



Positive Material Identification (PMI) Specification

03.01-12-Positive_Material_Identification (PMI)-specification



Document History

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1.0 Purpose

This specification is to provide the means to prevent mix-up of materials and to identify if incorrect filler wires used in welds. The specification covers the basic requirements for establishing a Positive Material Identification (PMI) program / alloy verification for alloys which are required to be verified to meet the minimum chemical requirements.

This document lays down the minimum requirements to be met for Positive Material Identification program during project procurement and construction stages.

2.0 Scope

This specification shall be used in the project phase by the Supplier / Vendor / Manufacturer at the manufacturing facilities and Contractor / Subcontractor at construction sites.

This specification shall be applied to EPC Contract as well as to the direct OQ Purchase orders. EPC Contractor shall be responsible for implementation of this specification by the Contractor, its Vendors, and subcontractors. For OQ direct POs, Vendor/Supplier shall be responsible for implementation.

Alloys that are in critical services or in high pressure / temperature services shall always be subject to PMI program based on the engineering evaluation. This PMI specification shall be part of the Invitation to Tender (ITT) and the Contract. Contractor shall perform an engineering evaluation during the early stages of the detail engineering phase and issue a project PMI specification for Company approval specifically applicable to this project considering service criticality, pressure and temperature conditions, and describing PMI requirements over and above the extent of PMI specified in Appendix 2 of this document.

Even without an engineering evaluation, different items that are to be subjected to PMI and the extent of PMI during project implementation are listed in Appendix 2, as a minimum.

Carbon steel components are not included within the scope of this document.

3.0 Confidentiality and Distribution

- This document is the property of OQ Group of Companies and shall be controlled as per the Governing Documents Policy of the Company.
- This document shall be part of the ITT/Contract and thus becomes a contract requirement for the Contractor / Vendor (for OQ direct PO) to comply with.
- This document shall be revised only by the document custodian, that is Projects CoE team.

4.0 PMI requirements

Positive Material Identification is an important quality control activity during procurement, construction, and maintenance of OQ plants and facilities. Failure to use the correct alloy in each application can result in loss of pressure containment, a threat to the safety of the facility and can lead to production loss.

Positive Material Identification (PMI) / Alloy Verification (AV) shall be performed at the point of application at a time which ensures that proper materials/welds have been used in the fabrication of an identifiable assembly (such as pipe lengths welded into spools or plates welded into pressure vessels). Starting material ordered from "Stock" shall receive a 10% PMI based on heat numbers (refer also Note 14 in Appendix 2).

Upon completion of fabrication or prior to release for shipment, PMI test documentation shall be made available to the Contractor and Company Inspectors for review and endorsement. The documentation shall demonstrate that PMI has been performed on individual plates, pipe, fittings, valve bodies and all



other applicable components that were used to fabricate items and welds as listed in Appendix 2. To the extent practical, drawings or weld maps shall be used to identify where PMI test was conducted, which corresponds to the PMI report.

Certified Material Test Reports (including those certified by a third party) are not to be considered as a substitute for PMI/AV or vice versa.

When a random inspection sample has been accepted, each part in the inspection lot shall be marked and segregated from materials waiting to be tested as outlined in the Vendor/Subcontractor PMI procedure. The Vendor/Subcontractor is required to provide specific details of the marking system to be utilized (see below section on "marking"), subject to the Contractor/Company review and written approval.

Marking: After PMI has been successfully completed, each piece should be marked with the letters "PMI" using indelible marker pen, preferably near the product marking, to show which items have been tested and are acceptable. Hard stamping may also be utilized where permitted. Unacceptable items shall be marked immediately with a red indelible permanent marker pen as PMI REJECTED and shall be quarantined. Colour coding may also be utilized in fabrication shop as described in the fabricator PMI procedure.

PMI inspection by the Contractor/Company Inspector does not relieve the Vendor/Subcontractor of his responsibility to fulfill the requirements as per contract/subcontract/PO and shall implement an effective quality control program.

Copies of all PMI test results shall be given to the Contractor/Company Inspector for review, during next inspection. The Vendor/Subcontractor PMI procedure shall indicate how permanent records of all PMI test results shall be documented (refer section "Documentation" below).

Controls shall be outlined in the Vendor/Subcontractor PMI procedure to prevent the accidental use of any untested materials and / or materials which have failed in a PMI test.

PMI requirements on alternative materials shall be as per the originally specified material. When the original specified material did not require PMI, the accepted alternative material also will not require PMI, however, use of alternate material / substitution shall be subject to Contractor/Company approval.

PMI shall be stated as a separate quality control activity on the Vendor/Subcontractor manufacturing / installation quality plan and Inspection and Test Plan.

PMI will be required at various stages in project implementation such as (list not exhaustive):

- Starting material for fabrication
- Finished equipment / component
- Welds in fabrication stage
- On-site material receiving
- On-site piping materials during and after fabrication/assembly
- On-site welds

In the event of any proposed substitution or deviation, the CONTRACTOR / Vendor shall submit details of the substitution or deviation in writing for Company (Owner) approval prior to substitution / use of a material having deviation. Substitution with an equal or better alloy than the specified ones can be considered for use / application but with the agreement of Company. All such cases shall be substantiated by calculation (if required) and other relevant documentation.

While performing works related to this specification, all applicable health and safety requirements shall be complied with, refer Project HSSE requirements documents.



4.1 Specifications, Codes, and standards

Order of precedence of documents shall be as per the contract or purchase order, not listed specifically in this document.

The following documents referenced herein shall form part of the technical requirements. Additional documents, when applicable, will be listed in the Contract, Requisition, purchase orders or other documents to Contractor and suppliers. Company and Contractor shall specify and include this PMI specification in all applicable contracts, Purchase orders and subcontracts.

API 570	Piping Inspection Code: Inspection, Repair, and Rerating of In-service Piping Systems
API RP 578	Material Verification Program for New and Existing Alloy Piping Systems
API 581	Risk-Based Inspection
API 941	Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants
ASME Section II, Part A	Materials: Ferrous Material Specifications
ASME Section II, Part B	Materials: Nonferrous Material Specifications
ASME Section II, Part C	Materials: Specifications for Welding Rods, Electrodes and Filler Metals
ASME BPVC. Section V	Non-Destructive Examination.
ASME Section IX	Welding and Brazing Qualifications
ASTM A193 / A193M	Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High Temperature or High-Pressure Service and Other Special Purpose Applications
ASTM A194/A194M	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High temperature Service, or Both
PFI ES-22 R16	Recommended Practice for Colour Coding of Piping Materials
PFI ES-42 R16	Standard for Positive Material Identification of Piping Components using Portable X-Ray Emission Type Equipment
OQ guideline 03.01.17	Quality Control of Materials and Equipment-Guideline
OQ specification 03.01.22	Project Quality Management Requirements-Specification
OQ specification 03.01.14	Material and equipment certification requirements-specification

4.2 Test Equipment

The equipment and/or methods used for PMI as per this specification shall be able to positively identify and provide a quantitative, recordable, elemental composition measurement of the alloying elements specified in Appendix 1 "Alloy Elements Required for PMI Inspection".

Testing shall be done in compliance with the requirements described in the Equipment manual provided by the manufacturer of the alloy analyser being used. Modification of these requirements, if any, must be approved by the Contractor and Company.

Each analyser shall be calibrated according to the requirements of the manufacturer of the alloy analyser. At the beginning and end of each shift, the instrument must be checked against a known standard for each alloy type to be inspected during the shift.

Analyzer instruments and methods used for PMI examination shall be approved by Contractor/Company, approval shall be based on the following principles:



- Portable X-ray fluorescent spectrometers with direct reading of alloy grade or composition in the applicable range are acceptable.
- Portable arc-emission spectrometers with direct reading of alloy grade or composition in the applicable range are acceptable.

Other methods, such as spectrographic or wet chemical analysis of sample drillings shall not be used unless specifically approved by Contractor and Company for a particular application. Magnetic and electromagnetic testing are not acceptable for PMI.

This test method (PMI) is to identify alloy materials and is not intended to establish the exact conformance of a material to the material test certificate. Identification of materials by visual stamps/markings alone should not be considered as a substitute for PMI testing but may be an important component of an overall quality assurance program. A variety of PMI test methods are available to determine the identity of alloy materials. The primary methods include portable X-ray fluorescence, portable optical emission spectroscopy, whereas laboratory chemical analysis may be used as a means for confirmation in the event of any dispute.

Portable X-ray Fluorescence:

There are several variants of portable X-ray fluorescence spectrometers available. Handheld XRF analyzers work by measuring the fluorescent (or secondary) X-rays emitted from a sample when excited by a primary X-ray source. Each of the elements present in a sample produces a set of characteristic fluorescent X-rays, or "unique fingerprints". The material under analysis emits a characteristic spectrum of X-rays which may be analysed both qualitatively and quantitatively to determine which elements are present and in what quantity. The results of this analysis can be reported in either or both of the following formats:

- As a match against one of many reference spectra stored in the instrument, i.e., 316 stainless steel or 5 Cr – 1/2 Mo steel.
- Each element present is reported as a percentage. Because of the inherent limitations of the technique it is not possible to detect all elements. Elements lighter than sulphur (S) cannot be detected using portable X-ray fluorescence spectrometers. Therefore, this technique cannot be used to detect carbon (C).

Instrument: NITON XL2 800 XRF ANALYZER (for an example, not limited to)

Primary calibration: Primary calibration will be performed by the instrument manufacturer taking due care over power settings and interelement effects for each program. Adjustments to these programs should only be carried out by authorized / approved personnel

Calibration at work: As a minimum the instrument shall be calibrated at the beginning of the test period (shift) and at the end of the test period and after an interval of 50 analyses. Calibration shall be carried out using the certified reference standard. Calibration of the instrument should be carried out to the manufacturer's instructions using the certified reference standard supplied with the instrument. Instruments will be serviced by the manufacturer and will be calibrated by an approved engineer or approved service agency on a yearly basis. The calibration certificate will always remain with the instrument. Certified reference standard will always remain with the instrument.

Test Procedure: Detailed PMI procedure shall be submitted by Contractor/Subcontractor/Vendor as applicable. Areas of contamination, loose scale and paint shall be avoided while selecting test locations. Single or multi analysis may be taken in one or more locations.



Extent of PMI: Refer Appendix 2.

Acceptance Criteria: Refer section below on “acceptance criteria”.

4.3 Testing personnel

The person(s) performing the PMI shall demonstrate documented proof of their capabilities and experience in performing PMI.

Persons performing PMI should be trained and qualified in accordance with the applicable PMI procedure used for PMI examination. Qualification of the person performing the test, including records of training and experience, should be submitted for review Contractor/Company, when requested.

4.4 Testing requirements

PMI shall be conducted on all the pressure retaining components, including piping items, valves (including valve internals), welds, bolting and gaskets to the extent defined in Appendix 2 for the alloy groups listed in Appendix 1 unless specifically exempted.

PMI test is not a substitution for chemical analysis but is a method for alloy verification. PMI testing may be carried out to supplement the mill certificate where this is available but not meant to replace a material certificate.

This specification is a requirements document to be applied while executing a contract or PO during project execution. This is a general specification meant for all OQ projects; however, EPC Contractor / Subcontractor/ Vendor shall prepare a project / PO specific PMI specification / procedure for Company approval without compromising the applicable requirements of this document.

Through the application of the PMI program it is envisaged that all critical project materials conform to specified requirements, independent of any certification and markings that may exist.

PMI is implemented to ensure that dangerously inappropriate alloys are not incorporated in the completed process plant, either by accident or misinformed action.

PMI provides documentary evidence to authorities or endusers that reasonable quality control procedures have been used in building any plant where failure could have serious consequences.

PMI also envisages to detect utilization of inappropriate welding consumables), if any. PMI provides a record for future plant maintenance.

PMI also provides a tool for identification of any corrosion resistance overlaying.

In addition to that in Appendix 1 and Appendix 2, the minimum extent of PMI should be such that to enable a full check of the pressure or corrosion envelope of all piping, vessels or equipment deemed to be critical. The definition of "critical" should be based on the likely losses resulting from a consequence of the item failing due to use of an inappropriate metal for the duty.

4.5 Extent of PMI

Extent of PMI testing as described in Appendix 2 shall be implemented. In addition, project specific PMI requirements as confirmed by engineering specification or engineering assessment (refer item 1 in Appendix 2) for critical services of the specific project (eg.: wet H₂S, hydrogen service, cryogenic service, high temp service, high pressure service etc) shall also be complied with where applicable. Even if not listed specifically, following alloys shall be included as a minimum in the PMI program:

- Chromium-Molybdenum alloys (low alloy steel)
- Modified Chromium-Molybdenum steels (9Cr-1Mo-V alloys).
- Low Ni steels (2½Ni, 3½Ni and 9Ni).
- 321H, 347H



- Alloy 20
- Alloy 400 (Monel) and Ni-resist.
- Titanium.
- Duplex stainless steel 2205.
- Super duplex stainless steel 2507
- Alloy 904L
- Stainless steel 316
- Stainless steel 304
- Other materials when PMI is specifically specified in project documents (such as requisition documents)

4.6 Acceptance criteria

Primarily, materials tested shall satisfy the controlling standard or specification (for example: ASTM or ASME IIA, IIB or IIC composition requirements) read in conjunction with the following criteria.

- The material under investigation shall contain the percentage of alloying elements specified in the material specification.
- Welds with consumables that match or nearly match the base metal composition shall be within the ranges allowed in ASME SEC IIC for each element.
- For dissimilar metal alloy welds the effect of dilution from different base metal and the filler metal should be considered to determine the nominal as-deposited weld metal composition.

PMI acceptance criteria for each alloy shall be specified in PMI procedure.

Components or welds which are found to comply with the applicable material specification shall be accepted. Acceptance or rejection shall consider the accuracy of the portable testing equipment used (refer equipment catalogue), and the same shall be included in the Contractor/Vendor/Subcontractor PMI procedure, to be issued for Company review. If alloy individual element determinations for selected elements in Appendix 1, are outside of the range specified by the applicable material standard, the component shall be rejected or a referee analysis shall be performed in accordance with this specification (refer definition of "referee analysis" in the DEFINITIONS section).

All unacceptable materials shall be identified, marked, removed, and replaced with the specified materials.

4.7 Non-conformance

Non-conforming items or welds shall be replaced immediately or re-analysed successfully with acceptable method at the Contractor/Vendor/Subcontractor responsibility. The Contractor and Company shall be informed, in writing, of any non-conformances observed during PMI at shop or site. Where deemed necessary, a non-conformance report (refer 03.01.38 Project Non-conformance Control Procedure) shall be issued by the party who noticed the non-conformity. The non-conformance report shall include provision for root cause analysis and a proposed corrective action plan.

All non-conforming components shall be removed and replaced with acceptable material, unless agreed otherwise by Company in writing. Rejected material shall be identified by markings and segregated from acceptable material to prevent inadvertent use.

If an item from a representative sample (inspection lot) is rejected:

- 100% of the remaining components from which the sample was taken shall be examined.



- 100% of the components from the next delivery from the same manufacturer or supplier/Subcontractor shall be examined.

If no further components are rejected, the extent of examination shall return to that specified per the Contract, this specification and the extent as originally specified.

If referee examination becomes a requirement, positive confirmation shall be performed by quantitative analysis (eg: wet chemical analysis or by spectrometer). Quantitative analysis shall provide recordable, elemental composition results for positive identification of alloying elements listed in Appendix 1. Alternatively, an independent laboratory analysis using any of the acceptable methods referenced in this specification may be performed. The independent laboratory shall be approved in writing by the Contractor/Company.

4.8 Documentation (Records, Reports & Marking)

PMI Inspection Report: A signed and dated record for documenting the PMI examination shall be provided to the Company (Owner)/Contractor in the format approved by the Company. PMI report shall be part of the PMI procedure issued for Company review.

Fabricated items with multiple components and welds shall include a map showing the location of each test showing:

- Each component PMI tested by the manufacturer.
- Each piece of equipment, by item number, PMI tested by the Shop Fabricator/Subcontractor, including a test location map.
- Each piping spool, by line number and piping spec, including the spool or fabrication drawing, showing the test locations/weld numbers by the Shop/Site Fabricator or Site Constructor.

Results of examinations for PMI shall be recorded on a PMI Inspection Report, which includes all of the elements required to be verified as in Appendix 1, and all additional data as required by this Specification. Reports downloaded from the alloy analyser are acceptable as an attachment to a PMI Inspection Report.

PMI Inspection report shall indicate the following, as a minimum, for each inspection lot examined:

- Manufacturer/fabricator/Subcontractor name.
- Contract / PO number.
- Date(s) of testing.
- PMI procedure number.
- Name of person and company performing the test.
- Number and type of each component/weld inspected.
- Material manufacturer, mill test certificate number, heat number, and lot number if applicable.
- Material specification.
- Method of examination (laboratory or site analyzer).
- Type of analyzer, including manufacturer, model number and serial number.
- Equipment calibration date and validity.
- Inspection lot size (number of pieces or items examined).
- Results of the test (weight percentage of elements).
- Drawing number
- Compliance or non-compliance status. (accepted/rejected).



- Description of the material marking (after testing).
- Name and signature of PMI Operator.
- Sign off boxes for Vendor, Subcontractor, Contractor, Company (as applicable)

Inspection report having above information shall be made available to Contractor and Company when required.

Inspection reports shall become part of the permanent equipment / piping / material QC record and be included in the final data package or equipment/piping data books and site QC dossier for Site testing.

Documentation associated with the PMI program shall be available for audit by the Contractor and Company **up to Initial acceptance (IA)** after the material/equipment is supplied.



Appendix 1: ALLOY ELEMENTS TO BE TESTED FOR PMI INSPECTION

Alloy	Cr	Ni	Mo	Cb/Nb	Ti	Cu	Co	Al	Zn	Sn	Pd	V
1/2Mo steel			X									
Cr-Mo steels	X		X									
Cr-Mo-V steels	X		X									X
13Cr-4Ni	X	X										
13Cr-4Ni/CA6NM	X	X	X									
12Cr/CA15	X	X										
Ni alloys		X										
304/304L/304H (note 1)	X	X										
308/309/310 (notes 1 and 3)	X	X										
316/317 (note 1)	X	X	X									
321/321H (note 1)	X	X			X							
347/347H (note 1)	X	X		X								
410/430	X	X										
Alloy 2205	X	X	X									
CD4MCu/Alloy 2507/ UNS32750/ Zeron100/ UNS 32760	X	X	X			X						
Alloy 20	X	X	X	X		X						



Alloy	Cr	Ni	Mo	Cb/Nb	Ti	Cu	Co	Al	Zn	Sn	Pd	V
6 Moly Stainless Steel Alloys	X	X	X									
Alloy C-276	X	X	X									
Alloy 400 UNS N04400		X				X						
Alloy 600	X	X										
Alloy 625 and 625LCF	X	X	X	X	X							
Alloy 800	X	X			X	X		X				
Alloy 825	X	X	X		X	X						
Ni-resist	X	X				X						
25Cr-35Ni	X	X		X	X			X				
Cu-Ni alloy		X				X						
Brass						X			X	X		
Al-Brass						X		X	X			
Al-Bronze						X		X	X			
Stellites	X	X					X					
Titanium Gr 2/7					X							
Titanium Gr 12		X	X		X							
Titanium Gr 16					X						X	

Note 1: Where specified/applied in high temperature service per Code or where in High Temperature Hydrogen service (API RP941), all austenitic H-grades require analysis of Carbon Content for conformance with the Material Specification. Since “sorting”



cannot be accomplished by XRF techniques, portable OES or spark techniques (for example, see Oxford Instruments PMI-Master Pro") shall be employed; or drillings for wet analysis can be substituted. Since "L"-grades do not represent Code required design (e.g., potential liabilities as in the case of "H"-grades) nor are these a potential catastrophic mix-up event and therefore do not require sorting (including where defined within pressure boundary weldments).

Note 2: The list of materials is not exhaustive and shall not be considered as limiting the alloy metals subject to PMI. For alloy materials not covered in the table, the Supplier / Subcontractor shall seek Contractor/Company approval for elements to be analysed.

Note 3: Additional check for Si may be required when the difference between 310S and 310H is essential.

Appendix 2: EXTENT OF PMI TEST REQUIREMENTS (Note 13)

Item to be tested	SHOP (1), (3), (7)	SITE (4)
Critical services of the specific project (wet H ₂ S, hydrogen service, cryogenic service, high temp service, high pressure service, lethal service, amine service etc)	As per engineering evaluation (refer section 2.0)	As per engineering evaluation
Pressure Containing components for Pressure Vessels, Tanks and Heat Exchangers (heads, flanges, Plates, forgings, nozzles (pipe), internal linings)	100%	NA
Pressure containing forgings such as nozzles, flanges and "olets" (for pressure vessels)	100%	NA
Fired heater tubes	100%	NA
Pressure containing castings or fabricated casings for pumps, compressors, steam turbines, combustion turbines, turbo-expanders, and other process equipment (Including casing, rotors, shaft, impeller, thrust disc, Casing Bolts & Nuts, turbine nozzle box and Shroud, Flanges)	100%	NA
Expansion Joints (all pressure containing components)	100%	NA
Valves including manual, automated (control, on-off, MOV), etc. (all pressure containing parts of valves) Note: Internals shall be PMI tested just prior to assembly and valve bodies after assembly	10%	10% (9)
Piping welds (10)	10%	10%
Instrumentation: Pressure containing housing for Class 900 or higher	5%	NA



Item to be tested	SHOP (1), (3), (7)	SITE (4)
Orifice meter tube, Orifice Meter run, Orifice plate, venturi tube, vortex/ultrasonic flow meter rotors of all pressure classes		
Thermowells	5%	5%
Alloy Piping and piping components	5%	5%
Bulk Piping Components	5%	10%
Tubes, tube sheets and other internal alloy pressure containing parts for vessels, exchangers, condensers and boilers (11)	5%	1% (8)
Shop fabricated spools (pipe, pipe fittings, flanges etc) - each item within the spool shall be counted as one component for determining total number of items / lot size (5)	5%	NA
Alloy Bolting (11)	(6)	1%
Pressure Containing Welds including vessels and exchangers (12)	5%	NA
RTJ ring gaskets	5%	5%
Site Tank welds (one PMI test for every 10 meters of weld length)	NA	as in column 1

Notes-

- Note 1: 100% PMI (this means PMI for every plate, forging, nozzle, pipe, weld etc. on one (1) spot, as applied in, for example, a pressure vessel).
- Note 2: Unless otherwise specified, the random (noted as less than 100% in table above) number of pieces for inspection shall be calculated and rounded off to the next higher number. If the calculated sample size is less than 5, minimum 5 samples or the whole lot whichever is lower shall be tested.
- Note 3: Extent shown is first verification, this may be at material supplier, fabrication shop or site.
- Note 4: Extent shown shall be considered as additional verification after verification at shop/supplier. The extent of first verification at site (material purchased by Construction or site welding) shall be the same as shown for "shop".
- Note 5: Provided the heat number can be identified throughout fabrication. If this condition does not satisfy, then 100% verification is required.



- Note 6: 1% of each alloy heat/lot of bolts/studs and nuts for structural fabrication and pressure retaining bolting for pipe fabrication, and 10% pressure retaining fasteners for equipment shall be verified. ASTM A193-B16 bolts/studs shall be 10% alloy verified regardless of application.
- Note 7: The Supplier shall provide material certification for materials requiring alloy verification in accordance with the Purchase Order requirements.
- Note 8: Applicable only if site is performing re-tubing. Not applicable for shop fabricated equipment.
- Note 9: Applicable only if random pieces are shipped to site for site assembly.
- Note 10: The following requirements shall be followed for random inspection of piping welds:
- One test per WPS as a minimum.
 - Per welder, every first five (5) welds shall be tested.
 - Every batch (heat) of consumables shall be regarded as one lot.
- Note 11: For items such as tubes, fasteners, bolts and nuts, a reduced random inspection sample shall normally be acceptable, but requires prior written approval from the Purchaser. If any piece from a random inspection sample is found to be unacceptable, each piece of the lot shall be examined.
- Note 12: Pressure containing welds - minimum 5% of the quantity of as deposited welds from each Welding Procedure Specification (weld cover pass only) for girth welds or longitudinal seams. This shall include one test minimum for each WPS applied; and the first five (5) welds for each welder; each batch of consumables shall be considered one lot. For Pressure Vessel Longitudinal Seams this requirement to be applied to each ten feet of a weld seam, or one check of each seam, if less than ten feet long.
- Note 13: Exempt from PMI - The following components are exempted from PMI requirements, unless specifically designated for PMI in the contract / specification documents:
- All components and welds manufactured from materials excluded from PMI (materials not listed in Appendix 2) are listed below.
 - Internal instrument parts, e.g., float/displacer, diaphragm.
 - Non-pressure retaining pressure vessel internals such as, baffles, trays, clips, supports, pall-rings, support rings, etc.
 - Non-pressure retaining fired heater, heat exchanger and boiler internals such as, tube hangers, tube supports, baffles, etc.
 - Non-pressure retaining welds.
 - Electrical components.
 - valve components (seat rings, bonnet bolts and gaskets) (refer note 14)
 - Spiral wound metallic gaskets.
 - Instrument tubing.
 - Compression type ferrules, fittings and components (e.g. valves, filters, etc.) for use with 19.05 mm (3/4 inch) outside diameter and smaller tubing.
 - Steam tracing, instrument air, seal oil, lube oil and hydraulic pipe and tubing.
 - Pressure containing instrument housings in alloy systems or housings with a design pressure below ASME Class 900 [e.g. gauge glass housings and chamber].



- All B7/B7M bolts and 2H/2HM nuts.
- All L7/L7M bolting.

Note 14: Starting material ordered from "Stock" shall receive a 10% PMI based on heat numbers.

Note 15: If specified in a project document or contract or PO or equipment catalogue description, PMI is required for operationally important non pressure components

5.0 Key Performance Indicators

KPI is not applicable as this is specification document to be included in the contract or purchase order.

6.0 Roles and Responsibilities

Projects Delivery

- will include this specification in contract scope of work and in appendix C-6 of the contract
- will include this specification in the scope of work of the vendor (for direct OQ PO related to specific project)

Contractor

- will implement PMI as per Contractor's scope
- will ensure compliance by Contractor's vendors and subcontractors

Vendor (direct OQ PO)

- will implement requirements of this specification

Projects CoE

- Will review and update this specification as required



Definitions

Alloy: Metallic materials that contain alloying elements, such as chromium, nickel, or molybdenum, which are intentionally added or used to enhance mechanical or physical properties and / or corrosion resistance. The term "Alloy" is to include materials such as non-ferrous grades including aluminum, cupro-nickels and titanium or similar.

Alloy Verification (AV): Is interchangeably the same or equivalent for PMI and extends to the process of performing PMI.

Carbon Steel: Steel conforming to ASME Section IX and P-Number 1 shall be considered carbon steel.

Contractor: an entity to carry out services for Company in accordance with a contract.

CRA: Corrosion Resistant Alloy.

Inspection Lot: A group of like items per heat from a single manufacturer from which a random inspection sample is taken for testing.

Lot Size: Number of pieces available in the inspection lot at the time a random inspection sample is selected.

Manufacturer: The vendor or supplier from which the Company / Contractor buys equipment and/or materials.

Mill test report/certificate: A certified document that permits each component to be identified according to the original heat of material from which it was produced and identifies the applicable material specification (including documentation of all test results required by the material specification).

Owner / Company: OQ Group Companies

Positive Material Identification (PMI): A procedure used to verify that a metallic component used in a design meets the specified alloy material.

Random Inspection Sample: One or more items selected at random, which shall represent the general chemistry of the inspection lot.

Referee Examination: Any questionable results which do not positively identify a material examined, shall be re-examined by an alternate means which can properly characterize the specified alloy.

Shall: denotes a requirement that is mandatory.

Should: means something that is recommended but not mandatory.

Shop: manufacturing location, mill, vendor fabrication shop and site fabrication shop

Site: location where facility is installed

Stock: Material or equipment supplied from or stored within a common source or area.

Subcontractor: The party which is contracted, normally at site, for fabrication and installation services

Supplier: Manufacturer or Vendor contracted to fabricate or supply an item or service. (see also "Vendor")

Vendor: The party with whom the contract / subcontract / PO is placed, for supply an equipment, item or service.



Feedback Form

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DOCUMENT INFORMATION

Title	Positive Material Identification (PMI)-Specification
Document Code	03.01.19-Positive_Material_Identification (PMI)-specification
Purpose	to provide the details a Positive Material Identification (PMI) program for alloys used in OQ projects
Audience	OQ Projects
Category	Operational
Subcategory	Projects CoE
Effective Date	August 2021
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Document Advisor	Projects CoE-Quality
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RELATED AND SUPPORTING DOCUMENTS

Policy	N/A
Policy Manual	N/A
Process	N/A
Procedures	03.01.06-Project_Quality_Management-Procedure 03.01.17-Quality_Control_of_Materials_and_Equipment -Guideline
Related Documents and Forms	03.01.22-Project_Quality_Management_Requirements—specification



DOCUMENT APPROVALS		
Authorized Approver	Date	Signature(s)
Leader Project CoE	08/09/2021	