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TG OCTG

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Ballot Rationale: To review, comment, and vote on the proposed API 5C1, Care and Use of Casing and Tubing, 19th Edition. Comments may be submitted on the entire draft. Please examine the document thoroughly, checking for accuracy with references, descriptions, terminology, and requirements.

Ballot Text:

Care and Use of Casing and Tubing

API RECOMMENDED PRACTICE 5C1
NINETEENTH EDITION, XXXX 202X

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Introduction

Tubing and casing are essential for onshore and offshore well integrity in the energy industry. Tubulars need to be properly, secured, handled and protected during storage, transportation and installation to prevent damage to the pipe body and threaded connections from impact or corrosion. Finally, improper make-up of connections may limit performance. Failure to properly handle, store and install tubulars may result in delays or repairs for a well.

1 Scope

This document contains provisions for the safe and efficient handling, running, and pulling of steel tubulars. It is intended to provide practical information to address many of the issues related to tubular handling and storage. The as-installed phases of the tubular's life are out of scope for the document. In addition, this document is not intended to be used as a specification for running services.

Some generalized provisions on prevention of damage to casing and tubing by corrosive fluids are provided in this document. However, it is not within the scope to provide detailed suggestions for corrosion control under specific conditions.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any addenda) applies.

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

API Technical Report 5C3, *Calculating Performance Properties of Pipe Used as Casing or Tubing*

API Recommended Practice 7G-2, *Drill Stem Design and Operating Limits*

API Recommended Practice 5A5, *Field Inspection of New Casing, Tubing, and Plain-end Drill Pipe*

API Recommended Practice 5B1, Gauging and Inspection of Casing, Tubing, and Line Pipe Threads

API Bulletin 5T1, *Imperfection and Defect Terminology*

API Specification 5CT, *Specification for Casing and Tubing*

API Specification 5CRA, *Specification for Corrosion Resistant Alloy Seamless Tubes for Use as Casing, Tubing and Coupling Stock*

API TR 5TP, *Technical Report on Torque-Position Assembly Guidelines for API Casing and Tubing Connections*

3 Terms, Definitions, Symbols, Acronyms, and Abbreviations

3.1 Terms and Definitions

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

3.1.1
accessory material
Seamless casing or tubing, or seamless thick-walled tubes or mechanical tubes, or bar stock or hot forgings used for the manufacture of accessories.

3.1.2
API threads
Threads conforming to the provisions in API 5B.

3.1.3
casing
Pipe run from the surface and intended to line the walls of a drilled well.

3.1.4
connection
Threaded assembly of tubular components.

3.1.5
coupling
Internally threaded cylinder for joining two lengths of threaded pipe.

3.1.6
defect
Imperfection of sufficient magnitude to warrant rejection of the product based on criteria defined in API 5CT.

3.1.7
drift mandrel
cylinder, machined to specified dimensions, that is passed through a pipe to locate obstructions and/or to assess compliance with the appropriate specifications

3.1.8
full-body
Complete cross-section of the product.

3.1.9
full-length
Complete length of the product (end-to-end).

3.1.10
hand-tight
Threaded connection that has been made up by hand without the aid of tongs or other mechanical devices.

3.1.11
imperfection
Discontinuity in the product wall or on the product surface that can be detected by a NDE method

3.1.12
inspection
Process of measuring, examining, testing, gauging or otherwise comparing a unit of product with the applicable requirements.

3.1.13
length
Piece of pipe that can be plain-end, threaded, or threaded and coupled, that is in accordance with the range length requirements specified in API 5CT.

3.1.14
lifting / handling plug

Used for casing or tubing that screws into a casing or tubing box connection to protect the box threads during handling or the insertion of tools. It can also aid in lifting, depending on the design the lift nubbin, it could be specifically designed to lift only 1 joint, or up to the stated tension rating. The plug can also be used when an integral box type connection is being ran to potentially help in case the casing or tubing slips through the elevators or slips.

3.1.16
lifting sub
A short casing/tubing component that is temporarily connected to the top of the casing / tubing assembly that is to be lifted vertically, such as when running or pulling operations. The external profile on the upper section of the lifting sub is similar to that of the casing / tubing, thus enabling the rig elevators to lift the assembled tool string safely.

3.1.17
linear imperfection
Imperfection which includes, but is not limited to, seams, laps, cracks, plug scores, cuts and gouges.

NOTE See API 5T1.

3.1.18
manufacturer
One or more of the following, depending on the context: pipe mill; processor; threader; coupling manufacturer, pup joint manufacturer; accessory manufacturer.

3.1.19
non-linear imperfection
Imperfection which includes, but is not limited to, pits and round-bottom die stamping.

NOTE See API 5T1.

3.1.20
NORM (naturally occurring radioactive material)
Radioactive substance that exists naturally in the environment.

NOTE NORM can become TENORM; see 3.27.

3.1.21
pipe
Casing, tubing and pup joints as a group.

3.1.22
pipe mill
Firm, company or corporation that operates pipe-making facilities.

3.1.23
plain-end pipe
Pipe, either upset or non-upset, furnished without threads.

3.1.24
power-tight
A threaded connection that has been fully made up by mechanical means using power tongs or a screw-on machine.

3.1.25
Power Tongs
“Power tongs” (Make-up equipment) means pneumatically or hydraulically operated tools that serve to spin the pipe up tight or, in some instances, serve to apply the final makeup torque.

3.1.26
product
Pipe, coupling, coupling stock, coupling material, coupling blank or accessory material, either individually or collectively as applicable.

3.1.27
pup joint
Casing or tubing of length shorter than Range 1.

3.1.28
pup joint material
Casing or tubing, or thick-wall tubes or mechanical tubes, or bar stock used for the manufacture of pup joints.

3.1.29
proprietary connection
A threaded connection that is not specifically referenced or controlled by an API standard.

3.1.30
purchaser
Party responsible for the definition of requirements for a product order and payment for that order.

3.1.31
seamless pipe
Wrought steel tubular product made without a weld seam.

3.1.32
Stabbing Guide
Helps guide the pin into the box threads while preventing pin and box face damage

3.1.33
technologically enhanced naturally occurring radioactive materials
TENORM
Naturally occurring radioactive materials that are concentrated or exposed to the accessible environment resulting from human activities.

3.1.34
thread compound
Substance applied to threaded pipe connections prior to make-up for lubrication during assembly and disassembly and for assistance in pressure sealing.

NOTE 1 See API 5A3.

NOTE 2 Some thread compounds can also contain substances that provide storage compound properties.

3.1.35
thread protector
Cap or insert used to protect threads and seals during handling, transportation and storage.

NOTE See API 5CT.

3.1.36
tubing
Pipe placed in a well to produce or inject fluids.

4 Running and Pulling Casing and Tubing

4.1 General Preparation and Inspection before Running

4.1.1 New casing and tubing should be delivered free of defects. Some additional checks in the field, described more later, are often employed to confirm the state of the tubulars

NOTE For critical well applications, post mill inspection may be considered.

4.1.2 Basic checks on tubulars and equipment should be performed:

1) Casing and tubing are the correct OD, weight, grade, and connection to be run.

    i. If any length cannot be clearly identified, it should be laid aside until its grade, weight, or type of joint can be positively established.

2) Pup joints and accessories are correct, and connection compatibility is confirmed

3) The proper thread compound is available and within expiration date

4) Make-up equipment of the right size, torque gauges and/or load cell that has been calibrated to a known industry standard, etc. and to be supported by competent personnel.

5) Well control equipment such as pipe rams, circulation tools, etc., if needed, are available

6) Running tools such as stabbing guides, lifting plugs, lifting subs, drifts, circulating tools, elevators/bails, slips etc. are on location and correct for the product being run.

    NOTE: Lifting/handling plug or lifting sub capacity should be confirmed before use. Some are designed to lift the entire string, while others may be only rated for a single stand or joint

7) Pipe is laid out on the racks so it can be safely drifted and tallied (if planned) and efficiently run in hole.

    NOTE: If a mixed string is to be run, check to determine that the appropriate casing will be accessible on the pipe rack when required according to program.

4.1.3 Casing and tubing shall be handled on racks or on wooden or metal surfaces free of rocks, sand, or dirt.

4.1.4 Except when needed for inspection, measurement, or doping, casing shall be handled with thread protectors in place.

4.2 Inspection

4.2.1 Casing and Tubing

NOTE The provisions in this section are not intended to be a cause for rejection of casing or tubing provided the threads are in accordance with the requirements of the latest edition of API 5B that they were manufactured to.

4.2.1.1 Prior to running, each length of casing and tubing should be drifted for its entire length with drift mandrels conforming to API 5CT.

4.2.1.2 Casing or tubing that does not pass the drift test should marked and segregated.

4.2.1.3 The length of each piece of casing or tubing shall be measured prior to running. A steel tape or other proven measurement methods, that is calibrated in decimal feet (meters) to the nearest 0.01 ft (m) may be used.

4.2.1.4 The measurement of casing and tubing should be made from the outermost face of the coupling or box to the position on the externally threaded end where the coupling or the box face stops when the joint is made-up power tight.

NOTE 1 On round-thread joints, this position is to the plane of the vanish point on the pipe; on buttress-thread casing, this position is to the base of the triangle stamp on the pipe. The total of the individual lengths measured represent the running length of the string, without allowance for pipe stretch.

NOTE 2 Proprietary connections are typically measured from the face of the coupling to the end of the pin. The loss of length from make-up (make-up loss) is then subtracted from each length. This make-up loss value can be obtained from the vendor's connection data sheet

4.2.1.5 If the casing or tubing is not delivered ready to run (rig-ready), before running the thread protectors shall be removed from both field and coupling ends and the threads cleaned thoroughly, repeating as additional rows become uncovered.

4.2.2 Threads

4.2.2.1 Pin and box threads should be visually inspected per API 5A5 and the appropriate thread compound is applied as part of the cleaning and rig preparation process. If the tubular is delivered ready to be run (rig-ready), the threads should be visually inspected while running. Threads found to be damaged shall be marked and laid aside unless satisfactory means are available for correcting thread damage.

4.2.2.1.1 For Proprietary Connections, vendor specific rig inspection, acceptance, and field repair criteria should be followed

4.2.2.2 Couplings should be inspected for make-up position in accordance with API 5B1.

4.2.2.2.1 On round-thread joints, this position is to the plane of the vanish point of the pipe. If the standoff is greater than two (2) turns for RD threads, the coupling shall be inspected for tightness in accordance with API 5B1.

4.2.2.2.2 On buttress-thread joints, this position is to the base of the triangle stamp on the pipe. If the standoff is greater than one (1) turn from the base of the triangle stamp for BC threads, the coupling shall be inspected for tightness in accordance with API 5B1.

4.2.2.3 Loose or under-made couplings should be marked and segregated.

4.2.2.4 If couplings are not supplied ready to run (rig-ready) after cleaning and inspecting, thread compound shall be applied to the entire internal threaded surface area.

4.2.2.5 The selection of a thread compound should be given careful consideration by the user as it performs the important roles of lubricating the thread surfaces to facilitate joint make-up and breakout without galling and fills voids between the mating thread surfaces. Thread compounds should be in accordance with API 5A3.

4.2.2.6 In the case of proprietary connections, connection vendor recommendations for an appropriate thread compound should be followed.

4.2.2.7 If PTFE rings are to be installed, ring grooves should be cleaned prior to installation of rings and compound applied to complete internal threaded areas or couplings after the ring is installed.

4.2.2.8 PTFE rings should be installed by pinching the individual ring into a “smile”, inserting the ring into one side of the groove, and opening up the ring into its original circular shape by pressing the entire ring around the circumference of the groove and seating the ring in place. The use of a wooden handle (e.g. dope brush handle) may be used to press the ring into the groove. See Annex A for more details on PTFE rings.

4.2.2.9 A clean thread protector shall be placed on the field end of the pipe to prevent damage while rolling pipe on the rack and pulling into the derrick. Several thread protectors may be cleaned and used repeatedly for this operation.

4.2.2.10 For API 5CT, SR13, connections, if polytetrafluoroethylene (PTFE) rings are installed on box ends, a box thread protector applicable for SR13 connections shall be used, to ensure that the protector thread area has sufficient clearance to be engaged properly on the box end.

4.3 Equipment

4.3.1 Elevators

4.3.1.1 Slip-type elevators should be used for long strings where the weight of the string could damage the coupling face or cause connection jump-out if collar pull (side-door) elevators are used. This will also apply to special clearance or special bevel couplings

4.3.1.2 Both spider type and elevator slips should be clean, not dull, ~~and sharp~~ and should fit properly.

4.3.1.3 The slip length should be long enough to accommodate heavy casing and tubing strings and avoid slip-crushing of the pipe.

4.3.1.4 The spider shall be level.

4.3.1.5 Slip and tong marks “Grip Marks” depth should be kept to a minimum.

4.3.1.6 For sour service and/or corrosion resistant grades, non-marking or low stress dies should be used in slips, elevators, and tongs.

4.3.1.7 Dies should be cleaned periodically as the pipe varnish coating, and or dirt can minimize the contact area of the dies thus causing cuts or gouges exceeding pipe minimum wall requirements or slippage.

NOTE: As a rule of thumb, cleaning the dies once per 50 joints can be targeted with adjustment based on field experience

4.3.1.8 If collar-pull elevators are used, the bearing surface should be inspected for the following:

a) uneven wear that may produce a side lift on the coupling with danger of the elevator jumping off of the coupling; and

b) uniform distribution of the load when applied over the bearing face of the coupling.

4.3.1.9 Spider and elevator slips should be examined and monitored to see that all dies are lowering uniformly. If the dies lower unevenly, there is danger of damaging or deforming the pipe.

4.3.2 Tongs

4.3.2.1 Tongs may be sized to produce 150 % of the expected maximum make-up torque in accordance with Annex B, Table B.1. For BC connections, API 5TP can be a guide for maximum expected make-up torque (although this torque shall not be used for conventional make-up as described in this document).

4.3.2.2 For proprietary connections, refer to the vendor's specification data sheet.

4.3.2.3 Tongs should be examined for wear on hinge pins and hinge surfaces.

4.3.2.4 If a backup line is utilized, the backup line attachment to the backup post should be level with the tong in the backup position, and at 90° to the tong to avoid incorrect torque readings and uneven load distribution on the gripping surfaces of the casing.

4.3.2.5 The length of the backup line should be such as to cause minimum bending stresses on the casing or tubing and to allow full stroke movement of the make-up tong.

4.3.2.6 The backup line should be of cored or braided wire; nylon slings, etc.. chains are not recommended.

4.3.2.7 Tongs that will not crush the tubular should be used and should fit properly to avoid crushing the pipe O.D and/or unnecessary cuts or gouges on the pipe thus reducing the wall thickness.

4.3.2.8 Tong dies should fit properly and conform to the curvature of the casing and tubing.

4.3.2.9 The use of pipe wrenches is not recommended.

4.3.2.10 Integral tongs should be level and allow sufficient vertical travel for making-up connections.

4.3.2.11 Integral tongs should be appropriately sized for the product being run.

4.3.2.12 Torque subs should be verified to be working correctly and within calibration date.

4.3.2.13 Fill-up tools should be correctly sized and verified to prevent damage to the threaded connections during fill-up and running.

4.3.2.14 The power tong should be provided with a properly sized and calibrated torque gauge, load cell, of a known accuracy.

4.4 Connection Make-up

4.4.1 General

4.4.1.1 The initial stages of make-up should be observed for any irregularities in make-up or in the speed of make-up, since they can be indicative of crossed threads, dirty or damaged threads, or other unfavorable conditions.

4.4.1.2 To aid in the prevention of galling when making up API 5B connections in the field, the connections should be made-up at a speed not to exceed 25 rpm.

4.4.1.3 Casing and tubing tends to wobble at its upper end when making-up, indicating that the thread may not be in line with the axis of the casing. If this situation occurs, the speed of rotation should be decreased to prevent galling of threads.

4.4.1.4 If wobbling persists despite reduced rotational speed, the casing should be laid down for inspection.

4.4.1.5 An analysis should be performed before using wobbling casing in a position in the string where a heavy tensile load is imposed.

4.4.1.6 If casing running tool (CRT, top drive) systems are used, gripping surfaces and/or dies should be clean and correctly sized for product being run.

4.4.1.7 API connection make-ups are position based as described in the sections below.

NOTE: If running a torque-position string, refer to API TR 5TP for additional information

4.4.1.8 For round thread connections, torque values are provided in Annex B as guidance but should not be used as definitive values if contradicted by position procedure.

NOTE Round thread torque values in Annex B were obtained by taking 1 % of the calculated pullout value as experience showed that these values were generally comparable to values obtained in field make-up tests using API modified thread compound. Compounds other than API modified may result in different torque values. The values in Annex B were rounded to the nearest 10 ft-lb (10 N-m). The torque values apply to casing with zinc-plated or phosphate-coated couplings. When making up connections with tin-plated couplings, 80 % of the listed value can be used as a guide. When making up round thread connections with PTFE rings, 70 % of the listed values can be used as a guide. Buttress connections with PTFE seal rings may make-up at torque values different from those normally observed on standard buttress threads.

4.4.1.9 Proprietary connections may be a position- or torque-based make-up in accordance with the vendor's recommended practice.

4.4.1.10 A properly sized stabbing guide should be used. (A properly sized stabbing guide should latch snugly around the coupling/box connection and also cover the bearing face to prevent damage to the pin end that is being removed or inserted into the box connection.)

4.4.1.11 Joints that are questionable as to their make-up may be cleaned, inspected and re-made-up.

4.4.1.11.1 If the torque range was achieved, but the position was short, the pin nose should be visually inspected for signs of contact with the mating pin indicating a possible pitch diameter problem, incorrect torque or a reduced friction factor dope was utilized.

4.4.1.11.2 For API 5CT, SR13 connections, a new PTFE ring shall be installed if the PTFE ring is removed for box inspection or from an unsuccessful make-up attempt.

NOTE For API 5CT SR13 connections, an incorrectly installed PTFE ring can show signs of shredding, which can prevent the correct make-up position from being achieved. See Annex A for more details.

4.4.1.12 If the re-make-up is still questionable, the joint should be backed out and the casing laid down for inspection and repair. The joint shall not be reused without repair or regauging, even if the joints have little appearance of damage.

4.4.1.13 In making-up the field joint, it is possible for the coupling to make-up (turn) slightly on the mill end. This may not indicate that the coupling on the mill end is too loose but simply that the field end has reached the tightness at which the coupling was bucked on at the manufacturer's facility.

4.4.1.14 A joint should be pulled to verify that the coupling face stand-off from the mill pin nose is within the API 5B acceptance make-up criteria in the following situations:

a) if a mill installed coupling appears to be loose;

b) if not made-up to correctly to position from mill;

c) the coupling rotated, greater than ¼ turn, during field end make-up.

4.4.1.15 Thread galling of materials such as martensitic chromium steels L80-1 % Cr, 3 % Cr, 9 % Cr and 13% Cr, can occur during movement—stabbing or pulling and make-up or breakout. Galling resistance of threads is primarily controlled in two areas—surface preparation and finishing during manufacture, and careful handling practices during running and pulling.

4.4.2 Make-up Position and Torque: Round Threads

4.4.2.1 When starting to run casing from each shipment, after running any thread-locked joints, establish the torque window. Make up 10 joints where the face of coupling is at the vanish point of the field pin. Record the torque for each of these make-ups. From these 10 values determine the average torque. Going forward, the average torque shall be used as the nominal make-up torque and the minimum and maximum torque will be plus or minus 25% of this average value. This window is now considered as the recommended torque window to used for the acceptance of future torques during the make up of the string.

NOTE: This process should be repeated if an alternate size/wt/grade is run (e.g., tapered string)

4.4.2.2 Joint life of tubing under repeated field make-up is inversely proportional to the field make-up torque applied. Therefore, in wells where leak resistance is not a factor, minimum field make-up torque values should be used to prolong joint life.

4.4.2.3 The torque values shown in Annex B have been selected to provide recommended make-up under normal conditions and should be considered as typical. They should not be used in lieu of those established in 4.4.2.1, but can give a target and may warrant investigation if the established nominal torque is substantially different.

4.4.2.4 Use the nominal torque established in 4.4.2.1 for the rest of the run. The torque gauge and the approximate position of the coupling face with respect to the thread vanish point position shall be observed on each make-up to verify position.

4.4.2.5 If the make-up is such that the thread vanish point is buried two thread turns and 75 % of the recommended torque established in 4.4.2.1 is not reached, the joint should be treated as a questionable joint.

4.4.2.6 If the make-up is such that more than two thread turns remain exposed when the recommended torque is reached, apply additional torque up to the maximum value. If the standoff (distance from face of coupling to the thread vanish point) is greater than two thread turns when this additional maximum value torque is reached, the joint should be treated as a questionable joint.

NOTE For non-API O.D. sizes such as 9 7/8 in. and 13 5/8 in. casing, additional threads can remain exposed after make-up.

4.4.2.7 Sizes 16 in., $18^{5}/_{8}$ in., and 20 in. RD threads have triangle stamps. The base of the triangle can aid in locating the thread vanish point, however the position of the coupling with respect to the base of the triangle shall not be a basis for acceptance or rejection. All other sections of this clause apply.

4.4.3 Buttress Thread Casing Connection Sizes – 4 1/2 in. through 20 in.

4.4.3.1 When starting to run casing from each shipment, after running any thread-locked joints, establish the torque window. Make up 10 joints where the face of coupling is at the base of the triangle of the field pin. Record the torque value for each of these make-ups. From these 10 values determine the average torque. Going forward, the average torque shall be used as the nominal make-up torque and the minimum and maximum torque will be plus or minus 25% of this average value. This window is now considered as the recommended torque window to used for the acceptance of future torques during the make up of the string.

NOTE: This process should be repeated if an alternate size/wt/grade is run (e.g., tapered string)

4.4.3.2 Use the torque value established in 4.4.3.1 for the remainder of the connection run. The torque gauge and the approximate position of the coupling face with respect to the Triangle shall be observed on each make-up to verify position.

4.4.3.3 If the make-up does not reach within one (1) turn from the base of the triangle stamp, additional torque shall be applied to a maximum of 125 % of the previous established value.

4.4.3.4 If connections are exceeding the apex of the triangle stamp, the torque shall be reduced to a maximum of 75 % of the previous established values.

4.4.3.5 Connections made-up beyond the triangle stamp should be broken out and evaluated prior to further use.

4.4.3.6 Connections unable to achieve the proper make-up position within the torque range established in 4.4.3.1 should be treated as questionable.

NOTE Buttress connections with PTFE seal rings can make-up at torque values different from those normally observed on standard buttress threads.

4.4.4 Thread locking compound

4.4.4.1 The application of anaerobic thread sealant and thread-locking compounds to API and proprietary connections shall be performed in accordance with the manufacturer's requirements.

4.4.4.2 The friction factor of the compound may result in different torques than the remainder of the string

a) For API connections, use necessary torque to make up to position

b) For proprietary connections, refer to manufacturer's recommendations.

NOTE: These recommendations may contain instructions for adjusting torque and/or specific areas to which compound is applied

4.4.5 Making-up Power-tight Connections with Different Yield Strengths

4.4.5.1 When the yield strength of one connection is lower than the other mating member, the specified torque value for the lower yield strength connection shall be used. It may be necessary to adjust the torque values when making-up power-tight API and proprietary connections where the yield strengths of the pipe connection and the mating connection are different. This can occur with couplings and other connections on accessories and downhole tools.

EXAMPLE Mating a Grade N80 pipe connection with a Grade P110 coupling or accessory.

4.5 Filling Casing

4.5.1 General

4.5.1.1 To facilitate running and maintaining the hydrostatic head to contain reservoir pressures, the casing should be periodically filled with mud while being run.

NOTE In most cases, filling every six to ten lengths will suffice.

4.5.1.2 Insufficient pipe filling, followed by a string failure, may result in a drop in hydrostatic head below reservoir pressure.

4.5.1.2.1 High external to internal pressure differential from insufficient filling may stress the float equipment or collapse the tubular. When assessing the capacity of the equipment to withstand the load, extra surge pressure from running speed should be included.

4.5.1.3 Filling should be done with a mud having the weight to maintain hydrostatic balance, using a hose sized to expedite the filling operation. A quick opening and closing plug valve on the mud hose can facilitate the operation and prevent overflow.

4.5.1.4 If rubber hose is used, a quick-closing valve should be mounted where the hose is connected to the mud line, rather than at the outlet end of the hose.

4.5.1.5 At least one other discharge connection should be left open on the mud system to prevent buildup of excessive pressure when the quick-closing valve is closed while the pump is still running. A copper nipple at the end of the mud hose may be used to prevent damaging of the coupling threads during the filling operation.

NOTE The foregoing mud fill-up practice may be unnecessary if automatic fill-up casing shoes and collars or top drive fill up tools are used.

4.6 Picking up, Stabbing, Making Up, and Lowering

4.6.1 General

4.6.1.1 The movement of pipe should be planned and executed to minimize human interaction with the tubulars.

CAUTION Movement of the pipe requires caution to ensure safety of the crew.

4.6.1.2 Use of a hands-free approach, avoiding working on top of tubulars and using mechanical assistance tools (for example: push sticks, a hold-back rope at v-door to dedicated floor monkey) should be implemented.

4.6.1.3 Personnel should be aware of noted hazard zones and be adequately familiar with safe practices for moving and running tubulars. If the pipe will be drifted while picking up from catwalk, ensure communication and safe practices for personnel at each pipe end.

4.6.1.4 Movement of the pipe requires caution to ensure the pipe body and connections are not damaged. Lower or roll each piece of casing or tubing carefully to the catwalk without dropping. A pin-end thread protector shall be used while moving pipe.

4.6.1.5 Thread protectors shall not be removed from field end of casing or tubing until ready to stab. Avoid hitting casing or tubing against any part of derrick or other equipment.

4.6.1.6 A hold-back rope at the v-door or other automated methods shall be used to prevent pipe swing.

4.6.1.7 If necessary, thread compound should be applied over the entire surface of threads just before stabbing.

4.6.1.8 A thin even coat of API thread compound on the required thread surfaces should be used. The thread form should be covered, but fully discernable.

4.6.1.9 Brushes or utensils used in applying thread compound should be kept free of foreign matter, and contamination.

4.6.1.10 The thread compound shall not be thinned.

4.6.2 Stabbing

4.6.2.1 When stabbing, casing and tubing it shall be lowered carefully to avoid damaging the threads.

4.6.2.2 Properly sized stabbing guides as noted in 4.4.1.10, shall be used to avoid connection damage during the running or pulling operations.

4.6.2.3 After stabbing, the casing should be rotated very slowly at first to ensure that threads are engaging properly and not cross-threading.

4.6.3 Lowering

4.6.3.1 When handling casing and tubing strings, documented procedures should be implemented to reduce the likelihood of damage.

4.6.3.2 When setting slips, documented procedures should be implemented to avoid shock loads.

NOTE Dropping a string even a short distance can loosen couplings in the string.

4.6.3.3 Casing should not be set down on bottom or placed in compression to reduce the likelihood of buckling, especially in the part of the well where casing is unsupported.

4.7 Running Tubing

4.7.1 General

NOTE: This section only highlights additional elements of running/pulling tubing that are not covered elsewhere

CAUTION Due to the permissible tolerance on the outside diameter immediately behind the tubing upset, difficulties can occur when wrap-around seal-type hangers are installed on tubing manufactured on the high side of the tolerance; therefore, the user should select the joint of tubing to be installed at the top of the string.

4.7.1.1 When tubing is pulled into the derrick, documented procedures shall be implemented to ensure that the tubing is not bent and couplings and pin ends are not handled without protectors installed.

4.7.1.2 When running doubles or triples, documented procedures shall be implemented to prevent bowing and resulting errors in alignment when the tubing is allowed to rest too heavily on the coupling threads.

4.7.1.3 Intermediate supports may be placed in the derrick to limit bowing of the tubing.

4.7.1.4 Joint weight compensation-type equipment should be used.

4.7.1.5 Power tubing tongs with computer torque turn capabilities are recommended for high-pressure or condensate wells to ensure uniform make-up and tight joints.

4.7.1.6 Joint life of tubing under repeated field make-up is inversely proportional to the field make-up torque applied. Therefore, in wells where leak resistance is not a factor, minimum field make-up torque values should be used to prolong joint life.

4.8 Recovery of Casing and Tubing

4.8.1 General

4.8.1.1 A caliper survey prior to pulling a worn string of tubing should be performed to provide a quick means of segregating badly worn lengths for removal if tubing will be re-run.

NOTE: Some Operators use EMI inspection equipment while pulling each joint

4.8.1.2 Breakout tongs should be positioned close to the coupling but not too close to avoid deforming the pipe where the tong dies contact the pipe surface, especially if the joint is tight and/or the casing is thinner wall. Back-ups should be placed over the mill (lower) end of the coupling to prevent mill end back-out, with a space of 1/3 to 1/4 of the pipe OD between the tong and the coupling to prevent unnecessary friction in the threads.

4.8.1.3 Not recommended but If tapping is required, only the flat face of the hammer shall be used; use of a hammer's peen face is not permitted.

4.8.1.4 Tapping shall be performed lightly at the middle and completely around the coupling. Tapping near the end or on opposite sides only is not permitted.

4.8.1.5 The threads shall be completely disengaged before lifting the tubular out of the coupling.

4.8.1.6 Tubulars stacked in the derrick should be set on a firm wooden platform and with a protector that is rated for the increased load since the design of some protectors cannot support the joint or stand without damage to the field thread.

4.8.1.7 Threads shall be protected from dirt and damage when the tubular is out of the hole.

4.8.1.8 Tubing set back in the derrick should be properly supported to prevent undue bending.

NOTE: Tubing sizes 2 3/8 in. and larger may be pulled in stands approximately 60 ft (18.3 m) long or in doubles of Range 2.

NOTE: Stands of tubing sizes 1.900 in. OD or smaller, and stands longer than 60 ft (18.3 m) may require intermediate support.

4.8.1.9 Threads shall be undamaged, clean, and coated with compound before rerunning.

4.8.1.10 When appropriate, rerun tubing should be rotated (moved from the top of the string to the bottom) each time the tubing is pulled to distribute joint and tubing wear.

4.8.1.11 Joints that will be rerun should have their couplings retightened if needed to prevent leaks.

4.8.1.12 A calibrated weight indicator should be used when tubular is being ran or in a stuck condition.

CAUTION The stretching of the tubing string can lead to the assumption that the tubing is free when it is not.

4.8.1.13 After a hard pull to loosen a string of tubing, the joints, connections, subjected to pulling should be retightened.

4.8.1.14 Threads should be cleaned and lubricated or should be coated with a material to minimize corrosion.

4.8.1.15 Clean protectors should be placed on the tubular before it is laid down, if it may be rerun.

4.8.1.16 Pipe and threads should be inspected, appropriate compound and protectors applied before tubing is stored or reused.

4.8.1.17 In the event a string has failed, and an investigation is to be performed, an attempt should be made to retrieve the failed portion in the as-failed condition

NOTE: Proper preservation of the failure surface is required to aid failure analysis

4.8.1.18 Pulled pipe should be evaluated for NORM and TENORM contamination..

4.9 Possible Causes of Tubular Troubles

4.9.1 Some of the more common causes of casing troubles are listed as follows.

a) Improper casing/tubing selection for depth and pressures encountered.

b) Insufficient inspection of each length of casing/tubing or threaded connections.

c) Damage in mill, transportation, and/or field handling.

d) Failure to observe procedures in running and pulling casing or tubing.

e) Improperly machined threads or couplings.

f) The use of poorly manufactured couplings for replacements and additions.

g) Improper care in storage.

h) Excessive torquing of casing or tubing to force it through tight places in the hole.

i) Pulling too hard on a string (to free it). This can loosen the couplings in the string. Couplings should be retightened with tongs before finally setting the string.

j) Rotary drilling inside casing. Setting the casing with improper tension after cementing. Drill-pipe wear while drilling inside casing. Doglegs in deviated holes, or occasionally in straight holes where corrective measures are taken, can result in excess internal wear, particularly when the doglegs are high in the hole. Casing wear can be exacerbated by excessive rotation speed while drilling.

k) Wireline cutting, or downhole tools.

l) Buckling of casing or tubing in an enlarged, washed-out or uncemented cavity if too much tension is released in landing.

m) Dropping a string, even a very short distance.

n) Connection leaks under external or internal pressure, are a common trouble, and may be due to the following:

o) Incorrect thread compound, or improper application of thread compound

p) Improper make up of connections. under or over torquing.

q) Contamination within connections during make-up.

r) Galled threads, due to contamination, improper stabbing, damaged threads, excessive make-up rpm , over torquing, or wobbling during spinning or tonging operations.

s) Improper manufacturing of threaded connections.

t) Excessive overpull on string.

u) Excessively making and breaking connections.

v) Tong placement too high on casing or tubing, especially on breaking out. This gives a bending effect that tends to gall the threads.

w) Improper joint make-up at mill.

x) Casing ovality or out-of-roundness.

y) Improper landing practice, which produces stresses in the threaded joint in excess of the yield point.

z) Missing or incorrect installation of PTFE rings in API 5CT, SR13 connections.

5 Transportation, Handling, and Storage

5.1 General

5.1.1 API tubular goods in general, and threads in particular, are made with such precision that they require careful handling, and whether new, used, or reconditioned, they shall always be handled with thread protectors in place.

5.2 Transportation

5.2.1 Water (Ocean, Sea, etc..) Transportation

5.2.1.1 Pipe suppliers or their agents should provide supervision at the time of loading and unloading of water carriers to guard against the following:

a) improper or insufficient dunnage;

b) inadequate bracing to prevent shifting during lurching of the ship;

c) stowing pipe in or adjacent to bilge water;

d) toxic chemicals or other corrosive material;

e) dragging pipe along the pile and permitting couplings or thread protectors to hook together or strike the edge of a hatch opening or bump against the ship rail.

5.2.2 Railroad Transportation

5.2.2.1 When loading pipe on freight cars wooden stringers should be provided across the bottom of the car to provide suitable support for pipe, to allow space for lifting, and to keep pipe away from dirt.

5.2.2.2 If the bottom of the car is uneven, the stringers should be rigidly shimmed so that their tops will be in the same plane.

5.2.2.3 Stringers should not be placed under couplings or the upset part of pipe.

5.2.2.4 The load should be tied down and properly bulkheaded to keep it from shifting.

5.2.3 Truck Transportation

5.2.3.1 Pipe shall be loaded on bolsters and tie down with suitable chain or straps at the bolsters. In hauling long pipe, an additional chain or straps should be provided in the middle.

5.2.3.2 Pipe shall be loaded with all couplings on the same end of the truck.

5.2.3.3 The truck shall not be overloaded to the point where there is potential that the load cannot be delivered to its destination safely. ~~without unloading.~~

5.2.3.4 Load binding chains and straps that become loose because of load settling shall be retightened.

5.3 Handling

5.3.1 Thread protectors shall be tightly in place before loading or unloading.

5.3.2 Pipe shall not be unloaded by dropping.

5.3.3 Pipe shall be handled in a manner that prevents damage to the threads or dings or dents the body of the pipe.

NOTE 1 Damaged threads can leak or part.

NOTE 2 Dents and out-of-roundness can reduce the collapse resistance and other performance properties of the pipe and drift not able to pass.

5.3.4 Special handling may be necessary for sour service and corrosion resistant alloy (CRA) material.

5.3.5 Impact against adjacent pipe or other objects can cause a local increase in the hardness of the pipe to the extent that they become susceptible to sulfide stress cracking.

5.3.6 For pipe with special handling requirements, the pipe owner should notify their service providers of these special handling requirements and to which pipe the special requirements are applicable.

5.3.7 When unloading by hand, rope slings shall be used to control the pipe.

5.3.8 Pipe shall be rolled parallel to the stack when rolling down skids.

CAUTION Even when thread protectors are in place, do not allow pipe to gather momentum or to strike the ends to prevent damaging the threads.

5.3.9 A spreader bar with a choker sling(s) should be used when handling long pipe.

5.3.10 Each choker-sling shall be double wrapped.

5.4 Storage

5.4.1 Pipe should be racked in level horizontal layers at least 18 in. (457 mm) above the ground surface.

5.4.2 Separate layers of pipe with at least three wooden slats placed perpendicular to pipe at each end and in the middle.

5.4.3 Slats should be approximately 4 in. x 2 in. (100 mm x 50 mm).

5.4.4 Racking of pipe should accommodate the following:

a) easy accessibility and appropriate allowance for verification of pipe identification/markings;

b) tally, visual examination of pipe bodies and/or connections;

c) rack full-length drifting.

5.4.5 Pipe should not be racked more than 10 ft (3.1 m) above the bottom layer. Larger slats may be necessary to ensure sufficient clearance for forklift handling.

5.4.6 Pipe may be stored at heights greater than 10 ft (3.1 m) with the implementation of documented procedures to prevent deformation of the bottom layers of pipe and ensure that the pipe is safely secured.

5.4.7 Pipe shall not be stored directly on ground, rails, and steel or concrete floors.

5.4.8 Pipe should rest on supports properly spaced to prevent bending of the pipe or damage to the threads.

5.4.9 The stringers should lie in the same plane and be level, and should be supported by piers adequate to carry the full stack load without settling.

5.4.10 Wooden strips should be provided as separators between successive layers of pipe so that no weight rests on the couplings using at least three spacing strips. Longer term storing of high chrome pipe on wooden racks can cause crevice corrosion.

5.4.11 A corrosion barrier should be utilized between the high chrome pipe and wooden supports.

5.4.12 Spacing strips shall be placed at right angles to pipe and directly above the lower strips and supports to prevent bending of pipe.

5.4.13 Adjoining lengths of pipe shall be staggered in the tiers an amount approximating the length of the coupling.

5.4.14 Racks should be equipped with end stops to ensure no pipe inadvertently rolls or falls off the rack.

5.4.15 Pipe shall be blocked by nailing 1 × 2 or 2 × 2 blocks at both ends of the spacing strips, or by specifically made blocks designed for securing pipe in place.

5.4.16 Pipe in storage should be inspected periodically and protective coatings applied when necessary to arrest corrosion.

6 Inspection and Classification of Used Casing and Tubing

6.1 Inspection and Classification Procedures

6.1.1 Inspection Capability

6.1.1.1 Accepted methods of inspecting the body section of pipe include the following:

a) visual;

b) mechanical gauging;

c) magnetic flux leakage;

d) eddy current;

e) ultrasonic;

f) gamma ray.

These inspection techniques are limited to location of cracks, pits, and other surface breaking imperfections. See API 5CT for additional information.

6.1.1.2 Service-induced defects considered to be representative of defects associated with used pipe inspection are as follows:

a) outside and inside corrosion damage;

b) inside surface wireline (longitudinal) damage;

c) outside transverse and longitudinal slip and tong cuts;

d) inside surface drill pipe wear (casing only);

e) transverse cracking (work tubing only);

f) inside surface sucker rod wear (tubing only).

6.1.2 Measurement of Pipe Wall (Minimum Wall)

Wall thickness shall be measured with by one of the following methods:

a) pipe wall micrometers;

b) ultrasonic pulse-echo instruments;

c) gamma-ray devices that the operator can demonstrate to be within 2 % accuracy by use of test blocks sized to approximate pipe wall thickness.

6.1.3 Procedure

6.1.3.1 Used casing and tubing should be classified according to the loss of nominal wall thickness listed in Table 1.

6.1.3.2 The percentages in Table 1 represent reductions in the body wall from the API specified pipe wall thickness. This loss of wall thickness affects the body areas along both the inside and outside surfaces. Pipe with loss of wall thickness in the threaded portion and/or upset section, whether threaded and coupled external upset or integral joint, shall not be classified in accordance with Table 1.

6.1.3.3 Loss of wall thickness in the heavier upset sections can be acceptable at a higher percentage without penalty depending on the intended service. Damage and wall reductions affecting the threaded ends of pipe shall be evaluated depending on the anticipated service by the owner of the pipe.

6.1.3.4 In addition to the body wall loss classification shown in Table 1, the color code identification system used to denote the conditions is provided in Table 2. The color coding should consist of a paint band of the appropriate color approximately 2 in. (50 mm) wide around the body of the pipe approximately 1 ft (610 mm) from the box end.

NOTE The color code and remaining wall thickness classifications in Table 1 differ from those in API 7G-2.

Table 1—Classification and Color Coding of Used Casing and Tubing

Class	Color Band	Loss of Nominal Wall Thickness %	Remaining Wall Thickness (percent minimum) %
2	Yellow	0 – 15	85
3	Blue	16 – 30	70
4	Green	31 – 50	50
5	Red	Over 50	less than 50

Table 2—Color Code Identification

Conditions	Color
Damaged field- or pin-end threads	One red paint band approximately 2 in. (50 mm) wide around the affected coupling or box end.
Damaged coupling or box connections	One red paint band approximately 2 in. (50 mm) wide around the pipe adjacent to affected threads.
Pipe body will not pass drift test	One green paint band approximately 2 in. (50 mm) wide at the point of drift restriction and adjacent to the color band denoting body wall classification.

6.1.4 Performance Properties

6.1.4.1 Performance properties of new casing, tubing, and drill pipe are based on equations in API 5C3. However, there is no standard method for calculating performance properties of used casing and tubing. Casing and tubing wear (metal loss) and corrosion usually occur on the inside surface.

6.1.4.2 Used casing and tubing shall be evaluated by the pipe owner for internal and external corrosion.

NOTE Small pits or other localized metal loss may not be damaging depending on the application of the pipe

6.1.4.3 If cracks are detected in a length of pipe during inspection and are verified to be of sufficient length or depth per API 5CT to be identified by either visual, optical, or magnetic particle inspection, the joint shall be rejected and considered unfit for further service.

6.2 Metal Loss

6.2.1 Pipe Wall

6.2.1.1 Metal losses in used casing and tubing usually occur on the inside surface and range from isolated pits, gouges, or cuts to substantial reductions caused by mechanical wear or sand cutting. Wear occurs inside casing and liners by rotation and movement of the drill string while drilling

6.2.2 Threads

6.2.2.1 Casing and tubing threads should be inspected for the following:

a) pulled round threads;

b) galling;

c) fatigue cracks in the last engaged thread.

6.2.2.2 A fast thread lead at the area of last thread engagement of round threads indicates the threads were stretched when pulled at loads exceeding the yield strength of the connection. They can make into a coupling on the next make-up but will not have the anticipated joint strength and can have inadequate leak resistance.

6.2.2.3 Galling can be encountered while breaking out connections, particularly when backups are placed on the coupling. Also on repeated make-up, the threads make-up more each time and interference occur.

6.2.2.4 Work tubing and strings subjected to reciprocal tension stress often develop fatigue cracks at the root of the last engaged thread that can reduce tension values or propagate to joint failure during further use. These situations can require shopping of the threads to restore the length to usable status. Threaded connections may not gauge properly after being made up power tight, therefore minor deviations from the specified tolerances should be accepted.

6.2.3 Pin Pitch Diameter Reduction

Tubing that has made multiple round trips in the hole, as in the case of work strings, can have pins threads reduced in diameter due to successive yielding by repeated makeups. This condition can reduce joint strength, leak resistance, and in severe cases, lead to abutment of pin ends near the center of the coupling in the made-up connection.

6.3 Service Rating

6.3.1 Final rating of a length of pipe for further services requires consideration of the ID wall condition and remaining wall thickness to evaluate resistance of the body to collapse, burst, and tension; consideration of the thread condition to evaluate resistance to leaks; and consideration of the pin pitch diameter to evaluate make-up.

6.3.2 Depending on circumstances and emergency needs, gauging of the threads may be performed along with the usual wall inspection to determine final performance properties.

6.3.3 Utilization of the used casing or tubing should be based on experience and judgment with respect to well conditions and environmental factors.

7 Reconditioning

7.1 Tubular goods damaged through use or abuse shall be reconditioned and verified to be in accordance with API 5CT.

7.2 The acceptability of reconditioned threads shall be confirmed by gauging and inspection in accordance with API 5B.

8 Field Welding of Attachments on Casing

8.1 Introduction

8.1.1 Field weldability is not a primary factor in the selection of steel for the manufacture of casing and tubing. Steels most suitable for field welding do not have the desired performance properties for downhole use.

8.1.2 The heat from welding can affect the mechanical properties of high-strength casing steels. Cracks and brittle areas are likely to develop in the heat-affected zone. Hard areas or cracks can cause failure, especially when the casing is subjected to tool-joint battering. Strength loss reducing burst and collapse can also occur. Therefore, unless precautions are taken, welding can have adverse effects on the tubulars.

8.1.3 Practices and equipment that eliminate the need for welding should be implemented.

EXAMPLE The use of cements or locking attachments rather than welding bottom joints to prevent them from unscrewing. Similarly, the use of mechanical means for attachment of centralizers and scratchers.

8.1.4 When welding is required, there shall be proven practices and documented welding procedures in place that can minimize the adverse effects of welding.

NOTE See API 5C6 for information on welding of connectors to pipe.

9 Proprietary Connections and Chrome/CRA Grades

9.1 General

9.1.1 Proprietary connections are used on API 5CT and API 5CRA tubular products. Typically, these connections are handled and run differently than API connections. This section is a general guideline; manufacturer's specific procedures should be used, when applicable. This section also provides general information on the running, pulling, handling, and storage of chrome/corrosion resistant alloy (CRA) tubulars.

9.1.2 Proprietary connections include metal to metal seal (commonly referred to as premium) and non metal to metal seal (commonly referred to as semi-premium) connections. Proprietary connections may be either threaded and coupled, or semi-flush or flush integral connections.

9.2 Preparations before Running

9.2.1 Running Recommendations

9.2.1.1 General

Tubulars shall be run in accordance with the manufacturer's guidelines. Some key parameters that should be verified prior to running are included in 9.2.1.2 through 9.2.1.6

9.2.1.2 API Compatibility

9.2.1.2.1 Some semi-premium connections are designated as "buttress compatible". API buttress accessories and running tools may be acceptable without using crossovers.

9.2.1.2.2 The manufacturer's interchangeability requirements shall be followed.

9.2.1.3 Crossovers

For non-buttress compatible semi-premium and other proprietary connections including metal seal connections, crossovers may be required to accommodate accessories, cementing tools, well control tools, etc.

9.2.1.4 Running Tools

Proprietary connections can require specific running tools such as the following:

a) handling plugs for integral connections; a minimum of three handling plugs on location are recommended;

b) stabbing guides;

c) safety clamp for flush, semi-flush integral connections, or special clearance threaded and coupled connections;

d) single joint elevators;

e) weight compensator;

f) casing running tool (CRT);

g) torque turn computer monitoring system;

h) low or non-marking dies for sour service or CRA grades; non-ferrous dies for CRA pipe;

i) padded or sour service pipe handling equipment for sour service or CRA grades;

j) strap wrenches for hand starting connections, if recommended by connection manufacturer;

k) calibrated tongs with appropriate size and torque capacity.

9.2.1.5 Handling and Running

The following key parameters shall be verified:

a) Proprietary connection performance data sheet.

b) Correct thread compound and application procedure as designated by connection manufacturer or manufacturer's approved thread compound list.

c) Torque values for specific connection and thread compound used. In addition to minimum, optimum, and maximum torque values, some proprietary connections have minimum and maximum shoulder torque values.

d) Additional requirements for minimum, maximum delta turns, delta torque, make-up speed (rpm).

e) Acceptance and rejection criteria for make-up charts.

9.2.1.6 Running Support

Many proprietary connection manufacturers recommend use of authorized field service personnel to assist in inspecting and running connections on location. Authorized field service personnel can:

a) Inspect and potentially field repair damaged connections.

b) Ensure that the correct thread compound is used and applied correctly.

c) Ensure that the product is being run in compliance with the manufacturer's recommendations and that running equipment and tools are correct and operating correctly and within calibration when required.

d) Review and disposition torque turn make-up charts to ensure compliance with manufacturer's recommendations.

9.3 Pipe Handling

9.3.1 Pipe Handling from Trucks

9.3.1.1 When handling pipe from trucks to interim storage or rig racks, documented procedures shall be implemented to minimize any damage to the pipe body and connection.

9.3.1.2 Tubular products shall have protectors in place prior to movement.

9.3.1.3 Any pipe or tubular product that is dropped vertically greater than 1 ft (300 mm) during any movements shall be identified, segregated, and visually examined for any mechanical damage to the pipe body and threads. Additional inspections may be needed based on manufacturer recommendations, after the visual inspection is performed.

9.3.1.4 Nylon pipe body slings/straps shall be used for handling.

9.3.1.5 End hooks may be used only with the correct type of thread protector.

9.3.2 Unusable Pipe

9.3.2.1 Unusable pipe shall be marked and segregated.

9.3.2.2 Rust, scale, dirt and debris shall be removed from the inside and outside surfaces.

9.3.2.3 Dented, bent or otherwise damaged pipe shall be removed for possible repair.

9.3.2.4 Any pipe or tubular product that is rejected for visual thread damage or is unable to pass the full-length drift test shall be marked accordingly and segregated.

9.3.3 Cleaning Connections

9.3.3.1 Prior to running, connections shall be clean and free of all debris and contaminants.

9.3.3.2 Cleaning may be performed using liquid solvents (not diesel or other types of fuels) or high-pressure water.

9.3.3.3 Cleaning methods should conform to the recommendations of the proprietary threader or manufacturer.

9.3.3.4 Non-metallic brushes shall be used to remove adhered solids or heavy residual compounds.

9.3.3.5 The thread surfaces, both the pin and box threads, shall be visually inspected along with the seal areas for any nicks, dings, gouges, pitting or other types of imperfections or mechanical damage that is considered detrimental to the connection integrity and does not meet the manufacturer's proprietary connections requirements.

9.3.3.6 Rejected tubulars shall be marked and segregated.

9.3.3.7 Minor damage on pin and box connections may be repaired if allowed by the manufacturer of the specific proprietary connection.

9.3.3.8 Prior to making field repairs, a documented procedure should be implemented that addresses the allowable repairs, acceptance criteria, and the documentation of the filed repairs.

9.3.3.9 If pipe is moved from the rig site back into interim or long-term storage, uncontaminated acceptable thread compound shall be re-applied to the complete threaded or machined surfaces with a thin and even application.

9.3.3.10 The thread compound should be applied with a "moustache" style brush or paint brush.

9.3.3.11 A suitable thread compound shall be used for long-term storage.

9.3.3.12 Connections can be delivered with the appropriate running compound already applied. In this case, the compound shall be inspected to verify that it has not been contaminated and is visually in good condition prior to running.

NOTE If the compound is in good condition cleaning is not necessary.

9.3.3.13 Compound shall be added where it is removed by the protectors.

10 CRA Grades

10.1 CRA Steel Special Handling Precautions

10.1.1 Joints shall be handled one at a time using nylon slings.

10.1.2 Documented procedures shall be implemented to minimize joints contacting each other, i.e. "banging together" to prevent local surface hardened spots, which can lead to corrosion.

10.1.3 Pipe racks and pick-up/lay-down equipment shall be padded to help prevent unnecessary contact between joints and other steel components.

10.2 High Chrome Steel Running Procedures

The following apply to the running of high chrome steel.

a) Single joint compensators should be used.

b) Low stress dot dies or other non-marking systems in tongs, elevators and slips should be used. Non-directional, fine tooth, low stress dies with 360° contacts may be used as well.

c) The tube shall be rotated by hand with a strap wrench until the threads are fully engaged. Final make up with power tongs shall not exceed 6 rpm.

d) Torque turn monitoring shall be used when running high chrome steel tubes.

11 Storage of CRA Materials

11.1 Removing Tubular Goods

CRA tubulars should be removed from their export packing immediately upon receipt and store them indoors in a dry atmosphere where possible.

11.2 Tubular Inspection

11.2.1 CRA tubulars shall be inspected at intervals not to exceed three months depending on atmospheric conditions.

11.2.2 CRA tubular inspection should include the following:

a) checking the OD for discoloring or pitting;

b) checking the ID for discoloring or pitting;

c) removing the thread protectors and checking the condition of connections and storage compound;

d) replacing the connection storage compound as required, applying evenly on the connection.

11.3 Long Term CRA Storage

11.3.1 A storage compound shall be applied to CRA tubular connections for storage periods exceeding two months.

11.3.2 API thread compounds are not recommended for use as a long-term storage.

11.4 Outdoor Storage

11.4.1 If outdoor storage is the only option, the following additional procedures apply.

a) CRA materials shall be protected from rain and spray with tarpaulins or plastic covering.

NOTE Sweating and condensation can occur if there is insufficient air circulation.

b) CRA materials shall not be stored in conditions with stagnant water or moisture.

c) Pipes shall be rolled a minimum of every 30 days to verify that no moisture remains trapped between stripping and pipe OD to allow trapped moisture to dry.

d) It is recommended to use plastic stripping or zinc paint on wood strips to avoid direct contact between pipes and wood.

e) Pipe shall be stored with one end elevated to allow condensation or other trapped water to drain from pipe ID.

11.4.2 Refer to the manufacturer's storage instructions for additional information.

11.5 Storage following Pulling (Short Term or Long Term)

The following apply to CRA steel products when removed from a well due to the materials pitting susceptibility caused by chlorides in an oxygen rich environment.

a) Tubulars should be flushed with fresh water and stored with one end elevated immediately upon removing from the well to allow condensation or other trapped water to drain from pipe ID.

b) After drainage is completed, the connections should be cleaned, dried and inspected.

c) If field repairs are necessary, they shall be performed in accordance with manufacturer's instructions.

d) Storage compound should be applied to cleaned and dried connections and installed with thread protectors.

NOTE Steps a) through d) are applicable if pipe is to be re-run within 12 to 72 hours.

e) For storage periods of 1 week to 4 weeks, Steps a) through d) should be applied with the exception that water soluble corrosion inhibitor for brine solutions should be sprayed on the OD and ID of pipe after drainage is complete.

f) For storage periods greater than 1 month, Steps a) through d) should be applied with the exception that an external pipe coating of clear varnish and an internal pipe coating should be applied.

Annex A
(informative)

Seal Ring Installation

A.1 General

The following supplementary instructions are intended to aid in the correct installation of non-metallic seal rings in API connections.

A.2 Identification

API 5CT, SR-13 seal ring couplings have a blue paint band in addition to API grade stencil color markings as shown in Figure A.1.

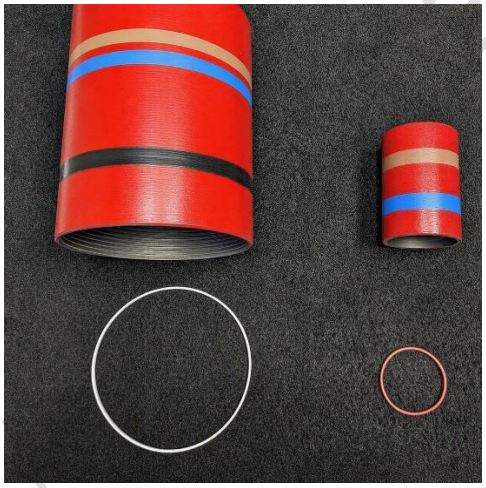


Figure A.1 – 7 in. BC and 2 7/8 in. EUE SR couplings and Seal Rings

A.3 Installation

A.3.1 General

A.3.1.1 If non-metallic rings (PTFE) are installed, seal ring grooves should be cleaned prior to installation.

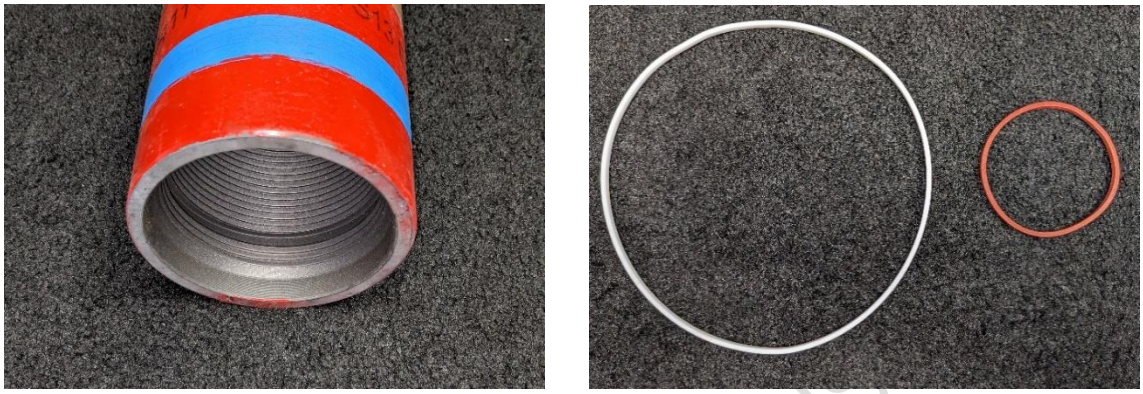
A.3.1.2 PTFE seal rings should be installed by pinching the individual ring into the shape of a “smile”, inserting the seal ring into one side of the groove, and opening the seal-ring into its original circular shape by pressing the entire ring around the circumference of the groove and seating the seal ring in place.

A.3.1.3 A dope brush with a wooden handle may be used to press the ring in the groove.

A.3.2 Installation Procedure

PTFE seal rings shall be installed in accordance with the following procedure.

1) Inspect the seal ring and seal ring groove damage as shown in Figure A.2. Seal rings shall be unused, clean, and dry, and without visible damage. the seal ring groove shall be clean and dry and have no sharp edges or burrs protruding into the groove.



a) Seal Ring Groove **b) Seal Rings**

Figure A.2 – Seal Ring Groove and Seal Rings

2) Form seal ring into the shape below prior to installing in seal ring groove as shown in Figure A.3. Avoid sharp bends or forming “kinks” in the seal ring.

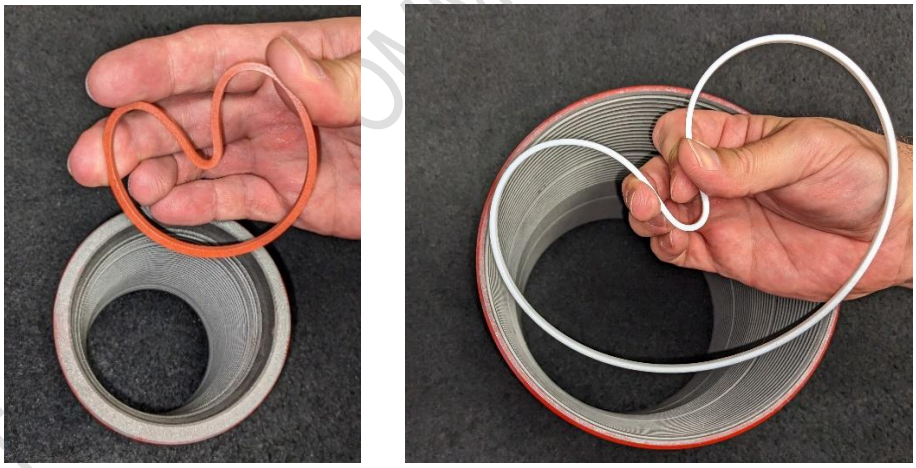


Figure A.3 – Seal Ring Forming

3) Install the seal ring in one side of the seal ring groove as shown in Figure A.4.

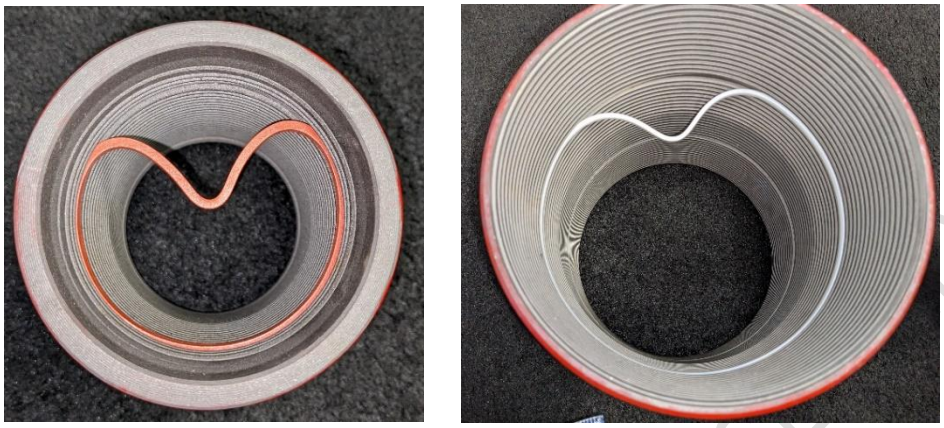


Figure A.4 –Seal Ring Placing

4) Snap ring into place around seal ring groove as shown in Figure A.5.

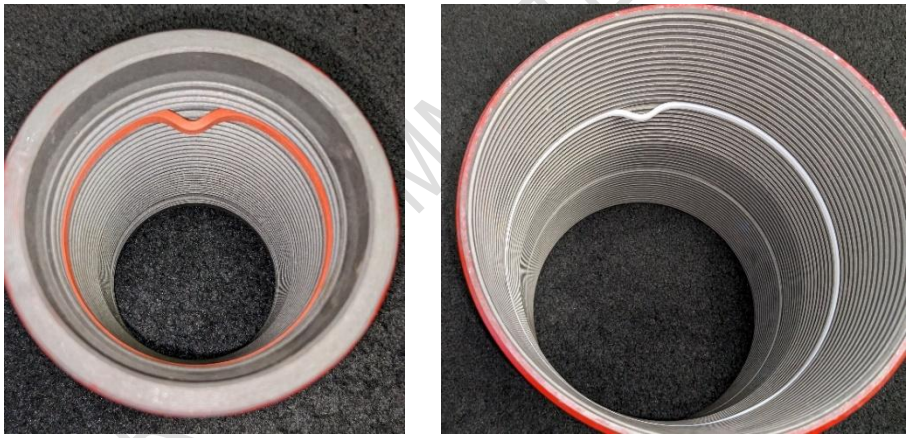


Figure A.5 – Snapping Seal Ring into Place

5) Use a soft rounded tool such as a wooden brush handle to completely snap the seal ring into place as shown in Figure A.6.

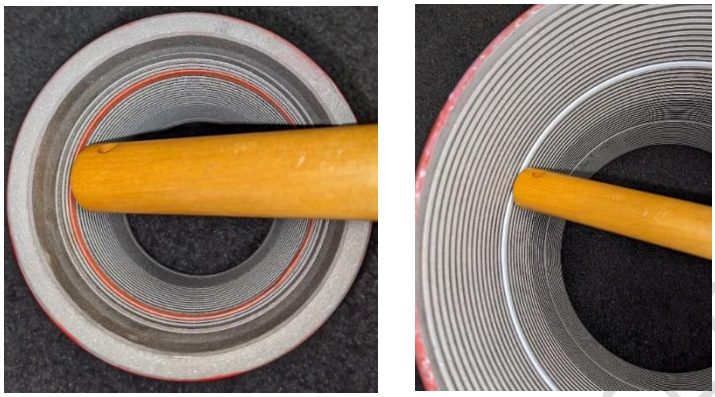


Figure A.6 – Completing Seal Ring Installation

6) Inspect and verify that the seal ring is fully seated 360° in the seal ring groove as shown in Figure A.7 and Figure A.8.

Figure A.7 – Properly Seated Seal Rings

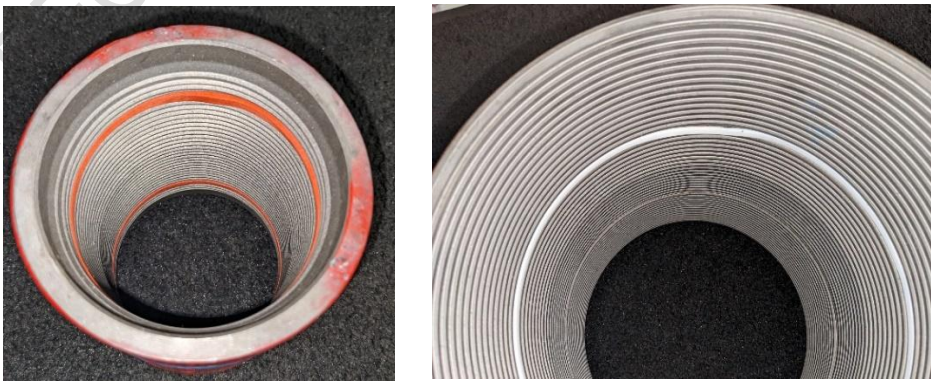


Figure A.8 – Seal Rings not Fully Seated

7) After seal ring installation, seal ring couplings shall have thread compound applied to the internal threads for the entire thread area.

Annex B
(informative)

Make-up Torque Guidelines

Table B.1 contains torque values that have been selected to provide recommended make-up for 8-round thread casing under normal conditions.

Table B.1—Casing Make-up Torque Guideline for 8-Round Thread Casing

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
4 1/2	9.50	4.500 (114.30)	0.205 (5.21)	H40	770 (1040)	--
4 1/2	9.50	4.500 (114.30)	0.205 (5.21)	J55	1010 (1380)	--
4 1/2	10.50	4.500 (114.30)	0.224 (5.69)	J55	1320 (1790)	--
4 1/2	11.60	4.500 (114.30)	0.250 (6.35)	J55	1540 (2090)	1620 (2200)
4 1/2	9.50	4.500 (114.30)	0.205 (5.21)	K55	1120 (1520)	--
4 1/2	10.50	4.500 (114.30)	0.224 (5.69)	K55	1460 (1980)	--
4 1/2	11.60	4.500 (114.30)	0.250 (6.35)	K55	1700 (2310)	1800 (2430)
4 1/2	11.60	4.500 (114.30)	0.250 (6.35)	L80	--	2230 (3030)
4 1/2	13.50	4.500 (114.30)	0.290 (7.37)	L80	--	2710 (3670)
4 1/2	11.60	4.500 (114.30)	0.250 (6.35)	N80	--	2280 (3090)
4 1/2	13.50	4.500 (114.30)	0.290 (7.37)	N80	--	2760 (3740)
4 1/2	11.60	4.500 (114.30)	0.250 (6.35)	C90	--	2450 (3320)
4 1/2	13.50	4.500 (114.30)	0.290 (7.37)	C90	--	2970 (4030)
4 1/2	11.60	4.500 (114.30)	0.250 (6.35)	R95	--	2580 (3500)
4 1/2	13.50	4.500 (114.30)	0.290 (7.37)	R95	--	3130 (4240)
4 1/2	11.60	4.500 (114.30)	0.250 (6.35)	T95	--	2580 (3500)
4 1/2	13.50	4.500 (114.30)	0.290 (7.37)	T95	--	3130 (4240)
4 1/2	11.60	4.500 (114.30)	0.250 (6.35)	P110	--	3020 (4100)
4 1/2	13.50	4.500 (114.30)	0.290 (7.37)	P110	--	3660 (4960)
4 1/2	15.10	4.500 (114.30)	0.337 (8.56)	P110	--	4400 (5960)
4 1/2	15.10	4.500 (114.30)	0.337 (8.56)	Q125	--	4910 (6650)
5	11.50	5.000 (127.00)	0.229 (5.59)	J55	1330 (1810)	--
5	13.00	5.000 (127.00)	0.253 (6.43)	J55	1690 (2290)	1820 (2470)

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
5	15.00	5.000 (127.00)	0.296 (7.52)	J55	2070 (2800)	2230 (3020)
5	11.50	5.000 (127.00)	0.229 (5.59)	K55	1470 (1990)	--
5	13.00	5.000 (127.00)	0.253 (6.43)	K55	1860 (2520)	2010 (2730)
5	15.00	5.000 (127.00)	0.296 (7.52)	K55	2280 (3090)	2460 (3340)
5	15.00	5.000 (127.00)	0.296 (7.52)	L80	--	3080 (4170)
5	18.00	5.000 (127.00)	0.362 (9.19)	L80	--	3930 (5320)
5	21.40	5.000 (127.00)	0.437 (11.10)	L80	--	4860 (6590)
5	23.20	5.000 (127.00)	0.478 (12.14)	L80	--	5350 (7260)
5	24.10	5.000 (127.00)	0.500 (12.70)	L80	--	5610 (7610)
5	15.00	5.000 (127.00)	0.296 (7.52)	N80	--	3140 (4250)
5	18.00	5.000 (127.00)	0.362 (9.19)	N80	--	4000 (5420)
5	21.40	5.000 (127.00)	0.437 (11.10)	N80	--	4950 (6710)
5	23.20	5.000 (127.00)	0.478 (12.14)	N80	--	5450 (7400)
5	24.10	5.000 (127.00)	0.500 (12.70)	N80	--	5720 (7760)
5	15.00	5.000 (127.00)	0.296 (7.52)	C90	--	3380 (4590)
5	18.00	5.000 (127.00)	0.362 (9.19)	C90	--	4310 (5850)
5	21.40	5.000 (127.00)	0.437 (11.10)	C90	--	5340 (7240)
5	23.20	5.000 (127.00)	0.478 (12.14)	C90	--	5880 (7980)
5	24.10	5.000 (127.00)	0.500 (12.70)	C90	--	6170 (8370)
5	15.00	5.000 (127.00)	0.296 (7.52)	R95	--	3560 (4830)
5	18.00	5.000 (127.00)	0.362 (9.19)	R95	--	4550 (6160)
5	21.40	5.000 (127.00)	0.437 (11.10)	R95	--	5620 (7630)
5	23.20	5.000 (127.00)	0.478 (12.14)	R95	--	6200 (8400)
5	24.10	5.000 (127.00)	0.500 (12.70)	R95	--	6500 (8810)
5	15.00	5.000 (127.00)	0.296 (7.52)	T95	--	3560 (4830)
5	18.00	5.000 (127.00)	0.362 (9.19)	T95	--	4550 (6160)
5	21.40	5.000 (127.00)	0.437 (11.10)	T95	--	5620 (7630)
5	23.20	5.000 (127.00)	0.478 (12.14)	T95	--	6200 (8400)
5	24.10	5.000 (127.00)	0.500 (12.70)	T95	--	6500 (8810)
5	15.00	5.000 (127.00)	0.296 (7.52)	P110	--	4170 (5650)
5	18.00	5.000 (127.00)	0.362 (9.19)	P110	--	5310 (7210)
5	21.40	5.000 (127.00)	0.437 (11.10)	P110	--	6580 (8920)
5	23.20	5.000 (127.00)	0.478 (12.14)	P110	--	7250 (9830)

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
5	24.10	5.000 (127.00)	0.500 (12.70)	P110	--	7600 (10,310)
5	18.00	5.000 (127.00)	0.362 (9.19)	Q125	--	5930 (8050)
5	21.40	5.000 (127.00)	0.437 (11.10)	Q125	--	7340 (9960)
5	23.20	5.000 (127.00)	0.478 (12.14)	Q125	--	8090 (10,970)
5	24.10	5.000 (127.00)	0.500 (12.70)	Q125	--	8490 (11,510)
5 1/2	14.00	5.500 (139.70)	0.244 (6.20)	H40	1300 (1760)	--
5 1/2	14.00	5.500 (139.70)	0.244 (6.20)	J55	1720 (2330)	--
5 1/2	15.50	5.500 (139.70)	0.275 (6.99)	J55	2020 (2730)	2170 (2940)
5 1/2	17.00	5.500 (139.70)	0.304 (7.72)	J55	2290 (3110)	2470 (3340)
5 1/2	14.00	5.500 (139.70)	0.244 (6.20)	K55	1890 (2560)	--
5 1/2	15.50	5.500 (139.70)	0.275 (6.99)	K55	2220 (3000)	2390 (3240)
5 1/2	17.00	5.500 (139.70)	0.304 (7.72)	K55	2520 (3410)	2720 (3680)
5 1/2	17.00	5.500 (139.70)	0.304 (7.72)	L80	--	3410 (4630)
5 1/2	20.00	5.500 (139.70)	0.361 (9.17)	L80	--	4200 (5700)
5 1/2	23.00	5.500 (139.70)	0.415 (10.54)	L80	--	4930 (6690)
5 1/2	17.00	5.500 (139.70)	0.304 (7.72)	N80	--	3480 (4710)
5 1/2	20.00	5.500 (139.70)	0.361 (9.17)	N80	--	4280 (5800)
5 1/2	23.00	5.500 (139.70)	0.415 (10.54)	N80	--	5020 (6810)
5 1/2	17.00	5.500 (139.70)	0.304 (7.72)	C90	--	3750 (5090)
5 1/2	20.00	5.500 (139.70)	0.361 (9.17)	C90	--	4620 (6270)
5 1/2	23.00	5.500 (139.70)	0.415 (10.54)	C90	--	5430 (7360)
5 1/2	17.00	5.500 (139.70)	0.304 (7.72)	R95	--	3960 (5360)
5 1/2	20.00	5.500 (139.70)	0.361 (9.17)	R95	--	4870 (6600)
5 1/2	23.00	5.500 (139.70)	0.415 (10.54)	R95	--	5720 (7750)
5 1/2	17.00	5.500 (139.70)	0.304 (7.72)	T95	--	3960 (5360)
5 1/2	20.00	5.500 (139.70)	0.361 (9.17)	T95	--	4870 (6600)
5 1/2	23.00	5.500 (139.70)	0.415 (10.54)	T95	--	5720 (7750)
5 1/2	17.00	5.500 (139.70)	0.304 (7.72)	P110	--	4620 (6270)
5 1/2	20.00	5.500 (139.70)	0.361 (9.17)	P110	--	5690 (7720)
5 1/2	23.00	5.500 (139.70)	0.415 (10.54)	P110	--	6680 (9060)
5 1/2	23.00	5.500 (139.70)	0.415 (10.54)	Q125	--	7470 (10,120)
6 5/8	20.00	6.625 (168.28)	0.288 (7.32)	H40	1840 (2490)	--

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
6 5/8	20.00	6.625 (168.28)	0.288 (7.32)	J55	2450 (3320)	2660 (3600)
6 5/8	24.00	6.625 (168.28)	0.352 (8.94)	J55	3140 (4250)	3400 (4620)
6 5/8	20.00	6.625 (168.28)	0.288 (7.32)	K55	2670 (3620)	2900 (3940)
6 5/8	24.00	6.625 (168.28)	0.352 (8.94)	K55	3420 (4640)	3720 (5050)
6 5/8	24.00	6.625 (168.28)	0.352 (8.94)	L80	--	4730 (6410)
6 5/8	28.00	6.625 (168.28)	0.417 (10.59)	L80	--	5760 (7810)
6 5/8	32.00	6.625 (168.28)	0.475 (12.07)	L80	--	6660 (9030)
6 5/8	24.00	6.625 (168.28)	0.352 (8.94)	N80	--	4810 (6520)
6 5/8	28.00	6.625 (168.28)	0.417 (10.59)	N80	--	5860 (7940)
6 5/8	32.00	6.625 (168.28)	0.475 (12.07)	N80	--	6780 (9190)
6 5/8	24.00	6.625 (168.28)	0.352 (8.94)	C90	--	5210 (7060)
6 5/8	28.00	6.625 (168.28)	0.417 (10.59)	C90	--	6350 (8610)
6 5/8	32.00	6.625 (168.28)	0.475 (12.07)	C90	--	7340 (9950)
6 5/8	24.00	6.625 (168.28)	0.352 (8.94)	R95	--	5490 (7440)
6 5/8	28.00	6.625 (168.28)	0.417 (10.59)	R95	--	6690 (9070)
6 5/8	32.00	6.625 (168.28)	0.475 (12.07)	R95	--	7740 (10490)
6 5/8	24.00	6.625 (168.28)	0.352 (8.94)	T95	--	5490 (7440)
6 5/8	28.00	6.625 (168.28)	0.417 (10.59)	T95	--	6690 (9070)
6 5/8	32.00	6.625 (168.28)	0.475 (12.07)	T95	--	7740 (10,490)
6 5/8	24.00	6.625 (168.28)	0.352 (8.94)	P110	--	6410 (8690)
6 5/8	28.00	6.625 (168.28)	0.417 (10.59)	P110	--	7810 (10,590)
6 5/8	32.00	6.625 (168.28)	0.475 (12.07)	P110	--	9040 (12,250)
6 5/8	32.00	6.625 (168.28)	0.475 (12.07)	Q125	--	10,110 (13,710)
7	17.00	7.000 (177.80)	0.231 (5.87)	H40	1220 (1650)	--
7	20.00	7.000 (177.80)	0.272 (6.91)	H40	1760 (2380)	--
7	20.00	7.000 (177.80)	0.272 (6.91)	J55	2340 (3170)	--
7	23.00	7.000 (177.80)	0.317 (8.05)	J55	2840 (3850)	3130 (4240)
7	26.00	7.000 (177.80)	0.362 (9.19)	J55	3340 (4530)	3670 (4980)
7	20.00	7.000 (177.80)	0.272 (6.91)	K55	2540 (3450)	--
7	23.00	7.000 (177.80)	0.317 (8.05)	K55	3090 (4190)	3410 (4630)
7	26.00	7.000 (177.80)	0.362 (9.19)	K55	3640 (4930)	4010 (5440)
7	23.00	7.000 (177.80)	0.317 (8.05)	L80	--	4350 (5890)
7	26.00	7.000 (177.80)	0.362 (9.19)	L80	--	5110 (6930)

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
7	29.00	7.000 (177.80)	0.408 (10.36)	L80	--	5870 (7960)
7	32.00	7.000 (177.80)	0.453 (11.51)	L80	--	6610 (8970)
7	35.00	7.000 (177.80)	0.498 (12.65)	L80	--	7340 (9950)
7	38.00	7.000 (177.80)	0.540 (13.72)	L80	--	8010 (10,860)
7	23.00	7.000 (177.80)	0.317 (8.05)	N80	--	4420 (5990)
7	26.00	7.000 (177.80)	0.362 (9.19)	N80	--	5190 (7040)
7	29.00	7.000 (177.80)	0.408 (10.36)	N80	--	5970 (8100)
7	32.00	7.000 (177.80)	0.453 (11.51)	N80	--	6720 (9110)
7	35.00	7.000 (177.80)	0.498 (12.65)	N80	--	7460 (10,120)
7	38.00	7.000 (177.80)	0.540 (13.72)	N80	--	8140 (11,040)
7	23.00	7.000 (177.80)	0.317 (8.05)	C90	--	4790 (6500)
7	26.00	7.000 (177.80)	0.362 (9.19)	C90	--	5630 (7630)
7	29.00	7.000 (177.80)	0.408 (10.36)	C90	--	6480 (8780)
7	32.00	7.000 (177.80)	0.453 (11.51)	C90	--	7290 (9890)
7	35.00	7.000 (177.80)	0.498 (12.65)	C90	--	8090 (10,970)
7	38.00	7.000 (177.80)	0.540 (13.72)	C90	--	8830 (11,970)
7	23.00	7.000 (177.80)	0.317 (8.05)	R95	--	5050 (6850)
7	26.00	7.000 (177.80)	0.362 (9.19)	R95	--	5930 (8050)
7	29.00	7.000 (177.80)	0.408 (10.36)	R95	--	6830 (9250)
7	32.00	7.000 (177.80)	0.453 (11.51)	R95	--	7680 (10,420)
7	35.00	7.000 (177.80)	0.498 (12.65)	R95	--	8530 (11,560)
7	38.00	7.000 (177.80)	0.540 (13.72)	R95	--	9310 (12,620)
7	23.00	7.000 (177.80)	0.317 (8.05)	T95	--	5050 (6850)
7	26.00	7.000 (177.80)	0.362 (9.19)	T95	--	5930 (8050)
7	29.00	7.000 (177.80)	0.408 (10.36)	T95	--	6830 (9250)
7	32.00	7.000 (177.80)	0.453 (11.51)	T95	--	7680 (10,420)
7	35.00	7.000 (177.80)	0.498 (12.65)	T95	--	8530 (11,560)
7	38.00	7.000 (177.80)	0.540 (13.72)	T95	--	9310 (12,620)
7	26.00	7.000 (177.80)	0.362 (9.19)	P110	--	6930 (9390)
7	29.00	7.000 (177.80)	0.408 (10.36)	P110	--	7970 (10,800)
7	32.00	7.000 (177.80)	0.453 (11.51)	P110	--	8970 (12,160)
7	35.00	7.000 (177.80)	0.498 (12.65)	P110	--	9960 (13,500)
7	38.00	7.000 (177.80)	0.540 (13.72)	P110	--	10,870 (14,730)

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
7	35.00	7.000 (177.80)	0.498 (12.65)	Q125	--	11,150 (15,110)
7	38.00	7.000 (177.80)	0.540 (13.72)	Q125	--	12,160 (16,490)
7 5/8	24.00	7.625 (193.68)	0.300 (7.62)	H40	2120 (2870)	--
7 5/8	26.40	7.625 (193.68)	0.328 (8.33)	J55	3150 (4270)	3460 (4690)
7 5/8	26.40	7.625 (193.68)	0.328 (8.33)	K55	3420 (4640)	3770 (5110)
7 5/8	26.40	7.625 (193.68)	0.328 (8.33)	L80	--	4820 (6530)
7 5/8	29.70	7.625 (193.68)	0.375 (9.53)	L80	--	5670 (7680)
7 5/8	33.70	7.625 (193.68)	0.430 (10.92)	L80	--	6640 (9000)
7 5/8	39.00	7.625 (193.68)	0.500 (12.70)	L80	--	7860 (10,650)
7 5/8	42.80	7.625 (193.68)	0.562 (14.27)	L80	--	8910 (12,090)
7 5/8	45.30	7.625 (193.68)	0.595 (15.11)	L80	--	9470 (12,840)
7 5/8	47.10	7.625 (193.68)	0.625 (15.88)	L80	--	9970 (13,520)
7 5/8	26.40	7.625 (193.68)	0.328 (8.33)	N80	--	4900 (6640)
7 5/8	29.70	7.625 (193.68)	0.375 (9.53)	N80	--	5750 (7800)
7 5/8	33.70	7.625 (193.68)	0.430 (10.92)	N80	--	6740 (9140)
7 5/8	39.00	7.625 (193.68)	0.500 (12.70)	N80	--	7980 (10,820)
7 5/8	42.80	7.625 (193.68)	0.562 (14.27)	N80	--	9060 (12,280)
7 5/8	45.30	7.625 (193.68)	0.595 (15.11)	N80	--	9620 (13,040)
7 5/8	47.10	7.625 (193.68)	0.625 (15.88)	N80	--	10,130 (13,730)
7 5/8	26.40	7.625 (193.68)	0.328 (8.33)	C90	--	5320 (7210)
7 5/8	29.70	7.625 (193.68)	0.375 (9.53)	C90	--	6250 (8470)
7 5/8	33.70	7.625 (193.68)	0.430 (10.92)	C90	--	7330 (9930)
7 5/8	39.00	7.625 (193.68)	0.500 (12.70)	C90	--	8670 (11,750)
7 5/8	42.80	7.625 (193.68)	0.562 (14.27)	C90	--	9840 (13,330)
7 5/8	45.30	7.625 (193.68)	0.595 (15.11)	C90	--	10,450 (14,160)
7 5/8	47.10	7.625 (193.68)	0.625 (15.88)	C90	--	11,000 (14,910)
7 5/8	26.40	7.625 (193.68)	0.328 (8.33)	R95	--	5600 (7600)
7 5/8	29.70	7.625 (193.68)	0.375 (9.53)	R95	--	6590 (8930)
7 5/8	33.70	7.625 (193.68)	0.430 (10.92)	R95	--	7720 (10,470)
7 5/8	39.00	7.625 (193.68)	0.500 (12.70)	R95	--	9140 (12,390)
7 5/8	42.80	7.625 (193.68)	0.562 (14.27)	R95	--	10,370 (14,050)
7 5/8	45.30	7.625 (193.68)	0.595 (15.11)	R95	--	11,010 (14,930)
7 5/8	47.10	7.625 (193.68)	0.625 (15.88)	R95	--	11,590 (15,720)

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
7 5/8	26.40	7.625 (193.68)	0.328 (8.33)	T95	--	5600 (7600)
7 5/8	29.70	7.625 (193.68)	0.375 (9.53)	T95	--	6590 (8930)
7 5/8	33.70	7.625 (193.68)	0.430 (10.92)	T95	--	7720 (10,470)
7 5/8	39.00	7.625 (193.68)	0.500 (12.70)	T95	--	9140 (12,390)
7 5/8	42.80	7.625 (193.68)	0.562 (14.27)	T95	--	10,370 (14,050)
7 5/8	45.30	7.625 (193.68)	0.595 (15.11)	T95	--	11,010 (14,930)
7 5/8	47.10	7.625 (193.68)	0.625 (15.88)	T95	--	11,590 (15,720)
7 5/8	29.70	7.625 (193.68)	0.375 (9.53)	P110	--	7690 (10,420)
7 5/8	33.70	7.625 (193.68)	0.430 (10.92)	P110	--	9010 (12,220)
7 5/8	39.00	7.625 (193.68)	0.500 (12.70)	P110	--	10,660c(14,460)
7 5/8	42.80	7.625 (193.68)	0.562 (14.27)	P110	--	12,100 (16,440)
7 5/8	45.30	7.625 (193.68)	0.595 (15.11)	P110	--	12,850 (17,420)
7 5/8	47.10	7.625 (193.68)	0.625 (15.88)	P110	--	13,530 (18,340)
7 5/8	39.00	7.625 (193.68)	0.500 (12.70)	Q125	--	11,940 (16,190)
7 5/8	42.80	7.625 (193.68)	0.562 (14.27)	Q125	--	13,550 (18,370)
7 5/8	45.30	7.625 (193.68)	0.595 (15.11)	Q125	--	14,390 (19,520)
7 5/8	47.10	7.625 (193.68)	0.625 (15.88)	Q125	--	15,150 (20,540)
8 5/8	28.00	8.625 (219.08)	0.304 (7.72)	H40	2330 (3150)	--
8 5/8	32.00	8.625 (219.08)	0.352 (8.94)	H40	2790 (3780)	--
8 5/8	24.00	8.625 (219.08)	0.264 (6.71)	J55	2440 (3310)	--
8 5/8	32.00	8.625 (219.08)	0.352 (8.94)	J55	3720 (5050)	4170 (5660)
8 5/8	36.00	8.625 (219.08)	0.400 (10.16)	J55	4340 (5880)	4860 (6590)
8 5/8	24.00	8.625 (219.08)	0.264 (6.71)	K55	2630 (3570)	--
8 5/8	32.00	8.625 (219.08)	0.352 (8.94)	K55	4020 (5460)	4520 (6130)
8 5/8	36.00	8.625 (219.08)	0.400 (10.16)	K55	4680 (6350)	5260 (7140)
8 5/8	36.00	8.625 (219.08)	0.400 (10.16)	L80	--	6780 (9190)
8 5/8	40.00	8.625 (219.08)	0.450 (11.43)	L80	--	7760 (10,530)
8 5/8	44.00	8.625 (219.08)	0.500 (12.70)	L80	--	8740 (11,840)
8 5/8	49.00	8.625 (219.08)	0.557 (14.15)	L80	--	9830 (13,320)
8 5/8	36.00	8.625 (219.08)	0.400 (10.16)	N80	--	6880 (9330)
8 5/8	40.00	8.625 (219.08)	0.450 (11.43)	N80	--	7880 (10,680)
8 5/8	44.00	8.625 (219.08)	0.500 (12.70)	N80	--	8870 (12,020)
8 5/8	49.00	8.625 (219.08)	0.557 (14.15)	N80	--	9970 (13,520)

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
8 5/8	36.00	8.625 (219.08)	0.400 (10.16)	C90	--	7490 (10,150)
8 5/8	40.00	8.625 (219.08)	0.450 (11.43)	C90	--	8580 (11,630)
8 5/8	44.00	8.625 (219.08)	0.500 (12.70)	C90	--	9650 (13,080)
8 5/8	49.00	8.625 (219.08)	0.557 (14.15)	C90	--	10,850 (14,710)
8 5/8	36.00	8.625 (219.08)	0.400 (10.16)	R95	--	7890 (10,700)
8 5/8	40.00	8.625 (219.08)	0.450 (11.43)	R95	--	9040 (12,260)
8 5/8	44.00	8.625 (219.08)	0.500 (12.70)	R95	--	10,170 (13,790)
8 5/8	49.00	8.625 (219.08)	0.557 (14.15)	R95	--	11,440 (15,510)
8 5/8	36.00	8.625 (219.08)	0.400 (10.16)	T95	--	7890 (10,700)
8 5/8	40.00	8.625 (219.08)	0.450 (11.43)	T95	--	9040 (12,260)
8 5/8	44.00	8.625 (219.08)	0.500 (12.70)	T95	--	10,170 (13,790)
8 5/8	49.00	8.625 (219.08)	0.557 (14.15)	T95	--	11,440 (15,510)
8 5/8	40.00	8.625 (219.08)	0.450 (11.43)	P110	--	10,550 (14,300)
8 5/8	44.00	8.625 (219.08)	0.500 (12.70)	P110	--	11,860 (16,090)
8 5/8	49.00	8.625 (219.08)	0.557 (14.15)	P110	--	13,350 (18,100)
8 5/8	49.00	8.625 (219.08)	0.557 (14.15)	Q125	--	14,960 (20,280)
9 5/8	32.30	9.625 (244.48)	0.312 (7.92)	H40	2540 (3440)	--
9 5/8	36.00	9.625 (244.48)	0.352 (8.94)	H40	2940 (3990)	--
9 5/8	36.00	9.625 (244.48)	0.352 (8.94)	J55	3940 (5340)	4530 (6140)
9 5/8	40.00	9.625 (244.48)	0.395 (10.03)	J55	4520 (6120)	5200 (7050)
9 5/8	36.00	9.625 (244.48)	0.352 (8.94)	K55	4230 (5740)	4890 (6630)
9 5/8	40.00	9.625 (244.48)	0.395 (10.03)	K55	4860 (6590)	5610 (7610)
9 5/8	40.00	9.625 (244.48)	0.395 (10.03)	L80	--	7270 (9860)
9 5/8	43.50	9.625 (244.48)	0.435 (11.05)	L80	--	8130 (11,030)
9 5/8	47.00	9.625 (244.48)	0.472 (11.99)	L80	--	8930 (12,100)
9 5/8	53.50	9.625 (244.48)	0.545 (13.84)	L80	--	10,470 (14,190)
9 5/8	58.40	9.625 (244.48)	0.595 (15.11)	L80	--	11,510 (15,600)
9 5/8	40.00	9.625 (244.48)	0.395 (10.03)	N80	--	7370 (10,000)
9 5/8	43.50	9.625 (244.48)	0.435 (11.05)	N80	--	8250 (11,190)
9 5/8	47.00	9.625 (244.48)	0.472 (11.99)	N80	--	9050 (12,270)
9 5/8	53.50	9.625 (244.48)	0.545 (13.84)	N80	--	10,620 (14,390)
9 5/8	58.40	9.625 (244.48)	0.595 (15.11)	N80	--	11,670 (15,820)
9 5/8	40.00	9.625 (244.48)	0.395 (10.03)	C90	--	8040 (10,900)

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
9 5/8	43.50	9.625 (244.48)	0.435 (11.05)	C90	--	8990 (12,190)
9 5/8	47.00	9.625 (244.48)	0.472 (11.99)	C90	--	9870 (13,380)
9 5/8	53.50	9.625 (244.48)	0.545 (13.84)	C90	--	11,570 (15,690)
9 5/8	58.40	9.625 (244.48)	0.595 (15.11)	C90	--	12,720 (17,250)
9 5/8	40.00	9.625 (244.48)	0.395 (10.03)	R95	--	8470 (11,490)
9 5/8	43.50	9.625 (244.48)	0.435 (11.05)	R95	--	9480 (12,850)
9 5/8	47.00	9.625 (244.48)	0.472 (11.99)	R95	--	10,400 (14,100)
9 5/8	53.50	9.625 (244.48)	0.545 (13.84)	R95	--	12,200 (16,540)
9 5/8	58.40	9.625 (244.48)	0.595 (15.11)	R95	--	13,410 (18,180)
9 5/8	40.00	9.625 (244.48)	0.395 (10.03)	T95	--	8470 (11,490)
9 5/8	43.50	9.625 (244.48)	0.435 (11.05)	T95	--	9480 (12,850)
9 5/8	47.00	9.625 (244.48)	0.472 (11.99)	T95	--	10,400 (14,100)
9 5/8	53.50	9.625 (244.48)	0.545 (13.84)	T95	--	12,200 (16,540)
9 5/8	58.40	9.625 (244.48)	0.595 (15.11)	T95	--	13,410 (18,180)
9 5/8	43.50	9.625 (244.48)	0.435 (11.05)	P110	--	11,050 (14,980)
9 5/8	47.00	9.625 (244.48)	0.472 (11.99)	P110	--	12,130 (16,440)
9 5/8	53.50	9.625 (244.48)	0.545 (13.84)	P110	--	14,220 (19,280)
9 5/8	58.40	9.625 (244.48)	0.595 (15.11)	P110	--	15,630 (21,200)
9 5/8	47.00	9.625 (244.48)	0.472 (11.99)	Q125	--	13,600 (18,440)
9 5/8	53.50	9.625 (244.48)	0.545 (13.84)	Q125	--	15,950 (21,630)
9 5/8	58.40	9.625 (244.48)	0.595 (15.11)	Q125	--	17,540 (23,770)
10 3/4	32.75	10.750 (273.05)	0.279 (7.09)	H40	2050 (2790)	--
10 3/4	40.50	10.750 (273.05)	0.350 (8.89)	H40	3140 (4250)	--
10 3/4	40.50	10.750 (273.05)	0.350 (8.89)	J55	4200 (5700)	--
10 3/4	45.50	10.750 (273.05)	0.400 (10.16)	J55	4930 (6680)	--
10 3/4	51.00	10.750 (273.05)	0.450 (11.43)	J55	5650 (7660)	--
10 3/4	40.50	10.750 (273.05)	0.350 (8.89)	K55	4500 (6100)	--
10 3/4	45.50	10.750 (273.05)	0.400 (10.16)	K55	5280 (7160)	--
10 3/4	51.00	10.750 (273.05)	0.450 (11.43)	K55	6060 (8210)	--
10 3/4	51.00	10.750 (273.05)	0.450 (11.43)	L80	7940 (10,760)	--
10 3/4	55.50	10.750 (273.05)	0.495 (12.57)	L80	8840 (11,990)	--
10 3/4	51.00	10.750 (273.05)	0.450 (11.43)	N80	8040 (10,900)	--
10 3/4	55.50	10.750 (273.05)	0.495 (12.57)	N80	8950 (12,140)	--

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
10 3/4	51.00	10.750 (273.05)	0.450 (11.43)	C90	8790 (11,920)	--
10 3/4	55.50	10.750 (273.05)	0.495 (12.57)	C90	9790 (13,270)	--
10 3/4	60.70	10.750 (273.05)	0.545 (13.84)	C90	10,890 (14,770)	--
10 3/4	65.70	10.750 (273.05)	0.595 (15.11)	C90	11,980 (16,240)	--
10 3/4	51.00	10.750 (273.05)	0.450 (11.43)	R95	9270 (12,560)	--
10 3/4	55.50	10.750 (273.05)	0.495 (12.57)	R95	10,320 (13,990)	--
10 3/4	51.00	10.750 (273.05)	0.450 (11.43)	T95	9270 (12,560)	--
10 3/4	55.50	10.750 (273.05)	0.495 (12.57)	T95	10,320 (13,990)	--
10 3/4	60.70	10.750 (273.05)	0.545 (13.84)	T95	11,480 (15,570)	--
10 3/4	65.70	10.750 (273.05)	0.595 (15.11)	T95	12,630 (17,130)	--
10 3/4	51.00	10.750 (273.05)	0.450 (11.43)	P110	10,790 (14,630)	--
10 3/4	55.50	10.750 (273.05)	0.495 (12.57)	P110	12,020 (16,300)	--
10 3/4	60.70	10.750 (273.05)	0.545 (13.84)	P110	13,370 (18,130)	--
10 3/4	65.70	10.750 (273.05)	0.595 (15.11)	P110	14,710 (19,950)	--
10 3/4	60.70	10.750 (273.05)	0.545 (13.84)	Q125	15,020 (20,360)	--
10 3/4	65.70	10.750 (273.05)	0.595 (15.11)	Q125	16,520 (22,400)	--
11 3/4	42.00	11.750 (298.45)	0.333 (8.46)	H40	3070 (4170)	--
11 3/4	47.00	11.750 (298.45)	0.375 (9.53)	J55	4770 (6460)	--
11 3/4	54.00	11.750 (298.45)	0.435 (11.05)	J55	5680 (7700)	--
11 3/4	60.00	11.750 (298.45)	0.489 (12.42)	J55	6490 (8800)	--
11 3/4	47.00	11.750 (298.45)	0.375 (9.53)	K55	5090 (6900)	--
11 3/4	54.00	11.750 (298.45)	0.435 (11.05)	K55	6060 (8220)	--
11 3/4	60.00	11.750 (298.45)	0.489 (12.42)	K55	6930 (9400)	--
11 3/4	60.00	11.750 (298.45)	0.489 (12.42)	L80	9130 (12,370)	--
11 3/4	60.00	11.750 (298.45)	0.489 (12.42)	N80	9240 (12,520)	--
11 3/4	60.00	11.750 (298.45)	0.489 (12.42)	C90	10,110 (13,710)	--
11 3/4	60.00	11.750 (298.45)	0.489 (12.42)	R95	10,660 (14,460)	--
11 3/4	60.00	11.750 (298.45)	0.489 (12.42)	T95	10,660 (14,460)	--
11 3/4	60.00	11.750 (298.45)	0.489 (12.42)	P110	12,420 (16,830)	--
11 3/4	60.00	11.750 (298.45)	0.489 (12.42)	Q125	13,950 (18,920)	--
13 3/8	48.00	13.375 (339.73)	0.330 (8.38)	H40	3220 (4370)	--
13 3/8	54.50	13.375 (339.73)	0.380 (9.65)	J55	5140 (6970)	--

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
13 3/8	61.00	13.375 (339.73)	0.430 (10.92)	J55	5950 (8070)	--
13 3/8	68.00	13.375 (339.73)	0.480 (12.19)	J55	6750 (9160)	--
13 3/8	54.50	13.375 (339.73)	0.380 (9.65)	K55	5470 (7410)	--
13 3/8	61.00	13.375 (339.73)	0.430 (10.92)	K55	6330 (8580)	--
13 3/8	68.00	13.375 (339.73)	0.480 (12.19)	K55	7180 (9740)	--
13 3/8	68.00	13.375 (339.73)	0.480 (12.19)	L80	9520 (12,910)	--
13 3/8	72.00	13.375 (339.73)	0.514 (13.06)	L80	10,290 (13,950)	--
13 3/8	68.00	13.375 (339.73)	0.480 (12.19)	N80	9630 (13,060)	--
13 3/8	72.00	13.375 (339.73)	0.514 (13.06)	N80	10,400 (14,110)	--
13 3/8	68.00	13.375 (339.73)	0.480 (12.19)	C90	10,570 (14,330)	--
13 3/8	72.00	13.375 (339.73)	0.514 (13.06)	C90	11,420 (15,480)	--
13 3/8	68.00	13.375 (339.73)	0.480 (12.19)	R95	11,140 (15,110)	--
13 3/8	72.00	13.375 (339.73)	0.514 (13.06)	R95	12,040 (16,320)	--
13 3/8	68.00	13.375 (339.73)	0.480 (12.19)	T95	11,140 (15,110)	--
13 3/8	72.00	13.375 (339.73)	0.514 (13.06)	T95	12,040 (16,320)	--
13 3/8	68.00	13.375 (339.73)	0.480 (12.19)	P110	12,970 (17,580)	--
13 3/8	72.00	13.375 (339.73)	0.514 (13.06)	P110	14,010 (18,990)	--
13 3/8	72.00	13.375 (339.73)	0.514 (13.06)	Q125	15,760 (21,360)	--
16	65.00	16.000 (406.40)	0.375 (9.53)	H40	4390 (5950)	--
16	75.00	16.000 (406.40)	0.438 (11.13)	J55	7100 (30)	--
16	84.00	16.000 (406.40)	0.495 (12.57)	J55	8170 (11,080)	--
16	75.00	16.000 (406.40)	0.438 (11.13)	K55	7520 (10,190)	--
16	84.00	16.000 (406.40)	0.495 (12.57)	K55	11,730 (8650)	--
18 5/8	87.50	18.625 (473.08)	0.435 (11.05)	H40	5590 (7580)	--
18 5/8	87.50	18.625 (473.08)	0.435 (11.05)	J55	7540 (10,220)	--
18 5/8	87.50	18.625 (473.08)	0.435 (11.05)	K55	7940 (10,770)	--
20	94.00	20.000 (508.00)	0.438 (11.13)	H40	5810 (7870)	6730 (9,120)
20	94.00	20.000 (508.00)	0.438 (11.13)	J55	7830 (10,620)	9070 (12,300)
20	106.50	20.000 (508.00)	0.500 (12.70)	J55	9130 (12,370)	10,560 (114,320)
20	133.00	20.000 (508.00)	0.635 (16.13)	J55	11,920 (16,160)	13,790 (18700)
20	94.00	20.000 (508.00)	0.438 (11.13)	K55	8230 (11,160)	9550 (12,950)

Designation		Outside Diameter	Wall Thickness	Grade	Round Thread Short	Round Thread Long
Size	Weight	D in. (mm)	t in. (mm)		ft-lb (N • m)	ft-lb (N • m)
20	106.50	20.000 (508.00)	0.500 (12.70)	K55	9590 (13,000)	11,130 (15,090)
20	133.00	20.000 (508.00)	0.635 (16.13)	K55	12,520 (16,980)	14,530(19,700)

Table B.2 contains torque values that have been selected to provide recommended make-up for round thread tubing under normal conditions.

Table B.2 – Tubing Make-up Torque Guidelines for Round Thread Tubing

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
1.050	1.14	--	--	1.050 (26.7)	0.113 (2.87)	H40	NU	140 (190)
1.050	1.14	--	--	1.050 (26.7)	0.113 (2.87)	J55	NU	180 (240)
1.050	1.14	--	--	1.050 (26.7)	0.113 (2.87)	L80	NU	240 (330)
1.050	1.14	--	--	1.050 (26.7)	0.113 (2.87)	N80	NU	250 (340)
1.050	1.14	--	--	1.050 (26.7)	0.113 (2.87)	C90	NU	260 (350)
1.050	1.14	--	--	1.050 (26.7)	0.113 (2.87)	R95	NU	270 (370)
1.050	1.14	--	--	1.050 (26.7)	0.113 (2.87)	T95	NU	270 (370)
1.050	1.14	--	--	1.050 (26.7)	0.113 (2.87)	P110	NU	320 (430)
1.050	--	1.20	--	1.050 (26.7)	0.113 (2.87)	H40	EUE	460 (620)
1.050	--	1.20	--	1.050 (26.7)	0.113 (2.87)	J55	EUE	600 (810)
1.050	--	1.20	--	1.050 (26.7)	0.113 (2.87)	L80	EUE	810 (1100)
1.050	--	1.20	--	1.050 (26.7)	0.113 (2.87)	N80	EUE	830 (1130)
1.050	--	1.20	--	1.050 (26.7)	0.113 (2.87)	C90	EUE	880 (1190)
1.050	--	1.20	--	1.050 (26.7)	0.113 (2.87)	R95	EUE	920 (1250)
1.050	--	1.20	--	1.050 (26.7)	0.113 (2.87)	T95	EUE	920 (1250)
1.050	--	1.20	--	1.050 (26.7)	0.113 (2.87)	P110	EUE	1080 (1460)
1.050	1.48	--	--	1.050 (26.7)	0.154 (3.91)	H40	NU	230 (310)
1.050	1.48	--	--	1.050 (26.7)	0.154 (3.91)	J55	NU	290 (390)
1.050	1.48	--	--	1.050 (26.7)	0.154 (3.91)	L80	NU	390 (530)
1.050	1.48	--	--	1.050 (26.7)	0.154 (3.91)	N80	NU	410 (560)
1.050	1.48	--	--	1.050 (26.7)	0.154 (3.91)	C90	NU	430 (580)
1.050	1.48	--	--	1.050 (26.7)	0.154 (3.91)	R95	NU	450 (610)
1.050	1.48	--	--	1.050 (26.7)	0.154 (3.91)	T95	NU	450 (610)
1.050	1.48	--	--	1.050 (26.7)	0.154 (3.91)	P110	NU	530 (720)
1.050	--	1.54	--	1.050 (26.7)	0.154 (3.91)	H40	EUE	540 (730)
1.050	--	1.54	--	1.050 (26.7)	0.154 (3.91)	J55	EUE	700 (950)
1.050	--	1.54	--	1.050 (26.7)	0.154 (3.91)	L80	EUE	940 (1270)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
1.050	--	1.54	--	1.050 (26.7)	0.154 (3.91)	N80	EUE	970 (1320)
1.050	--	1.54	--	1.050 (26.7)	0.154 (3.91)	C90	EUE	1020 (1380)
1.050	--	1.54	--	1.050 (26.7)	0.154 (3.91)	R95	EUE	1080 (1460)
1.050	--	1.54	--	1.050 (26.7)	0.154 (3.91)	T95	EUE	1080 (1460)
1.050	--	1.54	--	1.050 (26.7)	0.154 (3.91)	P110	EUE	1260 (1710)
1.315	1.70	--	--	1.315 (33.4)	0.133 (3.38)	H40	NU	210 (280)
1.315	1.70	--	--	1.315 (33.4)	0.133 (3.38)	J55	NU	270 (370)
1.315	1.70	--	--	1.315 (33.4)	0.133 (3.38)	L80	NU	370 (500)
1.315	1.70	--	--	1.315 (33.4)	0.133 (3.38)	N80	NU	380 (520)
1.315	1.70	--	--	1.315 (33.4)	0.133 (3.38)	C90	NU	400 (540)
1.315	1.70	--	--	1.315 (33.4)	0.133 (3.38)	R95	NU	420 (570)
1.315	1.70	--	--	1.315 (33.4)	0.133 (3.38)	T95	NU	420 (570)
1.315	1.70	--	--	1.315 (33.4)	0.133 (3.38)	P110	NU	490 (660)
1.315	--	1.80	--	1.315 (33.4)	0.133 (3.38)	H40	EUE	440 (600)
1.315	--	1.80	--	1.315 (33.4)	0.133 (3.38)	J55	EUE	570 (770)
1.315	--	1.80	--	1.315 (33.4)	0.133 (3.38)	L80	EUE	760 (1030)
1.315	--	1.80	--	1.315 (33.4)	0.133 (3.38)	N80	EUE	790 (1070)
1.315	--	1.80	--	1.315 (33.4)	0.133 (3.38)	C90	EUE	830 (1130)
1.315	--	1.80	--	1.315 (33.4)	0.133 (3.38)	R95	EUE	870 (1180)
1.315	--	1.80	--	1.315 (33.4)	0.133 (3.38)	T95	EUE	870 (1180)
1.315	--	1.80	--	1.315 (33.4)	0.133 (3.38)	P110	EUE	1030 (1400)
1.315	--	--	1.72	1.315 (33.4)	0.133 (3.38)	H40	IJ	310 (420)
1.315	--	--	1.72	1.315 (33.4)	0.133 (3.38)	J55	IJ	400 (540)
1.315	--	--	1.72	1.315 (33.4)	0.133 (3.38)	L80	IJ	530 (720)
1.315	--	--	1.72	1.315 (33.4)	0.133 (3.38)	N80	IJ	550 (750)
1.315	--	--	1.72	1.315 (33.4)	0.133 (3.38)	C90	IJ	580 (790)
1.315	--	--	1.72	1.315 (33.4)	0.133 (3.38)	R95	IJ	610 (830)
1.315	--	--	1.72	1.315 (33.4)	0.133 (3.38)	T95	IJ	610 (830)
1.315	2.19	--	--	1.315 (33.4)	4.55	H40	NU	320 (430)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
1.315	2.19	--	--	1.315 (33.4)	4.55	J55	NU	420 (570)
1.315	2.19	--	--	1.315 (33.4)	4.55	L80	NU	560 (760)
1.315	2.19	--	--	1.315 (33.4)	4.55	N80	NU	580 (790)
1.315	2.19	--	--	1.315 (33.4)	4.55	C90	NU	610 (830)
1.315	2.19	--	--	1.315 (33.4)	4.55	R95	NU	640 (870)
1.315	2.19	--	--	1.315 (33.4)	4.55	T95	NU	640 (870)
1.315	2.19	--	--	1.315 (33.4)	4.55	P110	NU	750 (1020)
1.315	--	2.24	--	1.315 (33.4)	4.55	H40	EUE	540 (730)
1.315	--	2.24	--	1.315 (33.4)	4.55	J55	EUE	710 (960)
1.315	--	2.24	--	1.315 (33.4)	4.55	L80	EUE	950 (1290)
1.315	--	2.24	--	1.315 (33.4)	4.55	N80	EUE	980 (1330)
1.315	--	2.24	--	1.315 (33.4)	4.55	C90	EUE	1040 (1410)
1.315	--	2.24	--	1.315 (33.4)	4.55	R95	EUE	1090 (1480)
1.315	--	2.24	--	1.315 (33.4)	4.55	T95	EUE	1090 (1480)
1.315	--	2.24	--	1.315 (33.4)	4.55	P110	EUE	1280 (1740)
1.660	2.09	--	--	42.2	3.18	H40	NU	270 (360)
1.660	2.09	--	--	42.2	3.18	J55	NU	350 (470)
1.660	--	--	2.10	42.2	3.18	H40	IJ	360 (490)
1.660	--	--	2.10	42.2	3.18	J55	IJ	470 (640)
1.660	2.30	--	--	42.2	3.56	H40	NU	270 (370)
1.660	2.30	--	--	42.2	3.56	J55	NU	350 (470)
1.660	2.30	--	--	42.2	3.56	L80	NU	470 (640)
1.660	2.30	--	--	42.2	3.56	N80	NU	490 (660)
1.660	2.30	--	--	42.2	3.56	C90	NU	510 (690)
1.660	2.30	--	--	42.2	3.56	R95	NU	540 (730)
1.660	2.30	--	--	42.2	3.56	T95	NU	540 (730)
1.660	2.30	--	--	42.2	3.56	P110	NU	640 (870)
1.660	--	2.40	--	42.2	3.56	H40	EUE	530 (720)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
1.660	--	2.40	--	42.2	3.56	J55	EUE	690 (940)
1.660	--	2.40	--	42.2	3.56	L80	EUE	940 (1270)
1.660	--	2.40	--	42.2	3.56	N80	EUE	960 (1300)
1.660	--	2.40	--	42.2	3.56	C90	EUE	1020 (1380)
1.660	--	2.40	--	42.2	3.56	R95	EUE	1070 (1450)
1.660	--	2.40	--	42.2	3.56	T95	EUE	1070 (1450)
1.660	--	2.40	--	42.2	3.56	P110	EUE	1260 (1710)
1.660	--	--	2.33	42.2	3.56	H40	IJ	380 (520)
1.660	--	--	2.33	42.2	3.56	J55	IJ	500 (680)
1.660	--	--	2.33	42.2	3.56	L80	IJ	680 (920)
1.660	--	--	2.33	42.2	3.56	N80	IJ	690 (940)
1.660	--	--	2.33	42.2	3.56	C90	IJ	730 (990)
1.660	--	--	2.33	42.2	3.56	R95	IJ	770 (1040)
1.660	--	--	2.33	42.2	3.56	T95	IJ	770 (1040)
1.660	--	--	2.33	42.2	3.56	P110	IJ	910 (1230)
1.660	3.03	--	--	42.2	4.85	J55	NU	510 (690)
1.660	3.03	--	--	42.2	4.85	L80	NU	690 (940)
1.660	3.03	--	--	42.2	4.85	N80	NU	710 (960)
1.660	3.03	--	--	42.2	4.85	C90	NU	760 (1030)
1.660	3.03	--	--	42.2	4.85	R95	NU	790 (1070)
1.660	3.03	--	--	42.2	4.85	T95	NU	790 (1070)
1.660	3.03	--	--	42.2	4.85	P110	NU	930 (1260)
1.660	--	3.07	--	42.2	4.85	H40	EUE	680 (920)
1.660	--	3.07	--	42.2	4.85	J55	EUE	880 (1190)
1.660	--	3.07	--	42.2	4.85	L80	EUE	1190 (1610)
1.660	--	3.07	--	42.2	4.85	N80	EUE	1220 (1650)
1.660	--	3.07	--	42.2	4.85	C90	EUE	1300 (1760)
1.660	--	3.07	--	42.2	4.85	R95	EUE	1370 (1860)
1.660	--	3.07	--	42.2	4.85	T95	EUE	1370 (1860)
1.660	--	3.07	--	42.2	4.85	P110	EUE	1600 (2170)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
1.900	--	--	2.40	48.3	3.18	H40	IJ	450 (610)
1.900	--	--	2.40	48.3	3.18	J55	IJ	580 (790)
1.900	2.75	--	--	48.3	3.68	H40	NU	320 (430)
1.900	2.75	--	--	48.3	3.68	J55	NU	410 (560)
1.900	2.75	--	--	48.3	3.68	L80	NU	560 (760)
1.900	2.75	--	--	48.3	3.68	N80	NU	570 (770)
1.900	2.75	--	--	48.3	3.68	C90	NU	610 (830)
1.900	2.75	--	--	48.3	3.68	R95	NU	640 (870)
1.900	2.75	--	--	48.3	3.68	T95	NU	640 (870)
1.900	--	2.90	--	48.3	3.68	H40	EUE	670 (910)
1.900	--	2.90	--	48.3	3.68	J55	EUE	880 (1190)
1.900	--	2.90	--	48.3	3.68	L80	EUE	1190 (1610)
1.900	--	2.90	--	48.3	3.68	N80	EUE	1220 (1650)
1.900	--	2.90	--	48.3	3.68	C90	EUE	1300 (1760)
1.900	--	2.90	--	48.3	3.68	R95	EUE	1360 (1840)
1.900	--	2.90	--	48.3	3.68	T95	EUE	1360 (1840)
1.900	--	2.90	--	48.3	3.68	P110	EUE	1600 (2170)
1.900	--	--	2.76	48.3	3.68	H40	IJ	450 (610)
1.900	--	--	2.76	48.3	3.68	J55	IJ	580 (790)
1.900	--	--	2.76	48.3	3.68	L80	IJ	790 (1070)
1.900	--	--	2.76	48.3	3.68	N80	IJ	810 (1100)
1.900	--	--	2.76	48.3	3.68	C90	IJ	860 (1170)
1.900	--	--	2.76	48.3	3.68	R95	IJ	900 (1220)
1.900	--	--	2.76	48.3	3.68	T95	IJ	900 (1220)
2.063	--	--	3.25	52.4	3.96	H40	IJ	570 (770)
2.063	--	--	3.25	52.4	3.96	J55	IJ	740 (1000)
2.063	--	--	3.25	52.4	3.96	L80	IJ	1010 (1370)
2.063	--	--	3.25	52.4	3.96	N80	IJ	1030 (1400)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
2.063	--	--	3.25	52.4	3.96	C90	IJ	1100 (1490)
2.063	--	--	3.25	52.4	3.96	R95	IJ	1160 (1570)
2.063	--	--	3.25	52.4	3.96	T95	IJ	1160 (1570)
2 3/8	4.00	--	--	60.3	4.24	H40	NU	470 (640)
2 3/8	4.00	--	--	60.3	4.24	J55	NU	610 (830)
2 3/8	4.00	--	--	60.3	4.24	L80	NU	830 (1130)
2 3/8	4.00	--	--	60.3	4.24	N80	NU	850 (1150)
2 3/8	4.00	--	--	60.3	4.24	C90	NU	910 (1230)
2 3/8	4.00	--	--	60.3	4.24	R95	NU	960 (1300)
2 3/8	4.00	--	--	60.3	4.24	T95	NU	960 (1300)
2 3/8	4.60	--	--	60.3	4.83	H40	NU	560 (760)
2 3/8	4.60	--	--	60.3	4.83	J55	NU	730 (990)
2 3/8	4.60	--	--	60.3	4.83	L80	NU	990 (1340)
2 3/8	4.60	--	--	60.3	4.83	N80	NU	1020 (1380)
2 3/8	4.60	--	--	60.3	4.83	C90	NU	1080 (1460)
2 3/8	4.60	--	--	60.3	4.83	R95	NU	1140 (1550)
2 3/8	4.60	--	--	60.3	4.83	T95	NU	1140 (1550)
2 3/8	4.60	--	--	60.3	4.83	P110	NU	1340 (1820)
2 3/8	--	4.70	--	60.3	4.83	H40	EUE	990 (1340)
2 3/8	--	4.70	--	60.3	4.83	J55	EUE	1290 (1750)
2 3/8	--	4.70	--	60.3	4.83	L80	EUE	1760 (2390)
2 3/8	--	4.70	--	60.3	4.83	N80	EUE	1800 (2440)
2 3/8	--	4.70	--	60.3	4.83	C90	EUE	1920 (2600)
2 3/8	--	4.70	--	60.3	4.83	R95	EUE	2030 (2750)
2 3/8	--	4.70	--	60.3	4.83	T95	EUE	2030 (2750)
2 3/8	--	4.70	--	60.3	4.83	P110	EUE	2380 (3230)
2 3/8	5.80	--	--	60.3	6.45	L80	NU	1420 (1930)
2 3/8	5.80	--	--	60.3	6.45	N80	NU	1460 (1980)
2 3/8	5.80	--	--	60.3	6.45	C90	NU	1550 (2100)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
2 3/8	5.80	--	--	60.3	6.45	R95	NU	1640 (2220)
2 3/8	5.80	--	--	60.3	6.45	T95	NU	1640 (2220)
2 3/8	5.80	--	--	60.3	6.45	P110	NU	1920 (2600)
2 3/8	--	5.95	--	60.3	6.45	L80	EUE	2190 (2970)
2 3/8	--	5.95	--	60.3	6.45	N80	EUE	2240 (3040)
2 3/8	--	5.95	--	60.3	6.45	C90	EUE	2390 (3240)
2 3/8	--	5.95	--	60.3	6.45	R95	EUE	2520 (3420)
2 3/8	--	5.95	--	60.3	6.45	T95	EUE	2520 (3420)
2 3/8	--	5.95	--	60.3	6.45	P110	EUE	2950 (4000)
2 3/8	--	7.45	--	60.3	8.53	L80	EUE	2700 (3660)
2 3/8	--	7.45	--	60.3	8.53	N80	EUE	2760 (3740)
2 3/8	--	7.45	--	60.3	8.53	C90	EUE	2950 (4000)
2 3/8	--	7.45	--	60.3	8.53	R95	EUE	3110 (4220)
2 3/8	--	7.45	--	60.3	8.53	T95	EUE	3110 (4220)
2 7/8	6.40	--	--	73.0	5.51	H40	NU	800 (1080)
2 7/8	6.40	--	--	73.0	5.51	J55	NU	1050 (1420)
2 7/8	6.40	--	--	73.0	5.51	L80	NU	1430 (1940)
2 7/8	6.40	--	--	73.0	5.51	N80	NU	1470 (1990)
2 7/8	6.40	--	--	73.0	5.51	C90	NU	1570 (2130)
2 7/8	6.40	--	--	73.0	5.51	R95	NU	1650 (2240)
2 7/8	6.40	--	--	73.0	5.51	T95	NU	1650 (2240)
2 7/8	6.40	--	--	73.0	5.51	P110	NU	1930 (2620)
2 7/8	--	6.50	--	73.0	5.51	H40	EUE	1250 (1690)
2 7/8	--	6.50	--	73.0	5.51	J55	EUE	1650 (2240)
2 7/8	--	6.50	--	73.0	5.51	L80	EUE	2250 (3050)
2 7/8	--	6.50	--	73.0	5.51	N80	EUE	2300 (3120)
2 7/8	--	6.50	--	73.0	5.51	C90	EUE	2460 (3340)
2 7/8	--	6.50	--	73.0	5.51	R95	EUE	2600 (3530)
2 7/8	--	6.50	--	73.0	5.51	T95	EUE	2600 (3530)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
2 7/8	--	6.50	--	73.0	5.51	P110	EUE	3040 (4120)
2 7/8	7.80	--	--	73.0	7.01	L80	NU	1910 (2590)
2 7/8	7.80	--	--	73.0	7.01	N80	NU	1960 (2660)
2 7/8	7.80	--	--	73.0	7.01	C90	NU	2090 (2830)
2 7/8	7.80	--	--	73.0	7.01	R95	NU	2200 (2980)
2 7/8	7.80	--	--	73.0	7.01	T95	NU	2200 (2980)
2 7/8	7.80	--	--	73.0	7.01	P110	NU	2580 (3500)
2 7/8	--	7.90	--	73.0	7.01	L80	EUE	2710 (3670)
2 7/8	--	7.90	--	73.0	7.01	N80	EUE	2770 (3760)
2 7/8	--	7.90	--	73.0	7.01	C90	EUE	2970 (4030)
2 7/8	--	7.90	--	73.0	7.01	R95	EUE	3120 (4230)
2 7/8	--	7.90	--	73.0	7.01	T95	EUE	3120 (4230)
2 7/8	--	7.90	--	73.0	7.01	P110	EUE	3660 (4960)
2 7/8	8.60	--	--	73.0	7.82	L80	NU	2160 (2930)
2 7/8	8.60	--	--	73.0	7.82	N80	NU	2210 (3000)
2 7/8	8.60	--	--	73.0	7.82	C90	NU	2370 (3210)
2 7/8	8.60	--	--	73.0	7.82	R95	NU	2490 (3380)
2 7/8	8.60	--	--	73.0	7.82	T95	NU	2490 (3380)
2 7/8	8.60	--	--	73.0	7.82	P110	NU	2920 (3960)
2 7/8	--	8.70	--	73.0	7.82	L80	EUE	2950 (4000)
2 7/8	--	8.70	--	73.0	7.82	N80	EUE	3020 (4090)
2 7/8	--	8.70	--	73.0	7.82	C90	EUE	3230 (4380)
2 7/8	--	8.70	--	73.0	7.82	R95	EUE	3400 (4610)
2 7/8	--	8.70	--	73.0	7.82	T95	EUE	3400 (4610)
2 7/8	--	8.70	--	73.0	7.82	P110	EUE	3980 (5400)
2 7/8	--	9.45	--	73.0	8.64	L80	EUE	3180 (4310)
2 7/8	--	9.45	--	73.0	8.64	N80	EUE	3260 (4420)
2 7/8	--	9.45	--	73.0	8.64	C90	EUE	3480 (4720)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
2 7/8	--	9.45	--	73.0	8.64	R95	EUE	3670 (4980)
2 7/8	--	9.45	--	73.0	8.64	T95	EUE	3670 (4980)
3 1/2	7.70	--	--	88.9	4.49	H40	NU	920 (1250)
3 1/2	7.70	--	--	88.9	4.49	J55	NU	1210 (1640)
3 1/2	7.70	--	--	88.9	4.49	L80	NU	1660 (2250)
3 1/2	7.70	--	--	88.9	4.49	N80	NU	1700 (2300)
3 1/2	7.70	--	--	88.9	4.49	C90	NU	1820 (2470)
3 1/2	7.70	--	--	88.9	4.49	R95	NU	1920 (2600)
3 1/2	7.70	--	--	88.9	4.49	T95	NU	1920 (2600)
3 1/2	9.20	--	--	88.9	6.45	H40	NU	1120 (1520)
3 1/2	9.20	--	--	88.9	6.45	J55	NU	1480 (2010)
3 1/2	9.20	--	--	88.9	6.45	L80	NU	2030 (2750)
3 1/2	9.20	--	--	88.9	6.45	N80	NU	2070 (2810)
3 1/2	9.20	--	--	88.9	6.45	C90	NU	2220 (3010)
3 1/2	9.20	--	--	88.9	6.45	R95	NU	2340 (3170)
3 1/2	9.20	--	--	88.9	6.45	T95	NU	2340 (3170)
3 1/2	9.20	--	--	88.9	6.45	P110	NU	2740 (3710)
3 1/2	--	9.30	--	88.9	6.45	H40	EUE	1730 (2350)
3 1/2	--	9.30	--	88.9	6.45	J55	EUE	2280 (3090)
3 1/2	--	9.30	--	88.9	6.45	L80	EUE	3130 (4240)
3 1/2	--	9.30	--	88.9	6.45	N80	EUE	3200 (4340)
3 1/2	--	9.30	--	88.9	6.45	C90	EUE	3430 (4650)
3 1/2	--	9.30	--	88.9	6.45	R95	EUE	3620 (4910)
3 1/2	--	9.30	--	88.9	6.45	T95	EUE	3620 (4910)
3 1/2	--	9.30	--	88.9	6.45	P110	EUE	4230 (5740)
3 1/2	10.20	--	--	88.9	7.34	H40	NU	1310 (1780)
3 1/2	10.20	--	--	88.9	7.34	J55	NU	1720 (2330)
3 1/2	10.20	--	--	88.9	7.34	L80	NU	2360 (3200)
3 1/2	10.20	--	--	88.9	7.34	N80	NU	2410 (3270)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
3 1/2	10.20	--	--	88.9	7.34	C90	NU	2590 (3510)
3 1/2	10.20	--	--	88.9	7.34	R95	NU	2720 (3690)
3 1/2	10.20	--	--	88.9	7.34	T95	NU	2720 (3690)
3 1/2	10.20	--	--	88.9	7.34	P110	NU	3190 (4330)
3 1/2	12.70	--	--	88.9	9.53	L80	NU	3140 (4260)
3 1/2	12.70	--	--	88.9	9.53	N80	NU	3210 (4350)
3 1/2	12.70	--	--	88.9	9.53	C90	NU	3440 (4660)
3 1/2	12.70	--	--	88.9	9.53	R95	NU	3630 (4920)
3 1/2	12.70	--	--	88.9	9.53	T95	NU	3630 (4920)
3 1/2	12.70	--	--	88.9	9.53	P110	NU	4240 (5750)
3 1/2	--	12.95	--	88.9	9.53	L80	EUE	4200 (5690)
3 1/2	--	12.95	--	88.9	9.53	N80	EUE	4290 (5820)
3 1/2	--	12.95	--	88.9	9.53	C90	EUE	4610 (6250)
3 1/2	--	12.95	--	88.9	9.53	R95	EUE	4850 (6580)
3 1/2	--	12.95	--	88.9	9.53	T95	EUE	4850 (6580)
3 1/2	--	12.95	--	88.9	9.53	P110	EUE	5680 (7700)
4	9.50	--	--	101.6	5.74	H40	NU	940 (1270)
4	9.50	--	--	101.6	5.74	J55	NU	1240 (1680)
4	9.50	--	--	101.6	5.74	L80	NU	1710 (2320)
4	9.50	--	--	101.6	5.74	N80	NU	1740 (2360)
4	9.50	--	--	101.6	5.74	C90	NU	1870 (2540)
4	9.50	--	--	101.6	5.74	R95	NU	1970 (2670)
4	9.50	--	--	101.6	5.74	T95	NU	1970 (2670)
4	--	11.00	--	101.6	6.65	H40	EUE	1940 (2630)
4	--	11.00	--	101.6	6.65	J55	EUE	2560 (3470)
4	--	11.00	--	101.6	6.65	L80	EUE	3530 (4790)
4	--	11.00	--	101.6	6.65	N80	EUE	3600 (4880)
4	--	11.00	--	101.6	6.65	C90	EUE	3870 (5250)
4	--	11.00	--	101.6	6.65	R95	EUE	4080 (5530)

Outside Diameter D (in.)	NU T&C	EU T&C	IJ	Outside Diameter D in. (mm)	Wall Thickness t in. (mm)	Grade	Thread Type	Torque ft-lb (N • m)
4	--	11.00	--	101.6	6.65	T95	EUE	4080 (5530)
4 1/2	12.60	--	--	114.3	6.88	H40	NU	1320 (1790)
4 1/2	12.60	--	--	114.3	6.88	J55	NU	1740 (2360)
4 1/2	12.60	--	--	114.3	6.88	L80	NU	2400 (3250)
4 1/2	12.60	--	--	114.3	6.88	N80	NU	2440 (3310)
4 1/2	12.60	--	--	114.3	6.88	C90	NU	2630 (3570)
4 1/2	12.60	--	--	114.3	6.88	R95	NU	2780 (3770)
4 1/2	12.60	--	--	114.3	6.88	T95	NU	2780 (3770)
4 1/2	--	12.75	--	114.3	6.88	H40	EUE	2160 (2930)
4 1/2	--	12.75	--	114.3	6.88	J55	EUE	2860 (3880)
4 1/2	--	12.75	--	114.3	6.88	L80	EUE	3940 (5340)
4 1/2	--	12.75	--	114.3	6.88	N80	EUE	4020 (5450)
4 1/2	--	12.75	--	114.3	6.88	C90	EUE	4330 (5870)
4 1/2	--	12.75	--	114.3	6.88	R95	EUE	4560 (6180)
4 1/2	--	12.75	--	114.3	6.88	T95	EUE	4560 (6180)

Bibliography

[1] API Specification 5C6, *Pipe with Welded Connectors*

[2] AWS Specification A5.1, *Covered Carbon Steel Arc Welding Electrodes*

[3] ASTM E453, *Standard Practice for Examination of Fuel Element Cladding Including the Determination of the Mechanical Properties*