	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
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1. INTRODUCTION

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. DEFINITIONS & ABBREVIATIONS

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
SITE	Indicates Paradip Refinery in Odisha, India
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit
BIS	Bureau of Indian Standards

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3. Scope

This specification lays down the provisions for minimum requirements of various materials to be used in Civil & Structural works.

This JSS covers typical General specification for some standard items only and the CONTRACTOR shall comply with the requirement as given in 080557C-000-JSD-1700-001/002 for specific cases and for any other items not mentioned/specified in this JSS. The requirement for various type of Buildings /Unit / Structures etc., as specified in the document 080557C-000-JSD-1700-001/002 shall be the governing one.

The CONTRACTOR shall submit the detailed specification for the items not covered in this specification for Approval by OWNER'S/ENGINEER IN CHARGE during execution.

4. Water

Water used in construction for all Civil & structural works shall be clean and free from injurious amounts of oil, acids, alkalis, organic matters or other harmful substances which may be deleterious to concrete, masonry or steel. The pH value of water sample shall be not less than 6. Potable water will be considered satisfactory. All requirements of IS: 456 have to be met.

Tests on water samples shall be carried out in accordance with IS: 3025 and these shall fulfil all the guidelines and requirements given in IS: 456.

Water for curing shall be of the same quality as used for concreting and masonry works.

5. Aggregate for Concrete

Coarse and fine aggregates for Civil and Structural works shall conform in all respects to IS: 383 (Specification for coarse and fine aggregates from natural sources for concrete). Aggregates shall be obtained from an approved source known for the satisfactory quality of its materials.

Aggregates shall consist of naturally occurring (crushed or uncrushed) stones, gravel and sand or a combination thereof. These shall be chemically inert, hard, strong, dense durable, clean and free from veins, adherent coatings, injurious amounts of alkalis, vegetable matter and other deleterious substances such as iron pyrites, coal, lignite, mica, shale, sea shells etc.



Aggregates, which may chemically react with alkalis of cement or might cause corrosion of the reinforcement, shall not be used.

The maximum quantities of deleterious materials in the aggregates as determined in accordance with IS: 2386 - Part-II (Methods of Test for aggregates for concrete), shall not exceed the limits defined in IS: 383.

5.1 Coarse Aggregates

Coarse aggregates are the aggregates, which are retained on 4.75mm IS sieve. It shall have a specific gravity not less than 2.6 (saturated surface dry basis).

These may be obtained from crushed or uncrushed gravel or stone and may be supplied as single sized or graded. The grading of the aggregates shall be as per IS: 383 or as required by the mix design, to obtain densest possible concrete.

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5.2 Fine Aggregates

Fine aggregates are the aggregates which pass through 4.75mm IS sieve but not more than ten percent (10%) pass through 150 micron IS sieve. These shall comply with the requirements of grading Zones-II and III of IS: 383. Fine aggregates conforming to grade Zone-IV shall not be used for reinforced concrete works.

Fine aggregates shall consist of material resulting from natural disintegration of rock and which has been deposited by streams or glacial agencies, or crushed stone sand or gravel sand. Sand from seashores, creeks or riverbanks affected by tides, shall not be used for filling or concrete works.

5.3 Sampling & Testing

The CONTRACTOR shall carry out all tests including mix designs of concrete, at the start of work as well as during any stage of construction as per the requirement. Tests shall be carried out in accordance with IS: 516 - Methods of test for strength of concrete and IS: 2386 - Methods of test for aggregates of concrete. The method of sampling shall be in accordance with the requirements given in IS: 2430.

5.4 Storage of Aggregates

Storage of all types of aggregates at the site of work shall be as specified in IS: 4082. Aggregates shall in no case be stored near excavated earth or directly over ground surface.

Fine aggregates delivered at the site in wet condition or becoming wet due to rain or any other means, shall not be used for at least 24 hours. For the use of such aggregates the CONTRACTOR shall adjust the water content in accordance with IS: 2386 to achieve the desired mix.

5.5 Sand (For Masonry & Filling)



5.5.1 Sand for Masonry Mortars

The sand shall consist of natural sand, crushed stone sand or crushed gravel sand or a combination of any of these. The sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain the amount of clay, silt and fine dust more than specified in IS: 2116.

The sand shall not contain any harmful impurities such as iron pyrites, alkalis, salts, coal or other organic impurities, mica, shale or similar laminated materials, soft fragments, sea shells in such form or in such quantities as to affect adversely the hardening, strength or durability of the mortar.

The maximum quantities of clay, fine salt, fine dust and organic impurities in the sand, when tested in accordance with IS: 2386, shall not be more than 5% by mass in natural sand, or crushed gravel sand or crushed stone sand.

For organic impurities, when determined in accordance with IS: 2386, colour of the liquid shall be lighter than that indicated by the standard solution specified in IS: 2386.

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5.5.2 Grading of Sand

The particle size grading of sand for use in masonry mortars shall be within the limits as specified in Table - 1 below:

IS Sieve designation	Percentage Passing by mass
4.75 mm	100
2.36 mm	90 to 100
1.18 mm	70 to 100
600 micron	40 to 100
300 micron	5 to 70
150 micron	0 to 10

In case of sand whose grading falls outside the specified limits due to excess or deficiency of coarse or fine particles, this shall be processed to comply with the standard by screening through a suitably sized sieve and/ or blending with required quantities of suitable sizes of natural sand particles or crushed stone screening which is by themselves unsuitable. The various sizes of particles of which the sand is composed shall be uniformly distributed throughout the mass.

5.5.3 Sampling and Testing



The method of sampling shall be in accordance with IS: 2430. The amount of material required for each test shall be as specified in relevant parts of IS: 2386. All tests shall be carried out in accordance with the relevant parts of IS: 2386.

If further confirmation as to the satisfactory nature of the material is required, compressive test on cement mortar cubes (1:6) may be made in accordance with IS: 2250 using the supplied material in place of standard sand and the strength value so obtained shall be compared with that of another mortar made with a sand of acceptable and comparable quality.

5.5.4 Sand for Filling

Sand for filling shall meet the requirements of IS: 383 and shall be natural sand, hard, strong, and free from any organic and deleterious materials. Sand obtained from seashores, creeks or riverbanks affected by tides, shall not be used for filling. Fine aggregates suitable for concreting works shall be suitable for filling also. No sand below grading Zone - III as per IS: 383 shall be allowed for filling.

The fill shall be constructed in layers, each layer being compacted to the required density before the next layer is laid. The compacted thickness shall be 100mm for the first layer and 200 mm for each subsequent layer.

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Before compaction, blending of the earth and sand shall be carried out on the ground using the following procedure:

- 1) Earth (all lumps and clods should be broken by manual means) and sand shall be deposited in alternate heaps, with close control on the volume of the heaps to ensure that the desired ratio of earth to sand is achieved.
- 2) The well mixed filler material shall be transported to the excavated pits for backfilling.

Compaction of the backfill material shall be carried out using mechanical compactors or hand manual compaction as per requirement.

The top surface of each layer shall be roughened before placing the subsequent layer to ensure proper keying in between layers.

Prior to compaction, the moisture content of the material shall be brought to within $\pm 2\%$ of the optimum moisture content as obtained from the tests (as above) by addition or removal of water, accompanied by thorough mixing to ensure a uniform moisture content. Each layer shall be compacted to at least 95% of the maximum dry density as obtained from the Standard Proctor Test.

If the testing indicates that any part of the fill does not meet the requirements, that part shall be reworked by the Contractor at his own cost till the specified density is achieved.



The Contractor shall submit daily laboratory and observations report. This shall provide details of location of sample, time of collection, time it was placed in oven, the moisture content and density test results.

6. Cement

Unless otherwise specifically called for, cements for RCC and PCC/ lean concrete works shall be one of the following:

43 or 53 grade ordinary Portland cement	IS: 8112 / IS: 12269
Portland Pozzolana cement (fly ash based)	IS: 1489 (Part-I)
Portland Pozzolana cement (calcined clay based)	IS: 1489(Part-2)
Portland slag cement	IS: 455
Sulphate resistant Portland cement (SRC)	IS: 12330

For masonry applications, the use of Masonry cement (conforming to IS: 3466) can be made. Each consignments of the cement shall be subjected to tests and analysis as per requirement of the relevant Indian standard codes.

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7. Steel

All steel bars, sections, plates and other miscellaneous steel materials, etc. shall be free from loose mill scales, rust as well as oil, mud paint or other coatings. The materials, construction specifications such as dimensions, shape, weight, tolerances, testing etc. for all materials covered under this section, shall conform to respective IS codes.

7.1 Reinforcement Bars

TMT steel bars of minimum grade Fe 500D conforming to IS: 1786 shall be used. Wherever warranted by soil investigation report, HYSD Fe500D corrosion resistant bars conforming to IS: 1786 shall be used in foundations, piles and pile caps. For Liquid retaining structures such as sump, cooling towers, ETP, DM plant, reservoirs etc, HYSD Fe500D corrosion resistant bars shall be used.

Bar Diameters to be used are 8, 10, 12, 16, 20, 25, 28 & 32 (in mm)

Mild steel Round Bars, as per IS 432 – Grade 1, shall be used as Lugs for Insert Plates and Insert Angles.

Fabric Reinforcement shall be provided as per IS 1566 wherever required.

7.2 Structural Steel

Structural Steel shall be of yield stress of 250 N/mm² conforming to Grade A of IS: 2062 & shapes as per SP 6 conforming to IS: 800/ IS: 12778 (wide flange/narrow flange sections) or Universal beams and Columns as per BS. Other structural steel sections shall conform to following IS codes:

Structural Steel shall comply with requirements as follows:

For ISMB, ISMC, ISA (Angles) : IS 2062 Grade E250B0/BR

For Flats : IS 2062 Grade E250B0/BR



For Plates : IS 2062 Grade E250BR / E350BR

For Universal Columns/Beams : BSEN 10025 S275JR / S275J0 /S355J0

Tubular / Hollow steel should conform to Yst 310 of IS:1161.

Properties of steel section shall be as follows:

- Roller section as per IS: 808
- Parallel flanged sections as per IS: 12778.
- Circular Hollow sections (CHS) as per IS: 1161.
- Square Hollow sections (SHS) / Rectangular Hollow Sections (RHS) as per IS: 4923.

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7.3 Miscellaneous Steel Materials

Miscellaneous steel materials shall conform to the following IS codes:



- ◆ Expanded Metal Steel Sheets for General purposes IS: 412
- ◆ Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement (Grade-I)
(For mild steel bars of rungs, metal inserts, grating etc.) IS: 432
- ◆ Hexagonal head bolts, screws and nuts of product Grade-C IS: 1363
- ◆ Cold-formed light gauge structural steel sections IS: 811
- ◆ Technical supply conditions for threaded steel fasteners IS: 1367
- ◆ Plain washers IS: 2016
- ◆ Steel wire ropes for general engineering purposes IS: 2266
- ◆ Thimbles for wire ropes IS: 2315
- ◆ Bulldog grips IS: 2361
- ◆ Mild steel tubes, tubular and other wrought steel fittings IS: 1239
(For handrail, tubular sections)
- ◆ Drop forged sockets for wire ropes for general purposes IS: 2485
- ◆ Steel chequered plates IS: 3502
- ◆ Hexagonal bolts and nuts (M42 to M150) IS: 3138
- ◆ High Strength Structural Bolts IS: 3757
- ◆ High Strength Bolts IS: 4000

7.4 Anchor Bolts

Material for Anchor Bolts shall be of mild steel conforming to Grade A of IS: 2062 unless otherwise specified.

8. Brick

Bricks for masonry works shall conform to IS: 1077 - specification for common burnt clay building bricks and shall be of class 7.5 for 230 mm and above thick walls (with minimum compressive strength of 7.5 N/mm²) and class 7.5 for 115 mm thick walls (with minimum compressive strength of 7.5 N/mm²). Physical requirements, quality, dimensions, tolerances etc. of common burnt clay building bricks shall conform to the requirements of IS: 1077.

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Bricks shall be hand moulded or machine moulded and shall be made from suitable soils. The bricks shall have smooth rectangular faces with sharp corners and shall be well burnt, sound, hard, tough and uniform in colour. These shall be free from cracks, chips, flaws, stone or humps of any kind.

Testing of the bricks shall be done as per IS: 5454 and IS: 3495. Water absorption shall not be more than 20% by its dry weight when soaked in cold water for 24 hours.

Locally available bricks of non-modular size (230 x 115 x 75mm) in place of bricks of modular size (190 x 90 x 90mm) can be used in case the bricks satisfy the other requirements of IS: 1077 (Class 5.0).

9. Stone

All stones used for masonry works shall conform to the requirements of following IS codes.

- ♦ Method of identification of natural building stones IS: 1123
- ♦ Recommendations for dimensions and workmanship
of natural building stones for masonry work IS: 1127
- ♦ Recommendations for dressing of natural building stones IS: 1129

9.1 Quality of Stones

Stones shall be hard, dense, strong, sound, durable, clean and uniform in colour. They shall also be free from veins, adherent coatings, injurious amounts of alkalis, vegetable matters and other deleterious substances such as iron pyrites, coal, lignite, mica, sea shells etc. As far as possible stones from one single quarry shall be used for any work. The strength of stones should be adequate to carry the imposed load and shall meet all the requirements of IS: 1905, taking into account the appropriate crushing strength of stone and type of the mortar used. The percentage of water absorption, when tested in accordance with IS: 1124 shall not exceed 5 percent.

The length of the stone shall not exceed 3 times the height. Width of stone on base shall not be less than 150mm and in no case exceed 0.75 times the thickness of the wall. Height of the stone shall not be more than 300mm.



10. Admixtures

10.1 General Requirements for Admixtures

All concrete admixtures shall comply with the following Indian Standards.

- ♦ Specification for integral cement water proofing compounds IS: 2645
- ♦ Specification for other admixtures for concrete IS: 9103

In case of non-availability of any IS code for testing and acceptability criteria, relevant American, British or German Code shall be applicable.

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No admixture shall impair the durability of the concrete nor combine with the ingredients to form harmful compounds neither increase the risk of corrosion of reinforcement. Once use of admixtures has been established, strict check shall be maintained not to alter the proportions of ingredients and water-cement ratio of the Design Mix during execution. The chloride contents in admixtures shall not exceed 2% by mass of the admixture or 0.03% by mass of the cement. Admixtures, which do not meet the requirements stipulated in this document, shall not be used.

11. Water Proofing Compounds

The permeability of the specimen with the admixture shall be less than half of the permeability with a similar specimen without the use of these compounds. These compounds shall be used in such proportion as recommended by manufacturer but in no case it shall exceed 3% by weight of cement. The initial setting time of the cement with the use of these compounds shall not be less than 30 minutes and final setting time shall not be more than 10 hours. Tests shall be carried out in accordance with IS: 4031.

Compressive strength of the specimen at 3 days shall not be less than 160 kg/cm² nor 80% of the 3 days compressive strength of mortar cubes prepared with same cement and sand only, whichever is higher. Similarly compressive strength at 7 days shall not be less than 220 kg/cm² or less than 80% of the 7 days compressive strength prepared with the same cement and sand only, whichever is higher. The test to determine the compressive strength shall conform to IS: 4031.

12. Water Bars (Water Stops)



PVC water bars shall be used in reinforced concrete construction of liquid retaining structures or any other structure to safeguard them from hydrostatic pressure and water leakage and any relative movement between to parts of the structure due to thermal loading shrinkage or differential movement of foundations. These shall be performed and shall provide permanent watertight seal along the entire joint in the poured concrete structures. These shall also be flexible enough to withstand deflection/displacements at joints arising due to variation of temperatures or settlement of foundations.

Performance requirements of PVC water bars shall meet the requirements of IS: 12200. These shall be of an approved make and or ribbed/serrated/plane type with a bulb at the centre. The thickness and width of water bars shall in no case be less than 5mm and 150mm respectively. However, for concrete sections greater than 300mm thick, the width of water bars shall not be less than 230 mm.

13. Bitumen / Bituminous Materials

Bitumen to be used for various types of work shall meet all the requirements of relevant IS codes as given below:

- ◆ Specification of Paving Bitumen IS: 73
- ◆ Specification for bitumen mastic for flooring IS: 1195
- ◆ Specification for Bitumen felts for waterproofing and damp proofing. IS: 1322

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- ◆ Specification for Bituminous compounds for waterproofing and caulking purposes. IS: 1834
- ◆ Specification for preformed fillers for expansion joint in concrete pavements and structures. IS: 1838
- ◆ Specification for bitumen mastic for use in waterproofing of roofs IS: 3037
- ◆ Specification for bitumen primer for use in waterproofing and damp proofing IS: 3384
- ◆ Specification for Bitumen Mastic for Tanking and damp proofing. IS: 5871
- ◆ Specification for Glass fibre base coal tar pitch & bitumen felts IS: 7193
- ◆ Code of practice for damp proofing using bitumen mastic IS: 7198
- ◆ Specification for bitumen Mastic, Anti-static and Electrically conducting grade IS: 8374

Tests and acceptable criteria shall be as per relevant IS codes.

14. PVC Pipes

PVC pipes shall conform to the requirements of IS: 4985.

15. Wood/ Timber

Wood recommended for platforms of cold vessels or below cold vessels/ exchangers shall be hard and shall be of group A, Grade-I and shall have safe permissible stress of 7 N/mm² in compression, perpendicular to grains on outside location as per IS: 883. General characteristics like durability, treatability etc. shall conform to IS: 883 and IS: 3629.



Timber required to be used for formwork shall be fairly dry before use. It should maintain its shape during the use and even when it comes into contact with moisture from the concrete. Storage of Wood/Timber shall be as per the requirements of IS: 4082.

For proper identification and selection of suitable timber for formwork, following codes shall be referred.

- ◆ Classification of commercial timbers and their zonal distribution IS: 399
- ◆ Specification for ballies for general purposes IS: 3337
- ◆ Specification for Plywood for concrete shuttering work IS: 4990

16. Anti-Termite Compounds

Chloropyrifos emulsifiable concentrates (1%) conforming to IS: 8944 shall be used for treatment of soil for protection of buildings, if so required against attack by subterranean termites.

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17. Polysulphide Sealants

All Polysulphide Sealants shall conform to IS: 12118. Test conditions and requirements shall be as given in the above referred IS code.

18. Grouting

Sand-Cement Grout (Type G1), Ordinary grout consisting of 1 part of OPC and 2 parts of clean, dry well graded sand mixed with water to obtain the required consistency shall only be used under the base plates of cross-overs, short pipe supports (not exceeding 1.5 m height) and small operating platforms (not exceeding 2 m height) not supporting any equipment.

Non-Shrink (premix type) Cement Base Grout (Type G2) with a minimum crushing strength of 40N/mm² as per specifications shall be used under column bases of all major steel structures and in anchor bolt sleeves/pockets for stationary equipments.

Epoxy Grout (Type G3), as per specifications, shall be used for grouting under all compressors (unless otherwise specified on manufacturer's drawings), and under heavy equipments where so indicated on Drawings.

For rotating equipment bases and pockets, (above 300 kW rating), grout shall be as per requirements of equipment vendor, as per the approved list / as per the decision of Engineer-in-Charge.