



# PMI Just In Case

Positive Material Identification  
Ferritscope Testing

QUALITY DOCUMENT

## MEASUREMENT OF FERRITE CONTENT IN AUSTENITIC & DUPLEX STEEL

DOCUMENT No

**QD-FER-01**

REVISION

**02**

DATE

**10<sup>th</sup> October 2010**

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## 1.0 Purpose

To define the scope and method of measuring ferrite content in austenitic and duplex steel.

## 2.0 Scope

This procedure describes the methods used for non-destructive measurements of ferrite content in all duplex stainless steels, including welding, using a ferrite scope.

## 3.0 References

Fischer Feritscope FMP30 Operating Manual.  
NORSOK M-630 addendum on 22Cr and 25Cr duplex material.

## 4.0 Responsibilities

Personnel applying this procedure shall be familiar with this procedure and be competent in the use of a Fischer Feritscope FMP30.

## 5.0 Safety

- 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.

## 6.0 Equipment

Test equipment shall:

- be suitable for the range of 10–80% ferrite.
- be suitable for the range of surface curvatures and orientations to be encountered such as welds and small bore fittings.
- be sufficiently portable to gain access to each checkpoint under evaluation and be suitable for work within limited spaces.
- be capable of providing 'direct read-out' quantitative results.
- have Calibration Blocks that cover the ferrite range 10-80% with relevant certification.
- ferrite measurements may be influenced when material thickness is less than 2.5mm. In such cases a correction factor given in the operating manual of the equipment may be used.

## 7.0 Surface Preparation

### 7.1 General.

Whenever grinding is necessary to obtain a proper measurement surface, the finishing grinding shall be with a minimum 400 grit wheel, belt sander (or equivalent).

Ferrite measurements shall not be employed directly on angle ground surfaces.

In case of an angle ground surface, a minimum of 0.125mm further grinding shall be performed with grinding wheels up to 400 grit to free the measurement surface of any pre-existing angle grinding marks.

### 7.2 Rolled, Wrought and Forged products

Measurements shall be carried out on a clean surface in accordance with 7.1

### 7.3 Welds

The cap of welds shall be ground flat to the extent that ferrite readings can be obtained with the probe in use. The grinding finish shall be in accordance with 7.1

### 7.4 Tools used for surface preparation

Tools or materials used to prepare a test surface shall be isolated to groups of material to minimise the risk of erroneous results or contamination.

## 8.0 Calibration of Equipment

Fischer ferrite scopes have three levels of calibration as described in detail in the operating manual of the equipment.

### 8.1 Normalization (re-zero) for Thin and Curved Materials

Ferrite measurements shall be corrected when thin or curved materials are inspected. The correction can be done using correction curves given in the operating manual of the equipment.

### 8.2 Corrective Calibration

A corrective calibration of the equipment shall be performed whenever the probe is changed. As the probe wears, the calibration frequency should be increased. Excessively worn probes, as indicated by unstable measurements, shall not be used.

### 8.3 Master Calibration

A master calibration of the equipment has been performed by the manufacturer using internationally accepted, secondary standards. A new master calibration may be necessary if the original calibration is lost due to memory failure.

## 9.0 Ferrite Measurement Locations

The surface condition of the location to be tested shall be free of any foreign material, including oxidation, and have no residual contaminants from scales, coatings, paints or embedded remnants from contact with other materials, which may interfere with the test.

### 9.1 Pipe, Fittings, Flanges, Forgings and Bar.

Component	NB of Component		
	D ≤ 6"	6" < D ≤ 12"	D > 12"
Pipe (Note 7)	3 (Notes 2 & 3)	3 (Notes 2 & 3)	3 (Notes 2 & 3)
Tee	1 (Note 3)	4 (Notes 2 & 3)	5 (Notes 2 & 4)
Flange & Fittings	1 (Note 3)	3 (Notes 2 & 3)	3 (Notes 2 & 3)
O'lets	1 (Note 3)	2 (Note 4)	6 (Note 5)
Forgings	2 (Note 6)	4 (Note 6)	4 (Note 6)
Bars & Shapes	1 (Notes 1 & 6)	2 (Notes 1 & 6)	4 (Notes 1 & 6)

Note 1 - Test consists of the average of 3 readings

Note 2 - Tests at extreme ends + 2 extra when component contains a weld

Note 3 - Tests at centre + 1 extra when component contains a weld

Note 4 - Tests at centre on opposite sides

Note 5 - Tests at centre and extreme ends on opposite sides

Note 6 - Tests at thinnest and thickest part

Note 7 - For Duplex Stainless Steels only weld metal testing is required, base material testing may be omitted.

### 9.2 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.

### 9.3 Valves

	NB of Valve Body			
	D ≤ 2"	2" < D ≤ 4"	4" < D ≤ 12"	D > 12"
Body (Note 8)	2 (Note 2)	6 (Note 3)	12 (Note 4)	12 (Note 4)
Bonnet	1 (Note 5)	1 (Note 5)	3 (Note 6)	3 (Note 6)
Stem	1 (Note 5)	1 (Note 5)	3 (Note 6)	3 (Note 6)
Ball/Wedge/Plug	1 (Note 5)	2 (Note 2)	6 (Note 3)	6 (Note 3)

Note 1 - Test consists of the average of 3 readings

Note 2 - Tests at centre on opposite sides

Note 3 - Tests at centre and extreme ends on opposite sides

Note 4 - Tests at centre and extreme at 4 quadrant positions

Note 5 - Test at centre

Note 6 - Tests at centre and on OD or end

Note 7 - Any welds in pressure parts shall be tested at the centre and at each end

Note 8 - Wafer type valve to be tested at centre location only

#### 9.4 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 centre of the weld.

### 10.0 Identification and Marking

When required by the client or contract, all test items verified to be within the specified tolerance shall be suitably marked.

### 11.0 Evaluation of Results

Where readings at one location are outside the specified ferrite content range, two additional locations shall be taken in the vicinity of the first measuring point.

If either of the additional locations yields ferrite readings outside the specified ferrite content, the product shall be rejected,

If the two additional measuring points give readings within the ferrite content acceptance range, additional surface preparation shall be performed for the first measuring location and the measurement repeated. If acceptable result is obtained the product shall be accepted.

Unless specified by client, acceptance criteria for ferrite value shall be within the range of 30 to 60% for Duplex and 35 to 65% ferrite for Super Duplex.

Any tested materials falling outside of the above criteria shall be immediately quarantined pending further investigation by the company.

### 12.0 Reporting

All readings shall be the subject of a written 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 the following information:

- Client
- Client Reference No
- Part Identification
- Date of Test
- Heat Treatment Status
- Procedure No, and Revision
- Equipment used
- Material type
- Statement indicating test result of item tested
- Operator name and Signature.

APPENDIX I

 PMI - JUST IN CASE	<b>FERRITSCOPE REPORT</b>	CERT No: <b>11811-FER-001</b>
		REV: <b>0</b>
		PAGE: <b>1 of 1</b>

CLIENT: <b>B.A. OFFSHORE</b>	PMI-JIC REF: <b>PMI-JIC-10013</b>
CLIENT PO No: <b>11811-02</b>	PROCEDURE No. <b>QD-FR-01 Iss 01</b>
CLIENT WORKS ORDER No: <b>WO-11811</b>	EQUIPMENT: <b>FERRITSCOPE MP30 S/No 090000872</b>

ITEM	DESCRIPTION OF EXAMINED MATERIAL	Recorded Values of Ferrite %						Ave	MATERIAL	CAST No
		1	2	3	4	5	6			
<b>TAG No: 013-SP-062</b>										
1	40" NB BODY - 0"	41.8	43.7	41.9	40.6	—	—	42.0	2507ss	483202
1	40" NB BODY - 120"	41.5	40.3	45.6	40.4	—	—	42.0	2507ss	483202
1	40" NB BODY - 240"	39.4	45.0	40.9	44.1	—	—	42.4	2507ss	483202
2	40" NB 150# FFWN FLANGE - 0"	47.5	47.3	53.9	42.2	—	—	49.0	2507ss	AUAC
2	40" NB 150# FFWN FLANGE - 120"	54.0	52.9	48.8	49.1	—	—	51.3	2507ss	AUAC
2	40" NB 150# FFWN FLANGE - 240"	42.1	43.9	57.6	41.1	—	—	49.2	2507ss	AUAC
7A	36" NOZZLE - 0"	42.5	41.2	47.7	44.4	—	—	43.8	2507ss	483202
7A	36" NOZZLE - 120"	40.5	41.7	47.7	44.3	—	—	42.2	2507ss	483202
7A	36" NOZZLE - 240"	42.8	43.1	43.4	42.2	—	—	42.9	2507ss	483202
7B	36" NB 150# FFWN FLANGE - 0"	51.8	49.9	37.9	58.6	—	—	51.6	2507ss	AUAC
7B	36" NB 150# FFWN FLANGE - 120"	52.1	51.0	51.8	53.6	—	—	52.3	2507ss	AUAC
7B	36" NB 150# FFWN FLANGE - 240"	50.5	51.8	50.5	54.7	—	—	51.9	2507ss	AUAC
8A	BASE PLATE - 0"	38.9	39.6	49.5	42.4	—	—	42.6	2507ss	481762
8A	BASE PLATE - 120"	40.3	41.7	45.3	40.5	—	—	42.0	2507ss	481762
8A	BASE PLATE - 240"	46.2	37.4	41.6	43.2	—	—	42.1	2507ss	481762
<b>2" Pressure Safety Valve</b>										
1	45-PSV-92514 BODY	44.1	49.1	48.2	43.6	—	—	46.3	2205 SS	QC 5408
	BONNET	44.9	46.9	45.6	49.9	—	—	46.8	2205 SS	QC 5262
	CAP	38.6	42.7	45.3	41.7	—	—	42.1	2205 SS	QC 5346
	NOZZLE	53.2	40.7	55.7	56.0	—	—	51.4	2205 SS	QB 14480

COMMENTS:  
 Minimum individual acceptance value shall be 35% and the minimum average shall be 42%

	OPERATOR	CUSTOMER INSPECTOR	THIRD PARTY INSPECTOR
NAME:	R.Pringle		
SIGNATURE:			
DATE:	25 June 2009		