FORMAT NO. : HSE-24 REV 0

Boom Lift Inspection Checklist

Name of Contractor: **Project:**

Name of Work: **Job No:**

Vehicle Identification/Registration No: **Date:**

Sr. No.	Description	Observation	Remarks & Suggestions
1	Operating and emergency controls are in proper working condition, EMO button or Emergency Stop Device		
2	Functional upper drive control interlock (i.e. foot pedal, spring lock, or two hand controls)		
3	Emergency Lowering function operates properly		
4	Lower operating controls successfully override the upper controls		
5	Both upper and lower controls are adequately protected from inadvertent operation.		
6	Control panel is clean & all buttons/switches are clearly visible (no paint over spray, etc.)		
7	All switch & mechanical guards are in good condition and properly installed		
8	All Safety Indicator lights work		
9	Drive controls function properly & accurately labelled (up, down, right, left, forward, back)		
10	Motion alarms are functional		
11	Safety decals are in place and readable		
12	Guardrails and anchor points are in place, and in good condition		
13	Work platform & extension slides are clean, dry, & clear of debris		
14	Work platform extension slides in and out freely with safety locking pins in place to lock setting on models with extension platforms.		
15	Any defects such as cracked welds, fuel leaks, hydraulic leaks, damaged control cables or wire harness, etc.		
16	Braking devices are operating properly		
17	The manufacturer's operations manual is stored on AWP (in all languages of the operators)		
18	Oil level, Hydraulic Oil Level, Fuel Level, Coolant Level		

19	Battery Charge		
20	Outriggers in place or functioning. Associated alarms working		
21	Tyres and wheels are in good condition, with adequate air pressure if pneumatic		
22	Wheel chokes are present and are used whenever required		
23	Moving & rotating parts guarded		
24	Load chart provided		
25	Fire Extinguisher		
26	Spark Arrestor, if operated by using fuel(For Running Refinery/ Petrochemical/Chemical Plant)		
27	Serial number plate with Load capacity		
28	TPI Certificate		
29	Colour Coding		
30	Insurance		
31	Pre Medical Check-up& Periodic Medical check-up (every 6 months) including vision test for Operator		
32	Safety Induction for Operator		
33	Others		

Signature & Name of Operator:

Signature & Name of Contractor's Concern Engineer

Signature & Name of Contractor's Safety Officer

मंगलूर रिफाइनरीएंड पेट्रोकेमिकल्स लिमिटेड

MANGALORE REFINERY & PETROCHEMICALS LIMITED

(ऑयल एंड नैचुरल गैस कारपोरेशन लिमिटेड की सहायक कंपनी)

(A Subsidiary of Oil and Natural Gas Corporation Limited)

एचएसई विभाग HSE DEPARTMENT

अंत कार्यालय ज्ञापन INTER OFFICE MEMO

प्रेषक From	मुख्य महा प्रबंधक (एच.एस.ई & आई.एस.ओ) CGM (HSE & ISO)	प्रापक To	समूह महा प्रबंधक (सामग्री) GGM (Materials)
दिनांक Date	04 जनवरी 2020, 04 January 2020	संदर्भ सं Ref. No.	HSE/IOM/2019-20/237

विषय Sub : Revised Contractor Safety Policy of MRPL

The Contractor Safety Policy of MRPL was reviewed recently and the existing penalty system for safety violations was amended.

A copy of revised Safety Policy is enclosed.

सादर With best regards,

04/01/2020

यु. वि. ऐताल U.V. Aithal

मुख्य महा प्रबंधक (एच.एस.ई. & आई.एस.ओ) CGM (HSE & ISO)

CC: GGM (I/c Refinery) - For kind information please

MANGALORE REFINERY AND PETROCHEMICLAS LTD.

CONTRACT WORKER'S SAFETY POLICY – REV.

INDEX

Sr. no.	Topic	Page no.
1	1.SCOPE	3
2	2.REFERENCE	3
3	3.SAFETY REQUIREMENTS FOR CONTRACTORS	3
4	4.PERSONNEL	4
5	5.HEALTH AND HYGIENE	8
6	6.VEHICLE MOVEMENT	9
7	7.SAFE MEANS OF ACCESS	10
8	8.EXCAVATION, TRENCHING AND EARTH REMOVAL	11
9	9.DEMOLITION	12
10	10.PERSONAL PROTECTIVE EQUIPMENTS	13
11	11.PAINTING	14
12	12.LIFTING MACHINES TOOLS AND TACKLES	15
13	13.TEMPORARY SHEDS	16
14	14.ERECTION	17
15	15.WORK ON TALL CHIMNEYS	20
16	16.SAFETY OF ELECTRICAL WORKS	21
17	17.CATCH NETS	21
18	18.PROTECTION AGAINST MOVING VEHICLES	22
19	19.HANDLING MATERIALS	22
20	20.STACKING AND PILING	22
21	21.WELDING AND GAS CUTTING	22
22	22.GRINDING	23
23	23.HOUSE KEEPING	23
24	24.FIRE SAFETY	24
25	25.WORK PERMIT SYSTEM	24

26	26.WORK IN AND AROUND WATER BODIES	25
27	27.PUBLIC PROTECTION	25
28	28.OTHER STATUTORY PROVISIONS	25
29	29.GUIDELINES AND GENERAL PROCEDURES FOR SUPPLY AND USE OF ELECTRICITY AT SITE	26
30	30.PORTABLE ELECTRICAL EQUIPMENT	32
31	31.ROLE OF CONTRACTOR INCASE OF EMERGENCY AND SIREN	34
32	32.TRAINING	34
33	33.LIST OF PERSONAL PROTECTIVE EQUIPMENTS	34
34	34.MANDATORY FOR THE CONTRACTOR EMPLOYEES WHILE WORKING AT SITE	34
35	35.SPECIFICATIONS FOR SAFETY HELMETS-HDPE	35
36	36.SPECIFICATION FOR SAFETY BELT	35
37	37.SPECIFICATION FOR FALL ARRESSTOR DEVICE	36
38	38.SPECIFICATION FOR DUST MASK	36
39	39.SPECIFICATION FOR REPLACEABLE FILTERS	36
40	40.SPECIFICATION FOR SAFETY SHOES	36
41	41.STANDARD SPECIFICATION FOR PVC HAND GLOVES	36
42	42.SPECIFICATION FOR ELECTRICAL PPE (SHOCK PROOF)	36
43	43.PENALTY / FINE	37

MANGALORE REFINERY AND PETROCHEMICLAS LTD.

CONTRACT WORKER'S SAFETY POLICY

1.SCOPE :

This policy is applicable to all the contractors and their employees working in MRPL. This is also applicable to sub-contractors, suppliers, vendors and visitors. All the contractors are required to ensure that they and their employees comply with relevant safety requirements as mentioned in this Safety Policy depending on the nature of work. This policy is not a substitute to the statutory rules and regulations and also the prevailing MRPL Safety Requirements. This is to further reinforce the existing Safety Standards in Refinery.

2.REFERENCE : This document should be read in conjunction with following :

- General Conditions of contract (GCC)
- Special Conditions of Contract (SCC)
- Job specifications

3.SAFETY REQUIREMENTS FOR CONTRACTORS:

-Contractor shall furnish Safety policy and Safety Manual of their Company and his track record in safety for past three years to the Engineer Incharge.

Contractor shall furnish details of their safety department with CVs of safety officers in his bid document to Engineer Incharge.

-The contractor MUST employ Qualified Safety Officers as per the table below, having about 5 years of relevant experience in chemical units or Petrochemical Plants or refineries, as per The Factories Act 1948 / Building and other construction workers (Regulation of Employment and conditions of service) Act 1996 and Central Rules 1998 / The Karnataka Factories Rules 1969. Contractor shall ensure that all his workmen are aware about the nature of risk involved in their work and have adequate training for carrying out their work safely. Such Safety Officers appointed shall be dedicated and responsible only for safety. They should not be given any other responsibility. The contractor and his sub-contractor, if any, shall comply with the instructions given by MRPL Engineer In- Charge or his authorized nominee regarding safety precautions, protective measures, house-keeping requirements etc. Engineer-In-Charge from MRPL shall have the right to stop the work of the contractor, if in his opinion, proceeding with the work will lead to an unsafe and dangerous condition. Engineer-In-Charge shall get the unsafe condition removed or provide protective equipment at the contractors cost, which ever is applicable.

Table

Max. no. of employees < 30	One discipline (Engr. / Supervisor) with safety experience can function as Safety Staff on part time basis.
No. of employees : 30 – 100	One Safety Supervisor on full time responsibility.
No. of employees : 101 – 250	For Manpower Supply – Oriented Maintenance contract – One Safety Supervisor on full time responsibility. For Service – Oriented Maintenance / Project contract One Safety Engineer on full time responsibility + One Safety Supervisor on full time responsibility
Upto 250 Persons deployed by him at site	Deploy one Safety Officer and additionally deploy Three Safety Supervisors
For 251 to 500 Persons	Two Safety Officers, Six Safety Supervisors and Ten Safety Stewards
For more than 500 persons	Three Safety Officers, Ten Safety Supervisors and Twenty Safety Stewards

Qualification criteria of safety officer:

BSc (Physics Chemistry only)/Diploma (Mech/Elect/Civil only) with post graduate Diploma in Industrial safety with min of 5 years experience in supervisory cadre.

OR

BE/BTech (Mechanical/Electrical/Civil only) with post graduate Diploma in Industrial safety with min of 2 years experience in supervisory cadre.

Qualification criteria of safety supervisor:

BSc (Physics Chemistry only)/Diploma (Mech/Elect/Civil only) with qualification in industrial safety with relevant experience.

4. **PERSONNEL** :

- Personnel / workmen (age 18 years & above) deployed at site should be physically / medically fit. Labours/workers shall not bring children/babies inside the refinery.

SMOKING IS STRICTLY prohibited inside the refinery.

- Contractors and their workmen should restrict their activities to the site allocated to them.

- All contract men shall wear IS make PPEs like gloves, goggles, face shields, full body safety harness, safety belt, Safety Helmets, Safety Shoes etc during the work. They will not be permitted

to enter the Refinery without wearing Safety Helmet, Safety Goggles & Safety Shoes. Damaged PPEs shall be taken out from use and disposed off properly.

- The contractor shall ensure that their men do not tamper with the facilities in operation. They shall not operate any Valves/ Switches etc.

- The contractor shall ensure that his workmen do not move around freely inside refinery premises other than the assigned place of work & also do not sleep anywhere (Below piperacks / equipments / trucks / etc.) inside refinery premises.

- The personnel engaged by the Contractor shall maintain good conduct and discipline commensurate with Industrial standard. If in the opinion of the Engineer-in-charge any of the personnel have not maintained good conduct and discipline, the Contractor shall remove such personnel immediately from MRPL premises and provide alternate personnel.

- The contractor Supervisors and Engineers must get themselves conversant with MRPL's Standard Operating Procedures (SOP), safety norms, Rules and Regulations that are in force. They must also be conversant with the MRPL's Emergency Procedures and Emergency telephone numbers and should ensure display of same at prominent place.

- Special safety precautions to be taken by the contractor or their personnel working in an operating refinery are given below. The safety procedure may undergo a change from time to time, which will be intimated to the contractor to follow and implement them.

- In addition to the following minimum safety requirements, the contractor must comply with the safety requirements, norms, rules and regulations as per the Factories Act 1948 and Karnataka Factories Rules 1969, OISD Guidelines 207 and other OISD standards / guidelines and Indian Standards.

- The contractor must prepare a detailed "Safety Programme" and submit it to Engineer In-charge of MRPL immediately after the finalization of contract / placing of LOI / order. This will include Safety Policy, Safety Responsibilities at various levels, Formations of Safety Committees and meetings, Method statements, Job Safety Analysis (JSA), Safety inspections, various pre-inspection checklists, Safety manuals, Safety Audits, Emergency Plans, Safety procedures to be implemented for all the activities, deputation of Safety Officers, enforcement of safety practices.

- Contractor shall devise a procedure on Accident Reporting. All accidents including Near Misses and property damages to be reported as per the MRPL's Accident Reporting Procedure in force. All Accidents including Near Misses to be communicated immediately to Engineer Incharge over

telephone / verbally / and later submit the accident report. All accidents must be investigated, classified, analysed & comply with the recommendations to avoid its recurrence. Monthly Accident statistics must be developed and circulated. Contractor shall maintain a register of all such accidents.

- During the mobilization, equipments, machines, tools, tackles etc. to be inspected at the site from where it is being mobilized. Damaged ones should be discarded and ensured not mobilized at MRPL site. The statutory checks, inspections and certification is carried out before mobilizing at MRPL site. Necessary repairs and maintenance to be carried out and equipment, machine, tools, tackles etc. is mobilized at MRPL site in working condition. The previous records of maintenance and the competent person's certificates to be made available during mobilization and submitted to MRPL Engineer Incharge. The equipments, machines, tools, tackles, etc to be tagged and mobilized.

- A Safety Committee must be formed to discuss accidents, Unsafe Acts and Unsafe conditions. This should be chaired by the High ranking Official / Site-In-Charge with equal participation both from supervisory and non-supervisory cadres of employees. Engineer In-Charge of MRPL also should be involved in such meetings as an observer. The frequency of meetings shall be once in a month minimum and actions taken to avoid recurrence of Nearmiss, Minor injuries etc.

Circular of the meeting must also be issued to MRPL Engineer Incharge at least one week in advance. Minutes of the meetings to be prepared on the same day and submitted on next day of the meeting.

The contractor shall take all safety precautions during the execution of awarded work and shall maintain and leave the site safe at all times. At the end of each working day and at all times when the work is temporarily, suspended, he shall ensure that all materials, equipment and facilities will not cause damage to existing property, personal injury or interfere with other works of the Refinery. The contractor shall comply with all applicable provisions of the safety regulations, clean up programme and other measures that are in force at the site.

- Safety Inspections of the site to be conducted daily and Safety Audits to be conducted once in three months by a team of Senior Officials of the contractor. Report on findings of such Audit to be submitted to the Engineer Incharge and compliance report of the suggestions on findings to be submitted weekly to Engineer Incharge.

Daily Safety Inspection of jobs and safety audit to be conducted every month and the report and protocol signed by all parties, Contractor's safety officers with signatures of Site Incharges of contractor shall be part of subsequent RA bill.

- Method statement along with Job Safety Analysis to be submitted at least 15 days in advance before starting of any activity.

Prior information of high risk jobs as planned shall be informed with short details of the work, job safety analysis report to the Engineer Incharge at least 48 hours before starting of such jobs.

High risk jobs like fabrication at height, lifting and shifting, erection of equipments etc shall be video recorded by the contractor.

- The contractor shall provide and maintain all lights, guards, fencing, warning sign, caution boards, other safety measures and provide for vigilance as and where necessary or as required by the Engineer-In-Charge or by any duly constituted authority for the protection of workers or forthe safety of others. The caution boards shall also have appropriate symbols visible during night also.

- Adequate lighting facilities, including emergency lighting, such as floodlights, hand lights and area lighting shall be provided along with ELCBs by the contractor at the site of work with isolation switch known to all at site with proper display, storage area of materials and equipment and temporary access roads within his working area. The contractor shall obtain written approval of the Engineer-In-Charge to the lighting scheme and place of tapping prior to its installation.

Use of devices like Distress alarm system for all personnel entering into confined space to be mandatory. Biometric attendance of personnel entering confined space should be maintained. Necessary Biometric punch machine to be arranged by the contractor at his own cost for this purpose. Staircases shall have temporary hand rail and guard till permanent handrails are fabricated and installed.

The contractor shall plan his operations so as to avoid interference with the other departmental works, other contractors or sub-contractors at the site. In case of any interference, necessary coordination shall be sought by the contractor from the Department for safe and smooth working.

The contractor shall be held fully responsible for non-compliance of any of the safety measures, procedures and delays, implications, injuries, fatalities, property damage and environmental degradation and compensation arising out of such situations or incidents. The contractor should device a procedure to maintain head count of his personnel manually or with an installation of

punching machine at site and ensure evacuation of his personnel through defined emergency exit in case if situation demands and also during confined space entry.

- Smoking is prohibited in the Refinery / work site / offices.

Consumption of alcohol and any other intoxicating material shall be also treated as safety violation and heavy penalty shall be levied on the main contractor.

- Radiography source and also the Explosives used for controlled blasting will not be permitted to be stored at site. Detailed accident report with photographs to be submitted to factory manager and Engineer In-charge from MRPL immediately.

- Contractor's Vehicles/Engines and approved electrical / mechanical equipments & lifting tools / tackles, welding generator that are to be used inside refinery are to be certified by competent authority. Statutory checks are to be carried out and records are to be maintained by contractors to ensure healthiness. These certificates will be regularly checked by MRPL engineer in-charge.

- The Contractor shall ensure that all industrial consumables such as Oxygen, Acetylene, Argon, Nitrogen, welding electrodes etc. are approved by MRPL, tested and records maintained by the contractor as per Gas Cylinder Rules before they are used for the job. LPG for gas cutting purpose is not allowed.

- The Fire prevention / protection and safety equipments (including Personal Protective Equipments) should be certified by MRPL engineer in-charge.

5. HEALTH AND HYGIENE :

- Sufficient number of toilets shall be provided by the contractor for its workmen and hygiene standard should be maintained.

Contractor to ensure no water stagnation at site.

Potable water facility for all workers shall be provided and maintained by the contractor.

Inspection of drinking water, sanitation, shall be done by MRPL. Availability of dust masks shall be ensured by the contractor at site.

Contractor to maintain affordable hygienic canteen for the workers.

- The contractor must maintain record of medical examinations of its employees as per The Factories Act 1948 and The Karnataka Factories Rules, 1969 and The Building and other construction workers (Regulation of Employment and conditions of service) Act 1996 and Central Rules 1998. This will include eye test of crane operators, vehicle drivers and all others. Also

Fitness certificate by the Medical Officer for working at height to be produced for each employee requiring to work at height.

- Adequate means and personnel for rendering first aid should be readily available at site and during working hours at places where work is carried out.
- Medical aid for First-Aid should be available.
- First Aid kits or boxes, as appropriate, should be provided at the workplaces and on motor vehicles, cranes, etc. and be protected against contamination by dust, moisture, etc.
- When workers are employed underground or beneath structures or pits or other conditions in which they may need to be rescued, suitable rescue equipment like tripod with pulley and safety belt should be readily available at site at or near the work site along with trained rescue workers.

6. VEHICLE MOVEMENT :

- The contractor shall conduct his operation so as not to interfere with the use of existing roads at or near locations where the work is being performed.
- Speed limit inside the refinery is 16 KMPH which should be strictly followed. For heavy machinery like cranes / forklift / RMC trucks, etc. the speed limit is 5 KMPH maximum.
- Special precautionary measures should be taken during transportation of long sized cargo, route as defined should be followed and for safety of personnel (with proper escort) and damages to the facilities should be avoided. Procedure for vehicle entry and Speed limits in Refinery should be strictly followed. Vehicles and cargos passing through refinery should have PESO approved spark arrestor fitted.
- When interference to traffic is inevitable, notice of such shall be given to the Engineer- In-Charge of MRPL well in advance with the details of start of the work and time required, storage of materials, and details of the proposed methods of providing the required facilities for safe and continuous use of roads and obtain his clearance.
- The contractor shall exercise full care to ensure that no damage is caused by him or his workmen, during the operation, to the existing water supply, sewerage, power or telecommunication lines or any other services or works. The contractor shall be required to provide and erect before starting of the work, substantial barricades, guardrails and warning signs. He shall furnish, place and maintain adequate warning lights, signals etc, as required by the Engineer-In-Charge.
- Vehicles must have green red flags and whistles for the cleaner to guide driver. All vehicles entering MRPL premises shall have cleaner / helper.

- The vehicles must be maintained as per the preventive maintenance schedule of the manufacturer / supplier. Only Drivers that are trained in Defensive Driving shall be deployed inside Refinery.

- Vehicles to be inspected fortnightly by trained technicians as per the inspection checklist. Pre-inspection checklist to be formed to that effect.

- All vehicles to bear a sticker. "If you notice this vehicle is over speeding then please inform on telephone no 08242882192 / 2191 / 2194 / 2771 / 2731".

- Tractors and trucks / cranes / forklift should not be used for transporting personnel.

- Every vehicle should have the contractor's name prominently displayed on Tractor Trolleys, trucks, jeeps, cranes, JCBs, Poclains, trailers. The display board should be put on front and rear side of each of the vehicle.

Tractor trolleys must have independent brake systems both on tractor as well as on trolleys.

- All vehicles must be fitted with PESO approved spark arrestors.

Tippers/trucks carrying debris and soil/mud/sand shall ensure that there is no spillage of material on road. If any such spillage observed the same need to be cleaned and cleared by the contractor immediately. Wheels of the trucks and vehicles shall be clean and free from mud.

- Contractor to maintain Inspection and maintenance logs for every vehicle.

- Any kind of repair work on contractor's vehicle is to be carried out only inside the work shop or designated place and not allowed inside the battery area or any where at on road or at site.

7. **SAFE MEANS OF ACCESS** :

- The contractor must possess adequate numbers of self retractable type fall arresstors (of different sizes viz. 6 m, 20m, 40m, and 60 m), Safety nets and Safety Belts (Full Body Safety Harness) (ISI approved).

- Adequate and safe means of access and exits shall be provided for all work places, at all elevations. Using of scaffolding members (avoiding a ladder) for approach to high elevation shall not be permitted.

- Suitable scaffolds shall be provided for workmen for all works that cannot be done safely from the ground, or from solid construction except such short duration work as can be done safely from ladders. Ladder shall be of rigid construction having sufficient strength for the intended loads and made of metal and all ladders shall be maintained well for safe working condition. If the ladder is used for carrying materials as well, suitable foot holds and handholds shall be provided on the ladder. Ladders shall not be used for climbing carrying materials in hands. While climbing both the

hands shall be free. Ensure positioning of person at base / grade level while it is in use. All ladders, platforms, full body safety harness and safety nets should be inspected regularly and records should be maintained. Damaged items shall immediately be taken out of service and disposed off.

- Scaffolding staging more than 1.5 m above the ground or floor, swung or suspended from an overhead support or erected with stationary support and ladder shall conform to relevant IS specification. Timber bamboo scaffolding is not allowed inside the Refinery.
- Working platforms of scaffolds shall have toe boards 15cms in height to prevent materials from falling down.
- A sketch of the scaffolding proposed to be used shall be prepared and approval of the contractor's Mechanical Engineer obtained prior to start of erection of scaffolding. All scaffolds shall be examined and certified with proper display of tags by contractors Mechanical Engineer before use.
- Safe means of access shall be provided to all working platforms and other elevated working places. Every ladder shall be securely fixed. No single portable ladder shall be over 9m in length. For ladders upto 3m in length the width between side rails in the ladder shall in no case be less than 300mm. For longer ladders this width shall be increased by atleast 20mm for each additional metre of length. Step shall be uniform and shall not exceed 300mm.
- Working platform and gangway along the side of pipe racks shall be provided. Under no circumstance the contractor employees should step on pipes at pipe racks.

8. EXCAVATION, TRENCHING AND EARTH REMOVAL :

- A Work Permit must be taken for any excavation or earth removal inside the existing refinery premises from Engineer In-Charge MRPL, as the area of work has underground pipelines, cables etc.
- All trenches 1.2m or more in depth shall at times be supplied with at least one ladder for each spacing of 3.0m in length or fraction thereof. Ladder shall be extended from bottom of the trench to at least 1m above the surface of the ground.
- The sides of the trench which are 1.2m or more in depth shall be stepped back to give suitable slope (angle of repose) or securely held by timber bracing (i.e. shoring of the excavated trench or pit should be done), so as to avoid the danger of sides from collapsing. The excavated material shall not be placed within 2m of the edges of the trench or half of the depth of the trench, whichever is more. Cutting shall be done from top to bottom. Under no circumstances under-cutting shall be done.

- The contractor shall ensure the stability and safety of the excavation, adjacent structures, services and the works.

- Open excavations shall be fenced off by railing (ledger pipes) and warning signals installed at well-lit places so as to prevent persons falling into the excavations.

- All blasting operations shall be carried out on the basis of procedures approved by Inspector of explosives. All works in this connection shall be carried out as per IS code of practice. Barricades, Warning signs etc. shall be placed on the roads / open area. Prior approval of such operation shall be obtained from Engineer-In-Charge of works. The blasting procedure being followed by the contractor must be submitted with MRPL engineer in-charge.

- The contractor must submit the methodology, safety aspects, schedule, License and other relevant features of control blasting operations.

- Wherever manual removal of earth is involved, earth shall be removed from the top by maintaining the proper slope equal to the angle of re-pose of the earth. Manual removal of earth / lowering of person in a pit should be done with tripod and pulley besides use of Full body Safety Harness by person.

- Such work shall be constantly supervised by the contractor's responsible persons.

9. **DEMOLITION** :

Before any demolition work is commenced and also during the progress of the work :

- Proper approvals shall be taken from Engineer in-Charge MRPL before commencing demolition.

- Area around shall be barricaded with cautionary signs and posting of security guards or supervisors for preventing unauthorised entries of personnel.

- All roads and open area adjacent to the work site shall either be closed or suitably protected. Appropriate warning signs shall be displayed for cautioning approaching persons.

- No floor, roof or other part of the building shall be overloaded with debris or materials as to render it unsafe.

- Entries to the demolition area shall be restricted to authorized persons only.

Contractor to place separate collection facility of waste like metal, on metal non degradable and bio degradable wastes and shall dispose to designated place daily basis.

Contractor shall be responsible to clear dry grass and wooden items etc from and around his working site/storage/fabrication yard etc to prevent any fire accidents.

10. PERSONAL PROTECTIVE EQUIPMENTS :

- All proper "ISI" marked Personal Protective Equipments (PPEs) as considered necessary by the Engineer-In-Charge shall be kept available by contractor for the use of the persons employed on the site and maintained in a condition suitable for immediate use. Also the contractor shall take adequate steps to ensure proper use of equipment by those concerned. The PPEs are to be provided by the contractor.

- All persons employed at Refinery shall use safety helmets, safety shoes and safety goggles as minimum safety gears. For other types of works, persons working in that area shall also use the required PPEs, as advised by the Engineer-In-Charge of MRPL.

- Workers employed on mixing asphaltic materials, cement and lime mortars shall use Gumboots, safety goggles, hand gloves and proper respirator.

- Persons engaged in welding and gas-cutting works shall use suitable welding face shields with welder's helmet. The persons assisting the welders shall use suitable goggles. Protective goggles shall be worn while chipping and grinding.

- Stonebreakers shall use protective goggles. They shall be seated at sufficiently safe intervals or distance.

- Persons engaged in or assisting in shot blasting (Sand blasting is prohibited) operations and cleaning the equipment after shot blasting shall use suitable gauntlets, overalls, dust mask, dust proof goggles, safety shoes and protective hood supplied with fresh air.

- All persons working with 3M lifeline and hook at height above ground or floor and exposed to risk of falling down shall use safety belts (Full Body Safety Harness with double life line and scaffolding hooks, ISI marked) which should be properly secured to solid object unless otherwise protected by cages, guard railings, etc. In places where the use of full body safety harness is impractical, suitable safety net of adequate strength fastened to substantial supports shall be employed under proper valid permit.

- When workers are employed in sewers and inside manholes, which are in use, the contractor shall ensure that the manholes are opened and are adequately ventilated at least for an hour. The atmosphere inside the space shall be checked for the presence of any toxic gas or oxygen deficiency and recorded in the confined space entry permit, availability of standby person at manhole must be ensured before the personnel are allowed to get into the man-holes. The manholes opened shall be cordoned off with suitable railing and provided with warning signals or

caution boards or barricade tape to prevent accidents. There shall be proper illumination in the night.

11. PAINTING :

- Respirators shall be provided by the contractor for use when paint is applied, safety of personnel in vicinity also should be considered while painting.
- Overalls shall be supplied by the contractor to the workmen and adequate facilities shall be provided to enable the painters for decontamination at the cessation of work.
- All solvent-based paints, thinners shall be stored in separate well ventilated storage kept under proper surveillance.
- Smoking, open flames or sources of ignition / hot work shall not be allowed in places where paints and other flammable substances are stored, mixed or used. A caution board, with the instructions written in national / regional language, "SMOKING / HOT WORK – STRICTLY PROHIBITED" shall be displayed in the vicinity where painting is in progress or where paints are stored. Symbols shall also be used for caution boards.
- Suitable IS marked First Aid Fire Fighting equipments shall be kept available at a place where flammable paints are stored, handled or used.
- When painting work is done in a closed room or in a confined space, adequate ventilation shall be provided. Workers shall wear suitable supplied air type breathing apparatus. Work shall be carried out under a valid work permit.
- Epoxy resins and their formations used for painting shall not be allowed to come in contact with the skin. The workers shall use PVC gloves and / suitable barrier creams.
- Adequate ventilation shall be provided especially when working with hot resin mixes.
- Increased personal hygiene shall be practiced to control inadvertent contact with the resin and eliminate its effects.
- Workers shall thoroughly wash hands and feet before leaving the work. Work clothes shall be changed and laundered frequently.

-Care must be taken while carrying out painting inside confined space. There shall be safety devices to monitor the personnel working inside confined space like vessels during painting of internal surface. Suitable painting methods shall be adopted as specified elsewhere. It should not be clubbed with hot work and proper ventilation should be available to draw out the solvent vapours. Manual painting is to be adopted instead of spray painting.

12. LIFTING MACHINES TOOLS AND TACKLES :

- Supplier's / Manufacturer's manual for operations / safety / periodical maintenance of all Cranes, winches, JCBs, Poclains, Excavators, Trucks, tractors, Vehicles, etc. MUST be made available at site from the moment it is brought at site and the same should be strictly adhere to.

- Lifting machines, tools and tackles shall be of good mechanical construction, sound material, adequate strength, free from any defects and shall be kept in good working condition.

- Lifting machines, tools, tackles, equipments etc. to have identification tags of steel plate of size 2"x 2" tied to it using steel wire of 4 mm size. The details like reference number, Safe Working Load (SWL), date of testing, next due date of testing, etc. to be punched on this plate.

- Contractor must produce Competent Authority's (Authorised by The Directorate of Factories, Karnataka state) Certificate of testing in the prescribed form of Lifting Machines, Chains, ropes and lifting tackles well in advance. Only valid Lifting Machines, tools etc. to be used and to be re-certified before expiry of certificate. Also, these equipments will be inspected by Engineer In-Charge of MRPL as and when required. The same procedure is applicable for all other Electrical Equipments, tools, machines, D.G sets, compressors, etc.

Lifting equipments for testing by competent authority to include JCB, Poclain, Excavators, etc.

The ringer crane to be tested and certified every time by Competent Person it is dismantled and reassembled. This certification must also include stability of soil on which it is assembled.

Use of Hydra is not permitted inside refinery/construction premises. Hydraulically jacked lifting machines to be used.

- Lifting machines, tools, tackles, equipments etc. to be inspected in addition to the Competent Authority's certification. This should be done fortnightly by experienced trained mechanical foreman and technicians and record of such inspection to be maintained.

- Every rope and sling used in hoisting or lowering of materials or as a means of suspension shall be of good quality and adequate strength and free from any defect.

- Every crane operator or lifting appliance operator shall have a driving License for Heavy Vehicle, proper physical fitness such as eye sight etc. and with adequate experience. No persons under the age of 21 years shall be in charge of any hoisting machine or give signal to operator of such machine.

- In case of every lifting machine (and of every chain, ring, hook, shackle, swivel and pulley block used in hoisting or as means of suspensions) the safe working load shall be ascertained and clearly

marked. In case of a lifting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load.

- The contractor shall notify the safe working load of the machine to the Engineer-In- Charge whenever he brings any machinery to site for work and get it verified by the Engineer-In-Charge, supported by a valid test certificate by the competent person.

- Motors, gearing transmission, couplings, belts, chain drives and other moving parts of hoisting appliances shall be provided with adequate safeguards. Hoisting appliances shall be provided with such means as to reduce to the minimum risk of any part on a suspended load becoming accidentally displaced or lowered.

- The contractor must have a team of Experienced Mechanical Personnel (having minimum of 5 yrs. experience in carrying out safety inspection and testing of Lifting machines, Tools and Tackles etc.), to conduct periodical (Daily, fortnightly, monthly and quarterly) inspection and testing of Lifting machines, Tools and Tackles and to maintain its records.

- Crane shall not be used as hoist. Incase cranes are used as hoist then factory Inspector's permission to be taken in advance and to be subject to biannual testing by competent person as required for hoist under Factories Act 1948. Also, the design of cage to be got approved by the competent person well in advance. Two ropes or chains to be provided to the cage, separately connected with the cage, suspended independently and capable of carrying the whole weight of the cage.

- Contractor to maintain operation, inspection and maintenance logs for every lifting equipment, tool and tackle.

13. **TEMPORARY SHEDS** :

- Before erecting temporary shelters like sheds or tents anywhere at site, written permission of the concerned Engineer In-charge must be obtained.

- Temporary sheds for site office should be avoided. Instead contractor shall arrange for portal cabins for site office / stores.

- Temporary shed should not be erected using scaffolding pipes. The shed should be made of safe construction material.

- The temporary shed should be erected after proper designing following engineering design practices in conformance with normal safety standards to ensure the stability and safety.

- Temporary shed should bear the contractor's name.

- Temporary piping, hose connections and electrical wiring to these temporary sheds must be laid in such manner that they do not cause tripping, hitting or electrocution hazards.

14. ERECTION :

- At the planning stage consideration should be given, by those responsible for the design, to the safety of the workers who will subsequently be employed in the erection of such structures. A detailed erection scheme / schedule shall be furnished well in advance for all the critical erections.

- Care should be exercised by design engineers and other professional persons, not to include anything in the design which would necessitate the use of unwarrantably dangerous structural procedures and undue hazards, which could be avoided by design modifications.

- Facilities should be included in the design for such work to be performed with the minimum risk.

- Detailed Safety Procedure should be submitted as a part of Heavy Equipment erection scheme. Heavy Equipment erection scheme must be submitted at least one month in advance.

- Erection engineer to conduct training on rigging before every heavy lift / erection for crane operator, foreman and riggers.

- Erection of structural platforms, gratings and hand rails to be done on priority. The procurement of gratings, structural members for hand rails to be done on priority.

- Prefabricated parts should be so designed and made that they can be safely transported and erected.

- As far as practicable the safety of prefabricated parts while erection should be ensured by appropriate means, such as provision and use of :

a) Ladders;

b) Gangways;

c) Fixed platforms;

d) Platforms, Buckets, boatswain's chairs, etc. suspended from lifting appliances;

e) Safety belts and lifelines; and

f) Safety nets or catch platforms.

- Ladders to be inspected fortnightly by experienced trained mechanical foreman and mechanical technicians and record of such inspection to be maintained.

- The boatswain's chairs/ platforms used in structural erection to be inspected and checked once in fortnight and record maintained.

- In addition to the conditions of stability of the part when erected, when necessary to prevent danger the design should explicitly take into account:

a) the conditions and methods of attachment in the operations of stripping, transport, storing and temporary support during erection; and

b) Methods for the provision of safeguards such as railings and working platforms, and, when necessary, for mounting them easily or prefabricated parts.

- The hooks and other devices incorporated in prefabricated parts that are required for lifting and transporting them should be so shaped, dimensioned and positioned as:

a) to withstand with a sufficient margin the stresses to which they are subjected; and

b) not set up in the part stresses that could cause failures, or stresses in the building not provided for in the plans.

- Prefabricated parts made of concrete should not be stripped before the concrete has set and hardened sufficiently to ensure the safety of the operation.

- Store places should be so constructed that:

a) There is no risk of prefabricated parts falling or overturning; and

b) Storage conditions generally ensure stability having regard to the method of storage and atmospheric conditions.

- Prefabricated parts made of concrete should not be erected before the concrete has set and hardened to the extent provided for in the plans.

- While they are being stored, transported, raised or set down, prefabricated parts should not be subjected to stresses prejudicial to their stability.

- Trailers only to be used for transportation of pipes. Crane to be used for erection at site.

- Every lifting appliance should :

a) be suitable for the operation; and

b) be approved by a competent person, or tested under a roof load 20 percent heavier than the heaviest prefabricated part.

c) Ringer mode of a heavy crane MUST be inspected, checked and certified by competent person every time it is dismantled and erected. The report must bear the stability of the soil on which it is erected.

- Lifting hooks should have the maximum permissible load marked on them.

- Tongs, clamps and other appliances for lifting prefabricated parts should :

a) be of such shape and dimensions as to ensure a secure grip without damaging the part ; and

b) be marked with the maximum permissible load in the most unfavourable lifting conditions.

- Prefabricated parts should be lifted by methods or appliances that prevent them from spinning accidentally.

- The temporary basket cages / Platforms / Buckets / boatswain's chairs, etc. used for lifting / working at height suspended from lifting appliances or suspended from structures or beams MUST be certified by competent person and provisions or conditions as stipulated during certification to be adhere to.

- While prefabricated parts are being lifted measures should be taken to prevent workers from being struck by objects falling from a height and area around such site should be barricaded with cautionary signs.

- When necessary to prevent danger, before they are raised from the ground, prefabricated parts should be provided with safety devices such as railings and working platforms to prevent falls of persons.

- If workers are exposed to danger when releasing prefabricated parts from lifting appliances, adequate safety measures should be taken.

- At workplaces adequate instructions should be given to the workers on the methods, arrangements and means required for the construction, storage, transport, lifting and erection of prefabricated parts.

- When it is not practicable to install protective guardrails and toe boards the workers should be provided with and use safety belts and lifelines to limit the height of the fall.

- Overhead screens to be provided to prevent workers from being struck by falling objects.

- The safety devices (guard-rails, toe-boards, safety belts and lifelines) should not be removed so long as the risk remains.

- Precautions should be taken to prevent fires being caused by rivet-heating equipment.

- Rivet heaters should extinguish their fires before leaving work.

- Extra care should be taken to prevent fall of objects, tools, etc. from height.

- Before structural steel parts are lifted, care should be taken that any object that could fall is fastened or removed.

- Structural steel parts should not be dragged while being lifted if that could cause danger.

- Steel trusses that are being erected should be adequately shored, braced or guyed until they are permanently secured in position.

- While structural members are being moved into place the load should not be released from the hoisting rope until the members are securely fastened in place.

- Structural members should not be forced into place by the hoisting machine while any worker is in such a position that he could be injured by the operation.

- No load should be placed on open-web steel joists until they have been placed in position and secured.

- Erection of pipes to be done using web belts only. Web belts must be inspected and checked fortnightly internally by the contractor and records maintained. Damaged ones to be cut to pieces and record to be maintained.

- Nipples and other accessories used for hydrotest and subject to high pressures to be inspected, checked and tested by experienced trained mechanical foreman and mechanical technicians and records maintained. Damaged parts to be replaced immediately with the new ones.

- Discarding criteria of web belts to be procured from the supplier / manufacturer by the contractor and submitted to MRPL Engineer Incharge.

15. **WORK ON TALL CHIMNEYS** :

SCAFFOLDS :

- All workmen should be certified medically fit by medical practitioner before working at height. Mock up drills MUST be conducted by the contractor for all these workmen and issue Working at Height passes to only those who has experience of working at height, is declared medically fit and shows confidence during mock up drills.

- For the erection and repair / painting of tall chimneys and vertical structures scaffolding should be provided. Scaffolds after erection should be certified by competent mechanical engineer for its strength before use and be displayed with a tag "Certified for use".

-Scaffolds should confirm to relevant Indian Standards. Contractor MUST have a team of trained scaffolders including trained Scaffolding engineer.

- Fixed inside scaffolding should be securely anchored in the chimney wall.

- The scaffold floor should always be at least 65 cm (26 in) below the top of the chimney.

- Under the working floor of the scaffolding the next lower floor should be left in position as a catch platform.

- Suspended outside platform (inspection scaffolds) should be provided as per the relevant standards as stated above.

- Use of Catch platforms, stairs, ladders and Iron rung, lifting tools, tackles and work with hot asphalt, tar should be carried out as per the procedures outlined in relevant ILO manual.

- Full Body Safety Harness (Safety Belt) with lifelines (of various sizes 2', 5' and 9' double lanyards) and safety nets being used should confirm to relevant standards and are to be inspected, tested, periodically and records be maintained. Damaged safety belts and nets should be discarded, taken out of service and disposed off.

- Safety belts must be used while working at height. The life lines (lanyard) MUST be tied to firm support. Incase of absence of firm support provision of wire rope of adequate size tied with lifting tackles to be made to tie the safety belt life line (lanyard).

- All Safety belts to be inspected once in a month and damaged ones to be discarded. Suppliers / Manufacturers Discarding criteria of safety belts to be submitted to MRPL. The record of inspection and the results to be maintained. And a copy to be submitted to Engineer Incharge.

- The scaffolds to be inspected and certified by the competent mechanical Engineer before use and subsequently, at least once in a week.

16. **Safety of Electrical works:**

Before starting work in live electrical panels, proper electrical isolation shall be ensured. The same to be inspected by the electrical in charge and necessary isolation tag shall be attached. Proper electrical isolation permit system along with LOTO (Locking Out / Tagging Out) system shall be maintained by the contractor. Triplicate copy of such permits shall be submitted to MRPL.

17. **CATCH NETS** :

- Where workers cannot be protected against falls from heights by other means they should be protected by catch nets.

- Catch nets should be made of good quality fiber cordage, wire or woven fabric or material of equivalent strength and durability.

- The perimeter of catch nets should be reinforced with cloth-covered wire rope, manila rope or equivalent material.

- Catch nets should be provided with adequate means of attachment to anchorage.

- Catch nets to be inspected fortnightly, tested and records maintained. Damaged safety nets should be discarded and record maintained.

18. PROTECTION AGAINST MOVING VEHICLES :

Workers who are regularly exposed to danger from moving vehicles should wear;

a) distinguishing clothing, preferably bright yellow or orange in colour; or

b) devices of reflecting or otherwise conspicuously visible material.

Light Vehicle shall have reverse horn and Heavy Vehicles shall have trained helpers with whistle and red and green flags for directing the driver.

19. HANDLING MATERIALS :

- Mechanical means should be provided and used for lifting and carrying loads.
- Personnel should have knowledge of safe ways of material handling.

20. STACKING AND PILING :

- Materials and objects should be so stacked and unstacked that no person can be injured by materials or objects falling, rolling, overturning, falling apart or breaking.
- Area earmarked for stacking and piling should be barricaded and only authorised personnel be allowed to carry out stacking and piling jobs.
- Proper stacking and piling should be done as per the guidelines of ILO.

21. WELDING AND GAS CUTTING :

- Welding and gas cutting operations shall be done only by qualified and authorised persons and as per IS specification and code of practice.
- All the hoses used on compressed gas cylinders (Acetylene, Oxygen etc.) to be as per IS.
- Welding and gas cutting shall not be carried out in places where flammable or combustible materials are kept and where there is danger of explosion due to presence of flammable / gaseous mixtures. Contractor shall continuously monitor the area with Explosimeter / H_2S meters.
- Welding and gas cutting equipments including hoses and cables shall be maintained in good condition. It should be checked daily by the user and fortnightly by the supervisor and recorded.
- Barriers shall be erected to protect other persons from harmful rays from the work. When welding or gas cutting is done in elevated positions / on trenches / inside refinery units, precautions shall be taken to prevent sparks or hot metals falling on persons or flammable materials (Welding booths shall be constructed).
- Use of proper PPEs by personnel involved in Gas cutting / Electric Arc welding should be ensured. Use of Welders Helmet with face shield by the welders is a MUST.

- Fire extinguisher shall be available near the location of welding operations. Valid permit shall be obtained before flame cutting / welding is taken up & comply with all the permit requirements.

- Contact of personnel with the electrode or other live parts of electric welding equipment shall be avoided.

- Extreme caution shall be exercised to prevent accidental contact of electrodes with ground.

- The welding cables shall not be allowed to get entangled with power cables. It shall be ensured that movement of materials does not damage the cables.

- Oxy-Acetylene cylinders must be mounted on trolley with chain holding the compressed gas cylinders. The compressed gas cylinders must have pressure gauges fitted over it and Oxy-Acetylene Gas cutting set should be fitted with flash back arrestor at both the torch and cylinder ends.

- Under no circumstance the compressed gas cylinder should be taken inside the confined space or excavated pits. Hydraulic test certificates of all compressed gas cylinders should be maintained and furnished as and when required.

22. GRINDING :

- All portable grinders shall be used only with their wheel guards in position to reduce the danger from flying fragments should the wheel break during the use.

- Grinding wheels of specified diameter only shall be used on a grinder – portable or pedestal- in order not to exceed the prescribed peripheral speed.

- Helmet with face shield shall be used during grinding operation.

23. HOUSE KEEPING :

The contractor shall at times keep his work spot, site office and surroundings clean and tidy from rubbish, scrap, surplus materials and unwanted tools and equipment.

- Welding and other electrical cables shall be routed as to allow safe traffic by all concerned.

- No materials on any of the sites of works shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The Engineer-In-Charge may require the contractor to remove any materials which, are considered to be of danger or cause inconvenience to the public.

- At the completion of the work, the contractor shall have removed from the work premises all scaffoldings, surplus materials, rubbish and all sheds and sanitary arrangements used / installed for his workmen on the site.

- House keeping of the workplace shall be done strictly by the Contractor on daily basis or as required by the Engineer-in-charge. Contractor to collect all debris/ scrap and dump at designated Scrap Yard as defined by MRPL authorities.

- A separate house keeping team to be formed and made available round the clock.

24. FIRE SAFETY :

- Adequate number of duly calibrated Explosimters, Oxygen meters, Hydrogen Sulphide detectors (Portable / Fixed) or any other multiple gas detector should be made available at site by the contractor.

- Combustible materials like timber, bamboos, paints etc. shall not be used at MRPL site for scaffolding or for supports.

Containers of paints, thinners and allied materials shall be stored in a separate room, which shall be well ventilated, and free from excessive heat, sparks, flame or direct rays of the sun. The containers of paint shall be covered or properly fitted with lid shall not be kept open except while using.

- Fire extinguishers as approved by Engineer-In-Charge shall be located at the work site at appropriate places.

- Adequate number of contract workmen shall be given education and training in fire fighting and extinguishing methods.

25. WORK PERMIT SYSTEM :

- MRPL's Work Permit system (As per MRPL Safety Manual) to be strictly followed.

- All jobs within refinery should be executed with a safety work permit only. These will be issued by the concerned operating personnel of MRPL (Refinery Shift Manager or any authorised person). However, he can withdraw the permit when the stipulated conditions are not complied with at the work spot.

- Area is safe for performing the Work. Job is continuously supervised by qualified supervisor.

Responsibility of Performing Authority :

To obtain an approved Work Permit duly filled and signed by authorities as per the MRPL's Work Permit System before starting the work in the area.

- To visit job sites and ensure that it is prepared accordingly.

- The person performing the job shall be in possession of the permit till the completion of the job. The permit should be produced for inspection at any time. The Work Permit shall be displayed at job site in the plastic folder.

- To understand the scope of the work and implications involved.

- To restrict the work to the area / equipment specified in the work permit.

- To comply with the instructions given on the Work Permit.

- To follow Plant Safety Rules and Procedures.

- To be alert at all times for the development of unexpected situations.

To stop the work immediately on detecting any unsafe condition and promptly inform the Issuing Authority. Follow MRPL's Onsite Disaster Management Plan (DMP).

- To return the Permit duly signed after completion of the job to the Issuing Authority. Contractor must adhere to work permit system and other safety regulations.

26. WORK IN AND AROUND WATER BODIES:

When the work is done near any place, where there is a risk of drowning, all necessary rescue equipment such as life buoys and life jackets shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision shall be made for prompt first-aid treatment of all injuries likely to be sustained during the course of the work. Persons who do not know swimming shall not be engaged alone for any work where risk of drowning exists. Sufficient number of life buoys or life jackets shall be provided.

27. PUBLIC PROTECTION :

The contractor shall make all necessary provisions to protect the public. He shall be bound to bear the expenses for defense of every action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of any precaution required to be taken to protect the public. He shall pay the damage and cost which may be awarded in any such suit, action or proceedings to any such person, or the amount which may be fixed as a compromise by any such person.

28. OTHER STATUTORY PROVISIONS :

Notwithstanding the above clauses there is nothing in these to exempt the contractor from the provisions of any other Act or Rules or Indian Standards or OISD standards or OISD guidelines in force in the Republic of India. In particular all operations involving the transport, handling, storage and use of explosives shall be as per the standing instructions and conform with Indian Explosives

Act, 1884 and the explosives Rules, 1983. The Factories Act 1948 and The Karnataka Factories Rules, 1969, Handling, transport, storage and use of Compressed gas cylinders and Pressure vessels shall conform with the Gas Cylinders rules 1981 and Static and Mobile pressure Vessels (Unfired) Rules 1981. In addition, The Building and other construction workers (Regulation of Employment and conditions of service) Act 1996, The Indian Electricity Act, 1910 and Indian Electricity Rules 1956, The Atomic Energy Act 1962, The Radiation Protection Rules 1971, Radiation Protection Manual of Nuclear Facilities and the Atomic Energy (Factories) Rules 1988 and various rules and Act relevant to the activities being performed shall also be strictly complied with.

- No Child labour should be brought in for work.
- MRPL holds the right to issue warnings / Heavy penalties (monetary fine) / suspend work at any time or terminate the contract for a loss / damage and a pattern of frequent failure to adhere to Safety Laws, regulations and Onsite Safety procedures. In general a heavy monetary fine will be deducted straight from the contractor's bill for each violation of Safety Rules / Unsafe Act / Unsafe Condition observed, for each First-Aid injury, for each Lost Time injury / Near Miss Accident and for each fatality.

29. GUIDELINES AND GENERAL PROCEDURES FOR SUPPLY AND USE OF ELECTRICITY AT SITE :

Following safety requirements shall be complied with before the contractor uses the power supply.

- The contractor shall submit a list of licensed electrical staff to be posted at site.
- It shall be the responsibility of the contractor to provide and maintain complete installation on the load side of the supply point with regard to the safety requirements at site. All cabling and installation shall comply with the appropriate statutory requirements given below and shall be subject to approval of the Departmental Engineer-In-Charge / Electrical Engineer.

(a) Indian Electricity Act, 1910

(b) Indian Electricity Rules, 1956

(c) National Electric code, 1985

(d) Other relevant rules of Local bodies and Electricity Boards.

- Where distribution boards are located at different places the contractor shall submit schematic drawing indicating all details like size of wires, overhead of cable feeders, earthing etc. The position and location of all equipment and switches be given.

- The contractor shall make his won arrangements for main earth electrode and tapings thereof. The existing earth points available at site can be used at the discretion of the Departmental Electrical Engineer with prior permission. Method of earthing, installation and earth testing results shall conform to relevant I.S. Specifications.

- Overhead High Tension (HT) cable routes to be marked and physically barricaded to prevent crane coming in contact with it.

-All three-phase equipment shall be provided with double earthing. All light fixtures and portable equipment shall be effectively earthed to main earthing.

- All earth terminals shall be visible. No gas pipes and water pipes shall be used for earth connection. Neutral conductor shall not be treated as earth wire.

- Every electrically operated machine or equipment to be independently earthed.

- Earth pits to be provided near DG sets, electrically operated machines, equipments etc.

DG sets used in Refinery shall be installed inside acoustic enclosure to minimise noise pollution. Exhaust of DG sets shall be routed to safe height.

- Continuity and resistance of all earth connections to be inspected and checked and tested fortnightly and records to be maintained.

- The contractor shall not connect any additional load without prior permission of Departmental Electrical Engineer.

- Joints in earthing conductors shall be avoided. Loop earthing of equipment shall not be allowed. However, tapings from an earth bus may be done.

- The entire installation shall be subjected to the following tests before energisation of installation including portable equipment :

a) Insulation resistance test

b) Polarity test of switches

c) Earth continuity test

d) Earth electrode resistance

- The test procedures and their results shall conform to relevant IS specifications. The contractor shall submit a test report for his complete installation every 2 months or after rectifying any faulty section in the specimen test report. One such test report for the complete installation shall be submitted before onset of monsoon.

- Only persons having valid wireman's license shall be employed for carrying out electrical work and repair of electrical equipment installation and maintenance at site. The job shall be supervised by a qualified licensed supervisor.

- Electricians to be provided with red helmet for easy identification.

- Electrical equipment and installations shall be installed and maintained as to prevent danger from contact with live conductors and to prevent fires originating from electrical causes like short circuits, overheating etc. Installation shall not cause any hindrance to movement of men and materials.

- Materials for all electrical equipment shall be selected with regard to working voltage, load and working environment. Such equipment shall conform to the relevant Indian Standards.

- The minimum clearance to be maintained for all overhead lines along roads and across roads shall be as per the statutory requirements.

- Grounding conductor of wiring system shall be of copper or other corrosion-resistant material. An extra grounding connection shall be made in appliances / equipment where chances of electric shock is high.

- Electric fuses and / or circuit breakers installed in equipment circuits for short circuit protection shall be of proper rating. It is also recommended that high rupturing capacity (HRC) fuses are used in all circuits. The Earth Leakage Circuit Breaker (ELCB) of 30mA max capacity shall be provided in the circuits. (ELCB) of 30mA max shall me provided on each Extension board.

- Wherever cables or wires are laid on poles, a guard wire of adequate size shall be run along the cables / wire and earthed effectively. Metallic poles as a general rule, shall be avoided and if used shall be earthed individually. Anticlimbing guards and danger notices shall be provided on poles. Each equipment shall have individual isolating switches.

-Wires and cables shall be properly supported and an approved method of fixing shall be adopted. Loose hanging of wires and cables shall be avoided. Lighting and power circuits shall be kept distinct and separate.

-Reinforcement rods or any metallic part of structure shall not be used for supporting wires and cables, fixtures, equipment, earthing etc.

- All cables and wires shall be adequately protected mechanically against damages. In case the cable is required to be laid underground, it shall be adequately protected by covering the same with

bricks, Plain Cement Concrete (PCC) tile or any other approved means and provided with cable markers.

- All armored cables shall be properly terminated by using, suitable cable glands. Multistranded conductor cables shall be connected by using cable lugs/sockets. Cable lugs shall preferably be crimped. They shall be of proper size and shall correspond to the current rating and size of the cable. Twisted connections will not be allowed.
- All cable glands, armoring and sheathing of electric cables, metal circuits and their fittings, metallic fittings and other non-current carrying parts of electrical equipment and apparatus shall be effectively grounded.
- All the Distribution Boards, switches, fuse units, bus bar chambers, ducts, cubicles etc. shall have MS enclosures and shall be dust, vermin and water proof. The Distribution Boards, switches etc. shall be so fixed that they shall be easily accessible, change shall be done only after the approval of the Departmental Electrical Engineer. Distribution Boards used inside the process units shall be of Flame Proof type (Intrinsically safe type).
- Each Distribution Board shall have ELCB of 30mA max capacity.
- The contractor shall provide proper enclosures / covers of approved size and shape for protection of all the switchboards, equipment etc. against rain. Exposed live parts of all electrical circuits and equipment shall be enclosed permanently. Crane trolley wires and other conductors which cannot be completely insulated shall be placed such that they are inaccessible under normal working conditions.
- Iron soclad industrial type plug outlets are preferred for additional safety.
- Open type Distribution Boards shall be placed only in dry and ventilated rooms; they shall not be placed in the process units, vicinity of storage batteries or otherwise exposed to chemical fumes.
- Isolating switches shall be provided close to equipment for easy disconnection of electrical equipment or conductors from the source of supply when repair or maintenance work has to be done on them.
- In front of distribution boards a clear space of 90cm shall be maintained in order to have easy access during emergency.
- Adequate working space shall be provided around electrical equipment, which require adjustment or examination during operation.

- As far as possible electrical switches shall be excluded from a place where there is danger of explosion. All electrical equipment such as motors, switches and lighting fittings installed in workroom where there is possibility of explosion hazard shall be explosion proof.

- All connections to lighting fixtures, starters or other power supplies shall be provided with PVC insulated, PVC sheathed twin/three/four core wires to have better mechanical protection for preventing possible damage to equipment or injury to personnel. Taped joints shall not be allowed. Electric starter of motors, switches shall not be mounted on wooden boards. Only sheet mounting or iron framework shall be used.

- All the lighting fixtures and lamp holders shall be of good quality and in good condition. Badly repaired or broken holders, etc. shall not be used.

- Only PVC insulated and PVC sheathed wires or armoured PVC insulated and sheathed cables shall be used for external power supply connections of temporary nature. Weatherproof rubber wires shall not be used for any temporary power supply connections.

- Taped joints in the wires shall not be used. Incase joints are required on electrical cables then only heat shrinkable PVC sleeves will be allowed.

- The bulbs/lamps used for illumination and testing purpose shall have cover or guard to protect them from accidental breakages. Only 24V supply system shall be used for hand lamps etc. while working inside metallic tanks or conducting vessels(Confined spaces).

- After installation of new electric system and or other extensive extensions to existing installations, thorough inspection shall be made by Contractor's Electrical Engineer before the new system or new extension is put in use.

- All persons who work with electrical installation/equipment shall be aware of the electrical hazards, use of protective devices and safe operational procedures. They shall be given training in fire fighting, first aid and artificial resuscitation techniques, location of isolation switches, etc.

- The supervisor shall instruct the workers in the proper procedure, specify and enforce the use of necessary protective equipment such as adequately insulated pliers, screw drivers, fuse pullers, testing lamps and similar hand tools. Only wooden ladders shall be used to reach the heights in electrical work.

- No material or earthwork shall be allowed to be dumped below or in the vicinity of the bare overhead line conductors.

- Separate work permits shall be issued for individual group leaders working on the same system which shall be returned after the completion of the work to the Engineer-In-Charge.

- Before any maintenance work is commenced on electrical installations/equipment, the circuits shall be de-energised and ascertained to be dead by positive test with an approved voltage testing device. Switches shall be tagged or the fuse holders withdrawn before starting the work. Adequate precautions shall be taken in two important aspects viz. LOTO system to be followed.

- That there shall be no danger from any adjacent live parts and

- That there shall be no chances of re-energisation of the equipments on which the persons are working. (Tag out and lock out LOTO system to be strictly followed).

- While working on or near a circuit, whenever possible the use of one hand may be practiced even though the circuit is supposed to be dead. The other hand may preferably be kept in pocket.

- When it is necessary to touch electrical equipment (for example when checking for overload of motors) back of the hand may be used. Thus, if accidental shock were to cause muscular contractions, one would not "freeze" to the conductor.

- Operation of electrical equipment shall be avoided when standing on wet floor or when hands are wet. Rubber mats should be placed infront of Panels / Distribution Boards as per Indian Standrads.

- Before blown fuses are replaced, the circuit shall be locked out and an investigation shall be made for the cause of the short circuit or overload.

- When two persons are working within reach of each other, they shall never work on different phases of the supply.

- When structural repairs, modification or painting work are to be undertaken, appropriate measures shall be taken for the protection of persons whose work may bring them into the proximity of live equipment / circuit.

- It shall be ensured that the insulation and wire size of extension cords is adequate for the voltage and current to be carried.

- While tapping electricity from the socket, plug top must be used. It shall be ensured that no extension boards are over loaded while tapping. Only standard three pin plugs (Naked Wire is prohibited) shall be used for tapping electricity. Broken sockets/plugs shall be replaced immediately with good ones. Only joint free cables shall be used for connecting equipment/Use of apparatus.

- Floors shall be kept free from trailing electrical cables to avoid tripping hazard.

- Power supply to all the machines and lighting fixture shall be switched off when not in use.

- Temporary electrical connections shall be removed as soon as the stipulated work is over. After completion of the works, the contractor shall dismantle the distribution boards and the other facilities he may have erected.

- Unauthorised tapping of power by others from distribution boards under the control of the contractor shall be prohibited at all circumstances.

- No flammable materials shall be stored in any working area near the switchboards.

- Safety work permits shall be used for switching off the main feeder and equipment by the contractor.

- "MEN ON LINE" "DO NOT SWITCH ON" "DANGER" or "CAUTION" boards as applicable shall be used during maintenance works on the electrical equipment.

30. PORTABLE ELECTRICAL EQUIPMENT :

- Portable electrical tools must be examined, maintained and tested daily, fortnightly and quarterly so that the equipment and its leads are in good order. Register shall be maintained for inspection recording the testing dates and results of the equipments. Inspection checklists to be formed to that effect. The recertification of lifting tools, tackles, equipments etc. must be carried out well before the expiry of its validity period.

- All portable appliances shall be provided with three core cable and three pin plugs. The third pin of the plug shall invariably be earthed. It shall be ensured that the metal part of the equipment shall be effectively earthed.

- All connections to portable equipment or machines from the panel/distribution board/extension board shall be taken using 3 core double insulated PVC flexible copper wire in one length. No joints shall be allowed in this flexible wire. In case length of wire is not sufficient for a particular location then the supply can be tapped by providing another extension board comprising of switch, socket and ELCB of 30mA max..

- Flexible cables for portable lamps, tools and apparatus shall be regularly examined, tested periodically and maintained to ensure safety.

- For excavations, one time clearance from electrical is required for a particular area.

- Contractor shall get their welding machine / Stress Relieving (SR) electrical equipment / all

portable machine certified by MRPL / MRPL authorised contractor and seal will be fixed on machine to that effect. Certificate from third party mentioning the checks carried out, repairs carried out and safe to use to be submitted to Engineer Incharge.

Revalidation to be done once in 4 months. Incase contractor does not comply, it will be done by MRPL and four times the cost of repair will be back charged to contractor.

- Incase of welding, separate return cable from job piece to welding machine to be connected. Wires not to be used. PVC insulated cables only to be used.
- All lighting circuits/temporary connections for portable machine should have ELCB's of30mA capacity max.
- All ELCBs to be tested once in 15 days using ELCB testers (and not by the lamp with open wires) and record maintained. Also separate register for ELCB trips (TRIP REGISTER) shall be maintained. It shall be daily signed by the site Incharge of the contractor.
- Earthing of Neutral, which will act as return path, is not allowed.
- Electricians should have wireman license.
- During monsoons, monsoon protection for electrical equipment to be done.
- All feeders in contractor distribution panel to be clearly lettered with load details for isolation incase of emergency.
- Insulated tools like screwdriver, cutting plier, tester to be used.
- Each contractor should have one set of multimeter, ELCB tester and tong tester.
- First aid kit to be available.
- The contractor must have a team of Experienced Electricians (having minimum of 10 yrs. experience in carrying out safety inspection and testing of Electrical Equipments, tools, portable electrical machines and appliances etc.). to conduct periodical (Daily, fortnightly, monthly and quarterly) inspection and testing of Electrical Equipments, tools and portable electrical machines, tools and appliances and to maintain its records.
- All power cable ends should have industrial plug on one side and other end directly into the machine. (No naked end pinning into will be permitted).
- For any job within MCC / SRR a work permit will be issued by MRPL operation. Job should not be started without these permits.

31. ROLE OF CONTRACTOR INCASE OF EMERGENCY AND SIREN :

- Contractor shall instruct his workers to follow instructions strictly in case of fire siren / emergency or if advised or felt necessary by Engg. In-charge. If evacuation is ordered they must leave the work site and proceed towards the nearest designated assembly point. The contractor and its employees MUST follow specific instructions (Roles and Responsibilities incase of fire / onsite emergency) that will be given during training from time to time. All contractor employees MUST undergo such training, before their deployment at the work site. Contractor shall arrange & conduct such trainings for his employees and also employees of sub-contractors.

- Contractor shall instruct his workers to stop all jobs immediately incase release of liquid/gas/toxic/hazardous chemicals etc, and inform the concerned MRPL personnel available at site.

32. TRAINING :

- The contractor to conduct Induction training of all employees and record maintained.

- The contractor will have to depute all his employees (including Engineers, supervisors and workmen), before they commence work for the first time at MRPL site and subsequently once in a year, to undergo Safety training. They will get photo gate passes only after the completion of the training. Contractors MUST have and get conversant with Material Safety Data Sheets of all the Chemicals in MRPL. It is a MUST for them to carry the photo passes with them and produce it when demanded at site.

- Tool box talks to be conducted every day before starting of each sift and before commencing of work after lunch break by the concerned Engineer.

33. LIST OF PERSONAL PROTECTIVE EQUIPMENTS

The contractor must poses the following minimum safety Items cum Personal Protective Equipments. All Personal Protective Equipments used at site to be of approved make.

34. MANDATORY FOR THE CONTRACTOR EMPLOYEES WHILE WORKING INSIDE REFINERY :

* Deployment of adequate nos. of safety officers as per table above and making available the mandatory items as per the minimum list below is a MUST as a part of mobilization activity.

1. Safety Helmet.
2. Safety shoes (Conforming to IS standards with ankle protection, steel toe and anti-skid / acid, alkali and water proof soles).

3. Hand gloves (Leather impregnated cotton hand gloves).
4. Spectacle type goggles with toughened glass lenses, plain face shields with and without chin guards.

The contractor must use the "ISI" marked Personal Protective Equipments specific to the job .

It is mandatory to have minimum backup stock of all the PPEs in addition to what is already in use at site.

35. SPECIFICATIONS FOR SAFETY HELMETS-HDPE.

1) Helmet Safety Industrial HDPE white colour.
2) Contractor's Logo at front side.
3) Conforming to IS 2925, ISI marked & DGMS approved.
4) Nape strap type adj. type 6 point adj. head band & sweat band with 3/4"Cotton Chin strap.

* Green helmets for Safety Personnel and Red helmets for electricians to be provided and used by them.

36. SPECIFICATION FOR FULL BODY SAFETY HARNESS) SAFETY BELT

Full Body Safety Harness (Safety belts) must be double lanyard type with scaffolding hook having self closing latch (spring type).

Different type of hooks to be available based on the nature of job / type of support. Safety belts should be ISI marked and should conform to IS 3521 and DGMS approved and stamped.

Safety belts, safety straps, lifelines, permanent anchors and connections should both separately and when assembled :

a) be capable of supporting safely a suspended load of at least 450 kg (1,000 lb) ; and
b) have a breaking strength of at least 1,150 kg (2,500 lb).

If hooks are used for attaching safety belts to fixed anchors, they should be self closing safety hooks of various types and sizes.

When a lifeline or safety strap is liable to be served, cut, abraded or burned, it should consist of a wire rope or a wire-cored fiber rope.

Safety straps should be so fastened to safety belts that they cannot pass through the belt fittings if either end comes loose from its anchorage.

Metal thimbles should be used for connecting ropes or straps to eyes, rings and snaps. Safety belts, safety straps and lifelines should be so fitted as to limit the free fall of the wearer to 1m (3ft 3in).

37. SPECIFICATION FOR FALL ARRESSTOR DEVICE

Fall arresstor device with self-retracting cable integrating locking mechanism combined with an energy deception element fully automatic having cables of various lengths, ISI and DGMS and or any international approval. Only Poly Amide rope shall be used.

38. SPECIFICATION FOR DUST MASK

Dust Mask made of superior quality non-aging chemical-resistant rubber half face piece with reflex sealing flaps for protection against nuisance dust, (<0.5 micron) toxic dusts, gases and vapours with replaceable filters.

39. SPECIFICATION FOR REPLACEABLE FILTERS

For protection against nuisance dust, toxic dusts, gases and vapours upto a concentration of 500 ppm. To be fitted on aforesaid Dust Mask.

40. SPECIFICATION FOR SAFETY SHOES

1. Safety Shoes, Jodhpury style- as per is 11226- 1985 with guarantee for 1& 1/2 years (all weather).
2. Acid/ alkali/ waterproof heat resistant, antiskid green PVC Nitrile sole.
3. Steel toe cap as per relevant "IS".
4. Upper plain leather, high ankle, with metallic 4 eyelets.
5. ISI marked.
6. The supplier should give guarantee of use of safety shoes during rainy season.

41. STANDARD SPECIFICATION FOR PVC HAND GLOVES

Hand contoured for greater comfort & feature an embossed nonslip grip for handling wet or greasy objects cotton flock lining absorbs perspiration maximises easy on/off black with straight cuff each pair pack.

42. SPECIFICATION FOR ELECTRICAL PPE (SHOCK PROOF)

Hand gloves used for live electrical works shall be of proper electrical rating.

Electrical (shock proof) Safety Shoes (Jodhpury type) with acid/ alkali/ water proof, heat resistant, antiskid sole with guarantee for 1&1/2 years (all weather).

1. Upper plain leather.
2. ISI marked & latest certificate of testing from any of the govt. recognised institution for electrical resistance.

GUMBOOTS with steel toe should be used by personnel during rainy season.

The aforesaid guidelines are the minimum safety requirements and the contractor should exceed them so as to achieve "ZERO ACCIDENT" which is our MOTO.

43. TYPE SAFETY VIOLATIONS AND PENALTY SYSTEM:

All the contractors working for MRPL shall strictly follow the safety norms as per the rules and regulations of MRPL. Contractors who violate safety norms while executing the jobs will be penalized financially.

The details of penalty amount against each safety violations is enclosed as Annexure-B.

****

Annexure B

SL no	Type of Safety Violations	Amended/New penalty
1	No Lost Time Incident (NLTI) – Reporting back to duty within 48 hrs	First occasion Rs2500/- Second occasion Rs 5000/- Third occasion Rs 10000/- In addition to other expenses borne by contractor towards treatment. Existing Policy : none
2	Reportable Lost Time Incident (RLTI)- No reporting to duty within 48 hrs	First occasion Rs10000/- Second occasion Rs 25000/- Third occasion Rs 50000/- In addition to other expenses borne by contractor towards treatment. Existing Policy : none
3	Disability	Rs.1,50,000/- per person Existing Policy : none
4	Fatal	Rs.5,00,000/- per person Existing Policy : none
5	Vehicle Accident -Vehicle damaging Property or Vehicle to Vehicle Accident.	Rs.25000/- and Repairs/damage/restoration Existing Policy : none
6	For not using Personal Protective Equipment like (Safety Helmet, Safety Goggles, Safety Shoes, Hand gloves, Boiler suit, etc)	Rs. 500/- Per day / per item / per person for first violation. Rs. 1000/- for second onwards.
7	Working without permit / Clearance (Cold Work)	Rs.5,000/- per occasion After 3 violations, holiday listing for 6 months.
8	Hot work without proper permit / Clearance	Rs. 10,000/- per occasion. After 3 violations, holiday listing for 6 months.
9	Non-use of safe electricity at work site (non installation of ELCB, using poor joints of cables, using naked wire without top plug into socket, laying wire / cables on the roads, etc.	Rs. 3,000/ per item
10	Working at heights without safety belt (Full Body Safety Harness), using non-standard scaffolding and not arranging fall protection arrangement as required.	First occasion Rs2500/- Second occasion Rs 5000/- Third occasion Rs 10000/- After three occasions, holiday listing for 6 months.
11	Unsafe handling of compressed gas cylinders (No trolley, jubilee clips, double gauge regulator, Improper storage / handling).	Rs 500/- per occasion.
12	Non fencing / barricading of excavated	Rs. 1,000/- per occasion.

17/10/19

	areas.	
13	Use of domestic/commercial LPG cylinder for cutting purpose	Rs. 1,000/- per occasion.
14	Non-display of name board, permit, etc, at site.	Rs. 500/- per occasion.
15	Not providing shoring / strutting / proper slope and not keeping the excavated earth at least 1.5 m away from the excavated area.	Rs. 2000/- per occasion.
16	Wrong parking of vehicles or parking the vehiclesat non-designated places inside refinery.	Rs. 1,000/- per occasion.
17	Absence of contractor representative in refinery safety meetings whenever called.	Rs. 3,000/- per meeting.
18	Non-deployment of safety supervisor / supervisor responsible for safety at work site required as per Special Safety Conditions.	Rs. 3,000/- per day.
19	Failure to maintain safety register and records by contract Safety Supervisor or the Supervisor responsible for safety.	Rs. 1,000/- per day
20	Failure to have daily safety site inspection / audits, monthly safety meetings and maintain records (by contractors themselves).	Rs. 1,000/- for each occasion
21	Failure to submit monthly safety report by the 5th of the next month to the Engineer - in -Charge.	Rs. 1,000/- per occasion
22	Poor Housekeeping.	Rs. 1,000/- per site / per day.
23	Failure to follow injury reporting system.	Rs. 10,000/- per occasion.
24	Violation of safety condition as per Job Safety Analysis (JSA)	Rs. 10,000/- per Occasion
25	Over-speeding of vehicle i.e speed > 16 KMPH while driving inside refinery.	1. The driver will be removed and gate pass will be withdrawn. 2. Contract will be cancelled upon repeated three violations.
26	Overtaking of vehicles while driving inside refinery.	1. The driver will be removed and gate pass will be withdrawn. 2. Contract will be cancelled upon repeated three violations.

27/10/19

27	Driving of vehicle without valid license.	First occasion Rs1000/- Second occasion Rs 2000/- 1. The driver will be removed and gate pass will be withdrawn. 2. Contract will be cancelled upon repeated three violations.
28	Driving vehicle without PESO approved or PESO approved but damaged spark arrester.	1. The driver will be removed and gate pass will be withdrawn. 2. Contract will be cancelled upon repeated three violations.
29	Driving vehicle on "NO ENTRY ROADS".	1. The driver will be removed and gate pass will be withdrawn. 2. Contract will be cancelled upon repeated three violations.
30	Denying to produce the photo Gate Pass on demand.	1. Rs.500/- per person per occasion
31	Contract worker found drunk/intoxicated state inside the refinery	1. Rs.15000 / - per person per occasion.

17/10/19

PREAMBLE TO QUOTATION OF PRICES ON GEM PORTAL (INDIAN BIDDER)

RFQ NO. JP/B943-318-CC-MR-6003/3

ITEM: COLUMN/ TOWER CARBON STEEL, COLUMN/ TOWER STAINLESS STEEL

Name of Bidder : M/s _____

1	**Bidder to quote price(s) in respective field(s) against GeM Custom Catalog in GeM Portal only (except for Prices for "Two year Operation and Maintenance Spares" and "lubricants, sealing fluid & other consumables for each Rotating Equipment"). Price(s) quoted any-where else other than in respective fields provided in GeM Portal shall not be given cognizance and shall not be evaluated.**
2	Scope of supply including testing, inspection, documentation etc. shall be strictly as per Material Requisition and other documents which are part of the Bidding Document.
3	Bidders quoted prices are for complete scope as per MR and are inclusive of drawing and documentation charges for all supplies and services as per MR.
4	Price Basis: On FOT Site Basis inclusive of Packing and Forwarding (P&F) charges, freight charges, GST and all other Taxes and duties.
5	Bidder to note that evaluation shall be done on ITEM VALUE WISE basis. The order shall be awarded on ITEM VALUE WISE basis to the Lowest (L1) Evaluated Techno-Commercially acceptable bidder.
6	Following shall be considered for the purpose of Item wise Price Evaluation, including GST (after effecting Input Tax Credit) and all other Taxes and duties. - Supply Price on FOT Project Site Basis (i.e., inclusive of Freight Charges up to Project Site)
7	Bidder to submit a copy of pre-filled Unit Rates for Addition/ Deletion (Doc. No. JP/B943-UR-6003) enclosed with this Price Schedule, duly signed and stamped along with the unpriced bid, as a token of acceptance. Bidder shall not alter or modify the pre-filled Unit Rates for Addition/Deletion. Non-compliance may lead to rejection of your offer. Bidder to furnish quotation for GST for Unit Rates for Addition/Deletion in the enlcosed **Annexure-A1**. **These prices shall not be considered for evaluation.**
8	Inspection shall be carried out by EIL Approved and appointed TPI Agency as per the requirement of the MR and charges of the same shall be borne by EIL/Owner. **Bidder shall not include the charges of TPI in their quoted price.**
9	Quoted prices are firm and fixed till complete execution of the entire order and no variation on any account is allowed, unless otherwise categorically specified in Bidding Document.
10	In case of any discrepancy in the item description, quantity, etc. in the price schedule format/GeM Catalogue vis-a vis the details provided in MR, the MR details shall prevail.
11	Bidder confirm that he has noted the contents of the Preamble to the Price Schedule, Price Schedule, RFQ, Material Requisition etc and quoted his prices accordingly without any deviation.

BIDDER'S SIGNATURE:
COMPANY'S NAME:
SEAL:

Annexure-A1

UNIT RATES FOR ADDITION/DELETION

Offer shall contain the EIL Pre-Filled sheets given below, else Offer will be rejected. Please note that the same EIL sheets as given below shall be enclosed in the Offer. Bidder shall not enclose his own sheets.

JOB	B943
MR	B943-318-CC-MR-6003 Rev A dated 21/11/2024

Sr. No.	Description	Quantity	Unit Rate
06.00	Unit Rates - Addition Deletion		
06.001	**External Support Clip of material SA 516 GR 70**	**1 kg**	230 /kg
06.002	**External Support Clip of material SA 516 GR 60**	**1 kg**	230 /kg
06.003	**External Support Clip of material SA 240 GR 316 L**	**1 kg**	590 /kg
06.004	**Pipe Davit 100NB Sch 160**	**1 m**	6 700 /m
06.006	**Pipe Davit 200 NB Sch 160**	**1 m**	22 260 /m
06.008	**Change in support dimension of material SA 516 GR 60**	**1 kg**	230 /kg
06.009	**Change in nozzle pipe size/length of material SA 240 GR 316L**	**1 kg**	590 /kg
06.010	**Change in non standard flange/LWN/SRN nozzle of material SA 105**	**1 kg**	280 /kg
06.012	**Change in euipment dimesion/thickness of material SA 516 GR 60**	**1 kg**	230 /kg
06.013	**External Support Clip of material IS 2062 GR.B**	**1 kg**	160 /kg
06.014	**Pipe Davit 150NB Sch 80**	**1 m**	8 520 /m
06.015	**Pipe Davit 200NB Sch 80**	**1 m**	12 930 /m
06.016	**Change in nozzle pipe size/length of material SA 312 TP316L**	**1 kg**	590 /kg
06.017	**Change in standard flange/LWN/SRN nozzle of material SA 182 Gr. F316L**	**1 kg**	600 /kg
06.020	**Change in support dimension of material IS 2062 Gr.E 250 QUALITY B**	**1 kg**	160 /kg
06.021	**Change in internals of material SS 316L**	**1 kg**	680 /kg
06.022	**Change in support dimension of material SA 516 GR 70**	**1 kg**	230 /kg
06.023	**Change in euipment dimesion/thickness of material SA 312 TP 316L**	**1 kg**	590 /kg
06.024	**Change in euipment dimesion/thickness of material SA 516 GR 70**	**1 kg**	230 /kg
06.025	**Change in nozzle pipe size/length of material SA 106 GR B**	**1 kg**	150 /kg
06.026	**Change in standard flange/LWN/SRN nozzle of material SA 105**	**1 kg**	280 /kg
06.027	**Change in support dimension of material SA 106 GR B**	**1 kg**	150 /kg
06.028	**Change in welded internals of material SA 516 GR 60**	**1 kg**	280 /kg
06.029	**Change in welded internals of material SA 516 GR 70**	**1 kg**	280 /kg

Material Requisition (Top Sheet)

Item Description :	COLUMN/TOWER CARBON STEEL,COLUMN/TOWER STAINLESS STEEL		
Item Code :	01BA, 01BB	**Destination :**	As per Commercial Documents
Item Category :	I	**Delivery Period :**	As per Commercial Documents

Requisition Number (Always quote this Number given below as reference)

B943	318	CC	MR	6003	A
Job No.	**Unit/ Area**	**Main Cost Centre**	**Doc. Code**	**Sr. No.**	**Rev.**

14/11/2024	80	42
Date	**Divn.**	**Dept.**
	Originator	

Notes :

1. This sheet is a record of all the Revisions of this Requisition.
2. Vendor shall note the item category and shall submit his offer in line with the requirements included in attached 'Instructions to Vendors'.
3. The nature of the Revision is briefly stated in the 'Details' column below, the Requisition in its entirety shall be considered for contractual purposes.

Rev.	Date	Prepared By	Checked By	Approved By	Details
A	14/11/2024	Pravin Kumar	Pankaj Kumar Prasad	Tarun Kumar	ISSUED FOR BIDS

This is a system generated approved document and does not require signature.

Print Date : 11/14/2024 4:29:05PM

Sr. No.	Tag No./Item Code/ [ID.No.]	Description	Quantity	Delivery Location
01.00		Residual Design & engineering, procurement of all materials and bought out components, manufacture / fabrication including assembly / sub assembly at shop/site, all NDT & PWHT, inspection by TPIA (Note-1), testing , hydrotest, surface preparation, application of primer & finish paint (including supply of touch-up paint) as per painting specification, pickling & passivation of SS surface, supply of internals including demister pad with supports, all mandatory , special tools & tackles (as applicable), packing , delivery & documentation as per the enclosed specifications, instructions to vendors, job specification, data sheets etc. and other codes and standards attached or referred to.		
01.001	**DA-31801**	**STRIPPER**	**1 Nos**	
01.002	**DA-31802**	**SPLITTER**	**1 Nos**	
01.003	**DA-31803**	**BIO ATF CAUSTIC COLUMN**	**1 Nos**	
01.004	**DA-31804**	**BIO ATF WASH WATER COLUMN**	**1 Nos**	
02.00		Loading & Unloading of Columns sections at site (refer commercial document), handling, storage at site, assembly at site, site weld (Circumferential-seam in horizontal position) , NDT, surface preparation & application of of primer & finish paint, inspection and completing the column in all respects at site as per MR. All machinery, lifting equipment's, tools and tackles, power rollers, etc. for site assembly shall be in vendor's scope.		
02.002	**{02}DA-31802**	**For Item SL. No. 01.002**	**1 No**	
03.00		Transportation from Vendors work / shop to site in single piece for items listed against Sr. No. 3.001 , Sr. No. 3.003, Sr. No. 3.004 Transportation of column sections for items listed against Sr. No. 3.002 from vendor shop to assembly yard/ work site (where final C-seam welding shall be performed), as per the enclosed EIL standard specifications, instructions to vendors, job specification, datasheets etc.		
03.001	**{03}DA-31801**	**For Item SL. No. 01.001**	**1 No**	
03.002	**{03}DA-31802**	**For Item SL. No. 01.002**	**1 No**	
03.003	**{03}DA-31803**	**For Item SL. No. 01.003**	**1 No**	
03.004	**{03}DA-31804**	**For Item SL. No. 01.004**	**1 No**	

Sr. No.	Tag No./Item Code/ [ID.No.]	Description	Quantity	Delivery Location
04.00		Deleted		
05.00		Deleted		
06.00		Unit Rates		
06.001		**External Support Clip of material SA 516 GR 70**	**1 kg**	
06.002		**External Support Clip of material SA 516 GR 60**	**1 kg**	
06.003		**External Support Clip of material SA 240 GR 316L**	**1 kg**	
06.004		**Pipe Davit 100NB Sch 160**	**1 m**	
06.006		**Pipe Davit 200 NB Sch 160**	**1 m**	
06.008		**Change in support dimension of material SA 516 GR 60**	**1 kg**	
06.009		**Change in nozzle pipe size/length of material SA 240 GR 316L**	**1 kg**	
06.010		**Change in non standard flange/LWN/SRN nozzle of material SA 105**	**1 kg**	
06.012		**Change in euipment dimesion/thickness of material SA 516 GR 60**	**1 kg**	
06.013		**External Support Clip of material IS 2062 GR.B**	**1 kg**	
06.014		**Pipe Davit 150NB Sch 80**	**1 m**	
06.015		**Pipe Davit 200NB Sch 80**	**1 m**	
06.016		**Change in nozzle pipe size/length of material SA 312 TP316L**	**1 kg**	
06.017		**Change in standard flange/LWN/SRN nozzle of material SA 182 Gr. F316L**	**1 kg**	
06.020		**Change in support dimension of material IS 2062 Gr.E 250 QUALITY B**	**1 kg**	
06.021		**Change in internals of material SS 316L**	**1 kg**	
06.022		**Change in support dimension of material SA 516 GR 70**	**1 kg**	
06.023		**Change in euipment dimesion/thickness of material SA 312 TP 316L**	**1 kg**	
06.024		**Change in euipment dimesion/thickness of material SA 516 GR 70**	**1 kg**	

Sr. No.	Tag No./Item Code/ [ID.No.]	Description	Quantity	Delivery Location
06.025		**Change in nozzle pipe size/length of material SA 106 GR B**	**1 kg**	
06.026		**Change in standard flange/LWN/SRN nozzle of material SA 105**	**1 kg**	
06.027		**Change in support dimension of material SA 106 GR B**	**1 kg**	
06.028		**Change in welded internals of material SA 516 GR 60**	**1 kg**	
06.029		**Change in welded internals of material SA 516 GR 70**	**1 kg**	
07.00		Deleted		
08.00		Deleted		
09.00		Drawings and documents as per attached Vendor Data requirement for all supplies and services covered above in Sr.Nos.1.00 to Sr.No.8.00	Lot	
10.00		Deleted		
11.00		Deleted		
12.00		Deleted		
13.00		Deleted		
14.00		Deleted		
15.00		Deleted		
16.00		Deleted		
17.00		Deleted		
18.00		Deleted		
19.00		Deleted		
20.00		Deleted		
21.00		Deleted		
22.00		Deleted		
23.00		Deleted		
24.00		Deleted		
25.00		Deleted		
31.00		Deleted		
32.00		Deleted		

- Bidder shall quote prices in EIL Price Schedule except for Sr.No.09.00. Price for documentation is implied to be included in the prices quoted against Sr.No. 01.00 to Sr.No. 32.00

  Vendor to note that the numbers given in square '[]' and curly '{}' brackets are not for their use and meant for store purpose only. Items shall be tagged as per main equipment Tag No. only.

Other Remarks
General Remarks
1. 1. INSPECTION IS BY TPIA APPOINTED BY EIL. COST OF THIRD PARTY INSPECTION SHALL NOT BE CONSIDERED BY THE BIDDER. 2. REFER SL.NO.6 UNIT RATES:- A.) QUOTED RATES SHALL BE APPLICABLE FOR COMPONENTS / PARTS / ATTACHMENTS INCLUDING THE FABRICATION & TESTING. B.) THE UNIT RATES QUOTED SHALL BE APPLICABLE FOR ADDITION AS WELL AS FOR DELETION OF THE ITEMS.

List of Attachments						
Sr. No.	**Document Title**	**Document No.**	**Revision**			
			Rev.	**Rev.**	**Rev.**	**Rev.**
			Date	**Date**	**Date**	**Date**
LIST OF ATTACHMENT						
1.	List of Attachment	B943-80-42-LL-6003	A			
			14/11/2024			

LIST OF APPLICABLE SPECIFICATIONS & STANDARDS

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
A	14.11.2024	ISSUED FOR BIDS	PK	PKP	TK

LIST OF APPLICABLE SPECIFICATIONS

[X] indicates applicability

	Title	Doc No.	Shts.	Rev
[X]	General specification for pressure Vessels	6-12-0001	15	6
[X]	Supplementary specification for carbon steel vessels	6-12-0002	7	8
[ ]	Supplementary specification for low alloy steel vessels	6-12-0003	7	5
[X]	Supplementary specification for austenitic stainless steel vessels	6-12-0006	7	6
[ ]	Supplementary specification for stainless steel clad vessels	6-12-0007	10	5
[ ]	Supplementary specification for 3½ % Ni steel pressure vessels	6-12-0008	7	5
[X]	Standard specification for boiler quality carbon steel plates	6-12-0011	7	8
[X]	Standard specification for weldable structural quality steel plates for storage tanks and vessels	6-12-0014	5	6
[ ]	Standard specification for clad plates	6-12-0015	5	5
[ ]	Standard specification for 3½%Ni steel plates for pressure vessels	6-12-0016	5	4
[ ]	Standard specification for 1%Cr-½%Mo & 1½%Cr-½%Mo steel plates	6-12-0017	5	5
[ ]	Standard specification for 2.25-Cr-1 Mo steel plates	6-12-0018	6	4
[X]	Standard specification for stainless steel plates	6-12-0020	5	8
[X]	Packing, marking & shipping specification.	6-14-0009	6	5
[ ]	Standard specification for shop & field painting.	6-79-0020	59	0
[ ]	Standard specification for mechanical agitators	6-26-0001	12	3
[ ]	Material requirements for carbon steel components used in sour service for petroleum refinery environments	6-79-0013	6	1
[X]	Standard Specification for Positive Material Identification (PMI) at Vendor's works	6-81-0001	8	3
[X]	Inspection & Test Plan for Seamless Pipes	6-81-0003	6	5
[X]	Inspection & Test Plan for forged, seamless & welded fittings	6-81-0005	6	8

	Title	Doc No.	Shts.	Rev
[X]	Inspection & Test Plan for flanges, spectacle blinds and drip rings.	6-81-0006	6	5
[X]	Inspection & Test Plan for bolting material	6-81-0007	6	4
[X]	Inspection & Test Plan for gaskets.	6-81-0008	5	4
[X]	Inspection & Test Plan for pressure vessels/coulmns carbon steel	6-81-0011	7	4
[X]	Inspection & Test Plan for pressure vessels/Stainless steel	6-81-0014	7	4
[X]	Inspection & Test Plan for trays and tower internals.	6-81-0015	6	3
[X]	Standard Specification For Health, Safety & Environment (Hse) Management At Construction Sites	6-82-0001	102	0
[X]	Specification for quality management system requirements from bidders	6-78-0001	7	2
[X]	Specification for documentation requirements from suppliers	6-78-0003	11	2
[X]	Standard specification for positive material identification (PMI) at construction sites	6-82-0002	10	4
[X]	Inspection & test plan for wire mesh demisters	6-81-0060	5	3
[X]	Job specification for shop & field painting.	B644-000-06-42-PLS-01	45	0

LIST OF APPLICABLE STANDARDS

[X] indicates applicability

	Title	Doc No.	Shts.	Rev
[X]	Vessel tolerances	7-12-0001	2	6
[ ]	Support for horizontal vessel	7-12-0002	1	6
[ ]	Wooden pillows for saddle support	7-12-0003	1	6
[X]	Skirt base details	7-12-0004	1	7
[X]	Skirt opening details	7-12-0005	2	6
[ ]	Angle leg support	7-12-0006	2	6
[x]	Pipe leg support	7-12-0007	1	6
[X]	Bracket support for vertical vessel (For reference)	7-12-0008	1	6
[ ]	Manhole with hinged cover	7-12-0009	2	7
[X]	Manhole with davit	7-12-0010	2	7
[X]	Ladder rungs for manhole/ demister	7-12-0011	1	6
[ ]	Retaining plate	7-12-0012	1	6
[X]	Nozzle reinforcement and projection	7-12-0013	1	7
[ ]	Pad nozzles for vessels	7-12-0014	1	6
[X]	Standard bolt hole orientation	7-12-0015	1	6
[ ]	Alloy liner details	7-12-0016	2	6
[ ]	Sight glasses for pressure vessels	7-12-0017	2	6
[ ]	Internal flanges	7-12-0018	1	6
[X]	Vortex breakers	7-12-0019	1	6
[X]	Inlet deflector baffle	7-12-0020	1	6
[X]	Support ring and bolting bar	7-12-0021	1	6
[X]	Support ring sizes for packed tower's internals	7-12-0022	1	6
[X]	Pipe davit	7-12-0023	3	7
[X]	Lifting lug top head type (For reference)	7-12-0024	1	8
[X]	Fire proofing and insulation supports	7-12-0025	2	6
[X]	Earthing lug	7-12-0026	1	6
[X]	Name plate	7-12-0027	1	6
[X]	Manufacturer name plate	7-12-0028	1	6
[X]	Bracket for name plate	7-12-0029	1	6
[ ]	Name plate for small equipment	7-12-0030	1	5
[ ]	Details of forged nozzles	7-12-0031	1	5
[ ]	Supports for internal feed pipe	7-12-0032	2	5
[ ]	Hot insulation supports for horizontal	7-12-0033	1	5

	Title	Doc No.	Shts.	Rev
	vessel			
[ ]	Pipe davit support detail for cold insulated vessels	7-12-0034	1	5
[X]	Typical details of wiremesh demister and its supports	7-12-0036	4	5
[ ]	SR nozzle neck (for reference)	7-12-0037	1	4
[ ]	Piping Loads / Allowable nozzle loads	7-12-0038	4	1
[ ]	Skirt Monkey Ladder	-	1	0
[X]	Demister Data Sheet	$$	-	-

$$ To be provided to successful bidder.

INSTRUCTIONS TO BIDDERS

Rev. No.	Date	Purpose	Prepared By	Checked By	Approved By
A	14.11.2024	ISSUED FOR BIDS	PK	PKP	TK

INSTRUCTIONS TO BIDDERS

(A) Bidding Instructions

It is understood that-

a) The quoted price includes for the "HOLDS" details of which are indicated on the Drg.
b) The weights indicated on EIL Engineering Drgs. do not form the basis for offer, since these are approximations only.
c) Spares as included in Doc. No. B943-80-42-SS-6003 are included in the quoted price.

(B) Technical Instructions

1. **In the event of conflict, most stringent requirement in following order of precedence shall govern:**

   a) EIL Mechanical Data Sheet
   b) Process Data Sheet
   c) Job specification
   d) Licensor Standards & Specifications (as applicable)
   e) EIL specifications and standards
   f) Codes

   However in event of conflict it shall be the duty of the Vendor to bring it to EIL / MRPL attention for resolution and resolve it before proceeding with the manufacture. EIL / MRPL comments shall be final and binding on vendor without any cost and delivery implications.

2. The shape of dished end / toricone, profile of conical reducer, knuckle radius, cone angle and overall height shall be as per engineering drawing. Minimum thickness of shell, cone and dished end shall be achieved taking into account thinning and scaling etc.

3. Dished ends and hot formed pressure parts shall have 10% or 2mm (whichever is higher) allowance for scaling and thinning, in order to achieve minimum thickness specified on the drawing.

4. a. Wherever hot forming and subsequent heat treatment is involved, adopted procedure shall not impair the mechanical properties of the material beyond the limits specified in respective material specification.

   b. For low temperature equipment and hot formed parts, number of production coupons and the tests thereon shall be as per requisition.

5. Post weld heat treatment and all non-destructive testing like radiography, ultrasonic testing, magnetic particle/dye penetrant examination etc. shall be conducted as per requisition.

6. **Equipment shall be completely fabricated, assembled, hydro-tested at shop.**
   Transportation of Column DA-31801, DA-31803, DA-31804 in single piece from vendor shop to designated place at site is in the scope of the Vendor.
   Transportation of Column DA-31802 in two sections from vendor shop to designated place at site and further assembly at site is in the scope of the Vendor.(Refer Job spec B943-80-42-SP-6003)

Internal installation shall be done at shop with suitable transportation securing measures by Vendor.

Temporary wedges (if required) shall be provided for supporting the internals which shall be removed by mechanical contractor at site unless otherwise specified. Equipment vendor shall furnish detailed procedure for removal of temporary wedges.

7. Workmanship and materials, in bidder's scope of supply, shall be guaranteed.

8. Pickling and passivation of stainless steel (SS~~) clad~~ surfaces and internal / external surface of SS internals shall be carried out.

9. ~~For anchor bolts of SA 193 Gr B7, Tensile allowable stress shall be considered as 274 N/mm^2. The grade of concrete to be used is M30 having characteristic cube strength of 30N/mm^2. The maximum allowable stress for concrete is 12N/mm^2 as per working stress design.~~

10. Erection weight given in equipment data sheet is approximate. Vendor shall calculate the actual equipment weight and furnish calculation. Erection weight furnished in vendor drawing shall be based on fabricator's calculation. **Calculation of Centre of Gravity (C.G.) of the equipment shall also be done by vendor and marked on the equipment & in the fabrication GA drawing**

11. ~~For IBR vessels complete design of equipment as per IBR, approval of drawings, documents, stagewise inspection and final certification of the equipment by Inspectorate of Boilers shall be included in Bidder's scope.~~

12. ~~**For items which are to approved by PESO, Nagpur, Design, approval of drawings, documents, stagewise inspection and final certification of the equipment by PESO shall be included in Bidder's scope and getting approval from PESO shall be sole responsibility of bidder**.~~

13. The main equipment shall not be subcontracted, however the bought out items/ components can be sub-ordered or sub-contracted to EIL approved vendors/sub-contractors only and sub-vendor shall quote based on their enlistment capability with EIL.

14. Fabricator to supply the template for checking the orientation of anchor bolts on foundation and to ensure matching of base plate that is drilled in advance.Templates shall be supplied by supplier within 2-3 months from the date of placement of order and **cost towards the same shall be included in the base price quoted for the equipment**.

15. Gaskets used for hydrotesting of equipment shall be of the same specification as service gaskets and the fabricator shall supply new gaskets for manholes and nozzles with blind /companion flanges apart from spares. Gaskets used for hydrotest shall not be used for actual hook up.

16. (a) Design, fabrication & supply of transportation saddles and extension pieces for transportation of equipment up to site (adjacent to equipment foundation) is in scope of Bidder. Additionally design and supply of stools required for unloading of equipment from trailer is also in Bidder's scope of supply. Vendor to provide isolation (like rubber sheet etc.) between steel saddles and Equipment.

Finalization of numbers and dimensions of transportation saddle shall be based on reconciliation with transportation agency being mobilized at the time of execution for at site. Accordingly, dimensions of extension pieces and stools shall be finalized. **Bidder to consider the same and include the same in base price.**

(b) Bidder to leave the transportation saddles & bolted extensions at site. The same will not be returned back & price quoted accordingly. Care shall be taken to prevent rusting of saddles during transportation.

17. Fabricator shall exercise utmost care during loading/unloading & Transportation of equipment so that no damage to any part of the equipment occurs. Suitable type and no. of supports shall be provided for supporting the equipment.

18. Number of temporary attachments / cleats, lifting lug / trunnion used for site assembly should be kept minimum. Temporary attachments / cleats shall be removed by fabricator after complete execution of work if desired by engineer-in-Charge leaving 12mm from the shell & grinding of all cut edge burrs.

19. Fabricator shall ~~also design and~~ provide Tailing lug & suitable stiffening arrangement at the base anchor chair locations so that deformation/buckling of base and bottom zone do not occur at the time of lifting while the columns are being erected.

20. Fabricator shall design and provide Trunnions/lugs for erection of equipment/ equipment sections. For additional design requirements refer drawing / MR.

21. Transportation of equipment shall be governed by commercial conditions. It is the sole responsibility of bidder to adhere to the rules of all statutory authorities enforced time to time in the Transportation sector during movement at their risk & cost.

(i) The Package / Equipment with length upto 20 Meter, width upto 4.0 Meter, Height upto 4.0 Meter and Weight upto 32 MT can be transported on Mechanical Trailers. However additional support is to be given for the length to avoid overhanging.

(ii) The Package / Equipment where any of the dimension (Length, Width, Height or Weight) exceeds the limits indicated in Point No. (i) above, shall compulsorily be transported by Hydraulic Axles in compliance to all statutory norms of the authorities concerned.

(iii) For the movement by Hydraulic Axles, the GPS Tracking System shall be installed on the Prime Mover(s) of the vehicle(s). The operational password for the GPS Tracking System shall be provided to EIL / Owner, to enable all concerned to monitor movement en-route.

(iv) **ODC Criteria:**

The Maximum Transportable dimensions (inclusive of all projections & saddle height) /Weight are as under:

Equipment up to dimensions 20 Mtrs. (L) x 4.5.0 Mtrs. (W) x 4.5 Mtrs. (H) inclusive of all Nozzle/Saddle Projections/height and weight upto 100 MT can be brought to the petrochemical complex

(v) MORTH approval shall be taken before commencement of transportation by Road & copy of same shall be submitted to EIL. Movement should not commence without MORTH approval.

22. ~~For all the equipment greater than 100 Ton weight vendor shall confirm the orientation which the equipment to be dispatched, from site. This confirmation to be taken 1 month prior to dispatch of equipment. Vendor has to strictly load the equipment as per the orientation received from site so that unloading & erection can be carryout smoothly~~

23. **Transportation from shop to designated place at site is in the scope of the Vendor.** ~~**Further, Vendor to note that Equipment transportation / movement during transit & especially inside the premises may call for the use of SPMT platform vehicle, for easy maneuvering, which should be properly assessed & included in the quoted price by the Vendor as part of his responsibility. Thus, Vendor to select the transportation logistics accordingly. Necessary unloading / loading into the SPMT trailer bed, if required, shall be in the scope of the Vendor.**~~

24. ~~**All the requirements for material, testing, precautions during fabrication at shop as per Licensor's spec. no. NL866900/P.02/0121 shall be fulfilled by the Vendor for Column 416-C-1003.**~~

25. Fabricator to note that quoted price shall include following finished weights for internal attachments. Any increase / decrease in weight shall be settled as per Unit Rates of addition/ Deletion.

ITEM NO.	MOC	Internal Attachments	Additional wt.
DA-31801	SS 316L	Supporting arrangement for cartridge trays/ other internals	25 kg
DA-31802	SA516 GR 70	Bed and distributer support ring	75 kg

The above weights are over and above the internal attachments like distributor & its supports for which details are already shown in Mechanical Data Sheet and Process Data Sheet.

26. All externals shall be supplied and welded by vessel fabricator in accordance with the details furnished.

Fabricator to note that quoted price shall include following finished weights for Piping clips and Structural Clips. Any increase / decrease in weight shall be settled as per Unit rate of addition/ deletion

27. During fabrication or hydro-test conditions in horizontal position, the supports for shell shall be so provided that combined stresses in any shell component (based on corroded thickness for site test) do not exceed the following:

Tensile : 90% of ambient yield
Compressive : Code allowable stress

28. For marine transportation of all equipments and for inland transportation of SS/SS Clad equipment the following shall be taken care / provided by vendor:

After completion of all testing and inspection, the inside of complete equipment shall be thoroughly drained and dried out. Equipment shall be completely dried by passing air for sufficient time until no further increase in relative humidity of outgoing air is observed. After drying, the equipment shall be purged and filled with dry N_2 at 0.25 kg/cm^2. The equipment shall be provided with pressure gauge to monitor N_2 pressure and ½" non-return valve. Vendor to provide all accessories to ensure that N_2 pressure is maintained up to equipment delivery at site. All threaded holes other than tell-tale holes for testing shall be suitably protected with steel bar plugs. All nozzles not provided with blind flange shall be provided with steel covers, temporary gaskets and bolts. All external surfaces shall be properly protected / covered against sea environments.

29. ~~**Mandatory spares requirements shall be as follows:**~~
~~The "List of Mandatory Spares" shall be furnished by the Vendor indicating the mandatory spare(s) and it's quantity as per "Scope of work and Supply". After final approval of the above "List of Mandatory Spares", vendor shall provide price break up against of each type of mandatory spares directly to Owner / EIL for making data entry into owner's SAP system.~~

30. **All Load bearing weld joints of all types of Davits shall be suitably tested by one of the NDT methods in accordance to the approved ITP.**

31. For skirt supported equipment, 50 mm thick fireproofing shall be provided both inside and outside surface of skirt. Fire proofing shall be by others, Vendor to provide fire proofing nuts accordingly.

32. ~~**Simulated heat treatment is applicable for all plates > 50 mm thickness. Amendment to clause no. 3.4 of EIL specification 6-12-0011.**~~

(C) General Instructions

1. **INSPECTION & TESTING**

a) All materials including those used for internals shall be procured with stage-wise inspection by TPIA at mills. Stage wise & final inspection of the equipment including all components and internals shall be carried out by TPIA

TPIA shall be appointed by EIL. Cost toward third-party inspection shall NOT be included in quoted price by bidder.

~~**a) For indigenous Vendors: EIL shall be inspection agency for equipments and its indigenous components. Incase internals/forging/plates etc. are procured from abroad, the inspection shall be carried out by third party inspection agency. Quoted price for TPIA (as applicable) shall include for the same. Charges for EIL inspection to be borne by the OWNER.**~~

b) Refer commercial document for TPIA.

c) Virtual Monitoring for critical fabricated Equipment

"EIL / OWNER would review the actual job progress at place of fabrication/Manufacturing shop as & when desired or on monthly basis.

Vendor shall have provisions for showing live feed of job status / Work in progress at place of fabrication / shop floor for the ordered equipment by use of high resolution cameras / helmet cameras or any suitable electronic device during virtual progress review. Recording of the job status (in soft) shall be captured & submitted to EIL / Owner after each review.
Vendor shall ensure that requisite facilities to show virtual job progress/ Work in Progress are available at their manufacturing shop/place of fabrication and in case these are not available same shall be installed within one month of award".

2. Raw material procurement may proceed prior to approval of vendor drawings on the basis of Purchase Requisition. However for plates & nozzles where there is no Hold in size, thickness, etc, material procurement shall be initiated by successful vendor based on MR drawings immediately after placement of order.

3. Shell rolling/welding and dished - head fabrication shall commence without awaiting fabrication drawing approval.
Inspection shall be carried out in accordance with Purchase Requisition documents till approved fabrication drawings are available.

4. Material for shell, dished ends and skirt shall be considered as major raw material wherever identification of major raw material is one of the payment milestones.

5. Purchase requisition shall be issued within two weeks of Fax of intent (FOI). Final nozzle sizes (without any holds) shall be issued along with purchase requisition or latest within two months of Fax of intent (FOI).

6. Nozzle orientation of the equipment shall be issued latest by mid of contractual delivery period reckoned from date of issue of Fax of Intent (FOI).

7. Pipe support/structural clip details shall be issued latest by three months before contractual delivery date.

8. Minimum course width shall be 1 metre. Maximum no. of longitudinal seams shall be as follows:

(a)	Vessels upto 2 metre diameter	:	1 seam
(b)	Vessels from 2 metre upto 4 metre dia.	:	2 seam
(c)	Vessels from 4 metre upto 6 metre dia.	:	3 seam
(d)	Vessels from 6 metre upto 8 metre dia.	:	4 seam
~~(e)~~	~~Vessels from 8 metre upto 14 metre dia.~~	~~:~~	~~5 seam~~

In any case, distance between two longitudinal seams shall not be less than 3 meter.

9. If any discrepancy is found during design and fabrication stages, the fabricator shall inform EIL immediately and shall obtain necessary clarification/approval before proceeding with that portion of the job any further.

EIL's review of fabricator's drawings and documents must not be considered as a check and shall not relieve the fabricator of his responsibilities to supply equipment as per requisition. Fabricator shall remain responsible for conflicts between his drawings/documents and EIL drawings/documents.

10. English language and metric units shall be used in all documents. Drawings shall be prepared in prescribed sizes as standardized by bureau of Indian standards (BIS) and shall be preferably in the sizes such as 210 x 297, 297 x 420, 420 x 597, 597 x 841, 841 x 1189 mm.

11. All fabricator's drawings submitted to EIL shall be based on purchase requisition and shall bear reference number and revision of the corresponding EIL drawings. In addition, it shall indicate item number, client's name, project name, fabricator's name, purchase order number, purchase requisition number, drawing number, revision number etc. all in the lower right hand corner. All revisions shall be clearly marked by encircling with revision marks.

12. Submission of required drawings/documents shall be the responsibility of fabricator. In the event of fabricator's failure to meet this requirement, the supply of equipment shall be considered as incomplete
Vendor must ensure that all the vendor documents are thoroughly checked and approved at vendor's end by vendor's competent engineer and responsible engineering office in charge before the same are submitted to EIL for review.

13. **Review of Vendor drawings and Preparation & Submission of Document Control Index (DCI):**

a) Vendor shall prepare Document Control Index (list of those drawings, which are to be submitted to EIL along with the submission dates for each drawing) after placement of FOI. Drawings / documents shall be listed in DCI & submitted in portal.

b) Vendor shall strictly adhere to this drawing submission schedule. Successful bidder to submit DCI (document control index) and all the vendor data through vendor portal (http://edocx.eil.co.in/vportal) only. The detail guidelines for uploading the documents on vendor portal are available on the site itself.

c) Vendor to note that unscheduled documents (documents which are not listed in DCI) shall not be accepted by EIL. All vendor drawings/documents shall be submitted as scheduled document only.

d) All the drawings documents shall be indexed and submitted tagwise. Merging or clubbing of documents for equipment tags are not acceptable.

14. Dimensions of all flanges shall be as per ANSI B16.5 for nozzle sizes 24"NB and below and as per ANSI B16.47 Series B for sizes greater than 24"NB unless otherwise stated.

15. Fabrication drawings shall be submitted in following stages:
Stage-I

- General arrangement drawing indicating design data, fabricated equipment's weight, general notes, nozzle schedule, detail of shell, heads, skirt/supporting arrangement, main weld seams, nozzle orientation plan, ~~cutting layout (in case of free issue material)~~ etc.

- Detail of all nozzles, manholes, accessories etc.

- Bill of material for each item showing part size, quantity, material specification, scope of supply and weight etc.

Stage-II

- Detail of internals such as tray, tray support ring, support beam, inlet weir and bolting bar.
- Detail of internal distributor, demister support and packing support, etc.
- Detail of external clips for ladder, platform, pipe support, insulation, fire proofing, pipe davit, lifting trunnion, tailing lugs, lifting lugs etc.
- Shell development drawing incorporating all attachments and weld seams, highlighting all the fouling along with suggestions for resolution.
- Bill of material for each item showing part size, quantity, material specification, scope of supply and weight etc.
- ~~In case of owner's free issue plate material, fabricator shall submit plate cutting diagram for EIL's approval~~.

16. After receipt of order, fabricator shall submit to EIL, the planning of fabrication which shall indicate the details and scheduled date of:

- Sub orders.
- Purchase of materials such as plates, pipes, forged flanges, bolting, gaskets, etc.
- Start of fabrication of dished ends and shell, welding of shell and heads.
- Welding of nozzles and external attachments such as cleats etc.
- Phased program of shop/site fabrication of equipment section, shop assembly, testing and dispatch to site.

This planning shall be established to extend from purchasing of equipment components to the end of fabrication and delivery of equipment.

17. ~~In case; any plate material is supplied by owner, fabricator shall tabulate each plate detail as per following table:~~

~~Plate No./ Plate mark~~	~~Material Specification~~	~~Size of Plate Thk x Width x Length (mm) x (M) x (M)~~	~~Equipment Number~~	~~Ref. Dwg. No.~~	~~Part number and qty.~~

~~Size of Plate Thk x Width x Length (mm) x (M) x (M)~~	~~Heat/ sample number~~	~~Plate Weight (Kgs.)~~	~~Used plate weight (Kgs.)~~	~~Burnout losses (Kgs.)~~

~~Returnable offcut size with sketch~~	~~Returnable offcut weight (Kgs.)~~	~~Non returnable scrap weight (Kgs.)~~	~~Remarks~~

~~Fabricator shall be allowed 2% burnout losses against the material consumed in case of pressure vessels and 1% in case of storage tanks and spheres unless otherwise specified. In general purchase conditions.all offcuts of width 800mm and perimeter 2400mm in carbon steel materials and 150mm width and perimeter 1500mm in stainless steel materials shall be returned to owner, unless otherwise specified. Returnable offcuts shall have original plate markings transferred and duly stamped by inspector. All other non returnable scrap shall be sold by fabricator on the basis of owner's instructions and approval.~~

18. Words “fabricator”, “vendor”, “contractor” appearing anywhere in the requisition/Specifications/ Standards etc. shall be read as “bidder”.

19. **Bidder to note that interference of nozzles with circumferential seams is not acceptable. Vendor to take suitable care to avoid fouling of external/internal attachments with shell seams**.

20. Standard Inspection and test plans are attached with requisition for guidance. Vendor shall submit inspection test plans for the approval of visiting inspection engineer. Inspection shall take care of all the requirements of specifications. Inspection engineer has the authority to modify the plan depending on the criticality of the item.

SCOPE OF SUPPLY

Rev. No	Date	Purpose	Prepared By	Checked By	Approved By
A	14.11.2024	ISSUED FOR BIDS	PK	PKP	TK

1.0 VENDOR'S SCOPE

1.1 Complete equipment along with all the accessories as per requirements of requisition except as covered in exclusions in clause 2.0.

All items specifically not specified and also not covered in exclusions in clause 2.0 but required to complete the work in all respect as per the requisition is in vendor's scope.

1.2 All consumables tools, tackles, machinery & accessories for completing the equipment in all respect as per requisition.

1.3 Gasket / Studs / bolts and nuts for manway / handholes / ~~internal flanges~~ / nozzles with blind flange / shell flange ~~/ reducing flange / companion flange~~, including jack bolts for manways and reducing flanges

~~1.4 High strength Anchor Bolt assembly for column~~

1.5 All the drawings and documents (including residual design calculations) as specified in the requisition.

1.6 Spares:

Mandatory Spares (to be quoted separately):

i) 10% (min 2 nos. in each size) of fasteners and two set of gaskets for each nozzle shown with blind flange / reducing flange / shell flange / companion flange.

ii) For Demister~~ / Mist eliminator / Coalescer~~/ Any Other Internal Bolts: 20% (min. 4 nos. of each size/type) extra fasteners (bolts, nuts, clamps, spacers etc.) as required for holding the Demister~~ / Mist eliminator / Coalescer.~~

~~iii) Sight/light glass: 4 sets of each installed glass.~~

2.0 EXCLUSIONS

- Supply & installation of Permanent instruments
- Erection of equipment
- Supply and application of Fire proofing
- Tray/down comer/seal pan/chimney tray not welded to the equipment
- Packed Beds
- Supply & application of Insulation.

JOB SPECIFICATION FOR SITE ASSEMBLY OF COLUMN

(HORIZONTAL ASSEMBLY)

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
A	14.11.2024	ISSUED FOR BIDDS	PK	PKP	TK

This specification covers scope of work and supply at site (Refer Commercial document) for site assembly and welding of site joint and subsequent local NDT, PWHT and box-type (from inside) hydrotest (as applicable) for Columns DA-31802

1. Vendor shall fabricate the complete Column, carry out all NDT including the hydro testing of entire Column in single piece at shop. After hydro test the Column shall be cut in two sections, and weld edge prepared for welding at site. Vendor shall consider extra length to account for cutting in sections & re-welding at site. Fabricator shall trial assemble the Column sections after cutting the Column into sections at shop, match mark, provide alignment/fitment cleats, spiders at open end sections to maintain circularity, etc., before dispatch of Column sections to site.

2. Transportation of Column sections to site (where final Circumferential-seam welding shall be carried out), unloading at site, handling, conducting visual inspection of weld edges and conducting DP test, completing site seam(s) in horizontal position. It is vendor's responsibility to maintain verticality and plumbness of the completed Column. **Erection of completed Column is NOT envisaged in vendor's scope.** Requirements called out in the specifications, codes, standards, drawings and other special conditions stipulated in the MR shall be adhered to.

3. Tentative location of site Circumferential seam (C-seam) is shown in the Mechanical Datasheet of Columns. However, section length shall be decided based on transportation feasibility so that all work is done at Fabricator's shop and only minimum closing circumferential seams are done at site. Fabricator to provide additional length to take care of cutting and rejoining allowance.

4. Fabricator shall carry out complete route survey taking into account the overall dimensions of Column sections from fabricator works to site and within site. It is the responsibility of the bidder to obtain approval from various statutory bodies such as follows for the movement of the consignment.

   Electricity Board
   Railways
   P.W.D.
   Local Authorities
   Mercantile Marine Deptt.
   Irrigation authorities
   Environment authorities

   All roads within the plant battery limit for transportation of column sections till the assembly point are in bidder's scope. In case of any required modifications like strengthening of road or widening etc. the same shall be informed to EIL Engineer-in-charge at site / Owner. Any required modification in route with in plant battery limit shall be in bidder's scope with permission of EIL Engineer / Owner. Overall plot plan and equipment layout are attached for indicating equipment location at site will be provided to the successful bidder.

5. Assembly of Column sections shall not be undertaken without the use of power rollers / automatic welding machine with mounting on column throughout the circumference (the welding machine shall move on the mounting rail for complete circ. welding). Fabricator shall mobilize crane(s) of adequate capacity to handle column sections for site assembly in horizontal position. In case bidder adopts power roller option, bidder shall provide power rollers of adequate capacity and numbers for carrying out the job at site. The rollers shall be properly placed so that column is not damaged while

fabrication. In addition, supply of idlers of adequate capacity and number is the responsibility of the fabricator. All power rollers and idlers shall be kept on compacted ground/hard stand, as necessary and shall be properly leveled before rollers are kept. Compaction/ strengthening of ground, if reqd. for assembly shall be in vendor's scope and shall be included for in the quoted price. Only plain leveled ground within the unit shall be provided for site activities by Owner. (Refer Commercial document)

6. Fabricator shall erect stationary shed for all site activities. In addition a temporary movable shed shall also be provided by fabricator to ensure protection from wind and rain for all site activities like welding etc. In addition, fabricator shall provide proper storage for all critical equipments, machinery, tools & tackles, consumables etc.

7. Based on the schedule and quantum of site activities, fabricator shall provide all resources such as welders, fitters, markers, supervisors, QA/QC personnel, NDT personnel, NDT equipments, welding materials, temporary circumferential stiffeners, saddles of adequate strength, tools & tackles, baking ovens/portable ovens for electrodes, saw machines etc. required for carrying out C-seam welds, NDT etc. All welding shall be carried out by qualified welders with approved procedures. NDT personnel shall be qualified to ASNT level-II. Qualified welding inspectors from approved body shall be employed.

8. Lifting lug / Trunions / tailing lug shall be provided on the column sections for assembly/ handling.

9. Construction power: Refer commercial document.

10. Construction/ Hydrotest water: Refer commercial document.

11. Pumps for hydrostatic test / (as applicable) shall be of adequate capacity (to be arranged by fabricator) so that filling and pressurizing is being carried out to the required conditions. While draining water, adequate care shall be taken to avoid any damage to the Column. Draining shall be so regulated that occurrence of vacuum and subsequent damage is avoided. After hydrotest box type compartment shall be cut and remaining portion of the same shall be ground flush with grinding. Drying of Column shall be carried out by blowing hot/dry air.

12. Fabricator shall keep the Column sections well ventilated and well illuminated during all activities inside the Column. For this purpose suitable exhaust, air purge connections and low voltage/ I2V with step down transformer connection shall be provided.

13. All safety requirements of the plant as dictated by the operation group of the client shall be adhered to by fabricator. All necessary safety equipments required shall be arranged by fabricator. Fabricator shall provide dedicated safety engineer throughout the contract period.

14. After completion of all site activities and handing over the complete Columns in horizontal position on saddles, vendor shall clear the site of all debris, scrap and all materials used for assembly/testing etc. to the satisfaction of Engineer-in-Charge.

NOZZLES AND CONNECTIONS (नोजल व कनैक्शन)

MARK / मार्क	QTY / क्वान्टिटी	NOM. DIA नामिनल डांया	SCH./THK. शड्यूल व थिकनैस	FLANGES CLASS क्लास	FLANGES TYPE टाईप	FLANGES FACING फेसिंग	PROJECTION NOTE-4 प्रोजेक्शन	PAD W x T पैड	SERVICE सर्विस
F1	1	80	40S	150	WN	RF	440	40X T	FEED
B	1	80	40S	150	WN	RF	SEE DWG.	40X T	BOTTOM OUTLET
T	1	80	40S	150	WN	RF	SEE DWG.	40X T	TOP OUTLET
~~H~~	~~3~~	~~200 (H)~~	~~80S~~	~~150~~	~~WN~~	~~RF~~	~~440~~	~~95X T~~	~~HANDHOLE + BF + GASKET + BOLTING~~
V	1	40	40S	150	WN	RF	SEE DWG.	-	VENT
LI1-4	4	50 (H)	40S	150	WN	RF	390	-	LEVEL INSTRUMENTS
LG1-2	2	50 (H)	40S	150	WN	RF	390	-	LEVEL GAUGE
PI1-2	2	50 (H)	40S	150	WN	RF	390	-	PRESSURE INSTRUMENTS
TI	1	50 (H)	40S	150	WN	RF	390	-	TEMPERATURE INSTRUMENTS
R	1	80	40S	150	WN	RF	440	40X T	REFLUX
ST	1	80	40S	150	WN	RF	440	40X T	STRIPPING STEAM
SO	1	50	40S	150	WN	RF	390	-	STEAM OUT

T' DENOTES CORRESPONDING SHELL/DISH END NOMINAL THICKNESS

LICENSOR'S SPECIFICATION
लाइसन्सर स्पेसिफिकेशन्स

FOUNDATION LOADING DATA (OPERATING CONDITION)
फाऊंडेशन लोडिंग डाटा (ऑपरेटिंग कनडिशन)

TYPE	MAX MOMENT AT BASE (M) (kgm)	MAX. SHEAR FORCE AT BASE (H) (kg)
SEISMIC (DB)	NOTE-17	NOTE-17
SEISMIC (MC)	NOTE-17	NOTE-17
WIND	NOTE-17	NOTE-17

GENERAL NOTES (जनरल नोट्स)

UNLESS STATED OTHER WISE

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. ALL ANCHOR BOLT HOLES TO STRADDLE N/S CENTRE LINE.
3. NORTH DIRECTION WHEREVER SHOWN IS WITH RESPECT TO PLAN VIEW.
4 (A). FOR NOZZLES ON SHELL PROJECTIONS ARE REFERRED FROM VESSEL CENTER LINE TO FLANGE CONTACT FACE.
4 (B). FOR NOZZLES ON HEAD PROJECTIONS ARE REFERRED FROM HEAD T.L TO FLANGE CONTACT FACE.
5. THE INDICATED THICKNESS IS THE MINIMUM ACCEPTABLE AFTER CONSTRUCTION.
6. FLANGE GASKET FACE SHALL HAVE 125 AARH FINISH.
7. DIMENSIONS OF FLANGES FOR NOZZLES UPTO 600NB SHALL BE AS PER ANSI B16.5 AND FOR NOZZLE ABOVE 600NB SHALL BE AS PER ASME B 16.47 SERIES B UNLESS SPECIFIED OTHERWISE.
8. ID OF WELD NECK FLANGES SHALL MATCH WITH CORRESPONDING ID OF NOZZLE PIPE/SHELL.
9. NOZZLES 50NB AND BELOW SHALL BE STIFFENED WITH 2 NOS. 40 x 6 THK FLATS 90º APART.
10. ALL STAINLESS STEEL SURFACES SHALL BE PICKLED AND PASSIVATED AS PER ASTM A380.
11. IGC TEST SHALL BE CARRIED OUT ON PLATE REPRESENTATIVE OF EACH HEAT ASA PER ASTM A262 PRACTICE E/B .
12. SURFACE PREPARATION & SHOP PRIMER AS PER JOB SPECIFICATION FOR SURFACE PREPARATION AND PROTECTIVE COATING IS IN VENDOR'S SCOPE (FIELD COATING SYSTEM IS BY OTHERS)
13. VESSEL SHALL BE SUBJECTED TO STEAM OUT CONDITIONS OF 0.5 Kg/Cm²(g) AT 200 ºC
14. NOZZLE-PI TO BE LOCATED IN VAPOUR SPACE.
15. NOZZLE-TI TO BE LOCATED IN LIQUID PHASE.
16. ALL INTERNAL TO BE MADE WITH SS 316L.
17. THIS COLUMN IS SUPPORTED BY STRUCTURE (BY OTHERS). HOWEVER PAD FOR GUIDE SUPPORT AND GUIDE SUPPORT (LOOSE SUPPLY) SHALL BE PROVIDED BY VESSEL FABRICATOR. (B)
18. VENDOR TO DESIGN SUITABLE LIFTING LUG IN LINE WITH EIL STD. 7-12-0024.
19. ~~PICKLING & PASSIVATION OF SS SURFACES SHALL BE CARRIED OUT AS PER ASTM A380/JOB SPECIFICATION (AS APPLICABLE).~~ (B)
20. ALL INSIDE WELDS SHALL BE OF GROUND FLUSHED AND GROUND SMOOTH. (B)
21. AS DIAMETER COLUMN IS SMALL CARTRIDGE TRAYS ARE ENVISAGED IN THIS COLUMN. CORRESPONDINGLY CLOSE TOLERANCES SHALL BE MAINTAINED BY EQUIPMENT FABRICATOR TO ENSURE ASSEMBLY / DISASSEMBLY OF CARTRIDGE TRAYS. (REFER EIL STD 7-12-0001). PLUMBNESS, DIAMETER, OVALITY SHALL BE STRICTLY MAINTAINED FOR EASE OF INSERTION OF THE CARTRIDGE TRAYS. (B)

COLUMN IS STRUCTURE SUPPORTED/GUIDED

PLATFORM OR PIPE CLIPS NOT TO BE SUPPORTED ON THE EQUIPMENT

SPECIFICATIONS (स्पेसिफिकेशन्स) (B)

X	DENOTES APPLICABLITY	
X	GENERAL SPEC. FOR PRESSURE VESSEL	6-12-0001
X	SUPP. SPEC. FOR AUSTENITIC SS VESSELS	6-12-0006
	SUPP. SPEC. FOR CLAD VESSELS	6-12-0007
X	STD. SPEC. FOR STRUCTRAL QUALITY PLATES	6-12-0014
	STD. SPEC. FOR CLAD PLATES	6-12-0015
X	STD. SPEC. FOR STAINLESS STEEL PLATES	6-12-0020
X	SPEC.FOR SURFACE PREPARATION&PROTECTIVE COATING	B943-000-06-42-PLS-01

STANDARDS (स्टैण्डर्डस)

X	VESSEL TOLERANCES	7-12-0001
	SUPPORT FOR HORIZONTAL VESSEL	7-12-0002
	WOODEN PILLOWS FOR SADDLE SUPPORT	7-12-0003
	SKIRT BASE DETAILS	7-12-0004
	SKIRT OPENING DETAILS	7-12-0005
	ANGLE LEG SUPPORT	7-12-0006
	PIPE LEG SUPPORT	7-12-0007
X	BRACKET SUPPORT FOR VERTICAL VESSEL	7-12-0008
	MANHOLE WITH HINGED COVER	7-12-0009
X	MANHOLE WITH DAVIT (FOR REFERENCE)	7-12-0010
	LADDER RUNGS FOR MANHOLE/DEMISTER	7-12-0011
	RETAINING PLATE	7-12-0012
X	NOZZLE REINFORCEMENT AND PROJECTION	7-12-0013
	PAD NOZZLES FOR VESSELS	7-12-0014
X	STANDARD BOLT HOLE ORIENTATION	7-12-0015
	ALLOY LINER DETAILS	7-12-0016
	SIGHT GLASSES FOR PRESSURE VESSELS	7-12-0017
	INTERNAL FLANGES	7-12-0018
X	VORTEX BREAKERS	7-12-0019
	INLET DEFLECTOR BAFFLE	7-12-0020
X	SUPPORT RING AND BOLTING BAR (FOR REFERENCE) (B)	7-12-0021
	SUPPORT RING SIZES FOR PACKED TOWERS	7-12-0022
	PIPE DAVIT	7-12-0023
X	LIFTING LUG TOP HEAD TYPE (FOR REFERENCE) (B)	7-12-0024
	FIRE PROOFING AND INSULATION SUPPORTS	7-12-0025
X	EARTHING LUG	7-12-0026
X	NAME PLATE	7-12-0027
X	MANUFACTURER NAME PLATE	7-12-0028
X	BRACKET FOR NAME PLATE	7-12-0029
X	NAME PLATE FOR SMALL EQUIPMENT	7-12-0030
	DETAILS OF FORGED NOZZLES	7-12-0031
	SUPPORTS FOR INTERNAL FEED PIPE	7-12-0032
	HOT INSULATION SUPPORT FOR HORIZONTAL VESSEL	7-12-0033
	PIPE DAVIT SUPPORT FOR COLD INS. VESSELS	7-12-0034
	TYP. DETAILS OF WIRE MESH DEMISTER SUPPORTS	7-12-0036
	S.R NOZZLE NECK	7-12-0037
	ALLOWABLE NOZZLE LOADS	7-12-0038

REFERENCE DRAWINGS(रेफरेन्स डाईग)

	NOZZLE ORIENTATIONS
	LADDERS/PLATFORM CLEATS
	PIPE SUPPORT CLEATS
	TRAY SUPPORT AND BOLTING BARS
	DEMISTER DATA SHEET

HOLD UPS (होल्ड अप्स) (B)

X	NOZZLE ORIENTATIONS	X	SIZE OF NOZZLES ~~H1-3,~~ LI1-4, LG1-2, PI1-2
X	NOZZLE ELEVATIONS		PIPE SUPPORT CLEATS
X	BRACKET ELEVATION		LADDER/PLATFORM CLEATS
	DETAILS OF INTERNALS	X	TRAY SUPPORT/BOLTING BARS
X	GUIDE STRUCTURE SUPP. CLEAT		PIPE DAVIT
			PACKING SUPPORT

DESIGN DATA (डिजाइन डाटा)

CODE	ASME SECTION VIII DIV-1
WORKING PRESSURE (kg/cm²g)	TOP: 2.3, BOTTOM: 2.6
DESIGN PRESSURE (kg/cm²g)	INT. 5.1 EXT. --
WORKING TEMPERATURE (°C)	TOP: 122-132, BOTTOM: 156.5-164.5
DESIGN TEMPERATURE (°C)	195
MDMT (°C)	16
CORROSION ALLOWANCE (mm)	NIL
TYPE OF HEAD	TOP: FLANGED, BOTTOM: 2:1 ELLIPTICAL
JOINT EFFICIENCY	SHELL 0.85 HEAD / CONE 1
RADIOGRAPHY	SHELL SPOT HEAD / CONE FULL
POST WELD HEAT TREATMENT	AS PER CODE / SPEC.
HEAT TREATMENT	HEAD: AS PER CODE / SPEC.
OPERATING MEDIUM	HYDROCARBON (VAPOR-LIQUID)
SP. GRAVITY	
WIND SPECIFICATION	IS-875 (PART-3)
SEISMIC	SITE SPECTRA + IS-1893 (PART-4)
CAPACITY (M^3)	3.24 (B)
PAINTING/CLEANING	AS PER JOB SPECIFICATION (REFER NOTE)
INSULATION THICKNESS (mm) (IH)	50 [X] HOT [ ] COLD
FIRE PROOFING CLEATS	NIL [ ] YES [X] NO
HYDROSTATIC TEST (kg/cm2g)	HORIZONTAL / VERTICAL (AT TOP)
PRESSURE (NEW & COLD)	6.63 (B)
INSPECTION BY	[ ] EIL [ ] CIB [X] TPIA

MATERIAL OF CONSTRUCTION (मैटिरियल ऑफ कन्सट्रक्शन)

(AS PER ASME / IS ~~OR EQUIVALENT~~)

SHELL/~~BOOT~~	SA 312 TP 316L (SEAMLESS) (B)
REINFORCEMENT PAD/~~INSERT PLATE~~	SA 240 GR.316L
HEADS	SA 240 GR.316L / SA 403 GR.WP 316L (B)
SHELL FLANGES	SA 182 GR.F316L
NOZZLE FLANGES	SA 182 GR.F316L
NOZZLE NECK UPTO 150 NB	SA 312 TP316L (SEAMLESS) (B)
NOZZLE NECK ABOVE 150 NB	SA 240 GR.316L
PIPE FITTINGS	SA 403 GR.WP316L
GASKET EXTERNAL	SPIRAL WOUND GASKET WITH SS 316L
	METAL WINDING AND GRAFOIL FILLER
	MATERIAL WITH SS OUTER & SS 316L (B)
	INNER RING AS PER ASME B 16.20.
GASKET INTERNAL	COMPRESSED FIBRE ASBESTOS FREE
EXTERNAL STUDS/BOLTS/NUTS	SA 193 GR.B7 / SA 194 GR.4
INTERNAL STUDS/BOLTS/NUTS	SS 316L (B)
~~SKIRT/~~ SUPPORT	SA 240 GR. 316L
~~SKIRT/~~ SUPPORT BASE	SA 240 GR. 316L
INTERNAL PARTS (WELDED)	SA 240 GR.316L / SA 312 TP 316L
CLIPS & ATTACHMENTS (EXTERNAL)	SA 240 GR. 316L
CLIPS & ATTACHMENTS (EXTERNAL)	SA 240 GR. 316L
WRAPPER PLATE	-
DEMISTER/GRID	-
PAD FOR EXTERNAL ATTACHMENT	SA 240 GR. 316L
ROLLER GUIDE SUPPORT	SA 240 GR. 316L
SUPPORT GUIDE	CS/SS (B)

SPECIAL SERVICE : -

STATUTORY REGULATIONS (स्टैचुअरी रेगुलेशन्स)

- **INDIAN BOILER REGULATIONS (IBR)**
- **DEPARTMENT OF EXPLOSIVES, NAGPUR (CCOE)**

APPROXIMATE WEIGHT (kgs) (PER ITEM) (एपरौक्सिमेंट वजन)

ERECTION (B)	5600	OPERATING (B)	8100
HYDROTEST(SHOP)	8700	HYDROTEST (FIELD)	9900

NUMBER OF ITEMS : ONE

ENGINEERS INDIA LIMITED NEW DELHI इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम)	JOB NO: कार्य सख्या	B943	UNIT NO: युनिट सख्या	318				
	CLIENT : क्लाईट	MRPL						
	PLANT : प्लांट	DEMOBIO-ATF PLANT						

REV	DATE	REVISION	BY	CHECKED	APPROVED		
B	14.11.2024	REVISED AS MARKED	NS	PK	PKP	TK	
A	06.09.2024	ISSUED FOR COMMENTS	NS	PK	PKP	TK	

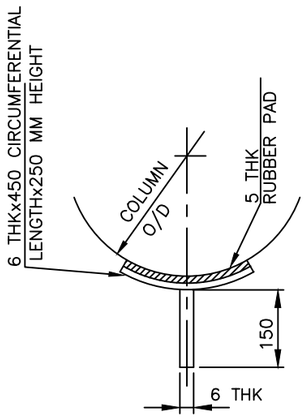
DESIGN DATA	STRIPPER	डिजाइन डाटा	स्ट्रिपर
ITEM NO.	DA-31801	आइटम नम्बर	डीए-31801

DRAWING NUMBER डाईग नम्बर	REV
B943-318-80-42-DS-3001	B
SHEET 1 OF 2	

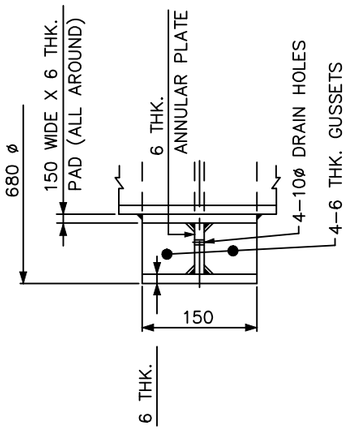
FORMAT NO.3-8042-0501 REV.0 (28.02.2024) A3-420 X 297

FILE NAME : B943-318-80-42-DS-3001-B-2

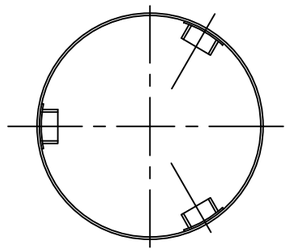
THIS COLUMN IS GUIDED BY STRUCTURE ALONG ENTIRE LENGTH. PIPING, PLATFORM TO BE SUPPORTED BY STRUCTURE INDEPENDENT OF COLUMN. DEFLECTION OF COLUMN & STRUCTURE SHALL BE LIMITED TO L/200.



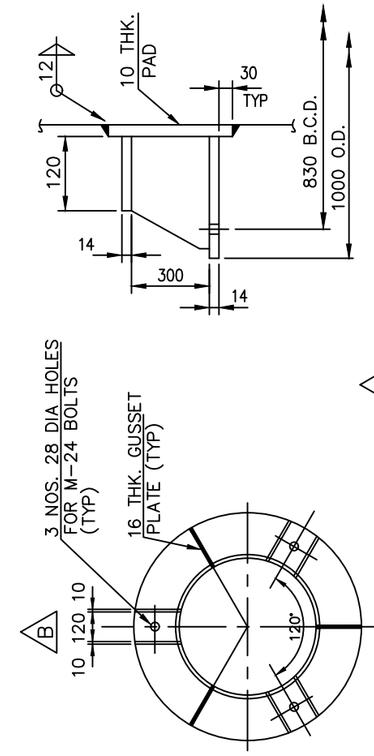
4 NOS. STRUCTURE SUPPORT GUIDE CLEATS (HOLD)



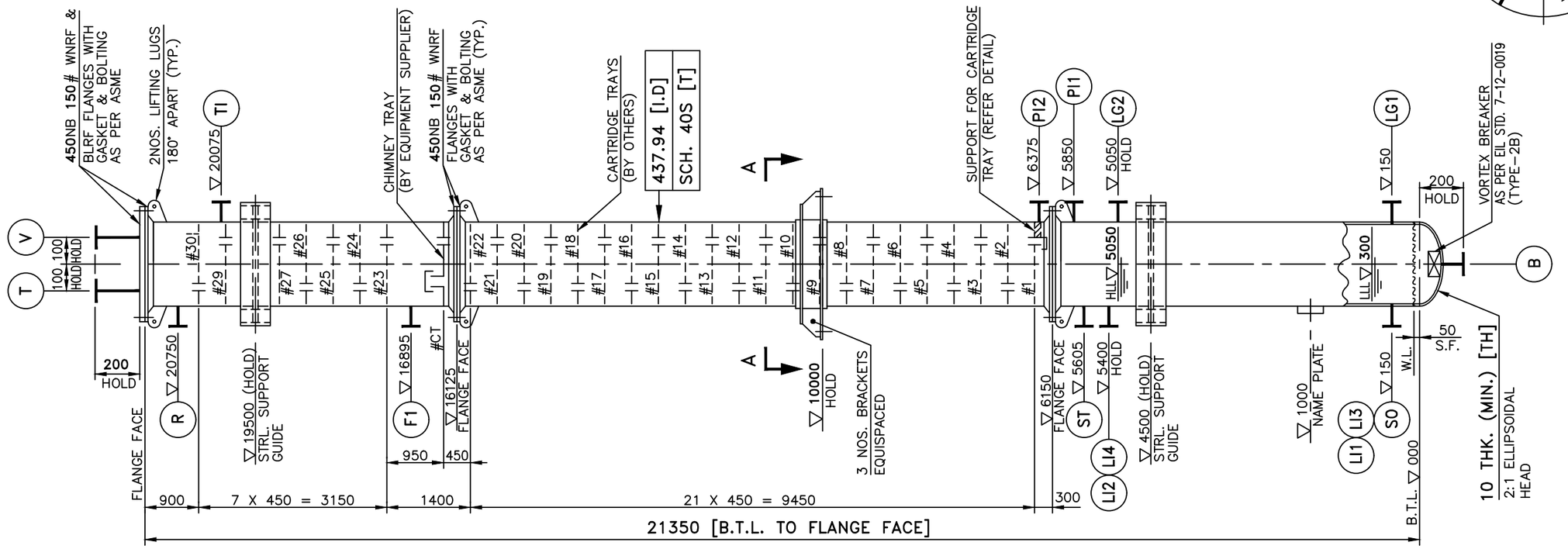
STRUCTURAL SUPPORT GUIDE (HOLD)



TYPICAL CARTRIDGE TRAY SUPPORT DETAIL (DETAILS SHALL BE AS PER APPLICABLE TRAY SUPPORT & BOLTING BAR DRAWING) (HOLD)



B BRACKET SUPPORT DETAIL (ALL OTHER DIMENSIONS AS PER EIL STD.)



B	13.11.2024	REVISED AS MARKED	NS	PK	PKP	TK
A	18.10.2024	ISSUED FOR COMMENT	NS	PK	PKP	TK
REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED

ENGINEERS INDIA LIMITED
NEW DELHI

JOB NO. : B943 UNIT NO.: 318
CLIENT : MRPL
PLANT : DEMO BIO-ATF PLANT

VESSEL DESIGN DATA
STRIPPER
ITEM NO. DA-31801

वेसेल डिजाइन डाटा
स्ट्रिपर
आइटम नम्बर डीए-31801

DRAWING NO. B943-318-80-42-DS-3001 REV. B
SHEET 2 OF 2

1-1641-0503 REV.0 A3-420x297

NOZZLES AND CONNECTIONS (नोजल व कनैक्शन)

MARK / मार्क	QTY / क्वान्टिटी	NOM. DIA नामिनल डांया	SCH./THK. शड्ल व थिकनैस	FLANGES CLASS / क्लास	FLANGES TYPE / टाईप	FLANGES FACING / फेसिग	PROJECTION NOTE-4 / प्रोजेशन	PAD W x T / पैड	SERVICE / सर्विस
F1	1	50	160	300	WN	RF	610	-	FEED
B	1	50	160	300	WN	RF	SEE DWG.	-	BOTTOM OUTLET
T	1	350	8 THK	150	WN	RF	630 (H)	-	TOP OUTLET
V	1	50	160	150	WN	RF	630 (H)	-	VENT
LI1-4	4	50 (H)	160	150	WN	RF	610	-	LEVEL INSTRUMENTS
LG1-2	2	50 (H)	160	150	WN	RF	610	-	LEVEL GAUGE
PI1-5	5	50 (H)	160	150	WN	RF	610	-	PRESSURE INSTRUMENTS (NOTE-12)
TI1-4	4	50 (H)	160	150	WN	RF	610	-	TEMPERATURE INSTRUMENTS (NOTE-13)
MH1-4	4	500	8 THK	150	WN	RF	720	215X T	MANHOLE + BF + GASKET + BOLTING + DAVIT
RI	1	150	80	150	WN	RF	SEE DWG.	85X T	REBOILER INLET
RR	1	300	8 THK	150	WN	RF	660	$$	REBOILER RETURN
MCF	1	50 (H)	160	150	WN	RF	610	-	PUMP MINIMUM FLOW
R	1	50	160	150	WN	RF	610	-	REFLUX
SO	1	50	160	150	WN	RF	610	-	STEAM OUT
AO	1	400 ID	12 THK.	AS PER EIL STD.				200 X T	ACCESS OPENING
SKV 1-2	2	100	Sch 40	AS PER EIL STD.				-	SKIRT VENT

T' DENOTES CORRESPONDING SHELL/DISH END NOMINAL THICKNESS

B $$ 810 x 810 x 20 THK. INSERT PLATE INCLUDING 1:3 TAPER.

LICENSOR'S SPECIFICATION
लाइसन्सर स्पेसिफिकेशन्स

B FOUNDATION LOADING DATA (OPERATING CONDITION)
फॉऊडेशन लोडिगं डाटा (ऑपरेटिंग कनडिशन)

TYPE	MAX MOMENT AT BASE (M) (kgm)	MAX. SHEAR FORCE AT BASE (H) (kg)
SEISMIC (DB)	8250	500
SEISMIC (MC)	-	-
WIND	16000	1270

GENERAL NOTES (जनरल नोट्स)

UNLESS STATED OTHER WISE

1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2 ALL ANCHOR BOLT HOLES TO STRADDLE N/S CENTRE LINE.
3 NORTH DIRECTION WHEREVER SHOWN IS WITH RESPECT TO PLAN VIEW.
4 (A) FOR NOZZLES ON SHELL PROJECTIONS ARE REFERRED FROM VESSEL CENTER LINE TO FLANGE CONTACT FACE.
4 (B) FOR NOZZLES ON HEAD PROJECTIONS ARE REFERRED FROM HEAD T.L TO FLANGE CONTACT FACE.
5 THE INDICATED THICKNESS IS THE MINIMUM ACCEPTABLE AFTER CONSTRUCTION.
6 FLANGE GASKET FACE SHALL HAVE 125 AARH FINISH.
7 DIMENSIONS OF FLANGES FOR NOZZLES UPTO 600NB SHALL BE AS PER ANSI B16.5 AND FOR NOZZLE ABOVE 600NB SHALL BE AS PER ASME B16.47 SERIES B UNLESS SPECIFIED OTHERWISE.
8 ID OF WELD NECK FLANGES SHALL MATCH WITH CORRESPONDING ID OF NOZZLE PIPE/SHELL.
9 NOZZLES 50NB AND BELOW SHALL BE STIFFENED WITH 2 NOS. 40 x 6 THK FLATS 90º APART.
10 SURFACE PREPARATION/SHOP PRIMER & FINISH PAINT AS PER JOB SPECIFICATION FOR SURFACE PREPARATION AND PROTECTIVE COATING IS IN VENDOR'S SCOPE.
11 VESSEL SHALL BE SUBJECTED TO STEAM OUT CONDITIONS OF 0.5 Kg/Cm²(g) AT 200 ºc.
12 NOZZLE-PI TO BE LOCATED IN VAPOUR SPACE.
13 NOZZLE-TI TO BE LOCATED IN LIQUID PHASE.
14 ALL BUTT WELD (CIRCUMFERENTIAL AND LONGITUDINAL SEAMS) IN PRESSURE PART INCLUDING NOZZLE NECK TO FLANGE, PIPE TO PIPE, PIPE TO PIPE FITTING SHALL BE FULLY RADIOGRAPHED.
B 15 THIS COLUMN IS SUPPORTED BY STRUCTURE (BY OTHERS). HOWEVER PAD FOR GUIDE SUPPORT AND GUIDE SUPPORT (LOOSE SUPPLY) SHALL BE PROVIDED BY VESSEL FABRICATOR.
B 16 **TOTAL COLUMN SHALL BE HYDROTESTED AT SHOP AND CUT IN TO TWO PIECES(WITH SUFFICIENT TOLERANCES FOR SITE WELD) AND TRANSPORTED TO SITE WITH MAXIMUM WORK BEING COMPLETED AT SHOP FOR EACH SECTION SO AS TO REDUCE SITE ACTIVITIES.**
B 17 COLUMN SHALL BE ASSEMBLED AT SITE IN HORIZONTAL POSITION COMPLETE IN ALL RESPECT INCLUDING NDT & HYDROTESTING (AS APPLICABLE) IN HORIZONTAL POSITION IS IN COLUMN FABRICATOR SCOPE.
B 18 ALL NOZZLES FABRICATED FROM PLATES SHALL BE FULLY RADIOGRAPHED.

ODC COLUMN (NOTE-16, 17)

COLUMN IS STRUCTURE SUPPORTED/GUIDED

NO PIPING/LADDER PLATFORM CLEATS TO BE SUPPORTED ON THIS EQUIPMENT

SPECIFICATIONS (स्पेसिफिकेशन्स)

X	DENOTES APPLICABLITY	
X	GENERAL SPEC. FOR PRESSURE VESSELS	6-12-0001
X	SUPP. SPEC. FOR CS VESSELS	6-12-0002
X	STD. SPEC. FOR BQCS PLATE	6-12-0011
X	STD. SPEC. FOR STRUCTRAL QUALITY PLATES	6-12-0014
X	SPEC.FOR SURFACE PREPARATION&PROTECTIVE COATING	B943-000-06-42-PLS-01

STANDARDS (स्टैण्डर्डस)

X	VESSEL TOLERANCES	7-12-0001
	SUPPORT FOR HORIZONTAL VESSEL	7-12-0002
	WOODEN PILLOWS FOR SADDLE SUPPORT	7-12-0003
X	SKIRT BASE DETAILS	7-12-0004
X	SKIRT OPENING DETAILS	7-12-0005
	ANGLE LEG SUPPORT	7-12-0006
	PIPE LEG SUPPORT	7-12-0007
	BRACKET SUPPORT FOR VERTICAL VESSEL	7-12-0008
	MANHOLE WITH HINGED COVER	7-12-0009
X	MANHOLE WITH DAVIT	7-12-0010
X	LADDER RUNGS FOR MANHOLE/DEMISTER	7-12-0011
	RETAINING PLATE	7-12-0012
X	NOZZLE REINFORCEMENT AND PROJECTION	7-12-0013
	PAD NOZZLES FOR VESSELS	7-12-0014
X	STANDARD BOLT HOLE ORIENTATION	7-12-0015
	ALLOY LINER DETAILS	7-12-0016
	SIGHT GLASSES FOR PRESSURE VESSELS	7-12-0017
	INTERNAL FLANGES	7-12-0018
X	VORTEX BREAKERS	7-12-0019
	INLET DEFLECTOR BAFFLE	7-12-0020
B X	SUPPORT RING AND BOLTING BAR (FOR REFERENCE)	7-12-0021
X	SUPPORT RING SIZES FOR PACKED TOWERS	7-12-0022
X	PIPE DAVIT	7-12-0023
X	LIFTING LUG TOP HEAD TYPE	7-12-0024
X	FIRE PROOFING AND INSULATION SUPPORTS	7-12-0025
X	EARTHING LUG	7-12-0026
X	NAME PLATE	7-12-0027
X	MANUFACTURER NAME PLATE	7-12-0028
X	BRACKET FOR NAME PLATE	7-12-0029
	NAME PLATE FOR SMALL EQUIPMENT	7-12-0030
	DETAILS OF FORGED NOZZLES	7-12-0031
	SUPPORTS FOR INTERNAL FEED PIPE	7-12-0032
	HOT INSULATION SUPPORT FOR HORIZONTAL VESSEL	7-12-0033
	PIPE DAVIT SUPPORT FOR COLD INS. VESSELS	7-12-0034
	TYP. DETAILS OF WIRE MESH DEMISTER SUPPORTS	7-12-0036
	S.R NOZZLE NECK	7-12-0037
	ALLOWABLE NOZZLE LOADS	7-12-0038

REFERENCE DRAWINGS(रेफरेन्स डाईग)

NOZZLE ORIENTATIONS	
LADDERS/PLATFORM CLEATS	
PIPE SUPPORT CLEATS	
TRAY SUPPORT AND BOLTING BARS	
DEMISTER DATA SHEET	

HOLD UPS (होल्ड अप्स)

X	NOZZLE ORIENTATIONS	X	SIZE OF NOZZLES LI1-4,LG1-2,PI1-5,TI1-4,MCF
X	NOZZLE ELEVATIONS		PIPE SUPPORT CLEATS
X	SUPPORT HEIGHT		LADDER/PLATFORM CLEATS
	DETAILS OF INTERNALS		TRAY SUPPORT/BOLTING BARS
		X	PIPE DAVIT
		X	PACKING SUPPORT

DESIGN DATA (डिजाइन डाटा)

CODE	ASME SECTION VIII DIV-1
WORKING PRESSURE (kg/cm²g)	TOP: (-)0.89, BOTTOM: (-)0.84
DESIGN PRESSURE (kg/cm²g)	INT. 3.5 EXT. FV
WORKING TEMPERATURE (°C)	TOP: 167, BOTTOM: 239.5
DESIGN TEMPERATURE (°C)	255
MDMT (°C)	16
CORROSION ALLOWANCE (mm)	3
TYPE OF HEAD	2:1 ELLIPTICAL
JOINT EFFICIENCY	SHELL 0.85 HEAD / CONE 1
RADIOGRAPHY	SHELL SPOT HEAD / CONE FULL
POST WELD HEAT TREATMENT	NIL
HEAT TREATMENT	HEAD: AS PER CODE / SPEC.
OPERATING MEDIUM	HYDROCARBON (VAPOR + LIQUID)
SP. GRAVITY	0.749
WIND SPECIFICATION	IS-875 (PART-3)
SEISMIC	SITE SPECTRA + IS-1893 (PART-4)
CAPACITY (M^3)	10.56
PAINTING/CLEANING	AS PER JOB SPECIFICATION (REFER NOTE)
INSULATION THICKNESS (mm) (IH)	65 [X] HOT [ ] COLD
FIRE PROOFING CLEATS	[X] YES [ ] NO
HYDROSTATIC TEST (kg/cm2g)	HORIZONTAL / VERTICAL (AT TOP)
PRESSURE (NEW & COLD)	4.55
INSPECTION BY	[ ] EIL [ ] CIB [X] TPIA

B MATERIAL OF CONSTRUCTION (मैटिरियल ऑफ कन्सट्रक्शन)

(AS PER ASME / IS ~~OR EQUIVALENT~~)

SHELL ~~/ BOOT~~	SA 516 Gr.70
REINFORCEMENT PAD / INSERT PAD	SA 516 Gr.70
HEADS	SA 516 Gr.70
SHELL FLANGES	-
NOZZLE FLANGES / LWN	SA 105
NOZZLE NECK UPTO 250 NB	SA 106 GR. B
NOZZLE NECK ABOVE 250 NB	SA 516 Gr.70
PIPE FITTINGS	SA 234 GR. WPB
GASKET EXTERNAL	SPIRAL WOUND GASKET WITH SS 316L
	METAL WINDING AND GRAFOIL FILLER
	MATERIAL WITH CS OUTER & SS 316L
	INNER RING AS PER ASME B 16.20.
GASKET INTERNAL	COMPRESSED FIBRE ASBESTOS FREE
EXTERNAL STUDS/BOLTS/NUTS	SA 193 GR.B7 / SA 194 GR.2H
INTERNAL STUDS/BOLTS/NUTS	SS 304
~~SKIRT/ SUPPORT~~	SA 516 GR.70/ IS 2062 GR. E 250 QUALITY B
~~SKIRT/ SUPPORT~~ BASE	IS 2062 GR. E 250 QUALITY B
INTERNAL PARTS (WELDED)	SA 516 GR.70/ SA 106 GR.B
INTERNAL PARTS (BOLTED)	
CLIPS & ATTACHMENTS (EXTERNAL)	SA 516 GR.70/ IS 2062 GR. E 250 QUALITY B
WRAPPER PLATE	-
DEMISTER/GRID	-
PAD FOR EXTERNAL ATTACHMENTS	SA 516 GR.70
SUPPORT GUIDE	SA 516 GR.70

B

INTERNAL GASKETS SHALL BE SUITABLE FOR DESIGN TEMP. AND OPERATING LIQUID.

SPECIAL SERVICE :

STATUTORY REGULATIONS (स्टैचुअरी रेगुलेशन्स)

INDIAN BOILER REGULATIONS (IBR)
DEPARTMENT OF EXPLOSIVES, NAGPUR (CCOE)

B APPROXIMATE WEIGHT (kgs) (PER ITEM) (एपरौक्सिमेंट वजन)

ERECTION	6550	OPERATING	13000
HYDROTEST(SHOP)	17100	HYDROTEST (FIELD)	17100
NUMBER OF ITEMS :	ONE		

B	13.11.2024	REVISED AS MARKED	NS	PK	PKP	TK		
A	18.10.2024	ISSUED FOR BIDS / ENGG.	NS	PK	PKP	TK		
REV	DATE	REVISION	BY	CHECKED	APPROVED			

ENGINEERS INDIA LIMITED
NEW DELHI
इंजीनियर्स इंडिया लिमिटेड
(भारत सरकार का उपक्रम)

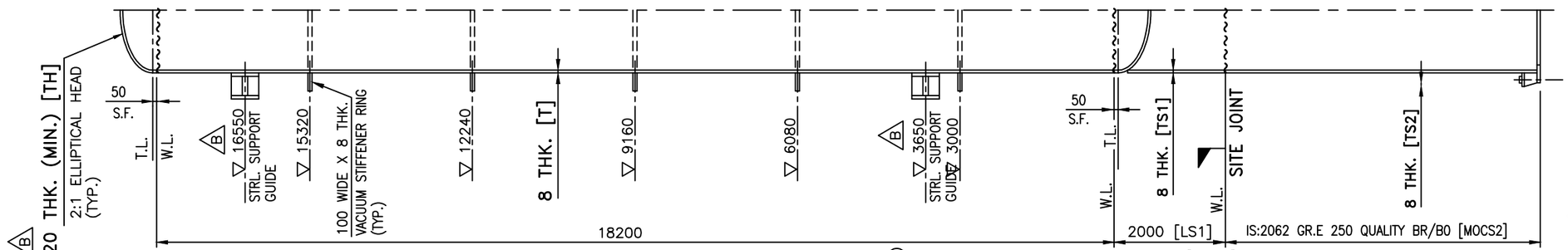
JOB NO: कार्य सख्या	B943	UNIT NO: युनिट सख्या	318
CLIENT : क्लाईट	MRPL		
PLANT : प्लांट	DEMO BIO-ATF PLANT		

DESIGN DATA	डिजाइन डाटा	DRAWING NUMBER डाईग नम्बर	REV
SPLITTER	स्प्लिटर	B943-318-80-42-DS-3002	B
ITEM NO. DA-31802	आइटम नम्बर डीए-31802	SHEET 1 OF 2	

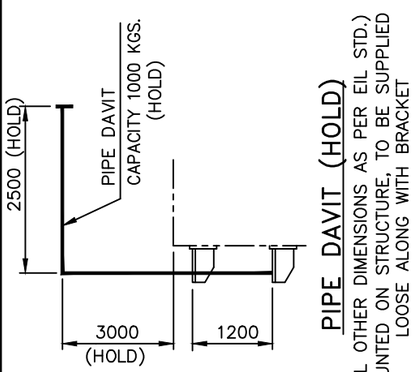
FORMAT NO.3-8042-0501 REV.0 [28.02.2024] A3-420 X 297

FILE NAME : B943-318-80-42-DS-3002-B-2

91

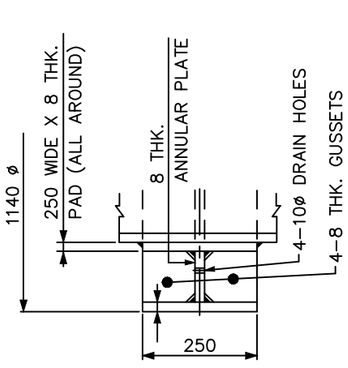


4 NOS. STRUCTURE SUPPORT GUIDE CLEATS (HOLD)

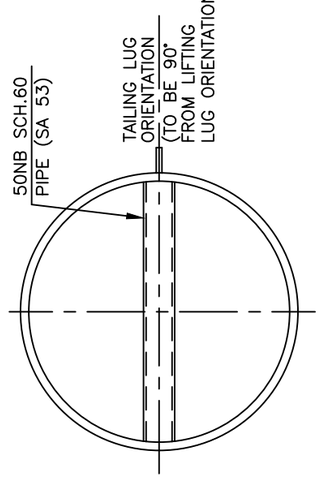


PIPE DAVIT (HOLD)

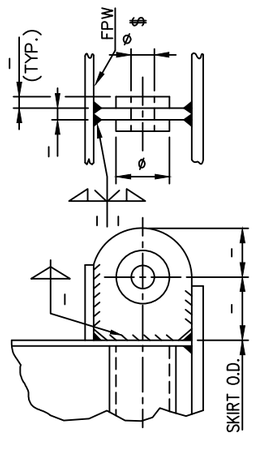
(ALL OTHER DIMENSIONS AS PER EIL STD.)
MOUNTED ON STRUCTURE, TO BE SUPPLIED LOOSE ALONG WITH BRACKET



STRUCTURAL SUPPORT GUIDE (HOLD)

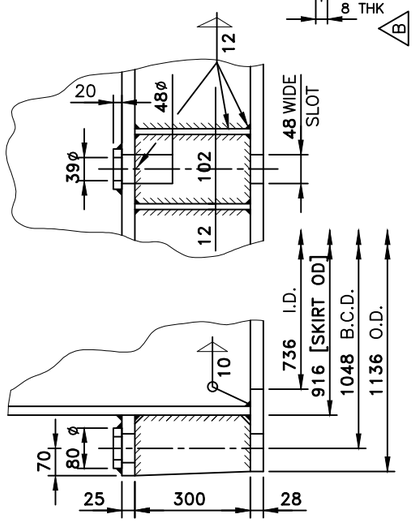


STIFFENING DETAIL OF SKIRT



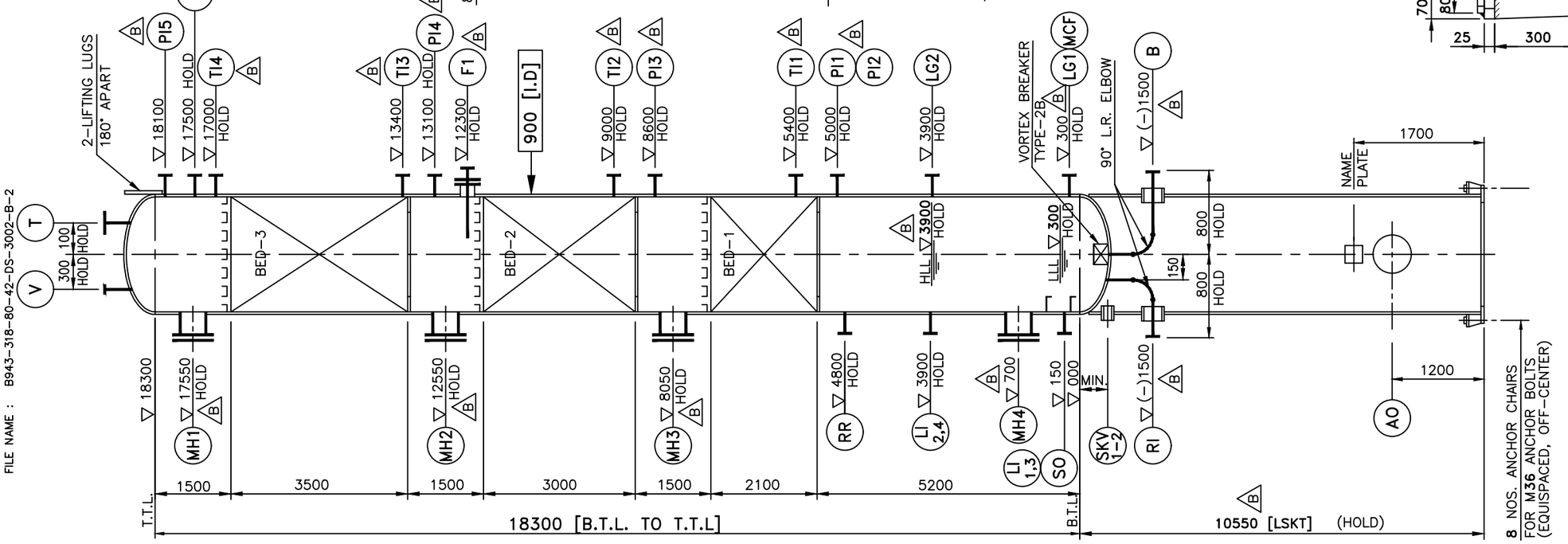
TAILING LUG DETAIL (HOLD)

$ VENDOR TO ENSURE ADEQUACY OF HOLE DIA. SUITABLE MAKE HOLE OF CROSSBY WIDE BODIED D-SHACKLE TO BE SHOWN IN VENDOR DRAWING.



SKIRT BASE DETAIL

(ALL OTHER DIMENSIONS AS PER EIL STD.)



B	13.11.2024	REVISED AS MARKED	NS	PK	PKP	TK
A	23.08.2024	ISSUED FOR BIDS/ENGG.	NS	PK	PKP	TK
REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED

ENGINEERS INDIA LIMITED
NEW DELHI

JOB NO. : B943 UNIT NO.: 318
CLIENT : MRPL
PLANT : DEMO BIO-ATF PLANT

VESSEL DESIGN DATA
SPLITTER
ITEM NO. DA-31802

वेसेल डिजाइन डाटा
स्प्लिटर
आइटम नम्बर डीए-31802

DRAWING NO. B943-318-80-42-DS-3002 REV. B
SHEET 2 OF 2

1-1641-0503 REV.0 A3-420x297

NOZZLES AND CONNECTIONS (नोजल व कनैक्शन)

MARK मार्क	QTY क्वान्टिटी	NOM. DIA नामिनल डांया	SCH./THK. शड्ल व थिकनैस	FLANGES CLASS क्लास	FLANGES TYPE टाईप	FLANGES FACING फेसिग	PROJECTION NOTE-4 प्रोजेशन	PAD W x T पैड	SERVICE सर्विस
F1/F	1	50/150	160/80	300	WN	RF	825	-	FEED + BF + GASKET + BOLTING
B F2	1	40	160	300	WN	RF	570	-	FEED (CAUSTIC)
B	1	50	XXS	300	WN	RF	SEE DWG.	-	BOTTOM OUTLET
T	1	50	160	300	WN	RF	SEE DWG.	-	TOP OUTLET
B H	1	200(H)	80	300	WN	RF	620	110X T	HANDHOLE + BF + GASKET + BOLTING
V	1	40	XXS	300	WN	RF	SEE DWG.	-	VENT
UC	1	40	XXS	300	WN	RF	570	-	UTILITY CONNECTION
B LI1-2	2	80	160	300	WN	RF	570	-	LEVEL INSTRUMENTS
B LG1-2	2	50(H)	160	300	WN	RF	570	-	LEVEL GAUGE
SV	1	50(H)	160	300	WN	RF	SEE DWG.	-	SAFETY VALVE
SK1-2	2	50	160	300	WN	RF	570	-	SKIMMING

T' DENOTES CORRESPONDING SHELL/DISH END NOMINAL THICKNESS

LICENSOR'S SPECIFICATION
लाइसन्सर स्पेसिफिकशन्स

FOUNDATION LOADING DATA (OPERATING CONDITION)
फॉऊडशन लोडिगं डाटा (ऑपरेटिंग कनडिशन)

TYPE	MAX MOMENT AT BASE (M) (kgm)	MAX. SHEAR FORCE AT BASE (H) (kg)
SEISMIC (DB)	-	-
SEISMIC (MC)	-	-
WIND	-	-

GENERAL NOTES (जनरल नोट्स)

UNLESS STATED OTHER WISE

1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2 ALL ANCHOR BOLT HOLES TO STRADDLE N/S CENTRE LINE.
3 NORTH DIRECTION WHEREVER SHOWN IS WITH RESPECT TO PLAN VIEW.
4 (A) FOR NOZZLES ON SHELL PROJECTIONS ARE REFERRED FROM VESSEL CENTER LINE TO FLANGE CONTACT FACE.
4 (B) FOR NOZZLES ON HEAD PROJECTIONS ARE REFERRED FROM HEAD T.L TO FLANGE CONTACT FACE.
5 THE INDICATED THICKNESS IS THE MINIMUM ACCEPTABLE AFTER CONSTRUCTION.
6 FLANGE GASKET FACE SHALL HAVE 125 AARH FINISH.
7 DIMENSIONS OF FLANGES FOR NOZZLES UPTO 600NB SHALL BE AS PER ANSI B16.5 AND FOR NOZZLE ABOVE 600NB SHALL BE AS PER ASME B16.47 SERIES B UNLESS SPECIFIED OTHERWISE.
8 ID OF WELD NECK FLANGES SHALL MATCH WITH CORRESPONDING ID OF NOZZLE PIPE/SHELL.
9 NOZZLES 50NB AND BELOW SHALL BE STIFFENED WITH 2 NOS. 40 x 6 THK FLATS 90º APART.
10 SURFACE PREPARATION & SHOP PRIMER AND APPLICABLE FINISH PAINT AS PER JOB SPECIFICATION FOR SURFACE PREPARATION AND PROTECTIVE COATING IS IN VENDOR'S SCOPE.
11 HC LIQUID DENSITY IS IN THE RANGE OF 740-750 KG/M3 AND THE DENSITY OF CAUSTIC SOLUTION IS 1011 KG/M3.
12 COMPLETE EQUIPMENT SHALL BE POST WELD HEAT TREATED. HARDNESS OF ALL CS PORTION, WELDS AND HAZ AFTER PWHT SHALL BE LIMITED TO 200 BHN / AS LIMITED PER LICENSOR DOCUMENTS.
13 VESSEL SHALL BE SUBJECTED TO STEAM OUT CONDITIONS OF 0.5 Kg/Cm²(g) AT 200 ºC
14 B THIS COLUMN IS SUPPORTED BY STRUCTURE (BY OTHERS). HOWEVER PAD FOR GUIDE SUPPORT AND GUIDE SUPPORT (LOOSE SUPPLY) SHALL BE PROVIDED BY VESSEL FABRICATOR.
15 LIFTING LUG SHALL BE DESIGNED & SUPPLIED BY VENDOR CONSIDERING ACTUAL EQUIPMENT ERECTION WEIGHT WITH AN IMPACT FACTOR OF 1.5. THE INDUCED STRESS IN SHELL & LUG SHALL BE WITHIN 0.9 OF YIELD. MINIMUM THICKNESS OF LUGS SHALL BE 14MM.
16 ALL BUTT WELD (CIRCUMFERENTIAL AND LONGITUDINAL SEAMS) IN PRESSURE PART INCLUDING NOZZLE NECK TO FLANGE, PIPE TO PIPE, PIPE TO PIPE FITTING SHALL BE FULLY RADIOGRAPHED.
17 EQUIPMENT SHALL BE COMPLETELY FABRICATED AND HYDROTEST AT VENDORS WORK/SHOP AND SUPPLIED IN SINGLE PIECE.
18 B ALL INTERNALS TO BE MADE OF SS316L.

COLUMN IS STRUCTURE GUIDED

NO PIPING/LADDER PLATFORM CLEATS TO BE SUPPORTED ON THIS EQUIPMENT

EQUIPMENT IS IN CAUSTIC SERVICE

SPECIFICATIONS (स्पेसिफिकेशन्स)

X	DENOTES APPLICABLITY	
X	GENERAL SPEC. FOR PRESSURE VESSELS	6-12-0001
X	SUPP. SPEC. FOR CS VESSELS	6-12-0002
X	STD. SPEC. FOR BQCS PLATE	6-12-0011
X	STD. SPEC. FOR STRUCTRAL QUALITY PLATES	6-12-0014
X	SPEC.FOR SURFACE PREPARATION&PROTECTIVE COATING	B943-000-06-42-PLS-01
X	STD. SPEC. FOR HARDNESS REQUIREMENT	6-15-0091

STANDARDS (स्टैण्डर्डस)

X	VESSEL TOLERANCES	7-12-0001
	SUPPORT FOR HORIZONTAL VESSEL	7-12-0002
	WOODEN PILLOWS FOR SADDLE SUPPORT	7-12-0003
	SKIRT BASE DETAILS	7-12-0004
	SKIRT OPENING DETAILS	7-12-0005
	ANGLE LEG SUPPORT	7-12-0006
X	PIPE LEG SUPPORT	7-12-0007
	BRACKET SUPPORT FOR VERTICAL VESSEL	7-12-0008
	MANHOLE WITH HINGED COVER	7-12-0009
X	MANHOLE WITH DAVIT (FOR REFERENCE)	7-12-0010
	LADDER RUNGS FOR MANHOLE/DEMISTER	7-12-0011
	RETAINING PLATE	7-12-0012
X	NOZZLE REINFORCEMENT AND PROJECTION	7-12-0013
	PAD NOZZLES FOR VESSELS	7-12-0014
X	STANDARD BOLT HOLE ORIENTATION	7-12-0015
	ALLOY LINER DETAILS	7-12-0016
	SIGHT GLASSES FOR PRESSURE VESSELS	7-12-0017
	INTERNAL FLANGES	7-12-0018
X	VORTEX BREAKERS	7-12-0019
	INLET DEFLECTOR BAFFLE	7-12-0020
	SUPPORT RING AND BOLTING BAR	7-12-0021
	SUPPORT RING SIZES FOR PACKED TOWERS	7-12-0022
	PIPE DAVIT	7-12-0023
	LIFTING LUG TOP HEAD TYPE	7-12-0024
X	FIRE PROOFING AND INSULATION SUPPORTS	7-12-0025
X	EARTHING LUG	7-12-0026
X	NAME PLATE	7-12-0027
X	MANUFACTURER NAME PLATE	7-12-0028
X	BRACKET FOR NAME PLATE	7-12-0029
	NAME PLATE FOR SMALL EQUIPMENT	7-12-0030
	DETAILS OF FORGED NOZZLES	7-12-0031
X	SUPPORTS FOR INTERNAL FEED PIPE	7-12-0032
	HOT INSULATION SUPPORT FOR HORIZONTAL VESSEL	7-12-0033
	PIPE DAVIT SUPPORT FOR COLD INS. VESSELS	7-12-0034
	TYP. DETAILS OF WIRE MESH DEMISTER SUPPORTS	7-12-0036
	S.R NOZZLE NECK	7-12-0037
	ALLOWABLE NOZZLE LOADS	7-12-0038

REFERENCE DRAWINGS(रेफरेन्स डाईग)

	NOZZLE ORIENTATIONS
	LADDERS/PLATFORM CLEATS
	PIPE SUPPORT CLEATS
	TRAY SUPPORT AND BOLTING BARS
	DEMISTER DATA SHEET

B HOLD UPS (होल्ड अप्स)

X	NOZZLE ORIENTATIONS	X	SIZE OF NOZZLES LG1-2, SV, H
X	NOZZLE ELEVATIONS		PIPE SUPPORT CLEATS
X	SUPPORT HEIGHT		LADDER/PLATFORM CLEATS
	DETAILS OF INTERNALS		TRAY SUPPORT/BOLTING BARS
			PIPE DAVIT
			PACKING SUPPORT

DESIGN DATA (डिजाइन डाटा)

CODE	ASME SECTION VIII DIV-1
WORKING PRESSURE (kg/cm²g)	TOP: 12.4 BOTTOM: 12.9
DESIGN PRESSURE (kg/cm²g)	INT. 17.5 EXT. --
WORKING TEMPERATURE (°C)	40
DESIGN TEMPERATURE (°C)	145
MDMT (°C)	16
CORROSION ALLOWANCE (mm)	3
TYPE OF HEAD	2:1 ELLIPTICAL
JOINT EFFICIENCY	SHELL 1 HEAD / CONE 1
RADIOGRAPHY	SHELL FULL HEAD / CONE FULL
POST WELD HEAT TREATMENT	YES (COMPLETE COLUMN) (NOTE-12)
HEAT TREATMENT	HEAD: AS PER CODE / SPEC.
OPERATING MEDIUM	BIO-ATF + CAUSTIC
SP. GRAVITY	NOTE-11
WIND SPECIFICATION	IS-875 (PART-3)
SEISMIC	SITE SPECTRA + IS-1893 (PART-4)
CAPACITY (M^3)	2.71
PAINTING/CLEANING	AS PER JOB SPECIFICATION (NOTE-10)
INSULATION THICKNESS (mm) (IH)	NIL ☐ HOT ☐ COLD
FIRE PROOFING CLEATS	☒ YES ☐ NO
HYDROSTATIC TEST (kg/cm2g)	HORIZONTAL / VERTICAL (AT TOP)
PRESSURE (NEW & COLD)	22.75
INSPECTION BY	☐ EIL ☐ CIB ☒ TPIA

MATERIAL OF CONSTRUCTION (मैटिरियल ऑफ कन्सट्रक्शन)

(AS PER ASME / IS ~~OR EQUIVALENT~~)

SHELL / BOOT	SA 516 Gr.60
REINFORCEMENT PAD ~~/ INSERT PAD~~	SA 516 Gr.60
HEADS	SA 516 Gr.60
SHELL FLANGES	SA 105
NOZZLE FLANGES / LWN	SA 105
NOZZLE NECK UPTO 250 NB	SA 106 GR. B
NOZZLE NECK ABOVE 250 NB	SA 516 Gr.60
PIPE FITTINGS	SA 234 GR. WPB
GASKET EXTERNAL	SPIRAL WOUND GASKET WITH SS 316L
	METAL WINDING AND GRAFOIL FILLER
	MATERIAL WITH CS OUTER & SS 316L
	INNER RING AS PER ASME B 16.20.
GASKET INTERNAL	COMPRESSED FIBRE ASBESTOS FREE
EXTERNAL STUDS/BOLTS/NUTS	SA 193 GR.B7 / SA 194 GR.2H
INTERNAL STUDS/BOLTS/NUTS	SS 304
~~SKIRT/~~ SUPPORT	SA 106 GR.B
~~SKIRT/~~ SUPPORT BASE	IS 2062 GR. E 250 QUALITY B
INTERNAL PARTS (WELDED)	SA 516 GR.60
INTERNAL PARTS (BOLTED)	SS 316L
CLIPS & ATTACHMENTS (EXTERNAL)	-
WRAPPER PLATE	-
DEMISTER/GRID	-
PAD FOR EXTERNAL ATTACHMENTS	SA 516 GR.60

SPECIAL SERVICE :

STATUTORY REGULATIONS (स्टैचुअरी रेगुलेशन्स)

- **INDIAN BOILER REGULATIONS (IBR)**
- **DEPARTMENT OF EXPLOSIVES, NAGPUR (CCOE)**

APPROXIMATE WEIGHT (kgs) (PER ITEM) (एपरौक्सिमेंट वजन)

ERECTION	3000	OPERATING	5000
HYDROTEST(SHOP)	5400	HYDROTEST (FIELD)	5400
NUMBER OF ITEMS :	ONE		

ENGINEERS INDIA LIMITED
NEW DELHI
इंजीनियर्स इंडिया लिमिटेड
(भारत सरकार का उपक्रम)

JOB NO: कार्य सख्या	B943	UNIT NO: युनिट सख्या	318
CLIENT : क्लाईट	MRPL		
PLANT : प्लांट	DEMO BIO-ATF PLANT		

REV	DATE	REVISION	BY	CHECKED	APPROVED	
B	14.11.2024	REVISED AS MARKED	NS	PK	PKP	TK
A	17.10.2024	ISSUED FOR COMMENTS	NS	PK	PKP	TK

DESIGN DATA
BIO-ATF CAUSTIC COLUMN
ITEM NO. DA-31803

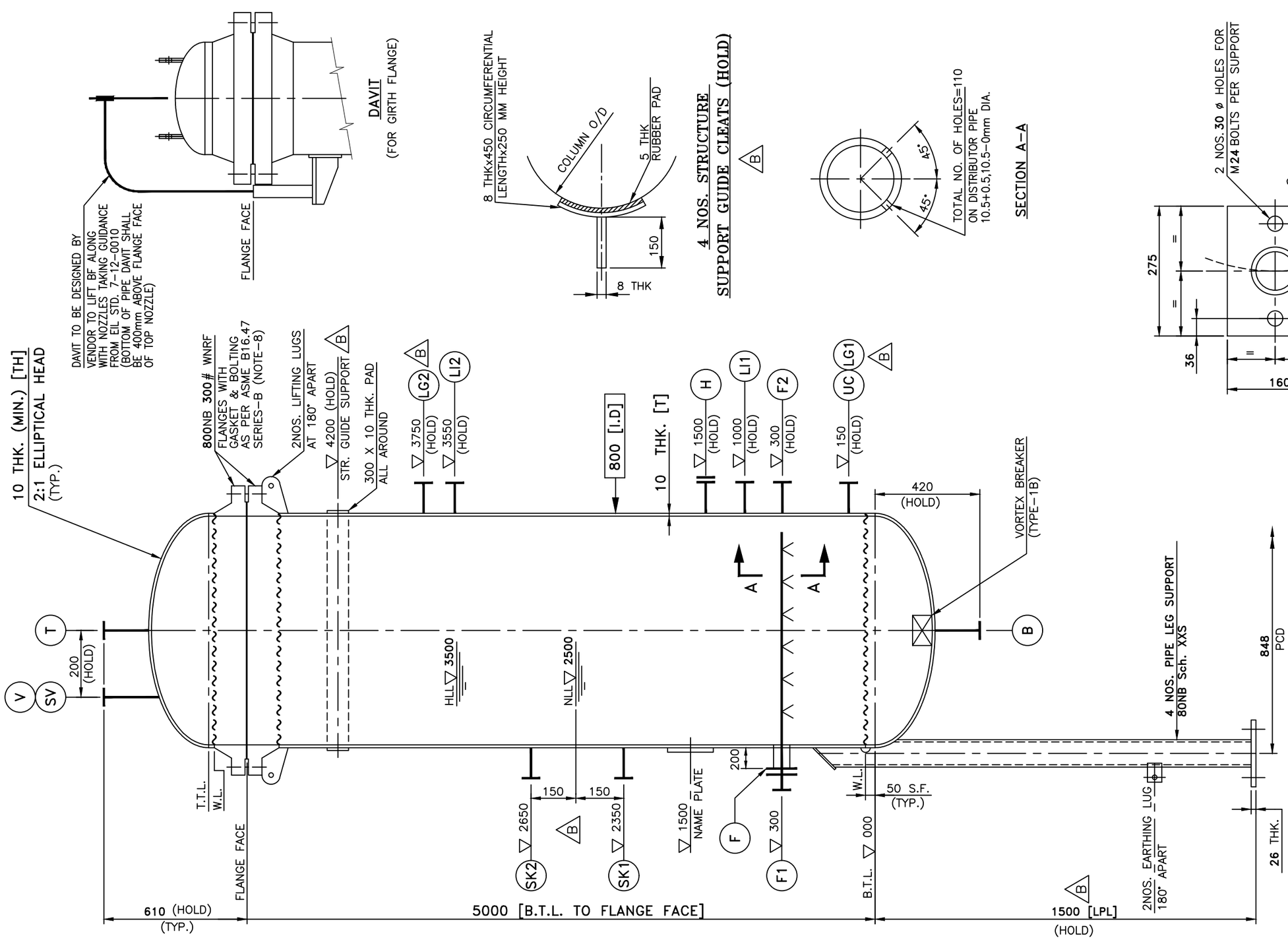
डिजाइन डाटा
बायो-एटीफ कॉस्टिक कॉलम
आइटम नम्बर डीए-31803

DRAWING NUMBER डाईग नम्बर: **B943-318-80-42-DS-3003** REV: B

SHEET 1 OF 2

FORMAT NO.3-8042-0501 REV.0 (28.02.2024) A3-420 X 297

FILE NAME : B943-318-80-42-DS-3003-B-2



REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
B	14.11.2024	REVISED AS MARKED	NS	PK	PKP	TK
A	17.10.2024	ISSUED FOR COMMENTS	NS	PK	PKP	TK

ENGINEERS INDIA LIMITED
NEW DELHI

JOB NO. : B943 UNIT NO. : 318
CLIENT : MRPL
PLANT : DEMO BIO-ATF PLANT

VESSEL DESIGN DATA
BIO-ATF
CAUSTIC COLUMN
ITEM NO.DA-31803

वेसेल डिजाइन डाटा
बायो-एटीएफ
कॉस्टिक कॉलम
आइटम नम्बर डीए-31803

DRAWING NO. B943-318-80-42-DS-3003 | REV. B

SHEET 2 OF 2

1-1641-0503 REV.0 A3-420x297

NOZZLES AND CONNECTIONS (नोजल व कनैक्शन)

MARK मार्क	QTY क्वान्टिटी	NOM. DIA नामिनल डांया	SCH./THK. शड्यूल व थिकनैस	FLANGES CLASS क्लास	FLANGES TYPE टाईप	FLANGES FACING फेसिंग	PROJECTION NOTE-4 प्रोजेक्शन	PAD W x T पैड	SERVICE सर्विस
F1/F	1	50/150	160/80	300	WN	RF	825	-	FEED + BF + GASKET + BOLTING
F2	1	50	160	300	WN	RF	570	-	FEED
B	1	50	XXS	300	WN	RF	SEE DWG.	-	BOTTOM OUTLET
T	1	50	160	300	WN	RF	SEE DWG.	-	TOP OUTLET
B H	1	200(H)	80	300	WN	RF	620	110X T	HANDHOLE + BF + GASKET + BOLTING
V	1	40	XXS	300	WN	RF	SEE DWG.	-	VENT
UC	1	40	XXS	300	WN	RF	570	-	UTILITY CONNECTION
B LI1-2	2	80	160	300	WN	RF	570	-	LEVEL INSTRUMENTS
B LG1-2	2	50(H)	160	300	WN	RF	570	-	LEVEL GAUGE
SV	1	50(H)	160	300	WN	RF	SEE DWG.	-	SAFETY VALVE
SK1-2	2	50	160	300	WN	RF	570	-	SKIMMING

T' DENOTES CORRESPONDING SHELL/DISH END NOMINAL THICKNESS

LICENSOR'S SPECIFICATION
लाइसन्सर स्पेसिफिकेशन्स

FOUNDATION LOADING DATA (OPERATING CONDITION)
फॉऊडेशन लोडिंग डाटा (ऑपरेटिंग कनडिशन)

TYPE	MAX MOMENT AT BASE (M) (kgm)	MAX. SHEAR FORCE AT BASE (H) (kg)
SEISMIC (DB)	-	-
SEISMIC (MC)	-	-
WIND	-	-

GENERAL NOTES (जनरल नोट्स)

UNLESS STATED OTHER WISE

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. ALL ANCHOR BOLT HOLES TO STRADDLE N/S CENTRE LINE.
3. NORTH DIRECTION WHEREVER SHOWN IS WITH RESPECT TO PLAN VIEW.
4 (A). FOR NOZZLES ON SHELL PROJECTIONS ARE REFERRED FROM VESSEL CENTER LINE TO FLANGE CONTACT FACE.
4 (B). FOR NOZZLES ON HEAD PROJECTIONS ARE REFERRED FROM HEAD T.L TO FLANGE CONTACT FACE.
5. THE INDICATED THICKNESS IS THE MINIMUM ACCEPTABLE AFTER CONSTRUCTION.
6. FLANGE GASKET FACE SHALL HAVE 125 AARH FINISH.
7. DIMENSIONS OF FLANGES FOR NOZZLES UPTO 600NB SHALL BE AS PER ANSI B16.5 AND FOR NOZZLE ABOVE 600NB SHALL BE AS PER ASME B16.47 SERIES B UNLESS SPECIFIED OTHERWISE.
8. ID OF WELD NECK FLANGES SHALL MATCH WITH CORRESPONDING ID OF NOZZLE PIPE/SHELL.
9. NOZZLES 50NB AND BELOW SHALL BE STIFFENED WITH 2 NOS. 40 x 6 THK FLATS 90º APART.
10. SURFACE PREPARATION & SHOP PRIMER AS PER JOB SPECIFICATION FOR SURFACE PREPARATION AND PROTECTIVE COATING IS IN VENDOR'S SCOPE (FIELD COATING SYSTEM IS BY OTHERS)
11. HC LIQUID DENSITY IS IN THE RANGE OF 740-750 KG/M3 AND THE DENSITY OF WATER IS IN THE RANGE OF 994-102 KG/M3.
12. COMPLETE EQUIPMENT SHALL BE POST WELD HEAT TREATED. HARDNESS OF ALL CS PORTION, WELDS AND HAZ AFTER PWHT SHALL BE LIMITED TO 200 BHN / AS LIMITED PER LICENSOR DOCUMENTS.
13. MESH BLANKET SHALL CONSIST OF 300mm LAYER WITH DENSITY OF 144 KG/M^3.
14. ALL INTERNAL TO BE MADE WITH SS 316L.
15. MOC OF MESH BLANKET IS SS 304L / SS 316L.
16. VESSEL SHALL BE SUBJECTED TO STEAM OUT CONDITIONS OF 0.5 Kg/Cm²(g) AT 200 ºc.
17. B THIS COLUMN IS SUPPORTED BY STRUCTURE (BY OTHERS). HOWEVER PAD FOR GUIDE SUPPORT AND GUIDE SUPPORT (LOOSE SUPPLY) SHALL BE PROVIDED BY VESSEL FABRICATOR.
18. LIFTING LUG SHALL BE DESIGNED & SUPPLIED BY VENDOR CONSIDERING ACTUAL EQUIPMENT ERECTION WEIGHT WITH AN IMPACT FACTOR OF 1.5. THE INDUCED STRESS IN SHELL & LUG SHALL BE WITHIN 0.9 OF YIELD. MINIMUM THICKNESS OF LUGS SHALL BE 14MM.

COLUMN IS STRUCTURE GUIDED

NO PIPING/LADDER PLATFORM CLEATS TO BE SUPPORTED ON THIS EQUIPMENT

EQUIPMENT IS IN CAUSTIC SERVICE

SPECIFICATIONS (स्पेसिफिकेशन्स)

X	DENOTES APPLICABLITY	
X	GENERAL SPEC. FOR PRESSURE VESSELS	6-12-0001
X	SUPP. SPEC. FOR CS VESSELS	6-12-0002
X	STD. SPEC. FOR BQCS PLATE	6-12-0011
X	STD. SPEC. FOR STRUCTRAL QUALITY PLATES	6-12-0014
X	SPEC.FOR SURFACE PREPARATION&PROTECTIVE COATING	B943-000-06-42-PLS-01
X	STD. SPEC. FOR HARDNESS REQUIREMENT	6-15-0091

STANDARDS (स्टैण्डर्डस)

X	VESSEL TOLERANCES	7-12-0001
	SUPPORT FOR HORIZONTAL VESSEL	7-12-0002
	WOODEN PILLOWS FOR SADDLE SUPPORT	7-12-0003
X	SKIRT BASE DETAILS	7-12-0004
X	SKIRT OPENING DETAILS	7-12-0005
	ANGLE LEG SUPPORT	7-12-0006
	PIPE LEG SUPPORT	7-12-0007
	BRACKET SUPPORT FOR VERTICAL VESSEL	7-12-0008
	MANHOLE WITH HINGED COVER	7-12-0009
X	MANHOLE WITH DAVIT (FOR REFERENCE)	7-12-0010
	LADDER RUNGS FOR MANHOLE/DEMISTER	7-12-0011
	RETAINING PLATE	7-12-0012
X	NOZZLE REINFORCEMENT AND PROJECTION	7-12-0013
	PAD NOZZLES FOR VESSELS	7-12-0014
X	STANDARD BOLT HOLE ORIENTATION	7-12-0015
	ALLOY LINER DETAILS	7-12-0016
	SIGHT GLASSES FOR PRESSURE VESSELS	7-12-0017
	INTERNAL FLANGES	7-12-0018
X	VORTEX BREAKERS	7-12-0019
	INLET DEFLECTOR BAFFLE	7-12-0020
	SUPPORT RING AND BOLTING BAR	7-12-0021
	SUPPORT RING SIZES FOR PACKED TOWERS	7-12-0022
	PIPE DAVIT	7-12-0023
B X	LIFTING LUG TOP HEAD TYPE (FOR REFERENCE)	7-12-0024
X	FIRE PROOFING AND INSULATION SUPPORTS	7-12-0025
X	EARTHING LUG	7-12-0026
X	NAME PLATE	7-12-0027
X	MANUFACTURER NAME PLATE	7-12-0028
X	BRACKET FOR NAME PLATE	7-12-0029
	NAME PLATE FOR SMALL EQUIPMENT	7-12-0030
	DETAILS OF FORGED NOZZLES	7-12-0031
X	SUPPORTS FOR INTERNAL FEED PIPE	7-12-0032
	HOT INSULATION SUPPORT FOR HORIZONTAL VESSEL	7-12-0033
	PIPE DAVIT SUPPORT FOR COLD INS. VESSELS	7-12-0034
X	TYP. DETAILS OF WIRE MESH DEMISTER SUPPORTS	7-12-0036
	S.R NOZZLE NECK	7-12-0037
	ALLOWABLE NOZZLE LOADS	7-12-0038

REFERENCE DRAWINGS(रेफरेन्स डाईग)

NOZZLE ORIENTATIONS	
LADDERS/PLATFORM CLEATS	
PIPE SUPPORT CLEATS	
TRAY SUPPORT AND BOLTING BARS	
DEMISTER DATA SHEET	

B HOLD UPS (होल्ड अप्स)

X	NOZZLE ORIENTATIONS	X	SIZE OF NOZZLES LG1-2, SV, H
X	NOZZLE ELEVATIONS		PIPE SUPPORT CLEATS
X	SUPPORT HEIGHT		LADDER/PLATFORM CLEATS
	DETAILS OF INTERNALS		TRAY SUPPORT/BOLTING BARS
			PIPE DAVIT
			PACKING SUPPORT

DESIGN DATA (डिजाइन डाटा)

CODE	ASME SECTION VIII DIV-1
WORKING PRESSURE (kg/cm^2g)	TOP: 11.9 BOTTOM: 12.4
DESIGN PRESSURE (kg/cm^2g)	INT. 17.5 EXT. --
WORKING TEMPERATURE (°C)	40
DESIGN TEMPERATURE (°C)	145
MDMT (°C)	16
CORROSION ALLOWANCE (mm)	3
TYPE OF HEAD	2:1 ELLIPTICAL
JOINT EFFICIENCY	SHELL 1 HEAD / CONE 1
RADIOGRAPHY	SHELL FULL HEAD / CONE FULL
POST WELD HEAT TREATMENT	AS PER CODE / SPEC. (NOTE-12)
HEAT TREATMENT	HEAD: AS PER CODE / SPEC.
OPERATING MEDIUM	BIO-ATF + CAUSTIC + WATER
SP. GRAVITY	NOTE-11
WIND SPECIFICATION	IS-875 (PART-3)
SEISMIC	SITE SPECTRA + IS-1893 (PART-4)
CAPACITY (M^3)	2.71
PAINTING/CLEANING	AS PER JOB SPECIFICATION (REFER NOTE)
INSULATION THICKNESS (mm) (IH)	☐ HOT ☐ COLD
FIRE PROOFING CLEATS	☒ YES ☐ NO
HYDROSTATIC TEST (kg/cm2g)	HORIZONTAL / VERTICAL (AT TOP)
PRESSURE (NEW & COLD)	22.75
INSPECTION BY	☐ EIL ☐ CIB ☒ TPIA

MATERIAL OF CONSTRUCTION (मैटिरियल ऑफ कन्सट्रक्शन)

(AS PER ASME / IS ~~OR EQUIVALENT~~)

SHELL / BOOT	SA 516 Gr.60
REINFORCEMENT PAD / INSERT PAD	SA 516 Gr.60
HEADS	SA 516 Gr.60
SHELL FLANGES	SA 105
NOZZLE FLANGES / LWN	SA 105
NOZZLE NECK UPTO 250 NB	SA 106 GR. B
NOZZLE NECK ABOVE 250 NB	SA 516 Gr.60
PIPE FITTINGS	SA 234 GR. WPB
GASKET EXTERNAL	SPIRAL WOUND GASKET WITH SS 316L
	METAL WINDING AND GRAFOIL FILLER
	MATERIAL WITH CS OUTER & SS 316L
	INNER RING AS PER ASME B 16.20.
GASKET INTERNAL	COMPRESSED FIBRE ASBESTOS FREE
EXTERNAL STUDS/BOLTS/NUTS	SA 193 GR.B7 / SA 194 GR.2H
INTERNAL STUDS/BOLTS/NUTS	SS 304
~~SKIRT~~/ SUPPORT	SA 516 GR.60/ IS 2062 GR. E 250 QUALITY B
~~SKIRT~~/ SUPPORT BASE	IS 2062 GR. E 250 QUALITY B
INTERNAL PARTS (WELDED)	SS 316L
INTERNAL PARTS (BOLTED)	SS 316L
CLIPS & ATTACHMENTS (EXTERNAL)	SA 516 GR.60/ IS 2062 GR. E 250 QUALITY B
WRAPPER PLATE	-
DEMISTER/GRID	SS 304L/SS316L
PAD FOR EXTERNAL ATTACHMENTS	SA 516 GR.60

SPECIAL SERVICE :

STATUTORY REGULATIONS (स्टैचुअरी रेगुलेशन्स)

INDIAN BOILER REGULATIONS (IBR)

DEPARTMENT OF EXPLOSIVES, NAGPUR (CCOE)

APPROXIMATE WEIGHT (kgs) (PER ITEM) (एपरौक्सिमेंट वजन)

ERECTION	3000	OPERATING	5000
HYDROTEST(SHOP)	5400	HYDROTEST (FIELD)	5400
NUMBER OF ITEMS :	ONE		

ENGINEERS INDIA LIMITED
NEW DELHI
इंजीनियर्स इंडिया लिमिटेड
(भारत सरकार का उपक्रम)

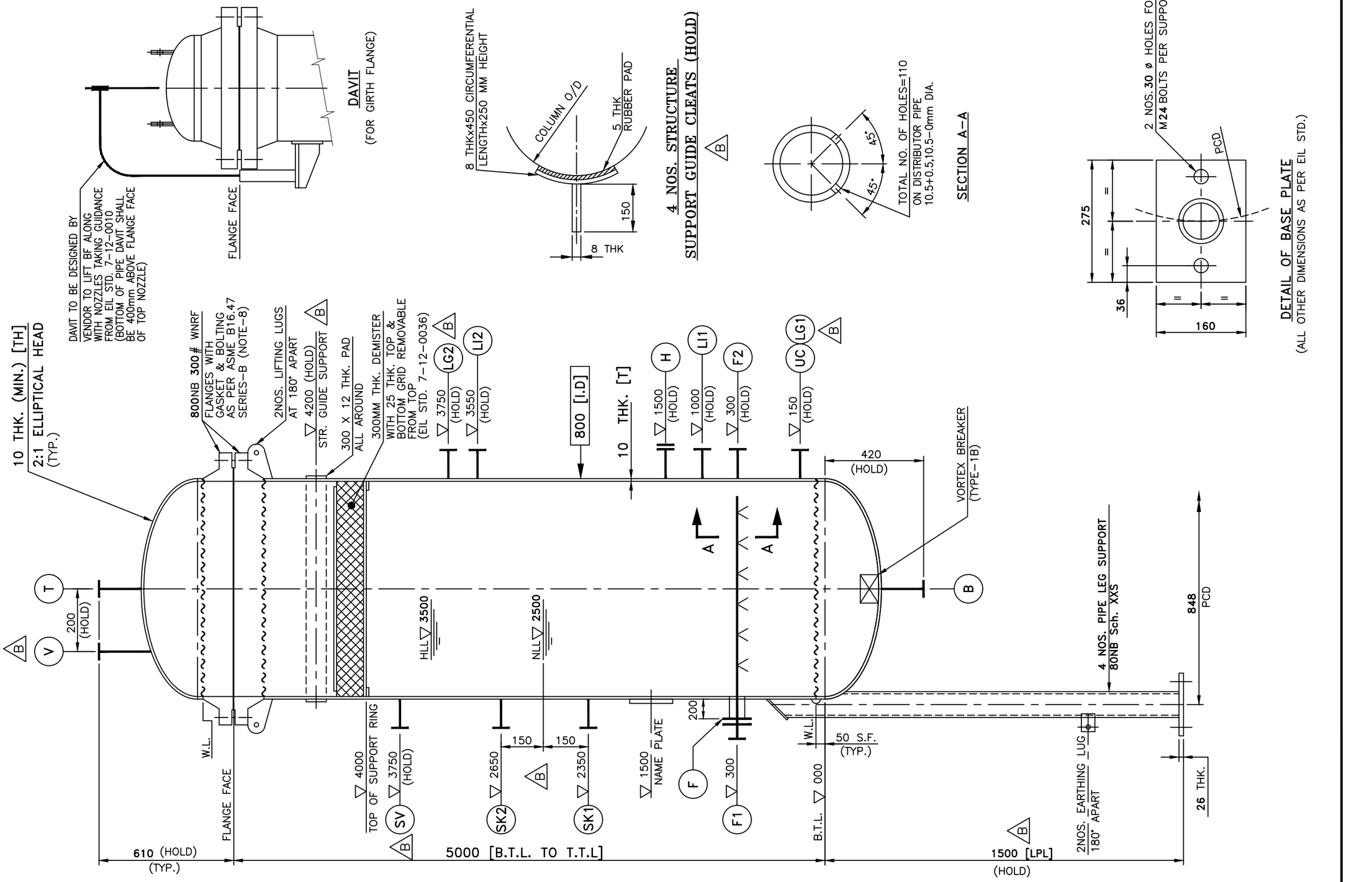
JOB NO: कार्य सख्या	B943	UNIT NO: युनिट सख्या	318
CLIENT : क्लाईंट	MRPL		
PLANT : प्लांट	DEMO BIO-ATF PLANT		

REV	DATE	REVISION	BY	CHECKED	APPROVED	
B	14.11.2024	REVISED AS MARKED	NS	PK	PKP	TK
A	17.10.2024	ISSUED FOR COMMENTS	NS	PK	PKP	TK

DESIGN DATA	डिजाइन डाटा	DRAWING NUMBER डाईग नम्बर	REV
BIO-ATF WASH WATER COLUMN	बायो-एटीफ वॉश वॉटर कॉलम	B943-318-80-42-DS-3004	B
ITEM NO. DA-31804	आइटम नम्बर डीए-31804	SHEET 1 OF 2	

FORMAT NO.3-8042-0501 REV.0 (28.02.2024) A3-420 X 297

FILE NAME : B943-318-80-42-DS-3004-B-2



DAVIT
(FOR GIRTH FLANGE)

4 NOS. STRUCTURE
SUPPORT GUIDE CLEATS (HOLD)
B

SECTION A-A

DETAIL OF BASE PLATE
(ALL OTHER DIMENSIONS AS PER EIL STD.)

ENGINEERS INDIA LIMITED
NEW DELHI

JOB NO. : B943 UNIT NO. : 318
CLIENT : MRPL
PLANT : DEMO BIO-ATF PLANT

REV.	DATE	REVISION	BY	CHK	APPROVED	APPROVED
B	14.11.2024	REVISED AS MARKED	NS	PK	PKP	
A	17.10.2024	ISSUED FOR COMMENTS	NS	PK	PKP	

VESSEL DESIGN DATA
BIO-ATF WASH WATER COLUMN
ITEM NO.DA-31804

वेसेल डिजाइन डाटा
बायो-एटीएफ वॉश वॉटर कॉलम
आइटम नम्बर डीए-31804

DRAWING NO. B943-318-80-42-DS-3004 | REV. B
SHEET 2 OF 2

1-1641-0503 REV.0 A3-420x297

VENDOR DATA REQUIREMENTS
FOR
ISSUED FOR BIDS

Rev. No.	Date	Purpose	Prepared by	Checked by	Approved by
A	14-NOV-2024	ISSUED FOR BID	PK	PKP	TK

VENDOR DATA REQUIREMENTS

The following drawings/documents marked "✔" shall be furnished by the bidder.

S. NO.	DESCRIPTION	WITH BID	POST ORDER			REMARKS
			FOR REVIEW	FOR RECORD	WITH DATA BOOK (FINAL)	
1.	GENERAL ARRANGEMENT DRAWING INDICATING DESIGN DATA FABRICATED EQUIPMENT WEIGHT, GENERAL NOTES, NOZZLE SCHEDULE, DETAIL OF SHELL, HEADS, SUPPORTING ARRANGEMENT, MAIN WELD SEAMS, NOZZLE ORIENTATION PLAN.		✔		✔	*Documents shall be submitted within 3 to 4 weeks. Plate cutting layout is not to be submitted. (NOTE-18)*
2.	DETAIL OF NOZZLES, ACCESSORIES ETC		✔		✔	*Documents shall be submitted within 3 to 4 weeks. (NOTE-18)*
3.	DETAIL OF INTERNALS SUCH AS TRAY SUPPORT RING, BOLTING BAR PACKING BED SUPPORT, DEMISTER, SUPPORT RINGS, SUPPROTING BEAMS, CLEATS, ETC.			✔	✔	*Documents shall be submitted highlighting areas of discrepancy or fouling, etc. within 10 to 12 weeks.*
4.	DETAILS OF DEMISTER PAD & INTERNALS LIKE DISTRIBUTOR INCLUDING THEIR SUPPORTS		✔		✔	*Documents shall be submitted within 8 to 10 weeks. (NOTE-18)*
5.	DETAIL OF EXTERNAL CLIPS FOR LADDER, PLATFORM, PIPE SUPPORTS, INSULATION CLEATS, FIRE PROOFING CLEATS, PIPE DAVIT ETC.			✔	✔	*Documents shall be submitted highlighting areas of discrepancy or fouling, etc. within 10 to 12 weeks.*
6.	CALCULATION & DETAIL FOR LIFTING LUG / TRUNION AND TAILING LUG ETC.			✔	✔	*Documents shall be submitted within 8 to 10 weeks. (NOTE-18)*
7.	SHELL DEVELOPMENT DRAWINGS INCORPORATING ALL ATTACHMENTS AND WELD SEAMS			✔	✔	*Documents shall be submitted highlighting areas of discrepancy or fouling, etc. within 6 to 8 weeks.*
8.	DETAIL OF INSULATION CLIPS, FIRE PROOFING CLIPS			✔	✔	*Documents shall be submitted highlighting areas of discrepancy or fouling, etc. within 10 to 12 weeks.*
9.	DETAILS OF TEMPLATE FOR FOUNDATION			✔	✔	*Documents shall be submitted within 3 to 5 weeks. (NOTE-18)*
10.	MATERIAL TEST CERTIFICATES @				✔	
11.	WELDING PROCEDURES AND QUALIFICATION TEST REPORTS @				✔	
12.	DESTRUCTIVE AND NON-DESTRUCTIVE TEST REPORTS @				✔	
13.	RADIOGRAPHIC EXAMINATION REPORTS WITH FILMS @				✔	*VENDOR TO STORE THESE FOR 5 YEARS*
14.	HEAT TREATMENT PROCEDURE AND TIME TEMPERATURE CHARTS @				✔	

S. NO.	DESCRIPTION	WITH BID	POST ORDER			REMARKS
			FOR REVIEW	FOR RECORD	WITH DATA BOOK (FINAL)	
15.	CODE CERTIFICATES (INCLUDING INSPECTION CERTIFICATE, HYDROSTATIC TEST CERTIFICATE, LOCAL CODE REQUIREMENTS, RUBBING OF CODE STAMP AND NAME PLATE ETC.) @				✔	
16.	ASSEMBLY AND INSTALLATION DETAILS			✔	✔	*Documents shall be submitted within 12 weeks.*
17.	DETAIL OF PIPE DAVIT			✔	✔	*Documents shall be submitted highlighting areas of discrepancy or fouling, etc. within 10 to 12 weeks.*
18.	ERECTION DRAWINGS (INCLUDING WEIGHTS, CENTRE OF GRAVITY AND SLINGING FACILITIES ETC.)			✔	✔	*Documents shall be submitted within 1 weeks after final inspection.*
19.	CERTIFIED 'AS BUILT' DRAWINGS INCORPORATING ACTUAL DIMENSIONS AND MATERIAL USED, DULY CERTIFIED BY THE INSPECTOR @			✔	✔	*Documents approved by Inspector shall be submitted within 2 weeks after dispatch of equipment.*
20.	DATA FOLDER AS PER SPECIFICATION @			✔	✔	*Documents approved by Inspector shall be submitted within 2 weeks after dispatch of equipment.*
21.	INSPECTION AND TESTING PLAN @				✔	
22.	PACKING AND FORWARDING INSTRUCTIONS @				✔	
23.	TRANSPORTATION SCHEME @			✔	✔	*Documents shall be submitted within 12 weeks.*
24.	LIST OF SPARES PARTS WITH DETAILS			✔	✔	*Documents shall be submitted within 5 to 6 weeks .*
25.	DETAIL OF MANHOLES, ACCESSORIES ETC			✔	✔	*Documents shall be submitted within 3 to 4 weeks .*

Notes :

1. All post order documents shall be submitted / approved through EIL eDMS portal.
2. Refer - 6-78-0001: Specification for quality management system from Bidders.
3. Refer - 6-78-0003: Specification for documentation requirement from Suppliers.
4. All drawings & documents shall be submitted in A4 or A3 paper sizes. Documents in higher paper size shall be submitted in exceptional circumstances or as indicated in the MR/Tender.
5. Post order- The schedule of drawing / data submission shall be mutually agreed between EIL & the bidder / contractor / supplier during finalization of Document Control Index (DCI).
6. Post order, drawing / document review shall commence only after approval of Document Control Index (DCI).
7. Document shall be provided with equipment no. while enlisting in vendor portal/DCI.
8. All drawings shall be thoroughly checked and duly signed by fabricator. Unchecked drawings and drawings without revisions clearly marked shall be returned without review. Successive review of the same fabricator's drawing shall apply only to PMC's latest data sheet/comments on the previous revision. Drawings and documents returned to fabricator for revision shall be resubmitted preferably with in 10 days of receipt.

9. All drawings shall be drawn in AUTOCAD R-14 or above. No hand drawn drawings shall be accepted. All residual calculations ahll be computerized.
10. Documents and letters shall be furnished in electronic format. The software used shall be as follows:
a)MS OFFICE 2000 or above
b)ABODE ACROBAT 5.0 & above
11. Vendor shall note that the vendor drawing for the following standard components (as applicable) shall not be reviewed by EIL. It shall be solely vendor's responsibility to ensure the correctness of these drawings as per EIL / LICENSOR Standards and Drawings. If any discrepancy/mistake is found at a later date the vendor shall rectify the same at his time and cost.
-Manhole davit/hinge arrangement & Ladder rungs
-Pipe Davit
-EIL Name plate, Manufacturer's Nameplate, Nameplate bracket
-Skirt (Pipe) opening details, Access Opening Details, Skirt vent
-Lifting lugs (Standard Type)
-Fireproofing nad Insulation Support
-Earthing lug
-Pipe support cleats and ladder and platform cleats (Fouling of external support cleats (if any), shall be highlighted to EIL along with shell development drawing and suggestion for resolution)
12. Bill of Material shall form part of the respective drawing
13. Also refer other department's VDR :-
14. Structures
15. DCI shall be prepared by the vendor based on the VDR and submitted within 15 days from the date of FOA.
16. Vendor shall submit record / information category documents to Engineer-in-charge with one copy through e-DMS portal to EIL-HO and vendor shall proceed further without waiting for comments from EIL / Owner.
17. "@" indicates submission of documents to Inspection Agency. All inspection related documents (QA/QC/ITP) shall be submitted to TPIA.
18. DURATION OF SUBMISSION MARKED AGAINST EACH DRAWING / DOCUMENT SHALL BE CONSIDERED FROM DATE OF FOA.
19. On completion of order, Supplier shall submit the final documents to the Owner/ Consultant, as per ¿Supplier Data Requirement¿ with 2 nos. hard copies (1 Original + 1Duplicate) and 3 nos. soft copies in external HDD in addition to submission through EIL Vendor Portal. The final documents supplied shall be duly endorsed by the TPIA as "VERIFIED AND CERTIFIED FOR COMPLETENESS OF DOCUMENTATION AS PER SUPPLIER DATA REQUIREMENT".

VENDOR DATA REQUIREMENTS
FOR
PROTECTIVE COATINGS-B943-318-CC-MR-6003

Rev. No.	Date	Purpose	Prepared by	Checked by	Approved by
0	19-SEP-2024	ISSUED FOR BIDS	JATIN	SAHIL	SS

VENDOR DATA REQUIREMENTS

The following drawings/documents marked "✔" shall be furnished by the bidder.

COATING SYSTEMS

S. NO.	DESCRIPTION	WITH BID	POST ORDER			REMARKS
			FOR REVIEW	FOR RECORD	WITH DATA BOOK (FINAL)	
1.	Schedule of Vendor Documents		✔		✔	
2.	Painting Scheme / Schedule/specifications (Including particulars of surface conditions, surface preparation and coating system etc. and inspection).		✔		✔	
3.	Paint manufacturer?s Credentials/PTR (Past Track record)			✔	✔	
4.	Paint Pre-qualification Certificates as per the specifications.		✔		✔	
5.	Paint datasheets and Material safety Datasheets (MSDS)		✔		✔	
6.	GA Drawing of the equipment for which the painting schedule is proposed		✔		✔	

Notes :

1. "TICK" denotes applicability.
2. Post order, drawing / document review shall commence only after approval of Document Control Index (DCI).
3. All post order documents shall be submitted / approved through EIL eDMS portal.
4. Final documentation shall be submitted in hard copy (Six prints) and soft (two CDs/DVDs) in addition to submission through EIL eDMS.
5. Refer - 6-78-0001: Specification for quality management system from Bidders.
6. Refer - 6-78-0002: Specification for documentation requirements from Contractors.
7. Refer - 6-78-0003: Specification for documentation requirement from Suppliers.
8. All drawings & documents shall be submitted in A4 or A3 paper sizes. Documents in higher paper size shall be submitted in exceptional circumstances or as indicated in the MR/Tender.
9. Post order- The schedule of drawing / data submission shall be mutually agreed between EIL & the bidder / contractor / supplier during finalization of Document Control Index (DCI).

SPC-000009

Rev No	Rev Date	Description	Prepared By	Checked By	Approved By
0	01/09/2015	Revised, Renumbered and Reissued	HP	AC	KH

1. OBJECTIVE

1.1 This procedure provides general guidelines to compile and submit the Final Documents to MRPL by any agency executing a specific job against a W.O. or a P.O. issued by MRPL or by any agency on behalf of MRPL

1.2 Final Document as per these guidelines shall be prepared ***in addition*** to the documents issued during project execution (construction documents), which is normally released in piece meal basis while the job is in progress.

1.3 This is a general guideline for all projects of MRPL, however any addition or deletion of the clauses based on the specific project requirement shall be approved by PMC or the Engineer-in-charge of MRPL. An approved deviation note shall be furnished for this purpose.

2. COMPONENTS OF THE FINAL DOCUMENTS

2.1 *BASIC DESIGN & EXTENDED BASIC DESIGN PACKAGES*

Basic and extended design packages shall be compiled and the revision control shall be maintained by the respective PMC or the similar agency of the project. At the completion of the project complete and updated sets of design packages with all latest revisions shall be handed over to MRPL.

2.2 *MASTER INDEX FOR DOCUMENTS & DRAWINGS*

2.2.1 These shall be treated as a key document for reviewing completeness of the documentation at any point of time. It shall show details of documents/ drawing applicable for any equipment / system / service. Master Drawing/Document Index shall have following columns :-

Unit	Job No	Doc Folder No.	Sr. No.	Drw./Doc. No.	Rev.	No of Sheet	Equip.	Drawing Title	Remarks

Rev	Date	Prepared by	Checked by	Approved by PMC/Consultant	Approved by MRPL

2.2.2 A detailed list of PO/Contract to be furnished to MRPL Engineering Documentation Centre to ensure that documentation of equipment / contract is/are submitted in totality.

2.2.3 A complete list of drawings and documents including document control index to be submitted ***in addition to clause 2.2.1.***

2.3 *SECTIONS OF THE FINAL VENDOR/ENGINEERING DOCUMENT FOLDER*

2.3.1 Section A : Contents

Shall have following columns:-

Sr. No.	Drawing No.	Rev.	No of Sheet	Equipment	Drawing Title	Digital file name (SOFTCOPY)

This content to be certified by the PMC/Consultant/Engineer-in-charge of MRPL for its completeness in all respects.

2.3.2 Section B : Technical Documents/Drawings

An approved Vendor Data Requirement Sheet (VDR) shall be obtained from PMC / Engineer-in-charge of MRPL under following headings and drawings and documents shall be submitted accordingly.

B1-Mechanical

B2-Electrical

B3-Instrumentation

B4-Civil / Structural

B5-Process Engineering

B6-Any Others

2.3.3 Section C : Inspection and Test Records including IBR/Statutory certificates

2.3.4 Section E : As built drawings

In this section asbuilt drawings for all site fabricated items, engineering drawings like process, piping, civil, electrical, instrumentation, plot plan, line schedules, pipe supports index/register, piping isometrics, fire fighting etc. shall be compiled in an orderly manner.

1. The file format shall be labeled as mentioned in section 3
2. All as built drawings shall be approved by authorised signatory of (with sign & seal)

2.3.5 Section G : Digital Copy

1. Two sets of digital copies shall be submitted in CD/DVD with proper lable. If size of the total files of a PO/Equipment is crossing more than 20GB same to be submitted in external hard disk.

2. All drawings shall be on the latest version of AutoCAD. If drawing is prepared in other format same need to be converted in to the latest AutoCAD version..

3. Caeser II / PVElite : Native files of engineering documents/drawings prepared using Caeser II / PVElite shall be submitted in soft copies.

4. Operating manuals and others documents shall be on MS Word / Excel or on searchable pdf. format. Soft copy should have separate files as per clause no. 2.3.1 contents of the document folder.

5. Hand written/filled test reports to be submitted in pdf format.

6. Radiography films preferably to be submitted in digital format.

2.4 FIELD INSPECTION DOCUMENTATION

2.4.1 A detailed index to the content shall be available at the beginning of each file

2.4.2 Each inspection reports shall be indexed with the report number and number of pages

2.4.3 All Documents/Reports shall be approved in its totality by stamping & signing the Master Indexes as per section 2.2.1.

2.4.4 Radiography films shall be indexed and included with the final documentation package.

2.4.5 All radiographic films shall be put in an aluminum box/container with lock and key.

2.4.6 As built drawings if any shall be compiled as per section 2.3.6

2.4.7 Digital Copy : as per clause no. 2.3.7

3. FILE FORMAT OF DOCUMENTATION FOLDER

3.1 **Filing** : As far as possible separate folder has to be prepared for each equipment / system / service, however if documentation for a particular equipment / system /service are required to be filed in more than one files due to the volume, identical folder no. suffixing numbers of files e.g. 1/5, 5/5 etc shall be mentioned. On the other hand if the volume of documentation is less

one folder may be used for more than one equipment of the same group, e.g. two or more pumps may be filed in one file, but not pumps, compressors, exchanger etc in one single file.

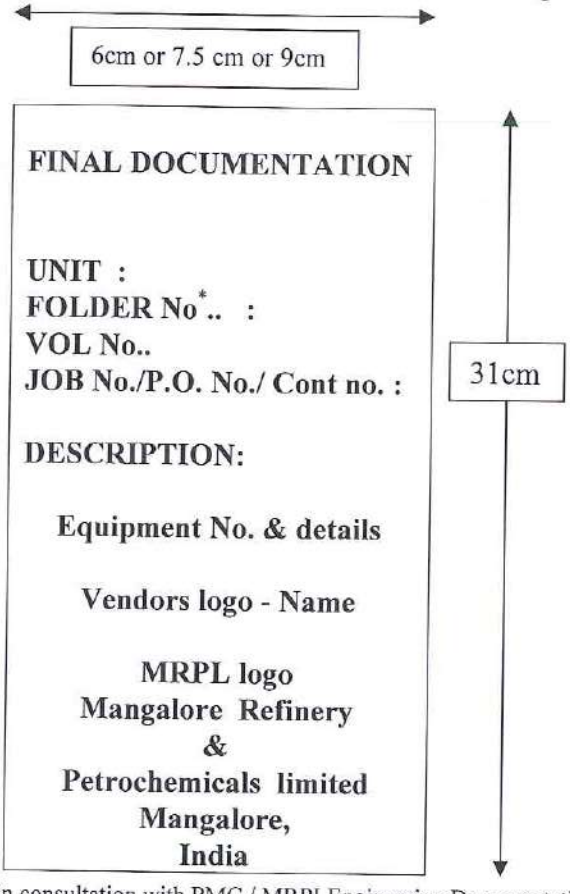
3.2 **Drawing Filing** : Each single drawing shall be put in separate transparent **A/4 size** drawing pouch and shall not be punched.

3.3 **File size** : All documents and drawings shall be compiled in A4 size file(s) (28cm x 31cm), with 2-clips. Width of the file can be, 6.0 cm or 7.5 cm or 9.0 cm. based on the volume of documents

3.4 **Document size** : The documents / drawings submitted in file shall be in its original size (A0/A1/A2/A3/A4), and to be folded in A4 size to accommodate in the A4 size drawing pouch as mentioned in 3.2.

3.5 **Digital Copies :** Each single CD/DVD shall have proper lables and to be filed in a separate distinct section of the document folder.

File label : Each file shall display following information on its spine.



* To be provided in consultation with PMC / MRPLEngineering Documentation Centre.

4. SUBMISSION OF DOCUMENTS

4.1 All final documents duly compiled by this procedure alongwith deviation note as mentioned in section 1.3 shall be handed over to MRPL Engineering Documentation Centre through PMC / consultant / Engineer-in-charge of the project.

4.2 Completion Certificate from PMC/Consultant/Engineer-in charge, as per following format shall be attached in all document folder

---

COMPLETION CERTIFICATE OF FINAL DOCUMENTATION

Name of Supplier/ Contractor :

Customer :

Project :

Project No. :

Purchase Order No./ Contract No. :

Purchase Requisition No./ Tender No. : Rev.No.:

Name of the work/Equipment :

MRPL Equipment Tag. No. :

Supplier's / Contractor's Works Order No. :

No of files :

Certified that the Engineering Documents / Manufacturing & Test Certificates submitted by the supplier are duly checked by us and found complete in all respect in accordance with the final documentation procedure No. SPC-000009 and approved VDR (clause 2.3.2).

Signature	:	Signature	: .....
Date	:	Date	: .....
Name	:	Name	: .....
Designation	:	Designation	: .....
Department	:	Department	: .....

Supplier /Contractor

PMC/Overall contracor

4.3 Piecemeal submission shall be avoided.

4.4 If any document /drawing is required to be submitted in later date after submission of final folder, shall clearly appear in the content (section 2.3.1) with a note "LATER" duly approved by PMC / Consultant / Engineer-in charge

4.5 Number of sets of Final Documents

Sr.No.	Document Group	# Copies	Digital File
1	Basic /Extended Design Packages	6	2
2	Vendor / Engineering Documentation / Drawings (As-Built Final)	3	2
3	Final Field Inspection Reports (Documents)	1	2
4	Final Field Inspection Reports (Drawings)	3	2
5	Radiography films	1	2

SPECIFICATION FOR SURFACE PREPARATION AND PROTECTIVE COATING

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
0	21.08.24	ISSUED AS JOB SPECIFICATION	JATIN	SAHIL	S. SRIDHAR

Abbreviations:

AS	:	Alloy Steel
ASTM	:	American Society for Testing and Materials
AWWA	:	American Water Works Association
CS	:	Carbon Steel
DFT	:	Dry Film Thickness
GI	:	Galvanized Iron
ID	:	Internal Diameter
ISO	:	International Organization for Standardization
LTCS	:	Low temperature Carbon Steel
MS	:	Mild Steel
MR	:	material requisition
NB	:	Nominal Bore
NA	:	Not applicable
OD	:	Outside Diameter
OEM	:	Original Equipment Manufacturer
OSHA	:	Occupational Safety and Health Act
RCC	:	Reinforced Cement Concrete
RH	:	Relative humidity
SS	:	Stainless Steel
SOR	:	Schedule of Rate
SSPC	:	Steel Structure Painting Council
WFT	:	Wet Film Thickness

Sl. No.	CONTENTS	PAGE NO.
1.0	General	4
2.0	Scope	4
3.0	Reference codes & standards	5
4.0	Surface Preparation	8
5.0	Coating Application	11
6.0	Paint materials	14
7.0	Selection of Coating systems	19
8.0	Guidelines for Storage and handling	30
9.0	Colour code	30
10.0	Identification of vessels, piping etc.	31
11.0	Painting for civil defense requirements	32
12.0	Quality control, inspection and testing	32
13.0	Paint material Guarantee certificate	35
14.0	Qualification criteria of painting CONTRACTOR/Sub CONTRACTOR	35
15.0	Pre-Qualification/acceptance criteria of paint coating system	38
16.0	Method of sampling & dispatch for laboratory testing	38
	Annexure I-Color code	39

1.0 GENERAL

1.1 This technical specification shall be applicable for the work covered by the contract and without prejudice to the provisions of various international codes of practice, standard specifications etc. It is understood that the CONTRACTOR shall carry out the work in all respects with the best quality of materials and workmanship and in accordance with the best engineering practice and instructions of Engineer-In-Charge in consultation with SMMS.

1.2 This specification covers the requirement for protective coating for new construction.

2.0 SCOPE

2.1 Scope of work covered in the specification shall include, without being limited to, the following:

This specification defines the requirements for surface preparation, selection and application of primers and coatings on external surfaces of items mentioned in clause 2.2 of this specification and quality control, inspection & testing of the coating systems. The items listed in clause 2.2 and the heading of tables of paint systems are non-exhaustive. However, the CONTRACTOR is fully responsible for carrying out all the necessary painting, coating and lining job on external and internal surfaces as per the contract requirement.

2.2 Extent of work covered in this specification:

2.2.1 The following surfaces and materials shall require shop, pre-erection and field painting, as applicable:

a. All Carbon Steel structures.

b. All Carbon Steel and Alloy steel piping, equipment, valves, fittings & stacks.

c. All Carbon Steel and Alloy steel tanks.

d. Tanks internal as per applicable datasheets & contract requirements.

e. All insulated CS pipes, equipment, valves, fittings & stacks.

f. All insulated SS pipes, equipment, valves, fittings, vessels & stacks.

g. All structural steel supports, walkways, handrails, ladders, platforms etc.

h. Flare lines, external surfaces of steel chimney with or without refractory lining and internal surfaces of steel chimney without refractory lining.

2.2.2 Marking and Identification of painted items:

a. Identification of color bands on all piping, as required, including aluminum cladding over insulation, galvanized, SS and nonferrous piping.

b. Identification lettering/ numbering on all painted surfaces of equipment/piping, aluminum cladding over insulation, galvanized, SS and non-ferrous piping.

c. Marking / identification signs on painted surfaces of equipment and piping including hazardous service.

2.2.3 Supply and prequalification testing of all primers, paints and all other materials required for painting (other than OWNER supplied materials)

2.2.4 Application of pre-erection/fabrication and shop primer.

2.2.5 Repair work of damaged pre-erection/ fabrication and shop primer and weld joints in the field/site before and after erection.

2.2.6 Quality control, testing and inspection during all stages of work (surface preparation, application of coating and testing of applied coating).

2.2.7 Exclusions:

All metallic surfaces do require painting except for following materials. These materials are not painted unless specified by the contractual provisions and the same shall be painted as per the relevant specifications:

a. Un-insulated stainless steel.
b. Plastic and/or plastic-coated materials.
c. Galvanized Iron.
d. Aluminum.
e. Ni-Alloys.
f. Glass.
g. Ceramics.
h. Machined surfaces.
i. Label and names plates.

Note: Galvanized steel doesn't require painting for corrosion protection. However, if painting is mandated due to OWNERs instructions/contractual provision/ for colour coding requirement mentioned in this specification or by OWNER, then the coating system in Table 4.0 shall be followed.

3.0 REFERENCE CODES & STANDARDS

3.1 Latest editions of the following codes and standards are applicable for the work covered by this standard:

American Society for Testing and Materials (ASTM):

ASTM Volume 6.01	Paint - Tests for Chemical, Physical, and Optical Properties; Appearance
ASTM Volume 6.03	Paint -- Pigments, Polymers, Resins, Naval Stores, Cellulosic Esters, and Ink Vehicles
ASTM D6677	Standard Test Method for Evaluating Adhesion by Knife

ASTM D5894	Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D870	Standard Practice for Testing Water Resistance of Coatings Using Water Immersion
ASTM D2485	Standard Test Methods for Evaluating Coatings for High Temperature Service
ASTM D2247	Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
ASTM D4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D4060	Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D4752	Standard Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D4940	Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blast Cleaning Abrasives
ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM D543	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM C868	Standard Test Method for Chemical Resistance of Protective Linings
ASTM G42	Standard Test Method for Cathodic Disbonding of Pipeline Coatings Subjected to Elevated Temperatures
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D1475	Standard Test Method for Density of Liquid Coatings, Inks, and Related Products
ASTM D823	Standard Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panel
ASTM D2369	Standard Test Method for Volatile Content of Coatings
ASTM D1640/D1640M-14	Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
ASTM D522/D522M	Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
ASTM D968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1044	Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion
ASTM D1849	Standard Test Method for Package Stability of Paint
ASTM D2247	Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
ASTM D5146	Standard Guide to Testing Solvent-Borne Architectural Coatings

Steel Structures Painting Council (SSPC)

SSPC SP-1	Solvent cleaning
SSPC Painting manual Vol.1	Good Painting practices
SSPC Painting manual Vol.2	Systems & specification
SSPC VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC AB1	Mineral and Slag Abrasives
SSPC PA 2	Measurement of Dry Paint Thickness with Magnetic Gauges
SSPC SP-1	Solvent cleaning
SSPC Painting manual Vol.1	Good Painting practices
SSPC Painting manual Vol.2	Systems & specification
SSPC VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC AB1	Mineral and Slag Abrasives
SSPC PA 2	Measurement of Dry Paint Thickness with Magnetic Gauges

National Association for Corrosion Engineer (NACE):

NACE RP 0287	Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape
NACE SP 0198	Control of Corrosion under Thermal Insulation and Fireproofing Materials
NACE SP 0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

International Organization for Standardization (ISO):

ISO 12944	Corrosion Protection of steel Structures by Protective Paint System
ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles-Specifications and test methods.
ISO 8501-1/ SIS-05 59 00	Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness— Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8502-3	Preparation of steel substrates before application of paints and related products -Tests for the assessment of surface cleanliness - Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
ISO 8502-9	Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness—Part 9: Field method for the conductometric determination of water-soluble salts
ISO 2808	Paints and varnishes - Determination of film thickness
ISO 2811	Paints and varnishes — Determination of density

Other Standards

NORSOK M-501	Surface preparation and protective coating
RAL CLASSIC	Color matching system

4.0 SURFACE PREPARATION

4.1 General

Adhesion of the paint film to the surface depends largely on the degree of cleanliness of the metal surface and proper surface preparation have large contribution to the success of the paint protective system. Following method shall be employed for surface preparation:

a. Abrasive blast cleaning: Applicable in all cases.

b. Mechanical or power tool cleaning: Shall be used for repair & touch up, and any other area due to practical constraints with prior permission from EIL Engineer-in charge.

4.2 Applicable Standards:

Latest editions of the following codes and standards are applicable for the surface preparation work:

TABLE-1: SURFACE PREPARATION STANDARDS

Sl. No.	GRADE OF SURFACE CLEANLINESS	VARIOUS INTERNATIONAL STANDARDS (EQUIVALENT)		
		ISO 8501-1/ SIS-05 59 00	SSPC, USA	NACE, USA
1.	Solvent cleaning	-	SSPC-SP-1	-
2.	Manual or hand tool cleaning	St 2	SSPC-SP-2	-
3.	Mechanical or power tool cleaning	St 3	SSPC-SP-3	-
4.	White metal	Sa 3	SSPC-SP-5	NACE No.1
5.	Near white metal	Sa 2½	SSPC-SP-10	NACE No.2
6.	Commercial Blast	Sa 2	SSPC-SP-6	NACE No.3
7.	Brush-off Blast for SS, galvanized steel and non-ferrous metals	-	SSPC-SP-16	-
8.	Surface Preparation of Concrete	-	SSPC-SP-13	NACE No.6

4.3 Sequence of surface preparation:

4.3.1 Solvent Cleaning

Mill scale, rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained. Unless otherwise specified, surface preparation shall be done as per provisions of relevant tables given elsewhere in this specification. Before surface preparation by blast cleaning, the surface shall be cleaned to remove all grease, oil etc. as per SSPC-SP-1.

4.3.2 Blast cleaning with abrasives

The surfaces shall be blast cleaned using one of the abrasives listed below and at an appropriate distance & angle depending on nozzle size maintaining constant velocity and pressure.

a. The quality of abrasives shall be free from contaminants and impurities and shall meet the requirements of SSPC AB1.

b. The compressed air shall be free from moisture and oil.

c. On completion of blasting operation, the blasted surface shall be clean and free from any scale or rust. Blast cleaning shall not be done outdoors in bad weather without adequate protection. If there is dew on the metal surface, it shall be cleaned. If possible, a vacuum collector shall be installed to collect and recycle the abrasives.

d. Surface roughness profile: The surface roughness profile for carbon steel and low alloy steels to be coated shall be in accordance with the written recommendations of the paint Manufacturer and shall be measured as per ASTM D4417, method B. When roughness profile is not specified by the paint Manufacturer, then surface roughness profile as specified below in this specification shall be followed.

- The surface roughness profile shall be between 40 µm and 70 µm for coatings up to thickness 500 µm and between 70 µm and 125 µm for coating systems over 500 µm thickness. In all cases, the surface roughness shall have a sharp angular profile.

- If stainless steel, hot dip galvanised or non-ferrous metal surfaces are to be painted then blast cleaning shall be carried out as per SSPC-SP-16, using a fine non-iron containing abrasive.

- On galvanised surfaces, the zinc layer shall not be damaged; a smooth uniform surface roughness shall be achieved. No defects such as break through or crisping of the zinc layer shall occur. The surface roughness shall be in the range of 20 µm to 30 µm or as agreed with the paint Manufacturer.

e. Abrasives: Abrasive for use in blast cleaning steels shall be in accordance with ISO 8504-2. Steel or iron grit is commonly used as recyclable abrasives. When steel shot is used, it shall be used together with steel grit. The shot content of such a mix shall not exceed 67 %.For blasting stainless steel, non-(free) iron containing abrasive shall be used, e.g. Garnet or aluminium oxide. Abrasives used for blast cleaning shall be free from oil, grease, moisture, chloride contamination etc. and shall have crystalline silica not more than 1%.

Test methods for abrasives shall be in accordance with the tests specified in the ISO 11125 and ISO 11127 series for metallic and non-metallic abrasives respectively. Each batch of abrasive should be tested to check that the abrasive meets the requirements as specified in the relevant ISO standard. The conductivity of non-metallic abrasives to be used for stainless steels shall be maximum 15 mS/m. For all other non-metallic abrasives, the conductivity shall not exceed 25 mS/m. OWNER/PMC shall approve the use of alternative abrasive materials. Abrasive used shall be as per following specification:

Type	Generic Name	Standard
Metallic	Iron grit	ISO 11124-2
	Steel grit	ISO 11124-3
Natural mineral	Staurolite	ISO 11126-9
	Garnet	ISO 11126-10
Synthetic mineral	Copper slag	ISO 11126-3
	Aluminium oxide	ISO 11126-7

4.3.3 Mechanical or power tool cleaning

Power tool cleaning shall be done by mechanical striking tools, chipping hammers, grinding wheels or rotating steel wire- brushes. Excessive burnish of the surface shall be avoided as it can reduce paint adhesion. On completion of cleaning, the detached rust, mill scale etc. shall be removed by clean rags and /or washed by water/steam and thoroughly dried with compressed air jet before application of paint.

4.4 General Notes for surface preparation/blasting:

a. Surface shall not be coated in rain, wind or in an environment where injurious airborne elements exist.

b. Surface shall not be coated when the steel surface temperature is less than 3 ^{0}C above dew point.

c. Surface shall not be coated, when the relative humidity is greater than 85%.

d. Surface shall not be coated when the temperature is below 10^{o}C and the ambient/substrate temperature is below the paint manufacturers recommended temperature of application and curing.

e. The paint application shall not be done when the wind speed exceeds 20 km per hour.

f. The illuminance during coating and inspection shall be at least 500 Lux.

4.5 Use of Dehumidifier

In case of internal coating of storage tanks, dehumidifier shall be used to control humidity level below 60%. Dehumidifier should depress the dew point of air in the enclosed space, sufficient enough so as to maintain it more than 3^{o}C below the metal substrate temperature during entire period of blasting and coating application. During the interval time between application of primer coat and subsequent intermediate and top coats or between blast cleaning completion and start of application of primer coat, dehumidifier unit should be in continuous operation to ensure that no condensation occurs on the substrate.
The Engineer in-Charge shall have the right to disallow usage of dehumidifier if the performance is not meeting the specified requirements. Under such circumstances, the CONTRACTOR shall remove the equipment and replace the same with another equipment to provide satisfactory results without any additional cost to the OWNER.

4.6 Surface preparation of concrete:

The external surface of RCC to be painted shall be dry and clean. Any loose particle of sand, cement, aggregate etc. shall be removed and surface shall be prepared as per SSPC-SP-13.

5.0 COATING APPLICATION

5.1 Blast cleaned surface shall be coated with complete application of primer as soon as practicable but in no case later than 4 hours the same day. However, at times of unfavorable weather conditions, the Engineer-In-Charge shall have the liberty to control the time period, at his sole discretion and/or to insist on re-cleaning before primer application is taken up. In general, during unfavorable weather conditions, blasting and painting shall be avoided as far as practicable.

5.2 To the maximum extent practicable, each coat of paint shall be applied as a continuous film with uniform thickness and free of probes. Any spots or areas missed in application shall be re-coated and permitted to dry before the next coat is applied.

5.3 Each coat shall be in proper state of cure or dryness before the application of succeeding coat. Material shall be considered dry for re-coating when an additional coat can be applied without the development of any detrimental film irregularities such as lifting or loss of adhesion of the under coat. Manufacturer's instructions shall be followed for inter-coat interval.

5.4 When the successive coat of the same colour have been specified, alternate coat shall be tinted, when practical, sufficiently to produce enough contrast to indicate the complete coverage of the surface. The tinting material shall be compatible with the material underneath and shall not be detrimental to its service life and shall be recommended by the original paint manufacturer.

5.5 Airless spray application shall be in accordance with steel structure paint manual Vol.1 & Vol.2 by SSPC, USA

5.6 Brush application of paint shall be in accordance with the following:

a. Brushes shall be of a style and quality that will enable proper application of paint.

b. round or oval brushes are most suitable for rivets, bolts, irregular surfaces, and rough/ pitted steel. Wide flat brushes are suitable for large flat areas but they shall not have width over 5 inches.

c. Paint shall be applied into all corners.

d. Any runs or sags shall be brushed out.

e. There shall be a minimum of brush marks left in the applied paint.

f. Surfaces not accessible to brushes shall be painted by spray, daubers, or sheepskin.

5.7 Applied paint should have the desired wet film thickness specified by manufacturer. For each coat, the painter should know the WFT corresponding to the specified DFT and standardize the paint application technique to achieve the desired WFT. This has to be ensured in the qualification trial.

5.8 Irregular surfaces such as sharp edges, welds, small brackets, and interstices may stripe coated to ensure specified DFT is achieved. Paint manufacturer recommendation should be followed before deciding for brush application.

5.9 Unless otherwise instructed, final coating (i.e. application of field primer, intermediate and top coats) on pre-erection/ shop primed equipment shall be applied at site, only after all welding & testing like NDT are completed as well as after completion of steam blowing.

5.10 Drying of coated surfaces

a. No coat shall be applied until the preceding coat has dried. The material shall be considered dry for re-coating when another coat can be applied without the development of any film irregularities such as lifting or loss of adhesion of undercoats. Drying time of the applied coat should not exceed maximum specified for it as a first coat. If this exceeds, the paint material has possibly deteriorated or mixing is faulty.

b. No paint shall be force dried under conditions which will cause chalking, wrinkling, blistering formation of pores, or detrimentally affect the conditions of the paint.

c. No drier shall be added to paint on the job unless specifically called for in the manufacturers' specification for the paint.

d. Paint shall be protected from rain, condensation, contamination, snow and freezing until dried to the fullest extent practicable.

5.11 Spot repair of damaged primer

a. Where pre-erection/shop primer has been damaged at isolated localized spots during handling and transportation or after erection / welding, its repair shall be done as given below and as per the Table-3 of this specification.

b. Surface preparation: Quickly remove the primer from damaged area by mechanical scraping and emery paper conforming to SSPC-SP-3 to expose the white metal. Blast clean the surface, if possible. Feather the primed surface, over the intact adjacent surface surrounding the damaged area, by emery paper.

Primer coating: One coat of F-8/F-9/F-16 shall be applied (as per the applicable design temperature and in conjunction with Table-3) wherever damage was observed on pre-erection / pre fabrication or shop primer.

c. If damaged areas are found to be extensive and spread over large areas (as required by Engineer-in charge), then entire pre-erection/pre-fabrication/shop primer shall be removed by blasting to achieve SSPC-SP-10 and entire blasted surface shall be primed again with F-8/ F-9 or F-16, as applicable, for the intended design temperature. (See note of Table-3). If the prepared surface lies adjacent to a sound coated surface, the surface preparation shall overlap the coated surface by at least 50mm. The remainder of existing coated surface shall be properly protected with shields or screens to prevent any possible damage to the coating.

5.12 Equipment:

a. All tools, brushes, rollers, spray guns, blast material, hand power tools for cleaning, all equipment, scaffolding materials, shot & grit blasting equipment , air compressors etc. required

shall be suitable for the work and shall be arranged by the CONTRACTOR in sufficient quantity at the site. The manufacturers test certificates **/** data sheets for all the above mentioned items shall be reviewed by Engineer-In-Charge at site before start of the work.

b. All paint spraying equipment, including mixers, shall be thoroughly cleaned before mixing of new materials. All coating materials shall be mixed and thoroughly stirred in accordance with the instructions of the paint Manufacturer. Sufficient agitation to maintain good mixing shall be applied until the product is used. If air is entrapped in the product during mixing/stirring, sufficient time should be allowed for the air bubbles to escape before application. Only thinners specified by the paint Manufacturer shall be used.

5.13 Shop coating

a. Shop coated equipment (coated with primer & finishing coat) should not be repainted unless paint is damaged. Repair of primer shall be carried out as per Table-3 of paint systems depending upon the compatibility of paint. Intermediate and final coats over repaired primer shall be as per applicable tables mentioned in this specification**.**

c. Shop primed equipment and surfaces will only be 'spot cleaned' in damaged areas by means of power tool brush cleaning or hand tool cleaning and then spot primed before applying one coat of field primer, unless otherwise specified. If shop primer is not compatible with field primer, then shop coated primer should be completely removed before application of selected paint system for a particular environment.

d. For package units/Items/ OEM equipment, shop primer & coating system should be as per the paint system given in this specification. However, manufacturers' standard may be followed after review by EIL but shall adhere to the minimum DFT specified in ISO-12944-5; C5 (Very high durability). For system under insulation, minimum guidelines as per NACE RP 0198 shall be followed.

In this case, guarantee of the coating system lies with package supplier/OEM. EIL's decision in this regard is final and binding on Supplier/Contractor/manufacturer

5.12 Guidelines for Documentation / records

a. A written quality plan with procedure for qualification trials and for the actual work including test and inspection plan & procedure for approval before start of work.

b. Daily progress report with details of weather conditions, particular of applications, no. of coats and type of materials applied, anomalies, progress of work versus program.

c. Results of measurement of temperatures, relative humidity, surface profile, film thickness, holiday detection, adhesion tests with signature of appropriate authority.

d. Particulars of surface preparation and paint application during trials and during the work.

e. Details of non-compliance, rejects and repairs.

f. Type of testing equipment and calibration.

g. Code and batch numbers of paint materials used.

Note: The coating applicator must maintain a job record consisting of all the information as per 5.12.b. to 5.12.g above as well as the approved procedure of work (5.12.a. above). The job record consisting of information in accordance to 5.12.b. to 5.12.g shall be entered on daily basis and should be daily signed by Engineer-in-charge.

6.0 PAINT MATERIALS

Typical characteristics and codes of various paint materials used in this specification are as follows.

TABLE-2: PAINT MATERIALS
(Refer to *general notes* at the end of this table)

DESCRIPTION	P-6	P-7	P-4
Technical name	Epoxy Zinc Phosphate Primer	Cold Galvanizing product	Etch Primer/Wash Primer
Type and composition	Two component polyamine cured epoxy resin medium, pigmented with zinc phosphate.	One pack synthetic resin based zinc galvanizing containing min 92% of electrolytic zinc dust of 99.95% purity.	Two pack polyvinyl butyral resin medium cured with phosphoric acid solution pigmented with zinc tetroxy chromate.
Volume solids % Minimum	49	37	9
DFT per coat, µ	40-50	40-50	8-10
Theoretical covering capacity in m^2/coat/ litre	9.8-12.2	3.4-4.4 m^2/kg	9.0-11.2
Weight per liter in Kg/litre (min.)	1.4±0.05	2.67 kg at 15°C	1.2±0.05
Touch dry at 30°C (max.)	30 min.	10 min.	2 hrs.
Hard dry at 30°C (max.),Hrs.	8	24	24
Over-coating interval, hrs.	Min. 8	Min. 4	Min. 4-6
Pot life at 30°C for two Component paints, hrs.	6 - 8	NA	NA
Adhesion (ASTM D 4541)	>7	NA	NA
Temperature resistance (min) ° C (ASTM D 2485) *Note 8	80 (Method A)	50 (Method A)	NA

TABLE- 2: PAINT MATERIALS (Contd.)

DESCRIPTION	F-2	F-3	F-6A/B	F-6C
Technical name	Acrylic Polyurethane finish paint	Chlorinated rubber based finish paint	Epoxy-High Build coating	Solvent less epoxy coating
Type and composition	Two-pack aliphatic isocynate cured acrylic finish paint (free of alkyd/polyester resins).	Single pack Plasticized chlorinated rubber based medium with chemical and weather resistant pigments.	F-6A Two-Pack Aromatic polyamine cured epoxy resin medium suitably pigmented. F-6B: polyamide cured epoxy resin medium suitably pigmented with MIO.	Two pack, cured with Amine Adduct; catalyzed epoxy resin suitably pigmented
Volume Solids % (min.)	40	36	57	98
DFT per coat, µ	30-40	30-40	100-125	300-450
Theoretical covering capacity in m^2/coat/litre	10-13.3	9-12	4.6-5.7	2-3.9
Weight per liter in Kg/litre (min.)	1.15	1.15	1.42	1.40
Touch dry at 30 °C (max)	30 min.	30 min.	3 hrs.	3 hrs.
Hard dry at 30 °C (max.).	8 hrs.	8 hrs.	16 hrs.	16 hrs.
Full cure at 30 °C (for immersion/ high temperature service)	NA	NA	5 days	5 days
Over-coating Interval, hrs	Min.12.	Min. Overnight	Min. Overnight Max. 5 days	Min. 8. Max. 48
Pot life (approx.) at 30 °C for two component paints, hrs	5-8	NA	3-6	0.5
Adhesion (ASTM D 4541)	>5	>4	>7	>8
Abrasion Resistance (ASTM D4060)	<300 mg /1000 cycles/CS17 or	NA	NA	NA

For 1000 g load	<100 mg /1000 cycles/CS10			
Temperature resistance (min.) ° C (ASTM D 2485) *Note 8	80 (Method A)	60 (Method A)	80 (Method A)	120 (Method A)

TABLE- 2: PAINT MATERIALS (Contd.)

DESCRIPTION	F-7	F-8	F-9	F-11	F-12
Technical name	High build coal tar epoxy coating.	Self-priming type surface tolerant high build epoxy coating (complete rust control Coating)	Inorganic zinc silicate Coating containing zinc content min. 80%. Shall pass MEK rub test as per ASTM D4752 with resistance rating >4	Heat resistant synthetic medium based two pack Aluminum Paint suitable up to 250°C dry temp.	Heat resistant silicone Aluminum Paint suitable up to 540°C dry temp.
Volume Solids % Minimum.	62	75	57	35	18
DFT per coat in µ	100-125	100-125	65-75	15-20	15-20
Theoretical covering capacity in M^2/coat/ litre	5-6.2	6-7.5	7.6-8.8	17.5-23.3	9-12
Weight per liter in Kg/litre (min.)	1.40	1.41	2.3	0.95	1.00
Touch dry at 30°C (maximum)	4 hrs.	3 hrs.	0.5 hrs.	3 hrs.	0.5 hrs.
Hard dry at 30°C (maximum),	48 hrs.	24 hrs.	12 hrs.	12 hrs	24 hrs.
Full cure 30°C (for immersion /high Temperature sev.)	5 days	5 days	NA	NA	NA
Over-coating interval, hrs	Min. 24 hrs Max.5days	Min. 10	Min. 12 hrs at 20°C & 50% RH	Min. 24	Min. 24

Pot life at 30°C for two component Paints, hrs	4-6	1.5	4-6	NA	NA
Adhesion MPa (ASTM D 4541)	>5	>5	>5	NA	NA
Temperature resistance (min.) ° C (ASTM D 2485) *Note 8	80 (Method A)	80 (Method A)	400 (Method B)	250 (Method A)	540 (Method B)

TABLE- 2: PAINT MATERIALS (Contd.)

DESCRIPTION	F-14	F-15	F-16	F-17	F-20
Technical name	Polyamine cured coal tar epoxy	Two-component Epoxy phenolic coating cured with Polyamine adduct hardener	Inert polymeric matrix coating suitable for under insulation for CS and SS.	Novolac epoxy phenolic coating cured with Polyamine adduct hardener	Glass flake reinforced vinyl ester coating.
Type & composition	Specially formulated polyamine cured coal tar epoxy suitable for application under insulation	Two pack ambient temperature curing epoxy phenolic coating system suitable for application under insulation	Suitable for high temperature service and under insulation coating for CS, alloy steel and SS	Novolac epoxy phenolic coating cured with Polyamine adduct hardener	Two component glass flake filled vinyl ester lining for under immersion services up to 90 deg. C.
Volume Solids % Minimum.	67	67	50	98	98
DFT per coat in microns	100-125	75-100	100-125	300-450	500-600
Theoretical covering capacity in M^2/coat/ litre	5.4-6.7	6.7-8.9	4-5	2.2-3.3	1.6-2
Weight per liter in Kg/litre (min.)	1.45	1.65	>1.3	1.7	>1.2
Touch dry at 30°C (max)	4 hrs.	3 hrs.	1 hrs.	2 hrs.	2 hrs.

Hard dry at 30°C (max).	24 hrs.	24 hrs.	16 hrs.	24 hrs.	4 hrs.
Full cure 30°C (for immersion / high temp service)	168 hrs (7 days)	168 hrs (7 days)	NA	168 hrs (7 days)	96 hrs (4 days)
Over-coating interval	Min. 6 hrs Max.5 days	Min. 36 hrs Max.21 days	Min.6 hrs Max. Not applicable	Min. 16 hrs Max.21 days	Min. 4 hrs Max.3 days
Pot life at 30ºC, hrs (for two component paints)	4	4-6	1	1	50 min-1 hr.
Adhesion, MPa (ASTM D 4541)	>6	>7	NA	>8	>7, Tensile strength >20N/mm2 (ASTM D 638)
Temperature resistance (min.) º C (ASTM D 2485) *Note 8 & 9	125 (Method A)	150 (Method A)	650 (Method B)	200 (Method A)	125 (Method A)

General notes for TABLE-2:

1. Covering capacity and DFT achieved per coat depends on method of application. Covering capacity specified above is theoretical. For estimation of actual quantity of paints required, include the losses during application. Minimum specified DFT should be maintained in any case.
2. All primers and finish coats should be ambient temperature curing and air drying unless otherwise specified.
3. All paints shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. Wherever a deviation is noticed from the specification in manufacturer data sheet, more stringent one between the data sheet and the specification shall prevail e.g. if this specification recommends Sa 2 ½ and the manufacturer data sheet requires Sa3, the surface preparation shall be done as per Sa 3. However in another case if this specification requires the surface preparation of Sa 2 ½ and the manufacturer data sheet recommends only Sa 2 as minimum, the surface preparation shall be done as per Sa 2 ½.
4. Technical data sheets for all paints shall be supplied at the time of submission of quotations.
5. Internationally recognized & acceptable testing method shall be used for lab testing wherever testing standards are not mentioned.
6. Touch dry, hard dry, pot life, full cure period, & over coating interval shall be as per manufacturer's data sheets and no testing is required. Slight variation in the values of these parameters along with weight per liter may be permissible with the discretion of engineer-in-charge in consultation with SMMS.
7. Temperature resistance tests (ASTM D2485) shall be carried out for minimum required temperature resistance indicated.

8. Wherever ASTM D 2485 method B is applicable, test results of the panels subjected to salt spray (ASTM B 117) after muffle furnace exposure shall be submitted for pre-qualification purpose.
9. F6-C shall be suitable for drinking water service and should have certification from competent authority.

7.0 SELECTION OF COATING SYSTEMS

The external coating system for EIL projects should be selected based on the C5 environment (very high durability) as per ISO12944-2, design temperature, involved services of the steel substrate and plant location.

The paint system to be applied for a specific job shall be arrived at sequentially as given below:

a. Identify the environment from area classification details and choose the appropriate table.
b. Identify the design temperature from the technical documents.
c. Identify the specific field paint system and surface preparation requirement from the above identified table and temperature range.
d. Identify the shop priming requirement from based on compatibility of the above paint system.
e. Identify the need of repair of shop primer and execute as per Table-3.

7.1 Classification based on plant location:

a) Plant located in inland area (more than 50 km from coast).

- For offsite areas and utilities: Table-5 to be followed.
- For process units, DM plant, CPP and Cooling towers: Table-6 to be followed.

b) Plant located on sea coast or within 50 km from sea coast.

- For process units, DM plant, CPP, Cooling tower, offsite & utilities etc.: Table-6 to be followed.

c) For external surface of above ground tanks, Table-8 to be followed for all locations (inland or coastal)

TABLE-3: REPAIR OF PRE-ERECTION/PRE-FABRICATION OR SHOP PRIMER AFTER ERECTION/WELDING

(For all un-insulated CS, LTCS & alloy steel items in all environments)

Sl. No.	Design Temp. in °C	Surface Preparation	Coating System	Total DFT in Microns (min.)	Remarks
3.1	-45 to 80	SSPC-SP-3	1 coat of F-8 @ 125 µ DFT/coat	125	See Note-1 below and clause 5.11
3.2	81 to 400	SSPC-SP-3	1 coat of F-9 @ 65-75 µ DFT/coat	65-75	
3.3	401 to 550	SSPC-SP-3	1 coat of F-16 @ 125 µ DFT/coat	125	

Note for Table-3:

1. The application and repair of pre-erection/pre-fabrication and shop primer given in above tables shall be done for all the items to be painted. In case the damages of primer are severe and spread over large area, entire primer shall be removed by blasting to achieve SSPC-SP-10 and surfaces to be primed again with F-8/ F-9/F-16, as applicable. After the repairs of the primer, suitable intermediate and final coats shall be applied as per applicable coating systems mentioned in Table 5.0 to Table 13.0.

TABLE-4: COATING SYSTEM FOR GALVANIZED ITEMS (Refer clause 2.2.7)

Sl. No.	Design Temp. in °C	Coating System	Total DFT in Microns (min.)	Remarks
4.1	Up to 60	Hot Dip Galvanizing with thickness as per ISO 1461, Surface preparation over galvanization as per SSPC SP 16 & ISO 12944-4; 1 coat of F-6B @ 100µ DFT/coat + 1 coat of F-2 @ 40 microns DFT/coat	140µ of finish coat (excluding the thickness of galvanizing)	Special primers like etch primer may also be considered for coating on galvanized surfaces

Notes for Table-4:

1. F-6B shall be modified type and suitable for coating over galvanization.
2. Repair of the damaged areas of galvanized coatings due to welding during erection shall be carried out as per recommended practice ISO 1461, using cold galvanizing spray process. Organic paint systems are not acceptable for the repair.
3. After repair of damaged galvanized coating by cold galvanization (P-7), the repaired area shall be top coated with paint system as given in table-4 above (i.e. 1 coat of F-6B @ 100µ DFT/coat + 1 coat of F-2 @ 40µ DFT/coat).
4. Galvanized gratings don't require painting in general until otherwise specified elsewhere or as per the requirement of the OWNER. Galvanized items may require painting to meet the colour coding requirement of the OWNER. Contractor has to ensure the applicable colour coding prior to application of coating as per this clause.

TABLE-5: COATING SYSTEM FOR INLAND PLANTS (OFFSITES & UTLITIES)

(For all un-insulated above ground CS, LTCS & Alloy steel piping, equipment, structures, valves, Vessels & columns, stacks etc.)

Sl. No.	Design Temp. in °C	Surface Preparation & Pre-erection/Shop Primer	Coating System		Total Final DFT in Microns (min.)	Remarks
			Primer	Finish Coat		
5.1	-45 to -15	SSPC-SP-10; 1coat of F-9 @ 65-75µ DFT/coat	-	-	65-75	a. No over-coating shall be done on

5.2	-16 to 80	SSPC-SP-10; 1coat of F-9 @ 65-75µ DFT/coat	1 coat of P-6 @ 40 µ DFT/coat	1coat of F-6B @ 100 µ DFT/coat+ 1 coat of F-2 @ 40µ DFT/coat	245-255	F-9. b. Surface profile for F-9 shall be 30-40 µm c. F-12 shall be ambient temperature curing type
5.3	81 to 250	SSPC-SP-10; 1coat of F-9 @ 65-75µ DFT/coat	-	2 coats of F-11 @ 20µ DFT/coat (2x20=40)	105-115	
5.4	251 to 400	SSPC-SP-10; 1coat of F-9 @ 65-75µ DFT/coat	-	2 coats of F-12 @ 20µ DFT/coat (2x20=40)	105-115	
5.5	401-650	SSPC-SP-10; 1 coat of F-16 @ 125 µ	-	1 coat of F-16 @ 125 µ	250-300	-

TABLE-6: COATING SYSTEM FOR CORROSIVE AREAS (PROCESS UNITS, COOLING TOWER, DM AND CPP etc.)

(For all un-insulated above ground CS, LTCS & Alloy steel piping, equipment, structures, valves, vessels & columns, furnace stacks etc.)

Sl. No.	Design Temp. °C	Surface Preparation & Pre-erection/Shop Primer	Coating System		Total DFT in Microns (min.)	Remarks
			Primer	Finish Coat		
6.1	-45 to -15	SSPC-SP-10; 1coat of F-9 @ 65-75µ DFT/	-	-	65-75	a)No over coating on F-9 is allowed b) F-12 shall be ambient temperature curing type c) Surface profile for F-9 shall be 30-40 µm
6.2	-16 to 80	SSPC-SP-10; 1coat of F-9 @ 65-75µ DFT/ coat	1 coat of P-6 @ 40 µ DFT/ coat	2 coats of F-6B @ 100 µ DFT/coat + 1 coat of F-2 @ 40µ DFT/coat (2x100 + 40= 240)	345-355	
6.3	81 to 400	SSPC-SP-10; 1coat of F-9 @ 65-75µ DFT/ coat	-	2 coats of F-12 @ 20µ DFT/coat 2x20=40	105-115	
6.4	401-650	SSPC-SP-10; 1 coat of F-16 @ 125 µ	-	1 coat of F-16 @ 125 µ	250-300	-

NOTES for TABLE-5 & TABLE-6:

1. The list of items given in the heading of the above table is not exhaustive. There may be more items for a particular contract where these specifications are used. The CONTRACTOR is fully responsible for completing painting including prefabrication primer for all the items supplied and fabricated as per contract document and scope of work.

2. If the application of pre-erection/pre-fabrication/shop primer has already been completed, the same shall not be repeated in the field. In case the damages to the primer coat are severe and spread over large areas, the Engineer-In-Charge may decide & advise re-blasting and re-application of the primer coat. Repair of pre-fabrication/pre-erection primer, if required, shall be done as per Table-3.

3. Flare line within unit or offsite areas shall be coated as per clause 6.3 of Table-6.

4. For external surface of RCC Chimney, 2 coats of F-6 B@ 100µ DFT/coat to obtain a total DFT of 200 µ shall be applied after proper surface preparation as per guidelines in clause 4.6.

TABLE-7: COATING SYSTEMS FOR EFFLUENT TREATMENT PLANT (ETP)

Sl. No.	Design Temp. in °C	Surface Preparation	Coating system		Total DFT in Microns (min.)	Remarks
			Primer	Finish Coat		
7.1	For external surfaces of steel items: screens, walk way bridges, clarifier/thickener scrapping mechanism, baffles, Media filters/vessels (PSF, DMF, MMF, & ACF etc.), vertical pumps, CS/MS tanks/ vessels and structures.					
	-14 to 80	SSPS-SP-10	1 coat of F-9 @ 65-75µ DFT/coat	2 coats of F-6A @100µ DFT/coat + 1 coat of F-2 @ 40µ DFT/coat (2x100+40= 240)	305	-
7.2	For internal surfaces of steel items: all effluent handling units such as TPI, DAF, tube settlers, clarifiers, tanks, sludge tanks and sewage tank, wet slop oil tanks etc., scrapping mechanism in clarifier etc.					
	-14 to 80	SSPS-SP-10	1 coat of F-15 @ 80µ DFT/coat.	2 coats of F-15 @180µ DFT/coat (2x80=160)	240	-
7.3	All R.C.C./concrete surfaces exposed to effluent water / liquid such as tanks, structures, drains etc., all effluent handling units such as API, TPI, DAF, tube settlers, clarifiers, tanks, sumps, sludge sumps/tanks and sewage sumps/tank, wet slop oil sump/tanks etc.					
	-14 to 80	As per clause 4.6 of this specification	Epoxy screed lining		3000	Note 1
7.4	Internal surface of equipment like Media filters/vessels (PSF, DMF, MMF, & ACF etc.), activated carbon filters, alkaline, acids & other high corrosive service					

	Up to 90	SSPC-SP-10	1 coat of clear two component solvent free vinyl ester primer @ 100µ DFT/ Coat + 2 coats of F-20 @ 500µ DFT/ Coat	1100	Note-2

NOTES for TABLE-7:

1. Contractor shall follow manufacturer recommendations to develop epoxy screed lining procedure for EIL review and approval.
2. This coating system is applicable in conjunction with relevant PDS of the equipment.

TABLE-8: EXTERNAL COATING SYSTEMS FOR CARBON STEEL AND LOW ALLOY STEEL STORAGE TANKS

Sl. No.	Design Temp. in °C	Surface Preparation	Coating system (Note-1)		Total DFT in Microns (min.)	Remarks
			Primer	Finish Coat		
8.1	All external surfaces of shell, wind girders, appurtenances, roof tops of all above ground tank including top side of external and internal floating roof and associated external structural works.					
8.1.1	-14 to 80	SSPC-SP-10	1coat of F-9 @ 65-75µ DFT/coat + 1coat of P-6 @ 40µ DFT/ coat	2 coats of F-6B @ 100µ DFT /coat + 1 coat of F-2 @ 40µ DFT/ coat	345-355	-
8.1.2	81 to 450	SSPC-SP-10	1coat of F-9 @ 65-75µ DFT/coat	1 coat of F-16 @ 125 µ DFT / coat	190-200	
8.2	External surfaces of bottom plate (in contact with soil) for all storage tanks.					
8.2.1	-14 to 80	SSPC-SP-10	1 coat of F-9 @ 65-75µ DFT/ coat	3 coats of F-7@ 150µ DFT/coat (3x150=450)	515-525	-
8.2.2	81 to 200	SSPC-SP-10	1 coat of F-17 primer @ 400µ DFT/ coat	1 coat of F-17 finish coat @ 400µ DFT/ coat	800-825	Note-4
8.3	For underside of the bottom plate (not in contact with soil)(in case tank is not lifted during PWHT) (Note- 2)					

8.3.1	-29 to 400	SSPC SP-10	1 coat of F-16 @ 125 µ	1 coat of F-16 @ 125 µ	250-300	Note-3

Notes for TABLE-8:

1. All paint coating application including primer for tanks shall be carried out at field after erection and completion of entire welding.

2. For underside of bottom plate as per clause no.8.3.1:

   a) Painting shall be carried out before laying the bottom plate for tanks with non-Post Weld Heat Treatment (PWHT).
   b) For tanks with PWHT, painting shall be carried out after PWHT.

   c) In case tank is not lifted during PWHT then painting shall be applied before laying the bottom plate.

3. This coating system is also applicable for temperature ranges not covered in 8.2 above.

4. This coating system is also applicable for bottom plates having MOC as Stainless Steel.

TABLE-9: INTERNAL COATING SYSTEMS FOR CARBON STEEL AND ALLOY STORAGE TANKS

Sl. No.	Design Temp. in °C	Surface Preparation	Coating system		Total DFT in Microns (min.)	Remarks
			Primer	Finish Coat		
9.1	Internal side of bottom plate and first shell course of Crude oil tanks					
9.1.1	-14 to 90	SSPC-SP-10	1 Coat of F-6A @ 100 µ DFT/coat	1 Coat of F-6C @ 400 µ DFT/coat	500	-
9.2	Underside of floating roof, internal surfaces of shell for full height above first course, oil side surfaces of deck plates, oil side surfaces of pontoons, support structures, roof legs, drain pipes and ladders etc. of crude oil tanks					

9.2.1	-14 to 90	SSPC-SP-10	1 coat of F-15 primer @ 80µ DFT/ coat	1 coat of F-15 intermediate coat @ 80µ DFT/coat + 1 coat of F-15 finish coat @ 80µ DFT/ coat	240	-
9.3	All internal surfaces of hydrocarbon, slops, amine solutions, sour water and other hydrocarbon-water solutions tanks but not limited to: Underside of floating roofs, internal surface of cone roof, inside of bottom plate, internal surfaces of shell for full height, underside of floating roof, oil side surfaces of deck plates, oil side surfaces of pontoons, support structures, roof legs, drain pipes and ladders etc.					
9.3.1	-14 to 45	SSPC-SP-10	1 coat of F-9 @ 65-75 µ DFT/coat	-	65-75	-
9.3.2	46 to 90	SSPC-SP-10	1 coat of F-15 primer @ 80µ DFT/ coat	1 coat of F-15 intermediate coat @ 80µ DFT/coat + 1 coat of F-15 finish coat @ 80µ DFT/ coat	240	-
9.3.3	91 to 200	SSPC-SP-10	-	1 coat of F-17 @ 400µ DFT/coat	400	-
9.4	Potable, Raw & Fire water, De-mineralized (DM) water & Condensates etc. All internal surfaces but not limited to internal surfaces of shell for full height, bottom plate, accessories, roof and roof structures of cone and dome roof tanks etc.					
9.4.1	-14 to 60	SSPC-SP-10	1 Coat of F-6A @ 100µ DFT/coat	1 coat of F-6C @ 300-350 µ DFT/ coat	400-450	-
9.4.2	61 to150	SSPC-SP-10	1 coat of F-15 primer @ 80µ DFT/ coat	1 coat of F-15 intermediate coat @ 80µ DFT/coat + 1 coat of F-15 finish coat @ 80µ DFT/ coat (80+80=160)	240	-
9.5	Hydrochloric acid (HCl) 10 %, Bio ATF Feed. All internal surfaces but not limited to internal surfaces of shell for full height, bottom plate, accessories, roof and roof structures of cone and dome roof tanks etc.					
9.5.1	-14 to 125	SSPC-SP-10	1 Coat of clear two component solvent free vinyl ester primer @ 100µ DFT/ Coat	2 Coats of F-20 @ 500µ DFT/ Coat	1100	-
9.6	Aggressive solvents like hexane, hexene, benzene, xylene and toluene etc.: All internal surfaces but not limited to internal surfaces of shell for full height, bottom plate, accessories, roof and roof structures of cone and dome roof tanks etc.					

9.6.1	-14 to 65	SSPC-SP-10	1 coat of F-9 @ 65-75µ DFT/ coat	-	65-75	-
9.7	Ethylene glycol tanks: All internal surfaces but not limited to internal surfaces of shell for full height, bottom plate, accessories, roof and roof structures of cone and dome roof tanks etc.					
9.7.1	All	SSPC-SP-10	-	3 coats of vinyl chloride co-polymer @ 75µ /Coat; (3x75=225)	225	-
9.8	Inside pontoon and inside of double deck of all floating roofs					
9.8.1	-14 to 80	SSPC-SP-3	1 coat of F-8 @ 100µ DFT/coat	1 coat of F-8 @ 100µ DFT/coat	200	-
9.8.2	81 to150	SSPC-SP-10	1 coat of F-15 primer @ 80µ DFT/ coat	1 coat of F-15 intermediate coat @ 80µ DFT/coat + 1 coat of F-15 finish coat @ 80µ DFT/ coat (80+80=160)	240	-
9.8.3	151 to 200	SSPC-SP-10	-	1 coat of F-17 @ 400µ DFT/coat	400	-
9.9	Alkalis up to 50 % concentration: All internal surfaces but not limited to internal surfaces of shell for full height, bottom plate, accessories, roof and roof structures of cone and dome roof tanks etc.					
9.9.1	Up to 60°C	SSPC-SP-10	1 coat of F-15 primer @ 80µ DFT/ coat	2 Coats of F-6 A @ 100µ DFT/coat (2x100=200)	280	-

General Note for Table-9: The list of surfaces to be painted are not exhaustive. All internal surfaces of all type of tanks including structural items shall be coated as per the above table. No CS surface shall be kept un-painted.

TABLE-10: COATING SYSTEMS FOR EXTERNAL SIDE OF UNDERGROUND CARBON STEEL PLANT PIPING AND VESSELS

Sl. No.	Design Temp. in °C	Surface Preparation & Shop Primer	Coating system		Total DFT in Microns (min.)	Remarks
			Surface Preparation & Primer	Finish Coat		
10.1	Underground carbon steel plant piping.					
10.1.1	25 to 65	-	SSPC-SP-10; 1 coat of synthetic fast drying primer 25 @µ DFT/ coat	1 layer of coal tar tape coating @ 2mm +1 coat of synthetic fast drying primer @25 µ DFT/ coat + 1 layer of coal tar tape coating @ 2mm /layer as per 6-79-0011 Latest revision	4 mm	The primer DFT is not measurable. Re-conciliation primer shall be done by coverage of maximum 10 sq.m/litre
10.1.2	61 to 200	-	SSPC-SP-10; 1 coat of F-17 primer @400 µ DFT/ coat	1 coat of F-17 @ 400 DFT/coat	800	-
10.2	External side of underground storage vessels					
10.2.1	-45 to 80	SSPC-SP -10; 1 coat of F-9 @ 65-75µ DFT/ coat	-	3 coats of F-7 @ 100µ DFT/coat	365-375	-
10.2.2	81 to 200	SSPC-SP -10	1 coat of F-17 primer @400 µ DFT/ coat	1 coat of F-17 @400µ DFT/ coat	800	-

TABLE-11: COATING SYSTEMS FOR UNDER INSULATION (ALL UNIT AREAS & OFFSITES)
(For insulated piping, equipment, storage vessels, tanks, columns etc. of CS, LTCS, Alloy steel, SS, DSS and SDSS in all environments.)

Sl. No.	Design Temp. °C	Surface Preparation & Pre-erection/Shop Primer	Coating system		Total DFT Microns (min.)	Remarks
			Primer	Finish paint		
11.1	Carbon steel, LTCS and Alloy steel Piping, Storage tanks, Vessels, Equipment etc.					
11.1.1	-45 to 125	SSPC-SP-10; 1coat of F-15 @ 75µ DFT/coat	None	2 coats of F-15 @75µ DFT/coat	225	Note 1
11.1.2	126 to 450	SSPC-SP-10; 1 coat of F-16 @ 125µ DFT/coat	None	1 coat F-16 @ 125µ DFT/coat	250	
11.2	Stainless Steel, Duplex Stainless steel, Super Duplex stainless steel & Piping, Tanks, Vessels & Equipment etc.					
11.2.1	-45 to 125	SSPC-SP-16; (15-25µ surface profile) 1 coat of F-15 @75 µ DFT/coat	None	2 coats of F-15 @75µ DFT/coat	225	Note 1
11.2.2	126 to 650	SSPC-SP-16; (15-25µ surface profile) 1 coat of F-16 @125µ DFT/coat	None	1 coat of F-16 @125µ DFT/coat	250	
11.3	Cyclic service of CS, LTCS, SS, DSS, SDSS & Alloy Steels (Note-1)					
11.3.1	-45 to 150 (Note-1)	SSPC-SP-10 For CS, LTCS & Alloy steel. SSPC-SP-16 for SS; (15-25µ surface profile) 1 coat of F-15 @75 µ DFT/coat	None	2 coats of F-15 @75µ DFT/coat	225	Note-2&3

11.3.2	-180 to 650	SSPC-SP-10 for CS, LTCS & Alloy steel. SSPC-SP-16 for SS (15-25µ surface profile) 1 coat of F-16 @ 125µ DFT/coat	None	1 coat of F-16 @ 125µ DFT/coat	250	-

Notes

1. Coating system for any other design temperature range not covered in Sr. No. 11.1 & Sr. No. 11.2 shall be as per Sr. No. 11.3.2.
2. In case of overlapping of cyclic temperature ranges as mentioned in 11.3.1 and 11.3.2 then clause 11.3.1 shall be followed.
3. Alternatively, for this temperature range, 1 coat of F-17 @ 400 µ is also acceptable.

General notes for TABLE-11:

1. “Cyclic Service” is characterized by rapid or periodical temperature fluctuation or temperature cycles or as defined in the process datasheet.
2. The blasting abrasives for SS and alloy steels shall be aluminum oxide or garnet only.
3. The coating system applicable for any other temperature range shall be reviewed if it is encountered.

TABLE-12: INTERNAL COATING SYSTEMS FOR WATER SIDE COMPONENTS OF CS, SS, DSS & NON-FERROUS HEAT EXCHANGERS

Sl. No.	Design Temp. in °C	Surface Preparation & Pre-erection/Shop Primer	Coating System		Total Final DFT in Microns (min.)	Remarks
			Primer	Finish paint		
12.1	Up to 80	SSPC-SP-10 for CS and SSPC-SP-16 for SS	1 coat of F-15 @ 80 µ DFT/coat	2 coats of F-15 @ 80 80 µ DFT/coat	240	-
12.2	81 to 200	SSPC-SP-10 for CS and SSPC-SP-16 for SS	-	2 coats of F-17@ 400µ/coat	800	-

Note for Table-12:

1. Coating systems are applicable as per requirement specified in the data sheets of the respective exchangers or equipment.

GENERAL NOTES FOR TABLE: 5 TO 12

1. For uninsulated or insulated items, scope of surface preparation, application of primers to finish coat including repair shall be as per applicable contractual documents like SOR, MR, and PR etc. The list of items are not exhaustive.

8.0 GUIDELINES FOR STORAGE & HANDLING

8.1 All paints and painting materials shall be stored in rooms only which are to be arranged by CONTRACTOR and approved by Engineer-In-Charge for the purpose. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separate from adjacent building. A signboard bearing the word “PAINT STORAGE- NO NAKED LIGHT-HIGHLY INFLAMMABLE” shall be clearly displayed outside. Manufacturers’ recommendation /Materials safety datasheet shall be followed for storage and handling of paint materials.

Note: This specification doesn’t address all the safety concerns if any, associated with its use. It is responsibility of the user of this specification to establish appropriate safety and health practice and determine the applicability of regulatory limitations prior to use.

9.0 COLOUR CODE

The colour coding system as per Annexure-1 of this specification shall be followed.

9.1 Identification

The system of colour coding consists of a ground colour and secondary colour bands superimposed over the ground colour. The ground colour identifies the basic nature of the service and secondary colour band over the ground colour distinguishes the particular service. The ground colour shall be applied over the entire length of the un-insulated pipes. For insulated lines, ground colour shall be provided as per specified length and interval to identify the basic nature of service and secondary colour bands to be painted on these specified length to identify the particular service. Above colour code is applicable for both unit and offsite pipelines.

9.2 Ground colour

On un-insulated pipes, the entire pipe has to be painted in ground colour. On metal cladded insulated lines, minimum 2 m long portion should be painted.

9.3 Colour bands

9.3.1. Location of colour bands:

a. At battery limits.
b. Intersection points & change of direction points in piping.
c. Midway of piping section, near valves, across culverts.
d. At 50 m interval on long stretch pipes.
e. At starting and termination points.

9.3.2. Minimum width:

NB	Width
3" and below	75 mm
Above 3" to 6"	NB X 25 mm
Above 6" to 12"	NB X 18 mm
Above 12"	NB X 15 mm

For insulated pipes, NB indicates OD of the insulation.

Sequence: Colour bands shall be arranged in sequence as shown above and the sequence follows the direction of flow. The width of the 1st Band to 2nd band is 4:1.
Wherever deemed required by process department or safety, pipes handling hazardous substances will be given hazard marking of 30 mm wide diagonal stripes of black and golden yellow.

9.4 Identification markings on equipment/piping

Equipment tag numbers shall be stenciled/neatly painted using normal 'Arial' lettering style on all equipment and piping (both insulated & un-insulated) after completion of all paint works. Lettering colour shall be either black or white, depending upon the background, so as to obtain good contrast.

Operations group shall specify the location of the marking.

Size of the making shall be as follows:

Columns, vessels, heaters	: 150 mm
Pumps and other machinery	: 50 mm
Piping	: OD / 2 with maximum 100 mm
Storage tanks	: (as per drawings)

9.5 Colour coding for control valve

a) Carbon steel body : Signal grey (RAL7004)
Alloy steel body : Golden yellow (RAL1004)
Stainless steel body : Natural

b) The actuator of the control valve shall be painted as:

Direct action (open on air failure) valves : Traffic Green (RAL 6024)
Reverse acting (close on air failure) valves: Traffic Red (RAL 3020)

The painting status shall be comprehensively updated every 6 months for compliance.

10.0 IDENTIFICATION OF VESSELS, PIPING ETC.

10.1 Equipment number shall be stenciled in black or white on each vessel, column, equipment & machinery (insulated or un-insulated) after painting. Line number in black or white shall be stenciled on all the piping of more than one location as directed by Engineer-In-Charge. Size of letter printed shall be as below:

Column & vessels : 150 mm (high)
Pump, compressor & other machinery: 50 mm (high)
Piping : 40-150 mm

10.2 Identification of storage tanks

The storage tanks shall be marked as detailed in the drawing.

11.0 PAINTING FOR CIVIL DEFENCE REQUIREMENTS

Painting for civil defense is a specific requirement and should be applicable as per instructions of OWNER and competent government authorities.

11.1 The following items shall be painted for camouflaging, if required by the client:

a. All columns
b. All tanks in offsite
c. Large vessels
d. Spheres

11.2 Two coats of selected finishing paint as per defense requirement shall be applied in a particular pattern as per clause 11.3 and as per the instructions of Engineer-In-Charge.

11.3 Method of camouflaging

a. Disruptive painting for camouflaging shall be done in three colours in the ratio of 5:3:2 (all matte finish).

Dark Green		Light Green		Dark Medium Brown
5	:	3	:	2

b. The patches should be asymmetrical and irregular.
c. The patches should be inclined at 30º to 60º to the horizontal.
d. The patches should be continuous where two surfaces meet at an angle.
e. The patches should not coincide with the corners.
f. Slits and holes shall be painted in dark shades.
g. Width of patches should be 1 to 2 m.

12.0 QUALITY CONTROL, INSPECTION AND TESTING

12.1 All painting materials including primers and thinners brought to site by CONTRACTOR for application shall be procured directly from manufactures as per specifications and shall be accompanied by manufacturers' test certificates. Paint formulations without certificates are not acceptable (see section 14.0 & 15.0).

12.2 The CONTRACTOR must produce test certificate from pre-qualified paint manufacturer for various tests as detailed out in section 15.0 of this document. The Engineer-In-Charge, in consultation with SMMS, shall have the right to test wet samples of paint at random for verifying quality of paint supplied. CONTRACTOR shall arrange to have such tests, as instructed, performed at his cost at any one of the NABL accredited laboratories under a TPI agency.

Samples for the test will be drawn at random in presence Engineer-In-Charge or his representations. Following tests to be carried out if called:

a. Specific Gravity
b. % solids by weight (% zinc content in case of inorganic or organic zinc primer)
c. Drying time (touch dry & full curing)
d. Adhesion test on a test panel prepared at the site (ASTM D 6677).

Test methods for above tests shall be as per relevant ASTM or ISO Standard.

12.3 The painting work shall be subject to inspection by Engineer-In-Charge at all times. In particular, following stage-wise inspection will be performed and CONTRACTOR shall offer the work for inspection and approval of every stage before proceeding with the next stage. The record of inspection shall be maintained in the registers. Stages of inspection are as follows:

a. Surface preparation
b. Primer application
c. Each coat of paint

12.3.1 Following tests are to be carried out during surface preparation:

a. Test for presence of oil/grease and contamination

The steel substrate after degreasing as per SSPC-SP-1 shall be tested as per following procedure to validate absence of oil and grease contamination:

- Visual inspection - continue degreasing until all visible signs of contamination are removed.
- Conduct a solvent evaporation test by applying several drops or a small splash of residue-free tri-chloromethane on the suspect area especially pitting, crevice corrosion areas or depressed areas. An evaporation ring formation is indicative of oil and grease contamination. Continue degreasing and inspection till test is passed.

b. **Tests for surface finish of blasted surface** shall be done by visual inspection using SSPC-VIS1. Clear cellophane tape test as per ISO 8502-3 shall be used to confirm absence of dust on blasted surface. Checks shall be done on each component at least once per 200 m^2 of blasted surface and a minimum of 3 checks per shift.

c. **Test for presence of soluble salt** as per method ISO 8502-9. Maximum allowable salt content shall be considered 20 mg/m^2.Checks shall be done on each component at least once per 200 m^2 of blasted surface and minimum of 3 checks per shift. In case salt exceeds specified limit, the contaminated surface shall be cleaned by method as per Annexure-C of ISO 12944-4 (water cleaning). After cleaning, surface shall be retested for salt after drying.

d. **Blast Profile Measurement**: (In-Process testing during actual production before application coating). The angular profile depth measurement shall be done by profile tape as per method ASTM D 4417 method B (Profile depth gauge micrometer)/ calibrated Digital gauge meter. Spot measurement shall be carried out every 15m^2 of blasted surface. At each spot three measurements shall be taken over an area of 10 cm^2 and average of measurements to be

recorded and reported. If profile is less than specified range, blasting shall continue till greater specified depth profile is achieved.

e. **Tests for blasting media:** Blasting Media (For every fresh batch of media and one random test during blasting)**.** Blasting Media shall be visually inspected for absence of contamination and debris using 10 X magnification.

- Inspection for the absence of oil contamination shall be conducted using following procedure :
  - Fill a small clean 200 ml bottle half full of abrasive.
  - Fill the bottle with potable water, cap and shake the bottle.
  - Inspect water for oil film/slick. If present, the blasting media is not to be used.

- Soluble salt contamination if suspected shall be verified by method ASTM D 4940. If present, media to be replaced.

- Clean blasting equipment, especially pot and hoses, and then replace blasting media and retest.

f. **Test for Blasting Air** (Once Daily before start of blasting and once at random during Blasting). The air for blasting shall be free from moisture and oil. The compressor air shall be checked for oil and water contamination per ASTM D 4285.

In addition to above, record should include type of shop primer already applied on equipment e.g. zinc silicate or zinc rich epoxy or zinc phosphate. Any defect noticed during the various stages of inspection shall be rectified by the CONTRACTOR to the entire satisfaction of Engineer-In-Charge before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, CONTRACTOR shall be responsible for rectifying any defects found during final inspection/guarantee period/defect liability period as defined in general conditions of the contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint should be applied to make-up the DFT specified without any extra cost to OWNER, the extra coat should have prior approval of Engineer-in-charge.

12.4 Final inspection of finished coating shall consist of the following:

a. Coating DFT & WFT check: DFT measurement shall be as per ISO 2808. Type-II electronic gauge shall be used as described in ASTM D7091. DFT gauge calibration, adjustment of gauge coating thickness, frequency and number of coating thickness measurement shall be as per ASTM D7091 and SSPC-PA2. Measured DFT shall have a tolerance as per SSPC-PA-2 level-3 of the dry film thickness, specified in this specification. Once in every layer of coating application, spot checks of WFT shall be carried out during the coating application according to ISO 2808, Method No. 1A- comb gauge. This is to ensure that film thickness is being achieved as per the specification.

b. **Adhesion testing:** Adhesion of the primer to the steel substrate and inter-coat adhesion of the subsequent coat(s) after curing for at least a week after application of the topcoat shall be examined by a knife test in accordance with ASTM D6677. For the knife test, if the rating is better than 8, the adhesion is considered acceptable. The adhesion is destructive and tested areas shall be repaired afterward using the spot repair procedure. Alternatively, the applicator may perform the adhesion test on a steel panel coated using the same surface preparation and

coating application procedure as the work piece. Adhesion testing shall be carried out for each component at least once per 200 m^2 of coated surface.

c. **Holiday detection check:** Holiday testing of non-conductive coatings shall be carried out in accordance with NACE SP0188. For immersion, buried & under insulation services, 100% of coated area shall be inspected for holidays. For atmospheric exposure, 10% of coated area which must include weld seams, corners and edges to be holiday tested. Voltage at which test is to be carried out will depend upon DFT of coating being tested and shall be as per NACE SP0188. Any holiday is unacceptable and should be marked and repaired immediately**.**

The CONTRACTOR shall arrange for spot checking of paint materials for specific gravity, glow time (ford cup) and spreading rate.

13.0 PAINT MATERIAL GUARANTEE CERTIFICATE

The CONTRACTOR shall guarantee that the chemical and physical properties of paint materials used are in accordance with the specifications contained herein/to be provided during execution of work and shall submit necessary certificate of the paint material.

14.0 QUALIFICATION CRITERIA OF PAINTING CONTRACTOR/SUB-CONTRACTOR

Painting CONTRACTOR who is awarded any job for EIL, Projects under this specification must have necessary equipment, machinery, tools and tackles for surface preparation, paint application and inspection. The CONTRACTOR must have qualified, trained and experienced surface preparator, paint applicator, inspector and supervisors. The CONTRACTOR supervisor, inspector, surface preparator and paint applicator must be conversant with the standards referred in this specification.

15.0 PRE-QUALIFICATION/ACCEPTANCE CRITERIA FOR PAINT COATING SYSTEM

15.1 Pre-qualification of paint coating manufacturer and their products

Paint manufacturer meeting the following requirements shall be considered by the CONTRACTOR for supply of the paint products.

a) Manufacturer should have been in continuous business of paint coating formulation and manufacturer for at least past 5 years.
b) Manufacturer should possess past experience of supplying his products to hydrocarbon, petrochemical, fertilizer. Chemical processing industry or offshore platforms in the past 5 years.
c) Coating manufacturer should have supplied at least 10000 litre of an individual product to hydrocarbon, petrochemical, fertilizer. Chemical processing industry or offshore platforms.
d) The manufacturer's manufacturing procedure & QA/QC system shall meet ISO 9001 requirements and preferably should possess ISO 14000 certificate.
e) The Quality control set up should be manned by qualified paint technologists whose biodata should be sent along with quality control organization chart.

The Past Track record of the manufacturers as mentioned above shall be substantiated by providing relevant documents to EIL-SMMS for their review and acceptance. This shall include Work Orders, Purchase orders and ISO 9001 certification covering all the requirements mentioned from bullets a) to e) above.

CONTRACTOR shall procure the paint materials from the qualified manufacturer meeting above requirements and after obtaining prequalification testing approval as per requirements mentioned in clause 15.2 below.

15.2 Pre-Qualification Testing procedure:

The paint manufacturer engaged by the mechanical contractor shall carry out the tests in NABL accredited government laboratories or in suggested list of laboratories below, as a part of qualification. Paint manufacturer shall provide the paint samples to laboratory for testing of the parameters mentioned in Table-2 (typical characteristics) and Table-13 (tests on coating systems) of this specification. The testing laboratory will confirm the compliance of the paint material with respect to the acceptance criteria mentioned in the respective tables. Colored photographs of coated test panels should be taken before and after the test and should be enclosed along with test report. Contractor shall furnish these test certificates along with all necessary supporting documents/information to EIL-SMMS for approval/ acceptance. The paint manufacturer will be qualified and approved by EIL-SMMS for supply of paints after review/assessment of the submissions made by the contractor. Test certificates which are more than 3 years old will not be considered. Paint manufacturers are advised to carryout pre-qualification testing accordingly for paints supply to EIL projects.

List of suggested laboratories:

1. National Test house – Kolkata
2. National Test house-Mumbai
3. HBTU- Kanpur
4. GIRDA (Gujarat Industrial Research & Development Agency)- Vadodara
5. Indian institute of chemical technology – Hyderabad
6. RITES – Kolkata
7. ICT- Mumbai

TABLE-13: PRE-QUALIFICATION TESTING

SYSTEM No.	COATING SYSTEM	REFERENCE CLAUSE (from table-3 to 12)	TOTAL DFT µ (min)
1.	F-9+P6+F6B+F2	6.2	345
2.	F9+F12+F12	6.3	105
3.	F15+F15+F15	9.2.1	240
4.	F16+F16	8.3.1	250
5.	F17	9.3.3	400
6.	F8	3.1	125
7.	F20+F20	9.3.1	1100
8.	F6A+F6C	9.1.1	500
9.	F9+F7+F7+F7	10.2.1	365
10.	F15+F6A+F6A	9.9.1	280

S. No.	TEST	FOR SYSTEM NUMBER	DURATION	ACCEPTANCE CRITERIA
1.	Cyclic Test Salt Spray : 72 hrs. Drying in air: 16 hrs. UV-A340 nm weather meter: 80 hrs. One cycle: 168 hrs. (25 cycles at 168 hrs. each cycle) (ASTM D5894)	1	4200 hrs.	Shall pass. No chalking, cracking, flaking, blistering or peeling shall be observed.
2.	Chemical Resistance Test **(**ASTM D543)			
2a.	10% & 40% NaOH	3, 5, 7, 9 & 10	1000 hrs.	Shall pass. No cracking, discoloration, blistering, peeling or softening of film shall be observed.
2b.	5% H2SO4		168 hrs.	
2c.	Xylene		4 weeks	
2d.	Acetone		4 weeks	
2e.	Ethanol		4 weeks	
2f.	Kerosene		4 weeks	
2g.	Sea water		2000 hrs.	
3.	Immersion in DM/DI water @90^0 (ASTM C868)	3, 5, 7, 9 & 10	30 days	No softening, blistering or film damage.
4.	Resistance to DM water using water immersion. (ASTM D870)	8	2000 hrs.	Shall pass. No chalking, cracking, flaking, blistering or peeling.
5.	100% Humidity Test (ASTM D2247)	1 to 10 (except system-2)	1440 hrs.	Shall pass
6.	Thermal Shock Resistance Test; 5 cycles @ 30 minutes in furnace at 120 ° C and 15 minutes in water after quenching in water for each cycle. (ASTM D2485 method A)	2, 3, 4, & 10 (For system-2, testing to be done after heating the panels at 400°C for 2 hrs.)	-	Shall pass

7.	Cathodic Disbondment Test (ASTM G42 @80°C)	3, 5, 9, & 10	-	Diameter of cathodic Disbondment < 10 mm with 6 mm diameter artificial holiday.
8.	Assessment of Adhesion and artificial ageing as per ISO 19277	3, 4, 5, 9 & 10	-	Shall Pass

Each coating product to be qualified shall be identified by the Specific gravity of base and curing agent (ISO 2811). The identification shall be carried out on the batch, which is used for the pre-qualification testing.

15.3 Information to be furnished during delivery of paint materials:

CONTRACTOR along with delivery of paint material has to furnish following information from paint manufacturer to EIL for acceptance/approval of products:

a) Batch test certificates:

Along with paint products delivery to site from the pre-qualified coating manufacturer, CONTRACTOR has to produce test certificate (from paint manufacturer) for each category of product for the following test items. All test results must mention clearly the batch no. and category of product tested. Tests to be conducted for following properties:

- Specific Gravity
- % solids by weight (% zinc content in case of inorganic or organic zinc primer) ~ ASTM D521.

b) Product information sheet/ technical data sheet for each category of product.

The contractor shall be fully responsible for the quality of the paints products as per prequalification testing. After the paint materials are supplied to site, the supplier shall organize random sampling and testing in a NABL laboratory as per discretion of the Engineer-in-charge in consultation with SMMS. Failing to meet the specified quality requirements may cause rejection of the paint products.

16.0 METHOD OF SAMPLING & DISPATCH FOR LABORATORY TESTING

(Pre-Qualification tests (sec. 15.2), Batch testing (sec. 15.3) and Inspection testing (sec. 12.0))

16.1 Samples of coating materials should be submitted to the laboratory in sealed containers with batch no. and test certificate on regular format of manufacturer's testing laboratory.

16.2 All test panels should be prepared by testing laboratory. Surface preparation for a system shall be done in accordance with this specification. For individual products testing, minimum shall be Sa 2.5. Colour photographs of test panels should be taken before and after the test and should be enclosed along with test report. Sample batch no. and manufacturer's test certificate should be enclosed along with the report. Test report must contain details of observation and rusting if any, as per the testing code.

16.3 Manufacturers should intimate EIL, details of sample submitted for testing, name of testing agency, date, and contact personnel of the testing agency.

ANNEXURE-1: COLOUR CODE

SR. No.	SERVICE	RECOMMENDED COLOUR FOR PAINT SYSTEM	RAL COLOUR CODE	
			BASE COLOUR	BAND COLOUR
HYDROCARBON LINES (UNINSULATED)				
1	CRUDE SOUR	Basalt Grey with 1 deep orange band	7012	2011
2	CRUDE SWEET	Basalt Grey with 1 signal red band	7012	3001
3	LUBE OILS	Basalt Grey with 1 grass green band	7012	6010
4	FLARE LINES	White Aluminum	9006	
5	LPG	Deep Orange with 1 oxide red band	2011	3009
6	PROPYLENE	Deep Orange with 2 Cobalt blue bands	2011	5013
7	NAPTHA	Deep Orange with 1 grass green band	2011	6010
8	M.S.	Deep Orange with 1 Basalt Grey band	2011	7012
9	AV.GASOLINE (96 RON)	Deep Orange with 1 band each of grass green, white and signal red bands	2011 6010	9010 3001
10	GASOLINE (regular, leaded)	Deep Orange with 1 Jet black band	2011	9005
11	GASOLINE (premium, leaded)	Deep Orange with 1 Cobalt blue band	2011	5013
12	GASOLINE (white)	Deep Orange with 1 white band	2011	9010
13	GASOLINE (Aviation 100/130)	Deep Orange with 1 signal red band	2011	3001
14	GASOLINE (Aviation 115/145)	Deep Orange with 1 traffic purple band	2011	4006
15	N-PENTANE	Deep Orange with 2 Cobalt blue bands	2011	5013
16	DIESEL OIL (White)	Oxide red with 1 white band	3009	9010
17	DIESEL OIL (Black)	Oxide red with 1 traffic yellow band	3009	1023
18	KEROSENE	Oxide red with 1 grass green band	3009	6010
19	HY.KEROSENE	Oxide red with 2 grass green bands	3009	6010
20	DISUFIDE OIL (EX-MEROX)	Oxide red with 1 jet black band	3009	9005
21	M.T.O	Oxide red with 3 grass green bands	3009	6010
22	DHPPA	Oxide red with 2 white bands	3009	9010
23	FLUSHING OIL	Oxide red with 2 jet black bands	3009	9005
24	LAB FS	Oxide red with 2 Basalt Grey bands	3009	7012

25	LAB RS	Oxide red with 3 Basalt Grey bands	3009	7012
26	LAB (Off. Spec)	Oxide red with 1 light grey band	3009	7035
27	N-PARAFFIN	Oxide red with 1 Cobalt blue band	3009	5013
28	HEAVY ALKYLATE	Oxide red with signal red band	3009	3001
29	BLOW DOWN, VAPOR LINE	Off white / Aluminum with 1-Brown band	9006	8004
30	BLOWDOWN	Off white / Aluminum with 2 copper brown bands	9006	8004
31	A.T.F.	Clay Brown with 1 white band	8003	9010
32	TOULENE	Clay Brown with 1 traffic yellow band	8003	1023
33	BENZENE	Clay Brown with 1 grass green band	8003	6010
34	LAB PRODUCT	Clay Brown with 1 Cobalt blue band	8003	5013
35	FUEL OIL	Jet Black with 1 traffic yellow band	9005	1023
36	FULE OIL (Aromatic rich)	Jet Black with 2 traffic yellow bands	9005	1023
37	ASPHALT	Jet Black with 1 white band	9005	9010
38	SLOP AND WASTE OILS	Jet Black with 1 deep orange band	9005	2011
39	SLOP AROMATICS	Jet Black with 2 deep orange bands	9005	2011
CHEMICAL LINES				
40	TRI-SODIUM PHOSPHATE	Lemon Yellow with 1 violet blue band	1012	5000
41	CAUSTIC SODA	Lemon Yellow with 1 jet black band	1012	9005
42	SODIUM CHLORIDE	Lemon Yellow with 1 white band	1012	9010
43	AMMONIA	Lemon Yellow with 1 Cobalt blue band	1012	5013
44	CORROSION INHIBITOR	Lemon Yellow with 1 Aluminum band	1012	9006
45	HEXAMETA PHOSPHATE	Lemon Yellow with 2 jet black bands	1012	9005
46	ACID LINES	Golden Yellow with 1 signal red band	1004	3001
47	RICH AMINE	Lemon Yellow with 2 Cobalt blue bands	1012	5013
48	LEAN AMINE	Lemon Yellow with 3 Cobalt blue bands	1012	5013
49	SOLVENT	Lemon Yellow with 1 grass green band	1012	6010
50	LCS	Lemon Yellow with 1 Blue Grey	1012	7031
WATER LINES				

51	RAW WATER	Sky blue with 1 jet black band	5015	9005
52	INDUSTRIAL WATER	Sky blue with 2 signal red band	5015	3001
53	TREATED WATER	Sky blue with 1 oxide red band	5015	3009
54	DRINKING WATER	Sky blue with 1 grass green band	5015	6010
55	COOLING WATER	Sky blue with 1 light brown band	5015	1011
56	SERVICE WATER	Sky blue with 1 signal red brown	5015	3001
57	TEMPERED WATER	Sky blue with 2 grass green bands	5015	6010
58	DM WATER	Sky blue with 1 aluminum band	5015	9006
59	DM WATER ABOVE 150°F	Sky blue with 2 jet black bands	5015	9005
60	SOUR WATER	Sky blue with 2 traffic yellow bands	5015	1023
61	STRIPPED WATER	Sky blue with 2 Cobalt blue bands	5015	5013
62	ETP TREATED WATER	Sky blue with 2 oxide red bands	5015	3009
FIRE PROTECTION SYSTEM (ABOVE GROUND)				
63	FIRE WATER FOAM & EXTINGUISHERS	Carmine Red	3002	
AIR & OTHER GAS LINES (UNINSULATED)				
64	SERVICE AIR	Yellow green with 1 signal red band	6018	3001
65	INSTRUMENT AIR	Yellow green with 1 jet black band	6018	9005
66	NITROGEN	Yellow green with 1 deep orange band	6018	2011
67	FREON	Yellow green with 1 traffic yellow band	6018	1023
68	CHLORINE	Lemon Yellow with 1 oxide red band	1012	3009
69	SO_2	Lemon Yellow with 2 white bands	1012	9010
70	H_2S	Deep Orange with 2 oxide red bands	2011	3009
71	GAS (Fuel)	Deep Orange with 1 aluminum band	2011	9006
72	GAS (Sour)	Deep Orange with 2 aluminum bands	2011	9006
73	GAS (Sweet)	Deep Orange with 2 signal red band	2011	3001
74	HYDROGEN	Deep Orange with 1 Pale green band	2011	6021
STEAM AND CONDENSATE LINES (UNINSULATED)				
75	HP STEAM	White Aluminum with 1 traffic yellow band	9006	1023
76	MP STEAM	White Aluminum with 1 signal red band	9006	3001

77	MLP STEAM	White Aluminum with 1 orange band	9006	2011
78	LP STEAM	White Aluminum with 1 light green band	9006	6021
79	CONDENSATE	Sky blue with 1 white band	5015	9010
80	CONDENSATE ABOVE 150°F	Sky blue with 3 oxide red band	5015	3009
81	BFW	Sky blue with 2 signal red bands	5015	3001
Note: For all insulated steam lines, the colour coding shall be followed as given for un-insulated lines with the specified length of colour bands.				
INSULATED HYDROCARBON PIPING				
82	IFO SUPPLY	Jet Black ground colour with 1 traffic yellow band in centre	9005	1023
83	IFO RETURN	Jet Black ground colour with 1 grass green band in centre	9005	6010
84	HPS	Jet Black ground colour with 1 signal red band in centre	9005	3001
85	BITUMEN	Jet Black ground colour with 2 signal red bands in centre	9005	3001
86	CLO	Jet Black ground colour with 1 brown band in centre	9005	8004
87	VB TAR	Black ground colour with 2 copper brown bands in centre	9005	8004
88	VR AM (BITUMEN / VBU FEED)	Jet Black ground colour with 1 Cobalt blue band in centre	9005	5013
89	VR BH	Black ground colour with 2 Cobalt blue bands in centre	9005	5013
90	VAC. SLOP	Black ground colour with 1 white band in centre	9005	9010
91	SLOP	Black ground colour with 1 deep orange band in centre	9005	2011
92	CRUDE SWEET	Basalt Grey ground colour with 1 signal red band in centre	7012	3001
93	CRUDE OUR	Basalt Grey ground colour with 1 deep orange band in centre	7012	2011
94	VGO / HCU	Oxide red ground colour with 2 iron grey bands in centre	3009	7011
95	OHCU BOTOM / FCCU FEED	Oxide red ground colour with 2 iron grey bands in centre	3009	7011
UNINSULATED EQUIPMENT, TANKS AND STRUCTURES				
96	HEATER STRUCTURE	Iron grey	7011	
97	HEATER CASING	White Aluminum	9006	
98	VESSELS & COLUMNS	White Aluminum	9006	

99	HYDROGEN BULLETS	Antique Pink	3014	
100	LPG VESSELS	Oxide red	3009	
101	SO_2 VESSEL	Lemon Yellow	1012	
102	HEAT EXCHANGER	White Aluminum	9006	
103	FO TANK AND HOT TANKS	Jet Black	9005	
104	ALL OTHER TANKS	White Aluminum	9006	
105	CAUSTIC / AMINE / ACID TANKS	Golden yellow	1004	
106	SOUR WATER	Sky Blue	5015	
107	OUTER SURFACE IN BOILER HOUSE	Aluminum	9006	
108	COMPRESSORS AND BLOWERS	Basalt Grey	7012	
109	PUMPS	Pigeon Blue	5014	
110	MOTORS & SWITCH GEAR	Pastel Blue	5024	
111	HAND RAILING	Signal red	3001	
112	STAIRCASE, LADDER AND WALKWAYS	Jet Black	9005	
113	LOAD LIFTING EQUIPMENT AND MONORAILS ETC	Clay Brown	8003	
114	GENERAL STRUCTURE	Jet Black	9005	
115	FLUE GAS STACK	Jet Black	9005	
PIPES AND FITTINGS OF ALLOY STEEL AND SS MATERIAL IN STORE				
115	IBR	Signal red	3001	
116	9Cr-1Mo	Pale Green	6021	
117	5Cr-0.5Mo	Light Blue	5012	
118	$2_{1/4}$Cr-1 Mo	Luminous Yellow	1026	
119	$1_{1/4}$Cr-½ Mo	Traffic Yellow	1023	
120	SS-304	Grey Blue	5008	
121	SS-316	Blue Lilac	4005	
122	SS-321	Pigeon Blue	5014	
SAFETY COLOUR SCHEMES				
123	DANGEROUS OBSTRUCTION	Jet Black and Bright Red Orange band	9005	2008
124	DANGEROUS OR EXPOSED PARTS OF MACHINERY	Bright Red Orange	2008	
STRUCTURAL ITEMS AND OTHERS				
125	PIPE RACK STRUCTURAL	Basalt Grey	7012	

126	CHEQUERED PLATE (BOTH FACES)	Jet Black	9005
127	GRATING	Jet Black	9005
128	LADDER RUNGS & RAILING VERTICAL POSTS	Jet Black	9005
129	HAND RAIL, MIDDLE RAIL, TOE PLATE	Signal Red	3001
130	LADDER VERITAL POSTS	Signal Red	3001
131	BUILDING STRUCTURAL, STEEL COLUMNS; BRACKETS, BEAMS, BRACINGS, ROOF TRUSSES, PURLING'S, SIDE GIRTS, LOUVERS, STRINGERS	Basalt Grey	7012
132	OVERHEAD MONORAIL	Signal Red	3001
133	MONORAIL STOPPER PLATES	Signal Red.	3001
134	COKE CUTTING SYSTEM	Signal Red.	3001
135	EOT / HOT CRANES	Lemon Yellow	1012
136	TRANSFORMERS, & BATTERY ROOM STRUCTURAL	Basalt Grey	7012

प्रेशर वेसल्स के सामान्य विनिर्देश

GENERAL SPECIFICATION FOR PRESSURE VESSELS

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
7	12.03.2024	REVISED AND REISSUED AS STD. SPEC.	PS	TKh	KA/NK	MN
6	28.08.2018	REVISED AND REISSUED AS STD. SPEC.	SK	TK	KJH	RKT
5	30.06.2010	REVISED AND REISSUED AS STD. SPEC.	KA	RKT	AKM/DM	N.DUARI
4	20.11.2009	REVISED & REISSUED AS STD. SPEC.	VB	RKG	AKM	N.DUARI
3	15.05.2000	REVISED AND REISSUED AS STD. SPECN.	RKT	AKM	CRMN	MI
2	15.12.1994	REVISED AND REISSUED AS STD. SPECN.	DD	AKM	VC	AS

Abbreviations:

AI	:	Authorized Inspector
ASME	:	American Society of Mechanical Engineers
DNV	:	Det Norske Veritas
IBR	:	Indian Boiler Regulations
ISO	:	International Organisation for Standardisation
NB	:	Nominal Bore
PESO	:	Petroleum & Explosives Safety Organisation
PWHT	:	Post Weld Heat Treatment

Static Equipment Standards Committee

Convenor: Mr. Nalin Kumar

Members:
Mr. K. Anjaneyulu (Co-Convener)
Mr. Tarun Kumar (Emp. No. A328)
Mr. Tarun Khurana (Coordinator)
Mr. P V S Satyanarayana
Mr. Anish Trehan
Mr. P Barik
Mr. Saikat Chakraborty
Mr. Piyush Suryavanshi
Mr. Mittal Kumar Patel
Mr. Srikanth Karanam
Mr. Aasheesh Handa (Projects)
Mr. Prabhakar Choudhary (SMMS)
Mr. Avdhesh Agarwal (SCM-Inspection)

CONTENTS

1.0 SCOPE 4

2.0 REFERENCES 4

3.0 DESIGN 5

4.0 FABRICATION 6

5.0 INSPECTION & TESTING 10

6.0 SUPPLY 12

7.0 GUARANTEE 13

8.0 SITE FABRICATION AND ERECTION 13

9.0 DATA FOLDER 14

1.0 SCOPE

1.1 This specification covers the general requirements for design, fabrication, workmanship, erection, inspection, testing and supply of unfired pressure vessels and is intended to supplement the minimum requirements of the applicable codes.

1.2 Supplementary specification indicating special or additional requirements shall form addenda to this specification and shall govern. Supplementary specification, when made addenda to this specification shall be referred to in the Material Requisition and / or Purchase Order. Following are the supplementary specifications:

a)	6-12-0002	Supplementary specification for carbon steel vessels.
b)	6-12-0003	Supplementary specification for low alloy steel vessels.
c)	6-12-0006	Supplementary specification for austenitic stainless steel vessels.
d)	6-12-0007	Supplementary specification for stainless steel clad vessels.
e)	6-12-0008	Supplementary specification for 3½ %Ni steel pressure vessels.

1.3 In case of conflict, the order of precedence shall be as follows:

a) Statutory Requirement
b) Engineering drawing
c) Specifications and standards
d) Codes

In general, the most stringent requirement out of the above shall govern. However, in such a case, vendor shall promptly refer the conflicts to client / EIL in writing to obtain client / EIL instruction before proceeding with manufacture. Decision of client / EIL shall be binding without any time and cost implication.

2.0 REFERENCES

2.1 Design Codes

The following codes in the edition and addenda referred to in the datasheet shall form the basis for design, fabrication, inspection, testing and acceptance of equipment:

(a) ASME Boiler and Pressure Vessel Code Section VIII Div. 1

(b) ASME Boiler and Pressure Vessel Code Section IX and Sec V.

(c) Indian Boiler Regulations- IBR (whenever applicable).

(d) The Static and Mobile Pressure Vessels (Unfired) Rules 2016 (whenever applicable).

2.2 Material Codes

Material to be used shall conform to:

(a) ASME Boiler and Pressure Vessel Code Sec. II.

(b) Indian Standard specification.

Other specifications of equivalent grade can be used only after written approval from EIL.

2.3 Regulations

National laws and regulations together with any local by-laws for the country or state wherever the vessels are to be used must be complied with by the fabricator.

3.0 DESIGN

3.1 Design Pressure

3.1.1 Design pressure specified shall be at the top of vertical vessel or at the highest point of horizontal vessel.

3.1.2 The design pressure at any lower point shall be determined by adding the maximum operating liquid head and any pressure gradient within the vessel.

3.2 Corrosion Allowance

3.2.1 Corrosion allowance shall be added to both sides of tray support rings and other fixed internal non-pressure parts.

3.2.2 Removable internal parts (with the exception of trays) which are bolted or clamped in place, shall be provided with extra thickness equal to half the specified corrosion allowance on each surface exposed to vessel contents.

3.2.3 Full corrosion allowance shall be added to the throat thickness necessary for strength or sealing in case of fillet and seal welds on internal attachments.

3.3 During fabrication or shop/site hydro-test conditions in horizontal position, the supports for shell shall be so provided that combined stresses in any shell component (based on corroded thickness for site test) do not exceed the following:

(a) Tensile : 90% of ambient yield

(b) Compressive: Code allowable stress

3.4 All conical reducers shall be designed as tori conical type with knuckle radius at each end as minimum 10% of the adjoining diameter, unless otherwise specified in requisition. 100% radiography shall be carried out for all weld seams of tori cone.

3.5 Statutory Approvals

3.5.1 For vessels coming under the purview of Indian Boiler Regulations, it shall be vendor's responsibility to get approval from IBR authorities pertaining to design, drawings, material of construction, fabrication, inspection and testing etc.

3.5.2 For vessels coming under the purview of Static and Mobile Pressure Vessel rules, it shall be vendor's responsibility to get approval from Petroleum & Explosives Safety Organization (PESO) pertaining to design, drawings, material of construction, fabrication, inspection and testing etc.

3.6 Internals

3.6.1 For support beams, allowable deflection shall be limited to L/325 where L is the length of the beam.

3.6.2 For plates, allowable deflection shall be limited to T/2 where T is the corroded thickness of plate.

3.6.3 Allowable stress at design temperature shall be as per applicable Code.

4.0 FABRICATION

4.1 Head/Dished Ends

4.1.1 Dished ends shall preferably be of seamless construction. However, dished ends with one chordal weld seam are acceptable. In such cases, the width of chordal plate shall not be less than one third of the blank diameter and chordal seam shall clear nozzle opening. Intermediate heat treatment, if considered necessary, shall be carried out by the fabricator.

4.1.2 Whenever a dished end is made of more than two plates, it must have a seamless crown plate. Whenever a nozzle or a manhole is positioned at the center of the dished end, the crown plate should be larger than the nozzle /manhole reinforcing pad.

4.1.3 Wherever hot forming and subsequent heat treatment is involved, adopted procedure shall not impair the mechanical properties of the material beyond the limits specified in respective material specification.

4.2 Nozzles, Manholes, Handholes and Attachments

4.2.1 Manhole cover shall be provided with a davit or hinge as per EIL standard and Handhole cover shall be provided with suitable lifting handles.

4.2.2 Inside edges of Manholes/Handholes shall be rounded off smooth with a minimum radius of 3mm.

4.2.3 All nozzles shall be set-in type, unless otherwise specified in requisition. Set on type nozzle for size 50 NB and below can be used with prior approval.

4.2.4 Reinforcing pads whenever required as per drawings or Code shall be of the same material or equivalent as the vessel component to which it is welded. All reinforcing pads shall be provided with two 1/8" (3 mm) NPT tapped holes located 180 apart for air soap solution test with a pressure of 1.25 kg/cm2 (g). This test shall also be required to be carried out for slip on flanges. Higher test pressures are not recommended because of accompanying risks and also because the soap bubbles have a chance to blow off. Tell-tale holes in the reinforcing pads shall be plugged with hard grease unless otherwise indicated after the hydro test of the vessel.

4.2.5 Wrapper plates, reinforcing pads, saddle plates or stiffeners of higher thickness than specified can be used provided there is no change in basic dimensions and with the approval from Inspection Agency. No separate deviation permit is required for the same.

4.3 Flanges

4.3.1 When tongue and groove or male and female faced flanges are used, groove or female face shall be in nozzle flange. However, when the nozzle is located in the bottom, the groove or female face shall be in the cover.

4.3.2 Dimensions of flanges shall be as per ASME B16.5 for sizes up to 600 mm NB (24" NB) and as per ASME B 16.47 series 'B' for sizes greater than 600 mm NB (24" NB).

4.4 Fasteners and Gaskets

4.4.1 All bolts/studs shall have ISO threading unless otherwise specified. Studs shall extend beyond nuts at least by 2 threads & studs shall be threaded to full length. Bolts/studs (to be tightened by hydraulic bolt tensioner) shall be longer than normal length by minimum 1 nut diameter.

Hydraulic bolt tensioner shall be used for following bolt sizes and conditions and shall be supplied by vendor unless otherwise specified in the Requisition:

Nominal Bolt Size	Conditions
All Sizes	When specified by Process Licensor/Project specifications
50 mm and Over	All flange joints
38 mm and to 50 mm	Class 600 and above
	Hydrogen service (Partial Pressure of Hydrogen > 7 Kg/cm2g)
	Design Temperature above 370oC
	Inlet, outlet and quench nozzle flanges of reactors/separators (#)
25 mm to 38 mm	Design Temperature above 370oC
	Inlet, outlet and quench nozzle flanges of reactors/separators (#)

Applicable only for Hydrocracker/DHDT/DHDS/VGO-HDT Reactors and Hot & Cold Separators.

4.4.2 All internal bolts shall be provided with double nuts.

4.4.3 Threads on external bolting shall be lubricated with graphite grease for working temperature up to 200°C and with Molybdenum Di-sulphide for higher temperature.

4.4.4 In addition to stamping of the specifications & manufacturer's symbol as specified in ASME material specifications, size shall be clearly punch marked on one of the ends of the stud. Similarly, the nuts shall have the size punch marked on one of the faces. In case of tapped hole the size shall be punch marked near the hole without disturbing the gasket seating area. Further for all alloy/SS metallurgy bolts & nuts shall also be identified by distinct color marking at the stud end/bolt side face.

4.4.5 Gaskets shall conform to ASME B16.20 and ASME B 16.21.

4.5 Internals and Externals

4.5.1 All removable internals shall pass through the manhole.

4.5.2 Internal baffles, tray support beams or other internals spanning a chord or diameter of the vessel shall be provided with means to allow differential thermal expansion between the part and the vessel shell.

4.5.3 Internal pressure piping shall be seamless and of same specification as the external connected piping. However internal non-pressure piping can be either seamless or welded type.

4.5.4 Internal flanges for pressure piping shall be forged flanges. However internal flanges for non-pressure piping can be fabricated from plate.

4.5.5 Tray/seal pan support rings, downcomer bolting bars and all internals, beam supports welded to the vessel shall be supplied and welded by vessel fabricator in accordance with the details furnished by EIL.

4.5.6 The internal baskets, mesh screens, support grid, distributor/mixing trays, distributor pipes, outlet collector etc. of equipment shall be fitted at shop unless otherwise specified in requisition. Equipment shall be transported along with internals fitted. Temporary wedges (if required) shall be provided for supporting the internals which shall be removed by mechanical contractor at site under vendor's supervision unless otherwise specified. Additionally, manway panels shall be provided for mesh screens, support grids, distributor/mixing trays etc. to ensure accessibility for future inspection, loading/unloading of catalyst/inert balls etc.

In case the internals are to be supplied loose as per requisition, the internal baskets, mesh screens, support grid, distributor/mixing trays, distributor pipes, outlet collector etc. of equipment shall be trial fitted,

then removed and crated for dispatch with vessel. These items should be tagged for field identification and installation.

4.5.7 All externals shall be supplied and welded by vessel fabricator in accordance with the details furnished by EIL.

4.5.8 Internal perforated plate inside the vessel shall be removable type unless specified otherwise and should be able to pass through nearest manhole.

4.5.9 Unless specified otherwise, Full support rings shall be provided below catalyst bed to support same.

4.6 Name Plate

Each vessel shall be supplied with EIL name plate and manufacturer name plate as per EIL Standards.

4.7 Welding

4.7.1 Flame cut edges shall be ground by the fabricator as required to remove slag, detrimental discoloration and non-uniformity of edges.

4.7.2 All pressure bearing butt welds shall be full penetration, double welded joints. When second side welding is not possible due to inaccessibility, single welded butt joints with root run by Tungsten Inert Gas Process (TIG) can be used to ensure full penetration. Backing strip can be used only after obtaining prior approval from EIL. For sub-zero temperatures, backing strips shall not be used.

4.7.3 Nozzles and Manways and their reinforcement pads shall be attached to vessel with full penetration welds.

4.7.4 Seams in supporting skirt shall be made with full penetration butt welds. Connections between skirt and vessel head shall be made with a smooth flat faced weld unless otherwise indicated in the engineering data sheet. Width of the weld at skirt end shall be equal to the skirt thickness and its height shall at least be twice its width.

4.7.5 All main weld seams shall be clear of nozzles, reinforcement pads, internals, tray support rings, cleats and stiffening rings by 50 mm minimum (weld edge to weld edge). In case the same is unavoidable following requirements shall apply:

a) Nozzles without reinforcing pad

i) Any weld seam having distance (weld edge to weld edge) to nozzles within 50 mm (but not fouling with weld seam) shall be fully radiographed and dye penetrant examined to a length equal to 100 mm on each side measured from nearest point to nozzle edge.

ii) Any weld seam fouling with nozzle opening shall be fully radiographed and dye penetrant examined to a length equal to 3 times of outside diameter of nozzle i.e. 1.5 times of outside diameter of nozzle on each side after installation of nozzles. Nozzle to vessel fillet weld shall be provided with smooth concave radius.

b) Nozzles with reinforcing pad

i) Any weld seam having distance (weld edge to weld edge) to reinforcing pad within 50 mm (but not fouling with weld seam) shall be fully radiographed and dye penetrant examined to a length equal to 100 mm on each side measured from nearest point to reinforcing pad edge.

ii) Any weld seam not fouling with nozzle opening but coming under reinforcement pad shall be ground flush, fully radiographed and dye penetrant examined to a length equal to portion of weld seam below reinforcement pad + 100 mm on each side.

iii) Any weld seam fouling with nozzle opening shall be ground flush, fully radiographed and dye penetrant examined to a length equal to higher of 3 times of outside diameter of nozzle i.e. 1.5 times of outside diameter of nozzle on each side or length equal to portion of weld seam below reinforcement pad + 100 mm on each side.

In case other attachments like internals, tray support rings, cleats etc. is fouling with weld seam, the weld seam portion coming under the attachment plus 100 mm length on each side shall be ground flush, fully radiographed and dye penetrant examined before welding of any such attachment.

4.7.6 Vendor shall submit welding procedure specification and qualification record to purchaser's inspector or authorized representative for approval as per ASME Boiler and Pressure Vessels Code Section IX.

Previously qualified welding Procedure Qualification Record (PQR) under EIL, CEIL, Lloyds, DNV, TUV and Bureau Veritas shall also be acceptable.

4.7.7 Welding consumables shall be as per ASME Boiler and Pressure Vessel Code Sec. II Part C and shall be indicated in fabrication drawings.

4.7.8 Welding shall not commence unless the concerned procedures are approved.

4.7.9 Only welders who are qualified in the accepted procedure shall be employed for welding.

4.7.10 All internal/external attachments (nozzles, cleats etc.) with fillet welds to the vessel pressure components in case of Hydrogen service, cyclic service and vessels with design temperature (-)29oC and lower, vessels with design temperature 370oC and higher for carbon steel and 425oC and higher for low alloy steel shall be ground smooth and generous concave contour shall be provided.

4.7.11 Minimum shell course width shall be 1 meter. Maximum no. of longitudinal seams shall be as follows:

(a)	vessels up to 2 meter diameter	:	1 seam
(b)	vessels from 2 meter up to 4 meter diameter	:	2 seam
(c)	vessels from 4 meter up to 6 meter diameter	:	3 seam
(d)	vessels beyond 6 meter diameter	:	seam nos. can be proportionately decided

4.8 Post Weld Heat Treatment

4.8.1 Vessels shall be post weld heat treated when specified on the engineering drawings. In no case shall the post weld heat treatment performed be less than that specified in the code.

4.8.2 Vessels shall be post weld heat treated as a complete unit including skirt/support, wherever practicable.

4.8.3 All flange faces shall be suitably protected against oxidation during post weld heat treatment.

4.9 Tolerances

4.9.1 Tolerances shall be as per drawing/standard/code.

4.9.2 For dimensions not provided with tolerances, fabricator shall maintain dimensions as per good engineering practice.

5.0 INSPECTION & TESTING

5.1 All vessels shall be offered for inspection to purchaser or his authorized inspector.

5.2 Inspectors shall have free access to all workshops of contractors or sub-contractors.

5.3 Inspection shall be carried out both during fabrication and before delivery and also for sub-ordered materials, if any. In addition to final inspection and certification by Inspector, Inspector's written approval shall be obtained by the manufacturer at all stages of fabrication including, but not limited to the following:

a) Raw material identification
b) Edge preparation for welding, including visual check for laminations.
c) Alignment of longitudinal seams.
d) Rolling tolerance on individual sections
e) Alignment of sections
f) Root pass clearing before welding.
g) Nozzle setting.
h) Dimensional check.
i) Radiographic / Ultrasonic Examination.
j) Dye penetrant examination/Magnetic particle examination.
k) Stress relieving.
l) Calibration records of measuring instruments.
m) Pressure Test (Hydrostatic/Pneumatic test).
n) Any other special test such as for leak, corrosion, hardness etc.
o) Surface preparation, primer and painting.

5.4 Radiography

5.4.1 The extent of radiography shall be as specified on the engineering drawings. In no case shall the radiographic examination be less than that specified in the code. However, spot radiography is the minimum requirement for all vessels.

5.4.2 When spot radiography is specified, the following requirements shall supplement the requirements specified in ASME Section VIII Division I:

Each category A or B pressure containing weld shall be spot radiographed in accordance with ASME Section-VIII Division-I, paragraph UW-52 as a minimum requirement. Each Spot radiograph shall be a minimum of six inches (150mm) in length and minimum one spot shall be selected in each circumferential & longitudinal seam. Additionally, at least one T-joint in each circumferential seam shall also be selected. Welds from each welding procedure, welded/welding operator shall be examined. DIA shall be consulted in marking the areas to be radiographed.

5.4.3 All nozzles fabricated from plate, irrespective of thickness of plate, shall be 100% radiographed. When Full radiography is specified due to Service requirement, 100% radiography shall be carried out of all butt welds including nozzle flange to nozzle neck, pipe to pipe and pipe to fitting.

5.4.4 Weld seams of formed ends shall be 100% radiographed after forming and heat treatment, if any.

5.4.5 The specified radiography of welds may be performed before or after post weld heat treatment (PWHT). If performed before PWHT, an additional radiography or alternatively, ultrasonic examination shall be performed after PWHT.

5.4.6 The technique employed and the weld quality achieved shall meet the requirement of the code.

5.4.7 If vendor intends to carry out radiography by Computed Radiography technique, then demo should be carried out under AI to prove vendor's capability to produce acceptable images meeting the Code requirements.

5.4.8 In case Supplier want to perform UT in lieu of RT based on Code para UW 51 (a) (4), the same is acceptable for Carbon Steel and Low Alloy Steel materials subject to the following:

a) The thickness of weld is greater than 13 mm.

b) The joint is either Category A or Category B joint except shell to hemispherical dished end joint. (Category of joint as defined by Code).

c) Automated recordable UT machine incorporating TOFD and pulse echo probes or TOFD and Phased Array mounted on the same chassis that automatically traverses along the joints to be inspected and displaying both results simultaneously on a single screen may be considered in lieu of RT.

d) Calibration block of similar material & thickness shall be used. Calibration block shall have suitable notches to simulate longitudinal as well as transverse cracks on outside and inside surface. Setup should be capable of detecting defects on outside as well as inside while scanning from one surface only.

e) The system that is proposed to be deployed in lieu of radiography shall be submitted along with the track record prior to use for EIL review. The Supplier shall demonstrate successfully the capability of AUT machine and the defects evaluation in the same screen during the site visit of EIL representative. Based on which, the approval of the parties and their AUT system shall be given.

f) Qualified NDT persons shall be deployed to perform UT.

g) Acceptance criteria shall be as per Code para UW 51.

5.5 All nozzle to shell welds (Root and Final run) shall be examined by magnetic particle/ Dye- penetrant examination.

5.6 Hydrostatic Test

5.6.1 All necessary precautions shall be taken to guard against the risk of brittle fracture during hydrostatic test in the shop and at site. The temperature of testing medium shall be as per Code. Prior to hydrostatic test, all weld spatter, weld stubs, scale, dirt etc. shall be removed from vessel.

5.6.2 Hydrostatic test shall be conducted at pressures mentioned in engineering drawings after complete fabrication and post weld heat treatment, as applicable. After hydrostatic testing, Equipment shall be completely dried by passing hot air for sufficient time until no further increase in relative humidity of outgoing air is observed. Alternatively vacuum drying of the equipment is also acceptable.

5.6.3 Clean potable water shall be used for hydrotest. Sea water shall not be used.

5.6.4 During hydrotest, care shall be taken to avoid local stresses in shell from exceeding 90 % of the yield strength of the material at the temporary saddle supports.

5.6.5 Vessels shall not be painted or coated either internally or externally prior to the hydrostatic pressure tested.

5.7 For all weld overlays used in hydrogen or H2S service with design temperature greater than 350oC, Hydrogen disbonding test shall be carried out. The test condition shall be representative of the actual design conditions and the procedure shall be submitted to Inspection Agency for approval. Rate of cooling shall be 100oC/hr (min.) unless specified otherwise in datasheets. Holding time shall be 48 hours unless specified otherwise in datasheets.

5.8 Vendor shall ensure that all alloy steel and stainless steel material are properly identified and finally check tested by a PMI analyzer before dispatch of equipment as per EIL Specification 6-81-0001.

6.0 SUPPLY

6.1 Surface Cleaning and Painting

6.1.1 Surface cleaning and painting shall be as per standard specification for shop and field painting (6-44-0004) or as per job specification as applicable. Paint system shall be selected as per the environments specified on engineering drawing.

6.1.2 All completed equipment shall be cleaned internally and externally to remove scale, dirt, sand, water and foreign matter.

6.1.3 All flanged faces and other machined surfaces shall be greased or protected with rust preventive coating.

6.1.4 Except for machined surfaces, all exterior surfaces of vessels and columns including skirts and integral supports shall be painted to prevent rust, corrosion or damage during transit and storage before erection and final painting.

6.2 Marking

In addition to General purchase conditions, the following requirements shall also be complied with:

6.2.1 All loose components such as studs, nuts, washers, gaskets etc. shall be packed in crates and shall be marked for the project, consignee, consigner, job number, item number, order number, gross and net weight, dimensions etc.

6.2.2 Additional indications such as North/East/South/West along with center of gravity shall be clearly marked with white paint.

6.2.3 Vessels which have been post weld heat treated or have an applied lining, e.g. lead, glass, rubber etc., shall have a suitable warning printed on the visible portion on the outside of vessel.

6.2.4 Specific marking with white paint for slinging shall be provided for all heavy lifts weighing 5 tons and above.

6.2.5 A copy of packing list shall accompany the material enclosed in a water tight envelope fastened inside a shell connection with an identifying arrow sign "Documents" applied with indelible paint.

6.2.6 If it is necessary to separate the unit into different parts for transportation all components and subassemblies shall be carefully identified and match marked to prevent any error in assembly.

6.3 Packing and Shipment

In addition to General Purchase Conditions, the following requirement shall also be complied with:

6.3.1 Packing

a) Vessels, unless provided with their own steel saddles for entire protection, shall be provided with suitable wooden/steel saddles with steel ties and tension rods. The minimum height of the saddle shall correspond to the maximum projected length of the connected attachments, plus an additional clearance of 45mm. Saddles spacing shall depend on the length of the equipment.

b) Equipment shall be provided with suitable type and adequate number of supports to prevent any deformation during transportation and handling. These supports shall not be removed until the equipment is placed in position at job site.

c) All connections/protrusions shall be suitably protected. Flanges shall be provided with bolts on metal covers (minimum 5 mm thk) using at least four bolts. (Wiring on covers is not acceptable). For ocean shipment, flanged openings shall be additionally covered with heavy plastic bags taped to nozzle. All tell-tale holes shall be plugged with hard grease before dispatch. Tapped orifices shall have threaded plugs.

d) Fragile or machined components shall be especially protected against nature during handling and transit.

e) Pre-fabricated sections shall be protected by temporary stiffeners at each non-supported end. Edges of plates for section to be welded shall also be protected.

6.3.2 Shipment

All dispatches of equipment shall be done in accordance with the relevant terms of the Purchase Order.

7.0 GUARANTEE

Unless otherwise specified in General Purchase conditions regarding guarantee, the following shall govern:

7.1 Manufacturer shall guarantee that all materials used in the equipment are new and have been submitted to regular acceptance procedure and are free from any defect regarding quality, form and appearance.

7.2 Vessel(s) shall be guaranteed for design, raw materials and workmanship for a duration as defined in General Purchase Conditions. When design has been carried out by EIL, the word design shall be excluded from the guarantee clause. The manufacturer shall be completely responsible for any design work carried out by him. EIL's approval of his design will not relieve him of his responsibility to ensure satisfactory performance of such item.

7.3 Approval of work by EIL or release of vessels for shipment shall in no way release or relieve the manufacturer of any responsibility for carrying out all provisions of this specification.

8.0 SITE FABRICATION AND ERECTION

8.1 Where size or shape of vessel makes it impossible to ship it in one piece, the fabricator shall ship number of shop fabricated sections as defined in requisition. Assembly and testing shall be completed by vessel fabricator at site in horizontal position (for erection by others) in strict accordance with the provisions of applicable order/specification.

8.2 Where size or shape of vessel makes it impossible to erect in single piece, the fabricator shall ship number of shop fabricated sections as defined in requisition. Erection, assembly and testing shall be completed by vessel fabricator at site in vertical position in strict accordance with the provisions of the applicable purchase order/specifications.

8.3 In either of the above two cases, the following additional requirements shall apply:

8.3.1 All pieces shall be shop fit up into sections and each section fit to the adjacent one by the fabricator and all pieces match marked thereafter.

8.3.2 Suitable erection lugs /tailing lugs and locating pins shall be provided by the fabricator to ensure proper fit up & handling of the equipment.

8.3.3 All radiographic requirements for welds completed in the shop shall be made by the fabricator before the part of section leaves the shop.

8.3.4 For equipment requiring PWHT, complete or local PWHT may be carried out at site.

8.4 All lifting lugs/trunnions and tailing lugs shall be designed with an impact factor of minimum 1.5 unless otherwise specified.

9.0 DATA FOLDER

Manufacturer shall complete requisite copies of data folder as required in purchase order. This folder shall contain the following information duly certified by Inspector:

a) Manufacturer's Code Certificate

b) Fabrication drawing of vessel showing 'As Built' dimensions and 'As Built' erection weight.

c) Material Test Certificates with their cast /heat and test numbers

d) Welding procedure qualification reports

e) Welder qualification reports

f) Radiographic results

g) Ultrasonic, Magnetic particle, Dye-penetrant test results (if applicable)

h) Hardness, corrosion and leak test records (if applicable)

i) Record charts showing complete heat treatment cycle (if applicable)

j) Production test coupon results (if applicable)

k) Charpy V notch test results (if applicable)

l) Record chart of pressure test (Hydrostatic and/or pneumatic)

m) Rubbing of name plate

n) Any other documentation as required in the purchase requisition/purchase order.

कार्बन स्टील वैसल्स के पूरक विनिर्देश

SUPPLEMENTARY SPECIFICATION FOR CARBON STEEL VESSELS

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
9	23.11.2023	REVISED AND REISSUED AS STD. SPEC.	PSV	TK	KA/NK	MN
8	26.06.2018	REAFFIRMED AND REISSUED AS STD. SPEC.	SK	TK	KJH	RKT
7	30.06.2010	REVISED AND REISSUED AS STD. SPEC.	KA	RKT	AKM/DM	N.DUARI
6	25.09.09	REVISED AND REISSUED AS STD. SPEC.	VB	RKG	AKM	N.DUARI
5	12.04.04	REVISED AND REISSUED AS STD. SPEC.	DNN	AKM	SSA	SKG

Abbreviations:

ASME	:	American Society of Mechanical Engineers
BHN	:	Brinell Hardness Number
HAZ	:	Heat Affected Zone
LWN	:	Long Weld Neck
NB	:	Nominal Bore
PWHT	:	Post Weld Heat Treatment
UTS	:	Ultimate Tensile Strength

Static Equipment Standards Committee

Convenor: Mr. Nalin Kumar

Members: Mr. K. Anjaneyulu
Mr. Tarun Kumar (Emp. No. A328)
Mr. Tarun Khurana (Coordinator)
Mr. Anish Trehan
Mr. P V S Satyanarayana
Mr. Saikat Chakraborty
Mr. Piyush Suryavanshi
Mr. Mittal Kumar Patel
Mr. Srikanth Karanam
Mr. Ayush Mathur (Project)
Mr. Prabhakar Choudhary (SMMS)
Mr. Avdhesh Agarwal (SCM- Inspection)

CONTENTS

1.0 SCOPE 4

2.0 DESIGN 4

3.0 ELECTRODES 4

4.0 FABRICATION 4

1.0 SCOPE

This supplementary specification indicating additional requirements for fusion welded carbon steel vessels shall form addenda to General Specification for Pressure Vessels (6-12-0001) in its latest revision.

2.0 DESIGN

Reinforcement for nozzle openings shall be self reinforced type for equipment where nominal thickness of shell/head exceeds 50 mm. Nozzles of size up to 50 NB LWN can be used in place of self reinforced nozzles.

3.0 ELECTRODES

3.1 Electrodes conforming to following specification shall be used. In case of any deviation, prior approval from EIL shall be obtained.

S. No.	Material to be welded		Electrode Specification
1.	General Structure Welding	:	ASME IIC SFA 5.1 E-6013
2.	Pressure Parts		
a.	Steels with UTS upto 70,000 psi	:	ASME IIC SFA 5.1 E7016/ E7018
b.	Steels with UTS upto 80,000 psi	:	ASME IIC SFA 5.5 E8016-X/ E8018-XX depending upon the alloy element.
c.	Low temperature service		
	Below 0°C and upto (-) 46°C Steels to SA-516 / 516M, SA-537 / 537M, SA-333 / 333M Gr. 6 and SA-350 / 350M LF2	:	ASME IIC SFA 5.1 E 7016-1/ E7018-1

3.2 All electrodes and fluxes shall be properly baked/dried as per manufacturer's recommendation before use.

3.2.1 All bare electrodes and fluxes shall be selected as per ASME IIC .All weld metal shall have equal or better mechanical properties than the parent metal.

3.2.2 Only dry flux shall be used.

4.0 FABRICATION

4.1 Plate Forming

4.1.1 Forming of shell plates and heads shall be carried out by machine, either hot or cold, in such a way so as to preserve the specified material properties and to produce a regular finish.

4.1.2 Magnetic particle/Dye penetrant examination shall be carried out on the outside and inside surfaces including edges of torispherical or elliptical heads in knuckle zone, after forming, for detection of cracks.

4.2 Edge Preparation

4.2.1 The preparation of edges to be welded shall be done by machining, chipping, grinding, cold shearing, Oxy- acetylene flame cutting or a combination of these.

4.2.2 Chipping shall be followed by grinding to a smooth and regular finish.

4.2.3 Oxy-acetylene flame cutting done in any circumstances, shall be followed by machining or grinding to eliminate any discolouration of material affected.

4.2.4 All welding edges shall be checked by Magnetic particle/Dye penetrant examination for detection of cracks, laminations or segregations.

4.2.5 No welding shall be carried out when ambient temperature is less than 10° Celsius unless preheating is carried out.

4.3 Heat Treatment

4.3.1 Heat treatment of formed parts shall be carried out as per following:

a. Cold formed dished ends or knuckles shall be stress relieved, unless otherwise specified in requisition.

b. Hot formed dished ends or similar parts, which have not been uniformly heated in the normalising range in the final stages of manufacture shall be normalised.

c. When the completed vessel involves post weld heat treatment, heat treatment recommended in (a) above shall not be applicable.

4.3.2 Vessels in Hydrogen/Amine/ Sour (Wet H_2S)/Cyclic/Caustic/HIC service shall be PWHT.

4.4 Production Weld Tests

Production Weld Tests shall be applicable for vessels over 50 mm nominal thickness. The following requirements shall apply:

a. Two production test plate coupons representative of one longitudinal and another circumferential seam shall be provided for each procedure, position and thickness in each vessel shell.

b. One production test plate representative of the weld seams shall be provided for each procedure, position and thickness for welded dished ends/cones.

c. The production test plate shall be from material of the same heat and thickness as of shell/head/cone as applicable. During and after welding, the test plates shall be subjected to same heat treatment as and together with the course they represent. Extra coupons shall be preserved to take care of eventuality of retests.

d. The tests mentioned below shall be carried out as per methods of testing in governing codes:

i. One transverse tension test

ii. Two side bend tests with weld located in the centre of bend.

iii. Hardness test on production test coupon weld & HAZ (Hardness limitations shall comply with requirement of EIL Spec. 6-15-0091)

iv. Micro & macro examination of welds

v. Charpy V notch tests on weld and HAZ.

a. For low temperature service (0°C & colder) impact test temperature shall be lowest of minimum ambient temperature, design temperature and minimum design metal temperature.

b. For vessel over 50 mm nominal thickness used for warmer service, the test temperature shall be lower of 0°C or lowest ambient temperature of the site.

c. The acceptance criteria for energy absorption shall be as per Table A 2.15 of SA-20 / 20M. In case the acceptance criteria is not available in SA-20, then applicable design code shall be referred unless otherwise specified in requisition.

4.5 Hardness Survey

Hardness Limitation for Vessels, where PWHT is required shall comply with requirement of EIL Spec. 6-15-0091.

ऑस्टेनिटिक स्टेनलैस स्टील वैसल्स के पूरक विनिर्देश

SUPPLEMENTARY SPECIFICATION FOR AUSTENITIC STAINLESS STEEL VESSELS

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
7	15.12.2023	REVISED AND REISSUED AS STD. SPEC.	MKP	TK	NK	MN
6	26.06.2018	REVISED AND REISSUED AS STD. SPEC.	SK	TK	KJH	RKT
5	30.06.2010	REVISED AND REISSUED AS STD. SPEC.	KA	RKT	AKM/DM	N.DUARI
4	25.09.09	REVISED AND REISSUED AS STD. SPEC	VB	RKG	AKM	N.DUARI
3	12.04.04	REVISED AND REISSUED AS STD. SPEC	DNN	AKM	SSA	SKG

Abbreviations:

AISI	American Iron and Steel Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials
AWS	American Welding Society
BHN	Brinell Hardness Number
HAZ	Heat Affected Zone
IGC	Inter Granular Corrosion
IS	Indian Standards
MIG	Metal Inert Gas
NB	Nominal Bore
TIG	Tungsten Inert Gas
PPM	Parts Per Million

Static Equipment Standards Committee

Convenor: Mr. Nalin Kumar

Members:

Mr. K.Anjaneyulu
Mr. Tarun Kumar (Emp. No. A328)
Mr. Tarun Khurana (Coordinator)
Mr. P V S Satyanarayana
Mr. Anish Trehan
Mr. Saikat Chakraborty
Mr. Piyush Suryavanshi
Mr. Mittal Kumar Patel
Mr. Srikanth Karanam
Mr. Ayush Mathur (Projects)
Mr. Prabhakar Chowdhary (SMMS)
Mr. Avdesh Agrawal (SCM-Inspection)

CONTENTS

1.0 SCOPE 4

2.0 DESIGN 4

3.0 MATERIALS 4

4.0 FABRICATION 4

5.0 HYDROTEST 6

1.0 SCOPE

This supplementary specification indicating additional requirements for fusion welded austenitic stainless steel vessels shall form addenda to General Specification for Pressure Vessels (6-12-0001) in it's latest revision.

2.0 DESIGN

Reinforcement for nozzle openings shall be self-reinforced type for equipment where nominal thickness of shell/head exceeds 50 mm. Nozzles of size up to 50 NB LWN can be used in place of self-reinforced nozzles.

3.0 MATERIALS

3.1 Austenitic stainless steel plates for shell, head and other pressure parts shall be as specified in, but not limited to, the following: SA 240 Type 304, 304L, 321, 347, 316, 316L, 316Ti and 317.

3.2 Nozzle neck shall be seamless pipe in accordance with SA 312 or SA 376. However, nozzle neck above 100 mm NB size may be fabricated out of plate.

3.3 Stiffening rings, external lugs for platforms, ladders, insulation supports, pipe supports and other non-pressure parts welded to the vessel directly shall be of same material as of shell.

3.4 Insulation support ring angles and rods not welded to the shell shall be of SA 36/ IS 2062 Gr. E250 Quality A or better.

3.5 All internal parts shall be of same material as of shell.

3.6 Gaskets

For ring type joints, metal oval rings of A 182F type SS grade having hardness minimum 15 BHN less than that of flange face shall be used.

3.7 Unless otherwise specified in Material Requisition/Engineering drawing all 300 series materials shall be intergranular corrosion (IGC) tested as per ASTM A 262 Practice E. The bend test specimen shall be examined at a magnification of 200 x.

4.0 FABRICATION

4.1 Plate Forming

4.1.1 Forming of shell plates, heads and knuckles shall be carried out by machine, either hot or cold, in such a way so as to preserve the specified material properties and to produce a regular finish. If hot forming is carried out, subsequent solution annealing is required. Subsequently, micro etching test and IGC test as per ASTM A 262 Practice E unless specified otherwise in engineering drawing shall be carried out to ascertain suitability and effectiveness of solution annealing. The bend test specimen shall be examined at a magnification of 200 x.

4.1.2 Cold formed ends and knuckles shall be solution annealed if any of the following condition exists:

i) Specifically called for on Engineering Drawing.

ii) Hardness value after forming exceeds 235 BHN

iii) Nominal thickness of the plate is 16mm or above.

4.1.3 If austenitic stainless steel is to be hot worked, it shall be heated in a neutral or an oxidising atmosphere in an oil, gas or electric furnace and shall not be allowed to come in direct contact with the flame.

4.1.4 Fit-up clips should invariably be attached only on outside portion of the equipment using approved procedures for such welding. Where clips are attached internally, these shall match the shell material. Any external attachment welded directly to shell shall match the shell material.

4.2 Plate Cutting and Edge Preparation

4.2.1 The permitted thermal cutting processes shall be plasma arc or oxy-gas flux injection in which flux is injected through oxygen cutting jet. The flux may be iron powder, Sodium Carbonate or powdered marble. Oxy-acetylene arc cutting by metal electrode shall not be permitted.

4.2.2 When thermal cutting is used, a machining or grinding allowance of 1.5 to 3.0 mm shall be provided to allow for removal of heat affected material.

4.2.3 All plate edges shall be checked by Dye Penetrant examination for detection of cracks, laminations or segregations after cutting and before carrying out further work upon them. Sheared edges shall be carefully examined for cracks.

4.3 Welding

4.3.1 As far as practicable, the welds shall be left unground so as to maintain maximum corrosion resistant surface but shall be cleaned free of weld slag, heat tint, scale and other such contaminants.

4.3.2 All welding shall be done by a metal arc process such as Manual metallic arc, Argon-arc or submerged arc welding.

4.3.3 For single side weld, root-run shall be made by TIG or MIG process and shall have inert gas shielding at the back of the weld.

4.3.4 The table below shows the acceptable consumables to be used for various base metals. Covered welding electrodes shall be in accordance with the specification AWS A5.4/ASME IIC SFA-5.4. Welding rods and bare electrodes used as filler metal shall be in accordance with the specification AWS A5.9/ASME IIC SFA-5.9.

Stainless Steels	Electrodes
Type AISI 304	E - 308
Type AISI 304L	E - 308L
Type AISI 304H	E - 308H
Type AISI 321 and 347	E - 347
Type AISI 316	E - 316L or E - 318
Type AISI 316L	E - 316L
Type AISI 316Ti	E - 318
Carbon Steel to Austenitic Stainless Steel	E - 309/ 309 Mo

4.3.5 Unless otherwise specified in Material Requisition/Engineering drawing, all consumables shall be procured with intergranular corrosion (IGC) tested as per ASTM A 262 Practice E. This shall be explicitly indicated in consumable batch test certificate.

4.4 Pre and Post Weld Heat Treatment

4.4.1 For austenitic stainless steel, no preheat would be necessary but care shall be taken to maintain inter pass temperature of 100°C.

4.4.2 Whenever heat treatment on stainless steel is carried out, it shall be followed by Micro etching test and IGC test as per ASTM A 262 Practice E, unless specified otherwise, to ascertain suitability and effectiveness of solution annealing. The bend test specimen shall be examined at a magnification of 200 x.

4.5 Non-Destructive Test

4.5.1 All cold formed dished ends, cones, tori conical sections etc. shall be checked for surface cracks by dye penetrant method after heat treatment, if any, on the inside and outside.

4.5.2 Dye-penetrant examination shall be carried out for weld root, back chip and final run for detection of cracks.

4.5.3 Unless otherwise specified in Material Requisition/Engineering drawing, IGC test shall be carried out at HAZ and weld as per ASTM A 262 Practice E unless specified otherwise. The bend test specimen shall be examined at a magnification of 200 x.

4.6 Surface Cleaning

4.6.1 In order to obtain adequate corrosion resistance, the surface of stainless steel (both inside and outside) must be cleaned of oxides, scale and welding flux. This shall be done using stainless steel wire brushes.

4.6.2 All paint shall be removed from the vessel surface using suitable solvent and stainless steel brushes. The solvent shall not be harmful to the vessel and free from chlorides and fluorides.

4.6.3 All oil and grease shall be removed using hot clean water and suitable detergent. All traces of detergent shall be removed with several rinses of clean water.

4.6.4 After completion of fabrication and testing, all stainless steel surfaces (both inside and outside) shall be pickled and passivated in accordance with ASTM A 380. The pickling and passivation procedure shall be submitted to EIL for approval.

5.0 HYDROTEST

5.1 Clean fresh water shall be the primary hydrostatic test medium unless use of a different medium is approved by the purchaser. Hydrostatic testing of austenitic stainless steel vessels shall be done with potable quality water having chloride content less than 50 PPM.

5.2 If chloride content is greater than 50 PPM and up to a maximum of 150 PPM, a sufficient quantity of Sodium Nitrate shall be added to provide a test medium of 0.5% by weight Sodium Nitrate Solution. Water with a chloride content of greater than 150 PPM shall not be used for hydrotesting.

After hydrotesting, vessels shall be dried thoroughly using hot air, immediately after draining to prevent the possibility of evaporation and concentration of chlorides.

बायलर क्वालिटी कार्बन स्टील प्लेटों का मानक विनिर्देश

STANDARD SPECIFICATION FOR BOILER QUALITY CARBON STEEL PLATES

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
9	08.02.2022	REVISED AND REISSUED AS STD. SPEC.	VK	KA	NK	SM
8	19.01.2017	REVISED & REISSUED AS STD. SPEC.	RNK	SK/KJH	RKT	RN
7	30.06.2010	REVISED & REISSUED AS STD. SPEC.	KA	RKT	AKM/DM	N.DUARI
6	10.09.09	REVISED & REISSUED AS STD. SPEC.	VB	RKG	AKM	N.DUARI
5	16.04.04	REVISED & REISSUED AS STD. SPEC.	DNN	AKM	SSA	SKG

Abbreviations:

ASME	American Society of Mechanical Engineers
EN	European Norm
HIC	Hydrogen Induced Cracking
IBR	Indian Boiler Regulations
SSC	Sulphide Stress Cracking

STANDARDS COMMITTEE

SMED-I (Static Equipment) (Group code 12,13,15,26)

Mr. Nalin Kumar (Convener)
Mr. K. Anjaneyulu
Mr. Tarun Kumar (Emp no. A328) {Coordinator}
Mr. Anish Trehan
Mr. PVS Satyanarayana
Mr. Tarun Khurana
Mr. Saikat Chakraborty
Mr. Srikanth Karanam
Mr. Ayush Mathur (Projects)
Mr. S Ghosal (SMMS)
Mr. Avdhesh Agrawal (SCM)

CONTENTS

1.0	SCOPE	4
2.0	GENERAL	4
3.0	SUPPLEMENTARY TECHNICAL REQUIREMENTS	4
4.0	CERTIFIED DOCUMENTS	6
5 .0	PAINTING AND COATING	6
6.0	INSPECTION AUTHORITY	7

1.0 SCOPE

1.1 This specification covers requirements for carbon steel plates intended primarily for pressure vessels/heat exchangers. The steel plates shall meet the requirements of ASME Boiler and Pressure Vessel Code Section II (latest). This is intended to supplement the minimum applicable requirements of the material specification indicated in the material requisition.

1.2 Following codes, standards etc shall be followed in their latest edition and addenda, errata, amendments unless specified otherwise:

1.2.1 ASME Sec VIII Div 1

1.2.2 ASME Sec II part A

1.2.3 EN 10163: Delivery Requirements for Surface Conditions.

1.2.4 EN 10204: metallic products – Types of Inspection Documents.

2.0 GENERAL

2.1 Plates supplied to this specification shall conform to specification SA-20 of ASME sec II part A with additional requirements mentioned herein.

2.2 The tolerance on thickness of steel plates shall be positive only.

2.3 Final Rolling shall be lengthwise.

2.4 The plates shall be free from injurious defects and shall have workmanlike finish. Reconditioning/repair of plates by welding shall not be permitted. Surface conditions shall meet requirements of EN 10163 Class A Subclass 3.

3.0 SUPPLEMENTARY TECHNICAL REQUIREMENTS

3.1 All plates shall be supplied in normalised condition except when the applicable material specifications require supply of plates in quenched and tempered condition.

3.2 a. One product analysis of each heat shall be carried out and reported. Chemical analysis shall be as per applicable specification.

b. The carbon content for plates shall not exceed 0.23%.

Additionally, one of the following requirements for carbon equivalent based on heat analysis, shall be also satisfied:

$$Ceq = C + \frac{Mn}{6} \leq 0.42 \quad \text{.....} \quad \text{(Eqn. - 1)}$$

$$Ceq = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Cu+Ni}{15} \leq 0.43 \quad \text{.....} \quad \text{(Eqn. - 2)}$$

Equation-1 shall be used when applicable material specification specifies C and Mn only.

Equation-2 shall be used when applicable material specifies the above elements or restricted chemical requirements are specified or supplementary requirements S19 and S21 of SA-20 are specified in material requisition.

For HIC services, these requirements shall be as listed separately.

3.3 Ultrasonic Examination of Plates

a. Plates having thickness 16 mm to 50 mm (both inclusive) shall be examined ultrasonically as per SA-435.

b. For thicknesses above 50mm ultrasonic examination shall be carried out as per SA-578 and shall have acceptance standard of level-B.

c. For quenched and tempered steel plates, ultrasonic examination shall be done after the heat treatment of plates.

3.4 Simulated Heat Treatment of Test Coupons

The following heat treatment shall be conducted on the test coupons representative of heat treated plates before the specified mechanical testing like tensile, bend, impact tests, etc. to meet minimum ASME Sec. II Part - A requirements and these details shall also be recorded on the test certificates.

a. All plates supplied in Normalised condition and intended for hot rolling / hot forming:

Heat Treatment Cycle

One normalising* + One stress relieving as per UCS-56 of ASME Sec. VIII Div.1 complying with UCS-85 of ASME Section VIII Div. 1.

Note: Any other special requirement shall be specified in MR.

b. All plates supplied in Quenched & Tempered condition and intended for hot rolling/ hot forming:

Heat Treatment Cycle

One normalising* + quenched & tempering + One stress relieving as per UCS-56 ASME Section VIII Div.1 complying with UCS-85 of ASME Section VIII Div.1.

Note : Tempering temperature shall be at least 20° C above highest stress relieving temperature.

* Normalising cycle shall be as per Material Test Certificate (MTC).

c. All plates supplied in Quenched & Tempered condition and intended for cold forming:

Heat Treatment Cycle

One stress relieving as per UCS-56 ASME Section VIII Div.1 complying with UCS-85 of ASME Section VIII Div.1.

3.5 Impact test requirements shall be ascertained as per ASME Sec VIII Div.1 or Div.2 as applicable. When required, Impact testing shall be performed as per supplementary requirement of S5 of specification SA-20 and acceptance criteria for energy absorption shall be as per table A2.15 of SA-20.

3.6 If specified in the material requisition, plates shall meet the requirements of Indian Boiler Regulations (IBR).

3.7 Additional Requirements for High Thickness Plates

Plates above 50mm thickness shall meet following additional requirements:

a. Vacuum Degassing treatment as per the supplementary requirement S1 of specification SA-20. If vacuum degassing is not reported in the test certificates, then through thickness tests as per SA 770 shall be conducted and minimum reduction in area of 35% shall be ensured.

b. Charpy V-notch impact test as per the supplementary requirement S5 of specification SA-20.

Material meant to be used for design temperature warmer than 0°C, impact test shall be carried out at 0°C or MDMT whichever is lower and acceptance criteria for energy absorption shall be as per Table A2.15 of SA-20. Incase the acceptance criteria is not available in SA-20, then applicable design code shall be referred unless otherwise specified in material requisition.

c. Simulated heat treatment of test coupons for all plates as per Clause 3.4 mentioned above.

4.0 CERTIFIED DOCUMENTS

The supplier shall furnish certificates/documents (number of copies as specified in requisition) inclusive of all the following tests required as per specification duly certified by the Inspecting Authority before shipment of plates. The actual values obtained shall be recorded in the test certificates/documents. Material certificates shall conform to EN 10204 Type 3.1/3.2 as specified.

a. Chemical Analysis

b. Mechanical Tests

c. Data of heat treatment i.e. initial temperature, heating rate, soaking temperature, cooling rate, etc.

d. Simulated Heat Treatment of Mechanical Test coupons (S3 of SA-20) at indicated Heat Treatment Cycle (if specified in the requisition or whenever applicable)

e. Ultrasonic Examination (S8 or S12 of SA-20)

f. Charpy V-notch impact tests (S5 of SA-20 if specified in the requisition or whenever applicable)

g. Certification as per IBR (if specified in the requisition)

h. SSC and/or HIC tests (if specified in material requisition)

i Additional tests (if specified in requisition).

5.0 PAINTING AND COATING

No painting/coating of any kind is permitted on the steel plates, except stencil marking. However steel plates shall be carefully protected and packed against any damage during transit and shall be of sea worthy condition.

6.0 INSPECTION AUTHORITY

Material test certificates, duly certified by Mill's Quality Assurance Department are acceptable i.e. 3.1 certification as per EN 10204. However, if third party inspection is required specifically for plates in material requisition, all test certificates and documents shall be duly certified by the third party. i.e. 3.2 certification as per EN 10204.

भंडारण टैंक एवं वैसल के लिये वेल्डिंग योग्य स्ट्रक्चरल क्वालिटी स्टील प्लेटों का मानक विनिर्देश

STANDARD SPECIFICATION FOR WELDABLE STRUCTURAL QUALITY STEEL PLATES FOR STORAGE TANKS AND VESSELS

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
7	27.03.2023	REVISED AND REISSUED AS STD. SPEC.	NSK 27/03/23	TK 27/03/23	NK	SM
6	22.09.2017	REVISED AND REISSUED AS STD. SPEC.	SK	KJH	RKT	RN
5	30.06.2010	REVISED AND REISSUED AS STD. SPEC.	KA	RKT	AKM/DM	N.DUARI
4	15.09.09	REVISED & REISSUED AS STD. SPEC.	VB	RKG	AKM,	N.DUARI
3	08.04.04	REVISED & REISSUED AS STD. SPEC.	DNN	AKM	SSA	SKG

Abbreviations:

EN	:	European Norm
IS	:	Indian Standard

Static Equipment Standards Committee

Convenor : Mr. Nalin Kumar

Members :

Mr. K. Anjaneyulu
Mr. Tarun Kumar (Emp. No. A328)
Mr. Tarun Khurana (Coordinator)
Mr. Anish Trehan
Mr. P V Satyanarayana
Mr. Saikat Chakraborty
Mr. Piyush Suryavanshi
Mr. Mittal Kumar Patel
Mr. Srikanth Karnam
Mr. Ayush Mathur (Project)
Mr. Prabhakar Choudhary (SMMS)
Mr. Avdhesh Agarwal (SCM-Inspection)

CONTENTS

1.0 SCOPE 4

2.0 GENERAL 4

3.0 SUPPLEMENTARY TECHNICAL REQUIREMENTS 4

4.0 CERTIFIED DOCUMENTS 4

5.0 PAINTING AND COATING 5

6.0 INSPECTION AUTHORITY 5

1.0 SCOPE

1.1 This specification covers additional and supplementary requirements for weldable structural quality Steel Plates to IS: 2062 (latest), intended primarily for storage tanks and vessels.

1.2 Following Codes, standards etc. shall be followed in their latest edition and addenda, errata, amendments unless specified otherwise:

1.3 IS:2062, IS:1852, IS:10842 (All Parts)

1.4 EN 10163 (All Parts): Delivery for Surface Condition.

1.5 EN 10204: Metallic products – Types of Inspection Documents.

2.0 GENERAL

2.1 The maximum under tolerance permissible on the thickness of plate shall be 0.25 mm. Tolerances on other dimensions of plates shall be as per IS: 1852.

2.2 Direction of final rolling shall be lengthwise.

2.3 Reconditioning/Repair of plates by welding shall not be permitted. Surface finish shall be ground/flush smooth and shall be free from any surface imperfection.

3.0 SUPPLEMENTARY TECHNICAL REQUIREMENTS

3.1 Heat analysis and product analysis shall be carried out for each heat and chemical composition shall meet the limits as specified in IS: 2062.

3.2 Y-groove weld crackability test as per IS: 10842 shall be carried out for plates conforming to Gr. E250 C having thickness 12mm and above.

3.3 Charpy impact test shall be carried out on the plates having thickness greater than 12 mm conforming to Grade E250 BR, E250 B0 & E250 C. Test temperature and acceptance criteria for energy absorption shall be as mentioned in Table-2 of the specification IS: 2062.
For Thickness less than 12 mm (for materials E250 Gr.B0 & E250 Gr.C), if required, the minimum impact energy values of reduced sizes shall be as per Fig. 2 of the specification IS: 2062.

4.0 CERTIFIED DOCUMENTS

The supplier shall furnish certificates/documents (number of copies as specified in requisition) inclusive of all the following tests required as per specification, duly certified by the Inspecting Authority before shipment of plates. The actual values obtained during tests shall be recorded in the test certificates/documents. Material certificates shall conform to EN 10204 Type 3.1/3.2 as required.

a. Chemical Analysis
b. Mechanical Tests
c. Data of heat treatment
d. Charpy V-notch impact tests
e. Y- groove crackability test

5.0 PAINTING AND COATING

No painting/coating of any kind is permitted on the steel plates except stencil marking. However steel plates shall be carefully protected and packed against any damage during transit and shall be of sea worthy conditions.

6.0 INSPECTION AUTHORITY

Material test certificates, duly certified by Mill's Quality Assurance Department are acceptable i.e. 3.1 certification as per EN 10204. However, if third party inspection is required specially for plates in requisition, all test certificates and documents shall be duly certified by the third party. i.e. 3.2 certification as per EN 10204.

स्टेनलैस स्टील प्लेटों का मानक विनिर्देश

STANDARD SPECIFICATION FOR STAINLESS STEEL PLATES

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
9	29.05.2023	REVISED AND REISSUED AS STD. SPEC.	NSK	TK	NK	SM
8	22.09.2017	REVISED AND REISSUED AS STD. SPEC.	RNK	SK/KJH	RKT	RN
7	30.06.2010	REVISED AND REISSUED AS STD. SPEC.	KA	RKT	AKM/DM	N.DUARI
6	25.09.09	REVISED AND REISSED AS STD. SPEC	VB	RKG	AKM	N.DUARI
5	16.04.04	REVISED AND REISSED AS STD. SPEC	DNN	AKM	SSA	SKG

Abbreviations:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials
EN	European Standard
BHN	Brinell Hardness Number
SS	Stainless Steel

Static Equipment Standards Committee

Convenor : Mr. Nalin Kumar
Members :

Mr. K.Anjaneyulu
Mr. Tarun Kumar
Mr. Tarun Khurana (Coordinator)
Mr. Anish Trehan
Mr. P V Satyanarayana
Mr. Saikat Chakraborty
Mr. Piyush Suryavanshi
Mr. Mittal Patel
Mr. Srikanth Karanam
Mr. Ayush Mathur (Projects)
Mr. Prabhakar Chowdhary (SMMS)
Mr. Avdhesh Agrawal (SCM-Inspection)

CONTENTS

1.0 SCOPE 4

2.0 GENERAL 4

3.0 SUPPLEMENTARY TECHNICAL REQUIREMENTS 4

4.0 CERTIFIED DOCUMENTS 5

5.0 PAINTING AND COATING 5

6.0 INSPECTION AUTHORITY 5

1.0 SCOPE

1.1 This specification covers requirements for chromium, chromium-nickel and chromium-manganese-nickel stainless and heat resisting steel plates intended primarily for pressure vessels/heat exchangers. The steel plates shall meet the requirements of ASME Boiler and Pressure Vessel Code Section II (latest). This is intended to supplement the minimum applicable requirements of the material specification indicated in the material requisition.

1.2 Following codes, standards etc. shall be followed in their latest edition and addenda, errata, amendments unless specified otherwise:

1.2.1 ASME Sec II Part A.

1.2.2 EN10163 (All parts): Delivery Requirements for Surface Conditions.

1.2.3 EN 10204: Metallic products- Types of Inspection Documents.

2.0 GENERAL

2.1 Plates supplied to this specification shall conform to specification SA-480 with additional requirements mentioned herein.

2.2 Adequate tolerance shall be considered on Plate length and width for shear and plasma cutting. The tolerance on thickness of plates shall be positive only.

2.3 Final Rolling shall be lengthwise.

2.4 Plates shall have no. 1 finish on both sides with reference to SA-480. Cold Rolled plates, if permitted by Requisition, shall have no. 2B finish. Repair/reconditioning of plates shall not be permitted.

3.0 SUPPLEMENTARY TECHNICAL REQUIREMENTS

3.1 All plates shall be supplied in hot-rolled, fully annealed and pickled condition. All stabilized grades of Stainless Steel (SS 321, SS 347etc.) shall be given stabilization heat treatment in addition to solution annealing. The soaking temperatures for stabilization heat treatment shall be 915°C ± 10°C and soaking period shall be minimum of 4 hours (2 hours for thickness $\leq$ 3.5mm).

3.2 Unless specified otherwise in material requisition, plate representative of each heat shall be subjected to intergranular corrosion tests as per ASTM A-262 Practice E for all the 300 series materials. The bend test specimen shall be examined at a magnification of 200 x; and bent specimen shall be free of any cracks or grain dropping.

3.3 For straight chrome (13% Cr) material, maximum carbon content shall not exceed 0.06%. Hardness of UNS no.S41000, S41008 and S40500 shall be less than 241 BHN unless otherwise specified in the ASME BPV Section II, material specification.

3.4 a. Plate having thickness 16 mm to 50 mm (both inclusive) shall be examined ultrasonically as per SA-435.

b. For thickness above 50mm ultrasonic examination shall be carried out as per SA-578 and shall have acceptance standard of level-B.

3.5 All mandatory tests as per material specification shall be carried out. However tension test specimen shall be from finished material and shall be selected in transverse direction.

4.0 CERTIFIED DOCUMENTS

The supplier shall furnish certificates/documents (number of copies as specified in requisition) inclusive of all the following tests required as per specification duly certified by the Inspecting Authority before shipment of plates. The actual values obtained shall be recorded in the test certificates/documents. Material certificates shall conform to EN 10204 Type3.1/3.2 as required.

a. Chemical Analysis

b. Mechanical Tests

c. Data of heat treatment i.e. initial temperature, heating rate, soaking temperature, cooling rate, etc.

d. Ultrasonic Examination

e. Intergranular corrosion test for 300 series

f. Intergranular corrosion test for series other than 300 (whenever specified in the requisition)

g. Type of finish for plate surfaces

5.0 PAINTING AND COATING

Plates are not to be painted/coated but shall be covered with plastic foils or paper or by other means for careful protection and shall be packed against any damage during transit and sea-weather conditions.

6.0 INSPECTION AUTHORITY

Material test certificates, duly certified by Mill's Quality Assurance Department are acceptable i.e. 3.1 certification as per EN 10204. However, as specified, if third party inspection is required specifically for plates, all test certificates and documents shall be duly certified by the third party. i.e. 3.2 certification as per EN 10204.

ट्रे एवं टावर इन्टरनल की पैकिंग, अंकन एवं प्रेषण के लिये विनिर्देश

PACKING, MARKING AND SHIPPING SPECIFICATIONS FOR TRAYS AND TOWER INTERNALS

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
5	10.07.20	REVISED AND REISSUED AS STANDARD SPECIFICATION	PG	AK	KA	SKS
4	12.09.14	REVISED AND REISSUED AS STANDARD SPECIFICATION	DSG	IK/ SKM	AP	SC
3	16.11.09	REAFFIRMED AND REISSUED AS STANDARD SPECIFICATION	PG	SKM/HCN	AKG	ND
2	21.07.04	REAFFIRMED AND REISSUED AS STANDARD SPECIFICATION	PB	SKM/HCN	RKA	SKG

Abbreviations:

SME	Static & Machinery Equipment
SCM	Supply Chain Management

SME Standards Committee

Convenor: Mr. K Anjaneyulu

Members:
Mr. Sanjay Mazumdar
Mr. Arun Kumar
Mr. Inder Kumar
Mr. Tarun Kumar
Mr. Anish Trehan
Mr. Srikanth Karanam
Mr. Neeraj Agarwal (Projects)
Mr. S Ghosal (Process)
Mr. T Kamalakannan (SCM)

CONTENTS

1.0	INTENT	4
2.0	PACKING	4
3.0	MARKING	5
4.0	SHIPMENT	5
	SKETCHES	6

1.0 INTENT

This specification defines the minimum requirements for packing, marking and shipping of Trays, Tower Internals, Tower Packing and other associated components so as to ensure the damage free transportation. This specification shall not be construed as final and shall not relieve the vendor of their responsibility of adequate packing of the same for damage free transportation depending upon the mode of transportation to be adopted finally.

2.0 PACKING

2.1 Trays, Tower Internals and Tower Packing for different columns shall not be mixed in one box and shall be packed (item wise) separately for each column.

2.2 Unless otherwise in the Engineering drawings, the internals and its associated components shall not be painted.

2.3 All carbon steel components are to be protected against rusting with two coats of rust preventive coating such as Castrol Rustilo DWX 32 and all the stainless steel components are to be cleaned free from foreign materials and shall be supplied duly pickled and passivated.

2.4 All components shall be provided with match and identification marks and also bear the column number. All identical components shall have the same markings which shall strictly correspond with numbers given on fabrication drawings. Markings shall be done with indelible paint or ink which does not contain any metallic pigments.

2.5 All Internal components shall be properly packed, crated and boxed in a manner such as to protect all parts from damage or loss during transit. It will be Internals Supplier's responsibility to pack and ensure damage free transit for the mode of transportation finally adopted and adequate for storage at site for a minimum period of 6 months. Trays & Tower Internals shall be wrapped in polythene and supplied in wooden cases, as per either EIL Standard specification or Vendor's proven Standard (In case, Installation of internals is in Vendor's Scope otherwise follow EIL standard specification). Vendor may use Euro Bags or equivalent for Random Packings (if installation by same agency otherwise follow EIL standard specification). Maximum weight of each case shall preferably be limited to 250 kgs.

2.6 Nuts, Bolts, Studs, Clips, Washers, Clamps, Gaskets, Pipes etc.

All supplementary materials like nuts, bolts, clips, washers, clamps, gaskets, pipes and other components required for internals assembly shall be placed in separate boxes item wise. Nuts, bolts, clamps, washers etc. for individual item shall be packed in separate containers and due care shall be taken to ensure that different types as well as sizes of bolting, clamps etc. are not allowed to get intermixed. Separate packages for different types of bolts, nuts, clamps, washers etc. for identical components for each column should be made out and then encased in a bigger container which shall be properly marked with the description of materials packed and the column number etc. as directed in 3.1 below. The quantity and description of materials packed shall also be displayed on the smaller packages enclosed in these boxes. All Constructional Spares shall be packed in separate containers. The packing for individual components would be done in the same manner as required for supplementary materials and the box shall be marked with "MANDATORY SPARES"/"OPERATIONAL SPARES" in addition to other particulars as per 3.1 below. All Mandatory Spares shall be packed separately and shall not be mixed with Constructional Spares.

2.7 Packing Cases

Packing Cases can be constructed as per following general guidelines and drawing attached with this specification. However, vendor may adopt his own practices if same is equivalent or better, to ensure damage free transportation.

(a) Crates and boxes over 500 mm long shall be reinforced with a minimum of two steel straps or hoop spaced in 500 mm centers maximum. When the container weight exceeds 250 kg, skids shall be bolted to the container frame.

(b) Sheathed crates and boxes containing a net weight over 200 kg and all open sided crates shall have diagonal bracing in all faces.

(c) Flat boxes (containers with two dimension that are four times the third) shall have diagonal bracing on the two large faces and shall have the four steel straps secured with nails or screws when the contained weight is over 200 kg.

2.8 Extra precaution shall be taken while packing the Trays, Packings and internals for overseas jobs. Seaworthy packing must be ensured for overseas jobs to further reinforce and withstand the harsh conditions of maritime transport and extreme stresses.

3.0 MARKING

3.1 Cases and crates containing tray materials shall be marked at least on 3 sides; for the project, consignees, consignors, Job No., Order No., Gross & Net Weights, dimensions, description and quantity of materials etc. Column No. must appear on all the packing cases/boxes in bold letters.

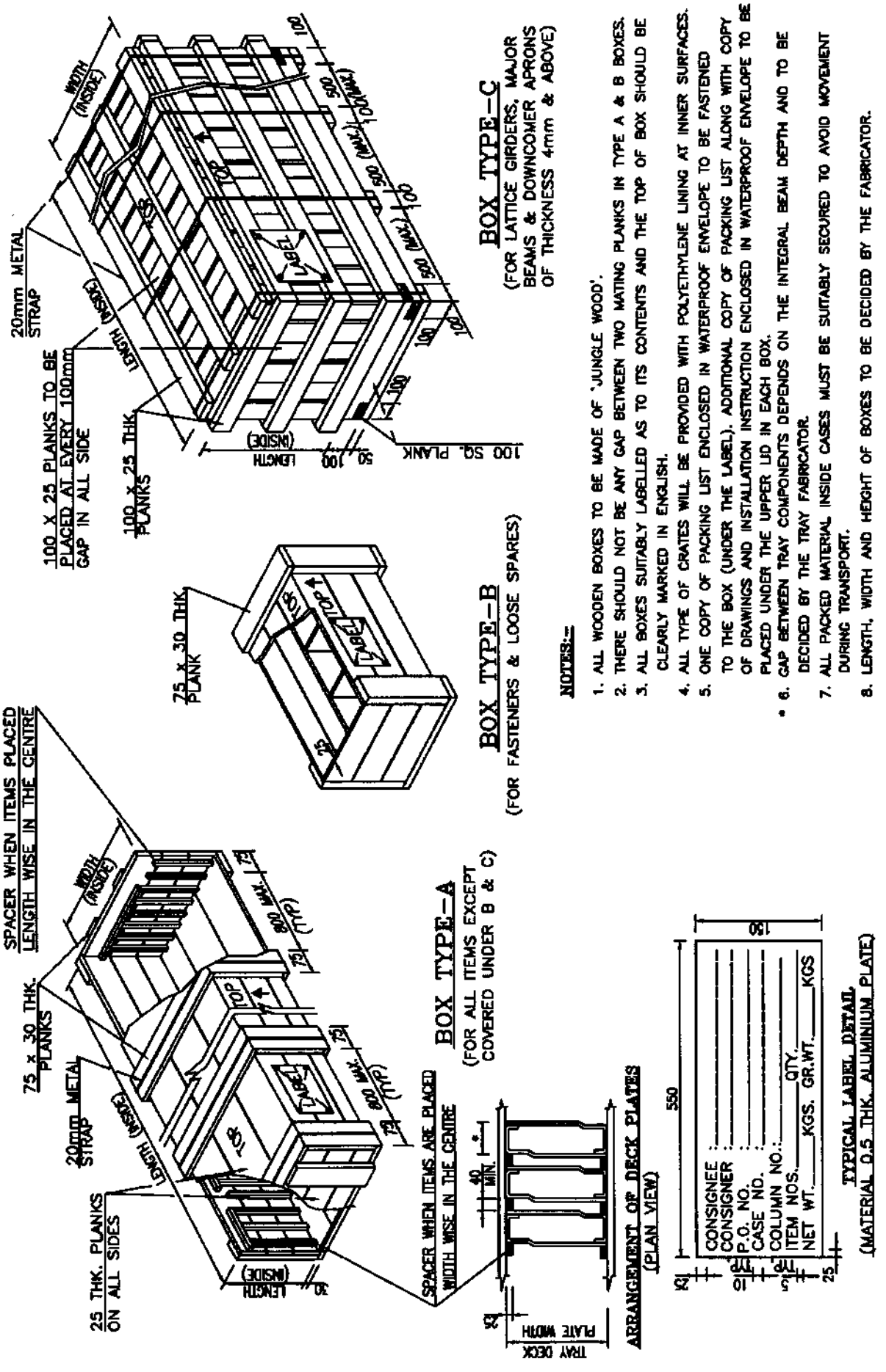
3.2 Additional markings such as "handle with care", "this side up" etc to be indicated by arrow. "Fragile" or any other additional indications for protection and safe handling shall be added in accordance with the type of materials.

3.3 For bulk uniform materials, when packed in several cases, progressive serial numbers shall be indicated on each cases.

3.4 A packing list shall accompany the material and shall be enclosed in a waterproof envelope / plastic lamination fastened to the package to enable verification on arrival of the consignment or when taking up of the delivery. It is necessary that additional copy of packing list with one copy of drawings along with one copy of installation instructions enclosed in a waterproof envelope / plastic lamination is also to be placed under the upper lid in each package.

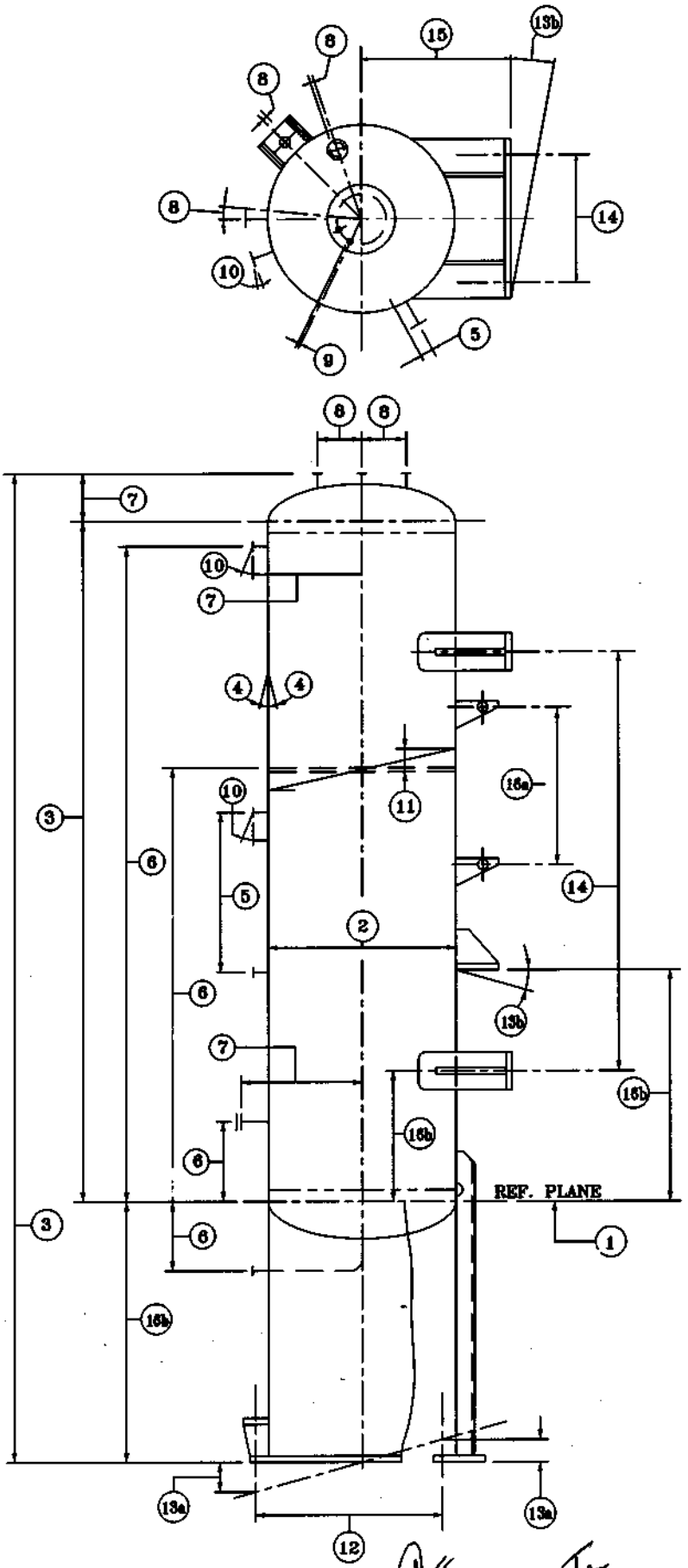
4.0 SHIPMENT

All dispatches of material shall be done in accordance with the relevant terms of the purchase order. Any other means of transport shall be resorted to only after prior approval in writing.



NOTES:–

1. ALL WOODEN BOXES TO BE MADE OF 'JUNGLE WOOD'.
2. THERE SHOULD NOT BE ANY GAP BETWEEN TWO MATING PLANKS IN TYPE A & B BOXES.
3. ALL BOXES SUITABLY LABELLED AS TO ITS CONTENTS AND THE TOP OF BOX SHOULD BE CLEARLY MARKED IN ENGLISH.
4. ALL TYPE OF CRATES WILL BE PROVIDED WITH POLYETHYLENE LINING AT INNER SURFACES.
5. ONE COPY OF PACKING LIST ENCLOSED IN WATERPROOF ENVELOPE TO BE FASTENED TO THE BOX (UNDER THE LABEL). ADDITIONAL COPY OF PACKING LIST ALONG WITH COPY OF DRAWINGS AND INSTALLATION INSTRUCTION ENCLOSED IN WATERPROOF ENVELOPE TO BE PLACED UNDER THE UPPER LID IN EACH BOX.
6. GAP BETWEEN TRAY COMPONENTS DEPENDS ON THE INTEGRAL BEAM DEPTH AND TO BE DECIDED BY THE TRAY FABRICATOR.
7. ALL PACKED MATERIAL INSIDE CASES MUST BE SUITABLY SECURED TO AVOID MOVEMENT DURING TRANSPORT.
8. LENGTH, WIDTH AND HEIGHT OF BOXES TO BE DECIDED BY THE FABRICATOR.



Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
7	18.01.2022	REAFFIRMED AND REISSUED AS STANDARD	NIKHIL		NK	SM
6	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN

NOTES

1. REFERENCE LINES SHALL BE LIGHTLY PUNCH-MARKED INSIDE AND OUTSIDE AROUND THE CIRCUMFERENCE OF THE SHELL PLATE ON THE TANGENT LINES OF THE VESSEL.
2. a) OUT OF ROUNDNESS (OVALITY) SHALL BE AS PER APPLICABLE CODE.
   b) OUTSIDE CIRCUMFERENCE OF SHELL SHALL BE WITHIN THE FOLLOWING LIMITS.
   ± 10 mm FOR NOMINAL DIAMETER 1200 mm AND UNDER.
   ± 12 mm FOR NOMINAL DIAMETER 1201 mm THROUGH 2400 mm.
   ± 20 mm FOR NOMINAL DIAMETER ABOVE 2400 mm.
   c) FOLLOWING TOLERANCES ON DIAMETER SHALL APPLY THROUGHOUT ITS LENGTH FOR VESSELS WITH TRAYS AND / OR PACKING. (FOR CARTRIDGE TYPE TRAY REFER SPECIAL NOTE-E).

VESSEL NOM. DIA.	TOLERANCE ON NOM. DIA.
2000 mm AND UNDER	± 0.5%
2001 mm TO 4000 mm	GREATER OF ± 10 mm OR ± 0.35%
4001 mm TO 8000 mm	GREATER OF ± 14 mm OR ± 0.25%
ABOVE 8000 mm	TO BE SPECIFIED ON VESSEL DRAWING.

3. TOLERANCE FOR LENGTH ± 5 mm PER 3000 mm, MAXIMUM 15 mm.
4. OUTSIDE SURFACE OF CYLINDER MAY BE OUT OF ALIGNMENT / STRAIGHTNESS NOT MORE THAN 6 mm PER 6000 mm STRAIGHT LENGHT, BUT NOT MORE THAN 20 mm FOR ANY LENGTH.
5. TOLERANCE FOR CENTRE TO CENTRE DISTANCE BETWEEN ANY PAIR OF INSTRUMENT CONNECTIONS TO BE AS FOLLOWS:-
   DISTANCE BETWEEN NOZZLES : ± 1 mm
   ORIENTATION : ± 1 mm
   NOZZLE FACE INCLINATION : ± 1/4°
6. ELEVATIONS FROM REFERENCE PLANE MAY VARY AS FOLLOWS:-
   MANHOLE: ± 12 mm, NOZZLE ± 6 mm, INTERNAL SUPPORTS: ± 3 mm, EXCEPT THAT LOCATIONS OF MANHOLES AND NOZZLES NEAR THE TRAY SHALL NOT VARY MORE THAN ± 3 mm FROM THE TRAY.
7. PROJECTION OF FLANGE FACE FROM SHELL CENTRAL LINE / TANGENT LINE MAY VARY ± 5 mm FOR NOZZLES AND ± 12 mm FOR MANHOLES.
8. CIRCUMFERENTIAL AND RADIAL DEVIATION OF NOZZLES, MANHOLES AND SUPPORTS FROM THE TRUE POSITION SHALL NOT VARY MORE THAN ± 3 mm.
9. BOLT HOLE ORIENTATION OF NOZZLES MAY VARY ± 2 mm AT BOLT CIRCLE.
10. VERTICAL AND HORIZONTAL DEFLECTION OF NOZZLE FLANGE FACES FROM PLANES NORMAL TO NOZZLE CENTRE LINES OR PARALLEL TO VESSEL CENTRE LINE SHALL NOT BE MORE THAN ± 1/2°
11. ALL TOLERANCES OF TRAY SUPPORTS TO BE AS PER TRAY SPECIFICATIONS / DRAWING.
12. THE BASE RING BOLT CIRCLE DIAMETER MAY VARY ± 5 mm. FOR ANY DIAMETER MEASURED AT POINTS 90° APART, DISTANCE BETWEEN TWO CONSECUTIVE HOLES MAY VARY BY ± 5 mm.
13. a) DEVIATION OF SUPPORT BASE FROM HORIZONTAL MAY BE AS FOLLOWS:-
    FOR VESSEL DIA. 1500 mm AND UNDER 3 mm
    FOR VESSEL DIA. OVER 1500 mm TO 2000 mm 5 mm
    FOR VESSEL DIA. OVER 2000 mm TO 4000 mm 6 mm
    FOR VESSEL DIA. OVER 4000 mm TO 5000 mm 8 mm
    FOR VESSEL DIA. OVER 5000 mm 10 mm
    b) DEVIATION OF SUPPORT BASE FOR BRACKET TYPE SUPPORT / SADDLE SUPPORT FROM HORIZONTAL MAY BE ± 1°
14. DISTANCE BETWEEN CL TO CL OF SUPPORTS AND BOLT HOLES IN SUPPORTS FOR HORIZONTAL VESSELS MAY VARY ± 3 mm.
15. DISTANCE BETWEEN CENTRE LINE OF HORIZONTAL VESSEL AND BOTTOM OF SUPPORT MAY VARY ± 3 mm.
16. a) TOLERANCE FOR CENTRE TO CENTRE DISTANCE BETWEEN ANY PART OF EXTERNAL STRUCTURAL ATTACHMENT SHALL NOT VARY MORE THAN ± 3 mm.
    b) TOLERANCE FOR DISTANCE FROM REFERENCE PLANE TO BASE OF VERTICAL SUPPORTS AND CENTRE LINE OF SADDLE SUPPORT MAY VARY ± 6 mm.

SPECIAL NOTES

A. CUMULATIVE TOLERANCES ON CONSECUTIVE DIMENSIONS SHALL BE LIMITED BY OVERALL DIMENSIONAL TOLERANCES. ALL TOLERANCES ARE FROM REFERENCE PLANE UNLESS OTHERWISE INDICATED.

B. INTERFERENCE BETWEEN INTERNAL AND EXTERNAL PARTS OR ANY RESTRICTION TO THE INTENDED FUNCTION OF ANY PART SHALL BE KEPT IN VIEW WHERE TOLERANCES ARE CUMULATIVE.

C. SPECIFIC TOLERANCES FOR ANY PART SHOWN ON EIL DRAWING SHALL BE GIVEN PREFERENCE TO THOSE GIVEN IN THIS STANDARD.

D. UNUSUALLY LARGE OR COMPLEX VESSELS MAY BE EXECUTED AS PER FABRICATOR'S STANDARD WHEN THE TOLERANCES AS SHOWN ARE UNREASONABLE. IN SUCH INSTANCES FABRICATOR'S TOLERANCES & LIMITS MUST BE SUBMITTED FOR APPROVAL.

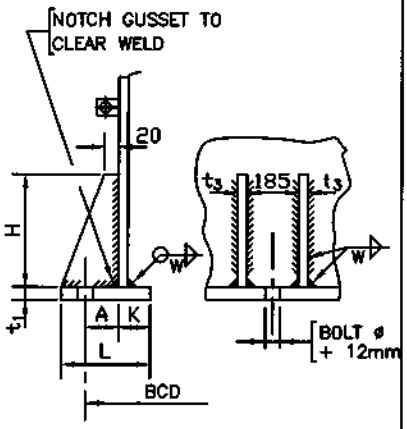
E. VESSEL UPTO AND INCLUDING 750 mm NOMINAL DIAMETER SHALL HAVE CARTRIDGE TYPE TRAY. FOLLOWING TOLERANCES ON DIAMETER SHALL APPLY THROUGHOUT ITS LENGTH.

VESSEL NOMINAL DIAMETER	TOLERANCE
500 mm AND UNDER	VESSEL I.D. $^{+1\ mm}_{-0\ mm}$
501 mm TO 750 mm	VESSEL I.D. ± 3 mm

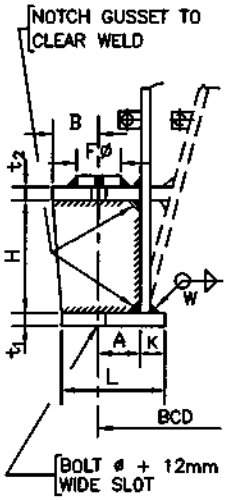
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
7	18.01.2022	REAFFIRMED AND REISSUED AS STANDARD	NIKHIL	SK	NK	SM
6	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN

Approved by

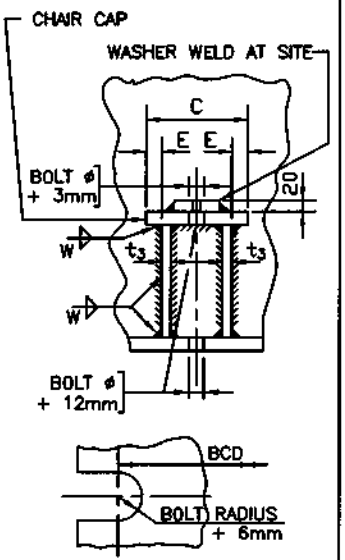
SKIRT BASE DETAILS



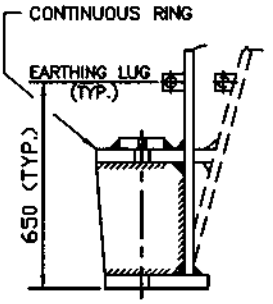
TYPE-1



TYPE-2
(SEE NOTE-6)



SLOT DETAIL



(ALL DIMENSIONS AND DETAILS ARE SAME AS SHOWN FOR TYPE-2 EXCEPT CONTINUOUS RING)

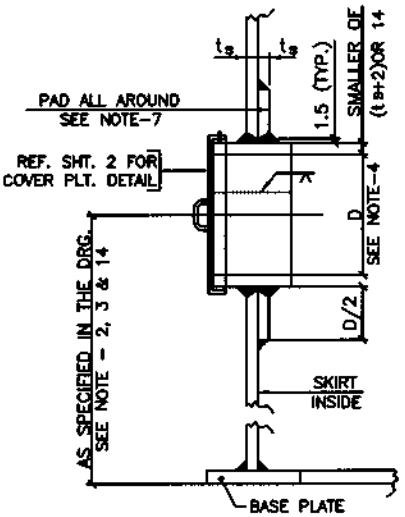
TYPE-3
(FOR CONTINUOUS RING ONLY)

BOLTø	t_1 *	t_2 *	t_3 *	A ▼	B	C	E	F	H	K	L *	W	TYPE	REMARKS
24	20	–	10	60	–	–	–	–	250	75	165	10	1	
27	20	–	10	60	–	–	–	–	250	80	170	10		
30	25	25	12	55	60	150	12	60	300	80	180	10	2 AND 3	
33	25	25	12	58	65	150	12	70	300	80	185	10		
36	25	25	12	66	70	150	12	80	300	90	200	10		
39	32	25	12	70	70	160	14	80	300	95	215	12		
42	32	25	12	72	70	160	14	90	300	100	230	12		
45	32	25	12	80	75	160	14	90	300	105	245	12		
48	32	30	14	83	75	180	16	100	380	110	260	14		
52	38	30	14	87	80	180	16	110	380	110	275	14		
56	38	30	16	91	85	180	18	120	380	115	280	14		
60	38	35	18	95	85	200	20	120	430	125	285	14		
64	38	35	18	104	90	200	25	130	430	135	300	16		
68	42	40	20	108	90	220	25	140	450	145	320	16		
72	42	40	20	112	95	220	25	150	450	150	340	16		

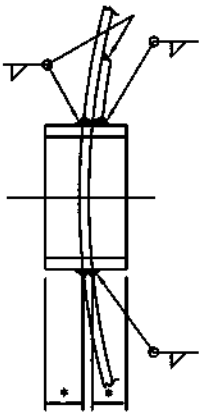
NOTES

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
2. BOLT CIRCLE DIAMETER (BCD), NUMBER AND SIZE OF THE BOLTS SHALL BE AS PER ENGINEERING DRAWING.
* 3. DIMENSIONS t1, t2, t3 AND 'L' ARE TO BE CHECKED IN EVERY CASE.
4. IN CASE OF ANY CONFLICT THE ENGINEERING DRAWING SHALL GOVERN.
5. NUMBER OF BOLTS USED IS TO BE A MULTIPLE OF 4 AND BOLTS SHALL STRADDLE VESSEL NORTH-SOUTH CENTRE LINE IN PLAN.
6. USE CONTINUOUS RING (CHAIR CAP) IF DISTANCE BETWEEN CONSECUTIVE BOLTS IS LESS THAN 400 mm.
7. CIRCULAR WASHER SHALL BE SHIPPED LOOSE AND WELDED AT SITE AFTER ANCHOR BOLTS ARE IN POSITION.
▼ 8. PREFERRED DIMENSION 'A'
9. EARTHING LUG SHALL BE LOCATED BETWEEN THE ANCHOR BOLTS AND SHALL BE AS PER STANDARD 7-12-0026.
10. WHEN THE ANCHOR CHAIR CAP IS NOT CONTINUOUS, THE BASE PLATE SHALL BE SUITABLY STIFFENED USING REMOVABLE STRUCTURAL SECTIONS (BEAM/SPIDER) AT SITE DURING ERECTION.

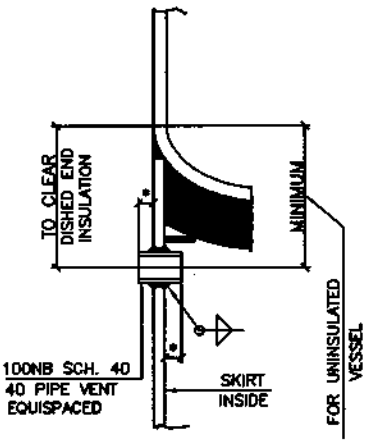
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
8	18.01.2022	REAFFIRMED AND REISSUED AS STANDARD	NS	TK	NK	SM
7	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN



ACCESS OPENING

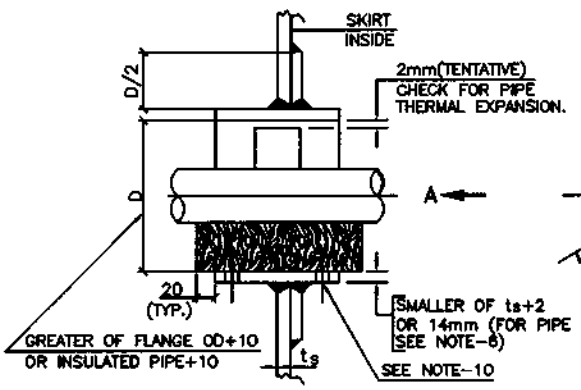


PLAN

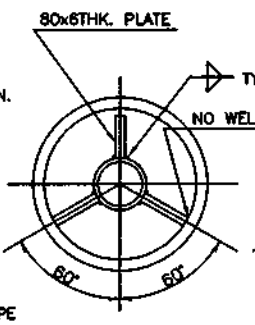


VENT
(SEE NOTE-5)

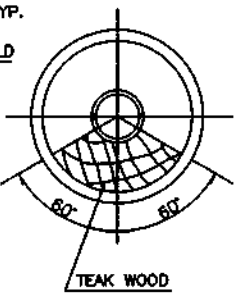
ACCESS OPENING/PIPE OPENING/ VENT OPENING (TYPICAL)



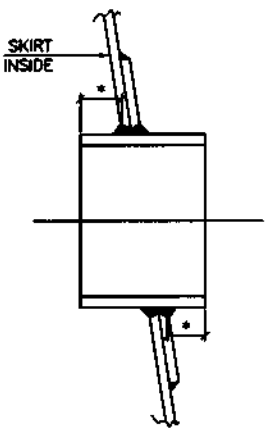
PIPE OPENING



VIEW A
(HOT TYPE VESSEL)

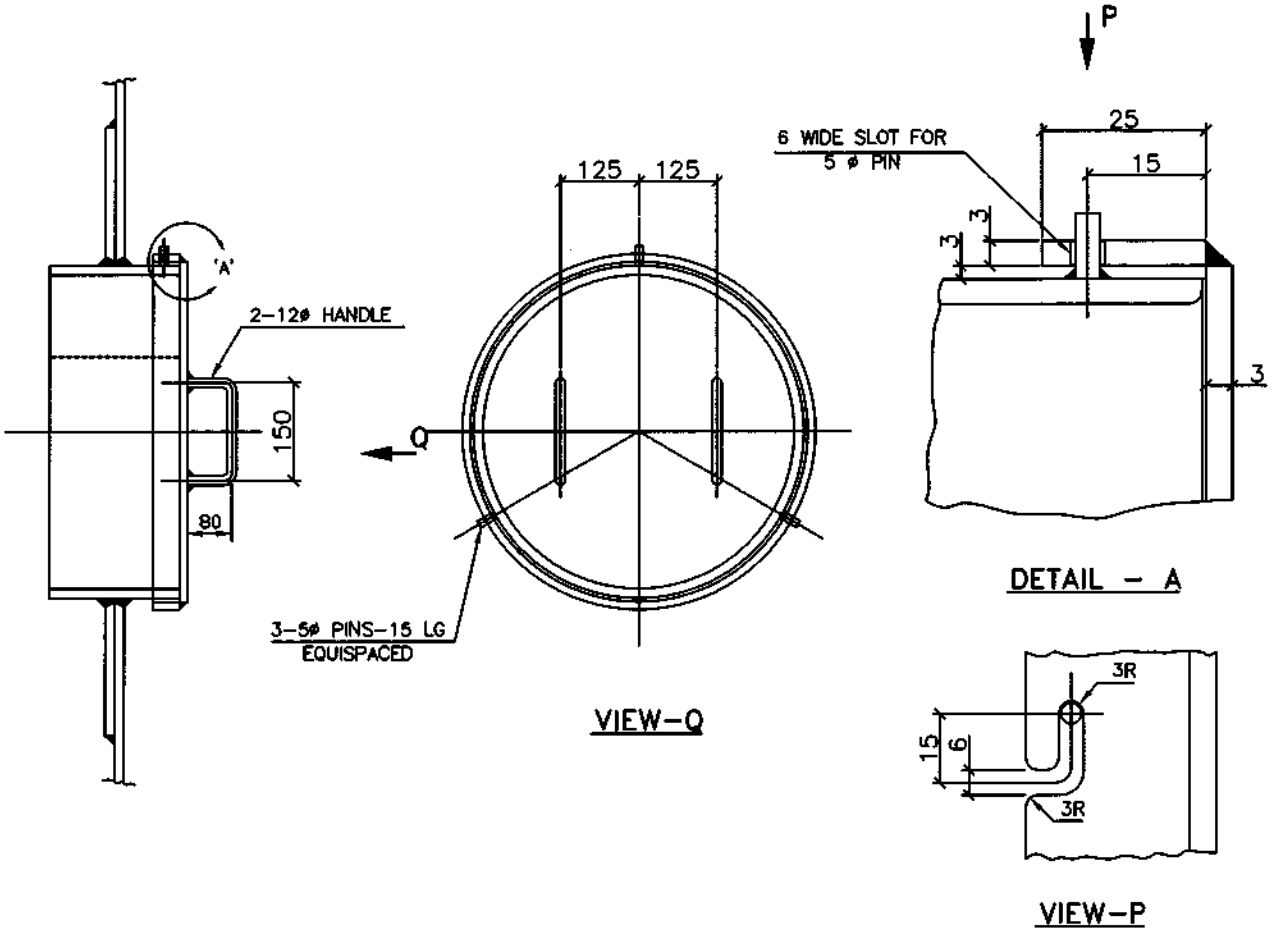


VIEW A
(COLD TYPE VESSEL)



FLARED SKIRT

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
7	18.01.2022	REAFFIRMED AND REISSUED AS STANDARD	NIKHIL	HK	NK	BM
6	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN



NOTES

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
2. ACCESS OPENING SHALL BE LOCATED BETWEEN ANCHOR BOLTS WHEREVER POSSIBLE.
3. ACCESS OPENING IS NOT TO BE BLOCKED BY BOTTOM HEAD.
4. (HOT TYPE VESSEL) (COLD TYPE VESSEL)

SKIRT DIAMETER	ACCESS OPENING DIA.(D)	NO. OF ACCESS OPENING
UP TO 1000	400	1
OVER 1000 UPTO 1500	450	1
OVER 1500 UPTO 3000	500	1
OVER 3000	500	2

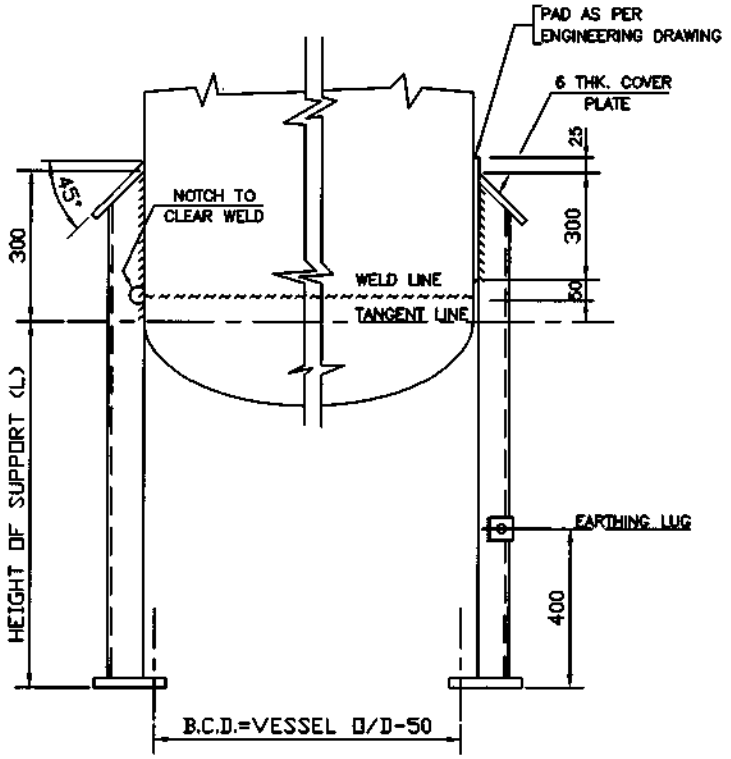
5.

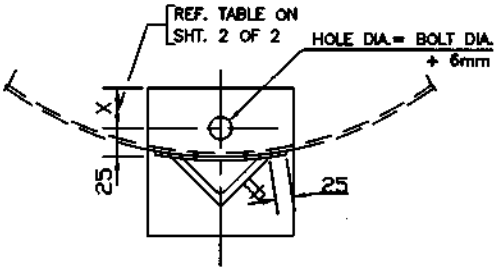
SKIRT DIAMETER	NO. OF VENT HOLES
UP TO 1000	2
OVER 1000 UPTO 2000	3
OVER 2000	4

6. MINIMUM SIZE OF PIPE SLEEVE IS 150NB SCH 40. USE SCH 40 UPTO 250NB PIPE SLEEVE. FOR 300NB AND ABOVE, PIPE SLEEVE SHALL BE FABRICATED FROM PLATE.
7. ALL OPENINGS 300 DIA. AND ABOVE SHALL BE PROVIDE WITH REINFORCEMENT PADS ON INNER SURFACE OF SKIRT.
8. IN CASE OF CONFLICT ENGINEERING DRAWING SHALL GOVERN.
9. IN FLARED SKIRT, OPENING DETAIL IS SAME AS THAT FOR CYLINDRICAL SKIRT.
10. WOODEN BLOCK SHALL BE FIXED TO SLEEVE WITH TWO NO. OF WOOD SCREWS.
11. ACCESS OPENING/PIPE OPENING/VENT SHALL BE OF SAME MATERIAL AS THAT OF SKIRT.
12. ALL FILLET WELDS SHALL BE 6 mm MINIMUM.
13. * PROJECTION OF SLEEVE/NECK SHALL BE GREATEST OF (30+INSULATION THK.), (30+FIRE PROOFING) & 50mm..
14. CENTER LINE OF ACCESS OPENING SHALL BE 850 MM (MINIMUM) ABOVE BOTTOM BASE RING FOR ANCHOR BOLTS OF SIZE M45 & BELOW AND 1100 MM (MINIMUM) FOR ANCHOR BOLTS OF SIZE ABOVE M45. IF ANCHOR CHAIR HEIGHT IS MORE THAN THAT OF GIVEN IN STANDARD. LOCATION OF ACCESS OPENING SHALL BE ESTABLISHED SUITABLY.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
7	18.01.2022	REAFFIRMED AND REISSUED AS STANDARD	NIKHIL		NK	SM
6	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN

ANGLE LEG SUPPORT





SUPPORT BASE DETAIL

NOTES

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
2. THIS STD. IS APPLICABLE FOR VESSEL DIAMETER UPTO AND INCLUDING 2000mm, MAXIMUM SHELL THICKNESS OF 20mm AND MAXIMUM LENGTH (T.L. TO T.L.) OF 3000mm VESSELS. BEYOND ABOVE RANGE REQUIRE SPECIAL CONSIDERATION.
3. FOR CALCULATION, FOLLOWINGS PARAMETERS HAVE BEEN CONSIDERED.
   a) WIND PRESSURE 200 Kg/m^2
   SHAPE FACTOR 0.7
   BASIC SEISMIC CO-EFFICENT (α_0) 0.08
   SOIL FOUNDATION SYSTEM FACTOR (β) 1.5
   IMPORTANCE FACTOR (I) 2.0
   b) EMPTY WEIGHT WITH WIND LOADING OR HYDROSTATIC WEIGHT WITH SEISMIC LOADING.
4. HEIGHT AND NUMBER OF LEG SUPPORTS AND SIZE OF ANCHOR BOLTS SHALL BE AS PER ENGINEERING DRAWING.
5. MINIMUM BOLT SIZE SHALL BE M 20.
6. MAXIMUM INSULATION THICKNESS CONSIDERED IS 150 mm.
7. IN CASE OF CONFLICT ENGINEERING DRAWING SHALL GOVERN.
8. ALL FILLET WELDS SHALL BE 6 mm MINIMUM.
9. MATERIALS SHALL BE AS PER ENGINEERING DRAWING.
10. EARTHING LUG SHALL BE AS PER STANDARD 7-12-0026.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
7	18.01.2022	REAFFIRMED AND REISSUED AS STANDARD	NIKHIL	HK	NK	SM
6	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN

Approved by

LEG SUPPORT SIZES

VESSEL O/D(mm)	NO.OF LEGS	LEG SIZE			BASE PLATE SIZE (mm)	X (mm)	MAXIMUM ALLOWABLE LOAD OF VESSEL (Kg.)
		MAX. VESSEL LENGTH (T.L. TO T.L.) UP TO AND INCLUDING 3.0 M					
		L = 1.5 M	L = 2.0 M	L = 2.5 M			
500	3	ISA 100x100x8	ISA 100x100x10	ISA 110x110x15	170x170x16 THK.	40	1500
800	4	ISA 100x100x10	ISA 130x130x8	ISA 130x130x12	200x200x16 THK.	45	3150
1000	4	ISA 100x100x12	ISA 130x130x10	ISA 150x150x12	230x230x16 THK.	45	4600
1250	4	ISA 110x110x15	ISA 150x150x10	ISA 150x150x12	230x230x16 THK.	45	6750
1600	4	ISA 130x130x15	ISA 150x150x15	ISA 150x150x18	230x230x16 THK.	60	9500
1750	4	ISA 150x150x12	ISA 150x150x18	ISA 200x200x12	300x300x16 THK.	60	12700
2000	4	ISA 150x150x18	ISA 200x200x12	ISA 200x200x15	300x300x20 THK.	75	16400

NOTES

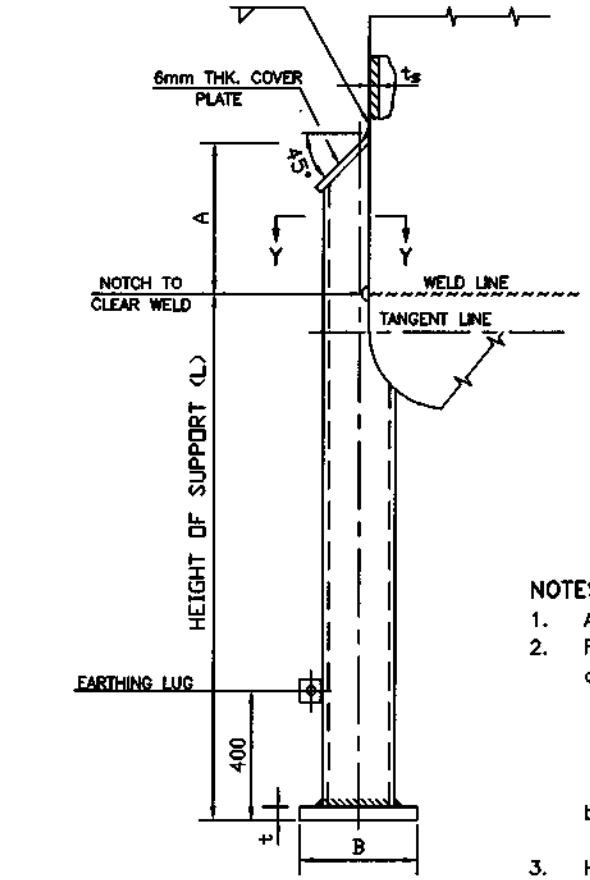
FOR A VESSEL WITH MAXIMUM SUPPORT LEG HEIGHT OF 1500mm, FOLLOWING ALTERNATIVE LEG SIZES MAY BE USED :–

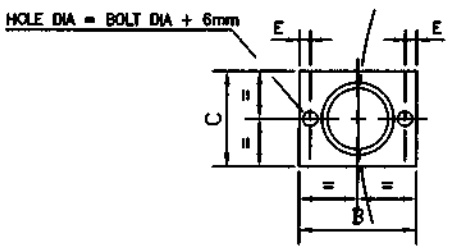
a) ISA 65x65x8 WITH HYDROSTATIC WEIGHT UPTO 500 Kg.

b) ISA 80x80x8 WITH HYDROSTATIC WEIGHT 501 Kg. TO 1000 Kg.

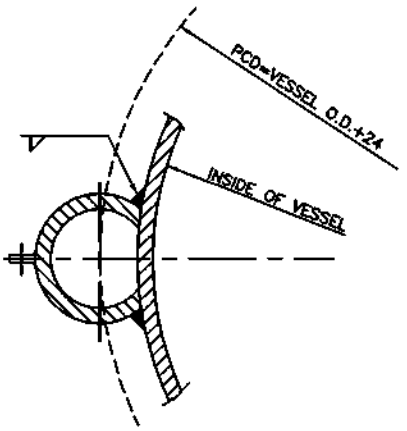
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
7	18.01.2022	REAFFIRMED AND REISSUED AS STANDARD	NIKHIL	HK	NK	SM
6	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN

PIPE LEG SUPPORT





SUPPORT BASE DETAIL



SECTION–YY

NOTES

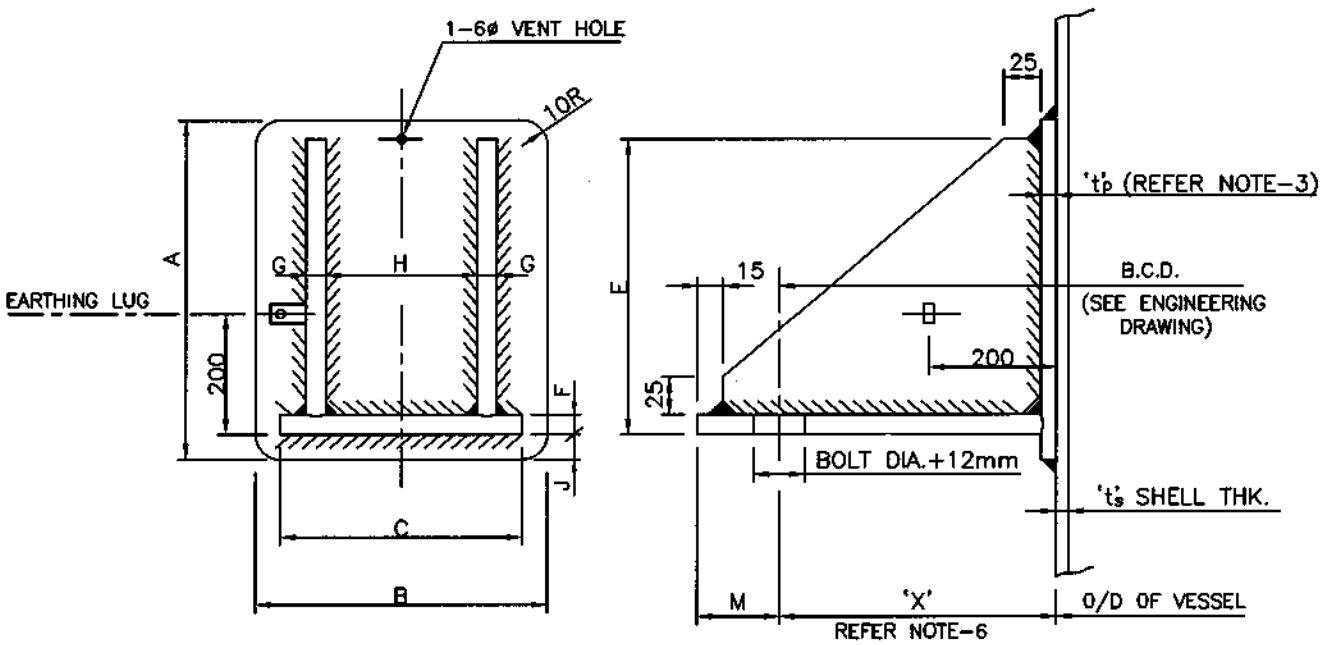
1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
2. FOR DESIGN OF SUPPORT, FOLLOWINGS PARAMETERS HAVE BEEN CONSIDERED.
   a) WIND PRESSURE 200 Kg/m^2
   SHAPE FACTOR 0.7
   BASIC SEISMIC CO–EFFICENT (α_0) 0.08
   SOIL FOUNDATION SYSTEM FACTOR (β) 1.5
   IMPORTANCE FACTOR (I) 2.0
   b) EMPTY WEIGHT WITH WIND LOADING OR HYDROSTATIC WEIGHT WITH SEISMIC LOADING.
3. HEIGHT AND NUMBER OF LEG SUPPORTS AND SIZE OF ANCHOR BOLTS SHALL BE AS PER ENGINEERING DRAWING.
4. MINIMUM BOLT SIZE SHALL BE M 20.
5. MAXIMUM INSULATION THICKNESS CONSIDERED IS 150 mm.
6. IN CASE OF CONFLICT ENGINEERING DRAWING SHALL GOVERN.
7. ALL FILLET WELDS SHALL BE 6 mm MINIMUM.
8. MATERIALS SHALL BE AS PER ENGINEERING DRAWING.
9. EARTHING LUG SHALL BE AS PER STANDARD 7–12–0026.
10. SUITABLE PAD FOR SS VESSEL SHALL BE PROVIDED.

LEG PIPE SIZE	A	B	C	E	t	MAXIMUM ALLOWABLE LOAD PER LEG (Kgs) MAXIMUM HEIGHT OF SUPPORT (L) IN METERS		
						2.0	2.5	3.0
50NB x EXTRA STRONG	120	230	140	36	20	2300	2050	1800
80NB x EXTRA STRONG	180	250	160	36	25	5700	5500	4900
100NB x EXTRA STRONG	230	310	185	42	25	9000	8600	8300
150NB x EXTRA STRONG	320	370	235	44	25	18500	18000	17500

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
7	18.01.2022	REAFFIRMED AND REISSUED AS STANDARD	NIKHIL	TK	NK	SM
6	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN

Approved by

VESSEL OUTSIDE DIA.	A	B	C	E	F	G	H	J	M	ANCHOR BOLT DIA.	'X' MAXIMUM	MAXIMUM ALLOWABLE VESSEL WEIGHT (TONNE)
1801 – 2000	650	500	400	550	25	14	350	50	SEE ENGINEERING DRAWING 60 (MINIMUM)	SEE ENGINEERING DRAWING M30 (MINIMUM)	550	60
1601 – 1800	600	450	350	500	25	14	300	50			540	55
1401 – 1600	550	400	300	450	25	14	250	50			540	50
1201 – 1400	500	350	250	450	25	12	200	25			470	40
1001 – 1200	450	320	220	400	20	12	180	25			450	30
801 – 1000	450	280	200	400	20	12	150	25			450	25



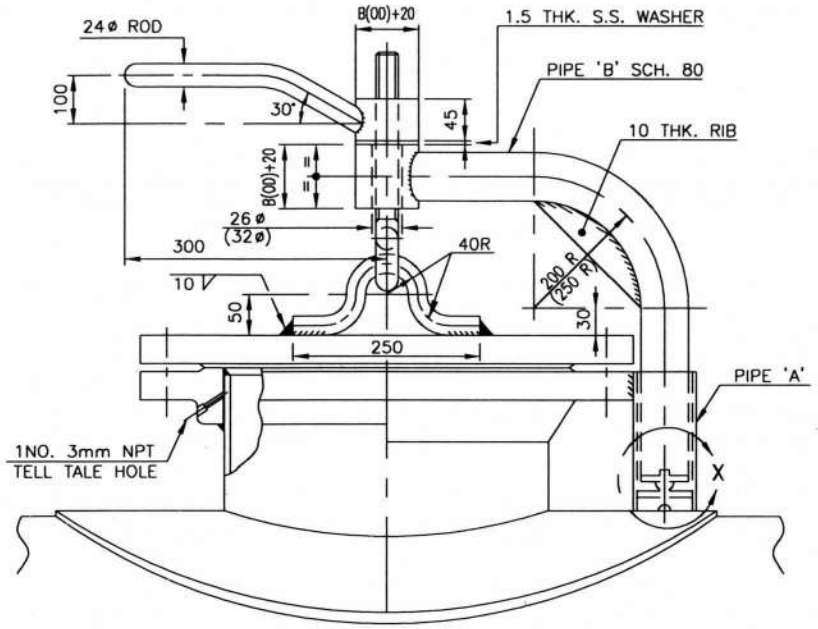
NOTES

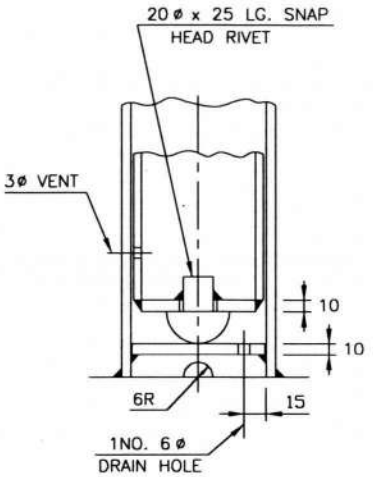
1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
2. NUMBER OF BRACKETS SHALL BE FOUR PER VESSEL.
3. PAD THICKNESS SHALL BE AS PER ENGINEERING DRAWING.
4. FOR VESSELS UPTO 800 mm DIA. REFER ENGINEERING DRAWING.
5. IN CASE OF CONFLICT ENGINEERING DRAWING SHALL GOVERN.
6. DISTANCE 'X' IS TO BE FINALISED CONSIDERING INSULATION THICKNESS, BOLT SIZE AND ERECTION REQUIREMENT AND SHALL BE KEPT MINIMUM.
7. EARTHING LUG SHALL BE AS PER STANDARD 7–12–0026.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
7	18.01.2022	REAFFIRMED AND REISSUED AS STANDARD	NS		NK	SM
6	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN

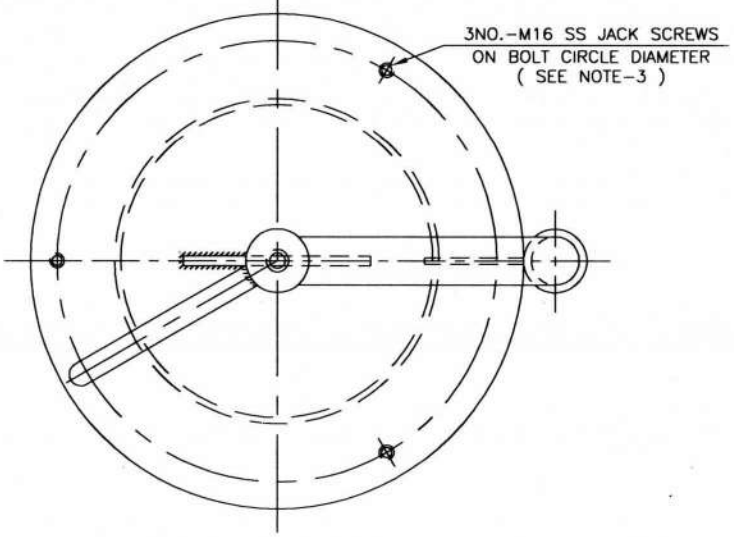
Approved by

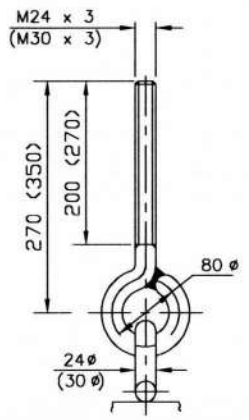
MANHOLE WITH DAVIT



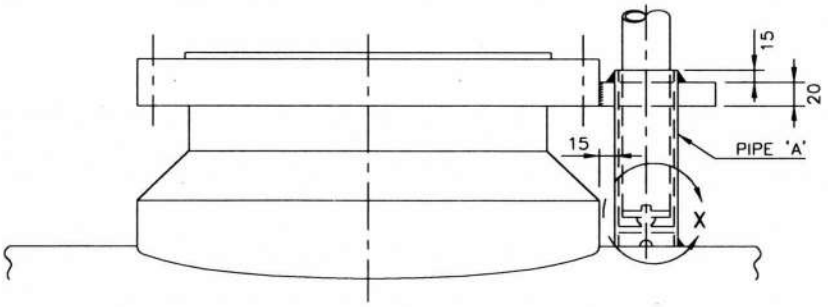


DETAIL 'X'

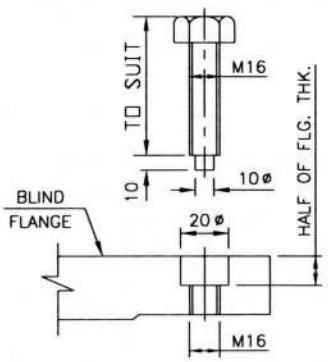




DETAIL OF EYE BOLT



TYP. DETAIL FOR SR MANHOLE



DETAIL OF JACK SCREW

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
8	07.07.2022	REVISED AND REISSUED AS STANDARD	JIT SINGH	PVSS/KA	NK	SM
7	31.10.2016	REAFFIRMED AND REISSUED AS STANDARD	JIT SINGH	SK/KJH	RKT	RN