CONTRO-TRACE HOOK-UP STEAM HOSE's
for
525 TPD Standby Sulphur Recovery Unit (SRU),
IOCL Paradip Refinery

1.0 SCOPE OF SUPPLY

1.1 This document indicates the requirements to be considered for supply of HOOK-UP STEAM HOSE'S, for IOCL Paradip 525 TPD Standby SRU Project.

1.2 The supplies shall meet the requirements of the following specifications, without any deviations:

- Bill of Material, Annexure-1
- Inspection and Test Plan for Piping Bulk Items and Specialties: 080557C-000-ITP-1300-001_B
- Fittings Small Bore 080557C-000-JSS-1340-001_A

1.3 The documentation, quality and inspection requirements shall be as per the Contract specifications.

2.0 Technical Details:

1. Hose Size: Flexible Hose 0.75"
2. First end :3/4" Male NPT (To suit to the ¾" FNPT).
3. Other end: ¾" FJIC (To suit to ¾" Male JIC). The FJIC connection shall be swivel type.
4. Qty Required :400 (No's)
5. Overall Length of Each hose: 2.0 m
6. Material of construction is hose MOC –SS321 , Braid MOC 304.
7. Hydrotest pressure – 20Barg
8. Temperature suitable Upto 205 Deg C.
9. The Hose shall be pre-Insulated with suitable material to withstand the temperature of 300 Deg and should be flexible , firmly fixed with the HOSE.

3.0 NOTES:

3.1 **The Delivery of certain Line items as mentioned in BOQ should be done within 4 weeks from PO placement date, kindly Review and acknowledge it.**

3.2 Bidder shall obtain necessary clarifications (if any) from BHEL, before bid submission. This is a no deviation tender and no deviation or price implication is acceptable after bid submission.

3.3 Bidder shall submit the following along with their bid:

- No Technical Deviation Certificate.
- Unpriced price bid format
- Drawing of the Hose being proposed shall be submitted.

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RECORD OF REVISIONS:

Rev No	Date	Revision Detail	Revised by	Approved by
00	23.02.2022	FIRST ISSUE	V Uday Kumar	Srikanth G

JOB SUPPLY SPECIFICATION FOR FITTINGS SMALL BORE 1 ½" AND BELOW

			Written By Karthikeyan Chokkalingam 2019.10.10 17:50:56 +05'30'	Checked By Subramanian Arumugam 2019.10.11 08:45:29 +05'30'	Approved By Vaidyasubramaniam V 2019.10.11 12:12:43 +05'30'	Authorized By Morischristopher Jesumarian 2019.10.15 21:06:24 +05'30'
A	9-OCT-2019	ISSUED FOR DESIGN	CK	AS	VV	JM
REV.	**DATE**	**DESCRIPTION**	**PREPARED**	**CHECKED**	**APPROVED**	**AUTHORIZED**

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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
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit
ASME	American Society of Mechanical Engineers

API	American Petroleum Institute
P&ID	Piping and Instrumentation Diagram
A/G	Above Ground
U/G	Under Ground
B/L	Battery Limit
ISBL	Inside Battery Limit
EOT	Electrically-operated Overhead Travelling
MTO	Material Take Off

3. SCOPE

This specification defines the technical requirements of carbon steel, alloy steel and stainless steel fittings of various types such elbows, tees, reducers, caps, weldolets, sockolets, threadolets, couplings, unions, plugs, nipples etc. commonly used in refineries, petro-chemical and other chemical / industrial plants.

Cast iron, non-metals, and other special design / special materials fittings etc. are not covered herein. However the specification may be used for any other type of fittings of different design or material of construction by suitably specifying additional requirements as may be applicable.

The requirements specified here are supplementary to Piping Material Specification (PMS).

4. TERMINOLOGY

MR	Material Requisition
PR	Purchase Requisition
PO	Purchase Order
CS	Carbon steel
LTCS	Low Temp. Carbon Steel
AS	Alloy Steel
SS	Stainless steel

WN	Welding Neck
BW	Butt Weld
SW	Socket Weld
SCRD	Screwed
DP	Dye-Penetrant Test
MP	Magnetic Particle Test
NDT	Non Destructive Testing
NPT	National Pipe Threads
PMI	Positive Material Identification
IGC	Inter Granular Corrosion
HIC	Hydrogen Induced cracking
SSC	Sulfide stress cracking
CRYO	Cryogenic
IBR	Indian Boiler Regulations
AARH	Arithmetic Average Roughness Height
BHN	Brinell Hardness Number
ITP	Inspection Test Plan
TPI	Third Party Inspection
MOC	Material of Construction
PBE	Plain both Ends
TBE	Threaded both Ends
TOE	Threaded one End
TSE	Threaded small end
TLE	Threaded large end

5. REFERENCE CODES & STANDARDS

The following codes shall be applicable, however purchaser may specify any other relevant code for any purpose at any time. The codes latest edition as on date of issue of material requisition shall be applicable. Some BS codes may have been superseded by ISO / BS –EN codes, the latest one shall be acceptable.

Code /Std. No	Description
API 5L	Specification for line pipe
ASME Sec 8 Div.1 UW-51	ASME Boiler and Pressure Code
ASME B1.20.1	Pipe Threads, General Purpose (Inch)

ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory –Made Wrought Buttwelding Fittings
ASME B16.11	Forged Fittings, Socket Welding and Threaded
ASME B16.25	Butt Welding Ends
ASME B31.1	Power Piping
ASME B31.3	Process Piping
ASME B36.10	Welded and seamless Wrought Steel Pipe
ASME B36.19	Stainless Steel Pipe
MSS SP-25	Standard Marking System for Valves, Fittings, Fittings, and Unions
MSS SP-83	Class 3000 Steel Pipe Union, Socket Welding and Threaded
MSS SP-97	Integrally Reinforced Forged Branch Oulet Fittings – Socket Welding, Threaded and Buttwelding Ends
NACE MR0103	Materials Resistant to Sulphide Stress Cracking in Corrosive Petroleum Refining Environments
NACE MR0175 / ISO 15156	Petroleum, Petrochemical and Natural Gas Industries – Materials for Use In H_2S-Containing Environments in Oil And Gas Production.
IS 1239 PART-II	Specification for Mild Steel Tubes, Tubulars and other Wrought Steel Fittings
IS 4736	Specifications for hot dip galvanized coatings on steel.
BS 3799	Specification for Steel Pipe Fittings, Screwed and Socket Welding for the Petroleum Industry
BS EN10204	Metallic Products – Type of Inspection Documents
ASTM Standards	As specified or relevant
080557C-000-SP-1390-009	Specification for colour coding of piping materials by vendors
080557C -000-JSS-1320-001	Job Supply Specification for Pipes

6. GENERAL REQUIREMENTS

- Fittings shall be manufactured, inspected and marked as per the manufacturing standards. Any conflict between the requisition, enclosures, and referred standards shall be brought to the notice of the purchaser for clarifications and resolution before proceeding with the manufacture. The purchaser's decision shall be final and binding to the vendor. No deviations shall be permitted except as communicated in writing in deviation permits.

- Fittings dimension, tolerances, chemical composition, physical properties, heat treatment, hydro-test (if applicable), and other testing requirements shall conform to relevant codes / standards, latest editions (including their supplementary requirements) as specified in the material requisition. Deviation from the above, if any, shall be specifically highlighted to the purchase by the vendor.

- Any conflicts between requirements of this specification, related standards and other attached documents shall be referred to the purchaser for clarification before proceeding with the manufacture, fabrication and procurement of the disputed part.

7. DESIGN REQUIREMENTS

7.1 Fitting Dimensions:

- Fittings dimensions up to 1 1/2" size shall conform to ASME B 16.11.
- Forged steel socket welded and threaded fittings shall be in accordance with ASME B16.11 unless otherwise noted. For items not covered under B16.11 reference may be made to BS 3799 or appropriate MSS-SP Std.
- Special fittings like weldolets sockolet, threadolet etc. which are not covered in ASME, MSS-SP shall be as per manufacturer's std. Contours of these fittings shall meet the requirements of ASME B31.3. Manufacturer shall submit drawings / catalogues of these items along with the offer.
- Threaded ends shall have NPT taper threads in accordance with ASME B1.20.1.

7.2 Fittings End Schedule / Thickness:

- Fittings outside diameter and schedule / wall thickness shall match pipe schedule as per ASME B36.10 / B36.19 /API 5L as the case may be. Sloping of inside contour of fittings shall be done wherever necessary to achieve this.
- For reducing butt weld fittings having different wall thickness at each end, the greater wall thickness of the fitting shall be employed and inside bore at each end shall be matched with the specified inside diameter.
- Bore of fittings shall correspond to the inside diameter of pipe for specified schedule / wall thickness. Ends shall be bevelled to suit the specified schedule/ thickness.
- Fittings ends shall be in accordance with ASME B16.11.

- Fittings wall thickness /schedule shall conform to the material requisition. Wall thickness higher or lower than the specified shall not be accepted.

7.3 Bends radius 5D, 6D and 10D

- These elbows are realized in accordance with B31-3. Upstream and downstream of each bending the straight length left during fabrication (and necessary to maintain the pipe) will be cut after bending.
- The bends welded from sectors should not be used.Ends will be beveled ends as per ANSI B16.25 or plain ended as specified in the PMS.
- Elbow will have no apparent folds due to the bending operation on the intrados. The elbows will have no apparent stripes or scratches due to the machinery on bending operation. All variation of internal diameter must be reduced. If any, this variation of internal diameter between straight pipe and bending must be smooth.

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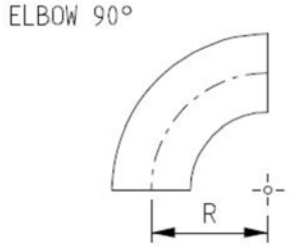
Radius = "R": Tolerances: +/- 1% max.



- Example: For 4" pipe diameter, 5D means R=500 mm / 6D means R=600mm,…
- Outside diameter at ends: Tolerance is +/- 3 mm for Diameter 10" and more.
- Thickness: The wall thickness reduction must be less than 12.5% of nominal thickness.
- After cold bending the bent sections of pipes made of carbon and low-alloy steels should be heattreated, if the ratio of the bend's mean radius to the nominal outside diameter of the pipe is less than 3.5, and the ratio of the nominal pipe wall thickness to its nominal outside diameter exceeds 0.05
- Bent sections of pipes made of austenitic steels should be heat treated regardless of pipe diameter and wall thickness.

7.4 Bevelled Ends:

All butt weld fittings shall have ends bevelled as per ASME B16.25.The weld contour shall be as follows.

Pipe Material	Pipe Wall Thickness	Weld Contour

Carbon Steel (Except Low Temp. Carbon Steel)	Up to 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Up to 10 mm	Figure 4
	> 10 mm & Up to 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

8. MATERIALS

8.1 General:

- Material shall be strictly adhered to as specified in the material requisition. Any substitution of materials shall require the prior written approval of purchaser.
- Forged fittings shall conform to the material specified, substitution of materials shall not be considered.
- Swage nipples (concentric / eccentric) if specified as pipe materials are acceptable in forging materials (up to 1 ½") made of corresponding CS/AS/SS material grades.
- Carbon steel used for fabrication of fittings shall be produced by open hearth, electric furnace or basic oxygen process. Vendor shall procure forging and other materials from approved sources only in case of outsourcing. Source of supplies shall be indicated in vendor's offer and prior approval is necessary for any changes later.
- Material used in the fabrication of all types of fittings shall be new without any corrosion, dents or other damage of any kind.
- All seamless pipes employed for manufacturing of fittings shall be required to have undergone hydro test to ASTM A530.
- All fittings shall be seamless in construction unless otherwise specified in detail description. Welded fittings shall not be acceptable in place of seamless fittings, however seamless fittings shall be provided in case of welded fittings provided it shall have a maximum negative tolerance on wall thickness of 0.3mm.
- Copper or copper alloys shall not be used in any part of the fittings that comes into contact with process fluid (subjected to licensor requirements).
- Structural steel grade such as IS2062, SA 36 or any other structural steel grade material shall not be used for manufacture of fittings.

8.2 Design and Manufacturing:

- Threaded fittings shall be class 3000 or 6000 as specified in MR. Class 2000 fittings shall not be supplied.
- Socket welding fittings shall be class 3000, 6000 or 9000 as specified in MR.
- Correlation of fitting class with pipe schedule shall generally conform to table-7 of ASME B 16.11 unless specified otherwise in MR.
- Unions shall be in accordance with MSS-SP-83, Threaded unions used for utility services shall be limited to 3000 Class, and unions of higher class shall not be used.
- Plugs shall be heavy hexagonal fabricated from solid bar stocks of compatible material as

the valves or fittings.

- Length of long half couplings shall be 100 mm unless otherwise specified in MR

8.3 Chemical Composition:

- Carbon steels including normalised grade shall have the Carbon content and Carbon equivalent (CE) as specified in the relevant code or as mentioned specifically in the material requisition. However, as a general, the Carbon content should not be more than 0.22% max. (For ferritic alloy steel, 0.14% max.) and CE should not be more than 0.43 for fittings intended for welding.

- The Carbon equivalent may be established by using the formula

$$CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$$

- All materials shall be supplied in a normalised condition. All impact tested carbon steel supplied to ASTM A 350 LF2 shall be class 1.
- Material supplied to ASTM A 516 Gr. 60- 70 shall be impact tested in accordance with the requirements of ASTM A 350, with test temperature and acceptance criteria in accordance with Grade LF2 class 1.
- Dual Marked Stainless Steel (e.g. 316/316L) shall be supplied provided that the chemical and mechanical properties comply with the requirements of both grades.
- L-grade Stainless Steel can be supplied in substitution of relevant dual marked under Client approval.

8.4 Heat Treatment:

- All welded fittings shall be normalised for CS and normalised and tempered for AS and 100% radio graphed by X-ray on all welds made by fitting manufacturers and also on the parent materials, in accordance with paragraph UW-51of ASME boiler and pressure vessel code, Section-VIII, Division 1.
- All 1 Cr. – ½ Mo and 1 ¼ Cr. – ½ Mo and 2 ¼ Cr. – 1 Mo, 9Cr-1Mo fittings shall be normalized and tempered. The normalizing and tempering heat treatment shall be a separate heating operation, not the hot forming operation.
- For all 1Cr.- ½ Mo and 1 ¼ Cr. – ½ Mo and 2 ¼ Cr. – 1 Mo, 9Cr-1Mo, the maximum room temperature tensile strength of all pressure retaining components and welds shall be 100,000 psi (7030 kg/cm2).
- For all 1Cr. - ½ Mo and 1 ¼ Cr. – ½ Mo and 2 ¼ Cr. – 1 Mo , 9Cr-1Mo,accelerated cooling from the austenitizing temperature is acceptable, where permitted by the applicable product from specification.
- All stainless steel fittings shall be supplied in solution heat-treated and pickled & passivated condition. Solution annealing for stainless steel fittings shall be carried out again after weld repairs.
- All types of 321 or 347 stainless steel fittings whose service temperature is above 454°C (Subjected to Licensor requirements) shall be in a stabilised heat treated condition.

Stabilizing heat treatment shall be carried out subsequent to the normal solution annealing. Soaking time and holding temperature for stabilizing heat Treatment shall be 4 hours and 900° C respectively.

- All fittings shall be heat treated in accordance with the applicable code / standard requirements.
- Fittings with heat treatment shall be stamped with heat number.
- The bevel ends of all butt weld fittings shall undergo 100% MP/DP test.
- Fittings shall be stress relived in accordance with applicable material specifications.

9. IMPACT TEST

When impact testing is required as per Table 323.2.2 of ASME B31.3, it shall be done in accordance with Table 323.3.1 using the testing methods and acceptance criteria described in paragraphs 323.3.2 through 323.3.5.

Test temperature, unless specifically called for otherwise in the individual material requisition, shall be –45°C for LTCS and –196°C for all grades of austenitic stainless steels in cryogenic service.

10. INTER-GRANULAR CORROSION (IGC) TEST

- For all austenitic stainless steel fittings intergranular corrosion (IGC) test shall have to be conducted as per following.

- ASTM A262 Practice 'B' with acceptance criteria of '60 mils/year (max.)' for all materials - forged, rolled, wrought and casting.

OR

- ASTM A262 Practice 'E' with acceptance criteria of 'No cracks as observed from 20X magnification' for all materials other than castings. 'Microscopic structure shall be observed from 250X magnification in addition.

- For IGC test two sets of samples shall be drawn from each Solution annealing lot; one set corresponding to highest carbon content and other set corresponding to the highest rating and the other to highest pressure rating. When testing is conducted as per Practice "E", photograph of microscopic structure shall be submitted for record.

- For some austenitic stainless steel grades such as SS309, 310, 316, 316H, etc. ASTM A262 Practice 'C' with acceptance criteria of' 15 mils / year (max.) shall be conducted, wherever specified in material requisition.

11. SPECIAL REQUIREMENTS

11.1 IBR Requirements:

- Fittings under the purview of "IBR"(Indian Boiler Regulations) shall each be individually accompanied by IBR certificate original in Form III-C duly approved by IBR authority / local authority empowered by the Central Boiler Board of India. Photocopy of original certificate duly attested by the local boiler inspector where the supplier is located is the minimum acceptable requirement.
- For carbon steel fittings under IBR the chemical composition shall conform to the following:

  Carbon (Max.) : 0.25 %

  Others (S ,P & Mn) : "As prescribed in IBR regulations"

- For materials 1 ¼ Cr – ½ Mo (ASTM A182 Gr.F11 Cl.2.) & 2 ¼ Cr- 1 Mo (A182 Gr.F22 Cl.3) where fittings are manufactured from pipes, from IIIC approved by IBR should include the tabulation of E_t, S_c & S_r values for the entire temperature range given below.

  E_t, S_c & S_r values shall be such that throughout the temperature range.

  $E_t / 1.5 \geq$

  $S_r / 1.5 \geq$ } S_A

  $S_c \geq$

S_A (PSI)												
TEMP (F) MATERIAL	500	600	650	700	750	800	850	900	950	1000	1050	1100
A182 GR.F11 /Cl.2.	20000	20000	20000	20000	19700	19200	18700	13700	9300	6300	4200	2800
A182 GR.F22 /Cl.3.	20500	20400	20200	20000	19700	19300	18700	15800	11400	7800	5100	3200

NOTE:

S_A values are from ASME B31.1. Values shall be as per the latest edition.

S_A : Allowable stress at the working metal temperature.

E_t : Yield point (0.2% proof stress at the working metal temperature).

S_c : The average stress to produce elongation of 1%(creep) in 100000 hrs at the working metal temperature.

S_r : The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature.

11.2 Hydrogen Service:

These special requirements are applicable for the fittings to be supplied for Hydrogen service as marked "Hydrogen Service" in material requisition.

- **Carbon Steel:**

All carbon steel fittings shall be normalized. The normalizing heat treatment shall be a separate heating operation and not a part of the hot forming operation.

All carbon steel fittings having wall thickness 9.53 mm and above shall be normalized Cold drawn pipes and fittings shall be normalized after the final cold draw pass for all thicknesses. In addition, fittings made from forgings shall have Carbon - 0.35% max and Silicon - 0.35% max. The normalizing heat treatment shall be a separate heating operation and not a part of the hot forming operation.

All carbon steel fittings having wall thickness 19 mm and above shall be post weld heat treated.

- **Alloy Steel:**

All alloy steel (Cr-Mo) fittings shall be normalized and tempered. The normalizing and tempering shall be separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be100,000 psi.

All alloy steel (Cr-Mo) fittings shall be post weld heat treated irrespective of type or thickness of weld.

For 9Cr-1Mo-V Grade 91 material all requirement s shall be as per API 938 B-2008.

Alloy 825 fittings welds shall be 100% radiographed.

- **Stainless steel:**

All austenitic stainless steel grades shall be solution annealed after welding. 100% radiography of welded joints shall be done both before and after PWHT.

For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No. (FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be performed in the "as welded" condition by Ferrite scope prior to post weld heat treatment.

- **Impact test:**

For all carbon steels and alloy steels fittings with thickness over 19 mm, Charpy -V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and in accordance with ASTM A370. Impact energies at 0° C shall average greater than 27J (20 ft-lb) per set of 3 specimens, with a minimum of 19J (15 ft-lb).

If welding is used in manufacture, impact test of Heat Affected Zone (HAZ) and weld metal shall also be carried out.

- **Hardness:**

  For carbon steel fittings hardness of weld and HAZ shall be limited to 200 BHN (max).

  For alloy steel fittings, hardness of weld and HAZ shall be limited to 225 BHN (max).

- **Radiography:**

  All girth welded joints (longitudinal and circumferential) shall be 100% radiographed in accordance with UW-51 of ASME Section VIII, Div-1 and ASME Section V.

11.3 NACE / Sour (Wet H2S) Service

- All items under this category shall generally be as par NACE MR0103 latest edition. Where NACE MR 0175 is specified, same shall be applicable.
- All steels shall be fully killed and fine grained.
- Hardness of the production weld shall be lower than 200 HB. This value is slightly lower than the one defined for the base metal (22 HRC or 237 HB) in order to anticipate potential non- homogeneity of certain weld deposits.
- The steel making process shall produce steel with high resistance to hydrogen sulphide attack i.e. HIC & SSC.
- All steels shall be manufactured by either basic oxygen or electric furnace process only.
- Carbon content shall be limited below 0.20 % w.
- CS base material shall be supplied in normalized condition (or quenched and tempered), regardless of thickness.
- Thermal stress relieving (PWHT) required for seamless piping welds as minimum, even if it is not required by code.
- Thermal stress relieving required for cold bend zones even if it is not required by code. Level of deformation may require recovery annealing to restore properties of steel.
- Carbon equivalent (CE) shall be limited to 0.43

  $$CE = C\% + Mn\% / 6 + (CR\% + Mo\% + V\%) / 5 + (Ni\% + Cu\%) / 15$$

- S & P % shall be within 0.010 & 0.020 wt % respectively. Ni shall be less than 1%.

- Fittings where specified HIC and or NACE, in the material requisition shall comply with latest edition of NACE standard specified.

FITTINGS (ELBOWS, TEES, REDUCERS, CAPS, COUPLINGS, SWAGES, WELDOLETS & SOCKOLETS)

Chemical composition as per Table 1 as specified against each product are permitted.

Table-1

Chemical composition for Fittings

Element	Percentage
C	0.20 % max
Mn	1.35 % max
Si	0.10 % to 0.35 % max
P	0.02 % max
Ni	0.20 % max
S	0.020 % max
Other	As per specification
Pcm	0.21 % max
CE	0.40 % max

Impurity level shall be controlled to avoid the occurrence of brittle phases during fabrication process or welding.

Fittings may be supplied in quenched and tempered or normalised or normalised and tempered condition. However, all bends by induction heating shall be tempered afterwards to meet hardness requirements.

- **Chemical Composition:**

This shall be carried out on heat as well as on finished product as per relevant product material specifications and shall meet the requirements on Table-1.

- **Mechanical Properties**

The following mechanical properties shall only be acceptable over and above that specified in the relevant product material specification.

Ultimate Tensile Strength = 77000 psi (max) on finished product

Ratio of yield to tensile strength shall not exceed 0.8 on finished product.

- **Hardness Test**

Max hardness shall be limited to HRC -22 or 248 HV5 or 237 BHN & Measurement shall be as per ASTM E -18 or E-92 or ASTM E-10.

Hardness test shall be conducted on sample of each heat and on each finished product. Waiver may be given only for those products which can get damaged due to hardness test. For small products which cannot be hardness tested individually the manufacturer shall be conduct test on a random basis by selecting component from production run or stores batches to ensure that the product complies fully with hardness requirement. The products for which hardness values are found in excess of specified value shall be rejected. If the hardness on the sample of heat is more than the acceptable value, then the entire raw material from the heat shall be rejected.

- **HIC Test**

This shall be carried out on one finished product (material-wise & type of constructions wise i.e. seamless and welded separately) per heat irrespective of size/thickness/type of fittings. HIC test requirement is as follows.

Forged : HIC testing is not required if chemical composition does not exceed Table-1 limits. Otherwise HIC test shall be carried out.

SSC test is not required. But in case of deviation of S & P % from Table-1 or the chemical analysis of the finished product or UTS being greater than 77000 psi the manufacturer shall either conduct SSC test on every heat successfully OR reject all the finished products made from that heat.

- **Selection of Test Samples**

A. Test specimen shall be taken from per heat of the finished product. Where the specimen cannot be taken from the finished product, a representative test specimen shall be taken from the same heat, heat treated in the same batch or charge as the product and shall undergo the same amount of working as the most worked section of the finished product.

B. In case the finished product is welded type, the test piece shall include the parent metal, weld metal and HAZ.

12. INSPECTION AND TESTING

- Vendor shall comply with the inspection test plan (ITP) for fittings attached to the material requisition as a minimum.
- However a detailed inspection and test plan (ITP) shall be submitted for review by the

purchaser along with bids. All fittings will be subject to inspection in accordance with the purchaser approved inspection and test plan (ITP).

- The certificates shall be issued, stamped and signed by the material manufacturer's inspector, who shall be independent of the manufacturer's production department. This certificate shall also be stamped and verified by the manufacturer's QA/QC department.
- Every fitting shall be subjected to all mandatory tests and checks called in the respective codes by purchaser or any third party as approved by the purchaser. For IBR fittings refer IBR requirements.
- Purchaser or his authorised representative (third party) will carry out stage wise inspection. All assistance shall be provided for the same and timely co-ordination shall be the responsibility of the vendor.
- All material test report for physical property, chemical composition, heat treatment, etc. shall be submitted for all mandatory and supplementary tests specified in accordance with applicable codes /standards or attached specifications.

13. POSITIVE MATERIAL IDENTIFICATION (PMI)

- Positive Material Identification (PMI) shall be performed as per the scope and procedures defined in specification for Positive Material Identification attached with the material requisition, on completion of all manufacturing activities including marking.
- All alloy materials tested by PMI shall be identified using either of the following methods by indicating "PMI OK"
  - Bar Code/ Hologram Sticker
  - A low stress stamp marking
  - Any other method

14. MARKING & PAINTING

- Marking shall be legible and carried out in accordance with ASME /ASTM /API /MSS/ codes as applicable.
- Marking shall be carried out by attaching corrosion resistant metal tags for small bore fitting up to 1 ½" size, the tags shall be securely attached to each package.
- All components shall additionally be hard stamped or vibro etched with heat number. For components manufactured from austenitic steel, marking shall be by vibro etching. Carbon steel and impact tested carbon steel shall be marked by round nosed low stress stamps.
- Paint / ink used for marking shall be free of any harmful metal or metallic salts such as zinc, lead or copper which may cause corrosive attack on heating, with particular attention being paid to austenitic steel.
- In addition to the marking requirements of the relevant product standard and MSS SP-25, the following information shall be marked on each component:

- Type of fitting
- Nominal diameter
- Schedule / Wall thickness
- MOC with grade
- Purchase order number
- Commodity code No./ SAP code No. (if any).
- Special items shall also be marked. Like "IBR","CRYO","NACE"

- All fittings shall be painted as per specification for colour coding of piping materials by vendors Doc No.080557C-000-SP-1390-009.
- For easy identification, fittings shall be painted as per above Spec. additionally fittings for following speciality services shall also be identified by colour markings as per below

IBR: Red, CRYO: Light Purple, NACE: Canary Yellow, HIC: Dark Brown

15. PROTECTION

- All fittings shall be well protected against corrosion and mechanical damage and kept dry, clean and free from dirt, moisture, or loose foreign materials of any kind.
- Stainless steel fittings shall be protected from the risk of saline corrosion during shipment.
- Rust preventive coating on machined surfaces to be welded shall be of easily removable type and shall not be harmful for welding.
- Fittings ends shall be suitably protected and the protectors shall be securely and tightly attached.

Beveled end	:	Wood, metal or plastic cover
Plain end	:	Plastic cap
Screwed end	:	Plastic cap

- Butt-welding ends of fittings, machined surface (Threads, Bevel end, etc.) shall be coated with a corrosion inhibitor. Steel end protectors for galvanized items shall be galvanized.

16. DESPATCH

- All fittings shall be supplied in separate seaworthy packing / bundles / lots item-wise, size / sch. wise, MOC wise, etc. Packing list shall be included as part of each package.
- Each packing / bundle / lot shall be marked with purchase order No., commodity code No., size, schedule / MOC etc..

17. CERTIFICATION & TRACEABILITY

Material certificates for all fittings shall be in accordance with EN 10204 type 3.1. All certificates shall be fully traceable to the item covered and shall be marked with the Purchasers order number, commodity code and tag/part number. They shall be clearly legible, in the English Language.

18. DOCUMENTATION

Vendor shall submit the documents with the offer as specified in the MR.

- If there is any deviation from the "Purchase Specification for Fittings", the same shall be listed clause wise. Even clauses which are acceptable shall be categorically confirmed as "Accepted". The Purchase Specification for fittings marked with deviations shall be returned with offer duly signed and stamped as token of acceptance. Clauses which are not relevant to the supply may be cross marked and mentioned "NA".
- Material test certificates for physical properties, chemical composition and heat treatment etc. shall be furnished.

19. OTHER REQUIREMENTS

- Guarantee/ Warranty, Quality plan, Inspection, PMI, documentation requirements and others shall be governed by purchase requirements attached with the material requisition.

INSPECTION AND TEST PLAN FOR

PIPING BULK ITEMS AND SPECIALITIES

Inspection category: 3

			Written By	Checked By	Approved By	Authorized By
			Karthikeyan Chokkalingam 2020.06.09 11:22:10 +05'30'	Mathivanan Ganesan 2020.06.09 11:34:30 +05'30'	Vaidyasubramaniam V 2020.06.09 13:07:48 +05'30'	Morischristopher Jesumarian 2020.06.09 23:36:32 +05'30'
B	9-JUNE-2020	ISSUED FOR DESIGN	CK	GM	VV/SL	JMC
A	14-OCT-2019	ISSUED FOR DESIGN	CK	AS	VV	JM
REV.	**DATE**	**DESCRIPTION**	**PREPARED**	**CHECKED**	**APPROVED**	**AUTHORIZED**

TABLE OF CONTENTS

ATTACHMENTS:

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
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related

SRU	Sulphur Recovery Unit
OISD	Oil Industry Safety Directorate
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
P&ID	Piping and Instrumentation Diagram
A/G	Above Ground
U/G	Under Ground
B/L	Battery Limit
ISBL	Inside Battery Limit
EOT	Electrically-operated Overhead Travelling
MTO	Material Take Off

3. SCOPE

3.1 This Inspection and Test Plan covers the minimum testing requirements of Piping components.

This Inspection and Test Plan is an engineering document which defines for each type of piping components:

- The type and extent of CONTRACTOR and PMC/OWNER involvement in each phase of fabrication, control and testing requiring an inspection.
- The resulting vendor's contractual obligations, in accordance with applicable project general purchase conditions.

Note: This Inspection and Test Plan may under no circumstances be used as a substitute for the vendor's Quality Control Plan.

3.2 Conflicts, Deviations and Clarifications:

Any conflicts between this specification and other applicable Engineering Standards, Material Specifications, Standard Drawings, Engineering Procedures, Company Forms or Industry standards, specifications, Codes and forms shall be brought to the attention of Authorized Representative by the Contractor for resolution.

Until the resolution is officially made by the Authorized Representative, the most stringent requirement shall govern.

Where applicable Codes or Standards are not called by this standard or its requirements are not clear, it shall be brought to attention of Authorized Representative by Contractor for resolution.

Direct all requests for deviations or clarifications in writing to the Authorized Representative for final resolution.

4. TERMINOLOGY

DFT	Dry Film Thickness
DPT	Dye Penetrant Testing
DHT	De-hydrogen Heat Treatment
ERTL	Electronics Regional Test Laboratory
FCRI	Fluid Control Research Institute
HT	Heat Treatment
HIC	Hydrogen Induced Cracking
ITP	Inspection and Test Plan
IP	Ingress Protection
IHT	Intermediate Heat Treatment
IC	Inspection Certificate
IGC	Intergranular corrosion
MPT/MT	Magnetic Particle Testing
MTC	Material Test Certificate
MRT	Mechanical Run Test
NDT	Non-Destructive Testing
NPSH	Net Positive Suction Head
PO	Purchase Order

PESO	Petroleum Explosive Safety Organization
PQR	Procedure Qualification Record
PR	Purchase Requisition
PMI	Positive Material Identification
RT	Radiography Testing
SSCC	Sulphide Stress Corrosion Cracking
TC	Test Certificate
TPI or TPIA	Third Party Inspection Agency
UT	Ultrasonic Testing
VDR	Vendor Data Requirement
WPS	Welding Procedure Specification
WPQ	Welders Performance Qualification

5. REFERENCE DOCUMENTS

PO / PR / Standards referred therein / Job Specifications / Approved documents.

The codes latest edition as on date of issue of material requisition shall be applicable. Some BS codes may have been superseded by ISO / BS –EN codes, the latest one shall be acceptable.

6. INSPECTION AND TEST REQUIREMENTS

6.1 Refer following Annexures for the Inspection and test requirements for the listed Piping bulk items and specialties.

- Annexure- 1 : ITP for Seamless Pipes
- Annexure - 2 : ITP for Welded Pipes
- Annexure - 3 : ITP for Fittings
- Annexure - 4 : ITP for Flanges
- Annexure - 5 : ITP for Valves
- Annexure - 6 : ITP for Gaskets
- Annexure - 7 : ITP for Bolting
- Annexure - 8 : ITP for Steam Traps
- Annexure - 9 : ITP for Strainers
- Annexure - 10: ITP for Hoses and Couplings

6.2 Extent of Inspection:

The extent of Inspection activities are defined as follows:

H: (Hold) Point

The Supplier cannot carry out the specified controls and tests without Inspector attendance.

Consequently, the attendance to witnessing is mandatory. The Supplier must notify the CONTRACTOR / PMC / OWNER by fax of the dedicated inspection activity at least fifteen (15) days in advance.

W: (Witness)

The Supplier must notify dedicated inspection activity at least fifteen (15) days in advance. CONTRACTOR / PMC / OWNER witnessing is not mandatory, but optional. If CONTRACTOR / PMC / OWNER does not elect to be present, the supplier may proceed with the intended activity, provided controls and test reports are made available for the inspector's review during his subsequent visit.

When a percentage value is indicated (i.e. W 10%) the inspection activities will be witnessed on spot basis as per percentage indicated.

R: (Review) - Review of Documents

The Supplier has either to submit to Inspector for comments the documents required prior to the performance of the dedicated activity or to transmit or make available for the review of Inspector the results of the controls and tests conducted, as the case may be.

7. SUPPLIER'S FABRICATION AND QUALITY CONTROL PLAN

The Supplier must issue a Fabrication and Quality Control Plan for each Equipment / Machinery / Package/ Bulk Item.

The Supplier's Fabrication and Quality Control Plan is a document which defines in a chronological manner the list of the operations of fabrication, controls and tests in accordance with his own "know-how" and with the requirements specified in MR.

Following information shall be clearly specified against each operation:

- Reference documents (drawings, procedures, etc.)
- Acceptance criteria (code, etc.)
- Recording documents for controls and tests

- Involvement of the Quality Control department of the Supplier and/or his sub-supplier

This Supplier's Fabrication and Quality Control Plan will have to include all inspection activities defined in Inspection and Test Plan as well as all inspection activities scheduled by Independent Inspection Authority and/or the Client.

8. INSPECTION RELEASE CERTIFICATE

This document issued by Inspector, permits the vendor to proceed with the packing and to notify the shipment.

9. QUALITY CONTROL MANUFACTURING DOSSIER "QCMD" (ex. Inspection Book)

This document must be completely reviewed during the final Inspection. Preliminary Copy (Waiting for CLIENT final approval), checked and signed by the Inspector, must be shipped together with the goods and indicated in the relevant Packing List.

TechnipFMC / IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery
	CLIENT	INDIAN OIL CORPORATION LIMITED

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Annexure - 1

INSPECTION AND TESTING REQUIREMENTS FOR SEAMLESS PIPES

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	Hydrostatic Test, Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	R	R		
2.0	**Material Inspection**							
2.1	Raw Material Inspection	Review of MTC for Chemical, Mechanical Properties, Size & steel making process, etc.	100%	Test Certificates	P	R		
3.0	**In Process Inspection**							
3.1	Heat Treatment	Normalizing, Tempering, Solution Annealing, Stabilization Heat treatment etc as applicable	100%	HT chart	P	R		
3.2	NDT As applicable	Surface & Internal Imperfections	PR/ Purchase Specifications	NDT Reports	P	R		
3.3	Identification of test Samples	Product Chemical, Tensile, Hardness, Impact, IGC and other test as applicable	Lots as per specification	Test Reports	P	H		
3.4	Product Analysis	Chemical Composition	Lot as per specification	Test Reports	P	W		
3.5	Destructive Testing	Tensile, Hardness, Impact, IGC and Other test as applicable	Lot as per specification	Test Report	P	W		
3.6	Corrosion Test (If any)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.7	Galvanizing (If Applicable)	Integrity Of Galvanished Coating	100%	Inspection Report	P	W		
4.0	**Final Inspection**							
4.1	Hydrostatic Testing	Leak Cheek	100%	Test Report	P	RW (Note 1)		
4.2	Visual and Dimensional Inspection (VDI)	Surface Condition, Straightness, End Finish, Bevel Angle,Root Face, Outer Dia, Thickness, length, End Finish, Marking, End Caps etc	100%	Inspection Report	P	W (Note-5)		
4.3	PMI Check(If applicable)	Chemical Check	As Applicable	Inspection Report	P	W		
4.4	Final Stamping	Stamping of Accepted Pipies	Stamping of Pipies which are witness by PMC/OWNER., Other pipes to have suppliers Identification	Inspection Report	P	H		
5.0	**Painting**							
5.1	Rust Preventive Coating & Color Coding(As applicable)	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. Carbon steel Pipes (Other than LTCS & Pipes for special services like NACE, H2, HIC, etc) upto 12" will be accepted on review of supplier test certificates. Supplier test Certificates to be reviewed by TPIA.

2.This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).

3. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.

4. For orders placed on stockist, items shall be accepted based on manufacturer's TC with EN10204 type 3.2 certification from client approved suppliers.

5.100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

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INSPECTION AND TESTING REQUIREMENTS FOR WELDED PIPES

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	Hydrostatic Test, Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	P	H		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	H		
2.0	**Material Inspection**							
2.1	Raw Material Inspection (**Special services like NACE, H2, HIC..etc)	Review of MTC for Chemical, & Mechanical Properties	100%	Test Certificates Suppliers inspection report	P	H		
3.0	**In Process Inspection**							
3.1	Welding	Welding Parameters as per WPS/PQR	100%	Inspection Reports	P	RW		
3.2	Heat Treatment	Stress Relieving, Normalizing, Tempering, Solution Annealing, Stabilization Heat treatment etc as applicable	100%	HT chart	P	W		
3.3	Corrosion & Metallurgical testing	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.4	Ferrite Checking of SS Pipes (as Applicable)	% Ferrite Check	Random On Weld	Inspection Report	P	W		
3.5	UT / RT As applicable	Surface & Internal Imperfections	PR / Purchase Specfication	RT Films, Reports & UT Reports	P	W		
3.6	Identification of test Samples	Product Chemical, Tensile, Hardness, Impact, IGC and other test as applicable	Lots as per specification	Test Reports	P	W		
3.7	Product Analysis	Chemical Composition	PR / Purchase Specfication	Test Reports	P	W		
3.8	Destructive Testing	Tensile, Hardness, Impact, IGC and Other test as applicable	Lot as per specification	Test Report	P	W		
3.9	Galvanizing (If Applicable)	Integrity Of Galvanished Coating	100%	Inspection Report	P	W		
4.0	**Final Inspection**							
4.1	Hydrostatic Testing	Leak Cheek	100%	Test Report	P	W		
4.2	Visual and Dimensional Inspection (VDI)	Surface Condition, Straightness, End Finish, Bevel Angle,Root Face, Outer Dia, Profile Thickness, length,End Finish, Marking etc,	100%	Inspection Report	P	W (Note-4)		
4.3	Hardness test(If applicable)	As per specification	100%	Test Report	P	W		
4.4	Corrosion test(If applicable)	As per specification	100%	Test Report	P	W		
4.5	PMI Check	Chemical Check	As Applicable	Inspection Report	P	W		
4.6	Final Stamping	Stamping of Accepted Pipies	Stamping of Pipies which are witness by PMC/OWNER	Inspection Report	P	P		
5.0	**Painting**							
5.1	Rust Preventive Coating & Color Coding(As applicable)	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).

2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.

3. For orders placed on stockist, items shall be accepted based on manufacturer's TC with EN10204 type 3.2 certification from client approved suppliers.

4.100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER

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Annexure - 3

INSPECTION AND TESTING REQUIREMENTS FOR FITTINGS

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	Heat Treatment/NDT	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ(If applicable)	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	H		
2.0	**Material Inspection**							
2.1	Raw Material Inspection (Billets, Rounds, Pipes, Coil, Plates, etc) (**Special services line NACE, H2, HIC..etc)	Review of MTC for Chemical, & Mechanical Properties, size & steel making process, etc	100%	Mill test Certificates, Suppliers inspection Report	P	H		
3.0	**In Process Inspection**							
3.1	Forming Welding	Forming & Welding Parameters	100%	Supplier's records	P	RW		
3.2	Ferrite check of SS welds (If applicable)	% Ferrite Check	100%	Inspection report	P	RW		
3.3	Heat Treatment	Stress Relieving, Normalizing, Tempering, Solution Annealing, Stabilization Heat treatment etc as applicable	100%	HT Chart/Report	P	RW		
3.4	NDT-RT As Applicable	Surface & Internal Imperfections	PR / Purchase Specfication	RT Films, Reports & UT Reports	P	R		
3.5	Corrosion & Metallurgical testing	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.6	NDT / UT As applicable	Surface & Internal Imperfections	PR / Purchase Specfication	UT Reports	P	W		
3.7	NDT-DPT/MPT of bevel ends	Surface / sub surface defects	100%	Test report	P	RW		
3.8	Identification of test Samples	Product Chemical, Tensile, Hardness, Impact, IGC and other test as applicable	Lots as per specification	Test Reports	P	W		
3.9	Product Analysis (as applicable)	Chemical Composition	PR / Purchase Specfication	Test Reports	P	W		
3.10	Destructive Testing	Tensile, Hardness, Impact, IGC and Other test as applicable	100%	Test Report	P	W		
3.11	Galvanizing (If Applicable)	Integrity Of Galvanished Coating	100%	Inspection Report	P	W		
4.0	**Final Inspection**							
4.1	Visual and Dimension	Size, Thickness / Schedule, Dimensions, Surface quality, Marking etc.	100%	Inspection Report	P	W (Note-6)		
4.2	Hardness testing on fittings (** Special services like NACE, H2, HIC,etc)	Hardness value of base metal & Weld / HAZ as applicable	Random 10%	Test report	P	W		
4.3	PMI Check (If applicable)	Chemical check	As Applicable	Inspection Report	P	W		
4.4	Final Stamping	Stamping of Accepted Fittings	Stamping of Fittings which are witness by PMC/OWNER	Inspection Report	P	P		
4.5	Final Stamping	Stamping of Accepted Pipies	Stamping of Pipies which are witness by PMC/OWNER	Inspection Report	P	P		
5.0	**Painting**							
5.1	Shot Blasting Rust Preventive Coating & color Coding	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
3. For orders placed on stockist, items shall be accepted based on manufacturer's TC with EN10204 type 3.2 certification from client approved suppliers.
4. For welded fittings, it is recommended to use low hydrogen consumable for AS, SS 410 fittings & HIC resistant consumable for HIC service fittings.
5. TPIA reserves the right to check raw material consumption and traceability records.
6. 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

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Annexure - 4

INSPECTION AND TESTING REQUIREMENTS FOR FLANGES

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	Heat Treatment, NDT and other Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	R		
2.0	**Material Inspection**							
2.1	Raw Material Inspection	Chemical, & Mechanical Properties	100%	Test Certificates	P	R		
3.0	**In Process Inspection**							
3.1	Welding / Forging	Forging & Welding Parameters	100%	Inspection report	P	RW		
3.2	Heat Treatment	Stress Relieving, Normalizing, Tempering, Solution Annealing, Stabilization Heat treatment etc as applicable	100%	HT Chart	P	RW		
3.3	Identification of test Samples	Product Chemical, Tensile, Hardness, Impact, IGC and other test as applicable	100%	Test Reports	P	RW		
3.4	Corrosion & Metallurgical testing	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.5	Product Analysis (As applicable)	Chemical composition	PR / Purchase Specfication	Test Reports	P	RW		
3.6	Destructive Testing	Mechanical, Impact, IGC and Other test as applicable	100%	Test Report	P	W		
3.7	NDT As applicable	Surface & Internal Imperfections	PR / Purchase Specfication	NDT Reports	P	RW		
3.8	Machining and Drilling	Visual & Dimensional check	Lot as per specification	Inspection report	P	R		
3.8	Galvanizing (If Applicable)	Integrity Of Galvanished Coating	100%	Inspection Report	P	W		
4.0	**Final Inspection**							
4.1	Final Inspection	1.Visual 2. Dimesnions 3. Hardness 4. Marking etc	100%	Inspection Report	P	W (Note-4)		
4.3	PMI Check(If applicable)	Chemical check	As Applicable	Inspection Report	P	W		
4.4	Final Stamping	Stamping of Accepted Items	Stamping of items which are witnessed by PMC / OWNER	Inspection Report	P	P		
5.0	**Painting**							
5.1	Rust Preventive Coating & color Coding	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. For Non NACE & Non Hydrogen service Carbon Steel Flanges, Spectacle Blinds & Drip rings upto 24" - 300 ANSI Class will be accepted on review of Supplier Test Certificates. Supplier Test Certificates to be reviewed by TPIA.
2. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
3. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
4.100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER..

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	CLIENT	INDIAN OIL CORPORATION LIMITED

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Annexure - 5

INSPECTION AND TESTING REQUIREMENTS FOR VALVES

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	Hydrostatic Test, Heat Treatment, NDT, Helium Leak Test and other Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	R, W - For New		
1.3	Pre-Qualification Tests	Fire safe Parameters & Qualification Record	PR / Purchase Specfication	Acceptance Report	P	W		
2.0	**Material Inspection**							
2.1	Cating & Forgings (Body, Bonnet, Disc, Stem, Body ring	Chemical, Mechanical, Heat Treatment, NDT, IGC & Other Properties as applicable	100%	Test Certificates	H	H		
2.2	Cating & Forgings (Body, Bonnet, Disc, Stem, Body ring	Visual & Dimensions	100%	Inspection Report	H	H		
2.3	Body and Bonnet Castings	Radiography Examination	PR / Purchase Specfication	Films and report	H	R		
2.4	Bars for Trim Material	Chemical Analysis	Each Heat	Test Certificates & Lab report	H	R		
2.5	Corrosion & Metallurgical testing (as applicable)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
2.6	Magnetic particle testing /Dye penetrant testing	As per NDE specification	100%	Test Report	P	W		
2.7	Gaskets, Gear units, Fasteners, Gland, Packings, etc	Physical / Chemical Properties	100%	Test Certificates & Lab report	H	R		
2.8	Actuators as applicable	Performance, Statutory Certificates as applicable	100%	Test Certificates, Inspection reports	H	H		
3.0	**In Process Inspection**							
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection report	P	RW		
3.2	Machining of components	Visual / Dimension	100%	Inspection report	W	R		
4.0	**Final Inspection**							
4.1	Hydrostatic / Pneumatic Test and Helium Leak Test as applicable	Leak Check	PR / Purchase Specfication	Test Report	P	RW (Note-1)		
4.2	Visual / Dimension	Surface & Dimension Check	100%	Test Report	P	W (Note-4)		
4.3	Functional test for Actuator Operated Valves	Satisfactory Performance	100%	Test Report	P	RW		
4.4	PMI Check (as aplicable)	Chemical	As Applicable	Inspection report	P	RW		
4.5	Strip Check (As applicable)	Verify Components & Differential hardness if applicable	PR / Purchase Specfication	Inspection report	P	RW (Note-1)		
4.6	Final Stamping	Stamping of Accepted Valves	Stamping of items which are witnessed by PMC / OWNER	Inspection report	P	P		
5.0	**Painting**							
5.1	Painting & color Coding as applicable	Visual / DFT Check	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. For Non NACE & Non Hydrogen service Carbon Steel valves upto 12" will be accepted on review of Supplier Test Certificates. Supplier Test Certificates to be reviewed by TPIA.
2. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).
3. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.
4. 100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

TechnipFMC / IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery
	CLIENT	INDIAN OIL CORPORATION LIMITED

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Annexure - 6

INSPECTION AND TESTING REQUIREMENTS FOR GASKETS

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	HT & Test Procedure	Documented Procedures	100%	Procedure Documents	P	R		
2.0	**Material Inspection**							
2.1	Raw Material Inspection	Chemical, Physical and other Properties as per applicable material specification	100%	Test Certificates	P	R		
3.0	**In Process Inspection**							
3.1	Punching & Finishing	Finish & Dimension	100%	Inspection Report	P	H		
3.2	Heat Trement for RTJ Gaskets (As applicable)	Time & Temperature	100%	HT Chart	P	H		
3.3	Corrosion & Metallurgical testing	Intergranular corrosion	Lot as per specification	Test Report	P	W		
4.0	**Final Inspection**							
4.1	Final Visual, Dimension & Testing	Compressibility, Recovery, Seal ability, Groove Hardness for Ring & Tongue Joint etc as applicable and Visual / Dimension	100%	Inspection Report	P	W (Note-3)		
4.2	Final Stamping	Stamping Of Accepted Gaskets	100%	Inspection Report	P	W		
4.3	PMI Check	Chemical Check	As Applicable	Inspection Report	P	W		
5.0	**Painting**							
5.1	Rust Prevention & Color Coding (As applicable)	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).

2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.

3.100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

TechnipFMC / IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery
	CLIENT	INDIAN OIL CORPORATION LIMITED

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INSPECTION AND TESTING REQUIREMENTS FOR BOLTING

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	Heat Treatmetn & NDT Procedures	Documented Procedures	100%	Procedure Documents	P	H		
2.0	**Material Inspection**							
2.1	Raw Material Inspection	Chemical, Steel making prcess, Macro etch, etc.,	100%	Test Certificates	P	R		
3.0	**In Process Inspection**							
3.1	Thread Rling, Hot Forging of Nuts/Boll Heads, Machining	Process parameters	100%	Inspection Reports	P	RW		
3.2	Heat Treatment	Normalizing & Tempering, Quenching & Tempering, Solution Annealing, Stabilization Heat Treatment, Strain Hardening, Nitriding etc., as applicable	100%	Inspection Reports	P	RW		
3.3	Corrosion & Metallurgical testing(If applicable)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.4	NDT As applicable	Defects detection	100%	Test Reports	P	W		
3.5	Identification of test Samples	Product Chemical, Proof Load Test, Stress Rupture, Tensile, Hardness, Impact, and other test as applicable	Lots as per specification	Test Reports	P	H		
3.6	Destructive Testing	Product Chemical, Proof Load Test, Stress Rupture, Mechanical Impact, and other test as applicable	Lot as per specification	Test Report	P	W		
3.7	Galvanizing (If Applicable)	Integrity Of Galvanished Coating	100%	Inspection Report	P	W		
4.0	**Final Inspection**							
4.1	Visual & Dimension	Visual Marking & Dimensions	100% by Suppler & Random by PMC/OWNER	Inspection Report	P	W(Note-3)		
4.2	Final Stamping	Stamping of Accepted Bolting Material	Stamping of bolting material which are witness by PMC/OWNER. Others to have suppliers Identification.	Inspection Report	P	W		
4.3	PMI Check(If applicable)	Chemical Check	As Applicable	Inspection Report	P	W		
5.0	**Painting**							
5.1	Rust Prevention & Color Coding (As applicable)	Visual & Color Coding as applicable	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).

2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.

3. Final Visual and Dimension shall be checked as per below sampling plan.

Lot Size (Nos.)	Sample Size (Minimum)
Upto 100	2% (Min. 2 Nos.)
101 to 500	1% (Min. 3 Nos.)
501 and above	0.5% (Min. 5 Nos.)

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INSPECTION AND TESTING REQUIREMENTS FOR STEAM TRAPS

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	Hydrostatic Test, Heat Treatment, NDT, Helium Leak Test and other Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	R W - New		
2.0	**Material Inspection**							
2.1	Raw Material Inspection	Chemical, Mechanical, Heat Treatment, NDT, IGC & Other Properties as applicable	100%	Test Certificates	P	W		
3.0	**In Process Inspection**							
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection report	P	RW		
3.2	Heat Treatment	PWHT as applicable	100%	HT Chart	P	RW		
3.3	Corrosion & Metallurgical testing(If applicable)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.4	RT As Applicable	Weld Defects	PR / Purchase Specfication	RT films & Reports	P	R		
3.5	NDT As Applicable	Surface & Internal Imperfections	PR / Purchase Specfication	Test Reports	P	RW		
4.0	**Final Inspection**							
4.1	Hydrostatic Testing	Leak Check	100%	Test Report	P	W		
4.2	Visual and Dimensional Inspection (VDI)	Surface Conditions & Dimension	100%	Inspection report	P	W (Note-3)		
4.3	PMI Check (If applicable)	Chemical Check	As Applicable	Inspection report	P	W		
4.4	Final Stamping	Stamping of Accepted traps	100%	Inspection report	P	W		
5.0	**Painting**							
5.1	Painting & color Coding	Visual, DFT & Color coding as applicable	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).

2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.

3.100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

TechnipFMC / IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery
	CLIENT	INDIAN OIL CORPORATION LIMITED

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INSPECTION AND TESTING REQUIREMENTS FOR STRAINERS

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	Hydrostatic Test, Heat Treatment, NDT, Helium Leak Test and other Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	W-New R-Existing		
2.0	**Material Inspection**							
2.1	Raw Material Inspection	Chemical, Mechanical, Heat Treatment, NDT, IGC & Other Properties as applicable	100%	Test Certificates	P	RW		
3.0	**In Process Inspection**							
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection report	P	RW		
3.2	Heat Treatment	PWHT as applicable	100%	HT Chart	P	RW		
3.3	Corrosion & Metallurgical testing(If applicable)	Intergranular corrosion	Lot as per specification	Test Report	P	W		
3.4	RT As Applicable	Weld Defects	PR / Purchase Specfication	RT films & Reports	P	R		
3.5	NDT As Applicable	Surface & Internal Imperfections	PR / Purchase Specfication	Test Reports	P	W		
4.0	**Final Inspection**							
4.1	Hydrostatic Testing	Leak Check	100%	Test Report	P	W		
4.2	Visual and Dimensional Inspection (VDI)	Surface Conditions & Dimension	100%	Inspection report	P	W (Note-4)		
4.3	PMI Check (if applicable)	Chemical Check	As Applicable	Inspection report	P	W		
4.4	Final Stamping	Stamping of Accepted strainers	Stamping of Strainers which are witnessed by PMC/OWNER	Inspection report	P	W		
5.0	**Painting**							
5.1	Painting & color Coding	Visual, DFT & Color coding as applicable	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. For Non NACE & Non Hydrogen service Strainers upto 6" 300# ANSI will be accepted on review of Supplier Test Certificates duly reviewed by TPIA.

2. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).

3. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.

4.100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER..

TechnipFMC / IndianOil	PROJECT	Standby SRU & Additional Tanks IOCL- Paradip Refinery	
	CLIENT	INDIAN OIL CORPORATION LIMITED	

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INSPECTION AND TESTING REQUIREMENTS FOR HOSES(METALLIC) AND COUPLINGS

SL NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION			
					SUPPLIER	CONTRACTOR/TPIA	PMC	OWNER
1.0	**Procedure**							
1.1	Hydrostatic Test & NDT Procedures	Documented Procedures	100%	Procedure Documents	P	R		
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	P	W- For New R-Existing		
2.0	**Material Inspection**							
2.1	Incoming Materials (Rubber hose / SS pipe / SS wire braiding / Flanges / Coupling)	Chemical & Mechanical Properties & IGC (For SS items if applicable)	100%	Test Certificates	P	R		
3.0	**In Process Inspection**							
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection report	P	RW		
3.2	NDT As Applicable	Weld soundness	100%	Test Reports	P	RW		
4.0	**Final Inspection**							
4.1	Hydrostatic/Pneumatic Testing	Leak Check	100%	Test Report	P	W		
4.2	Vaccum test, Steam Resistance, Electrical Continuity and other tests as applicable	Leak & Soundness check	100%	Test Report	P	W		
4.3	Visual and Dimensional Inspection (VDI)	Surface Conditions & Dimension	100%	Inspection report	P	W (Note-3)		
4.4	PMI Check	Chemical Check	As Applicable	Inspection report	P	W		
4.5	Final Stamping	Stamping of Accepted items	100%	Inspection report	P	W		
5.0	**Painting**							
5.1	Painting & color Coding	Visual, DFT & Color coding as applicable	100%	Inspection Report	P	W		
6.0	**Documentation & IC**							
6.1	Final documents	Review of Stage Inspection report / Test Reports	100%	Supplier TC & IC	P	H	R	
6.2	Inspection release certificate	Issue of Inspection release certificate	100%	Supplier TC & IC	-	H	R	

Legend: H-Hold (Do not proceed with approval), P-Perform, RW-Random Witness (As specified or 10% (min.1 no.of each size and type of Bulk item)), R-Review, W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable)

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).

2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in Job specification / Approved Documents.

3.100% Visual & 10% dimensional checks of each size, pressure rating and type of component at vendors' works by Third Party Inspection (TPI) and surprise checks by PMC/OWNER.

QAP GUIDELINES & FORMAT

(ANNEXURE)

The QAP format and guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement.

Note:

1. Typical /Indicative /Standard QAP(s) for equipment /package attached is reference document and to use by successful bidder in future for preparation and submission of QAP for BHEL /CUSTOMER approval.

2. No deviation to reference document is acceptable.

GUIDELINES TO VENDORS FOR PREPARATION OF QUALITY ASSURANCE PLAN

1. QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10.

2. Each page of QAP shall contain the following information.
   a) Vendor's name & address.
   b) Customer: BHEL, Hyderabad.
   c) Project.
   d) BHEL Product Standard Number/revision number as referred in P.O.
   e) BHEL Purchase Order Number & Date.
   f) Product as per P.O. description.
   g) QAP Number (unique and shall not repeat)/revision number/date.
   h) Page number and number of pages

3. QAP shall contain four parts / stages as follows.
   a) Raw materials and bought out items.
   b) In process Control / Inspection.
   c) Final assembly, Inspection & Testing.
   d) Painting, preservation & packing.

4. Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc).

5. Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT, DP etc.), hydrostatic test, calibration check etc.)

6. Under 'Class', indicate minor, major or critical depending on the importance of characteristic.

7. Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.)

8. Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.)

9. Under 'Reference document' and 'Acceptance norms', appropriate National & International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review & approval by our Engineering dept.

10. Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.

11. Please refer 'Agency' in QAP format.
    Under P: Perform, W: Witness, V: Verify
    Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR
    2: (Vendor / Sub vendor)

Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, Under Witness (W) column use 1. Under 'Verify' column, use code1.

12. Under 'D' please put (□ Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification.

13. Vendor's signature & stamp should be available on each page of QAP.

14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification & Approved Drawings.

15.The following operations/characteristics/check points may be included (AS APPROPRIATE)

a) Visual check
b) Dimensional check
c) Mechanical and Chemical properties.
d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.)
e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc.
f) Check for correctness for all components mounted as per General Arrangement Drawing, Bill of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc.
g) Verification of test certificate for protection class for the enclosures.
h) Mechanical functioning of switches.
i) Continuity of earthing and provision of earth points.
j) Colour coding of wiring, size, tightness & dressing of wiring.
k) Review of test certificates of assembled items, raw materials, internal test reports etc.
l) Witness of functional checks, which may include mechanical run & electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc.
m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc.
n) Material identification (for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.)
o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non-Destructive Tests.
p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating)
q) All tests as per BHEL Product Standard & approved drawings including Type tests and Routine tests on individual items and on System as a whole.
r) Packing and Preservation.

16. **QAP Format enclosed.**

17. For inspections outside India, customer/PMC approved TPIA to be hired by vendor and TPIA charges to be borne by vendor.

TPIA list:

~~a. M/s TUV SUD South Asia Pvt. Ltd.~~
b. M/s SGS India Pvt. Ltd.
c. M/s VCS Quality Services Private Limited
d. M/s International Certification Services Pvt. Ltd.
e. M/s ABS Industrial verification Pvt. Ltd.

f. M/s Projects and Development India Ltd.
g. M/s TATA Project Limited
h. M/s Certification Engineers International Limited
i. M/s Bureau Veritas (India) Pvt. Ltd.

VENDOR'S NAME & ADDRESS:	**MANUFACTURING QUALITY PLAN**		QP. NO.:	
	CUSTOMER: BHEL, HYDERABAD – 32. PROJECT: PRODUCT:	BHEL P.O.NO.: P.O. DATE: BHEL SPEC: REV:	REV NO:	DATE:
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SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
2.0	**INPROCESS INSPECTION**												
3.0	**FINAL INSPECTION & TESTING**												
4.0	**PRESERVATION & PACKING**												

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE **1 FOR BHEL/BHEL NOMINATED TPIA** & **2 FOR VENDOR/SUB VENDOR** AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY VENDOR'S SIGNATURE & STAMP	APPROVED BY BHEL QA SIGNATURE & STAMP	APPROVED BY CUSTOMER'S SIGNATURE & STAMP

PROJECT ENGINEERING & SYSTEMS DIVISION
RC PURAM, HYDERABAD.
QUALITY & BUSINESS EXELLENCE

INSPECTION / TC REVIEW FORMAT

1	Vendor's Name:		5	Applicable BHEL Spec No:	
2	Project:		6	Approved Drawing No:	
3	PO No:		7	Approved Data Sheet No:	
4	Item Description:		8	Approved QAP No:	

OFFER LIST

S.No	BBU/ PO Sr. No.	Item Description	Total Qty as per PO/BBU	Qty. already accepted	Qty offered for TC review	Cumulative Qty	Balance Qty
A							
B							
C							
D							

TC REVIEW REQUISITION

BBU / PO Sr. No.	QAP Clause No.	Format of Record	Certificate No. & Date	Page No.	REMARKS
A. Item Description:					
B. Item Description:					
C. Item Description:					
D. Item Description:					
E. Item Description:					

SUPPLIER / VENDOR SIGNATURE WITH SEAL	BHEL/ BHEL's TPIA SIGNATURE WITH SEAL
Dt:	**Dt:**