	PROJECT		Standby SRU & Additional Tanks		
	CLIENT		IOCL Paradip Refinery		
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SPECIFICATION FOR ROOFING AND CLADDING

B	08-11-2019	Issued For Design	SUR	KRK	JP / KC	JMC
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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 covers the requirement of sheeting for roofing and siding including corner ridge pieces, eaves filler pieces etc. and all other accessories.



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. APPLICABLE CODES

The Indian Standard codes applicable to this section shall include but not limited to the following:

- ◆ IS 277 : Galvanized steel sheets (Plain and corrugated).
- ◆ IS 459 : Corrugated and semi corrugated asbestos cement sheets.
- ◆ IS 513 : Cold rolled low carbon steel sheets and strips.
- ◆ IS 730 : Hook bolts for corrugated sheet roofing.
- ◆ IS 1230 : Cast iron rain water pipes and fittings.
- ◆ IS 1626 : A.C. Building Pipes and Pipe fittings, Gutter and Gutter fittings and roofing fittings (Part I to Part III).
- ◆ IS 1728 : Specification for sheet metal rain water pipes upto 100mm Nominal size, gutters, fitting, accessories.
- ◆ IS 2629 : Recommended Practice for hot dip galvanizing on iron and steel.
- ◆ IS 2858 : Code of Practice for roofing with Mangalore tiles.
- ◆ IS 3007 (Part 1) : Code of Practice for laying A.C. Sheets - Corrugated sheets.
- ◆ IS 3007 (Part 2) : Code of Practice for laying A.C. Sheets - Semi-corrugated sheets.
- ◆ IS 3978 : Code of Practice for manufacture of burnt clay Mangalore pattern roofing tiles.
- ◆ IS 4021 : Timber door window and ventilator frames.
- ◆ IS 4671 : Expanded polystyrene for thermal insulation.
- ◆ IS 6745 : Methods for determination of mass of zinc coating on zinc coated iron and steel articles.
- ◆ IS 8183 : Bonded mineral Wool.
- ◆ IS 13229 : Zinc for galvanizing.
- ◆ IS 14164 : Industrial application & finishing of thermal insulation material at temperature above 80 degree & upto 700 degree (Superseding IS: 7240 & IS: 7413).

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5. PRIORITY OF REQUIREMENTS

In case of any variation and discrepancy in condition between the special conditions, this specification and codes, order of priority shall be as under:-

- (1) Special conditions
- (2) This specification
- (3) Codes

6. PRECOATED GALVALUME SHEET ROOFING AND CLADDING

6.1 Material

The base metal of the roofing shall be cold rolled steel sheet manufactured out of 0.50 mm thick, 550 MPa (Yield strength) steel with galvanized by hot-dip process of Zinc Aluminium alloy of AZ-150 conforming to AS 1397 or ASTM 792.

Zinc coating	: 150 gm/m ² minimum on both side & 1.6% silicon coating
Primer coat	: Epoxy primer 5 microns minimum
Top coat	: Polyester coat
(Top exposed surface)	20 microns minimum of specified color
Back coat	: Epoxy coating
(Bottom unexposed surface)	5-7 microns minimum epoxy grey paint over 5 micron primer
Overall sheet thickness	: 0.55 mm minimum



6.2 Properties

The Precoated galvalume sheets shall meet the following performance standards.

Pencil Hardness	: Minimum HB
T-Bending Test	: 5T
Salt spray test	: 1000 hours (Exposed top side)
QUV Weatherometer Test	: 1000 hours
Humidity Test	: 1000 hours
Temperature Resistance	: 100° C for 24 hour
Impact Resistance	: Min 10J
Fire Performance	: Class-1

6.3 Profile

The profile shall have a depth of not less than 30mm and pitch of 190mm to 255mm.

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6.4 Accessories

All roofing accessories like ridge, gutters, north light curves etc shall be fabricated out of the approved Pre-coated sheet as per drawing.

Metallic self-drilling, self-tapping Fasteners and Fixing accessories shall be corrosion proof Meeting performance standard as per AS:3566, class-III having neoprene washers. Sealants shall be neutral cure type and cold setting variety.

6.5 Laying and fixing of sheets

Laying and fixing of sheets shall be as per approved manufacturer's instructions.

6.6 Guarantee

CONTRACTOR shall give a guarantee of 15 years for the coating of sheet.

7. CORRUGATED GALVANISED IRON SHEETS

7.1 General

This specification covers supply and erection of galvanized iron corrugated sheets including flashings, fittings, valley gutters etc. for roofing and cladding of buildings.

7.2 Material



Material for Galvanized Iron sheets shall be in accordance with IS: 277. Thickness of sheet and depth pitch of corrugation should be properly chosen depending on the spacing of purlins and loading. This should be supported by certificate from the manufacturer and approved by OWNER'S/ENGINEER IN CHARGE.

Grade of zinc coating shall be as per clause 7.3 of IS: 277.

Minimum recommended thickness of Corrugated Galvanized Iron sheet for various use shall be as follows: -

- | | | | |
|----|----------------|---|---|
| 1) | Roofing | : | 20 gauge (1mm minimum thickness) |
| 2) | Side cladding | : | 22 gauge (0.8mm minimum thickness) |
| 3) | Flashings | : | All necessary galvanized flashings, ridging, capping cable and corner trimmings shall be of 20 gauge. (1mm minimum thickness) |
| 4) | Valley gutters | : | 18 gauge (1.26mm minimum thickness) |

The sheets shall be free from cracks, split edges, twists, surface flaws, etc. They shall be clean, bright and smooth. The galvanizing shall be uninjured and in perfect condition. The sheet shall show no signs of rust or white powdery deposits on the surface. The corrugation shall be uniform in depth and pitch and parallel with the sides.

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7.3 Spacing of Purlins

One purlin each shall be provided at the ridge and the eaves. Spacing of purlins shall be as per manufacturer's recommendation for adopted sheet thickness and number of corrugations. Purlin shall coincide with the centre line of the end lap.

7.4 Painting for Purlins

The top surfaces of the purlins shall be painted before fixing the sheets and the embedded portion shall be applied with two coats of coal tar.

7.5 Laying of sheets

The sheets shall be laid and fixed in the manner described below unless otherwise shown in the working Drawings or as directed by OWNER'S/ENGINEER IN CHARGE.

Sheets shall be laid on the Purlins to a true plain with the lines of corrugations truly parallel or normal to the sides of the area to be covered, unless otherwise required as in special shaped roofs.

The sheets shall not generally be built into gables and parapets. They shall be bent up along their side edges close to the wall and the junction shall be protected by suitable flashing or by a projecting drip course, the latter to cover the junction by at least 75 mm.

7.6 Laps

All roofing sheets shall be provided with double corrugation side laps and 150mm end lap.

All side cladding sheets shall be provided with single corrugation side lap and 100mm end lap.

7.7 Cutting of sheets

Sheets shall be cut according to the dimensions and as per the drawings. Sheets shall be cut with a straight edge and chisel to give a straight finish.

7.8 Fixing of sheets

The sheets shall be fixed to the purlins and cladding runners with J or L polymer coated galvanized bolts, polymer cap, seal washer and thrust washer.



The bolts shall pass through the crown of the corrugations and shall be long enough to project at least 12mm above the top of their nuts.

The grip of J or L hook bolts on the side of purlins shall not be less than 25mm.

There shall be at least three hook bolts placed at ridges of corrugations in each sheet in every purlin and their spacing shall not exceed 300mm.

Sheets shall be joined together at side laps by polymer coated bolts and nuts. Each bolt shall be fixed with polymer cap, seal washer and polymer coated thrust washer.

Bolts shall be placed zigzag on overlapping corrugations. This spacing of the bolts shall not exceed 600mm in each of the staggered rows.

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7.9 Holes

Holes for all bolts shall be drilled in the ridges of the corrugations from the underside before placing in position. The holes in the sheet shall be at least 50mm from the edge. The holes in the washers shall be of exact diameter of the hook bolts or the seam bolts. The nuts shall be tightened from above to give a leak proof roof. Sheets with holes drilled wrongly shall be rejected.

7.10 Ridges and Hips

The overlap for ridges and hips on either side of G.I. sheet and end legs shall be at least 225mm. Ridges and hips shall be fixed to the purlins with polymer coated hook bolts, thrust washer and polymer cap. At least one of the fixing bolts shall pass through the end laps of ridges and hips on either side. If it is not possible extra hook bolts shall be provided. Ridges and hips shall fit squarely on the sheets.

7.11 Valleys and Flashings

The edge, wherever the roof sheeting or valley gutter is turned up against a wall shall be made weather proof with flashing. Flashing shall be bent to shape and fixed as specified. Lap over the sheet shall be minimum 150mm. End laps between flashing sheets shall not be less than 225mm. Flashing shall be inserted into brick work or masonry joints to a depth of 50mm and shall be filled with cement mortar (1:3). When flashing has to be laid at a slope, it shall be stepped at each course of masonry. The steps shall be cut back at an angle of at least 30°.

Valleys shall be bent to shape and shall have at least 225mm end lap and projection on either side under GI sheet. Valleys shall be fixed to the roof members below with polymer coated GI bolts, polymer cap, seal washer and polymer coated thrust washer. At least one fixing bolt shall pass through end laps of the valley piece.

7.12 Gutters

The longitudinal edges shall be turned back by 12mm and beaten to form a rounded edge. The ends of the sheet at junctions of pieces shall be hooked into each other and beaten flush to avoid leakage.

Gutters shall be laid to minimum 1:120 slope. Gutters shall be true to line and slope and shall be supported by brackets as specified.



7.13 Wind Ties

Wind ties shall be of 40mm x 6mm flat section unless otherwise specified. These shall be fixed at the two eaves end of the sheet. Fixing shall be done with the same bolts which secure sheets to the purlins. Slot holes shall be cut in the wind ties to allow for temperature variations.

8. “S” TYPE A.C. LOUVERS

8.1 Material and general specification for "S" type louvers shall be the same as those for Galvalume sheets in roofing.

8.2 The Louvers shall be fixed to the M.S. angle or flat supports of ends by means of G.I. bolts and nuts with G.I. and Bitumen washers. The distance between the bolt centers shall be about 200 mm. The minimum lap of louvers shall be 100 mm.

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9. TRANSLUCENT SHEETS

Translucent sheets shall be fiberglass reinforced polyester panels conforming to IS: 12866 or any other approved equivalent make, specified by OWNER'S/ENGINEER IN CHARGE. These sheets shall have a minimum thickness of 2 mm and shall be formed to match the profile of the metal sheeting panels. Translucent sheets shall have a light transmission factor of 55% to 80% and solar energy transmission of 25%.

10. PVC RAIN WATER PIPES

- 10.1** PVC Rain water pipes shall be of approved quality and make with pressure rating of 4kg/cm² conforming to IS codes. The supply shall include all necessary accessories e.g. Rain water shoes, heads, clamps, connections, suitable bonding agent etc. complete.
- 10.2** All pipes shall be fixed to Structural Steel columns, Brick/ Concrete work accurately as shown in relevant drawings with M.S. Clips or as approved by OWNER'S/ ENGINEER IN CHARGE.
- 10.3** All holes in walls and floors shall be made good by Cement Concrete M20.

11. ROOF EXTRACTORS



Roof extractors shall be fixed in position as shown on drawings. The work shall include making required opening in the sheeting, fixing the extractors as per the manufacturer's instructions with necessary fasteners. Lead fillers, felts or any other specified flashing should be tucked into the sheeting. The lead flashings used shall be weighing not less than 30 kg/m². No allowance in the rates for fixing of extractors on the roofs shall be made for wastage, cutting, extra bolts, nuts and washers, flashings, flat sheets etc.

12. WALL LOUVERS

Louvers shall be of units having minimum size of 1.0 m x 1.0 m with adjustable or nonadjustable blades. Paints and colour shall match sidewalls or as specified by Owner. Louvers shall include structural support members, necessary jamb trim, sealant and fasteners. Louver frames shall be fabricated from 1.2 mm thick sheets and louver blades shall be fabricated from minimum 0.91 mm thick sheets. In-adjustable louvers, blades shall be pivoted on 12 mm diameter rods. Louvers shall be equipped with an exterior mounted bird screen of Aluminium mesh that can be easily removed for cleaning. The louver design shall be such that water does not penetrate.

13. RIDGE VENTILATOR

Ridge Ventilator shall be of gravity type and shall be designed to accommodate the roof slope. Ventilators with or without dampers shall be fabricated from 0.63 mm thick pre-coated galvanised iron sheets with bird screen and end closures. Ventilator base shall be sealed at end connection. Edge of the skirt shall be sealed by a preformed rubber foam closure strip matching the roof panel configuration to close junction between ventilator base and roof panels. Dimensions and the location of ventilators shall be as shown on drawings.

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14. INSTALLATION

The work shall be completed to the satisfaction of Contractor's representative as per the approved detail drawings and as per the instructions of the manufacturer wherever necessary. Minimum end lap shall be 150 mm for roof and 100 mm for side cladding, or as specified by the manufacturer. Side lap shall be minimum 75 mm. End laps shall be sealed with approved silicone sealants.

Roof sheeting shall be fixed by crest fixing only. Side cladding shall be fixed preferably by crest fixing but may be fixed by valley fixing also. In valley fixing fastener locations shall be as close as possible to the ribs. Side lap fasteners shall be fixed at intervals of 350-450 mm to hold the side laps of sheets firmly in place and maintain a weatherproof joint. Holes must always be drilled and not punched. Extreme care shall be taken to avoid over tightening of fasteners that will lead to deformation of sealing washers, sheet damage and sometimes damage of the fastener threads. Fixing of flashings in masonry / concrete wall shall be done by making groove of appropriate height and depth and embedding the same with mastic / cement mortar (1:2) and water proofing compound. Special precautions shall be taken while carrying out work at laps and expansion joints to ensure that there is no leakage.

15. HANDLING & STORAGE AT SITE

All materials shall be handled and stored in a proper manner so as to avoid damage. Any material damaged in transit, storage or during erection shall be rejected forthright and replaced at CONTRACTOR's cost. Sheets shall be stacked on firm and levelled ground on wooden battens as per instructions of the OWNER'S/ENGINEER IN CHARGE. Sheeting or panels shall preferably be stored with a slight inclination in longitudinal direction to allow water, which may get into the stack, to drip off. Sheets shall be stored under cover when they are required to be stacked for a long period.