Oilfield Hammer Unions

API STANDARD 7HU2
FIRST EDITION, XXXXXXXXXX 201X
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Contents

To be created prior to publication.
1 Scope

1.1 Purpose

This document specifies minimum requirements for the dimensional and functional interchangeability, design, materials, inspection, marking, storing, and shipment of hammer union parts and assemblies for use in the petroleum and natural gas industries.

This document does not address how hammer unions are applied to other parts; such as integrally, welded, or threaded. Requirements for repair and remanufacture of hammer union parts are not included in this document.

Hammer unions manufactured under the requirements of this document are only to be considered interchangeable with hammer unions also manufactured to the requirements of this standard. Hammer unions manufactured under the requirements of this document is not assumed to be interchangeable with other hammer unions.

1.2 Applicability

This document is applicable only to the following figures, nominal sizes, temperatures, and service conditions of hammer unions:

- Figure Numbers: 602, 1002, and 1502
  - Nominal Size: 1”, 1.5”, 2”, 3”, and 4”
- Figure Numbers: 2002 and 2202
  - Nominal Size: 2” and 3”
- Temperature Range: -75°F to 250°F (-60°C to 121°C)
- Service: Standard and Sour Service

This document is only applicable to surface installations that are not intended to be insulated, buried or otherwise denied direct exposure to atmosphere.

1.3 Service Conditions

This document defines service conditions, in terms of pressure, temperature and material class for the well-bore constituents, and operating conditions.
1.4 Hammer Union Assembly Nomenclature

Figures 1 & 2 show hammer union parts covered in the scope of this standard.

Key

<table>
<thead>
<tr>
<th>Pressure-containing</th>
<th>Pressure-retaining</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 male end connector</td>
<td>3 nut retainer segments</td>
<td>2 segment retainer ring</td>
</tr>
<tr>
<td>5 resilient lip seal</td>
<td>4 union nut</td>
<td></td>
</tr>
<tr>
<td>6 female end connector</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A segment retainer ring in accordance with 5.2 shall be provided.

Figure 1 — Typical removable nut hammer union assembly
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**Figure 2 — Typical non-removable nut hammer union assembly**

**Key**

<table>
<thead>
<tr>
<th>Pressure-containing</th>
<th>Pressure-retaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  male end connector</td>
<td>2  union nut</td>
</tr>
<tr>
<td>3  resilient lip seal</td>
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<tr>
<td>4  female end connector</td>
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2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. However, not all documents listed may apply to your specific needs. The body of the standard should be referred to for how these documents are specifically applied.

API Specification 6A, Specification for Wellhead and Tree Equipment

ANSI/NACE MR0175-2015¹, Petroleum and natural gas industries—Materials for use in H₂S-containing environments in oil and gas production—Parts 1, 2, and 3

ASME B1.5, ACME Screw Threads

ASME B1.8, Stub ACME Screw Threads

ASNT SNT-TC-1A², Personnel Qualification and Certification in Nondestructive Testing

ASTM A370³, Standard Test Methods and Definitions for Mechanical Testing of Steel Products

ASTM D1418, Standard Practice for Rubber and Rubber Latices-Nomenclature

ASTM E10, Standard Test Method for Brinell Hardness of Metallic Materials

ASTM E110, Standard Test Method for Rockwell and Brinell Hardness of Metallic Materials by Portable Hardness Testers

ASTM E140, Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

EN 473⁴, Non-destructive testing — Qualification and certification of NDT personnel — General principles

ISO 6506 (all parts)⁵, Metallic materials – Brinell hardness test

ISO 6508 (all parts), Metallic materials – Rockwell hardness test

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

ISO 18265, Metallic materials – Conversion of hardness values

ISO 2859-1:1999, Sampling procedures for inspection by attributes-Part¹: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

¹NACE International (formerly the National Association of Corrosion Engineers), 1440 South Creek Drive, Houston, Texas 77084-4906, www.nace.org.

²American Society for Nondestructive Testing, 1711 Arlingate Lane, P.O. Box 28518, Columbus, Ohio 43228, www.asnt.org.


⁴European Committee for Standardization, Rue de Stassart 36, Brussels B-1050, Belgium.

3 Terms and Definitions

3.1 Definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1 acceptance criteria
Defined limits placed on characteristics of materials, products, processes or services.

3.1.2 accessible surface
Surface for purposes of non-destructive examination that can be viewed by direct line of sight.

3.1.3 chemical analysis
Determination of the chemical composition of material.

3.1.4 date of manufacture
Date of manufacturer's final acceptance of finished part.

3.1.5 figure number
Number historically used to designate pressure rating and seal type for oilfield hammer unions where the last two digits represent seal type ('02' is a square seal) and the first one or two digits represent pressure rating in thousands of psi.

NOTE The figure number cannot be relied upon for positive identification of pressure rating; it only designates dimensional compatibility for a given size. It is the user's responsibility to assure that unions are only assembled such that service and pressure ratings are compatible.

3.1.6 forge, verb
Deform metal plastically into desired shapes with compressive force.

NOTE Forging is usually a hot process. The use of dies is optional.

3.1.7 function
Operation of a product during service.

3.1.8 heat
Material originating from a final melt, or for remelted alloys, the raw material originating from a single remelted ingot.

3.1.9 heat treatment
Heat treating specified, timed sequence of controlled heating and cooling of materials for the purpose of changing physical or mechanical properties.
3.1.10 hot-work
Deform metal plastically at a temperature above the recrystallization temperature.

3.1.11 part
Individual piece used in a hammer union assembly

EXAMPLE Union nut, segment retainer set, male and female end, etc. are parts of a hammer union.

NOTE A part may also be a piece not in finished form.

3.1.12 pressure-containing part
Part exposed to retained fluids whose failure to function as intended results in a release of retained fluid to the environment.

3.1.13 pressure-retaining part
Part not exposed to retained fluids whose failure to function as intended results in a release of retained fluid to the environment.

3.1.14 rated working pressure
Maximum internal pressure that the pressure-containing part is designed to contain when in operation.

3.1.15 record, noun
Retrievable information.

3.1.16 relevant indication
Surface-rupture NDE indication with major dimensions greater than 1.6 mm (1/16 in).

NOTE Inherent indications not associated with a surface rupture are considered non-relevant.

3.1.17 retained fluid
Actual fluid contained by pressure-containing parts.

3.1.18 room temperature
Any temperature between 40°F and 120°F (4°C and 50°C).

3.1.19 segment retainer ring
Removable part that engages the groove of the nut retainer segments in the assembled condition shown in Figure 1, to keep the union nut and retainer segments together under normal make-up and break-down activities.
3.1.20 **sour service**
Exposure to oilfield environments that contain sufficient H2S to cause cracking of materials by the mechanisms addressed by ANSI/NACE MR0175.

3.1.21 **standard service**
Exposure to oilfield environments that do not contain sufficient H2S to cause cracking of materials by the mechanisms addressed by ANSI/NACE MR0175.

3.1.22 **visual examination**
Examination of parts for visible defects in material and workmanship.

3.1.23 **wetted surface**
Any surface that has contact with pressurized fluid, either by design or because of internal seal leakage.

3.1.24 **wrought**
Product, structure, or material that contains no cast dendritic elements.

3.1.25 **yield strength**
Stress level at which material plastically deforms and does not return to its original dimensions when the load is released based on the 0.2 % offset method in accordance with ISO 6892-1 or ASTM A370.

3.2 **Abbreviated Terms**
For the purposes of this document, the following abbreviated terms apply.

- AQL: acceptable quality level
- ER: equivalent round
- HBW: Brinell hardness number
- MT: magnetic particle testing
- NDE: non-destructive examination
- PT: liquid penetrant examination
- QTC: qualification test coupon

4 **Design and Performance — General Requirements**

4.1 **Service Conditions**

4.1.1 **Material Service Ratings**
For sour service, the material shall meet the requirements of ANSI/NACE MR0175 for chemistry, processing, and properties (e.g. hardness) for all pressure-containing (wetted surface) parts. Choosing materials for specific conditions is ultimately the responsibility of the purchaser.
NOTE It is necessary that users of this document recognize that resistance to cracking caused by H2S is influenced by a number of other factors, some of the limits for which are given in ANSI/NACE MR0175. These include, but are not limited to

— pH;
— temperature;
— chloride concentration;
— elemental sulphur.

NOTE Pressure-retaining parts are not required to meet the requirements of ANSI/NACE MR0175, regardless of standard or sour service.

### 4.1.2 Pressure Ratings

The rated working pressure for union connectors shall not exceed the pressure ratings in Table 1.

<table>
<thead>
<tr>
<th>Figure number</th>
<th>Pressure Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard (MPa)</td>
</tr>
<tr>
<td>602</td>
<td>6,000 (41.4)</td>
</tr>
<tr>
<td>1002</td>
<td>10,000 (69.0)</td>
</tr>
<tr>
<td>1502</td>
<td>15,000 (103.5)</td>
</tr>
<tr>
<td>2002</td>
<td>20,000 (137.9)</td>
</tr>
<tr>
<td>2202</td>
<td>—</td>
</tr>
</tbody>
</table>

When connectors of different pressure ratings are used in conjunction on equipment the lowest rated connector will determine the pressure rating of the equipment.

NOTE The designs of hammer unions in this Standard have been verified based on the methods in API 6A 20th Edition and the ASME Boiler & Pressure Vessel Code, Section VIII, Division 2, Part 5 (2013 edition).

### 4.1.3 Temperature Ratings

Parts shall be designated to operate in one or more of the specified temperature ratings with minimum and maximum temperatures as shown in Table 2.

Minimum temperature is the lowest temperature to which the part may be subjected. Maximum temperature is the highest temperature to which the part may be subjected.
5 Materials

5.1 General

This section describes the material requirements for segment retainer rings, resilient lip seals, pressure-containing parts, and pressure-retaining parts.

5.2 Segment Retainer Ring

Segment retainer rings shall be made of wrought spring steel.

5.3 Resilient Lip Seal

The resilient lip seal shall be made of non-metallic material, though a metallic ring may be included in the resilient lip seal. The resilient lip seal shall require a written material specification. The manufacturer’s written specification for resilient lip seal non-metallic materials shall define the following:

— generic base polymer(s)

— Note: ASTM D1418 provides standardized nomenclature for rubber polymers;

— physical property requirements;

— documentation requirements per Section 7.4.3;

— storage and age-control requirements.

The resilient lip seal shall be manufactured from materials which meet the requirements in the written material specification.

5.4 Metallic Pressure-Containing and Pressure-Retaining Parts

The requirements in 5.4 apply to metallic pressure-containing and pressure-retaining part materials.

Weld repair of material or product shall not be performed at any point in the manufacturing process.
5.4.1 Written Specification Requirements

All metallic pressure-containing and pressure-retaining parts shall require a written material specification. The requirements in 5.4 shall be defined in the written material specification.

5.4.2 All pressure-containing and pressure-retaining parts shall be manufactured from materials which meet the requirements in the written material specification. Hot-working Practices

All materials shall be formed using a hot-working practice(s) resulting in a reduction ratio of at least 3:1. In addition, the manufacturer shall document the reduction ratio.

Material in the as-cast condition does not meet the reduction ratio requirement and shall not be used.

5.4.3 Melting Practices

The manufacturer shall specify the melting practices.

5.4.4 Heat-treating

The manufacturer shall specify the heat treatment method for the material (such as quench and temper; normalize, quench and temper).

The manufacturer is not required to specify the times and temperatures for heat treatment.

All heat treating of material, parts, and qualification test coupons (QTC) shall be performed with “production type” equipment qualified in accordance with a recognized industry specification, such as API 6A 20th Edition Annex M, SAE AMS 2750, SAE AMHS6875, or ASTM A991.

“Production type” heat-treating equipment shall be considered equipment that is routinely used to process production parts having an equivalent round (ER) equal to or greater than the ER of the subject QTC.

5.4.5 Chemical Composition

The manufacturer shall specify the chemical composition and composition tolerances of the material.

Material composition shall be determined on a heat basis (or a remelt ingot basis for remelt grade materials) in accordance with a nationally or internationally recognized standard.

5.4.6 Material Qualification Testing

5.4.6.1 General

Minimum tensile and impact properties are required in order for material to be qualified for service. The required tensile and impact tests shall be performed on specimens removed from a QTC.

The QTC shall meet all API 6A QTC requirements.

All sour service pressure-containing part materials shall meet the requirements for 75K material, as shown in Table 3, and shall meet the material processing and material property requirements of ANSI/NACE MR0175.

All standard service pressure-containing part materials shall meet the requirements for 100K material, as shown in Table 3.
All pressure-retaining part materials shall meet the requirements for 100K material, as shown in Table 3.

### Table 3 — Material property requirements for metallic pressure-containing and pressure-retaining parts

<table>
<thead>
<tr>
<th>Material designation</th>
<th>0.2 % Yield strength min. psi (MPa)</th>
<th>Tensile strength min. psi (MPa)</th>
<th>Elongation in 2 in (50 mm) min. %</th>
<th>Reduction in area min. %</th>
<th>Minimum Brinell hardness</th>
<th>Maximum Brinell hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>75K</td>
<td>75,000 (517)</td>
<td>95,000 (655)</td>
<td>17</td>
<td>35</td>
<td>HBW 197</td>
<td>HBW 237</td>
</tr>
<tr>
<td>100K</td>
<td>100,000 (689)</td>
<td>120,000 (827)</td>
<td>15</td>
<td>35</td>
<td>HBW 248</td>
<td>HBW 341</td>
</tr>
</tbody>
</table>

#### 5.4.6.2 Tensile Testing

Tensile testing shall be conducted as follows:

a) Test method

Tensile testing shall be performed at room temperature in accordance with the procedures specified in ASTM A370.

A minimum of one tensile test shall be performed. The results of the tensile test(s) shall satisfy the requirements of Table 3 for the applicable material designation.

b) Retesting

If the results of the tensile test(s) do not satisfy the applicable requirements, two additional tests on two additional test specimens removed from the same QTC with no additional heat treatment may be performed in an effort to qualify the material. The results of each of these tests shall satisfy the applicable requirements.

#### 5.4.6.3 Impact Testing

Impact testing shall be conducted as follows:

a) Test method

Impact tests shall be performed in accordance with the procedures specified in ASTM A370 using the Charpy V-notch technique.

In order to qualify material for a temperature rating, the impact tests shall be performed at or below the lowest temperature of that classification range.

Three impact specimens shall be tested to qualify a heat of material. Impact properties as determined from these tests shall satisfy the applicable requirements of Table 4. In no case shall an individual impact value fall below two-thirds of that required as a minimum average. Similarly, no more than one of the three test results shall be below the required minimum average.

If sub-size specimens are used, the Charpy V-notch impact requirements shall be equal to that of the 0.394 in (10 mm) × 0.394 in (10 mm) specimens multiplied by the adjustment factor listed in Table 5.
b) Retesting

If a test fails, then a retest of three additional specimens removed from the same QTC with no additional heat treatment may be performed, each of which shall exhibit an impact value equal to or exceeding the required minimum average value.

c) Specimen orientation

The values listed in Table 4 are the minimum acceptable values for wrought or forged products tested in the transverse and/or longitudinal direction.

Table 4 — Charpy V-notch impact requirements 0.394 in (10 mm) × 0.394 in (10 mm)

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Minimum average impact value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transverse direction</td>
</tr>
<tr>
<td>Classification</td>
<td>Test °F (°C)</td>
</tr>
<tr>
<td>K</td>
<td>–75 (–60)</td>
</tr>
<tr>
<td>L, N</td>
<td>–50 (–46)</td>
</tr>
<tr>
<td>P</td>
<td>–20 (–29)</td>
</tr>
<tr>
<td>S, T, U,</td>
<td>0 (–18)</td>
</tr>
</tbody>
</table>

Table 5 — Adjustment factors for sub-size impact specimens

<table>
<thead>
<tr>
<th>Specimen dimension</th>
<th>Adjustment factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.394 in (10 mm) × 0.295 in (7.5 mm)</td>
<td>0.833</td>
</tr>
<tr>
<td>0.394 in (10 mm) × 0.197 in (5.0 mm)</td>
<td>0.667</td>
</tr>
<tr>
<td>0.394 in (10 mm) × 0.098 in (2.5 mm)</td>
<td>0.333</td>
</tr>
</tbody>
</table>

5.4.6.4 Hardness Testing

A minimum of one Rockwell or Brinell hardness test shall be performed on the QTC.

Hardness testing shall be performed at room temperature in accordance with the procedures specified in ISO 6506, ASTM E10, ISO 6508, ASTM E18, or ASTM E110.

The results of the hardness test(s) shall satisfy the requirements of Table 3 for the applicable material designation.

6 Dimensional Requirements

Dimensions shall be in accordance with Figures 3-9 and Tables 6-12 for the relevant hammer union parts. All dimensions are reported in US Customary (USC) inches.

Where a fraction is listed for thread size the dimension is to be interpreted to the exact significant digits for the fraction with no rounding applied. For example, 6 11/16" is exactly 6.6875 inches.
All machined surfaces shall have a maximum roughness of 125 micro-inch (μin) average roughness (Ra) with the exception that flow bores shall have a maximum roughness of 250 micro-inch (μin) average roughness (Ra) unless otherwise noted in Figures 3 through 7.
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FOOTNOTES
a   Break sharp corners
b   32μin Ra MAX
c   Trim partial leading thread to 0.09 min crest width
d   Trim partial trailing thread to 0.03 min crest width
e   For bores smaller than B
f   All machined features concentric within 0.005 total indicator runout (excludes bore beyond leading edge)

Figure 3 — Female End Connector
Table 6 — Dimensional Requirements for Female End Connector

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>SIZE</th>
<th>BORE START OF TAPER</th>
<th>SEAL BORE</th>
<th>SEAL GLAND BORE</th>
<th>SEAL GLAND DEPTH</th>
<th>THREAD LENGTH</th>
<th>THREAD TERMINATE</th>
<th>THREAD</th>
<th>Size-Pitch Type-Class</th>
<th>Standard (ASME)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>max</td>
<td>min</td>
<td>max</td>
<td>min</td>
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<td>min</td>
<td>min</td>
<td>max</td>
<td>min</td>
<td></td>
</tr>
<tr>
<td>602 &amp; 1002</td>
<td>1&quot;</td>
<td>1.125</td>
<td>2.035</td>
<td>2.025</td>
<td>1.625</td>
<td>1.615</td>
<td>0.490</td>
<td>0.480</td>
<td>0.710</td>
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<tr>
<td></td>
<td>1.5&quot;</td>
<td>1.560</td>
<td>2.755</td>
<td>2.745</td>
<td>2.230</td>
<td>2.220</td>
<td>0.550</td>
<td>0.540</td>
<td>0.990</td>
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<td>3.385</td>
<td>3.375</td>
<td>2.698</td>
<td>2.688</td>
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<td>4.995</td>
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<td>0.745</td>
<td>1.200</td>
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<td>2.698</td>
<td>2.688</td>
<td>0.817</td>
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1 Indicates critical dimension.
2 Truncated major diameter 3.765-3.780 per API 7HU1.
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Figure 4 — Removable Male End Connector Style 1

FOOTNOTES
a Break sharp corners
b 32μin Ra MAX
c For bores smaller than B
d Permissible marking location
e All machined features concentric within 0.005 total indicator runout (excludes bore beyond leading edge)
f N maintained minimum of T + nut segment retainer L from end connection face
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Table 7 — Dimensional Requirements for Removable Male End Connector Style 1

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<th>FIGURE SIZE</th>
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<th>FIGURE 1502</th>
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1 Indicates critical dimension.
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Figure 5 — Removable Male End Connector Style 2

FOOTNOTES
a Break sharp corners
b 32μin Ra MAX
c For bores smaller than B
d Permissible marking location
e All machined features concentric within 0.005 total indicator runout (excludes bore beyond leading edge)
f N maintained minimum of T+P + nut segment retainer L from end connection face
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### Table 8 — Dimensional Requirements for Non-Removable Male End Connector Style 2

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<tr>
<th>FIGURE SIZE</th>
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<th>DIAMETER OF FLANGE</th>
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<th>NUT RELIEF</th>
<th>NOSE DIAMETER</th>
<th>NOSE PROTRUSION</th>
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1 Indicates critical dimension
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Figure 6 — Non-Removable Male End Connector Style 1

FOOTNOTES

a Break sharp corners
b 32μin Ra MAX
c For bores smaller than B
d Permissible marking location
e All machined features concentric within 0.005 total indicator runout (excludes bore beyond leading edge)
Table 9 — Dimensional Requirements for Non-Removable Male End Connector Style 1

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<tr>
<th>FIGURE SIZE</th>
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<th>DIAMETER OF NECK</th>
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1 INDICATES CRITICAL DIMENSION
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FOOTNOTES
a  Break sharp corners
b  32μin Ra MAX
c  For bores smaller than B
d  Permissible marking location
e  All machined features concentric within 0.005 total indicator runout (excludes bore beyond leading edge)

Figure 7 — Non-Removable Male End Connector Style 2

Table 10 — Dimensional Requirements for Non-Removable Male End Connector Style 2

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<th>BORE DIAMETER OF FLANGE</th>
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<th>DIAMETER OF NECK</th>
<th>SPHERE CENTER</th>
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</table>

1 Indicates critical dimension.
Figure 8 — Union Nut

FOOTNOTES
a  Break sharp corners
b  Trim partial leading thread to 0.09 min crest width
c  Permissible marking location
d  All machined features concentric within 0.005 total indicator runout
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Table 11 — Dimensional Requirements for Union Nut

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<th>FIGURE</th>
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<th>NUT DIAMETER</th>
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<th>THREAD SIZE-Pitch Type-Class</th>
<th>Standard (ASME)</th>
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<td>3.445</td>
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<td>6.728</td>
<td>6 11/16&quot;-5 ACME-2G</td>
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</table>

1 Indicates critical dimension.
a  Break sharp corners
b  Separate into 3 equal pieces after machining
c  Permissible marking locations

All machined features concentric within 0.005 total indicator runout

Figure 9 — Nut Retainer Segments
Table 12 — Dimensional Requirements for Nut Retainer Segments

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>SIZE</th>
<th>DIAMETER OF FLANGE</th>
<th>THICKNESS OF FLANGE</th>
<th>NUT CLEARANCE</th>
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<td>0.740</td>
<td>0.710</td>
<td>1.425</td>
</tr>
<tr>
<td></td>
<td>4&quot;</td>
<td>6.433</td>
<td>6.423</td>
<td>0.635</td>
<td>0.625</td>
<td>0.780</td>
<td>0.750</td>
<td>1.660</td>
</tr>
<tr>
<td>2002 &amp; 2202</td>
<td>2&quot;</td>
<td>3.345</td>
<td>3.335</td>
<td>0.510</td>
<td>0.500</td>
<td>0.630</td>
<td>0.600</td>
<td>1.385</td>
</tr>
<tr>
<td></td>
<td>3&quot;</td>
<td>6.357</td>
<td>6.347</td>
<td>0.635</td>
<td>0.625</td>
<td>0.770</td>
<td>0.740</td>
<td>1.650</td>
</tr>
</tbody>
</table>

1 Indicates critical dimension.

NOTE: When all nut retainer segments are manufactured in accordance with this standard it is recommended, but not required, that they be the originally matched set of 3 pieces.
7 Quality control

7.1 General

This section specifies the quality control requirements and quality control record requirements for parts manufactured to meet this International Standard.

7.2 Measuring and Testing Equipment

Equipment used to inspect, test or examine material or other parts shall be identified, controlled, calibrated and adjusted at specified intervals in accordance with documented instructions, and consistent with nationally or internationally recognized standards specified by the manufacturer.

7.3 Quality-control Personnel Qualifications

7.3.1 Non-destructive Examination Personnel

Personnel performing NDE shall be qualified in accordance with the manufacturer's documented training program that is based on the requirements specified in ISO 9712, EN 473 or ASNT SNT-TC-1A.

7.3.2 Other Personnel

All other personnel performing measurements, inspections or tests for acceptance shall be qualified in accordance with the manufacturer's documented procedures and requirements.

7.4 Quality Control Requirements

7.4.1 General

7.4.1.1 Quality Control Instructions

All quality control work shall be controlled by the manufacturer's documented instructions, which include appropriate methodology and quantitative or qualitative acceptance criteria.

NDE instructions shall be detailed regarding the requirements of this International Standard and those of all applicable nationally or internationally recognized standards specified by the manufacturer. All NDE instructions shall be approved by a level III examiner.

7.4.1.2 Acceptance Status

The acceptance status of all parts and materials shall be indicated either on the parts or materials; or in records traceable to the parts or materials.

7.4.2 Metallic Parts

7.4.2.1 Hardness Testing

The following shall apply:

a) scope:
For pressure-containing sour service metallic parts, each part shall be hardness tested individually to confirm that the ANSI/NACE MR0175 hardness values have been satisfied.

For pressure-containing standard service metallic parts, parts shall be hardness tested with sampling in accordance with ISO 2859-1:1999, level II, 1.5 AQL.

b) test method:

Hardness testing shall be performed with Brinell or Rockwell methods in accordance with procedures specified in ASTM E110, ISO 6506, parts 1 through 4, ASTM E10 (Brinell), ISO 6508, parts 1 through 3, or ASTM E18 (Rockwell).

ISO 18265 or ASTM E140 shall be used for the conversion of hardness readings for materials within the scope of their application.

Tests shall be performed at a location determined by the manufacturer's specifications and following the last heat treatment cycle (including all stress-relieving heat treatment cycles) and all exterior machining at the test location.

c) acceptance criteria:

Parts shall meet the hardness requirements given in Table 3.

Parts below the minimum hardness levels are acceptable if the measured value satisfies the following requirement that the average tensile strength, as determined from the tensile tests results, shall be used with the QTC hardness measurements in order to determine the minimum acceptable hardness value for production parts fabricated from the same heat. The minimum acceptable Brinell hardness value for any part shall be determined by Equation (1):

\[
H_{BWc, \text{min.}} = \frac{R_{m, \text{min.}}}{\overline{R}_{m, \text{QTC}}} \left( \overline{H}_{BW, \text{QTC}} \right)
\]

where

- \(H_{BWc, \text{min.}}\) is the minimum acceptable Brinell hardness according to the HBW method for the part after the final heat treatment cycle (including stress-relieving cycles);
- \(R_{m, \text{min.}}\) is the minimum acceptable ultimate tensile strength for the applicable material designation;
- \(\overline{R}_{m, \text{QTC}}\) is the average ultimate tensile strength determined from the QTC tensile tests;
- \(\overline{H}_{BW, \text{QTC}}\) is the average of the Brinell hardness values according to the HBW method observed among all tests performed on the QTC.

7.4.2.2 Dimensional Inspection

Dimensional inspection shall be performed on parts.

The following apply:
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7.4.2.3 Traceability

Pressure-containing parts and pressure-retaining parts shall have traceability to the heat and heat-treatment performed on the parts.

Identification shall be maintained on materials and parts to facilitate traceability, as required by documented manufacturer requirements. See Section 8.

Manufacturer-documented traceability requirements shall include provisions for maintenance or replacement of identification marks and identification control records.

7.4.2.4 Surface NDE

When customer specifies NDE on parts covered under this standard, all accessible surfaces of each finished pressure-containing part within the scope of this standard shall be examined by liquid-penetrant or magnetic-particle methods after final heat treatment and final machining operations.

The following apply:

a) test method:

All materials shall be examined in accordance with procedures specified in ASTM E709 (MT) or ASTM E165 (PT). Prods are not permitted on wetted surfaces or sealing surfaces.

If any indications are believed to be non-relevant on the basis that they are not associated with a surface rupture (i.e. magnetic permeability variations, non-metallic stringers), they shall be examined by liquid-penetrant surface NDE methods to confirm their non-relevancy.

b) acceptance criteria:

The following acceptance criteria apply:

— no relevant indication with a major dimension equal to or greater than $\frac{3}{16}$ in (5 mm);

— no more than ten relevant indications in any continuous $6$ in$^2$ (40 cm$^2$) area;

— four or more relevant indications in a line separated by less than $\frac{1}{16}$ in (1.6 mm) (edge to edge) are unacceptable;

— no relevant indications in pressure contact sealing surfaces.
7.5 Quality Control Records Requirements

7.5.1 General

7.5.1.1 Purpose

The quality control records required by this International Standard are necessary to substantiate that all materials and products made to meet this International Standard do conform to the specified requirements.

7.5.1.2 Sour Service Part Records Requirements

The manufacturer shall maintain records to substantiate conformance of sour service pressure-containing metallic part material to ANSI/NACE MR0175.

7.5.1.3 Records Control

The following apply.

a) Quality control records required by this International Standard shall be legible, identifiable, retrievable and protected from damage, deterioration or loss.

b) Quality control records required by this International Standard shall be retained by the manufacturer for a minimum of ten years following the date of manufacture as marked on the parts associated with the records.

c) All quality control records required by this International Standard shall identify inspector and date of inspection.

7.5.2 Quality Control Records

7.5.2.1 Metallic Part records

The following records shall be retained by the manufacturer and reference the applicable heat or batch identification:

a) material test records:
   — tensile test,
   — impact test,
   — hardness test,
   — chemical analysis;

b) NDE personnel qualification records (if applicable);

c) Heat treatment temperature, time at temperature, and quench practice;

d) Surface NDE records referencing unique part identification numbers (if applicable);

e) Part hardness test record:
f) Records that dimensional inspection was performed (those activities required by 7.4.2.2)

7.5.2.2 Non-metallic Sealing Material Records

The seal supplier shall certify that materials and end products meet the specifications as required by Section 5.2.2.

Certification shall include:

- manufacturer's part number,
- specification number,
- compound number,
- batch number,
- cure/mold date,
- shelf-life expiration date.

8 Part Marking

8.1 Marking Requirements

8.1.1 General

Parts shall be marked as specified in Table 14.

8.1.2 Marking Method

Permanent marking methods shall be used to properly identify parts. Permissible methods include forging markings into bodies, and utilizing low-stress marking methods (i.e. dot, vibration, or rounded V stamping). Sharp V stamping is not permitted.

8.1.3 Assembly Name Plate

When the male or female union end is integral to an assembly, markings may be placed on a name plate. Markings on name plate shall meet the requirements of Table 14.

8.1.4 Marking Location Limitations

Male and female union parts shall be marked outside the dimensional boundaries defined in figures 3-7. The union nut and nut retainer segments shall be marked at the location(s) indicated in figures 8-9.
Table 14 — Marking requirements and locations

<table>
<thead>
<tr>
<th>Marking</th>
<th>Male &amp; Female End Connector Integral Part</th>
<th>Male &amp; Female End Connector Loose Part</th>
<th>Union Nut</th>
<th>Each Nut Retainer Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Size and Figure Number</td>
<td>Nameplate and/or Body / OD of Connector</td>
<td>OD of Connector</td>
<td>See Fig 8</td>
<td>See Fig 9 / Tag / Packaging</td>
</tr>
<tr>
<td>Rated Working Pressure</td>
<td>Nameplate and/or Body / OD of Connector</td>
<td>Packaging</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Temperature class</td>
<td>Nameplate and/or Body / OD of Connector</td>
<td>Packaging</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Sour service (if applicable)</td>
<td>Nameplate and/or Body / OD of Connector</td>
<td>Packaging</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Date of manufacture</td>
<td>Nameplate and/or Body / OD of Connector</td>
<td>Packaging</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>API 7HU2</td>
<td>Nameplate and/or Body / OD of Connector</td>
<td>OD of Connector</td>
<td>See Fig 8</td>
<td>See Fig 9 / Tag / Packaging</td>
</tr>
<tr>
<td>Manufacturer's name or mark</td>
<td>Nameplate and/or Body / OD of Connector</td>
<td>OD of Connector</td>
<td>See Fig 8</td>
<td>See Fig 9 / Tag / Packaging</td>
</tr>
<tr>
<td>Heat Number / Batch Number</td>
<td>Nameplate and/or Body / OD of Connector</td>
<td>OD of Connector</td>
<td>See Fig 8</td>
<td>See Fig 9 / Tag / Packaging</td>
</tr>
</tbody>
</table>

9 Storing and Shipping

9.1 Rust Prevention

Prior to shipment, parts shall have exposed metallic surfaces protected with a rust preventative.

9.2 Sealing-surface Protection

Exposed sealing surfaces shall be protected from mechanical damage during shipping.

9.3 Threads

Threads shall be protected from mechanical damage during shipping.
9.4 Age Control of Non-metallic Materials

The following storage requirements and conditions shall apply:

— indoor storage;
— maximum temperature not to exceed 49 °C (120 °F);
— protected from direct natural light;
— stored unstressed;
— stored away from contact with liquids;
— protected from ozone and radiographic damage.
Bibliography

ASME Boiler and Pressure Vessel Code (BPVC), Section VIII, Division 2:2013: Alternative Rules—Rules for Construction of Pressure Vessels


SAE AMS 2750, Pyrometry

SAE AMSH 6875, Heat Treatment of Steel Raw Materials