

# Supplementary Specification to API Specification 20E Subsea Fasteners (Alloy and Carbon Steel Bolting)

## Revision history

VERSION	DATE	PURPOSE
1.0	March 2021	Issued for Use

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## Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

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## Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2020).

## Table of Contents

	Foreword .....	1
	Introduction .....	3
1	Scope .....	5
	1.1 Purpose .....	5
	1.2 Applicability .....	5
2	Normative References .....	5
4	Qualification Bolting .....	5
	4.2 Qualification Testing .....	5
	4.3 Materials and Dimensions .....	6
	4.5 Records of Qualification .....	7
	4.6 Limits of Bolting Qualification .....	7
5	Production of Qualified Bolting .....	7
	5.1 Qualification of Procurement Sources for Raw Material .....	7
	5.2 Qualification of Suppliers for Subcontracted Operations .....	8
	5.4 Manufacturing Process Specification .....	8
	5.5 Raw Material .....	11
	5.7 Mechanical Properties .....	11
	5.8 Metallurgical Requirements .....	12
	5.9 Examination and Test Requirements .....	12
	5.10 Nondestructive Examination Requirements .....	13
	5.11 Dimensional and Visual Inspection .....	14
6	Calibration Systems .....	15
7	Test Report .....	15
	7.1 General .....	15
	7.2 BSL-1 .....	15
	7.3 BSL-2 and BSL-3 .....	15
8	Marking .....	16
	8.2 Marking Required by This Specification .....	16
	Bibliography .....	17

### List of Tables

Table 1—Bolting Test Requirements .....	5
Table 3—Sampling for Dimensional and Visual Inspection and Surface NDE .....	15

## Introduction

The purpose of this specification is to define a minimum common set of requirements for the procurement of subsea fasteners in accordance with API Specification 20E Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries for application requirements determined by the API 17 series of equipment standards, specifications and recommended practices, in the petroleum and natural gas industries.

This JIP33 standardized procurement specification follows a common document structure comprising the four documents as described below, which together with the purchase order documentation, define the overall technical specification for procurement. It should be noted, however, that this specification package for subsea fasteners does not include a data sheet.



### JIP33 Specification for Procurement Documents Supplementary Technical Specification

This specification is to be applied in conjunction with the supporting quality requirements specification (QRS) and information requirements specification (IRS) as follows.

#### **IOGP S-724: Supplementary Specification to API Specification 20E Subsea Fasteners (Alloy and Carbon Steel Bolting)**

This specification defines the technical requirements for the supply of the equipment and is written as an overlay to API Specification 20E, following the API Specification 20E clause structure. Clauses from API Specification 20E not amended by this specification apply as written to the extent applicable to the scope of supply.

Modifications to API Specification 20E defined in this specification are identified as Add (add to clause or add new clause), Replace (part of or entire clause) or Delete.

### **IOGP S-724Q: Quality Requirements for Subsea Fasteners (Alloy and Carbon Steel Bolting)**

The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of two generic conformity assessment system (CAS) levels (A and D) on the basis of evaluation of the associated service and supply chain risks. CAS A is intended to support additional control activities for the qualification of new products, while CAS D specifies no physical intervention, allowing for off-the-shelf commodity items to be purchased. The applicable CAS level is specified by the purchaser in the purchase order.

### **IOGP S-724L: Information Requirements for Subsea Fasteners (Alloy and Carbon Steel Bolting)**

The IRS defines the information requirements, including contents, format, timing and purpose to be provided by the supplier. It may also define specific conditions which invoke information requirements.

The terminology used within this specification and the supporting IRS and QRS follows that of API Specification 20E and is in accordance with ISO/IEC Directives, Part 2 as appropriate.

The IRS is published as an editable document for the purchaser to specify application specific requirements. The supplementary specification and QRS are fixed documents.

The order of precedence (highest authority listed first) of the documents shall be:

- a) regulatory requirements;
- b) contract documentation (e.g. purchase order);
- c) purchaser defined requirements (IRS, QRS);
- d) this specification;
- e) API Specification 20E.

## 1 Scope

### 1.1 Purpose

Add to sentence

as specifically applied to API 17 series equipment

### 1.2 Applicability

Add to sentence

for application to equipment covered by API 17 series of standards, specifications and recommended practices

## 2 Normative References

Add to section

API Standard 20D, *Qualification of Nondestructive Examination Services for Equipment Used in the Petroleum and Natural Gas Industry*

ASNT SNT-TC-1A, *Personnel Qualification and Certification in Nondestructive Testing*

ASTM A1010, *Standard Specification for Higher-Strength Martensitic Stainless Steel Plate, Sheet, and Strip*

ASTM F788, *Standard Specification for Surface Discontinuities of Bolts, Screws, Studs, and Rivets, Inch and Metric Series*

ASTM F812, *Standard Specification for Surface Discontinuities of Nuts, Inch and Metric Series*

ISO 6157-2, *Fasteners — Surface discontinuities — Part 2: Nuts*

ISO 6157-3, *Fasteners — Surface discontinuities — Part 3: Bolts, screws and studs for special requirements*

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

## 4 Qualification Bolting

### 4.2 Qualification Testing

**Table 1—Bolting Test Requirements**

Add "Dimensional and Visual Inspection" column to Table 1

BSL	Dimensional and Visual Inspection
BSL-1	5.11.2
BSL-2	5.11.3
BSL-3	5.11.4

#### 4.2.2

Replace first paragraph with

Test laboratories shall have a QMS complying with ISO 17025 or equivalent.

Add after first paragraph

If a laboratory does not hold a valid accreditation as per ISO 17025, its QMS shall be approved by the purchaser.

Delete "and liquid penetrant inspection" from second paragraph

Delete "and liquid penetrant inspection" from third paragraph

### 4.3 Materials and Dimensions

#### 4.3.1

Replace list items with

- ASTM A193/A193M Grades B7 and B7M (for BSL-1 only);
- ASTM A194/A194M Grades 2H (for BSL-1 only), 2HM (for BSL-1 only), 7, 7M, and with supplementary requirements S5 for all;
- ASTM A320/A320M Grades L7, L43 and L7M;
- ASTM A540 Grades B22 and B23 (for BSL-1 only).

Add NOTE to section

NOTE Fastener grades not listed in this section are not intended to be prohibited from use, but their use may require supplementary requirements provided by the purchaser.

#### 4.3.3

Replace "nut" with

internal

Replace "bolt" with

external

Add new section

#### 4.3.5

The maximum permitted heat-treated section thickness or nominal diameter shall be restricted to the requirements of the relevant ASTM specifications for the applicable grade.

NOTE This section applies to re-heat treatment of a rough product when machined from a bar larger than recommended diameters in the relevant ASTM specifications.

## 4.5 Records of Qualification

In list item b), add after "heat number"

and production number with manufacturing batch/lot number

Add new list item r)

r) manufacturing range approved;

Add new list item s)

s) bolting manufacturer's raw material specification reference;

Add new list item t)

t) hot work ratio (for BSL-2 and BSL-3).

## 4.6 Limits of Bolting Qualification

### 4.6.2 BSL-2 and BSL-3

Replace list item a) with

a) raw material manufacturer not previously qualified in accordance with Section 5;

Add new list item e)

e) raw material forming method;

Add new list item f)

f) decrease in hot work ratio from that used in qualification.

## 5 Production of Qualified Bolting

### 5.1 Qualification of Procurement Sources for Raw Material

#### 5.1.2

In first sentence, add before "the raw material supplier"

the bolting manufacturer shall confirm that

In first sentence, replace "shall maintain" with

maintains

Delete section b)

In section c), replace "BSL-3" with

BSL-2 and BSL-3

Add to section

Raw material sourced from stockists or distributors shall have their traceability maintained as applied by the raw material manufacturer.

## **5.2 Qualification of Suppliers for Subcontracted Operations**

### **5.2.2 Qualification Requirements**

Add new section

#### **5.2.2.3**

The following subcontracted operations shall have written procedures submitted for document control and approval by the manufacturer prior to use by the subcontractor during qualification and production bolting manufacture:

- a) forging/forming;
- b) heat treatment;
- c) metallurgical and mechanical testing;
- d) threading;
- e) plating/coating;
- f) NDE.

## **5.4 Manufacturing Process Specification**

### **5.4.1 General**

In first sentence, replace "listed in 5.4.3" with

listed in 5.4.3 and 5.4.4

Add new section

The following information shall be included in the MPS in addition to the items listed in 5.4.1:

- a) this specification number and version number;
- b) BSL;
- c) scope;
- d) fastener material grade, class and property class (where applicable);
- e) raw material hot work ratio (reduction), minimum;
- f) raw material hot work method;
- g) mechanical testing (and metallurgical testing where applicable);
- h) hardness testing and test location on the actual fastener;

- i) NDE;
- j) visual inspection;
- k) dimensional inspection;
- l) coating or plating (where applicable);
- m) markings including the location on the fastener;
- n) reference to (where applicable):
  - 1) API Specification Q1 certificate number;
  - 2) API Specification 20E licence number;
  - 3) fastener manufacturer's raw material specification;
  - 4) fastener product standard;
  - 5) fastener standard or specification;
  - 6) ISO 17020 or 17025 test facility accreditation number;
  - 7) supporting MPQ reference;
  - 8) supporting production manufacturing related procedures (e.g. NDE, coating or plating).

#### **5.4.5 BSL-1 Requirements**

Add new section

##### **5.4.5.5**

For induction heat treatment, qualification shall be in accordance with ASTM A1010.

Add new section

##### **5.4.5.6**

Forging furnace qualification shall be in accordance with the written procedure.

#### **5.4.6 BSL-2 Requirements**

##### **5.4.6.4**

Replace section with

For rolled threads, parts shall be stress relieved at a temperature within 18 °F to 50 °F (10 °C to 28 °C) below the final tempering temperature intended to establish mechanical properties.

Add NOTE to section

NOTE The upper limit is not applicable if the mechanical test is performed after stress relieving.

Add new section

**5.4.6.8**

One contact thermocouple attached to a part shall be used to verify heat treatment times and temperatures.

Add new section

**5.4.6.9**

The referenced thermocoupled part shall be placed in the location with the slowest heating rate or centrally in the furnace load.

Add new section

**5.4.6.10**

Continuous process heat treatment shall not be used.

Add new section

**5.4.6.11**

Batch process heat treatment shall be allowed.

Add new section

**5.4.6.12**

The maximum actual Rp0.2 (YS) shall be 135 ksi (930 MPa).

**5.4.7 BSL-3 Requirements**

**5.4.7.2**

Delete section 5.4.7.2

**5.4.7.3**

Delete section 5.4.7.3

**5.4.7.4**

Delete section 5.4.7.4

**5.4.7.5**

Delete section 5.4.7.5

## 5.4.8 Plating and Coating

### 5.4.8.1

Add new section

#### 5.4.8.1.1

Coating and plating application procedures shall be qualified.

Add new section

#### 5.4.8.1.2

Coating application procedure qualifications shall be valid unless a gap of three years in supply has elapsed.

## 5.5 Raw Material

### 5.5.2 BSL-2

Add new section

#### 5.5.2.5

The hot work ratio used for successful qualification shall be the minimum hot work ratio for production.

## 5.7 Mechanical Properties

### 5.7.1 General

Add new section

#### 5.7.1.1

Nut CVN impact testing, when required, shall be performed in accordance with ASTM A194/A194M, Supplementary Requirement S3.

Add new section

#### 5.7.1.2

Nut proof load testing, when required, shall be performed in accordance with ASTM A194/A194M, Supplementary Requirement S4.

Add new section

#### 5.7.1.3

If the specified proof load in ASTM A194/A194M, Tables S4.1 and S4.2 cannot be applied due to equipment limitation, a cross-section hardness test shall be performed in accordance with ASTM A194/A194M, 8.2.

Add new section

#### 5.7.1.4

A representative test bar shall only be used for specific test specimens that cannot be physically obtained from the product.

## 5.8 Metallurgical Requirements

### 5.8.1 General

Add to section

Metallurgical requirements shall apply after the final quality heat treatment.

## 5.9 Examination and Test Requirements

Add NOTE to section

NOTE When 100 % examination is not required, testing of non-sequential products is expected. Testing of sequential products to achieve random test results is considered inadequate.

### 5.9.2 Hardness Test Requirements

#### 5.9.2.1 General

Replace "ASTM A370, including Annex A3" with

ASTM F606/F606M

#### 5.9.2.2 BSL-1

##### 5.9.2.2.1 Hardness Testing of Bars and Fasteners

Delete Grade "4" from first sentence

In first sentence replace, "34 HRC" with

34.0 HRC

Replace second sentence with

Test frequency shall be 100 % as per ASTM A962 Supplementary Requirement S61.

Add to section

The allowable hardness for Grade 7M shall be within the range 93.0-99.0 HRB.

#### 5.9.2.3 BSL-2

##### 5.9.2.3.1 Hardness Testing of Bars and Fasteners

Delete "except that when a hardness traverse for bars heat treated by induction or electric resistance methods is required, all readings shall be within 3 HRC" from section

##### 5.9.2.3.3 Nuts Not Subject to Mandatory Proof Load

Add after "Tables 3 and 4"

S4.1 and S4.2

Add to section

For Grade 7 nuts not subjected to proof load testing, the difference between the core or cross section and surface hardness shall be 3 HRC maximum.

Add new section

**5.9.2.3.4**

The hardness test results shall not be converted.

**5.10 Nondestructive Examination Requirements**

**5.10.2 BSL-2**

**5.10.2.1**

Delete second sentence

Delete ", including personnel qualification" from third sentence

Delete fourth sentence

Add to section

Sample size shall be in accordance with Table 3.

Add new section

**5.10.2.1.1**

Surface NDE (magnetic particle examination) shall be performed on the final product prior to coating or plating.

Add new section

**5.10.2.1.2**

Personnel performing surface NDE (magnetic particle examination) shall be certified to ISO 9712 Level 2, ASNT ACCP Level 2 or ASNT SNT-TC-1A Level 2.

Add new section

**5.10.2.1.3**

Personnel approving surface NDE (magnetic particle examination) procedures shall be certified to ISO 9712 Level 3, ASNT ACCP Level 3 or ASNT SNT-TC-1A Level 3.

Add new section

**5.10.2.1.4**

Surface NDE (magnetic particle examination) shall be performed in accordance with API Standard 20D or equivalent.

Add new section

**5.10.2.1.5**

The acceptance criteria shall apply for surface and sub-surface indications.

**5.10.2.2**

Replace "with a diameter greater than 2.5 in. (63.5 mm) nominal" with

of diameters 1 in. (25.4 mm) nominal and larger

Add new section

**5.10.2.2.1**

Personnel performing volumetric NDE (ultrasonic examination) shall be certified to ISO 9712 Level 2, ASNT ACCP Level 2 or ASNT SNT-TC-1A Level 2.

Add new section

**5.10.2.2.2**

Personnel approving volumetric NDE (ultrasonic examination) procedures shall be certified to ISO 9712 Level 2, ASNT ACCP Level 2 or ASNT SNT-TC-1A Level 2.

Add new section

**5.10.2.2.3**

Volumetric NDE (ultrasonic examination) shall be performed in accordance with API Standard 20D or equivalent.

**5.10.3 BSL-3**

**5.10.3.2**

Replace section with

Volumetric NDE requirements specified for BSL-2 shall apply for BSL-3.

**5.11 Dimensional and Visual Inspection**

**5.11.1 General**

Replace first sentence with

The dimensions shall meet the requirements of the applicable product dimensional standard (e.g. ASME, ISO).

Delete fourth sentence

Add new section

**5.11.1.1**

Fasteners shall be free from cracks, bursts, seams, folds, thread laps and voids.

Add new section

#### 5.11.1.2

Surface discontinuities other than those listed in 5.11.1.1 shall be evaluated in accordance with ASTM F788, ASTM F812, ISO 6157-2 or ISO 6157-3.

Replace Table 3 title with

### Table 3—Sampling for Dimensional and Visual Inspection and Surface NDE

## 6 Calibration Systems

Add after "ANSI/NCSL Z540.3"

or IEC/ISO 17025

## 7 Test Report

### 7.1 General

Add new section

#### 7.1.1

When data is transferred, the original certification or test report shall accompany the fastener test report.

Add new section

#### 7.1.2

Product that has been retested or reheat treated as per ASTM A962, 16.1 or 16.2 (exclusive of retempering) shall be identified as such on the certificates.

### 7.2 BSL-1

Add to section

The BSL-1 report shall include references to this specification and the MPS.

### 7.3 BSL-2 and BSL-3

Add new list item

— reference to this specification;

Add new list item

— reference to MPS.

## 8 Marking

### 8.2 Marking Required by This Specification

In list item a), replace "20E1" with

20E1S

In list item b), replace "20E2" with

20E2S

In list item c), replace "20E3" with

20E3S

Add new section

#### 8.2.1

The manufacturing lot number shall be unique.

Add new section

#### 8.2.2

A raw material "cast" or "heat" number (or any part thereof) shall not be used as the unique manufacturing lot number.

Add new section

#### 8.2.3

Markings shall not be applied to the unthreaded shank or body section of bolts, screws, SHCSs, SHSSs and studs.

Add new section

#### 8.2.4

Where fasteners are specified to be coated or plated, the required markings shall be applied prior to coating or plating.

Add new section

#### 8.2.5

Markings on coated or plated fasteners shall be legible after coating or plating.

## Bibliography

### Add to section

- [3] API 17, *Series of equipment standards, specifications and recommended practices*

**Registered Office**

City Tower  
Level 14  
40 Basinghall Street  
London EC2V 5DE  
United Kingdom  
T +44 (0)20 3763 9700  
reception@iogp.org

**Brussels Office**

Avenue de Tervuren 188A  
B-1150 Brussels  
Belgium  
T +32 (0)2 790 7762  
reception-europe@iogp.org

**Houston Office**

15377 Memorial Drive  
Suite 250  
Houston, TX 77079  
USA  
T +1 (713) 261 0411  
reception-americas@iogp.org

| [www.iogp.org](http://www.iogp.org)

