

 	PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
	CLIENT	INDIAN OIL CORPORATION LIMITED		
STANDARD SPECIFICATION FOR POSITIVE MATERIAL IDENTIFICATION AT CONSTRUCTION SITES	Project No. 080557C001	Document No. 080557C-000-PP-804	Rev. No. 1	Page 1 of 11

## STANDARD SPECIFICATION FOR POSITIVE MATERIAL IDENTIFICATION AT CONSTRUCTION SITES

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## 1 SCOPE

- 1.1 This specification applies to metallic alloy materials as well as carbon steel materials as defined in this document used in piping, heater coils, storage tanks, vessels etc. at construction sites. Positive Material Identification (PMI) is to be carried out on Owner supplied material as well on materials purchased by the contractor after installation (before testing). PMI may be carried out at the ware house also for identification /segregation of materials as per instruction of Engineer in Charge

Any deviation from this specification must be approved by Owner/ PMC in the prescribed format.

## 2 DEFINITIONS

For this specification, the following definitions are applicable:

**“OWNER or IOC or IOCL or Client”** shall mean INDIAN OIL CORPORATION LIMITED

**“CONSULTANT or PMC”** shall mean TECHNIP INDIA LIMITED.

**“CONTRACTOR”** shall mean the bidder selected by the OWNER for performing the scope of works specified in the bid documents.

**“AUTHORISED REPRESENTATIVE”** shall mean OWNER's/CONSULTANT's representative authorized to act for and on behalf of OWNER/CONSULTANT, as the case may be

**“VENDOR”** shall mean any third party selected by either the OWNER or CONTRACTOR for supplying any of the equipment/materials for the Unit specified in the bid documents.

**“PROJECT”** shall mean Sulphur Recovery Unit and Additional Tanks Project, Paradip Refinery

**“UNIT”** shall mean the totality of the units and facilities comprised in the Scope of work, which forms a distinct operating system.

**“TPIA”** shall mean Third Party Inspection Agency

### Abbreviations:

API	:	American Petroleum Institute
ASM	:	American Society for Metals

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ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing and Materials
ITP	:	Inspection Test Plan
PMI	:	Positive Material Identification
RTJ	:	Ring Type Joint
TPI / TPIA	:	Third Party Inspection /Third Party Inspection Agency Carbon Steel
CS	:	Carbon Steel
AS	:	Alloy Steel
SS	:	Stainless Steel

## 2.1 Positive Material Identification (PMI)

The term Positive Material Identification (PMI) refers primarily for determination/ verification of alloy type or its composition using portable or mobile spectrometer/ alloy analyzer. For the purpose of this specification, some carbon steel materials as defined in clause no 3.1.9 in this document are also included for PMI checking to avoid mix up with Alloy steel during installation.

Chemical spot checking, resistivity testing, eddy current testing, electromagnetic alloy sorting, thermoelectric testing shall not be considered as PMI for this specification.

## 3 SPECIFIC APPLICABILITY

**3.1** The following items (AS/SS from clause 3.1.1 up to 3.1.10 and CS at clause 3.1.11) require PMI unless specifically exempted through a Concession/ Deviation permit by OWNER/CONSULTANT

**3.1.1** All pressure containing piping components including, thermowells instrument manifolds, RTJ gaskets, Spiral Wound gaskets other than carbon steel, fasteners etc. All valves installed on line.

**3.1.2** Tubular products used in the fabrication of heaters.

**3.1.3** Pressure - containing instrument housings (e.g. gauge glass housings, orifice meter tubes).

**3.1.4** Internal metallic linings/cladding, and weld overlay, done at site, used for protection against corrosive environments.

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### 3.1.5 Tubing

3.1.6 Stud, bolts & nuts and anchors used to hold refractory materials.

### 3.1.7 Plates

3.1.8 All pressure containing welds.

3.1.9 Pipe supports (welded/ bolted) such as pads, saddles, dummy pipes etc.

3.1.10 Any other components or materials specifically designated for PMI on the purchase order/ contract.

3.1.11 a) Pressure containing CS piping components of rating 900# and above

b) Pressure containing CS steel piping items under Hydrogen service.

c) Pressure Containing CS Piping where substitution of hardenable alloy materials in carbon steel piping systems may result to failure and loss of containment in process services like wet hydrogen sulfide (H<sub>2</sub>S), hydrofluoric acid (HF), sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) services etc.

## 3.2 Exclusions

The following items are exempted unless specifically designated for PMI in the purchase order/contract:

3.2.1 Internal instrument parts.

3.2.2 Internal machinery parts.

3.2.3 Internal non-pressure - containing baffles, trays, tray clips, supports, pall-rings, support rings, etc.

3.2.4 Electrical components.

3.2.5 Internal valve components.

3.2.6 Compression-type ferrules and fittings for use with 3/4 inch (19mm) outside diameter and smaller tubing.

3.2.7 All carbon steel piping components (including carbon steel pipe supports) other than those

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specified at 3. 1.11

**3.2.8** All carbon steel Studs/ bolts/ nuts.

**3.2.9** Carbon Steel Plates.

## 4 REFERENCES

American Society of Mechanical Engineers (ASME) BPV Code Section-II Part A, B and C.

ASME B 31 .3

American Society for Testing and Materials (ASTM): As applicable

Material Verification Program for New and Existing Alloy Piping Systems: API RP 578 Any other material specification referenced by the Purchase Order/Contract.

Any other applicable BIS / ISO /EN / BS material Standard /Specification.

## 5 GENERAL REQUIREMENTS

- 5.1** The test methods outlined in this specification are intended to identify the nominal composition of alloy/ Stainless steel materials. These test methods are not intended to establish the conformance of a material to a particular specification.
- 5.2** PMI shall not be considered as a substitute for required mill test reports listing chemical composition. In addition, mill test reports shall not be considered as confirming alloy/ composition verification.
- 5.3** The PMI activity shall be included in the overall quality plan and Inspection & Test Plan for fabrication/ erection. The contractor shall submit to OWNER/CONSULTANT, a procedure for PMI to comply with the requirements of this specification. Approval of PMI procedure shall be obtained from OWNER/CONSULTANT prior to commencement of fabrication/ erection as the case may be.
- 5.4** Contractor shall engage reputed TPIA specified in the contract to witness inspection at site and accordingly submit ITP for review of owner/ PMC. In case list of approved TPIA is not available in contract, prior approval shall be taken before engagement of TPIA.
- 5.5** A copy of PMI records duly verified by TPIA shall be submitted to Owner/PMC .

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**5.6** After installation, but prior to hydrostatic testing/painting/insulation, the contractor shall examine all components requiring PMI for proper compliance to this specification. A record of this final check duly endorsed by TPIA, as specified below, shall be submitted to OWNER/CONSULTANT and made part of the permanent inspection records.

**5.7 Owner Supplied Material If any**

Records signed by contractor and duly verified by TPIA (engaged by contractor)/ and reviewed by OWNER/CONSULTANT shall be generated as part of the receiving inspection at warehouse.

**5.8 Contractor Supplied Material**

Records signed by contractor and certified by an approved TPIA and reviewed by OWNER/CONSULTANT.

**5.9** After acceptance, all components shall be marked with a suitable and readily visible paint mark. These markings are in addition to markings/color coding required by other codes/specifications/Technical Notes.

**5.10** Controls shall be established to keep the non-conforming items identified till proper resolution of non-conformity.

**5.11** OWNER/CONSULTANT shall have the right to witness the performance of any PMI test.

**6 EXTENT OF PMI**

**6.1** PMI shall be done on each component (100 percent PMI inspection) including welds (Except carbon steel Piping welds), unless specifically exempted by OWNER/CONSULTANT.

**6.2** PMI shall be done on pipe supports (welded/ bolted) such as pads, saddles, dummy pipes etc. (100 percent PMI inspection) in all piping systems of alloy material.

**6.3** PMI shall be done on all bolts and nuts (100 percent PMI inspection) of flange joints in all piping systems of alloy material.

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## 7 PMI OF PIPING AND HEATER COIL COMPONENTS

PMI testing (irrespective of PMI done at earlier stages) shall be carried out when piping loops/ heater coils have been cleared for hydrostatic testing by OWNER/CONSULTANT. Hydrostatic Testing shall be carried out only when non- conforming components have been replaced with conforming components and subsequent Non- Destructive Testing, Post Weld Heat-Treatment, Hardness checking and re- verification by PMI etc., as required by specifications have been completed. PMI records shall form a part of piping /heater inspection records. Contractor shall demonstrate to PMC that each & every component of the piping system and heater coils has been subjected to PMI by providing line wise records of PMI duly endorsed by TPIA.

## 8 TESTING METHODOLOGY

- 8.1 The method used for PMI examination shall provide a quantitative determination of the alloying elements like chromium, nickel, molybdenum or vanadium in alloy steel items for the characteristic elements specified in clause 9.0
- 8.2 Instruments or methods used for PMI examination shall be able to provide quantitative, recordable, elemental composition results for positive identification of elements.
- 8.3 The acceptable instruments for alloy analyzer shall be either "portable X-ray Fluorescence" or optical Emission type each capable of verifying the percentage of elements within specified range. The instruments must have the printout facility and sensitivity to detect the elements in the specified range.
- 8.4 Chemical spot testing, magnets, alloy sorters and other methods using eddy current or triboelectric testing methods are not acceptable for PMI examination.
- 8.5 All PMI instruments shall have been serviced within a 6 month period of the time of use to verify the suitability of batteries, sources, etc, and the date of the last service shall be stated on the PMI report form.
- 8.6 The surfaces to be examined shall be prepared and cleaned by suitable means before PMI so that surface be free from grease, oil, paint or oxides. Testing shall be done after proper surface cleaning and other requirements as outlined by the manufacturer of the portable alloy analyzer. Modification, if any, of these procedures must be approved by OWNER/CONSULTANT.
- 8.7 Ring type joint gaskets shall be inspected by using portable X-ray fluorescence instrument.



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## 9 CHARACTERISTIC ELEMENTS

ALLOY	Cr	Ni	Mo	Cb	Ti	Cu	Al	C	Co	W	Fe
1½ Cr - ½ Mo	x		x								
2¼ Cr -1 Mo	x		x								
5 Cr - ½ Mo	x		x								
9 Cr - 1 Mo	x		x								
304	x	x									
304L	x	x						x*			
304H	x	x						x*			
310	x	x									
316	x	x	x								
316L	x	x	x					x*			
317	x	x	x								
317L	x	x	x					x*			
321	x	x			x			x*			
321H	x	x			x			x*			
347	x	x		x				x*			
347 H	x	x		x							
405	x				x		x				
410	x				x						
410S	x				x			x*			
430	x				x						
Alloy 20	x	x	x	x		x					
Hast C-276	x	x	x							x	
Alloy 600	x	x									
Alloy 601	x	x					x				
Alloy 625	x	x	x	x							
Alloy 800/800H	x	x				x		x*			
Alloy 825	x	x	x		x						
Monel 400		x				x					
9 Ni/3.5 Ni		x									
70/30 CuNi		x				x					
90/10 CuNi		x				x					
Duplex Stainless steel	x	x	x								

\*Testing of C is only required when in the Plant exists the same type of material but with L/H carbon content

- 9.1** Carbon Steel materials under clause no 3.1.11 shall be checked to confirm that no mix up has taken place with alloy steel Components.
- 9.2** Characteristic elements for materials not listed above shall be proposed by the Contractor for approval of the OWNER/CONSULTANT

## 10 CALIBRATION

- 10.1** Instruments used for PMI shall have the sensitivity to detect the alloying elements in the specified

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ranges. Instruments or methods used for examination shall be of the type that will provide quantitative, recordable, elemental composition results for positive identification of the alloy elements present.

- 10.2** Each alloy analyzer shall be calibrated using known alloy standards for intended materials to be checked by PMI. A calibration certification from the Manufacturer or his authorized agency shall be submitted to OWNER/CONSULTANT for records.
- 10.3** PMC/ Owner shall review the procedure and qualification and witness sample alloy/ carbon steel materials verification tests to confirm that the procedures, equipment and personnel are capable of providing consistent and accurate results. Certified samples, with full traceability, of a known alloy materials/ carbon steel materials shall be available for use as a random spot checking on instrument calibration.

## **11 SITE VERIFICATION OF ANALYZER**

Verification using Standard samples supplied by institutes such as ASM (American Society of Metals) for the intended materials type and grade shall be performed each day before using the analyzer. Such verification shall be done again if PMI test is to be performed on different grade or type of material.

## **12 PERSONNEL QUALIFICATION**

The persons performing the PMI test should be knowledgeable about properties of material, all aspects of operation of PMI equipment including the method of testing. Qualification/ experience documents of the person performing the PMI test including his training and experience shall be submitted to OWNER/CONSULTANT for review and approval.

## **13 ACCEPTANCE CRITERIA**

### **13.1 Base Metal**

PMI test results showing presence of characteristic elements up to 8% less than the minimum specified value in the material specification and up to 8% more than the maximum specified value in the material specification shall be acceptable.

### **13.2 Deposited Weld Metal**

For deposited weld metal between base metals of the same specification using matching consumables, the recorded presence of characteristic elements up to 12% less than the minimum

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specified value in the welding consumables specification and up to 12% more than the maximum specified value in the welding consumable specification shall be acceptable.

## 14 REJECTION CRITERIA

- 14.1** If the PMI test results fall outside the acceptable range as given in 13.0 above, the contractor shall obtain a quantitative check analysis performed by a laboratory acceptable to OWNER/CONSULTANT for a complete chemical analysis. Results of this analysis shall be submitted to OWNER/CONSULTANT, with contractor's recommendation, for final decision.



Decision of OWNER/CONSULTANT shall be final in this regard.

If any material component or weld is found unacceptable, all other represented materials (e.g. in case of fasteners, supports) or welds shall be considered suspect. In such cases, the contractor has the following options:

- 14.2.1** Scrapping all those represented materials or components and replacing with new components or welds.
- 14.2.2** Performing 100% examination of the remainder of the represented materials/ components and replacing each item that fails the PMI check.
- 14.2.3** If the performance of any verification activity is unacceptable to OWNER/CONSULTANT or if any material has been incorrectly identified, continuation of all further tests shall be subject to approval of OWNER/CONSULTANT until the problem is corrected.

## 15 DOCUMENTATION

- 15.1** PMI report duly verified by PMI agency and Inspection Representative of LSTK Contractor.
- 15.2** PMI report as per format no QC-21(Attached)
- 15.3** Basis and action for resolving and documenting PMI non-conformances.
- 15.4** Contractor shall demonstrate to OWNER/CONSULTANT that all components requiring PMI have been subjected to PMI testing and accepted.

 <b>TechnipFMC</b>		 IndianOil		PROJECT:											
				COMPANY:											
QUALITY CONTROL FORM <b>QC 21</b>				PROJ. No.:				SH. 1 OF__							
<b>POSITIVE MATERIAL IDENTIFICATION REPORT</b>				CONTRACTOR:											
PMI CARRIED OUT:    SHOP <input type="checkbox"/> FIELD <input type="checkbox"/>										BEFORE INSTALLATION <input type="checkbox"/>					
										AFTER INSTALLATION <input type="checkbox"/>					
EQUIPMENT: _____				ITEM DESCRIPTION _____											
PIPING COMPONENT: _____				SUPPLIER: _____											
				MR/PO: _____			REV: _____								
LINE/DRAWING Nr: _____				PIPING SUPPORT: _____											
FILLER METAL: _____ Ø _____				AWS: _____											
ALLOY ELEMENTS TO BE CHECKED: _____															
PMI EQUIPMENT: { _____ _____				ANALYTICAL LABORATORY METHODS: _____											
CALIBRATION:    YES <input type="checkbox"/> NO <input type="checkbox"/>															
SAMPLING:    10% <input type="checkbox"/> 100% <input type="checkbox"/> ____% <input type="checkbox"/>															
ITEM TO BE TESTED	IDENT CODE	ALLOY ELEMENTS												DATE & INITIALS	
		Cr	Ni	Mo	Cb/Nb	Ti	V	Cu	Al	C	Co	W	FE		
TEST RESULT:		ACCEPTABLE <input type="checkbox"/>		REMARKS:											
		NOT ACCEPTABLE <input type="checkbox"/>													
INSPECTORS		CONTRACTOR		TECHNIP		OWNER									
NAME															
SIGNATURE															
DATE															

