

## **API Ballot 4437**

<b>Work Item Number</b>	1066
<b>Title of Work Item</b>	Process for Evaluating Requests for Adding CRA Alloys and/or Grades
<b>Ballot Revision Level</b>	8
<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>	First Edition
<b>Revision Key</b>	<b>Black Text</b> = Current API Document <b>Red Text</b> = Additions <b>Red Text with Strikethrough</b> = Deletions

**Work Item Charge:** Develop a process for the inclusion of new alloys and/or grades into API 5CRA. Currently, the industry uses several CRA materials that are not included in API 5CRA and there is interest in adding materials. This effort would make the requirements consistent and adequate for the intended applications.

**Ballot Rationale:** This work item establishes a process for consistent submittal of proposals in adding news alloys and/or grades.

**Ballot Text:** below

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

## **Annex G**

### **(normative)**

## **Product Specification Level 2 (PSL-2)**

### **G.5 Process for update of chemical composition and/or grades**

The work group responsible for this International Standard decided to include in Table A.28 and Table C.28 only those chemical compositions from ISO 15156-3:2003, ISO 15156-3:2003/Cor 1:2005 and ISO 15156-3:2003/Cor 2:2005, including Annex D, with a well-established track record of manufacture and use as downhole tubulars for the grades and requirements specified in Table A.27 and Table C.27.

If users of this International Standard are aware of other chemistries **and/or grades** from ISO 15156-3 that have such a track record, they are requested to bring it to the attention of ISO/TC 67/SC 5 **or API SC5**, with supporting evidence, so they can be considered for incorporation. **Supporting evidence should include the information stated in the G.6.**

If, on the other hand, users of this International Standard believe that any of the chemistries as specified in Table A.28 or Table C.28 or grades and requirement presently incorporated in Table A.27 or Table C.27 should either be modified or removed from this International Standard, then this should be brought to the attention of ISO/TC 67/SC 5 **or API SC5**.

### **G.6 Guideline for supporting evidence submittal for update of chemical composition and/or grades**

#### **G.6.1 General information**

The submitter should review the requirements in this International Standard. For consistency in the submittal, the submittal shall use the terminology, processes and methods stated in this International Standard. If new terminology, processes and methods should be considered, the submitter shall clearly state and define the new terminology, processes and methods in the proposal. The following guideline states the minimum information to be submitted.

#### **G.6.2 Introduction of proposed material**

##### **G.6.2.1 Outline of material**

The submitter shall define the material characteristics for the CRA alloy **and/or grade** for updating into this International Standard and the intended application(s). The following characteristics shall be included in the outline:

- a) Nominal chemical composition.
- b) UNS number.
- c) State if listed in NACE MR0175/ ISO 15156-3 by UNS number or family.
- d) Products (e.g. tubing, casing, coupling stock or other).
- e) Grade (Specified minimum yield strength in units shown in Tables A.27 and Table C.27).
- f) State if seamless manufacturing process.
- g) Label 1 range (specified outside diameter).
- h) Label 2 range (wall thickness).
- i) Length range(s), see Tables A.16 and Table C.16.
- j) Intended applications, such as corrosion resistance (e.g. resistance to sulfide stress cracking, stress corrosion cracking, etc.).

#### **G.6.2.2 Manufacturing processes**

The manufacturing processes of the proposed CRA alloy and/or grade shall be described. Product manufacturing processes are defined in this International Standard. The submitter shall clearly state if new/different manufacturing processes should be considered with justification. As a minimum, the following shall be included in the submittal:

##### **a) Melting and casting processes**

- 1) Melting (include any special ladle metallurgy techniques employed).
- 2) Casting (continuous casting or ingot casting).

##### **b) Product forming process**

- 1) Seamless.
- 2) Starting material (e.g. Ingot/billet or rolled/forged bar/machined bar, hot finished hollow or other).
- 3) Product forming conditions (e.g. hot finished, hot-rolled/forged, or hot-extruded; cold-hardened (cold drawing, cold pilgering or other).
- 4) Heat treatment or cold hardened conditions (e.g. Quenched and tempered, solution-annealed, solution annealed and age hardened, cold hardened or other).
- 5) Heat treatment requirements (e.g. Temperature, time, quench media or other).
- 6) End sizing requirements.
- 7) Straightening requirements.
- 8) Processes requiring validation.
- 9) Approximate hot work deformation ratio (if critical to material performance).
- 10) For information, state the processing requirements of other API specifications that are not covered by the above points.

### **G.6.2.3 Manufacturing scale production record**

**G.6.2.3.1** The submittal shall include a summary record of industrial scale manufacturing, which includes the alloy nominal chemistry, UNS number, grade, product dimensions (Label 1, Label 2, wall thickness range and length range), quantities, and number of heats and lots. Industrial scale manufacturing requires material to be manufactured using mill scale (e.g. not lab scale) manufacturing processes. The record shall also include a summary of the applicable mechanical, metallographic, corrosion and NDE test results. The submittal shall include the mean, range and standard deviation for quantitative test results.

**G.6.2.3.2** The submittal shall include corrosion test results from at least three heats where samples were taken from industrial scale manufacturing. The chemical, mechanical and metallographic test results shall also be included.

The test samples should be from heats near the maximum proposed hardness limit (if hardness maxima are the governing NACE MR0175/ ISO 15156-3 acceptance criteria, otherwise the material should be near the upper end of the permitted yield strength range).

### **G.6.2.4 Field record of proposed material**

One of the most important attributes to be considered is the field application history of the proposed material. The submittal should provide field performance information with the field environmental conditions, if the material has had field usage, which includes pH, temperature, water cut, total pressure, elemental sulfur, partial pressure of H<sub>2</sub>S and CO<sub>2</sub> or other parameters that determine the resistance to general, localized and cracking corrosion resistance of the material. The field supply record shall include the product chemistry, UNS number, grade, product dimensions (Label 1, Label 2 and length range), quantities, number of heats and lots.

### **G.6.3 Details of proposed material**

The submittal shall describe the proposed material in terms of material properties, testing and inspection requirements. As applicable, the following shall be included in the submittal, in the applicable USC and SI units, along with the proposed frequencies of testing and inspection:

#### **a) Chemical composition**

State the proposed chemical elements, limits and UNS number. If applicable, state the minimum PRE. If the material could have susceptibility for the formation of detrimental precipitates, the submittal should include more conservative limits than included in the UNS number, for the appropriate elements to suppress/mitigate precipitate formation.

#### **b) Tensile properties**

State the proposed limits for yield strength, tensile strength, percent elongation, and percent reduction of area (if applicable).

**c) Hardness properties**

State the proposed mean hardness number and hardness number limits, the hardness test method/scale for through-wall and surface hardness (as applicable).

**d) Impact properties**

For the test specimen orientation and size, state the proposed minimum mean absorbed energy for average of three impact specimens and minimum individual impact specimen, minimum lateral expansion and minimum percent shear area (as applicable).

**e) Macrostructure and microstructure**

The submittal shall state the test location(s), orientation, proposed test method, photographs of macrostructure and microstructure, etchant(s), magnification(s) and requirements. If example reference photomicrographs would be beneficial to clarify microstructure acceptance in this International Standard, the submittal shall include photomicrographs with clear headers stating location, orientation, magnification, etchant, "pass" or "fail" (with stated reason for failure).

**f) Corrosion resistance**

If corrosion acceptance testing is proposed, provide details of the test method and acceptance criteria.

**g) Surface chromium depletion test results**

State the minimum surface chromium acceptance criteria for each material condition.

**h) Cleanliness evaluation**

State the cleanliness acceptance requirements. See Annex E for cleanliness evaluation and the groups where this evaluation applies as required within this International Standard.

**i) Flattening test**

State the proposed flattening test requirements.

**j) Dimensional requirements**

State if the proposed product(s) will meet the dimensional requirements within this International Standard. If there are proposed differences, state those details.

**k) Nondestructive inspection**

State if the proposed product(s) will meet the nondestructive inspection requirements within this International Standard and clarify the acceptance level (as applicable). If there are proposed differences, state those details.

**l) Hydrostatic test**

State if the proposed product(s) will meet the requirements within this International Standard. If there are proposed differences, state those details.