实创翻译

抽油杆规范

Specification for Sucker Rods, Polished Rods and Liners, Couplings, Sinker Bars, Polished Rod Clamps, Stuffing Boxes, and Pumping Tees

光杆、光杆衬套、接箍、加重杆、光杆卡子、盘根盒

API SPECIFICATION 11B
TWENTY-SEVENTH EDITION, MAY 2010

EFFECTIVE DATE: NOVEMBER 1, 2010

energy API
AMERICAN PETROLEUM INSTITUTE

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Upstream Segment

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Introduction

This specification has been developed by users, purchasers, suppliers and manufacturers of sucker rods, polished rods and liners, coupings, sinker bars, polished rod clamps, stuffing boxes, and pumping tees intended for use in the petroleum and natural gas industry worldwide. This specification is intended to give requirements and information to all parties in the design, manufacture and selection of sucker rods, polished rods and liners, coupings, sinker bars, polished rod clamps, stuffing boxes, and pumping tees. Furthermore, this specification addresses the minimum requirements with which the manufacturer is to claim conformity with this specification.

Included within this specification are normative annexes specifying equipment requirements and an informative annex providing a system illustration.

Attention is brought to users of this specification that requirements above those outlined in this specification can be required for individual applications. This specification is not intended to inhibit a manufacturer from offering, or the user or purchaser from accepting alternative equipment or other engineering solutions. This can be particularly applicable where there is innovative or developing technology. Where an alternative is offered, it is the responsibility of the manufacturer to identify any variations from this specification.

In this specification, quantities expressed in United States Customary (USC) units are also, where practical, expressed in International System (SI) units, either in parentheses in the text or on separate data sheets. USC units shall be the controlling units, SI units are included as a convenience for the user of this specification.

Specification for Sucker Rods, Polished Rods and Liners, Couplings, Sinker Bars, Polished Rod Clamps, Stuffing Boxes, and Pumping Tees

1 Scope

This specification provides the requirements and guidelines for the design of steel sucker rods and pony rods, polished rods, polished rod liners, couplings and sub-couplings, fiber reinforced plastic (FRP) sucker rods, sinker bars, polished rod clamps, stuffing boxes, and pumping tees as defined herein for use in the sucker rod lift method for the petroleum and natural gas industry. Annex A through Annex H provide the requirements for specific products. Annex I includes the requirements for thread gauges, Annex J illustrates the components of a sucker rod lift system, and Annex K shows examples of sucker rod discontinuities.

This specification does not cover sucker rod guides, sucker rod rotators, shear tools, on-off tools, stabilizer bars, sealing elements used in stuffing boxes, or interface connections for stuffing boxes and pumping tees. Also, installation, operation and maintenance of these products are not included in this specification.

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.

API Specification Q1/ISO 29001:2007, *Specification for Quality Programs for the Petroleum and Natural Gas Industry*

API Specification 5B, *Threading, Gauging and Thread Inspection of Casing, Tubing and Line Pipe Threads*

ANSI/ASME B1.1 [1], *Unified Inch Screw Threads, (UN and UNR Thread Form)*

ANSI/ASQ Z1.4 [2]*Sampling Procedures and Tables for Inspection by Attributes*

ASTM A370 [3], *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A395, *Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures*

ASTM A536, *Standard Specification for Ductile Iron Castings*

ASTM A751, *Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products*

ASTM D2583, *Test Method for Indention Hardness of Rigid Plastics by Means of a Barcol Impressor*

ASTM D2584, *Test Method for Ignition Loss of Cured Reinforced Resins*

ASTM D4475, *Test Method for Apparent Horizontal Shear Strength of Pultruded Reinforced Plastic Rods by the Short-Beam Method*

ASTM E18, *Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials*

ASTM E384, *Standard Test Method for Microindentation Hardness of Materials*

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1 ASME International, 3 Park Avenue, New York, New York 10016-5990, www.asme.org.
2 American Society for Quality, P.O. Box 300, Milwaukee, Wisconsin 53201-3005, www.asq.org.
3 ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org.

ISO 2859-1 [4], *Sampling procedures for inspection by attributes—Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 6508-1, *Metallic materials—Rockwell hardness test—Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

ISO 6892, *Metallic materials—Tensile testing at ambient temperature*

ISO 15156-1, *Petroleum and natural gas industries—Materials for use in H_2S-containing environments in oil and gas production—Part 1: General principles for selection of cracking-resistant materials*

ISO 15156-2, *Petroleum and natural gas industries—Materials for use in H_2S-containing environments in oil and gas production—Part 2: Cracking-resistant carbon and low alloy steels, and the use of cast irons*

ISO 15156-3, *Petroleum and natural gas industries—Materials for use in H_2S-containing environments in oil and gas production—Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys*

NACE No. 1/SSPC-SP 5 [5], *White Metal Blast Cleaning*

ANSI/NCSL Z540-1 [6], *Calibration Laboratories and Measuring and Test Equipment—General Requirements*

3 Terms and Definitions

For the purpose of this document the following terms and definitions apply. For quality system related terms used in this Specification and not defined below, see API Q1.

3.1
batch lots processing
Material processed in a machine in defined quantities or volumes.

3.2
body
The length of the rod located between the upset transitions, see Figure A.1.

3.3
continuous processing
Material flowing steadily through the processing equipment in an undefined quantity or volume.

3.4
couplings
Internally threaded components used to connect sucker rods, sinker bars, pony rods, or polished rods from the surface to the subsurface pump where both threads are of the same size and type.

3.5
dent
Local change in surface contour caused by mechanical impact, but not accompanied by a loss of metal.

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4 International Organization for Standardization, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, www.iso.org.
5 NACE International, 1440 South Creek Drive, Houston, Texas, 77084-4906, www.nace.org.
6 NCSL International, 2995 Wilderness Place, Suite 107, Boulder, Colorado 80301-5404, www.ncsli.org.

3.6
discontinuity
Interruption in the normal physical structure or configuration such as cracks, laps, seams, pits, and laminations.

3.7
end shear crack
Mill shear discontinuity, which shows as a crack across the pin end face.

3.8
fiber reinforced plastic (FRP) sucker rod
Sucker rod typically manufactured in three pieces and assembled by a process that provides connection of two metal end fittings connected to a non-metallic fiber reinforced plastic rod.

3.9
forging lap
Discontinuity produced when two metal surfaces fold against each other without metallurgical bonding.

3.10
forging overfill
Excessive metal stocking of the forging die resulting in a forging lap.

3.11
independent calibration agency
Organization providing calibration services that is independent of the manufacturer.

3.12
kink
Short, tight bend.

3.13
longitudinal
Direction along the long axis of the rod.

3.14
longitudinal discontinuity
Discontinuity where the orientation of the long axis of the discontinuity is within plus or minus 60 ° from the longitudinal direction and is longer in the longitudinal direction than in the transverse direction.

3.15
micro-crack
Crack undetectable by unaided visual inspection.

3.16
nick
Local change in surface contour accompanied by a loss in metal caused by mechanical impact.

3.17
on-off tools
Two-piece, reusable tool that provides a means of remotely connecting and disconnecting the sucker rods at or above the sucker rod pump.

3.18
pit
Small, regular or irregular crater where the major (longest) diameter is not more than twice the minor (shortest) diameter.

3.19
polished rod
Rod of standard length and diameter with a surface finish designed to facilitate a pressure seal in a stuffing box and to provide a mechanical link between equipment inside and outside the well.

3.20
polished rod clamp
Device attached to the polished rod, which in conjunction with the pumping unit carrier bar secures a polished rod to the surface pumping unit.

3.21
polished rod liner
A hard, sprayed metal, thin walled tube that is installed over and seals against the polished rod and stuffing box internal seals.

3.22
pony rod
Sucker rod of reduced length used to place the pump at the desired depth in the well.

3.23
pull back
Discontinuity in the sprayed metal coating where the coating does not extend to its intended surface coverage.

3.24
pumping tee
Tubing fitting assembled to the top of a pumping well and below a stuffing box, designed to discharge production fluids through a side opening connected to a flow line.

3.25
qualified person
Personnel with characteristics or abilities, gained through training and/or experience as measured against established requirements, standards or tests, that enable the individual to perform a required function.

3.26
reference master gauge
Gauge which has been certified by an independent calibration agency and is used for verification and calibration of working gauges.

3.27
rod guides
Metallic or polymeric materials attached to the sucker rod string to centralize the sucker rods and reduce sucker rod and tubing wear and/or reduce paraffin build-up.

3.28
rolled-in-scale
Surface discontinuity caused by scale (metal oxide) formed during a previous heating which has not been removed prior to bar rolling or upset forging.

3.29
rolling lap
Longitudinal surface discontinuity that can have the appearance of a seam, caused during rolling, fins, or sharp corners being folded over and then rolled into the bar surface without metallurgical bonding.

3.30
rolling overfill
Raised ridges formed during bar rolling.

3.31
scab (sliver)
Loose or torn segment of material or debris rolled into the surface of the bar.

3.32
seam
Longitudinal discontinuity which can be closed or open, but without metallurgical bonding, which can have the appearance of a straight line, scratch, or small longitudinal separation.

3.33
shake test
Perceptible movement of the gauge when rocked back and forth, see Annex I.6.

3.34
shear tools
Straight line pull safety joint release that provides a means of disconnecting the sucker rod string from the pump below the tool.

3.35
stabilizer bars
Special pony rod with rod guides, normally used above the pump or between sinker bars.

3.36
sinker bar
A steel rod of a specified length, normally in a larger diameter than the sucker rods, provided in standard sizes with externally threaded ends provided to add weight and stability to the sucker rod string.

3.37
stuffing box
Device with accessory sealing elements used in conjunction with the polished rod to facilitate sealing of the well bore.

3.38
sub-couplings
Internally threaded components with polished rod threads used to connect polished rods, pony rods, sucker rods, or sinker bars, to the subsurface pump, or to each other, where both threads are not of the same size.

3.39
sucker rod
Steel or fiber reinforced plastic rod of standard length and diameter with externally threaded ends, typically used for transmitting mechanical power to the subsurface pump.

3.40
sucker rod body
Body of the sucker rod or pony rod between the upset tapers.

3.41
sucker rod lift
Artificial lift method that lifts fluids (oil, water, condensate and/or gas) from a well with a sucker rod string and sucker rod pump operating in a linear reciprocating mode.

3.42
sucker rod rotator
Mechanical device that rotates the sucker rod string to circumferentially distribute sucker rod string wear.

3.43
sucker rod string
Assembly of sucker rods, pony rods, polished rod, sinker bars, couplings, sub-couplings and a polished rod clamp, as required, to actuate a subsurface sucker rod pump.

3.44
thread flank
Side of the thread between the crest and root of the thread.

3.45
total indicator runout (circular)
Total gauge reading as circular part is rotated 360°.

3.46
transverse
Direction at a right angle to the longitudinal axis.

3.47
transverse discontinuity
Discontinuity where the orientation of the long axis of the discontinuity is within plus or minus 30 ° from the transverse direction and is longer in the transverse direction than in the longitudinal direction.

3.48
underfill
Portion of the upset forging with a depression (typically insufficient metal) formed during forging.

3.49
upset transition
The end of the rod where the rod body diameter increases to the upset bead.

3.50
working gauge
Gauge used for direct measurement of product.

4 Symbols, Abbreviations and Gauge List

4.1 Symbols

Symbols used within this specification are defined as follows.

A	radius, sucker rod upset, body transition
C	radius, sucker rod upset, large diameter
BC1	coupling chamfer (see Table C.1 and Figure C.2)
BC2	counter bore depth, sucker rod coupling
BC3	thread chamfer, sucker rod coupling
BC4	counter bore depth, polished rod coupling
BP1	Radius, Polished rod

BP2	Length, Polished rod
BP3	Length to angle, Polished rod
BP4	Angle of cone, Polished rod
BR1	sucker rod shoulder radius or chamfer
BR2	radius, sucker rod pin undercut
D_E	diameter of elevator neck
D_F	outside diameter of pin shoulder
D_N	diameter of pin thread of FRP rod
D_Q	diameter of box counterbore
D_R	diameter of rod body
D_S	diameter of polished rod pin shank
D_{SB}	diameter of sinker bar
D_T	diameter of thread
D_U	diameter of upset bead
D_X	diameter of extension, maximum
D_1	diameter of stress relief
D_2	Minimum diameter, coupling
D_3	Diameter, coupling
D_4	diameter of polished rod pin-and-box cone base
E_S	pitch diameter
H	Height of sharp thread
L	length of coupling
L_B	length of sinker bar
L_c	length of end fitting of FRP rod
L_{DF}	length from pin shoulder to wrench flat
L_E	length of elevator neck, minimum
L_K	length of sucker rod
L_{nb}	total depth of box, minimum
L_R	length of stress relief
L_S	length of pin
L_{SH}	length of shoulder
L_W	length of wrench flat
L_{WS}	length of wrench square
L_Y	length of pony rods
L_{2S}	length of perfect polished rod threads
L_{3n}	length threads in box including counterbore
L_{3S}	length of polished rod pin
OD_p	Outer diameter, Polished rod
p	thread pitch
R_a	Surface roughness

R_P	rod pin size
Va	measurement between successive indentations during a hardness test
W_S	wrench square width

4.2 Abbreviations

Abbreviations used within this specification are defined as follows.

AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASNT	American Society for Non-Destructive Testing
ASQ	American Society for Quality
ASTM	American Society for Testing and Materials
FRP	fiber reinforced plastic
ISO	International Standards Organization
MTR	material test report
NACE	National Association of Corrosion Engineers
NIST	National Institute of Standards and Technology
NDE	non-destructive examination
OD	outside diameter
SPC	Society for Protective Coatings
TIR	total indicator runout
UN	unified national
UNR	unified national rounded

4.3 Gauge List

Symbols used within this specification to define gauges are defined as follows.

Symbol	Description
$GDB1_A$	diameter of ring collar, gauge B1
$GDB1_B$	minor diameter, gauge B1
$GDB1_C$	diameter of counterbore, gauge B1
$GLB1_A$	length of ring, gauge B1
$GLB1_B$	length of counterbore, gauge B1
$GDB2_A$	major diameter, gauge B2
$GDB2_B$	pitch diameter, gauge B2
$GDB2_C$	diameter thread relief, gauge B2
$GDB2_D$	diameter of plug collar, gauge B2
$GLB2_A$	length of thread, gauge B2
$GLB2_B$	length of plug, gauge B2

$GAB2_A$	face angle, gauge B2
$GDB3_A$	diameter of ring cone, gauge B3
$GDB3_B$	diameter of ring collar, gauge B3
$GDB3_C$	minor diameter, gauge B3
$GLB3_A$	length of ring, gauge B3
$GAB3_A$	angle, gauge B3
$GDB4_A$	major diameter, gauge B4
$GDB4_B$	pitch diameter, gauge B4
$GDB4_C$	relief diameter, gauge B4
$GDB4_D$	diameter of plug collar, gauge B4
$GDB4_E$	diameter of plug cone, gauge B4
$GLB4_A$	length of thread relief, gauge B4
$GLB4_B$	length of land, gauge B4
$GLB4_C$	thread length, gauge B4
$GLB4_D$	length of plug, gauge B4
$GAB4_A$	cone angle, gauge B4
$GAB4_B$	face angle, gauge B4
$GDB5_A$	minor diameter, gauge B5
$GLB5_A$	length of ring, gauge B5
$GDB6_A$	major diameter, gauge B6
$GDB6_B$	pitch diameter, gauge B6
$GLB6_A$	thread length, gauge B6
$GDP1_A$	truncated major diameter, gauge P1
$GDP1_B$	full form major diameter, gauge P1
$GDP1_C$	relief diameter, gauge P1
$GDP1_D$	pitch diameter, gauge P1
$GDP1_E$	diameter of plug, gauge P1
$GLP1_A$	length of truncated portion, gauge P1
$GLP1_B$	thread length, gauge P1
$GLP1_C$	length of plug, gauge P1
$GAP1_A$	face angle, gauge P1
$GDP2_A$	diameter of ring collar, gauge P2
$GDP2_B$	minor diameter, gauge P2
$GDP2_C$	diameter of counterbore, gauge P2
$GLP2_A$	countersink depth range, gauge P2
$GLP2_B$	length of counterbore, gauge P2
$GLP2_C$	length of ring, gauge P2
$GAP2_A$	chamfer angle, gauge P2
$GDP3_A$	major diameter, gauge P3
$GDP3_B$	relief diameter, gauge P3

$GDP3_C$	pitch diameter, gauge P3
$GDP3_D$	plug cone diameter, gauge P3
$GDP3_E$	diameter of plug collar, gauge P3
$GLP3_A$	length of thread relief, gauge P3
$GLP3_B$	thread length, gauge P3
$GLP3_C$	plug length, gauge P3
$GLP3_D$	length of land, gauge P3
$GAP3_A$	face angle, gauge P3
$GAP3_B$	cone angle, gauge P3
$GDP4_A$	diameter of ring cone, gauge P4
$GDP4_B$	diameter of ring collar, gauge P4
$GDP4_C$	minor diameter, gauge P4
$GLP4_A$	length of ring, gauge P4
$GAP4_A$	cone angle, gauge P4
$GDP5_A$	truncated major diameter, gauge P5
$GDP5_B$	full form major diameter, gauge P5
$GDP5_C$	pitch diameter, gauge P5
$GLP5_A$	thread length, gauge P5
$GLP5_B$	truncated thread length, gauge P5
$GDP6_A$	minor diameter, gauge P6
$GLP6_A$	length of ring, gauge P6
$GDP7_A$	truncated major diameter, gauge P7
$GDP7_B$	full form major diameter, gauge P7
$GDP7_C$	pitch diameter, gauge P7
$GDP7_D$	diameter of thread relief, gauge P7
$GDP7_E$	diameter of plug collar, gauge P7
$GLP7_A$	length of thread, gauge P7
$GLP7_B$	length of truncated portion, gauge P7
$GLP7_C$	length of plug, gauge P7
$GAP7_A$	face angle, gauge P7
$GDP8_A$	diameter of ring collar, gauge P8
$GDP8_B$	minor diameter, gauge P8
$GDP8_C$	diameter of counterbore, gauge P8
$GLP8_A$	countersink length range, gauge P8
$GLP8_B$	length of ring, gauge P8
$GLP8_C$	length of counterbore, gauge P8
$GAP8_A$	countersink angle, gauge P8
B1	gauge, go box-thread ring gauge (checking ring)
B2	gauge, go box-thread plug gauge
B3	gauge, box-cone ring gauge (fitting ring)

B4	gauge, box-cone plug gauge
B5	gauge, no-go box-thread ring gauge (checking ring)
B6	gauge, no-go box-thread plug gauge
P1	gauge, go pin-thread truncated setting plug gauge
P2	gauge, go pin-thread ring gauge
P3	gauge, go pin-cone plug gauge (fitting plug)
P4	gauge, pin-cone ring gauge
P5	gauge, no-go pin-thread truncated setting plug gauge
P6	gauge, no-go pin-thread ring gauge
P7	gauge, go pin-thread truncated setting plug gauge
P8	gauge, go pin-thread ring gauge

5 Functional Requirements

To order products which conform to this specification, the user or purchaser may determine the applicable well and environmental operational conditions, specify the requirements and/or identify the supplier's or manufacturer's specific products. Additional detailed ordering information can be found in Annex A through Annex H. Requirements may be conveyed to the manufacturer by means of the manufacturer's part number, data sheet, or other suitable documentation.

The following requirements may be specified as applicable:

a) required fluid volume or loads to be applied to the products;

b) material type and grade;

c) well depth, pump size, tubing size, or other mechanical well parameters;

d) well bore configuration (such as deviation, dog-legs, etc.);

e) produced fluid chemical and physical composition, including produced solids (sand production, scale, etc.), to which the products are exposed during their full life cycle;

f) the selected surface drive system;

g) pressure ratings, if applicable;

h) bottom hole static temperature and pressure;

i) planned chemical treatments;

j) bottom hole producing temperature and pressure.

6 Technical Requirements

6.1 General Requirements

Products designed and manufactured prior to the publication of this specification and in conformance with API 11B, 26th edition shall be considered as meeting the requirements of this specification.

6.2 Design Requirements

6.2.1 General

The design shall conform to the requirements of this specification.

6.2.2 Design Documentation

Design documentation shall as a minimum include drawings, and as applicable: assumptions, formulas, calculations, design requirements, testing, and acceptance criteria. Design documentation medium shall be clear, legible, reproducible, and retrievable. It shall include design verification, validation, reviews, and any necessary actions.

6.2.3 Design Review

Designs shall be reviewed and verified by a qualified person other than the person(s) who developed the original design to evaluate the ability of the design to meet requirements.

6.2.4 Design Verification

Design verification shall be performed to ensure that each product design meets the manufacturer's technical specifications.

6.2.5 Design Validation

Design validation shall be performed to ensure that the resulting product is capable of meeting the requirements for the specified application or intended use.

6.2.6 Design Changes

Design changes and changes to design documents that affect conformance to this specification shall require application of the same control features as those used to develop the original design.

6.3 Materials

6.3.1 General

The manufacturer shall have and conform to documented specifications for all materials used in products manufactured to this specification.

Products shall be manufactured in accordance with the materials specified in the applicable annexes.

6.3.2 Metals

6.3.2.1 General

Materials used for the manufacture of products made in accordance with this specification shall be as specified in the applicable annex.

6.3.2.2 Material Test Report (MTR)

Material test reports of materials used to manufacture products with traceability requirements shall include; the date of manufacture, mill heat number, chemical composition, hardness, yield strength, ultimate tensile strength, elongation and reduction in area, as applicable. These documents shall be maintained by the manufacturer for a period of at least five years. These records shall be provided to the end user as requested.

6.3.3 Non-metallic Materials for FRP Sucker Rods

The manufacturer's written specifications for non-metallic materials shall define those characteristics critical to the performance of the material. Included in these specifications are items such as composition, physical properties, mechanical properties, storage, and labeling requirements, as applicable.

7 Manufacturer Requirements

7.1 General

As a minimum, each of the following topics shall be addressed by the manufacturer.

7.2 Quality Control

7.2.1 General

To maintain accuracy, equipment used to measure, test and gauge products manufactured in accordance with this specification shall be identified, controlled, calibrated and adjusted, if necessary. This shall be performed at specified intervals in accordance with the manufacturer's specifications and the requirements of this specification.

Specific testing, and inspection criteria, including dimensional inspection and gauging, for each specific product are listed in the applicable annex.

Technologies for inspections with verifiable accuracies equal to or better than those listed in this specification may be applied with appropriate documentation approved by a qualified person.

7.2.2 Inspection/Measuring/Testing Equipment Calibration (Except for Thread Gauges)

Inspection, measuring, and testing equipment used for acceptance shall be identified, inspected, calibrated, and adjusted at specific intervals in accordance with documented procedures, and this specification. The calibration or verification of measuring and testing equipment used for product acceptance shall be traceable to the applicable national or specifications agency. Inspection, measuring, and testing equipment shall be used only within the calibrated range. Calibration shall conform with the requirements of ANSI NCSL Z540-1 or equivalent national standard. See Annex I for the calibration of thread gauges.

Calibration intervals for measuring and testing equipment shall be established based on repeatability and degree of usage. Calibration intervals shall be a maximum of three months until a recorded calibration history is established. Intervals may be lengthened or shortened based on calibration history. A calibration interval cannot be increased by more than twice the previous interval.

Calibration standards used to calibrate measuring and testing equipment shall be checked and approved at least once a year by an independent calibration agency with traceability to NIST or the applicable national or specifications agency.

7.2.3 Personnel Qualifications

All personnel performing quality control activities directly affecting material and product quality shall be qualified in accordance with the manufacturer's documented requirements.

7.2.4 Product Acceptance

7.2.4.1 General

Products designed and manufactured in accordance with this specification shall meet the requirements of the appropriate annexes of this specification. Records shall be maintained for a minimum of five years for all accepted

finished products. When specified, non-destructive examinations shall be performed and accepted according to the manufacturer's documented specifications which include acceptance criteria.

Dimensional inspection shall be performed by a qualified person to assure proper function and conformance with design criteria, specifications and final component dimensions.

7.2.4.2 Frequency and Acceptance of Inspection

7.2.4.2.1 Batch Lot Processing

Unless otherwise stated in this specification, frequency and acceptance of inspection of manufacturing lots shall be in accordance with the acceptance criteria for the single sampling plan for normal inspection, general inspection level I, acceptable quality level of 4.0 %, as specified in ANSI/ASQC Z1, or ISO 2859-1. More stringent inspection plans are acceptable.

NOTE ISO 11462-1 gives guidance and requirements on statistical process control.

The frequency and acceptance of inspection of manufacturing lots for pumping tees, polished rod clamps, polished rod liners, and stuffing boxes shall be in accordance with the acceptance criteria for the single sampling plan for normal inspection, general inspection level S2, acceptable quality level of 10.0 % as specified in ANSI/ASQC Z1, OR ISO 2859-1.

NOTE For the purposes of this specification ANSI/ASQ Z1.4 is equivalent to ISO 2859-1.

7.2.4.2.2 Continuous Processing

In continuous processing, a minimum of 10.0 % of the produced parts shall be inspected. Processing of non-conforming items shall conform to 7.2.5. Parts manufactured prior to the non-conforming items shall be inspected back to the last acceptable part and the non-conforming parts shall be dispositioned according to the manufacturer's documented procedures.

Acceptance criteria may be based on continuous monitoring and statistical process control such as described in ISO 11462-1.

7.2.4.3 Threads

Any product thread accepted by a calibrated reference master gauge or calibrated working gauge shall be considered as meeting product requirements.

7.2.5 Manufacturing Non-conformances

The manufacturer shall establish and maintain documented procedures to ensure that product which does not conform to specified requirements is prevented from unintended use or installation. This control shall provide for identification, evaluation, segregation, and disposition of non-conforming assemblies or components.

The responsibility for review and authority for the disposition of non-conforming product shall be defined by the manufacturer. Non-conforming product shall be:

a) reworked to meet the specified requirements or the specified requirements of another product;

b) accepted without repair by concession of a manufacturer's qualified and authorized person, provided the concession is within the design acceptance criteria and at no time is this product allowed to violate the requirements of this specification; or

c) rejected or scrapped.

Records of the nature of nonconformities and any subsequent actions taken, including concessions obtained, shall be maintained in accordance with manufacturer's documented procedures.

7.2.6 Coatings

Coatings shall be controlled by documented processing instructions, which include acceptance criteria which have been approved by a qualified person.

7.2.7 Heat Treating Furnace Instrumentation

Automatic controlling and recording instruments shall be used. Thermocouples shall be located in the furnace working zone(s). The controlling and recording instruments used for the heat treatment processes shall possess an accuracy to within ±1 % of their full scale range. Temperature controlling and recording instruments shall be calibrated at least once every six months until a documented calibration history can be established. Calibration intervals shall then be established based on repeatability, degree of usage and documented calibration history. Equipment used to calibrate the furnace equipment shall possess an accuracy to within ±0.25 % of full scale range.

7.2.8 Non-Destructive Examination (NDE)

When NDE is utilized, instructions shall be detailed in the manufacturer's documented procedures and conform to the requirements of this specification. All NDE instructions shall be approved by a Level III examiner qualified in accordance with an international or national standard such as ISO 9712 or ASNT Recommended Practice SNT-TC-1A.

Personnel performing NDE shall be qualified to at least Level II for evaluation and interpretation in accordance with an international or national standard such as ISO 9712 or ASNT Recommended Practice SNT-TC-1A. Any unacceptable indications shall be removed, repaired, and re-examined using the original NDE method.

In case discontinuities are detected by non-visual NDE methods, the evaluation may be supplemented by visual examination and measurement to determine the size of the discontinuity at the option of the manufacturer.

7.2.9 Traceability

All products manufactured under this specification shall be traceable as required by the applicable annex. Traceability shall be in accordance with the manufacturer's documented procedures. Traceability is considered sufficient if the product meets the traceability requirements of this specification when it leaves the manufacturer's inventory.

7.3 Product Identification

All products manufactured under this specification shall be marked in accordance with the requirements detailed in the appropriate normative Annex and the manufacturer's documented procedures.

7.4 Documentation

The manufacturer shall establish and maintain documented procedures to control documents and data required by this specification. These documents and data shall be clear, legible, reproducible and retrievable. These documents and data shall be retained in facilities that provide an environment which minimizes damage, deterioration, or loss. Documents and data may be in the form of any type of media, such as hard copy or electronic media, and shall be retained for a minimum of five years from the date of manufacture.

Annex A
(normative)

Steel Sucker Rods and Pony Rods

A.1 General

Steel sucker rods and steel pony rods shall be manufactured and supplied according to the requirements and specifications provided in this specification.

The application of sucker rod guides which affect the original mechanical, physical, or dimensional properties of the rod itself such that it no longer conforms to this specification, is not acceptable.

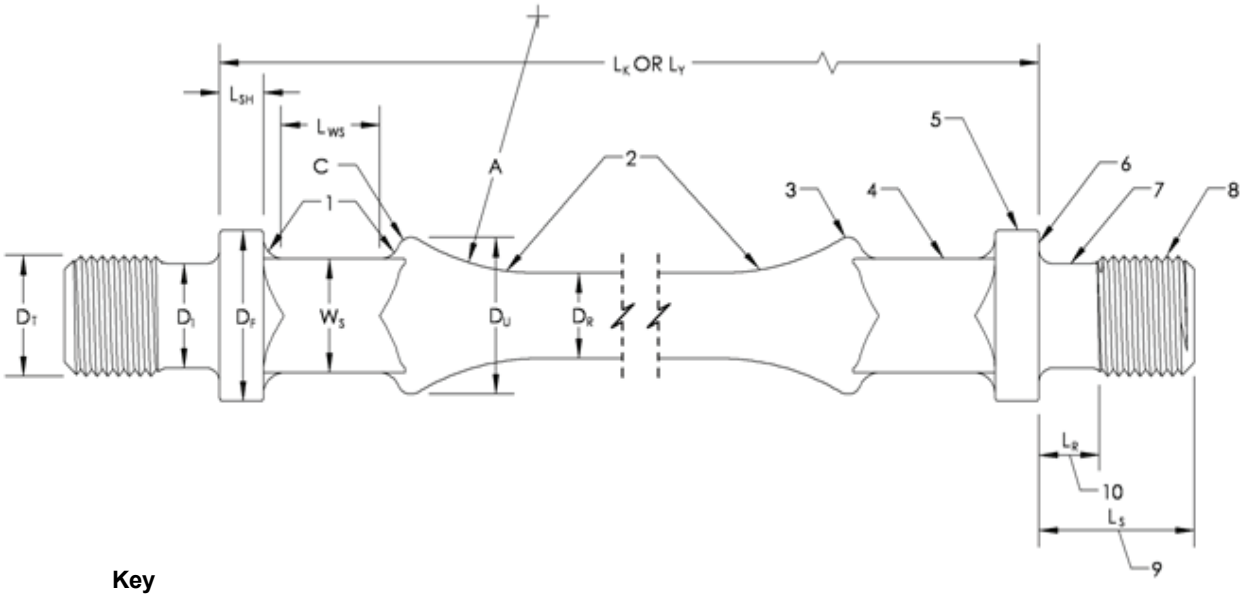
A.2 Design Requirements

A.2.1 General

The following general requirements shall be followed in the design of steel sucker rods and steel pony rods.

A.2.2 Dimensional Requirements

Steel sucker rods and steel pony rods shall be furnished in the sizes, lengths, and configurations shown in Figure A.1 and Table A.1. Steel rod ends shall conform to the dimensions given in Figure A.1, Figure A.2 and Figure A.3 and Table A.1, Table A.2 and Table A.3 as applicable.



Key

1	Shape of transition optional	6	face
2	sucker rod body	7	stress relief
3	upset bead	8	thread (same each end)
4	wrench square	9	pin length
5	pin shoulder	10	stress relief length

Figure A.1—Steel Sucker Rod and Pony Rod Illustration

A.2.3 Steel Sucker Rod and Pony Rod Pin End Connections

Requirements for sucker rod and pony rod pin and connection dimensions are provided in Tables A.1, A.2, and A.3, and Figures A.1, A.2, and A.3.

Table A.1—Dimensions and Tolerances for Steel Sucker Rods and Steel Pony Rods

Nominal size [a]		5/8 in.		3/4 in.		7/8 in.		1 in.		1 1/8 in.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
D_R Diameter of rod body	Dimension	0.625	15.88	0.750	19.05	0.875	22.23	1.0	25.40	1.125	28.58
	Tolerances	+ 0.007 – 0.014	+ 0.18 – 0.36	+ 0.008 – 0.016	+ 0.20 – 0.41	+ 0.008 – 0.016	+ 0.20 – 0.41	+ 0.009 – 0.018	+ 0.23 – 0.46	+ 0.010 – 0.020	+ 0.25 – 0.51
D_F Outside diameter of pin shoulder	Dimension	1.250	31.75	1.500	38.10	1.625	41.28	2.000	50.80	2.250	57.15
	Tolerances	+ 0.005 – 0.010	+ 0.13 – 0.25	+ 0.005 – 0.010	+ 0.13 – 0.25	+ 0.005 – 0.010	+ 0.13 – 0.25	+ 0.005 – 0.010	+ 0.13 – 0.25	± 0.015	± 0.38
W_S Width of wrench square	Dimension	0.875	22.23	1.00	25.40	1.00	25.40	1.3125	33.34	1.50	38.10
	Tolerances	± 0.031	± 0.79	± 0.031	± 0.79	± 0.031	± 0.79	± 0.031	± 0.79	± 0.031	± 0.79
L_{WS} Length of wrench square (minimum length, exclusive of fillet)	Dimension	1.250	31.75	1.250	31.75	1.250	31.75	1.500	38.10	1.625	41.28
L_K Length of sucker rod (measured from contact face of pin shoulder to contact face of pin shoulder)	Dimen-sions	296.0	7,518.4	296.0	7,518.4	296.0	7,518.4	296.0	7,518.4	296.0	7,518.4
		356.0	9,042.4	356.0	9,042.4	356.0	9,042.4	356.0	9,042.4	356.0	9,042.4
	Tolerances	± 2.0	± 50.8	± 2.0	± 50.8	± 2.0	± 50.8	± 2.0	± 50.8	± 2.0	± 50.8
L_Y Length of pony rods (measured from contact face of pin shoulder to contact face of pin shoulder)	Dimensions	20.0 44.0 68.0 92.0 116.0 140.0	508.0 1,117.6 1,727.2 2,336.8 2,946.4 3,556.0	20.0 44.0 68.0 92.0 116.0 140.0	508.0 1,117.6 1,727.2 2,336.8 2,946.4 3,556.0	20.0 44.0 68.0 92.0 116.0 140.0	508.0 1,117.6 1,727.2 2,336.8 2,946.4 3,556.0	20.0 44.0 68.0 92.0 116.0 140.0	508.0 1,117.6 1,727.2 2,336.8 2,946.4 3,556.0	20.0 44.0 68.0 92.0 116.0 140.0	508.0 1,117.6 1,727.2 2,336.8 2,946.4 3,556.0
	Tolerances	± 2.0	± 50.8	± 2.0	± 50.8	± 2.0	± 50.8	± 2.0	± 50.8	± 2.0	± 50.8
D_U Diameter of bead	Dimension	1.21875	30.96	1.406 25	35.72	1.500	38.10	1.90625	48.42	2.1875	55.56
	Tolerances	+ 0.005 – 0.125	+ 0.13 – 3.18	+ 0.005 – 0.125	+ 0.13 – 3.18	+ 0.005 – 0.125	+ 0.13 – 3.18	+ 0.005 – 0.1875	+ 0.13 – 4.76	+ 0.005 – 0.1875	+ 0.13 – 4.76
A (Typically verified in forging die quali-fication)	Dimension	1.875	47.63	2.250	57.15	2.625	66.68	3.0	76.20	3.375	85.73
	Tolerances	± 0.125	± 3.175	± 0.125	± 3.175	± 0.125	± 3.175	± 0.125	± 3.175	± 0.125	± 3.175
C (Typically verified in forging die quali-fication)	Dimension	0.125	3.18	0.125	3.18	0.1875	4.76	0.1875	4.76	0.187 5	4.76
	Tolerances	+.0625 -.015625	+1.59 -0.40	+.0625 -.015625	+1.59 -0.40	+.0625 -.015625	+1.59 -0.40	+.0625 -.015625	+1.59 -0.40	+.0625 -.015625	+1.59 -0.40
D_T Diameter of thread	Reference Dimension	0.9375	23.81	1.0625	26.99	1.1875	30.16	1.375	34.93	1.562 5	39.69
D_1 Diameter of stress relief	Dimension	0.790	20.07	0.915	23.24	1.040	26.42	1.227	31.17	1.414	35.92
	Tolerances	± 0.005	± 0.127	± 0.005	± 0.127	± 0.005	± 0.127	± 0.005	± 0.127	± 0.005	± 0.127
L_{SH} Length of shoulder, minimum	Dimension	0.125	3.18	0.125	3.18	0.125	3.18	0.125	3.18	0.125	3.18
L_R Length of stress relief	Dimension	0.516	13.11	0.594	15.09	0.672	17.07	0.797	20.24	0.875	22.23
	Tolerances	+ 0.03125 – 0.000	+ 0.79 – 0.00	+ 0.03125 – 0.000	+ 0.79 – 0.00	+ 0.03125 – 0.000	+ 0.79 – 0.00	+ 0.0312 5 – 0.000	+ 0.79 – 0.00	+ 0.03125 – 0.000	+ 0.79 – 0.00
L_S Length of pin	Dimension	1.250	31.75	1.4375	36.51	1.625	41.28	1.875	47.63	2.125	53.98
	Tolerances	+ 0.0625 – 0.000	+ 1.59 – 0.00	+ 0.0625 – 0.000	+ 1.59 – 0.00	+ 0.0625 – 0.000	+ 1.59 – 0.00	+ 0.0625 – 0.000	+ 1.59 – 0.00	+ 0.0625 – 0.000	+ 1.59 – 0.00

[a] See Figure A.1, Figure A.2 and Figure A.3.

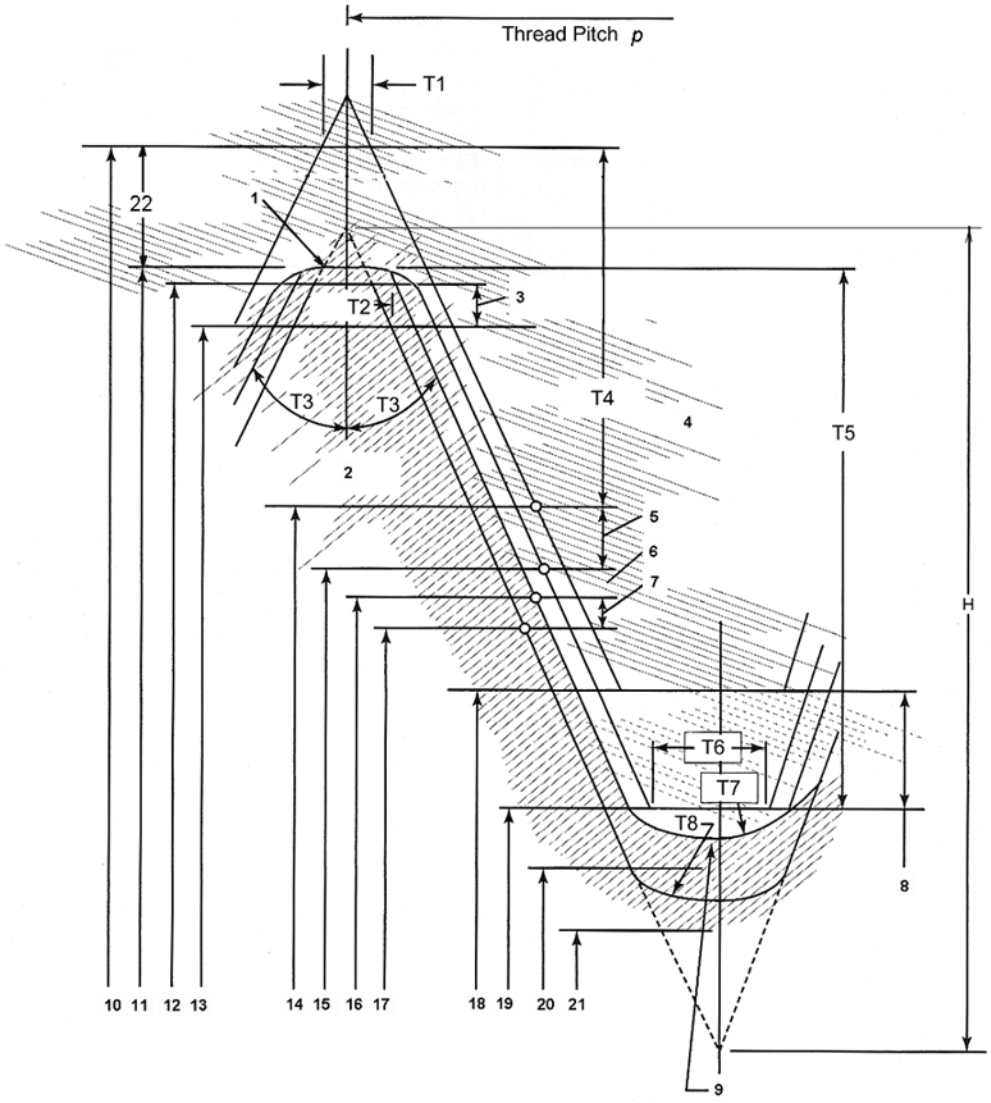
Table A.2—Specified Dimensions for Pin End Threads

Nominal size [a]		5/8 in.		3/4 in.		7/8 in.		1 in.		1 1/8 in.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
Maximum pin-thread major diameter	Dimension	0.9362	23.779	1.0611	26.952	1.1861	30.127	1.3735	34.887	1.5609	39.647
Minimum pin-thread major diameter	Dimension	0.9233	23.452	1.0482	26.624	1.1732	29.799	1.3606	34.559	1.5480	39.319
Maximum pin-thread pitch diameter	Dimension	0.8712	22.128	0.9962	25.303	1.1211	28.476	1.3085	33.236	1.4960	37.998
Minimum pin-thread pitch diameter	Dimension	0.8654	21.981	0.9900	25.146	1.1150	28.321	1.3020	33.071	1.4892	37.826
Maximum pin-thread minor diameter	Dimension	0.8135	20.663	0.9384	23.835	1.0634	27.010	1.2508	31.770	1.4382	36.530
BR1 Maximum radius or chamfer on sucker rod shoulder	Dimension	0.03125	0.79	0.03125	0.79	0.03125	0.79	0.0625	1.59	0.0625	1.59
BR2	Dimension	0.125	3.175	0.125	3.175	0.125	3.175	0.125	3.175	0.125	3.175
Radius, sucker rod pin undercut	Tolerances	+0.03125 -0.0	+0.79 -0.0	+0.03125 -0.0	+0.79 -0.0	+0.03125 -0.0	+0.79 -0.0	+0.03125 -0.0	+0.79 -0.0	+0.03125 -0.0	+0.79 -0.0

[a] See Figure A.1, Figure A.2 and Figure A.3.

A.2.4 Thread Form Requirements

The threaded portion of sucker rod shouldered connections shall be ten threads per inch and conform to the unified thread form with Class 2A-2B tolerances and allowances, as defined in ANSI/ASME B1.1. See Table A.3 for values. The design profile of the pin thread is type UNR with rounded root contour as shown in Figure A.2. The thread profile of the box thread is type UN having a flat root contour with a permissible round root contour beyond the 0.25 x pitch (0.25 p) flat width to allow for crest wear as shown in Figure A.2. As indicated herein, sucker rod threads are straight threads (see Figure A.2 and Figure A.3). The thread form shall be complete over the designed length and shall not contain tears, ruptures, shears, holes or seams that are outside of the acceptance criteria as defined by the manufacturer's procedures.



Key

1	0.010 in. (0.25 mm) radius, maximum, (The hollow crest of cold-formed threads shall not be considered to be detrimental)	12	maximum pin major diameter
2	pin-2A (external thread)	13	minimum pin major diameter
3	1/2 tolerance on major diameter of external thread	14	maximum box pitch diameter
4	box-2B (internal thread)	15	minimum box pitch diameter
5	1/2 PD tolerance on internal thread	16	maximum pin pitch diameter
6	1/2 Allowance (external thread only)	17	minimum pin pitch diameter
7	1/2 PD tolerance on external thread	18	maximum box minor diameter
8	1/2 tolerance on minor diameter of internal thread	19	minimum box minor diameter
9	permissible form of thread from worn tool	20	maximum pin minor diameter
10	maximum box major diameter	21	minimum pin minor diameter
11	minimum box major diameter	22	H/8 (0.01083 in (0.27497 mm))

Figure A.2—Thread Form

Table A.3—Thread Form Dimensional Relationships [a, d]

Dimensional element	Figure Label	Relationship	Value in.	Value mm
Height of sharp thread	H	0.86603*p*	0.086603	2.199716
Design form height of pin-thread	none	11H/16	0.059539	1.512305
Basic depth of pin crest truncation	none	H/8	0.01083	0.27508
Basic depth of pin root truncation	none	H/8	0.01083	0.27508
Radius of basic pin root	none	H/8	0.01083	0.27508
Allowance at pin root for worn tool	none	H/24	0.00361	0.09169
Basic height of box thread	none	5H/8	0.05413	1.37490
Basic depth of box minor diameter truncation	none	H/4	0.02165	0.54991
Basic depth of box major diameter truncation	22	H/8	0.01083	0.27497
Pin major diameter tolerance [b]	none	$(0.060\sqrt[3]{p^2})$ in.	0.012927	0.3283
Pin pitch diameter tolerance [b]	none	$\begin{pmatrix} 0.015\sqrt[3]{D} \\ +0.015\sqrt[3]{L_e} \\ +0.015\sqrt[3]{p^2} \end{pmatrix}$ in.	—	—
Box pitch diameter tolerance [b]	none	1.3 x pin pitch diameter tolerance	—	—
Box minor diameter tolerance	none	$(0.25p - 1.4p^2)$ in.	0.02100	0.533
Pin allowance [b]	none	0.30 × pin pitch diameter tolerance, in.	—	—
2 × box thread height [b]	none	1.250H	0.10825	2.750
2 × pin-thread addendum [b]	none	3/4H	0.06495	1.650
Thread pitch	*p*	----	0.100	2.54
	T1	----	0.00416	0.1057
	T2[c]	----	0.0125	0.3175
	T3	----	30°	30°
	T4	----	0.03969	1.008
	T5	----	0.05413	1.375
	T6	----	0.025	0.635
	T7	----	0.01443	0.3665
	T8	----	0.01083	0.2751

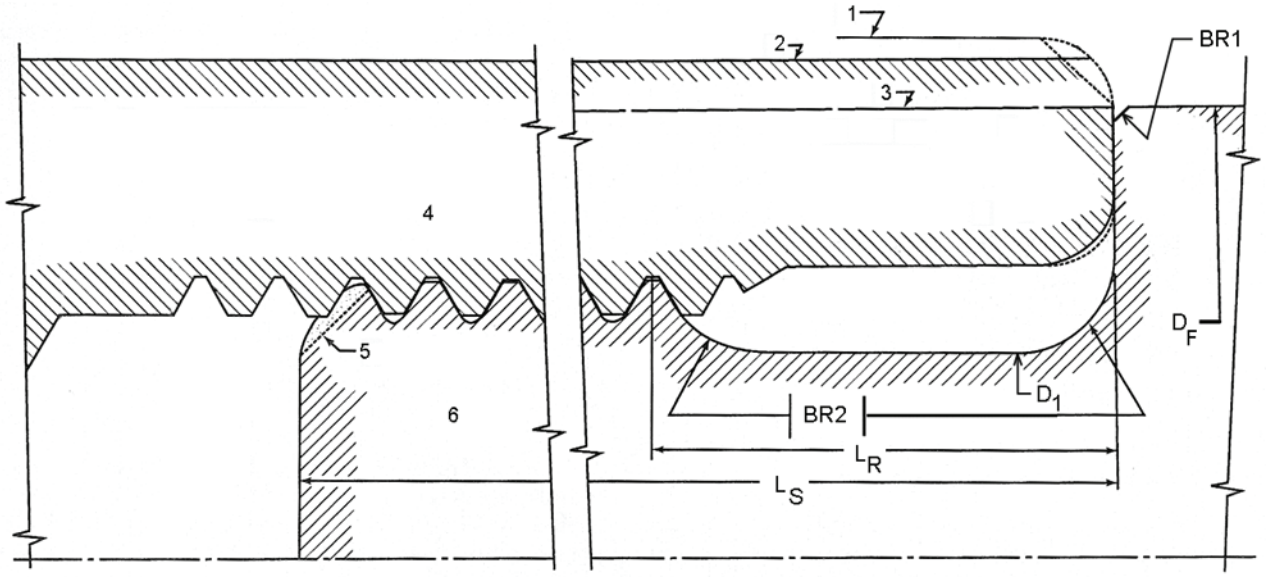
[a] See Figure A.2.

[b] See ANSI/ASME B1.1 for balance of formula.

[c] Half Pitch.

[d] Calculations shall be performed in U.S. customary units and converted to SI when completed.

A.3 Steel Sucker Rod and Steel Pony Rod Material Requirements



Key

1 OD of 1 in. (25.4 mm) coupling
2 OD of 5/8 in. (15.9 mm), 3/4 in. (19.1 mm), 7/8 in. (22.2 mm), and 1 1/8 in. (28.6 mm) coupling
3 OD of slim hole coupling
4 box
5 shape optional with manufacturer
6 pin

Figure A.3—Sucker Rod Connection

A.3.1 General

Steel sucker rod and steel pony rods shall be traceable to the heat of raw material and shall conform to 6.3.

A.3.2 Chemical Composition

The chemical composition of steel sucker rods and steel pony rods shall be any composition of AISI series steel, or equivalent, listed in Table A.4 which can be effectively heat treated to the mechanical property requirements of grades K, C, and D rods as shown in Table A.5.

Table A.4—Chemical Composition of Steel Sucker Rods

Grade	Chemical composition
K	AISI 46XX series steel[a]
C	AISI 10XX series steel[a]
	AISI 15XX series steel[a]
D carbon	AISI 10XX series steel[a]
	AISI 15XX series steel[a]
D alloy	AISI 41XX series steel[a]
D special	Special alloy shall be any chemical composition that contains a combination of nickel, chromium, and molybdenum that total a minimum of 1.15 % alloying content.

[a] Or an equivalent international series number steel.

Table A.5—Mechanical Properties of Steel Sucker Rods and Pony Rods

Grade	Minimum Yield (0.2 % offset)		Minimum Tensile		Maximum Tensile	
	psi	MPa	psi	MPa	psi	MPa
K	60,000	414	90,000	621	115,000	793
C	60,000	414	90,000	621	115,000	793
D	85,000	586	115,000	793	140,000	965

A.3.3 Chemical Analysis

Chemical analysis shall be performed on each mill heat of steel used in the manufacture of sucker rods or pony rods. This analysis shall be performed in accordance with ASTM A751. A material test report (MTR) is an acceptable means to conform to this requirement.

A.4 Mechanical Properties

A.4.1 General

The mechanical properties of steel sucker rods and steel pony rods shall conform to the strength values listed in Table A.5.

A.4.2 Mechanical Property Testing

Mechanical properties testing for steel rods shall be performed in accordance with ASTM A370, or ISO 6892. A minimum of two mechanical tests shall be performed on at least two rod bodies (one near the beginning and one near the end of each heat), after final thermal processing. Test samples shall meet the requirements of Table A.5. Continuous monitoring and/or statistical process control in conformance with ISO 11462-1 is an acceptable alternate method.

Manufacturing lots failing to meet the test criteria may be reprocessed and considered acceptable if the test criteria are met when the manufacturing lot is retested.

A.5 Dimensional Inspection

Sucker rods shall be inspected according to Table A.6. When a micrometer or caliper is used to measure a circular feature, rather than an allowable gap gauge, if a single diameter measurement is out of tolerance then a minimum of two additional measurements in different locations shall be taken. The measurements shall be averaged to determine the nominal dimension.

A.6 Straightness and Surface Finishes

A.6.1 Body Straightness

A.6.1.1 Bends

Sucker rods and pony rods shall be inspected for bends. Bend may be measured by one of the following methods.

a) Total indicator runout (circular) is measured on the rod surface at a distance (gauge length) of 6.00 in. (152.4 mm) from a support. Runout values are twice the amount of the gap over the gauge length.

Table A.6—Dimensional Inspection of Steel Sucker Rods, Steel Pony Rods, and Sinker Bars

Check For	Gauge or Measuring Instrument	Procedure
Threads minimum (under size)	P6 No-go pin-thread ring gauge	The product pin shall not enter the P6 ring gauge more than the third full turn of assembly.
Threads maximum (over size)	P8 Go pin-thread ring gauge	The product pin shall enter the P8 ring gauge to pin-shoulder face contact.
Pin-shoulder face Parallelism	P8 Go pin-thread ring gauge and 0.002 in. (0.051 mm) flat feeler gauge	The product shall enter the P8 ring gauge to pin-shoulder face contact. The feeler gauge shall not enter, at any point, between the face of the gauge and the product pin-shoulder face.
Stress relief D_1 maximum and minimum diameter	Micrometer, caliper or gap gauge	Maximum diameter: Measure to dimension D_1, Table A.1, plus the allowable (+) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall pass over the stress relief. Minimum diameter: Measure to dimension D_1, Table A.1, minus the allowable (–) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall not pass over the stress relief.
Pin-shoulder D_F Maximum and Minimum diameter	Micrometer, caliper, or gap gauge	Maximum diameter: Measure to dimension listed in Table A.1, plus the allowable (+) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall pass over the particular area being gauged. Minimum diameter: Measure to dimension listed in Table A.1, minus the allowable (–) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall not pass the particular area being gauged.
Upset bead D_U Maximum and Minimum diameter	Micrometer, caliper, or gap gauge	Maximum diameter: Measure to dimension listed in Table A.1, plus the allowable (+) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall pass over the particular area being gauged. Minimum diameter: Measure to dimension listed in Table A.1, minus the allowable (–) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall not pass the particular area being gauged.
Stress relief L_R and Pin length L_S maximum and minimum length	Caliper or gap gauges	Maximum length: Measure to dimension length listed in Table A.1, plus the allowable (+) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The product length shall not be longer. Minimum length: Measure to dimension length listed in Table A.1, or set gap gauge to assure product dimension is within the specified tolerance. The product length shall not be shorter.
Sucker rod and pony rod maximum and minimum diameter, D_R	Micrometer, caliper, or gap gauge[a]	Maximum diameter: Measure to dimension listed in Table A.1, plus the allowable (+) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall pass over the entire length of the rod body. Minimum diameter: Measure to dimension listed in Table A.1, minus the allowable (–) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall not pass over the entire length of the rod body.
Sucker rod and pony rod maximum and minimum length, L_K and L_Y	Tape measure	Maximum length: Measure to dimension listed in Table A.1, plus the allowable (+) tolerance. The product shall not be longer. Minimum length: Measure to dimension listed in Table A.1, minus the allowable (–) tolerance. The product shall not be shorter.
Wrench square width W_S maximum and minimum width	Micrometer, caliper, or gap gauge[b]	Maximum dimension: Measure to dimension listed in Table A.1, plus the allowable (+) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall pass over the entire width. Minimum dimension: Measure to dimension listed in Table A.1, minus the allowable (–) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall not pass over the entire width.
Wrench square length L_{WS}	Caliper or gap gauge	Measure to dimension listed in Table A.1, or set gap gauge to assure the product dimension is within the specified tolerance. The product length shall not be shorter.

[a] Anvils on measuring instruments shall be 0.125 in. (3 mm) wide minimum.

[b] Anvils on measuring instruments shall be 0.125 in. (3 mm) wide minimum and their length shall be equal to or exceed the wrench square width.

b) A 12.00 in. (304.8 mm) straight edge shall be held on the concave side of the bend. The amount of the bend is the gap measured between the straight edge and the concave rod surface.

A gauge length of 12.00 in. (304.8 mm) shall be used to determine the maximum allowable bend for all rod sizes $^{5}/_{8}$ in. to $1^{1}/_{8}$ in. (15.88 mm to 28.58 mm). The maximum allowable gap is 0.065 in. (1.65 mm) measured on one side as described in b) above, or 0.130 in. (3.30 mm) total indicator runout (circular) as described in a) above.

A.6.1.2 Pony Rods 2 ft in Length

Body straightness for a nominally 2 ft long (length measurement) (0.61 m) pony rod shall be measured with a gauge length of 6.00 in. (152.4 mm). The amount of TIR bend is measured via a dial indicator riding on the rod body 3 in. (76.2 mm) from a support. The maximum allowable TIR values for all rod sizes $^{5}/_{8}$ in. to $1^{1}/_{8}$ in. (15.88 mm to 28.58 mm) is 0.065 in. (1.65 mm). The maximum allowable gap value is 0.033 in. (0.84 mm).

A.6.1.3 Alternate Inspection Technologies

Technologies for inspections with verifiable accuracies equal to or better than those listed in this specification may be applied with appropriate documentation approved by a qualified person.

A.6.1.4 Kinks

Sucker rods and pony rods shall be inspected for kinks.

A kink shall be measured as follows: A 6.00 in. (152.4 mm) straight edge is held on the concave side of the kink. The amount of kink is the gap measured between the straight edge and the rod body surface. A gauge length of 6.00 in. (152.4 mm) shall be used to determine the maximum allowable gap. The maximum allowable gap in the middle of the gauge length is 0.125 in. (3.18 mm). Straightening of kinks is not acceptable and the rod must be rejected.

Technologies for inspections with verifiable accuracies equal to or better than those listed in this specification may be applied with appropriate documentation approved by a qualified person.

A.6.2 End Straightness

A.6.2.1 Sucker Rods and Pony Rods

End straightness shall be measured by supporting the rod body at a distance of 6.00 in. (152.4 mm) from the rod pin shoulder. The rest of the rod shall be supported at a maximum of 6.00 ft (1.83 m) with centers in the same plane. The amount of TIR bend is measured via a dial indicator, laser or other comparable measuring device. The amount of bend shall be measured at the machined surface of the pin shoulder OD. The maximum allowable TIR values for all rod sizes $^{5}/_{8}$ in. to $1^{1}/_{8}$ in. (15.88 mm to 28.58 mm) is 0.130 in. (3.30 mm).

A.6.3 Surface finish, Rod Body

A.6.3.1 General

Surface finish shall conform to the requirements of this section.

Upon removal of a discontinuity, all dimensional requirements shall be met.

A.6.3.2 Discontinuities

When the depth of a discontinuity cannot be measured, the discontinuity shall be removed to attain a smooth transition.

Discontinuities such as rolled-in scale, slivers, mechanical damage, etc., when removed, shall be removed to attain a smooth transition.

Longitudinal discontinuities are acceptable provided the depth or height does not exceed 0.020 in. (0.51 mm) from the adjacent surfaces. Longitudinal discontinuities which are less than 0.020 in. (0.51 mm) need not be removed.

Transverse discontinuities greater than 0.004 in. (0.10 mm) depth are unacceptable and shall be removed to attain a smooth transition.

Pits shall not exceed a depth of 0.008 in. (0.20 mm).

A.6.4 Surface Finish, Upset Area

A.6.4.1 General

The exterior surface of the upset area shall be inspected by qualified person(s) using the manufacturer's documented procedures. The inspection method shall be sufficient to identify the discontinuities as defined below.

Surface finish roughness of the machined upset area shall not be greater than 125 μin. (3.175 μm) R_a.

A.6.4.2 Discontinuities

When the depth of a discontinuity cannot be measured, the discontinuity shall be removed to attain a smooth transition.

Longitudinal discontinuities that occur in the area above the point where the upset diameter equals the width of the wrench square are acceptable. Longitudinal discontinuities which occur in any area of the upset from the rod body up to that point where the upset diameter equals the width of the wrench square are acceptable as long as the height or depth does not exceed 0.031 in. (0.79 mm). Longitudinal discontinuities which exceed 0.031 in. (0.79 mm) in this area shall be removed with a smooth transition provided that all dimensional tolerances are maintained.

Transverse discontinuities which are continuous around the upset, and deeper than 0.063 in. (1.60 mm), are unacceptable and shall be removed with a smooth transition. Upon removal of the discontinuity, all dimensional requirements shall be met. Transverse discontinuities deeper than 0.125 in. (3.18 mm) are unacceptable.

A.7 Packaging and Transportation Requirements for Finished Products

Packaging of steel sucker rods shall conform to the following requirements.

a) Prior to shipment, exposed metallic surfaces shall be protected with an atmospheric type of oil soluble rust preventative which shall not become fluid at a temperature less than 125 °F (52 °C).

b) Overall width of a steel sucker rod package shall be 30 in. ± 1 in. (762 mm ± 25 mm).

c) Maximum distance from edge of support/spacer to end of rod (coupling, if installed) shall be 20 in. (508 mm).

d) Maximum center-to-center distance down the length of the rod for supports and spacers shall be 72 in. (1.83 m).

e) Cross supports, spacers, and blocks shall be of material that is non-abrasive to the rod.

f) Supports shall be provided along the bottom of each bundle and shall be of such thickness as to prevent the rod ends or couplings from resting directly on a flat surface.

g) Spacers shall be provided such that rows of rod bodies do not contact each other during shipment.

h) Rods shall be placed between supports and spacers such that the ends of supports and spacers extend beyond the packaged rods.

i) Packages shall be designed to support the rods and be designed to be lifted and laid down with a handling device, such as a spreader bar and T-hooks without damage to the rods.

j) Unpackaged rods shall always be lifted with a handling device, such as a spreader bar with nylon straps, so designed to support the rods without damage.

k) It is not acceptable to lift the rods and packages using chains, cables, wires or with a forklift when the tine comes into contact with the rod bodies.

l) Trucks and trailers for handling rods and packages shall be provided with blockage, as required for removal of the lifting device, placed directly under the crosswise supports of the package so that the rods themselves shall not be in contact with the blockage. Straps shall not apply stress to rod bodies. A minimum of three tie down straps shall be used and only placed in such positions as to pass over the crosswise supports.

m) When in storage or for transportation, the packages shall be stacked so that the bottom support shall rest squarely on the top support of the lower package.

n) In all handling operations, care shall be exercised to prevent rods or rod ends from contacts which might cause nicks or bends, or injury to the threads by jamming of the thread protectors. Further, the rods shall never be handled in such a manner as to produce a permanent kink or bend. Kinked, bent, or nicked rods are permanently damaged and shall be discarded.

o) Couplings, rod bodies, upsets, and wrench squares shall never be hammered on with metallic tools for any reason. One blow can so damage any part of a rod or coupling as to result in early failure.

A.8 Packaging of Steel Pony Rods

Pony rods shall be packaged according to manufacturer’s requirements such that the rods will not be damaged during shipping.

A.9 Thread Protectors

Thread protectors shall be designed to protect the pin or box thread and contact face from physical damage during normal transportation and handling.

External thread protectors shall be installed on all external threads.

Internal thread protectors shall be installed in the open ends of all couplings installed on sucker rods and pony rods.

Thread protector caps or internal coupling protectors shall be removed in a manner so as to not cause damage to the product.

A.10 Storage for Finished Products

Steel sucker rods and pony rods shall be separated and stored according to grade and size. They shall be stored in such locations and in such a manner as to minimize deterioration from exposure to corrosive environments. They shall be stacked off the ground on racks or sills made of or surfaced with a material not abrasive to the rods.

For packaged rods, a rack or sill shall be provided under each support of the package. The packages shall be stacked so that the supports are in vertical alignment. See A.7 for packaging requirements.

For unpackaged rods, at least four rack or sill supports shall be provided and the end supports shall be located approximately 12 in. (300 mm) from the rod ends. The rod layers shall be separated by non-abrasive spacers placed directly above the rack or sill. The spacers shall be thick enough to prevent the rods from contacting adjacent layers. If the spacers are not notched, the outside rods in each layer shall be chocked to prevent the rods from rolling off the spacers.

Stored rods and pony rods shall be inspected at regular intervals. Any rust shall be removed with a wire brush and a suitable oil-soluble atmospheric corrosion protective coating applied.

A.11 Marking Requirements

A.11.1 Color Coding

Steel sucker rods and pony rods shall be marked according to Table A.7 on at least one end.

Table A.7—Color Marking Requirements

Grade	Color
C	White
K	Blue
D – Carbon steel	Brown
D – Alloy steel	Yellow
D – Special alloy	Orange

A.11.2 Marking

Steel sucker rods and steel pony rods shall be permanently marked. The markings shall be legible and die stamped or forged, or both, at the option of the manufacturer. The maximum depth shall be $^{1}/_{32}$ in. (0.787 mm). The following markings shall be applied to the wrench square on one or both ends. If applied to both ends, the marking on each end shall be complete. Markings shall be applied prior to the heat treatment of rods.

— Manufacturer’s name or mark.

— Nominal size (diameter of rod body) (see Table A.1).

— Grade (see Table A.4).

— The manufacturer’s identification code mark: the identification code shall identify the product with respect to the record of the date of manufacture, grade of steel, heat number, and metallurgical treatment. This record shall be available to the user or purchaser on request for five years from date of manufacture.

— Month of manufacture: the month of manufacture shall be designated by the numerals 01 through 12, chronologically, with January represented as number 01. Alternatively, the numerals 1 through 12 may be used.

— The year of manufacture: the year of manufacture shall be designated by the last two numerals of the year.

EXAMPLE A $^{5}/_{8}$ in. nominal size grade C sucker rod manufactured in February of 2009 shall be marked as follows.

Manufacturer's name or mark	Nominal size	Grade	Identification code	Month	Year
—	5/8	C	—	02	09

Other additional markings are allowed and may be applied as desired by the manufacturer or as requested by the user or purchaser, but shall be applied after the markings specified above.

A.12 Ordering information

Suggestions for ordering steel sucker rods and steel pony rods are as follows:

a) grade,

b) nominal size (body diameter),

c) length,

d) quantity,

e) special packaging requirements, if required.

Annex B
(normative)

Polished Rods and Liners

B.1 Sizes, Threads, and Couplings for Polished Rods

B.1.1 General

Polished rods and liners shall be manufactured and supplied according to the requirements and specifications provided in this specification.

B.1.2 Sizes

Polished rods shall be furnished in the nominal sizes shown in Table B.1.

Polished rod liners shall be furnished in the sizes shown in Table B.2.

B.1.3 Threads

Polished rods shall be furnished with polished rod pin threads on each end, as shown in Figure B.1.

B.1.4 Couplings

Couplings designed for use on polished rods shall conform to the requirements of Annex C for polished rod couplings.

NOTE The use of sucker rod couplings on polished rods can result in split couplings. The lack of matching tapers on sucker rod couplings and polished rod pins will prevent proper makeup.

B.2 Design Requirements

B.2.1 General

The following general requirements shall be followed in the design of polished rods and polished rod liners.

B.2.2 Dimensional Requirements

Polished rods shall be furnished in the sizes, lengths, and configuration shown in Figure B.1 and Table B.1. Threaded ends shall conform to the configuration shown in Figure B.1.

Polished rod liners shall be furnished in the sizes shown in Table B.2. Length and configuration are optional with the manufacturer.

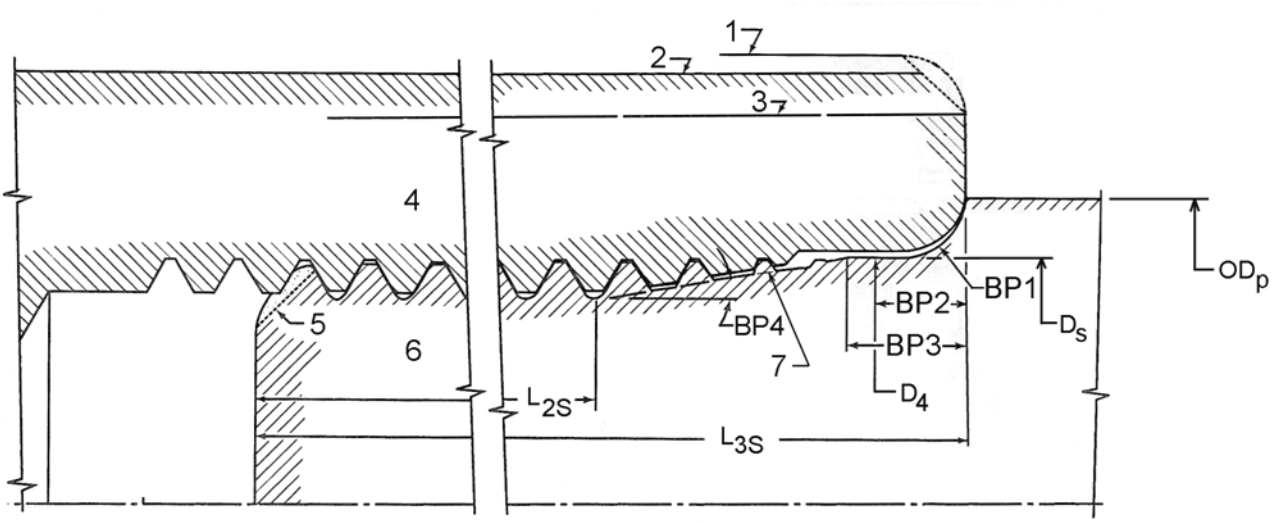
B.2.3 Dimensions and Tolerances for Pin End Threads

Polished rod threads are straight threads with the imperfect pin-threads on the 9° vanish cone (see Figure B.1).

Requirements for polished rod pin and connection dimensions are provided in Table B.3.

Refer to Figure B.1 for polished-rod thread details.

Refer to Table B.4 for thread gauging requirements.



Key

1 OD of 1 in. (25.4 mm) coupling
2 OD of 5/8 in. (15.9 mm), 3/4 in. (19.1 mm), 7/8 in. (22.2 mm), and 1 1/8 in. (28.6 mm) coupling
3 OD of slim hole coupling
4 box
5 shape of chamfer optional with manufacturer
6 pin
7 9 degree vanishing cone

NOTE For dimensional purposes only, not intended to show physical make-up.)

Figure B.1—Polished Rod Connection

Table B.1—General Dimensions and Tolerances for Polished Rod Liners

Nominal size		1 1/8 in.		1 1/4 in.		1 1/2 in.	
		in.	mm	in.	mm	in.	mm
OD_p diameter	Dimension	1.125	28.58	1.25	31.75	1.500	38.10
	Tolerances	+0.005 –0.010	+0.13 –0.25	+0.005 –0.010	+0.13 –0.25	+0.005 –0.010	+0.13 –0.25
Nominal diameter of pin-thread [a]	Dimension (for reference)	0.938	23.83	1.188	30.18	1.375	34.93
		1.063	27.00	—	—	—	—
Note: Sizes of sucker rods with which used [a]	Nominal Dimension (for reference)	5/8	—	7/8	—	1	—
		3/4	—	—	—	—	—
		ft	m	ft	m	ft	m
Standard Lengths [b]	Dimension	8, 11, 16, 22, 26, 30, 36, 40	2.4, 3.4, 4.9, 6.7, 7.9, 9.1, 11.0, 12.2	8, 11, 16, 22, 26, 30, 36, 40	2.4, 3.4, 4.9, 6.7, 7.9, 9.1, 11.0, 12.2	8, 11, 16, 22, 26, 30, 36, 40	2.4, 3.4, 4.9, 6.7, 7.9, 9.1, 11.0, 12.2

[a] There are two choices of thread sizes for 1 1/8 in. polished rod as shown above.

[b] Tolerance on length is ±2.0 in. (50.8 mm).

Table B.2—General Dimensions for Polished Rod Liners

Polished Rod Liner Size, Outside Diameter [a]		Size of Polished Rod With Which Used, For Reference Only	
in.	mm	in.	mm
1.375	34.93	$1\frac{1}{8}$	28.58
1.500	38.10	$1\frac{1}{4}$	31.75
1.750	44.45	$1\frac{1}{2}$	38.10
[a] Tolerance on OD is +0.003 in. / –0.002 in. (+0.08 mm / –0.05 mm).			

The threaded portion of polished rod pins shall be ten threads per inch (four threads per centimeter) and conform to the unified thread form with Class 2A-2B tolerances and allowances, as defined in ANSI/ASME B1.1. The design profile of the pin-thread is type UNR with rounded root contour as shown in Figure A.2. The thread profile of the box thread is type UN having a flat root contour with a permissible round root contour beyond the 0.25 × pitch (0.25 p) flat width to allow for crest wear as shown in Figure A.2. As indicated herein, polished rod threads are straight threads with the imperfect pin threads on the 9° vanish cone (see Figure B.1).

B.2.4 Thread Form

Polished rod thread dimensions shall be per Table B.3.

B.3 Polished Rod Material Requirements

B.3.1 General

Polished rods shall be traceable to the heat of raw material and shall conform to 6.3.

B.3.2 Chemical Composition

The chemical composition of polished rods shall be any composition of AISI recommended series steels that conform to the chemical and mechanical property requirements listed below. The chemical composition and limits shall be detailed in the material specification of the manufacturer.

a) Carbon steel: AISI 1035 – 1050 [7].

b) Stainless steel: AISI 304/316 or 431 [7].

c) Alloy steel:

   1) AISI 4120 – 4140 [7];

   2) AISI 4315 – 4340 [7];

   3) AISI 4615 – 4625 [7];

   4) AISI 8620 – 8630 [7].

Chemical composition of polished rod liners shall be as specified by the manufacturer. Steel polished rod liners shall be sprayed metal coated.

Chemical analysis shall be performed on each mill heat of steel used in the manufacture of polished rods. This analysis shall be performed in accordance with ASTM A751. A material certification is an acceptable means to conform to this requirement.

[7] Or an equivalent international series number steel.

Table B.3—Polished Rod Pin Connection Dimensional Requirements [a]

Nominal size		5/8 in.		3/4 in.		7/8 in.		1 in.		1 1/8 in.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
Maximum pin major diameter	Dimension	0.9362	23.779	1.0611	26.952	1.186	30.127	1.3735	34.887	1.5609	39.647
Minimum pin major diameter	Dimension	0.9233	23.452	1.0482	26.624	1.1732	29.799	1.3606	34.559	1.5480	39.319
Maximum pin pitch diameter	Dimension	0.8712	22.128	0.9962	25.303	1.1211	28.476	1.3085	33.236	1.4960	37.998
Minimum pin pitch diameter	Dimension	0.8654	21.981	0.9900	25.146	1.1150	28.321	1.3020	33.071	1.4892	37.826
Maximum pin minor diameter	Dimension	0.8135	20.663	0.9384	23.835	1.0634	27.010	1.2508	31.770	1.4382	36.530
L_{2S}	Dimension	0.575	14.61	0.825	20.960	0.825	20.960	1.200	30.48	1.450	36.83
Length of perfect polished rod threads[b]	Tolerances	+0.111 –0.000	+2.82 –0.00	+0.111 –0.000	+2.82 –0.00	+0.111 –0.000	+2.82 –0.00	+0.111 –0.000	+2.82 –0.00	+0.111 –0.000	+2.82 –0.00
L_{3S}	Dimension	1.125	28.58	1.375	34.93	1.375	34.93	1.750	44.45	2.000	50.80
Length polished rod pin	Tolerances	+0.061 –0.000	+1.55 –0.00	+0.061 –0.000	+1.55 –0.00	+0.061 –0.000	+1.55 –0.00	+0.061 –0.000	+1.55 –0.00	+0.061 –0.000	+1.55 –0.00
D_S	Dimension	0.9362	23.780	1.0611	26.952	1.1861	30.127	1.3735	34.887	1.5609	39.647
Diameter of polished rod pin shank	Tolerances	+0.0000 –0.0129	+0.000 –0.328	+0.0000 –0.0129	+0.000 –0.328	+0.0000 –0.0129	+0.000 –0.328	+0.0000 –0.0129	+0.000 –0.328	+0.0000 –0.0129	+0.000 –0.328
D_4 Diameter of polished rod pin-and-box cone base (theoretical)	Dimension	0.9430	23.952	1.0680	27.127	1.1930	30.302	1.3805	35.065	1.5680	39.827
$BP1$ Radius	Dimension	0.09375	2.38	0.09375	2.38	0.09375	2.38	0.09375	2.38	0.09375	2.38
$BP2$ Length to D_4	Dimension	0.150	3.81	0.150	3.81	0.150	3.81	0.150	3.81	0.150	3.81
	Tolerances	+0.000 –0.050	+0.00 –1.27	+0.000 –0.050	+0.00 –1.27	+0.000 –0.050	+0.00 –1.27	+0.000 –0.050	+0.00 –1.27	+0.000 –0.050	+0.00 –1.27
$BP3$	Dimension	0.175	4.45	0.175	4.45	0.175	4.45	0.175	4.45	0.175	4.45
Length to 9 ° angle	Tolerances	+0.050 –0.000	+1.27 –0.00	+0.050 –0.000	+1.27 –0.00	+0.050 –0.000	+1.27 –0.00	+0.050 –0.000	+1.27 –0.00	+0.050 –0.000	+1.27 –0.00
$BP4$ 9 ° angle	Dimension	9 °	9 °	9 °	9 °	9 °	9 °	9 °	9 °	9 °	9 °

[a] See Figure A.2 and Figure B.1.

[b] It is not required that dimension L_{2S} be measured separately.

B.3.3 Mechanical Properties for Finished Product

The mechanical properties of polished rods shall conform to the strength values as follows:

a) for carbon steels listed in B.3.2, the ultimate tensile strength shall be in the range of 90,000 psi to 160,000 psi (621 MPa to 1,103 MPa);

b) for alloy steels listed in B.3.2, the ultimate tensile strength shall be in the range of 95,000 psi to 160,000 psi (655 MPa to 1,103 MPa);

c) for stainless steels listed in B.3.2, the minimum ultimate tensile strength shall be 70,000 psi (482 MPa) for 304/316, and 90,000 psi (620 MPa) for 431.

NOTE Ultimate tensile strength of sprayed metal polished rods shall be controlled by process verification or other means specified by the manufacturer.

B.4 Inspection and Testing

B.4.1 Mechanical Property Testing

Mechanical properties tests for polished rods shall be performed in accordance with ASTM A370, ISO 6892 or verified by a material test report (MTR).

B.4.2 Dimensional Inspection

Dimensional inspection of polished rods shall be performed in accordance with Table B.4.

Dimensional inspection of polished rod liners shall be performed in accordance with Table B.2.

B.4.3 Rejected Polished Rods and Polish Rod Liners

Rejected rods and liners may be reworked according to the manufacturer's documented procedure and re-inspected in accordance with B.4.2.

B.4.4 Surface Finish

Surface finish roughness of polished rods and liners shall be checked with a surface finish gauge such as a profilometer or a comparator and shall have a surface finish of 8 μin. to 32 μin. (0.203 μm to 0.813 μm) R_a.

B.5 Sprayed Metal Polished Rod and Liner Requirements

Base metal shall be prepared prior to sprayed metal coating in accordance with the manufacturer’s procedure and specification to assure adequate bonding. Examples of effective surface preparation procedures are specified in SSPC-SP 5/NACE No. 1 or SSPC-SP 11.

The finished outside diameter of sprayed metal polished rods shall conform to Table B.1, except the tolerance on the OD between pin end and start of sprayed metal shall be +0.005 in. / – 0.040 in. (+0.13 mm / – 1.02 mm). The length of the sprayed metal surface shall be determined by the manufacturer. The chemical composition of the coating shall be per Table B.5.

The sprayed metal coating thickness for polished rods shall be 0.008 in. to 0.020 in. (0.20 mm to 0.51 mm) per side, as verified by diameter measurements before and after sprayed metal coating, or by using a commercial thickness tester.

Table B.4—Dimensional Inspection of Polished Rods

Check for	Gauge or Measuring Instrument	Procedure
Threads minimum (under size)	P6, No-go pin-thread ring gauge	The product pin shall not enter the P6 ring gauge more than the third full turn of assembly.
Threads maximum (oversize)	P2, Go pin-thread ring gauge	The product pin shall enter the P2 ring gauge to pin-shoulder face contact.
Pin cones	P4, Ring cone gauge, caliper or gap gauge	The product pin shall enter the P4 ring cone gauge to cone contact. When so engaged, the standoff of the gauge from the pin-shoulder face shall not be less than 0.100 in. (2.54 mm) and not greater than 0.150 in. (3.81 mm).
Pin shank D_S maximum and minimum diameter	Micrometer, caliper or gap gauge	Maximum diameter: Measure to dimension D_S listed in Table B.3 or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall pass over the pin shank. Minimum diameter: Measure to dimension D_S listed in Table B.3 minus the allowable (–) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall not pass over the pin shank.
Pin length maximum and minimum length, L_{3S}	Caliper or gap gauges	Maximum length: Measure to dimension listed in Table B.3 plus the allowable (+) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The pin length shall not be longer. Minimum length: Measure to dimension listed in Table B.3 or set gap gauge to assure product dimension is within the specified tolerance. The pin length shall not be shorter.
Outside diameter maximum and minimum	Micrometer, caliper, or gap gauge	Maximum diameter: Measure to dimension listed in Table B.1 or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall pass over the polished rod diameter. Minimum diameter: Measure to dimension listed in Table B.1 minus the allowable (–) tolerance or set gap gauge to assure the product dimension is within the specified tolerance. The gap gauge shall not pass over the polished rod diameter.

The sprayed metal coating thickness for polished rod liners shall be 0.006 in. to 0.020 in. (0.15 mm to 0.51 mm) per side, as verified by diameter measurements before and after sprayed metal coating, or by using a commercial thickness tester.

Sprayed metal coating hardness shall be 480 HV200 minimum. Sprayed metal polished rods, polished rod liners, or sprayed metal test coupons shall be hardness tested using the Vickers micro hardness procedure with a 200 gm load per ASTM E384 or equivalent Knoop hardness.

Acceptance of hardness testing shall be based on one test coupon (or one production sprayed metal polished rod or polished rod liner) per lot of powder used in the sprayed metal process.

B.6 Packaging

Packaging for polished rods and polished rod liners shall meet the manufacturer's specifications to prevent damage in transit.

B.7 Thread Protectors

Thread protectors shall be designed to protect the threads from physical damage during normal transportation and handling.

External thread protectors shall be installed on all external threads.

Thread protector caps or internal coupling protectors shall be removed in a manner so as to not cause damage to the product.

Table B.5—Sprayed Metal Chemical Composition for Polished Rods and Polished Rod Liners

Elements	Minimum Weight Percent	Maximum Weight Percent
Carbon	0.50	1.00
Silicon	3.50	5.50
Phosphorus	0.00	0.02
Sulfur	0.00	0.02
Chromium	12.00	18.00
Boron	2.50	4.50
Iron	3.00	5.50
Cobalt	0.00	0.10
Titanium	0.00	0.05
Aluminum	0.00	0.05
Zirconium	0.00	0.05
Nickel	Remainder	

B.8 Marking Requirements

B.8.1 Polished Rods

Polished rods shall be permanently marked on one or both ends, within 3 in. (76 mm) of the end, as specified below. Such markings shall be legible. The maximum depth shall be 0.031 in. (0.79 mm). If applied to both ends, the marking on each end shall be complete and legible.

a) Manufacturer's name or mark.

b) Nominal size (outside diameter) (see Table B.1).

c) The manufacturer's identification code mark: the identification code shall identify the product with respect to the record of the date of manufacture, type and grade of material, heat number, and metallurgical treatment if applicable. A record of this information shall be available to the user or purchaser on request for five years from date of manufacture.

d) Month of manufacture: the month of manufacture shall be designated by the numerals 01 through 12, chronologically, with January represented as number 01. Alternately, numerals 1 through 12 may be used.

e) The year of manufacture: the year of manufacture shall be designated by the last two numerals of the year.

EXAMPLE A 1 1/8 in. nominal diameter polished rod manufactured in February of 2009 shall be marked as follows.

Manufacturer's name or mark	Nominal size	Identification code	Month	Year
—	1-1/8	—	02	09

B.8.2 Polished Rod Liners

Polished rod liners shall be permanently marked. Such markings shall be legible.

a) Manufacturer's name or mark.

b) Month of manufacture: the month of manufacture shall be designated by the numerals 01 through 12, chronologically, with January represented as number 01. Alternatively, the numerals 1 through 12 may be used.

c) The year of manufacture: the year of manufacture shall be designated by the last two numerals of the year.

EXAMPLE A polished rod liner manufactured in February of 2009 shall be marked as follows.

Manufacturer's name or mark	Month	Year
—	02	09

B.9 Ordering Information

B.9.1 Polished Rods

Suggestions for ordering polished rods are as follows:

a) size (nominal outside diameter),

b) length,

c) end connections (nominal diameter of pin threads),

d) base material,

e) sprayed metal length if sprayed metal surface is chosen as an option, (length and location of sprayed metal surface),

f) quantity.

B.9.2 Polished Rod Liners

Suggestions for ordering polished rod liners are listed below:

a) size (outside diameter),

b) length,

c) quantity.

Annex C
(normative)

Sucker Rod Couplings, Polished Rod Couplings, and Sub-couplings

C.1 Couplings

C.1.1 General

Sucker rod couplings, polished rod couplings, and sub-couplings shall be manufactured and supplied according to the requirements provided in this specification and are used as connections for sucker rods, sinker bars, pony rods and polished rods, as applicable.

Sucker rod couplings, polished rod couplings, and sub-couplings may be manufactured as Class T (through-hardened) or Class SM (sprayed metal). Unless specified otherwise, the requirements listed below apply to both classes.

C.1.2 Sucker Rod Couplings

Sucker rod couplings have the same box thread size in each end and are used for connecting sucker rods and/or pony rods, and/or sinker bars with sucker rod threads. Dimensions shall conform to Table C.1 and Table C.2, Figure C.1 and Figure C.2, as applicable.

NOTE The use of sucker rod couplings on polished rods will result in the failure of the polished rod pin or coupling.

C.1.3 Polished Rod Couplings

Polished rod couplings have the same box thread size in each end and are used for connecting the polished rod and/or sinker bars with polished rod threads to the sucker rod string. Dimensions shall conform to Table C.1 and Table C.2, and Figure C.1 and Figure C.3 as applicable.

C.1.4 Sub-couplings

Sub-couplings have different sizes of box threads in each end and are used for connecting two sizes of sucker rods or a polished rod to a sucker rod string. External dimensions shall conform to Table C.1. Outside diameter (OD) and other dimensions shall conform to the larger coupling thread in Table C.1. Sub-coupling thread dimensions shall conform to Table C.2 and Figure C.3 as applicable.

Sub-couplings may be used on sucker rods or polished rods.

C.2 Design Requirements

C.2.1 General

The following general requirements shall be followed in the design of sucker rod couplings, polished rod couplings and sub-couplings.

C.2.2 Dimensional Requirements

Sucker rod couplings, polished rod couplings, and sub-couplings shall be furnished in the sizes, lengths, and configuration shown in Figure C.1 and Table C.1.

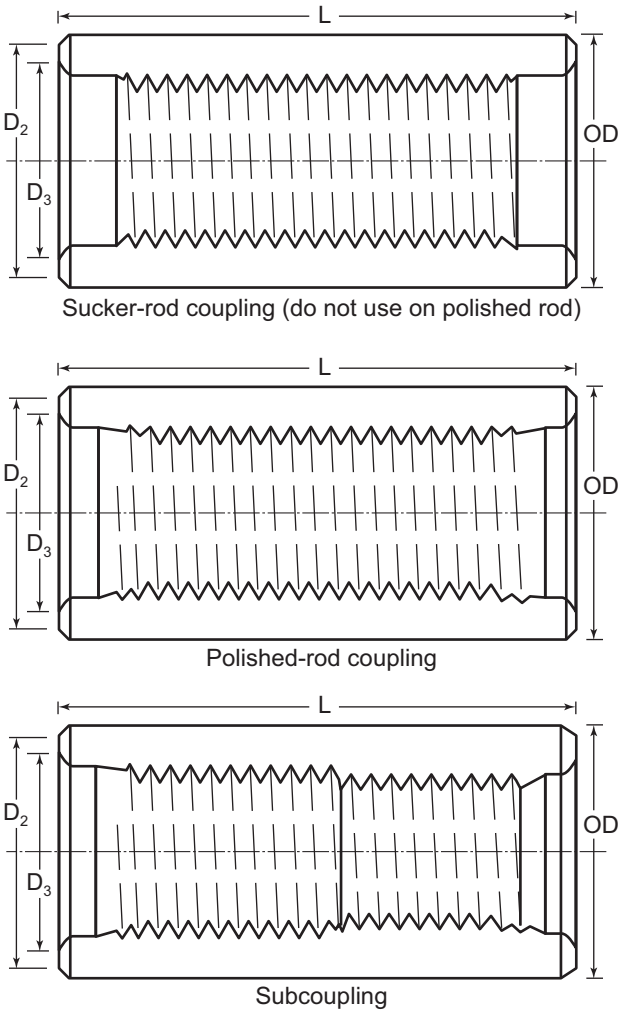


Figure C.1—Sucker Rod Coupling, Polished Rod Coupling, and Sub-Coupling

C.2.3 Specified Dimensions and Tolerances

External dimensions of sucker rod couplings, polished rod couplings, and sub-couplings shall conform to Table C.1.

C.2.4 Thread Form Requirements

Coupling and sub-coupling thread form shall be in accordance with A.2.4.

C.2.5 Pin and Box Requirements

Box connections shall conform to the dimensions of Figure C.2 for sucker rod threads or Figure C.3 for polished rod threads.

Table C.1—External Dimensions and Tolerances for Sucker Rod Couplings, Polished Rod Couplings, and Sub-couplings

Nominal size [a,b]		5/8 in.		3/4 in.		7/8 in.		1 in.		1 1/8 in.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
Full size sucker rod couplings, full size polished rod couplings and full size sub-couplings											
OD [a] Outside diameter	Size	1.500	38.10	1.625	41.28	1.812	46.0	2.187	55.6	2.375	60.33
	Tolerances	+0.005 –0.010	+0.13 –0.250	+0.005 –0.010	+0.13 –0.250	+0.005 –0.010	+0.13 –0.250	+0.005 –0.010	+0.13 –0.250	+0.005 –0.010	+0.13 –0.250
L [a] Length	Size	4.000	101.6	4.000	101.6	4.000	101.6	4.000[f]	101.6	4.500[g]	114.3
	Tolerances	+0.062 –0.000	+1.57 –0.000	+0.062 –0.000	+1.57 –0.000	+0.062 –0.000	+1.57 –0.000	+0.062 –0.000	+1.57 –0.000	+0.062 –0.000	+1.57 –0.000
D_2 [a] minimum	Size	1.365	34.67	1.490	37.85	1.677	42.60	1.990	50.55	2.177	55.30
D_3 [a]	Size	1.110	28.19	1.253	31.83	1.378	35.00	1.566	39.78	1.753	44.53
	Tolerances	+0.015 –0.055	+0.38 –1.39	+0.015 –0.073	+0.38 –1.85	+0.015 –0.073	+0.38 –1.85	+0.015 –0.073	+0.38 –1.85	+0.015 –0.073	+0.38 –1.85
*BC*1 [e] Maximum	Size	0.0625	1.59	0.0625	1.59	0.0625	1.59	0.09375	2.38	0.09375	2.38
Slim hole [c] sucker rod couplings, slim hole polished rod couplings and slim hole sub-couplings											
OD [a] Outside diameter	Size	1.250	31.8	1.500	38.10	1.625	41.3	2.000	50.80		
	Tolerances	+0.005 –0.010	+0.13 –0.250	+0.005 –0.010	+0.13 –0.250	+0.005 –0.010	+0.13 –0.250	+0.005 –0.010	+0.13 –0.250		
L [a] Length	Size	4.000	101.6	4.000	101.6	4.000	101.6	4.000[f]	101.6		
	Tolerances	+0.062 –0.000	+1.57 –0.000	+0.062 –0.000	+1.57 –0.000	+0.062 –0.000	+1.57 –0.000	+0.062 –0.000	+1.57 –0.000		
D_2 [a] minimum	Size	1.177	29.90	1.427	36.25	1.552	39.42	1.927	48.95		
D_3 [a]	Size	1.090	27.69	1.253	31.83	1.378	35.00	1.566	39.78		
	Tolerances	+0.015 –0.035	+0.38 –0.89	+0.015 –0.073	+0.38 –1.85	+0.015 –0.073	+0.38 –1.85	+0.015 –0.073	+0.38 –1.85		
*BC*1 [e] Maximum	Size	0.03125	0.79	0.03125	0.79	0.03125	0.79	0.03125	0.79		

[a] See Figure C.1.

[b] Nominal size of coupling is same as corresponding sucker rod nominal size.

[c] Slim hole is reduced outside diameter coupling.

[d] For sub-couplings and slim-hole sub-couplings, the *OD* and length shall be determined by the largest thread size.

[e] See Figure C.2. Shape optional with manufacturer.

[f] *L* = 4.500 in. (114.3 mm) for 1 in. sub-couplings, full size and slim hole.

[g] *L* = 5.000 in. (127.0 mm) for 1 1/8 in. full size sub-couplings.

Table C.2—Dimensional Requirements for Polished Rod and Sucker Rod Box Connections

Nominal size [a,b]		5/8 in.		3/4 in.		7/8 in.		1 in.		1 1/8 in.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
Diameter of thread	Size	0.938	23.83	1.063	27.00	1.188	30.18	1.375	34.93	1.563	39.70
L_{nb} [c,d] Total depth of box minimum	Dimension	1.750	44.45	1.938	49.23	2.125	53.98	2.500	63.50	2.750	69.85
L_{3n} [c,d] Total length of threads in box including counterbore, min	Dimension	1.410	35.81	1.600	40.64	1.790	45.47	2.000	50.80	2.250	57.15
Minimum box major diameter (basic) [e]	Dimension	0.9380	23.825	1.0630	27.000	1.1880	30.175	1.3754	34.935	1.5630	39.700
Maximum box pitch diameter [e]	Dimension	0.8806	22.367	1.0060	25.552	1.1310	28.727	1.3190	33.503	1.5068	38.273
Minimum box pitch diameter (basic) [e]	Dimension	0.8730	22.174	0.9980	25.349	1.1230	28.524	1.3105	33.287	1.4980	38.049
Maximum box minor diameter [e]	Dimension	0.851	21.62	0.976	24.79	1.101	27.97	1.288	32.72	1.476	37.49
Minimum box minor diameter [e]	Dimension	0.830	21.08	0.955	24.26	1.080	27.43	1.267	32.18	1.455	36.96
BC2 [c] Counterbore depth, sucker rod coupling	Dimension	0.4375	11.113	0.4375	11.113	0.4375	11.113	0.4375	11.113	0.4375	11.113
	Tolerances	+0.0625 –0.0000	+1.588 –0.000	+0.0625 –0.0000	+1.588 –0.000	+0.0625 –0.0000	+1.588 –0.000	+0.0625 –0.0000	+1.588 –0.000	+0.0625 –0.0000	+1.588 –0.000
BC3 [c] Thread chamfer angle	Dimension	30°	30°	30°	30°	30°	30°	30°	30°	30°	30°
BC4 [d] Counterbore depth, polished rod coupling	Dimension	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35
	Tolerances	+0.050 –0.000	+1.27 –0.00	+0.050 –0.000	+1.27 –0.00	+0.050 –0.000	+1.27 –0.00	+0.050 –0.000	+1.27 –0.00	+0.050 –0.000	+1.27 –0.00
D_Q [c,d,f] Diameter of box counterbore	Dimension	0.955	24.26	1.080	27.43	1.205	30.61	1.393	35.38	1.580	40.13
	Tolerances	+0.010 –0.000	+0.25 –0.00	+0.010 –0.000	+0.25 –0.00	+0.010 –0.000	+0.25 –0.00	+0.010 –0.000	+0.25 –0.00	+0.010 –0.000	+0.25 –0.00

[a] The hollow crest of cold-formed threads shall not be considered detrimental.

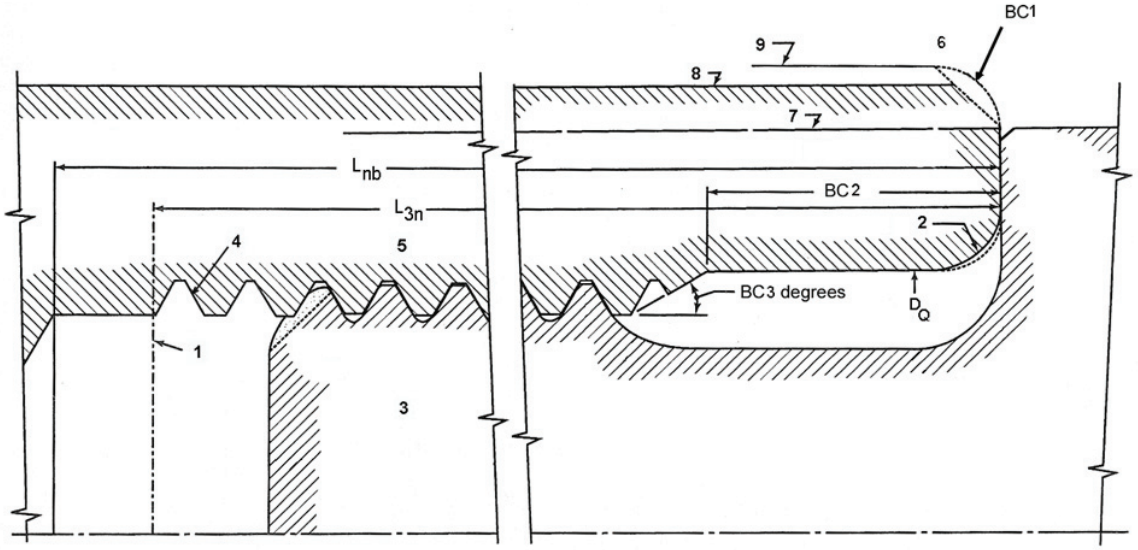
[b] See Table B.3 for polished rod box theoretical cone base dimension D_4.

[c] See Figure C.2.

[d] See Figure C.3.

[e] See Figure A.2.

[f] Tapping marks in the counterbore shall not be reason for rejection.



Key

1 Plane of end of thread in box
2 Shape optional with manufacturer
3 Pin
4 Coupling thread continuous at manufacturer's option
5 Box
6 Shape of coupling chamfer optional with manufacturer
7 OD of slim hole coupling
8 OD of $^5/_8$ in. (15.9 mm), $^3/_4$ in. (19.1 mm), $^7/_8$ in. (22.2 mm), and $1^1/_8$ in. (28.6 mm) coupling
9 OD of 1 in. (25.4 mm) coupling

Figure C.2—Sucker Rod Coupling Illustration

C.3 Steel Coupling and Sub-coupling Material Requirements

C.3.1 General

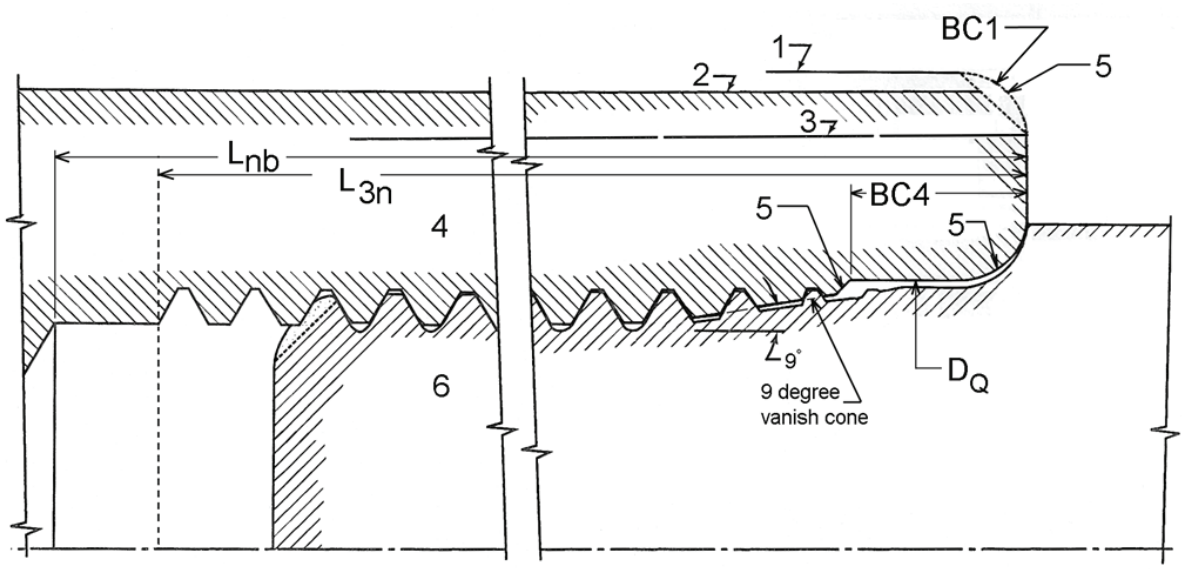
Couplings and sub-couplings shall be traceable to the heat of raw material and shall conform to 6.3.

C.3.2 Chemical Composition

The material shall be per manufacturer's specification and shall have a maximum sulfur content of 0.05 %.

C.3.3 Chemical Analysis

Chemical analysis shall be performed on each mill heat of steel used in the manufacture of couplings or sub-couplings. This analysis shall be performed in accordance with ASTM A751. A material test report (MTR) is an acceptable means to conform to this requirement.



Key

1	OD of 1 in. (25.4 mm) coupling	4	Box
2	OD of $^{5}/_{8}$ in. (15.9 mm), $^{3}/_{4}$ in. (19.1 mm), $^{7}/_{8}$ in. (22.2 mm), and $1^{1}/_{8}$ in. (28.6 mm) coupling	5	Shape optional with manufacturer
3	OD of slim hole coupling	6	Pin

NOTE For dimensional purposes only, not intended to show physical make-up.

Figure C.3—Polished Rod Coupling Illustration

C.3.4 Mechanical Properties

C.3.4.1 General

Mechanical properties shall be in accordance with the manufacturer's specification with a minimum tensile strength of 95,000 psi (655 MPa). One of the following means shall be used to conform to the tensile requirements:

— determination of the metal material hardness of 56 to 62 HRA inclusive; or

— material test report per 6.3.2.2 for the heat of steel from the original mill if further processing does not change mechanical properties; or

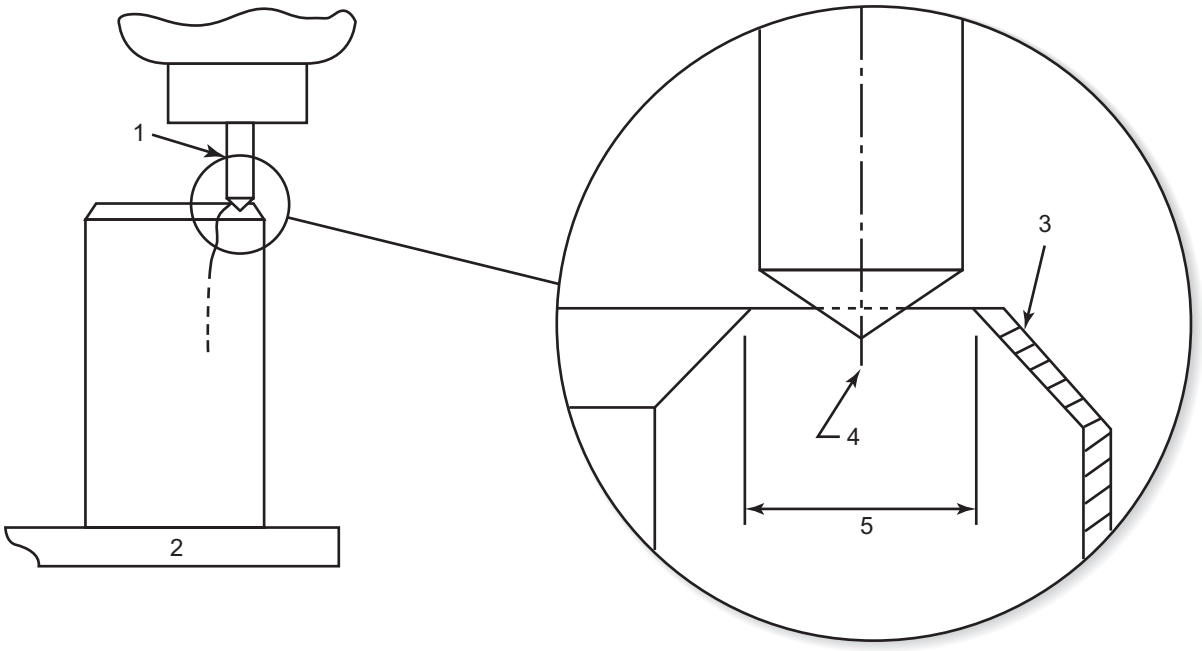
— a tensile test per ASTM A370, OR ISO 6892 with a minimum of two tests performed after final thermal processing.

C.3.4.2 Class T Couplings and Sub-couplings

When hardness testing is elected to verify the tensile properties of couplings and sub-couplings, the tests shall be performed after final thermal processing using the Rockwell A procedure per ISO 6508-1 or ASTM E18 (Figure C.4).

NOTE 1 For the purposes of this requirement, ISO 6508-1 and ASTM E18 are considered equivalent.

NOTE 2 Hardness test indentations are not detrimental if raised metal is carefully dressed-off.



Key

1 hardness tester penetrator
2 anvil or table
3 sprayed metal coating
4 approximate mid-point
5 exposed base metal

Figure C.4—Rockwell A Hardness Determination of Base Metal

C.4 Sprayed Metal Coating Requirements

C.4.1 Chemical Composition

The chemical composition of the coating shall conform to Table C.3.

C.4.2 Mechanical Properties

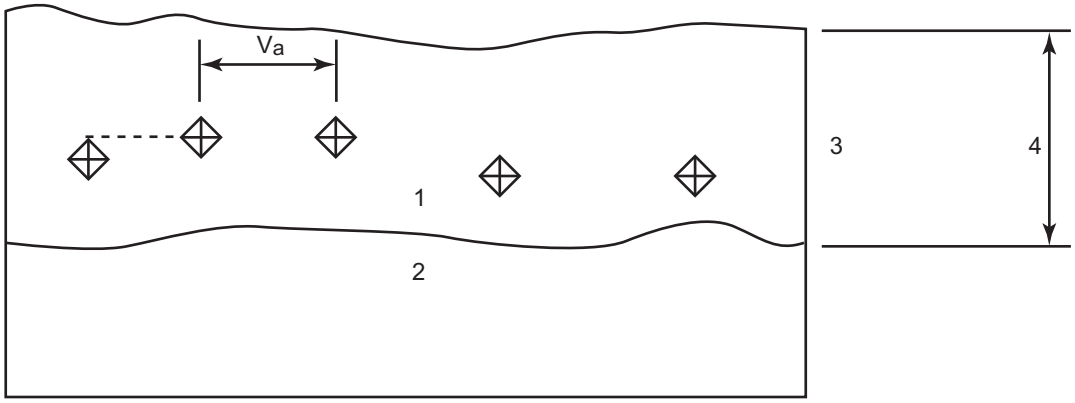
Spray metal coating hardness testing shall be performed on a minimum of one sprayed metal test coupon per lot of coating, or on one coupling or sub-coupling per lot of coating, or on one sprayed metal test coupon per 5,000 products, or on one coupling or sub-coupling per 5,000 products.

Testing shall be by the Vickers micro-hardness procedure with a 200 g load in accordance with ASTM E384 or equivalent Knoop hardness with Va dimension (see Figure C.5) being 0.003 in. to 0.013 in. (0.08 mm to 0.33 mm).

Sprayed metal coating hardness shall be 595 HV_{200} minimum.

C.4.3 Base Metal Preparation

Base metal shall be prepared as specified in SSPC-SP 5/NACE No. 1 prior to sprayed metal coating in accordance with manufacturer's procedure and specification.



Key

1 sprayed metal coating
2 base metal
3 mid-thickness
4 coating thickness
Va measurement between successive indentations during a hardness test

Figure C.5—Vickers Micro-hardness Determination of Spray Metal Coating

Table C.3—Sprayed Metal Coating Chemical Composition

Elements	Minimum Mass (weight) Percent	Maximum Mass (weight) Percent
Carbon	0.50	1.00
Silicon	3.50	5.50
Phosphorus	0.00	0.02
Sulfur	0.00	0.02
Chromium	12.00	18.00
Boron	2.50	4.50
Iron	3.00	5.50
Cobalt	0.00	0.10
Titanium	0.00	0.05
Aluminum	0.00	0.05
Zirconium	0.00	0.05
Nickel	Remainder	

C.4.4 Coating Thickness

Sprayed metal coating thickness shall be 0.010 in. to 0.020 in. (0.25 mm to 0.51 mm) per side and shall cover the outside diameter. Sprayed metal coating shall extend to the outside diameter of the contact face. Finished dimensions shall be as given in Tables C.1 and C.2.

C.5 Coupling and Sub-coupling Surface Finish

C.5.1 General

The surface finish roughness of the outside diameter of Class T couplings shall not be rougher than 125 μin. (3.175 μm) R_a.

The surface finish roughness of the outside diameter of Class SM couplings shall not be rougher than 63 μin. (1.587 μm) R_a. This does not apply to the chamfer or radius on the ends between the outside diameter of the contact face and the outside diameter of the coupling.

The surface finish roughness of the coupling face, pin undercut ends and adjacent radii for Class T or Class SM couplings shall not be rougher than 125 μin. (3.175 μm) R_a.

Pull back in the sprayed metal coating, that is detectable by unaided visual inspection, is unacceptable.

Pinholes in the sprayed metal coating, that are detectable by unaided visual inspection, are unacceptable.

Flaked-off sprayed metal coating is unacceptable.

Micro-cracks in the finished surface of sprayed metal couplings shall not be a cause for rejection.

C.5.2 Anti-galling Treatment

The anti-galling treatment applied to the coupling and sub-coupling threads shall be in accordance with manufacturer's specifications and used on all coupling and sub-coupling threads. It shall reduce the galling tendency during makeup of couplings, sucker rods, pony rods, or polished rods. Its use shall not affect the final acceptable dimensional requirements.

C.6 Dimensional Inspection

C.6.1 General

Dimensional inspection of all sucker rod couplings, polished rod couplings, and sub-couplings shall be performed in accordance with Table C.4.

C.6.2 Thread Alignment

Sucker rod couplings manufactured by boring and threading-through from one end are exempt from thread alignment testing.

Alignment tests on sub-couplings shall be made by screwing the sub-coupling onto a threaded test mandrel which has been accurately centered in a lathe, then screwing onto the other end of the sub-coupling a lathe-turned piece which will provide a measured length of about 1.0 ft (0.31 m). Care shall be taken to make certain that the coupling does not shoulder on either mandrel. A taper of 0.0625 in./ft (5.2 mm/m) on the mandrel thread is recommended. The extent of parallel misalignment shall be determined by the use of a micrometer indicator on the turned piece of the outer end as the assembly is rotated.

Any alternate technologies for testing with verifiable accuracies equal to or better than the above listed methods may be applied with appropriate documentation approved by qualified person(s).

Rejected parts may be reworked and re-inspected in accordance with Table C.1 and Table C.2, as applicable.

Table C.4—Dimensional Inspection of Sucker Rod Couplings, Polished Rod Couplings, and Sub-couplings

Check for	Gauge or Measuring Instrument	Procedure
Threads maximum (oversize)	B6, No-go coupling thread plug gauge	The B6 plug shall not enter the product box threads more than the third full turn of assembly.
Threads minimum (under size)	B2, Go coupling thread plug gauge	The B2 plug gauge shall enter the product box threads to the contact face.
Coupling face parallelism	B2, Go coupling thread plug gauge and a 0.002 in. (0.051 mm) flat feeler gauge	The B2 plug gauge shall enter the product box threads to the contact face. The feeler gauge shall not enter, at any point, between the face of the gauge and the product contact face.
Box cones (polished rod couplings and subcouplings only)	B4, coupling plug cone gauge and a caliper or gap gauges	The B4 plug cone gauge shall enter the product box threads to cone contact. When so engaged, the standoff of the gauge from the box face shall be not less than 0.100 in. (2.54 mm) and not more than 0.150 in. (3.81 mm).
Diameter of box counter bore D_Q and diameter D_3, maximum and minumum diameter	Micrometer, caliper, or gap gauge	Maximum diameter: Measure to applicable dimension D_Q or D_3, Tables C.1 and C.2 plus the allowable (+) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall not pass into the counter bore or if measuring D_3, it shall not pass inside the coupling face. Minimum diameter. Measure to applicable dimension D_Q or D_3, Tables C.1 and C.2 minus the allowable (–) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall pass into the counter bore or if measuring D_3, it shall pass inside the coupling face.
Coupling outside dimension OD maximum and minimum diameter	Micrometer, caliper, or gap gauges	Maximum diameter (coupling OD): Measure to dimension as listed in Table C.1, plus the allowable (+) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall pass over the coupling diameter. Minimum diameter (coupling OD): Measure to dimension as listed in Table C.1, minus the allowable (–) tolerance or set gap gauge to assure product dimension is within the specified tolerance. The gap gauge shall not pass over the coupling diameter.
Minimum diameter D_2	Micrometer, caliper or gap gauge	Minimum diameter: Measure to dimension as listed in Table C.1. The diameter shall be equal to or greater than listed dimension.
Coupling length	Micrometer, caliper, or gap gauge	Minimum length: Measure to dimension listed in Table C.1 or set gap gauge to same dimension. The product length shall not be shorter.

C.7 Coupling Marking

C.7.1 Marking

Couplings shall be permanently marked as follows. Such markings shall be legible. The maximum depth shall be 0.031 in. (.0.79 mm).

a) Manufacturer’s name or mark.

b) Nominal size.

c) Class.

d) Identification code. The code mark shall identify the product with respect to a record of the time of manufacture, grade of steel, heat number, and metallurgical treatment. This record shall be available to the user or purchaser on request for 5 years from date of manufacture.

e) The month of manufacture shall be designated by the numerals 01 through 12, chronologically, with January represented as number 01. Alternately, numerals 1 through 12 may be used.

f) The year of manufacture shall be designated by the last two numerals of the year.

EXAMPLE A Class T 3/4 in. nominal size, through hardened sucker rod coupling manufactured in April, 2009 and a sprayed metal sucker rod coupling manufactured in April, 2009 shall be marked as follows.

	Manufacturer's name or mark	Nominal size	Class	Identification code	Month	Year
Class T coupling	—	3/4	T	—	04	09
Class SM coupling	—	3/4	SM	—	04	09

C.7.2 Polished Rod Couplings and Sub-couplings

In addition to the marking requirements for sucker rod couplings contained herein, polished rod couplings and sub-couplings shall be marked with the letters "PR" in front of the manufacturer's name or mark.

EXAMPLE A 7/8 in. nominal size, class T polished rod coupling and a 3/4 in. × 7/8 in. nominal size sub-coupling manufactured in April, 2009 shall be marked as follows.

	Manufacturer's name or mark	Nominal size	Class	Identification code	Month	Year
Polished Rod Coupling						
PR	—	7/8	T	—	04	09
Sub-coupling						
PR	—	3/4 x 7/8	T	—	04	09

C.8 Ordering Information

Suggestions for ordering couplings and sub-couplings are as follows:

a) class;

b) type;

c) size;

d) quantity.

Annex D
(normative)

Fiber Reinforced Plastic (FRP) Sucker Rods

D.1 General

Fiber reinforced plastic (FRP) sucker rods and FRP pony rods shall be manufactured and supplied according to the requirements and specifications provided in this specification.

D.2 Design Requirements

D.2.1 General

The following general requirements shall be followed in the design of FRP sucker rods and FRP pony rods.

D.2.2 Dimensional Requirements

FRP sucker rods and FRP pony rods shall be furnished in the sizes, lengths, and configuration shown in Figure D.1 and Table D.1.

D.2.3 Specified Dimensions and Tolerances For Pin End Threads

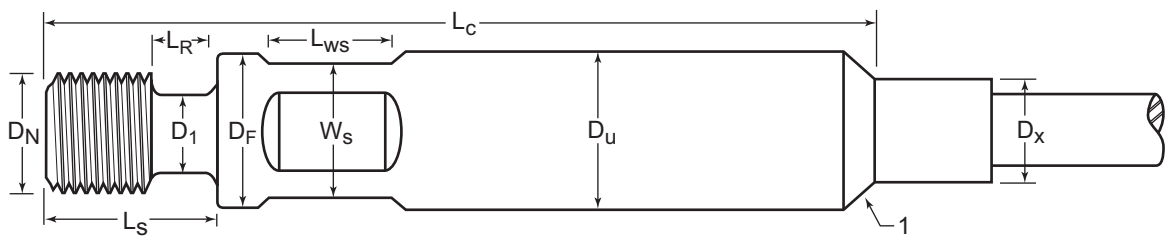
Requirements for dimensions of FRP sucker rod and pony rod pins and connections are provided in Annex A.

D.3 Material Requirements For FRP Sucker Rod and Pony Rods

D.3.1 End Fittings

D.3.1.1 General

The material used to manufacture this product shall be traceable and shall conform to 6.3.



Key

1 shape optional with manufacturer

Figure D.1—General Dimensions for FRP Sucker Rod Pin Ends

Table D.1—General Dimensions and Tolerances for FRP Sucker Rods and Pony Rods

Nominal Size		3/4 in.		3/4 in.		7/8 in.		1 in.		1 1/4 in.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
Rod body	Size	0.750	19.05	0.750	19.05	0.875	22.23	1.000	25.40	1.250	31.75
	Tolerances	±0.025	±0.635	±0.025	±0.635	±0.025	±0.635	±0.025	±0.635	±0.025	±0.635
Rod pin (connection)	Size	5/8	15.88	3/4	19.05	3/4	19.05	7/8	22.23	1	25.40
D_N Diameter of pin thread	Size	1 5/16	23.81	1 1/16	26.99	1 1/16	26.99	1 3/16	30.16	1 3/8	34.93
D_F Outside diameter of pin shoulder	Size	1.250	31.75	1.500	38.10	1.500	38.10	1.625	41.28	2.00	50.80
	Tolerances	+0.005 –0.010	+0.127 –0.254	+0.005 –0.010	+0.127 –0.254	+0.005 –0.010	+0.127 –0.254	+0.005 –0.010	+0.127 –0.254	+0.005 –0.010	+0.127 –0.254
W_S Width of wrench square	Size	1	25.40	1 5/16	33.34	1 5/16	33.34	1 5/16	33.34	1 1/2	38.10
L_{WS} [a] Length of wrench square, minimum	Size	1 1/4	31.75	1 1/4	31.75	1 1/4	31.75	1 1/4	31.75	1 1/4	31.75
D_U (Same as D_F) Diameter of end fitting	Size	D_F	D_F	D_F	D_F	D_F	D_F	D_F	D_F	D_F	D_F
D_1 Diameter of stress relief	Dimension	0.790	20.07	0.915	23.24	1.040	26.42	1.227	31.17	1.414	35.92
	Tolerances	±0.005	±0.127	±0.005	±0.127	±0.005	±0.127	±0.005	±0.127	±0.005	±0.127
L_R Length of stress relief	Dimension	0.516	13.11	0.594	15.09	0.672	17.07	0.797	20.24	0.875	22.23
	Tolerances	+0.031 –0.000	+0.79 –0.00	+0.031 –0.000	+0.79 –0.00	+0.031 –0.000	+0.79 –0.00	+0.031 –0.000	+0.79 –0.00	+0.031 –0.000	+0.79 –0.00
L_S Length of pin	Dimension	1.250	31.75	1.438	36.51	1.625	41.28	1.875	47.63	2.125	53.98
	Tolerances	+0.062 –0.000	+1.57 –0.00	+0.062 –0.000	+1.57 –0.00	+0.062 –0.000	+1.57 –0.00	+0.062 –0.000	+1.57 –0.00	+0.062 –0.000	+1.57 –0.00
L_C Length of end fitting	Size	b	b	b	b	b	b	b	b	b	b
D_X Maximum diameter of extension	Size	c	c	c	c	c	c	c	c	c	c

Length[d] of pin-and-pin sucker rod		Tolerances		Availability [e]				
in.	mm	in.	mm					
296	7,518	±2.00	±50.8	X	X	X	X	X
356	9,042	±2.00	±50.8	X	X	X	X	X
446	11,328	±2.00	±50.8	X	X	X	X	X

Length[d] of pin-and-pin pony rod		Tolerances		Availability [e]				
in.	mm	in.	mm					
32	813	±2.00	±50.8	X	X	X	X	X
68	1,727	±2.00	±50.8	X	X	X	X	X
104	2,642	±2.00	±50.8	X	X	X	X	X
212	5,385	±2.00	±50.8	X	X	X	X	X

[a] Minimum length exclusive of fillet.

[b] Not to exceed 10.0 in. (254.00 mm) exclusive of extension, if used.

[c] The extension is that portion of the rod body or that portion of the end fitting which is immediately adjacent to the smaller end of the elevator taper. If this section of the end fitting is longer than 0.250 in. (6.35 mm) the maximum outside diameter shall not be more than 0.200 in. (5.08 mm) larger than the diameter of the rod body. If this section of the end fitting is 0.250 in. (6.35 mm) or less in length, the outside diameter shall not be more than 0.250 in. (6.35 mm) larger than the diameter of the rod body.

[d] The length of sucker rods and pony rods shall be measured from contact face of pin shoulder to contact face of pin shoulder.

[e] "X" shows common availability by suppliers in lengths listed.

D.3.1.2 Chemical Composition

FRP sucker rod and FRP pony rod end fittings shall conform to one of the chemical compositions and grades as listed in Table A.4 or the following.

a) Grade A: this material shall meet the requirements of NACE MR0175 or ISO 15156 (Parts 1, 2, and 3) with the exclusion of 10.3.1 on sucker rod pumps and sucker rods.

b) Grade B: any chemical composition heat treated to give the specified mechanical properties listed in Table D.2.

The chemical composition and limits shall be detailed in the material specification of the manufacturer.

Chemical analysis shall be performed on each heat of steel used in the manufacture of end fittings. This analysis shall be in accordance with ASTM A751.

A material test report (MTR) as specified in 6.3.2 for the heat of material from the original mill manufacturer is an acceptable means to conform to the chemical analysis requirement.

D.3.1.3 Mechanical Properties

FRP sucker rod end fittings shall conform to the mechanical requirements listed in Table D.2.

Table D.2—FRP Sucker Rod End Fitting Grades and Mechanical Properties

Grade	Minimum Tensile Strength		Maximum Tensile Strength	
	psi	MPa	psi	MPa
A	90,000	621	115,000	793
B	115,000	793	140,000	965
K	90,000	621	115,000	793
C	90,000	621	115,000	793
D	115,000	793	140,000	965

D.3.2 Operating Temperatures

The maximum operating temperature and number of cycles to expected first failure of FRP sucker rods shall be as specified by manufacturer.

D.3.3 Stress Range Diagram

The manufacturer shall develop a basic material stress range diagram for each grade of product.

D.3.4 Ultimate Tensile Rating and Rod Weight

The ultimate tensile rating shall be established for each complete FRP sucker rod assembly by the manufacturer according to documented methods and established acceptance criteria.

The average weight expressed in lb/ft (kg/m) for a full length FRP sucker rod assembly for each grade and size shall be established.

D.4 Inspection and Testing

D.4.1 ASTM Testing

Manufacturers shall perform the following tests and verify conformance to the manufacturer's documented specifications:

a) hardness in accordance with ASTM D2583;

b) ignition loss conforming to ASTM D2584;

c) horizontal shear strength as specified in ASTM D4475.

A minimum of two tests shall be performed on each manufacturing lot; one at the beginning and one at the end of the production run.

D.4.2 Proof Testing

FRP sucker rods shall be proof-tested to 110 % of their maximum working stress. This is to ensure seating of the end fitting and detection of defects in assembly. Each rod shall be inspected for visible evidence (visible pull out of the rod from the end fitting) after this proof test.

D.4.3 Re-testing

Lots failing to meet the test criteria may be reprocessed and considered acceptable if the test criteria are met when the lot is retested.

D.4.4 Inspection

FRP rods shall be checked for component length to ensure dimensional conformance. This addresses the rod socket depth dimension, which is to be inspected. Inspection of socket depth and rod body length will ensure dimensional conformance with respect to overall length.

D.5 Packaging

Spacers shall be provided such that rows of rod bodies do not touch during shipment.

Spacers and supports shall be provided along the bottom of each bundle such that the bundle can be lifted by straps placed at three points along the rod length. The support points shall be located within 1 ft (0.3 m) of center and at points no more than 6 ft (2 m) from each end.

Supports shall be provided along the bottom of each side of the bundle at the support points to prevent lifting straps from coming in contact with the bottom layer of rods.

Sufficient clearance shall be provided for passing lifting straps underneath the bundle at the support points without lifting or prying the bundle.

D.6 Thread Protectors

Thread protectors for FRP rods shall conform to A.9.

D.7 Storage of FRP Rods

FRP rods shall be stored in accordance with A.10 and shall be protected from ultraviolet light according to manufacturer's recommendations.

D.8 Marking Requirements

FRP sucker rods shall be permanently marked on one or both ends as specified below. Such markings shall be legible. The maximum depth shall be 0.031 in. (0.79 mm). The following markings shall be applied to one or both ends. If applied to both ends, the marking on each end shall be complete.

a) Manufacturer’s name or mark.

b) Nominal rod body size and nominal connection size (see Table D.1).

c) Grade of end fitting (see Table D.2).

d) Month of manufacture: the month of manufacture shall be designated by the numerals 01 through 12, chronologically, with January represented as number 01. Alternately, the numerals may be 1 through 12.

e) The year of manufacture: the year of manufacture shall be designated by the last two numerals of the year.

EXAMPLE A $^{7}/_{8}$ in. (22.23 mm) grade A FRP sucker rod with $^{3}/_{4}$ in. (19.05 mm) sucker rod pins manufactured in February of 2009 shall be marked as follows:

Manufacturer’s name or mark	Size	Grade	Month	Year
—	7/8 – 3/4	A	02	09

D.9 Ordering Information

Suggestions for ordering FRP sucker rods and pony rods are as follows:

a) grade of end fittings;

b) nominal rod size (diameter);

c) connection nominal size;

d) length;

e) quantity;

f) packaging requirements.

Annex E
(normative)

Sinker Bars

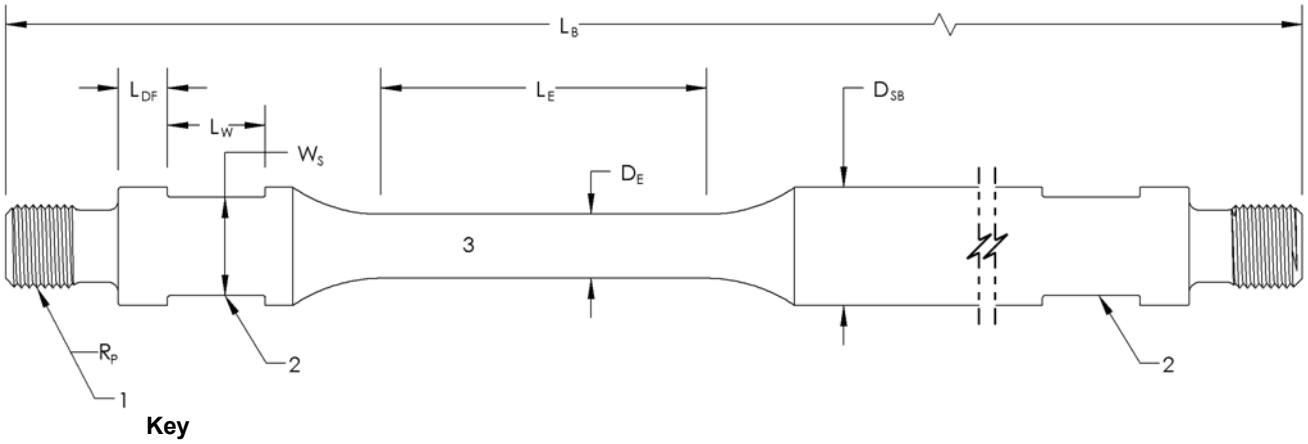
E.1 General

Sinker bars shall be manufactured and supplied according to the requirements and specifications provided in this specification.

E.2 Design Requirements

E.2.1 Dimensional Requirements

Sinker bars shall be furnished in the sizes, lengths, and configuration shown in Figure E.1 and Table E.1, and with pin threads on each end. The pin threads may be either sucker rod pin threads or polished rod pin threads.



Key

1 same thread detail both ends

2 Same flats detail both ends. Shape optional with manufacturer, two wrench flats standard, four flats optional

3 optional elevator neck, one end only

Figure E.1—Sinker Bar Nomenclature

E.2.2 Dimensions and Tolerances for Sinker Bars

Sinker bars with sucker rod threads shall conform to all of the requirements of this specification for sucker rod threads.

Sinker bars with polished rod threads shall conform to all of the requirements of this specification for polished rod threads.

Polished rod couplings or sub-couplings shall be used on sinker bars with polished rod pin threads.

Polished rod couplings or sucker rod couplings may be used on sinker bars with sucker rod pin threads.

NOTE The use of sucker rod couplings on sinker bars with polished rod pins may result in premature failures, primarily as a result of split couplings.

Table E.1—General Dimensions and Tolerances for Sinker Bars (Refer to Figure E.1)

Nominal Size		1 1/4 in.		1 3/8 in.		1 1/2 in.		1 5/8 in.		1 3/4 in.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
With Sucker Rod Threads											
D_{SB} Sinker bar diameter	Size	1.250	31.75	1.375	34.93	1.500	38.10	1.625	41.28	1.750	44.45
	Tolerances	+0.000 –0.030	+0.00 –0.76	+0.000 –0.030	+0.00 –0.76	+0.000 –0.030	+0.00 –0.76	+0.000 –0.030	+0.00 –0.76	+0.000 –0.030	+0.00 –0.76
L_{DF} Pin shoulder to wrench flat, maximum	Size	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05
W_S Width of wrench flat [a] (2 flats std)	Size	1.000	25.40	1.000	25.40	1.3125	33.34	1.3125	33.34	1.500	38.10
	Tolerances	±0.03125	±0.794	±0.03125	±0.794	±0.03125	±0.794	±0.03125	±0.794	±0.03125	±0.794
D_E Elevator neck diameter [b]	Size	0.875	22.23	1.000	25.40	1.000	25.40	1.000	25.40	1.000	25.40
	Tolerances	+0.009 –0.018	+0.23 –0.46	+0.009 –0.018	+0.23 –0.46	+0.009 –0.018	+0.23 –0.46	+0.009 –0.018	+0.23 –0.46	+0.009 –0.018	+0.23 –0.46
L_B Length of sinker bar [c]	Size	240	6,096	240	6,096	240	6,096	240	6,096	240	6,096
		300	7,620	300	7,620	300	7,620	300	7,620	300	7,620
		360	9,144	360	9,144	360	9,144	360	9,144	360	9,144
	Tolerances	±2.000	±50.80	±2.000	±50.80	±2.000	±50.80	±2.000	±50.80	±2.000	±50.80
L_W Length of wrench flat [d] minimum		1.250	31.75	1.250	31.75	1.250	31.75	1.250	31.75	1.25	31.75
R_P Rod pin size (nominal size)		5/8	—	5/8	—	3/4	—	7/8	—	7/8	—
L_E minimum length of elevator neck [b]		4.000	101.60	4.000	101.60	4.000	101.60	4.000	101.60	4.000	101.60
With Polished Rod Threads											
R_P Rod pin size [e] (Nominal size)	Size	3/4	—	3/4	—	7/8	—	—	—	—	—

[a] Four wrench flats optional with manufacturer.

[b] Elevator neck optional with manufacturer.

[c] Length of sinker bars shall be measured from outer end of pin to outer end of pin.

[d] Minimum length exclusive of fillet.

[e] Other sinker bar dimensions for sinker bars with polished rod threads are the same as for sinker bars with sucker rod threads as shown above in this table.

E.3 Sinker Bar Material Requirements

E.3.1 Chemical Composition

Sinker bars shall be manufactured from one of the following grades of material.

— Grade 1—Carbon steel, C, (AISI 10XX series steel or equivalent international series steel).

— Grade 2—Alloy steel, K, (AISI 43XX or 46XX series steel or equivalent international series steel).

— Grade 3—Alloy steel, D, (AISI 41XX or equivalent international series steel).

The chemical composition and limits shall be detailed in the material specification of the manufacturer.

E.3.2 Mechanical Properties

The mechanical properties of sinker bars shall conform to the strength values listed in Table E.2.

Table E.2—Mechanical Strength Properties

Grade	Minimum Tensile Strength	
	psi	MPa
1	90,000	621
2	90,000	621
3	115,000	793

E.3.3 Dimensional Inspection

Sinker bars shall be dimensionally inspected in accordance with Table E.1, A.6 and B.4 as applicable.

Rejected parts may be reworked and re-inspected to verify conformance with Table E.1.

E.4 Packaging

Sinker bars shall be packaged in accordance with the manufacturer's documented procedures.

E.5 Thread Protectors

Thread protectors shall be installed in accordance with A.9.

Thread protectors shall be designed to protect the pin thread and contact face from physical damage during normal transportation and handling.

Thread protectors shall be installed on all external threads.

E.6 Marking Requirements

Sinker bars shall be permanently marked, as specified below, on one or both ends within 5 in. (127 mm) from the pin end. If applied to both ends, the marking on each end shall provide the same information and be complete. Markings shall be legible. Maximum marking depth shall be 0.031 in. (0.79 mm).

a) Manufacturer's name or mark.

b) Grade (see E.3.1).

c) The manufacturer's identification code mark: the identification code shall identify the product with respect to the record of the date of manufacture, grade of steel, heat number, and metallurgical treatment. This record shall be available to the user or purchaser on request for five years from date of manufacture.

d) Month of manufacture: the month of manufacture shall be designated by the numerals 01 through 12, chronologically, with January represented as number 01. Alternately, numerals 1 through 12 may be used.

e) The year of manufacture: the year of manufacture shall be designated by the last two numerals of the year.

EXAMPLE A grade 1 sinker bar manufactured in March of 2009 shall be marked as follows:

Manufacturer's name or mark	Grade	Identification code	Month	Year
—	1	—	03	09

E.7 Color Coding

Sinker bars shall be marked on at least one end according to the following color code.

a) Grade 1 (C)—white.

b) Grade 2 (K)—blue.

c) Grade 3 (D)—yellow.

E.8 Ordering Information

Suggestions for ordering sinker bars are as follows:

a) grade;

b) size (body diameter);

c) nominal pin size;

d) length;

e) quantity.

Annex F
(normative)

Polished Rod Clamps

F.1 General

Polished rod clamps shall be manufactured and supplied according to the requirements and specifications provided in this specification.

F.2 Design Requirements

F.2.1 General

The following requirements shall be followed in the design of polished rod clamps.

F.2.2 Dimensional Requirements

F.2.2.1 General

Polished rod clamps shall be furnished for the polished rod sizes listed in Table B.1.

F.2.2.2 Chemical Composition

To meet the requirements of this specification, polished rod clamps shall be manufactured from any AISI or equivalent specification recommended cast iron or carbon steel as follows.

a) ASTM A536 ductile iron 65-45-12, or equivalent international series number.

b) Carbon Steel: AISI 1015 to 1045 or AISI 1515 to 1545, or equivalent international series number.

F.2.2.3 Mechanical Properties

The allowable hardness range for polished rod clamps is between 190 and 300 HB.

F.2.2.4 Maximum Load Rating

Each polished rod clamp design shall have a stated maximum load rating. The maximum rated load shall be no more than 75 % of the minimum load to initial slippage when a new polished rod clamp which has successfully completed validation testing per F.3 in accordance with this specification.

F.3 Inspection and Testing

F.3.1 Design Validation Test

F.3.1.1 General

The manufacturer shall perform and document a minimum of two tests per polished rod clamp size and design by the method detailed herein to ensure that the polished rod clamp for each size will conform to the published rated loads.

Only new polished rod clamps shall be used in this test. A polished rod whose nominal diameter and surface finish conforms to this specification shall be used. The polished rod clamp shall be installed in accordance with the

manufacturer's instructions on one end of a sample of polished rod of suitable length that meets the rest of the requirements of this specification.

This test is considered non-destructive and any clamp passing this test is considered usable.

Validation test results shall be retained for a minimum of five years after production of that clamp size and design.

F.3.1.2 Validation Test Procedure

The validation test shall be conducted according to the following steps.

a) The polished rod sample shall be suspended by the polished rod clamp from the upper crosshead of a tensile testing machine through a hole in a steel plate. The dimension of the hole shall be the nominal diameter of the polished rod plus 0.125 in. (3.18 mm). The tolerances on the hole diameter shall be + 0.016 / – 0.000 in. (+ 0.41 / – 0.00 mm).

b) The polished rod shall be gripped in the lower crosshead and a load applied and increased until the first slippage of 0.010 in. (0.25 mm) or more occurs between the polished rod and the polished rod clamp. This load shall be recorded.

c) The rate of separation of the crossheads under load shall not exceed 0.500 in. (12.70 mm) per minute or be less than 0.125 in. (3.18 mm) per minute.

d) The minimum slippage load [see b) above] multiplied by 0.75 shall be equal to or greater than the published maximum rated load of the polished rod clamp.

F.3.1.3 Post Test Evaluation

Examination of the surface of the polished rod after the test and removal of the polished rod clamp shall not reveal any indentation or deformation in excess of 0.010 in. (0.25 mm). Failure to conform to this requirement shall constitute a test failure. If a test results in a failure, a successful new validation test is required prior to product production.

F.3.2 Functional Test

F.3.2.1 Performance

The manufacturer shall perform a production test on a clamp. The test procedure as detailed in F.3.1.2 shall be followed with the exception that F.3.1.2 b) be modified such that it is not necessary to load to slippage. The applied load shall be the maximum rated load.

F.3.2.2 Post Test Evaluation

If the clamp slips before reaching this load, production of that clamp shall immediately be stopped and corrective measures applied. A successful retest shall be achieved prior to resuming production of that clamp design.

F.4 Marking Requirements

Each polished rod clamp shall be permanently marked by the manufacturer with the following information.

a) Manufacturer's name or mark.

b) Nominal polished rod size.

c) Maximum rated load.

A tag showing the manufacturer's installation instructions shall be securely attached (such as by wiring) to each polished rod clamp. This tag may be paper, plastic, or metal.

F.5 Ordering information

Suggestions for ordering polished rod clamps are as follows:

a) polished rod size;

b) load rating;

c) quantity.

Annex G
(normative)

Stuffing Boxes

G.1 General

Stuffing boxes shall be designed, manufactured, and supplied according to the requirements and specifications provided in this specification.

G.2 Design Requirements

G.2.1 General

The following requirements shall be followed in the design of stuffing boxes. The stuffing box maximum working pressure shall be supplied by the manufacturer.

G.2.2 Dimensional Requirements

Stuffing boxes shall be furnished for the polished rod sizes listed in Table B.1 and polished rod liners listed in Table B.2.

Nominal thread connection size of stuffing boxes shall be in accordance with the size and type of bottom connection. The bottom connection shall be either upset or non-upset external tubing threads conforming to API 5B.

G.2.3 Chemical Composition

The chemical composition of stuffing boxes shall be any composition of AISI recommended series materials listed below which meet the mechanical property requirements. The chemical composition and limits shall be detailed in the material specification of the manufacturer.

a) ASTM A395 ductile iron, or equivalent international series number.

b) Carbon steel: AISI 1018 to 1045, or an equivalent international series number steel.

c) Alloy steel: AISI 4130 to 4140, or an equivalent international series number steel.

G.2.4 Material Requirements

The minimum material tensile strength shall be 60,000 psi (414 MPa) and the minimum material yield strength shall be 40,000 psi (276 MPa).

G.3 Inspection and Testing

G.3.1 Design Validation Test

Each stuffing box design shall be validated by a hydrostatic test to at least twice the manufacturer’s rated working pressure. The test shall be conducted according to the manufacturer’s written procedures including acceptance criteria. The test results shall be documented.

G.3.2 Thread Inspection

Production stuffing box threads shall be inspected in accordance with the manufacturer’s documented procedures and acceptance criteria.

G.3.3 Radial Displacement Inspection

The maximum radial displacement of the axis of the packing chamber and the bottom thread, measured in a plane perpendicular to the axis, shall not exceed 0.031 in. (0.79 mm).

The maximum angular misalignment shall not exceed 0.179 degrees [0.750 in. (19.05 mm) over a 20.00 ft (6.1 m) projected axis].

G.4 Marking

Each stuffing box body shall be permanently marked by the manufacturer with the following information.

a) Manufacturer's name or mark.

b) Size and type of bottom thread.

c) Maximum working pressure rating.

d) Identification code: The code mark shall identify the product with respect to a record of the time of manufacture, grade of steel, heat number, and metallurgical treatment. This record shall be available to the user or purchaser on request for five years from date of manufacture.

e) Month of manufacture: The month of manufacture shall be designated by the numerals 01 through 12, chronologically, with January represented as number 01, with one or two digits optional. Alternately, numerals 1 through 12 may be used.

f) The year of manufacture shall be designated by the last two numerals of the year.

EXAMPLE A stuffing box body having a $2^{3}/_{8}$ in. (60.33 mm) upset tubing thread as a bottom connection and maximum working pressure of 2,500 psi (17.2 MPa) manufactured in April, 2009 shall be marked as follows.

Manufacturer's name or mark	Nominal size	Pressure rating	Identification code	Month	Year
—	2-3/8 EUE	2500	—	04	09

G.5 Ordering Information

Suggestions for ordering stuffing boxes are as follows:

a) size and type of thread connection;

b) working pressure;

c) quantity.

Annex H
(normative)

Pumping Tees

H.1 General

Pumping tees shall be designed, manufactured, and supplied according to the requirements and specifications provided in this specification.

H.2 Design Requirements

H.2.1 General

The following general requirements shall be followed in the design of pumping tees. The pumping tee maximum working pressure shall be supplied by the manufacturer.

H.2.2 Dimensional Requirements

Nominal size of pumping tees shall be in accordance with the size and type of top, bottom and flow line connections. Top and bottom connections shall be either upset or non-upset internal tubing threads conforming to API 5B. Flow line connections shall be line pipe threads conforming to API 5B. Bleeder outlet shall be 1 in. (25.4 mm) line pipe thread conforming to API 5B.

H.2.3 Chemical Composition

The chemical composition of pumping tees shall be any composition of AISI recommended series materials which meet the chemical and mechanical property requirements listed below. The chemical composition and limits shall be detailed in the material specification of the manufacturer.

a) ASTM A395 ductile iron, or equivalent international series number.

b) Carbon steel: AISI 1018 to 1045, or an equivalent international series number steel.

c) Alloy steel: AISI 4130 to 4140, or an equivalent international series number steel.

H.2.4 Material Mechanical Requirements

The minimum material tensile strength shall be 60,000 psi (414 MPa) and the minimum material yield strength shall be 40,000 psi (276 MPa).

H.3 Inspection and Testing

H.3.1 Design Validation Test

Each pumping tee design shall be validated by a hydrostatic test to at least twice the manufacturer's rated working pressure. The test shall be conducted according to the manufacturer's written procedures including acceptance criteria. The test results shall be documented.

H.3.2 Thread Inspection

Production pumping tee threads shall be inspected in accordance with the manufacturer's documented procedures and acceptance criteria.

H.3.3 Radial and Angular Misalignment Inspections

The maximum radial displacement of axes of pumping tees threads, measured in the plane of the tee face, shall not exceed 0.013 in. (0.33 mm).

The maximum angular misalignment shall not exceed 0.179° [0.750 in. per 20.00 ft (19.05 mm per 6.1 m) of projected axis].

H.4 Marking

Pumping tees shall be permanently marked by the manufacturer with the following information.

a) Manufacturer's name or mark.

b) Size and type of top, bottom and flow line threads.

c) Maximum working pressure rating.

d) Identification code: the code mark shall identify the product with respect to a record of the time of manufacture, grade of steel, heat number, and metallurgical treatment. Documentation of this record shall be available to the user or purchaser on request for five years from date of manufacture.

e) Month of manufacture: the month of manufacture shall be designated by the numerals 01 through 12, chronologically, with January represented as number 01, with one or two digits optional.

f) The year of manufacture shall be designated by the last two numerals of the year.

EXAMPLE A pumping tee having a $2^{3}/_{8}$ in. (60.33 mm) upset tubing thread on top, a $2^{7}/_{8}$ in. (73.03 mm) non-upset tubing thread on bottom, a 2 in. (50.80 mm) line pipe flow line connection, and maximum working pressure of 5,000 psi (34 MPa) manufactured in April 2009, shall be marked as follows.

Manufacturer's name or mark	Size of threads	Maximum pressure, psi	Identification code	Month	Year
—	2-3/8 EUE x 2-7/8 NU x 2 LP	2500	—	04	09

H.5 Ordering Information

Suggestions for ordering pumping tees are as follows:

a) size and type of connections;

b) working pressure;

c) quantity.

Annex I
(normative)

Thread Gauge Specification

I.1 General

Reference master thread gauges shall be used and calibrated according to the requirements and specifications provided in this specification.

This annex applies to all working thread gauges and reference master thread gauges as specified.

NOTE The basis sizes of thread elements of reference master gauges are identical with those of the product. Gauge tolerances encroach on the product tolerance; therefore, it is theoretically possible for one gauge to accept and another to reject a given product thread. For this reason, a product thread passing any certified reference master gauge shall be considered as within the product dimensions, provided such gauge is within the limits specified for used gauges. In case of dispute the owner of gauges in question shall furnish proof regarding compliance.

I.2 Sucker Rod Pin Connections

I.2.1 Go Pin-thread Truncated Setting Plug Gauge, P7—This gauge represents the maximum permissible pitch diameter of the pin thread. It is used 1) in setting the mating ring gauge P8 and the corresponding working ring gauge. 2) in checking the shoulder squareness of the working gauge, and 3) for detecting wear, I.6.

I.2.2 Go Pin-thread Ring Gauges, P8—This gauge mates with the P7 go pin-thread plug gauge. In case of dispute, this gauge may be used in gauging the product pin threads, but such use should be held to a minimum.

I.2.3 No-go Pin-thread truncated Setting Plug Gauge, P5*—This gauge represents the minimum permissible pitch diameter of the pin thread. It is used 1) in setting the mating ring gauge P6 and the corresponding working ring gauge and 2) for detecting wear, see I.6.

I.2.4 No-go Pin-thread Ring Gauge, P6*—This gauge mates with the P5 no-go pin-thread plug gauge. In cases of dispute, this gauge may be used in gauging the product pin threads, but such use should be held to a minimum.

** No-go pin-thread plug and ring gauges, P5 and P6 are used on both sucker rods and polished rods.*

I.3 Box Connections

I.3.1 Go Box-thread Ring Gauge (Checking Ring), B1—This gauge represents the minimum permissible pitch diameter of the box thread. It is used in checking the B2 go box-thread plug gauge and the corresponding working gauge, also in checking the shoulder squareness of the working gauge.

I.3.2 Go Box-thread Plug Gauge, B2—Go box-thread plug gauge B2 is used on polished rod couplings and sub-couplings but does not check the 9° cone. This gauge mates with the B1 go box-thread ring gauge. In cases of dispute, this gauge may be used in gauging the product box threads, but such use should be held to a minimum.

I.3.3 Box-cone Ring Gauge Fitting Ring, B3—Go box-cone plug and ring gauge B3 and B4 are used on polished rod couplings and sub-couplings. Do not use on sucker rod coupling. This represents the basic box cone. It is used as the master in establishing the standoff of the mating B4 plug gauge and the corresponding working plug gauge.

I.3.4 Box-cone Plug Gauge, B4—Go box-cone plug and ring gauge B3 and B4 are used on polished rod couplings and sub-couplings. Do not use on sucker rod coupling. This gauge mates with the B3 box-cone ring gauge. In cases of dispute, it may be used in gauging the product box cone, but such use should be held to a minimum.

I.3.5 No-go Box-thread Ring Gauge (Checking Ring), B5—No-go box-thread ring and plug gauge B5 and B6 are used on sucker rod coupling, polished rod coupling, and sub-coupling. This gauge represents the maximum permissible pitch diameter of the box thread. It is used in checking the mating plug gauge B6 and the corresponding working plug gauge.

I.3.6 No-go Box-thread Plug Gauge, B6—No-go box-thread ring and plug gauge B5 and B6 are used on sucker rod coupling, polished rod coupling, and sub-coupling. This gauge mates with the B5 no-go box-thread ring gauge. In cases of dispute, this gauge may be used in gauging the product box threads, but such use should be held to a minimum.

I.4 Polished Rod Pin Connections

I.4.1 Go Pin-thread Truncated Setting Plug Gauge, P1—This gauge represents the maximum permissible pitch diameter of the pin thread. It is used 1) in setting the mating ring gauge P2 and the corresponding working ring gauge, 2) in checking the shoulder squareness of the working gauge, and 3) for detecting wear, see I.6.

I.4.2 Go Pin-thread Ring Gauge, P2—P2 does not check 9° cone. This gauge mates with the P1 go pin-thread plug gauge. In case of dispute, this gauge may be used in gauging the product pin threads, but such use should be held to a minimum.

I.4.3 Pin-cone Plug Gauge (Fitting Plug), P3—This gauge represents the basic pin cone. It is used as the master in establishing the standoff of the mating P4 pin-cone ring gauge and the corresponding working ring gauge.

I.4.4 Pin-cone Ring Gauge, P4—This gauge mates with the P3 pin-cone plug gauge. In cases of dispute, it may be used in gauging the product pin cone, but such use should be held to a minimum.

I.4.5 No-go Pin-thread Truncated Setting Plug Gauge, P5*—This gauge represents the minimum permissible pitch diameter of the pin thread. It is used in setting the mating ring gauge P6 and the corresponding working ring gauge.

I.4.6 No-go Pin-thread ring Gauge, P6*—This gauge mates with the P5 no-go pin-thread gauge. In cases of dispute, this gauge may be used in gauging the product pin threads, but such use should be held to a minimum.

** No-go pin-thread plug and ring gauges, P5 and P6 are used on both sucker rods and polished rods.*

I.5 Hardening

Reference master gauges shall be hardened within the limits of Rockwell C 60-C 63 or equivalent hardness on a superficial scale. They shall be ground and lapped gauges, and shall conform to the dimensions and tolerances given in Table I.1 to Table I.8 and shall have been certified as required in I.16.

I.5.1 Taper

Pitch diameter taper of setting plug gauges (P1, P5, and P7) and thread plug gauges (B2 and B6) shall not exceed 0.00015 in. (0.0038 mm) over the length L_{TS}. The permissible taper shall be back taper (larger diameter at entering end) and shall be confined within the pitch diameter limits.

I.5.2 Precision Centers

Go plug gauges (P1, P7, and B2) and cone plug gauges (P3 and B4) shall have precision centers to permit measurement of runout of shoulder face and eccentricity of cone.

I.5.3 Construction

Cone ring gauges used on polished rods only shall be of the solid type (non-adjustable). Go and no-go ring gauges may be either solid or adjustable.

I.6 Shake Test

Go and no-go ring gauges shall be set with all ring gauge threads fully engaged with their mating set plugs.

The shake test shall be performed on the truncated portion of the set plug, with the ring gauge backed off two turns from any engagement with the full form portion of the set plug. For acceptance there shall be no perceptible shake. (Shake is perceptible movement of the gauge when rocked back and forth after engaging per this procedure.) This test for shake shall be made on the truncated portion of full and truncated setting plugs. An adjustable ring gauge may be set initially on either the full form or the truncated portion of the setting plug. When screwed onto the other portion of the setting plug there shall be only a slight change in fit if any. If there is perceptible shake or play in the looser fit, the ring gauge should be reconditioned to bring the gauge into tolerance.

I.7 Root Form

The minor diameter of thread plug gauges and setting plug gauges shall be cleared beyond a P/8 width of flat, either by an extrusion of the sides of the thread toward a sharp V or by an undercut to any dimension no wider than the width resulting from P/8 maximum width either side of centerline of the thread space.

The major diameter of go thread ring gauges shall be cleared by a clearance cut of substantially P/8 width and approximately central.

The root form of the go and no-go thread ring gauges shall be of sufficient depth to clear the maximum major diameter of the full form setting plug after the gauge has been properly set.

The major diameter of no-go thread ring gauges shall be cleared by a clearance cut of substantially P/4 width and approximately central.

I.8 Blunt Start

The partial threads of both ends of all gauges and the junction of the full and truncated portions of setting plugs shall be removed to a blunt start except at the entering end of P4 and B3 ring gauges and the counterbored end of P2, P8, and B1 ring gauges where a blunt start would be undesirable or impractical. Figure I.1, Figure I.2, Figure I.4, and Figure I.5 illustrate deviations from the blunt start.

I.9 Helix Angle

The helix angle correction shall be disregarded in all pitch diameter determinations.

I.10 Gauge Marking (by Manufacturer)

Certified reference master gauges shall be permanently marked by the gauge manufacturer with the markings given below. Plug gauges should preferably be marked on the body, although marking on the handle is acceptable on gauges in small sizes or when the handle is integral with the body. Any markings which are considered necessary by the gauge maker may be added. Unless otherwise stated, both plug and ring shall be marked as follows:

a) the gauge registration number;

b) the gauge symbol as given in I.2;

c) the nominal size of the rod;

d) the word 2A-PIN or 2B-BOX, as applicable;

e) the word GO or NO-GO or CONE as applicable;

f) the gauge manufacturer's name or identifying mark.

EXAMPLE A master go pin-thread plug gauge, for 3/4 in. sucker rod should be marked as follows:

Gauge registration number P7-3/4 2A-PIN-GO Mfrs. name or identifying mark

I.11 Certification Testing

All new and reconditioned reference master gauges shall be submitted for testing to one of the certifying agencies listed in I.16, within a period of two years, if an outside agency indicates on the test certificate that the gauges are approaching the specified limits of permissible wear.

I.12 Reinspection Line

Gauges submitted to a certifying or outside agency for retest shall be certified as satisfactory for continued use if they conform to the following requirements:

a) The pitch diameter of go and no-go plug gauges (P7, P5, B2, B6, and P1) shall be within the tolerance limits as specified in Table I.1, Table I.2, Table I.3, Table I.5, and Table I.6.

b) The minor diameter of go and no-go ring gauges (P8, P6, B1, B5, and P2) shall be within the tolerance limits as specified in Table I.1, Table I.2, Table I.3, Table I.5, and Table I.6.

c) The axial variation of shoulder face of go thread plug and ring gauges (P1, P2, P7, P8, B1, and B2) shall be within the limits shown in Table I.9.

d) Cone plug and ring gauges (P3, P4, B3, and B4) shall be checked for mating step value, which shall not vary by more than 0.0015 in. (0.038 mm) from the original value.

NOTE This is equivalent to a decrease in cone base diameter of 0.00047 in. (0.0019 mm) on plug, or to an increase of 0.00047 in. (0.119 mm) on ring, or to a combined change of 0.00047 in. (0.0119 mm).

e) The fit of go and no-go thread gauges on their mating gauges shall conform to the requirements specified in I.6.

I.13 Maintenance

Maintenance of gauges is the responsibility of the gauge owner, and gauges reported by the certifying or outside agency as in non-conformance with requirements should be promptly reconditioned or replaced, and resubmitted for test.

I.14 Gauges

I.14.1 Go Pin-thread Gauges

Go pin-thread gauges shall conform to the dimensions in Table I.1.

The P7 and P8 gauges are for undercut pins and were first required in the 14th Edition (1962).

Table I.1—P7 Go Pin-thread Truncated Setting Plug Gauge
P8 Go Pin-thread Ring Gauge
(For Gauging Sucker Rod Pin Connections)

Nominal Size of Rod [a, b, c]		5/8 in.	3/4 in.	7/8 in.	1 in.	1 1/8 in.
P7 [d]	Truncated major diameter, $GDP7_A$ +0.000/ –0.0006 (+0.000/–0.015)	0.9216 (23.409)	1.0465 (26.581)	1.1715 (29.756)	1.3589 (34.516)	1.5463 (39.276)
	Full form major diameter, $GDP7_B$ +0.0006/ –0.000 (+0.015/ –0.00)	0.9362 (23.779)	1.0611 (26.952)	1.1861 (30.127)	1.3735 (34.887)	1.5609 (39.647)
	Pitch diameter, $GDP7_C$ +0.000/ –0.0002 (+0.00/–0.005)	0.8712 (22.128)	0.9962 (25.303)	1.1211 (28.476)	1.3085 (33.236)	1.4960 (37.998)[e]
	Length thread, $GLP7_A$ ±0.015 (±0.38)	1.968 (49.99)	2.188 (55.58)	2.406 (61.11)	2.656 (67.46)	3.000 (76.20)
	Length truncated portion, $GLP7_B$ (1/2 of L_{TS}) ±0.015 (±0.38)	0.984 (24.99)	1.094 (27.79)	1.203 (30.56)	1.328 (33.73)	1.500 (38.10)
	Face angle, $GAP7_A$	90 °	90 °	90 °	90 °	90 °
	Diameter thread relief, $GDP7_D$ [f] + 0.0000/– 0.001 (+ 0.000/–0.025)	0.765 (19.43)	0.890 (22.61)	1.015 (25.78)	1.203 (30.56)	1.390 (35.31)
	Length of plug, $GLP7_C$ ±0.015 (±0.38)	2.284 (58.01)	2.582 (65.58)	2.878 (73.10)	3.253 (82.63)	3.675 (93.35)
	Diameter of plug or ring collar, $GDP7_E$ +0.000/ –0.010 (+0.00/ –0.25)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
P8 [d]	Diameter of plug or ring collar, $GDP8_A$ +0.000/ –0.010 (+0.00/ –0.25)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
	Minor diameter, $GDP8_B$ +0.000/ –0.0006 (+0.00/ –0.015)	0.8279 (21.029)	0.9529 (24.204)	1.0778 (27.376)	1.2652 (32.136)	1.4527 (36.899)
	Countersink length range, $GLP8_A$	0.09/0.10 (2.29/2.54)	0.09/0.10 (2.29/2.54)	0.09/0.10 (2.29/2.54)	0.09/0.10 (2.29/2.54)	0.09/0.10 (2.29/2.54)
	Countersink angle, $GAP8_A$	45°	45°	45°	45°	45°
	Diameter of counterbore, $GDP8_C$ +0.005/ 0.000 (+0.13/ 0.00)	0.955 (24.26)	1.080 (27.43)	1.205 (30.61)	1.393 (35.38)	1.580 (40.13)
	Length of ring, $GLP8_B$ +0.000/ –0.020 (+0.00/ –0.51)	1.250 (31.75)	1.438 (36.53)	1.625 (41.28)	1.875 (47.63)	2.125 (53.98)
	Length of counterbore, $GLP8_C$ ±0.015 (±0.38)	0.316 (8.03)	0.394 (10.01)	0.472 (11.99)	0.597 (15.16)	0.675 (17.15)

[a] All dimensions in inches (mm) at 68 °F (20 °C).

[b] See Figure I.1.

[c] All sizes, 10 threads per in. (25.40 mm). Class 2A2B.

[d] The P7 and P8 gauges are for undercut pins.

[e] Tolerances on $GDP7_C$ for 1 1/8 in. plug gauge are +0.0000/ –0.00025 in. (+0.000/ –0.0064 mm).

[f] This dimension defined by: $GDPB_B$ – 0.0625 in.

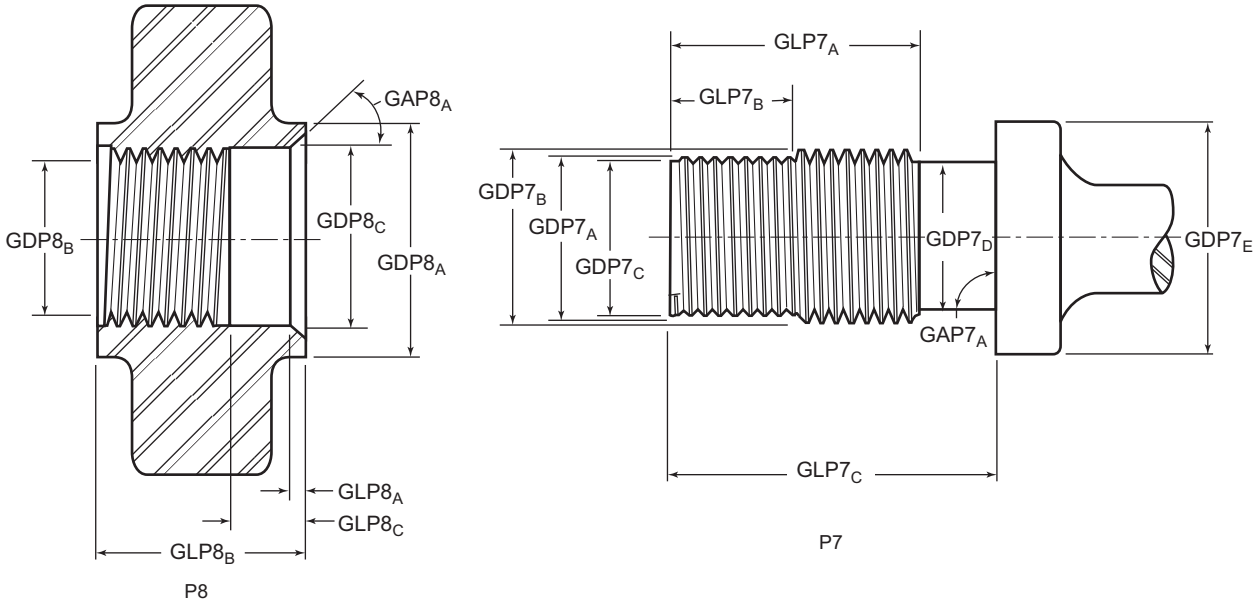


Figure I.1—Go Pin-thread Gauges (For Gauging Sucker Rod Pin Connections)

I.14.2 No-go Pin-thread Gauges

No-go pin-thread gauges shall conform to the dimensions in Table I.2. P5 and P6 gauges made to 2A and 2B tolerances under API 11B, 13th Edition, may be used. P5 and P6 gauges made under the 12th and prior editions of API 11B (not conforming to 2A and 2B tolerances) may not be used.

Table I.2—P5 No-go Pin-thread Truncated Setting Plug Gauge, P6 No-go Pin-thread Ring Gauge
(For Gauging Sucker Rod and Polished Rod Pin Connections)

	Nominal Size of Rod [a, b, c]	5/8 in.	3/4 in.	7/8 in.	1 in.	1 1/8 in.
P5	Truncated major diameter, $GDP5_A$ +0.000/ –0.0006 (+0.000/ –0.015)	0.9087 (23.081)	1.0333 (26.246)	1.1583 (29.421)	1.3453 (34.171)	1.5325 (38.926)
	Full form major diameter, $GDP5_B$ +0.0006/ –0.000 (+0.015/ –0.00)	0.9362 (23.779)	1.0611 (26.952)	1.1861 (30.127)	1.3735 (34.887)	1.5609 (39.647)
	Pitch diameter, $GDP5_C$ +0.0002/ –0.000 (+0.005/ –0.00)	0.8654 (21.981)	0.9900 (25.146)	1.1150 (28.321)	1.3020 (33.071)	1.4892 (37.826)[d]
	Length of thread, $GLP5_A$ ±0.015 (±0.38)	1.500 (38.10)	1.500 (38.10)	1.625 (41.28)	1.625 (41.28)	1.875 (47.63)
	Length of thread, $GLP5_B$ ±0.015 (±0.38)	0.750 (19.05)	0.750 (19.05)	0.8125 (20.64)	0.8125 (20.64)	0.9375 (23.81)
P6	Length of ring, $GLP6_A$ ±0.015 (±0.38)	0.688 (17.48)	0.688 (17.48)	0.750 (19.05)	0.750 (19.05)	0.812 (20.62)
	Minor diameter ring, $GDP6_A$ +0.0006/ –0.000 (+0.015/ –0.00)	0.8437 (21.430)	0.9683 (24.595)	1.0933 (27.770)	1.2803 (32.520)	1.4675 (37.275)

[a] All dimensions in inches (mm) at 68 °F (20 °C).

[b] See Figure I.2.

[c] All sizes, 10 threads per in. (25.40 mm). Class 2A and 2B.

[d] Tolerance on $GDP5_C$ for 1 1/8 in. (28.58 mm) plug gauge are +0.00025 in./ –0.0000 in. (+0.0064 mm/ –0.00000 mm).

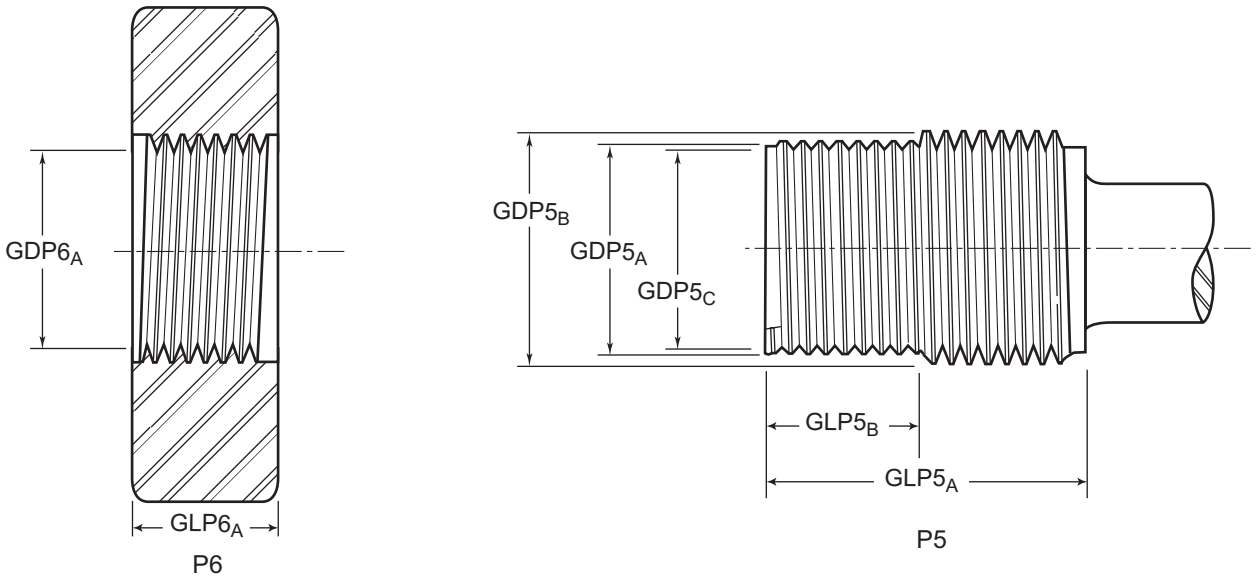


Figure I.2—No-go Pin-thread Gauges (For Gauging Sucker Rod and Polished Rod Pin Connections)

I.14.3 Go Box-thread Gauges

Go box-thread gauges shall conform to the dimensions in Table I.3. B1 and B2 gauges made under the 13th and prior editions of API 11B shall not be used, except on polished rod connections.

Table I.3—B1 Go Box-thread Ring Gauge (Checking Ring), B2 Go Box-thread Plug Gauge

(For Gauging Sucker Rod, Polished Rod, and Sub-coupling Box Connections)

	Nominal Size of Rod [a,b,c]	5/8 in.	3/4 in.	7/8 in.	1 in.	1 1/8 in.
B2 [d,e]	Major diameter, $GDB2_A$ +0.0006/ –0.0000 (+0.015/ –0.000)	0.9380 (23.825)	1.0630 (27.000)	1.1880 (30.175)	1.3754 (34.935)	1.5630 (39.700)
	Pitch diameter, $GDB2_B$ +0.0002/ –0.0000 (+0.005/ –0.000)	0.8730 (22.174)	0.9980 (25.349)	1.1230 (28.524)	1.3105 (33.287)	1.4980 (38.049)[f]
	Diameter thread relief, $GDB2_C$ [g] +0.0000/ –0.001 (+0.000/ –0.025)	0.778 (19.76)	0.903 (22.94)	1.028 (26.11)	1.216 (30.89)	1.403 (35.64)
	Face angle, $GAB2_A$	90°	90°	90°	90°	90°
	Length thread, $GLB2_A$ ±0.015 (±0.38)	1.011 (25.68)	1.200 (30.48)	1.386 (35.20)	1.636 (41.55)	1.886 (47.90)
	Length of plug or ring, $GLB2_B$ ±0.015 (±0.38)	1.311 (33.30)	1.500 (38.10)	1.686 (42.82)	1.936 (49.17)	2.186 (55.52)
	Diameter of plug or ring collar, $GDB2_D$ +0.000/ –0.010 (+0.000/ –0.25)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
B1 [e]	Diameter of plug or ring collar, $GDB1_A$ +0.000/ –0.010 (+0.000/ –0.25)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
	Length of plug or ring, $GLB1_A$ ±0.015 (±0.38)	1.311 (33.30)	1.500 (38.10)	1.686 (42.82)	1.936 (49.17)	2.186 (55.52)
	Length of counterbore, $GLB1_B$ ±0.010 (±0.25)	0.300 (7.62)	0.300 (7.62)	0.300 (7.62)	0.300 (7.62)	0.300 (7.62)
	Minor diameter, $GDB1_B$ +0.001/ –0.000 (+0.03/ –0.00)	0.840 (21.34)	0.965 (24.51)	1.090 (27.69)	1.278 (32.46)	1.465 (37.21)
	Diameter of counterbore, $GDB1_C$ +0.005/ –0.000 (+0.13/ –0.00)	1.128 (28.65)	1.253 (31.83)	1.378 (35.00)	1.566 (39.78)	1.753 (44.53)

[a] All dimensions in inches (mm) at 68 °F (20 °C).

[b] See Figure I.3.

[c] All sizes, 10 threads per in. (25.40 mm). Class 2A and 2B.

[d] B2 does not check 9 ° cone.

[e] B1 and B2 gauges are for box connections used with undercut pins.

[f] Tolerance on $GDB2_B$ for 1 1/8 in.(28.58 mm) plug gauge is +0.00025 in/ –0.0000 in (+0.0064 mm/ –0.00000 mm).

[g] $GDB2_C$ is defined by the equation: $GDB1_B$ – 0.0625 in.

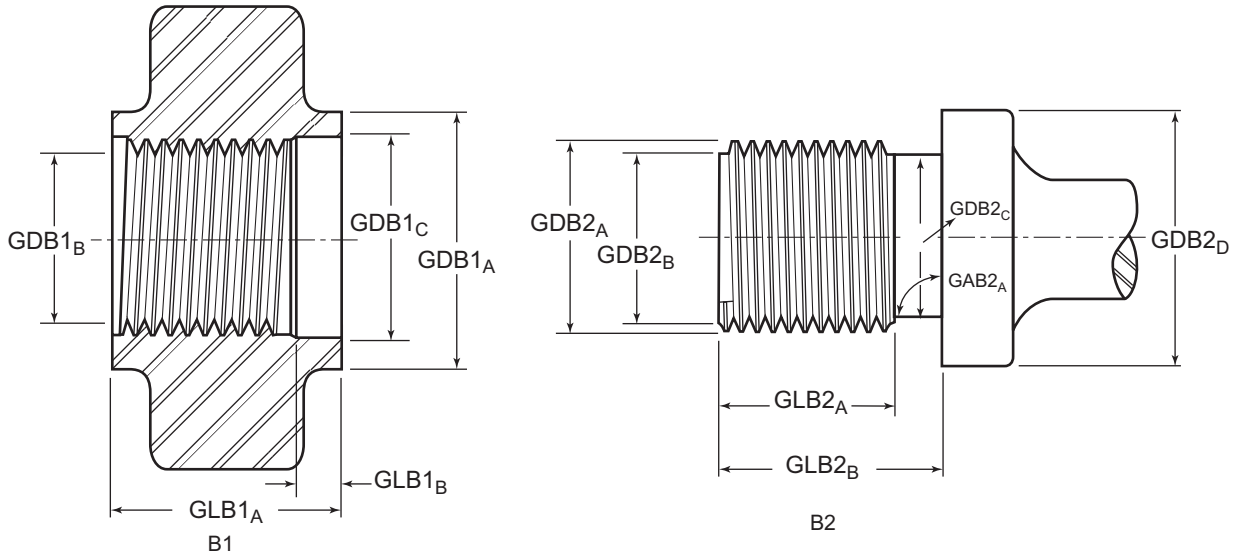


Figure I.3—Go Box-Thread Gauges (For Gauging Box Connections)

I.14.4 Box-cone Ring and Plug Gauges

Box-cone ring and plug gauges shall conform to the dimensions in Table I.4. B3 and B4 gauges made under any edition of API 11B may be used.

Table I.4—B3 Box-cone Ring Gauge (Fitting Ring), B4 Box-cone Plug Gauge
(For gauging polished rod and sub-coupling box connections.)

	Nominal Size of Rod [a, b, c]	5/8 in.	3/4 in.	7/8 in.	1 in.	1 1/8 in.
B4 [d]	Major diameter, $GDB4_A$ +0.0006/–0.000 (+0.015/ –0.00)	0.9233 (23.452)	1.0482 (26.624)	1.1732 (29.799)	1.3606 (34.559)	1.5480 (39.319)
	Pitch diameter, $GDB4_B$ +0.0005/–0.000 (+0.013/ –0.00)	0.8654 (21.981)	0.9900 (25.146)	1.1150 (28.321)	1.3020 (33.071)	1.4892 (37.826)
	Thread relief, $GLB4_A$ ±0.010 (±0.25)	0.150 (3.81)	0.150 (3.81)	0.150 (3.81)	0.150 (3.81)	0.150 (3.81)
	Cone angle, $GAB4_A$ +10’ / –0.0’	9°	9°	9°	9°	9°
	Face angle, $GAB4_B$ ±5’	90°	90°	90°	90°	90°
	Relief diameter, $GDB4_C$ [e] +0.00/–0.001 (+0.00/ –0.025)	0.760 (19.30)	0.885 (22.48)	1.010 (25.65)	1.197 (30.40)	1.384 (35.15)
	Land length, $GLB4_B$ ±0.010 (±0.25)	0.325 (8.26)	0.325 (8.26)	0.325 (8.26)	0.325 (8.26)	0.325 (8.26)
	Length thread, $GLB4_C$ ±0.015 (±0.38)	0.63 (16.00)	0.88 (22.35)	0.88 (22.35)	1.26 (32.00)	1.51 (38.35)
	Diameter of plug or ring collar, $GDB4_D$ +0.000/ –0.010 (+0.00/ –0.25)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
	Diameter plug cone, $GDB4_E$ +0.000/ –0.0002 (+0.00/ –0.005)	0.9430 (23.952)	1.0680 (27.127)	1.1930 (30.302)	1.3805 (35.065)	1.5680 (39.827)
	Length of plug or ring, $GLB4_D$ ±0.015 (±0.38)	1.03 (26.2)	1.28 (32.5)	1.28 (32.5)	1.66 (42.2)	1.91 (48.5)
B3 [d]	Length of plug or ring, $GLB3_A$ ±0.015 (±0.38)	1.03 (26.2)	1.28 (32.5)	1.28 (32.5)	1.66 (42.2)	1.91 (48.5)
	Diameter of ring cone, $GDB3_A$ [d]	See note d	See note d	See note d	See note d	See note d
	Diameter of plug or ring collar, $GDB3_B$ +0.000/ –0.010 (+0.00/ –0.25)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
	Angle, $GAB3_A$ +0/ –10’	9 °	9 °	9 °	9 °	9 °
	Minor diameter, $GDB3_C$ +0.000/ –0.001 (+0.00/ –0.03)	0.822 (20.88)	0.947 (24.05)	1.072 (27.23)	1.259 (31.98)	1.446 (36.73)

[a] All dimensions in inches (mm) at 68 °F (20 °C).

[b] See Figure I.4.

[c] All sizes, 10 threads per in. (25.40 mm). Class 2A and 2B.

[d] Diameter of ring cone (dimension $GDB3_A$)shall be such as to provide a standoff of 0.325 in. ±0.0015 in. (8.26 mm ±0.038 mm).

[e] $GDB4_C$ is defined by the equation: $GDB3_C$ – 0.0625 in.

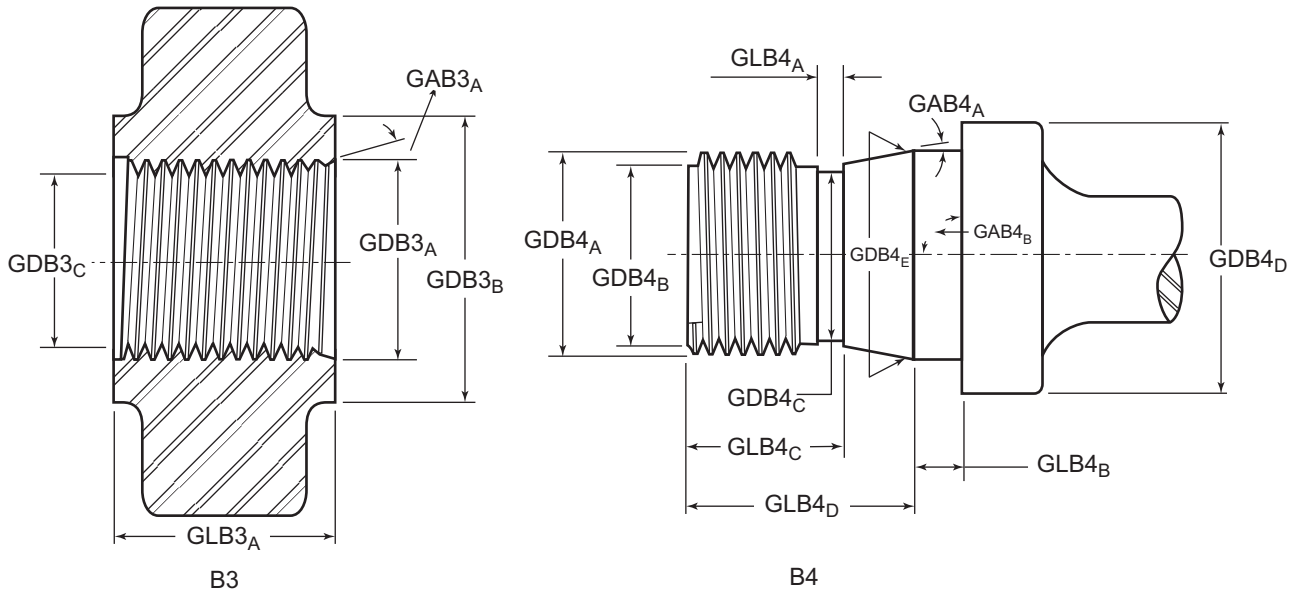


Figure I.4—Box-cone Gauges (For Gauging Box Connections)

I.14.5 No-go Box-thread Ring and Plug Gauges

No-go box-thread ring and plug gauges shall conform to the dimensions in Table I.5. B5 and B6 gauges made to 2A and 2B tolerances under API 11B, 13th edition may be used. B5 and B6 gauges made under the 12th and prior editions of API 11B (not conforming to 2A and 2B tolerances) may not be used.

Table I.5—B5 No-go Box-thread Ring Gauge (Checking Ring), B6 No-go Box-thread Plug Gauge
(For gauging sucker rod, polished rod, and sub-coupling box connections)

Nominal Size of Rod [a, b, c]		5/8 in.	3/4 in.	7/8 in.	1 in.	1 1/8 in.
B6	Major diameter, $GDB6_A$ +0.0000/ –0.0006 (+0.000/ –0.015)	0.9239 (23.467)	1.0493 (26.652)	1.1743 (29.827)	1.3623 (34.602)	1.5501 (39.373)
	Pitch diameter, $GDB6_B$ +0.0000/ –0.0002 (+0.000/ –0.005)	0.8806 (22.367)	1.0060 (25.552)	1.1310 (28.727)	1.3190 (33.503)	1.5068 (38.273) [d]
	Length of thread, $GLB6_A$ ±0.015 (±0.38)	0.625 (15.88)	0.625 (15.88)	0.750 (19.05)	0.750 (19.05)	0.875 (22.23)
B5	Length of ring, $GLB5_A$ ±0.015 (±0.38)	0.688 (17.48)	0.688 (17.48)	0.750 (19.05)	0.750 (19.05)	0.812 (20.62)
	Minor diameter, $GDB5_A$ +0.001/ –0.000 (+0.03/ –0.00)	0.840 (21.34)	0.965 (24.51)	1.090 (27.69)	1.278 (32.46)	1.465 (37.21)

[a] All dimensions in inches (mm) at 68 °F (20 °C).

[b] See Figure I.5.

[c] All sizes, 10 threads per in. (25.40 mm). Class 2A and 2B.

[d] Tolerance on $GDB6_B$ for 1 1/8 in. (28.58 mm) plug gauge is +0.00000/ –0.00025 (+0.0000/ –0.0064).

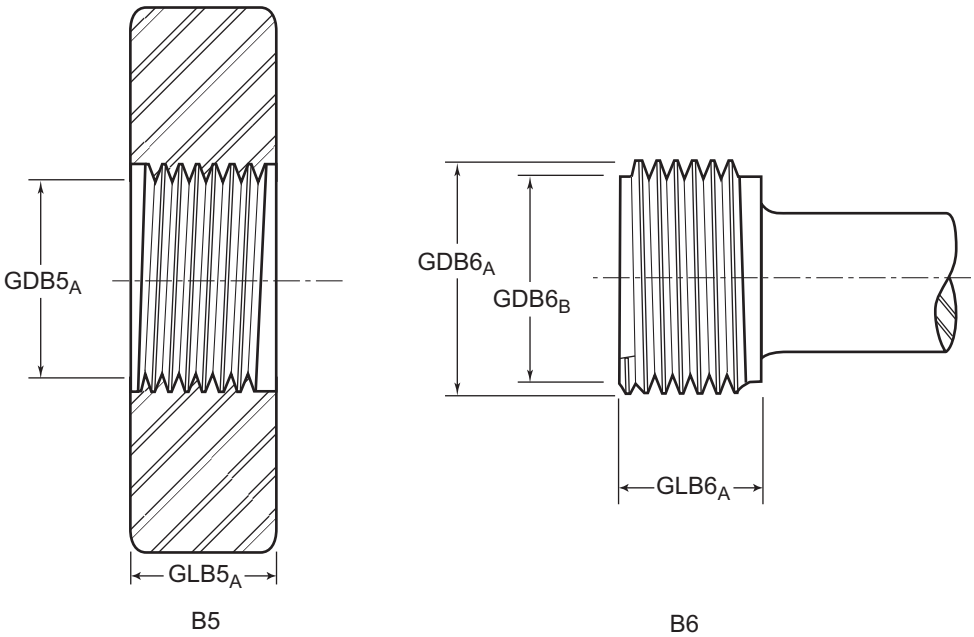


Figure I.5—No-go Box-thread Gauges (For Gauging Box Connections)

I.14.6 Go Pin-thread Truncated Setting Plug and Ring Gauges

Go pin-thread truncated setting plug and ring gauges shall conform to the dimensions in Table I.6. P1 and P2 gauges made to 2A and 2B tolerances under API 11B, 13th Edition, may be used. P1 and P2 gauges made under the 12th and prior editions of API 11B (not conforming to 2A and 2B tolerances) may not be used.

Table I.6—P1 Go Pin-thread Truncated Setting plug Gauge, P2 Go Pin-thread Ring Gauge
(For gauging polished rod pin connections)

	Nominal Size of Rod [a, b, c]	5/8 in.	3/4 in.	7/8 in.	1 in.	1 1/8 in.
P1	Truncated major diameter, $GDP1_A$ +0.0000/ –0.0006 (+0.000/ –0.015)	0.9216 (23.409)	1.0465 (26.581)	1.1715 (29.756)	1.3589 (34.516)	1.5463 (39.276)
	Full form major diameter, $GDP1_B$ +0.0006/ –0.0000 (+0.015/ –0.000)	0.9362 (23.779)	1.0611 (26.952)	1.1861 (30.127)	1.3735 (34.887)	1.5609 (39.647)
	Length of truncated portion, $GLP1_A$ ($1/2$ of L_{TS}) ± 0.015 (±0.38)	0.625 (15.88)	0.875 (22.23)	0.875 (22.23)	1.250 (31.75)	1.500 (38.10)
	Face angle, $GAP1_A$ ±5’	90°	90°	90°	90°	90°
	Relief diameter, $GDP1_C$ [e] +0.000/ –0.001 (+0.000/ – 0.025)	0.765 (19.43)	0.890 (22.61)	1.015 (25.78)	1.203 (30.56)	1.390 (35.31)
	Pitch diameter, $GDP1_D$ +0.0000/ –0.0002 (+0.000/ –0.005)	0.8712 (22.128)	0.9962 (25.303)	1.1211 (28.476)	1.3085 (33.236)	1.4960 (37.998)[d]
	Length thread, $GLP1_B$ ±0.015 (±0.38)	1.250 (31.75)	1.750 (44.45)	1.750 (44.45)	2.500 (63.50)	3.000 (76.20)
	Length of plug, $GLP1_C$ ±0.015 (±0.38)	1.800 (45.72)	2.300 (58.42)	2.300 (58.42)	3.050 (77.47)	3.550 (90.17)
	Diameter of plug or ring collar, $GDP1_E$ +0.0000/ –0.0010 (+0.000/ –0.025)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
P2	Diameter of plug or ring collar, $GDP2_A$ +0.0000/ –0.0010 (+0.000/ –0.025)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
	Minor diameter, $GDP2_B$ +0.0000/ –0.0006 (+0.000/ –0.015)	0.8279 (21.029)	0.9529 (24.204)	1.0778 (27.376)	1.2652 (32.136)	1.4527 (36.899)
	Chamfer angle, $GAP2_A$ ±2 degrees	45°	45°	45°	45°	45°
	Countersink depth range, $GLP2_A$	0.09/0.10 (2.29/2.54)	0.09/0.10 (2.29/2.54)	0.09/0.10 (2.29/2.54)	0.09/0.10 (2.29/2.54)	0.09/0.10 (2.29/2.54)
	Length of counterbore, $GLP2_B$ ±0.010 (±0.25)	0.550 (13.97)	0.550 (13.97)	0.550 (13.97)	0.550 (13.97)	0.550 (13.97)
	Diameter of counterbore, $GDP2_C$ +0.005/ –0.000 (+0.13/ –0.00)	0.955 (24.26)	1.080 (27.43)	1.205 (30.61)	1.393 (35.38)	1.580 (40.13)
	Length ring, $GLP2_C$ +0.000/ –0.020 (+0.00/ –0.51)	1.125 (28.58)	1.375 (34.93)	1.375 (34.93)	1.750 (44.45)	2.000 (50.80)

[a] All dimensions in in. (mm) at 68 °F (20 °C).

[b] See Figure I.6.

[c] All sizes, 10 threads per in. (25.40 mm). Class 2A and 2B.

[d] Tolerance on $GDP1_D$ for $1\,1/8$ in.(28.58 mm) plug gauge is +0.00000 in./ –0.00025 in. (+0.000 mm/ –0.0064 mm).

[e] $GDP1_C$ is defined by the equation: $GDP2_B$ – 0.0625 in.

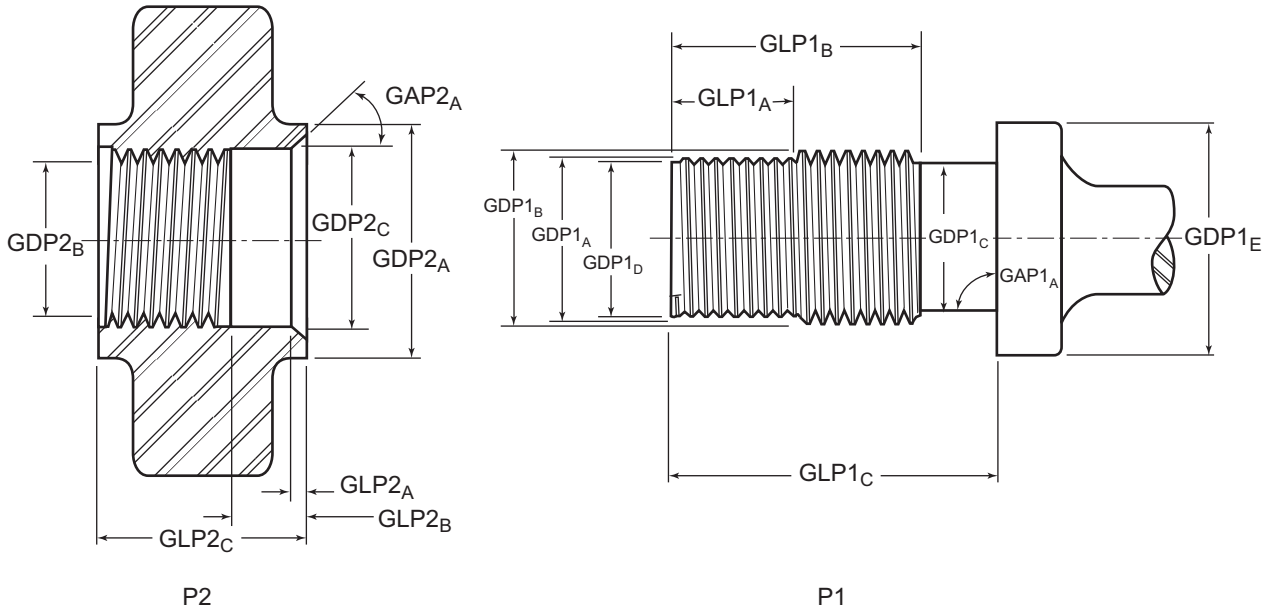


Figure I.6—Go Pin-thread Gauges (For Gauging Polished Rod Pin Connections)

I.14.7 Go Pin-cone Plug and Ring Gauges

Go pin-cone plug and ring gauges shall conform to the dimensions in Table I.7. P3 and P4 gauges made under any edition of Standard 11B may be used.

Table I.7—P3 Go Pin-cone Plug Gauge (Fitting Plug), P4 Pin-cone Ring Gauge
(For gauging polished rod pin connections)

Nominal size of rod [a, b, c]		5/8 in.	3/4 in.	7/8 in.	1 in.	1 1/8 in.
P3	Major diameter, $GDP3_A$ +0.0006/ –0.0000 (+0.015/ –0.000)	0.9456 (24.018)	1.0710 (27.203)	1.1960 (30.378)	1.3840 (35.154)	1.5718 (39.924)
	Thread relief length, $GLP3_A$ ±0.010 (±0.25)	0.150 (3.81)	0.150 (3.81)	0.150 (3.81)	0.150 (3.81)	0.150 (3.81)
	Face angle, $GAP3_A$ ±5’	90°	90°	90°	90°	90°
	Angle, $GAP3_B$ +10’ / –0'	9°	9°	9°	9°	9°
	Relief diameter, $GDP3_B$ [e] +0.000/ –0.001 (+0.00/ –0.025)	0.789 (20.04)	0.914 (23.22)	1.039 (26.39)	1.226 (31.14)	1.414 (35.92)
	Pitch diameter, $GDP3_C$ +0.0000/ –0.0005 (+0.000/ –0.013)	0.8806 (22.367)	1.0060 (25.552)	1.1310 (28.727)	1.3190 (33.503)	1.5068 (38.273)
	Length thread, $GLP3_B$ ±0.015 (±0.38)	0.630 (16.00)	0.880 (22.35)	0.880 (22.35)	1.260 (32.00)	1.510 (38.35)
	Length plug or ring, $GLP3_C$ ±0.015 (±0.38)	1.030 (26.16)	1.280 (32.51)	1.280 (32.51)	1.660 (42.16)	1.910 (48.51)
	Length, $GLP3_D$ ±0.010 (±0.25)	0.325 (8.26)	0.325 (8.26)	0.325 (8.26)	0.325 (8.26)	0.325 (8.26)
	Diameter plug cone, $GDP3_D$ +0.0000/0.0002 (+0.000/ 0.005)	0.9430 (23.952)	1.0680 (27.127)	1.1930 (30.302)	1.3805 (35.065)	1.5680 (39.827)
	Diameter of plug or ring collar, $GDP3_E$ +0.000/ –0.010 (+0.00/ –0.25)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
P4	Diameter of ring cone, $GDP4_A$ [d]	See note d	See note d	See note d	See note d	See note d
	Length plug or ring, $GLP4_A$ ± 0.015 (±0.38)	1.030 (26.16)	1.280 (32.51)	1.280 (32.51)	1.660 (42.16)	1.910 (48.51)
	Angle, $GAP4_A$ +0' / –10’	9°	9°	9°	9°	9°
	Diameter of plug or ring collar, $GDP4_B$ +0.000/ –0.010 (+0.00/ –0.25)	1.255 (31.88)	1.505 (38.23)	1.630 (41.40)	2.005 (50.93)	2.265 (57.53)
	Minor diameter, $GDP4_C$ +0.000/ –0.001 (+0.00/ –0.03)	0.851 (21.62)	0.976 (24.79)	1.101 (27.97)	1.288 (32.72)	1.476 (37.49)

[a] All dimensions in inches (mm) at 68 °F (20 °C).

[b] See Figure I.7.

[c] All sizes, 10 threads per in. (25.40 mm). Class 2A and 2B.

[d] Diameter of ring cone $GDP4_A$ shall be such as to provide a standoff of 0.325 in. ±0.0015 in. (8.26 mm ±0.038 mm).

[e] $GDP3_B$ is defined by the equation: $GDP4_C$ – 0.0625 in.

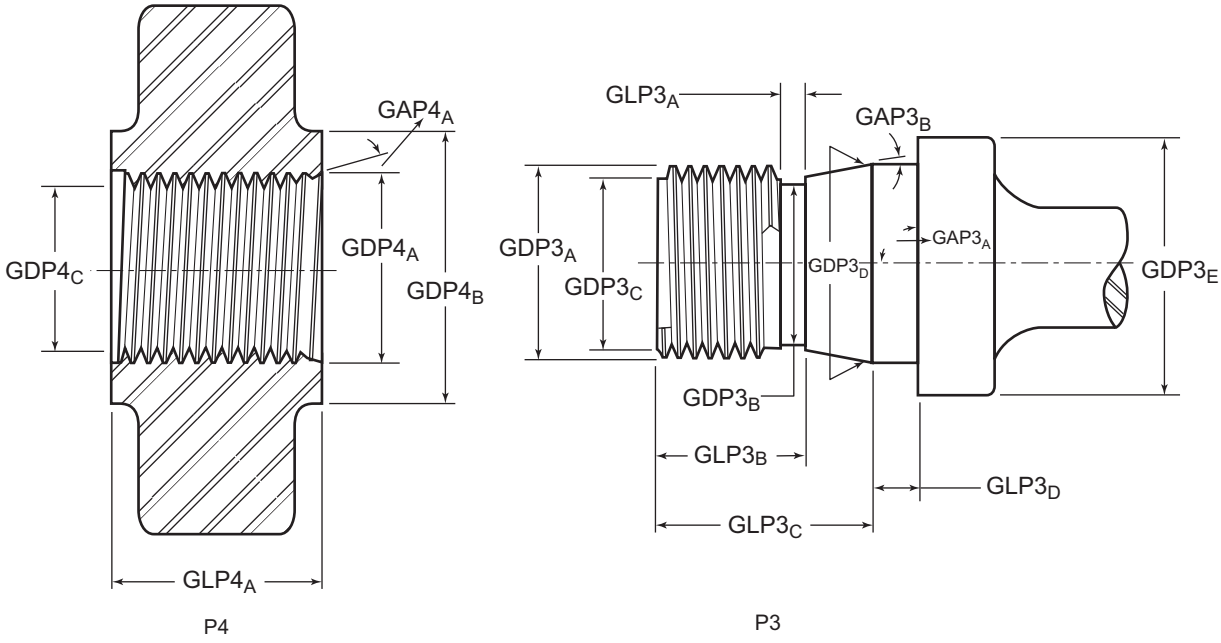


Figure I.7—Pin-cone Gauges (For Gauging Polished Rod Pin Connections)

I.15 Tolerances for Reference Master Gauges

I.15.1 Tolerances

Tolerances for reference master gauges shall conform to Table I.8.

Table I.8—Tolerances for Reference Master Gauges [a]

Plug Gauges	
Half angle of thread	±6 min
Lead [b]	±0.00025 (±0.0064)
Runout of shoulder face [c] (P1, P7, and B2)	0.0002 (0.005)
Eccentricity of cone with respect to thread (P3 and B4) – total indicator reading	0.0002 (0.005) 0.0004 (0.010)
Ring Gauges	
Half angle of thread	±6 min
Lead [b]	±0.00025 (±0.0064)
Runout of face [c] (P2, P8, and B1)	0.0002 (0.005)
Eccentricity of cone with respect to thread – total indicator reading	0.0003 (0.008) to 0.0006 (0.015)
Standoff from plug [d] (P4 and B3)	0.325 ±0.0015 (8.26 ±0.038)

[a] All dimensions in inches at 68 °F ±1 °F, (20 °C ±1 °C), except as otherwise indicated.

[b] The tolerance shown is the maximum deviation in lead between any two threads, whether adjacent or separated by an amount not exceeding the full length of threads less one full turn at each end. In the case of setting plugs, this tolerance applies to a length of thread equal to that of the thread in the mating ring gauge. On truncated setting plugs, the sign of any lead deviation present shall be the same on the fullform portion of the truncated portion and such deviation shall be uniform within 0.0001 in. (0.003 mm) over any portion equivalent to the length of the ring gauge.

[c] Runout shall be measured at distance $GDP2_A/2 - 0.125$ in. (3.18 mm) from the axis of the gauge.

[d] Ring shall be assembled with mating plug to cone contact by hand without spinning.

I.15.2 Axial Variation

Axial variation for the respective gauges shall conform to the requirements listed in Table I.9.

Table I.9—Allowable Axial Variation of Shoulder Face [a]

Gauge	Axial Variation of Shoulder Face [b]
P1	0.0003 (0.008)
P2	0.0004 (0.010)
P7	0.0003 (0.008)
P8	0.0004 (0.010)
B1	0.0004 (0.010)
B2	0.0003 (0.008)

[a] All dimensions in in. (mm) at 68 °F (20 °C).

[b] If the axial centers of plug gauges P7, B2, and P1 have been damaged so that a reliable determination of the variation in shoulder faces cannot be obtained, the combined variation of mating gauges shall be determined by the use of a gauge block, or a combination of gauge blocks, as feeler gauges. The combined variation shall not exceed 0.0007 in. (0.018 mm).

I.16 Gauge Certification

I.16.1 Certification Agencies

All new and reconditioned reference master plug and mating ring gauges, prior to use, shall have been certified to be in conformance with the stipulations given in Annex I, by one of the following agencies.

NOTE A schedule of fees for tests be obtained upon application to the testing agency.

a) Instituto Nacional De Technologia Industrial, Buenos Aires, Argentina.

b) National Institute of Metrology, Beijing, People's Republic of China.

c) National Institute of Standards and Technology, Gaithersburg, Maryland.

d) National Physical Laboratory, Teddington, Middlesex, England.

e) Oil Country Tubular Goods Inspection Laboratory.

f) China Natural Oil & Gas.

g) Exploration and Development Corporation BAOJI,SHAANXI People's Republic of China.

h) Physikalisch-Technische Bundesanstalt, Braunschweig, Germany.

I.16.2 Certification

The gauge certifying agency shall inspect new and reconditioned reference master gauges for conformance to the requirements of Annex I. For each gauge which complies with all requirements, the certifying agency shall issue a certificate to the gauge owner, stating that the gauge complies with API 11B. For each gauge which does not conform to all requirements, the certifying agency shall issue a report to the gauge manufacturer stating the reason for rejection and showing the measured value for those dimensions which are outside the permissible limits. Reference master gauges must be certified in complete sets, i.e. a reference master plug and a reference master ring gauge. A single reference master plug or a single reference master ring gauge may not be certified unless accompanied by a previously certified mating reference master gauge.

I.16.3 Marking (by Certifying Agency)

The certifying agency shall verify the markings required under I.10, and shall mark all acceptable reference master gauges (both plug and ring unless otherwise stated below) with the markings as follows.

NOTE 1 The certifying agency may mark the gauges with any additional markings considered necessary for proper identification.

NOTE 2 In recertifying reconditioned gauges, the markings as applied by the certifying agency making the previous test shall be replaced as necessary, so that only one set of markings appears on the recertified gauge.

a) Date of Certification—The date of certification shall be marked on all gauges. In recertifying reconditioned gauges, the previous certification date shall be replaced with the date of recertification. Dates of retest, as required by I.11, shall not be marked on reference master gauges.

b) Name or Mark of Certifying Agency—The identification mark of the certifying agency shall be place on all gauges.

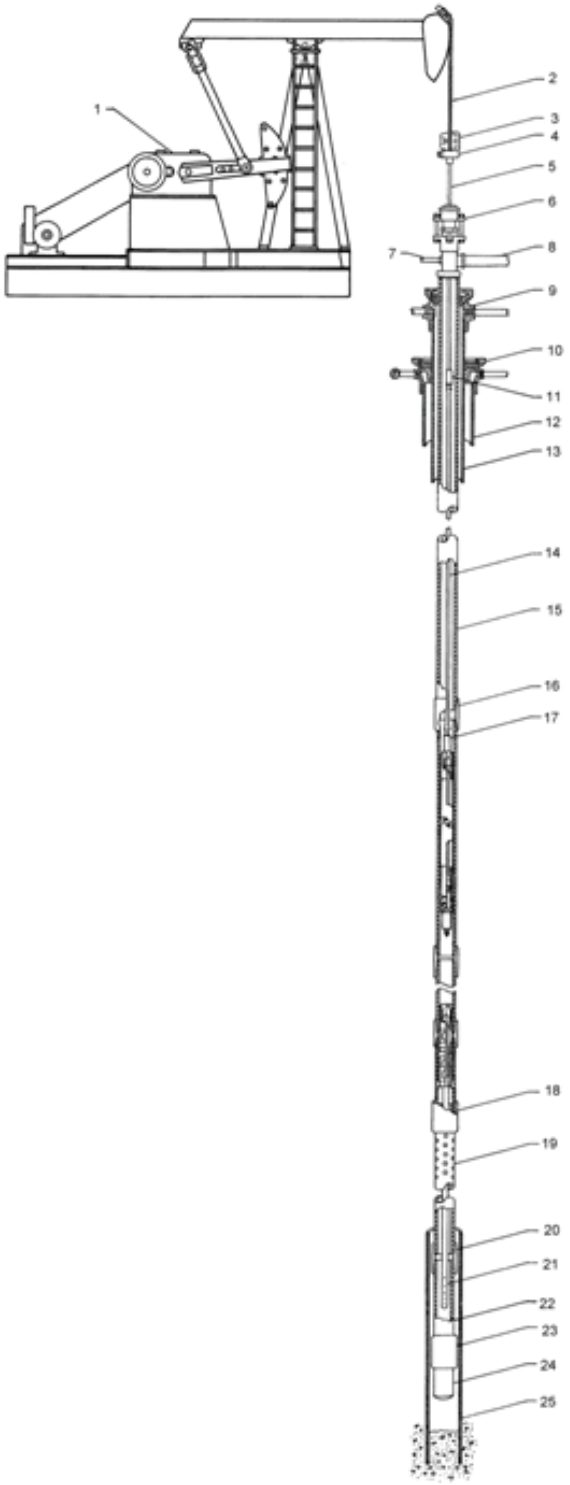
c) Mating Standoff—The initial mating standoff of cone gauges shall be marked on the ring gauge only for pin gauges, and on the plug gauge only for box gauges.

I.16.4 Retest

On gauges submitted to the certifying agency for retest (see I.11 for test period), the agency shall give the owner a report, stating whether or not the gauge is suitable for further use, and if not, giving the measurements of the elements which are outside the permissible limits. If the gauge is approaching the permissible limit of wear and, in the opinion of the certifying agency, should be retested within a two-year period, the report shall so state, giving the measurement for the element or elements on which the statement is based.

Annex J
(informative)

Sucker Rod Pumping System Illustration



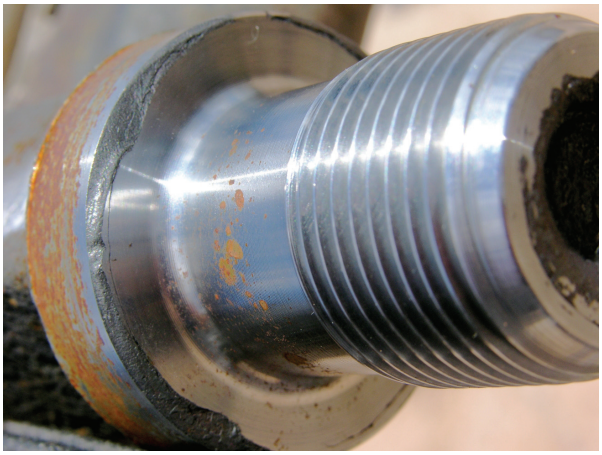
Key

1	pumping unit
2	wire line (bridle)
3	polished rod clamp
4	wire line hanger (carrier bar)
5	polished rod
6	stuffing box
7	bleeder
8	flow line
9	tubing head
10	casing head
11	polished rod sub-coupling
12	surface pipe
13	oil string (casing)
14	sucker rod
15	tubing
16	barrel coupling
17	sucker rod coupling
18	tubing coupling
19	perforated nipple
20	tubing coupling
21	gas anchor
22	mud anchor
23	tubing coupling
24	bull plug
25	bottom end of oil string (casing)

Annex K
(informative)

Representative Examples of Discontinuities

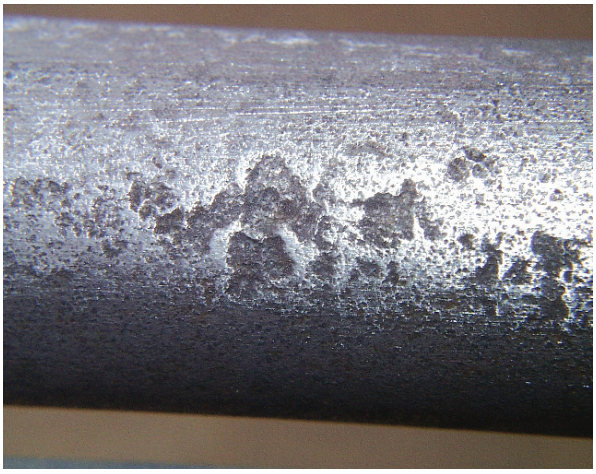
(May or may not be a cause for rejection, see Annex A of specification for requirements)



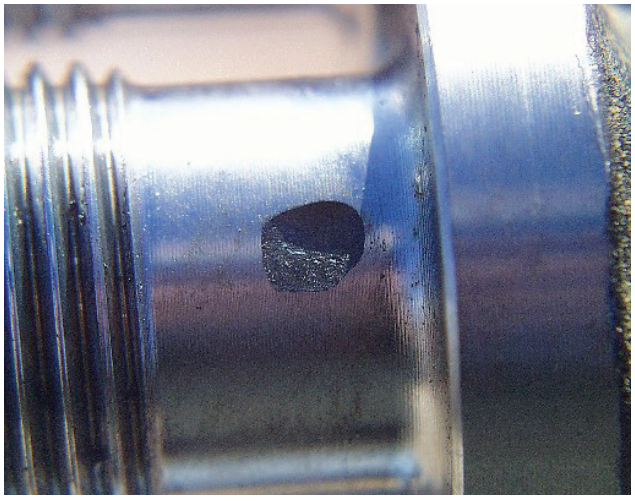
Pin Shoulder Contact Face Incomplete Machining

Thread Underfill

Forging Overfill Fold



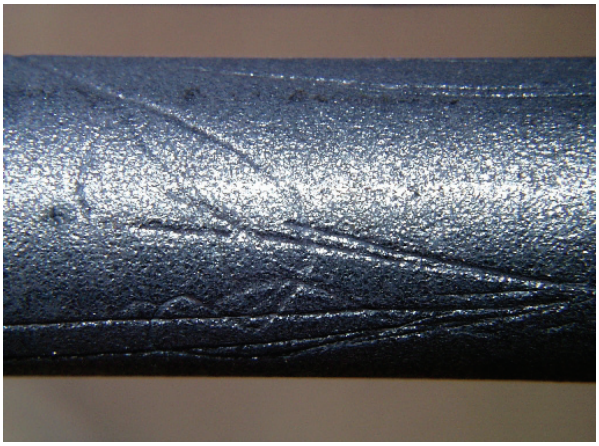
Mill Scale Impressions



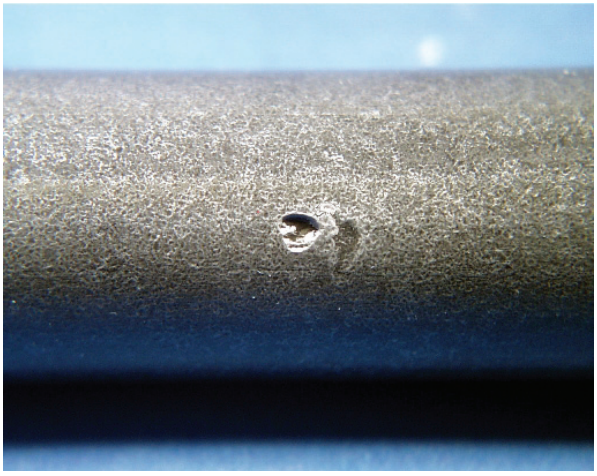
Stress Relief Defect

Shearing Burst

Forging Underfill



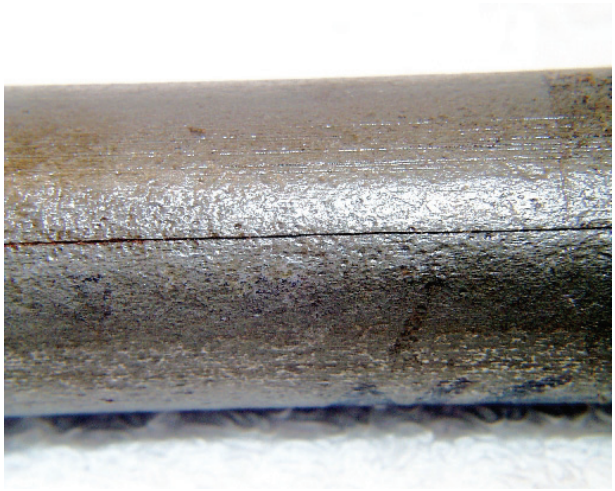
Surface Shearing From Foreign Objects Impressed During Hot Rolling Operation



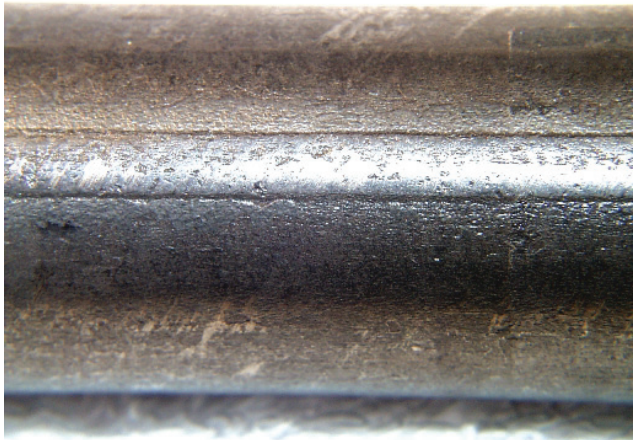
Pit From Removal of Tight Scab

Rolling Lap

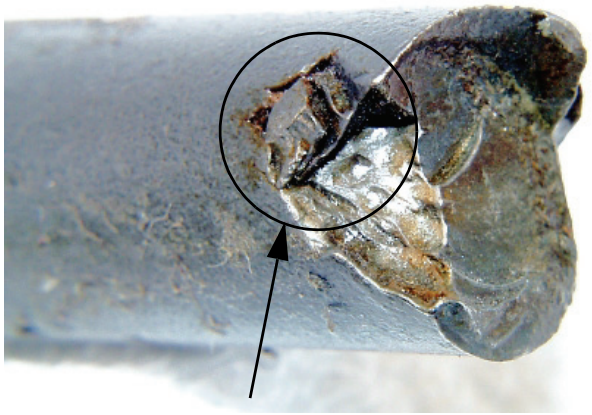
Scab



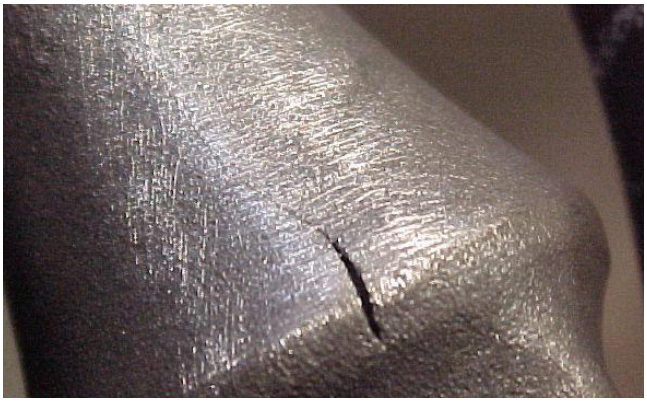
Seam



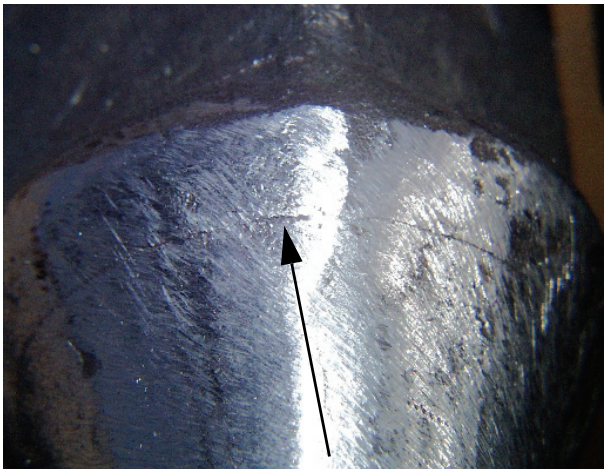
Rolling Overfill



Rolled-in Scale

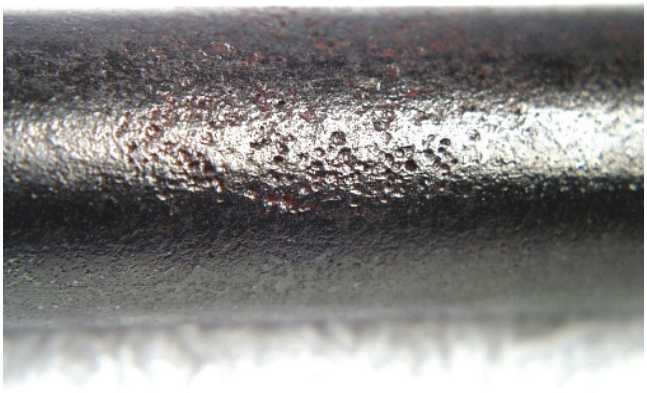


End Shear Crack



Forging Overfill

Dent



Pitting

Annex L
(informative)

Use of the API Monogram By Licensees

L.1 Scope

The API Monogram Program allows an API Licensee to apply the API Monogram to products. The API Monogram Program delivers significant value to the international oil and gas industry by linking the verification of an organization's quality management system with the demonstrated ability to meet specific product specification requirements. The use of the Monogram on products constitutes a representation and warranty by the Licensee to purchasers of the products that, on the date indicated, the products were produced in accordance with a verified quality management system and in accordance with an API product specification.

When used in conjunction with the requirements of the API License Agreement, API Specification Q1, in its entirety, defines the requirements for those organizations who wish to voluntarily obtain an API License to provide API monogrammed products in accordance with an API product specification.

API Monogram Program Licenses are issued only after an on-site audit has verified that the Licensee conforms to the requirements described in API Specification Q1 in total, and the requirements of an API product specification. Customers/Users are requested to report to API all problems with API monogrammed products. The effectiveness of the API Monogram Program can be strengthened by Customers/Users reporting problems encountered with API monogrammed products. A nonconformance may be reported using the API Nonconformance Reporting System available at https://ncr.api.org. API solicits information on new product that is found to be nonconforming with API specified requirements, as well as field failures (or malfunctions), which are judged to be caused by either specification deficiencies or nonconformities with API specified requirements.

This Annex sets forth the API Monogram Program requirements necessary for a supplier to consistently produce products in accordance with API specified requirements For information on becoming an API Monogram Licensee, please contact API, Certification Programs, 1220 L Street, N. W., Washington, DC 20005 or call 202-962-4791 or by email at certification@api.org.

L.2 References

In addition to the referenced standards listed earlier in this document, this Annex references the following standard:

API Specification Q1

For licensees under the Monogram Program, the latest version of this document shall be used. The requirements identified therein are mandatory.

L.3 API Monogram Program: Licensee Responsibilities

L.3.1 For all organizations desiring to acquire and maintain a license to use the API Monogram, conformance with the following shall be required at all times:

a) the quality management system requirements of API Specification Q1,

b) the API Monogram Program requirements of API Specification Q1, Annex A,

c) the requirements contained in the API product specification(s) for which the organization desires to be licensed,

d) the requirements contained in the API Monogram Program License Agreement.

L.3.2 When an API Licensed organization is providing an API monogrammed product, conformance with API specified requirements, described in API Specification Q1, including Annex A, is required.

L.3.3 Each Licensee shall control the application of the API Monogram in accordance with the following:

a) Each Licensee shall develop and maintain an API Monogram Marking Procedure that documents the marking / monogramming requirements specified by the API product specification to be used for application of the API Monogram by the Licensee. The marking procedure shall define the location(s) where the Licensee shall apply the API Monogram and require that the Licensee's license number and date of manufacture be marked on monogrammed products in conjunction with the API Monogram. At a minimum, the date of manufacture shall be two digits representing the month and two digits representing the year (e.g., 05-07 for May 2007) unless otherwise stipulated in the applicable API product specification. Where there are no API product specification marking requirements, the Licensee shall define the location(s) where this information is applied.

b) The API Monogram may be applied at any time appropriate during the production process but shall be removed in accordance with the Licensee's API Monogram Marking Procedure if the product is subsequently found to be nonconforming with API specified requirements. Products that do not conform to API specified requirements shall not bear the API Monogram.

c) Only an API Licensee may apply the API Monogram and its license to API monogrammable products. For certain manufacturing processes or types of products, alternative Monogram marking procedures may be acceptable. The current API requirements for Monogram Marking are detailed in the API Policy Document, Monogram Marking Requirements, available on the API Monogram Program website at http://www.api.org/certifications/monogram/.

d) The API Monogram shall be applied at the licensed facility.

e) The authority responsible for applying and removing the API Monogram shall be defined in the Licensee's API Monogram Marking Procedure.

L.3.4 Records required by API product specifications shall be retained for a minimum of five years or for the period of time specified within the product specification if greater than 5 years. Records specified to demonstrate achievement of the effective operation of the quality system shall be maintained for a minimum of 5 years.

L.3.5 Any proposed change to the Licensee's quality program to a degree requiring changes to the quality manual shall be submitted to API for acceptance prior to incorporation into the Licensee's quality program.

L.3.6 Licensee shall not use the API Monogram on letterheads or in any advertising (including company-sponsored web sites) without an express statement of fact describing the scope of Licensee's authorization (license number). The Licensee should contact API for guidance on the use of the API Monogram other than on products.

L.4 Marking Requirements for Products

These marking requirements apply only to those API licensees wishing to mark their products with the API Monogram.

L.4.1 Manufacturers shall mark equipment on the nameplate with the information identified in the marking section of this specification, as a minimum, including "API 11B".

L.4.2 As a minimum, equipment should be marked with English (Imperial) Units.

L.4.3 Nameplates, if required, shall be made of a corrosion-resistant material and shall be located as indication in the Marking section of this specification. If the location is not identified, then L.3.3.a shall apply.

L.4.4 Nameplates may be attached at the point of manufacture or, at the option of the manufacturer, at the time of field erection.

L.4.5 The API Monogram shall be marked on the nameplate, in addition to the marking requirements of this specification. The API Monogram License number shall not be used unless it is marked in conjunction with the API Monogram.

L.5 API Monogram Program: API Responsibilities

L.5.1 The API shall maintain records of reported problems encountered with API monogrammed products. Documented cases of nonconformity with API specified requirements may be reason for an audit of the Licensee involved, (also known as Audit for “cause”).

L.5.2 Documented cases of specification deficiencies shall be reported, without reference to Licensees, Customers or Users, to API Subcommittee 18 (Quality) and to the applicable API Standards Subcommittee for corrective actions.

Bibliography

[1] API RP 11BR, *Recommended Practice for Care and Handling of Sucker Rods*

[2] ANSI/ASME [8] B1.2, *Gauges and Gauging for Unified In Screw Threads*

[3] ANSI/ASQC [9] Z1.4, *Single Sampling Plan for Normal Inspection*

[4] ASNT [10] SNT-TC-1A, *Recommended Practice No. SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing*

[5] ISO [11] 9712, *Non-destructive Testing — Qualification and Certification of Personnel*

[6] ISO 11462-1, *Guidelines for implementation of statistical process control (SPC) — Part 1: Elements of SPC*

[7] ISO 11960, *Petroleum and natural gas industries — Steel pipes for use as casing or tubing for wells*

[8] NACE[12] No. 1/SSPC-SP 5, Joint Surface Preparation Standard: White Metal Blast Cleaning

[9] SSPC [13], Surface Preparation Specification No. 11 (SSPC-SP 11): Power Tool Cleaning to Bare Metal

8 ASME International, 3 Park Avenue, New York, New York 10016, www.asme.org.
9 American National Standards Institute, 25 West 43rd Street, 4th floor, New York, New York 10036, www.ansi.org.
10 American Society for Nondestructive Testing, Inc., 1711 Arlingate Lane, P.O. Box 28518, Columbus, Ohio 43228, www.asnt.org.
11 International Organization for Standardization, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, www.iso.org.
12 NACE International (formerly the National Association of Corrosion Engineers), 1440 South Creek Drive, Houston, Texas 77218-8340, www.nace.org.
13 The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburg, Pennsylvania 15222, www.sspc.org.

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