



**DEHDASHT PETROCHEMICAL INDUSTRY COMPANY**  
**DEHDASHT HIGH DENSITY POLYETHYLENE PROJECT**





Contract No.: DPIC/98-12	DOCUMENT TITLE: PMI Procedure	POI: IFA	Rev.: D1
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# PMI Procedure



PURCHASER'S COMMENT/APPROVAL STATUS						Purchaser: NARGAN
<input checked="" type="checkbox"/>	AP: Approved (Released for Manufacturing)					
2	AN: Approved With Minor Comments (Fabrication may Proceed)					
3	NF: Approved With Comments (Fabrication not Proceed)					
4	RJ: Rejected					
5	NR: Not be Returned					
Date:	<b>14-02-02</b>	Signature:				
D1	13-Feb-22	IFA	E.Nasrollahi	M.Razmger	S.Kabiriyani	
D0	30-Jan-22	IFA	E.Nasrollahi	M.Razmger	S.Kabiriyani	
<b>REV.</b>	<b>DATE ISSUE</b>	<b>Purpose of Issue</b>	<b>PREPARED</b>	<b>CHECKED</b>	<b>APPROVED</b>	



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## 1. Purpose



Positive Material Identification (PMI) is one of the more specialised non destructive testing methods. With positive material identification the alloy composition of materials can be determined. If a material certificate is missing or it is not clear what the composition of a material is, then PMI offers the solution. Because specifications for materials used in industry are increasingly more specific, the need for PMI testing has been on an increase for the past several years. Periodic plant maintenance shutdowns are less frequent and consequently the materials used in the plant are in use longer. A wider variety of alloys that are indistinguishable to the eye are being used in process plants. When facility and inspection staff replace components, they must be able to guarantee that the new part matches required specifications. Recent industrial accidents have cost the lives of workers and heightened the awareness of the need for accurate and comprehensive PMI inspections.

## 2. Scope

This procedure describes the methods to carryout Positive Material Identification (PMI) for verification of Grade or Alloy type and Quantitative Analysis of Alloying Elements present in the material without destroying the material by X-Ray Fluorescence Techniques.

## 3. DEFINITIONS

Client / Owner:	Persian Gulf Petrochemical Industrial Co. (PGPIC)
EPC Contractor:	Petropars Iran / Nargan Joint Venture
Vendor:	KASRAVAND Co.
Project:	DEHDASHT HIGH DENSITY POLYETHYLENE PROJECT

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## 4. Reference

- ASME sec II PART A & B & C

## 5. Personal Qualification

5.1. The technician who carries out alloy analyzing shall have the knowledge about material and shall have sufficient technique and experience concerning an alloy analyzer.

5.2. PMI shall be performed by QC part engineer in Kasravand Co., trained and specialized with equipment.

## 6. Methods

### 6.1. Method of PMI



The XRF principle (x-ray fluorescence) is one of the methods for PMI. Equipment used contains low radioactive sources (isotopes) or x-ray tubes. The exposed material reflects the radiation, generating energy. As every element has its own atomic structure, this reflection will generate a different energy level for every element. This energy is measured and detected, thus identifying the alloy elements. The other method for PMI is Spark emission spectrography. Spectrography is based on optical emission. The equipment consists of a probe which releases a spark that is used to vaporise the material being analyzed. The atoms and ions in this vapour produce a spectrum which can be optically measured and then recalculated to determine the components of the material.

Material properties like structure difference and heat treatments have no influence on the results of the PMI measurements. However, it is important that the surface is identical to rest of the material. Oxides, coatings and dirt on the material will influence the identification results. Also the surface must be smooth. Elements that can be identified using PMI include: Cr, Mn, Ni, Mo.

Interesting to know is that the exposure of radiation is sufficiently low, so that extra safety measures are not required. When dealing with exploitation licenses and preventive maintenance of technical installations, Non Destructive Testing and Examination (NDT / NDE) are indispensable techniques. NDT / NDE offer also the necessary guarantees when quality, expense saving, business security and safety is in order, for both existing and new installations. NDT / NDE decrease the risk of leakage or other defects, which increase the business integrity and safety within the installation and can save expenses.

### 6.2. XRF Method

The latest X - Ray Fluorescence (XRF) analyzers which is one of the quickest and most comprehensive methods for Positive Material Identification where low level radiation is fired at

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the material and the energy levels reflected back from each element is measured, so identifying the alloy elements. XRF works by exposing the material to a flux of x-rays. The atoms then absorb the energy and become temporarily excited and they fluoresce, or emit x-rays. The x-rays emitted by the sample's atoms possess clearly defined energies that are unique to the elements present in the sample. By measuring the intensity and energy, the XRF instrument can provide qualitative and quantitative analysis. In other words, it can identify the elements, measure the concentration of each and display them on the unit. In using XRF, we can make Positive Material Identification. The data can be downloaded from the unit and saved for reference or creating reports. The performance and capabilities of the XRF unit and a well laid procedure as per ASTM E 1476 procedure guarantee reliable and accurate results. PMI can be done on the shop floor to ensure that the documentation remains intact during the manufacturing process. A customer can also request a final PMI of the finished product, in which reports can be provided as part of the turn over package. This eliminates the need for any additional inspection, to insure that the material specifications have been met. PMI is also important for meeting the ASME Boiler and Pressure Vessel Code and the ASME Bio - processing Equipment Standard, which both require mill certifications and complete material traceability.

## 7. Equipment Used



- Thermo (Niton XL2 Analyzer)

## 8. Test Parts

### 8-1. Pipe, Fittings, Flanges, Forgings and Bar.

The tested material shall meet the percentage mentioned in the ASME/ASTM standard and it's relevant tolerances or table below with considering the tolerances mentioned in ASTM standard.

Element Material	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Nickel	Chromium	Molybdenum
S 304	0.080	2	0.045	0.030	0.75	8 ~ 10.5	18 ~ 20	.....
measurable	-	✓	-	-	-	✓	✓	✓
S 316	0.080	2	0.045	0.030	0.75	10 ~ 14	16 ~ 18	2 ~ 3
measurable	-	✓	-	-	-	✓	✓	✓

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### 8-2. Induction Bends

Five measurements in a row shall be taken across the start and stop transition of the induction bent area from unaffected area to fully induction heated material. A further four measurements covering the inner arc, outer arc, tangent start and tangent stop areas shall also be taken. Weld caps on a longitudinal weld seam shall also be measured.

### 8-3. Welds

The weld cap shall be either ground flush prior to measurements or part of the weld cap shall be ground to a flat surface in order to obtain reproducible results. When taking readings the probe shall be positioned in the center of the weld (shall be measured for welding consumable).

## 9. Calibration and Verification

Whenever replacing Radioisotopes, the equipment shall be calibrated by the Maker or a qualified organization. Calibration of the instrument has been carried out by the manufacturer at their factory/ calibration agency using various types and grades of Standards Reference Materials (SRM's) for various types of materials.

Verification shall be performed at site once daily by using standard reference samples, before commencing the actual testing or as and when required during the day.

## 10. Surface Preparations



The surface of the component subjected to the test shall be free from grease, oil, paint and oxides. The surface preparation shall be performed with a portable grinding machine or any other suitable equipment and the same should represent the original surface of the component.

Suitable for all weather conditions: -15 to +50 degrees centigrade.

## 11. Training

Personnel applying this procedure shall be familiar with this procedure and only trained personnel are permitted to operate the using equipment.

Directors of PMI Just In Case have attended a manufacturers training course in the use of the PMI equipment. Personnel subsequently employed by PMI Just In Case are trained in house. Certification of training is available on request.

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## 12. Safety

### 12.1 Exposure to Radiation:



Human dose to radiation is typically measured in rem, or in one-thousandths of a rem, called millirem (mrem), 1 rem = 1000mrem. The allowable limit for occupational exposure is 5,000 mrem/year for deep (penetrating) dose and 50,000 mrem/year for shallow (ie skin) dose or dose to extremities. Deep, shallow and extremity exposure from a properly used NITON XL3t analyzer should be less than 200 mrem per year even if the analyzer is used as much as 2,000 hours per year, with the shutter open continuously. (Source of information 'Thermo Scientific')

### 12.2 General

- Equipment shall be used in accordance with the manufacturer's equipment operating procedures and recommendations.
- All equipment shall be inspected for obvious defects prior to use.
- Client Health and Safety procedures will be adhered to at all times by personnel representing PMI-Just In Case.
- Personal Protection Equipment (PPE) shall be worn by the operator in accordance with client recommendations.

## 13. Procedure

- **13.1.** Push and detach "on/off/esc" by ringing sound of "beep", equipment is operated.
- **13.2.** "System Start" in the screen appears, numbers of "0 ~ 9" is counted.
- **13.3.** When screen of Log-On present, push the "Enter" button or push the touch screen, and then radiation warning will be showed.
- **13.4.** When radiation warning appears, select yes to make "Log-On".
- **13.5.** Password screen appear, insert personal identification number with direction or insert PIN for touching LCD screen and then words of "USER" at screen bottom present and is log-in
- **13.6.** Insert the Password and Log-on, "Main Menu" screen appears.
- **13.7.** Wait the about 30 second at this screen.(Warming up)
- **13.8.** Push the "Utilities" icon, "Calibrate" icon, "Calibrate Detector" icon, equipment states to calibrate. (Calibration is carried out about 4~5 minutes)
- **13.9.** Calibration of equipment is end, calibration value is presented.
- **13.10.** Push "Test" mode at the "Main menu" screen.
- **13.11.** At this screen, measurement is stated as pushing trigger of the equipment.
- **13.12.** Push and detach "on/off/esc" by ringing sound of "beep", equipment stop.

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## 14. Acceptance Criteria

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All results within the relevant material specification shall be considered acceptable and a considerable deviation of alloying elements / or absence of alloying elements with respect to the required material specification shall be considered non acceptable. A detailed Chemical analysis may be performed in a laboratory for the materials having very nominal deviation of Alloying Elements from the acceptable limits, as a referee method, before rejecting the material. In such cases a final decision to accept or reject is left to the client and their consultant. All rejected materials are identified and kept separately.

Note: As a minimum elements listed in Report Sample Format shall be verified except carbon content.

## 15. Marking

The verified and accepted materials shall be marked with 'AV'. +CODE

## 16. Documentation

After completion of test, the detailed report shall be made in the prescribed format having all the relevant data of the material tested and project information.



## 17. Report

All analysis checks shall be the subject of a typed test report, which shall be issued on completion of the examination.

If another reporting format is required, it shall be specified by the client or contract. In such instances, the client shall supply the relevant report sheets and copies of all completed reports will be retained on file.



The test report sheet shall generally contain, as a minimum, the following information:

- Client
- Client Reference No
- Part Identification
- Date of Test
- Report No
- Procedure No, and Revision
- Equipment used
- Material type
- Operator name and Signature.



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The Client will be made aware of all readings which fall outside of specification requirements as stated on drawings and responsibility of accepting or otherwise will be solely theirs.

Where required, or advised by the client, notes referring to any inaccuracies will be made in the Comment box at the end of the report.

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## 18. Sample format

	<b>Project:</b> DEHDASHT PETROCHEMICAL INDUSTRY COMPANY DEHDASHT HIGH DENSITY POLYETHYLENE PROJECT				
<b>Date:</b>	<b>Document Title:</b> Positive Material Identification Test Report		<b>Page:</b>		
<b>Project Name:</b>			<b>Customer</b>		
<b>Item No.</b>			<b>Serial No.:</b>		
<b>Service Name:</b>			<b>Surface Condition:</b>		
<b>Verification Method:</b>			<b>Method and identification of equipment used:</b>		
<b>Calibration certificate No. of the equipment:</b>					
<b>Acceptance Criteria</b>					
<b>Material</b>	<b>Chemical Composition (%)</b>				
	<b>Cr</b>	<b>Ni</b>	<b>Mo</b>		
<b>Applicable Code &amp; Standard:</b>					
<b>Test Result:</b>					
<b>Item Description</b>	<b>Material specification/ standard number and grade</b>	<b>Acture Value (%)</b>			<b>Result</b>
		<b>Cr</b>	<b>Ni</b>	<b>Mo</b>	
<b>QC Departement Kasravand Co.</b>		<b>TPI Inspector</b>		<b>Owner Inspector</b>	
<b>Name:</b>		<b>Name:</b>		<b>Name:</b>	
<b>Signature:</b>		<b>Signature:</b>		<b>Signature:</b>	
<b>Date:</b>		<b>Date:</b>		<b>Date:</b>	