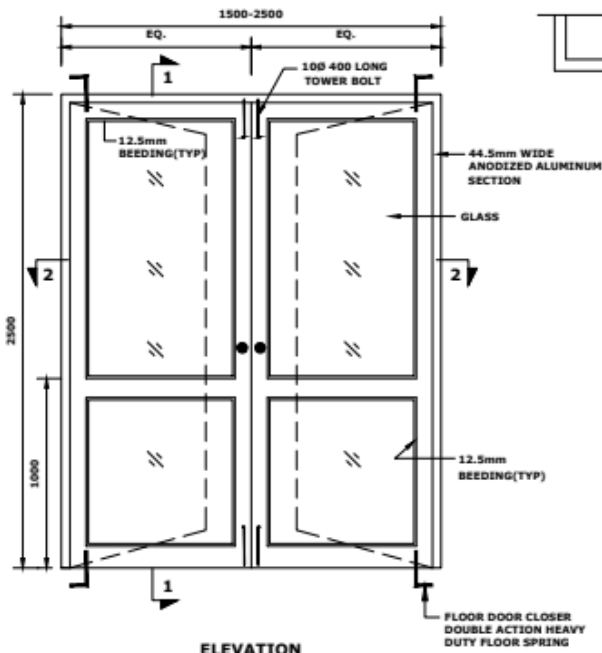
STANDARD FOR DETAIL  
OF GLAZED ALUMINUM DOOR

STANDARD DRAWING NO.

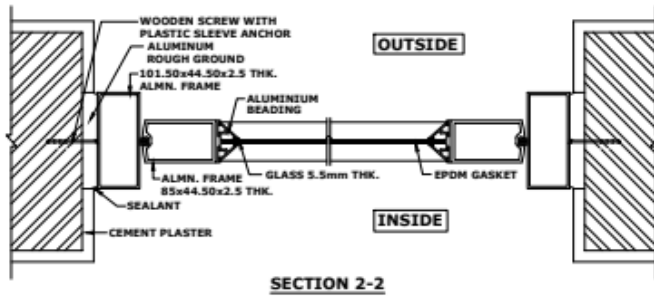
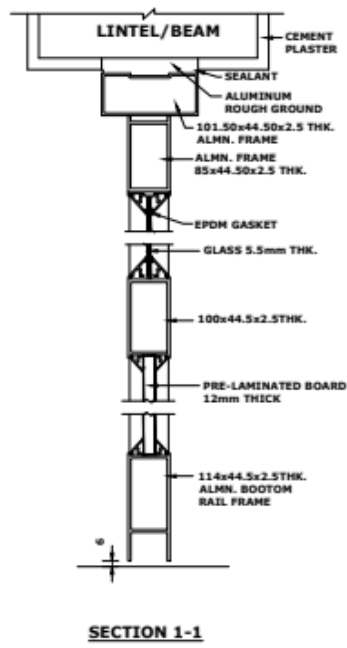
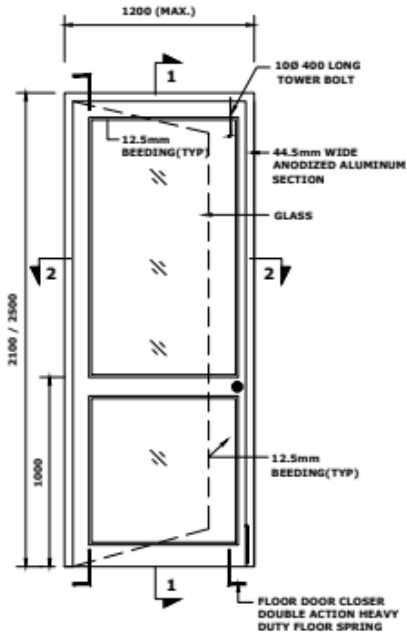
REV. SIZE

03 A4

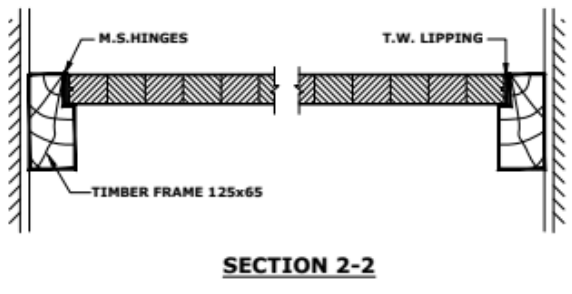
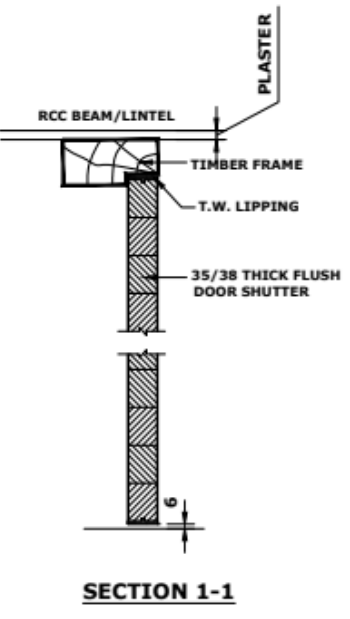
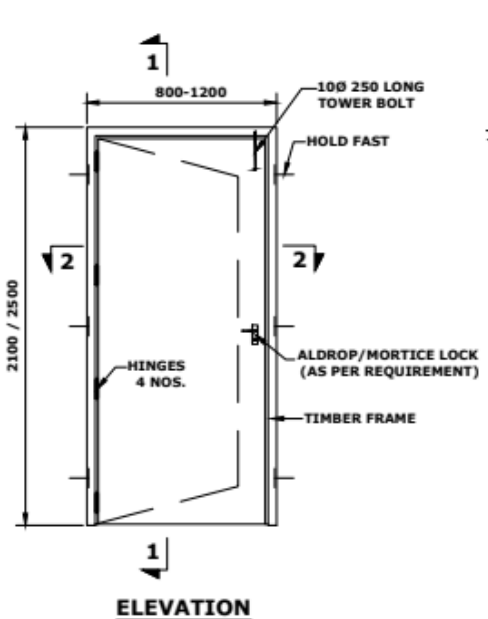
SHEET NO. 1 OF 2



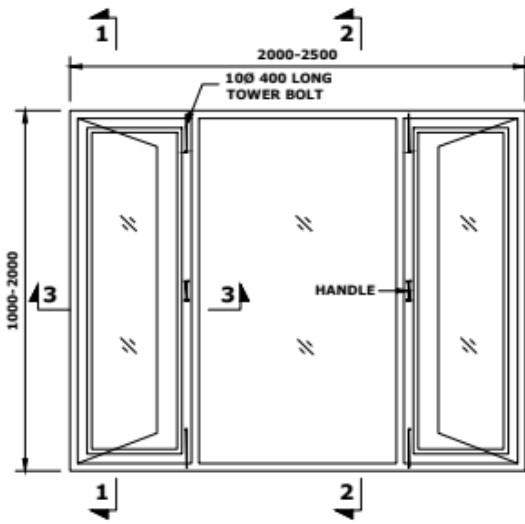
STANDARD FOR DETAIL OF GLAZED ALUMINUM DOOR	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.		03	A4
	2 OF 2			



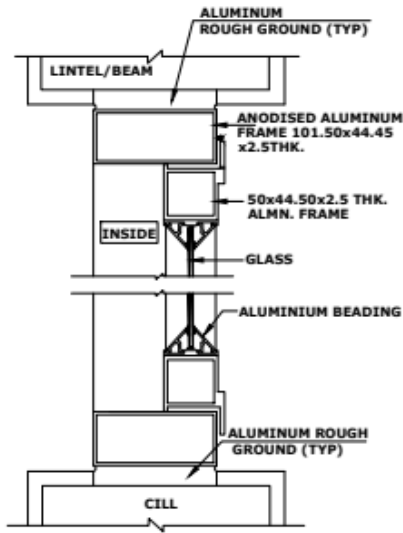
STANDARD FOR DETAIL OF WOODEN FLUSH DOOR	STANDARD DRAWING NO.		REV.	SIZE
			03	A4
	SHEET NO.	1 OF 1		



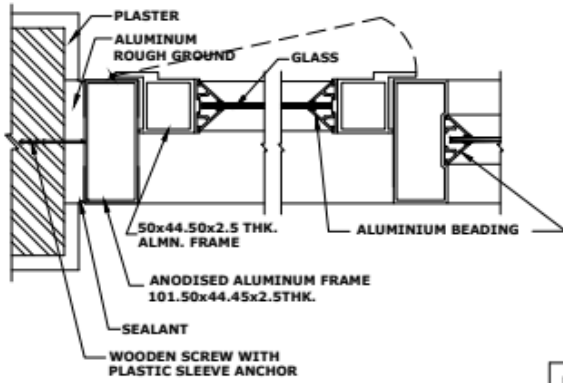
STANDARD FOR DETAIL OF GLAZED ALUMINUM WINDOW		STANDARD DRAWING NO.	REV.	SIZE
		SHEET NO.	1 OF 1	03 A4



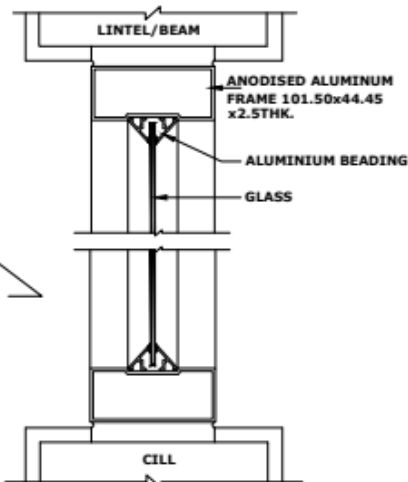
**ELEVATION**



**SECTION 1-1**

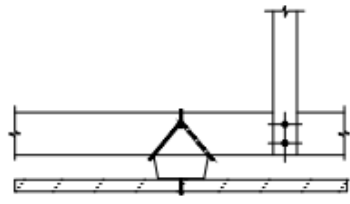
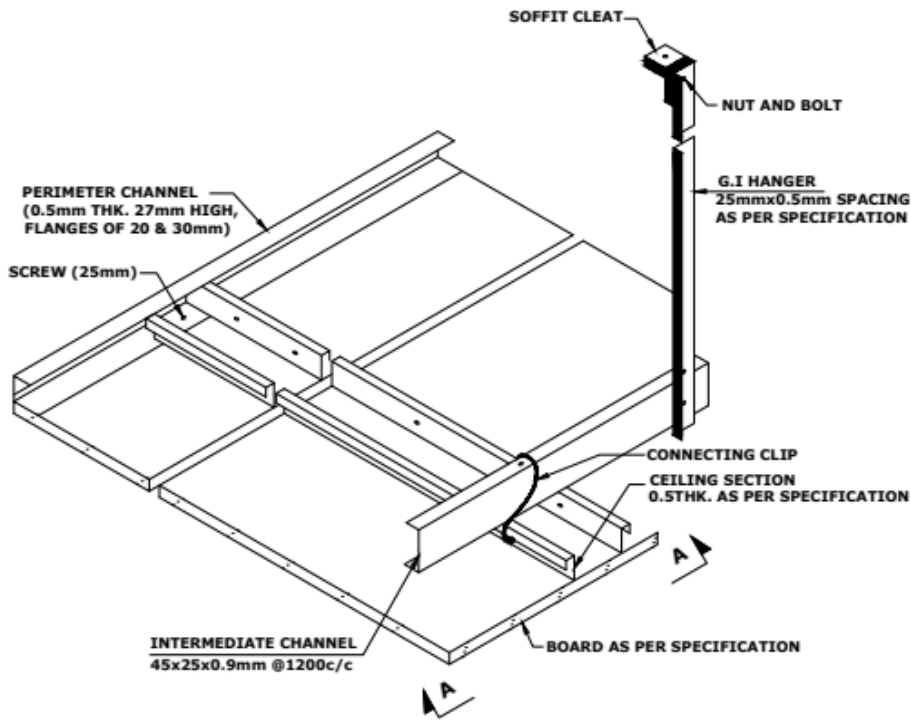


**SECTION 3-3**



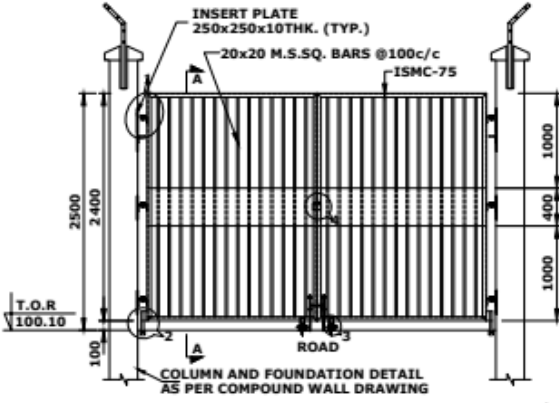
**SECTION 2-2**

E	STANDARD FOR DETAIL OF FALSE CEILING	STANDARD DRAWING NO.		REV.	SIZE
				03	A4
		SHEET NO.	1 OF 1		

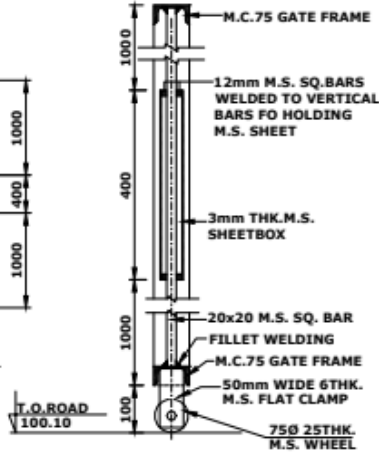


**VIEW A-A**

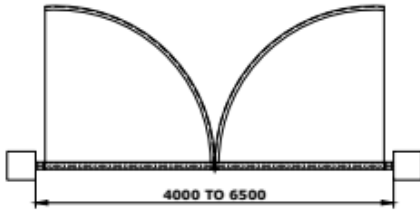
STANDARD FOR DETAIL OF HUNG GATE		STANDARD DRAWING NO.	REV.	SIZE
		SHEET NO. 1 OF 4		03 A4



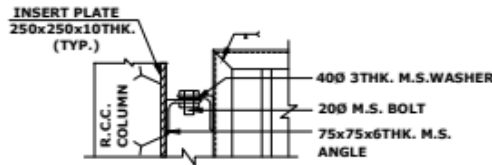
**ELEVATION**



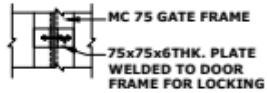
**SECTION A-A**



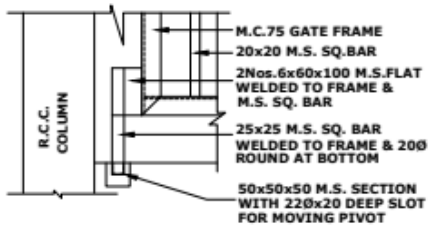
**PLAN**



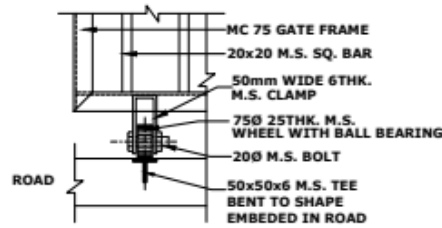
**DETAIL AT 1**



**DETAIL AT 4**

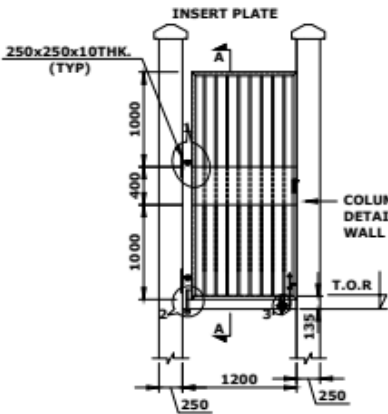


**DETAIL AT 2**

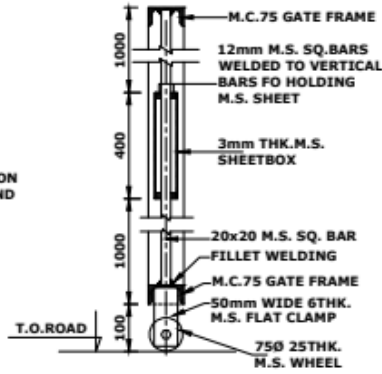


**DETAIL AT 3**

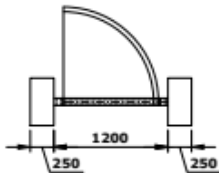
<b>STANDARD FOR DETAIL OF HUNG GATE</b>	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.		03	A4
	2 OF 4			



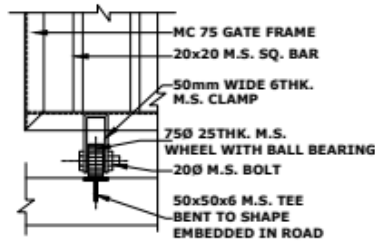
**ELEVATION**



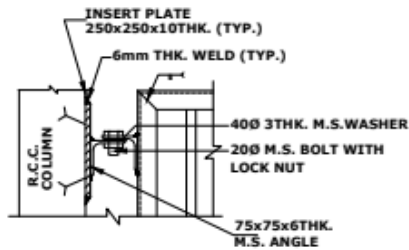
**SECTION A-A**



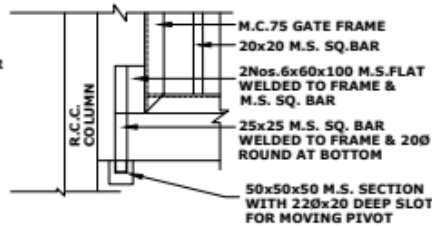
**PLAN**



**DETAIL AT 3**

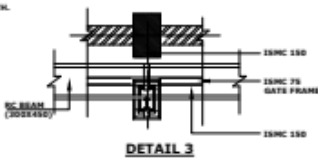
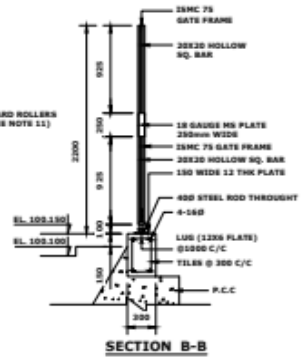
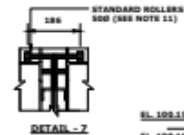
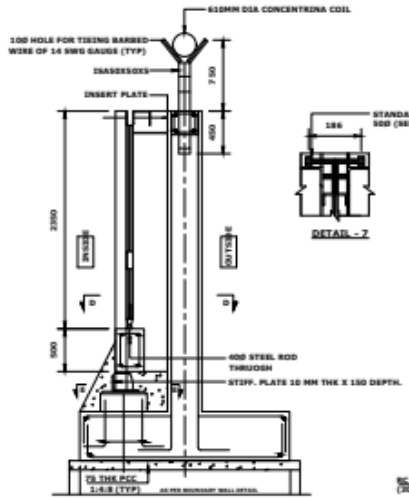
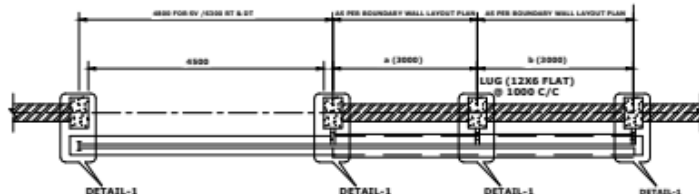
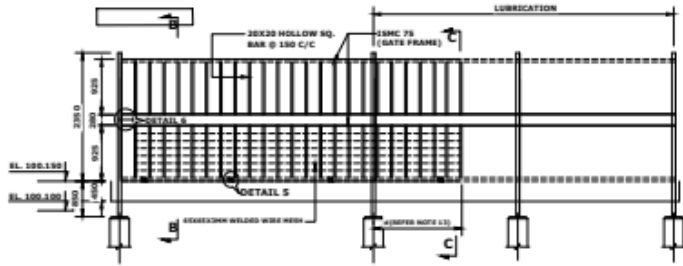


**DETAIL AT 1**



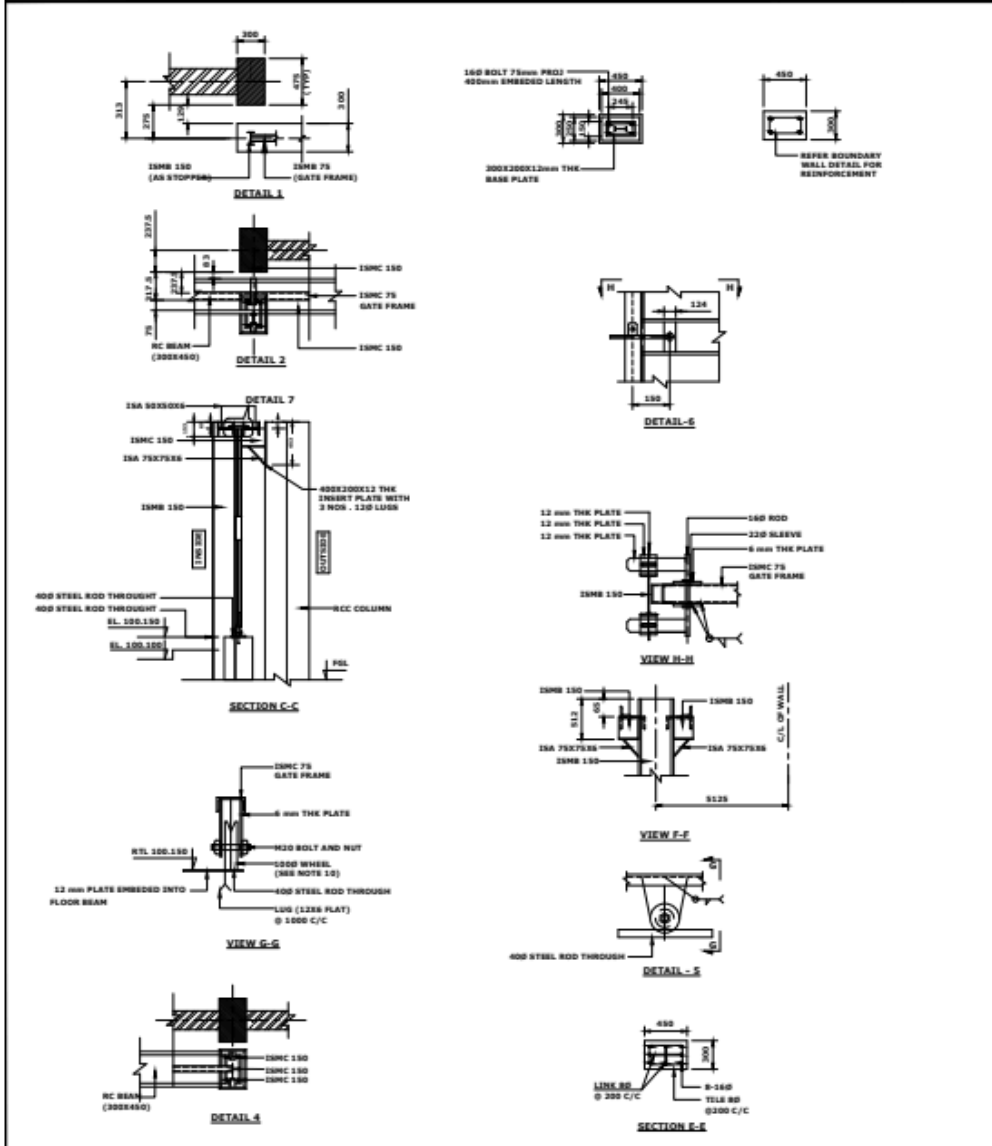
**DETAIL AT 2**

<b>STANDARD FOR DETAIL OF HUNG GATE</b>	<b>STANDARD DRAWING NO.</b>	<b>REV.</b>	<b>SIZE</b>
	SHEET NO. 3 OF 4	03	A4



CONTINUED ON SHEET 4

STANDARD FOR DETAIL OF HUNG GATE	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.	4 OF 4	03	A4



STANDARD FOR DETAIL  
OF STEEL DOOR (PRESSED STEEL)  
SINGLE SHUTTER

STANDARD DRAWING NO.

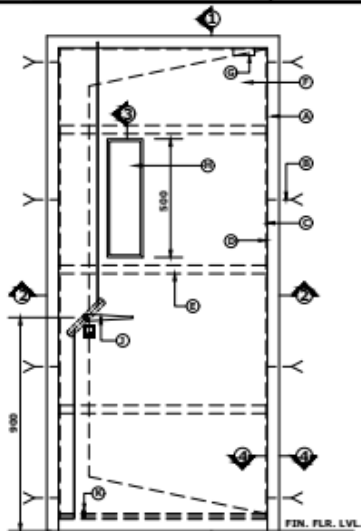
REV. SIZE

SHEET NO.

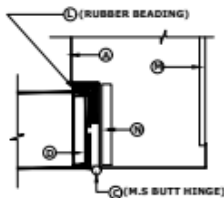
1 OF 2

03

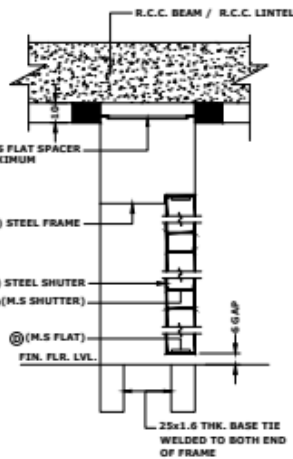
A4



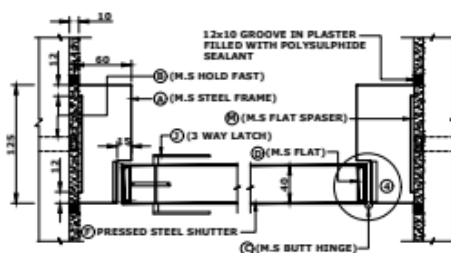
ELEVATION



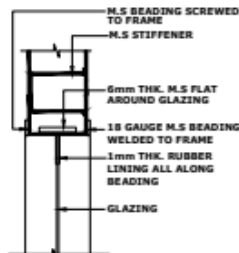
SECTION 4-4



SECTION 1-1



SECTIONAL PLAN 2-2

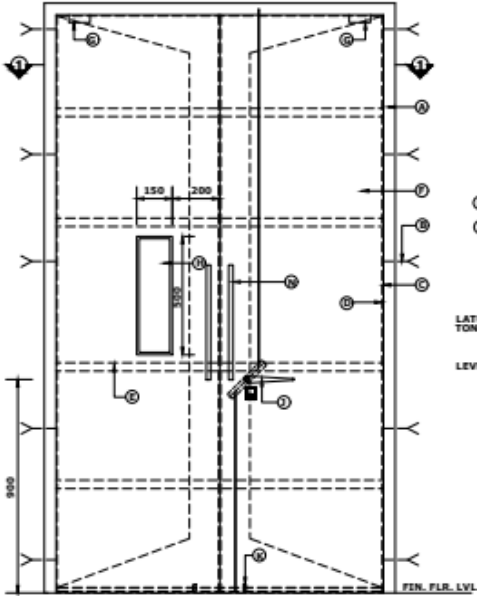


SECTION 3-3

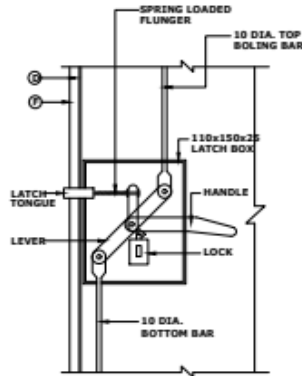
LEGEND:-

- ① 18 GAUGE PRESSED STEEL FRAME FINISHED WITH SYNTHETIC ENAMEL PAINT / ELECTROSTATIC. POWER COATING OVER RED-OXIDE ZINC CHROMATE PRIMER AS PER TENDER ITEMS
- ② M.S. HOLDFAST 300x25x6 THK. @MAXIMUM 600 C/C WELDED TO FRAME SPACER (M.)
- ③ 150 LONG M.S. BUTT HINGE @MAXIMUM 600C/C SCREWED TO FRAME AND SHUTTER.
- ④ 6 THK. M.S. FLAT CONTINUOUS ALONG PERIMETER OF SHUTTER.
- ⑤ 35 WIDE 16 GAUGE M.S. HORIZONTAL STIFFENER @500 C/C MAXIMUM.
- ⑥ 22 GAUGE PRESSED STEEL SHUTTER (OVERALL 40 THK.)
- ⑦ OVER HEAD HYDRAULIC DOOR CLOSER 9HEAVY DUTY)
- ⑧ VISION PANEL AS PER SPECIFICATION (OPTIONAL)
- ⑨ 3 WAY SPRING LOADED LATCH AND LOCKING SYSTEM.
- ⑩ SPRING LOADED PRESSURE DIE CAST ZINC ALLOY DOOR STOPPER.
- ⑪ NEOPRENE RUBBER BEADING FIXED WITH NEOPRENE RUBBER ADHESIVE (DUNLOP S-758 OR EQUIVALENT ALONG FRAME REBATE.
- ⑫ 50x5 THK. M.S. FLAT SPACER WELDED TO FRAME AT HOLD FAST LOCATION.
- ⑬ 40x150x5 THK. M.S. PAD WELDED TO FRAME AT ALL HINGE & LOCK LOCATION.

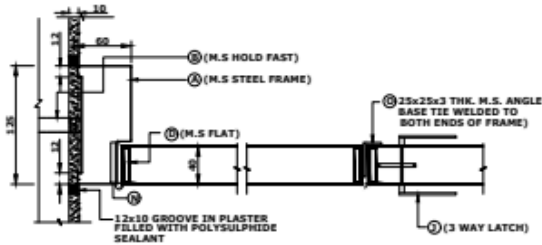
STANDARD FOR DETAIL OF STEEL DOOR (PRESSED STEEL) SINGLE SHUTTER		STANDARD DRAWING NO.	REV.	SIZE
		SHEET NO.	2 OF 2	03 A4



**ELEVATION**



**DETAIL OF 3 - WAY LATCH**

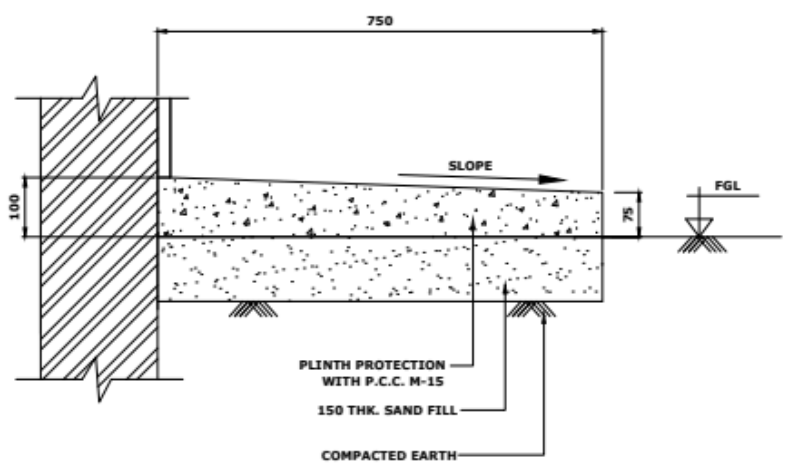


**SECTIONAL PLAN 1-1**

**LEGEND:-**

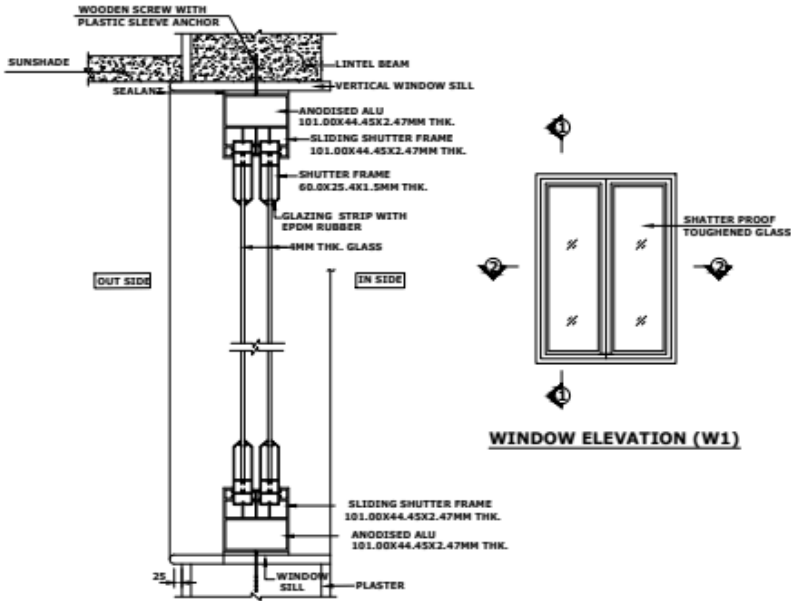
- ① 18 GAUGE PRESSED STEEL FRAME FINISHED WITH SYNTHETIC ENAMEL PAINT / ELECTROSTATIC. POWER COATING OVER RED-OXIDE ZINC CHROMATE PRIMER AS PER TENDER ITEMS
- ② M.S. HOLDFAST 300x25x5 THK. @MAXIMUM 600 C/C WELDED TO FRAME SPACER (M.)
- ③ 150 LONG M.S. BUTT HINGE @MAXIMUM 600C/C SCREWED TO FRAME AND SHUTTER.
- ④ 6 THK. M.S. FLAT CONTINUOUS ALONG PERIMETER OF SHUTTER.
- ⑤ 35 WIDE 16 GAUGE M.S. HORIZONTAL STIFFNER @500 C/C MAXIMUM.
- ⑥ 22 GAUGE PRESSED STEEL SHUTTER (OVERALL 40 THK.)
- ⑦ OVER HEAD HYDRAULIC DOOR CLOSER 9HEAVY DUTY
- ⑧ VISION PANEL AS PER SPECIFICATION (OPTIONAL)
- ⑨ 3 WAY SPRING LOADED LATCH AND LOCKING SYSTEM.
- ⑩ SPRING LOADED PRESSURE DIE CAST ZINC ALLOY DOOR STOPPER.
- ⑪ NEOPRENE RUBBER BEADING FIXED WITH NEOPRENE RUBBER ADHESIVE (DUNLOP S-758 OR EQUIVALENT ALONG FRAME REBATE.
- ⑫ 50x5 THK. M.S. FLAT SPACER WELDED TO FRAME AT HOLD FAST LOCATION.
- ⑬ PRESSURE DIE CAST ZINC ALLOY DOOR HANDLE 12 DIA. 300mm LONG.
- ⑭ 25x45x3 THK. M.S. ANGLE (VERTICAL) WELDED TO ONE SHUTTER FOR BEADING AT MEETING POINT.
- ⑮ 40x150x5 THK. M.S. PAD PLATE WELDED AT ALL HINGES AND LOCK LOCATIONS.

<b>STANDARD FOR DETAIL OF TYPICAL PLINTH PROTECTION DETAIL</b>	STANDARD DRAWING NO.		REV.	SIZE
			03	A4
	SHEET NO.	1 OF 1		

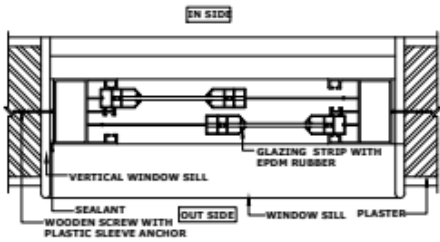


**TYP. PLINTH PROTECTION DETAIL**

STANDARD FOR DETAIL OF ALUMINIUM SLIDING WINDOW		STANDARD DRAWING NO.	REV.	SIZE
		SHEET NO.	1 OF 1	03 A4



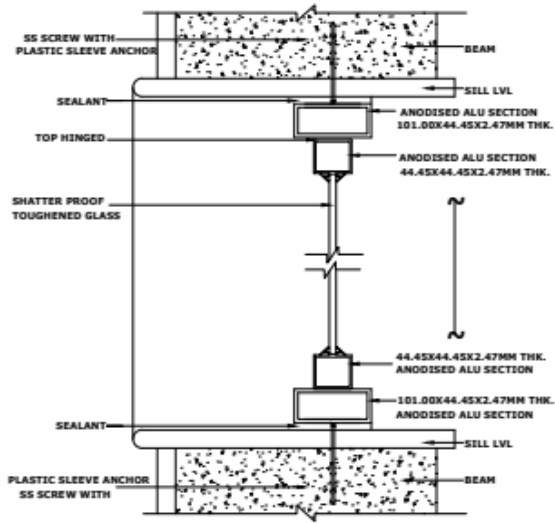
**SECTION 1-1**



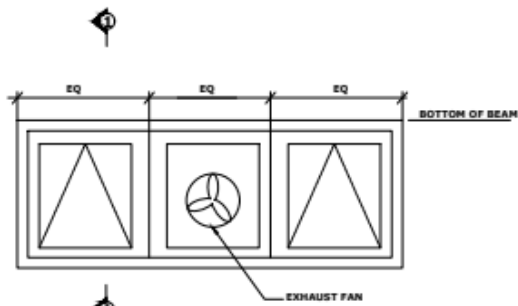
**SECTION 2-2  
DOUBLE PANEL ALUMINIUM WINDOW**

STANDARD FOR DETAIL  
OF ALUMINUM VENTILATOR

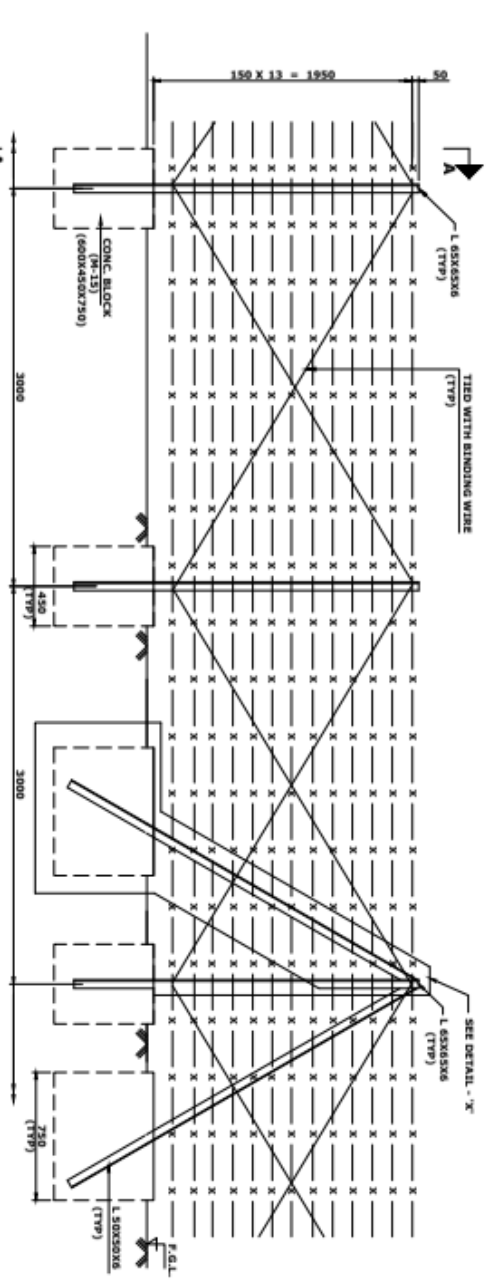
STANDARD DRAWING NO.		REV.	SIZE
		03	A4
SHEET NO.	1 OF 1		



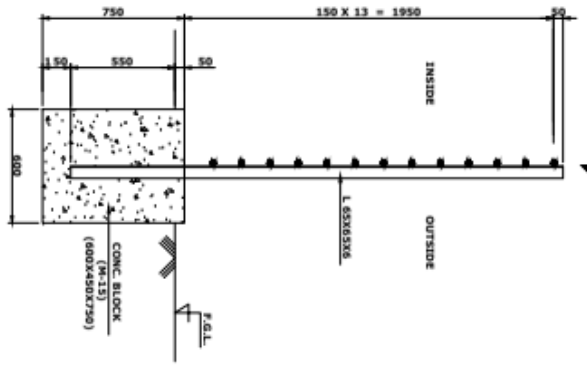
**SECTION 1-1**



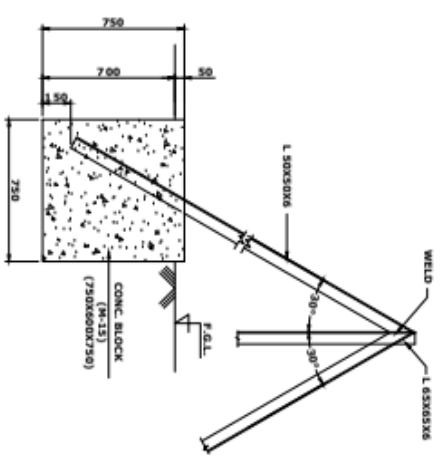
**VENTILATOR ELEVATION**



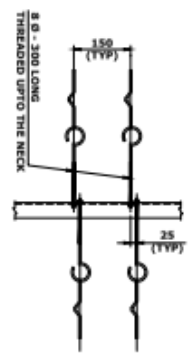
**BARBED WIRE FENCE**  
(outside)



**SECTION ELEVATION A - A**



**DETAIL - X**



**FIXING DETAIL OF STRAINING BOLT WITH POST**

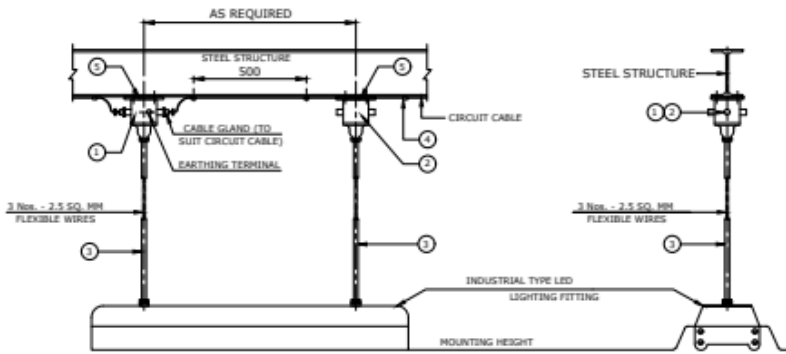
**STANDARD FOR DETAIL OF BARBED WIRE FENCING (WITH ANGLE IRON POST)**

- NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETERS.
  2. THE GALVANIZED STEEL BARBED WIRE DESIGNATED AS 16/2.2 SHALL BE USED UNLESS OTHERWISE SPECIFIED.
  3. HAVE LINE WIRE OF 61.5MM POINT WIRE OF 9.20MM & MINIMUM WEIGHT OF CONCRETE BARBED WIRE SHALL BE 105mm/m WITH 75mm DISTANCE BETWEEN TWO BARBED WIRES.
  4. LINE POST SHALL BE PLACED AT 3.0M C/C. STRET SHALL BE PROVIDED AT EVERY 15M. POST OF BOTH SIDE & END POST ON ONE SIDE.
  5. STRAINING BOLTS SHALL BE PROVIDED AT THE END POST & AT PLACES AS DIRECTED BY ENGINEER IN CHARGE.
  6. EXPOSED FOUNDATION BLOCK AT GROUP LEVEL SHALL BE FINISHED SMOOTH IN CEMENT MORTAR 1:6.
  7. GALVANIZED BARBED WIRE SHALL BE TIED TO THE ANGLE IRON POST EITHER WITH WELDED M.S WIRE OR WITH G.I WIRE THROUGH HOLES IN THE POST.

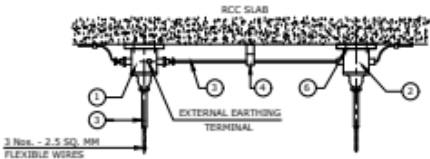
**STANDARD  
DRAWINGS**

**GENERAL NOTES:**

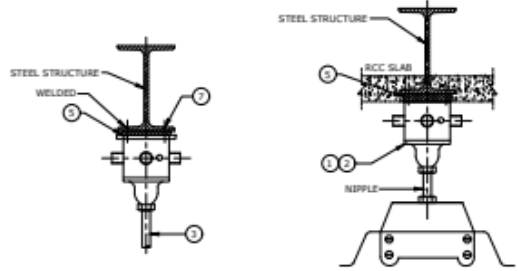
1. ENTIRE ELECTRICAL INSTALLATION SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH THE ELECTRICALLY RULES, OISD REGULATION ISI CODES, FIRE INSURANCE AND OTHER APPLICABLE CODES AND REGULATIONS.
2. EXCEPT AS SPECIFICALLY APPROVED BY THE CLIENT/CONSULTANT AT SITE INSTALLATION OF LIGHTING FITTING SHALL BE TAKEN ONLY AFTER ALL MAJOR SERVICE SUCH AS EQUIPMENT ERECTION, PIPING ETC. IN THAT PARTICULAR AREA HAVE BEEN COMPLETED.
3. ALL CABLES FROM LIGHTING PANEL TO LIGHTING FITTING SHALL BE IDENTIFIED WITH STAINLESS STEEL STRIP TAGS GIVING CIRCUIT REFERENCE NUMBER.
4. WIRING TO LIGHTING FITTING INSIDE PLANT AREA SHALL BE CARRIED OUT BY NEANS OF 3c x 2.5 SQ. MM YWY CABLES. FOR EARTHING OF LIGHTING FITTING AND JUNCTION BOX THIRD CORE SHALL BE USED.
5. GENERALLY IN PLANT AREA, THE LIGHTING FITTING SHALL BE DIRECTLY CONTROLLED FROM MINIATURE CIRCUIT BREAKERS PROVIDED IN THE LIGHTING DISTRIBUTION BOARD. HOWEVER, LOCAL CONTROL SWITCHES SHALL BE PROVIDED WHEREVER NECESSARY. I.e. FOR CONTROLLING LIGHTING FITTINGS IN TOILET BLOCK/OFFICE/STORE ROOM/SUB-STATION/CABLE CELLAR ENTRANCE ETC.
6. EXCEPT AS NOTED, MOUNTING HEIGHT OF BOTTOM LINE OF VARIOUS EQUIPMENT FROM FINISHED FLOOR LEVEL SHALL BE AS FOLLOWS:
  - A) SUB-LIGHTING DISTRIBUTION BOARD : 1200mm
  - B) LIGHTING CONTROL SWITCHES : 1200mm
  - C) RECEPTACLE WITH SWITCH : 800mm
7. EXCEPT AS SPECIFIED, CABLES FOR STREET LIGHTING SHALL BE DIRECTLY BURIED IN GROUND OR ROUTED IN CABLE TRENCH/DUCTS AS THE CASE MAY BE.
8. LIGHTING CABLES SHALL BE TAKEN THROUGH HIME PIPE BURIED IN GROUND AT SUITABLE DEPTH AT ALL ROAD CROSSING.
9. SINGLE PHASE SWITCHED SOCKET OUTLETS INCLUDING 10A & ABOVE SHALL BE FED AND CONTROLLED FROM PANEL (PP).
10. LIGHTING WIRING IN CONDUIT SHALL BE CARRIED OUT BY USING 19/25mm DIA. HEAVY GAUGE STEEL RIGID CONDUIT AND COPPER CONDUCTOR PVC FLEXIBLE WIRE SHALL BE USED :
  - A) LIGHTING FITTING & 6/16 AMPS. COMMERCIAL TYPE SWITCHED : 2.5 SQ.MM
  - B) 16/32A METAL CLAD INDUSTRIAL SWITCH SOCKET OUTLETS : 4.0 SQ.MM
  - C) FOLLOWING COLOUR WIRE SHALL BE USED :
    1. FOR 'R' PHASE : RED COLOUR COPPER CONDUCTOR PVC FLEXIBLE WIRE
    2. FOR 'Y' PHASE : YELLOW COLOUR COPPER CONDUCTOR PVC FLEXIBLE WIRE
    3. FOR 'B' PHASE : BLUE COLOUR COPPER CONDUCTOR PVC FLEXIBLE WIRE
    4. FOR 'N' PHASE : BLACK COLOUR COPPER CONDUCTOR PVC FLEXIBLE WIRE
    5. FOR EARTH : GREEN COLOUR 1.5 SQ. MM COPPER CONDUCTOR PVC FLEXIBLE WIRE
12. ALL SITE FABRICATED STEEL ASSEMBLIES SHALL BE PAINTED WITH TWO COATS OF ANTI-CORROSIVE PAINT AND TWO COATS OF EPOXY PAINTS.
13. ALL HARDWARE SHALL BE OF STAINLESS STEEL.



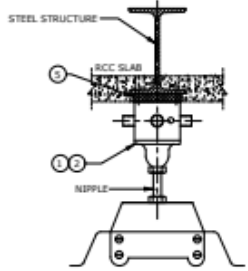
TYPICAL MOUNTING ARRANGEMENT OF LED LIGHTING FITTING ON STRUCTURE STEEL & WIRING WITH PVC INSULATED CABLE MOUNTING TYPE : SM1



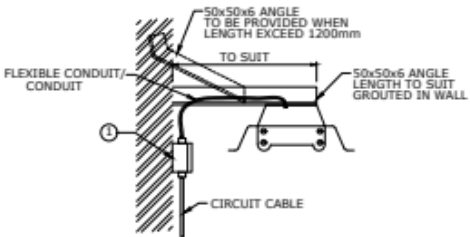
TYPICAL MOUNTING ARRANGEMENT OF LED LIGHTING FITTING ON R.C.C. SLAB & CONDUIT WIRING



TYPICAL MOUNTING DETAILS OF J.B. ON STRUCTURAL STEEL



MOUNTING TYPE : CM1



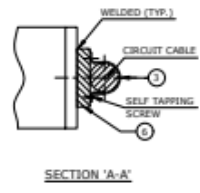
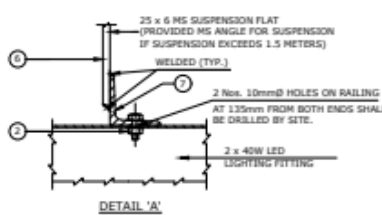
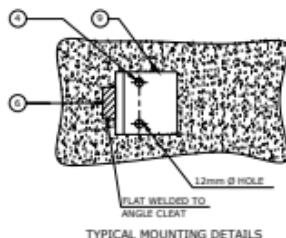
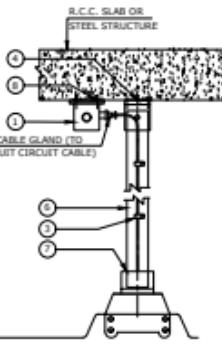
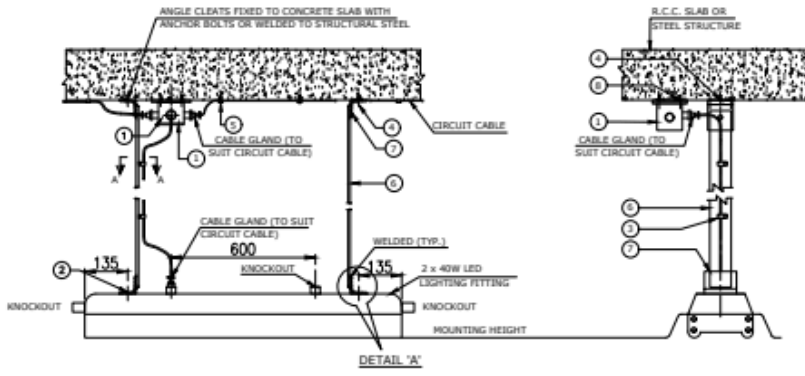
BRACKET MOUNTING ON WALL/COLUMN MTG. TYPE : BM1

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	JUNCTION BOX WITH CONE COVER, BALL & SOCKET WITH TERMINAL BLOCK.	1 NO.	
2	DUMBBY JUNCTION BOX WITH DOME COVER, BALL & SOCKET WITHOUT TERMINAL BLOCK.	1 NO.	
3	19mm Ø HEAVY GAUGE CONDUIT WITH BOTH END CHECK NUTS LENGTH TO SUIT MOUNTING HEIGHT (MAXIMUM LENGTH 2 Mtrs.)	2 NOS.	
4	G.I. SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF FIXING SCREW TO SUIT FOR CIRCUIT CABLE/CONDUIT.	AS REQUIRED	
5	25 x 6 THK. M.S. FLAT 200mm LONG FOR JUNCTION BOX MOUNTING ON STEEL STRUCTURE.	2 NOS.	
6	COUNTER SUNK SCREW WITH RAWAL PLUG FOR RCC SLAB OR SELF TAPPING COUNTER SUNK SCREW FOR STEEL STRUCTURE.	4 NOS.	
7	SELF TAPPING SCREW WITH WASHER FOR FIXING OF JUNCTION BOX ON 25 x 6mm MS FLAT.	AS REQUIRED	

TYPICAL SUSPENSION MOUNTING DETAILS OF INDUSTRIAL LED LIGHTING FITTING WITH SUSPENSION MORE THAN 2 Mtrs.

STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.		02	A4
1 OF 1			

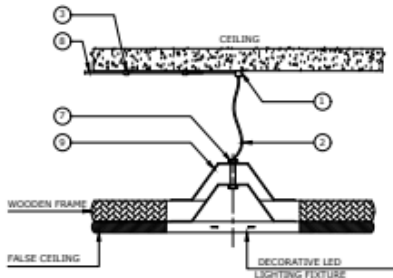


MATERIAL TAKE-OFF

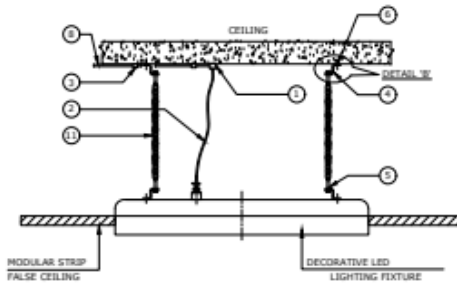
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	AWAY-100mm DIA ROUND JUNCTION BOX WITH TERMINAL BLOCK.	1 NOS.	
2	M8-40mm LONG BOLT WITH NUT AND PLAIN WASHER	2 NOS.	
3	G.I. SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF FIXING SCREW & NUT TO SUIT FOR CIRCUIT CABLE.	AS REQUIRED.	
4	M10-68mm LONG ANCHOR STUD WITH BOLT & PLAIN WASHER	4 NOS.	
5	SADDLE/CLEAT WITH FIXING SCREW OR M8-68mm LONG STUD, NUTS & LOCK WASHERS FOR CIRCUIT CABLE	AS REQUIRED.	
6	25 x 6mm THK. M.S. FLAT (LENGTH TO SUIT)	2 NOS.	
7	ISA 50 x 50 x 6 THK.-75mm LONG ANGLE CLEAT WITH 10 Ø HOLES	4 NOS.	
8	10mm Ø 35 LONG COUNTER SUNK SCREWS WITH RAWAL PLUG	2 NOS.	
9	ISA 50 x 50 x 6 THK.-150mm LONG ANGLE CLEAT WITH 2 NOS. 12 Ø HOLES	2 NOS.	

TYPICAL DETAILS OF DECORATIVE LIGHTING FIXTURE MOUNTING RECESSED OR BELOW FALSE CEILING

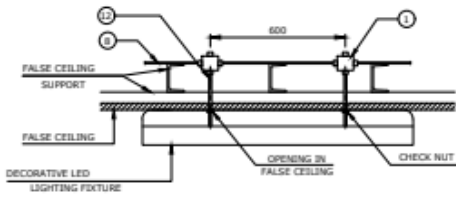
STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.		02	A4
1 OF 1			



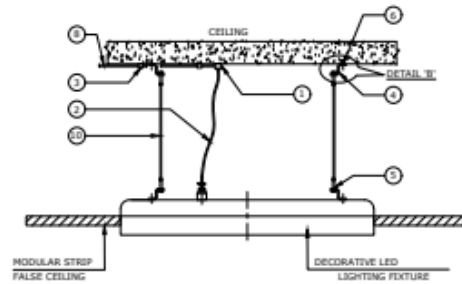
**RECESSED MOUNTING FIXTURE SUPPORTED ON WOODEN FRAME**  
TYPE : RM1



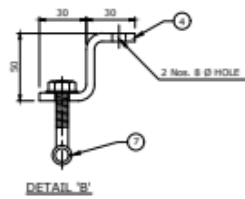
**RECESSED MOUNTING FIXTURE SUPPORTED ON CHAIN**  
TYPE : RM1



**FIXTURE MOUNTED BELOW FALSE CEILING**  
TYPE : RM2

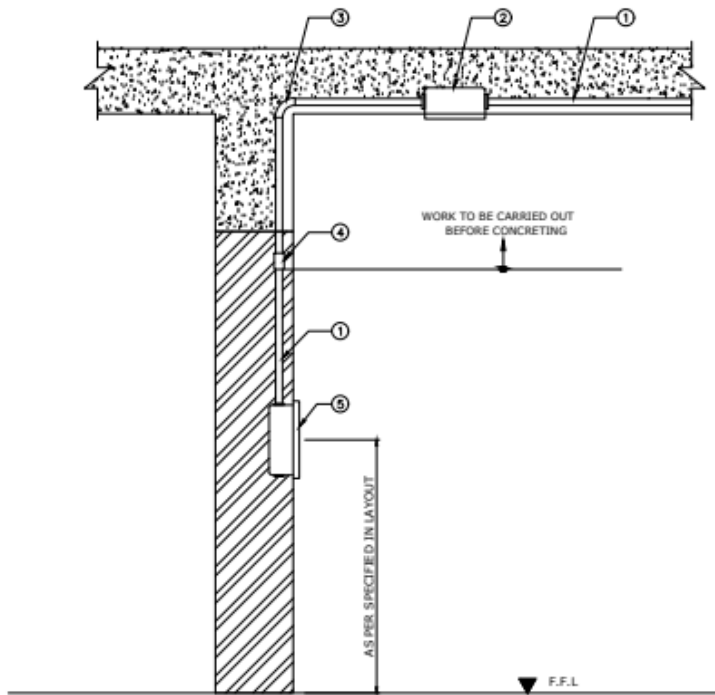


**RECESSED MOUNTING FIXTURE SUPPORTED WITH G.I. WIRE**  
TYPE : RM1



**MATERIAL TAKE-OFF**

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	JUNCTION BOX WITH DOME COVER	1 NOS.	
2	19 mm DIA PVC FLEXIBLE PIPE WITH 2 Nos. PVC STRAIGHT ADAPTOR	AS REQUIRED	
3	G.I./PVC SADDLE CLEAT WITH SUITABLE SCREWS	AS REQUIRED	
4	32 x 6mm THK, 110 mm LONG M.S. FLAT BEND 'Z' SHAPE	4 NOS.	
5	M6-30mm LONG G.I. EYE BOLT & NUT WITH WASHER	4 NOS.	
6	M6-35mm LONG ANCHOR STUD WITH NUT AND WASHER	2 NOS.	
7	M6-30mm LONG BOLT WITH SWING NUT AND 2 Nos. PLAIN WASHER	2 NOS.	
8	19mm DIA CONDUIT (AS SPECIFIED)	AS REQUIRED	
9	BRACKET MADE OUT OF 25 x 3mm THK. M.S. PLAT	2 NOS.	
10	10 SWG. G.I. WIRE (LENGTH TO SUIT)	2 NOS.	
11	SUPPORTING CHAIN (LENGTH TO SUIT)	2 NOS.	
12	19mm Ø CONDUIT WITH THREAD AT BOTH END AND NUT	2 NOS.	



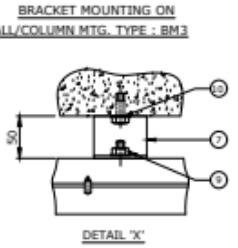
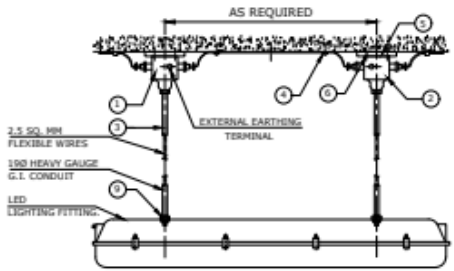
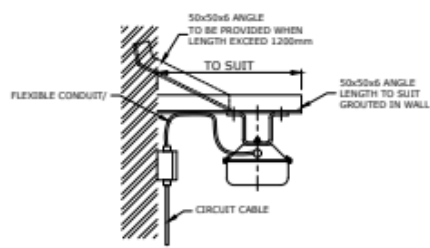
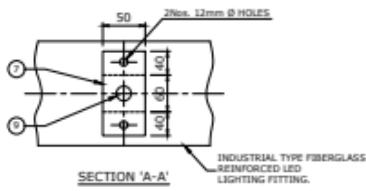
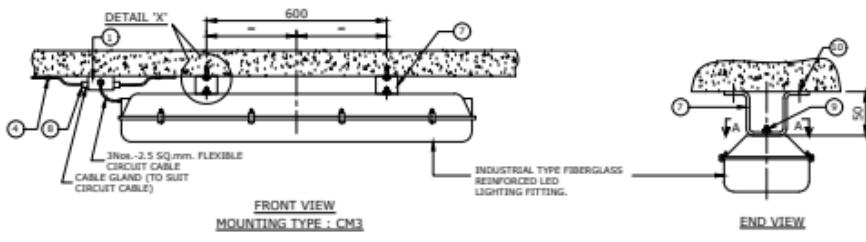
TYPICAL INSTALLATION DETAIL OF CONDUIT ENTRY FROM R.C.C SLAB INTO THE BRICK WALL

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	PVC/G.I. CONDUIT SIZE AS REQUIRED	AS REQUIRED	
2	WIRE PULL BOX WITH FLAT COVER	AS REQUIRED	
3	PVC/G.I. 90° BEND SIZE AS REQUIRED	AS REQUIRED	
4	PVC/G.I. COUPLING SIZE AS REQUIRED	AS REQUIRED	
5	SWITCH BOARD, SOCKET OUTLET ETC.	AS REQUIRED	

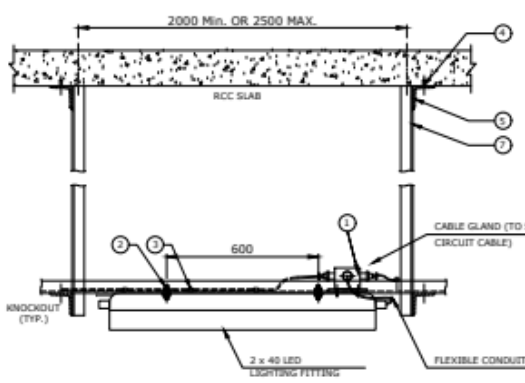
TYPICAL CEILING MOUNTING DETAILS OF INDUSTRIAL TYPE FIBERGLASS REINFORCED LED LIGHTING FITTING

STANDARD DRAWING NO.		REV.	SIZE
-----		02	A4
SHEET NO.	1 OF 1		

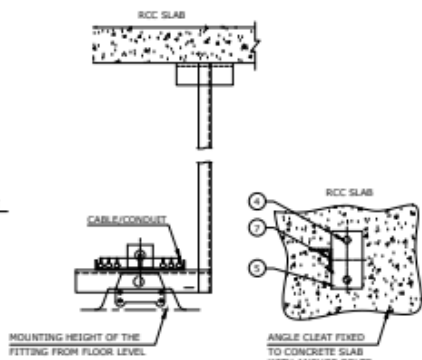


MATERIAL TAKE-OFF

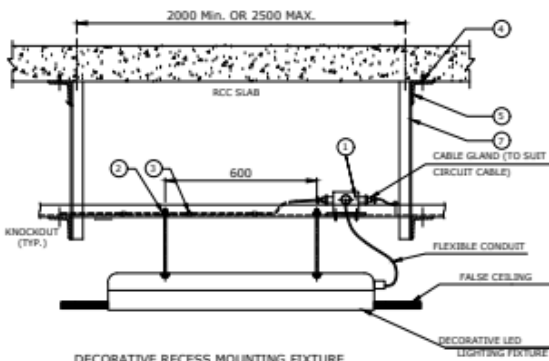
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	4WAY-100mm DIA ROUND JUNCTION BOX WITH TERMINAL BLOCK.	1 NO.	
2	DUMMY JUNCTION BOX WITH DOME COVER, BALL & SOCKET WITHOUT TERMINAL BLOCK.	1 NO.	
3	19mm Ø HEAVY GUAGE CONDUIT WITH BOTH END CHECK NUTS LENGTH TO SUIT MOUNTING HEIGHT (MAXIMUM LENGTH 3 Mtrs)	2 NOS.	
4	G.I. SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF FIXING SCREW TO SUIT FOR CIRCUIT CABLE/CONDUIT.	AS REQUIRED	
5	25 x 6 THK. M.S. FLAT 200mm LONG FOR JUNCTION BOX MOUNTING ON SLAB/STEEL STRUCTURE.	2 NOS.	
6	COUNTER SUNK SCREW WITH RAIBAL PLUG FOR RCC SLAB OR SELF TAPPING COUNTER SUNK SCREW FOR STEEL STRUCTURE.	4 NOS.	
7	240 x 50 x 6 THK. M.S. BRACKET FOR MOUNTING OF LIGHTING FITTING	2 NOS.	
8	M10-40mm LONG SCREW WITH RAIBAL PLUG FOR MOUNTING OF M.S. BRACKET TO CEILING	4 NOS.	
9	M6-40mm LONG BOLT WITH NUT & WASHER	2 NOS.	
10	M10-60mm ANCHOR BOLT FOR MOUNTING OF JUNCTION BOX TO CEILING	2 NOS.	
11	M8-25mm G.I. BOLT WITH 2 Nos. PLAIN AND 1 No. SPRING WASHER TO ANGLE	2 NOS.	



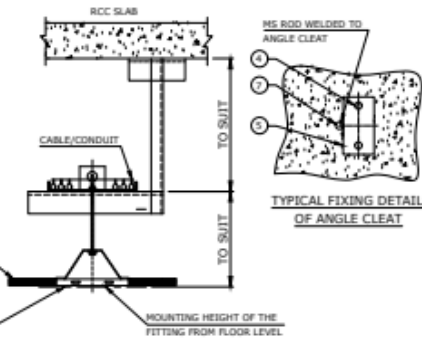
INDUSTRIAL SUSPENSION MOUNTING FIXTURE  
MOUNTING TYPE : SM4



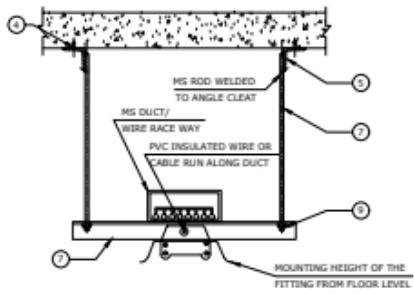
TYPICAL FIXING DETAILS OF ANGLE CLEAT



DECORATIVE RECESS MOUNTING FIXTURE  
MOUNTING TYPE : RM4



TYPICAL FIXING DETAILS OF ANGLE CLEAT



MATERIAL TAKE-OFF

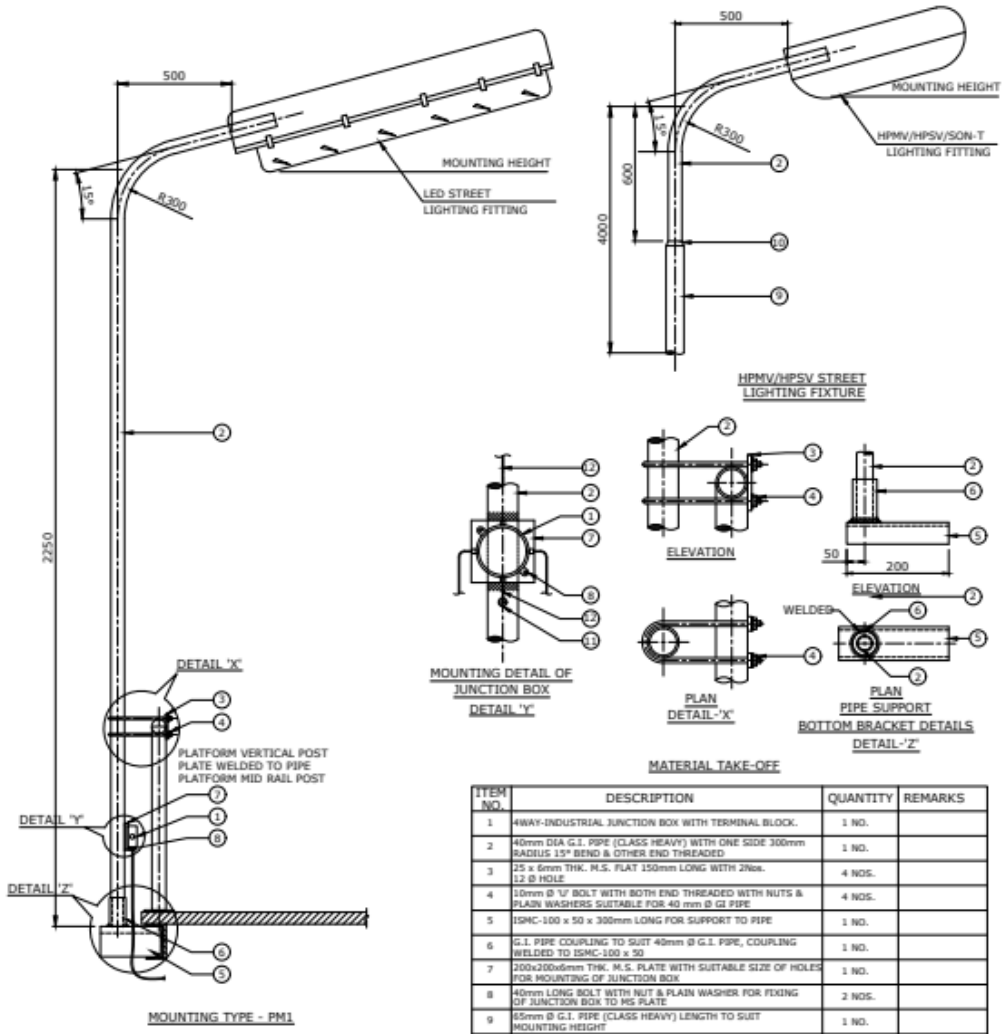
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	4WAY-100mm DIA ROUND JUNCTION BOX WITH TERMINAL BLOCK.	1 NO.	
2	19mm DIA CHECK NUT	4 NOS.	
3	G.I. SADDLE ALONG WITH SUITABLE SIZE OF FIXING SCREW & NUT TO SUIT FOR CABLE/CONDUIT.	AS REQUIRED	
4	M10x68mm LONG ANCHOR STUD WITH BOLT & PLAIN WASHER	AS REQUIRED	
5	ISA 50x6mm THK. 100mm LONG ANGLE CLEAT.	AS REQUIRED	
6	150mm OR 300mm WIDE PERFORATED CABLE TRAY OR DUCT/ WIRE RACE WAY CHANNEL.	AS REQUIRED	
7	ISA 25 x 25 x 6mm THK. ANGLE WELDED TO ANGLE OR 8mm DIA MS ROD WITH THREAD AT BOTTOM END	AS REQUIRED	
8	19mm DIA G.I. PIPE/CONDUIT	AS REQUIRED	
9	NUT SUITABLE FOR M8 BOLT WITH PLAIN WASHER	AS REQUIRED	

NOTES:

1. ALL FABRICATED STEEL STRUCTURE SHALL BE PAINTED WITH TWO COATS OF ANTI CORROSSIVE PAINT AND TWO COATS OF EPOXY PAINT OF APPROVED SHED.
2. ALL HARDWARE SHALL BE STAINLESS STEEL.

TYPICAL HANDRAIL PIPE MOUNTING DETAILS OF LED HPMV/HPSV LIGHTING FITTING ON PLATFORM

STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.		1 OF 1	02 A4



- NOTES:**
1. MOUNTING HEIGHT SHALL NOT EXCEED 4 METERS. FROM THE TOP OF PLATFORM.
  2. LIGHT FITTING SHALL BE WITH ONE EXTERNAL EARTH CONNECTION AND USE THREE CORE OR PVC FLEXIBLE CABLE FOR INTERNAL EARTHING. EARTH JUNCTION BOX WITH TWO EXTERNAL EARTH CONDUCTORS.
  3. CABLE GLANDS USED FOR TERMINATION OF FLEXIBLE CABLE SHALL BE DOUBLE SEAL WITH CONE GRIP TYPE.
  4. PLUG ALL UNUSED ENTRIES OF LIGHTING FITTING AND JUNCTION BOX WITH THREADED STOPPING PLUGS.
  5. WHEN MOUNTING HEIGHT IS MORE THEN 2.25M THEN 65 Ø G.I. PIPE WITH REDUCER SHALL BE USED.

TYPICAL MOUNTING DETAILS  
OF LED LIGHTING FITTING  
(WALL/COLUMN MOUNTED)

STANDARD DRAWING NO.

REV.

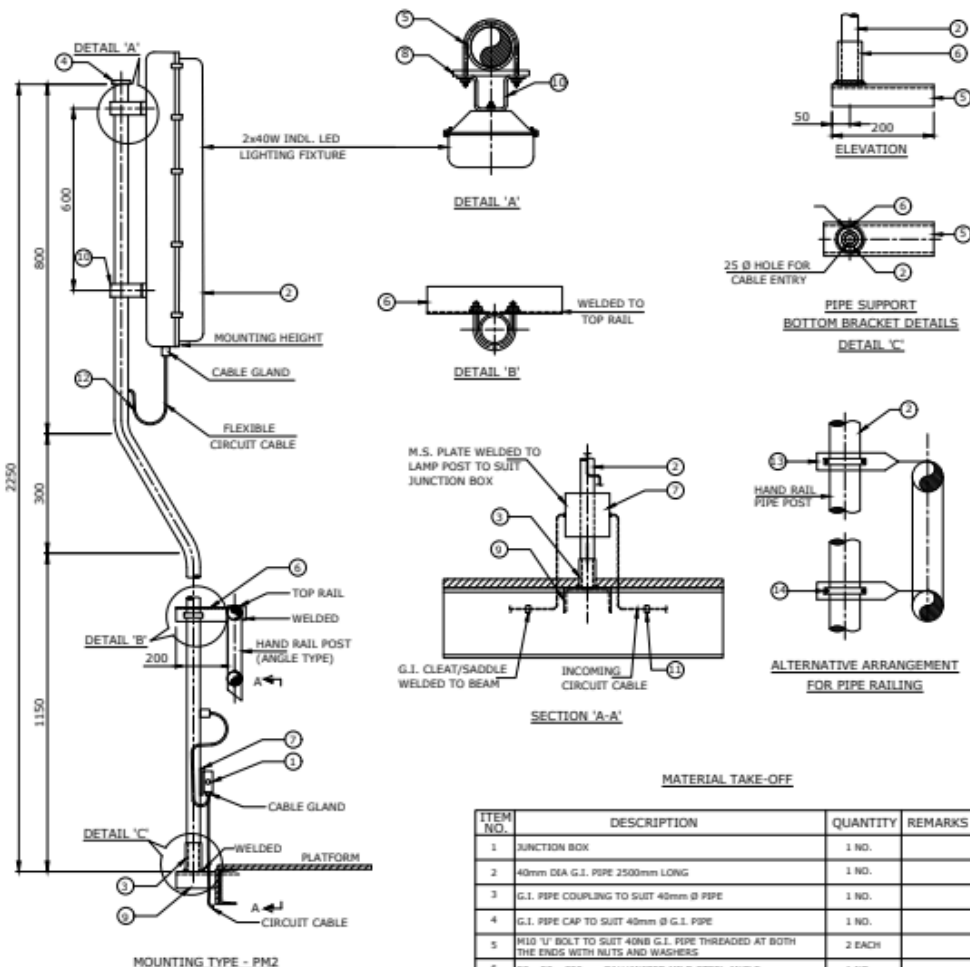
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02

A4

SHEET NO.

1 OF 1



**NOTES:**

1. ALL NUTS, BOLTS & WASHERS SHALL BE GALVANIZED OR ZINC PASSIVATED.
2. ALL SHARP EDGES AND BURR SHALL BE REMOVED.
3. SITE FABRICATION STEEL SHALL BE PAINTED IN ACCORDANCE WITH THE CONTRACT SPECIFICATION.
4. ALL DIMMES TO GALVANIZED FINISHED SHALL BE CLEANED AND APPLIED WITH 2 COATS OF ANTI-CORROSSIVE PAINT AND ZINC RICH PAINT.
5. WHERE POSSIBLE LOCATE LAMP POST ADJACENT TO HANDRAIL POST.

**MATERIAL TAKE-OFF**

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	JUNCTION BOX	1 NO.	
2	40mm DIA G.I. PIPE 2500mm LONG	1 NO.	
3	G.I. PIPE COUPLING TO SUIT 40mm Ø PIPE	1 NO.	
4	G.I. PIPE CAP TO SUIT 40mm Ø G.I. PIPE	1 NO.	
5	M10 1/2 BOLT TO SUIT 40NB G.I. PIPE THREADED AT BOTH THE ENDS WITH NUTS AND WASHERS	2 EACH	
6	50 x 50 x 300mm GALVANIZED MILD STEEL ANGLE	1 NO.	
7	150 Sq. x 6mm THK. M.S. PLATE	1 EACH	
8	50 x 6mm H.S. FLAT - 100mm LONG	1 NO.	
9	ISMC-100 x 50 x 6mm THK. -200mm LONG	AS REQUIRED	
10	BRACKET TO BE MADE OUT OF 25 x 6mm H.S. FLAT	2 NOS.	
11	G.I. CLEAT, SADDLE WITH SUITABLE SIZE SCREW	AS REQUIRED	
12	RURDER GROMMET	2 NOS.	
13	75 x 10mm THK. G.I. FLAT - 300mm LONG	2 NOS.	
14	G.I. SADDLE/CLEAT TO SUIT 40mm Ø G.I. PIPE WITH G.I. SCREWS AND WASHERS	AS REQUIRED	

TYPICAL MOUNTING DETAILS  
OF STREET LIGHTING FITTING  
(WALL/COLUMN MOUNTED)

STANDARD DRAWING NO.

REV.

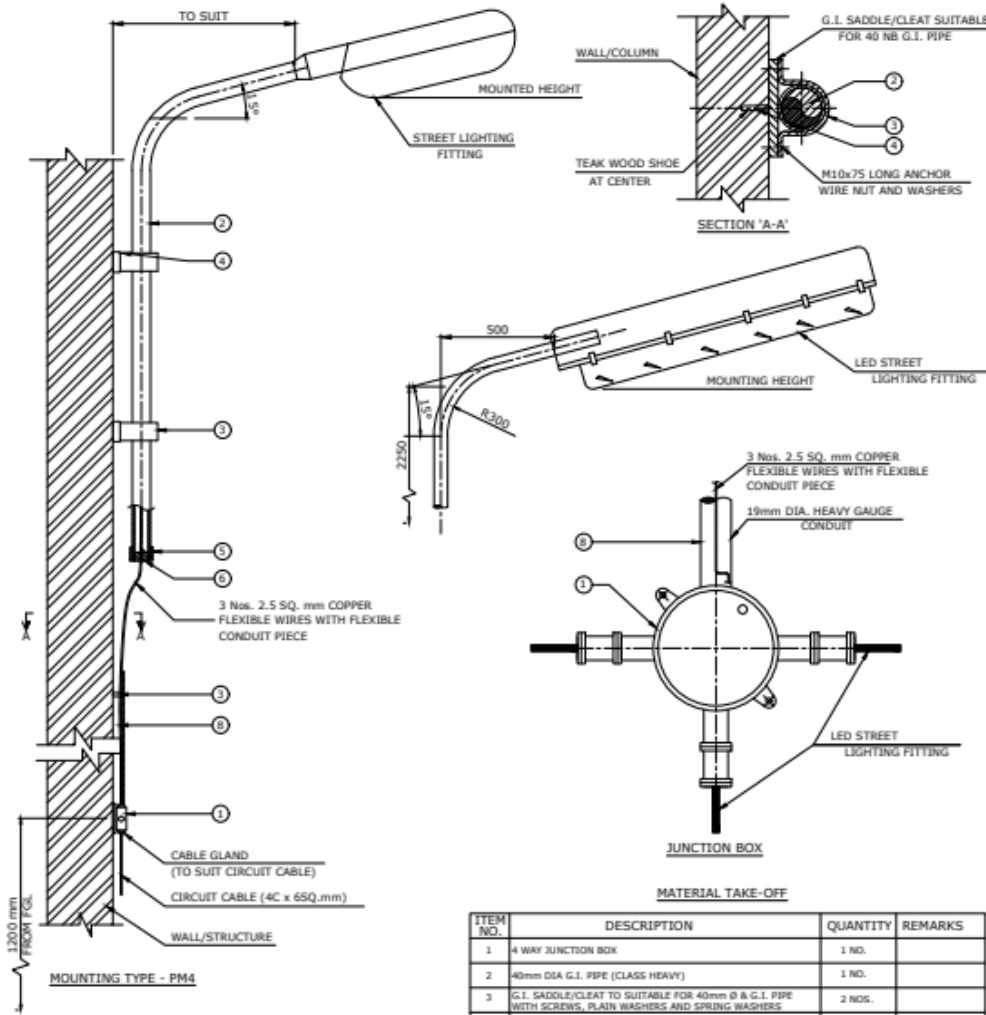
SIZE

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SHEET NO.

1 OF 1



MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	4 WAY JUNCTION BOX	1 NO.	
2	40mm DIA G.I. PIPE (CLASS HEAVY)	1 NO.	
3	G.I. SADDLE/CLEAT TO SUITABLE FOR 40mm Ø & G.I. PIPE WITH SCREWS, PLAIN WASHERS AND SPRING WASHERS	2 NOS.	
4	15mm THK. TEAK WOOD SHOE WITH BITUMINOUS PAINT	1 BLOCK	
5	G.I. PIPE COUPLING (TO SUIT 40mm Ø G.I. PIPE)	1 NO.	
6	RURDER GROHMET (TO SUIT 40mm Ø G.I. PIPE)	1 NO.	
7	50mm DIA G.I. PIPE SLEAVE	1 NO.	
8	19mm DIA G.I. HEAVY GAUGE CONDUIT	AS REQUIRED	
9	10A, 250V D.P WEATHER PROOF LIGHTING SWITCH WITH BOTTOM ENTRY	1 NO.	
10	SCREW WITH PLAIN WASHER AND RAWAL PLUG FOR FIXING Ø8 & LIGHTING SWITCH	8 NOS.	

TYPICAL MOUNTING DETAILS  
OF STREET LIGHTING FITTING

STANDARD DRAWING NO.

REV.

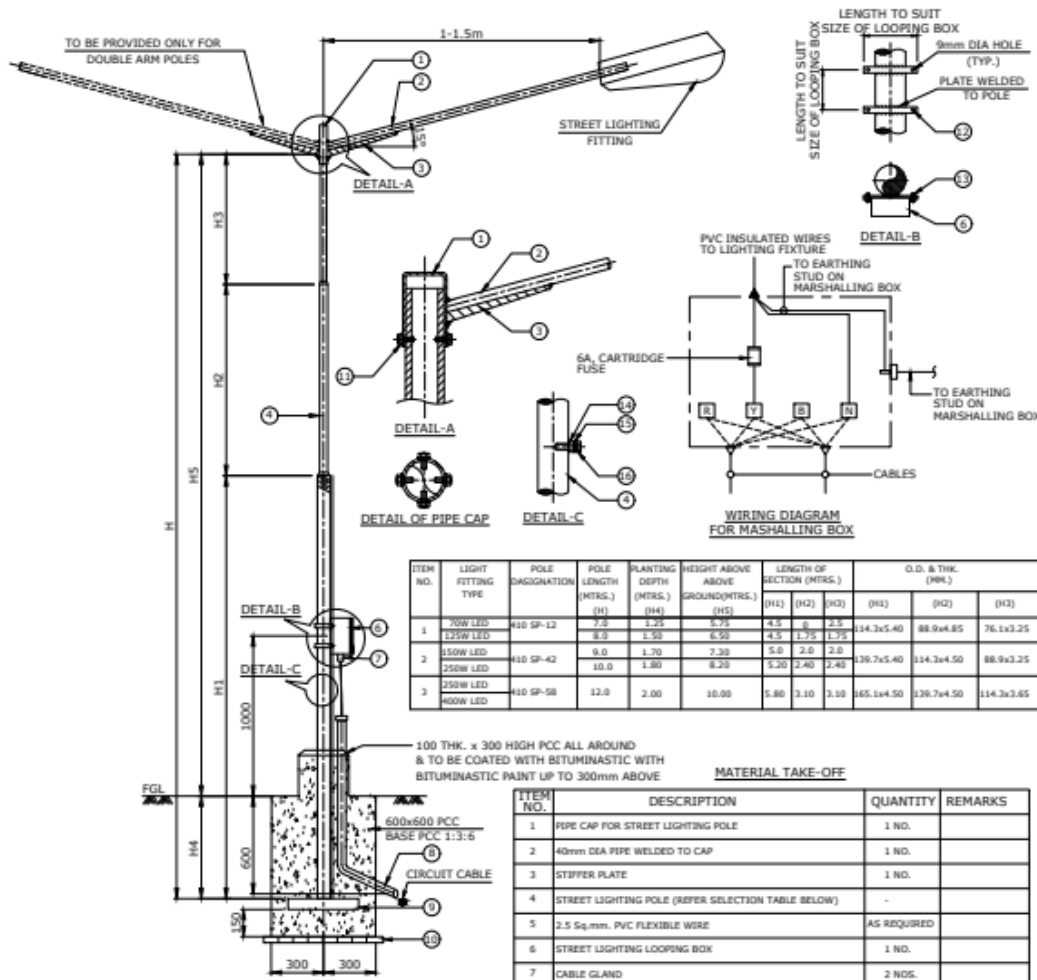
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SHEET NO.

1 OF 3

02

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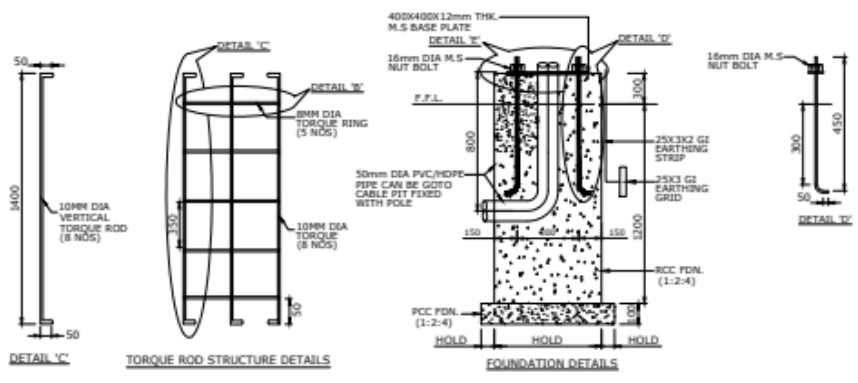
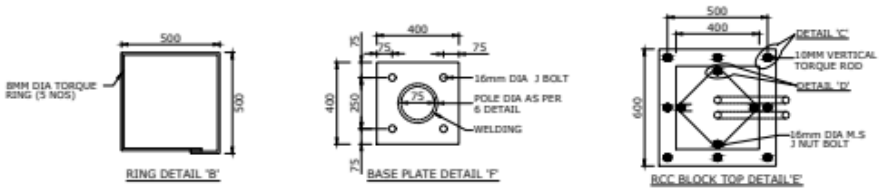
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. POLE MATERIAL SHALL BE G.I. OR H.S. AS PER PROJECT CONTRACT REQUIREMENTS.
3. AFTER INSTALLATION THE ASSEMBLY IS TO BE PREPARED, PRIMED AND PAINTED IN ACCORDANCE WITH THE PROJECT PAINTING SPECIFICATION IF MATERIAL IS H.S.
4. LIGHT FITTING FIXING DETAILS TO BE FURNISHED BY SITE.
5. EARTHING TERMINAL ARE LOCATED DIAMETRICALLY OPPOSITE.
6. ALL NUTS, BOLTS AND WASHERS SHALL BE GALVANIZED AND ZINC PASSIVATED.
7. MOUNTING DETAILS OF CONTROL GEAR BOX AND LOOPING BOX REFER INSTALLATION DETAILS.
8. ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
9. POLE SHALL BE MADE FROM TUBULAR STEEL PIPES SWAGED AND WELDED CONFORMING TO DESIGNATION AS MENTIONED IN ABOVE TABLE- AS IS-2713 (PART III) - 1980.
10. DOUBLE ARM SHALL BE EITHER AT 180° OR 30° AS PER THE LOCATION OF THE LIGHTING FITTING & SITE REQUIREMENT.

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	PIPE CAP FOR STREET LIGHTING POLE	1 NO.	
2	40mm DIA PIPE WELDED TO CAP	1 NO.	
3	STIFFER PLATE	1 NO.	
4	STREET LIGHTING POLE (REFER SELECTION TABLE BELOW)	-	
5	2.5 Sq.mm. PVC FLEXIBLE WIRE	AS REQUIRED	
6	STREET LIGHTING LOOPING BOX	1 NO.	
7	CABLE GLAND	2 NOS.	
8	80 NB G.I. PIPE FOR CABLES	AS REQUIRED	
9	250 x 250 x 6mm THK. BASE PLATE	1 NO.	
10	BRICK SOLING (SIZE 230x115x75mm)	15 NOS.	
11	M10 x 30mm LONG FULL THREADED BOLT	8 NOS.	
12	50x8mm THICK G.I. STRIP WELDED TO POLE	2 NOS.	
13	M8 x 30mm LONG THREADED BOLT, NUT & WASHER	4 NOS. EACH	
14	M10, NUT WELDED TO LIGHTING POLE	2 NOS.	
15	PLAIN AND SPRING WASHER SUITABLE FOR M10 BOLT	2 NOS. EACH	
16	M10 FULL THREADED BOLT 40mm LONG	2 NOS.	

<b>TYPICAL MOUNTING DETAILS OF STREET LIGHTING FITTING</b>	STANDARD DRAWING NO.		REV.	SIZE
	SHEET NO.		02	A4
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Pole Height (M)	Base Plate			Arch Bolt		
	Length (mm)	Width (mm)	Thickness (mm)	Anch Bolt (No. x Dia)	PCD (mm)	Anch Bolt $\phi$ to $\phi$
3	200	200	12	4 X 16	200	100
4	200	200	12	4 X 16	200	100
5	200	200	12	4 X 16	200	100
6	200	200	12	4X 20	200	100
7	200	200	12	4X 20	200	100
8	200	200	12	4X 20	200	100
8	200	200	12	4X 20	200	100
9	250	250	16	4X 24	250	125
9	300	300	16	4X 20	300	100
10	275	275	16	4X 24	275	137.5
10	250	250	16	4X 24	250	125
11	300	300	16	4X 24	300	150
12	320	320	16	4X 24	320	160
12	300	300	16	4X 24	300	150

Pole Height (M)	Base Plate			Arch Bolt			Anch Bolt $\phi$ to $\phi$
	Length (mm)	Width (mm)	Thickness (mm)	Anch Bolt (No. x Dia)	PCD (mm)		
3	200	200	12	4 X 16	200	100	0.25 + (1/2 / 06 000) = 0
4	200	200	12	4 X 16	200	100	
5	200	200	12	4 X 16	200	100	
6	200	200	16	4X 20	220	105	
7	250	250	16	4X 20	235	117.5	
8	250	250	16	4X 20	235	117.5	
9	275	275	16	4X 24	270	135	
10	275	275	16	4X 24	270	135	
11	300	300	16	4X 24	300	150	
12	320	320	16	4X 24	320	160	
12	300	300	16	4X 24	320	160	

**VERIFY BASE PLATE DIMENSION AND PCD BEFORE CASTING FOUNDATION**

TYPICAL MOUNTING DETAILS  
OF STREET LIGHTING FITTING

STANDARD DRAWING NO.

REV.

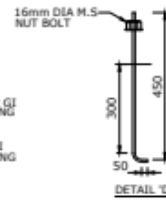
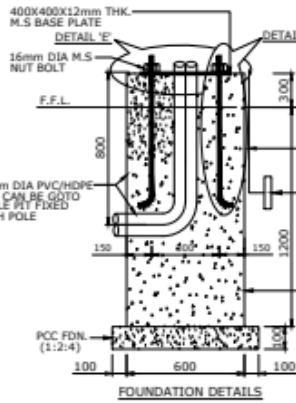
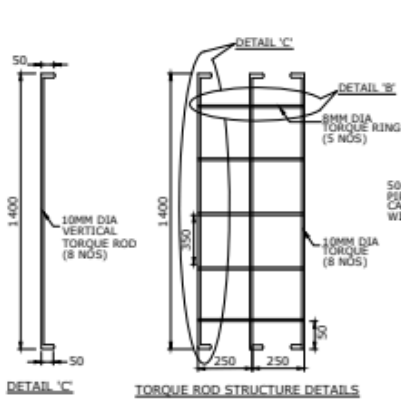
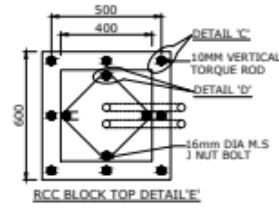
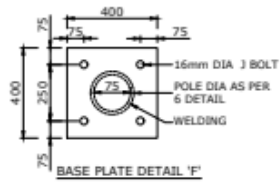
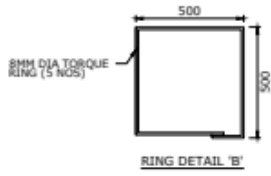
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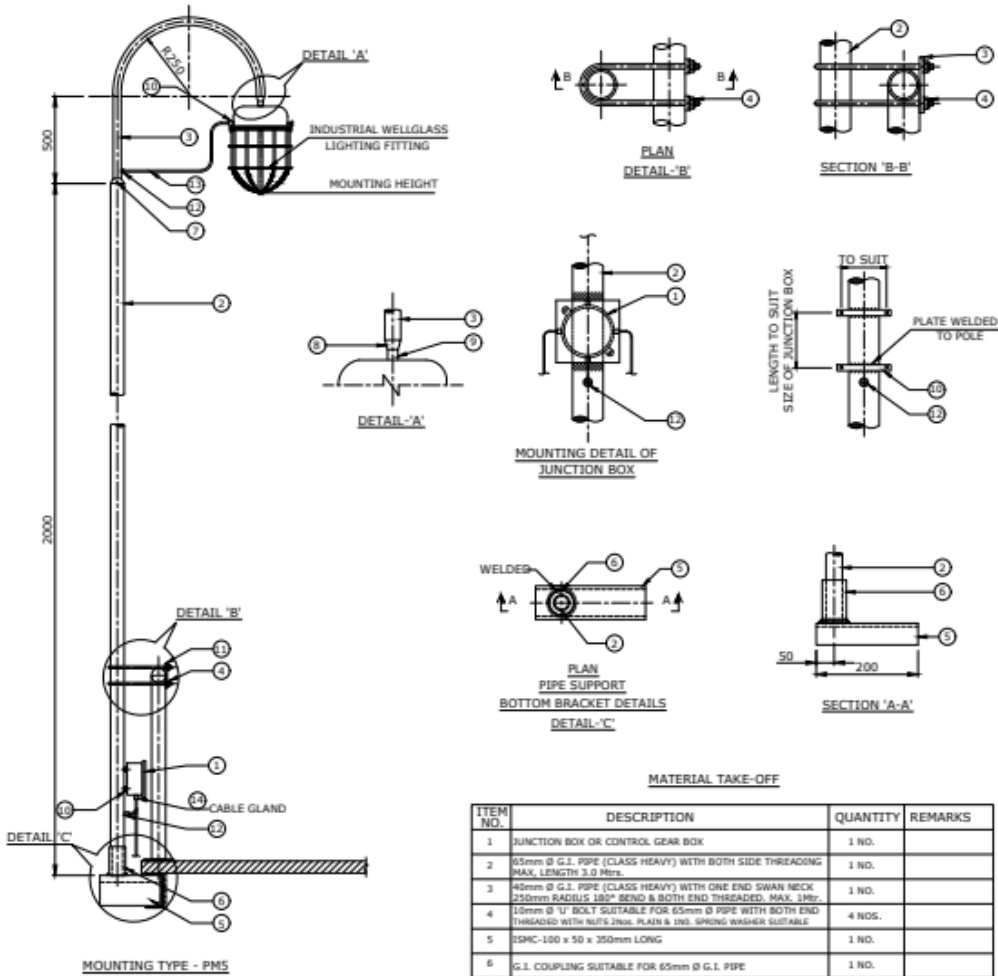
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SHEET NO.

3 OF 3



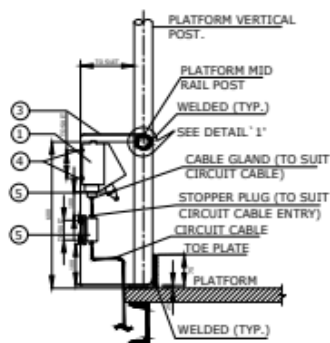


**NOTES:**

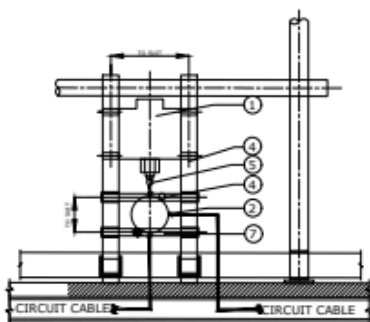
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. MOUNTING HEIGHT SHALL NOT EXCEED 2.5M FROM THE PLATFORM.
3. CABLE GLAND USED FOR TERMINATION OF FLEXIBLE CABLE SHALL BE DOUBLE SEAL WITH CONE GASP FOR BRADING.
4. PLUG ALL UNUSED ENTRIES OF LIGHTING FITTING AND JUNCTION BOX WITH THREADED STOPPING PLUGS.
5. ALL NUTS, BOLTS AND WAGHERS SHALL BE GALVANISED.
6. ALL SHARP EDGES AND BURRS SHALL BE REMOVED. SITE FABRICATED STEEL SHALL BE PAINTED WITH TWO COATS OF ANTS-CORROSIIVE PAINT AND TWO COATS OF EPOXY PAINTS.
7. ALL DAMAGE TO GALVANISED FINISHED SHALL BE MADE GOOD WITH ZINC RICH PAINT.
8. WHERE POSSIBLE LOCATE LAMP POST ADJACENT TO HANDRAL POST.

**MATERIAL TAKE-OFF**

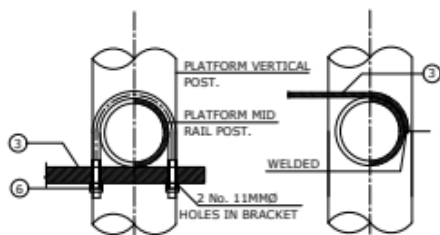
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	JUNCTION BOX OR CONTROL GEAR BOX	1 NO.	
2	65mm Ø G.I. PIPE (CLASS HEAVY) WITH BOTH SIDE THREADING MAX. LENGTH 2.0 Mtrs.	1 NO.	
3	40mm Ø G.I. PIPE (CLASS HEAVY) WITH ONE END SWAN NECK 250mm RADIUS 180° BEND & BOTH END THREADED. MAX. 1Mtr.	1 NO.	
4	10mm Ø 'U' BOLT SUITABLE FOR 65mm Ø PIPE WITH BOTH END THREADED WITH NUTS 2nos. PLAIN & 1NO. SPRING WAGHER SUITABLE	4 NOS.	
5	ESPC-100 x 50 x 350mm LONG	1 NO.	
6	G.I. COUPLING SUITABLE FOR 65mm Ø G.I. PIPE	1 NO.	
7	G.I. REDUCER - 60 x 40	1 NO.	
8	G.I. REDUCER - 40 x 19	1 NO.	
9	G.I. NIPPLE THREADED AT BOTH END	1 NO.	
10	150x150x6mm THK. M.S. PLATE WITH 2 Nos. 12mm Ø HOLES OR 50x5x300 LONG G.I. FLATE WITH 2 Nos. 12mm Ø HOLES.	1 NO./2 Nos.	REFER VIEW -A'
11	50 x 6 x 150mm LONG G.I. FLAT WITH 2 Nos. 12mm Ø HOLES.	4 NOS.	
12	RURDER GROMMET TO SUIT FLEXIBLE WIRE	2 NOS.	
13	2.5 Sq. mm SQ. FLEXIBLE CABLE	3.5Mtrs. MAX.	
14	CABLE GLAND SUITABLE FOR ITEM NO. 13	2 NOS.	



SIDE VIEW

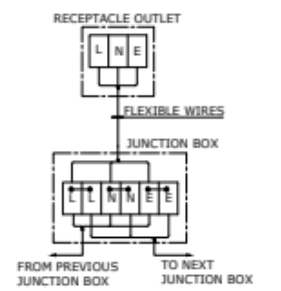


FRONT VIEW



ALTERNATE ARRANGEMENT FOR FIXING  
OF BRACKET TO MID RAIL POST

DETAIL - '1'



WIRING DIAGRAM FOR JUNCTION  
BOX TO RECEPTACLE

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	SMALL POWER SOCKET OUTLET	AS REQUIRED	
2.	JUNCTION BOX WITH TERMINAL BLOCK	AS REQUIRED	
3.	50 x 6mm THK. (LENGTH AS REQUIRED) MS FLAT FOR FIXING FOR POWER SOCKET OUTLET	3 MTRS.	
4.	M6 x 40mm LONG MS BOLT WITH NUT & WASHER FOR FIXING OF JUNCTION BOX ON BRACKET	8 NOS.	
5.	PLUG TO SUIT SMALL POWER SOCKET OUTLET	AS REQUIRED	
6.	M10 1/2 BOLT OF SUITABLE TO MID HANDRAIL POST WITH THREADED BOTH THE SIDE WITH NUT, LOCK NUT & WASHER	2 NOS.	
7.	50 x 6mm THK. (LENGTH AS REQUIRED) MS FLAT FOR FIXING JUNCTION BOX	2 NOS.	

NOTES:

1. ALL DIMENSION ARE IN MM.
2. DRILLING OF ITEM 3 AND 7 TO BE DETERMINED BY FABRICATOR TO THE SOCKET OUTLET AND JUNCTION BOX.
3. JUNCTION BOX, RECEPTACLES AND ACCESSORIES SHALL BE CALLED UP ON THE RELEVANT LAYOUT DRAWING MATERIAL LIST AS REQUIRED.
4. ALL CABLE AND GLANDS SHALL CALLED UP ON DISTRIBUTION BOARD SCHEDULE.
5. AFTER FABRICATION THE ASSEMBLY IS TO BE PAINTED WITH TWO COATS OF ANTI-CORROSSIVE PAINT AND TWO COATS OF EPOXY PAINT.
6. ALL NUTS, BOLTS, WASHERS SHALL BE GALVANISED OR ZINC PASSIVATED.
7. RECEPTACLES AND JUNCTION BOX SHALL BE CERTIFIED FOR THE HAZARDOUS AREA IN WHICH THEY ARE TO BE LOCATED.

TYPICAL MOUNTING DETAILS OF INDUSTRIAL WELLGLASS LIGHTING FITTING WITH BUILT-IN CONTROL GEAR BOX

STANDARD DRAWING NO.

REV.

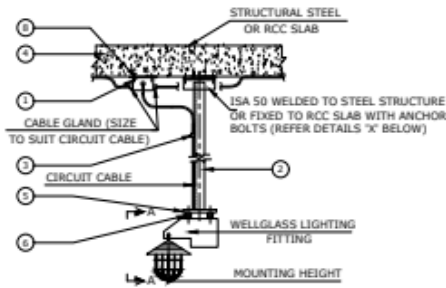
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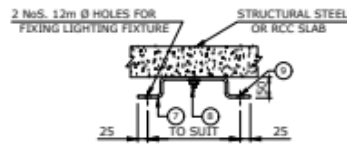
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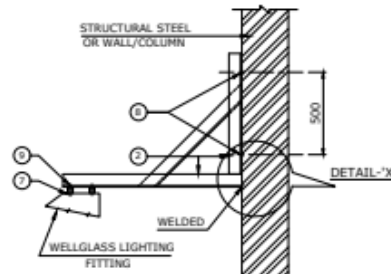
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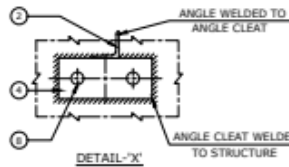
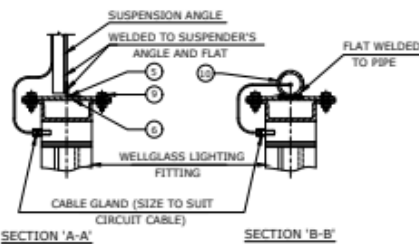
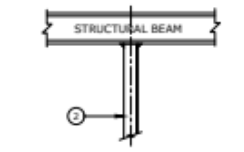
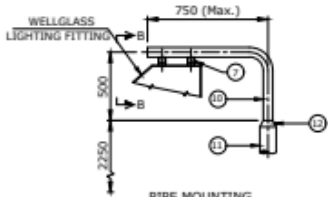
SUSPENSION MOUNTING MOUNTING TYPE-SMS



CEILING MOUNTING MOUNTING TYPE-CM5



BRACKET MOUNTING MOUNTING TYPE-BM5



MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	4WAY ROUND JUNCTION BOX	1 NO.	
2	ISA 50 x 50 x 6mm THK. -MAX. LENGTH 3500mm	1 NO.	
3	G.I. SADDLE/CLEAT LONG WITH SCREWS TO SUIT CIRCUIT CABLE	AS REQUIRED	
4	50 x 50 x 6 x 350 LONG ANGLE CLEAT WITH 2 Nos. 12 Ø HOLES (REFER DETAIL - 'X')	1 NO.	
5	25 x 25 x 6 x 300 LONG ANGLE CLEAT	1 NO.	
6	32 x 6 x 200 LONG G.I. FLAT WITH 3 Nos. 12 Ø HOLES	2 NOS.	
7	50 x 6 x 200 LONG G.I. FLAT WITH 2 Nos. 12 Ø HOLES	1 NO.	
8	M10 x 40mm LONG ANCHOR STUD WITH PLAIN AND SPRING WASHERS	1 NO.	
9	M10 x 30mm LONG G.I. BOLT WITH NUT, 2 PLAIN AND SPRING WASHERS	4 NOS.	
10	40mm Ø G.I. PIPE - CLASS HEAVY WITH MAX. LENGTH OF 1.5 Mtrs. WITH THREADED AT BOTH SIDES.	1 NO.	
11	65mm Ø G.I. PIPE - CLASS HEAVY WITH MAX. LENGTH OF 1.5 Mtrs. WITH THREADED AT BOTH SIDES.	1 NO.	

NOTES:

- ALL WELDED POINT SHALL CLEANED AND APPLY TWO COAT OF ANTI-CORROSION PAINT AND TWO COATS OF ZINC RICH PAINT.

TYPICAL DETAIL OF CEILING/SUSPENSION MOUNTED HIGHBAY LIGHTING FITTING

STANDARD DRAWING NO.

REV.

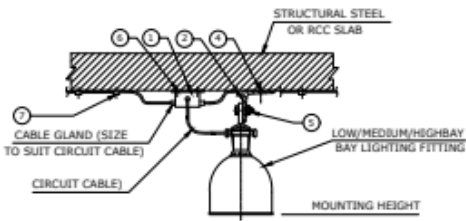
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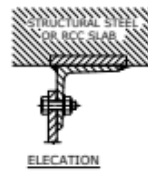
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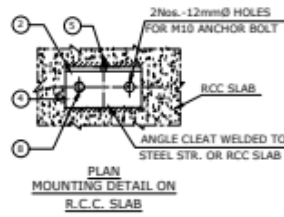
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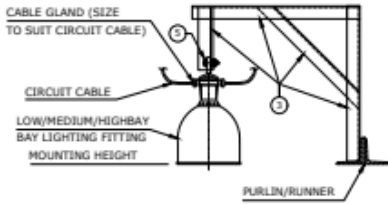
CEILING MOUNTED LIGHTING FITTING - CM6



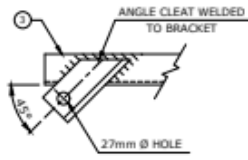
ELEVATION



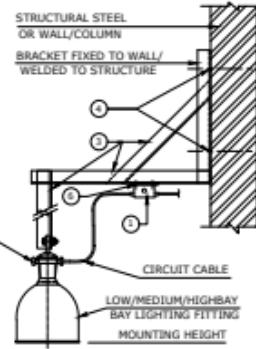
PLAN MOUNTING DETAIL ON R.C.C. SLAB



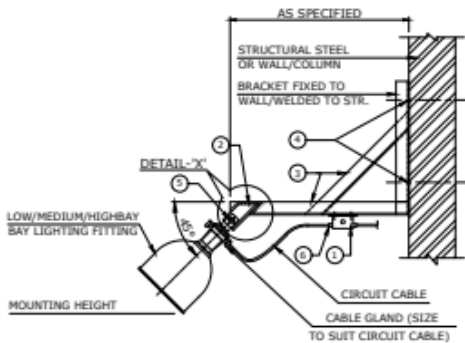
BRACKET MOUNTED ON PURLIN MOUNTING TYPE-BM6



DETAIL-'X'



BRACKET MOUNTING MOUNTING TYPE-BM6



BRACKET MOUNTED 30° OR 45° MOUNTING TYPE-BM6

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	HWAY ROUND JUNCTION BOX	1 NO.	
2	ISA 50 x 50 x 6mm THK. 160mm LONG ANGLE CLEAT WITH 2 Nos. 12mm Ø HOLES	1 NO.	
3	ISA 50 x 50 x 6mm THK. LENGTH TO SUIT MTG. HEIGHT OR BRACKET SUSPENSION MOUNTING TYPE TO SUIT HEIGHT	1 NO.	
4	M10-68mm LONG ANCHOR STUD WITH LOCK WASHERS AND NUTS FOR FIXING OF ISA IN RCC SLAB	2 NOS.	
5	M25-40mm LONG BOLT WITH NUT AND PLAIN WASHERS	1 NO.	
6	M10-40mm LONG BOLT WITH NUT AND PLAIN WASHERS FOR MOUNTING OF LIGHTING FITTING	2 NOS.	
7	SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF ANCHORING FIXING SCREWS TO SUIT FOR CIRCUIT CABLE SADDLE.	AS REQUIRED	

TYPICAL DETAIL OF ARRANGEMENT OF  
FLOOD LIGHT MOUNTED ON  
PLATFORM/WALKWAY

STANDARD DRAWING NO.

REV.

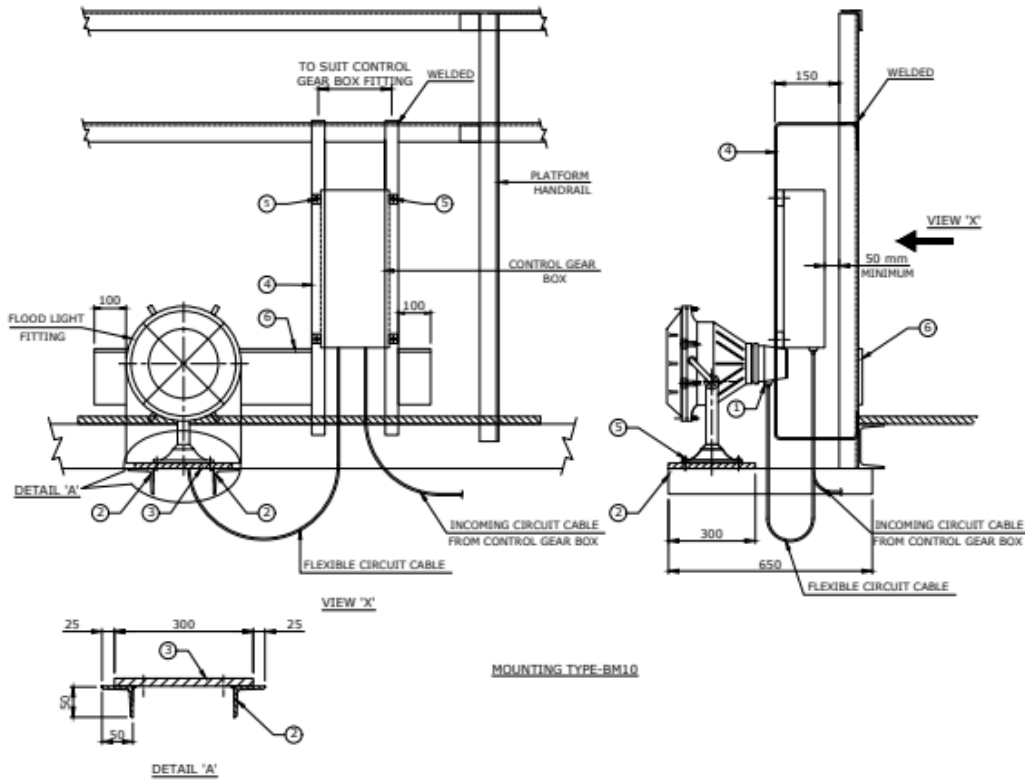
SIZE

SHEET NO.

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02

A4



MATERIAL TAKE-OFF

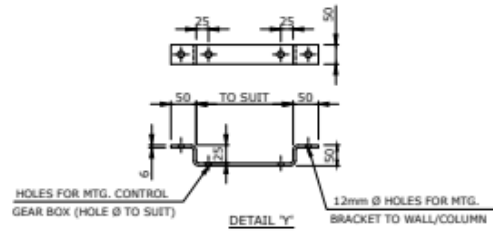
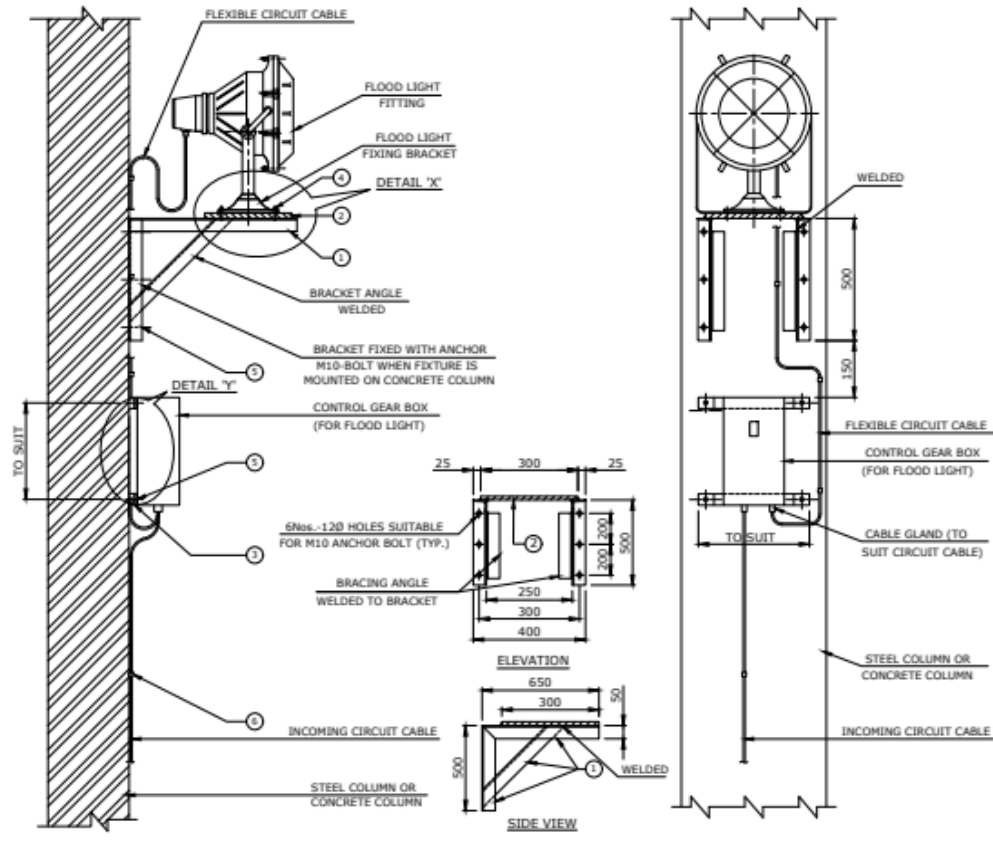
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	CABLE GLAND (SIZE TO SUIT CIRCUIT CABLE)	AS REQUIRED	
2	50 x 50 x 6mm THK. 650mm LONG M.S. ANGLE	2 NOS.	
3	300 x 300 x 6mm THK. MILD STEEL FLAT	AS REQUIRED	
4	50 x 6mm THK. MELD STEEL FLAT (LENGTH TO SUIT)	AS REQUIRED	
5	M10 x 50 LONG M.S. BOLT WITH NUT & WASHER	AS REQUIRED	
6	3 mm THK. KICK PLATE (SIZE TO SUIT AT SITE)	AS REQUIRED	

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. AFTER INSTALLATION THE ASSEMBLY IS TO BE PREPARED, PRIMED AND PAINTED.

TYPICAL MOUNTING ARRANGEMENT OF FLOOD LIGHT MOUNTED ON STEEL/CONCRETE COLUMN

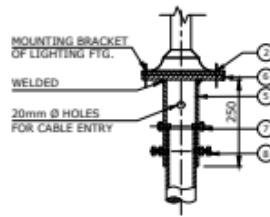
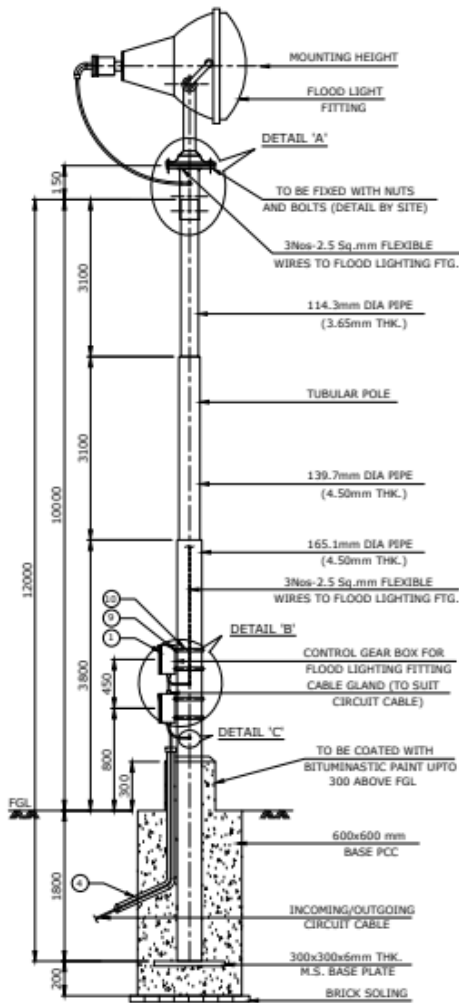
STANDARD DRAWING NO.		REV.	SIZE
SHEET NO.		02	A4
1 OF 1			



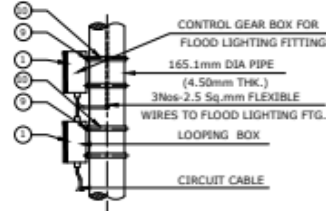
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	50 x 50 x 6mm THK. M.S. ANGLE (AS PER DETAIL-'X')	AS REQUIRED	
2	300 x 300 x 6mm THK. MILD STEEL PLATE FOR FIXING FLOOD LIGHT FITTING	1 NO.	
3	50 x 6mm THK. MILD STEEL FLAT (AS PER DETAIL-'Y')	2 NOS.	
4	M10-50mm LONG BOLT WITH LOCK NUT & WASHER FOR FIXING FLOOD LIGHT FITTING	4 NOS.	
5	M10-88mm LONG STUD WITH NUT & LOCK WASHER FOR FIXING BRACKET	10 NOS.	
6	SADDLE/CLEAT (TO SUIT CABLE SIZE) WITH SUITABLE SIZE FIXING ANCHOR BOLTS LOCK WASHERS 7 NUTS.	AS REQUIRED	

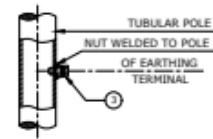
- NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETERS.
  2. AFTER INSTALLATION THE ASSEMBLY IS TO BE PAINTED WITH TWO COATS OF ANTI-CORROSSIVE PAINT AND TWO COATS OF EPOXY PAINTS.



DETAIL 'A'



DETAIL 'B'



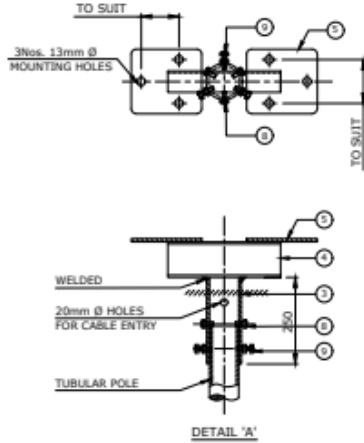
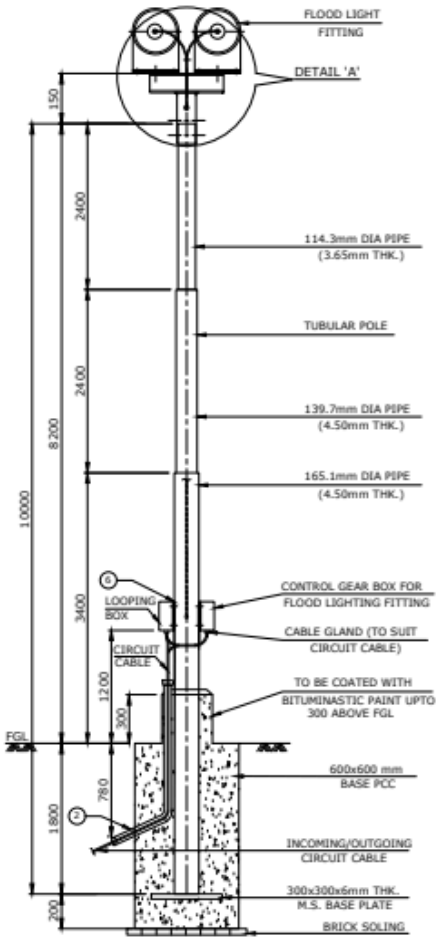
DETAIL 'C'

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	STREET LIGHTING LOOPING BOX	1 NO.	
2	M8 x 40mm LONG BOLT WITH NUTS & PLAIN WASHER FOR FIXING FLOOD LIGHT	AS REQUIRED	
3	EARTHING TERMINAL M10-40mm LONG BOLT WITH NUTS, 2Nos. SPRING WASHERS & 2Nos. PLAIN WASHERS	1 NO.	
4	75mm NB G.I. PIPE SLEAVE	2 NOS.	
5	M.S PIPE CAP TO SUIT 114.30mm DIA PIPE	1 NO.	
6	300 x 300 x 10mm THICK M.S. PLATE	1 NO.	
7	M10-40mm LONG BOLT TO BE USED AS STOPPER	3 NOS.	
8	M10 x 40mm LONG BOLT WITH LOCK NUT TO BE USED AS HOLDER	3 NOS.	
9	M8-40mm LONG BOLT WITH NUTS & PLAIN WASHER FOR FIXING OF CONTROL GEAR BOX & LOOPING BOX	8 NOS.	
10	BRACKET/CLAMP MADE OUT FROM 25x6mm THK. M.S. PLAT FOR FIXING OF CONTROL GEAR BOX & LOOPING BOX	4 NOS.	

NOTES:

1. LIGHTING FITTING FIXING DETAILS TO BE FURNISHED BY SITE.
2. EARTHING TERMINALS ARE LOCATED DIAMETRICALLY OPPOSITE.
3. ALL NUTS, BOLTS AND WASHER SHALL BE GALVANISED OR ZINC PASSIVATED.
4. MOUNTING DETAILS OF CONTROL GEAR BOX & LOOPING BOX REFER INSTALLATION DETAILS.
5. ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
6. POLE SHALL BE MADE FROM TUBULAR STEEL PIPES SWAGED AND WELDED CONFORMING TO DESIGNATION 412TF-60 AS PER IS-2713 (PART II) - 1980.



MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	STREET LIGHTING LOOPING BOX	-	
2	75mm NB G.I. PIPE SLEEVE	2 NOS.	
3	M.S PIPE CAP (TO SUIT 114.30mm DIA PIPE)	1 NO.	
4	100 x 50 x 6mm THK. M.S. CHANNEL (LENGTH TO SUIT)	AS REQUIRED	
5	300 x 300 x 6mm THICK M.S. PLATE	2 NOS.	
6	50 x 6mm THICK M.S. FLAT (LENGTH TO SUIT)	AS REQUIRED	
7	M10-30mm LONG BOLT WITH NUT, WASHER FOR FIXING FLOOD LIGHT	AS REQUIRED	
8	M10 BOLT (TO BE USED AS STOPPER)	3 NOS.	
9	M10 BOLT WITH LOCK NUT (TO BE USED AS HOLDER)	3 NOS.	

NOTES:

1. FIXING DETAILS TO BE FURNISHED BY SITE.
2. EARTHING TERMINALS ARE LOCATED DIAMETRICALLY OPPOSITE.
3. 2 Nos. 20mm Ø HOLES LOCATED DIAMETRICALLY OPPOSITE.
4. MOUNTING DETAILS OF CONTROL GEAR BOX & LOOPING BOX TO BE FIXED BY SITE.
5. FOR INCANDESCENT LAMP, FLEXIBLE CABLE TO GO DIRECTLY TO FITTING.
6. ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
7. ALL NUTS, BOLTS AND WASHER SHALL BE GALVANISED OR ZINC PASSIVATED.
8. POLE SHALL BE MADE FROM TUBULAR STEEL PIPES SWAGED AND WELDED CONFORMING TO DESIGNATION 410TP-60 AS PER IS-2713 (PART II) - 1980.

TYPICAL MOUNTING DETAIL OF 8 NOS. FLOOD LIGHTING FITTING ON LATTICE TYPE TOWER

STANDARD DRAWING NO.

REV.

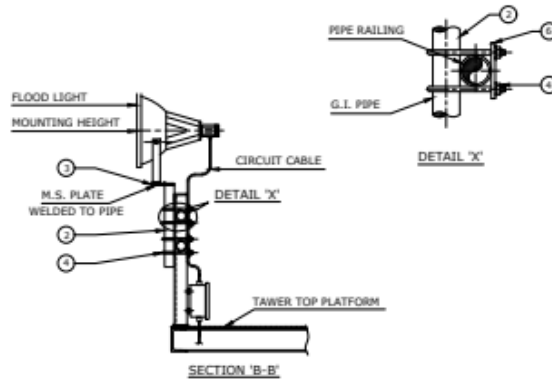
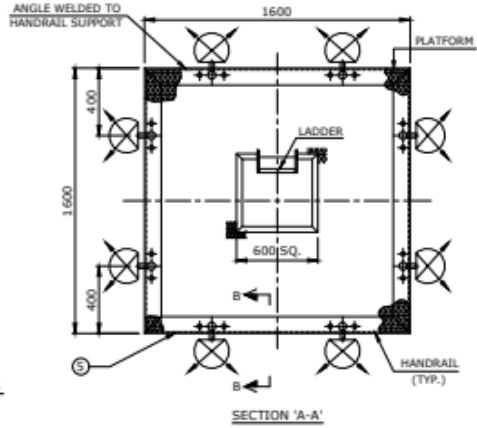
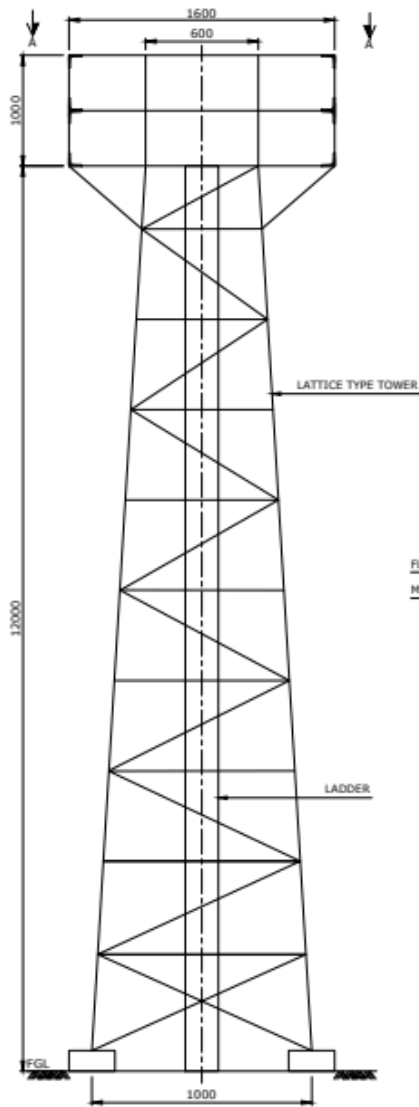
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SHEET NO.

1 OF 1

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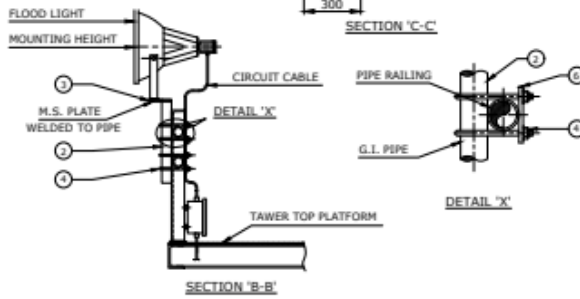
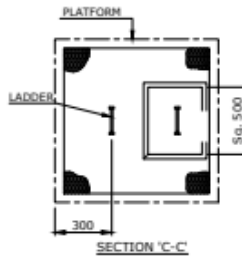
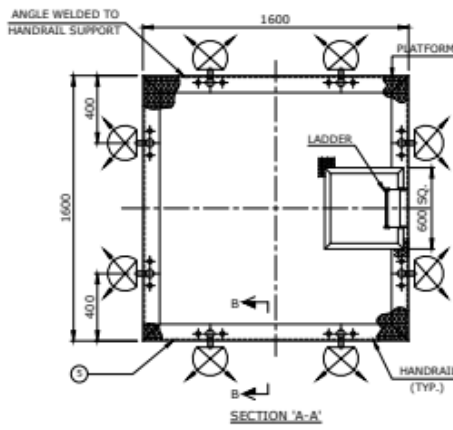
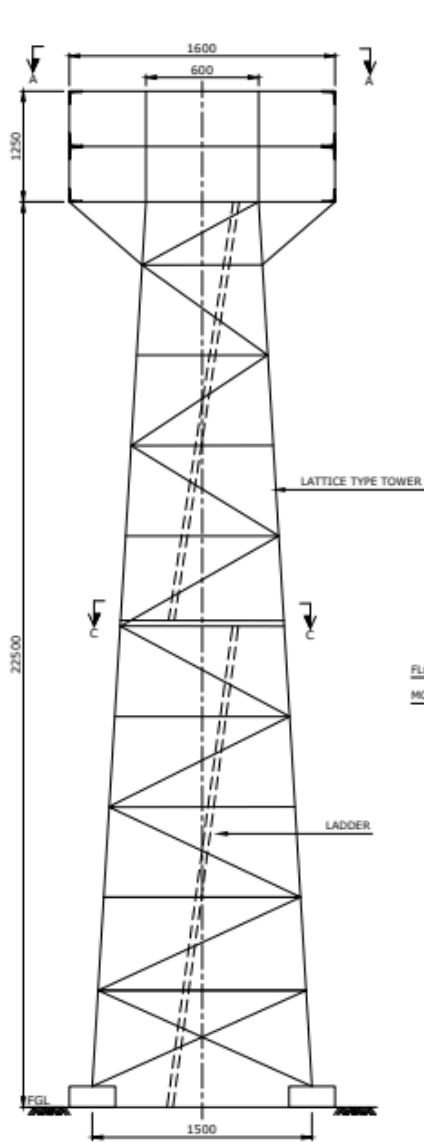
A4



MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	CONTROL GEAR BOX	AS REQUIRED	
2	40mm Ø G.I. PIPE (CLASS HEAVY) LENGTH TO SUIT	AS REQUIRED	
3	150 x 250 x 6mm THK. M.S. PLATE	AS REQUIRED	
4	M10 'U' BOLT OF SUITABLE SIZE (THREADED AT BOTH ENDS) WITH NUT AND WASHER	4 NOS.	
5	75 x 75 x 6mm THK. M.S. ANGLE (LENGTH TO SUIT)	AS REQUIRED	
6	25 x 6mm THICK M.S. FLAT (LENGTH TO SUIT)	AS REQUIRED	

NOTES:



MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	CONTROL GEAR BOX	AS REQUIRED	
2	40mm Ø G.I. PIPE (CLASS HEAVY) LENGTH TO SUIT	AS REQUIRED	
3	150 x 250 x 6mm THK. M.S. PLATE	AS REQUIRED	
4	M10 'U' BOLT OF SUITABLE SIZE (THREADED AT BOTH ENDS) WITH NUT AND WASHER	2 NOS.	
5	75 x 75 x 6mm THK. M.S. ANGLE (LENGTH TO SUIT)	AS REQUIRED	
6	25 x 6mm THICK M.S. FLAT (LENGTH TO SUIT)	AS REQUIRED	

NOTES:

TYPICAL MOUNTING DETAILS OF  
FLAMEPROOF LED  
LIGHTING FITTING

STANDARD DRAWING NO.

REV.

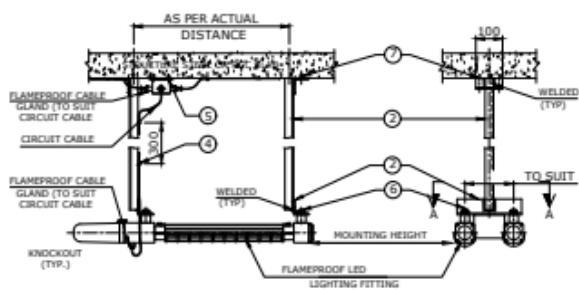
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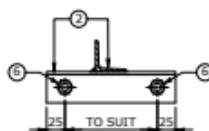
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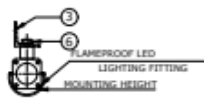
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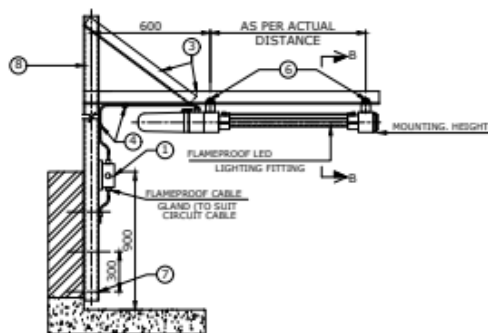
DETAIL FOR SUSPENSION MOUNTING  
MOUNTING TYPE : SM9



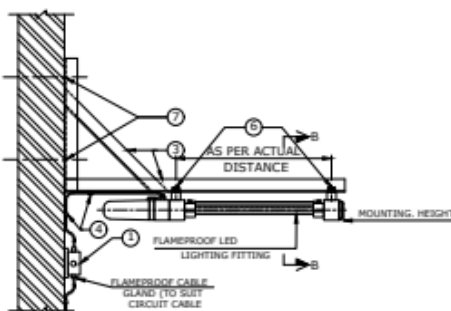
SECTION 'A-A'



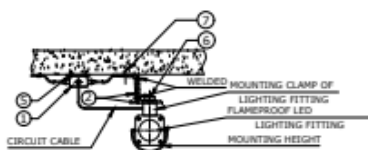
SECTION 'B-B'



DETAIL FOR ROOF/TERRACE MOUNTING  
MOUNTING TYPE : BM9



DETAIL FOR BRACKET MOUNTING  
MOUNTING TYPE : BM9

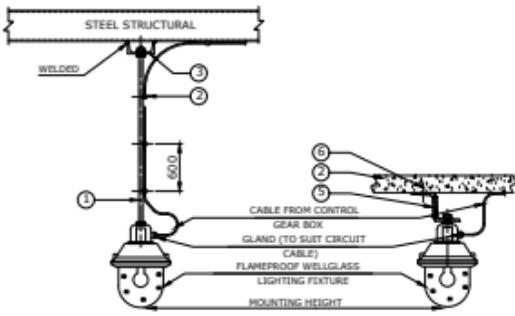


DETAIL FOR CEILING MOUNTING  
MOUNTING TYPE : CM9

MATERIAL TAKE-OFF

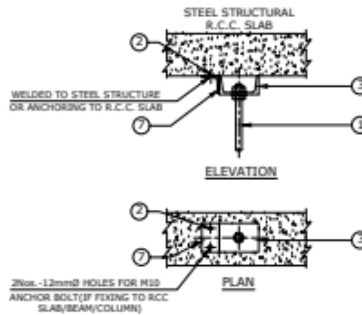
ITEM NO.	DESCRIPTION	QUANTITY			REMARKS
		CM	SM	BM	
1	FLAMEPROOF JUNCTION BOX WITH TERMINAL BLOCK.	1 NO.	1 NO.	1 NO.	
2	ISA 50 x 50 x 6mm THK. (LENGTH TO SUIT)	AS REQD.	AS REQD.	-	
3	BRACKET MADE OUT FROM ISA 75 x 75 x 6mm THK. (LENGTH TO SUIT).	-	-	AS REQD.	
4	SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF FIXING SCREWS TO SUIT FOR CIRCUIT CABLE.	AS REQD.	AS REQD.	AS REQD.	
5	M8-68mm LONG STUD ANCHOR WITH NUT & LOCK WASHER FOR JUNCTION BOX FIXING TO CEILING/WALL.	2 NOS.	2 NOS.	2 NOS.	
6	M10x40mm LONG BOLT NUT & PLAIN WASHER.	2 NOS.	4 NOS.	4 NOS.	
7	M10-68mm LONG STUD ANCHOR WITH NUT & LOCK WASHER FOR FIXING OF ISA TO CEILING/WALL.	2 NOS.	4 NOS.	4 NOS.	
8	ISMC -150 (LENGTH TO SUIT)	-	-	AS REQD.	

NOTES:

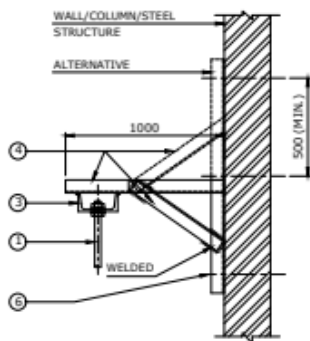


SUSPENSION MOUNTING  
MOUNTING TYPE : SMB

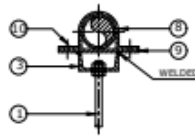
CEILING MOUNTING  
MOUNTING TYPE : CMB



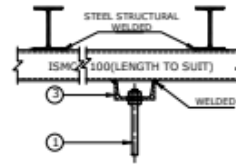
MOUNTING DETAIL ON  
R.C.C. SLAB



WALL/COLUMN BRACKET  
MOUNTING TYPE : BMB



TUBULAR TRUSS  
MOUNTING TYPE : PMB



SUSPENSION FROM STEEL  
STRUCTURE  
MOUNTING TYPE-SMB

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	10mm Ø H.S. ROD (LONG AS REQUIRED) THREADED WITH BOTH ENDS WITH 2 Nos. NUTS, 2Nos. PLAIN/SPRING WASHERS	2 NOS.	
2	SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF FIXING SCREWS. TO SUIT FOR CIRCUIT CABLE.	AS REQUIRED	
3	ISMC 100 x 50 - 75mm LONG (OR MORE LONG AS REQUIRED)	1 NO.	
4	BRACKET MADE OUT FROM ISA 50 x 50 x 6mm THK.	AS REQUIRED	
5	ISMC 75 x 40 - 50mm LONG (OR MORE LONG AS REQUIRED)	1 NO.	
6	M10-45mm LONG ANCHOR BOLT FOR MOUNTING OF PLATE/ BRACKET/ISMC TO WALL/COLUMN/CEILING	AS REQUIRED	
7	ISA 50 x 50 x 6mm THK. WITH 2 Nos. -Ø12mm HOLES	AS REQUIRED	
8	CLAMP/SADDLE (TO BE MADE OUT OF 50 x 6mm H.S. FLAT) WITH FIXING SCREWS. (CLAMP TO SUIT SIZE OF TRUSS/PIPE)	1 NO.	
9	50 x 6mm THK. H.S. FLAT (FOR SADDLE/CLAMP FIXING) LENGTH TO SUIT SIZE OF TRUSS/PIPE	1 NO.	
10	M10-45mm LONG BOLT WITH NUT & WASHER FOR CLAMP/ SADDLE BOLTED	2 NOS.	

NOTES:

TYPICAL HANDRAIL MOUNTED PIPE  
DETAILS OF FLAMEPROOF WELLGLASS  
LIGHTING FIXTURE

STANDARD DRAWING NO.

REV.

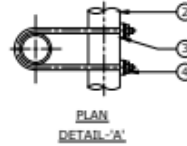
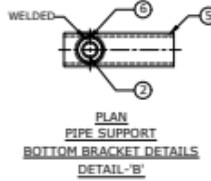
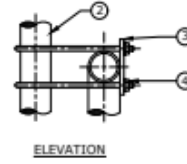
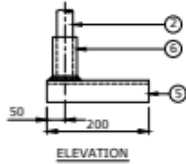
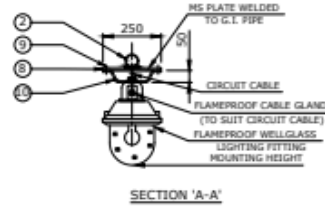
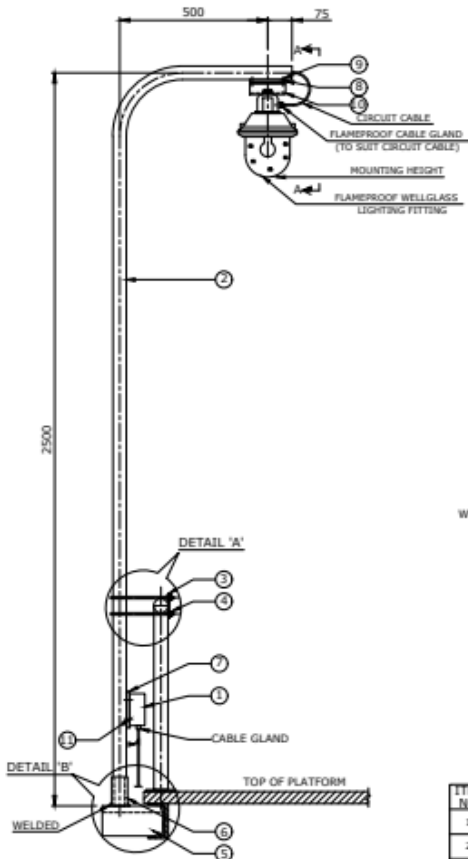
SIZE

02

A4

SHEET NO.

1 OF 1

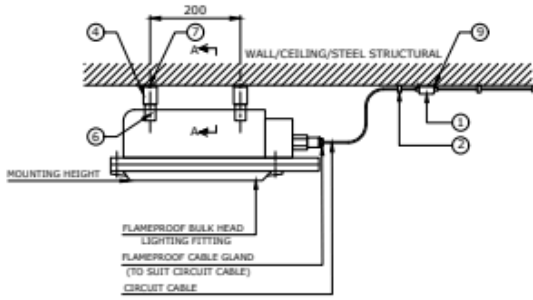


MATERIAL TAKE-OFF

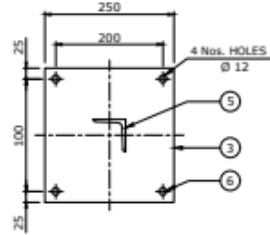
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	FLAMEPROOF CONTROL GEAR BOX	1 NO.	
2	40mm Ø G.I. PIPE (CLASS HEAVY) WITH ONE SIDE 300mm RADIUS 90° BEND & OTHER END THREADED	1 NO.	
3	CLAMP MADE OUT FROM 25x6mm THK. M.S. FLAT 150mm LONG FOR FIXING WITH 1/2" BOLT	4 NOS.	
4	10mm Ø 1/2" BOLT SUITABLE WITH BOTH END THREADED WITH NUTS & PLAIN WASHER SUITABLE FOR 40mm Ø G.I. PIPE	4 NOS.	
5	ISRC-100 x 50 x 200mm LONG FOR SUPPORT TO PIPE	1 NO.	
6	G.I. PIPE COUPLING TO SUIT 40mm Ø G.I. PIPE, COUPLING WELDED TO ISRC-100 x 50	1 NO.	
7	150 x 150 x 3mm THK. M.S. PLATE WITH SUITABLE SIZE OF HOLES FOR MOUNTING OF JUNCTION BOX	1 NO.	
8	25 x 6mm THK.-250 LONG M.S. FLAT WELDED TO G.I. PIPE	1 NO.	
9	M10-40mm LONG BOLT WITH NUT & PLAIN WASHER FOR FIXING OF BRACKET TO FLAT	2 NOS.	
10	BRACKET/CLAMP MADE OUT FROM 25 x 6mm THK. M.S. FLAT 325mm LONG FOR LIGHTING FITTING FIXING	1 NO.	
11	M6-40mm LONG BOLT WITH NUT & PLAIN WASHER FOR FIXING OF JUNCTION BOX TO MS PLATE	2 NOS.	

NOTES:

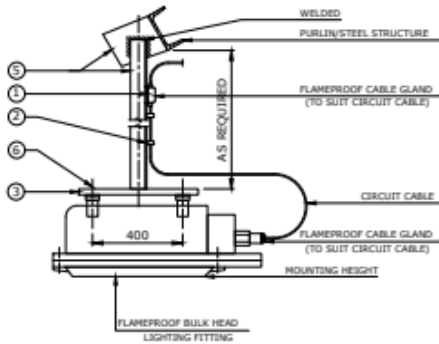
1. MOUNTING HEIGHT SHALL NOT BE EXCEED 4M FROM THE PLATFORM.
2. CABLE GLAND USED FOR TERMINATION OF FLEXIBLE CABLE SHALL BE DOUBLE SEAL WITH CONE GRP FOR BRADING.
3. PLUG ALL UNUSED ENTRIES OF LIGHTING FITTING AND JUNCTION BOX WITH THREADED STOPPING PLUGS.



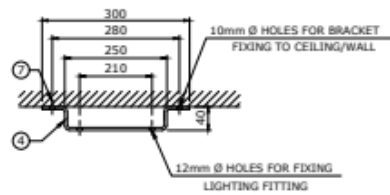
CEILING/WALL MOUNTED BULK HEAD LIGHTING  
FITTING MOUNTING TYPE : CM7



MOUNTING DETAILS OF PLATE



PENDENT (SUSPENSION) MOUNTING BULK HEAD  
LIGHTING FITTING (ON PURLIN)  
MOUNTING TYPE : SM7



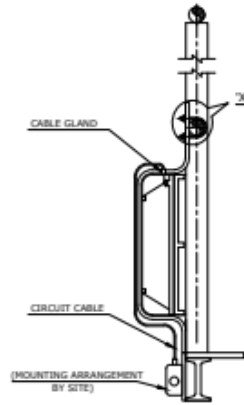
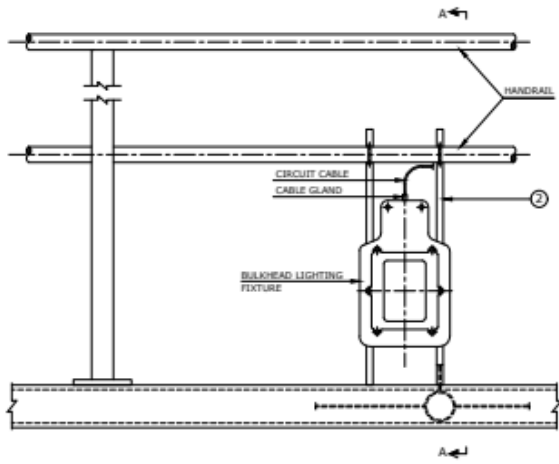
SECTION 'A-A'

MATERIAL TAKE-OFF

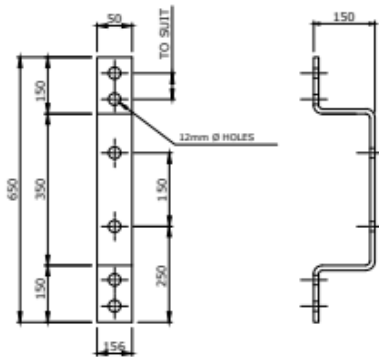
ITEM NO.	DESCRIPTION	QUANTITY		REMARKS
		CM7	SM7	
1	FLAMEPROOF CONTROL GEAR BOX	1 NO.	1 NO.	
2	SADDLE/CLEAT WITH FIXING SCREWS/ANCHOR STUD, NUTS & LOCK WASHERS FOR CIRCUIT CABLE	AS REQD.	AS REQD.	
3	250 x 250 x 8mm THK. H.S. PLATE	-	1 NO.	
4	MOUNTING BRACKET/CLAMP (TO MADE OUT FROM 25 x 6mm THK PLAT) FOR LIGHTING FITTING.	2 NOS.	-	
5	ISA 50 x 50 x 6mm THK. (LENGTH TO SUIT)	-	AS REQD.	
6	M10-40mm LONG BOLT WITH NUT & WASHER FOR BOLTING FITTING TO BRACKET	4 NOS.	4 NOS.	
7	M10-68mm LONG STUD WITH NUT & LOCK WASHER FOR BRACKET MOUNTING TO CEILING	4 NOS.	-	
8	M8-40mm LONG BOLT WITH NUT & WASHER FOR BOLTING JUNCTION BOX TO ANGLE	-	2 NOS.	
9	M8-68mm LONG ANCHOR STUD WITH NUT & LOCK WASHER FOR JUNCTION BOX MOUNTING TO CEILING	2 NOS.	-	

NOTES:

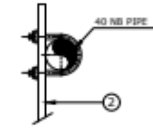
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
3. ALL NUTS, BOLTS AND WASHERS SHALL BE GALVANISED OR ZINC PASSIVATED.



SECTION 'A-A'



DETAIL OF FIXING BRACKET

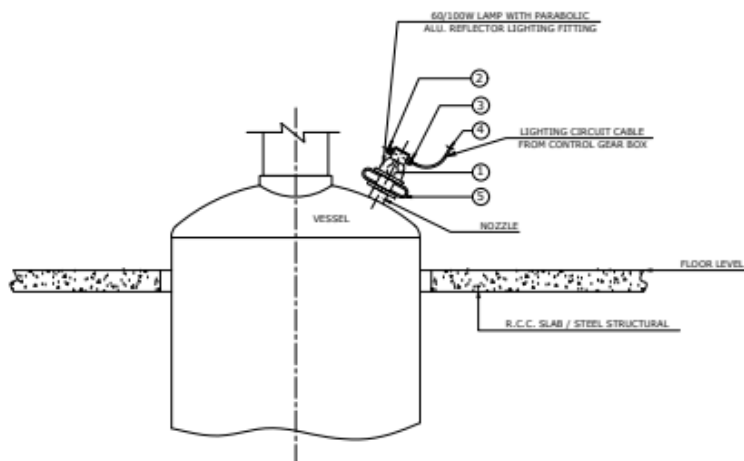


DETAIL 'X'

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	JUNCTION BOX	1 NOS.	
2	FIXING BRACKET MADE OUT OF 32 x 6mm M.S. PLAT	2 NOS.	
3	13mm 'U' BOLT SUITABLE SIZE (BOTH END THREADED) WITH NUTS WASHERS.	AS REQUIRED	

NOTES:

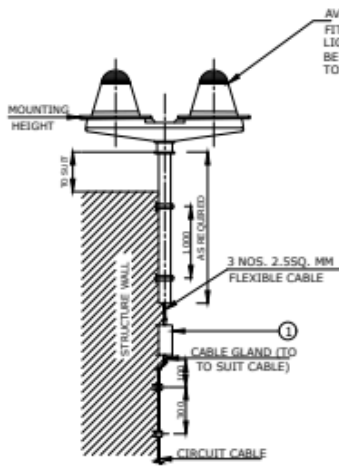


MATERIAL TAKE-OFF

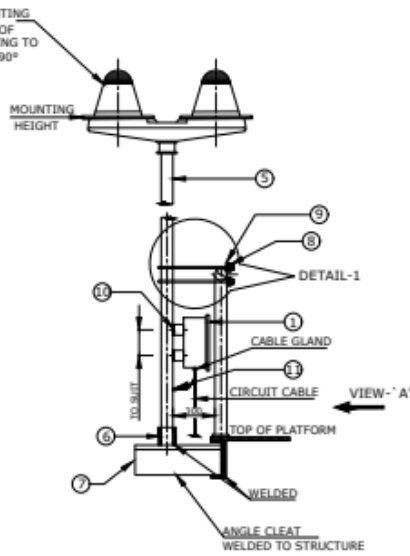
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	60/100 W LAMP & PARABOLIC ALUMINUM REFLECTOR	1 NO.	BY PURCHASER
2	PLUG	1 NO.	BY PURCHASER
3	CABLE GLAND (TO SUIT CIRCUIT CABLE)	AS REQUIRED	BY PURCHASER
4	CIRCUIT CABLE	AS REQUIRED	BY PURCHASER
5	6mm THK. M.S. MOUNTING BRACKET (SIZE TO SUIT)	1 NO.	BY PURCHASER

NOTES:

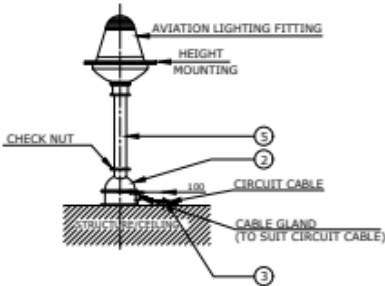
1. LONGER CABLE ROUTE SHALL BE SELECTED TO KEEP EXTRA LENGTH OF CABLE FOR REGLANDING IF NECESSARY.



**FITTING MOUNTED ON SIDE SUPPORT TO STRUCTURE/ WALL MOUNTING TYPE-PM11**



**FITTING MOUNTED ON PLATFORM MOUNTING TYPE-PM11**



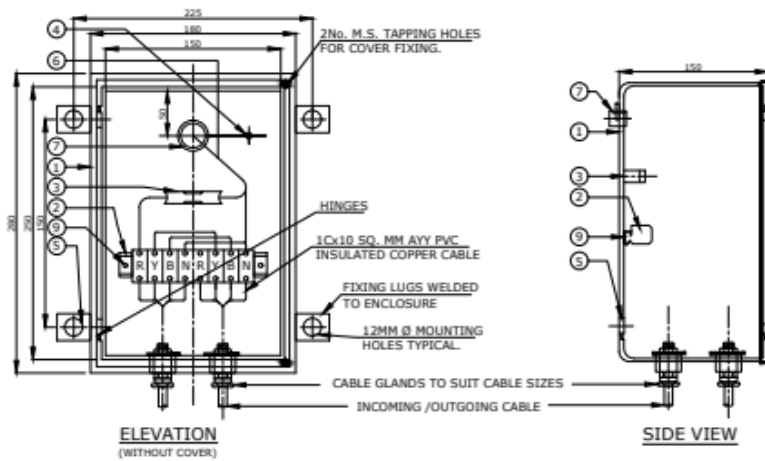
**FITTING DIRECTLY MOUNTED ON STRUCTURE/ CEILING MOUNTING TYPE PM-11**

**MATERIAL TAKE-OFF**

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	JUNCTION BOX WEATHER PROOF TYPE	1 No.	
2.	JUNCTION BOX WEATHER PROOF WITH DOME COVER TO SUIT 40 MM DIA G.I. PIPE.	1 No.	
3.	SADDLE/CLEAT WITH FIXING M.S. 60MM LONG SCREWS/ STUCKS, NUTS & LOCK WASHER FOR CIRCUIT CABLE.	AS REQUIRED	
4.	SADDLE/CLEAT WITH FIXING M.S. 60MM LONG SCREWS/ STUCKS, NUTS & LOCK WASHER FOR 40 MM DIA PIPE.	AS REQUIRED	
5.	40 MM DIA G.I. PIPE (LENGTH AS REQUIRED) WITH BOTH ENDS THREADED & CHECK NUTS.	1 No.	
6.	G.I. COUPLING SUITABLE FOR 40 MM DIA G.I. PIPE.	1 No.	
7.	ISPC-100x50x350 MM LONG.	1 No.	
8.	13 MM DIA 1/2 BOLT SUITABLE FOR 40 MM DIA PIPE WITH BOTH ENDS THREADED WITH NUTS 2ND. PLAIN AND 1ND. SPRING WASHERS WITH SUITABLE LENGTH.	4 No.	
9.	50x6x150MM LONG G.I. FLAT WITH 2ND. 12 MM DIA HOLES.	4 No.	
10.	150X150x6 THICK M.S. PLATE WITH 2ND. 12MM DIA HOLES OR 50x6x300 LONG G.I. FLAT WITH 2ND. 12MM DIA HOLES	1 No.	
11.	RURDER GROUTMENT TO SUIT FLEXIBLE WIRE.	2 No.	

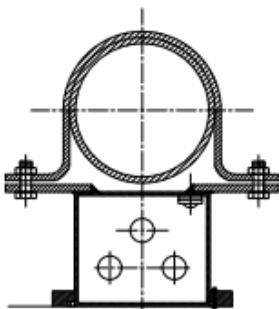
**NOTES:**

1. WEIGHT OF FITTING 5.5 KG.
2. USE FLEXIBLE WIRE FOR CONNECTION TO LIGHTING FROM JUNCTION BOX.
3. MOUNTING HEIGHT OF THE AVIATION LIGHTING FITTING SHALL BE AT HIGHER ELEVATION THAN THE STRUCTURE ON WHICH FITTING IS TO BE MOUNTED.



ELEVATION  
(WITHOUT COVER)

SIDE VIEW

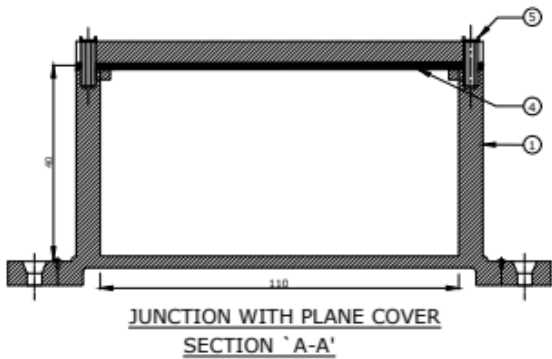
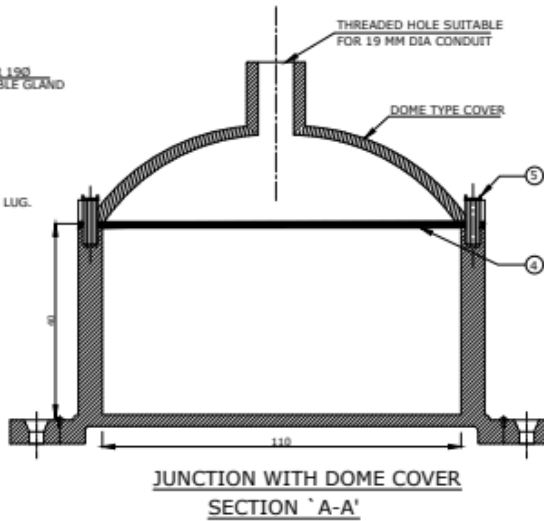
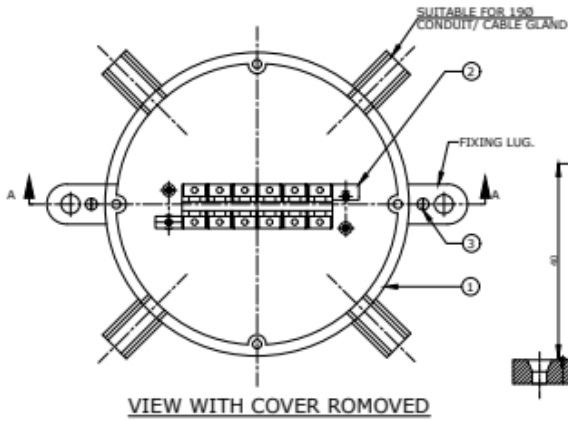


PLAN

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	2 MM THICK SHEET STEEL ENCLOSURE WITH COVER	1 No.	
2.	6 No. 30A, TERMINAL CONNECTOR SUITABLE FOR TERMINATING OF 4Cx10 SQ. MM CABLE (CHANNEL MFG.)	1 No.	
3.	4A, HRC FUSE	1 No.	
4.	19x20 MM LONG ROUND HEAD EARTHING SCREW WITH 2 No. PLAIN WASHER & 1 No. SPRING WASHER	2 No.	
5.	25x3 MMx70 MM LONG MS FLAT WITH 12 MM Ø HOLE WELDED TO ENCLOSURE LOGS FOR MOUNTING	4 No.	
6.	3Cx2.5 SQ. MM PVC FLEXIBLE WIRES	AS REQUIRED	
7.	20 MM Ø -25 MM LONG G.I. PIPE WELDED TO ENCLOSURE	1 No.	
8.	160x40 MM LONG BOLTS WITH NUT, LOCK NUT & PLAIN WASHERS FOR ENCLOSURE FIXING	4 No.	
	MOUNTING CHANNEL SUITABLE FOR 6 No. 30A, TERMINAL CONNECTOR (LENGTH AS REQUIRED)	1 No.	

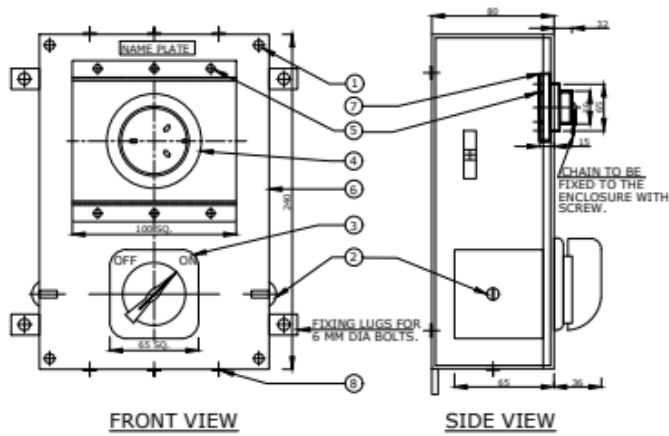
NOTES:



MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	JUNCTION BOX (CAST ALUMINIUM)	AS REQUIRED	
2.	TBA, 4 WAY, TERMINAL BLOCK	1 No.	
3.	8 MM LONG BRASS SCREW WITH 2 No. PLAIN AND SPRING WASHER FOR INTERNAL AND EXTERNAL EARTHING TERMINAL.	2 No.	
4.	DISC TYPE NEOPRENE GASKET.	1 No.	
5.	COVER FIXING G.I. SCREWS WITH WASHER	4 No.	

NOTES:



MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	5 MM DIA M/C SCREWS.	4 No.	
2.	5 MM DIA EARTHING SCREW WITH 2 No. PLAIN 1 No. SPRING WASHER.	2 No.	
3.	16A, 2 POLE, ON-OFF ROTARY SWITCH	1 No.	
4.	10A, 30 AND EARTH METAL CLAD SOCKET OUTLET	1 No.	
5.	3 MM DIA M/C SCREWS	6 No.	
6.	14 SWG P.L.S. BOX WITH COVER FOR MOUNTING OF SWITCH AND SOCKET OUTLET	1 No.	
7.	14 SWG P.L.S. SHEET FIXED TO COVER PLATE FROM INSIDE FOR MOUNTING OF SOCKET	1 No.	
8.	10 MM DIA KNOCKOUT	6 No.	

NOTES:

1. SIMILAR ARRANGEMENT CAN BE EMPLOYED FOR 20A, 5P & E, 30A, TP & E, 5D WITH 30A, DP & 0.3A, TP SWITCH RESPECTIVELY.
2. EPOXY BASED PAINT OF SPECIFIED SHADE SHALL BE APPLIED.
3. REAR ENGRAVED PERSPEX OF LAMINATED PLASTIC NAME PLATE WITH APPROPRIATE INSCRIPTION SHALL BE FIXED ON COVER WITH OR SUITABLE ADHESIVE.

GENERAL NOTES:

1. ENTIRE EARTHING INSTALLATION SHALL COMPLY WITH THE REQUIREMENT OF IS-3043 INDIAN ELECTRICITY RULES OISD REGULATION AND OTHER APPLICABLE STATUTORY REGULATIONS AND SAFETY CODES IN THE LOCALITY OF THE INSTALLATION.
2. PIPE ELECTRODE SHALL BE USED FOR EARTH ELECTRODES. THE EARTH ELECTRODES SHALL BE KEPT SUFFICIENTLY AWAY FROM STRUCTURE TO CLEAR FOUNDATIONS, FOOTING ETC. SPACING OF MINIMUM 6 METERS SHALL BE KEPT BETWEEN ADJACENT EARTH ELECTRODES.
3. RESISTANCE OF EARTHING STATION SHALL BE MEASURED AT EACH EARTH ELECTRODE AFTER ITS INSTALLATION BY MEANS OF AN EARTH MEGGER. RESISTANCE OF EARTHING GRID SHALL BE MAINTAINED WITHIN 1 OHM (BY ADDITION OF EARTH ELECTRODE IN PARALLEL, IF NECESSARY).
4. THE MAIN EARTH LOOP (MEL) IN PLANT AREAS SHALL BE GENERALLY ROUTED UNDERGROUND. EARTH CONDUCTORS TO INDIVIDUAL EQUIPMENT SHALL BE RUN ALONG WITH POWER AND CONTROL / LIGHTING CABLES. WHEN EQUIPMENT ARE LOCATED AWAY FROM M.E.L. , SUITABLE SUB LOOPS MAY BE RUN UP TO THEM FOR DERIVING CONNECTIONS FOR INDIVIDUAL EQUIPMENT.
5. ALL ELECTRICAL EQUIPMENT SHALL BE EARTHED AT TWO DISTINCT POINTS WITH EARTH CONDUCTOR.
6. PROCESS/ UTILITY PIPE RACK COLUMN SHALL BE EARTHED AT EVERY 25 mtr. AT NEAREST AVAILABLE EARTHING NETWORK AS PER IS : 3043.
7. ALL STRUCTURE STEEL WORK TO BE CONNECTED TO EARTHING SYSTEM.
8. FOR CONDUIT WIRING OF LIGHTING CIRCUITS, FOR EARTHING OF LIGHTING FITTINGS, JUNCTION BOXES 14 SWG
9. THE LIGHTNING PROTECTION SYSTEM SHALL BE DESIGNED IN ACCORDANCE WITH IS :62305' CODE OF PRACTICE FOR PROTECTION OF BUILDING AND ALLIED STRUCTURES AGAINST LIGHTNING'.
10. EARTH SYSTEM AND LIGHTNING PROTECTION SHALL BE BONDED TO EACH OTHER TO PREVENT SIDE FLASH OVER, IF ADEQUATE CLEARANCE BETWEEN THE TWO SYSTEM CAN NOT BE MAINTAINED.
11. WHEN EQUIPMENT DO NOT HAVE EXTERNAL EARTHING TERMINAL ELECTRICAL CONTRACTOR SHALL PROVIDE THE SAME ON EQUIPMENT. SIZES OF EARTH CONDUCTORS SHALL GENERALLY AS PER REQUIREMENTS.

EQUIPMENT EARTHING SCHEDULE

TYPE OF EQUIPMENT	EARTHING CONDUCTOR SIZE (SEE NOTE-1)
MOTORS UPTO & 3.7 kW	8 SWG SOLID G.I. WIRE
MOTORS FROM 5.5kW TO 30kW & WELDING RECEPTACLES	10mm (3/8") DIA G.I. WIRE ROPE
MOTORS ABOVE 30kW INCLUDING HV MOTORS	16mm (5/8") DIA G.I. WIRE ROPE/ 40x5 mm G.I. STRIP
BUILDING COLUMNS	40x5 mm G.I. STRIP
STORAGE TANKS (VERTICAL & HORIZONTAL)	40x5 mm G.I. STRIP
LOADING RACKS	40x5 mm G.I. STRIP
VESSELS & HEAT EXCHANGERS	40x5 mm G.I. STRIP
SMALL EQUIPMENT & INSTRUMENTS	8 SWG SOLID G.I. WIRE
LIGHTING, POWER & INSTRUMENT PANEL	10mm (3/8") DIA G.I. WIRE ROPE
MAIN EARTH BUS / MV & HT SWITCH GEAR INTERCONNECTIONS / POWER TRANSFORMER	AS SPECIFIED
EHV & HV SUB-STATION	AS SPECIFIED
PUSH BUTTON STATION	8 SWG SOLID G.I. WIRE
STREET LIGHTING POLES	10mm (3/8") DIA G.I. WIRE ROPE
LIGHTING TRANSFORMER	16mm (5/8") DIA G.I. WIRE ROPE
PIPE RACK	40x5 mm G.I. STRIP
BONDING OF PIPE	25 SQ. mm INSULATED FLEXIBLE CU. CABLE
LIGHTNING PROTECTION	25x3 mm G.I. EARTH STRIP

ELECTRODE FOR EARTHING SYSTEM

STANDARD DRAWING NO.

REV.

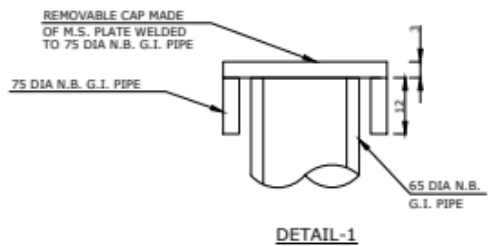
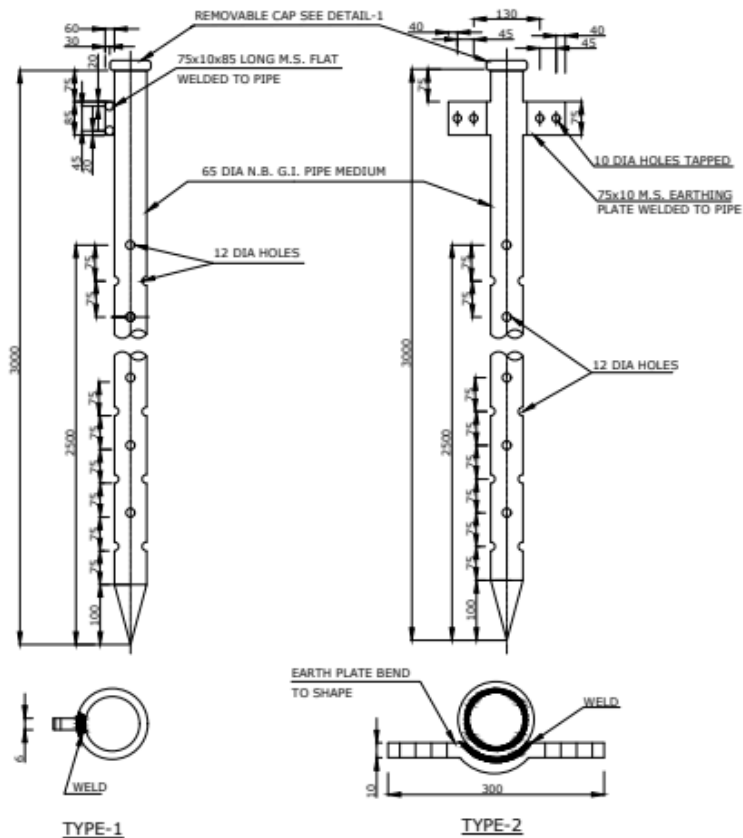
SIZE

SHEET NO.

1 OF 1

02

A4



NOTES:

1. THE PIPE ASSEMBLY SHALL BE HOT DIP GALVANISED AFTER FABRICATION.
2. UNLESS STATED OTHERWISE ON PLAN DRAWINGS, ONLY TYPE-2 SHALL BE USED.

EARTH ELECTRODE IN TEST PIT

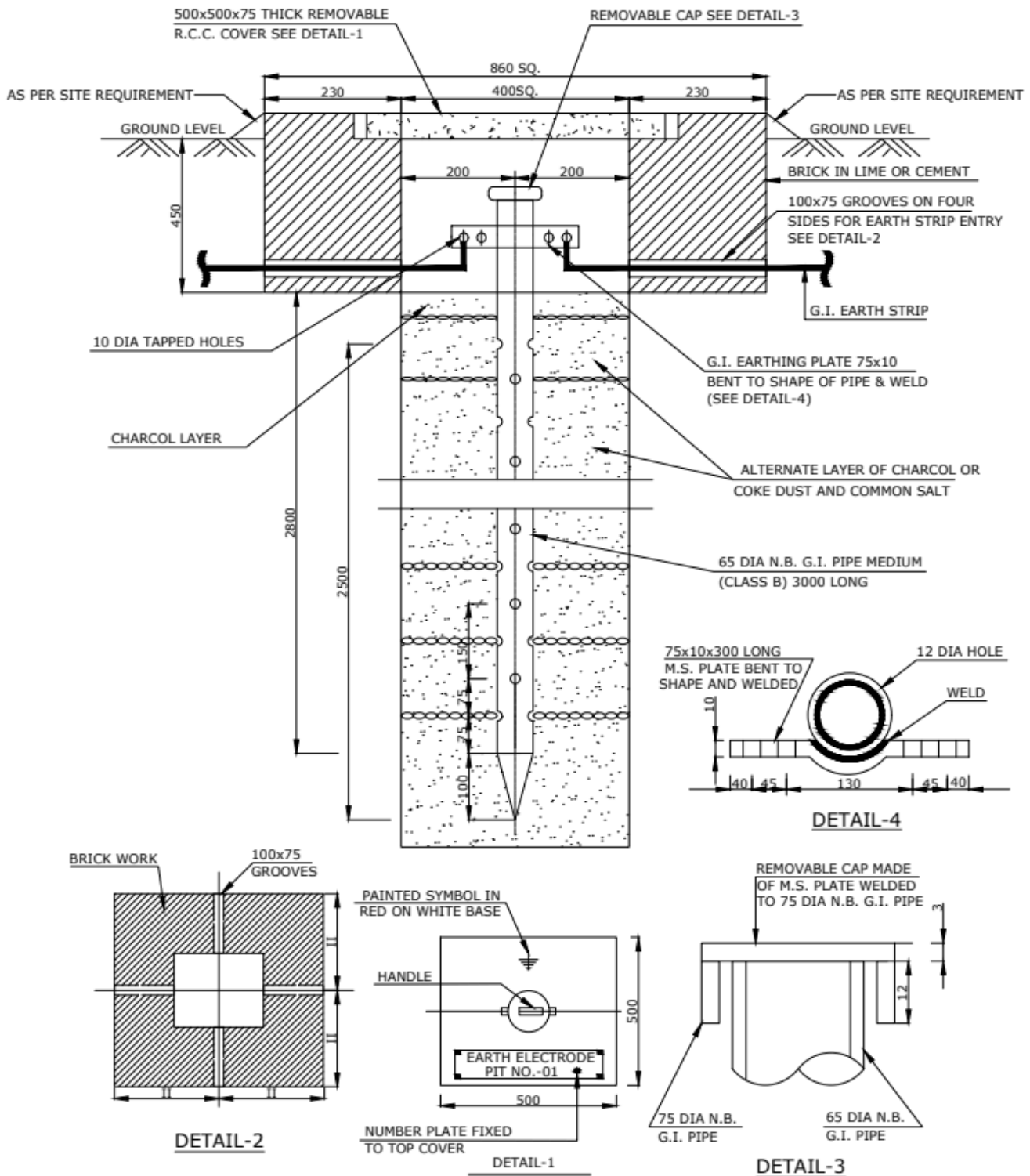
STANDARD DRAWING NO.

REV. SIZE

02 A4

SHEET NO.

1 OF 2



**NOTES:**

1. THE PIPE ASSEMBLY SHALL BE HOT DIP GALVANISED AFTER FABRICATION.
2. BRICK WORK SHALL BE DONE AFTER COMPACTING THE SOIL.

TYPICAL DETAILS OF DIRECTLY BURIED CHEMICAL EARTHING

STANDARD DRAWING NO.

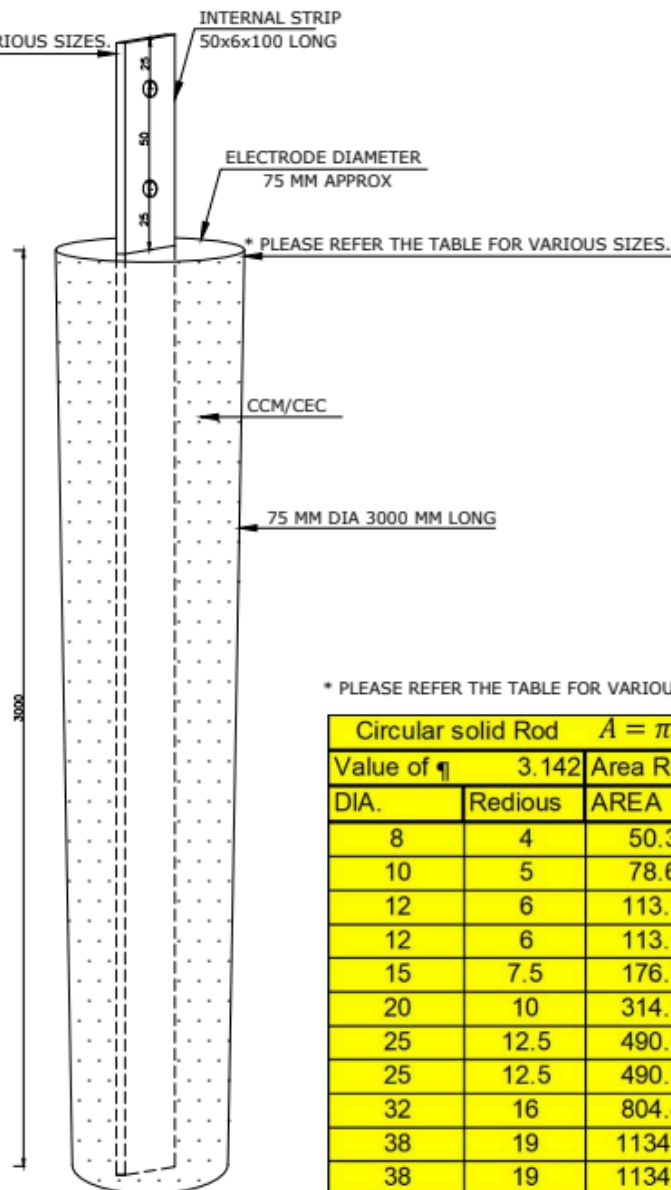
REV. SIZE

01 A4

SHEET NO.

2 OF 2

\* PLEASE REFER THE TABLE FOR VARIOUS SIZES.

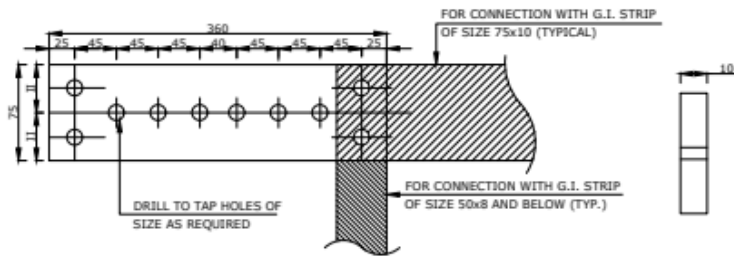


\* PLEASE REFER THE TABLE FOR VARIOUS SIZES.

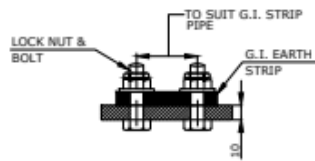
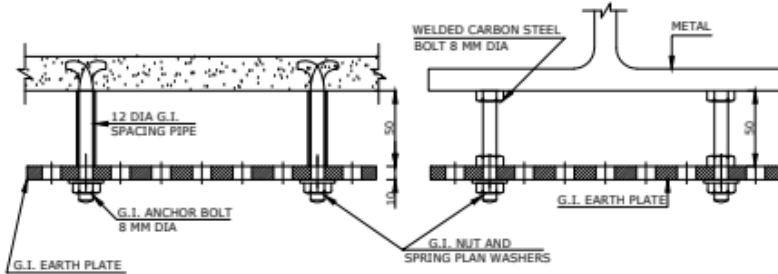
Circular solid Rod		$A = \pi r^2$	A = L X W		Earthing Strip		
Value of $\eta$		3.142	Area Rod	Area Strip	Earthing strip		
DIA.	Redious	AREA	AREA	Length	Width	Nos	
8	4	50.3	50	20	2.5	1	
10	5	78.6	75	25	3	1	
12	6	113.1	125	25	5	1	
12	6	113.1	128	32	4	1	
15	7.5	176.7	192	32	6	1	
20	10	314.2	300	50	6	1	
25	12.5	490.9	500	50	10	1	
25	12.5	490.9	520	65	8	1	
32	16	804.4	750	75	10	1	
38	19	1134.3	1200	100	12	1	
38	19	1134.3	1200	75	8	2	

NOTES:

1. CCM-CRYSTALLINE CONDUCTIVE MATERIAL / CEC-CHEMICAL EARTHING COMPOUND.
2. IT'S SUPERIOR CONDUCTIVE MATERIAL THAT SOLVES TOUGHEST GROUNDING PROBLEMS & MAKES CONDUCTIVITY LAYER CONTACTING WITH A ELECTRODE CLOSELY.
3. THE CCM/CEC NATURAL FEATURES OF STRONG ABSORBENT & MOISTURE RETENTION KEEP THE SOIL MOIST FOR A LONG TIME AND REDUCE SURROUNDING SOIL RESISTANCE.
4. CCM/CEC ENHANCING COMPOUND IS ENVIRONMENT FRIENDLY AND DOES NOT HARM GROUND WATER & NO HAZARDOUS CHEMICAL.
5. CCM/CEC CONTAINS CORROSION INHIBITOR TO PROTECT THE ELECTRODES AND PIPES.
6. CCM/CEC IS HIGHLY CONDUCTIVE & HANDLE ANY CLIMATIC CONDITION.
7. GI STRIP SHALL BE HOT DEEP GALVANIZE ZINK OXIDE.
8. CCM/CEC SHALL BE GRAPHITE,ALUMINUM SILICATE,IRON OXIDE,NATURAL EARTH MINERALS.
9. EARTHING SHALL BE COMPLY TO LATEST IS-3043.



G.I. EARTH PLATE



TYPICAL FIXING DETAIL OF G.I. EARTH STRIP TO EARTH PLATE

TYPICAL INSTALLATION OF EARTH PLATE ON R.C.C. STRUCTURES

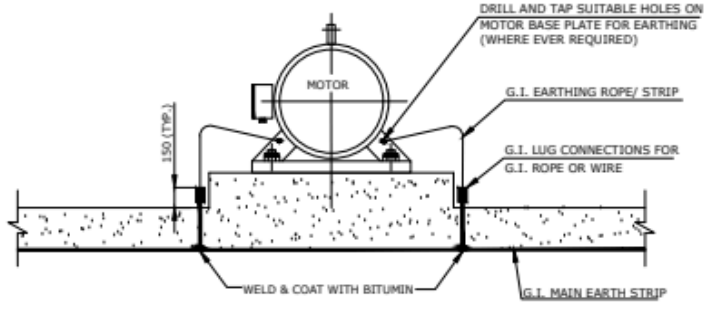
TYPICAL INSTALLATION OF EARTH PLATE ON STEEL STRUCTURES

NOTES:

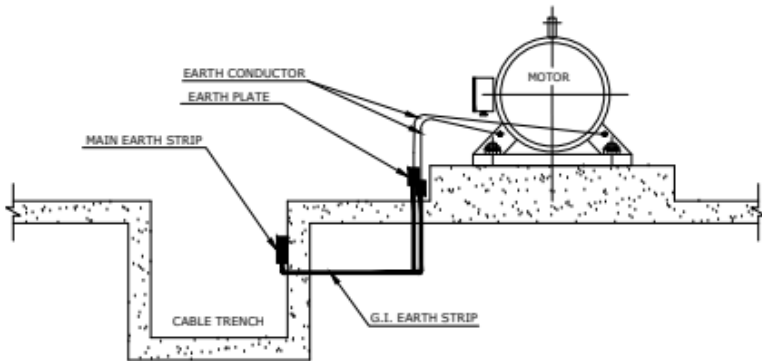
1. WHERE FIRE PROOFING OF STEEL STRUCTURES ARE ENCOUNTERED LENGTH OF CARBON STEEL BOLT SHALL BE INCREASED FOR FIXING OF EARTH PLATE.
2. ALL CONNECTIONS WITH EARTH PLATE SHALL BE MADE WITH G.I. BOLT, NUT, SPRING AND PLAIN WASHERS.

TYPICAL EARTHING FOR MOTOR

STANDARD DRAWING NO.		REV.	SIZE
		02	A4
SHEET NO.	1 OF 1		



**DETAIL-1**  
**REMOTE EARTH PLATE**



**DETAIL-2**  
**LOCAL EARTH PLATE**

**NOTES:**

1. MOTOR FOUNDATION BOLT SHALL NOT BE USED FOR EARTHING.

TYPICAL ARRANGEMENT FOR  
TRANSFORMER EARTHING  
(NEUTRAL SOLIDLY EARTHED)

STANDARD DRAWING NO.

REV.

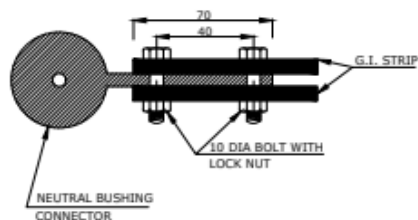
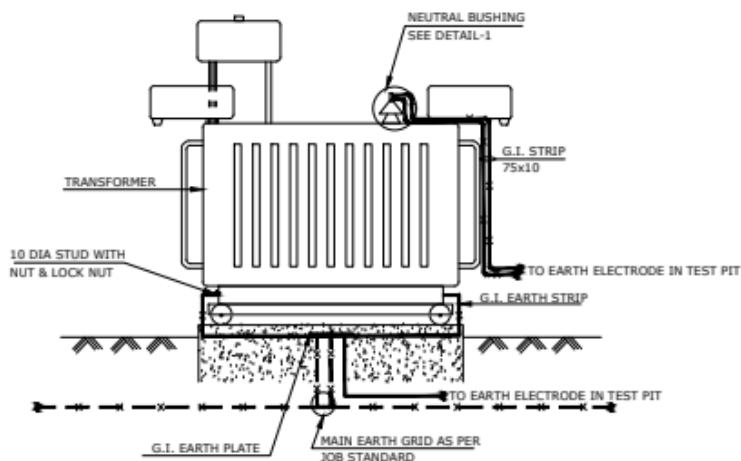
SIZE

02

A4

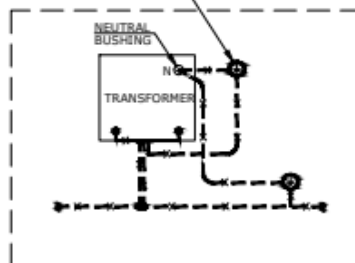
SHEET NO.

1 OF 1



DETAIL-1

EARTH ELECTRODE IN TEST PIT  
(SEE NOTE-3)



LING DIAGRAM

**NOTES:**

1. WHEREVER SEPERATE NEUTRAL BUSHING FOR EARTHING IS NOT PROVIDED THE NEUTRAL EARTHING SHALL BE DONE FROM BUS DUCT.
2. EARTH ELECTRODE IN TEST PITS SHALL BE SO LOCATED THAT DISTANCE BETWEEN TWO PITS SHALL BE MINIMUM 6 METER.
3. WHERE TRANSFORMERS NEUTRAL EARTHING IS DONE THROUGH N.G.R. THE CONNECTIONS BETWEEN NEUTRAL AND N.G.R. SHALL BE THROUGH CABLE. THE OTHER END END OF N.G.R. SHALL BE CONNECTED TO EARTH ELECTRODE.

TYPICAL EARTH CONNECTION FOR  
PUSH BUTTON STATION

STANDARD DRAWING NO.

REV.

SIZE

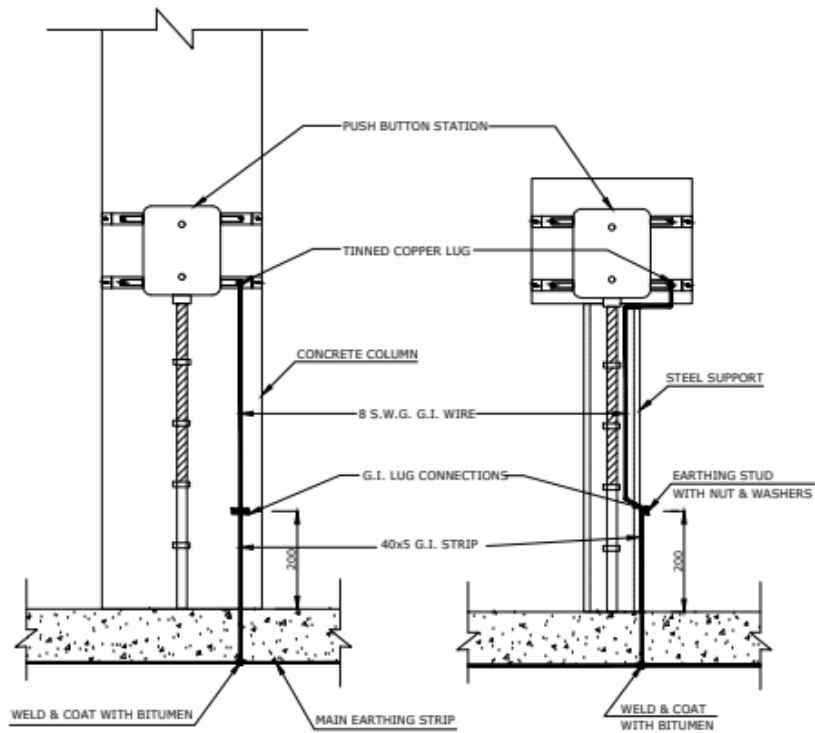
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02

A4

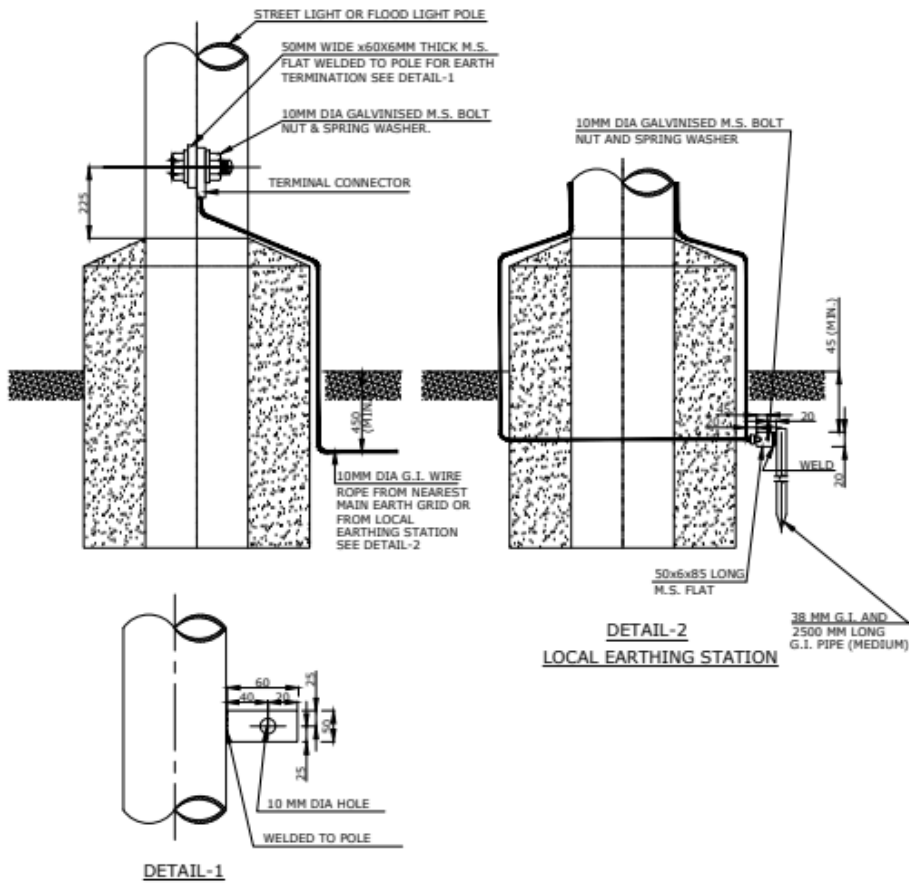
SHEET NO.

1 OF 1



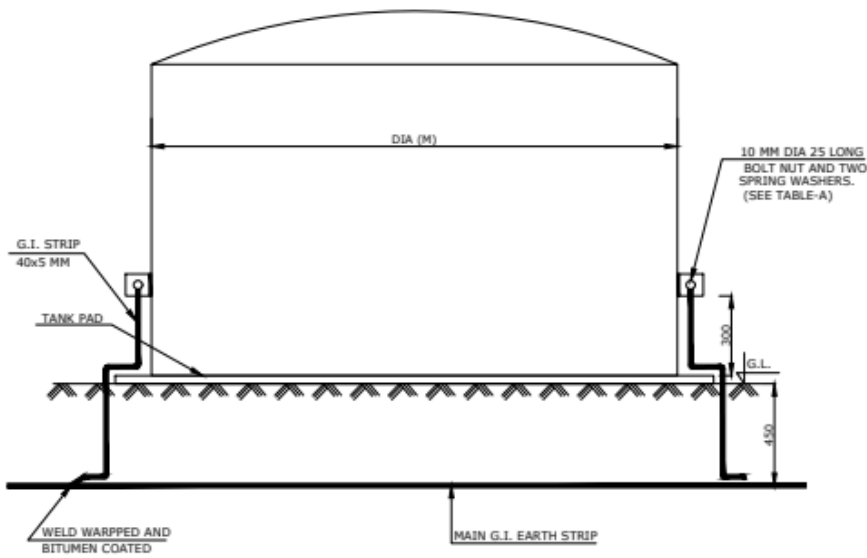
**NOTES:**

1. ALTERNATIVELY CONNECTION SHALL BE TAKEN FROM THE NEAREST AVAILABLE EARTH PLATE.



**NOTES:**

1. USE TWO EARTH WIRES IF VOLTAGE IN THE POLE JUNCTION BOX IS 415 VOLTS.



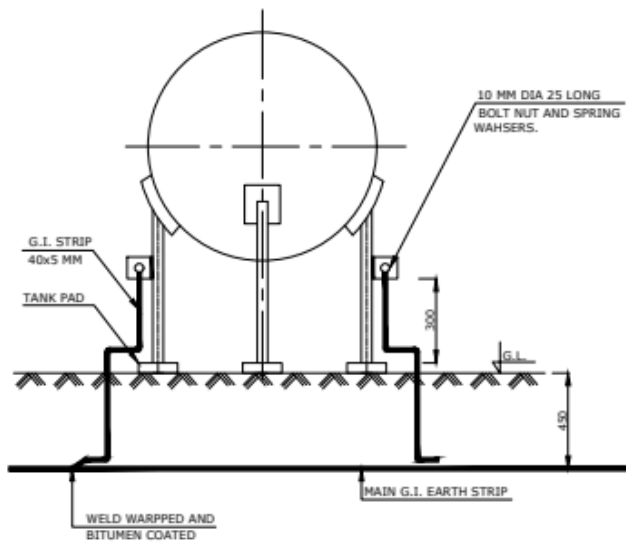
DETAIL-1 (TANK)

TABLE-A

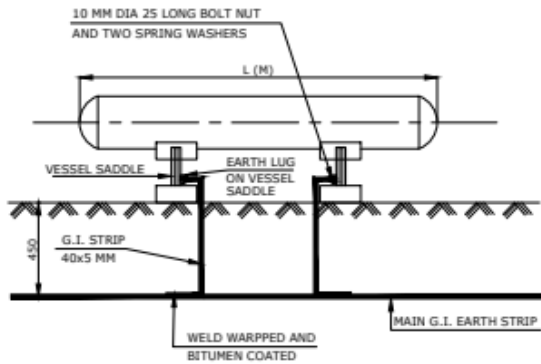
TANK DIAMETER (M)	EARTHING CONNECTION
<5	1
<20	2 AT 180°
<30	3 AT 120°
>40	4 AT 90°
>50	5 AT 72°
>60	6 AT 60°
>70	7 AT 51.43°
>80	8 AT 45°
>90	9 AT 40°



EARTH LUG ON TANK



DETAIL-3 (SPHERE)



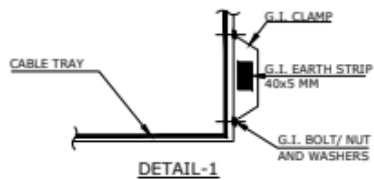
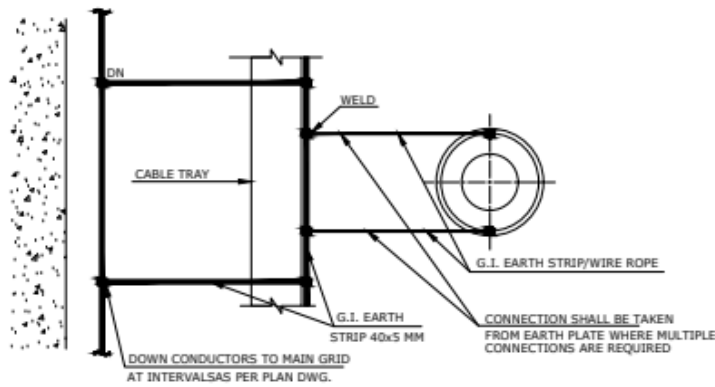
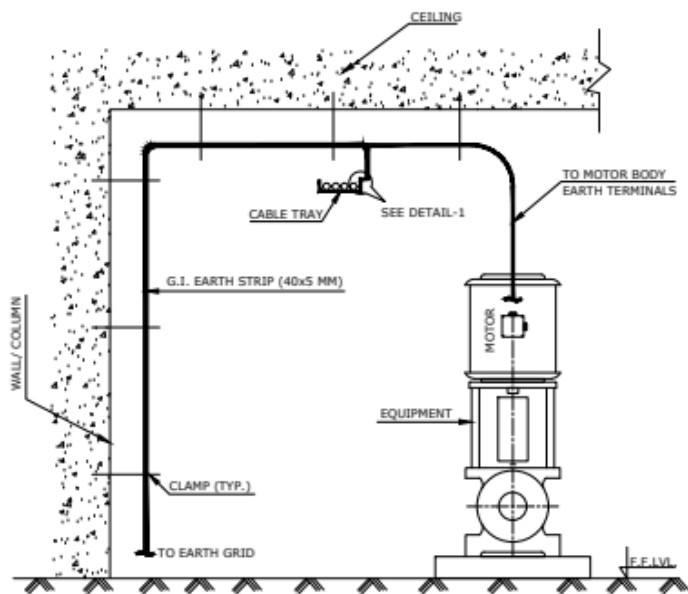
DETAIL-2 (HORIZONTAL VESSEL)

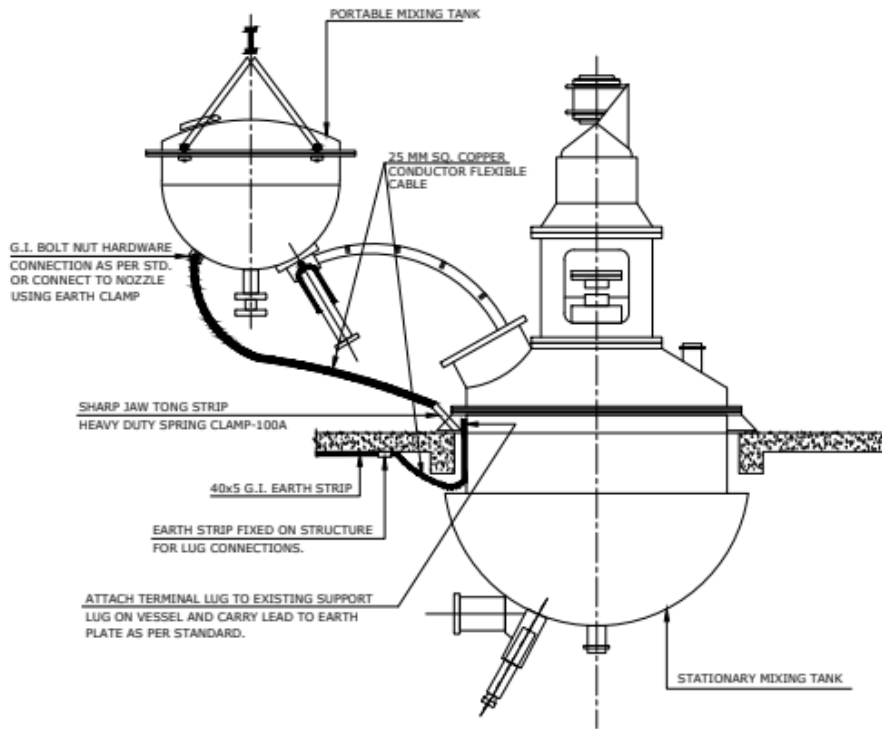
**NOTES:**

1. TWO NOS. OF EARTHING LUGS WILL BE AVAILABLE ON LEG SUPPORTS (DIAMETRICALLY OPPOSITE) OF EQUIPMENT FOR PROVIDING EARTH CONNECTION.
2. ALL VESSELS, SPHERES AND COLUMNS SHALL HAVE TWO EARTH CONNECTIONS IN GENERAL.
3. HORIZONTAL VESSEL OF LENGTH MORE THAN 20 METERS:-  
TWO EARTH LUGS ARE PROVIDED ON EACH SADDLE OF HORIZONTAL VESSELS.  
AS SUCH THERE SHALL BE TWO EARTH CONNECTIONS TO THE EARTH GRID FROM EACH SADDLE.

TYPICAL EARTHING OF CABLE TRAY AND ELECTRIC MOTOR

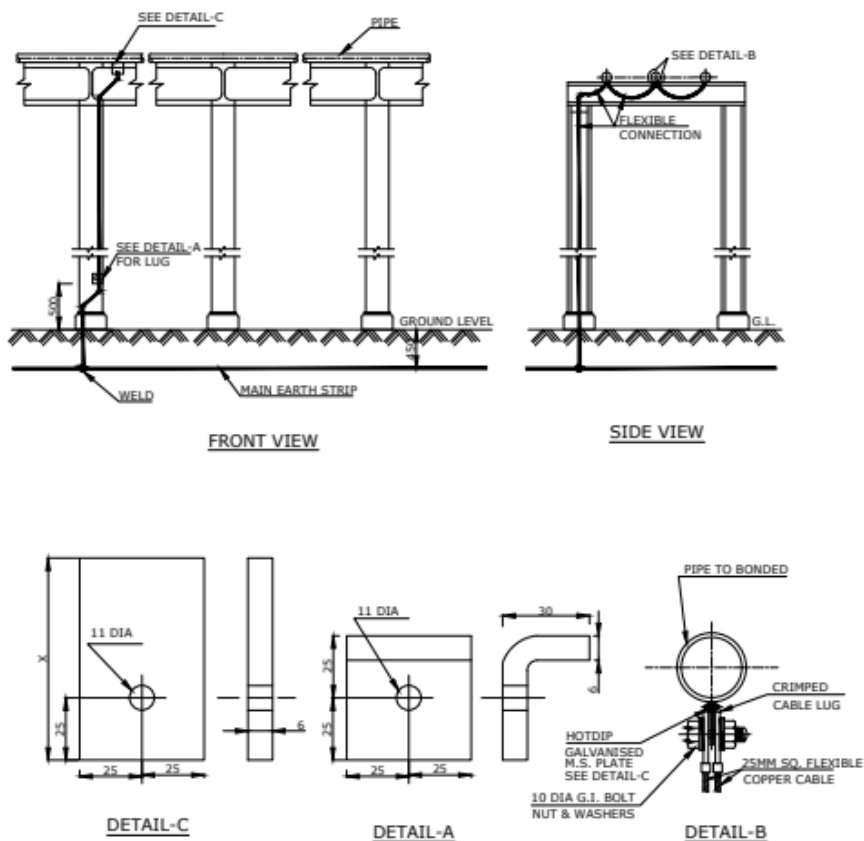
STANDARD DRAWING NO.	REV.	SIZE
	02	A4
SHEET NO.	1 OF 1	





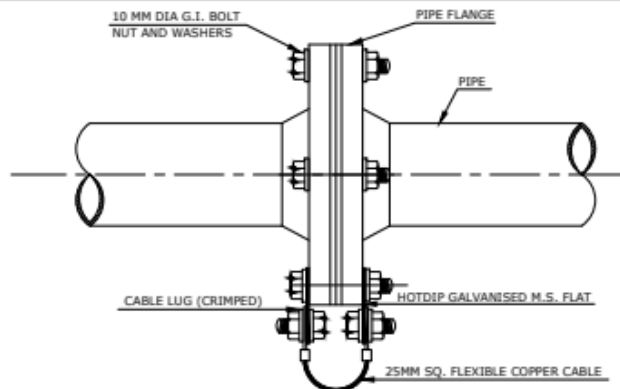
**NOTES:**

1. ALL PROCESSING EQUIPMENT SUCH AS MIXTURES, CHURNS, AUTOCLAVES, COLUMNS, CENTRIFUGES, FILTER PRESS PUMPS ETC. SHALL BE EARTHED IF NOT INDIRECT CONTACT WITH PROPERLY EARTHED STEEL MEMBERS.
2. ALL TEMPORARY EARTH CONNECTIONS SHALL BE MADE BEFORE OPENING THE VESSEL.

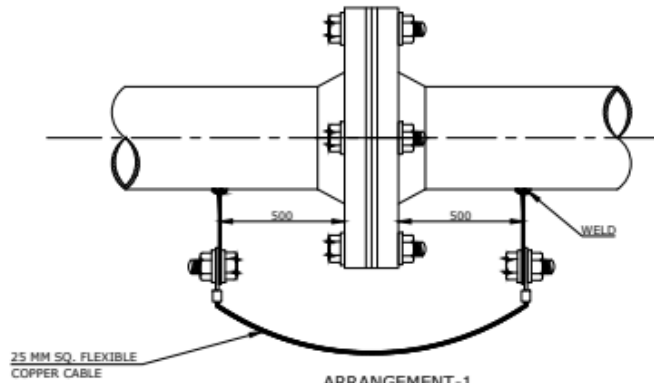


**NOTES:**

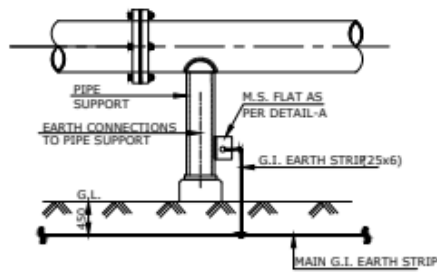
1. UNLESS MENTIONED OTHERWISE ON PLANS OR JOB SPECIFICATIONS, THE PIPELINES SHALL BE BONDED AND EARTHED AT THE ENTRY AND EXITS POINTS OF BATTERY LIMIT.
2. STEEL PIPE RACKS IN THE PROCESS UNIT AND OFFSITE AREA SHALL BE EARTHED AT EVERY 24 METRES.



ARRANGEMENT-2



ARRANGEMENT-1



ARRANGEMENT-3

**NOTES:**

1. HOT DIP GALVANISHED M.S. FLAT (50x 10x (x+50) WHERE x IS THE INSULATION THICKNESS) SHALL BE PROVIDED BY THE PIPING CONTACTOR.
2. SUPPLY OF FLEXIBLE COPPER CABLE, LUGS, BOLTS, NUTS, WASHERS HARDWARE AND MAKING CONNECTIONS, SHALL BE DONE BY ELECTRICAL CONTACTOR.

TYPICAL EARTHING  
ARRANGEMENT-WAGON

STANDARD DRAWING NO.

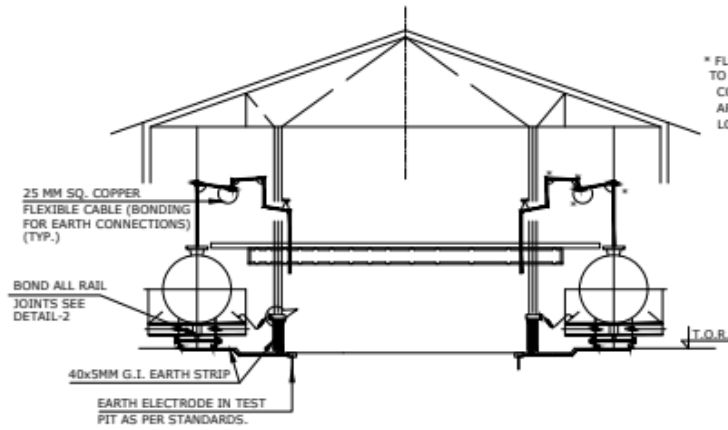
REV.

SIZE

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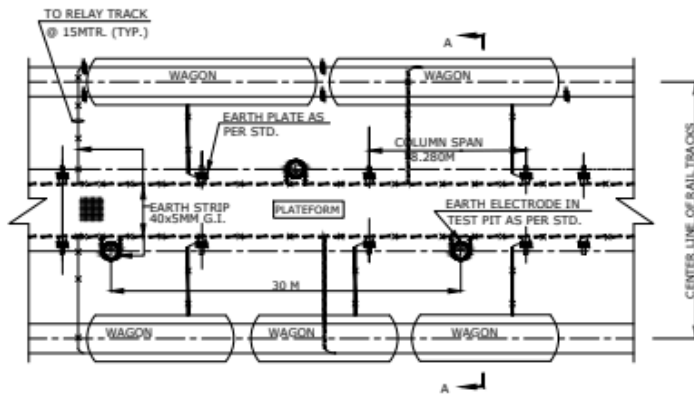
A4

SHEET NO. 1 OF 2



SECTION A-A

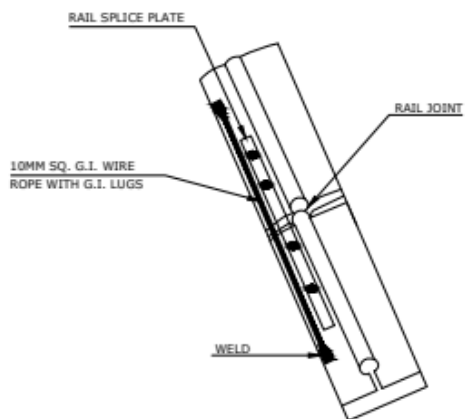
\* FLEXIBLE JUMPER CONNECTIONS ARE TO BE PROVIDED BY ELECTRICAL CONTRACTOR ONLY WHEN THE SAME ARE NOT SUPPLIED AS A PART OF LOADING ARM PACKAGES.



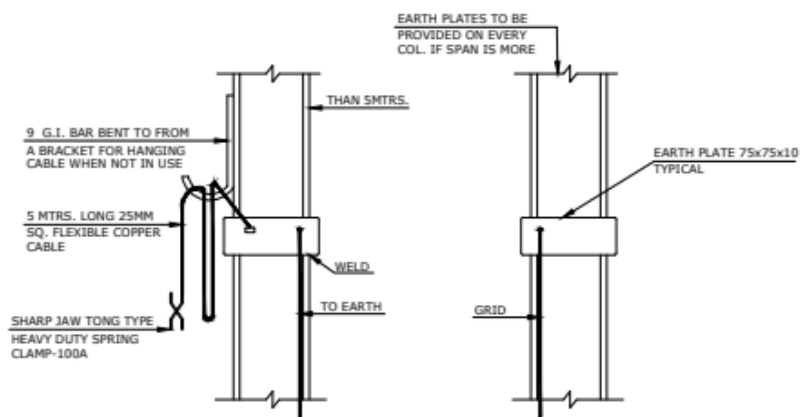
TYPICAL PART PLAN

NOTES:

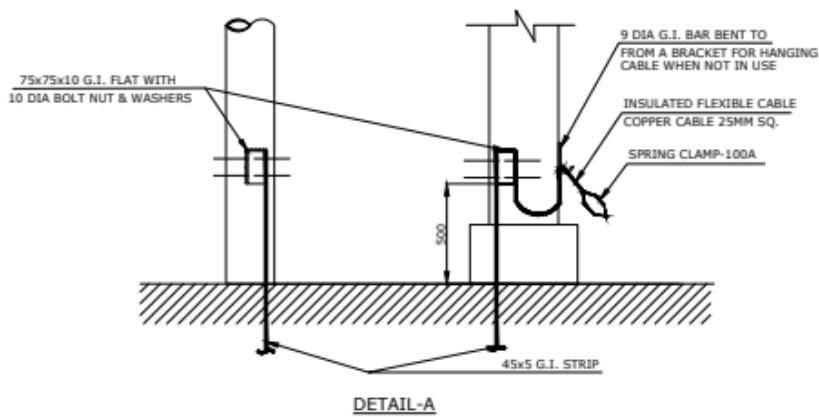
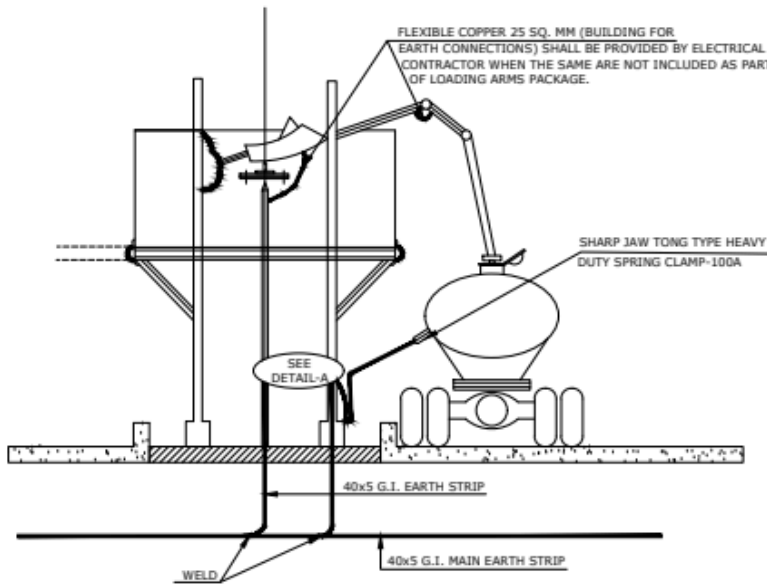
1. SUPPLY OF FLEXIBLE CABLE AND SPRING CLAMPS BY ELECTRICAL CONTACTOR ARE NOT REQUIRED WHEN MONITORING OF EARTH SCHEME AND THE ABOVE MATERIAL ARE INCLUDED AS PART OF PLANT AUTOMATION PACKAGE.



BONDING OF SINGLE RAIL  
DETAIL-2



DETAIL-1



**NOTES:**

1. SUPPLY OF FLEXIBLE CABLE AND SPRING CLAMPS BY ELECTRICAL CONTACTOR ARE NOT REQUIRED WHEN MONITORING OF EARTH SCHEME AND THE ABOVE MATERIAL ARE INCLUDED AS PART OF PLANT AUTOMATION PACKAGE.

FENCE GATE EARTHING  
(TRANSFORMER YARD)

STANDARD DRAWING NO.

REV.

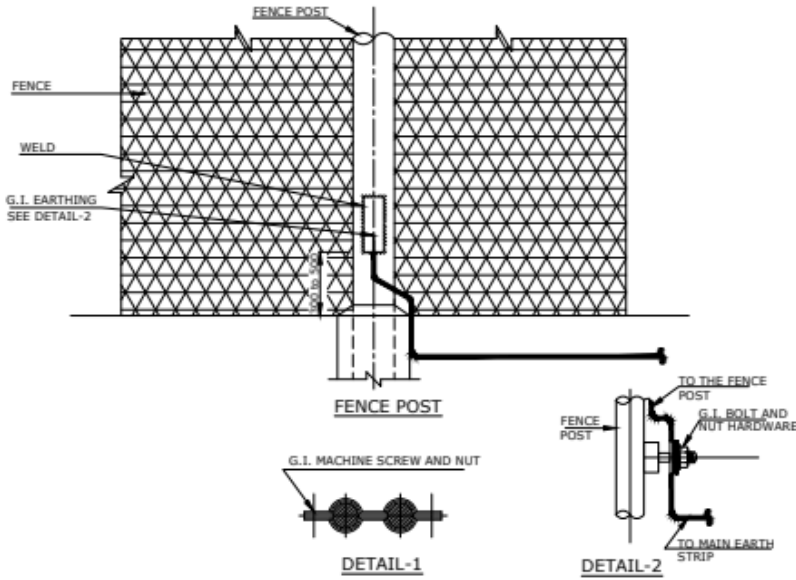
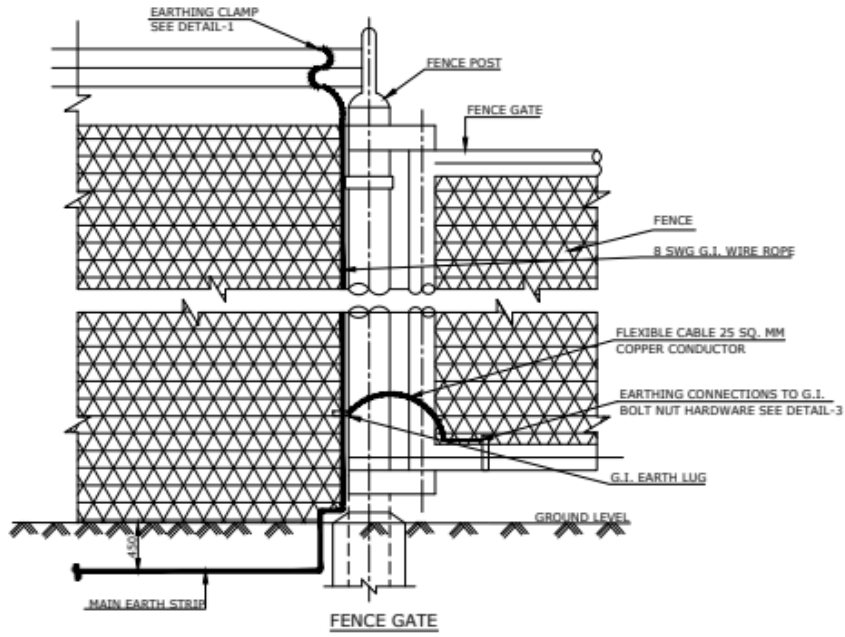
SIZE

SHEET NO.

1 OF 1

02

A4





TYPICAL DETAILS OF DIRECTLY BURIED EARTH ELECTRODE

STANDARD DRAWING NO.

REV.

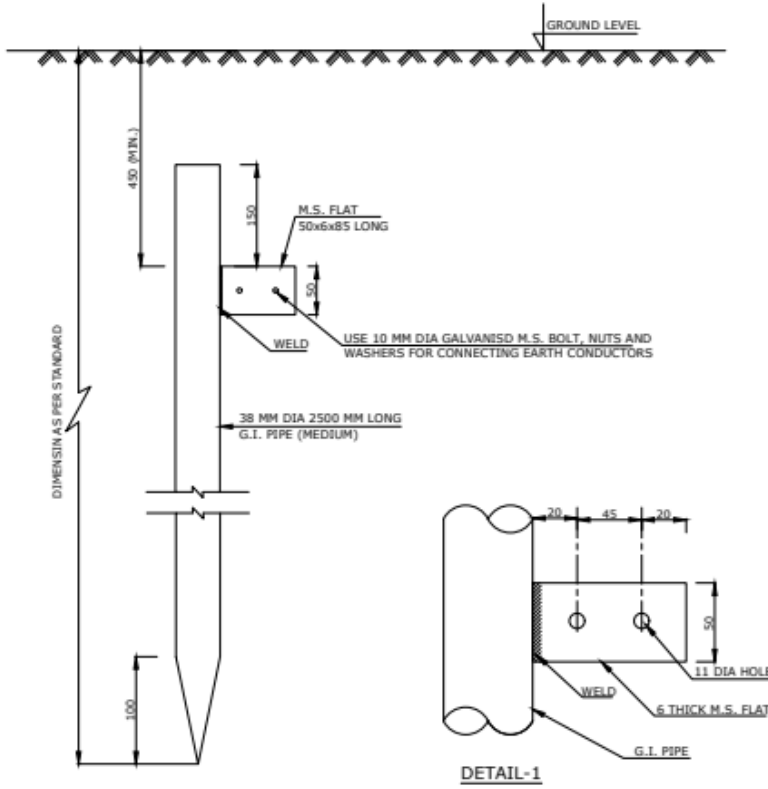
SIZE

02

A4

SHEET NO.

1 OF 1



**NOTES:**

1. ASSEMBLY SHALL BE HOT DIP GALVANISED AFTER FABRICATION.
2. THE ELECTRODE SHALL BE DRIVEN TO A DEPTH TO REACH PERMANENT MOIST SOIL.

TYPICAL DETAILS OF PLATE  
EARTH ELECTRODE

STANDARD DRAWING NO.

REV.

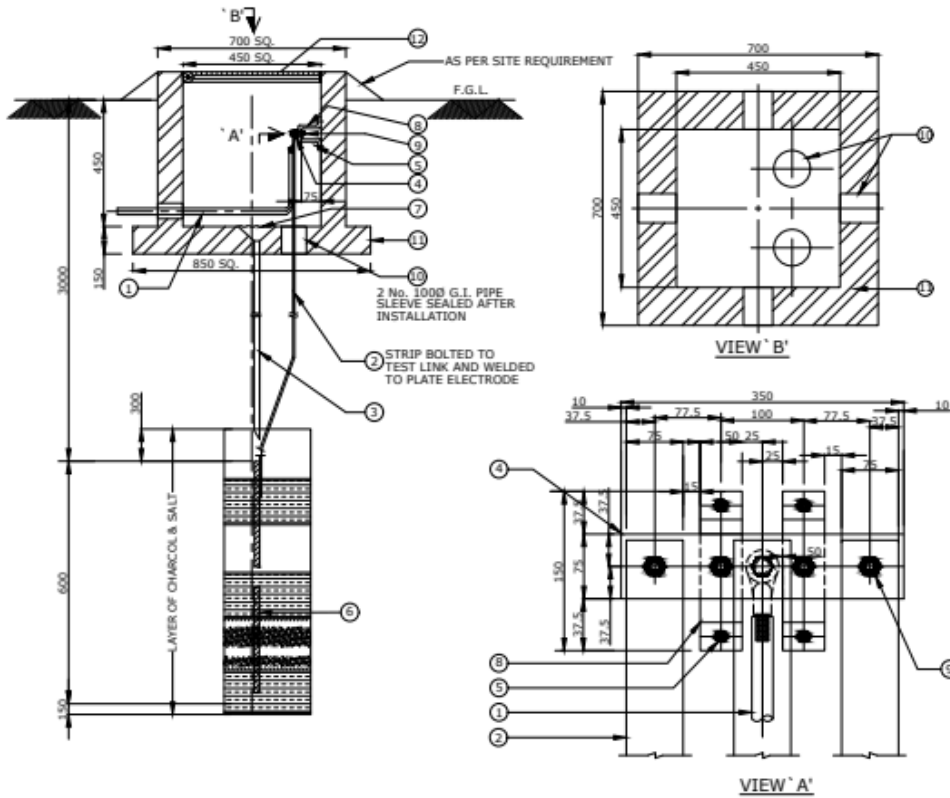
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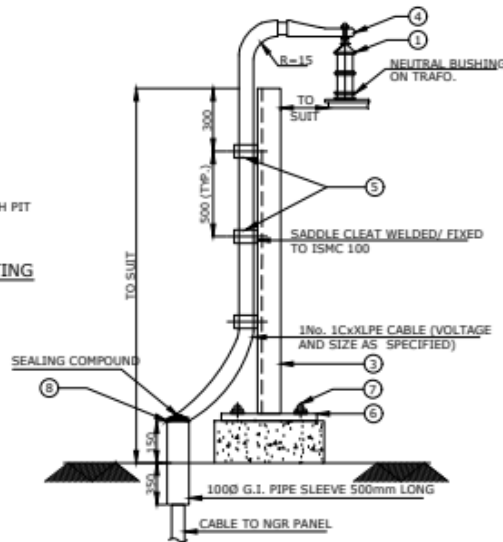
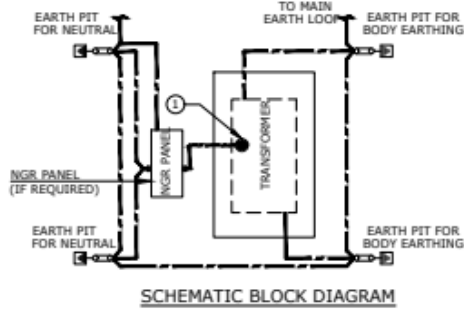
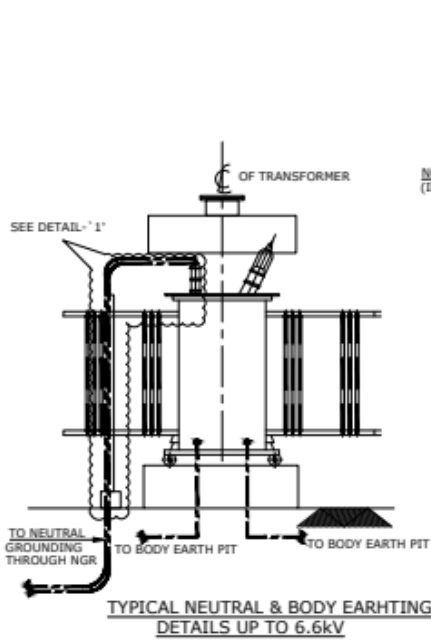
SHEET NO.

1 OF 1



MATERIAL TAKE-OFF

ITEM No.	DESCRIPTION	QUANTITY	REMARKS
1.	75x10mm G.I. STRIP/ 25x3mm COPPER STRIP/ 1C PVC INSULATED CABLES AS SPECIFIED IN CONTRACT DOCUMENTS.	AS REQUIRED	
2.	75x8mm G.I. STRIP/ 25x3mm COPPER STRIPS	2 No.	
3.	25Ø G.I. PERFORATED PIPE FOR WATERING.	1 No.	
4.	350x75x10 mm THICK G.I. TEST LINK	1 No.	
5.	M8 STAINLESS STEEL ANCHOR STUD WITH BOLT AND WASHER	4 No.	
6.	600x600x10 mm THICK G.I./3mm THICK COPPER EARTH ELECTRODE.	1 No.	
7.	WIRE MESH	1 No.	
8.	50x6 mm THICK 350 LONG G.I. SADDLE.	2 No.	
9.	M10 STAINLESS STEEL BOLT WITH 2 No. PLAIN & 1 No. SPRING WASHERS	5 No.	
10.	100Ø G.I. PIPE SLEEVE SEALED AFTER INSTALLATION.	6 No.	
11.	BRICK WATERING CHAMBER WITH PLASTER FINISH INSIDE & OUTSIDE	1 No.	
12.	C.I. REMOVABLE COVER HINGED TO CAST IRON FRAME.	1 No.	

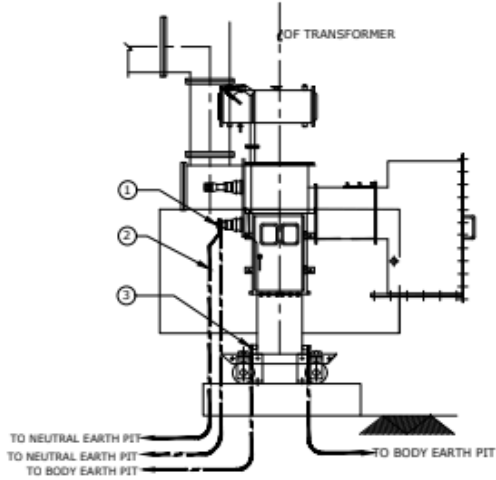


**MATERIAL TAKE-OFF**

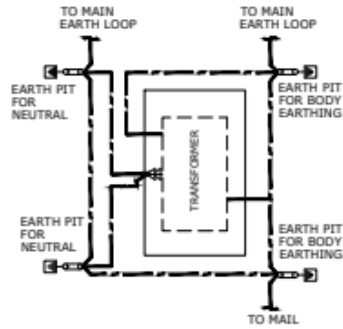
ITEM No.	DESCRIPTION	QUANTITY	REMARKS
1.	NEUTRAL BUSHING	1 No.	
2.	NUT & SPRING WASHERS TO SUIT TRANSFORMER BODY EARTHING	2 No.	
3.	ISMC 100-LENGTH TO SUIT	1 No.	
4.	CABLE LUG SUITABLE FOR CABLE SIZE	1 No.	
5.	MS SADDLE/ CLEAT TO SUIT CABLE DIA.	AS REQUIRED	
6.	150x150x6mm THICK PLATE WITH 4 No. 12Ø HOLES.	1 No.	
7.	M10 ANCHOR STUD WITH PLAIN AND SPRING WASHERS.	4 No.	
8.	SEALING COMPOUND	AS REQUIRED	

**NOTES :-**

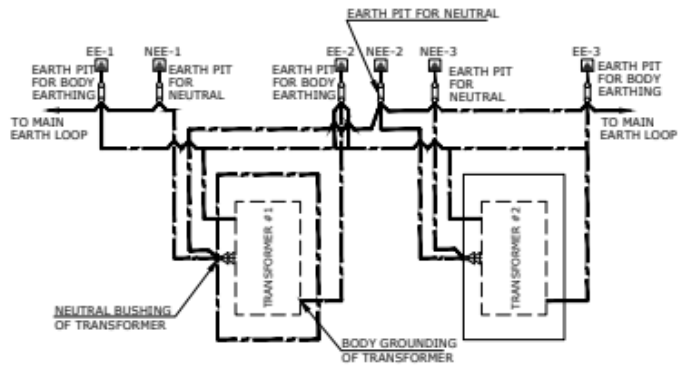
1. ALL HARDWARE SHALL BE OF STAINLESS STEEL.
2. ALL STEEL STRUCTURE USED FOR ELECTRICAL INSTALLATION SHALL BE APPLIED TWO COATS OF ANTI CORROSIVE PRIMER AND EPOXY PAINT OF APPROVED SHADE.



TYPICAL NEUTRAL & BODY EARTHING DETAILS UP TO 0.433kV



SCHEMATIC DIAGRAM FOR SINGLE TRANSFORMER



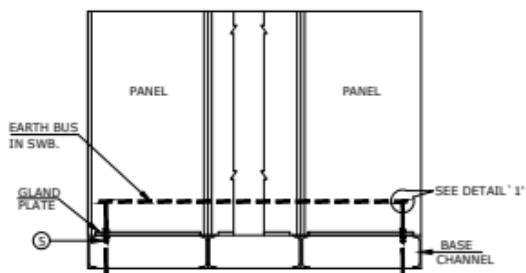
SCHEMATIC DIAGRAM FOR TWO TRANSFORMER

MATERIAL TAKE-OFF

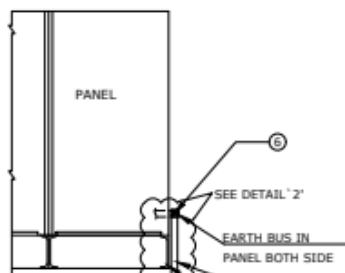
ITEM No.	DESCRIPTION	QUANTITY	REMARKS
1.	NEUTRAL BUSHING BY TRANSFORMER VENDOR	-	
2.	G.I. EARTH STRIP	AS PER DRG.	
3.	EARTHING PAD WITH BOLT NUT & SPRING WASHERS BY TRANSFORMER VENDOR	-	

NOTES :-

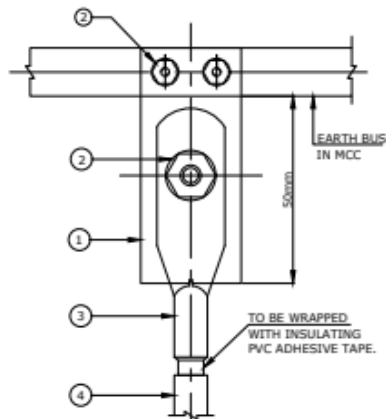
1. ALL HARDWARE SHALL BE OF STAINLESS STEEL.
2. ALL DAMAGE TO GALVANISED FINISHES SHALL BE PAINTED WITH ZINC RICH PAINT.
3. ALL STEEL STRUCTURE USED FOR ELECTRICAL INSTALLATION SHALL BE APPLIED TWO COATS OF ANTI CORROSIVE PRIMER AND EPOXY PAINT OF APPROVED SHADE.



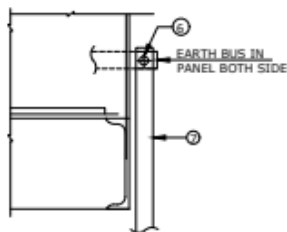
HV/LV SWITCHBOARD PANEL



HV/LV SWITCHBOARD PANEL



DETAIL '1'  
EARTHING BY CABLE  
ALTERNATIVE-1



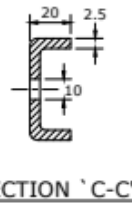
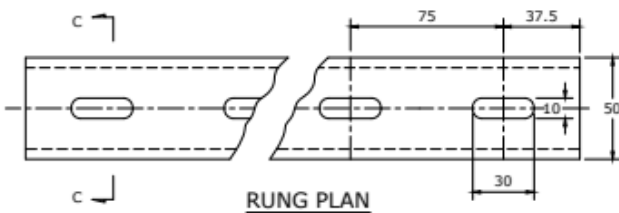
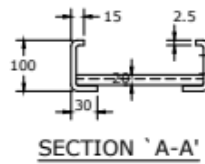
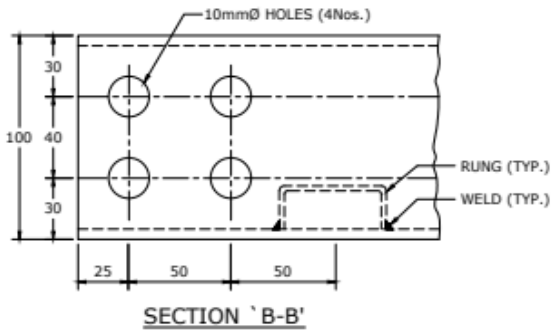
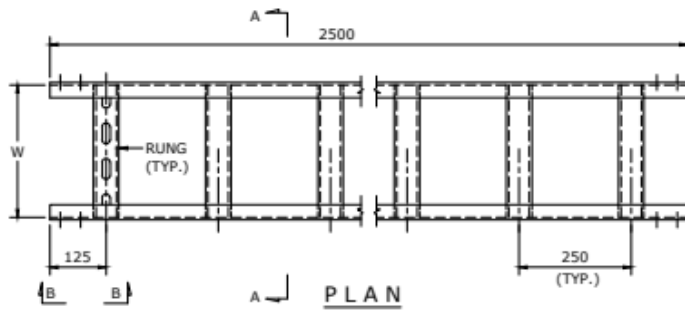
DETAIL '2'  
EARTHING BY G.I. STRIP  
ALTERNATIVE-2

MATERIAL TAKE-OFF

ITEM No.	DESCRIPTION	QUANTITY	REMARKS
1.	COPPER/ALUMINUM ADAPTER PLATE.	2 No.	ALT.-1
2.	M10 STAINLESS STEEL BOLT WITH 2No. PLAIN & 1No. SPRING WASHERS.	6 No.	ALT.-1
3.	CABLE LUG AND SOLDER	2 No.	ALT.-1
4.	1C ALUMINUM PVC INSULATED CABLE, CABLE SIZE AS SPECIFIED IN CABLE SCHEDULE	AS REQUIRED	ALT.-1
5.	CABLE GLAND SUITABLE FOR ITEM No. 4	2 No.	ALT.-1
6.	M10 BOLTS WITH 2No. PLAIN & 1No. SPRING WASHERS.	2 No.	ALT.-2
7.	G.I. STRIP.	AS REQUIRED	ALT.-2

NOTES :-

- PETROLEUM CONDUCTING JELLY SHALL BE APPLIED TO ALL SURFACES TO BE JOINED.
- ALL STEEL STRUCTURE USED FOR ELECTRICAL INSTALLATION SHALL BE APPLIED TWO COATS OF ANTI CORROSIVE PRIMER AND EPOXY PAINT OF APPROVED SHADE.
- ALL HARDWARE SHALL BE OF STAINLESS STEEL.



INSIDE TRAY WIDTH (W) - 150,300,450,600,800MM (AS PER MTO)  
MATERIAL - 12 GAUGE (2.5MM) M.S.SHEET/G.S./AL/FRP (AS PER MTO)

**NOTES:**

1. ALL DIMENSIONS ARE IN MM.
2. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
3. THE MATERIAL DIMENSIONAL DETAILS SHOWN ARE TYPICAL FOR GS STRESS.
4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRE HARDWARE AS PER DRG. No. SD-75-6706.
5. CABLE TRAYS SHALL DESIGN FOR 3000mm SUPPORT SPAN UNLESS NOTED OTHERWISE FOR SPECIFIED TRAY LOADING.

STANDARD DRAWING  
PERFORATED TYPE CABLE TRAY

STANDARD DRAWING NO.

REV.

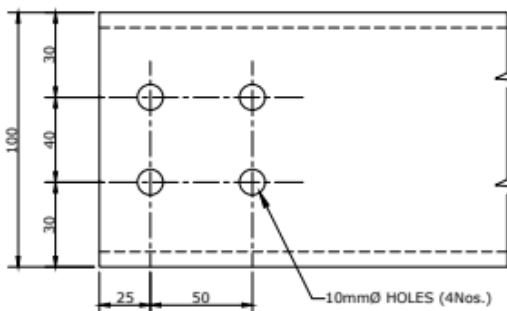
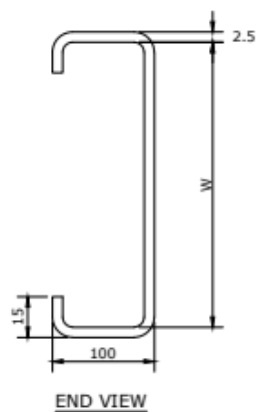
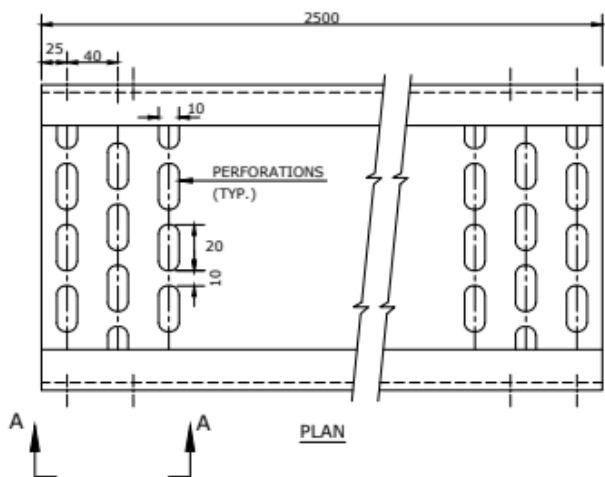
SIZE

02

A4

SHEET NO.

1 OF 1



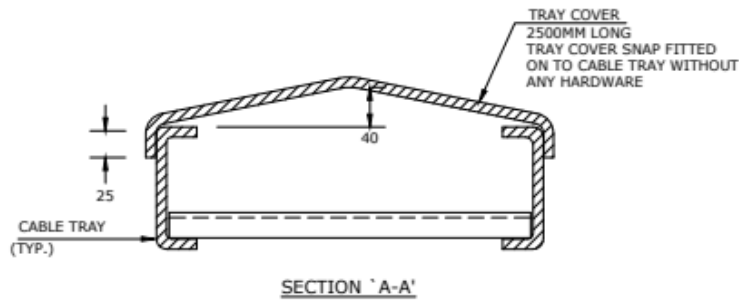
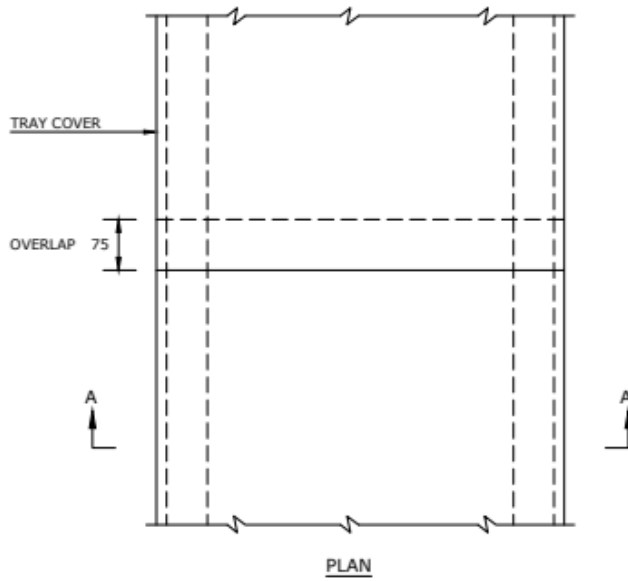
SECTION 'A-A'

INSIDE WIDTH (W) - 100,150,300,450,600,800MM (AS PER MTO)  
MATERIAL - 12 GAUGE (2.5MM) M.S.SHEET/G.S./AL/FRP (AS PER MTO)

**NOTES:**

1. ALL DIMENSIONS ARE IN MM.
2. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFIRMED TO RELEVANT IS/INTERNATIONAL STANDARDS.
3. THE MATERIAL DIMENSIONAL DETAILS SHOWN ARE TYPICAL FOR GS STRESS.
4. EACH CABLE TRAYS SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRED HARDWARE AS PER DRG. No. SD-75-6706.
5. CABLE TRAYS SHALL BE DESIGNED FOR 3000mm SUPPORT SPAN UNLESS NOTED OTHERWISE FOR SPECIFIED TRAY LOADING.

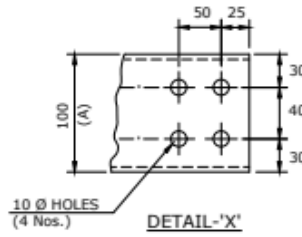
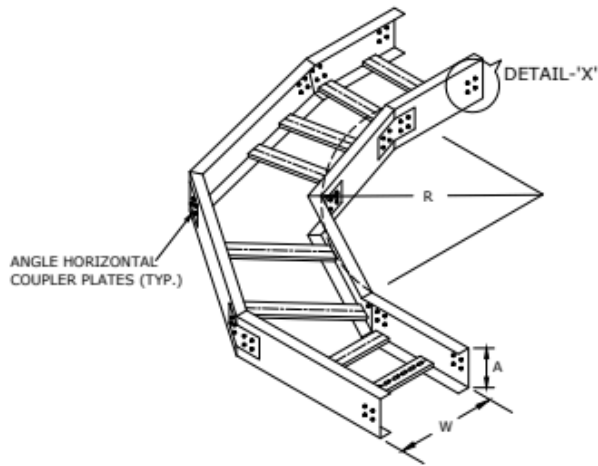
TYPICAL ARRANGEMENT OF COVERING CABLE TRAY



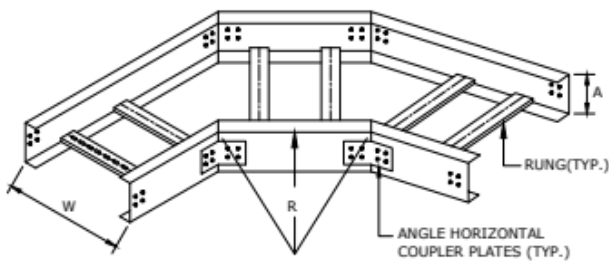
MATERIAL-16 GAUGE(1.7MM) M.S. SHEET/G.S./AL/FRP (AS PER MTO)  
TRAY COVER MATERIAL SAME AS OF TRAY & TRAY WIDTH AS PER MTO

NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. M.S. SHEET SHALL CONFORM TO IS2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. CABLE TRAY SUPPLIED WITH OTHER MATERIALS SHALL CONFORMED TO RELEVANT IS/INTERNATIONAL STANDARDS.



**90° HORIZONTAL RADIUS ELBOW**



**45° HORIZONTAL RADIUS ELBOW**

(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER MTO)

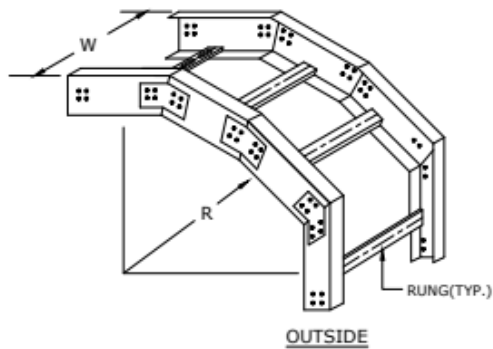
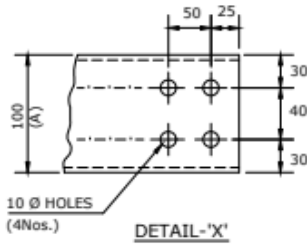
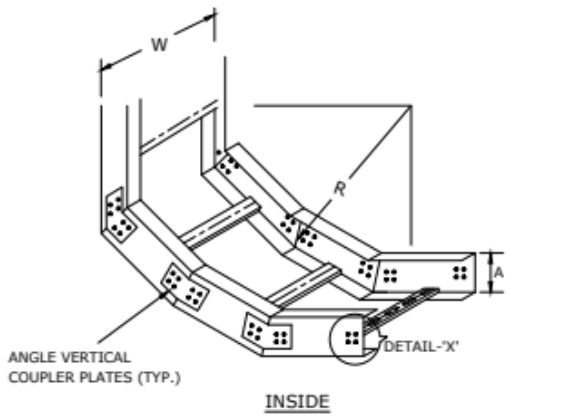
(A) DEPTH OF TRAY - 100MM UNLESS NOTED

(R) BENDING RADIUS (AS PER MTO)

**NOTES:**

1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER MTO).
3. M.S. SHEET SHALL CONFORM TO IS 2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS 4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. TRAY FITTINGS SUPPLIED WITH OTHER MATERIAL SHALL CONFORM TO RELEVANT IS/INTERNATIONAL STANDARDS.
4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRE HARDWARE AS PER DRG. No. SD-75-6706.
5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES & HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.

90° VERTICAL RADIUS ELBOW

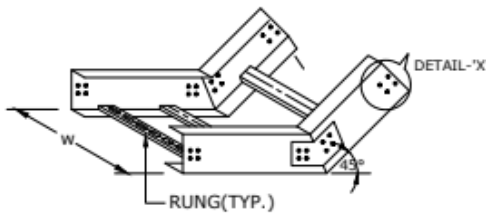


(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER MTO).  
 (A) DEPTH OF TRAY - 100MM UNLESS NOTED.  
 (R) BENDING RADIUS (AS PER MTO).

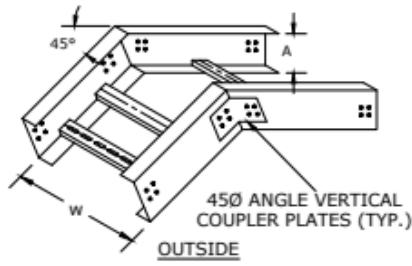
**NOTES:**

1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S./AL/FRP (AS PER MTO).
3. M.S. SHEET SHALL CONFORM TO IS 2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS 4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. TRAY FITTINGS SUPPLIED WITH OTHER MATERIAL SHALL CONFORM TO RELEVANT IS/INTERNATIONAL STANDARDS.
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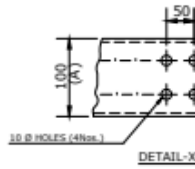
45° DIRECT VERTICAL ELBOW



INSIDE

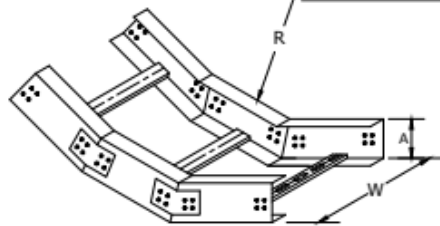


OUTSIDE

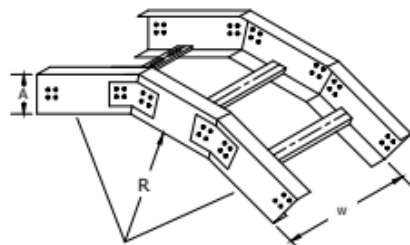


DETAIL-X

45° VERTICAL RADIUS ELBOW



OUTSIDE



INSIDE

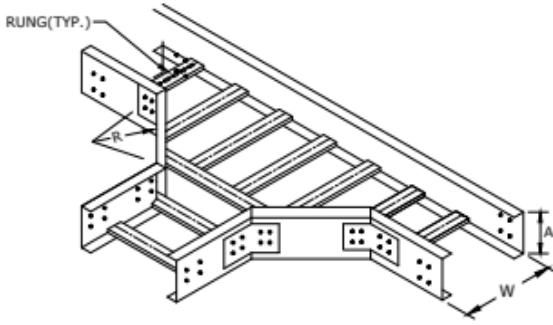
(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER MTO)

(A) DEPTH OF TRAY - 100MM UNLESS NOTED

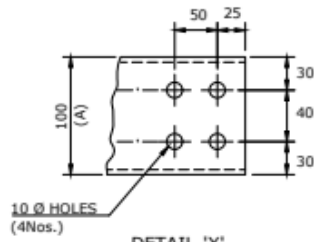
(R) BENDING RADIUS (AS PER MTO)

NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER MTO).
3. M.S. SHEET SHALL CONFORM TO IS 2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS 4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. TRAY FITTINGS SUPPLIED WITH OTHER MATERIAL SHALL CONFORM TO RELEVANT IS/INTERNATIONAL STANDARDS.
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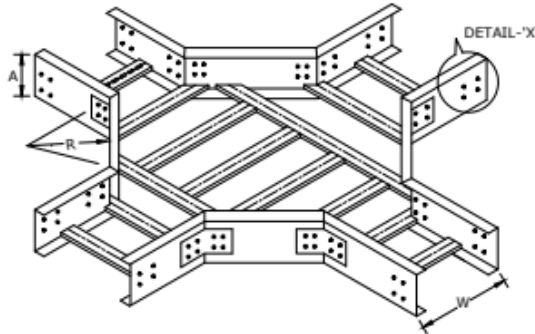


HORIZONTAL RADIUS TEE



10 Ø HOLES  
(4Nos.)

DETAIL-'X'

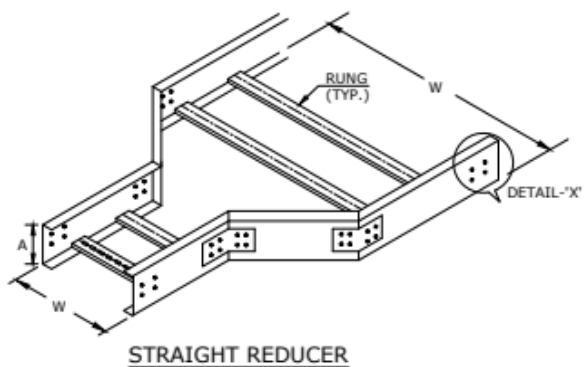
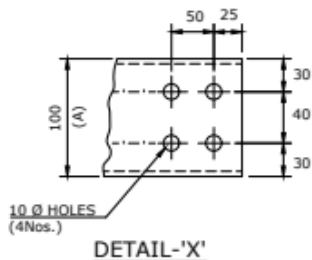
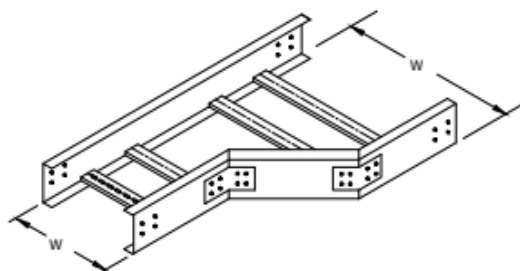


HORIZONTAL RADIUS CROSS

- (W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER MTO)  
 (A) DEPTH OF TRAY - 100MM UNLESS NOTED  
 (R) BENDING RADIUS (AS PER MTO)

**NOTES:**

1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER MTO).
3. M.S. SHEET SHALL CONFORM TO IS 2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS 4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. TRAY FITTINGS SUPPLIED WITH OTHER MATERIAL SHALL CONFORM TO RELEVANT IS/INTERNATIONAL STANDARDS.
4. EACH CABLE TRAY SHALL BE SUPPLIED COMPLETE WITH MATCHING COUPLER PLATES WITH REQUIRE HARDWARE AS PER DRG. No. SD-75-6706.
5. ALL TRAY FITTINGS SHALL BE SUPPLIED COMPLETE WITH MATCHING ANGLE HORIZONTAL COUPLER PLATES AND HARDWARE. ALTERNATIVELY WELDED ASSEMBLY MAY BE SUPPLIED FOR G.S. CABLE TRAY FITTINGS.

**STRAIGHT REDUCER****DETAIL-'X'****RIGHT TO LEFT HAND REDUCER**

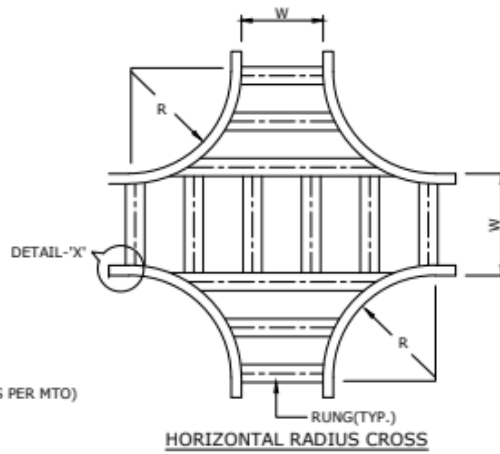
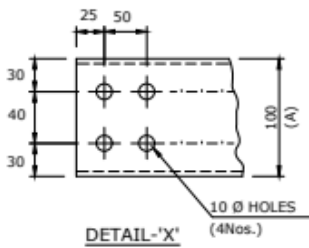
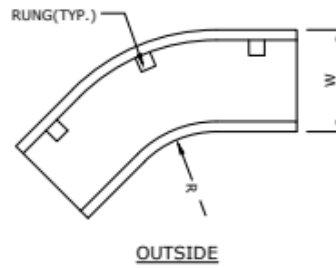
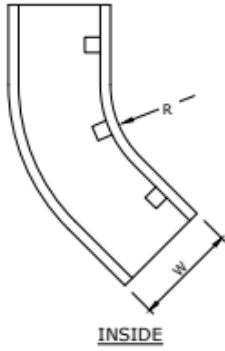
(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER MTO)

(A) DEPTH OF TRAY - 100MM UNLESS NOTED

**NOTES:**

1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER MTO).
3. M.S. SHEET SHALL CONFORM TO IS 2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS 4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. TRAY FITTINGS SUPPLIED WITH OTHER MATERIAL SHALL CONFORM TO RELEVANT IS/INTERNATIONAL STANDARDS.
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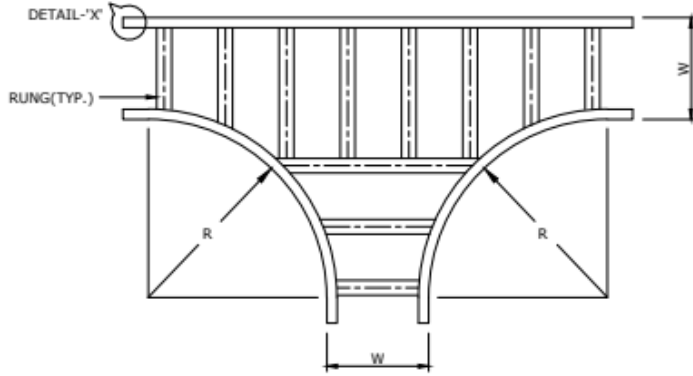
45° VERTICAL RADIUS ELBOW



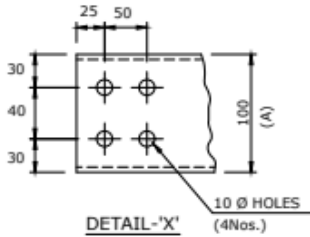
(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER MTO)  
(A) DEPTH OF TRAY - 100MM UNLESS NOTED  
(R) BENDING RADIUS (AS PER MTO)

NOTES:

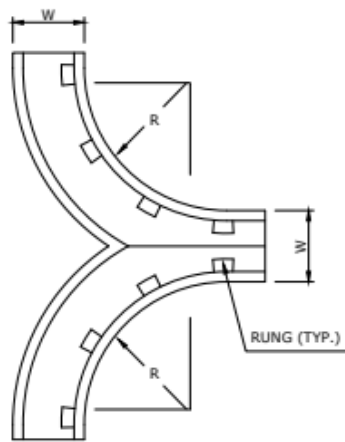
1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER MTO).
3. M.S. SHEET SHALL CONFORM TO IS 2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS 4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. TRAY FITTINGS SUPPLIED WITH OTHER MATERIAL SHALL CONFORM TO RELEVANT IS/INTERNATIONAL STANDARDS.
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HORIZONTAL RADIUS TEE



DETAIL-'X'

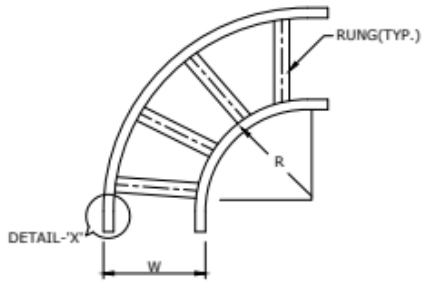


90° VERTICAL RADIUS TEE

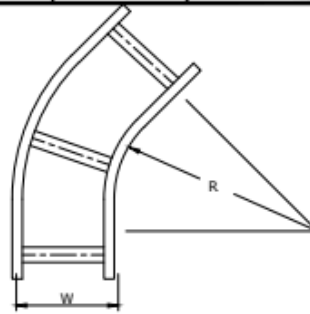
- (W) - INSIDE WIDTH OF TRAY-150,300,450,600,800MM (AS PER MTO)  
 (A) - DEPTH OF TRAY-100MM UNLESS NOTED  
 (R) - BENDING RADIUS (AS PER MTO)

NOTES:

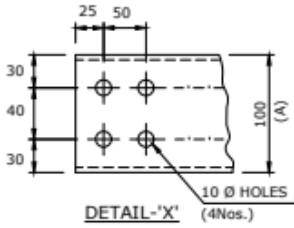
1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S/AL/FRP (AS PER MTO).
3. M.S. SHEET SHALL CONFORM TO IS 2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS 4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. TRAY FITTINGS SUPPLIED WITH OTHER MATERIAL SHALL CONFORM TO RELEVANT IS/INTERNATIONAL STANDARDS.
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90° HORIZONTAL RADIUS ELBOW



45° HORIZONTAL RADIUS ELBOW

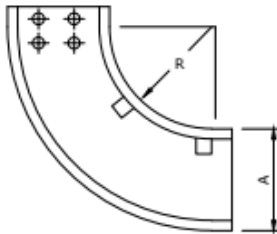


(W) INSIDE WIDTH OF TRAY - 150,300,450,600,800MM (AS PER MTO)

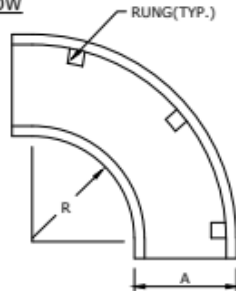
(A) DEPTH OF TRAY - 100MM UNLESS NOTED

(R) BENDING RADIUS (AS PER MTO)

90° VERTICAL MOULDED RADIUS ELBOW



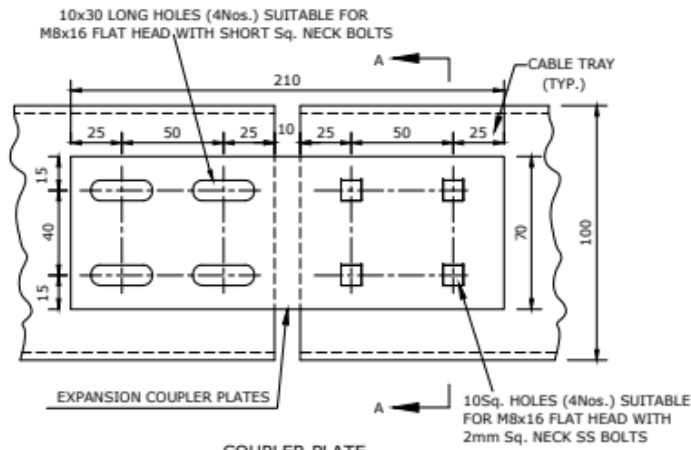
INSIDE



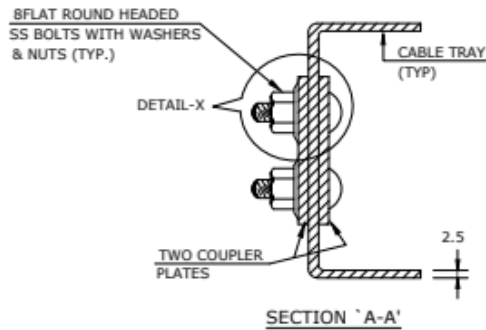
OUTSIDE

**NOTES:**

1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 12 GAUGE(2.5MM) M.S. SHEET/G.S./AL/FRP (AS PER MTO).
3. M.S. SHEET SHALL CONFORM TO IS 2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS 4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. TRAY FITTINGS SUPPLIED WITH OTHER MATERIAL SHALL CONFORM TO RELEVANT IS/INTERNATIONAL STANDARDS.
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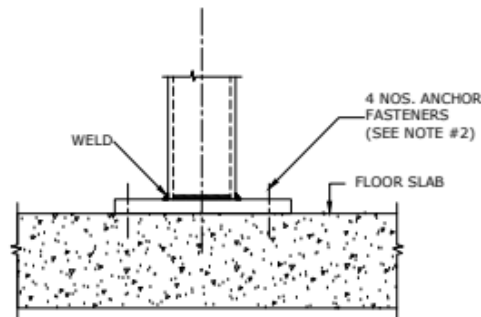
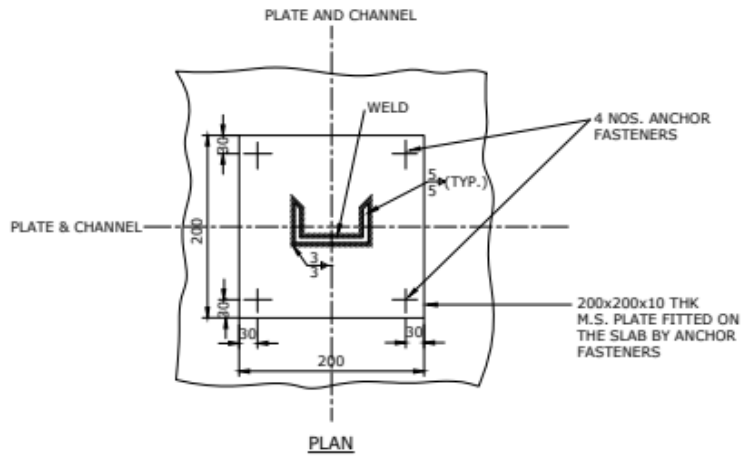


**COUPLER PLATE**  
**TYPICAL FOR LADDER TYPE**  
**AND PERFORATED TYPE TRAYS**



**NOTES:**

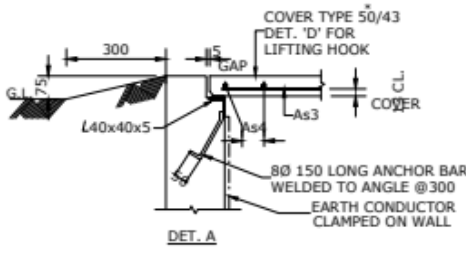
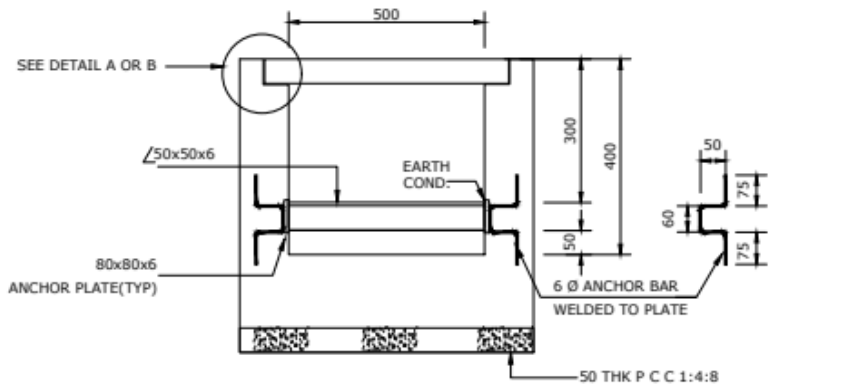
1. ALL DIMENSIONS ARE IN MM.
2. MATERIAL - 3MM M.S. SHEET/G.S/AL/FRP (AS PER MTO).
3. M.S. SHEET SHALL CONFORM TO IS 2062: 1992 OR EQUIVALENT INTERNATIONAL STANDARDS AND HOT DIP GALVANIZING SHALL BE DONE AS PER IS 4759: 1996 OR EQUIVALENT INTERNATIONAL STANDARDS. TRAY FITTINGS OF OTHER MATERIALS SHALL CONFORM TO RELEVANT IS/INTERNATIONAL STANDARDS.
4. NUTS/BOLTS/LOCKNUTS SHALL BE AS PER IS 1363(PART-1,2,3) : 1992/IS 1367(PART-5) : 1980 OR EQUIVALENT INTERNATIONAL STANDARDS.
5. WASHERS SHALL BE AS PER IS 2016 : 1967 OR EQUIVALENT INTERNATIONAL STANDARDS.



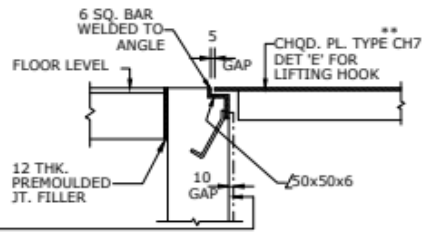
TYPICAL DETAIL OF FIXING M.S. PLATE TO FLOOR BY ANCHOR FASTENER  
FOR WELDING TRAY SUPPORT. (WHEREVER EMBEDDED PLATES OR STRUCTURAL  
BEAMS ARE NOT AVAILABLE).

**NOTES:**

1. ALL DIMENSIONS ARE IN MM.
2. THE ANCHOR FASTENER SHALL BE OF HEAVY DUTY TYPE. THE AXIAL HOLDING STRENGTH SHALL BE AS FOLLOWS  
BOLT DIAMETER. 16mm -- 5000Kg  
FOR ADEQUATE SAFETY FACTOR 25% OF THE ABOVE VALUE SHALL BE USED.
3. SAME DETAILS HOLD GOOD IF THE PLATE ARE FASTENED TO THE UNDERSIDE OF THE FLOOR SLAB.
4. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992.
5. WELDING SHALL BE DONE AS PER IS 816:1969.

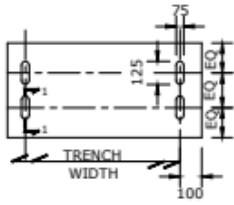


DET. A

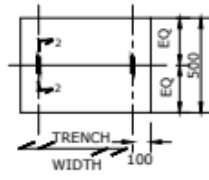


DET. B

\*\*CH7 = 7 THK. CHQD. PL



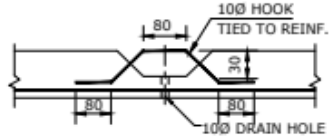
PLAN



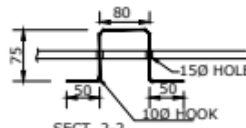
PLAN

R C COVER TYPE	THICKNESS mm.	As3	As4
50/72	50	7-6Ø	7-6Ø
50/36	50	7-6Ø	4-6Ø

50/36 MEANS 50mm. THK. x36 Kg.  
COVER WEIGHT OF 600mm COVER WIDTH.  
PROVIDE TWO COVERS OF 300mm WIDTH  
FOR EVERY 10m LENGTH OF TRENCH.



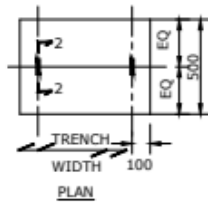
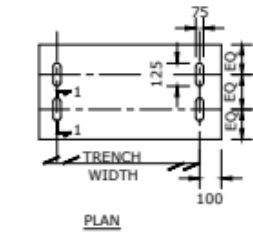
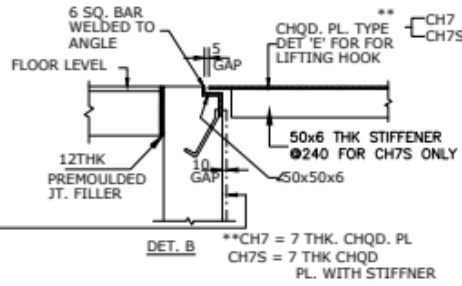
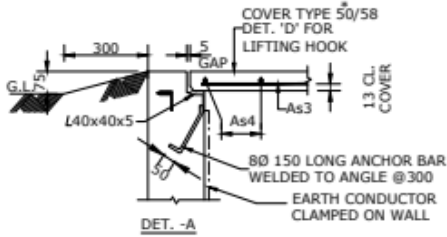
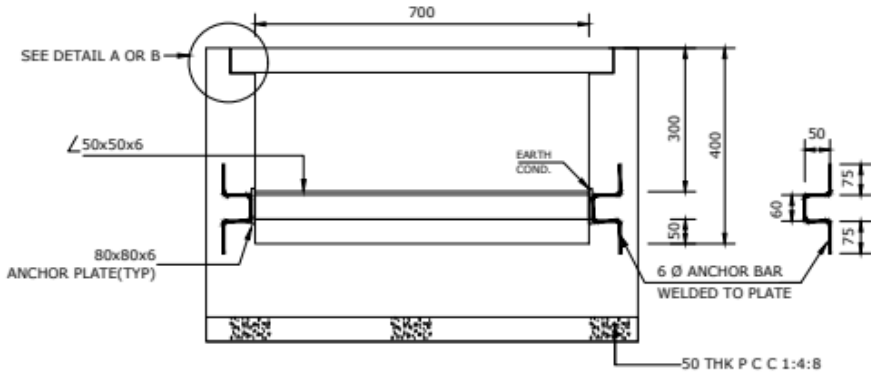
SECT. 1-1  
DET. D



SECT. 2-2  
DET. E

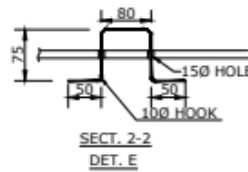
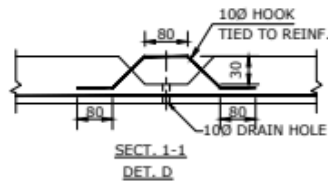
NOTES:

1. ALL DIMENSIONS ARE IN MM
2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



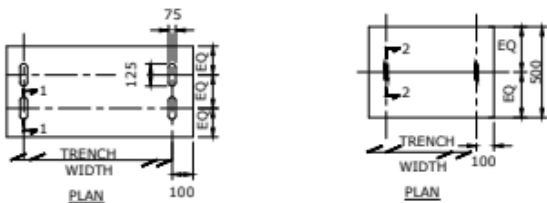
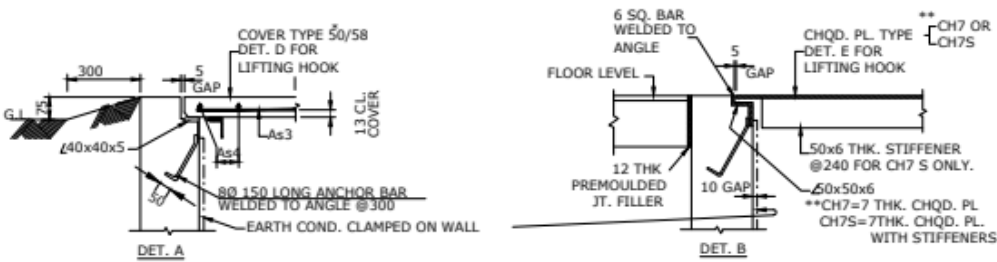
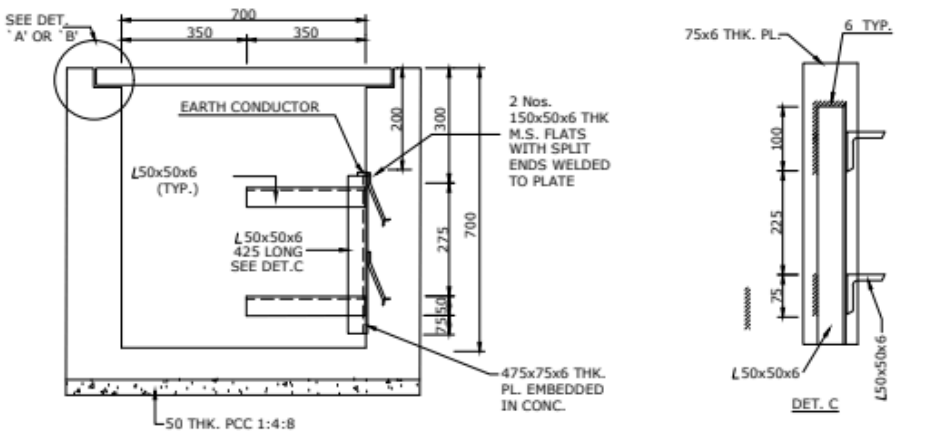
R C COVER TYPE	THICKNESS mm.	As3	As4
50/58	50	7-60	7-60

50/58 MEANS 50mm. THK.x58 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



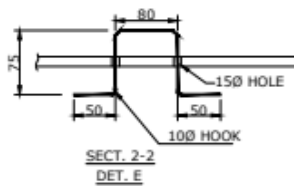
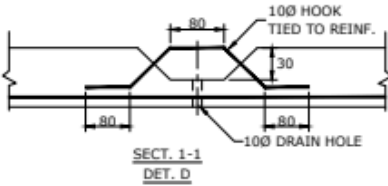
NOTES:

1. ALL DIMENSIONS ARE IN MM
2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992

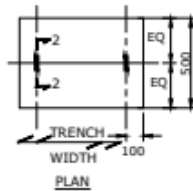
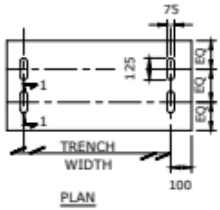
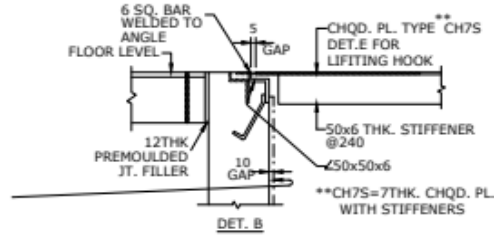
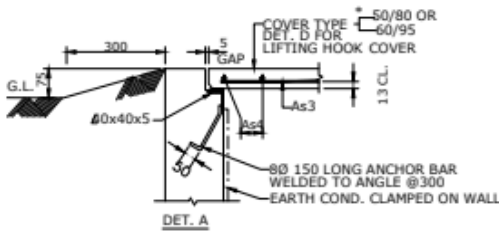
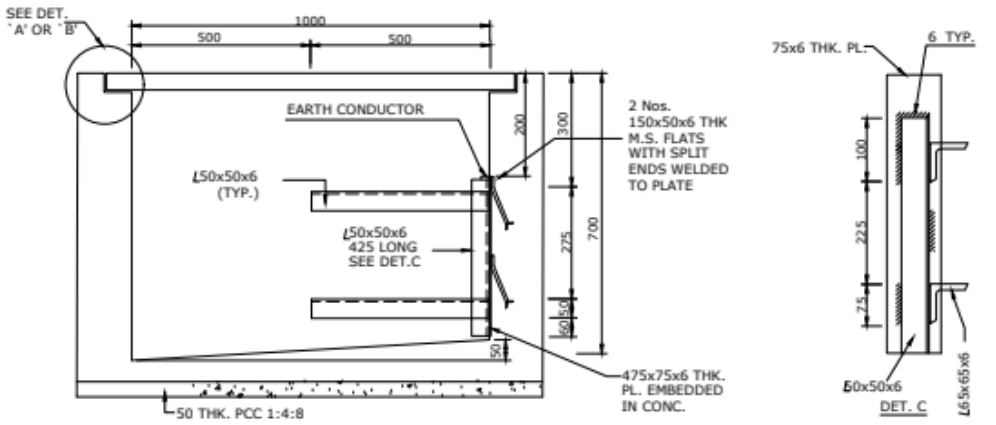


R C COVER TYPE	THICKNESS mm.	As3	As4
50/58	50	7-60	6-60

\* 50x58 MEANS 50mm. THK.x58 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.

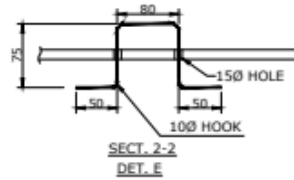
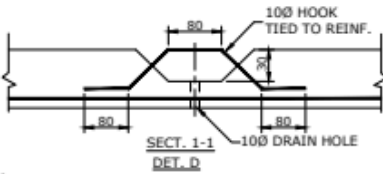


- NOTES:
1. ALL DIMENSIONS ARE IN MM.
  2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



R C COVER TYPE	THICKNESS mm.	As3	As4
50/80	50	7-6Ø	6-6Ø
60/95	60	7-8Ø	6-8Ø

60x95 MEANS 60mm. THK.x95 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



- NOTES:
1. ALL DIMENSIONS ARE IN MM.
  2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992

STANDARD DRAWING  
CABLE TRENCH TYPE - 1210

STANDARD DRAWING NO.

REV.

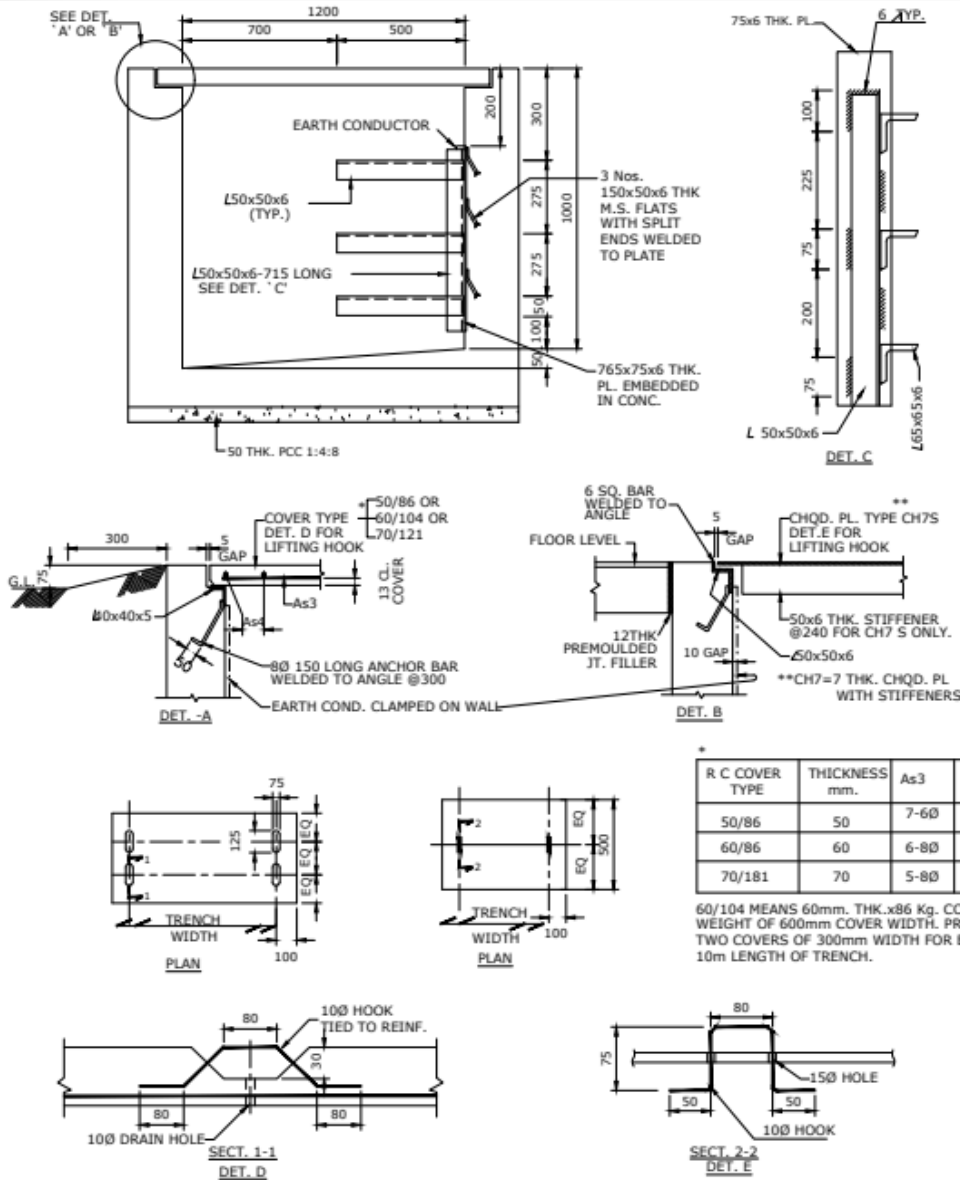
SIZE

02

A4

SHEET NO.

1 OF 1



NOTES:

1. ALL DIMENSIONS ARE IN MM
2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992

STANDARD DRAWING  
CABLE TRENCH TYPE - 1212

STANDARD DRAWING NO.

REV.

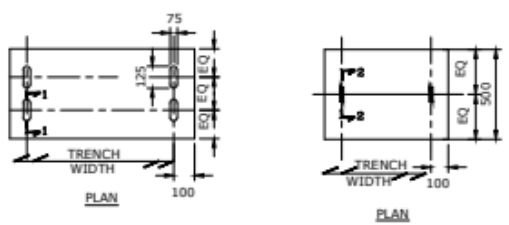
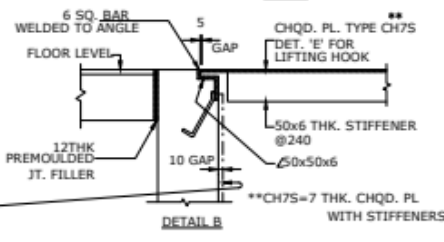
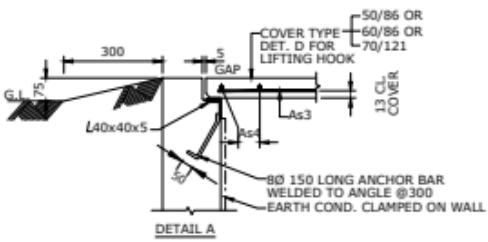
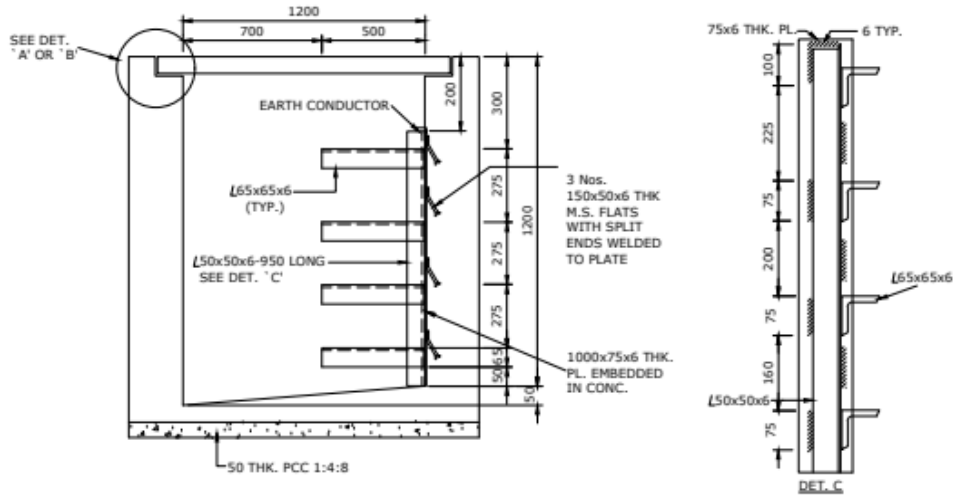
SIZE

02

A4

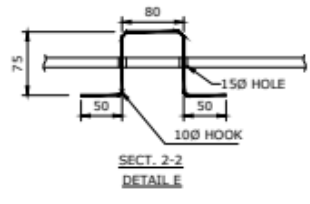
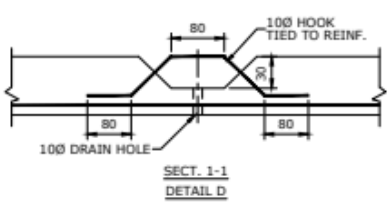
SHEET NO.

1 OF 1

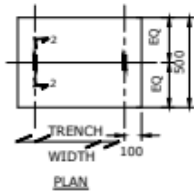
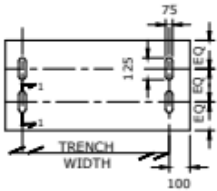
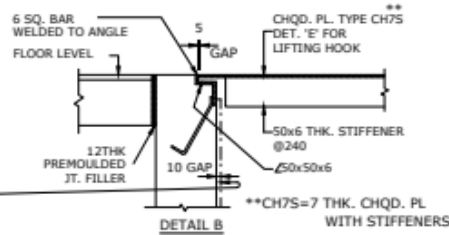
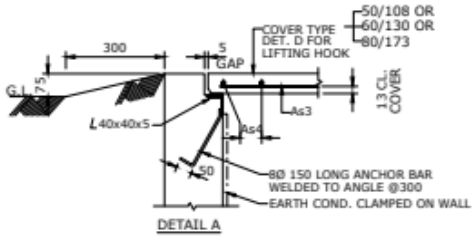
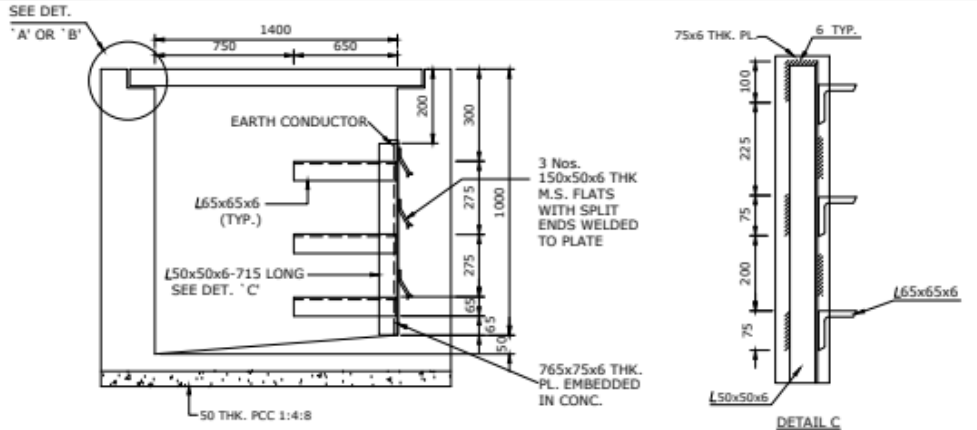


R C COVER TYPE	THICKNESS mm.	As3	As4
50/86	50	7-6Ø	9-6Ø
60/104	60	6-8Ø	7-8Ø
70/121	70	5-8Ø	7-8Ø

60x104 MEANS 60mm. THK.x104 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.

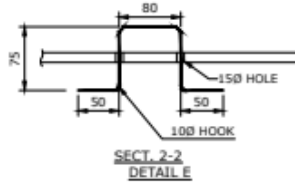
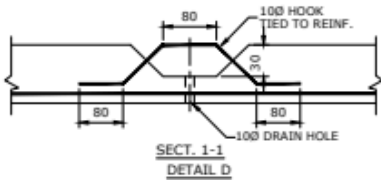


- NOTES:**
1. ALL DIMENSIONS ARE IN MM.
  2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992

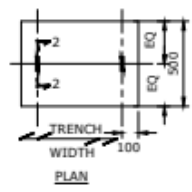
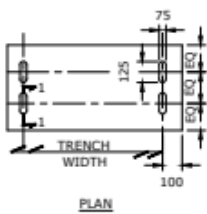
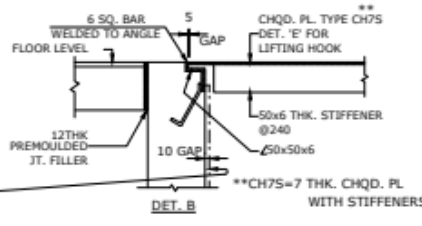
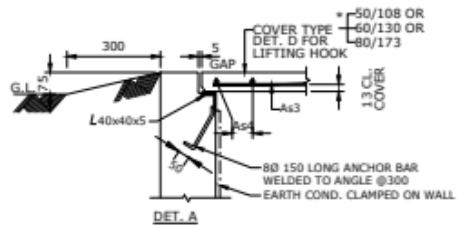
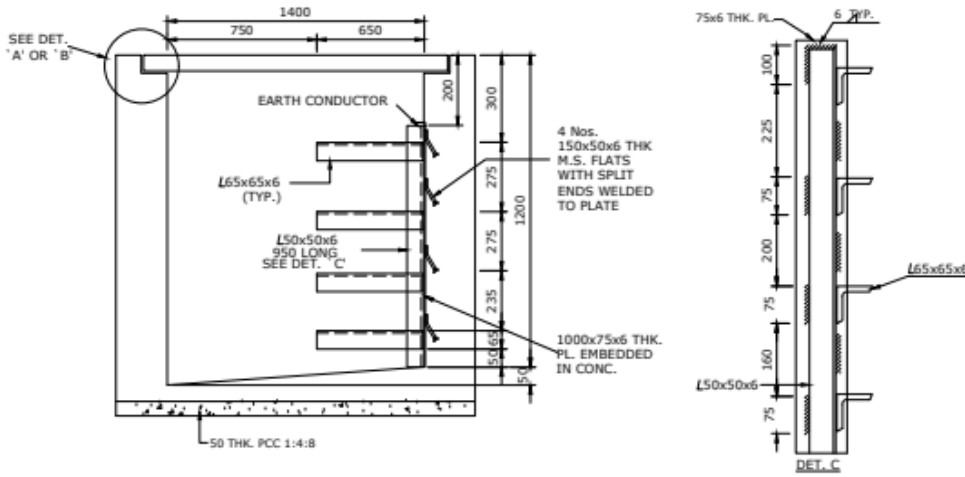


R C COVER TYPE	THICKNESS mm.	As3	As4
50/108	50	7-60	9-60
60/130	60	6-80	7-80
80/173	80	5-80	7-80

\* 60x130 MEANS 60mm. THK.x130 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



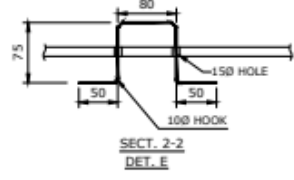
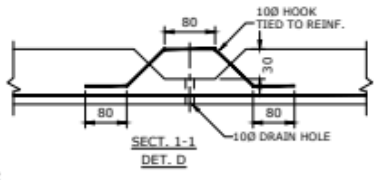
- NOTES:
1. ALL DIMENSIONS ARE IN MM.
  2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992



\*

R C COVER TYPE	THICKNESS mm.	As3	As4
50/108	50	7-6Ø	9-6Ø
60/130	60	6-8Ø	8-8Ø
80/173	80	5-8Ø	8-8Ø

60x130 MEANS 60mm. THK.x130 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.

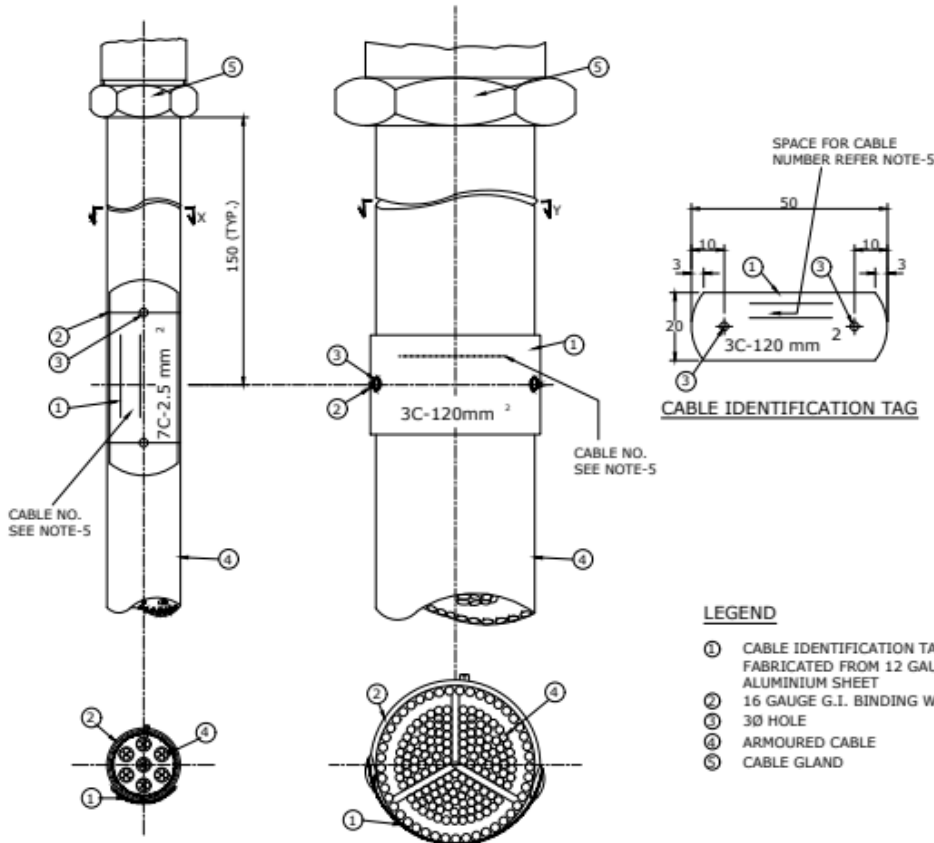


NOTES:  
1. ALL DIMENSIONS ARE IN MM.  
2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992









**TYPE-A (SECTION X-X)**

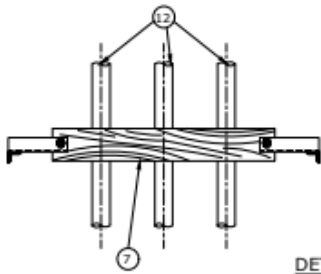
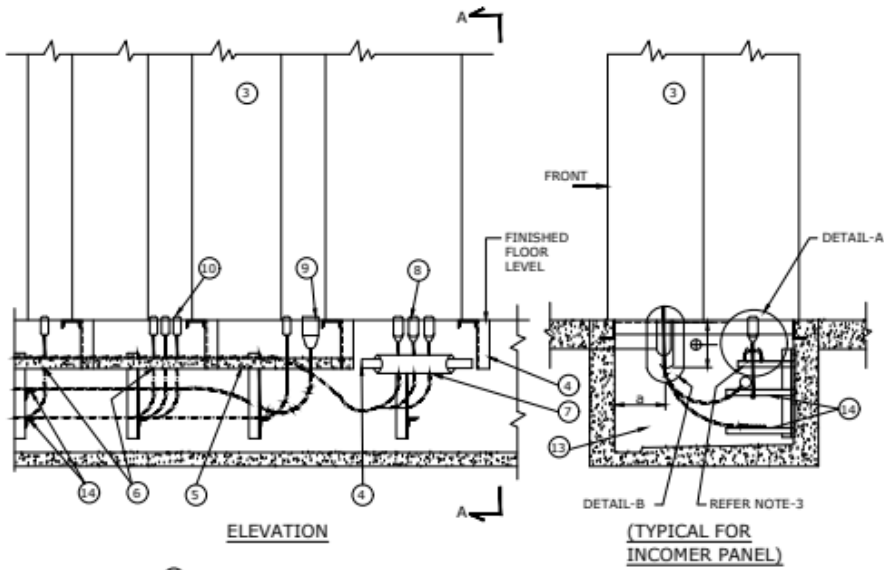
TYPICAL METHOD OF TYING THE TAG FOR CABLES WITH OVERALL DIA. <math>< 25</math> (ONLY FOR MULTICORE CABLES)

**TYPE-B (SECTION Y-Y)**

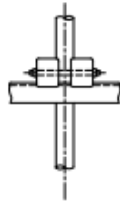
TYPICAL METHOD OF TYING THE TAG FOR CABLES WITH OVERALL DIA. >math>> 25</math>

**NOTES:**

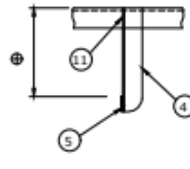
1. ALL DIMENSIONS ARE IN MM.
2. THE CABLE IDENTIFICATION NUMBER, NUMBER OF CORES AND SIZE SHALL BE EMBOSSED ON THE TAG.
3. THE TAG SHALL BE SUITABLY TIED APPROXIMATELY 150mm AWAY FROM THE CABLE GLAND AT BOTH ENDS OF THE CABLE.
4. THE TAG SHALL BE FREE FROM SHARP EDGES.
5. CABLE NUMBER SHALL BE EMBOSSED AS PER CABLE SCHEDULE.



DETAIL -A



SECTION A-A



DETAIL-B

LEGEND

- ① TO ⑫ REFER SH. 1 OF 2
- ⑬ CABLE TRENCH
- ⑭ CABLE SUPPORTING ARM

NOTES:

1. FOR NOTES REFER SHEET 1 OF 2.
2. CONTROL AND POWER CABLES IN TRENCH SHALL BE TIED TO THE SUPPORTING ARM WITH 3Ø NYLON CORD, IF CABLE TRAY IS NOT USED.
3. 5/8x50x6 FOR CLAMPING 1/C CABLES TO BE SUITABLY GROUTED AT SITE.

**NOTES:-**

1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE MENTIONED.
2. THE AREA CLASSIFICATION CONFORM TO THE LATEST ISSUE OF IS : 5572. INDIAN PETROLEUM RULES OISD-STD-113. OIL MINES REGULATIONS/DGMS GUIDELINES (FOR PROJECTS UNDER DGMS JURISDICTION) & RECOMMENDATIONS OF PROCESS LICENSOR AND PROJECT DESIGN BASIS.
3. THE AREA WITHIN 1.5M (EXTENDING IN ALL DIRECTIONS) OF SAFETY VENTS, PRODUCT SAMPLING LOCATIONS, PROCESS WATER DRAINS, ONLY SEWERS VENTS, INSPECTION HATCHES, DISCHARGE ORIFICE OF FIXED LIQUID LEVEL GAUGES, ROTARY OR DIP GAUGES, FILLER OPENINGS SHALL BE CLASSIFIED AS ZONE-1. FURTHER AN AREA FROM 1.5M TO 3.0M (EXTENDING IN ALL DIRECTIONS) FROM VENTS SHALL BE CLASSIFIED AS ZONE-2. HOWEVER THE VENTS OR DRAINS BLANKED DURING NORMAL OPERATION AND USED ONLY WHEN THE PLANT IS DEPRESSURISED OR UNDER SHUTDOWN, SHOULD NOT BE REGARDED AS AN OPERATIONAL VENT OR DRAIN OR SOURCE OF HAZARD.
4. OPEN TRENCHES, PITS OR SUMP BELOW GRADE WITHIN ZONE-2 AREA SHALL BE CLASSIFIED AS ZONE-1 AREA.
5. IN CASE OF PIPELINE HANDLING FLAMMABLE MATERIAL, WHERE WELL MAINTAINED VALVES, FITTINGS AND METERS ARE INSTALLED IN WELL VENTILATED AREAS OR PIT, THE EXTENT OF ZONE-2 AREA ABOVE THE GROUND SHALL BE CONSIDERED AS 4.0M IN ALL DIRECTIONS FROM THE POSSIBLE SOURCE OF HAZARD, ALTHOUGH THE PIT ITSELF SHALL BE CLASSIFIED AS ZONE-1 AREA.
6. GAS GROUPS ARE AS PER IS: 9570.
7. ROADS FULLY/PARTLY COVERED UNDER HAZARDOUS AREA CLASSIFICATION SHALL BE BARRICADED FOR VEHICULAR MOVEMENT.

**LEGENDS:-**



- ZONE-1, GAS GROUP IIA/IIB HAZAROUS AREA



- ZONE-2, GAS GROUP IIA/IIB HAZAROUS AREA



- ADDITIONAL ZONE-2, GAS GROUP IIA/IIB AREA  
(AREA SUGGESTED WHERE LARGE RELEASE OF  
VOLTAGE PRODUCTS MAY OCCUR)



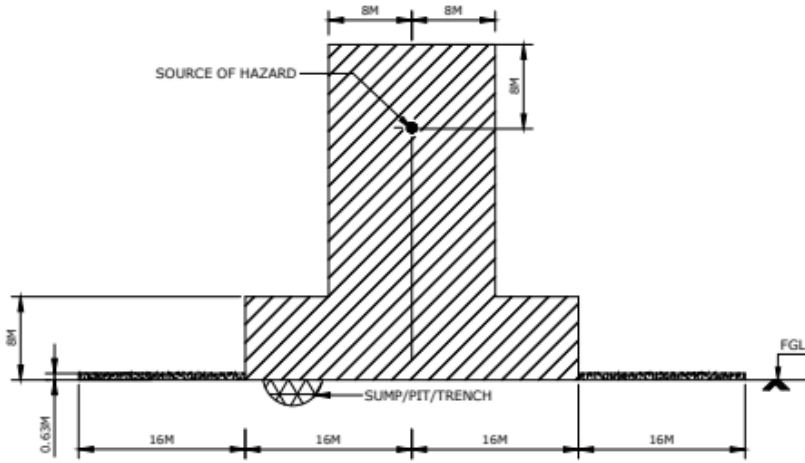
- ZONE-1, GAS GROUP IIC HAZAROUS AREA



- ZONE-2, GAS GROUP IIC HAZAROUS AREA

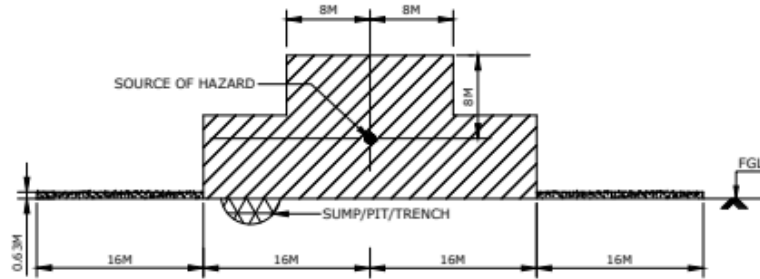


- SAFE AREA (NON HAZARDOUS)



**DETAIL-1**

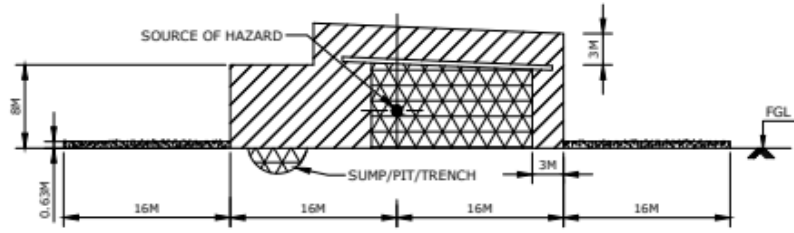
FREELY VENTILATED PROCESS AREA  
(HEAVIER THAN AIR GASES OR VAPOURS)  
(SOURCE OF HAZARD LOCATED ABOVE GROUND LEVEL)



**DETAIL-2**

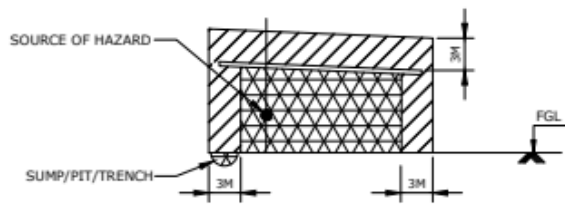
FREELY VENTILATED PROCESS AREA  
(HEAVIER THAN AIR GASES OR VAPOURS)  
(SOURCE OF HAZARD LOCATED NEAR GROUND LEVEL)

NOTES:



**DETAIL-3**

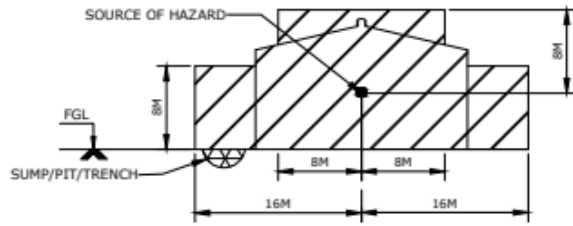
PROCESS AREA WITH RESTRICTED VENTILATION  
(HEAVIER THAN AIR GASES OR VAPOURS)



**DETAIL-4**

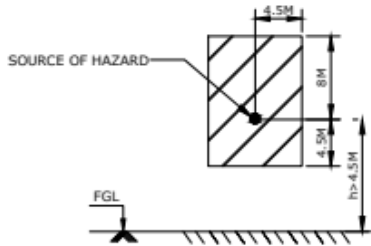
PROCESS AREA WITH RESTRICTED VENTILATION  
(HEAVIER THAN AIR GASES OR VAPOURS)

NOTES:

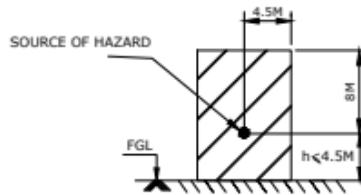


**DETAIL-5**

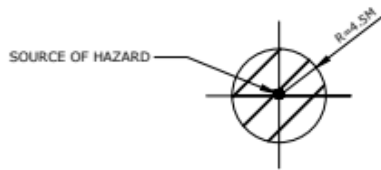
WELL VENTILATED INDOOR AREA  
(HEAVIER THAN AIR GASES OR VAPOURS)



**ELEVATION**



**ELEVATION**

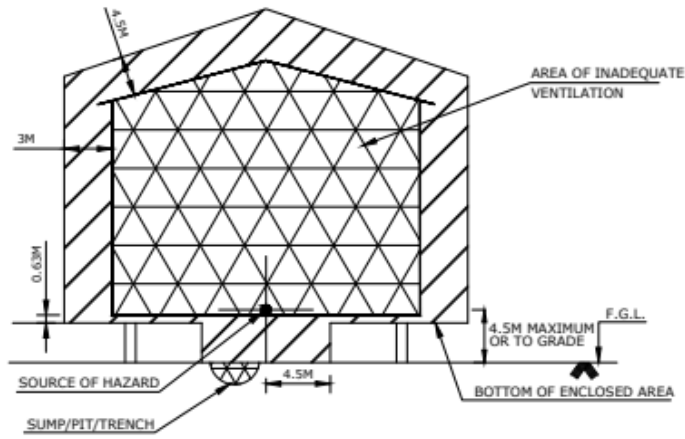


**PLAN**

**DETAIL-6**

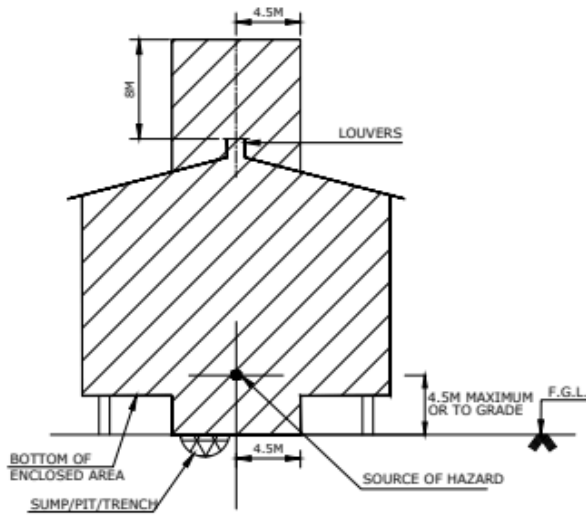
(FREELY VENTILATED PROCESS AREA)  
(FOR LIGHTER THAN AIR GASES OR VAPOURS)

**NOTES:**



**DETAIL-7**

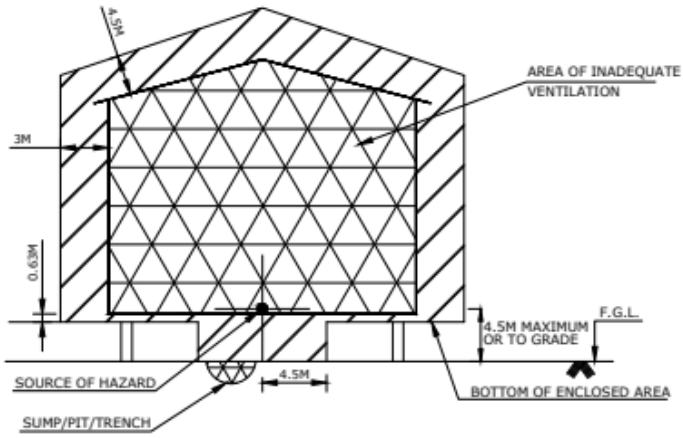
INADEQUATELY VENTILATED COMPRESSOR SHELTER  
(LIGHTER THAN AIR GASES OR VAPOURS)



**DETAIL-8**

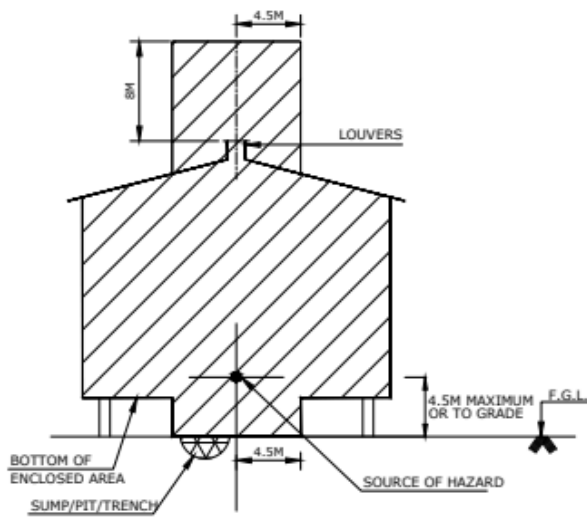
ADEQUATELY VENTILATED COMPRESSOR SHELTER  
(LIGHTER THAN AIR GASES OR VAPOURS)

NOTES:



**DETAIL-7**

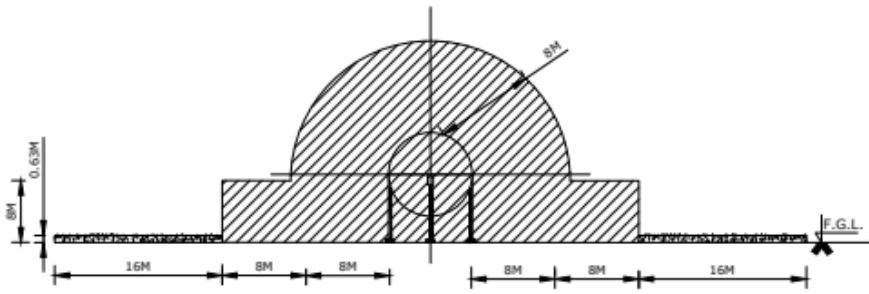
INADEQUATELY VENTILATED COMPRESSOR SHELTER  
(LIGHTER THAN AIR GASES OR VAPOURS)



**DETAIL-8**

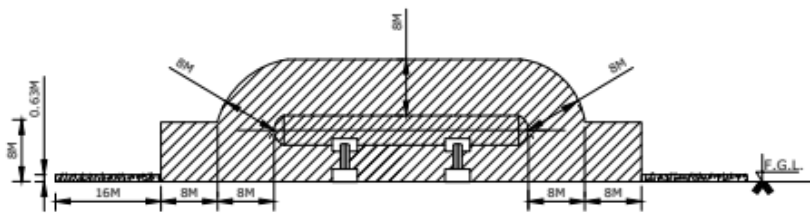
ADEQUATELY VENTILATED COMPRESSOR SHELTER  
(LIGHTER THAN AIR GASES OR VAPOURS)

NOTES:



**DETAIL-12 (SPHERE)**

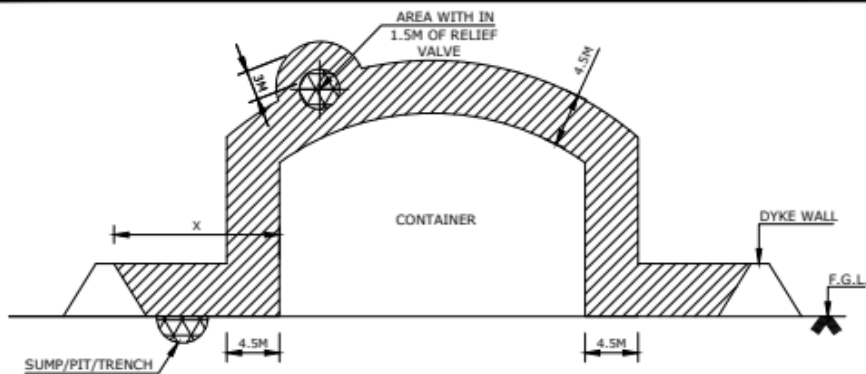
(HEAVIER THAN AIR GASES OR VAPOUR)



**DETAIL-13 (BULLET)**

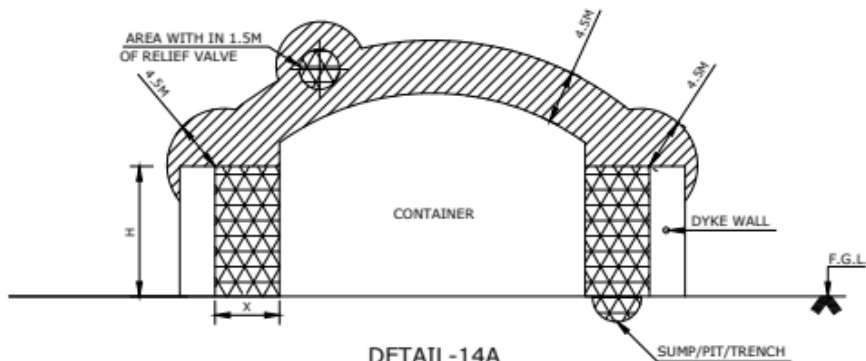
(HEAVIER THAN AIR GASES OR VAPOUR)

NOTES:



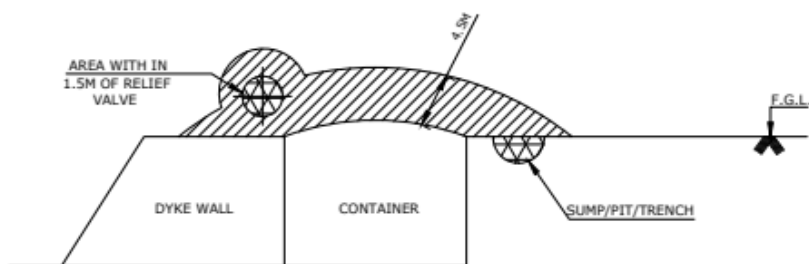
**DETAIL-14A**

DYKE HEIGHT LESS THAN DISTANCE FROM CONTAINER TO DYKE (H LESS THAN X)



**DETAIL-14A**

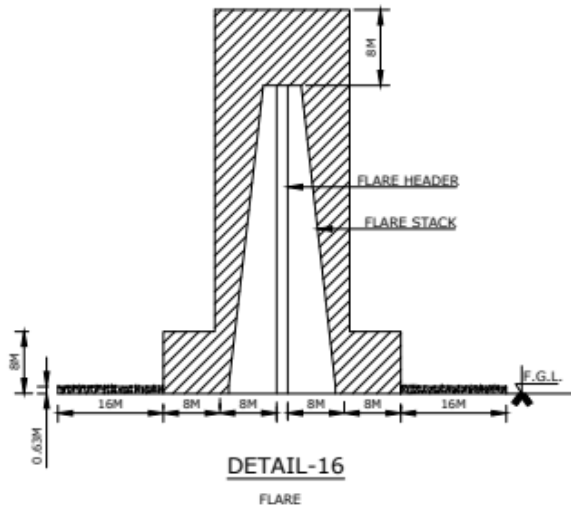
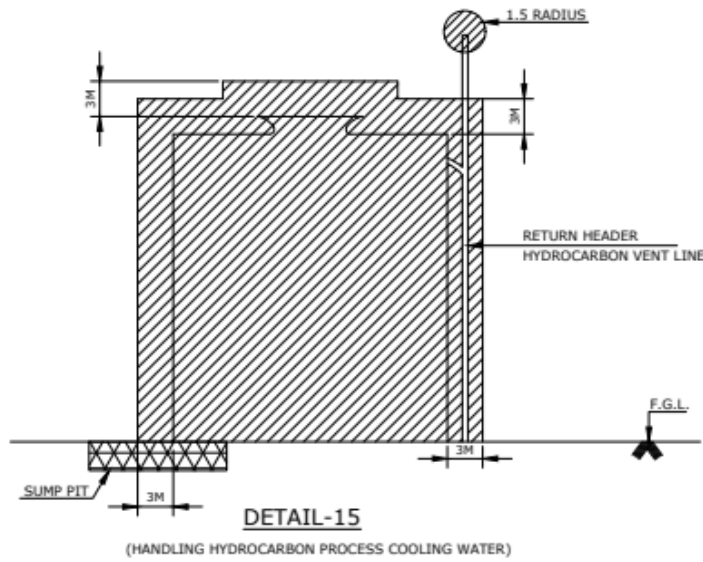
DYKE HEIGHT LESS THAN DISTANCE FROM CONTAINER TO DYKE (H GREATER THAN X)



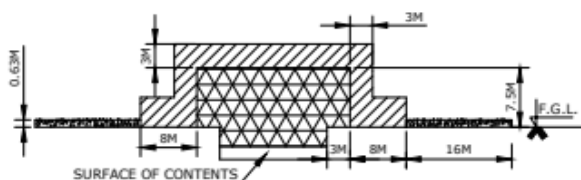
**DETAIL-14C (STORAGE BELOW GRADE)**

STORAGE TANKS FOR CRYOGENIC LIQUIDS

NOTES:

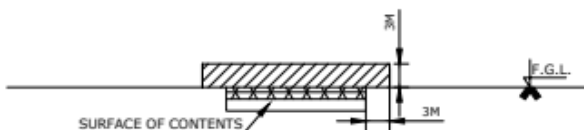


NOTES:



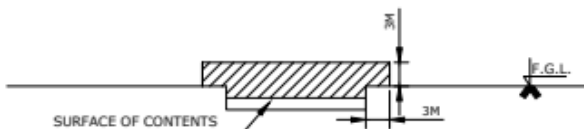
**DETAIL-17**

UNIT SEPARATORS, PRE-SEPARATORS AND SEPARATORS  
(APPLICABLE FOR OPEN TANKS OR BASINS)



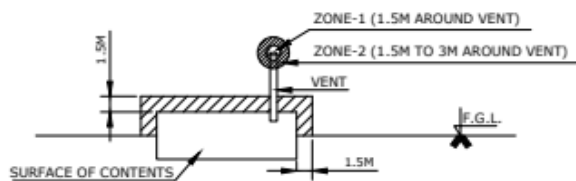
**DETAIL-18**

DISSOLVED AIR FLOTATION (DAF) UNITS  
(APPLICABLE FOR OPEN TANKS OR BASINS)



**DETAIL-19**

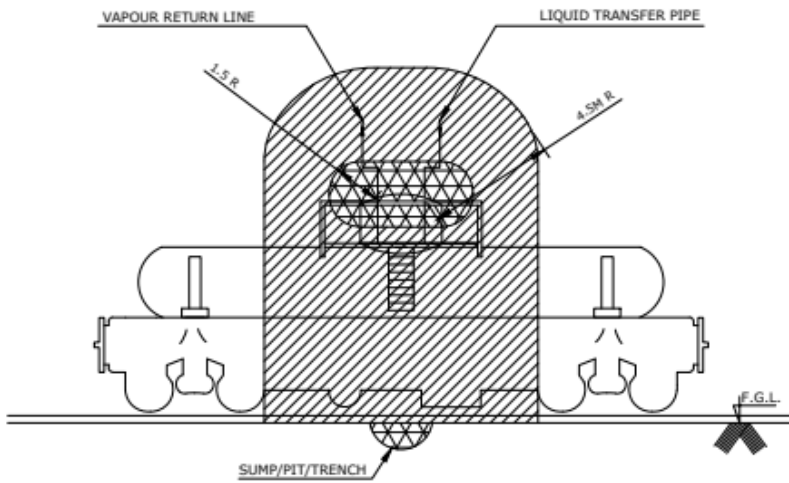
BIOLOGICAL OXIDATION (BIOX) UNITS



**DETAIL-20**

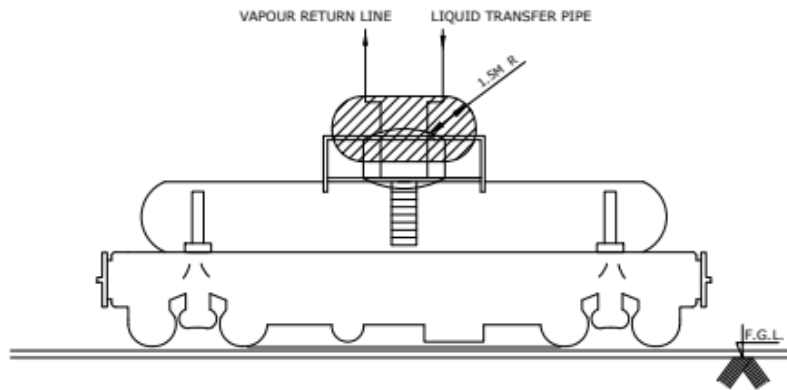
UNDERGROUND COVERED SUMP OR OILY WATER SEPARATOR

**NOTES:**



**DETAIL-21**

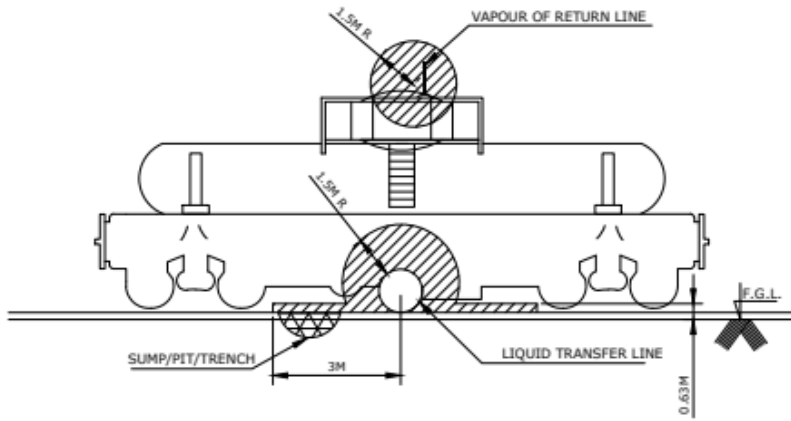
(MATERIAL: LIQUIFIED GAS/ COMPRESSED GAS/ CRYOGENIC LIQUID)  
 WAGON/TANK TRUCK LOADING AND UNLOADING VIA CLOSED SYSTEM.  
 PRODUCT TRANSFER THROUGH DOME ONLY



**DETAIL-22**

(MATERIAL: FLAMMABLE LIQUID)  
 WAGON/ TANK TRUCK LOADING AND UNLOADING VIA CLOSED SYSTEM.  
 PRODUCT TRANSFER THROUGH DOME ONLY

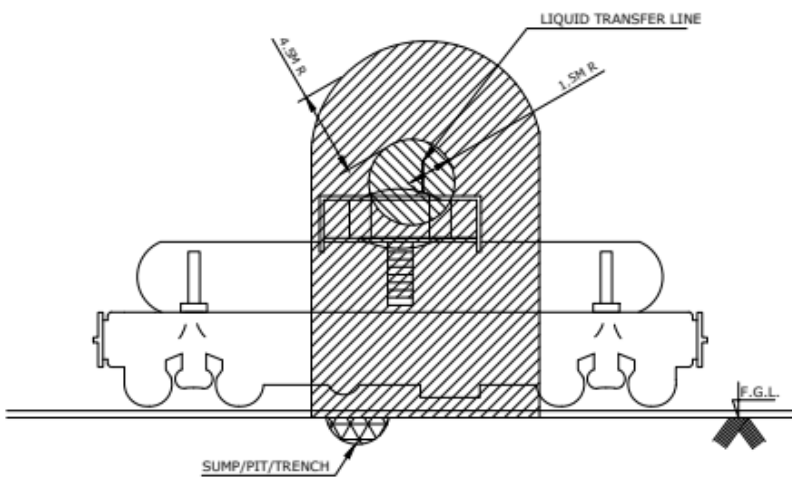
**NOTES:**



**DETAIL-23**

(MATERIAL: FLAMMABLE LIQUID)

WAGON/TANK TRUCK LOADING AND UNLOADING VIA CLOSED SYSTEM.  
BOTTOM PRODUCT TRANSFER ONLY

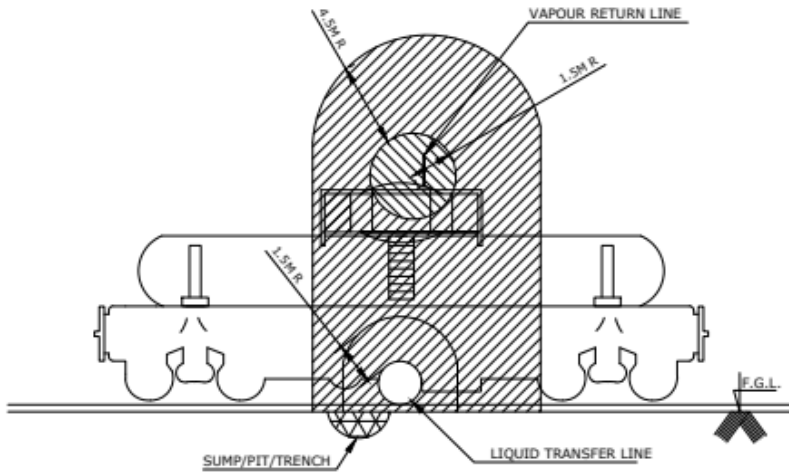


**DETAIL-24**

(MATERIAL: FLAMMABLE LIQUID)

WAGON/TANK TRUCK LOADING AND UNLOADING VIA OPEN SYSTEM.  
TOP OR BOTTOM PRODUCT TRANSFER ONLY

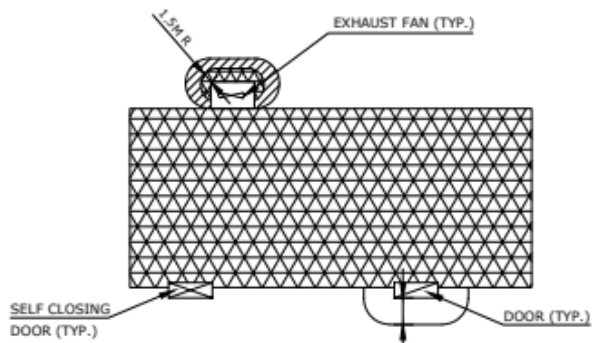
**NOTES:**



**DETAIL-25**

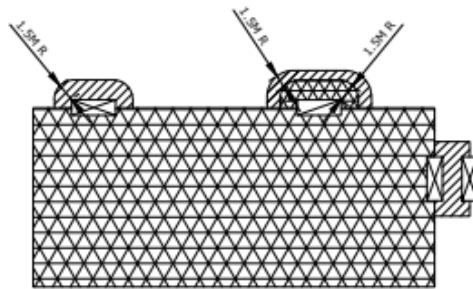
(MATERIAL: LIQUIFIED GAS/ COMPRESSED GAS/ CRYOGANIC GAS)  
WAGON/TANK TRUCK LOADING AND UNLOADING VIA CLOSED SYSTEM.  
PRODUCT TRANSFER THROUGH BOTTOM ONLY

NOTES:



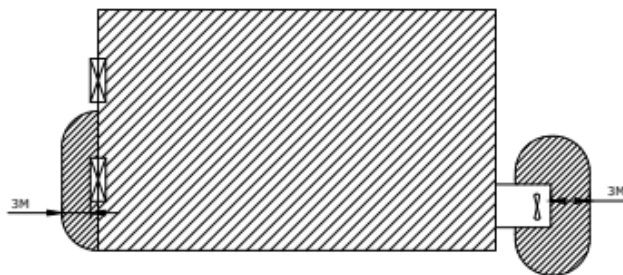
**DETAIL-26A**

FLAMMABLE SUBSTANCE RELEASED DURING NORMAL OPERATION WITH INADEQUATE VENTILATION



**DETAIL-26B**

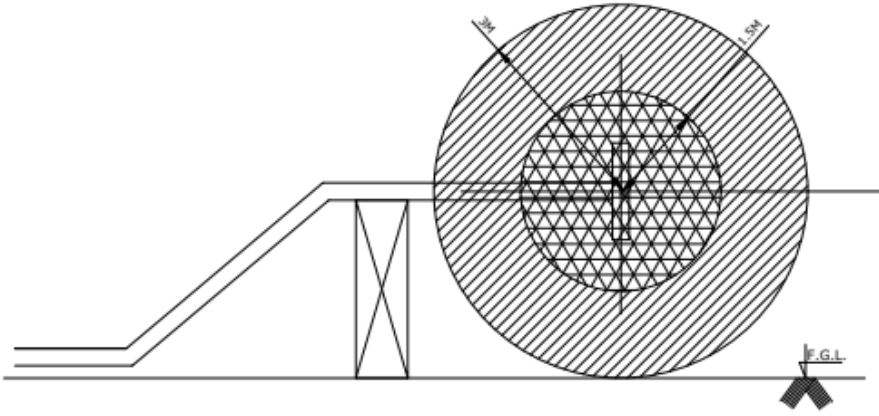
FLAMMABLE SUBSTANCE RELEASED DURING ABNORMAL SITUATION OR INFREQUENT OPERATIONS WITH INADEQUATE VENTILATION



**DETAIL-26C**

FLAMMABLE SUBSTANCE RELEASED DURING ABNORMAL SITUATION OR INFREQUENT OPERATIONS WITH ADEQUATE VENTILATION

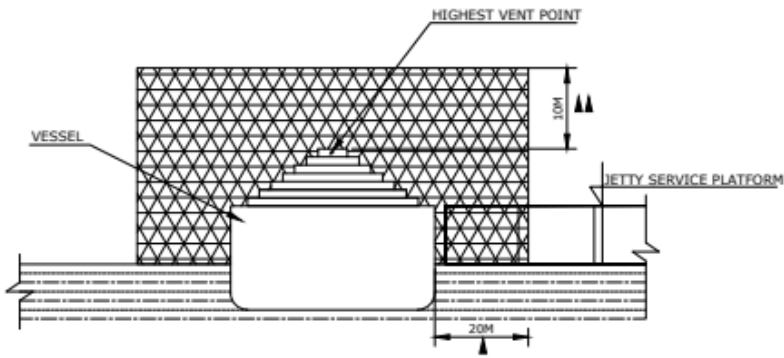
**NOTES:**



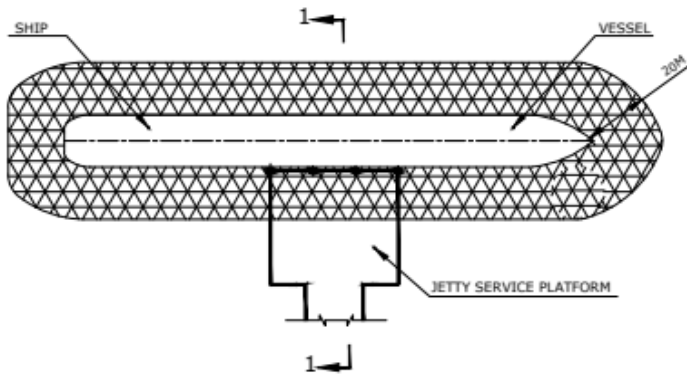
**DETAIL-27**

BALL OR PIG LAUNCHING OR RECEIVING INSTALLATION  
IN A NON-ENCLOSED, ADEQUATELY VENTILATED AREA

NOTES:



SECTION 1-1



PLAN  
DETAIL-28  
JETTIES OR MARINE FACILITIES

NOTES:

- ▲ SHALL BE REDUCED TO 10M IN CASE OF VESSELS WITH LOADING OR DISCHARGES RATES  $\leq 10M^3/MIN.$
- ▲▲ SHALL BE REDUCED TO 5M FOR LOADING RATES  $\leq 10M^3/MIN.$

2 POLE STRUCTURAL

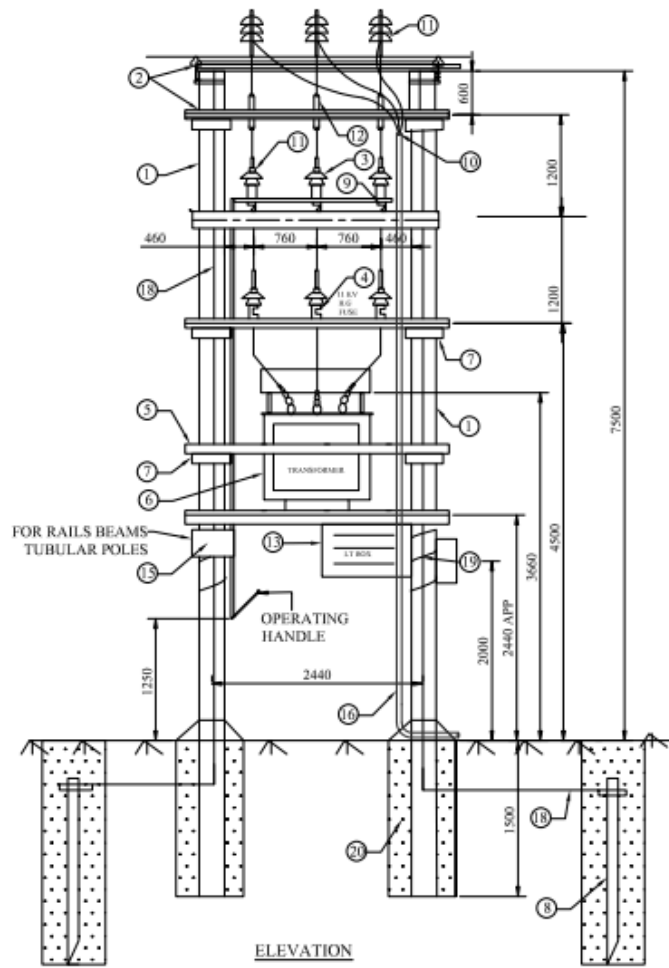
STANDARD DRAWING NO.

REV. SIZE

SHEET NO.

1 OF 1

02 A4



BILL OF MATERIAL (APRX. QTY.)

S.No	Description	QTY
1	POLE (RCC/MS) - 9m	2
2	CHANNEL 100X50	2
3	AB ISOLATOR / G.O. SWITCH	2
4	H.G. FUSE	3
5	ANGLE 50X50X6 - 2800 (APP.)	3
6	TRANSFORMER	1
7	CLAMP	1
8	EARTHING PIT	2
9	G.O. AB SWITCH	1
10	HT CABLE	1 SET
11	11 KV INSULATOR	1 SET
12	11 KV LIGHTING ARRESTS	3
13	DISTRIBUTION BOX	1
14	LT CABLE	2
15	DANGER BOARD	1
16	HT CABLE PIPE	AS REQD
17	LT CABLE PIPE	AS REQD
18	EARTHING STRIP	AS REQD
19	BARBED WIRE	AS REQD
20	POLE FOUNDATION	2