

## **API Ballot 4438**

<b>Work Item Number</b>	2407
<b>Title of Work Item</b>	PMI
<b>Ballot Revision Level</b>	0
<b>Type of Ballot</b> (Initial, Comment, Comment resolution (reference API ballot#), 1 <sup>st</sup> Re-ballot, 2 <sup>nd</sup> Re-ballot, etc.)	Initial (vote and comment)
<b>API Document Modified</b>	API Spec 5CRA
<b>API Document, API Modifying Document(s) and Revision Level(s)</b>	1 <sup>st</sup> Edition
<b>Revision Key</b>	Identify how deletions, additions, and changes to previous ballots, as applicable, are marked (e.g., Current changes to the API document in: <b>red</b> )

**Work Item Charge:** Add PMI requirements for material verification to API Spec 5CRA (Groups 2, 3, and 4).

**Ballot Rationale:**

1. Require mill PMI for verification (of the product marking in most cases),
2. Allow additional field PMI per API 5CRA Annex D for Purchaser Inspection, to address both verification and mixing or sorting concerns.

**Ballot Text:** below

NOTE See the ballot email notification for additional information regarding this ballot.

### **3 Normative References**

Add:

API Recommended Practice 578, *Guideline for a Material Verification Program (MVP) for New and Existing Assets*

ASTM E1476, *Standard Guide for Metals Identification, Grade Verification, and Sorting*

### **4 Terms, abbreviated terms, symbols and definitions**

#### **4.3 Abbreviated terms**

Add: PMI Positive Material Identification

### **5 Information to be supplied by the purchaser**

For 5.2, insert new row r): In requirement column add **Positive Material Identification**; in reference column add 7.1.

### **6 Manufacturing process**

#### **6.6 Traceability**

(no change required)

### **7 Material requirements**

#### **7.1 Chemical composition**

Add 5th paragraph: **For Groups 2, 3 and 4, each length of all products shall receive PMI testing in accordance with 9.17.**

### **9 Inspection and testing**

#### **9.1 Test Equipment**

(no change required)

#### **9.2 Type and frequency of tests**

No change to text. Add PMI to Tables A.20/C.20 (see below).

#### **9.3 Testing of chemical composition**

##### **9.3.1 Chemical analysis**

(no change required)

#### **Add new sub-section, 9.17:**

#### **9.17 Positive Material Identification (PMI) testing for material verification program for Groups 2, 3 and 4**

### **9.17.1 General** (revised 9.16.1 NDE text)

The PMI requirements are specified in 9.17.2 to 9.17.3. The test frequency for PMI is given in Table A.20 or Table C.20. The purchaser may conduct additional PMI tests to ensure compliance with this standard (see D.3). In case of dispute, an additional product chemical analysis in accordance with 7.1 shall be used as the referee method.

### **9.17.2 Products** (revised 9.16.3 text)

All products shall be tested in accordance with API 578 or ASTM E1476.

All methods shall have validated and documented capability to detect at a minimum the following elements in the tolerance range for the applicable material category: Cr, Ni, Mo.

PMI testing shall be carried out after final marking, or prior to final marking provided a validated and documented procedure that demonstrates traceability shall be maintained between PMI testing through final marking.

If testing produces an arc burn; the arc burn shall be treated as a defect as defined in 7.11.

### **9.17.3 Reference standards**

Reference standards traceability to international or national measurement standards shall be documented. Where no such standards exist, the basis used for calibration or verification shall be documented.

A documented procedure to identify and record the serial number of each standard is required. A documented standardization procedure which includes a requirement to average two or more readings shall be used.

### **9.17.4 Personnel qualifications**

All personnel performing PMI testing by the manufacturer shall be qualified by the manufacturer to each applicable test method and material category. A record of training shall be made available to the purchaser upon request.

## **11 Marking**

No change required. Marking is not needed since PMI test required for all products and PSLs.

## **13 Documents**

### **13.3 Test certificates**

Move current m) to n) and add new m):

m) Statement of compliance to the PMI requirements, the method used, and the serial number of each reference standard used.

---

### **Edit Tables A.20 and C.20 (below):**

**Tables A.20 — Type and frequency of tests for non-upset and upset products**

Type of test or requirements	Test requirements <sup>a</sup>	Frequency of testing <sup>b</sup>	Test methods	Requirements
1	2	3	4	5
Cast analysis	m <sup>d</sup>	1 per cast	9.3.2	7.1
Product analysis	Non-remelted alloy	2 per cast	9.3.2	7.1
	Remelted alloy	1 per ingot	9.3.2	7.1
Room-temperature tensile test	m <sup>d</sup>	1 per test lot <sup>c</sup>	9.5.2	7.2
Elevated-temperature tensile test	o <sup>d</sup>	1 per test lot <sup>c</sup>	9.5.2	7.2
Hardness test	m <sup>d</sup>	1 series/ test lot <sup>c</sup>	9.6.2	7.3
Impact or flattening test	m <sup>d</sup>	9.7.2	9.7.3 or 9.7.4.1	7.4, 7.5, 7.6, 7.7
Microstructure examination	m <sup>d</sup>	1 per test lot <sup>c</sup>	9.8.2	7.9
Visual inspection	m	Each product	9.15	7.10, 7.11, 8.4
Hydrostatic test	m <sup>d</sup> (o <sup>h</sup> ) <sup>d</sup>	Each pipe	9.14	7.12
Dimensional testing:				
— Outside diameter	m	Each end	9.9.2	Table A.15 and Table A.17
— Wall thickness	m	Each end	9.9.3	Table A.15 and Table A.17
— Drift test <sup>e</sup>	m	Each pipe	9.10	Table A.15 and Table A.18 or Table A.19
— Length	m	Each product	9.11	Table A.16
— Straightness	m	Each pipe	9.12	8.3.3
— Mass	m	Each product	9.13	Table A.15 and Table A.17
Non-destructive examination:				
— UT for longitudinal defects	m <sup>d</sup>	Each product	9.16	7.11
— UT for transverse defects	m <sup>d</sup>	Each product	9.16	7.11
— UT for laminar defects	m <sup>d</sup>	Each product	9.16	7.11
— UT for wall thickness <sup>e</sup>	m <sup>d</sup>	Each product	9.16	7.11
— UT manual on upset L+T <sup>e</sup>	m <sup>d</sup> (o <sup>f</sup> ) <sup>d</sup>	Each product	9.16	7.11
— EMI <sup>e</sup>	o <sup>d,f</sup>	Each product	9.16	7.11
— Liquid penetrant inspection	m (o <sup>f</sup> )	Only ground or machined area	9.16	7.11
— MT	o <sup>f</sup> (m <sup>g</sup> )	Only ground or machined area	9.16	7.11
— PMI	m	Each product for Groups 2, 3, and 4	9.17	7.1
<p><sup>a</sup> “m” signifies mandatory; “o” signifies optional (an agreement is required).</p> <p><sup>b</sup> For definition of “test lot”, see 4.1.19. See Table A.21 for the maximum number of product in a test lot.</p> <p><sup>c</sup> Minimum 1 per cast.</p> <p><sup>d</sup> It is required that records be retained.</p> <p><sup>e</sup> Not applicable to coupling stock.</p> <p><sup>f</sup> Option for group 1 only.</p> <p><sup>g</sup> Mandatory for upset ends of group 1.</p> <p><sup>h</sup> Option for CH only.</p>				

**Tables C.20 — Type and frequency of tests for non-upset and upset products**

Type of test or requirements	Test requirements <sup>a</sup>	Frequency of testing <sup>b</sup>	Test methods	Requirements
1	2	3	4	5
Cast analysis	m <sup>d</sup>	1 per cast	9.3.2	7.1
Product analysis	Non-remelted alloy	2 per cast	9.3.2	7.1
	Remelted alloy	1 per ingot	9.3.2	7.1
Room-temperature tensile test	m <sup>d</sup>	1 per test lot <sup>c</sup>	9.5.2	7.2
Elevated-temperature tensile test	o <sup>d</sup>	1 per test lot <sup>c</sup>	9.5.2	7.2
Hardness test	m <sup>d</sup>	1 series/ test lot <sup>c</sup>	9.6.2	7.3
Impact or flattening test	m <sup>d</sup>	9.7.2	9.7.3 or 9.7.4.1	7.4, 7.5, 7.6, 7.7
Microstructure examination	m <sup>d</sup>	1 per test lot <sup>c</sup>	9.8.2	7.9
Visual inspection	m	Each product	9.15	7.10, 7.11, 8.4
Hydrostatic test	m <sup>d</sup> (o <sup>h</sup> ) <sup>d</sup>	Each pipe	9.14	7.12
Dimensional testing:				
— Outside diameter	m	Each end	9.9.2	Table C.15 and Table C.17
— Wall thickness	m	Each end	9.9.3	Table C.15 and Table C.17
— Drift test <sup>e</sup>	m	Each pipe	9.10	Tables C.15 and Table C.18 or Table C.19
— Length	m	Each product	9.11	Table C.16
— Straightness	m	Each pipe	9.12	8.3.3
— Mass	m	Each product	9.13	Table C.15 and Table C.17
Non-destructive examination:				
— UT for longitudinal defects	m <sup>d</sup>	Each product	9.16	7.11
— UT for transverse defects	m <sup>d</sup>	Each product	9.16	7.11
— UT for laminar defects	m <sup>d</sup>	Each product	9.16	7.11
— UT for wall thickness <sup>e</sup>	m <sup>d</sup>	Each product	9.16	7.11
— UT manual on upset L+T <sup>e</sup>	m <sup>d</sup> (o <sup>f</sup> ) <sup>d</sup>	Each product	9.16	7.11
— EMI <sup>e</sup>	o <sup>d,f</sup>	Each product	9.16	7.11
— Liquid-penetrant inspection	m (o <sup>f</sup> )	Only ground or machined area	9.16	7.11
— MT	o <sup>f</sup> (m <sup>g</sup> )	Only ground or machined area	9.16	7.11
— PMI	m	Each product for Groups 2, 3, and 4	9.17	7.1
<sup>a</sup> “m” signifies mandatory; “o” signifies optional (an agreement is required). <sup>b</sup> For definition of “test lot”, see 4.1.19. See Table C.21 for the maximum number of product in a test lot. <sup>c</sup> Minimum 1 per cast. <sup>d</sup> It is required that records be retained. <sup>e</sup> Not applicable to coupling stock. <sup>f</sup> Option for group 1 only. <sup>g</sup> Mandatory for upset ends of group 1. <sup>h</sup> Option for CH only.				