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# GAIL INDIA LIMITED

# TENDER TENDER DOCUMENT FOR COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

## VOLUME II OF II (TECHNICAL)

**(BID DOCUMENT NO - 40/LEPL/GAIL/34-R0)**
**E-TENDER REF : 2022_GAIL_130117**

**OPEN DOMESTIC COMPETITIVE BIDDING**

**Project Management Consultant**
**Lyons Engineering Pvt. Ltd.**

www.lyonsengineers.com

| PMC: | TABLE OF CONTENTS<br><br>Coating Refurbishment and Associated Works of Vaghodia to RIL & GPU Gandhar to GNFC Pipeline | Doc No.<br>GAIL-TOC-GN-049-DL-001<br>Rev. 1 | CLIENT: |
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# GAIL INDIA LIMITED

# COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

## SCOPE OF WORK

## DOC. NO. - GAIL-040049-GN-DOC-SOW-001

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 17.10.2022 | Issued For Bid | MH | TR | SB | |
| 1 | 11.07.2022 | Issued For Bid | MH | TR | SB | |
| 0 | 08.03.2022 | Issued For Review | MH | TR | SB | |
| **Rev** | **Date** | **Purpose** | **Prepared By** | **Checked By** | **Approved By** | |

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## 1. INTRODUCTION

GAIL (India) Limited is the largest state-owned natural gas processing and distribution company and the youngest Maharatna company. GAIL is the nodal agency for transportation and supply of Natural Gas to various potential customers. The receipt of gas from the sources and its transportation and distribution is intended to be by means of a high-pressure trunk transmission gas grid from the gas receiving point to various customer stations.

M/s GAIL (India) Ltd. proposes to re-coat the following two pipelines

(i) The 18 inch "VAGHODIA - RIL VADODARA", 8.00 km stretch (approx..) natural gas pipeline, CTE (Coal Tar Enamel) coated, built in 1987

(ii) The 18 inch "GPU GANDHAR DT - GNFC RT" 29.5 Km(approx..) natural gas pipeline, CTE (Coal Tar Enamel) coated, built in 1992

Lyons Engineering Private Limited (LEPL) has been appointed as Engineering & Project Management Consultant by GAIL for the project.

Definitions:

| | |
|---|---|
| Project | Coating refurbishment and Associated works of "VAGHODIA - RIL VADODARA" & "GPU GANDHAR DT - GNFC RT" pipeline |
| Owner/Company | GAIL (India) Limited |
| Consultant | Lyons Engineering Pvt. Ltd. (LEPL) |
| Construction Contractor | All required Surveys including Route Surveys, Residual Engineering, Procurement and Construction etc, providing the required services. |
| Manufacturer, Vendor (or Supplier) | The organization selected to manufacture or supply the equipment, services or material, ordered in accordance with Technical Specification, data sheets etc. |

### 1.1 EXISTING PIPELINE FACILITY DESCRIPTION:

The pipeline schematic drawing of the above two existing pipelines are indicated (Refer Schematic-001 & 002)

## 1.2 PROPOSED WORKS SCHEMATIC:

- In the pipeline schematics drawing, the scope of the recoating work is broadly shown (Refer Schematic-003 & 004).

- Chainage wise details for coating refurbishment of the 8.0 KM stretch of VIP pipeline are as below:

| CHAINAGE FROM | CHAINAGE TO | LENGTH (KM) |
|---|---|---|
| 0 | 200 | 0.2 |
| 2000 | 4000 | 2 |
| 4000 | 6000 | 2 |
| 11.251 | 11.891 | 0.640 |
| 14.531 | 14.991 | 0.460 |
| 16.631 | 17.871 | 1.240 |
| 21.531 | 22.285 | 0.754 |
| 26.138 | 26.243 | 0.105 |
| 31.516 | 32.183 | 0.667 |
| TOTAL | | 8.066 |

The above drawings are indicative only and are furnished to the Bidder to understand the nature of work involved. However, bidder/contractor shall execute the work as per site condition and direction of Owner's Engineer-in-Charge (EIC).

- This document covers the details of work tendered, scope of work, and scope of material supply pertaining to **Coating refurbishment and Associated works of "VAGHODIA - RIL VADODARA" & "GPU GANDHAR DT - GNFC RT" GNFC pipeline**. All works and clauses of this document shall be applicable unless specifically mentioned otherwise.

- This document shall be read in conjunction with List of Attachments, Schedule of Rates, specifications, standards, drawings and other documents forming a part of the Tender Document.

## 2. WORK TENDERED

Work tendered in this bid package consists residual engineering, procurement (except free issue supply), supply, installation, repair, testing of various activities related to **Coating refurbishment and Associated works of "VAGHODIA - RIL VADODARA" & "GPU GANDHAR DT - GNFC RT" pipeline**.

The work involves in this project as follows:

- Survey the Pipeline ROU for topography and soil along with crossing locations and pipeline depth of cover.

- Remove the existing coal tar enamel coating and replace it by cold applied tape coating on existing pipeline

- Recoating of Burried Sectionalising Valves

- At any given time, the contractor will have to work at multiple fronts. The contractor has to plan and mobilize the resources accordingly to meet completion target Schedule of Owner.

- Any other work not mentioned but required for successful completion of work

## 3. SCOPE OF WORK

This section describes the 'Scope of Work' for the contractor to facilitate the understanding of the overall work required to be executed as part of this project. The description given in this section is not exhaustive and for complete understanding the overall scope of work, the Contractor must go through the subsequent sections of this document in detail.

The work shall be completed conforming to Drawings, technical specifications, data sheets as furnished in the tender and any other information provided by Engineer-In-Charge. The general scope of work includes the following:

## I. KEY ACTIVITIES

The key activities to be carried out by the Contractor as part of this project shall be as mentioned below. This is an indicative list of minimum required activities:

- Site visit for studying the ROW and existing facilities as per the scope of the project, understanding the existing terrain and conditions, getting familiar with the expected working conditions and a thorough understanding of the project scope of work. The Contractor shall be deemed to have acquainted himself well with the site and project requirements before submitting his offer.

- Study all the documents, including Drawings and Procedures prepared attached with this tender and understand the technical requirements of the work.

- Carry out Trenching and excavation in the designated sections (Refer Schematic-003 & 004)), expose the existing buried pipeline, carry out required engineering measurements including pipe thickness, removal of existing coal tar enamel coating, surface

preparation of the pipe for application of new cold applied tape coating, application of new coating as per procedure, back filling of the trench and restoration of the site.

- Coating material (Cold Tape) for pipelines to be free issued by GAIL.

- Coating refurbishment works for the length of the pipeline i.e. 37.5 km section & coating refurbishment for 2 nos. SVs shall be done (Refer Schematic-003 & 004). The scope includes exposing the buried valves, removal of existing coating, surface preparation, re-coating the valves as per procedure, backfilling and restoration of the site. In some location the Block valves are installed in RCC chamber. Contractor's scope also included dismantling of the RCC chamber for coating of valve and Construction of new RCC Chamber after completion of Coating works.

- Coating material for Sectionalising valves shall be free issued by GAIL.

- If contractor carries out any repair job after backfilling due to bad workmanship, all costs including excavation of the trench/recoating/ etc. shall be borne by the contractor and no extra payment shall be made by GAIL. Also, the cost of free issued coating material for coating repair shall be recovered from contractor.

- The contractor shall provide proper barricading / warning tape around the working area. In highly populated area, solid hard barriers shall be used to avoid any accidents (refer drawing attached), however caution tape with danger marking shall be provided at all other locations.

- In case of any exigencies/disasters or leak during the execution of job, the Contractor shall keep all the required manpower, equipment, Communication System and vehicles on stand-by for immediate containment and restoration.

- In Dry or Marshy areas, after excavation of trench, the earth may be swampy and adequate pipe support may be required by use of belt, chain pulley fitted to suitable cross members or pipes laid across trenches or by any other suitable arrangement. The suitable arrangement for the workable area also needs to be provided like placement of metal sheets or wooden planks etc.

  The above is a listing of broad activities to be carried out by the contractor as part of this project. However, the Scope of Contractor shall cover all the activities required for successful execution of the project at site, as per project requirements, specifications and work procedures, to the satisfaction of the owner/owner representative.

## II. SURVEY & SITE VISIT

- The Contractor shall carry out a detailed site visit including all the station facilities within project scope, for acquainting himself fully with the site, prevailing conditions, terrain, work requirement, site specific requirements and a thorough understanding of complete scope of work. Survey the Pipeline ROU for topography and soil along with crossing locations and pipeline depth of cover.

- Collect & record all required details / information, validate information provided in tender document and update the same wherever required.

- The contractor shall be deemed to have acquainted himself well with the prevailing site conditions and overall project requirement, before making his offer and no additional cost / time shall be admissible on account of any site condition.

## III. PROCUREMENT OF MATERIALS & SUPPLY AT SITE

- Contractor shall procure and supply all materials other than Free Issued Materials (FIM) issued by the Owner, required for this project in sequence and at appropriate time as per approved schedule requirements. All equipment, materials, components etc. shall be suitable for the intended service.

- List of recommended parties for bought out items has been enclosed with the bid package for various items. for items which are not covered in the list of recommended parties, contractor shall obtain company's prior approval for the vendor. Equipment/ material offered shall be field proven. Equipment requiring specialized maintenance or operation shall be avoided, as far as possible.

- Prepare detailed schedule for entire scope of work including material delivery and transportation to site, to meet project timelines.

- Prepare inspection & test plans for material as well as for project activities.

- Taking over of Free Issue Material (FIM) supplied by the Owner. Stores management including receipt, warehousing, preserving the material in good condition, issue of material to construction site, reconciling/ handing over surplus material to Company for Company supplied items at Company's storage yard.

- Carryout proper documentation of inspection and quality assurance programmers for bulk materials duly approved by Company. Contractor shall maintain an accurate and traceable listing of procurement records for the location, quality and character of all permanent materials in the Project.

- Contractor shall immediately report to the Company of all changes which will affect material quality, and recommend any necessary corrective actions to be taken.

- Submit weekly manufacturing progress reports highlighting hold ups and slippages, if any, to Company and take remedial measures.

- All purchase requisitions including purchase orders shall be approved by Company.

- Compliance with vendors and supplier's instructions and recommendations for transportation, handling, installation etc.

- Supply of all consumables for the project.

- Contractor shall provide inspection of the items at vendor's works by the reputed inspection agency and shall submit inspection reports of OWNER"s clearance. Contractor shall appoint anyone of the following TPIA for inspection purpose.
    i. Lloyds Register of Industrial Services.
    ii. Technischer Uberwachungs Verein (TUV)
    iii. Det Norske Veritas ( DNV)
    iv. STS Integrity Management Pvt. Ltd.
    v. AIB – Vincotte
    vi. Bureau Veritas
    vii. SGS
    viii. American Bureau Services (ABS)
    ix. Velosi Certification Services.

**A. Materials to be Supplied by Company/Owner as Free Issue**

i. Owner shall supply following materials as free issue: - Coating Materials

ii. Free issue material shall be supplied from M/s GAIL designated stores in Vaghodia or other locations as instructed by Engineer-In-Charge. Further, Contractor shall also return any unused materials after completion of work to owners designated store in Vaghodia or as directed by owner/ Engineer-in –Charge at its own cost.

iii. The Contractor shall be responsible for taking over of the material and subsequent handling, hauling, transportation to the actual work site(s) and storage & safe keeping of the materials.

iv. The Contractor shall inspect all Company supplied free issue materials at the time of taking over from the Company and defects noticed, if any, shall be brought to the notice of Company/Company representative and jointly recorded. Once the material has been taken over by the Contractor, all the responsibility for safe keeping of the materials and repair of damage/ defects to coating shall rest with the Contractor.

**B. Materials to be supplied by Contractor**

All materials (other than those mentioned in clause A above, consumables, equipment required for completion and successful commissioning of entire pipeline system shall be procured and supplied by the Contractor As a minimum, the materials to be supplied by Contractor shall, but not limited by any way, be as follows:

i. The procurement and supply, in sequence and at appropriate time, of all materials and consumables required for completion of the Work as defined in this bid document except the Company free issue material, shall be entirely the Contractor's responsibility and price quoted for the execution of the Work shall be inclusive of supply of all these materials.

ii. All materials supplied by the Contractor shall be strictly in accordance with the requirements of relevant Company material specifications enclosed with the tender document.

iii. All equipment's, materials, components etc. shall be new and specifically purchased for this job. All material to be supplied by the Contractor shall be purchased from the approved vendors of the Company, duly inspected by LEPL/ Third party inspection agencies mentioned in the bid documents.

iv. Any other material not specifically listed herein, but required for successful completion of the Work.

### C. Storage of Materials and Preservation

i. The contractor has to make available safe storage facility for storing the FIM and contractor's material, as per project requirement. The storage shall be fully covered with adequate protection from moisture, dirt, dust, wind and ingress of foreign items.

ii. The responsibility of storage, preservation and safeguard of all the material, including FIM, for the entire project duration, shall be in scope of contractor.

iii. In case of pilferage or theft or wastage of FIM, cost of the FIM shall be recovered from the Contractor, as per recovery rate mentioned in the Tender.

iv. All transportation of material including FIM, to and from the owner's store yard shall be in scope of Contractor.

v. 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 on ground.

## IV. QUALITY ASSURANCE & QUALITY CONTROL

a. Contractor shall prepare Quality Assurance & Quality Control Plan for project.

b. Contractor shall ensure adequate quality assurance and control including stage wise inspection, testing and certification.

c. Contractor shall appoint an independent TPIA for supply of material (Other than free issue) from Owner's vendor list. The TPIA appointed by contractor shall be common for inspection of complete scope of supply. All inspection reports shall be submitted for owner's review/approval. All materials shall be supplied with required certificate / approved document.

d. Contractor shall Carryout proper documentation of inspection and quality assurance programme for all equipment and bulk materials duly approved by Owner/owner's representative.

## V. CONSTRUCTION: INSTALLATION, APPLICATION PROCEDURES

The works to be executed at site, as part of this project, shall include but not limited to the following works:

i. The procedures for replacement of coating for pipeline are attached as a part of the document for reference of the contractor. However, the contractor shall be required to review the same and submit the application procedures on award of contract.

ii. Any procedure which is required for successful completion of the works at site, but not enclosed with the Tender, shall be prepared by the Contractor as part of scope of work, and shall be reviewed and approved by the Owner/Owner's representative.

iii. Similarly, all additional drawings, which are required for execution and successful completion of the works at site, but not enclosed with the Tender, shall be prepared by the Contractor as part of scope of work, and shall be reviewed and approved by the Owner/Owner's representative.

iv. Identification of buried pipeline / pipelines in the ROU/ROW for re-coating using pipeline locators and cross trenching at regular intervals or as per direction of Owner's Engineer-in-Charge (EIC).

v. Trenching using backhoe type excavator's up to a predetermined depth considering safety aspects and then trenching manually so as to prevent damage to the pipeline. The trench size shall be of sufficient width and depth for safe operation of the personnel for removal of the coating and application of the new rehabilitation coating. In some areas complete manual trenching may be required for protection of other facilities in ROU/ ROW as determined during cross trenching and as determined by site conditions.

vi. De-watering of the pipeline trench to ensure dry atmosphere for re-coating wherever required.

vii. In submerged area, pumping out of the surface and ground water using sludge, de-watering pumps or installing well point system for enabling excavation of the trench to access the pipeline. It would also include preparation of bund around the pipeline segment to prevent flow of surface water into the pipeline trench. The contractor shall be responsible to deploy of the necessary equipment /measures to enable excavation of trench and access to pipeline.

viii. In case the trench depth is more than 1.5 meters, the trench shall be securely shored and timbered.

ix. Surface preparation of the steel surface as per type of the coating as detailed later in this section. Surface preparation of the steel surface in dry area shall be abrasive blasting using copper slag.

x. Inspection of the steel surface for any pitting and reduction in wall thickness.

xi. Application of the refurbishment coating as per approved method statement / QA-QC procedures (to be submitted by Contractor for review and approval by OWNER/OWNER'S REPRESENTATIVE).

xii. Inspection and testing of the applied coating as per approved ITP (to be submitted by contractor for review and approval by OWNER/OWNER'S REPRESENTATIVE).

xiii. Cathodic Protection Cable to be connected on Pipe surface by pin brazing wherever it will be disconnected during recoating works. CP cable required for re connection will be provided by GAIL as free issue material.

xiv. Backfilling of the trench including compaction as per approved method statement / QA-QC procedures (to be submitted by Contractor for review and approval by OWNER/OWNER'S REPRESENTATIVE). If required additional soil shall have to be transported to ROW for backfilling.

xv. In rocky terrain padding over and around the pipe with fine sand/soil is to be done during backfilling up to a level of 150 mm above the pipeline.

xvi. Keeping the pipeline safe and operational 24x7, when exposed during coating refurbishment.

xvii. Night patrolling shall be provided for sections under construction / exposed for work, to ensure safety and integrity of the pipeline sections. The patrolling team shall be provided with suitable communication (phone) for any emergency. The details of personnel along with mobile no shall be submitted to the OWNER/OWNER'S REPRESENTATIVE/Owner. It is the responsibility of contractor to provide all necessary items (Torch, shoes etc.) to the personnel required for effective patrolling at night. Also, the contractor shall ensure sufficient lighting be provided along the open trench throughout the night in areas where residences are very near to the ROU/ROW Boundary.

xviii. Restoration of the ROU/ROW to its original condition.

xix. Contractor shall make proper waste disposal system for construction and related works.

xx. Contractor shall carry out all incidental and associated works and any other works not specifically listed there in but are required to be carried out to complete entire work related to pipelines and terminals.

## VI. HEALTH, SAFETY AND ENVIRONMENT (HSE)

i. Health & Safety Management, complying with Statutory, Regulatory and National &International Standards.

ii. All project related activities shall be carried out in full compliance to the HSE requirements of the Owner, and applicable statutory requirement.

iii. Adequate PPE shall be provided to all personnel working for the project, in compliance to HSE requirements.

iv. contractors are required to maintain a site registry during the whole tenure of the contract detailing all activities on a daily basis.

v. Contractor shall carry out Induction and strict implementation of Health, Safety & Environment (HSE) procedures, providing adequate barricades at work site wherever required, conducting periodic audit and ensuring the implementation of HSE measures. Contractor shall be fully responsible & liable for ensuring & implementing HSE at site & shall hold Engineer-In-Charge fully indemnify from all liabilities & consequences.

## VII. MANPOWER AND EQUIPMENT

i. Provide adequate manpower as per project requirement and timelines.

ii. Provide all Tools, Tackles, Machines and Equipment required as per minimum equipment list attached.

iii. All equipment provided by the Contractor for the project, shall be dedicated for this project only. Declaration for the same shall be submitted by bidder with the bid.

iv. Safeguard and storage of all equipment, tools and tackles, machinery, vehicles etc, arranged by the Contractor, shall be in Contractors Scope of work.

## VIII. CAMP FACILITY AND TRANSPORTATION

i. Setup main office facility at any one location with a RCM/project coordinator.

ii. Setup camp facilities for workers/ project personnel at/near project site as per project requirement.

iii. Provide adequate space, safe environment and working conditions for all workers.

iv. Provide safe drinking water, sanitation and other basic facilities to all workers.

v. Provide basic medical / first aid facilities.

vi. Arrange for safe transportation of workers to and from the site.

## IX. PROJECT MANAGEMENT INCLUDING DOCUMENT CONTROL SYSTEM

i. The contractor shall prepare the detailed project schedule.

ii. The contractor shall prepare the Project Execution Methodology.

iii. The contractor shall prepare the Material Management Plan

iv. Project Planning and Scheduling: The contractor is expected to perform proper planning based on the weather conditions of site and get regular weather forecasts from the meteorological department or other sources, as weather tracking would play a crucial part in project completion activity.

v. Detail planning of material and manpower required for each activity. Plan and schedule mobilization of Manpower as per project schedule.

vi. Monitoring and Reporting of progress on each front of the project.

vii. Expediting and Monitoring of all procurement excluding free issue material and construction activities at sites.

viii. Contractor shall submit following deliverables for adequate monitoring of project:

- Daily Progress Report (DPR) for construction works of project
- Weekly Progress Report (WPR) for Procurement covering all stages of material Including construction progress.
- Monthly Progress Report (MPR) with comparison.

ix. The details of content of the above reports shall be prepared by the Contractor for approval of Engineer-In-Charge.

x. Receipt of GAIL free issued materials and Installation of all free issue with necessary modification if needed.

## X. PERMISSIONS & LIAISONING

i. GAIL shall open the ROU/ROW and provide the same to contractor's work. Clearing of the ROU/ROW for execution of the project shall be in the scope of contractor.

ii. Crops / cultivation maybe present in the ROU/ROW at the time of coating works. In such cases, it is the responsibility of the contractor to reach agreement with the farmers so as not to affect the progress of work.

## XI. OWNER'S RESPONSIBILITY

a) Issuing clearance to contractor to work in the ROU/ROW only
b) Providing all free issue materials
c) Refer commercial volume

## 4. COATING DETAILS

### 4.1 Type of Refurbishment Coating:

GAIL intends to refurbish the defective coating by in-situ application of various types of protective cold applied coating systems depending on the terrain / trench conditions as detailed below and rectify the pitted portion of the pipeline steel by providing metallic sleeving in line with site conditions and decision of GAIL / PMC shall be binding and final.

The refurbishment coating system shall comprise of the following:

| Type of terrain / trench condition | Type of coating | Surface preparation |
|---|---|---|
| Dry ( pipe surface dry ) / Wet ROU/ROW during rainy season | 3 ply & 2 ply cold applied tape coating system comprising of three layers: primer, inner anti-corrosion tape(3ply) and outer mechanical layer(2ply) to be applied by hand wrapping machines. Filler mastic shall be provided for filling irregularities around weld reinforcement. | Abrasive blasting – Sa 2.5 with anchor profile 50-100 µ |

### 4.2 Coating refurbishment & Allied works:

It is envisaged that for each PIPELINE, recoating works will commence simultaneously at minimum locations as follows:

Pipeline 1(VIP Line) : Minimum 3 fronts

Pipeline 2(GNFC Line) : Minimum 3 fronts

In case during the progress of work, additional fronts are required to meet the project completion target, the same will have to be opened by the contractor, as per contract.

Contractor shall submit in the bid a detailed organizational chart of personnel to be deployed comprising of Project Manager, Planning Engineers, QA / QC Engineers, HSE Engineers for each location. Contractor shall deploy a team of qualified engineers in Mech./Civil/ Electrical stream for execution of each activity as detailed above. The team to be deployed should have similar experience of pipe trenching & coating activities of hydro-carbon pipelines.

Contractor shall deploy sufficient machinery to achieve the desired daily rate of progress for coating refurbishment at each location. The minimum equipment, machinery, test and inspection equipment list to be deployed for each location is attached with this document.

All equipment's shall be calibrated against specified test conditions and maintained in that order through regular testing. The testing interval shall be decided by Engineer-In-Charge. The air compressors deployed shall be in good working condition and shall be fitted with the required de-humidifiers, filters to ensure dry air at the required pressure is available at the blasting pot and the nozzle pressure is as required to ensure the required surface profile. Prior to deployment, the air compressors shall be checked by the Owner/Owner's representative. Only those air compressors and pump will be deployed which shall be approved. Stand by air compressors, pump and sufficient spares shall be available at site to ensure that there is no stoppage of work.

Fitness Certificate for all equipment to be used for the project shall be obtained by the Contractor from a TPI or Chartered engineer with a valid certificate from the Institution of Engineers, India.

## 5. CONTRACTOR'S RESPONSIBILITIES

Contractor's responsibilities, besides the scope of work to be performed by him defined earlier, shall also include the following:

### 5.1 Project Documentation

- Approved QAP/method statements of various activities as per tender requirement.
- Field coating logbook duly certified by PMC.
- Reconciliation statement duly certified by PMC for all free issue material- coating etc.
- Radiography records of welds
- Test certificates/Inspection reports of all bought out items included in contractors' scope
- Guarantee/warranty certificates of all bought out items
- Field logbook of pipe thickness recorded with GPS coordinates of welded pipe sleeves.
- Field logbook of all CP components installed including GPS coordinates of test lead posts

## 5.2 Project Close Out

i. Submission of all as built documentation, inspection reports, purchase orders, material reconciliation report both in soft and hard copy duly approved by Engineer-In-Charge.

ii. Submission of all NOC's from landowners, statutory authorities and agencies having jurisdiction.

iii. Submission of relevant documents, guarantee/ warrantee test certificates of all the items supplied by Contractor for the execution of the complete scope of work.

iv. Submission of closure reports including above documents.

v. Any other work not specifically listed but required for successful completion of entire pipeline system.

vi. For final submission only 6 sets of documents plus the original transparencies shall be handed over by the contractor. Soft copy of all as-built drawings shall be also submitted in AutoCAD. Videography/ photograph of all major activities/ milestone achieved shall also be arranged and submitted by the contractor.

# GAIL INDIA LIMITED

# COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

## COATING WORK

## DOC. NO. - GAIL-040049-GN-DOC-CRW-002

| | | | | | | |
|---|---|---|---|---|---|---|
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# INDEX

## 1. REMOVAL OF COATING AND INSPECTION OF PIPE SURFACE

Before the application of coating, all paint or temporary protection, previous coatings, oils or grease, grinding and welding slags, rust, unevenness, burrs, grooves, dirt, mud, moisture and any other foreign matter must be removed from the pipeline surface.

Removal of the old coal tar coating and cleaning, surface preparation of pipe conforming to Sa 2.5 by abrasive blasting (Copper slag blasting) for 3ply & 2 ply cold applied tape coating and hand tool / power tool cleaning conforming Swedish standard St-2 or St- 3 for visco-elastic & petrolatum tape coating application.

Pipe wall thickness of each pipe length exposed for coating refurbishment shall be measured using a standard digital ultrasonic thickness gauge duly calibrated, which shall be supplied by contractor at every weld location and at locations where pitting is observed or as advised by PMC/Owner. The wall thickness data shall be properly documented along with GPS coordinates of pitted sections.

Application of the required coating system 3ply & 2 ply cold applied tape system as per specified application procedure and manufacturer's recommendation.

### 1.1 REMOVAL OF OLD COAL TAR ENAMEL COATING:

Old coating shall be manually removed using scrappers and small brass hammers. In no case hard hammer shall be used that may result in formation of dent on pipe.

The old and damaged coating over the pipe shall be removed carefully with the scrappers and small brass hammers, so that outer surface of the pipe is not damaged. After the coating is removed, the pipe surface shall be thoroughly cleaned of old primer, scales, rust, if any, and dust particles. The cleaning of pipe surface shall be carried out to the satisfaction of GAIL / PMC.

### 1.2 INSPECTION OF PIPE SURFACE:

After excavation and removal of old CTE coating, thorough physical inspection of pipeline surface shall be carried out by the Contractor and Owner / PMC jointly. All pitting and corrosion patch if any, depth shall be measured with the PIT gauge (Pit gauge to be supplied by the Contractor).

Measuring the actual wall thickness of the pipe using ultrasonic meter at 3,6,9 and 12' o clock position every three meter and in addition to this also be measured at every weld location, at locations where pitting is observed and the suspected area and at equal intervals (Ultrasonic thickness gauge shall be arranged by the Contractor).

Based on these readings, the actual health of the pipe can be known. If all these defects are within the permissible limits, only then blasting shall be allowed at normal blasting pressure.

All the test equipment's as required shall have valid calibration certificates. The same shall be submitted for GAIL/PMC record.

## 2. COLD APPLIED TAPE

### 2.1 GENERAL REQUIREMENTS

Equipment, accessories, inspection and testing instruments for coating material as per manufacturer's recommendation shall be in good operating conditions for completing the coating refurbishment job. Adequacy of equipment and accessories shall be approved by the Owner / PMC prior to start of the coating works and shall be checked at regular intervals.

Necessary arrangements for power supply based on diesel driven generators and other utilities shall be made by the contractor for the completion of the job.

Any materials brought to site shall be as per the specification and applicable standard(s) and should be approved by Engineer-in-Charge (EIC).

All work shall be carried out in accordance with the specification and shall be phase-wise approved by the GAIL / PMC. All working procedures / method statement shall be approved in advance by GAIL / PMC.

Utmost care should be taken to avoid stepping on the pipe by the people during coating.

Training shall be provided by the contractor to the supervisors and applicators who are engaged, for coating application, inspection and quality assurance, through the coating manufacturer during trial run. Only those applicators certified by the coating manufacturer's representative shall be deployed for wrapping and coating application. In case the application crew gets replaced, certification for application of the wrapping and coating will have to be carried out by the coating manufacturer's representative again. In such cases of recertification, at least 20 days' notice will have to be given by the Contractor to GAIL / PMC to organize the coating representative manufacturer.

It is envisaged that the coating manufacturer representative will be available for training /certification for two times per calendar year for 15 days at the cost of Owner during the original contract period. However, if recertification is further required, contractor shall organize training from the coating manufacturer's representative at his own cost and at least 20 days' notice have to be given to the coating manufacturer / GAIL / PMC for the same.

Contractor will ensure that sufficient applicators are trained so as to ensure that there is no stoppage of work.

For 3ply & 2 ply cold applied tape application, hand wrapping machine for inner and outer wrap shall be free issued by GAIL / PMC. Contractor will ensure safe keeping and maintenance of the wrapping and coating machines. In case of any breakage / mishandling / theft, contractor will have to replace the machine from the coating manufacturer at no extra cost GAIL. Any spares required shall be directly procured by the coating applicator from the coating manufacturer at no cost to GAIL.

Coating material shall be free issued by GAIL from designated warehouses in Gujarat.

The contractor shall issue coating material as per proper schedule discussed by GAIL / PMC. The coating material along the ROW shall be stored in a temporary storage such as it does not get damaged due to rain etc. Any coating material which shall get wet, shall not be used and the cost of the material shall be recovered from the coating contractor as per recovery rate mentioned in this document. The temporary warehouse / storage yard shall have a cemented base with a leak proof roof and all 4 sides shall be brick lined to a height so that there is no ingress of water / rain. There should be adequate fire extinguishers provided in the warehouse.

The safe keeping of the free issued coating material shall be in Contractor's scope. Any loss damage to the free issued coating material, the contractor shall indemnify GAIL as per commercial terms & conditions.

GAIL / PMC will issue the coating material depending on the schedule and the progress to the nominated representative of the contactor. The coating material shall be transported to ROW in a truck with proper plastic / tarpaulin cover. Typically for a day's production of average 100 linear meters per day PER OPENING, 3ply & 2ply cold applied tape rolls of dimension 100mm width and length range of 15 to 30 meters required for 18" dia pipe are as follows:

| Pipe dia | Average linear distance coated / day (meter) | Average pipe surface area (square meter) | Size of rolls | No of rolls / primer used | Approximate weight (Kgs) |
|---|---|---|---|---|---|
| 18" | 100 | 141.3 | 100mm X 15 to 30 meter | Inner=97 Nos<br>Outer=97 Nos<br>Primer=22 L | 418 Kgs. |

Coating refurbishment at support locations shall be done only after backfilling the main section of pipeline to avoid unwanted sagging of mainline sections. Proper backfilling and any support required to avoid any wrinkle to new coating on main section shall be provided. Proper cleaning of overlapped area free from dirt and dust to be done.

## 2.2 Preparation of Pipe Surface

- Before starting of blasting, all fire and safety precautions should be taken and clearance should be taken from the Owner /PMC. All fire and safety precaution must be ensured prior to start of work by the contractor without any extra cost. Lower explosive limit (LEL) of hydrocarbon & O2 level near the trench must be recorded and proper escape route must be provided. Adequate Dry chemical powder fire extinguisher, water and sand must be available during working on site. The surface preparation of the pipe shall be as per type of coating used.

- For 3ply & 2ply cold applied tape the dry pipe surface shall be abrasive blasted using copper slag to surface finish of SA 2.5 and anchor profile of 50~100 microns.

Abrasive used for blast cleaning should normally contain large and small size particles. Larger particles crack the mill scale and existing coatings, whereas the smaller one results in increased cleaning rate. Particle size distribution should be selected to get required anchor profile during blast cleaning.

A near - white blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, old paint/primer, coating, oxides, corrosion products and or any other foreign matter.

The Contractor shall immediately bring to the Owner's attention any unacceptable pipe defects detected at the time of surface preparation and hold the pipe till cleared by owner for further action.

## 2.3 Preparation of Pipe Surface

Optimal environmental conditions are essential for surface preparation, application of coating to maximize successful performance.

Weather prediction technology shall be deployed (AcuRite Professional weather stations or equivalent) using weather stations, to be installed along the ROW.

Blasting / coating activity will be done only if the relative humidity is $\leq$ 85%. The surface temperature of the steel pipe shall be >30 above dew point. In case the coating has to be done at higher relative humidity the same shall be permitted as per recommendations of the coating manufacturer and directions of GAIL/PMC

The following measurements shall be taken and recorded before start of the work at each site/location:

- Ambient dew point.
- Relative humidity
- Dew point at near the metal surface.

- Surface temperature of the metal pipe

Relative humidity and dew point shall be recorded every 2 hours during blasting and coating application and shall be recorded in the coating logbook.

Coating contractor shall ensure that calibrated relative humidity / dew point measurement instruments and contact digital thermometers are available at each blasting / coating location. Valid calibration certificate of measuring equipment to be submitted.

## 3. 3 PLY & 2 PLY COLD APPLIED TAPE COATING

After the pipe has been inspected for corrosion pits / wall thickness measured, the pipe surface shall be abrasive blasted to surface finish of SA 2.5 and anchor profile of 50~100 microns. The salt contamination on the abrasive blasted steel surface shall be < 20mg/m2.

The contractor shall submit a method statement/ application procedure for approval of GAIL/PMC prior to start of work.

- **Cleaning of pipe surface area:**

Prior to abrasive blasting it shall be ensured that pipe surface shall be free of oil, grease salts and other contaminations Suitable solvents which do not leave any residuals like benzene, xylene or equivalent shall be used. Kerosene shall not be used for cleaning. Solvent cleaning procedure shall be according to SSPC-SP1.
Pipe surface will be dry prior to start of abrasive blasting.

- **Abrasive blasting:**

The steel surface shall be prepared by abrasive blasting. Copper slag shall be used as abrasive media for surface preparation of pipe surface. The copper slag shall be supplied as per ISO 11126-3(Preparation of steel Substrates before application of paints and related products - Specifications for non-metallic blast-cleaning abrasives - Part 3: Copper refinery slag).
Before start of the abrasive blasting operation, the contractor shall take approval for the compressor and hopper to be deployed from GAIL/PMC.

- **Air compressor:**

The contractor shall deploy minimum 2 sets of air compressors / blasting pots per opening to achieve an average blasting production rate of 70 to 110 meters / day for 18 dia pipeline respectively. The compressor shall not be older than 7 years from the date of award of project.
The diesel engine driven air compressor used shall be of rating 60 to 75 HP to produce displacement of 5.6 to 7.0. m3/min (200 to 250cfm) of clean compressed air at a pressure of 7 Kg/cm2. The contractor along with the bid shall specify HP rating of the compressors with the required compressed air output to get 7 kg/cm2 (100psi) pressure at the nozzle.

Clean compressed air is required to prevent contamination of coating materials and surfaces being prepared for coating as such air compressors to be deployed shall be fitted with suitable air dryers, oil / moisture traps with desiccants. The quality of the compressed air shall be checked two times / day as per ASTM D-4285-2012 “Standard Test Method for Indicating Oil or Water in Compressed Air”.

All oil / air pressure gauges attached to the compressor unit shall be in perfect working condition with valid calibration. Compressors with defective instruments shall not be acceptable.

The moisture traps and the condition of the desiccants / air dryers shall be checked regularly by the contractor’s maintenance crew.

- **Blasting Pot:**

Blasting pot along with the compressor of suitable size to ensure un-hindered blasting of the pipeline to achieve blasting production rate as specified above.

The capacity of the blasting pots to be deployed shall be indicated by the contractor in the technical bid.

The blasting pot will be fitted with pressure regulator with safety valve, water separator / filter &hoses.

- **Nozzle:**

The nozzle shall preferably be of ceramic type having orifice of 5/16” or as required to get the required surface finish of SA 2.5 with anchor profile of 50-100µ. Sufficient nozzles will always be available at each blasting location for quality blasting.

The compressor unit shall be deployed for blasting production only when the unit is able to satisfy the GAIL / PMC about required performance as stated above. In case the unit is not found suitable at any point of time during the course of operation, the Contractor shall make suitable replacement acceptable to GAIL / PMC without additional cost to the GAIL.

- **Blasting media:**

The abrasive blasting media to be used is copper slag. Brief specification of the abrasive media is as below:

| Specification for mineral and slag abrasives (ISO 11126-3 Part-3) | | |
|---|---|---|
| Property | Method | Requirements |
| Water Soluble Contaminants | ASTM D 4940 Conductivity | 1000 Micro-seimen max |

| | | |
|---|---|---|
| Oil content | Observe surface of extract | No oil |
| Moisture content | ASTM C 566 | 0.50% |
| Hardness | Moh's Scale | 6 minimum |
| Specific gravity | | 3.5 |
| Bulk density /Particle | | 1.87Kg/L (Particle size ranging from 0.5-2 mm) |

Manufacturer / Source of copper slag shall be specified by the contractor in the technical bid.

Test certificates of each batch complying to the above specified properties shall be provided by the Contractor.

No other abrasive media shall be used by the Contractor other than that specified in this document. The Contractor shall adopt good blasting practices such as those recommended in SSPC SP-COM.

The Contractor shall use size of abrasive media that will ensure the necessary anchor profile height specified.

At all times the blast cleaning abrasive shall be dry and free of oil, grease and other contaminants.

For heavily pitted localized surface, the nozzle shall be suitably rotated around its own axis in all planes and held at various angles so that the abrasive cleans out all the pores and interstices of the surface being blasted.

Suitable spray masks filter type air respirators, safety goggles and other safety equipment are to be provided by the Contractor to the persons engaged for the job. Blast cleaning team should take up precautionary measures to protect the pipeline during blasting operation. Proper personnel protection equipment required during blasting shall be used.

- **Checking of profile of the blasted surface:**

The blasted steel surface shall be inspected by Owner / PMC prior to application of the coating using
- Surface finish using surface comparator – SA 2.5
- Blasted profile using replica tape and micrometer (Press O Film)
- Blasted profile using digital surface profile gauge
- Chloride contamination using SCM 400 salt contamination meter.

Blasted profile shall be measured everyone meter in all the 3'o clock.6'o clock.9'o clock and 12'oclock locations using a surface profile gauge. Blasted profile shall also be measured every 20-30 meters at two locations 6'o clock and 12'o clock using Testex replica tape (PRESS-O-FILM). The record of blasted profile at every 20-30 meter shall be recorded and documented. The Testex replica tape shall be preserved and attached in the logbook.

Chloride contamination shall be checked every 50 meters at two location 6'o clock and 12 o'clock. The measurements will be recorded in coating application log book. The chloride level should be less than 20 mg/m2 as per ISO 21809-3 Clause 9.1.2.2.In case the chloride contamination is greater than above specified value, the surface shall be washed with potable water. The contractor shall be required to arrange for a potable water tanker for washing the pipe surface and again rechecking.

Depending on the consistency of the quality of the blasting Owner /PMC shall decide on changing the frequency of the above inspection.

After blasting / inspection, the coating application will commence immediately. The blasted pipe shall not be exposed to atmosphere for more than 4 hours to prevent flash rusting of the steel surface. The blast cleaned surface should never be left un-primed overnight.

However, the above elapsed time between blasting and commencement of coating activities shall be reduced as per directions of GAIL/PMC in case of high humidity in the air / trench. The surface temperature of the pipeline must be at least 3°C above the dew point temperature.

Coating contractor shall ensure that calibrated relative humidity / dew point measurement instruments and contact digital thermometers are available at each blasting location.

Blast cleaning shall not be conducted during times when the surface will become wet after blast cleaning or when ambient conditions are such that visible rusting occurs before coating, If any rust forms after blast cleaning, the surface shall be re-blasted before coating.

- **Coating application:**

The coating application shall be a continuous operation starting with a properly prepared pipe surface. Three steps, which shall be performed consecutively, shall consist of (1) primer application; (2) application of the inner-layer tape directly onto the primed pipe surface; and (3) application of the outer-layer tape directly on top of the inner-layer tape.

Ensure that the relative humidity is below 85% and surface temperature of pipe is at least 3°C above the dew point temperature.

**Application primer / filler mastic:**

The liquid adhesive (primer) shall be thoroughly and continuously mixed and agitated during application to prevent settling in the original drum.

The primer shall then be taken out in a small container and the cover of the primer drum should be immediately closed and sealed to reduce evaporation loss. The small container must also have a cover to reduce evaporation loss when not in use. The container should be always in cleaned condition.

The liquid adhesive shall be applied in a uniform thin film at the coverage rate recommended by the coating manufacturer. The application of the primer over steel pipe shall be carried out manually using good quality paintbrush 150mm wide. After application, the brush shall be cleaned with suitable solvent for next day usage. Contractor will ensure that there are sufficient paint brushes available at every site. In case the paint brush holder becomes loose or the bristles of the paint become hard, the paint brush shall be replaced. Contractor shall indicate in the method statement the frequency of replacing the paint brushes for quality and consistent application of the coating primer.

While applying the primer the wet film thickness “WFT” shall be measured and recorded. The primer WFT shall be 75- 100 microns and shall be as per coating manufacturer’s requirement. Coating has to be applied only when the primer is tacky to touch dry at ambient temperature or as recommended by the coating manufacturer. The typical tacky to touch dry time is about 5 ~ 10 minutes. The primer will become totally dry in less than 30 minutes and hence it has to be ensured that the coating is not applied after the primer has become completely dry or as recommended by the coating manufacturer.

The liquid adhesive coat shall be uniform and free from floods, runs, sags, drips, or bare spots. Care must be taken to ensure that the pipe surface from 3 O’ clock to 6 O’ clock to 9 O’ clock position has been thoroughly covered by primer.

In case the primer has completely dried, over-coat time interval of the primer shall be as per coating manufacturer’s recommendation.

Liquid adhesive application shall be limited to the amount of surface area that can be wrapped during the same workday as application of the liquid adhesive; otherwise, the steel must be re-primed. After liquid adhesive application and before the tape is applied, care shall be taken to prevent the contamination of the primed surface by any foreign materials, such as dirt and moisture.

In case the primer gets contaminated with dust or rain, the primer shall be cleaned from the pipe surface as per recommendation of Owner /PMC. The liquid-adhesive-coated pipe surface (i.e. primed surface) shall be free of any foreign substances, such as sand, grease, oil, grit, rust particles, or dirt prior to application of the inner wrap.

Filler mastic putty shall be applied at weld seam/girth welds, circumferential welds and on dents in carrier pipe surface to get an even and smooth surface to avoid formation of air pockets between pipe and inner tape, as per manufacturing recommendations and as directed by Owner /PMC. During the training the coating manufacturer will demonstrate the application of the filler mastic which will be followed by the coating contractor during actual application.

**Application of Inner / Outer tape**

Coating contractor shall ensure that the width of the trench is sufficient to rotate the hand wrapping machine around the pipe.

**Inner tape:**

The inner layer tape roll shall be fitted in hand operated machine supplied by the coating manufacturer. The release liner of the inner tape shall be gripped in the take up roller when the tape is being applied on the pipe.

The wheels of the hand wrapping machine shall be adjusted so that it holds the pipe surface such that the tension on the tape while application is maintained. The angle of the hand wrapping machine shall be set to get a 50% spiral overlap of the inner wrap to the tacky dry surface of the primed steel.

The tension knob will be tightened so as to give sufficient neck down tension of 1-2% to the tape while wrapping. The coating manufacturer instruction shall be followed for maintaining the tension.

After a couple of wraps, the required 50% overlap shall be checked to ensure that the machine is set at the correct angle. Less overlap will imply reduced overall thickness of the coating on the pipe and more overlap will imply extra consumption of the tape.

The overlap shall constantly be checked during the coating application.

When a new roll of tape is started, the ends shall be overlapped at least 4 in. (100 mm), measured circumferentially. The end of the spiral wrap shall be cut on the downside at the 3 or 9 o'clock position on the pipe.

When the wrapping of inner layer is over, the coated surface should be checked by hammering mildly with the wooden hammer, which will indicate presence of void/loose contact or air pocket, if any.

Wrapping should be done carefully keeping required tension to avoid air pockets and wrinkles. Air pockets & wrinkles, if formed, should be repaired immediately, by puncturing air pockets and putting patch of tape over it.

If wrinkling is observed over a longer length, then tape shall be removed as per directions of the Owner / PMC and the new tape shall be applied over the re-primed steel surface.

The overlap of tapes on CTE shall be at least 4 inch. (100mm) or as per manufacturer's required overlap if greater than 4 inch (100 mm).

Coating contractor shall ensure that coating supervisors/applicators understand the functioning / setting of the hand wrapping machine during the training imparted by the coating manufacturer at start of the job.

Coating contractor shall have to organize sufficient spares specially the tension rod from the coating manufacturer. All the cost of machine spares shall be to contractor's account.

**Outer tape:**

Once the application 3ply inner tape been wrapped on the primer coated pipe section, the application of outer mechanical protection layer 2ply tape shall be carried out with hand wrapping machine with recommended neck down tension 1-2%. The outer tape has to be applied smoothly on the 3ply inner layer tape surface without folding and air pockets. The minimum spiral overlap width shall be 50%. The outer tape has no plastic release liner.

Similar procedure in-line with the application of inner wrap is to be followed for application of outer layer two-ply tape coat.

The spiral overlap of the outer wrap shall not coincide with the overlap of the inner wrap.

The applied coating system shall have a minimum thickness of 2.5mm

Consumption pattern of the coating shall be as per the quantity mentioned later in this document along with tolerance value, however a consumption pattern will be established during trial run in presence of coating manufacturer along with applicable tolerance and this shall be adhered to by the contractor. Any consumption above the prescribed limit due to theft, wastage or repair of defect due to bad workmanship of the contractor personnel will be to the contractors account.

# GAIL INDIA LIMITED

# COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

## QUALITY ASSURANCE

## DOC. NO. - GAIL-040049-GN-DOC-QA-004

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| 1 | 11.07.2022 | Issued For Bid | JR | MH | TR | |
| 0 | 08.03.2022 | Issued For Review | SC | SKK | VNP | |
| **Rev** | **Date** | **Purpose** | **Prepared By** | **Checked By** | **Approved By** | |

# INDEX

## 1. VIUAL INSPECTION

The coated pipes shall be visually inspected for uniformity without any wrinkles, irregularities, overlapping width, cracks, trapped air, damage etc. Any repair arising out of visual inspection will be decided by GAIL / PMC.

## 2. THICKNESS MEASUREMENT

Coating thickness has to be measured with a digital coating thickness meter, which shall be arranged by the Contractor. Digital coating thickness meter shall be magnetic, electromagnetic or ultrasonic measuring instrument, with ± 1 % reading accuracy, calibrated for the range of coating thickness being measured. The coating thickness shall be measured at 3,6,9 and 12 o clock locations at every 3 meters and shall be recorded in the field coating logbook. GAIL / PMC can increase the frequency of inspection of thickness to ensure quality application of the coating.

As per ISO 21809-11:2019, dust contamination to be checked before coating application every 3m of pipe length; to be tested as per ISO 8502-03.

## 3. PEEL TEST

Peel test shall be done to measure the peeling force per unit width between the applied coating and pipe surface or the existing good coating. Peel test shall be carried out using calibrated hand digital peel test gauge to be supplied by coating contractor.

Cut the applied coating down to the pipe wall in the shape of a rectangular strip of 25mm wide x 200mm long. Lift off one end of the strip from the pipe over a length of 20mm. The lift off part of the strip shall be secured in the clamp of the hand peel test gauge. The coating shall then be peeled off at a constant peeling rate of 10 mm/min perpendicular to the surface of the pipe.

Measure at least 10 readings (peel values) @ 6 seconds each over a peel length of 10mm. Take the arithmetic average of the readings and record.

The frequency of peel test will be one in day's work. It shall be done after 24 hours of application.

| Type of coating system | Peel value (inner layer to pipe surface) as per ISO 21809 Part 3 (March 2016) | |
|---|---|---|
| | N/mm | Kg (for 25mm strip) |
| 3ply & 2 ply cold applied tape @ 23°C | ≥1 | ≥2.5 |
| Visco-elastic @23°C | ≥0.04, Coverage ≥95% | ≥0.1, Coverage ≥95% |
| Petrolatum tape | Leave a film of compound on the substrate | |

## 4. HOLIDAY INSPECTION

Holiday testing shall be carried for detecting pinholes / porosity / discontinuities in the applied coating. The test shall be as per ISO 21809 March 2016 shall be carried after 24 hours of application or shall be as per manufacturer's recommendation.

- The holiday detector machine along with crest voltmeter shall be supplied by the coating contractor.
- The holiday detector shall be calibrated every day using the crest voltmeter prior to start of the testing.
- The test shall be performed only on a coating that is free from surface moisture.
- The holiday detector and earth shall be connected to the coated pipe. The scanning electrode shall be passed over the surface of the coating being inspected with a continuous, relative movement not exceeding 300 mm/s.
- Excessive voltages, slow survey speeds or multiple passes can damage the coating. The voltage should only be applied when the electrode is moving. - Ring type electrode shall be used and will fit the required pipe size of 18" Dia.
- At the time of the test, the voltage shall be set at a value depending on the material and minimum thickness of the coating.

| Type of coating | Holiday detection voltage |
|---|---|
| 3ply & 2 ply cold applied tape @ 23°C<br>• Holiday testing to be done on inner + outer wrap<br>• Test voltage=5KV +5KV/mm<br>• Minimum thickness 2.5mm | 17.5KV |
| Visco-elastic tape @23°C<br>• Holiday testing to be done on inner wrap<br>• Test voltage=5KV +5KV/mm<br>• Minimum thickness 2.5mm | 17.5KV |
| Petrolatum tape<br>• Holiday testing to be done on inner +outer wrap<br>• Test voltage=5Kv/mm<br>• Minimum thickness 2.5mm | 12.5KV |

Holiday marking and repair: An electric spark between the electrode and the metal surface will indicate any holidays or missed places. All holidays or missed places so indicated shall be marked by chalk or crayon and repaired. The repair shall be carried as per the procedure given by the coating manufacturer.

All repairs shall be holiday tested as above.

# GAIL INDIA LIMITED

# COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

## MINIMUM EQUIPMENT LIST

## DOC. NO. - GAIL-040049-GN-DOC-MEL-005

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# INDEX

## 1. MINIMUM EQUIPMENT LIST

| Sr. No. | Equipment Description | Qty. (VIP Line) | Qty. (GNFC Line) |
|---|---|---|---|
| 1 | Crawler type excavator with bucket size> 0.6 cubic meter and suitable depth of excavation.<br>(ROW sections having multiple pipelines at depth of pipeline < 1 meter , the type of crawler excavator to be selected after discussion with GAIL / PMC so that the weight of excavator does not damage the pipelines.) | 1 | 1 |
| 2 | Submersible type sludge or dewatering pump of rating 10 ~20 HP and discharge capacity of minimum 50 m3/hour or as per site conditions and as per GAIL / PMC approval. | 1 | 1 |
| 3 | Well point dewatering system of capacity minimum 100 m3/hour or as per site conditions and as per GAIL / PMC approval. | 1 | 1 |
| 4 | Abrasive blasting machine with DG driven air compressor of minimum capacity 200-250 CFM. Air compressor will be fitted with water trap / moisture and GAIL filter to ensure dry air.<br>Abrasive blasting pot shall have a minimum capacity of 500Kg of copper slag . The Abrasive blasting machine shall also be fitted with air filters / moisture traps. The blasting crew shall be provided with blasting hoods / helmets with required personel protective equipment (PPE) | 1 | 1 |
| 5 | Pulse type high voltage holiday detection machine with ring type electrode suitable for pipe dia 18" along with crest voltmeter ( Make Spy USA /Tinker and Rasor , USA or equivalent as approved by PMC ) | 1 | 1 |
| 6 | Digital coating thickness gauge -upto 5 mm (Elecometer 456 or equivalent ) | 3 | 3 |
| 7 | Digital surface profile gauge ( Electrometer 224 or equivalent ) | 1 | 1 |
| 8 | Surface comparator ( Elecometer 125 or equivalent ) | 1 | 1 |
| 9 | Salt contamination meter (SCM 400 or equivalent) | 1 | 1 |
| 10 | Digital Thermometer with flat probe | 3 | 3 |
| 11 | Digital Hygrometer | 3 | 3 |
| 12 | Hand peel gauge for measuring coating adhesion. | 3 | 3 |

| | | | |
|---|---|---|---|
| 13 | Ultrasonic thickness gauge for measurement thickness of well pipe ( Olympus 270 M or eqivalent ) | 3 | 3 |
| 14 | Digital Pit and depth gauge | 3 | 3 |

NOTE:

1. All the equipment listed as above are mandatory equipments for this projects and shall be deployed within 30 days from the date of FOA/LOI or as per direction of Owner / Owner Representative and the same cannot be de-mobilised from the site unless or until written petition from the owner is granted.

2. The equipments indicated above are the minimum critical equipments, which are required to be deployed by the contractor. Any additional equipment/resources required to complete the project as per schedule shall be mobilized based on the project execution plan/project schedule.

# GAIL INDIA LIMITED

# COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

# CONTRACTOR'S OBLIGATIONS / RESPONSIBILITIES

## DOC. NO. - GAIL-040049-GN-DOC-COR-006

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## 1. PROJECT UPDATES

The Contractor shall be solely responsible for submitting regular updates / progress reports to PMC / Owner for routine progress monitoring and control. The project update documents shall include but not be limited to following: -

- Daily / Weekly / Monthly Project Reports
- Logistics Updates
- Project Progress Status Updates
- Material Receipt / Storage / Issue Reports
- Work Permits
- Site Clean-up & Restoration Status
- Site Handover status
- Project HSE Plans/Status
- Project Environment Plan/Status
- Project Man-power / resource deployment Plan/Status
- Community Engagement / Development Plan/Status

## 2. KEY ACTIVITIES

Contractor shall ensure that all levels of the Contractor management and site supervision personnel are fully aware of the following:

- Health, Safety and Environmental (HSE).
- Project Safety Objectives and Targets.
- Planning and Scheduling.
- Project Management and Control.
- Quality Assurance and Control.
- Construction Objectives.
- Key Milestone and Completion Dates.

## 3. RISK REGISTER

The CONTRACTOR shall prepare and submit a Risk Register which shall include all probable risks for the project execution/progress to achieve the target schedule. The project risk register shall be prepared and the risk categories (Low/Medium/High) shall be appropriately defined. The risk register shall be regularly updated based on the risks mitigation measures adopted during the course of execution. The risk register shall broadly cover the following items:-

- Risks due to delay in approvals/clearances
- Risks due to delay in deployment of resources / delay in mobilization
- Risks due to delay in procurement / delivery of materials
- Risks due to delay in opening of Corridor
- Risks due to Work being undertaken in restricted Corridor / adjacent to existing operating pipelines etc.
- Risks due to delay in issuing of work-permits
- Risks due to Local / Community / Social unrest
- Risks due to natural calamities
- Risks in construction due to any failure of the existing pipelines / utilities.
- Risks / delays due to addition/expansion of existing rail/road/power infrastructure thus impacting the construction of proposed development facilities
- The risk register shall be regularly updated and status briefed in Review Meetings.

## 4. WORKING METHODOLOGIES

The Contractor must draw up working methodologies including equipment, manpower and material needed for all phases of the construction.

- All working methodology must get approved by the Owner before starting work.
- Only approved working methodology will be strictly implemented at site during all construction stages.
- The Contractor shall deploy all equipment and material required to achieve the work as per his detailed methodology and agreed schedule.

- To comply with the agreed work schedule the contractor may have to work in shift or extended hours without any cost implication.

- If contractor carries out any repair job after backfilling due to his bad workmanship or as per his plan, then the cost of preparing trench and all other requirement are to be met at the cost of contractor and no extra payment shall be made.

# GAIL INDIA LIMITED

# COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

## ANNEXURE-I

## (TECHNICAL SPECIFICATIONS)

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GAIL INDIA LIMITED

# TECHNICAL SPECIFICATION
# FOR
# PLAIN CEMENT CONCRETE & ALLIED WORKS

## GAIL-STD-CV-DOC-TS-001

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## 1. INTRODUCTION

This specification covers the general requirements for concrete to be used on jobs using on-site production facilities including requirements in regard to the quality, handling, storage of ingredients, proportioning, batching, mixing and testing of concrete, and also requirements in regard to the quality, storage, bending and fixing of reinforcement. This also covers the transportation of concrete from the mixer to the place of final deposit and the placing, curing, protecting, repairing and finishing of concrete.

## 2. PLAIN CEMENT CONCRETE 1:3:6 OR AS SPECIFIED :

Plain cement concrete shall be in proportion of 1:3:6 or as specified. i. e. in volume by one part of cement, three part of coarse sand and six parts of black stone aggregate of size 40 mm size.

The building materials as stated above shall be mixed in dry condition with power driven concrete mixer. After materials are properly mixed, water shall be added and materials shall again be mixed in concrete mixer It should be watched that no excessive water is added so that permissible water cement ratio is maintained throughout during the progress of concrete work. . Before the concreting work, necessary centering work if so necessary shall be provided for which payment shall be done separately under respective items. All the materials shall be got tested for every lot from govt. approved Engineering testing laboratories as per I.S. code of practice and test certificates shall be submitted to Owner/site engineer .

The concrete so prepared shall be stacked in water tight platform .The concrete should not be thrown from height so that segregation may not take place. The concrete so placed shall be properly compacted with concrete vibrator machine to avoid voids .Moreover concrete shall be compacted in such a way that the surface is become smooth and no honey combing is observed.

After properly setting of concrete, curing shall be done for minimum period of seven days.

## 3. M-20 CEMENT CONCRETE :

The cement concrete shall be in proportion.(1:1.5:3) i.e. in volume by 1 part of cement,1.5 parts of coarse sand and 3 parts of black stone aggregate of size 20 mm size. The stone aggregate shall be of even size and black in color without any white spot. The aggregate shall be got approved from engineer in charge /Owner. The building materials as stated above shall be mixed in dry condition with power driven concrete mixer. After materials are properly mixed, water shall be added and materials shall again be mixed in concrete mixer. It should be watched that no excessive water is added so that permissible water cement ratio is maintained throughout during the progress of concrete work. Before concreting work, necessary centering work and reinforcement as per structural drawing shall be placed for which payment shall be done under respective items. All the materials shall be got tested for every lot from govt. approved Engineering testing laboratories as per I.S. code of practice and test certificates shall be submitted to Owner/Owners representative.

After setting of concrete, sufficient curing shall be done for minimum period of seven days. During concrete work, concrete cube of size 150m.m. x 150 m.m. x 150 m.m. shall be prepared and these concrete cubes shall be got tested for compressive strength from approved engineering testing laboratories and testing certificate should be submitted to Owner/Owners representative. The slump test shall also be carried out on site of work during every concrete work on site.

## 4. APPLICABLE CODES AND SPECIFICATIONS

The following specification, standards and codes shall form a part of this specification. All standards, tentative specifications, codes of practice, referred to herein, shall be the latest editions including all applicable official amendments and revisions.

In case of discrepancy, if any, between this specification and those referred to in the following, the latter shall be govern.

Applicable Specifications and Codes of Practices.

I.S. 269 - Specification for ordinary and low heat Portland cement.

I.S. 383 - Specification for coarse and fine aggregate from natural source for concrete.

I.S. 2386 - Method of test for aggregates for Concrete (Part I to VIII)

I.S. 516 - Method of test for strength of concrete

GAIL INDIA LIMITED

# TECHNICAL SPECIFICATION
# FOR
# STRUCTURAL CONCRETE

## GAIL-STD-CV-DOC-TS-005

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## 1.0 INTRODUCTION

This specification covers the materials, workmanship, special requirements & regulations with which the contractor must comply to achieve dense workable concrete, having the specified characteristic strength.

The mixing, placing, compacting, curing and finishing of concrete shall be done according to IS: 456-2000 "Code of Practice for Plain and Reinforced Concrete".

## 2.0 MATERIALS FOR CONCRETE

AGGREGATES

Aggregates shall comply with the requirements of IS: 383-1970 "Coarse and Fine Aggregates for Concrete". They shall be hard, strong, dense, durable, clean and free from veins and adherent coating, vegetable matter and other deleterious substances; and shall be obtained from approved sources. Aggregates shall not contain any harmful material such as pyrites, coal, lignite, shale or similar laminated material, clay, alkali, soft fragments, sea shells and organic impurities in such quantity as to affect the strength or durability of concrete. Aggregates which are chemically reactive with alkalies of cement shall not be used. Aggregates which are not sufficiently clean shall be washed in clean fresh water to the satisfaction of the Engineer.

TESTING

All aggregates shall be subject to inspection and testing. The Contractor shall submit samples for testing as may be required by the Engineer. Sampling and testing shall be carried out in accordance with IS: 2386-1963 "Methods of Test for Aggregates for concrete".

GRADING

The Contractor shall ensure that the full range of aggregate used for making concrete is graded in such a way as to ensure a dense workable mix. The delivery of aggregates will commence only when the Engineer has approved the samples and the quality and grade shall be maintained consistent and equal to the approved sample. Before construction commences, the Contractor shall carry out a series of tests on the aggregates and on the concrete to determine the most suitable grading of the available aggregates. Once the most suitable grading has been found, the grading shall be adopted for the construction of the works and periodic tests shall be carried out to ensure that it is maintained.

SIZE AND GRADING OF FINE AGGREGATES

The grading shall conform to IS: 383 and shall be within the limits of Grading Zone-III. The maximum size of particle shall be 4.75mm and shall be graded down. Sand containing more than 10% of fine grains passing through 150 micron sieve or having the fineness modulus less than 2 shall not be used for concrete work.

SIZE AND GRADING OF COARSE AGGREGATES

The nominal maximum size of the aggregates for each mark of concrete or for each type of

work shall depend upon the description of the particular item in the Schedule of Items and/or according to relevant clauses of IS: 456-2000. The aggregates shall be well graded and the grading shall conform to relevant requirements of IS: 383 depending upon the maximum nominal size as specified or as required.

TYPE OF COARSE AGGREGATES

The type of coarse aggregate viz., stone chips, gravel or broken brick shall be as described in the Schedule of Items. Unless otherwise specified in the Schedule of Items, stone chips shall be used as coarse aggregate.

- STONE CHIPS

It shall be crushed or broken from hard stone obtained from approved quarries of igneous or metamorphic origin. The stone chips shall be hard, strong, dense, durable and angular in shape. It shall be free from soft, friable, thin, flat, elongated or laminated and flaky pieces and free from dirt, clay lumps, and other deleterious materials like coal, lignites, silt, soft fragments, and other foreign materials which may affect adversely the strength & durability of concrete. The total amount of deleterious /foreign materials shall not exceed 5% by weight according to relevant clause of IS: 383.

- GRAVEL

It can be either river bed shingle or pit gravel. It shall be sound, hard, clean, and irregular in shape and suitably graded in size with or without some broken fragments. It shall be free from flat particles, powdered clay, silt, loam and other impurities. Before using, the gravel shall be screened and washed to the satisfaction of the Engineer. However, the foreign/deleterious materials shall not exceed 5% by weight.

- BROKEN BRICKS

These shall be obtained by breaking well burnt or over burnt dense brick bats. They shall be homogeneous in texture, well graded in size, roughly cubical in shape, clean and free from dirt, clay, silt or any other deleterious matter. Before use, these shall be screened.

FINE AGGREGATES

Unless specified otherwise it shall either be natural river sand or pit sand.

Sand shall be clean, sharp, strong, angular and composed of hard siliceous material. It shall not contain harmful organic impurities in such form or quantities as to affect adversely the strength and durability of concrete. Sand for reinforced concrete shall not contain any acidic or other impurities which are likely to attack steel reinforcement. The percentage of all deleterious materials including silt, clay etc., shall not exceed 5% by weight. If directed, sand shall be screened or washed before use to the satisfaction of Engineer.

CEMENT

Ordinary Portland cement / Portland slag cement complying with the requirements of IS:269-1989 and I.S. 455-1989 respectively shall be used for making plain and reinforced concrete, cement grout and mortar.

Other types of cement may be used depending upon the requirements of certain jobs with the

approval of the Engineer. These shall conform to the following standards:

The Contractor shall supply a copy of the manufacturer's test certificate for each consignment of cement supplied by him and consignments shall be used on work in the order of delivery. The Contractor shall supply samples of cement to the Engineer as frequently as he may require for testing. The sampling of cement for testing shall be according to IS: 3535-1986. All tests shall be in accordance with the relevant clauses of IS: 4031 (Part-I to Part-15) 1988 to 1991 & IS: 4032-1985.

In order to ensure due progress, the Contractor shall at all times maintain on the site at least such stock of cement as the Engineer may from time to time consider necessary. No cement shall be used upon the works until it has been accepted as satisfactory by the Engineer.

The cement shall be stored in such manner as to permit easy access for proper inspection and in a suitable weather-tight, well ventilated building to protect it from dampness caused by ingress of moisture from any source. Different types of cement shall be stored separately. Cement bags shall be stacked at least 15 to 20 cm clear of the floor leaving a space of 60 cm around the exterior walls. The cement shall not be stacked more than 10 bags high. Each consignment of cement shall be stacked separately to permit easy access for inspection.

WATER

Water used for mixing concrete and mortar and for curing shall be clean and free from injurious amounts of oil, acid, alkali, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. The pH value of water shall generally be not less than '6'. Water has to meet the requirements mentioned in clause 4.3 of IS: 456-2000. Water shall be obtained from an approved source.

Where it is obtained from a source other than a supply main, it shall be tested to establish its suitability. Water for construction purpose shall be stored in proper storage tanks to prevent any organic impurities getting mixed up with it.

ADMIXTURE

Admixtures to concrete shall not be used without the written consent of the Engineer. When permitted, the Contractor shall furnish full details from the manufacturer and shall carry out such test as the Engineer may require before any admixture is used in the work.

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REINFORCEMENT STEEL

Reinforcing bars for concrete shall be round steel bars of the following types as may be shown on the drawing:

- Plain mild steel bars conforming to Grade-I of IS: 432-1982 "Mild Steel & Medium Tensile Steel for Concrete Reinforcement".
- "High strength deformed steel bars conforming to IS : 1786-2008 for Concrete Reinforcement".
- Reinforcement fabrics conforming to IS:1566-1982 "Hard Drawn Steel Wire Fabric for Concrete Reinforcement"

All reinforcement bars shall be of uniform cross sectional area and be free from loose mill

scales, dust, loose rust, coats of paint, oil or other coatings which may destroy or reduce bond. Unit weight of reinforcement bars conforming to I.S. 1786-1985 is given below.

| Nominal Size (Dia) (mm) | Mass Per Meter Run (Kg) |
|---|---|
| 6 | 0.222 |
| 8 | 0.395 |
| 10 | 0.617 |
| 12 | 0.888 |
| 16 | 1.580 |
| 20 | 2.470 |
| 25 | 3.850 |
| 32 | 6.310 |

Binding wire for reinforcement shall be annealed steel wire 20 BWG conforming to IS : 280 - 1978 "Specification for Mild Steel Wire".

FOUNDATION BOLTS

Bolts to be embedded in concrete shall, unless otherwise detailed in drawings, conform to IS : 5624-1970 "Specification for Foundation Bolts". Material for bolts, shall, unless otherwise mentioned in drawings or the schedule of items, be of steel conforming to IS : 2062-1992.

Nuts and locknuts shall conform to IS : 1363 (Part 1 to 3) -1992 "Specification for Black Hexagon Bolts, Nuts and Lock Nuts (Diameter 6-39 mm) and Black Hexagon Screws "Specification for Hexagon Bolts and Nuts (M-42 to M-150)".

Plain washers shall conform to IS : 2016 -1967 "Specification for Plain Washers and spring washers shall conform to IS : 3063 -1972 "Spring Washers for Bolts, Nuts & Screws".

## 3.0 CONCRETE MIX PROPORTIONING

The mix proportion shall be selected to ensure adequate workability when handling and placing. On hardening, concrete shall have the required strength, durability and surface finish. The determination of the proportions of cement aggregates and water to attain the required strength shall be either:

- By determining the concrete mix; such concrete shall be called “Design Mix Concrete”, or
- By adopting nominal concrete mix; such concrete shall be called “Nominal Mix Concrete”.

Concrete of grade M20 and above shall be ‘Design Mix Concrete’ unless otherwise specified. In either case, the Contractor shall be solely responsible to ensure that the concrete has all the essential properties, i.e. characteristic compressive strength, and any additional properties that may be specified.

MIXES & MIXING

Concrete for construction shall be as detailed in the table of concrete mixes & as shown by test cube results as specified. This list may be extended by the addition of other mixes as required and to the approval of the Owner/Owner's Representative.
The criteria stated in the table of concrete mixes are designed to produce concrete of the required strength & durability.
The specified characteristics strength is for concrete which has been cured at a temperature of 20°C ± 1°C. The term "characteristics strength" represents the value of the strength of concrete corresponding to the probability that, for a normal statistics distribution of the test results for determining the strengths by the compression tests, only 5% of the test result have a value lower than the one determined in this way.
The mixes shall be designed mean strengths that are greater than the specified characteristics cube strength by a margin of 1.64 times the standard deviation expected from the concrete batching plant, except that no standard deviation of less than 3.5N/mm² shall be used as a basis for designing a mix.
Mixes shall be designed with due regard for minimum workability necessary to allow the contractor to place & compact the concrete as specified with the equipment he proposes to use in any particular situation.

| TABLE OF CONCRETE MIXES | | | |
|---|---|---|---|
| **Concrete Grade** | **Minimum Qty of cement Kg/m³** | **Maximum free water-cement ratio** | **Characteristics strength150 mm Cube** |
| M20 | 300 | 0.55 | 20 |
| M25 | 300 | 0.5 | 25 |
| M30 | 320 | 0.45 | 30 |
| M35 | 340 | 0.45 | 35 |
| M40 | 360 | 0.4 | 40 |

Where air-entrainment is specified the average air content as measure in accordance with relevant Indian codes:

a. Concrete containing 40 mm max. size aggregate 4.0%±1.0%
b. Concrete containing 20 mm max. size aggregate 5.0%±1.0%

These air contents are applicable at the time of concrete placing.

Concrete for paving or non structural pre-cast units shall have minimum flexural beam strength of 3.5 N/mm² at 28 days.

DESIGN MIX CONCRETE

At least two weeks before commencement of concreting of a particular grade in permanent works, the Contractor shall have obtained the Owner/Owner's Representative's approval of the Design Mix for that particular grade.

TRIAL MIXES

STRUCTURAL CONCRETE

The mix(s) shall be designed mixes in accordance with IS SP23 Handbook on Concrete Mixes and IS 10262 and as specified in this document. The relative proportions of the fine and coarse aggregates, the workability and strengths of the mixes shall be determined by production equipment trial mixes. The trial mixes shall be carried out in order to produce a concrete which can be properly placed and compacted, so that a dense impermeable concrete can be produced which shall adequately resist the ingress of damaging salts. If an admixture is proposed it shall be used in the trial mixes. The required workability for large foundations will differ from that for tall thin sections of structural concrete cast above ground and the trial mixes shall allow for both cases.

When the proposed workability and proportion of the aggregates and admixture (if any) for each of the grades of concrete has been established, test concrete shall be produced for approval. The following tests shall be carried out for each grade of concrete:

Four separate test mixes shall be prepared and six test cubes shall be made from each test mix for each grade of concrete. The test cubes shall be made and cured in accordance with IS 516.Testing shall be made in threes or multiples of threes. Only 28-day result shall be considered and the mean strength and standard deviation established for each grade.

The test mixes shall be accepted provided that:

a) The mix proportions and workability are in accordance with this Specification.

b) The standard deviation for all the different grades shall be worked out as per clause 2.1 of IS: 10262-1982.

c) The acceptance criteria shall be in accordance with clause 16 of IS 456.

| **Maximum Water Cement Ratio in Cement Concrete to Ensure Durability under specified exposure** | | |
|---|---|---|
| **Condition of Exposure** | **Concrete** | |
| | **Plain** | **Reinforced** |
| **Mild** | 0.6 | 0.55 |
| For Example Completely Protected against weather, or aggressive conditions, except for A brief period of exposure to normal condition during construction | | |
| **Moderate** | 0.6 | 0.50 |
| For Example Sheltered from heavy and wind driven rain and against freezing, whilst saturated with water, buried concrete in soil and concrete continuously under water | | |
| **Severe** | 0.5 | 0.45 |
| For Example Exposed to Sea water, alternate wetting and drying and to freezing while wet, subject to heavy condensate or corrosive fumes | | |

Based on the results of the preliminary test, the contractor shall select a final design mix for the trial mixes and shall furnish the same to the Owner/Owner's Representative. The contractor shall demonstrate that the proposed design mix will produce the grade and quality of concrete required with adequate workability

A fresh mix design shall be arrived at each time there is a change in the quality or source of materials

| **Minimum Cement Content (Ref IS 456, Table 5)** |
|---|
| **Plain Concrete** |

| Exposure | Min. Grade of Concrete | Min. Cement Content (kg/m3) |
|---|---|---|
| Mild | - | 220 |
| Moderate | M15 | 240 |
| Severe | M20 | 250 |
| Very Severe | M20 | 260 |
| Extreme | M25 | 280 |
| | | |
| **Reinforced Concrete** | | |
| **Exposure** | **Min. Grade of Concrete** | **Min. Cement Content (kg/m3)** |
| Mild | M20 | 300 |
| Moderate | M25 | 300 |
| Severe | M30 | 320 |
| Very Severe | M35 | 340 |
| Extreme | M40 | 360 |

NOMINAL MIX CONCRETE

No mix design or preliminary tests are necessary for Nominal Mix Concrete. Nominal Mix Concrete shall be restricted to works of minor nature in which the strength of concrete is not critical as decided by the Engineer. The limit of chloride content of concrete shall be as follows:

| Type or Use of Concrete | Max. Total Acid Soluble chloride content expressed as kg/m3 of concrete |
|---|---|
| Concrete containing metal and steam cured at elevated temperature and pre-stressed concrete. | 0.4 |
| Reinforced or plain concrete containing embedded metal | 0.6 |
| Concrete not containing embedded metal | 3.0 |

BATCHING

In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. If fine aggregate is moist and volume batching is adopted, allowance shall be made for bulking in accordance with IS 2386 (Part III). All measuring devices shall be accurate to + 3% and shall be regularly checked.
The water-cement ratio shall be maintained constant at its correct value. To this end, determination of moisture content in both fine and coarse aggregate shall be made by the Contractor at no extra cost. The frequency of tests shall be determined by the Engineer according to weather conditions.

## 4.0 FORMWORK

The design and construction of the formwork shall be the responsibility of the Contractor. However, if instructed by the Engineer, the drawings and calculations for the design of the formwork shall be submitted to the Engineer for approval. Design of formwork shall take account of safety and surface finish. The formwork shall be sufficiently rigid and tight to prevent loss of grout or mortar from the fresh concrete.
Formwork shall be designed to withstand the worst combination of self weight, reinforcement weight, wet concrete weight, concrete pressure, construction and wind loads together with dynamic effect caused by placing, vibrating and compacting the concrete. Forms shall be designed and constructed to maintain rigidity throughout the placing, ramming, vibration and setting of the concrete to the required shape, position and level and specified class of finish within the allowable tolerances. All joints shall be sufficiently tight to prevent leakage of grout. If movement or deflection of the formwork or loss of grout occurs, the damaged concrete supported by such formwork shall be removed and the concrete re-cast so that the required finish is obtained. Formwork and its supports should be designed to withstand the worst combinations of self-weight, reinforcement and wet concrete weights, concrete pressure, construction and wind loads. Due regard shall be taken to the type of mix when considering the design pressure on the formwork. The formwork shall be precambered by an amount equal to the expected maximum deflection shall be as shown on the drawings.
If timber forms are used they shall be of sound, well-seasoned timber free from loose knots. The forms shall be faced to give the specified class of finish for the structures. The formed surfaces of exposed concrete shall be smooth, true and free from all irregularities.
For below ground concrete except against existing structures, rough formwork, steel pans etc., provided all joints prevent the loss of grout.
The formwork shall be capable of being dismantled and removed from the cast concrete without shock, disturbance or damage. The arrangement shall be such that the soffit forms properly supported on props, can be retained in position for such period as may be required by maturing conditions or specifications.

CLEANING AND TREATMENT OF FORMS

All rubbish shall be removed from the interior of the forms before the concrete is placed. The faces of the forms in contact with the concrete shall be clean and treated with a suitable release agent, where applicable. Release agent shall be applied so as to provide a thin uniform coating to the forms without contaminating the reinforcement.

STRIKING OF FORM WORK

In normal circumstances where Ordinary Portland Cement is used, forms shall generally be removed after the expiry of the following periods:

| | |
|---|---|
| Walls, Columns and vertical faces of all structural members | 24 to 48 hours |
| Slabs (Props left Under) | 3 Days |
| Beam Soffits (Props left Under) | 7 Days |
| Removal of Props under Slabs: | |
| 1) Spanning upto 4.5m | 7 Days |
| 2) Spanning over 4.5m | 14 Days |

| | |
|---|---|
| Removal of Props under Beams and Arches: | |
| 1) Spanning upto 6.0m | 14 Days |
| 2) Spanning over 6.0m | 21 Days |

For other cements, the stripping time recommended for Ordinary Portland Cement shall be suitably modified. The number, size and position of props left under shall be such as to be able to safely carry the dead load of the slab, beam or arch, together with any live load likely to occur during curing or further construction.
Sleeves for through bolts shall not be provided in formwork for liquid retaining structures as they are potential hazard for leakage. Special devices shall be fabricated using two ordinary M20 nuts separated by two numbers 10 mm rounds welded to opposite flat side of the nuts. The faces of the nuts will have a compressible rubber bushing 20 mm thick. The overall dimension of the assembly shall be 50 mm less than the designed thickness of the concrete. Adjusting bolt shall pass through formwork and will lock into the nuts. While these bolts are tightened, the formwork will travel inwards.
Once the desired dimension is achieved, concrete will be poured. During removal of shuttering, the bolts will be removed to loosen the shuttering plates. The depression will be sealed using suitable concrete sealant.

SURFACE FINISHES FROM FORMWORK

Generally formwork shall be specified as either wrought or unwrought depending on the required surface finish.

UNWROUGHT FORMWORK

Unwrought Formwork shall consist of sawn boards, brick or concrete block work, sheet metal or other suitable material to give adequate support to the concrete.
Appearance is not of primary importance for this class of formwork.
Surfaces to which plaster, granolithic or other finish is to be applied shall be roughened while the concrete is still green.

WROUGHT FORMWORK

Wrought formwork shall be provided for concrete surfaces that are required to be finished smooth.
Wrought formwork shall be lined with metal or plywood having smooth surfaces and edges.
Formwork shall be furnished in largest practicable sizes to minimize the number of joints. Care shall be taken that there are no irregularities or roughness between successive sections of shuttering such that finished surfaces shall be free of board or shutter marks. Upon removal of formwork, surfaces of finished concrete shall be rubbed down with carborundum stone where necessary to obtain a uniform and smooth appearance.
The finish shall be such as to require no filling of surface pitting, butt fins, surface discoloration and other minor defects shall be remedied by approved methods.
Rendering of defective concrete as a means of making good will not be permitted except that, in case of minor porosity on the surface, approval may be given for the surface to be treated by rubbing down with a cement mortar of the same fine aggregate/cement ratio as the concrete. The treatment shall occur immediately after removing the formwork. Both cement and aggregate shall be from the same source as the concrete materials.

Concrete containing honeycombing, major air holes or similar defects shall be cut out and replaced as directed. No repair shall be executed without approval.

TIES

Where it is required to use internal ties and spacers, their type, spacing and use shall be approved. No part of any such tie or spacer remaining permanently embedded in the concrete shall be nearer than the specified cover to the finished surface of the concrete. Wire ties projecting through the concrete face shall not be permitted.

PERMANENT FORMWORK

Permanent formwork for elevated concrete floors in steel structures shall be profiled steel sheet. The sheet shall be of sufficient thickness to sustain all construction loads plus the weight of fresh concrete between supporting beams without excessive deflection. The underside of the sheet shall be coated with an approved corrosive resistant paint. The material shall conform to IS 513. The deflection shall be limited to span / 150. The sheet shall be fixed on the supporting beams at every alternate valley by 10 mm dia fusion welding with 22 mm dia x 2.5 mm thick reinforcing washer. Minimum 100 mm overlap shall be provided. The deck sheet end resting on wall shall have a seating of 150 mm minimum. Side laps shall be secured with tack welding to ensure that the slurry does not leak down. End laps shall always be on the supporting walls or on supporting beams. The overhang of the deck sheet shall be limited to 300 mm maximum. Temporary supports, where ever advised by the construction manager, shall be firm, and at the same level as the permanent supports and shall be in place till the concrete attains its full strength. While removing the temporary supports, care shall be taken that the slab is not disturbed.

FORMWORK FOR VIBRATED CONCRETE

If external vibrators are to be used for compaction of concrete, the type of vibrator, design of the formwork and the method of fixing the vibrators shall all be approved.

CLEANING AND TREATMENT OF FORMS

Before concreting is commencing the forms and previously cast concrete shall be thoroughly cleaned and free from all sawdust, tie wire, shavings, dust, dirt and other debris. Temporary openings shall be provided where necessary to drain away water and remove rubbish.
Release agents shall be applied and be compatible with the class of finish. Care shall be taken not to contaminate the reinforcement.

## 5.0 CONSTRUCTION JOINTS

The number of construction joints shall be kept to the minimum necessary for the execution of the work. Their location shall be carefully considered and approved by Engineer before concrete is placed. Construction joints shall normally be at right angles to the general direction of the member. The concrete at the joint shall be bonded with that subsequently placed against it, without provision for relative movement between the two. When the work has to be resumed on surface, which has hardened, such surface shall be roughened. It shall then be swept clean and thoroughly wetted. For vertical joint neat cement slurry shall be applied on the surface before it is dry. For horizontal joints the surface shall be covered with a layer of

mortar about 10 to 15 mm thick composed of cement and sand in the same ratio as the cement and sand in concrete mix. This layer of cement slurry or mortar shall be freshly mixed and applied immediately before placing of the concrete.
Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire brushes, care being taken to avoid dislodgement of particles of aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement slurry. On this surface, a layer of concrete not exceeding 150 mm in the thickness shall first be placed and shall be rammed against old work, particular attention being paid to corners and close spots; work thereafter shall proceed in the normal way. The number, size and positions of props left under shall be able to carry safely the dead load of the slab, beam or arch together with any live load likely to occur during curing or further construction. Cambers and chamfers, wherever shown in drawing shall be provided accordingly.

EXPANSION JOINTS

Expansion joints and joints around equipment in concrete paving shall be as detailed in the drawing and shall be formed with an approved bitumen impregnated fibreboard. The upper 20 mm shall be sealed with an approved two part, Polysulphide, oil resistant sealant (H.C. grade) or hot applied bitumen sealing compound, applied strictly in accordance with the manufacturer's instructions.
The joint filler shall be fixed firmly to the first placed concrete before the adjoining concrete is placed. The concrete must be thoroughly compacted on both sides of the joint. The location of expansion joints shall be shown on the engineering drawings.

CONTRACTION JOINTS

Contraction joints (either complete or partial) shall be located on the drawings and formed with a building paper membrane interface, or equivalent separating membrane and the upper 25 mm depth sealed. The steel reinforcement shall be continuous through partial contraction joints. The use of contraction joints should be kept to a minimum compatible with freedom from cracking.

JOINT FILLERS

Joint fillers and sealing compounds shall comply to IS 1834, IS 1838 and IS 11433.

## 6.0 REINFORCEMENT

Reinforcement shall comply with IS 1786 or IS 432. Different types of reinforcement may be used in the same structural member. Reinforcement shall be cut and bent in accordance with approved bar bending schedules.

CUTTING AND BENDING

Reinforcement shall be cut and/or bent in accordance with IS 2502. It is essential that reinforcement shall not be subjected to mechanical damage prior to embedment. In general, reinforcement shall be bent cold.
Bends in reinforcement shall have a substantially constant curvature.

It is permissible to bend mild steel reinforcement projecting from concrete provided that care is taken to ensure that radius of bend is not less than that specified in IS 2502. Grade Fe.415 bars shall not be re-bent or straightened without the Engineer's approval.

FIXING

Reinforcement shall be secured against displacement outside the specified limits. Actual concrete cover shall be not less than the required nominal cover minus 5 mm or two third the nominal cover whichever is more. In slabs, the actual concrete cover shall be not more than the required nominal cover plus.
5 mm on bars up to and including 12 mm size
10 mm on bars over 12 mm and up to 25 mm
15 mm on bars over 25 mm
Spacers and chairs shall be used to maintain the specified nominal cover to the steel reinforcement. Spacers or chairs shall be placed at a maximum spacing of 1 meter. Wherever reinforcing bars are intended to be in contact, they shall be securely bound together with 18 gauge annealed soft iron wire.
The mix used for spacer blocks made from cement, sand and fine aggregates shall be comparable in strength, durability and appearance to the surrounding concrete.
The position of reinforcement shall be checked before and during concreting, particular attention being directed to ensure that the nominal cover is maintained within the limits, given, especially in the case of cantilever sections.

SURFACE CONDITIONS

Concrete shall not be placed around reinforcement unless the reinforcement is free from mud, oil, paint, loose rust, grease or any other substance which can be shown to adversely effect the steel or concrete chemically or reduce the bond.

LAPS AND JOINTS

Laps and joints shall be made only by the methods specified and at the positions shown on the drawings or as agreed by the Engineer.

WELDING

Welding on site shall be avoided if possible, but may be permitted where suitable safeguards and techniques are employed. Generally, however, all welding shall be carried out in a workshop. The competence of the welder shall be demonstrated prior to and periodically during welding operations. Welding of mild steel bars shall be carried out in accordance with IS 2751. Welding of high strength deformed bars shall be in accordance with IS 9417. The carbon content of high yield strength deformed bars conforming to IS 1786 shall not be more than 0.25%. If carbon content exceeds the limits specified herein, specifically written down welding and testing procedure shall be followed.

TOLERANCES ON PLACING

Reinforcement shall be placed within the following tolerances:
1. For effective depth 200 mm or less + 10 mm
2. For effective depth more than 200 mm + 15 mm.

TYING OF REINFORCEMENT

Bars crossing each other, where required shall be secured by binding wire (annealed) conforming to IS 280. Every compression bar will be tied at least in two perpendicular directions.

## 7.0 TRANSPORTING, PLACING, COMPACTING AND CURING OF CONCRETE

TRANSPORTING

Concrete shall be transported from the mixer to the formwork as rapidly as possible by methods that will prevent the segregation, loss of any ingredients or ingress of foreign matter or water and will maintain the required workability. The concrete shall be deposited as close as possible to its final position to avoid handling or moving the concrete horizontally by vibrating. The addition of water at point of discharge is prohibited.

PLACING AND COMPACTING CONCRETE

All placing and compacting shall be carried out under suitable supervision and as soon after mixing as is practicable. Placing of concrete shall commence only after embedment in the concrete is securely fixed in position. Care shall be taken to avoid displacing reinforcement and damage to the faces of formwork, particularly when the concrete is allowed to fall freely through the depth of lift. The concrete shall not be dropped from a height of over 1.5 meters unless it is dropped by a tremie or chute. The bonding medium shall have the same cement-sand content as the concrete to be placed on it. Bonding planes shall generally be horizontal.
No concrete shall be placed in flowing water. Under water, concrete shall be placed in position by tremies or by pipeline from the mixer and never allowed to fall freely through the water.
Concrete shall be placed in successive horizontal layers in thicknesses not exceeding 500 mm. Concrete shall be thoroughly compacted by vibration or other means during placing and worked around the reinforcement, embedded fixtures and into corners of the formwork to form a solid void free mass having the required surface finish. When vibrators are used, vibration shall be applied continuously during the placing of each batch of concrete until the expulsion of air has practically ceased and in a manner that does not promote segregation. Over vibration shall be avoided to minimize the risk of forming a weak surface layer.
When internal or immersion type vibrators are used they shall have frequency of 7000 RPM. They shall be inserted in a vertical position at an interval of about 600 mm. Vibrators shall not be used to transport concrete inside the formwork. When external vibration is used, the design of formwork and disposition of vibration shall be such as to ensure efficient compaction and to avoid surface blemishes.
The Contractor shall keep a complete record of the work of concreting showing the time and date of placing. This record shall be available for inspection at any time by the Engineer. Structural concreting against open excavation will not be permitted.

CURING

Curing is the process of preventing the loss of moisture from the concrete while maintaining a satisfactory temperature. The prevention of moisture loss from the concrete is particularly important if the water/cement ratio is low.
Curing and protection shall start immediately after the compaction of the concrete to prevent it from:
Prematurely drying out, particularly by solar radiation and wind,
Leaching out by rain and flowing water.

Where members are of considerable bulk or length, the cement content of the concrete is high, the surface finish is critical; the method of curing shall be specified in detail.

Surfaces shall normally be cured for at least for 7 days. The most common methods of curing are:

- Covering the surface with a damp absorbent material like sacking and keeping the material constantly wet.
- By ponding top surface with water (sea water not permitted) for slabs and the like.
- By continuous or frequent applications of water to the surface, avoiding alternate wetting and drying and the application of cold water to warm concrete surfaces.
- Spraying the surface with an efficient curing membrane.

The curing compound shall conform to relevant Indian Standards and shall be applied in accordance with the manufacturer's instructions to provide a water loss not greater than 0.55 kg/ m2 in 72 hours. Curing compound shall be used where conventional curing by water cannot be accomplished, following approval of construction manager.

## 8.0 CONCRETING IN HOT WEATHER

In hot weather (above 40 deg C) special precautions shall be necessary to avoid the loss of moisture and/or rapid stiffening of the concrete, which prevents its proper compaction, can cause thermal and plastic cracking and a reduction in strength and durability.
During hot weather, the concreting shall be done as per the procedure set out in IS 7861 Part 1. At the time of placing, no part of the concrete shall have a temperature exceeding 35 deg C. The temperature of concrete can be reduced by cooling the water and aggregate.
During hot dry weather at the point of placement the fresh concrete shall be protected from drying winds and solar radiation by the provision of PVC or similar tented shelter, which shall remain to avoid exposure to the sun. Suitable method to shelter the surface shall be adopted such that finishing operations can be carried out whilst it is in place. To prevent early drying and cracking, the relative humidity shall be kept high and the concrete surfaces kept moist by spraying with clean water and covered with wet hessian.

Note: To avoid de hydration of concrete use OPC 43 grade cement.

## 9.0 CONCRETING IN ADVERSE WEATHER

Concreting shall not be permitted when storm or rain appears to be imminent. In the event that the rain storms or other severe weather conditions occur unexpectedly, concreting shall be stopped and appropriate temporary stop ends, vee grooves etc., placed as necessary. To meet such circumstances the contractor shall always have in readiness on site approved framed sheeting or tarpaulins for protection of newly placed concrete. Under water concreting shall be permitted only with the approval of construction manager. Concrete placed under water may be lowered in bottom opening skips or may be fed continuously through an approved tremie pipe. Unless otherwise agreed with the construction manager, the cement content of any concrete mix to be placed under water shall be increased by 20%.

## 10.0 SAMPLING AND STRENGTH OF CONCRETE

Samples from fresh concrete which is to be used in the works shall be taken as per IS 1199 and cubes shall be made, cured and tested at 28 days in accordance with IS 516.

Facilities required for testing materials and concrete in the field such as testing machine with an operator shall be made available at the Engineer's request.

Frequency of sampling and acceptance criteria for strength tests shall be as per clauses 15 and 16 of IS 456. Concrete test cubes may be cured by accelerated methods as described in IS 9013. Cubes may also be optionally tested at 7 days or at the time of striking the formwork. However, in all cases, the 28 days compressive strength specified in IS 456 shall be the criterion for acceptance or rejection of the concrete.

For pre casting work additional cubes shall be taken and tested at 3 days or prior to lifting. Higher rate of sampling will be required at the beginning of the Construction period in order to establish the level of quality control or where there are critical elements. All samples shall be clearly marked with their identification and accurate records shall be maintained.

The concrete will be deemed to comply with the specified design strength provided the acceptance criteria in IS 456 are met.

If any test results fail to comply with the above then the quantity of concrete represented by the results shall be at risk, and may be required to be removed and replaced. The 28 days cube crushing results shall be grouped consecutively in different groups and each group shall have standard deviation as specified IS 456

If the standard deviation is greater than this, the concrete production shall be reviewed. 7-Day Tests (In situ Concrete)

- Tests shall be carried out at 7 days to establish a relationship between the 7-day and 28 day strengths. The relationship shall be used to interpret further test results in order to predict the probable value of the corresponding 28-day strengths.
- Notice shall be given without delay of any 7 day test results which indicates that the corresponding 28 day test results are likely to fail to meet the specified strength, so that necessary action can be taken to minimize the effect of such possible failure.
- 3 Day Tests (Pre-cast Concrete)
- For pre-cast concrete tests shall be carried out at 3 and 7 days to establish the relationship with the 28 day results.

There shall be no production tests on blinding concrete.

## 11.0 INSPECTION

All materials, workmanship and finished construction shall be subject to the continuous inspection and approval of the Engineer. All materials supplied by the Contractor and all construction performed by the Contractor, rejected as not in conformity with the specifications and drawings shall be immediately replaced by the contractor at no cost to the Owner.

## 12.0 CLEAN UP

Upon the completion of concrete work, all debris, scraps of wood, etc., resulting from the work shall be removed and the premises left clean.

## 13.0 WORKABILITY

The concrete mix shall be designed by varying the relative proportion of fine and coarse aggregates to ensure adequate workability for working it into corners and angles of the

formwork and around the reinforcement without segregation of the materials or bleeding of the free water at the surface. On striking the formwork, the concrete shall present a face, which is uniform, free from honeycombing, surface crazing or excessive dusting. To confirm the workability of the designed mix for each grade of concrete, a series of workability tests shall be carried out on the preliminary trial mixes, unless acceptable data exists.

## 14.0 INITIAL SETTING TIME

The initial setting time shall be not less than ½ hour after the production concrete is discharged into the forms and with a maximum time between mixing and completion of placing concrete shall not exceed 1 hour. The total time between mixing and initial set shall be a minimum of 1 hour. There shall be a maximum setting time of 6 hours.
When trial mixes are made to determine the workability of the concrete, the initial setting time of the cement paste shall be determined as per IS 8142.

## 15.0 SLUMP

The slump of the structural concrete mixes shall be such that the concrete can be transported, placed into the forms, and compacted without segregation. Slump for pumpable concrete shall be determined by site trials and shall at least be 100 mm on site of pouring.

## 16.0 PRECAST CONCRETE

The requirements of this Specification relating to concrete and reinforcement shall be observed so far as they are applicable to reinforced concrete. In addition the following requirements specifically relating to pre-cast work should be met.

RECASTING YARD

The yard in which pre casting work is to be undertaken shall be cleaned and have firm level beds preferably of concrete with drainage channels between the beds. The beds shall have a surface of suitable quality to give the pre-cast units the required class of finish.
Where pre-cast units have projecting reinforcement the moulds shall, if necessary, be raised on stools above the general level of the pre casting yard.

MOULDS FOR PRE-CAST CONCRETE

The moulds shall be strongly constructed, closely jointed and true to the required shape with edges, corners and surfaces which comply with the relevant class of finish. Moulds are to be so designed that they can be readily taken apart and reassembled.

MARKING

All units shall be marked on the face which will not be exposed in the permanent works, with the date of manufacture and such distinguishing letters or numbers required for erection identification.

CURING, MATURING AND STACKING

The production schedules shall allow for proper curing and maturing of pre-cast concrete and shall be carried out as approved. The sides of the moulds may be removed after not less than

12 hours provided that the concrete has thoroughly set. All concrete surfaces shall be kept covered with thoroughly wetted hessian for at least 7 days.
Slinging, transporting and stacking may take place when designed handling stresses have been attained, but building or setting in the works shall not be permitted until the 28 days cube strength has been reached.
The time periods required for gain of strength of concrete may be reduced where approved special techniques are adopted such as vacuum or pressed concrete, steam curing or when a rapid hardening cement is used. No methods of accelerated curing shall be used without prior approval.

CEMENT/SAND MORTAR

Cement/sand mortar for bedding and jointing pre-cast members shall be of equivalent strength, quality and color to that of the concrete member being bedded or jointed. Cement/sand mortar shall be mixed in small quantities and used immediately. Particular attention shall be paid to compacting the cement/sand mortar to prevent the formation of voids and air pockets. The mortar mix shall be determined from tests following the recommendations of Indian Standard, alternatively grouting may be considered.

SURFACES FOR STRUCTURAL CONNECTIONS (MARINE STRUCTURES)

The surfaces of pre-cast concrete slabs and other units, which are to be in contact with in situ concrete, shall be prepared to achieve a good bond between the concrete unit and the adjoining concrete. The CONTRACTOR shall submit to the Owner/Owner's Representative his proposals for preparation of a suitable surface.

## 17.0 GROUTING

Where equipment manufacturer's drawings define a grouting procedure, said procedure shall be followed, subject to the approval of Owner/Owner's Representative. All recommendation and instructions of the grout manufacturer shall be followed by contractor.No grout shall be placed when the outside temperature is below 5 °C unless special approval provisions are made against freezing. The minimum compressive strength of grout shall be at least equal to the parent concrete.

MATERIAL

Sand cement dry pack shall be proportioned at the site, but all non-shrink grouts shall consist of only pre-measured, pre-packaged material supplied by the grout manufacturer, except water. Water to be used for mixing Portland cement grout shall be clean, potable and free from all deleterious materials such as oils, acids, alkalis and organic materials.

GROUT TYPES

SAND CEMENT DRY PACK AND ORDINARY MORTAR GROUT

Cement shall be Portland cement and shall conform to the requirements of IS 269. Sand shall be mixed at two to one ratio by weight with the cement with a ramming consistency and shall have a minimum compressive strength of 15 N/mm2 at 7 days.

NON-SHRINK CEMENT BASED GROUT

Non-shrink cement based grout must have a full range of consistencies, including dry pack, plastic and flowable state to be suitable for used in a variety of applications. Grout should be capable of being pumped flowable without segregation. Vibration only when expressly stated by manufacturer. Grout working time shall be minimum of 60 minutes regardless of application consistency used. The grout shall contain no metallic substances (catalyzed or non catalyzed), aluminum powder, water reducing agents, fluidizers, accelerators, super plasticizers, or other materials known to increase drying shrinkage and/ or compromise long term durability. Non-shrink cement based grout shall have a minimum compressive strength of 50 N/mm2 at 7 days.

NON-SHRINK EPOXY GROUT

Grout shall be 100 % solids system with the ability to be placed in flowable state. Non-shrink epoxy shall have a minimum allowable compressive strength of 60 N/mm2 at 7 days.

GROUT TYPE SELECTION

When the application is an unobstructed bearing plate or void which is not subject to impact or vibrations and allows the easy placement of grout without undue man-hour expenditure, used a sand cement dry pack or an ordinary mortar grout.
If one of the criteria cited above is not met (i.e. obstructed bearing plate or void or subject to impact or vibration) then use a pre-packaged, pre-measured, non-shrink, cement based grout.

STORAGE

Non-shrink cement based grout and epoxy grout aggregates shall be prepared by contractor in sound, dry bags and epoxy grout liquid components in sealed hardener and resin containers. Contractor shall be responsible for storing the grout in a dry, weatherproof area and within a temperature range of 4 °C to 32 °C.
Any material which becomes damp or otherwise defective shall be immediately removed from the site by contractor at his own expense.

SURFACE PREPARATION

All surfaces to be grouted shall be entirely free of oil, grease, dirt, wax, laitance, curing compounds and other foreign substances that may interfere with complete bearing or bonding. When removing laitance, a hand held pneumatic chipping hammer shall be of the largest tool, contractor shall take the utmost care to prevent any possible structural damage that could be caused by improperly or negligently removing the laitance.
When any cement based grouts are used, concrete surfaces shall be saturated with water for 24 hours prior to grout placement. Excess water shall be removed just prior to grouting.
When epoxy grouts are used, all surfaces shall be made completely dry prior to grouting.

LEVELLING AND ALIGNMENT

Prior to commencing grouting equipment bases, column bases or anchor bolts, leveling and alignment shall be performed to place and maintain said items in their final position during grouting. A minimum grout space of 25 mm shall be provided unless specified otherwise on the drawing. All metal surfaces which are to be in direct contact with the grout shall be thoroughly cleaned and made free of all grease, oil, dirt, wax or other foreign substance.

Leveling shims shall be removed when they would prevent uniform bearing under the base support such as tower bases rings. Removal of the shim shall be delayed long enough to ensure against disturbing the grout. Voids where shims have been removed shall be completely packed with grout before finishing.

MIXING

Grout types shall be mixed according to manufacturer's recommended procedures. Epoxy grout component ratio shall not be changed from that recommended by the manufacturers. No solvent or thinners shall be added to the mix. The amount of water added to a non-shrink cement based grout will determine its consistency. The lowest water/ grout ratio need to get the grout in place should be used.

PLACEMENT

Grout placement shall proceed in a manner that assures the filling of all voids and the intimate contact of grouting materials with surfaces to be grouted. The placement of grout shall be rapid and continuous so as to avoid cold joints under any base plate. All grouting shall be done in one direction only, placing grout on one side and working it to the other. Placement will be such as to provide full and uniform bearing under all foundation bearing surfaces. All exposed grout shall be provided with a 25 mm, chamfer, unless otherwise directed by purchaser's Owner/Owner's Representative.

CURING

Grout shall be cured according to manufacturer's recommendations. Forms shall remain in place with a minimum of 24 hours regardless of whether grout is cement based or epoxy. Cement based grout shall be protected from extreme drying conditions. Epoxy grout shall not be wet cured. The temperature of the base plate, concrete foundations and grout shall be maintained between 4°C and 32 °C during grouting and for a minimum of 24 hours thereafter.

GAIL INDIA LIMITED

# TECHNICAL SPECIFICATION FOR BRICK MASONRY WORK

## GAIL-STD-CV-DOC-TS-003

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# CONTENTS

## 1.0 INTRODUCTION

This specification deals with masonry and allied works in foundation, plinth and superstructure.

## 2.0 MATERIALS

Bricks for masonry in foundations, walls and other locations shall be common burnt clay building bricks having minimum crushing strength of 7.5 N/sq.mm. or such other strength as may be described in the Schedule of Items, when tested in accordance with IS : 1077-1992 "Common Burnt Clay Building Bricks". They shall be sound, hard and thoroughly well burnt, with uniform size having rectangular faces with parallel sides and sharp straight right angled edges and be of uniform colour with fine compact uniform texture. Bricks shall be of uniform deep red cherry or copper colour. They shall be free from flaws, cracks and nodules of free lime. Water absorption after 24 hours immersion in cold water shall be not more than 20% by weight. They shall not absorb more than 10% by weight of water after immersion for six hours. They shall emit a clear metallic ringing sound when struck by a mallet and shall not break when dropped on their face, from a height of 60 cm.

Fractured surface shall show homogeneous, fine grained uniform texture, free from cracks, air holes, laminations, grits, lumps of lime, efflorescence or any other defect which may impair their strength, durability, appearance and usefulness for the purpose intended. Under burnt or vitrified bricks shall not be used.

Samples of bricks brought to the site shall be tested periodically for compression and other tests according to IS: 3495 (Parts-1 to 4) -1992 "Method of Test for Burnt Clay Building Bricks". Where the size of bricks is not specifically mentioned, it shall be taken to mean conventional sizes as is commonly available in the area. In case modular bricks are to be used, it shall be accordingly specified in Schedule of Items. The bricks shall be classified on the basis of average compressive strength as given in Table 1 of IS: 1077-1992.

Bricks shall be unloaded by hand and carefully stacked and all broken bricks shall be removed from the site.

## 3.0 SAMPLES AND INSPECTION

Representative samples shall be submitted by the contractor and approved samples retained by the Engineer for comparison and future reference. Bricks shall be obtained from approved manufacturer. All bricks shall be subject to inspection on the site and shall be to the approval of the Engineer who may reject such consignment as are considered by him to be inferior to the quality specified. The Contractor shall provide all labour required for inspection and conduct such test as shall be required by the Engineer without additional charges.

## 4.0 SELECTION OF MORTARS

Mortar for masonry shall conform generally to IS: 2250-1981 "Code of Practice for Preparation and Use of Masonry Mortars", and proportion shall be as specified in the drawing or in the Schedule of Items.

Cement mortar shall be prepared by mixing cement and sand in specified proportion. It is convenient to take unit of measurement for cement as a bag of cement weighing 50 Kg equivalent to 0.035 cubic meters. Sand is measured in boxes of suitable size (say of 40 x 35 x 25 cm). It shall be measured on the basis of dry volume. In case of damp sand, the quantity shall be increased suitably to allow for bulkage in accordance with IS:2386-1963 (part-III) or by any approved method.

The mixing of the mortar shall be done preferably in a mechanical mixer. This condition may be relaxed by the engineer taking into account the nature, magnitude and location of the work. If mixed in the mixer, cement and sand in the specified proportion shall be fed in the mixer and mixed dry thoroughly, water shall be then added gradually and wet mixing continued for at least 3 minutes. In case of hand mixing also after mixing dry on a water-tight masonry platform, water shall be added and the mortar turned over and over, backward and forward several times.

Fresh mixed mortar, in case becoming stiff due to evaporation of water may be re-tempered by adding water as frequently as needed to restore the requirement of the consistency but this shall be permitted only upto a maximum of 2 hours from the time of addition of cement in the mortar.

## 5.0 STORAGE AND HANDLING

Bricks shall not be dumped at site. They shall be carefully handled and carefully stacked in regular tiers to avoid breakage and defacement of bricks and prevent contamination by mud or other materials. Bricks selected for different situations of work shall be stacked separately.

## 6.0 SOAKING & CLEANING

Bricks required for masonry shall be cleaned to be free from dirt, dust and sand and fully soaked in clean water by submerging in vats before use, till air bubbling ceases. The bricks shall not be too wet at the time of use. After soaking they shall be removed from the tank sufficiently early so that at the time of laying they are skin dry and stacked on a clean space.

## 7.0 LAYING

Brickwork in general shall be as per IS 2212-1991. Bricks shall be laid in English bond, unless otherwise specified, with frogs upward over a full bed of evenly laid mortar, and slightly pressed and tapped into final position to the lines levels and shape as shown in the drawing fully embedded in mortar. All joints including inside faces shall be flushed and packed. Not more than 8 courses shall generally be laid in a day. The first course itself shall be made horizontal by providing enough mortar in the bed joint to fill up any undulations. The horizontality of courses and the verticality of wall shall be checked very often with spirit level and plumb bob respectively.

Horizontal joints shall be truly horizontal and vertical joints shall line up in every alternate course. The joints shall not exceed 10 mm in thickness and shall be well finished and neatly struck. The joints shall be kept uniform throughout the brick work. All the brick joints of the face works shall be neatly raked out to a minimum depth of 15 mm with the help of raking tools and the faces of brick wall cleaned with wire brush to remove any splashes of mortar before the close of the day's work, while the mortar is still green and the last brick layer shall be cleaned with wire brush and the frogs free from mortar.

Walls coming in contact with R.C.C. structures shall perfectly be bonded with M.S. inserts or lugs where shown on drawings and the sides butting against the R.C.C structures neatly and efficiently flashed and packed with rich mortar & cement slurry at no extra cost. Where such lugs are not required to be provided, brick work shall be built tightly against columns, slabs or other structural parts, around door and window frames with proper distance to permit caulked joint. Where drawings indicate structural steel column or beam to be partly or wholly covered with brick work, bricks shall be built closely against all flanges and webs, with all spaces between steel and brick work filled solid with mortar not less than 10 mm thick.

Damaged or broken brick or brick bats shall not be used in brick work. Cut bricks may be used to complete bond or as closers or around irregular openings.

Bricks shall not be thrown from heights to the ground, but shall be handled carefully and put gently in position to avoid damaging the edges. Selected bricks of regular shape and dimension shall be used for face work.

Making of grooves, sleeves and chases shall be done, during the construction, to the lines, levels and position as shown in the drawing or as instructed by the Engineer. Such sleeves shall slope outward in external walls so that their surface cannot form channels for the easy passage of water inside.

Fixtures, plugs, frames, pipes, inserts etc., if any, shall be built in at the right places to the lines & levels as shown in the drawings while laying the course and not later by disturbing the brick work already laid.

Brick walls of one brick thick or less shall have one selected face in true plane and walls more than one brick thick shall have both the faces of wall in true plane.

All connected brick wo rk shall be carried out simultaneously with uniform heights throughout the work, and in exceptional cases, with the approval of the Engineer, the brick work built in any part of the work may be lower than another adjoining wall/connected wall by a maximum of one meter and the difference in height of adjoining wall/connecting wall shall be raked back according to bond by stepping at an angle not steeper than 45 degree, without sacrificing the necessary bond, horizontality of layers, verticality of joints and the wall.

## 8.0 PROTECTION OF BRICK WORK

The brick wall shall be protected and covered with gunny bags or water proof sheets from the effects of inclement weather, rain, frost, etc. during the construction and until the mortar sets. Care shall be taken during construction that the edges of jambs, sills and soffits of openings are not damaged.

## 9.0 CURING

Masonry in cement or composite mortar shall be kept continuously moist on all faces for a minimum period of 7 days by means approved by the Engineer.

## 10.0 SCAFFOLDING

Necessary and suitable scaffolding shall be provided at all heights to facilitate the construction of brick wall. Scaffolding shall be sound, strong and all supports and other members shall be sufficiently strong and rigid, stiffened with necessary bracings and shall be firmly connected to the walls securing them against swing or sway. Planks shall be laid over the scaffolding at required levels. Scaffolding shall preferably be of tubular steel, although the Engineer may permit other material, depending upon the circumstances.

Scaffolding shall be double, having two sets of vertical supports, particularly for the face wall and all exposed brick work. Single scaffolding may be used for buildings upto two storeys high or at other locations, if permitted by the Engineer. In such case the inner ends of horizontal members shall rest in holes provided in header course only. Such holes shall not be allowed in pillars under one meter in width, or immediately near the skew backs or arches. The holes thus left in masonry shall be filled with bricks set in rich mortar and the surface made good on removal of scaffolding.

If for any reason the Contractor is required to erect scaffolding in property other than that belonging to the Owner, including municipal corporation or local bodies, necessary permission shall be obtained by the Contractor from the appropriate authorities and necessary licensing fees if any shall have to be borne by him.

All scaffoldings once erected shall be allowed to remain in position, efficiently maintained by the Contractor, till all the finishing works required to be done are completed and shall not be removed without the approval of the Engineer. The Contractor shall allow workmen of other trades to make reasonable use of the scaffolding without any extra cost.

GAIL INDIA LIMITED

# TECHNICAL SPECIFICATION
# FOR
# BARRICADES

## GAIL-STD-CV-DOC-TS-004

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## 1.0 INTRODUCTION

This specification covers the requirement for site in-situ barricading where the work is commencing along the major and minor roads.

## 2.0 REFERENCE DOCUMENTS

Refer GAIL standard drawing no: - GAIL-STD-CV-DWG-TP-015

## 3.0 GENERAL

- Providing and installing the barricades of size 2.5 m X 2.0 m of the design and type as shown in the standard drawing no:- ENG-STD-CV-DWG-TP-011. Installation plan of Barricades is to be approved by Owner/Owner's Representative. Barricades are to be firmly fixed to the ground and are to be maintained during the progress of work.

- Barricades are to be painted with logo initially and repainting to be done whenever required.

- Wet mopping of Barricades shall be done quarterly in a month.

- In accordance with the requirements of this specification, the contractor shall submit the details specified in the following paragraphs covered by this specification.

- Wet mopping of Barricades shall be done quarterly in a month.

- Ground Space of one-meter width outside barricades shall be cleaned everyday.

- Reflector shall be placed on the barricades.

- Barricades shall have blinking red light for night getting power through generator or electric connection.

- To avoid traffic congestion/accident a trained supervisor shall be deployed as per directions of Owner/Owner's Representative.

- Dismantling of Barricades from the site and cleaning the site as per directions of Owner/Owner's Representative.

# GAIL INDIA LIMITED

# REPLACEMENT OF COATING AND ASSOCIATED WORK FOR GNFC & VIP LINE

# LOCATING PIPELINE, EXCAVATION AND PIPELINE EXPOSURE

## DOC. NO. - GAIL-ENG-PL-071-TS-005

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# INDEX

## 1. GENERAL REQUIREMENTS

The scope includes clearing of ROW for carrying out coating refurbishment works, identification of buried pipeline / pipelines in the ROW using pipeline locators and cross trenching at regular intervals, marking pipeline alignment as directed by the site engineer for the trench excavation work including but not limited to cutting/clearing the ROW of all bunds, dewatering surface water in submerged section/in pipe trenches, vegetation, bushes, trees etc. to enable movement of vehicles, equipment viz. compressor, welding sets etc. and to enable excavation of the trench for coat and wrap works.

GAIL/PMC shall show the contractor the location of the pipeline with the help of Pipeline markers, turning points, boundary pillars etc. in the ROW. However, establishing exact alignment of pipe is to be done by contractor by using Pipeline Locators or by digging bell-holes. No extra payment whatsoever in this respect shall be payable to bidder for this.

The checking or approving of any line, level or marks by the GAIL/PMC representative shall not in any way relieve the contractor of his responsibility for the correctness thereof. Earth work in excavation includes in all types of soils like hard murrum dry/wet condition, water logged areas requiring shoring/shuttering and de-watering of surface water / water in pipeline trench up to depth required to expose the pipeline all around and width including but not limited to road cutting and providing necessary by-pass roads for movement of vehicle / equipment etc. and further restoring the road to its original condition which shall be deemed to be within the purview of item as mentioned in SOR and as per the instructions of GAIL/PMC. No extra cost shall be applicable for any of the above activities, including providing bypass roads and restoration work.

The Contractor shall be liable for any and all damage to the GAIL pipeline/ other pipelines ,OFC cable paths, walkways, roads, dykes caused by him and agree to pay, indemnify the GAIL from any loss or damage or alleged damage to such structures caused by the Contractor.

## 2. EXCAVATION OF PIPE TRENCHES

- All excavations shall be carried out as per IS 3764 Excavation Work – Code of Safety and OISD-GDN- 192 – Safety Practices During Construction.

- Safety helmets shall be worn by all persons entering trench where hazards from falling stones excavated earth, timber or other materials exist.

- Appropriate safety footwear (rubber boots, protective covers, etc.) shall be worn by workers/ employees who are engaged in work requiring such protection.

- Suitable barricading of 1m height with glowing caution board shall be provided for excavation beyond 2.0 m depth.

- All trenches in soil / friable or unstable rock more than 2.0 m deep shall be securely shored and timbered. In case of high-water tables, continuous flow of water in the trench, shoring shall be required at lesser depth also and shall be as per instructions of GAIL/PMC.

- Excavations shall have suitable arrangement for moving in and out of the trench like ladders etc. are to be provided every 30 m of length or fraction thereof. Ladders shall extend at least one meter above the top of the cut to provide a hand hold when stepping on or off the ladder.

- Wherever necessary, suitable cross-over / temporary bridges should be provided and maintained over the open ditch to permit general public, property owners or his tenants to cross or move stock or equipment from one side of the trench to the other. The width of such crossovers shall not be less than 75 cm and shall be strong enough to withstand the intended use. During excavation, mechanical excavator should not touch GAIL's pipeline or adjacent pipelines of GAIL's / other companies. The earth around pipeline should be removed manually to prevent any damage to pipeline. Extra precaution must be taken while exposing pipeline.

- The Contractor shall also take additional precautions in places where there are other crossings like other pipelines, water pipes, OFC, power cables, drainage system underneath or above the Owner's pipeline.

- Excavation of earth shall be done in all kinds of soil including hard murrum, soft rock, hard rock, including but not limited to overburden earth containing large size boulders, by any/ all means except blasting. The job includes bailing out of water from the ground surface /pipe trench by using sludge/dewatering pumps including installation of well point system as instructed by GAIL/PMC to drain out the surface water for excavating the pipe trench, shoring, shuttering etc. . In addition to above, patches of rocky/murrum /waterlogged stretches may be found within normal stretches of soft/silty soil areas after excavation. The length of Rocky/murrum/waterlogged patches may vary after excavation of trench and no extra cost shall be applicable on account of the same.

- All equipment, materials, tools, tackle, chemical material, application etc. required for the works shall be in the scope of the Contractor.

- The contractor shall dig the pipeline trench by any method, except blasting. The Contractor shall ascertain pipe depth by making cross-trenching at suitable intervals 100~110 meters to understand exact depth of pipe, parallel pipes in the common ROW, fiber optic cable orientation with respect to the pipe so that damage to pipe, foreign pipes, fiber optic cable by excavator during excavation is avoided.

- Normally, the pipeline is buried up to a depth of 1.5m. However, the depth may vary depending on the site conditions.

- The depth of pipeline at Nala, Rail, Cart track and Road may be up to 3.0 m to 5.0 m or more on either side near the crossings depending on site conditions. Excavation at all places has to be carried out at all depths on ROW.

- Excavation shall require mechanical means (except blasting) / chiseling / pneumatic drilling for required length of stretch along the pipeline trench.

- The Contractor shall exercise special care in cleaning all debris, loose material, rock particles etc. from the ROW to prevent the soil intended to be used for backfilling the ditch, becoming mixed with such debris.

- The trench is to be cut to a grade that will provide sufficient space for carrying out surface preparation and coating refurbishment works.

- The trench size should be such that on all sides of the exposed pipe and including bottom there has to be a clearance as given below from the outer wall of pipe.

- Ground clearance : 500 mm
- Lateral clearance : 800 mm

- If there is one pipe in the ROW requiring refurbishment, the trench size for pipe at a normal depth of 1.2~1.5 meter shall be:

- Width 2.0-meter average Depth 1.5~ 2.0-meter depth.

- The types of soil in the terrain are hard murrum, soft/hard rock and soil containing large boulders. The Contractor shall clear the ROW and prepare site etc. for the convenient passage of all equipment by removing all bush, vegetation, undergrowth, stumps, rocks and other obstacles liable to impede the convenient passage of the equipment and carrying out the work unto the width as directed and to the satisfaction of Site Engineer. Where necessary, the minimum number of trees, bushes and shrubs shall be removed to clear through cultivated areas.

- In rough, steep terrain, the Contractor may have to construct bypass and access roads for its use. Where these are not on the ROW , the Contractor shall obtain necessary permission from landowners and tenants and be responsible for all damages caused by the construction and use of such roads at no extra cost to the Owner.

- The Contractor has to take care about the ROW facilities like TLP, boundary pillars, KM post, turning posts and caution boards during excavation. All these facilities are to be restored after coating & wrapping work to its original condition. No payment shall be paid for this work.

- Trenching in all waterlogged areas/ marshy areas/ water crossings like canal/nala crossings etc. shall be provided with shoring and shuttering.

- Along the ROW, at locations where pipeline is laid under concrete slabs to avoid surfacing of pipeline in waterlogged areas, the concrete chambers/slabs wherever necessary and as directed by GAIL/PMC shall be repaired/ replaced / restored as original.

- During excavation, the exposed pipeline section shall be provided with earth support to ensure maximum unsupported length of less than 10 m. However, if required contractor shall provide sandbags to support pipe section at a suitable distance, wherever required with the help of side boom / hydra, tripods, winches etc. during the course of repair/refurbishment work.

- The supported portions shall be taken up after completion of works on unsupported length. The unsupported length shall be backfilled and soil compacted adequately. Sandbags shall be provided as required to support the pipe before starting work on supported sections. The sand bags will be punctured / removed once area around it is backfilled and compacted properly.

- At road crossings where pipeline crosses a kuccha or Hard standing road etc. the scope would include exposing the pipe by road cutting, shoring, shuttering and providing necessary by-pass roads for movement of people and vehicle / equipment and further restoring the site to its original condition without any extra cost and as per the instructions of GAIL/PMC.

- The roads up to a maximum height of 3 m above ground level from Toe will be taken up for cutting for refurbishment of coating.

- Restoration of roads to its original shall be performed by the contractor for only SH/NH, PWD or Govt. roads, defense roads, forest roads.

- Public travel shall not be unnecessarily inconvenienced, nor shall it be wholly constructed at any point, without consent of the responsible authorities. The Contractor shall at his cost furnish and maintain watchman, detours, lights, barricades and signs where necessary to fully protect the public.

- The Contractor shall be responsible for making the temporary approach road to ROW wherever required, at his own cost and risk and shall keep the GAIL indemnified for any claim or damages whatsoever caused by the Contractor in this regard. Wherever any permission, etc. required to be taken from Govt. authorities towards these, contractor shall be responsible for obtaining such permission and shall keep GAIL indemnified from all such claims, damages arising out of the above, from any / all quarters. However, GAIL shall extend help wherever required.

- With regard to soil conditions and/or the topography of the ground, the trench shall be excavated and finished to the minimum dimensions as indicated above or as directed by GAIL/PMC representative for earth & rock with a view to expose the pipeline and to provide for sufficient working space for carrying out the coating work all round the circumference of pipeline.

- The excavated length of pipeline shall be such as to carry out the intended length of coat and wrap as per standard coating practices and the Contractor shall quote accordingly.

- While backfilling, the soil recovered from around the pipe i.e. in close vicinity of the pipeline shall be used for backfilling over the newly coated pipe, care shall be exercised to see that no loose debris or foreign material or stones are used for backfilling directly on in the trench.

- For depth of excavation more than 2.5mtr (measured from undisturbed ground level (GL) to pipe top) found at areas such as in canal beds/water courses and/or specific locations if any, specified and certified by EIC, rates shall be applicable as per provision of SOR.

- Locating all existing nearby underground pipelines & cables by pipe/ cable locator and marking/ flagging-off their location suitably before beginning of any construction activity, on both sides of the crossing and within crossing limits, such that no existing pipeline/ cable gets damaged. Any damage to the existing pipelines/ cables due to the constructional activities by the contractor shall be attributable to the Contractor. Contractor shall be responsible for claims if any arising out of damage/ obstruction to any existing facilities such as public utilities like roads, electric cables, pipes, OFC lines of DOT etc. where the claims will cover the restoration costs as well as loss of revenue due to down time. All such claims including claims due to delay in restoration of such facilities shall be settled by the Contractor at Contractor's own expense including carrying out coordination & Liasoning with local people, without any time and cost implication to Company.

- OFC cable of GAIL is laid in the same RoW at a distance of 2 meters or less horizontal separation and depth 1.5 meter or less from the ground. All care to protect the GAIL's OFC during excavation and other operation of coating refurbishment work shall be taken by contractor. Any damage to OFC shall be repaired at the cost of the contractor causing damage.

- The contractor is warned that while excavation job is carried out, the pipeline, which is carrying highly explosive petroleum product, should not be damaged and chiseling, hammering etc. shall not be resorted to on the pipeline surface in any case.

- The contractor shall be responsible for taking all necessary precautions to prevent any damage whatsoever to the pipeline. Each project site should be equipped with all preventive measures including keeping minimum 4nos fire extinguishers duly charged and in good working condition near each work site.

- Contractor shall make available First Aid Box as per standard practices and one standby vehicle at each opening for emergency situations. Contractor shall have all the details of nearby Police Station, Hospital, Fire Station etc. and display the same at each location. The Contractor shall also coordinate with district administration for the works carried out under their jurisdiction.

- Contractor must ensure all PPEs for each of the labour & supervisors. Non-compliance in this regard shall attract penalty and deducted from RA Bill/s of the contractor.

  The Contractor shall provide suitable drainage arrangement to prevent surface water entering the trenches. The Contractor shall engage dewatering/sludge pumps or well point system as per approval from GAIL/PMC to keep the trench free of water.

In such areas, even though the water shall be drained out continuously from the working trench, the trench shall be muddy and clay, contractor to make suitable arrangements to ensure safe working of the personnel in such areas so as to not to effect the progress of the work/personnel safety at no extra cost to the GAIL.

## 3. OPENING OF THE TRENCH OF THE PIPELINE

The pipeline will be exposed 300~400 meters at a stretch and as directed by GAIL /PMC. Contractor will ensure that the exposed pipeline in the trench is re-coated within the shortest span but not more than5 to 6 days. 24x7 security shall be provided by the contractor for the exposed pipelines. Flood lights shall be provided for safety at suitable distances.

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## 4. MAXIMUM UNSUPPORTED LENGTH OF PIPE FOR RECOATING

a. Maximum unsupported length of pipeline shall not exceed 10 m.
b. During excavation, pipe support shall be left as unexcavated/undisturbed pipe length i.e. original earth support of suitable width (approx. 0.7m-1.0 m as per site condition).
c. After completion of coating of main stretch (8m–10m), pipe at such supports shall be taken up for coating refurbishment.
d. Prior to removal of above earth support, following precautions shall be taken:

- Back filling (minimum up to pipe top) of pipe length already exposed and re-coated.
- Proper compaction of backfill of such re-coated pipe length.
- If required, sand bag supports shall be provided

## 5. CROSSINGS

The scope of work includes excavation and coating repair at all types of uncased road crossings. Trenching at crossings shall include road cutting, shoring and shuttering and providing necessary bypass roads as per requirement for movement of vehicle/ equipment etc. and further restoring the road to its original condition as per the instructions of GAIL/PMC/Concerned Authority.

The scope of work also includes excavation and coating at all water crossings like canal/nala crossings etc. including providing shoring and shuttering. The coating at canal crossings shall be exempted where the mainline pipe was laid through HDD or at design submerged crossings and at locations where concrete coating or concrete cover for Exposure repairs has been provided.

The Contractor shall be responsible for making all necessary arrangement to bail or pump out water from the trench or from wet area or submerged area, wherever required, during excavation and operations of coat and wrap , without any extra cost/ liability to the GAIL.

Suitable types of shoring and shuttering, whenever necessary if the depth of the trench is more than 1.5m, shall be adopted to with-hold the vertical face of trench or cutting in slope/stepped cutting resorted to as per site requirements and as directed by the GAIL/PMC.

In locations, where the trench is cut across roads, patches, walkways etc., the Contractor shall provide temporary bridges / suitable bypass of adequate strength & proper construction to allow the passage of normal traffic with minimum of inconvenience and interruptions. The Contractor should make good and restore the area etc. to its original condition without any extra cost.

The permission of road cutting shall be taken by owner, however necessary intimation/co-ordination with the concerned local official to be made by the concerned contractor prior to start of the road cutting job and only on his concurrence shall the job start.

# GAIL INDIA LIMITED

# REPLACEMENT OF COATING AND ASSOCIATED WORK FOR GNFC & VIP LINE

# BACKFILLING, FINAL RESTORATION OF ROU AND MESUREMENT

## DOC. NO. - GAIL-ENG-PL-071-TS-006

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| 0 | 01.06.2020 | Issued For Review | DP | SKK | VNP | |
| **Rev** | **Date** | **Purpose** | **Prepared By** | **Checked By** | **Approved By** | |

## 1.0 BACKFILLING, FINAL RESTORATION OF ROU AND MESUREMENT

Backfilling of the excavated trench is to be carried out as per specification of this tender document. Contractor shall ensure satisfactory restoration of the respective pieces of land, after completion of work and will submit the same to the EIC along with the final bill.

The supervision of the work shall be carried out by GAIL /PMC. In case of any ambiguity about quality of the job, decision of GAIL/PMC shall be final.

The Contractor will take all protective measures to prevent damage of standing crops in vicinity of ROW & anywhere in the surrounding vicinity during execution of the work & transportation of the material/ machine/manpower etc. However, if any such damage of the crop occurs outside the ROW, it will be the responsibility of the contractor to compensate to the concerned farmers GAIL /PMC will not be liable to any claim by farmers/land owners for any type of crop/other damage due to work & transportation of the material/ machine/manpower etc. by the contractor. All such claims will be borne by the contractor only.

While backfilling the trench after application of tape, special care needs to be taken to ensure that the coating surface is not damaged or pebbles/ hard particles do not penetrate the same. The back filling of trench gradually shall be done with selected soft earth or fine sand all around the pipe in full trench width up to 150mm height above the pipe. The decision of GAIL /PMC with respect to back filling with soil or sand and compaction of soil /sand shall be final and binding.

Wherever there is a sloped terrain / trench, where pipeline bend is in line with ground profile, intermittent retaining walls are to be made with the help of filled polythene sandbags and pipe level is to be maintained. The job shall be done as per directions of GAIL / PMC and no extra payment shall be made towards the same.

The balance excavated quantity of earth subsequent to provision of soft earth pad for the pipe by screening shall be used for providing original cover as it was before starting of the work. Sandbags used for support shall be retained to ensure that the pipe does not sag during backfilling and subsequent resettlement of soil. It is to be ensured that sandbags are punctured so that coated pipe does not get damaged.

In case the backfill material contains stones, pebbles, rocks etc., of sizes bigger than 50mm, the same shall be removed from excavated stack to obtain backfill free from such materials. The backfill material should not contain any such item that may damage the coating at the time of backfilling.

The backfilling operation shall be performed in such a manner as to provide support under the pipe and to avoid any damages to the new coating and also to pipe. The filling material used at bottom should be compacted to provide good support and prevent resting of pipe on sharp edges.

In all stretches of rocky area fine sand padding is to be carried out as approved by GAIL / PMC. In other stretches, earth padding is to be carried out using soft soil. The soft soil used for earth padding should be free from lumps, stones, boulders, rocks, hard clay etc.

If soft soil is not available or unable to sieve at/near the site, the soil is to be imported from other area for earth padding. GAIL/PMC shall decide the stretch for sand padding or earth padding.

The excavated quantity of earth subsequent to complete backfilling shall be neatly centered over the ditch and neatly rounded there on to a minimum height of 0.30 meters above adjacent ground level (i.e. formation of crown over pipe trench).

Rocks/ boulders separated from back fill shall be disposed off suitability. The entire field/ ground shall be brought to the original level and conditions, which existed prior to taking up of the job. Also any additional backfill generated due to soft earth padding/sand shall be suitably disposed off in line with directions of GAIL / PMC. Backfilling at top of trench shall be with original topsoil kept separately to maintain originality and fertility of topsoil.

All fencings, bunds and other structures shall be restored to their original condition and the damaged structures shall be restored to the Owner's satisfaction. i.e. entire ROW shall be smoothened to a manner satisfactorily to the GAIL/PMC.

Trenches excavated through small watercourses shall be backfilled with the same material excavated from it. If this is unstable, backfilling shall be done with suitable material. The backfilled earth shall be properly compacted to ensure that the no undue settlement takes place in the area.

Effective measures (like putting sandbags at a prefixed interval or embankment protection and other civil protection works to arrest any soil or bank erosion, shall be provided The Contractor shall ensure that the trench is backfilled within 48hours of completion of coating activity on the pipeline, If the same is not done the Contractor may be asked to re-do the coating if the coating has got damaged at no extra cost to the Owner and the coating supply material cost shall be recovered.

Supply of Free Issue Material Supply of Material: GAIL's responsibility shall be confined to supply the following materials to the Contractor at free of cost from any of the nearby Owner's stores/ godowns:

i. Coating materials (3ply/ 2ply cold applied system, visco elastic wrap, petrolatum coating system).
ii. Hand wrapping machines (as per availability)

Materials shall be made available to the contractor from respective defined locations as specified in the tender.

The permission of road cutting shall be taken by owner, however necessary intimation/co-ordination with the concerned local official to be made by the concerned contractor prior to start of the road cutting job and only on his concurrence shall the job start.

# GAIL INDIA LIMITED

# REPLACEMENT OF COATING AND ASSOCIATED WORK FOR GNFC & VIP LINE

# MATERIAL HANDLING, FINAL RESTORATION OF ROU AND MEASUREMENT

## DOC. NO. - GAIL-ENG-PL-071-TS-007

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| 0 | 01.06.2020 | Issued For Review | DP | SKK | VNP | |
| **Rev** | **Date** | **Purpose** | **Prepared By** | **Checked By** | **Approved By** | |

# INDEX

## 1. GENERAL

The Cardboard boxes are to be stored with the arrow marked for the verticality, in a stack not higher than 1.2 meter. They are to be stored under a shed and away from the direct sun. No heavy item should be placed on the tape/paint boxes.

The primer drums are to be stored under a shed and away from the source of any flame/ spark/ fire.

## 2. MATERIAL TRANSPORTATION

The Contractor shall be responsible for collecting the free issued coating material from the GAIL Storage locations and to transport the same to the job site for placement/ utilization at his own cost, according to the terms of the contract.

## 3. MATERIAL CONSUMPTION

The Contractor shall adhere to the consumption rate of materials as indicated by the manufacturer/GAIL/PMC such as primer, tape coat and other coating material with accessories and pipes for sleeving as per format of consumption of materials attached. Materials shall be provided by GAIL/PMC based on the quantities required spread wise on daily progress basis or as decided by Engineer-in-Charge.

However, materials consumption can be modified by the GAIL/PMC, based on the field trials made at site and approved. Any additional requirement over and above the quantity arrived at as above will be charged by the Owner as per the rates given in this document

On completion of works or upon the early termination of the contract, the Contractor shall forthwith at his own risk & cost transport to the GAIL's stores or otherwise as directed by PMC all surplus materials including but not limited to salvageable wastage remaining in the hands of the Contractor.

If in the opinion of the GAIL/PMC any materials returned by the Contractor are not in good condition or is unusable, GAIL/PMC may reject the same, in which event the Contractor shall be deemed to have failed to return and the charges of the same shall be deducted from the contractor.

The cost in lieu of all empty primer drums shall be deducted from the Contractor's bills at the uniform rate of Rs 10/- per 20 kg Primer drum. Primer remaining unused for the last drum while completing the work shall be accounted and no recovery shall be made for unused quantity of last drum. However, certification of PMC shall be required for the same.

All materials issued by the Owner to the Contractor shall be preserved against deterioration and corrosion due to poor or improper storage while under the Contractor's custody. Any damage/losses suffered, on account of non-compliance with the requirements stipulated

herein shall be considered as losses suffered due to wilful negligence on the part of the Contractor and shall be charged.

Minimum theoretical consumption of GAIL supplied coating material / km.

3ply / 2 ply cold applied tape:

| Pipe size inch | Inner tape, m2 | Outer tape, m2 | Primer L | Filler Kg |
|---|---|---|---|---|
| 18” | 3160 | 3218 | 206 | |

The above consumption levels are minimum theoretical.

Tolerance over the minimum theoretical consumption level shall be +5%.

Consumption of material shall be verified at the PQT / PPT stage in the presence of Coating representative and a tolerance limit shall be set. Any extra consumption if any during the PQT / PPT shall be accepted only after due verification and acceptance of GAIL / PMC.

Coating contractor have to work within the tolerance limits. Any consumption over the accepted tolerance limit shall be recovered from running bills.

# GAIL INDIA LIMITED

# COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

## ANNEXURE-II

## (Existing Alignment Sheet/Crossing Drawings)

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1 | 11.07.2022 | Issued For Bid | SS | JR | TR | |
| 0 | 08.03.2022 | Issued For Review | SS | SKK | HM | |
| **Rev** | **Date** | **Purpose** | **Prepared By** | **Checked By** | **Approved By** | |

# GAIL INDIA LIMITED

# COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

# DRAWINGS

| | | | | | | |
|---|---|---|---|---|---|---|
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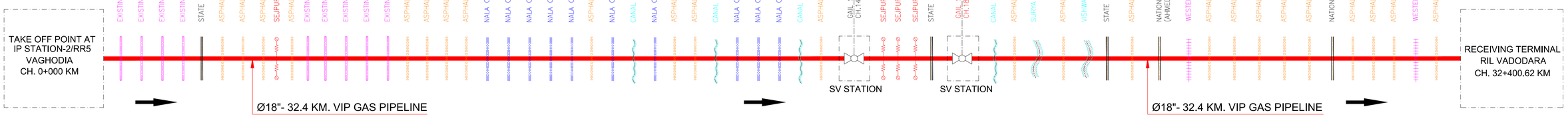
| | | | | | | |
| 0 | 08.03.2022 | Issued For Review | VK | SKK | SB | |
| **Rev** | **Date** | **Purpose** | **Prepared By** | **Checked By** | **Approved By** | |

# INDEX

| Sr. No. | Contents | Document / Drawing No. |
|---|---|---|
| 1 | Schematic Diagram of Existing Pipeline Vaghodia to RIL Vadodara (VIP Line) | GAIL-034071-PR-DWG-SCHM-001 |
| 2 | Schematic Diagram of Existing Pipeline CPF Gandhar to GNFC (GNFC Line) | GAIL-034071-PR-DWG-SCHM-002 |
| 3 | Schematic Diagram for Coating Replacement Work - VIP Line | GAIL-034071-PR-DWG-SCHM-003 |
| 4 | Schematic Diagram for Coating Replacement Work - GNFC Line | GAIL-034071-PR-DWG-SCHM-004 |
| 5 | Typical Barricades drawing | GAIL-STD-CV-DWG-TP-001 |

# SCHEMATIC DIAGRAM FOR AT VAGHODIA TO RIL VADODARA - PART-A




## CROSSING DETAILS

| CROSSING | SYMBOLS | NO. OF CROSSING |
|---|---|---|
| EXISTING PIPE | | 09 NOS. |
| STATE HIGHWAY | | 03 NOS. |
| ASPHALTED ROAD | | 24 NOS. |
| HT LINE | | 04 NOS. |
| NALA | | 10 NOS. |
| CANAL | | 04 NOS. |
| NADI | | 02 NOS. |
| NATIONAL EXPRE. | | 02 NOS. |
| RAILWAY LINE | | 02 NOS. |

LEGENDS:-

- NATIONAL/STATE HIGHWAY
- ASPHALTED, RCC, METALLED, BRICK ROAD
- RAILWAY LINE
- NALA, DRAIN
- CANAL
- RIVER/NADI
- PIPELINE
- VALVE
- EXISTING PIPE

| REV. | DATE | DESCRIPTION | PREP. | CHKD. | APPD. |
|---|---|---|---|---|---|
| 0 | 14.05.20 | ISSUED FOR REVIEW | VKS | TR | SB |

CLIENT: GAIL (INDIA) LIMITED.

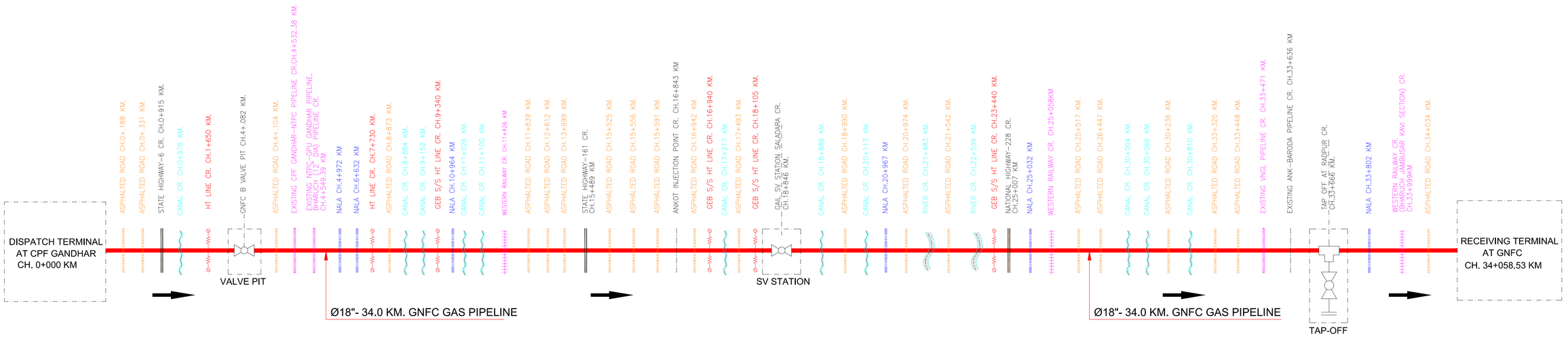
PMC: LYONS ENGINEERING PVT. LTD.

PROJECT: REPLACEMENT OF COATING AND ASSOCIATED WORK

| SCALE | TITLE |
|---|---|
| N.T.S. | SCHEMATIC DIAGRAM OF EXISTING PIPELINE VAGHODIA TO RIL VADODARA (VIP LINE) |

| SIZE | JOB NO. | DRAWING NUMBER | SHEET | REV. |
|---|---|---|---|---|
| A3 | 034 | GAIL-034071-PR-DWG-SCHM-001 | 1 OF 1 | 0 |

# SCHEMATIC DIAGRAM FOR AT CPF GANDHAR TO GNFC -- PART-B




## CROSSING DETAILS

| CROSSING | SYMBOLS | NO. OF CROSSING |
|---|---|---|
| EXISTING PIPELINE | | 03 NOS. |
| STATE HIGHWAY | | 02 NOS. |
| ASPHALTED ROAD | | 21 NOS. |
| HT LINE | | 06 NOS. |
| NALA | | 06 NOS. |
| CANAL | | 11 NOS. |
| NADI/RIVER | | 02 NOS. |
| NATIONAL HIGHWAY | | 01 NO. |
| RAILWAY LINE | | 03 NOS. |
| ANKOT INJECTION | | 02 NOS. |

LEGENDS:-

- NATIONAL/STATE HIGHWAY
- ASPHALTED, RCC, METALLED, BRICK ROAD
- RAILWAY LINE
- ANKOT INJECTION POINT
- NALA, DRAIN
- CANAL
- RIVER
- PIPELINE
- VALVE
- EXISTING PIPELINE

| REV. | DATE | DESCRIPTION | PREP. | CHKD. | APPD. |
|---|---|---|---|---|---|
| 0 | 14.05.20 | ISSUED FOR REVIEW | VKS | TR | SB |

CLIENT: GAIL (INDIA) LIMITED.

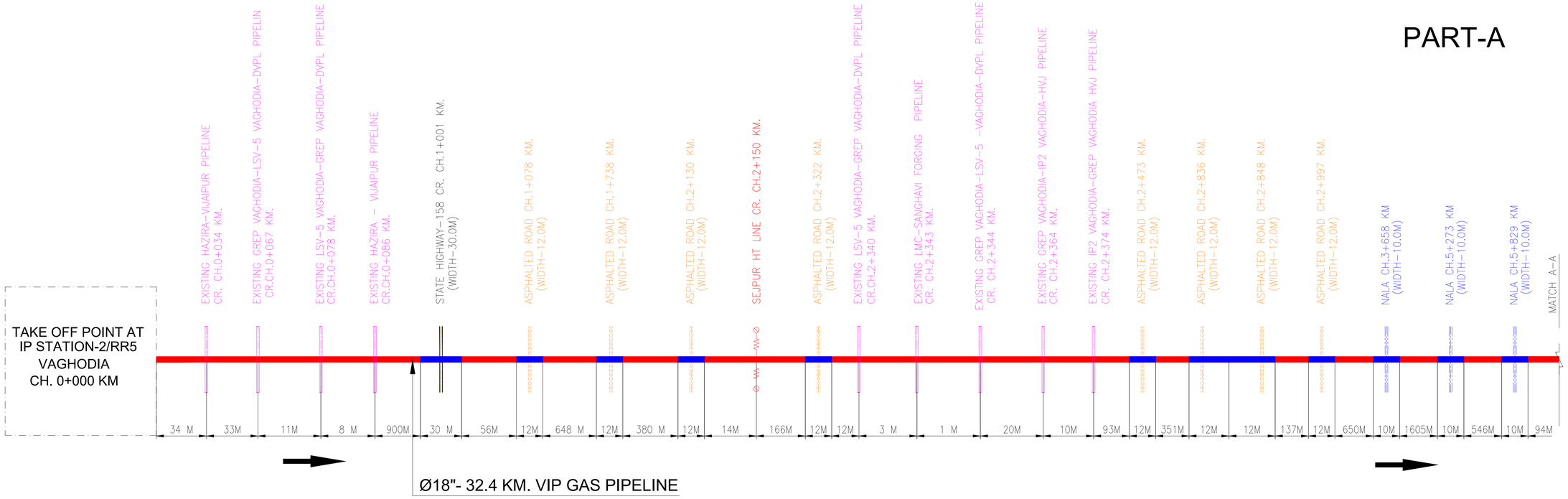
PMC: LYONS ENGINEERING PVT. LTD.

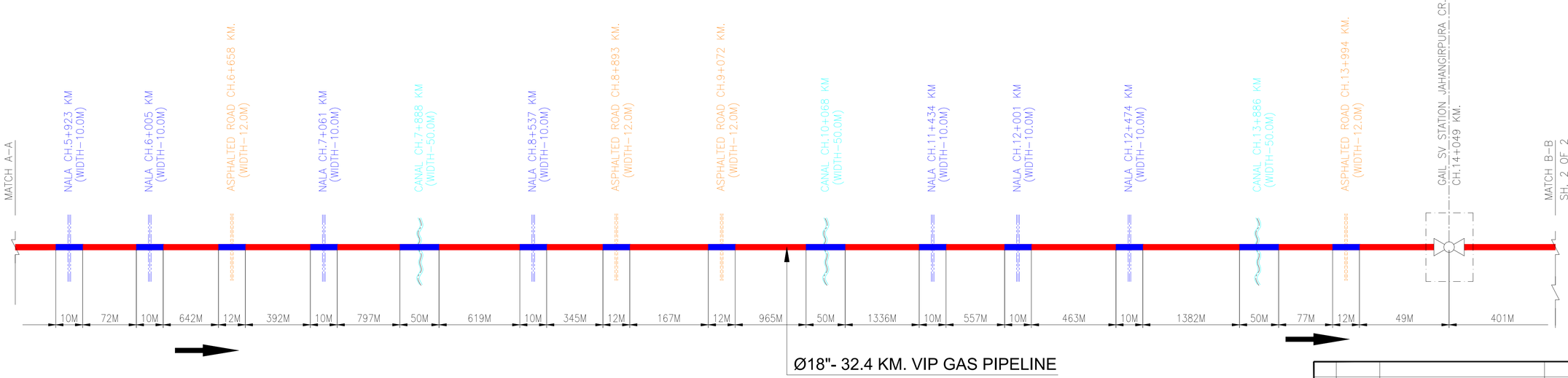
PROJECT: REPLACEMENT OF COATING AND ASSOCIATED WORK

| SCALE | TITLE |
|---|---|
| N.T.S. | SCHEMATIC DIAGRAM OF EXISTING PIPELINE CPF GANDHAR TO GNFC (GNFC LINE) |

| SIZE | JOB NO. | DRAWING NUMBER | SHEET | REV. |
|---|---|---|---|---|
| A3 | 034 | GAIL-034071-PR-DWG-SCHM-002 | 1 OF 1 | 0 |

# PART-A




LEGENDS:-

- NATIONAL/STATE HIGHWAY
- ASPHALTED, RCC, METALLED, BRICK ROAD
- RAILWAY LINE
- ANKOT INJECTION POINT
- NALA, DRAIN
- CANAL
- RIVER
- PIPELINE
- VALVE
- EXISTING PIPELINE

| REV. | DATE | DESCRIPTION | PREP. | CHKD. | APPD. |
|---|---|---|---|---|---|
| 0 | 09.06.20 | ISSUED FOR REVIEW | VKS | TR | SB |

CLIENT: GAIL (INDIA) LIMITED.

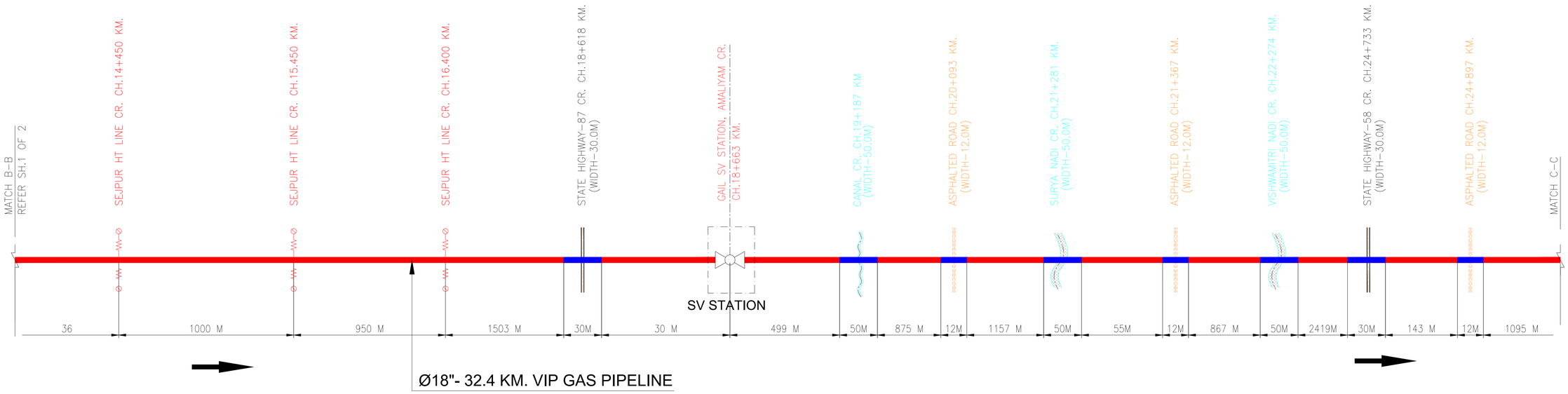
PMC: LYONS ENGINEERING PVT. LTD.

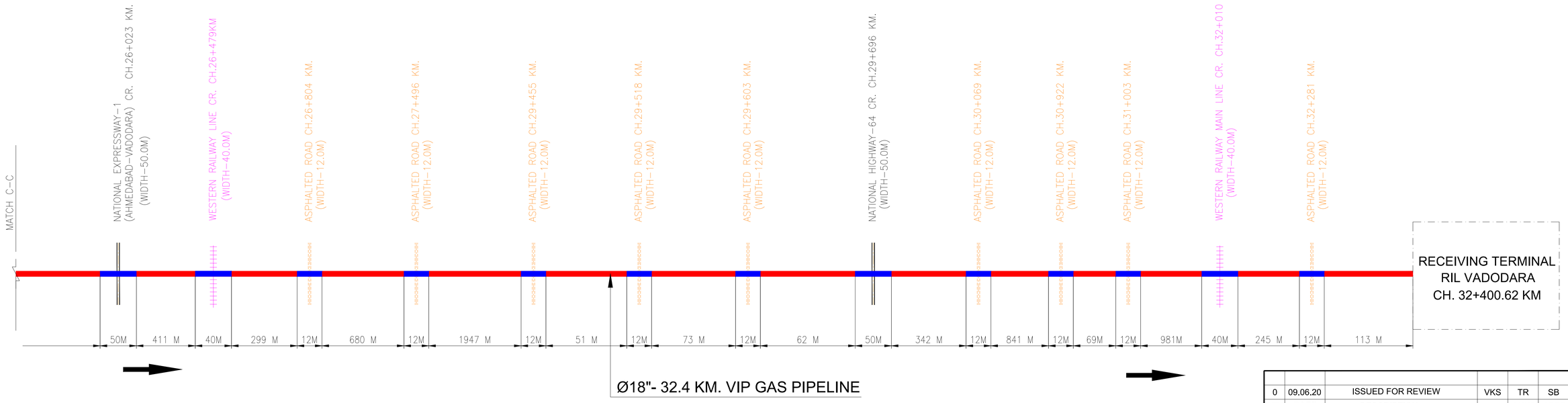
PROJECT: REPLACEMENT OF COATING AND ASSOCIATED WORK

| SCALE | TITLE |
|---|---|
| N.T.S. | SCHEMATIC DIAGRAM FOR RECOATING WORK - VIP LINE |

| SIZE | JOB NO. | DRAWING NUMBER | SHEET | REV. |
|---|---|---|---|---|
| A2 | 034 | GAIL-034071-PR-DWG-SCHM-003 | 1 OF 2 | 0 |

# PART-A




LEGENDS:-

- NATIONAL/STATE HIGHWAY
- ASPHALTED, RCC, METALLED, BRICK ROAD
- RAILWAY LINE
- ANKOT INJECTION POINT
- NALA, DRAIN
- CANAL
- RIVER
- VALVE
- EXISTING PIPELINE

- PIPELINE RECOATING – TOTAL LENGTH =31.450 KM.(APPROX.)
- PIPELINE UNDER CROSSING – TOTAL LENGTH =0.948 KM(APPROX.)

| REV. | DATE | DESCRIPTION | PREP. | CHKD. | APPD. |
|---|---|---|---|---|---|
| 0 | 09.06.20 | ISSUED FOR REVIEW | VKS | TR | SB |

CLIENT: GAIL (INDIA) LIMITED.

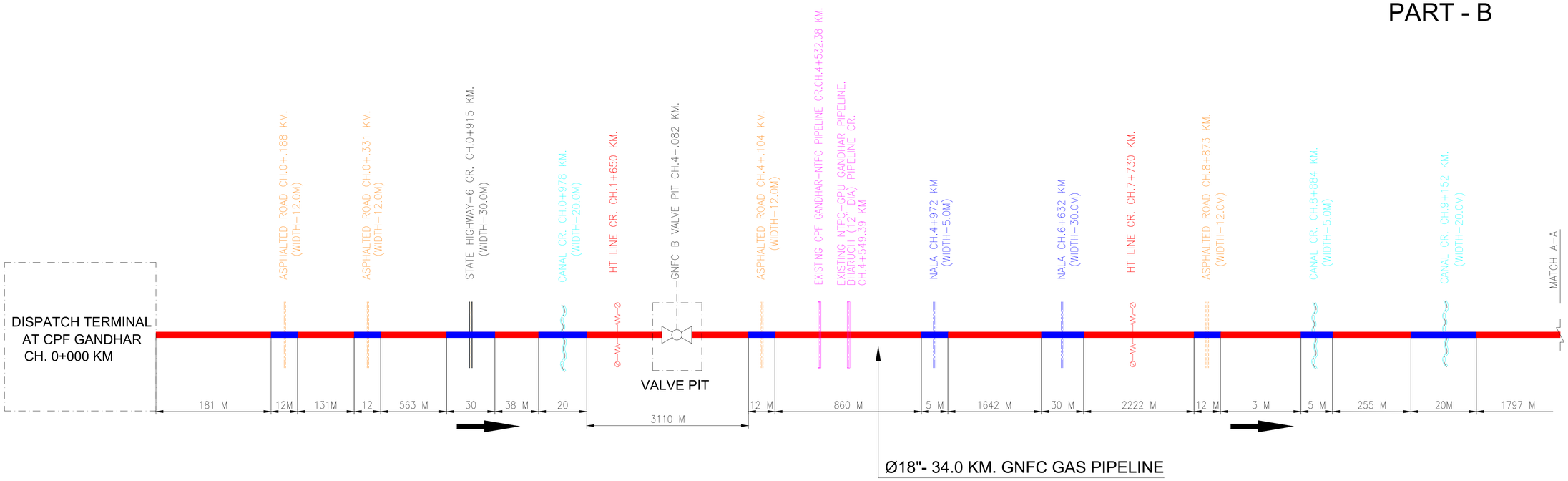
PMC: LYONS ENGINEERING PVT. LTD.

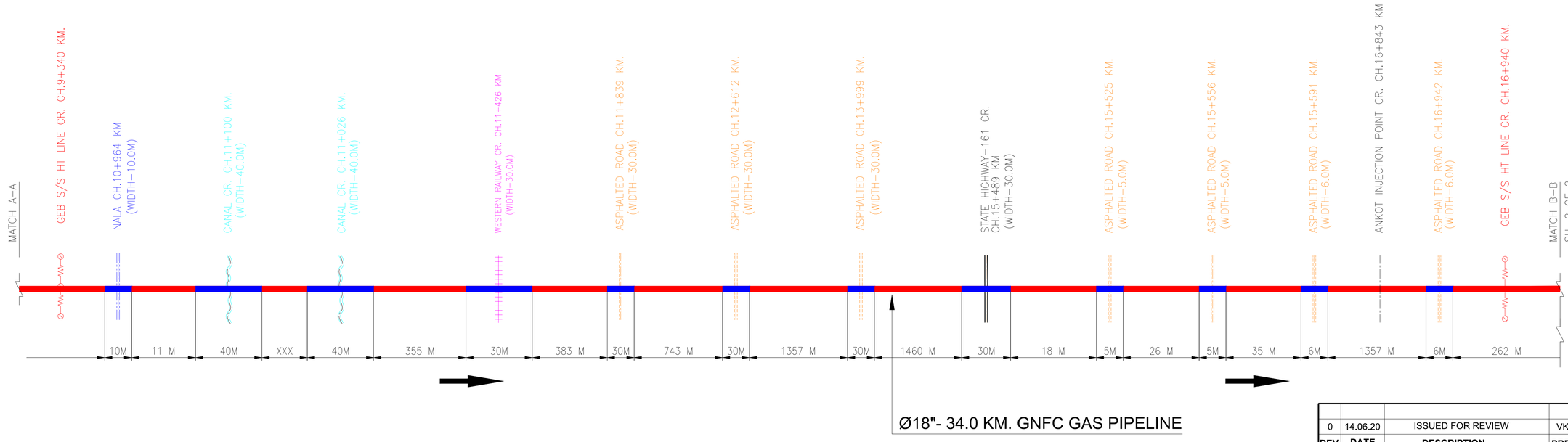
PROJECT: REPLACEMENT OF COATING AND ASSOCIATED WORK

| SCALE | TITLE |
|---|---|
| N.T.S. | SCHEMATIC DIAGRAM FOR RECOATING WORK - VIP LINE |

| SIZE | JOB NO. | DRAWING NUMBER | SHEET | REV. |
|---|---|---|---|---|
| A2 | 034 | GAIL-034071-PR-DWG-SCHM-003 | 2 OF 2 | 0 |

# PART - B




LEGENDS:-

- NATIONAL/STATE HIGHWAY
- ASPHALTED, RCC, METALLED, BRICK ROAD
- RAILWAY LINE
- ANKOT INJECTION POINT
- NALA, DRAIN
- CANAL
- RIVER
- PIPELINE
- VALVE
- EXISTING PIPELINE

| REV. | DATE | DESCRIPTION | PREP. | CHKD. | APPD. |
|---|---|---|---|---|---|
| 0 | 14.06.20 | ISSUED FOR REVIEW | VKS | TR | SB |

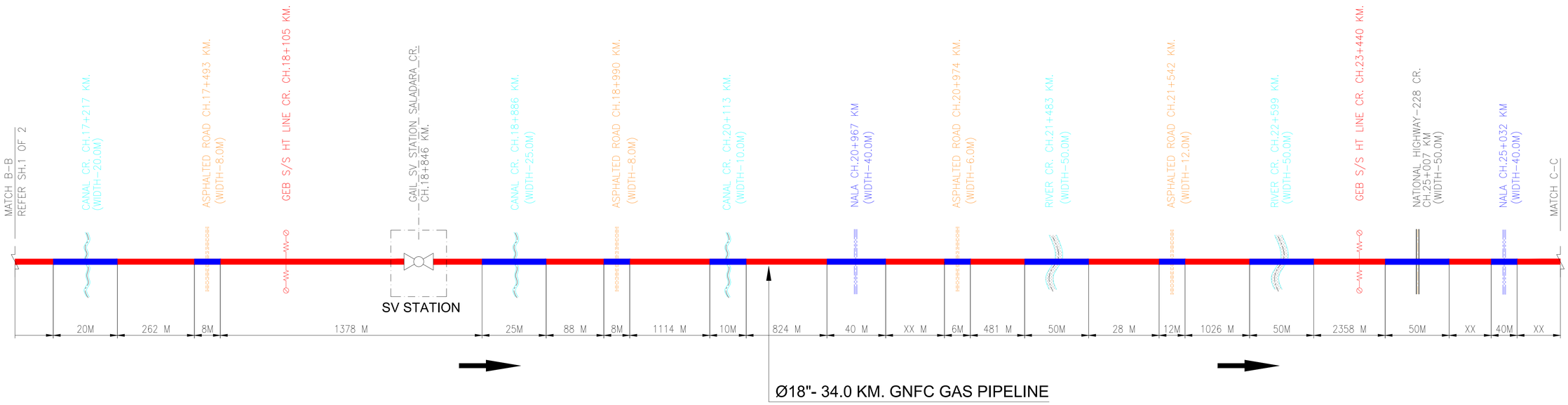
CLIENT: GAIL (INDIA) LIMITED.

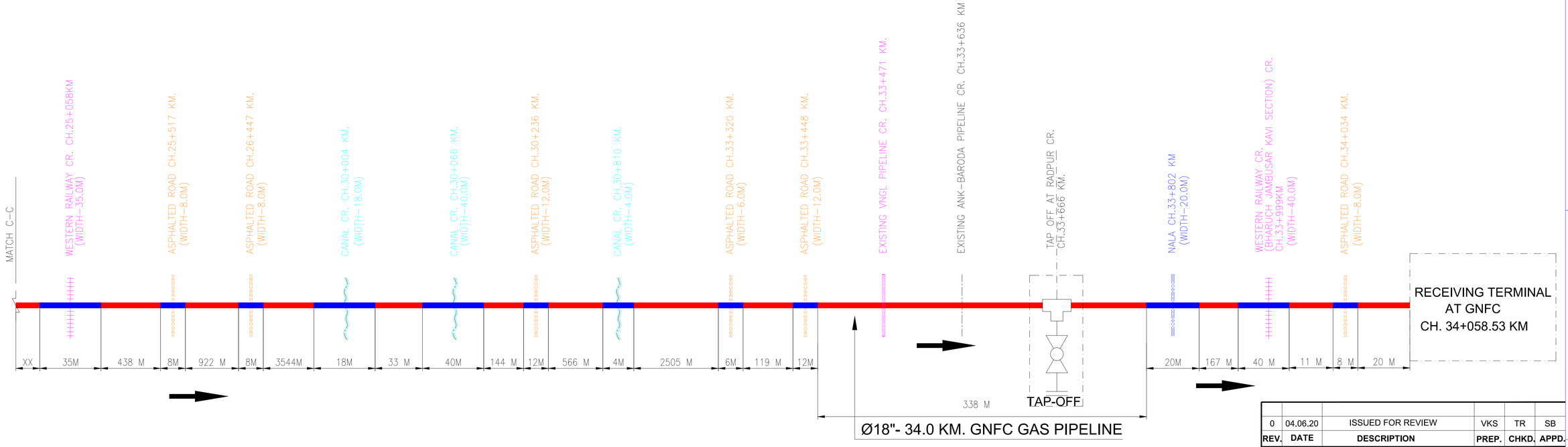
PMC: LYONS ENGINEERING PVT. LTD.

PROJECT: REPLACEMENT OF COATING AND ASSOCIATED WORK

| SCALE | TITLE | | | |
|---|---|---|---|---|
| N.T.S. | SCHEMATIC DIAGRAM FOR RECOATING WORK - GNFC LINE | | | |
| **SIZE** | **JOB NO.** | **DRAWING NUMBER** | **SHEET** | **REV.** |
| A2 | 034 | GAIL-034071-PR-DWG-SCHM-004 | 1 OF 2 | 0 |

# PART - B




LEGENDS:-

- NATIONAL/STATE HIGHWAY
- ASPHALTED, RCC, METALLED, BRICK ROAD
- RAILWAY LINE
- ANKOT INJECTION POINT
- NALA, DRAIN
- CANAL
- RIVER
- VALVE
- EXISTING PIPELINE

- PIPELINE RECOATING – TOTAL LENGTH =33.108 KM.(APPROX.)
- PIPELINE UNDER CROSSING – TOTAL LENGTH =0.950 KM(APPROX.)

| REV. | DATE | DESCRIPTION | PREP. | CHKD. | APPD. |
|---|---|---|---|---|---|
| 0 | 04.06.20 | ISSUED FOR REVIEW | VKS | TR | SB |

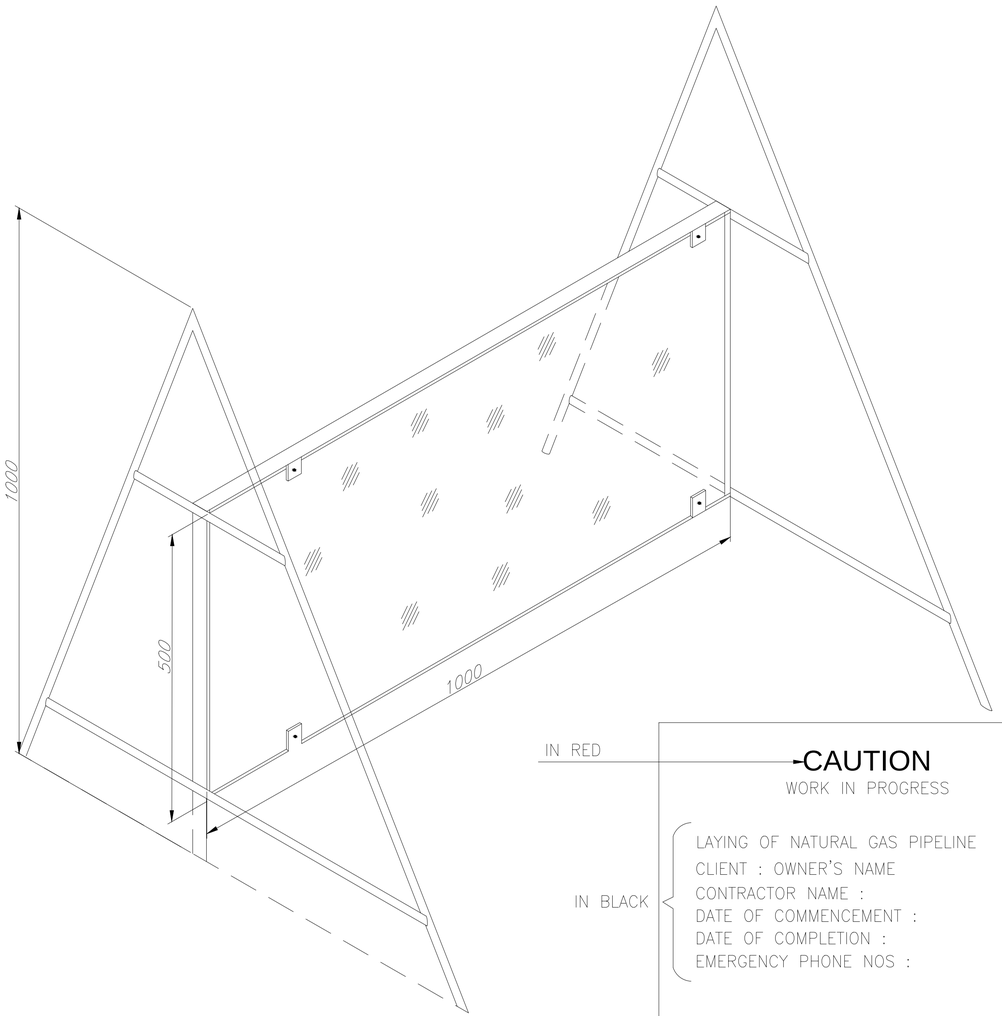
CLIENT: GAIL (INDIA) LIMITED.

PMC: LYONS ENGINEERING PVT. LTD.

PROJECT: REPLACEMENT OF COATING AND ASSOCIATED WORK

| SCALE | TITLE |
|---|---|
| N.T.S. | SCHEMATIC DIAGRAM FOR RECOATING WORK - GNFC LINE |

| SIZE | JOB NO. | DRAWING NUMBER | SHEET | REV. |
|---|---|---|---|---|
| A2 | 034 | GAIL-034071-PR-DWG-SCHM-004 | 2 OF 2 | 0 |




IN RED → CAUTION

WORK IN PROGRESS

IN BLACK

LAYING OF NATURAL GAS PIPELINE
CLIENT : OWNER'S NAME
CONTRACTOR NAME :
DATE OF COMMENCEMENT :
DATE OF COMPLETION :
EMERGENCY PHONE NOS :

## NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.

| REV. | DATE | DESCRIPTION | PREP. | CHKD. | APPD. |
|---|---|---|---|---|---|
| 0 | 01.06.20 | ISSUED FOR REVIEW | DV | JR | SB |

CLIENT: GAIL (INDIA) LIMITED

PMC: LYONS ENGINEERING PVT. LTD.

PROJECT: REPLACEMENT OF COATING AND ASSOCIATED WORK

| SCALE | TITLE: TYPICAL BARRICADES DRAWING | | | |
|---|---|---|---|---|
| AS SHOWN | | | | |
| **SIZE** | **JOB NO.** | **DRAWING NUMBER** | **SHEET** | **REV.** |
| A3 | 034 | GAIL-STD-CV-DWG-TP-001 | 1 OF 1 | 0 |

# STANDARD SPECIFICATION FOR HEALTH, SAFETY AND ENVIRONMENT (HSE) MANAGEMENT AT CONSTRUCTION SITES

# GAIL-STD-HSE-DOC-TS-001

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 0 | 08.03.2022 | Issued for Review | SC | SB | HM | |
| **Rev** | **Date** | **Purpose** | **Prepared By** | **Checked By** | **Approved By** | |

## 1.0 SCOPE

This specification establishes the health, Safety and environment (HSE) management requirement to be complied by Contractors during construction.

Requirements stipulated in this specification shall supplement the requirements of HSE management given in relevant Act (s)/legislations, General Conditions of Contract (GCC), Special Conditions of Contract (SCC) and Job (Technical) Specifications. Where different documents stipulate different requirements, the most stringent shall apply.

## 2.0 REFERENCES

The document should be read in conjunction with following:

- General Conditions of Contract (GCC)
  Special Conditions of Contract (SCC)
  Building and other construction workers (regulation of employment and condition of service) Act,1996
  Job (Technical) specifications
  Relevant IS Codes
  Statutory requirements

## 3.0 REQUIREMENTS OF HEALTH, SAFETY & ENVIRONMENT (HSE) MANAGEMENT SYSTEM TO BE COMPLIED BY BIDDERS

### 3.1 MANAGEMENT RESPONSIBILITY

#### 3.1.1 **HSE Policy & Objectives**

The Contractor should have a documented HSE policy & objectives to demonstrate commitment of their organization to ensure health, safety and environment aspects in their line of operations.

#### 3.1.2 **Management System**

The HSE management system of the Contractor shall cover the HSE requirements including but not limited to what is specified under para 1.0 and para 2.0 above.

#### 3.1.3 **Indemnification**

Contractor shall indemnify & hold harmless Owner/Consultant & their representatives free from any and all liabilities arising out of non-fulfilment of HSE requirements.

#### 3.1.4 **Personnel deployment**

Contractor as a minimum requirement shall designate/deploy the following persons at site:

a) Up to 250 persons deployed by him at site - Designate one safety supervisor

b) For 251 to 500 persons - Deploy one qualified &

| | | | |
|---|---|---|---|
| | | | \Experienced safety Engineer/Office in addition to Deployed by him at site the Safety Supervisor as described in (a) above. |
| c) | For more than 500 persons | - | Deploy an additional Safety Engineer/ Officer for every 500 Persons or part deployed by him at site thereof, in addition to (b) above. |

No work will be started at site until above safety personnel are mobilized at site. The contractor shall submit a safety organogram clearly indicating the lines of responsibility, reporting system and furnish Bio-Data/Resume/Curriculum Vitae with contact details of the safety personnel he intends to mobilize, at least 1 moth before the intended mobilization.

3.1.5 **Implementation & Monitoring**

Contactor shall be fully responsible for planning, implementing and monitoring all HSE requirements and compliance of all laws & statutory requirements. The Contractor shall also ensure that the HSE requirements are clearly understood & faithfully implemented at all levels at site.

3.1.6 **Awareness**

The Contractor shall promote and develop consciousness about Health, Safety and Environment among all personnel working for the Contractor. Regular awareness programs and fabrication shop/work site meetings shall be arranged on HSE activities to cover hazards involved in various operations during construction.

3.1.7 **Fire prevention & First-aid**

The contractor shall arrange suitable first aid measures such as First Aid Box, trained personnel to administer First Aid, stand-by ambulance or vehicle and install fire protection measures such as: adequate number of steel buckets with sand & water and adequate number of appropriate fire extinguishers to the satisfaction of OWNER/CONSULTANT.

3.1.8 **Documentation**

The contractor shall evolve a comprehensive, planned and documented system for implementation and monitoring of the HSE requirements. This shall be submitted to OWNER/CONSULTANT for approval. The monitoring for implementation shall be done by regular inspections and compliance to the observations thereof. The Contractor shall get similar HSE requirements implemented at his sub-contractor(s) work site/office. However, compliance of HSE requirements shall be the responsibility of the Contractor. Any review/approval by OWNER/CONSULTANT shall not absolve contractor of his responsibility/liability in relation to all HSE requirements.

3.1.9 **Audit**

Non-Conformances on HSE by Contractor (including his sub-contractors) as brought out during review/audit by his internal audit team as well as OWNER/Consultant's representative shall be resolved forthwith by Contractor. Compliance report shall be submitted to OWNER/CONSULTANT.

3.1.10 **Meetings**

The Contractor shall ensure participation of his top most executive at site (viz. Resident Engineer/Site-in-Charge) in Safety committee/HSE Committee meetings arranged by OWNER/CONSULTANT. The compliance of any observations during the meeting shall be arranged urgently. He shall assist OWNER/CONSULTANT to achieve the targets set by them on HSE during the project implementation.

3.1.11 The Contractor shall adhere consistently to all provisions of HSE requirements. In case of non-compliance or repeated failure in implementation of any of the HSE provisions; OWNER/CONSULTANT may impose stoppage of work without any cost & time implication to the Owner and/or impose a suitable penalty, up to a cumulative limit of 1.0% (one percent) of the contract value with a ceiling of Rs.10 lacs (Rupees Ten Lacs only). This penalty shall be in addition to all other penalties specified elsewhere in the contract. The decision of imposing stoppage work, its extent and penalty shall rest with OWNER/CONSULTANT. The same shall be binding on the Contractor. The penalty does not make the contractor eligible to continue the work in unsafe manner.

3.2 HOUSE KEEPING

3.2.1 Contractor shall ensure that a high degree of house keeping is maintained and shall ensure interalia; the following:

All surplus earth and debris are removed/disposed off from the working areas to identified location(s). Unused/surplus cables, steel items and steel scrap lying scattered at different places within the working areas are removed to identified location(s).
All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified location(s).
Roads shall be kept clear and materials like pipes, steel, sand, boulders, concrete, chips and bricks etc. shall not be allowed on the roads to obstruct free movement of men & machines.
Fabricated steel structural, pipes & piping materials shall be stacked properly for erection.Water logging on roads shall not be allowed.
No parking of trucks/trolleys, cranes and trailors etc. shall be allowed on roads, which may obstruct the traffic movement.
Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas. Trucks carrying sand, earth and pulverized materials etc. shall be covered while moving within the plant area/or these materials shall be transported with top surface wet.
The contractor shall ensure that the atmosphere in plant area and on roads is free from particulate matter like dust, sand, etc. by keeping the top surface wet for ease in breathing.
At least two exits for any unit area shall be assured at all times.

3.3 HSE MEASURES

3.3.1 **Construction Hazards**

Contractor shall ensure that during the performance of the work, all hazards have been identified, assessed and eliminated.

A list of construction hazards along with their effects & preventive measures is given in the Annexure-V.

### 3.3.2 **Accessibility**

The Contractor shall provide safe means of access to any working place including provisions of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen and OWNER/CONSULTANT.

### 3.3.3 **Personal Protective Equipments (PPEs)**

The contractor shall ensure that all their staff and workers including their sub-contractor(s)'s have been issued & wear appropriate PPEs like safety helmets, safety shoes, safety belt, full body harness, protective goggles, gloves etc. All these gadgets shall conform to applicable IS Specifications/CE or other applicable international standards.

For shot blasting, the usage of protective helmets (approved by the competent authority), gauntlet and protective clothing is mandatory.

For offshore contracts, contractor shall provide PPEs (new) to CONSULTANT & Owner's personnel at his (contractor's) cost. All personnel shall wear life jacket at all time.

### 3.3.4 **Working at height**

The contractor shall issue height permit for working above 3 meters height after verifying and certifying the checkpoints as specified in the attached permit. He shall also undertake to ensure compliance to the conditions of the permit during the currency of the permit including adherence to personal protective equipments.

The permit shall be issued initially for one week or expected duration of an activity and extended further for the balance duration. This permit shall be applicable in areas where specific clearance from Owner's operation Department/Safety Department is not applicable. CONSULTANT field Engineers/Safety Officers/Area Coordinators may verify and sign this permit during the execution of the job.

In case work is undertaken without taking sufficient precautions as given in the permit, CONSULTANT Engineers may cancel the permit and strop the work till satisfactory compliance is arranged. Contractors are expected to maintain a register for issuance of permit and extensions thereof including preserving the used permits for verification during audits etc.

Contractor shall arrange (at his cost) and ensure sue of Fall Arrester Systems by his workers. Fall arresters are to be used while climbing tall structures. These arresters should lock automatically against the anchorage line, restricting free fall of the user. The device is to be provided with a double security opening system to ensure safe attachment or release of the user at any point of rope. In order to avoid shock, the system should be capable of keeping the person in vertical position in case of a fall.

Contractor shall ensure that Life Lines are used by all personnel while working at height. One end of the life line shall be firmly tied with the worker and the other end with a fixed and rigid structure. The life line should be strong enough to take the load of the worker in case of a fall.

Contractor shall provide Roof Top Walk ladders for carrying out activities on sloping roofs in order to reduce the changes of slippages.

Contractor shall ensure that a proper Safety Net System is used wherever the hazard of fall from height is present. The safety net shall be located not more than 9.0 meters below the working surface extending on either side up to sufficient margin to arrest or to reduce the consequences of a possible fall of persons working at different heights.

### 3.3.5 **Electrical installations**

The contractor shall ensure that electrical systems and equipment including tools and tackles are properly selected, installed, used and maintained.

The contractor shall deploy qualified and licensed electricians for proper and safe installation and for regular inspection of construction power distribution lines/points including their earthing. A copy of the license shall be submitted to CONSULTANT for records.

### 3.3.6 **Welding/Gas cutting**

Contractor shall ensure that flash back arresters conforming to BS: 6158 or equivalent are installed on all gas cylinders while in use. All cylinders shall be mounted on trolleys. All welding machines shall have effective earthing. To eliminate radiation hazard, Tungsten electrodes used for Gas Tungsten Arc Welding shall not contain Thorium.

### 3.3.7 **Ergonomics and tools & tackles**

The Contractor shall assign to his workmen, tasks commensurate with their qualification, experience and state of health. All lifting tools, tackles, equipment, accessories including cranes shall be tested periodically by statutory/competent authority for their condition and load carrying capacity. Valid test and fitness certificates from the authority shall be submitted to Owner/CONSULTANT for their review/acceptance before the lifting tools, tackles, equipment, accessories and cranes are used.

Contractor shall ensure installation of Safe Load Indicator (SLI) on all cranes (while in use) to minimize overload risk. SLI shall have capability to continuously monitor and display the load on the hook, and automatically compare it with the rated crane capacity at the operating condition of the crane. The system shall also provide visual and audible warnings at set capacity levels to alert the operator in case of violations.

### 3.3.8 **Occupational Health**

The contractor shall identify all operations that can adversely affect the health of its workers and issue and implement mitigation measures. For surface cleaning operations, sand blasting shall not be permitted even if not explicitly stated elsewhere in the contract.

### 3.3.9 **Hazardous substances**

Hazardous and/or toxic materials such as solvent coating or thinners shall be stored in appropriate containers, which shall be labeled with the name of the materials, the hazards associated with its use and necessary precautions to be taken.

Where contact or exposure of hazardous materials/Noise pollution exceeds the specified limit or otherwise have harmful affects, appropriate personal protective equipments such as gloves, earmuffs, goggles, aprons, chemical resistant clothing, respirator, etc. shall be used.

### 3.3.10 **Spills**

Chemical and other spills shall be contained and cleaned up immediately to prevent further contamination.

### 3.3.11 **Radiation exposure**

a) All personnel exposed to physical agents such as non-ionizing radiation, ultraviolet rays or similar other physical agents shall be provided with adequate shielding or protection commensurate with the type of exposure involved.
b) For ionizing radiation, requirements of Bhabha Atomic Research Centre (BARC) shall be followed.

### 3.3.12 **Road Safety**

The contractor shall ensure adequately planned road transport safety management system. The vehicles shall be fitted with reverse warning alarms. The contractor shall also ensure a separate pedestrian route for safety of the workers and comply with all traffic rules and regulations.

For pipeline jobs, the contractor shall submit a comprehensive plan covering transportation of pipes, movement of side booms, movement of vehicles on the ROW, etc.

### 3.3.13 **Welfare measures**

Contractor shall at the minimum, ensure the following facilities at work sites :

A crèche where 10 or more female workers are having children below the age of 6 years.

Reasonable canteen facilities at appropriate location depending upon site conditions.

Rest rooms (separate for male workers and female workers)
Toilets, drinking water, adequate lighting at site and labour camps, commensurate with applicable Laws/Legislation.

### 3.3.14 **Environment Protection**

Contractor shall ensure proper storage and utilization methodology of materials that are detrimental to the environment. Where required, contractor shall ensure that only the environment friendly materials are selected and emphasize on recycling of waste materials such as metals, plastics, glass, paper, oil and solvents.

For pipeline jobs, top soil shall be stacked separately while making ROW through fields. This fertile soil shall be placed back on top after backfilling.

### 3.3.15 **Rules & Regulations**

All persons deployed at site shall be knowledgeable of and comply with the environmental laws, rules and regulations relating to the hazardous materials, substances and wastes.

Contractor shall not dump, release or otherwise discharge or dispose off any such materials without the express authorization of OWNER/CONSULTANT.

## 3.4 TOOL BOX MEETING (TBM)

Contractor shall conduct daily TBM with workers prior to start of work and shall maintain proper record of the meeting. A suggested format is given below. The TBM is to be conducted by the immediate supervisor of the workers.

| **TOOL BOX MEETING RECORDING SHEET** | | |
|---|---|---|
| Date & Time | | |
| Subject | | |
| Presenter | | |
| Hazards Involved | | |
| Precautions to be taken | | |
| Worker's Name | Signature | Section |
| | | |
| Remarks, if any | | |

The topics during TBM shall include:

Hazards related to work assigned on that day and precautions to be taken.
Any forthcoming HSE hazards/events/instruction/orders, etc.

The above record can be kept in local language, which workers can read. These records shall be made available to OWNER/CONSULTANT whenever demanded.

## 3.5 TRAINING

Contractor shall ensure that all his personnel possess appropriate training to carryout the assigned job safely. The training should be imparted in a language understood by them and should specifically be trained about.

Potential hazards to which hey may be exposed at their workplace
Measures available for prevention, recurrence and elimination of these hazards

The topics during training shall cover, at the minimum:

Education about hazardous jobs and precautions required
Emergency and evacuation plan
HSE requirements
Fire fighting and First-Aid
Use of PPEs

Records of the training shall be kept and submitted to OWNER/CONSULTANT whenever demanded.

For off-shore and jetty jobs, contractor shall ensure that all personnel deployed have undergone structured training on swimming, use of lifeboats, basket landing, etc.

### 3.6 INSPECTION/AUDIT

The contractor shall carry out daily HSE inspection and record observations at a central location. These inspection records shall be freely accessible to Owner/CONSULTANT representatives. He shall also carry out internal HSE audits as well as cooperate during HSE audits by Owner/CONSULTANT, which will be at least two times during the project execution period.

## **4.0** DETAILS OF HSE MANAGEMENT SYSTEM BY CONTRACTOR

### 4.1 ON AWARD OF CONTRACT

The Contractor shall submit a comprehensive Health, Safety and Environment manual or procedure and HSE Plans for approval by OWNER/CONSULTANT prior to start of work. The Contractor shall participate in the pre-start meeting with OWNER/CONSULTANT to finalize HSE Plans including the following:

Job procedure to be followed by Contractor for activities covering handling of equipments, scaffolding, electric installations, etc. describing the risks involved, actions to be taken and methodology for monitoring each activity.
OWNER/CONSULTANT review/audit requirement.
Organization structure along with responsibility and authority, records/reports etc. on HSE activities.
Procedures for reporting and investigation of accidents and near misses
HSE Training programmes.
Reference to Rules, Regulations and Statutory requirements.
HSE reports.

### 4.2 DURING JOB EXECUTION

4.2.1 Contractor shall implement approved Health, Safety and Environment management procedure/plan/manual including but not limited to as brought out under Para 3.0. Contractor shall also ensure :

to arrange workmen compensation insurance, registration under ESI Act, third party liability insurance etc., as applicable

to arrange all HSE permits before start of activities (as applicable), like permits for hot work, confined space, working at heights, storage of chemical/explosive materials and its use and implement all precautions mentioned therein. In this regard, requirements of Oil industry Safety Directorate Standard No. Std-105 “Work Permit Systems” shall be complied with while working in existing plants.

to submit, timely, the completed checklist on HSE activities Monthly HSE report, accident reports, investigation reports etc. as per OWNER/CONSULTANT requirements. Compliance of instructions on HSE shall be done by Contractor and informed urgently to OWNER/CONSULTANT.

That his top most executive at site attends all the Safety Committee/HSE meetings arranged by OWNER/CONSULTANT. Only in case of his absence from site that a second senior most

person shall be nominated by him, in advance, and communicated to OWNER/CONSULTANT.

Display at site office and work locations caution boards, list of hospitals, emergency services available, etc.

Provide posters, banners for safe working to promote safety consciousness.
Assess, analyze and mitigate the construction hazards.
Carryout audits/inspection at his works as well as sub contractor works as per approved HSE document and submit the reports for OWNER/CONSULTANT review.
Assistance and cooperation during HSE audits by OWNER/CONSULTANT, and submit compliance report.
Generation and submission of HSE records/report as per HSE Plan. And this specification.
Apprise OWNER/CONSULTANT on HSE activities at site.
Carryout all dismantling activities safely, with prior approval of OWNER/CONSULTANT representative.

## 1.0 RECORDS

The contractor shall maintain/submit HSE records in the following reporting formats:

1. Monthly HSE checklist cum compliance report Accident/Fire report
   Supplementary Accident & Investigation report
2. Monthly HSE report
3. Permit for working above 3 mete height
4. HSE Plan

**IS – CODES FOR HSE**

| | |
|---|---|
| SP:53 | Safety code for the use, Care and protection of hand operated tools. |
| IS: 816 | Code of practice for safety and health requirements in electric and gas welding and cutting operations |
| IS: 1179 | Eye and Face precautions during welding, equipment etc. |
| IS: 1860 | Safety requirements for use, care and protection of abrasive grinding wheels. |
| IS: 1989(Part–I & II) | Leather safety boots and shoes |
| IS: 2925 | Industrial Safety Helmets |
| IS: 3016 | Code of practice for fire safety precautions in welding and cutting operations. |
| IS: 3043 | Code of practice for earthing. |
| IS: 3521 | Industrial Safety belts and harness. |
| IS: 3738 | Rubber boots. |
| IS: 3996 | Safety Code of scaffolds and ladders. |
| IS: 4770 | Rubber gloves for electrical purposes |
| IS: 5216 (Part-I | Recommendations on Safety procedures and practices in electrical works |
| IS: 5557 | Industrial and Safety rubber lined boots. |
| IS: 5983 | Eye protectors |
| IS:6519 | Selection, care and repair of Safety footwear |
| IS: 6994 (Part-I) | Industrial Safety Gloves (Leather & Cotton Gloves) |

| | |
|---|---|
| IS: 7293 | Safety Code for working with construction Machinery |
| IS: 9167 | Ear protectors |
| IS: 11006 | Flash back arrestor (Flame arrestor) |
| IS:11016 | General and safety requirements for machine tools and their operation |
| IS: 11226 | Leather safety footwear having direct moulded rubber sole |
| IS: 11972 | Code of practice for safety precaution to be taken when entering a sewerage system |
| IS: 13367 | Code of practice-safe use of cranes |
| IS: 13416 | Recommendations for preventive measures against hazards at working place |

## ANNEXURE - II

## DETAILS OF FIRST AID BOX

| SL.NO. | DESCRIPTION | *QUANTITY* |
|---|---|---|
| 1. | Small size Roller Bandages, 1 inch wide (Finger Dressing small) | 6 Pcs. |
| 2. | Medium size Roller Bandages, 2 inch wide (Hand and Foot Dressing) | 6 Pcs. |
| 3. | Large size Roller Bandages, 4 inch wide (Body Dressing Large) | 6 Pcs. |
| 4. | Large size Burn Dressing (Bun Dressing Large) | 4 Pkts. |
| 5. | Cotton wool (20 gms packing) | 4 Pkts. |
| 6. | Antiseptic Solution Dettol (100 ml.) or Savalon | 1 Bottle |
| 7. | Mercurochrome Solution (100 ml.) 2% in water | 1 Bottle |
| 8. | Sal-volatile (20 ml. Ammonia) | 1 Bottle |
| 9. | A Pair of Scissor | 1 Piece |
| 10. | Adhesive Plaster (1.25 cm x 5 m) | 1Spool |
| 11. | Eye pads in Separate Sealed Packet | 4 Pcs. |
| 12. | Tourniquet | 1 No. |
| 13. | Safety Pins | 1 Dozen |
| 14. | Tine IODINE (100 ml.) | 1 Bottles |
| 15. | Ointment for burns (Burnol 20 gms.) | 1 Bottole |
| 16. | Polythene Wash cup for washing eyes | 1 No. |
| 17. | Potassium Permanganate (20 gms.) | 1 Pkt. |
| 18. | Tinc. Benzoine (100 ml.) | 1 Bottole |
| 19. | Triangular Bandages | 2 Nos. |
| 20. | Band Aid Dressing | 5 Pcs. |
| 21. | Iodex (25 gms.) | 1 Bottole |
| 22. | Tongue Depressor | 1 No. |
| 23. | Boric Acid Powder (20 gms.) | 2 Pkt. |
| 24. | Sodium Bicarbonate (20 gms.) | 1 Pkt. |
| 25. | Dressing Powder (Nebasulf) (10 gms.) | 1 Bottole |
| 26. | Medicinal Glass | 1 No. |
| 27. | Duster | 1 No. |
| 28. | Booklet (English & Local Language) | 1 No. each |
| 29. | Soap | 1 No. |
| 30. | Toothache Solution | 1 No. |
| 31. | Eye Ointment | 1 Bottle |
| 32. | Vicks (22 gms.) | 1 Bottle |
| 33. | Forceps | 1 No. |
| 34. | Cottom Buds (5 nos.) | 1 Pkt. |
| 35. | Note Book | 1 No. |
| 36. | Splints | 4 Nos. |
| 37. | Lock | 1 Piece |
| 38. | Life Saving/Emergency/Over-the Counter Drugs | As decided at site |
| | NOTE : Type of Box<br>Size | Aluminum<br>14” x 12” x 4” |

**Annexure-III**

**TYPES OF FIRE EXTINGUISHERS AND THEIR APPLICATION**

| | **CARBON DIOXIDE** | **DRY CHEMICAL** | | | | **WATER TYPE** | | | | **FOAM** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | SODIUM POTASSIUM BICARBONATE | | MULTI PURPOSE A B C | | | | | | |
| | CO2 | CARTRIDGE OPERATED | STORED PRESURE | STORED PRESSURE | CARTRIDGE OPERATED | STORED PRESSURE | CARTRIDGE OPERATED | WATER PUMP TANK | SODA ACID | FOAM |
| CLASS A FIRES WOOD PAPER TRASH HAVING GLOWING EMBERS | x | X | x | _/ | _/ | _/ | _/ | _/ | _/ | _/ |
| | (BUT CAN CONTROL MINOR SURFACE FIRES) | | | | | | | | | |
| CLASS B FIRES FLAMMABLE LIQUIDS GASOLINE OIL PAIN GRASE ETC. | _/ | _/ | _/ | _/ | _/ | X | X | X | X | _/ |
| CLASS C FIRES ELECTRICAL EQUIPMENT | _/ | _/ | _/ | _/ | _/ | X | X | X | X | X |

LEGEND : _/ : CAN BE USED

X : NOT TO BE USED

***ANNEXURE-IV***

***INDICATIVE LIST OF STATUTORY ACTS & RULES***

Indian Explosives Act, 1984
The Motor Vehicles Act, 1988
The Factories Act, 1949
The Petroleum Act, 2002
Workmen Compensation ‘act
Static/Mobile Pressure Vessel Act
Indian Electricity Act
Indian Boiler Act, 1923
Water (Prevention & Control Pollution) Act, 1974
Water (Prevention & Control of Pollution) Cess Act-1977
The Mines & Minerals (Regulation & Development) Act-1947
The Air (Prevention & control of Pollution) Act-1981
The Atomic Energy Act-1962
The Radiation Protection Rules-1971
The Indian Fisheries Act-1954
The Indian Forest Act-1927
The Wild Life (Protection) Act-1972
The Environment (Protection) Act-1986
The Environment (Protection) Rules-1986
The Hazardous Wastes (Management & Handling) Rules-1989
The Manufacture, Storage & Import of Hazardous Chemicals Rules-1989
The Central Motor Vehicles Rules-1989
The Building and Other Construction Workers (Regulation of Employment and Condition of Service) Act, 1996

## ANNEXURE-V

### *CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES*

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| (A) EXCAVATION<br>• Pif Excavation up to 3.0m | ➢ Falling into pit | ➢ Personal injury | ➢ Provide guard rails/barricade with warning signal.<br>➢ Provide at least two entries/exits.<br>➢ Provide escape ladders. |
| | ➢ Earth Collapse | ➢ Suffocation/ Breathlessness<br>➢ Buried | ➢ Provide suitable size of shoring and strutting, if required.<br>➢ Keep soil heaps away from the edge equivalent to 1.5m or depth of pit whichever is more.<br>➢ Don't allow vehicles to operate too close to excavated areas. Maintain at least 2m distance from edge of cut.<br>➢ Maintain sufficient angle of repose. Provide slope not less than 1:1 and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock.<br>➢ Battering/benching the sides. |
| | ➢ Contact with buried electric cables<br>➢ Gas/Oil Pipelines | ➢ Electrocution<br>➢ Explosion | ➢ Obtain permission from competent authorities, prior to excavation, if required.<br>➢ Locate the position of buried utilities by referring to plant drawings.<br>➢ Start digging manually to locate the exact position of buried utilities and thereafter use mechanical means. |
| • Pit Excavation beyond 3.0m | ➢ Same as above plus<br>➢ Flooding due to excessive | ➢ Can cause drowning situation | ➢ Prevent ingress of water<br>➢ Provide ring buoys<br>➢ Identify and provide suitable size dewatering pump or well point system |

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | rain/ underground water | | |
| | ➢ Digging in the vicinity of existing Building/ Structure | ➢ Building/Structure may collapse<br>➢ Loss of health & wealth | ➢ Obtain prior approval of excavation method from local authorities<br>➢ Use under-piping method<br>➢ Construct retaining wall side by side |
| | ➢ Movement of vehicles/ equipments close to the edge of cut. | ➢ May cause cave-in or slides<br>➢ Persons may get buried | ➢ Barricade the excavated area with proper lighting arrangements<br>➢ Maintain at least 2m distance from edge of cut<br>➢ Strengthen shoring and strutting |
| • Narrow deep excavations for pipelines, etc. | ➢ Same as above plus<br>➢ Frequent cave-in or slides | ➢ May cause severe injuries or prove fatal | ➢ Battering/benching of sides<br>➢ Provide escape ladders |
| | ➢ Flooding due to Hydro testing | ➢ May arise drowning situation | ➢ Same as above plus<br>➢ Bail out accumulated water<br>➢ Maintain adequate ventilation |
| • Rock excavation by blasting | ➢ Improper handling of explosives | ➢ May prove fatal | ➢ Ensure proper storage, handling & carrying of explosives by trained personnel.<br>➢ Comply with the applicable explosive acts & rules. |
| | ➢ Uncontrolled explosion | ➢ May cause severe injuries or prove fatal | ➢ Allow only authorized persons to perform blasting operations.<br>➢ Smoking and open flames are to be strictly prohibited. |
| | ➢ Scattering of stone pieces in atmosphere | ➢ Can hurt people | ➢ Use PPE like goggles, face mask, helmets etc. |
| • Rock excavating by blasting (Contd) | ➢ Entrapping of persons/animals. | ➢ May cause severe injuries or prove fatal | ➢ Barricade the area with red flags and blow siren before blasting. |
| | ➢ Misfire | ➢ May explode suddenly | ➢ Do not return to site for at least 20 minutes or unless announced safe by |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | | | designated person. |
| • Piling Work | ➢ Failure of pile-driving equipment | ➢ Can hurt people | ➢ Inspect Piling rigs and pulley blocks before the beginning of each shift. |
| | ➢ Noise pollution | ➢ Can cause deafness and psychological imbalance. | ➢ Use personal protective equipments like ear plugs, muffs, etc. |
| | ➢ Extruding rods/casing | ➢ Can hurt people | ➢ Barricade the area an install sign boards<br>➢ Provide first-aid |
| | ➢ Working in the vicinity of 'Live-Electricity' | ➢ Can cause electrocution / asphyxiation | ➢ Keep sufficient distance from Live-Electricity as per IS code.<br>➢ Shut off the supply, if possible<br>➢ Provide artificial/rescue breathing to he injured. |
| (B) CONCRETING | ➢ Air pollution by cement | ➢ May affect Respiratory System | ➢ Wear respirators or cover mouth and nose with wet cloth. |
| | ➢ Handling of ingredients | ➢ Hands may get injured | ➢ Use gloves and other PPE. |
| | ➢ Protruding reinforcement rods. | ➢ Feet may get injured | ➢ Use Safety shoes.<br>➢ Provide platform above reinforcement for movement of workers. |
| | ➢ Earthing of electrical mixers, vibrators, etc. not done | ➢ Can cause electrocution / asphyxiation | ➢ Ensure earthing of equipments and proper functioning of electrical circuit before commencement of work. |
| | ➢ Falling of materials from height | ➢ Persons may get injured | ➢ Use hard hats<br>➢ Remove surplus material immediately from work place<br>➢ Ensure lighting arrangements during night hours. |
| | ➢ Continuous pouring by same gang | ➢ Cause tiredness of workers and may lead to | ➢ Insist on shift pattern<br>➢ Provide adequate rest to workers between subsequent pours. |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | | accident. | |
| | ➢ Revolving or concrete mixer/ vibrators | ➢ Parts of body or clothes may get entrapped. | ➢ Allow only mixers with hopper<br>➢ Provide safety cages around moving motors<br>➢ Ensure proper mechanical locking of vibrator |
| • Super-structure | ➢ Same as above plus<br>➢ Deflection in props or shuttering material | ➢ Shuttering/p rops ma collapse and prove fatal | ➢ Avoid excessive stacking on shuttering material<br>➢ Check the design and strength of shuttering material before commencement of work<br>➢ Rectify immediately the deflection noted during concreting |
| | ➢ Passage to work place | ➢ Improperly tied and designed props/planks may collapse | ➢ Ensure the stability and strength of passage before commencement of work<br>➢ Do not overload and stand under the passage |
| (C) REINFORCEMENT | ➢ Curtailment and binding of rods | ➢ Persons may get injured | ➢ Use PPE like gloves, shoes, helmets, etc.<br>➢ Avoid usage of shift tools |
| | ➢ Carrying of rods for short distance/at heights | ➢ Workers may get injured their hands and shoulders. | ➢ Provide suitable pads on shoulders and use safety gloves<br>➢ Tie up rods in easily liftable bundles<br>➢ Ensure proper staging. |
| | ➢ Checking of clear distance/cover with hands | ➢ Rods may cut or injure the finger | ➢ Use measuring devices like tape, measuring rods, etc. |
| | ➢ Hitting projected rods and standing on cantilever rods | ➢ Persons may get injured and fell down | ➢ Use safety shoes and avoid standing unnecessarily on cantilever rods<br>➢ Avoid wearing of loose clothes |
| | ➢ Falling of material from height | ➢ May prove fatal | ➢ Use helmets<br>➢ Provide safety nets |
| | ➢ Transport | ➢ Protruded | ➢ Use red flags/lights at the |

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | ation of rods by trucks | rods may hit the persons | ends<br>➢ Do not protrude the rods in front of or by the side of driver's cabin.<br>➢ Do not extend the rods 1/rd of deck length or 1.5 m which is less |
| (D) WELDING AND GAS CUTTING | ➢ Welding radiates invisible ultraviolet and infrared rays | ➢ Radiation can damage eyes and skin. | ➢ Use specified shielding devices and other PPE of correct specifications<br>➢ Avoid throated tungsten electrodes for GTAW |
| | ➢ Improper placement of oxygen and acetylene cylinders | ➢ Explosion may occur | ➢ Move out any leaking cylinder<br>➢ Keep cylinder in vertical position<br>➢ Use trolley for transportation of cylinders and chain them<br>➢ Use flash back arrestors |
| | ➢ Leakage/cuts in hoses | ➢ May cause fire | ➢ Purge regulators immediately and then turn off<br>➢ Never use grease or oil on oxygen line connections and copper fittings on acetylene lines<br>➢ Inspect regularly gas carrying hoses<br>➢ Use the current for which the cable is designed<br>➢ Always use red hose for acetylene and other fuel gases and black for oxygen |
| | ➢ Opening-up of cylinder | ➢ Cylinder may burst | ➢ Always stand back from the regulator while opening the cylinder<br>➢ Turn valve slowly to avoid bursting<br>➢ Cover the lug terminals to prevent short circuiting. |
| | ➢ Welding of tanks, container or pipes storing | ➢ Explosion may occur | ➢ Empty them before welding<br>➢ Never attach the ground cable to tanks, container or pipe storing flammable liquids |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | flammable liquids | | ➢ Never use LPG for gas cutting |
| (E) RADIOGRAPHY | ➢ Ionizing radiation | ➢ Radiations may react with the skin and can cause cancer, skin irritation, dermatitis, etc. | ➢ Ensure safety regulations as per BARC before commencement of job.<br>➢ Cordon off the area and install Radiation warning symbols<br>➢ Restrict the entry of unauthorized persons<br>➢ Wear appropriate PPE and film bagdges issued by BARC |
| | ➢ Transportation and Storage of Radiography source | ➢ Same as above | ➢ Never touch or handle radiography source with hands<br>➢ Store radiography source inside a pit in an exclusive isolated storage room with lock and key arrangement. The pit should be approved by BARC<br>➢ Radiography source should never be carried either in passenger bus or in a passenger compartment of trains.<br>➢ BARC have to be informed before source movement.<br>➢ Permission from Director General of Civil Aviation is required for booking radio isotopes with airlines. |
| | ➢ Loss of Radio isotope | ➢ Same as above | ➢ Try to locate with the help of Survey Meter<br>➢ Inform BARC(*) |
| (F) ELECTRICAL INSTALLATION AND USAGE | ➢ Short circuiting | ➢ Can Cause Electrocution or Fire | ➢ Use rubberized hand gloves and other PPE<br>➢ Don't lay wires under carpets, mats or door ways.<br>➢ Allow only licensed electricians to perform on electrical facilities<br>➢ Use one socket for one appliance<br>➢ Ensure usage of only fully insulated wires or cables<br>➢ Don't place bare wire ends in a socket |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | | | ➢ Ensure earthing of machineries and equipments<br>➢ Do not use damaged cords and avoid temporary connections<br>➢ Use spark-proof/flame proof type field distribution boxes.<br>➢ Do not allow open/bare connections<br>➢ Provide all connections through ELCB<br>➢ Protect electrical cables/equipment's from water and naked flames<br>➢ Check all connections before energizing |
| | ➢ Overloading of Electrical System | ➢ Bursting of system can occur which leads to fire | ➢ Display voltage and current ratings prominently with 'Danger' sings.<br>➢ Ensure approved cable size, voltage grade and type<br>➢ Switch off the electrical utilities when not in use<br>➢ Do not allow an unauthorized connections<br>➢ Ensure proper grid wise distribution of Power. |
| | ➢ Improper laying of overhead and underground transmission lines/cables | ➢ Can cause electrocution and prove fatal | ➢ Do not lay unarmored cable directly on ground, wall, roof of trees<br>➢ Maintain at least 3m distance from HT cables<br>➢ All temporary cables should be laid at least 750 mm below ground on 100 mm fine sand overlying by brick soling<br>➢ Provide proper sleeves at crossings/intersections<br>➢ Provide cable route markers indicating the type and depth of cables at intervals not exceeding 30m and at the diversions/termination. |
| (G) FIRE PREVENTION AND PROTECTION | ➢ Small fires can become big ones | ➢ Cause burn injuries and may prove fatal | ➢ In case a fire breaks out, press fire alarm system and shout "Fire, Fire"<br>➢ Keep buckets full of sand & |

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | and may spread to the surrounding areas | | water/fire extinguishing equipment near hazardous locations<br>➢ Confine smoking to 'Smoking Zones' only<br>➢ Train people for using specific type of fire equipments under different classes of fire<br>➢ Keep fire doors/ shutters, passages and exit doors unobstructed<br>➢ Maintain good house keeping and first-aid boxes (for detail refer Annex-2)<br>➢ Don't obstruct assess to f<br>➢ Fire extinguishers<br>➢ Do not use elevators for evacuation during fire<br>➢ Maintain lightening arrestors for elevated structures |
| | ➢ Improper selection of Fire extinguishers | ➢ It may not extinguish the fire | ➢ Ensure usage of correct fire extinguisher meant for the specified fire (for details refer Annexure-III)<br>➢ Do not attempt to extinguish Oil and electric fires with water. Use foam cylinders/CO2/sand or earth. |
| | ➢ Improper storage of highly inflammable substances | ➢ Same as above | ➢ Maintain safe distance of flammable substances from source of ignition<br>➢ Restrict the distribution of flammable materials to only min. necessary amount<br>➢ Construct specifically designed fuel storage facilities<br>➢ Keep chemicals in cool and dry place away from hat. Ensure adequate ventilation<br>➢ Before welding operation, remove or shield the flammable material properly<br>➢ Store flammable materials in stable racks, correctly labelled |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | | | ➢ Wipe off the spills immediately |
| | ➢ Short circuiting of electrical system | ➢ Same as above<br>➢ Can cause Electrocution | ➢ Don't lay wires under carpets, mats or door ways<br>➢ Use one socket for one appliance<br>➢ Use only fully insulated wires or cables<br>➢ Do not allow open/bare connections<br>➢ Provide all connections through ELCB<br>➢ Ensure earthing of machineries and equipments |
| (H) VEHICULAR MOVEMENT | ➢ Crossing the Speed Limits (Rash driving) | ➢ Personal injury | ➢ Obey speed limits and traffic rules strictly<br>➢ Always expect the unexpected and be a defensive drive<br>➢ Use sat belts/helmets<br>➢ Blow horn at intersections and during overtaking operations.<br>➢ Maintain the vehicle in good condition<br>➢ Do not overtake on curves, bridges and slopes |
| | ➢ Adverse weather condition | ➢ Same as above | ➢ Read the road ahead and ride to the left<br>➢ Keep the wind screen and lights clean<br>➢ Do not turn at speed<br>➢ Recognize the hazard, understand the defense and act correctly in time. |
| | ➢ Consuming alcohol before and during the driving operation | ➢ Same as above | ➢ Alcohol and driving do not mix well. Either choose alcohol or driving.<br>➢ If you have a choice between hitting a fixed object or an on-coming vehicle, hit the fixed object<br>➢ Quit the steering at once and become a passenger. Otherwise take sufficient rest and then drive.<br>➢ Do not force the driver to drive fast and round the clock |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | | | ➢ Do not day dram while driving |
| | ➢ Falling objects/ Mechanical failure | ➢ May prove fatal | ➢ Ensure effective braking system, adequate visibility for the drives, reverse warning alarm<br>➢ Proper maintenance of the vehicle as per manufacturer instructions |
| (I) PROOF TESTING (HYDROSTATIC/ PNEUMATIC TESTING | ➢ Bursting of piping<br>➢ Collapse of tanks<br>➢ Tanks flying off | ➢ May cause injury and prove fatal | ➢ Prepare test procedure & obtain CONSULTANT/ Owner's approval<br>➢ Provide separate gauge for pressurizing pump and piping/equipment<br>➢ Check the calibration status of all pressure gauges, dead weight testers and temperature recorders<br>➢ Take dial readings at suitable defined intervals and ensure most of them fall between 40-60% of the gauge scale range<br>➢ Provide safety relief valve (set at pressure slightly higher than test pressure) while testing with air/nitrogen<br>➢ Ensure necessary precautions, stepwise increase in pressure, tightening of bolts/ nuts, grouting, etc. before and during testing<br>➢ Keep the vents open before opening any valve while draining out of water used for hydro testing of tanks<br>➢ Pneumatic testing involves the hazard of released energy shored in compressed gas. Specific care must therefore be taken to minimize the chance of brittle failure during a pneumatic leak test. Test temperature is important in this regard and must be |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | | | considered when the designer chooses the material of construction<br>➢ A pressure relief device shall be provided, having a set pressure not higher than the test pressure plus the lesser of 345 KPa (50 psi) or 10% of he test pressure. |
| (J) WORKING AT HEIGHTS | ➢ Person can fall down | ➢ May sustain severe injuries or prove fatal | ➢ Provide guard rails/barricade at the work place<br>➢ Use PPE like safety belts, full body harness, life line, helmets, safety shoes, etc.<br>➢ Obtain a permit before starting the work at height above 3 meters<br>➢ Fall arrest systems like safety nets, etc. must be installed<br>➢ Provide adequate working space (min. 0.6 m)<br>➢ Tie/weld working platform with fixed support<br>➢ Use roof top walk ladder while working on a slopping roofs<br>➢ Avoid movement on beams |
| | ➢ | ➢ May hit the scrap/ material stacked at the ground or in between | ➢ Keep the work place neat and clean<br>➢ Remove the scrap immediately |
| | ➢ Material can fall down | ➢ May hit the workers working at lower levels and provide fatal | ➢ Same as above plus<br>➢ Do not throw or drop material or equipment from height<br>➢ All tools to be carried in a tool-kit bags or on working uniform<br>➢ Remove scrap from the planks<br>➢ Ensure wearing of helmet by the workers at low level |
| (K) CONFINED | ➢ Suffocation/ | ➢ Unconsciousness, death | ➢ Use respiratory devices, if required |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| SPACES | drowning | | ➢ Avoid over crowding inside a confined space<br>➢ Provide Exhaust Fans for ventilation<br>➢ Do not weal loose clothes, neck ties, etc.<br>➢ Check for presence of hydrocarbons, O2 level<br>➢ Obtain work permit before entering a confined space<br>➢ Ensure that the connected piping of the equipment which is to be opened is pressure free, fluid has been drained, vents are open and piping is positively isolated by a blind flange |
| | ➢ Presence of foul smell and toxic substances | ➢ Inhalation can pose threat to life | ➢ Same as above plus<br>➢ Check for hydrocarbon and Aromatic compounds before entering a confined space<br>➢ Depute one person outside the confined space for continuous monitoring and for extending help in case of an emergency |
| | ➢ Ignition/flame can cause fire | ➢ Person may sustain burn injuries or explosion may occur | ➢ Keep fire extinguishers at a hand distance<br>➢ Remove surplus material and scrap immediately<br>➢ Do not smoke inside a confined space<br>➢ Do not allow gas cylinders inside a confined space<br>➢ Use low voltage (24V) lamps for lighting<br>➢ Use tools with air motors or electric tools with max. voltage of 24V<br>➢ Remove all equipments at the end of the day |
| (L) HANDLING AND LIFTING EQUPMENTS | ➢ Failure of load lifting and moving equipments | ➢ Can cause accident and prove fatal | ➢ Avoid standing under the lifted load and within the operating radius of cranes<br>➢ Check periodically oil, brakes, gears, horns and tyre pressure of all moving machinery<br>➢ Check quality, size and |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | | | condition of all chain pulley blocks, slings, U-clamps, D-shackles, wire ropes, etc.<br>➢ Allow crane to move only on hard, firm and levelled ground<br>➢ Allow lifting slings as short as possible and check gunny packing at the friction points<br>➢ Do not allow crane to tilt its boom while moving<br>➢ Install Safe Load Indicator |
| | ➢ Overloading of lifting equipments | ➢ Same as above | ➢ Safe lifting capacity of derricks and winches written on them shall be got verified.<br>➢ The max safe working load shall be marked on all lifting equipments<br>➢ Check the weight of columns and other heavy items painted on them and accordingly decide about eh crane capacity, boom and angle of erection<br>➢ Allow only trained operators and riggers during crane operation |
| | ➢ Overhead electrical wires | ➢ Can cause electrocution and fire | ➢ Do not allow boom or other parts of crane to come within 3 m reach of overhead HT cables<br>➢ Hook and load being lifted shall preferably remain in full visibility of crane operator. |
| (M) SCAFFOLDING, FORMWORK AND LADDERS | ➢ Person can fall down | ➢ Person may sustain severe injuries and prove fatal | ➢ Provide guard rails for working at height<br>➢ Face ladder while climbing and use both hands<br>➢ Ladders shall extend about 1m above landing for easy access and tying up purpose<br>➢ Do not place ladders against movable objects and maintain base at ¼ unit of the working length of the ladder |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | | | ➢ Suspended scaffolds shall not be less than 500 mm wide and tied properly with ropes<br>➢ No loose planks shall be allowed<br>➢ Use PPE, like helmets, safety shoes, etc. |
| | ➢ Failure of scaffolding material | ➢ Same as above | ➢ Inspect visually all scaffolding materials for stability and anchoring with permanent structures.<br>➢ Design scaffolding for max. load carrying capacity<br>➢ Scaffolding planks shall not be less than 50x250 mm full thickness lumber or equivalent. These shall be cleared or secured and must extend over the end supports by at least 150mm and not more that 300 mm<br>➢ Don't overload the scaffolds<br>➢ Do not splice short ladders to make a longer one. Vertical ladders shall not exceed 6m. |
| | ➢ Material can fall down | ➢ Persons working at lower level gets injured | ➢ Remove excess material and scrap immediately<br>➢ Carry the tools in a tool-kit bag only<br>➢ Provide safety nets |
| (N) STRUCTURAL WORKS | ➢ Personal negligence and danger of fall | ➢ Can cause injury or casualty | ➢ Do not take rest inside rooms built for welding machines or electrical distribution system<br>➢ Avoid walking on beams at height<br>➢ Wear helmet with chin strap and safety belts when working at height<br>➢ Use hand gloves and goggles during grinding operations<br>➢ Cover or mark the sharp and projected edges<br>➢ Do not stand within the operating radius of cranes |
| | ➢ Lifting/sli | ➢ Same as | ➢ Do not stand under the lifted |

| ***ACTIVITY*** | ***TYPE OF HAZARD*** | **EFFECT OF HAZARD** | **PREVENTIVE MEASURES** |
|---|---|---|---|
| | pping of material | above | load<br>➢ Stack properly all the materials. Avoid slippage during handling<br>➢ Control longer pieces lifted up by cranes from both ends<br>➢ Remove loose materials from height<br>➢ Ensure tightening of all nuts and bolts |
| (O) PIPELINE WORKS | ➢ Erection/lowering failure | ➢ Can cause injury | ➢ Do not stand under the lifted load<br>➢ Do not allow any person to come within the radii of the side boom handling pipes<br>➢ Check the load carrying capacity of the lifting tools and tackles<br>➢ Use safe Load Indicators<br>➢ Use appropriate PPEs |
| | ➢ Other | ➢ Same as above | ➢ Wear gum boots in marshy areas<br>➢ Allow only one person to perform signalling operations while lowering of pipes<br>➢ Provide night caps on pipes<br>➢ Provide end covers on pipes for stoppage of pigs while testing/cleaning operations |

**MONTHLY HSE CHECKLIST CUM COMPLIANCE REPORT**

PROJECT : ……. CONTRCTOR: ……..…….

DATE : ……. OWNER : ……...

INSPECTED BY: …….

Note: Write 'NA' wherever the item is not applicable.

**MONTHLY HSE CHECKLIST CUM COMPLIANCE REPORT**

| SL. NO. | ITEM | YES | NO | REMARKS | ACTION |
|---|---|---|---|---|---|
| **1** | **HOUSEKEEPING** | | | | |
| a) | Waste containers provided and used | | | | |
| b) | Sanitary facilities adequate and clean | | | | |
| c) | Passageways and Walkways clear | | | | |
| d) | General neatness of working areas | | | | |
| e) | Others | | | | |
| **2** | **PERSONNEL PROTECTIVE EQUIPMENT** | | | | |
| a) | Goggles; Shields | | | | |
| b) | Face protection | | | | |
| c) | Hearing protection | | | | |
| d) | Safety shoes | | | | |
| e) | Hand protection | | | | |
| f) | Respiratory Masks etc. | | | | |
| g) | Safety Belts | | | | |
| h) | Safety Helmet/Hard Hat | | | | |
| I) | Others | | | | |
| **3** | **EXCAVATIONS/OPENINGS** | | | | |
| a0 | Openings properly covered or barricaded | | | | |
| b) | Excavations shored | | | | |
| c) | Excavations barricaded | | | | |
| d) | Overnight lighting provided | | | | |
| e) | Others | | | | |
| **4** | **WELDING & GAS CUTTING** | | | | |
| a) | Gas cylinders chained upright | | | | |
| b) | Cables and hoses not obstructing | | | | |
| c) | Screens or shields used | | | | |
| d) | Flammable materials protected | | | | |
| e) | Fire extinguisher(s) accessible | | | | |
| f) | Others | | | | |
| **5** | **SCAFFOLDING** | | | | |
| a) | Fully decked platforms | | | | |
| b) | Guard and intermediate rails in place | | | | |
| c) | Toe boards in place | | | | |

**MONTHLY HSE CHECKLIST CUM COMPLIANCE REPORT**

| SL. NO. | ITEM | YES | NO | REMARKS | ACTION |
|---|---|---|---|---|---|
| d) | Adequate shoring | | | | |
| e) | Adequate access | | | | |
| f) | Others | | | | |
| **6** | **LADDERS** | | | | |
| a) | Extension side rails 1m above | | | | |
| b) | Top of landing | | | | |
| c) | Properly secured | | | | |
| d) | Angle ± 70 from horizontal | | | | |
| e) | Others | | | | |
| **7** | **HOISTS, CRANES AND DERRICKS** | | | | |
| a) | Condition of cables and sheaves OK | | | | |
| b) | Condition of slings, chains, hooks and eyes OK | | | | |
| c) | Inspection and maintenance logs maintained | | | | |
| d) | Outriggers used | | | | |
| e) | Signs/barricades provided | | | | |
| f) | Signals observed and understood | | | | |
| g) | Qualified operators | | | | |
| h) | Others | | | | |
| **8** | **MACHINERY, TOOLS AND EQUIPMENT** | | | | |
| a) | Proper instruction | | | | |
| b) | Safety devices | | | | |
| c) | Proper cords | | | | |
| d) | Inspection and maintenance | | | | |
| e) | Others | | | | |
| **9** | **VEHICLE AND TRAFFIC** | | | | |
| a) | Rules and regulations observed | | | | |
| b) | Inspection and maintenance | | | | |
| c) | Licensed drivers | | | | |
| d) | Others | | | | |
| **10** | **TEMPORARY FACILITIES** | | | | |
| a) | Emergency instructions posted | | | | |
| b) | Fire extinguishers provided | | | | |
| c) | Fire-aid equipment available | | | | |
| d) | Secured against storm damage | | | | |
| e) | General neatness | | | | |
| f) | In accordance with electrical requirements | | | | |
| g) | Others | | | | |
| **11** | **FIRE PREVENTION** | | | | |
| a) | Personnel instructed | | | | |
| b) | Fire extinguishers checked | | | | |
| c) | No smoking in Prohibited Areas | | | | |
| d) | Hydrants Clear | | | | |
| e) | Others | | | | |
| **12** | **ELECTRICAL** | | | | |
| a) | Use of 3-core armoured cables | | | | |

**MONTHLY HSE CHECKLIST CUM COMPLIANCE REPORT**

| SL. NO. | ITEM | YES | NO | REMARKS | ACTION |
|---|---|---|---|---|---|
| b) | Usage of 'All insulated' or 'double insulated' electrical tools | | | | |
| c) | All electrical connection are routed through ELCB | | | | |
| d) | Natural Earthing. | | | | |

**MONTHLY HSE CHECKLIST CUM COMPLIANCE REPORT**

| SL. NO. | ITEM | YES | NO | REMARKS | ACTION |
|---|---|---|---|---|---|
| | at the source of power (main DB) | | | | |
| e) | Continuity and tightness of earth conductor | | | | |
| f) | Covering of junction boxes, panels and other energized wiring places | | | | |
| g) | Ground fault circuit interrupters provided | | | | |
| h) | Prevention of tripping hazards | | | | |
| I) | Others | | | | |
| **13** | **HANDLING AND STORAGE OF MATERIALS** | | | | |
| a) | Properly stored or stacked | | | | |
| b) | Passageways clear | | | | |
| c) | Others | | | | |
| **14** | **FLAMMABLE GASES AND LIQUIDS** | | | | |
| a) | Containers clearly identified | | | | |
| b) | Proper storage | | | | |
| c) | Fire extinguishers nearby | | | | |
| d) | Others | | | | |
| **15** | **WORKING AT HEIGHT** | | | | |
| a) | Erection plan and work permit obtained | | | | |
| b) | Safety nets | | | | |
| c) | Safety belts, full body harness and lanyards; chute lines | | | | |
| d) | Others | | | | |
| **16** | **CONFINED SPACE** | | | | |
| a) | Work permit obtained | | | | |
| b) | Test for toxic gas and sufficient availability of oxygen conducted | | | | |
| c) | At least one person outside the confined space for monitoring deputed | | | | |
| d) | Availability of sufficient means of entry, exit and ventilation | | | | |
| e) | Fire extinguishers and first-aid facility ensured | | | | |
| f) | Lighting provision made by using 24V lamps | | | | |
| g) | Proper usage of PPEs ensured | | | | |
| **17** | **RADIOGRAPHY** | | | | |
| a) | Proper storage and handling of source as per BARC guidelines | | | | |
| b) | Working permit obtained | | | | |
| c) | Cordoning of the area done | | | | |
| d) | Use of appropriate PPE's ensured | | | | |
| e) | Proper training to workers/supervisors imparted | | | | |

**MONTHLY HSE CHECKLIST CUM COMPLIANCE REPORT**

| SL. NO. | ITEM | YES | NO | REMARKS | ACTION |
|---|---|---|---|---|---|
| f) | Minimum occupancy of workplace ensured | | | | |
| **18** | **HEALTH CHECKS** | | | | |
| a) | Hygienic conditions at labour camps OK? | | | | |
| b) | Availability of First-aid facilities | | | | |
| c) | Proper sanitation at site, office and labour camps | | | | |
| d) | Arrangement of medical facilities | | | | |
| e) | Measures for dealing with illness | | | | |
| f) | Availability of Portable drinking water for workmen & staff | | | | |
| g) | Provision of crèches for children | | | | |
| **19** | **ENVIRONMENT** | | | | |
| a) | Chemical and other effluents properly disposed | | | | |
| b) | Cleaning liquid of pipes disposed off properly | | | | |
| c) | Seawater used for hydro-testing disposed off as per agreed procedure | | | | |
| d) | Lubricant Waste/Engine oils properly disposed | | | | |
| e) | Waste from Canteen, offices, sanitation etc. disposed properly | | | | |
| f) | Disposal of surplus earth, stripping materials, oily rags and combustible materials done properly | | | | |
| g) | Green belt protection | | | | |

## ACCIDENT / FIRE REPORT

**(To be submitted by Contractor after every accident within 24 hours of accident)**

Report: …….

Name of Site Date: …….

---

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 CONSULTANT | 1 COPY |
| | | CONSULTANT HO Constn. Through RCM | 3 COIES |
| | | Proj.Mgr. CONSULTANT, Through RCM | 1 COPY |

SUPPLEMENTARY ACIDENT & INVESTIGATION REPORT

Project: ……

Supplementary to Report No. : ……. (Copy enclosed)

Site: ……. Date:

Contractor:
……

---

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

---

BRIEF DESCRIPTION & CAUSE OF ACCIDENT

---

NATURE OF INJURY/DAMAGE

---

COMMENTS FROM MEDICAL PRACTITIONER, WHO ATTENDED THE VICTIM/INJURED

---

SUGGESTED IMPROVEMENT IN THE WORKING CONDITION, IF ANY

---

LOSS OF MAN HOURS 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 CONSULTANT | 1 COPY |
| | | CONSULTANT HO Constn. Through RCM | 3 COIES |
| | | Proj.Mgr. CONSULTANT, Through RCM | 1 COPY |

**MONTHLY Health, Safety & Environment (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*** | ***CUMULTIVE*** |
|---|---|---|
| Total strength (Staff + Workmen) | | |
| Number of HSE meetings organized at site | | |
| Number of HSE awareness programmes conducted at site | | |
| Whether workmen compensation policy taken | Y/N | -- |
| Whether workmen compensation policy is valid | Y/N | -- |
| Whether workmen registered under ESI Act | Y/N | -- |
| Number of Fatal Accidents | | |
| Number of Loss Time Accidents (Other than Fatal) | | |
| Other accidents (Non Loss Time) | | |
| Total number of accidents | | |
| Total man-hours worked | | |
| Man-hour loss due to fire and accidents | | |
| Compensation cases raised with Insurance | | |
| Compensation cases resolved and paid to workmen | | |
| Remarks, if any : | | |

DATE : **SIGNATURE OF CONTRACTOR**
***WITH SEAL***

TO : OWNER 1 COPY
RCM/SITE-IN-CHARGE CONSULTANT 1 COPY

## PERMIT FOR WORKING ABOVE 3 METER HIGHT

(Strike out whichever is not applicable)

Project Site : …… Sr. No.: ……
Name of the work: …….. Date: ……
Name of Contractor : …….. Nature of Work : ……
Total No.of Workers: …….. Exact location of work : ……
Duration of work: from ..…… to

The following items have been checked and compliance shall be ensured during the currency of the permit:

| Sl. | ITEM | DONE | NOT REQD. |
|---|---|---|---|
| 1. | Equipment/Work Area inspected | ☐ | ☐ |
| 2. | Considered hazard from other routine/non-routine operations and concerned person alerted | ☐ | ☐ |
| 3. | ELCB provided | ☐ | ☐ |
| 4. | Proper lighting provided | ☐ | ☐ |
| 5. | Area cordoned off. | ☐ | ☐ |
| 6. | Precautions against public traffic taken | ☐ | ☐ |
| 7. | Sound Scaffolding provided | ☐ | ☐ |
| 8. | Adequate protected Platform provided | ☐ | ☐ |
| 9. | Access and Exit to the area (Ladder properly fixed) | ☐ | ☐ |
| 10. | Floor Openings covered | ☐ | ☐ |
| 11. | Safety Net provided | ☐ | ☐ |

A. Following personal protective equipment are provided (√ mark) and used as relevant Safety helmet/Gloves/Goggles/Shoes/Face Shield/Life Line/Safety Belt/Safety Harness.
B. This permit shall be available at the work site at all times.
C. Permit shall be issued for maximum one week only (Monday to Sunday).
D. This permit shall be applicable in non-operational areas.
E. After completion of the work, used permits shall be preserved for record purposes.
F. Additional precautions, if any …….

**Permission is granted to work (See overleaf) = Yes/No.**

Name of Contractor's Supervisor (Initiator)

Name of Contractor's Safety Officer (Issuing Authority)

***GRANT OF PERMIT AND EXTENSIONS***

| Sl. No. | Validity Period From …… To …… | Work time From …..Hrs. To …….Hrs. | Initiator (Supervisor of Contractor) | Issuing Authority (Safety Officer) of Contractor | Verification by CONSULTANT with date |
|---|---|---|---|---|---|
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Additional safety instructions, if any.

## HEALTH, SAFETY & ENVIRONMENT (HSE) PLAN

| Division/Department : | | | | Project Name : | | | | |
|---|---|---|---|---|---|---|---|---|
| Activity/Process Description | Procedure Number | Code of Conformance | Performer | Checker Reviewer | Approver | Sampling Plan | | Owner's/ PMC's Audit Requirements |
| | | | | | | Reviewer | Approver | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

## ELECTRICAL

Electrical power is the mainstay of any construction activity, at the same time it requires utmost care in it's utilization to avoid accidents due to electrical shock, fire incidents or electric short circuits. Exposure of electrical installation to adverse environmental conditions increase the risk of such accidents. Hence it is necessary to take extra precautions for such installations to ensure safety of personnel and equipment. This standard addresses the safety measures required to be adopted for the electrical installations by all contractors during construction phase.

All electrical connections/work for electrical installations shall be carried out as per provisions of the latest revision of the following codes and standards in addition to the requirements of statutory authorities and ie rules :
Oisd-std-173 : fire prevention and protection system for electrical installations.
Sp-30 (bis) : national electric code.
The installation shall have approval from concerned statutory authorities.

1. All electrical connections shall be done by an electrician with valid licence and to the satisfaction of engineer-in-charge.
2. One competent licenced electrician shall be made available by contractor at site round the clock to attend to the normal/emergency jobs.
3. All switch boards/welding machines shall be kept in well ventilated and covered shed. The shed shall be elevated to avoid water logging. No flammable materials shall be used for constructing the shed. Also flammable materials shall not be stored in and around electrical equipment/switchboard. Adequate clearances and operational space shall be provided around the equipment.
4. Fire extinguishers and insulting mats shall be provided in all power distribution centres.
5. Temporary electrical equipment shall not be employed in hazardous areas without obtaining safety permit.
6. Proper housekeeping shall be done around the electrical installations.
7. All temporary installations shall be tested before engineering, to ensure proper earthing, bonding, suitability of protection system, adequacy of feeders/cables etc.
8. All welders shall use hand gloves irrespective or holder voltage.
9. Multilingual (English, Hindi and local language) caution boards, shock treatment charts and instruction plate containing location of isolation point for incoming supply, name and telephone number(s) of contact person in emergency shall be provided in substations and near all distribution boards/local panels.
10. Operation of earth leakage device shall be checked regularly by temporarily connecting series test lamp (2 bulbs of equal rating connected in series) between phase and earth.
11. The following design features shall be ensured for all electrical installations during construction phase.

12.1 Each installation shall have a main switch with a protective device, installed in an enclosure adjacent to the metering point. The operating height of the main switch shall not exceed 1.5 m. The main switch shall be connected to the point of supply by means of armoured cable.

12.2 The outgoing feeders shall be double or triple pole switches with fuses/mcbs. Loads in a three phase circuit shall be balanced as far as possible and load on neutral should not exceed 20% of load in the phase.

12.3 The installation shall be adequately protected against overload, short circuit and earth leakage by the use of suitable protective devices. Fuses wherever used shall be hrc type. Use of rewirable fuses shall be strictly prohibited. The earth leakage device shall have an operating current not exceeding 30 ma.

12.4 All connections to the handtools/welding receptacles shall be taken through proper switches, sockets and plugs.

12.5 All single phase sockets shall be 3 pin type only. All unused sockets shall be provided with socket caps.

12.6 Only 3 core (p+n+e) overall sheathed flexible cables with minimum conductor size of 1.5 mm2 copper shall be used for all hand tools.

12.7 Only metallic distribution boxes with double earthing shall be used at site. No wooden boxes shall be used.

12.8 All power cables shall be terminated with compression type cable glands. Tinned copper lugs shall be used for multistrand wires/cables.

12.9 Cables shall be free from any insulation damage.

12.10 Cables shall be laid underground at a minimum depth of 900 mm, covered with sand, brick and soil for ensuring mechanical protection. Cables shall not be laid in water logged area as far as practicable. Cable route markers shall be provided at every 25 m of buried trench route. When laid above ground, cables shall be properly cleated or supported on rigid poles of at least 2 m high. Minimum head clearance of 6 meters shall be provided at road crossings.

12.11 Under ground road crossings for cables shall be avoided to the extent feasible. In any case no under ground power cable shall be allowed to cross the roads without pipe sleeve.

12.12 All cable joints shall be done with proper jointing kit. No taped/temporary joints shall be used.

12.13 An independent earthing facility should preferably be established within the temporary installation premises. All appliances and equipment shall be adequately earthed. In case armoured cables are used, the armour shall be bonded to the earthing system.

12.14 All cables and wire rope used for earth connections shall be terminated through tinned copper lugs.

12.15 In case of local earthing, earth electrodes shall be buried near the supply point and earth continuity wire shall be connected to local earth plate for further distribution to various appliances. All insulated wires for earth connection shall have insulation of green colour.

12.16 Separate core shall be provided for neutral earth/structures shall not be used as a neutral in any case.

12.17 On/off position of all switches shall be clearly designated/ painted for easy isolation in emergency.

12.18 All insulations shall be inspected by engineer-in-charge atleast once in a month.

**GAIL INDIA LIMITED**

# LIST OF RECOMMENDED PARTIES
# FOR
# BOUGHT OUT ITEMS

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 0 | 22.11.2021 | Issued for Bid | AS | VK | SB | |
| **Rev** | **Date** | **Purpose** | **Prepared By** | **Checked By** | **Approved By** | |

## TABLE OF CONTENTS

## LIST OF SUPPLIERS OF MAJOR BOUGHT-OUT ITEMS

## 1. (MECHANICAL & FIRE FIGHTING EQUIPMENT)

### A). MAINLINE & MECHANICAL

### i) Pipe Carbon Steel To Indian Standards

1. A.S.T. Pipes Pvt. Ltd. (AST Group)
2. Advance Steel Tube Ltd.
3. Apl Apollo Tubes Ltd. (Er. Bihar Tubes Ltd.)
4. Asian Mills Pvt. Ltd.
5. Asrani Tubes Limited
6. Dadu Pipes (P) Ltd.
7. Essar Steel Limited(Er Hazira Pipes Mill)
8. Gaurang Products Pvt Ltd. (Ast Group)
9. Goodluck Steel Tubes Ltd.
10. HiǦTech Pipes Limited
11. Indus Tube Limited
12. Jindal Industries Ltd
13. Jindal Pipes Ltd.
14. Jindal Saw Ltd (Kosi Works)
15. Jotindra Steel & Tube Ltd
16. Lalit Pipes and Pipes Ltd.
17. Maharashtra Seamless Ltd.
18. Man Industries (India) Ltd. – Pithampur
19. Man Industries (India) Ltd. Anjar
20. Mukat Tanks & Vessels Ltd.
21. Nezone Tubes Limited
22. North Eastern Tubes Limited
23. Pratibha Industries Limited
24. Pratibha Pipes & Structural Ltd.
25. Psl Ltd (Chennai)
26. Psl Ltd (V1, V2 & Nc)
27. Rama Steel Tubes Ltd.
28. Ratnamani Metals and Tubes Ltd.
29. Ravindra Tubes Limited
30. Samshi Pipe Industries Limited

31. Surya Roshni Ltd.
32. Swastik Pipes Ltd.
33. Utkarsh Tubes & Pipes Ltd. (Formly Bmw)
34. Welspun Corp. Limited (Dahej)
35. Zenith Birla (India) Limited

**ii) Pipe & Tubulars To A.P.I. Standards**

1. Arcelormittal Tubular Products Roman Sa, Romania
2. Bhel (Trichy),India
3. Dalmine Spa (Enquiry To Tenaris),UAE
4. Eewkorea Co. Ltd (Germany), Korea
5. Eew Korea Co. Ltd. (Korea), Korea
6. Eisenbau Kramer Gmbh, Germany
7. Hyundai Rb Co. Ltd. South Korea
8. Ilva Lamiere E Tubi Srl (Enq To Ilva Spa, Italy
9. Inox Tech. Spa, Italy
10. Ismt Ltd. Ahmednagr, India
11. Ismt Ltd. Baramati, India
12. Jindal Pipes Ltd., India
13. Jindal Saw Ltd. (Kosi Works), India
14. Jindal Saw Ltd. (Nashik Works), India
15. Lalit Pipes and Pipes Ltd. India
16. Maharashtra Seamless Ltd., India
17. Man Industries (I) Ltd. (Pithampur), India
18. Mukat Tanks & Vessels Ltd., India
19. Pratibha Industries Limited, India
20. Ratnamani Metals and Tubes Ltd., India
21. Siderca S.A.I.C (Enquiry Totenaris), UAE
22. Sumitomo Metal Ind. Ltd., India
23. Surya Roshni Ltd., India
24. Swastik Pipes Ltd, India
25. Tata Steel Uk Limited (Formerly C702)
26. Tubos De Acero De Mexico Sa (Enq. Tenaris), UAE
27. Tubos Reunidos Sa Spain
28. Umran Steel Pipe Inc (Turkey), Turkey
29. Valcovny Trub Chomutov, Czech Republic
30. Vallourec and Mannesmann Tubes, France

31. Welspun Corp Limited (Dahej), India

### iii) Pipe/Tube CS (Seamless) To ASTM STDs

1. Arcelormittal Tubular Products Roman Sa, Romania
2. Bhel (Trichy), India
3. Changshu Seamless Steel Tube Co. Ltd., China
4. Dalmine Spa (Enquiry To Tenaris, UAE
5. Heavy Metals & Tubes Limited (Mehsana), India
6. Ismt Ltd. Ahmedngr, India
7. Ismt Ltd. Baramati India
8. Jfe Steel Corporation, UAE
9. Jindal Sdaw Ltd (Nashik Works) India
10. Klt Automotive and Tubular Products Ltd., India
11. Mahalaxmi Seamless Limited, India
12. Maharashtra Seamless Ltd, India
13. Products Tubulares S.A.U, Spain
14. Ratnadeep Metal Tubes Ltd., India
15. Staineest Tubes Pvt Ltd., India
16. Sumitomo Metal Ind. Ltd., India
17. Tubos Reunidos Sa Spain
18. Valcovny Trub Chomutov, Czech Republic
19. Vallourec Andmannesmann Tubes France
20. Yangzhou Chengde Steel Pipe Co. Ltd Dubai (UAE)

### iv) Pipe Carbon Steel (Welded) To ASTM STDs

1. Eew Korea Co. Ltd. (Germany), Korea
2. Eew Korea Co. Ltd. (Korea), Korea
3. Eisenbau Kramer Gmbh, Germany
4. Hyundai Rb Co. Ltd., South Korea
5. Inox Tech. Spa, Italy
6. Jindal Saw Ltd (Kosi Works), India
7. Lalit Pipes and Pipes Ltd., India
8. Man Industeries (I) Ltd.(Pithampur), India
9. Man Industries (India) Ltd. Anjar, India
10. Mukat Tanks & Vessels Ltd., India
11. Ratnamani Metals And Tubes Ltd., India
12. Sumitomo Metal India Ltd., India

13. Tata Steel Uk Limited

## v) Valve

### a) Globe Valves

1) M/S BDK (New Delhi)
2) M/S Datre Corpn (Calcutta)
3) M/S KSB Pumps (New Delhi)
4) M/S L&T (New Delhi)
5) M/S Neco Schuber & Salzer Ltd. (New Delhi)
6) M/S Niton Valve (Mumbai)
7) M/S Ornate Valves (Mumbai)
8) M/S Panchavati Valves (Mumbai)
9) AV Valves Ltd.
10) BHEL (Trichy), India
11) Econo Valves Pvt Ltd, India
12) Fouress Engg (I) Ltd (Aurangabad)
13) Guru Industrial Valves Pvt Ltd
14) Leader Valves Ltd, India
15) NSSL Ltd. (Neco Schubert & Salzerltd)
16) Oswal Industries Ltd, India
17) Petrochemical Engineering Enterprises, India
18) Sakhi Engineers Pvt Ltd
19) Shalimar Valves Pvt Ltd
20) Steel Strong Valves India Pvt Ltd, India
21) Petro Valves Pvt. Limited, Ahmedabad

### b) Check Valves

1. M/s Advance Valves Pvt. Ltd., Noida
2. M/s Aksons & Mechanical Enterprises, Mumbai
3. M/s Larsen & Toubro Limited (M/s Audco India Limited, Chennai)
4. M/s AV valves Ltd., Agra
5. M/s BDK engineering India Ltd., Hubli
6. M/s BHEL,OFE &OE Group, New Delhi
7. M/s Datre Coroportion Limited, Calcutta
8. M/s Leader Valves Ltd., Jalandhar
9. M/s Neco schubert &Salzer Ltd., New Delhi
10. M/s Niton Valves Industries (P) Ltd., Mumbai

11. M/s Precision Engg.Co., Mumbai
12. Econo Valves Pvt Ltd, India
13. Fouress Engg (I) Ltd (Aurangabad)
14. KSB Pumps Ltd (Coimbatore), India
15. NSSL Ltd. (Neco Schubert & Salzerltd)
16. Oswal Industries Ltd, India
17. Panchvati Valves & Flanges Pvt Ltd, India
18. Petrochemical Engineering Enterprises, India
19. Sakhi Engineers Pvt Ltd
20. Shalimar Valves Pvt Ltd
21. Steel Strong Valves India Pvt Ltd, India

### c) Plug Valves

1. M/s Breda Energia Sesto Industrial Spa, Italy
2. M/s Fisher Sanmar Ltd., Chennai
3. M/s Larsen & Toubro Ltd., New Delhi
4. M/s Nordstrom Valves, USA
5. M/s Serck Audco Valves, UK
6. M/s Sumitomo Corporation India Pvt. Ltd., New Delhi
7. M/s Z Corporation, Korea
8. M/s Hawa Valves (India) Pvt. Ltd., Mumbai
9. M/s Steel Strong Valves India Pvt. Ltd., Navi Mumbai
10. M/s Econo Valves
11. M/s Flow-Serve PTE (Mfr. SERCK), India

### d) Ball Valves

1. M/s Hawa Valves (India) Pvt. Ltd, Navi Mumbai
2. M/s Larsen & Toubro, Delhi
3. M/s Microfinish Valves Pvt. Ltd., Noida
4. M/s Oswal Industries Ltd., Gandhi nagar
5. M/s Virgo Engineers Ltd., Delhi
6. M/s Boteli Valve Group Co. Ltd., China
7. M/s Cameron (Malaysia) SDN BHD, Malaysia
8. M/s Dafram S.P.A., Italy
9. M/s Fangyuan Valve Group Co. Ltd., China

10.M/s Franz Schuck GmbH, Germany

11.O.M.S. Saleri (Italy)

12.Pibi Viesse S.P.A (Italy)

13.Nuovo Pignone (Italy)

14.Perar S.P.A (Italy)

15.Pietro Fiorentini (Italy)

16.Cooper Cameron Valv Italy SRL-FRM, Itly

17.Petrol Valves SRL

18.Tormene Gas Technology S.P.A (VALVITALIA)

19. AB Industries, Ahmedabad

20. Norflow Controls, Ahmedabad,

21. Niton Valves Inds. Pvt. Ltd., Mumbai

22. Steel Strong Valves (I) Pvt Ltd., Navi Mumbai,

23. Dembla Valves Ltd, Gurugram

24. Hawa Engineers Ltd, Ahmedabad

25. Micon Engineers(hubli) Pvt Ltd, Dharwad

26. V A Valves, Jalandhar,

27. PHBB Valves Pvt Ltd, Maharashtra

28. * Or as per attached Technical Criteria.

## vi) Split Tee

1) M/s Ipsco, Canada

2) M/s TD Willamsons, USA

3) M/s Pipefit Engineers

4) M/s Sawan Engineers

5) M/s Furmanite International Ltd.

6) M/s VKVC

7) M/s Bhotika

8) M/s Huwelco Inc.

9) M/s Plant-Tech

**vii) Flow Tee**

1) M/s Coprosider SPA, Italy

2) M/s GEA Energy System India Limited, Chennai

3) M/s Multitex Filteration

4) M/s Pipeline Engineering, UK

5) M/s Scomark Engg. Limited (U.K.)

6) M/s Skeltonhall Limited, Engaland(U.K.)

7) M/s Technospecial SPA, Italy

8) M/s Tectubi SPA, Italy

9) M/s RMA Germany

10) M/s Pipefit Engineers Pvt. Ltd

11) M/s Sawan Engineers Pvt Ltd

12) M/s United Forge Industries

13) * Or as per attached Technical Criteria.

**viii) Flanges**

1. M/s Aditya Forge Ltd., Vadodara

2. M/s Amforge Industries Ltd., Mumbai

3. M/s CD Engineering Co., Ghaziabad

4. M/s Echjay Forgings Pvt. Ltd. (Bombay), Mumbai

5. M/s Echjay Industries Ltd., Rajkot

6. M/s Forge & Forge Pvt. Ltd., Rajkot

7. M/s Golden Iron & Steel Works, New Delhi

8. M/s JK Forgings, New Delhi

9. M/s Metal Forgings Pvt. Ltd., Mumbai

10. M/s Perfect Marketings Pvt. Ltd., New Delhi

11. M/s Sky Forge, Faridabad

12. M/s S&G, Faridabad
13. Chaudhry Hammer Works Ltd, India
14. JAV Forgings (P) Ltd, India
15. Kunj Forgings Pvt Ltd, India
16. MS Fittings
17. R.N. Gupta & Co. Ltd, India
18. R.P. Engineering Pvt Ltd, India
19. Sanghvi Forgings & Engineering Ltd
20. Shri Ganesh Forgings Ltd., India
21. Uma Shankar Khandelwal & Co., India
22. Sawan Engineers, Baroda
23. Stewarts & Lloyds of India Ltd., Kolkata
24. Engineering Services Enterprises
25. Pipefit Engineers Pvt. Ltd.
26. Utsah Engineering Pvt Ltd
27. Vivial Forge Pvt Ltd
28. Norma (India) Ltd
29. United Forge Industries
30. * Or as per attached Technical Criteria.

**ix) Fittings**

1. M/s Commercial Supplying Agency, Mumbai
2. M/s Dee Development Engineers Ltd.
3. M/s Eby Industries, Mumbai
4. M/s Flash Forge Pvt. Ltd., Vishakhapatnam
5. M/s Gujarat Infra Pipes Pvt. Ltd., Vadodara
6. M/s M.S. Fittings Mfg. Co. Pvt. Ltd., Kolkata
7. M/s Stewarts & Lloyds of India Ltd., Kolkata

8. M/s Teekay Tubes Pvt. Ltd., Mumbai
9. M/s Pipe Fit, Baroda
10. M/s Sky Forge, Faridabad
11. M/s S&G, Faridabad
12. M/s Sawan Engineers, Baroda
13. Eby Fasteners, India
14. Leader Valves Ltd, India
15. R.N. Gupta & Co. Ltd, India
16. Exten Engg Pvt Ltd
17. Sivananda Pipe & Fittings Ltd
18. Vivial Forge Pvt Ltd
19. Janta Engineers & Company (Iron)
20. United Forge Industries
21. * Or as per attached Technical Criteria.

## x) Gaskets

1. IGP Engineers (P) Ltd., Madras
2. Madras Industrial Products, Madras
3. Dikson & Company, Bombay
4. Banco Products (P) Ltd., Vadodara
5. Goodrich Gaskets Pvt Ltd
6. Starflex Sealing India Pvt Ltd, India
7. Teekay Meta Flex Pvt Ltd
8. UNIKLINGER Ltd
9. HEM Engg. Corp.
10. Unique Industrial Packing Pvt. Ltd.

## xi) Fasteners

1. Nireka Engg. Co. (P) Ltd., Calcutta
2. Precision Taps & Dies, Bombay
3. AEP Company, Vithal Udyog Nagar
4. Fix Fit Fasteners, Calcutta
5. Precision Engg. Industries, Baroda
6. Echjay Forgings Pvt. Ltd., Bombay
7. Capital Industries, Bombay
8. Boltmaster India Pvt Ltd, India
9. Deepak Fasteners Limited, India
10. Fasteners & Allied Products Pvt Ltd, India
11. Hardwin Fasteners Pvt Ltd, India
12. J.J. Industries, India
13. Multi Fasteners Pvt Ltd, India
14. Nexo Industries, India
15. Pacific Forging & Fasteners Pvt Ltd, India
16. Pioneer Nuts & Bolts Pvt Ltd, India
17. Precision Auto Engineers, India
18. President Engineering Works, India
19. Sandeep Engineering Works, India
20. Syndicate Engineering Industries, India

## xii) Welding Electrodes

For Mainline - Root: Lincoln, and Other passes: Lincoln.
For Piping- Root: Lincoln, Other passes: Lincoln, D&H

## xiii) Fire Fighting

## Equipments

### a) Fire

### Extinguishes

1. Avon Services (Production & Agencies) Pvt. Ltd., Bombay
2. Kooverji Devshi & Co., Bombay
3. Zenith Fire Services, Bombay
4. Safex Fire Services, Bombay
5. Reliable (Fire Protection) India Ltd., Bombay
6. Brij Basi Hi

7. Tech Udyog
8. Bharat Engg Works, India
9. Gunnebo India Ltd
10. Nitin Fire Protection Industries Ltd, India
11. Supremex Equipments, India
12. Vimal Fire Controls Pvt Ltd., India

### b) Fire Hydrants, Monitors, Deluge Valve, Nozzles

1. Zenith
2. Minimax
3. Newage
4. HD Fire
5. Vijay Fire
6. Asco Strumech Pvt Ltd, India
7. Brij Basi Hi
8. Tech Udyog
9. Gunnebo India Ltd
10. Nitin Fire Protection Pvt Ltd
11. Shah Bhogilal Jethamal & Brothers
12. Venus Pumps & Engineering Works

### c) RRL Hose

1. Jayshree
2. Newage

### d) Hoses

1. Ashit Sales Corporation, Bombay
2. Royal India Corporation, Bombay
3. Gayatri Industrial Corporation
4. Simplex Rubber Products Ltd., Ahmedabad
5. Zaverchand Marketing Pvt. Ltd., Baroda
6. Presidency Rubber Mill, Calcutta
7. The Cosmopolite, Calcutta
8. Simplex Rubber Products, Thane

### e) Hose Delivery

1. Chhatarya Rubber & Chemical Industries,
2. Nitin Fire Protection Industries Ltd, India

### f) Fire Hose Accessories

1. Asco Strumech Pvt Ltd
2. Brij Basi Hi-tech Udyog
3. Gunnebo India Ltd
4. Shah Bhogilal Jethamal & Brothers
5. Vimal Fire Controls Pvt Ltd., India

### g) Heat Shrinkable Sleeves

1. Covalence Raychem (Berry Plastics Corporation)
2. Canussa – CPS
3. CYJ Changtong New Material company

### h) Cold Applied Tapes

1. Denso GmBH
2. Polyken (Berry Plastics Corporation)

### i) PUR Coating

1. Powercrete (Berry Plastics Corporation)

### j) Casing End Closure

1. Raci, Italy
2. Raychem RPG Limited

### k) Casing Insulators

1. Raci, Italy
2. Raychem RPG Limited

### l) Rockshield

1. Raychem RPG Limited

### m) Warning Tape /Mesh

1. Sparco Multiplast Pvt. Ltd., Ahmedabad
2. M/s Raychem RPG Limited
3. Singhal Industries Private Limited

### n) High Build Epoxy Coating

1. Berry Plastics – Powercrete
2. Specialty Polymer Canada
3. Denso Protal, Canada

### o) Casing Insulators

1. Raci, Italy
2. Raychem RPG Limited
3. Veekay Vikram

## xiv) DRY GAS FILTER & FILTER SEPERATOR

1. Grand Prix Fab (Pvt.) Ltd.(New Delhi)
2. Perry Equipment, USA
3. Faudi Filter, Germany
4. Forain S.r.l., Italy
5. ABB, Faridabad
6. Burgess Manning, USA
7. Multitex Filtration Engineers India
8. Triveni Plenty Engg. Ltd. (New Delhi)
9. Siirtec International Contractor S.P.A (Italy)
10. Flashpoint, Pune india
11. Filteration Engineers (I) Pvt Ltd, India
12. Gujarat Otofilt, India
13. Tormene Gas Technology
14. Ultrafilter (India) Pvt Ltd, India
15. Ravi Techno Systems Pvt Ltd, India
16. Siirtec Nigi S.P.A
17. Filtan Filter Anlagenbau Gmbh
18. Fairley Arlon BV
19. PECO Facet
20. EPE Epenstenner GMBH
21. Filtrex srl
22. Petromar Engineered Soln

23. Plenty Filter
24. Eurofiltec
25. PTI Technologies Inc

**xv) FILTER ELEMENT**

1. Peco – Facet
2. Velcon
3. Pall – Filterite
4. Burgress Manning

**xvi) NDT Agency**

1. NDT Services, Ahmedabad
2. GEECY Industrial Services Pvt. Ltd., Mumbai
3. Corrosion Control Services, Mumbai
4. Perfect Metal Testing & Inspection Agency, Calcutta
5. Inter Ocean Shipping Co., New Delhi
6. RTD, Mumbai
7. Sievert, Mumbai
8. X-Tech, Vizag

#Note:– If NDT services not provided by above recommended agency, Then contractor will engage the other NDT agency shall be accepted subjected to the valid applicable license (BARC) and Satisfactory performance.

**xvii) Long Radius Bends**

1. M/s BHEL, Trichy, Tamilnadu
2. M/s Jindal SAW Limited, (Koshi Works), U.P.
3. M/s PSL Limited, Gandhidham, Gujarat
4. M/s Welspun, Gujarat
5. M/s Fabricon, Belgium
6. M/s Sawan Engineers Pvt Ltd
7. M/s Gujarat Infra

8. M/s P K Tubes
9. M/s DEE Development
10. Pipefit Engineers Pvt. Ltd.
11. United Forge Industries
12. * Or as per attached Technical Criteria.

**xviii) PIG LAUNCHERS/ RECEIVERS/ PIG SIGNALERS**

1. Bassi Luigi Fittings B.V., Holland
2. BRAUN STAHL PIPE TEC, GERMANY
3. FORAIN, ITALY
4. Fluidel SRL, ITALY
5. RMA Maschinen- und, GERMANY
6. Siiritec Nigi, Itlay
7. SCHUCK ARMATUREN, GERMANY
8. T.D. Williamson Inc., USA
9. Tectubi SPA, Italy
10. Taylor Forge Engineering System INC, USA
11. Tormene Americana S.A. (Argentina)
12. Tormene Gas Technology S.p.A., Italy
13. PIPELINE ENGINEERING, UNITED KINGDOM
14. Krohne, Oil & Gas BV, Drive Houston,
15. Multitex Filtration Engrs. Ltd, New Delhi
16. BGR ENERGY SYSTEMS LIMITED New Delhi
17. Glapwell Contracting Services Ltd. UK
18. FULGOSI GIOVANNI S.n.c di Corrado & C, ITALY
19. VEEKAY VIKRAM & CO, GUJARAT
20. GBM S.R.L, ITALY
21. Multitex Filtration Engineers Ltd., India
22. Cardew Ltd., Alexeander

23. Forain S.R.L.
24. GD Engineering, India
25. Pipeline Engineering, UK
26. Bliss Anand Pvt Ltd
27. Control Plus Oil and Gas Solutions Pvt Ltd
28. Grand Prix Engineering Pvt Ltd
29. VEE Kay Vikram & Co. LLP
30. Oswal Infrastructure Pvt Ltd
31. * Or as per attached Technical Criteria.

## xix) HOT TAPPING VENDERS

1. Furmanite International Ltd.
2. Huwelco Inc.
3. Unique Hydrographics
4. Conmate Energy
5. Propipe SL
6. Plant-Tech
7. TDW

## xx) INSULATING JOINTS

1. IGP Engineers Pvt Ltd
2. Advance Electronic Systems
3. * Or as per attached Technical Criteria.

## 2. LIST OF MATERIALS OF RECOMMENDED BRAND AND/ OR MANUFACTURE

### B. (CIVIL & STRUCTURE)

Unless otherwise specifically mentioned in the Schedule of Items, Contractor has to use materials as listed below, of only these brand names/Company's names, which are mentioned in the approved list for civil, water supply and sanitary items thereon.

## CIVIL

| Sr. No. | Items/ Name of Products | Make/ Brands/ Manufactures |
|---|---|---|
| 1. | Reinforcement Steel | TATA,SAIL,RINL,IISCO,RATHI |
| 2. | Cement | Ambuja, ACC, JK, Grasim, Ultratech, Birla, L&T, Or Approved Equivalent Cement make |
| 3. | Structural Steel | TATA,SAIL,RINL,IISCO,ESSAR, ISPAT |
| 4. | Pre- engineered building (PEB) firms | Kirby Building system India ltd ,Interach Building Product limited, Tata blue scope steel ,Lloyd Insulation India ltd, Everest Industries. Ltd. Modern Prefab System Pvt Ltd,Aster Building Solution Pvt.Ltd, Octamec Engineering Ltd,Jindal Mectec Pvt Ltd,Fedders Lioyd Corporation Ltd. |
| 5. | Structural Steel Tubes ISI Marked | TATA, JINDAL , SURYA , SWASTIK |
| 6. | (a) Zincalume colour coated steel sheet(COIL)<br>(b) Profile of Sheet(as per tender specification) | (a)Tata Blue scope, Dongbu Steel ,Union Steel, JSW STEEL Ltd.<br><br>Kirby Building system India ltd ,Interach Building Product limited, Tata blue scope steel ,Lloyd Insulation India ltd, Everest Industries. Ltd. Modern Prefab System Pvt Ltd,Aster Building Solution Pvt.Ltd, Octamec Engineering Ltd,Jindal Mectec |
| 7. | Polycarbonate Sheet | Sabic Innovative Plastic , Everest |
| 8. | Mineral wool for thermal insulation of ceilings<br>( Under deck insulation) | Rock wool (india) Ltd. Minwool Rock Fibres Ltd., Lloyd<br>Insulation, |
| 9. | Rolling shutters(ISI marked) | Swastic, Hercules, Shubdwar, M/s Bharat Rolling Shutters Industries Agra, Bengal Rolling Shutter Rama Rolling Shutter Works, Gandhi Entrance Automations Private |

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| 10. | Wind driven air Ventilators | Apurva Enterprises (Mumbai), SVS Wind Driven Turbo Ventilator(Ahmadnagar),Real Green Engineers Pvt.Ltd. Bangalore;Sun Green Ventilation system |
| | | Mumbai, Multi colour, Anchit Ispat Pvt Ltd. (Faridabad), |
| 11. | Synthetic Enamel Paint (1st quality only) | ICI Paint (Dulux), Asian Paint (Apcolite), Berger Paints (Luxol). Goodlass Nerolac Paints (Nerolac), Jenson & Nicholson Paints Ltd (Borolac), Shalimar, |
| 12. | G.I SHEET | ESSAR,JSW,,SAIL |
| 13. | Sheeting Screw | Corroshield, Buildex, |
| 14. | Chemical for Antitermite treatment | DE- NOCIL Bombay, Pest Control of India, Trishul |
| 15. | Factory made Panelled Door shutter | M/s Goel Brothers Raipur New Industrial Area Raipur (CG)<br>M/s Hindustan Housing factory Ltd- New Delhi<br>M/s Delhi Construction Eqpt Sadar Bazar Delhi<br>M/s Joinery manufacturing Co Calcutta<br>M/s Goyal Industries Faridabad<br>M/s Surbhi Metal (India) Ltd, Jodhpur |
| 16. | Flush doors IS-2191, 2202 | M/s Mysore Wood Products<br>M/s Laxmi Doors, Faizabad Road, Chinhat, Lucknow<br>M/s Merino flush doors<br>M/s Poineer Timber Products, Chandigarh, M/S Goyal Industries Faridabad |
| 17. | Fly proof doors (Made out of solid block marine grade) | M/S Laxmi Doors, Faizabad Road, Chinhat, Lucknow, Northern doors Kanpur |
| 18. | Natural Fibre Thermo Composite door/window shutter & frames, roofing sheets etc | Durosam |
| 19. | PVC Panel Door (Solid Core) | Rajshri Plastiwood Limited, Sintex, Hindopan, Marino |
| 20. | Pressed steel door frames/ cupboard and window frames (manufacturers) | M/s SAIL, M/s TATA |

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| 21. | Pressed steel door frames/ cupboard and window frames (fabricators) | M/s Loyal safe works Mayapuri, N/Delhi<br>M/s Multiwyn Industrial Corpn Calcutta<br>M/s Metal Window Corpn N/Delhi<br>M/s Chhabra Steel Udyog, 260 Sadar Bazar, Meerut Cantt<br>M/s Delite safe works, Rani Jhansi Road, N/Delhi M/s Ishwar Industries, 175/A Bombay Bazar, Meerut Cantt<br>M/s Chandni Industries, J-142, Patel Nagar 1st, Ghaziabad. |
| 22. | Steel Windows, Ventilators(as per IS-1038 of 1983) & frames pressed steel door/window | M/S Multiwyn Industrial Corpn<br>Calcutta M/S Metal Window Corp<br>N/ Delhi Govind Enterprises, Delhi<br>M/S Chhabra Steel Udyog 260, Sadar Bazar, Meerut Cantt, Agent steel MFG Pvt Ltd, Ahmedabad, Godrej, M/S Chandni Industries, J-142, Patel |
| 23. | Al Section for Al Door/ Window/ Partitions | Hindalco, Indal, Ajit India, Jindal |
| 24. | AluminumI Door/ Window/ Glazing Fabricated and Anodized | M/s Ahlcon<br>M/s Alumilite Pvt Ltd, M/s Ajit<br>India Pvt Ltd,<br>M/s Ramniklal S Raste Agra, Argent Industries, M/s Aluminium Tech Industries, I-2249 DSIDC Narela, Delhi, |
| 25. | Aluminium door and windows Fittings | M/s Elite Enterprises C/6 Shalimar Hardware<br>133, Jarg Mahal, Dhobitalao Mumbai 400002. M/s Mohan Metal Industries 178/2-A, Bhole Nath Nagar, Shahadara, Delhi 110032. |
| 26. | Automatic Glass Door | Ditec (Gandhi) |
| 27. | Aluminium Grill | Alu Grill, Arihant Aluminium Corporation, Decogrille |
| 28. | Door Closer | Everite, Golden, Gandhi |
| 29. | Floor Spring | Prabhat,Everite |
| 30. | Builders Hardware | M/s Golden Industries Pvt. Ltd., Everite,<br>Solo, Hardwyn |
| 31. | Plywood for general purpose<br>(IS-303) | National Plywood Inds Pvt Ltd, S Fancy lane, 8th floor Calcutta-700001, |
| 32. | Pre laminated Particle board | Kitply, Bhutan board, Ecoboard, Novapan, Archid ply, Merinova, Merino |
| 33. | Laminated Sheets | Formica, Merino Lam, Greenlam, National |
| 34. | Modular Partitions | Godrej, Blowplast |
| 35. | False Ceiling (Mineral Fibre Board) | Armstrong, , Daiken, Luxalon, Llyods, Gypboard,Trac,Aerolite |
| 36. | False Ceiling (POP/ Gypsum Board) | Gypboard, Anchor ceiling tiles, LA |

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| 37. | Aluminium False Ceiling | Lloyds,Armstrong,Luxlon,Trac |
| 38. | Flooring Tiles ( Mosaic / Terrazzo / PCC ) (1st quality only) | M/S Mehtab Tiles, NITCO, Royal Tiles, Gem Tiles, Hindustan Tiles, M/S National Tiles & Industries, Ultra Tiles |
| 39. | Glazed Ceramic Tiles, Non-Skid (Floor/Wall), (1st quality only) | Kajaria, Somany, NITCO. Murudeshwar Ceramic Ltd ( Navin Diamond tile ), Johnson ( Marbonite ), Marbito, Somany, Orient, Asian |
| 40. | Vitrified/ Designer Vitrified Tiles (1st quality only) | Asian, Marbonite (Johnson), Kerrogres (Kajaria), NITCO, Orient |
| 41. | PVC Tiles/Flooring (IS 3461) (1st quality only) | Marblex Tiles, Krishna Tiles, Polyfin, Armstrong, Wonder floor. |
| 42. | False Flooring | Godrej or equivalent |
| 43. | Glass Mosaic Tiles (1st quality only) | Paladio, Coral, Accura, Bisazza, Italia, Mridul. |
| 44. | Designer Paver Tiles/ Interlocking tiles ISI marked/ Grass-jointed Tiles | Pavit, Ultra, Hindustan, Eurocon, Vyara, National Tiles, Gem, Unistone, Konkrete, Unitile |
| 45. | Glass reinforced Paver block | Unistone or equivalent |
| 46. | Wall care Putty for Base preparation (1st quality only) | Birla Wall care putty, Berger, Jenson & Nicholson, JK White |
| 47. | White Cement (1st quality only) | Birla, JK |
| 48. | Cement based Paints (1st quality only) | Super Snowcem, Duracem, Super Acrocem. |
| 49. | Dry Distemper / Oil bound Distemper (1st quality only) | Goodlass Nerolac Paint, Shalimar Paint, Jenson & Nicholson, Asian Paint, Berger. ICI |
| 50. | Acrylic Washable Distemper (1st quality only) | Asian, Berger, ICI Dulux, Jenson & Nicholson, Nerolac,Shalimar,Garware & Goodlass |
| 51. | Plastic Emulsion Paint (1st quality only) | Asian, Berger, ICI, Nerolac, Jenson & Nicholson, Shalimar,Garware & Goodlass |
| 52. | Exterior Acrylic Emulsion (1st quality only) | ICI (Weathercoat), Excel (Nerolac), Apex (Asian), Berger, Jenson & Nicholson, Shalimar,Garware & Goodlass |
| 53. | Polymer based Paint | STP,CICO |
| 54. | Textured Paint / Wall Tile (1st quality only) | Unitile, Heritage, Spectrum, Iokos, Acropaints, Asian |

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| 55. | Flexible board for Expansion joint | STP or equivalent |
| 56. | Grout | Shrinkomp,Fosroc,Fairmate |
| 57. | Integral water proofing compound | STP, Pidilite, Fosroc, CICO, Sika. |
| 58. | Concrete Admixture | Pidilite, Fosroc, CICO, Sika. |
| 59. | Water proofing for cementitions surface IS-2645 | Acrocrete & Acrocote, CICO, Fosroc, STP |
| 60. | Bituminous Product | M/s Faridabad Spinning & Woolen Mills Pvt Ltd, 837, SP Mukherjee Marg Delhi, M/s STP Ltd (Formerly Shalimar Tar Products) M/s Bitufelt Pvt Ltd 123/377 Fazalm Ganj Kanpur 208012, Texas, Texas India Ltd, |
| 61. | Hardeners | Ironite, Ferrok, Hardonate |
| 62. | Construction Chemicals | Choksey, CICO, Forsroc, Sika |
| 63. | Non Metalic Surface Hardners | CICO, Fosroc, STP, Sika |
| 64. | Corrugated, Semi Corrugated & AC Sheets (IS-459-1970,IS-2098) | M/s Everest Bldg Products Ltd Jata Sankar Bosa Marg Muland (west) Bombay 400080, M/s Ramco AC Sheets “SWASTIK”, M/s Eternit Everest Ltd, UP Asbestos Ltd |
| 65. | GI Sheet ISI Marked | Multicolor, TATA, Bluescope, JSW, Colour Plus, Interarch, Lloyds, Jindal, |
| 66. | Sheet Glass /Structural Glazing | Hindustan Pilkington Glass Works, Saint Gobain, Modi |
| 67. | Multiell / Multiwall Polycarbonates Panel | M/s Coxwell Domes Engineering , Delhi, M/s Lexan , M/s Gallina India Pvt. Ltd. |
| 68. | Stainless Steel Cladding | Jindal |
| 69. | Punch Tape Concertina Coil | Global Technocrat, S.G.Engineers Delhi |
| 70. | Punch Tape In Plastic Spool | Global Technocrat, S.G.Engineers Delhi |
| 71. | Stainless Steel Railing | Jindal |
| 72. | FRP/ HDPE Garbage Bins | Sintex, Swift, Nutech, Sheetal |
| 73. | Thermoplastic Road Marking Paint | Shalimark (STP) |
| 74. | Bollard | STP |
| 75. | Cateye | TATA, STP |
| | Readymade Speed | STP |
| 77. | Fountain | Ripples, Green Evolutions, Agritech Services, Premier |
| 78. | Multi-Vent | Multicolor |

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| 79. | Sanitary ware | Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Parryware (superfine), Cera (Ist quality), Classica (Ist / |
| 80. | WC seat cover ISI Marked | Parryware, Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Cera (Ist quality), Classica (Ist / standard) |
| 81. | PVC Flushing Cistern IS: 774-1984 (ISI Certified) | Parryware, Hindustan Sanitary Wares, Cera. |
| 82. | Faucets & Taps, Stop Valves & Pillar Taps, Surgical basin mixer, Shower rose etc. | Gem, Parko, Parryware, HSW, Jaquar,Orient |
| 83. | Kitchen Stainless Steel Sink | Diamond, Nirali, Neel Kanth, Jayna |
| 84. | Looking Mirror | Saint Gobain, Modi Float, Triveni Float Glass, Crown, Atul,Ashai |
| 85. | Ready-made Bathroom Cabinets | Commander Gratings (I) Pvt Ltd, Gratolite Cabinet, A-4 Sector Viii Noida-202701, Alpina, Cera. |
| 86. | Float Valve | Leader, Bombay Metal & Alloy Co, Bombay superflow. |
| 87. | SGSW Pipes (IS-651) ISI Marked | Perfect Agra, Devraj Ind Gaziabad, Buran, RK, Prince, |
| 88. | CI (Centrifugally Cast) Pipes for sewage disposal ISI marked | NICCO, SRIF, A-1 Singhal Casting Co Agra, Jindal Saw, Kesoram, NECO |
| 89. | PVC rain water/sewage pipes (IS-4985) | Reliance, Finolex, Supreme, Kisan, Prince,Hindustan Plastic & machine corporation,Polypack industries (P) Ltd. |
| 90. | HDPE Water storage Tanks (Rotational Moulded) | Sintex, Swift, Nutech, Sheetal |
| 91. | Cast Iron Pipes and Fittings | Hindustan Engineering Products Company Calcutta, S..L.C., Standard approved manufacturers of any other brand of fittings |
| 92. | RCC Pipes | Indian Hume Pipe Company, Delhi / Allahabad / Chandigarh / Lucknow; Hindustan Pressure Pipes, Kolhapur; Dhere Concrete Products, Pune or any other approved manufacturer conforming B.I.S. |
| 93. | Brass Fittings | Leader Engineering Works, Jalandhar; L & K Mathura; Luster Sanitary, Jalandhar; Annapurna Metal Works, Calcutta; Neta Metal Works, Jalandhar; Honey Industrial |
| 94. | C.P. Fittings | Ego Metal Works, Ballabhgarh; Jaquar Industries, Delhi; Soma Plumbing Fixtures Limited, Calcutta; Gem Sanitary Appliances Pvt. Ltd.,Delhi; Essco Sanitations, Delhi; Bilmet, |

| | | |
|---|---|---|
| 95. | Stone Ware (Salt-Glazed) Pipes | Hind Ceramics Limited, Orissa; Ceramic Industries Limited, Sambalpur; Shrikamakshi Agencies, Madras; Binary Udyog Pvt. Limited, Howrah; Tirumati Moulds Limited, Nagpur; Kiran Potteries, Hyderabad; Perfect Sanitary |
| 96. | Asbestos Cement Pipes and Fittings | Ganga Asbestos Limited, U.P.; Hyderabad Asbestos Cement Products Limited; J.K. Super Pipe Industries, Nanded; Konark Cement and Asbestos Limited, Orissa; Maharashtra Asbestos Limited, Bombay; Poddar Industrial Corporation, Patna; |
| 97. | HDPE pipes and fittings | ORI-PLAST,HASTI |

## STRUCTURE

| Sl. No. | Items/Name of Products | Makes/Brands/Manufactures |
|---|---|---|
| 1 | Structural Steel | SAIL / TATA / RINL / IISCO / ESSAR / ISPAT |
| 2 | Structural Steel Tubes ISI Marked | TATA / JINDAL / SURYA / SWASTIK |
| 3 | Synthetic Enamel Paint Ist Quality only | ICI Paint (Deluxe), Asian Paint (Apcolite), Shalimar Paint (Superlac), Goodlass,Nerolac Paint(Nerolac), Berger Paints |

Any materials not fully specified in these specification and which may be offered for use in the works shall be subject to approval of Engineer, without which it shall not be used anywhere in the construction works.

## 3. LIST OF RECOMMENDED SUPPLIERS OF MAJOR BOUGHT-OUT ITEMS

### C. (ELECTRICAL)

### i) Air Conditioner

1. O General
2. Daikin
3. Hitachi

### ii) Batteries (Lead Acid)

1. Amco Batteries Ltd.
2. Exide Industries Ltd.
3. HBLNIFE Power System Ltd.
4. Amara Raja Batteries Ltd.

### iii) Batteries (Nickel Cadmium)

1. Amco Batteries Ltd.
2. HBLNIFE Power Systems Ltd.

### iv) Batteries Charger/DC-DC Converter

1. Amara Raja Power System (P) Ltd.
2. BCH.
3. Chhabi Electricals Pvt. Ltd.
4. Caldyne Automatics Limited
5. Dubas
6. HBL Nife Power Systems Ltd.
7. Universal Industries Products

8. Universal Instrument Mfg Co Pvt Ltd

**v) Cable – Fire Alarm & Communication Cables**

1. Cords Cable Industries Ltd.
2. CMI
3. Delton cables Ltd.
4. ELKAY Telelinks
5. KEI Industries Ltd.
6. Reliance Engineers Ltd.

**vi) Cable – HT (XLPE)**

1. Universal Cable Ltd.
2. KEI Industries Ltd.
3. Industrial Cables
4. NICCO Corporation Ltd.
5. Uniflex
6. Polycab.
7. Torrent cables Ltd.

**vii) Cable – LT Power and Control**

1. Cords Cable Industries Ltd.
2. Universal Cable Ltd.
3. KEI Industries Ltd.
4. Havells.
5. Delton
6. Elkay Telelinks
7. Evershine Electricals
8. Ecko
9. Ravin
10. Rallison.
11. Suyog
12. Netco
13. Uniflex
14. Paramount
15. Gloster
16. Associated cables Pvt Ltd.
17. CMI

18. Gemscab
19. Industrial cables
20. NICCO
21. Polycab
22. Torrent

**viii) Cable – Gland**

1. .Baliga
2. .Comet
3. Flexpro
4. Flameproof
5. FCG
6. Electro Werke
7. Dowels
8. CCI

**ix) Cable – Lugs**

1. Dowels
2. Jainson
3. Ismal

**x) Cable – Tray**

1. Ercon Composites
2. Yamuna Power & Infrastructure Ltd.

**xi) Cable Termination and Jointing Kit**

1. CCI
2. Raychem
3. M-Seal

**xii) Ceiling/Exhaust/Pedestal Fans & Circulators**

1. Bajaj Electricals Ltd.

2. Crompton Greaves Ltd.
3. Khaitan Electricals Ltd.
4. Havell's

**xiii) Contractors – AC Power**

1. Andrew Yule
2. ABB
3. BHEL
4. C&S
5. Havell's
6. L&T
7. Schneider
8. Siemens Ltd.
9. Telemechanique

**xiv) Control Transformer**

1. AE
2. Indushree
3. Intra Vidyut
4. Kalpa Electricals
5. Transpower Industries Ltd.
6. Siemens

**xv) DG Set**

1. Sterling and Wilson.
2. GD ankalesaria.
3. Deev Genset.
4. Jackson
5. Sudheer Gensets.
6. Power Engineering(India) Pvt Ltd.

**xvi) Earthing Materials**

1. Rukmani Electrical & Components Pvt Ltd.
2. Indiana Grating Pvt Ltd.

3. Jef Techno Solutions Pvt Ltd

Flame proof LDB's/ JB,s/Control Station/ switches

7. FCG

8. Sudhir

9. Prompt Engineering Works

10. Flame Proof equipments pvt. Ltd.

11. Baliga Lighting Equipments Pvt. Ltd.

12. Flexpro Electricals Pvt. Ltd.

#Note:- If material is not supplied by above recommended manufacture list, Then material of other make shall be accepted on MTC basis.

**xvii) <u>High Mast</u>**

1. Bajaj Electricals Limited
2. Crompton Greaves Limited.
3. Philips India Limited
4. Surya Roshani

**xviii) <u>High Voltage PCC/ MCC panels</u>**

1. BHEL
2. Control and Switchgear
3. Siemens
4. Tricolite Electrical Industries
5. Schneider
6. CGL
7. L&T

**xix) <u>Indicating Lamps</u>**

1. Alstom Ltd.
2. BCH
3. L&T Ltd.
4. Siemens Ltd.
5. Vaishno Electricals

**xx) <u>Indicating Meters</u>**

1. ABB

2. AMCO
3. AE
4. Alstom Ltd. (EE)
5. Conzerv/Schneider
6. Elecon Measurement Pvt. Ltd.
7. HPL Electric & Power Pvt. Ltd.
8. MECO Instruments Ltd.
9. Minilec
10. Rishabh Instruments Pvt. Ltd.
11. Trinity energy system
12. kaycee
13. Salzer

**xxi) Lighting Fixtures**

1. GE Lighting Pvt. Ltd.
2. Bajaj Electricals Ltd.
3. Crompton Greaves Ltd.
4. Philips India Ltd.

**xxii) Lighting Fixtures – Flameproof**

1. Bajaj Electricals Ltd.
2. Baliga Lighting Equipment Pvt. Ltd.
3. Crompton Greaves Ltd.
4. CEAG Flameproof Controlgear Pvt. Ltd.
5. Flexpro Electricals Pvt. Ltd.
6. Philips India Ltd.
7. Sudhir Switchgears Pvt. Ltd.
8. FCG.

**xxiii) Miniature Circuit Breakers (MCBs) and Lighting DB**

1. ABB
2. Hagger
3. Havell's India Ltd.
4. Indo Asian Fusegear Ltd.
5. Legrand

6. MDS Switchgear Ltd.
7. Schneider
8. Siemens Ltd.
9. HPL

**xxiv) Moulded Case Circuit Breaker (MCCBs)**

1. ABB
2. Andrew yule
3. Larsen & Toubro
4. Schneider
5. Siemens
6. Control and Switchgear

**xxv) Protection Relays – Thermal**

1. BCH
2. L&T Ltd.
3. Siemens Ltd.
4. Telemenchanique & Controls (India) Ltd.

**xxvi) Low Voltage Power Control Center (PCC)/ MCC/ PDB/ MLDB/ LDB**

1. ABB
2. BCH
3. C & S
4. Elecmech Switchgear & Instrumentation
5. KMG ATOZ
6. L&T
7. Pyrotech Electronics Pvt. Ltd.
8. Risha control Engineers Pvt. Ltd.
9. Siemens
10. Tricolite Electrical Industries
11. Unilec Engineers ltd.
12. Vidyut Control India Pvt. Ltd.
13. Control and Schematic
14. Zenith Engineering

**xxvii) Push Buttons**

1. BCH
2. Alstom Ltd.
3. L&T
4. Siemens Ltd.
5. Telemenchanique & Controls (India) Ltd.
6. Vaishno Electricals

**xxviii) Switches - Control**

1. BCH
2. Easum Reyrolle Relays & Devices Ltd.
3. Alstom
4. Kaycee Industries Ltd.
5. L&T
6. Siemens Ltd.

**xxix) Switches – 5/15A Piano/ Plate, Switch Socket**

1. Anchor Electronics & Electricals Pvt. Ltd.
2. Kingal Electricals Pvt. Ltd.
3. North-West Switchgear Ltd.

**xxx) Switch Socket Outlets (Industrial)**

1. Alstom Ltd.
2. Best & Cromption Engineering Ltd.
3. BCH
4. Crompton Greaves Ltd.
5. Essen Engineering Company Pvt. Ltd.

**xxxi) Solar Modules**

1. Tata BP Solar (I) Ltd.
2. REIL, Jaipur.
3. CEIL, Sahibabad.
4. HBL Power

**xxxii) Solar Street Lighting**

1. Tata BP Solar (I) Ltd.
2. REIL, Jaipur.
3. CEIL, Sahibabad.
4. HBL.

**xxxiii) Terminals Blocks**

1. Connectwell
2. Controls & Switchgear Co. Ltd.
3. Elmex Controls Pvt. Ltd.
4. Essen Engineering Co. Pvt. Ltd.

**xxxiv) Tranformers**

1. ABB
2. Andrew Yule
3. Areva
4. BHEL
5. Bharat Bijlee
6. Crompton Greaves
7. EMCO Ltd.
8. Intra Vidyut
9. Indushree
10. Indcoil
11. Kirloskar
12. Skippers Electricals
13. Transformers & Rectifiers (I) Ltd.
14. Voltamp

**xxxv) UPS System and Inverter**

1. DB Power
2. Aplab
3. Keltron
4. Hi-Rel
5. Dubas
6. Toshiba Corporation
7. Fuzi Electric Co Ltd

**xxxvi) GI-Octogonal Pole**

1. Bajaj
2. Transrail
3. Wipro

**xxxvii) <u>List Of Recommended Manufacturers for Heater</u>**

1. Escorts Limited, Faridabad, Haryana
2. Spherehot / Kanti Lal Chuni Lal & Sons Appliances Pvt Ltd.Surat
3. Kerone, Bhayander(E), Thane - 401105
4. Excel Heaters, Andheri (West), Mumbai - 400 053, India
5. Nirmal Industrial Controls Pvt. Ltd. , Mulund(W), Mumbai - 400 080

**NOTE: -** Item/Vendor, which are not listed above, shall be subject to prior approval from Client/Consultant.

## 4. LIST OF MATERIALS OF RECOMMENDED BRAND AND/ OR MANUFACTURE

### D. (INSTRUMENTATION)

### I. OFC JOINT CLOSURE

Manufacture/Procurement, Testing and supply of suitable OFC Joint closures including all necessary accessories of any of the following make:

1. Raychem
2. 3M
3. Siemens
4. Any other make from the approved vendor list of client with supporting paper

### II. PRESSURE GAUGES

1. AN Instruments Pvt Ltd
2. Badotherm Process Instruments
3. Baumer Bourdon Haenni S.A.S
4. British Rototherm Co Ltd
5. Budenberg Gauge Co Ltd
6. Dresser Inc
7. Forbes Marshall (Hyd) Pvt Ltd
8. General Instrument Consortium

9. H. Guru Instruments (South India) Pvt Ltd
10. Manometer (India) Pvt Ltd
11. Nagano Keiki Seisakusho Ltd
12. Hirlekar Precision, India
13. Waaree Instruments Ltd
14. Walchandnagar Industries Ltd (Tiwac Divn)
15. Wika Alexander Wiegand & Co GmbH
16. Wika Instruments India Pvt Ltd
17. Ashcroft India Pvt Ltd.

**III. TEMPERATURE GAUGES**

1. AN Instruments Pvt Ltd.
2. Badotherm Process Instruments B.V.
3. Bourdon Haenni S.A.
4. Dresser Inc.
5. General Instruments Consortium
6. H. Guru Instruments (South India) Pvt. Ltd
7. Nagano Keiki Seisakusho Ltd
6. Sbeletro Mechanicals
8. TRAC

**IV. FIELD INSTRUMENTS (P, DP, F, L, T)**

1. ABB Ltd
2. Honeywell
3. Fuji Electric Instruments Co Ltd
4. Yokogawa
5. Invensys India Pvt.Ltd

## V. FLOW COMPUTERS

1. Emerson
2. Instromet International (Belgium)
3. FMC Measurement Solutions (UK)
4. RMG (Germany)
5. OMNI Flow Computers Inc.
6. Thermo Fisher, USA

## VI. PRESSURE REGULATOR AND SLAM SHUT VALVE

1. Pietro Fiorentini S.P.A. (Italy)
2. Emerson
3. RMG-Regel Messtechnik (Germany
4. Mokveld Valves BV (Netherlands)
5. Schlumberger (USA)
6. Gorter Controls B V (Netherlands)
7. Instromet International NV
8. Nirmal Industrial Controls Pvt Ltd. (up to 6” size only)
9. ESME Valves Ltd
10. Kaye & Macdonald Inc.
11. Nuovo Pignone S.P.A (Italy) (GE Oil Co.)
12. Richards Industries (Formerly Treloar)
13. Samson AG Mess-und Regeltechnik
14. Tormene Gas Technology
15. Dresser Inc, USA (upto 8” size, 300# class only)

## VII. PRESSURE SAFETY VALVES

1. Keystone Valves (India) Pvt. Ltd.
2. Larson & Toubro Ltd.
3. Lesser GmbH & Co KG
4. Mekaster Engg Ltd..
5. Tyco Sanmar Ltd. (New Delhi)

6. Anderson Greenwood Crosby
7. BHEL (Trichy)
8. Curtiss Wright Flow Control Corporation
9. Dresser Inc.
10. Fukui Seisakusho Co. Ltd
11. Nakakita Seisakusho Co Ltd
12. Nuovo Pignone S.P.A (Italy) (GE Oil co)
13. Parcol S.P.A
14. Safety Systems UK Ltd
15. Tai Milano S.P.A
16. Weir Valves & Controls France
17. Bliss Anand Pvt Ltd.

## VIII. FLOW CONTROL VALVES

1. Fouress Engg. (New Delhi)
2. Fisher Xomox (New Delhi)
3. MIL Control Ltd. (Noida)
4. KOSO India Pvt ltd
5. Samson Control (Thane)
6. Dresser Valves India Pvt Ltd.
7. Fisher Controls
8. Valvitalia Italy
9. CCI Valve technology
10. Flowserve Pvt Ltd.
11. Metso Singapore Pvt Ltd.
12. Instrumentation Ltd Palghat
13. Dresser Inc. USA

## IX. CONTROL PANEL & ACCESSORIES

1. Keltron Controls Ltd., Kerala
2. Elechmec Corporation Ltd., Mumbai

3. Industrial Controls & Appliances Pvt. Ltd.,
4. Alstom System Ltd., Noida
5. Emerson Process Management (I) Pvt. Ltd.
6. ABB Instruments Ltd., New Delhi
7. Larsen & Toubro Ltd.
8. Control & Automation, New Delhi
9. GE Fanuc Systems Pvt. Ltd., New Delhi
10. Rockwell Automation (I) Ltd., Ghaziabad
11. Honeywell Automation Ltd.
12. Rittal
13. Pyrotech Elcronics Pvt Ltd.
14. Positronics Pvt Ltd.
15. Electronics Corporation of India Ltd.

## X. JUNCTION BOXES AND CABLES GLANDS

1. Ex-Protecta
2. Flameproof Control Gears
3. Baliga
4. Flexpro Electricals

## XI. CONTROL AND SIGNAL CABLES

1. Associated Cables
2. Brook
3. Associated Flexibles & Wires (Pvt) Ltd
4. Universal Cables Ltd,India
5. Delton Cables Ltd, India
6. KEI Industries Ltd INDIA
7. CMI Limited
8. Cords Cable Industries Ltd, India
9. Elkay Telelinks (P) Ltd., India

10. Udey Pyrocables Pvt Ltd, India
11. Goyolene Fibres (I) Pvt Ltd, India
12. Netco Cable Industries Pvt Ltd, India
13. Nicco Corporation Ltd, India
14. Paramount Communications Ltd, India
15. Polycab Wires Pvt Ltd, India
16. Radiant Cables Pvt Ltd, India
17. Reliance Engineers Ltd., India
18. Suyog Electricals Ltd, India
19. Thermo Cables Ltd

## XII. INDICATORS & CONTROLLERS

1. Yokogawa
2. Eurotherm Chessel
3. Honeywell
4. Emerson

## XIII. BARRIERS

1. MTL
2. STHAL
3. P&F
4. Phoenix

## XIV. GAS CHROMATOGRAPH

1. ABB
2. Emerson
3. Instromet International, NV
4. RMG Regal+Messtechnik GmbH
5. Yokogawa

## XV. I/P CONVERTERS

1. ABB
2. Emerson
3. IMI Watson Smith Ltd.
4. Moore Controls Ltd
5. Shreyas Instruments Pvt Ltd, India
6. Thermo Brandt Instruments

## XVI. SS FITTINGS, INSTRUMENT VALVES & MANIFOLDS

1. Aura Inc.
2. Hoke
3. Excelsior Engg Works, India
4. Parker
5. Swagelok Co.
6. Swastic Engineering Works, India
7. Comfit & Valves Pvt.Ltd
8. Arya Crafts & Engg.Pvt. Ltd

## XVII. SS TUBES

1. Sandvik
2. Hoke
3. Parker
4. Swagelok Co.
5. Heavy metal & tubes LTD
6. Nuclear Fuel Complex .India
7. Ratnamani Metal & Tube Ltd
8. Jindal Saw

## XVIII. GAS DETECTION SYSTEM

1. Crowcon Detection Instruments Ltd
2. Detection Instruments (I) Pvt Ltd

3. Detector Electronics Corporation
4. Drager Safety AG & Co. KGAA
5. General Monitors Ireland Ltd
6. Mine Safety Appliances Company
7. MSA – Mines Safety Appliances (India) Ltd
8. Industrial Scientific Oldham France S.A.
9. Riken Keiki Co Ltd
10. Simrad Optronics Icare
11. Honeywell Analytics
12. Net Safety Monitoring Inc.
13. Simtronics SAS

## 5. LIST OF RECOMMENDED MANUFACTURERS

### E. (SHOP & FIELD PAINTING)

### I. Indian Vendors

1. Asian Paints(I) Ltd.
2. Berger Paints Ltd.
3. Goodlass Nerlolac Paints Ltd.
4. Jenson And Nicholson Paint Ltd & chokuGu Jenson & Nicholson Ltd.
5. Shalimar Paints Ltd.
6. Sigma Coating, Mumabai
7. CDC Carboline Ltd.
8. Premier Products Ltd.
9. Coromandel Paints & Chemicals Ltd.
10. Anupam Enterprises
11. Grand Polycoats
12. Bombay Paints Ltd.
13. Vanaprabha Esters & Glycer, Mumbai
14. Sunil Paints and Varnishes Pvt. Ltd.

15. Courtaulds Coating & Sealants India (Pvt.) Ltd.
16. Mark-chem Incorporated, Mumbai (for phosphating chemicals only)
17. VCM Polyurethane Paint (for polyurethane Paint only)

**II. Foreign Vendors for Overseas Products**

1. Sigma Coating, Singapore
2. Ameron, USA
3. Kansai Paint, Japan
4. Hempel Paint, USA
5. Valspar Corporation, USA
6. Courtaulds Coating, UK.

## 6. RECOMMENDED MANUFACTURE LIST FOR TELECOM BOUGHT OUT ITEMS

### Fiber Optic Cable and Accessories

### Vendor Details

1. Aksh Optifibre Limited
2. Vindhya Telelink Limited
3. Finolex Cables Ltd
4. RPG Cables Limited
5. Tamilnadu telecommunication Limited
6. UM Cables Limited
7. Himachal Futuristic Communications Limited
8. Birla Ericsson Optical Limited
9. Uniflex Cables Ltd
10. Sterlite Optical technologies Limited

### HDPE Duct (For OFC) and Accessories

Manufacture/Procurement, Testing and supply of suitable HDPE duct pipe including all necessary accessories of any of the following make:

1. Raychem
2. 3M
3. Siemens
4. Sangir
5. Duraline
6. Any other make from the approved vendor list of client with supporting paper.

# INSULATION JOINTS

## 4.1 **TECHNICAL CRITERIA:**

4.1.1 The bidder shall be a manufacturer of Monolithic Insulating Joints.

4.1.2 Bidder should have designed, manufactured, tested and supplied atleast one (1) number of Monolithic Insulating Joint that are of same type, equal or higher in terms of size and pressure rating as quoted for, in the last (7) years reckoned from the bid due date.

**Note:**

1. Experience of only the bidding entity shall be considered. A Job executed by a Bidder for its own plant/ project cannot be considered as experience for the purpose of meeting of this Tender Document. However, jobs executed for Subsidiary/Fellow subsidiary / Holding company will be considered as experience for the purpose of meeting Subject to submission of tax paid invoice (s) duly certified by Statutory Auditor of the Bidder towards payments of statutory tax in support of the job executed for Subsidiary/Fellow subsidiary/ Holding company. Such Bidders to submit these documents in addition to the documents specified to meet of this Tender Document.

2. Bids from Consortium/Joint bids/multiple bids/alternative bids shall not be accepted in the instant tender.

3. Bidder shall not be affiliated with a firm or entity, (i) that has provided consulting services related to works to employer during preparatory stages of works or of the period of which the work form a part, or (ii) that has been hired (or proposed to be hired) by the employer as Engineer/Consultant for the contract.

# PIG TRAPS

## 4.1 **TECHNICAL CRITERIA**

(i) Bidder shall be a manufacturer of Pig Launcher / Receiver.

(ii) The Bidder should have designed, manufactured, tested and supplied at least one (01) number Pig Launcher / Receiver that are of equal or higher in terms of size & pressure rating as quoted for, in last seven (07) years reckoned from the bid due date.

(iii) The Bidder or its proposed supplier of Quick Opening End Closure (QOEC) to be installed on Pig Launcher/ Receiver should have designed, manufactured, tested and supplied at least one (01) number Quick Opening End Closure (QOEC) that are equal or higher in terms of size and pressure rating as quoted for in last seven (07) years reckoned from the bid due date.

Note:

(i) A job executed by a bidder for its own Plant/Projects will not be considered as experience for the purpose of meeting of the Tender. However, jobs executed for Subsidiary / Fellow Subsidiary / Holding company will be considered as experience for the purpose of meeting subject to submission of tax-paid invoice(s) duly certified by Statutory Auditor of the bidder towards payments of statutory tax in support of the job executed for Subsidiary/ Fellow Subsidiary / Holding Company. Such bidders to submit these documents in addition to the documents specified in the Bid Document to meet of the tender documents.

(ii) Bidder shall not be affiliated with a firm or entity, (i) that has provided consulting services related to works to employer during preparatory stages of works or of the period of which the work form a part, or (ii) that has been hired (or proposed to be hired) by the employer as Engineer / Consultant for the contract

# FLANGE & FITTINGS

## 4.1 **TECHNICAL CRITERIA:**

### 4.1.1 **FOR – FLANGES, SPECTACLE BLIND**

4.1.1.1 The bidder shall be a manufacturer of items as quoted.

4.1.1.2 The bidder, in last seven (7) seven years reckoned form the bid due date, should have designed, manufactured, tested and supplied from the proposed manufacturing plant at least one (1) number of Flange/Spectacle Blind equal or higher in terms of size & Pressure rating specified in the group as quoted for.

### 4.1.2 **FOR – EQUAL TEE, UNEQUAL TEE, CONCENTRIC REDUCER,WELDOLET,SOCKOLET,ELBOW**

4.1.2.1 The bidder shall be a manufacturer of items as quoted.
4.1.2.2 The bidder, in last seven (7) seven years reckoned form the bid due date, should have designed, manufactured, tested and supplied from the proposed manufacturing plant at least one (1) number of Equal Tee/Unequal Tee/Concentric Reducer/ Weldolet/Sockolet /Elbow of atleast equal or higher in terms of size & pressure rating specified in the group as quoted for.

### 4.1.3 **FOR – FLOW TEE**

4.1.3.1 The Bidder shall be a manufacturer of items as quoted.

4.1.3.2 Bidder should have designed, manufactured, tested and supplied at least one (1) number of Flow Tee, that are of same type, equal or higher in terms of size & pressure rating as quoted for, in the last seven (7) years reckoned from the bid due date.

### 4.1.4 **FOR – BEND**

4.1.4.1 The bidder shall be a manufacturer of items as quoted.

4.1.4.2 The bidder, in last seven (7) seven years reckoned form the bid due date, should have designed, manufactured, tested and supplied from the proposed manufacturing plant at least one (1) number of Bend which is at least equal or higher in terms of size &pressure rating specified in the group as quoted for.

**Note:**

1. Experience of only the bidding entity shall be considered. A Job executed by a Bidder for its own plant/ project cannot be considered as experience for the purpose of meeting of this Tender Document. However, jobs executed for Subsidiary/Fellow subsidiary / Holding company will be considered as experience for the purpose of meeting subject to submission of tax paid invoice (s) duly certified by Statutory Auditor of the Bidder towards payments of statutory tax in support of the job executed for Subsidiary/Fellow subsidiary/ Holding company. Such Bidders to submit these documents in addition to the documents specified to meet of this tender.

2. Bids from Consortium/Joint bids/multiple bids/alternative bids shall not be accepted in the instant tender.

3. Bidder shall not be affiliated with a firm or entity, (i) that has provided consulting services related to works to employer during preparatory stages of works or of the period of which the work form a part, or (ii) that has been hired (or proposed to be hired) by the employer as Engineer/Consultant for the contract.

# BALL VALVE

## 4.1 **TECHNICAL CRITERIA**

(i) Bidder shall be a manufacturer of Ball Valves as per API 6D Specification and shall have a valid license to use API monogram for the proposed manufacturing Plant(s).

(ii) Bidder shall have designed, manufactured, tested and supplied from the proposed manufacturing plant at least one (1) number Ball Valve as per API 6D, specifications, identical in terms of design and equal or higher in terms of size and rating, as quoted for, in the last seven (7) years reckoned from the bid due date.

(iii) The bidder or his proposed supplier of Gas powered / Gas over oil actuator(s) shall have designed, manufactured, tested and supplied at least one (1) number valve actuator of similar type / model, as being offered, within the last seven (7) years reckoned from the bid due date. Documents submitted for qualification should clearly specify the actuation medium as natural gas.

**Note:**

(i) A job executed by a bidder for its own Plant/Projects will not be considered as experience for the purpose of meeting of the Tender. However, jobs executed for Subsidiary / Fellow Subsidiary / Holding company will be considered as experience for the purpose of meeting subject to submission of tax-paid invoice(s) duly certified by Statutory Auditor of the bidder towards payments of statutory tax in support of the job executed for Subsidiary/ Fellow Subsidiary / Holding Company. Such bidders to submit these documents in addition to the
documents specified in the Bid Document to meet of the tender documents.

(ii) Bidder shall not be affiliated with a firm or entity, (i) that has provided consulting services related to works to employer during preparatory stages of works or of the period of which the work form a part, or (ii) that has been hired (or proposed to be hired) by the employer as Engineer / Consultant for the contract.

**Notes:**

1. Bidder can select vendor from this VENDOR LIST and mention the same in the checklist for technical evaluation attached with the tender. The offered bid must include filled datasheet indicating make, model, size, rating of offered instrument/ equipment duly supported by sizing calculation of offered equipment (wherever applicable).

2. Vendors who have already supplied above equipment in other terminals of GAIL (I) Ltd, shall also be considered qualified for this tender provided the supplier equipment are commissioned and running successfully and they have not been put on holiday in list of Client/LEPL/ Other PSU

3. Equipment / Instruments of any make which is offered by one bidder and acceptable to GAIL (I) Ltd shall be accepted for other bidder also. After placement of order, on request of the successful bidder list of other qualified makes for a particular item (for which successful bidder wants to change the vendor) shall be provided.

4. Bidder shall take prior approval of the make / model no of the offered item and it shall be from the list given above. However additional vendors will be considered in exceptional cases, provided they have supplied for similar application to reputed gas transmission/distribution companies, in quantities at least half the numbers being supplied for this tender, and working satisfactorily for minimum 6 months. Documentary evidence substantiating above shall be submitted for taking approval.

5 For procuring bought out items from vendors other than those listed above, the same may be acceptable subject to the following: -

   a) The vendor/ supplier of bought out item(s) is a manufacturer/ supplier of said item(s) for intended services and the sizes being offered is in their regular manufacturing supply range.

   b) Should have supplied at least one single random length (i.e. 5.5 meters to 6.5 meters) for item assorted pipes / tubes and for other items, which are to be supplied in quantity on number-basis (other than assorted pipes / tubes) minimum 01 (One) number of same or higher in terms of size and rating as required for intended services. The bidder should enclose documentary evidences i.e. PO copies, Inspection Certificate etc. for the above, along with their bids.

6 For any other item(s) for which the vendor list is not provided, bidders can supply those item(s) from vendors/ suppliers who have earlier supplied same item(s) for the intended services in earlier projects and the item(s) offered is in their regular manufacturing/ supply range. The bidder is not required to enclose documentary evidences (PO copies, Inspection Certificate etc.) along with their offer, however in case of successful bidder, these documents shall require to be submitted by them within 30 days from date of Placement of Order for approval to CLIENT / LEPL.

7 The details of vendors indicated in this list are based on the information available with LEPL, Contractor shall verify capabilities of each vendor for producing the required quantity with. PMC does not guarantee any responsibility on the performance of the vendor. It is the contractor's responsibility to verify the correct status of vendor and quality control of each parties and also to expedite the material in time.

# GAIL INDIA LIMITED

# COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL AND GPU GANDHAR TO GNFC PIPELINE

## SCHEDULE OF RATES
## (SOR)

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 17.10.2022 | Issued For Bid | JR | TR | SB | |
| 1 | 11.07.2022 | Issued For Bid | JR | TR | SB | |
| 0 | 08.03.2022 | Issued For Review | SR | SKK | HM | |
| **Rev** | **Date** | **Purpose** | **Prepared By** | **Checked By** | **Approved By** | |

GAIL (India) Limited

# SUMMARY OF RATES

Lyons Engineering Pvt. Ltd.

**Project :Coating Refurbishment and Associated works of Vaghodia to RIL & GPU Gandhar to GNFC Pipeline in Gujarat**

| Sl. | Section | Description of work | In Figures | In Words |
|---|---|---|---|---|
| 1 | A | Vaghodia to RIL | - | |
| 2 | B | GPU Gandhar to GNFC | - | |
| 3 | | Gross Total Amount (inclusive of all applicable taxes & duties excluding GST) [1+2] | | |
| 4 | | **GST @ 18% on net Total amount mentioned at Sl. No. 3 above.** | | |
| 5 | | **GST @ --% on -- % on value of free issue material of INR 16 Crores** | | |
| 6 | | **Grand Total Amount for (Sl. No. 3+4+5)** | | |

| GAIL (India) Limited | SCHEDULE OF RATES (SOR): SECTION-A: COATING REFURBISHMENT AND ASSOCIATED WORKS<br>(VAGHODIA - RIL VADODARA LINE (18" dia x 8 Km Length)) | Lyons Engineering Pvt. Ltd. |
|---|---|---|

**Project :Coating Refurbishment and Associated works of Vaghodia to RIL & GPU Gandhar to GNFC Pipeline in Gujarat**

**Name of Bidder:**

**Currency: INR**

| SOR Item No. | Description of Item | GPU Gandhar to GNFC | Qty. | ESTIMATED UNIT RATE INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT | ESTIMATED TOTAL AMOUNT INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT |
|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) |
| A00100 | COATING AND WRAPPING OF PIPELINE | | | | |
| | Receiving and taking over, as defined in the specifications, handing, loading, transportation and unloading of Owner-supplied 3 PLY & 2PLY coating materials along with associated materials like Primer, Filler Material etc. from Owner's designated stock-yard to Contractor's stock-yard / workshop / work-site including preliminary activities, preparation of drawings, wherever required etc. including handling, stacking, on the pipeline right-of-use / pipeline route alignment, carrying out inspection of Company-supplied materials, at the time of taking over, including execution of all works, including loading and unloading, arrangement of all additional land required for Contractor's storage, access for construction, procurement and supply of all materials (except Owner-supplied materials), consumables, equipment, labour and other inputs, carrying out all temporary, ancillary, auxiliary works, as per drawings, specifications, other provisions of Contract Document and instructions of Engineer-in-Charge (EIC), including, but not limited to, carrying out following works: | | | | |
| | Survey required for entire pipeline route at the time of construction including marking the route map, alignment sheet, topographical sheet & other survey drawings, etc., preparation of AFC drawings showing survey details, and submit same to Owner for review. | | | | |
| | Excavating in all type of soil including hard murrum & rock for exposing existing pipeline in ROW normally buried at 1.5 m to 2.5 mtr depth (The depth may vary near road/ rail / nala/ cart track crossing or at locations where subsequent filling has taken place) . The rates are inclusive of shoring, shuttering, de-watering of surface water and water in pipeline trench & cutting of cart tracks, Kachha irrigation channel and embankment falling in ROU and making bye pass for the movement of equipments and restoration of the same to its original condition upon the completion of the job. During excavation all necessary precautions are to be taken by providing sand bag/earth support to ensure maximum unsupported length of less than 10 m.The size of the trench width and depth will be suitable for ensuring free movement of the GAIL/PMC supplied hand wrapping machine for coating application. | | | | |
| | Removing old coat & wrap with scrappers using wooden/ brass hammers etc. Safe disposal of the old coal tar coating as directions of Owner/PMC. | | | | |
| | Suface preparation of pipe by copper slag abrasive blasting to achieve Sa21/2 finish with anchor pattern 50 to 100 microns.Checking and marking the blasted steel surface area for surface imperfections/pits/damages and recording the length of the pipe from girthweld to girthweld. | | | | |
| | Measuring the wall thickness of the pipe using ultrasonic meter at 3,6,9 and 12' o clock position every three meter and at locations where pitting is observed. | | | | |
| | Application of the coating material to be free issued by GAIL.<br>(i) Applying liquid adhesive primer at the blasted surface with hand brush.<br>(ii) Applying 3ply tape inner layer with 50% overlap with the help of hand operated machine followed by an 2ply tape outer layer for additional mechanical protection also to be applied with 50% overlap with the help of hand operated machine to the satisfaction of GAIL/PMC. | | | | |
| | Inspection and testing of the coating - thickness testing, 100% holiday detection, peel test. The frequency of the testing shall be as per approved QAP. | | | | |
| | Backfilling of the trench gradually with available soft selected earth all around the pipe in full trench width up to 12" below the pipe to 12" above the pipe. During back filling contractor shall properly provide compaction of the backfilled earth & restore the worksite / to original conditions. | | | | |
| | Restoration of the ROU to its original condition including restoration of field boundaries/ fencing/ field demarcation post / drains / channels / roads / irrigation pipes of the farmers / ROU boundary pillars / TLPs / KM posts / warning sign boards / markers/ Turning point markers etc. to the satisfaction of GAIL/PMC. | | | | |
| | Preparation of as-built drawings, documents (2 soft copy in AutoCad format in CD, 2 soft-copies in PDF format (in CD) and 4 set of hard-copies ) All the works shall be executed in accordance with the provision of Contract and direction of GAIL Engineer-In-Charge(EIC) | | | | |
| A00101 | 3 PLY& 2 PLY cold applied system at Dry Areas/ Wet Area during Rainy season: | Meter | 8000 | | - |

| GAIL (India) Limited | SCHEDULE OF RATES (SOR): SECTION-A: COATING REFURBISHMENT AND ASSOCIATED WORKS<br><br>(VAGHODIA - RIL VADODARA LINE (18" dia x 8 Km Length)) | Lyons Engineering Pvt. Ltd. |
|---|---|---|

| | |
|---|---|
| Project :Coating Refurbishment and Associated works of Vaghodia to RIL & GPU Gandhar to GNFC Pipeline in Gujarat | |
| Name of Bidder: | |
| | |
| Currency: INR | |

| SOR Item No. | Description of Item | GPU Gandhar to GNFC | Qty. | ESTIMATED UNIT RATE INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT | ESTIMATED TOTAL AMOUNT INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT |
|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) |
| | | | | | |

| GAIL (India) Limited | SCHEDULE OF RATES (SOR): SECTION-A: COATING REFURBISHMENT AND ASSOCIATED WORKS<br>(VAGHODIA - RIL VADODARA LINE (18" dia x 8 Km Length)) | Lyons Engineering Pvt. Ltd. |
|---|---|---|

**Project :Coating Refurbishment and Associated works of Vaghodia to RIL & GPU Gandhar to GNFC Pipeline in Gujarat**

**Name of Bidder:**

**Currency: INR**

| SOR Item No. | Description of Item | GPU Gandhar to GNFC | Qty. | ESTIMATED UNIT RATE INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT | ESTIMATED TOTAL AMOUNT INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT |
|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) |
| A00200 | **EXTRA EXCAVATION FOR DEPTH BEYOND 2.5M DEPTH TO 3.5 M DEPTH** | | | | |
| A00210 | Extra excavation for depth beyond 2.5m depth and upto 3.5 M depth in river/ canal beds and other specific locations: Excavation in all types of ordinary and hard soils including hard murrum including de-watering the excavated pits necessary shoring,strutting including backfilling, stacking selected excavated material for back filling and/ or disposing outside the premises of GAIL, if the depth of the pipe (from top of pipe) is more than 2.5m depth from average land surface level. Payment shall be made for quantity in cum to be calculated beyond 2.5 depth (from top of pipe to surface level) of pipe | Cubic Meter | 1200 | | - |
| A00300 | **EXTRA EXCAVATION FOR DEPTH BEYOND 3.5 M DEPTH** | | | | |
| A00310 | Extra excavation for depth beyond 3.5 mtr depth in canal beds and other specific locations: Excavation in all types of ordinary and hard soils including hard murrum including de-watering the excavated pits necessary shoring, shuttering including backfilling, stacking selected excavated material for back filling and/ or disposing outside the premises of GAIL, if the depth of the pipe (from top of pipe) is more than 3 mtr depth from average land surface level. Payment shall be made for quantity in cum to be calculated beyond 3 mtr depth (from top of pipe to surface level) of pipe. Average depth considered up to 6 mtr. | Cubic Meter | 600 | | - |
| A00400 | **SUPPLY AND FILLING OF SELECTED EARTH/MOORUM (EXCLUDING BLACK COTTON SOIL)** | | | | |
| A00410 | Supplying and filling selected earth/moorum (excluding black cotton soil) from Contractor's own borrow areas including royalty, with all leads and lifts in low laying areas and filling to required grade and level including watering, compacting at optimum moisture content to 90% of Proctor's density, consolidation and rolling with 8to10 tonne power roller in layers not exceeding 20cm thickness, complete in all respects inclusive of cost of all labour, materials ,tools, tacklesss etc. as per drawings, specification and direction of GAIL Engineer-In-Charge(EIC) | Cubic Meter | 400 | | - |
| A00500 | **PUMPING OUT OF WATER** | | | | |
| A00510 | Pumping out of water including dewatering trenches, ponds, depressions etc. by contractor's own pump with all labour, hoses, consumables, fuel etc. complete as per the direction of the Engineer-in-charge. Note: This item shall be operated only after getting the approval of the Engineer-in-charge. This item shall be included only when Dewatering/ Pumping out of water is not included in any other item. (This item pertains to only such pumping of water as is envisaged at the time of tendering and do not include those that need be covered under contractual risk).From ponds, pits, trenches etc. where volume is not measurable. Note: Unit of measurement is H (hour) which shall be measured as number of hrs. of pump running per horse power (HP) of pump used. | Days | 80 | | - |
| A00600 | **REPAIR AND RECONNECTION OF CATHODIC PROTECTION (CP) CABLES ON PIPELINE** | | | | |
| A00610 | Repair and reconnection of CP cables on existing Pipelines through Pin Brazing as per drawing, specification and direction of GAIL/PMC Engineer-In-Charge | Nos. | 40 | | - |
| **Note: (1)** The quantities given above against individual items are indicative and shall not be considered to be binding. The quantities may be increased, decreased or deleted at site at the time of actual execution. Procurement shall be done as per actual site condition, approved construction drawings and as per instruction of EIC. The unit rate shall be operated to work out the final payment to the contractor; | | | | | |
| **TOTAL: SECTION-A [COATING REFURBISHMENT AND ASSOCIATED WORKS OF VAGODIA TO RIL]- VIP LINE** | | | | | **-** |

GAIL (India) Limited

## SCHEDULE OF RATES (SOR): SECTION-B: COATING REFURBISHMENT AND ASSOCIATED WORKS

## (GPU GANDHAR DT - GNFC RT LINE (18" dia x 29.5 Km Length))

Lyons Engineering Pvt. Ltd.

**Project :Coating Refurbishment and Associated works of Vaghodia to RIL & GPU Gandhar to GNFC Pipeline in Gujarat**

**Name of Bidder:**

**Currency: INR**

| SOR Item No. | Description of Item | GPU Gandhar to GNFC | Qty. | ESTIMATED UNIT RATE INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT | ESTIMATED TOTAL AMOUNT INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT |
|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) |
| B00100 | COATING AND WRAPPING OF PIPELINE | | | | |
| | Receiving and taking over, as defined in the specifications, handing, loading, transportation and unloading of Owner-supplied 3 PLY & 2PLY coating materials along with associated materials like Primer, Filler Material etc. from Owner's designated stock-yard to Contractor's stock-yard / workshop / work-site including preliminary activities, preparation of drawings, wherever required etc. including handling, stacking, on the pipeline right-of-use / pipeline route alignment, carrying out inspection of Company-supplied materials, at the time of taking over, including execution of all works, including loading and unloading, arrangement of all additional land required for Contractor's storage, access for construction, procurement and supply of all materials (except Owner-supplied materials), consumables, equipment, labour and other inputs, carrying out all temporary, ancillary, auxiliary works, as per drawings, specifications, other provisions of Contract Document and instructions of Engineer-in-Charge (EIC), including, but not limited to, carrying out following works: | | | | |
| | Survey required for entire pipeline route at the time of construction including marking the route map, alignment sheet, topographical sheet & other survey drawings, etc., preparation of AFC drawings showing survey details, and submit same to Owner for review. | | | | |
| | Excavating in all type of soil including hard murrum & rock for exposing existing pipeline in ROW normally buried at 1.5 m to 2.5 mtr depth (The depth may vary near road/ rail / nala/ cart track crossing or at locations where subsequent filling has taken place) . The rates are inclusive of shoring, shuttering, de-watering of surface water and water in pipeline trench & cutting of cart tracks, Kachha irrigation channel and embankment falling in ROU and making bye pass for the movement of equipments and restoration of the same to its original condition upon the completion of the job. During excavation all necessary precautions are to be taken by providing sand bag/earth support to ensure maximum unsupported length of less than 10 m.The size of the trench width and depth will be suitable for ensuring free movement of the GAIL/PMC supplied hand wrapping machine for coating application. | | | | |
| | Removing old coat & wrap with scrappers using wooden/ brass hammers etc. Safe disposal of the old coal tar coating as directions of Owner/PMC. | | | | |
| | Suface preparation of pipe by copper slag abrasive blasting to achieve Sa21/2 finish with anchor pattern 50 to 100 microns.Checking and marking the blasted steel surface area for surface imperfections/pits/damages and recording the length of the pipe from girthweld to girthweld. | | | | |
| | Measuring the wall thickness of the pipe using ultrasonic meter at 3,6,9 and 12' o clock position every three meter and at locations where pitting is observed. | | | | |
| | Application of the coating material to be free issued by GAIL.<br>(i) Applying liquid adhesive primer at the blasted surface with hand brush.<br>(ii) Applying 3ply tape inner layer with 50% overlap with the help of hand operated machine followed by an 2ply tape outer layer for additional mechanical protection also to be applied with 50% overlap with the help of hand operated machine to the satisfaction of GAIL/PMC. | | | | |
| | Inspection and testing of the coating - thickness testing, 100% holiday detection, peel test. The frequency of the testing shall be as per approved QAP. | | | | |
| | Backfilling of the trench gradually with available soft selected earth all around the pipe in full trench width up to 12" below the pipe to 12" above the pipe. During back filling contractor shall properly provide compaction of the backfilled earth & restore the worksite / to original conditions. | | | | |
| | Restoration of the ROU to its original condition including restoration of field boundaries/ fencing/ field demarcation post / drains / channels / roads / irrigation pipes of the farmers / ROU boundary pillars / TLPs / KM posts / warning sign boards / markers/ Turning point markers etc. to the satisfaction of GAIL/PMC. | | | | |
| | Preparation of as-built drawings, documents (2 soft copy in AutoCad format in CD, 2 soft-copies in PDF format (in CD) and 4 set of hard-copies ) All the works shall be executed in accordance with the provision of Contract and direction of GAIL Engineer-In-Charge(EIC) | | | | |
| B00101 | 3 PLY & 2 PLY cold applied system at Dry Areas/ Wet Area during Rainy season: | Meter | 29500 | | - |
| | | | | | |

GAIL (India) Limited

# SCHEDULE OF RATES (SOR): SECTION-B: COATING REFURBISHMENT AND ASSOCIATED WORKS

## (GPU GANDHAR DT - GNFC RT LINE (18" dia x 29.5 Km Length))

Lyons Engineering Pvt. Ltd.

**Project :Coating Refurbishment and Associated works of Vaghodia to RIL & GPU Gandhar to GNFC Pipeline in Gujarat**

**Name of Bidder:**

**Currency: INR**

| SOR Item No. | Description of Item | GPU Gandhar to GNFC | Qty. | ESTIMATED UNIT RATE INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT | ESTIMATED TOTAL AMOUNT INCLUSIVE OF ALL TAXES, DUTIES, LEVIES, FREIGHT, INSURANCE, INCLUDING INSURANCE OF FREE ISSUE MATERIALS, TAXES ON BUILDING AND OTHER CONSTRUCTION WORKERS, ETC. BUT EXCLUDING GST AS DEFINED IN BID DOCUMENT |
|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) |
| B00200 | **EXTRA EXCAVATION FOR DEPTH BEYOND 2.5M DEPTH TO 3.5 M DEPTH** | | | | |
| B00210 | Extra excavation for depth beyond 2.5m depth and upto 3.5 M depth in river/ canal beds and other specific locations: Excavation in all types of ordinary and hard soils including hard murrum including de-watering the excavated pits necessary shoring,strutting including backfilling, stacking selected excavated material for back filling and/ or disposing outside the premises of GAIL, if the depth of the pipe (from top of pipe) is more than 2.5m depth from average land surface level. Payment shall be made for quantity in cum to be calculated beyond 2.5 depth (from top of pipe to surface level) of pipe | Cubic Meter | 3000 | | - |
| B00300 | **EXTRA EXCAVATION FOR DEPTH BEYOND 3.5 M DEPTH** | | | | |
| B00310 | Extra excavation for depth beyond 3.5 mtr depth in canal beds and other specific locations: Excavation in all types of ordinary and hard soils including hard murrum including de-watering the excavated pits necessary shoring, shuttering including backfilling, stacking selected excavated material for back filling and/ or disposing outside the premises of GAIL, if the depth of the pipe (from top of pipe) is more than 3 mtr depth from average land surface level. Payment shall be made for quantity in cum to be calculated beyond 3 mtr depth (from top of pipe to surface level) of pipe. Average depth considered up to 6 mtr. | Cubic Meter | 1500 | | - |
| B00400 | **SUPPLY AND FILLING OF SELECTED EARTH/MOORUM (EXCLUDING BLACK COTTON SOIL)** | | | | |
| B00410 | Supplying and filling selected earth/moorum (excluding black cotton soil) from Contractor's own borrow areas including royalty, with all leads and lifts in low laying areas and filling to required grade and level including watering, compacting at optimum moisture content to 90% of Proctor's density, consolidation and rolling with 8to10 tonne power roller in layers not exceeding 20cm thickness, complete in all respects inclusive of cost of all labour, materials ,tools, tacklesss etc. as per drawings, specification and direction of GAIL Engineer-In-Charge(EIC) | Cubic Meter | 1000 | | - |
| B00500 | **PUMPING OUT OF WATER** | | | | |
| B00510 | Pumping out of water including dewatering trenches, ponds, depressions etc. by contractor's own pump with all labour, hoses, consumables, fuel etc. complete as per the direction of the Engineer-in-charge. Note: This item shall be operated only after getting the approval of the Engineer-in-charge. This item shall be included only when Dewatering/ Pumping out of water is not included in any other item. (This item pertains to only such pumping of water as is envisaged at the time of tendering and do not include those that need be covered under contractual risk).From ponds, pits, trenches etc. where volume is not measurable. Note: Unit of measurement is H (hour) which shall be measured as number of hrs. of pump running per horse power (HP) of pump used. | Days | 200 | | - |
| A00600 | **REPAIR AND RECONNECTION OF CATHODIC PROTECTION (CP) CABLES ON PIPELINE** | | | | |
| A00610 | Repair and reconnection of CP cables on existing Pipelines through Pin Brazing as per drawing, specification and direction of GAIL/PMC Engineer-In-Charge | Nos. | 100 | | - |
| **Note: (1)** The quantities given above against individual items are indicative and shall not be considered to be binding. The quantities may be increased, decreased or deleted at site at the time of actual execution. Procurement shall be done as per actual site condition, approved construction drawings and as per instruction of EIC. The unit rate shall be operated to work out the final payment to the contractor; | | | | | |
| **TOTAL: SECTION-B [COATING REFURBISHMENT AND ASSOCIATED WORKS OF GPU GANDHAR TO GNFC]- GNFC LINE** | | | | | **-** |