

Gauging and Inspection of Casing, Tubing, and Line Pipe Threads

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FOREWORD

This recommended practice is under the jurisdiction of the API Subcommittee on Standardization of Tubular Goods.

No provision of this recommended practice shall be cause for rejection of casing or tubing provided the threads are in accordance with the requirements of the latest edition of API Standard 5B.

This recommended practice is presented as a guide and instructional tool for pipe mill inspectors, third party inspectors, and users interested in developing skills in inspection of threads on oil country tubular goods and line pipe. It includes pictures of numerous gauges and measuring instruments. Every effort has been made to present gauges without regard to the origin of manufacture. Additionally, inclusion of certain gauges should not be construed as an endorsement of the instrument or its manufacture. Similarly, the exclusion of any gauge is not an indication of dissatisfaction with that instrument.

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Gauging and Inspection of Casing, Tubing, and Line Pipe Threads

1 Introduction

The ability of line pipe and oil country tubular goods (such as, oil and gas well casing and tubing) to perform properly depends on the physical integrity of the pipe body and connections. Threads at each end of the pipe provide a means of joining the pipe segments into a continuous “string” of pipe. There are many thread configurations applied to oil country tubular goods. However, they all have two functions in common: they must resist leakage and tensile failures. This is accomplished by applying threads which are specially designed and accurately machined. Laboratory and prototype testing prior to marketing of the connection verifies the proper design. Accurate machining depends on a repetitive process to simulate tool wear. Excessive tool wear and/or damage after machining reduces the thread’s performance.

This recommended practice provides guidance and instruction on the correct use of thread inspection techniques and equipment to assure dimensionally accurate connections. The inspector carries a heavy responsibility. This responsibility can be discharged properly only if the inspector is adequately trained. This recommended practice provides the training and insight necessary to perform an adequate inspection of line pipe and oil country tubular goods connections.

1.1 BACKGROUND

Casing and *tubing* are two terms which are used to describe oil country tubular goods that become part of a completed oil and gas well.

When these terms are used in field drilling and production operations, the term “casing” applies to pipe that is used to line the drilled hole to protect the well from formation fluid flow or formation collapse. It is a permanent part of the well in which bottom sections of casing are cemented in place. At times, cement is circulated to the surface. Among the various types of casing are conductor pipe, surface casing, intermediate or protective casing, and production casing (Figure 1). These casing strings extend to the surface. A section of the hole lined with pipe that does not reach the surface is called a liner. Liners may or may not be cemented in place.

The term “tubing” applies to the innermost pipe in a well. Well fluids are brought to the surface through the tubing. The tubing may be isolated from the casing by a production packer. Tubing is frequently removed from the hole and at times is replaced.

The terms *casing* and *tubing*, when used in a steel mill or in API specifications, are oriented to size and not necessarily to end use. The mills may not know what will be the end use of their pipe. Accordingly, in mill practice and in API specifications, casing generally covers pipe 4¹/₂-in. OD or larger. Tubing generally covers pipe 4¹/₂-in. OD and smaller. This

publication uses the terms casing and tubing in the mill/API sense. In most cases, this will also conform to the end use description.

Each of the pipe connections must be capable of withstanding internal and/or external pressure without leakage. The competence of the design and the accuracy of manufacture of the connection provides assurance of the required leak resistance. API connections are among the most accurately machined threads currently mass produced. Each component shape and size is designed and machined to interact with the mating component to form a fluid seal.

Inspecting the threaded ends of pipe determines if the manufactured product is in compliance with the design specification. Oil country tubular goods and line pipe are inspected at the manufacturer’s facility prior to shipment. Additionally, the pipe may be inspected at the pipe yard, job site, and/or drilling rig.

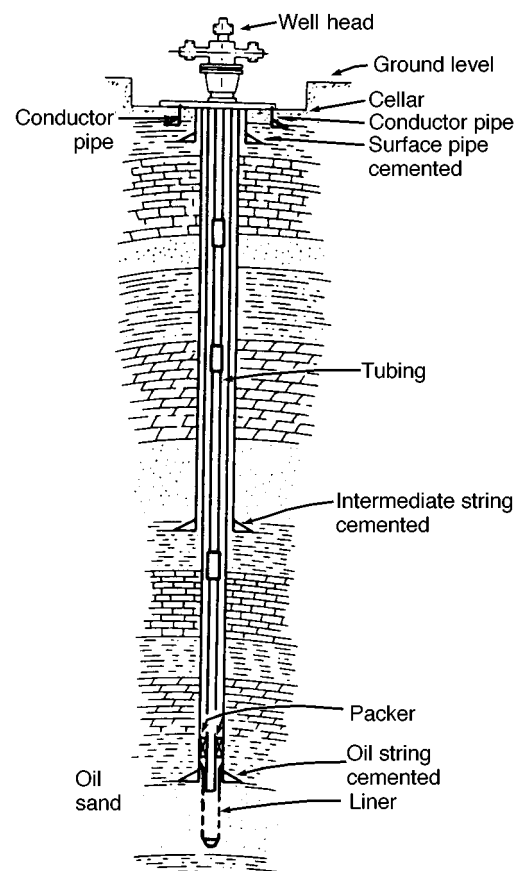


Figure 1—Schematic Diagram of an Oil or Gas Well Completed with a Hung Liner

The manufacturer's inspection is not normally an inspection of each individual connection. Rather, it is normally an inspection of a statistically designed sample based on manufacturer's experience. The field inspection generally is an inspection of each threaded end. The scope of the field inspection varies based on the owner's desires and the inherent constraints of field inspection.

Corrosion resistance and sealing ability of connections are improved by plating the threads, usually in the coupling or box, with zinc, tin, or metallic phosphate. The plating produces a beneficial effect; however, it generally interferes with the precision of gauging of these threads because it's difficult to plate threads uniformly. This is particularly true of zinc and tin, which are electroplated. The portion of the thread closest to the anode receives the greatest thickness of plated metal. Some manufacturers may prefer to apply the coating to the pipe (pin end) member, particularly on special or premium-type connections. In all cases, coatings are applied for the purposes of (a) antigalling during makeup, (b) anticorrosion while in storage, or (c) as an aid to sealing (in threads) for leak resistance.

Gauging of threads by manufacturers is performed prior to coating. Field gauging of coated threads may be less accurate than gauging at the manufacturer's facility. Discretion should be used, therefore, in interpreting the results of field gauging of coated threads. Additionally, manufacturer gauging is performed prior to assembly of the pipe components. Accordingly, gauging of assembled (made-up) threaded components can result in the components not conforming with the specification values because of makeup distortion.

Off-specification components of coated, but unmade-up components can be recognized by field gauging. If a dispute arises, however, the coating shall be removed and the component regauged.

The manufacturers make a conscious effort to eliminate off-specification tubular goods within the financial and statistical constraints of the manufacturer. Users, particularly at critical wells or pipelines, desire an inspection at the drilling rig or field site to eliminate any thread damage which occurred during shipment, or any off-specification threads which may not have been found at the manufacturer's facility.

It is important to locate and eliminate damaged or off-specification pipe. Rejecting "good" pipe, however, results in a financial burden being imposed on the manufacturer and/or operator. Thus, inspection shall be performed with care and reason.

1.2 SCOPE

Information contained in this recommended practice is intended for use of pipe manufacturer inspectors, quality control personnel, field inspectors, threading unit operators, and users and purchasers of oil country tubular goods and line pipe.

This publication was prepared under the auspices of the API Subcommittee of Tubular Goods and the Resource Group on Threading and Gauging. As such, the scope is limited to inspection of API casing, tubing, and line pipe connections. However, the basic techniques of gauge usage apply to any threads for which the thread element specifications are known. Specifically, this recommended practice was written to supplement and augment the latest editions of API Specifications 5CT and 5L, which mandate physical and mechanical properties of casing, tubing, and line pipe. Additionally, this recommended practice is designed to be used with the latest edition of API Specification 5B, *Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads*. It does not duplicate the massive dimensional tables contained in the latest edition of API Spec 5B. Instead, it provides instruction in inspection techniques appropriate to comparing the dimension of the product with specified dimensions and tolerances for that product. Accordingly, the primer can be used for the inspection of API thread elements without direct reference to the latest edition of Spec 5B. In all cases, the latest edition of Spec 5B takes precedence if a dispute arises between parties.

This publication uses photographs to demonstrate the proper use of representative gauges normally used by thread inspectors. Gauges presented are limited to those appropriate to both mill and field use. Thus, nonportable instruments such as comparators and contour readers are not included. However, there is no intent to limit the use of such instruments or methods by inspectors.

2 References

This specification includes by reference, either in total or in part, the following:

API

Spec 5B	<i>Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads</i>
Spec 5CT	<i>Specification for Casing and Tubing</i>
Spec 5L	<i>Specification for Line Pipe</i>
RP 5A5	<i>Recommended Practice for Field Inspection of New Casing, Tubing, and Plain End Drill Pipe</i>

2.1 REQUIREMENTS

Requirements of other standards included by reference in this specification are essential to the safety and interchangeability of the equipment produced.

2.2 EQUIVALENT STANDARDS

Other nationally or internally recognized standards shall be submitted to and approved by API for inclusion in this specification prior to their use as equivalent standards.

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 addendum: The addendum of an external thread is the radial distance between the major and pitch cylinders or cones, respectively. The addendum of an internal thread is the radial distance between the minor and pitch cylinders or cones, respectively.

3.2 basic size: The theoretical size from which all variations are measured.

3.3 black-crested threads: Threads that are not fully crested have historically been and continue to be referred to as “black-crested threads,” because the original mill surface has not been removed. Black-crested threads is a useful descriptive term; however, it should be pointed out that there can be non-full-crested threads that are not black-crested.

3.4 chamfer: The beveled surface, beginning at the end of the pipe or coupling, in which the thread form starts.

3.5 crest: The top of the thread.

3.6 crest clearance: The distance between the crest and root of mating threads.

3.7 crest truncation: The distance between the sharp crest (crest apex) and the finished crest.

3.8 dedendum: The distance between the pitch line and root of thread.

3.9 effective thread length: (See Figures 1, 3 and 8 in Spec 5B). The dimension designated as L2 for line pipe and round thread tubing and casing. This is the theoretical point at which the vanish cone angle begins.

3.10 external thread: A thread on the external surface of a pipe.

3.11 flank angle: The angle between the individual flanks and the perpendicular to the axis of the thread measured in an axial plane. A flank angle of a symmetrical thread is commonly termed the half angle of the thread.

3.12 flank or side: The surface of the thread which connects the crest with the root.

3.13 full-crest thread length: The length measured parallel to the thread axis from the end of the pipe to the first non-full-crested thread.

Note: The partial threads in the chamfer are considered to be within the full-crest thread length.

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

3.15 hand-tight mating standoff: The length at hand-tight engagement from the face of the coupling to the vanish point of the threads for casing and tubing round threads and line pipe threads; and to the base of the triangle for buttress threads.

3.16 handling-tight: Sufficiently tight that the coupling cannot be removed except by use of a wrench.

3.17 height of thread: The distance between the root and crest of the thread measured normal (perpendicular) to the thread axis.

3.18 imperfect thread length: The buttress threads located beyond the L7 plane (away from the pipe ends).

3.19 included angle: The angle between the flanks of the threads measured in an axial plane.

3.20 internal thread: Thread on the internal surface of a coupling or pipe.

3.21 last engaged thread: The last thread on a pin contacting the coupling threads.

3.22 last scratch (vanish point): The last visible evidence of the continuous machined root as it stops or runs out (buttress thread).

3.23 lead: The distance from a point on a thread to a corresponding point on the next thread turn, measured parallel to the thread axis. Lead tolerances are expressed in terms of “per inch of threads” and “cumulative”, and lead errors must be determined accordingly. For interval measurements over lengths other than 1 inch the observed deviation should be calculated to the per inch basis. For cumulative measurements observed deviations represent the cumulative deviation.

3.24 leading or front flank (stab flank): The flank of the pipe thread facing the near open end of pipe. The flank of the coupling thread facing the open end of the coupling. See Figures 3 through 7.

3.25 length of thread engagement: The length of contact between two mated parts measured axially.

3.26 load or pressure flank: The flank of the pipe thread facing away from the open end of the pipe. The flank of the coupling or box thread facing away from the open end of the coupling. The 3° flank on buttress thread. (Figures 3 through 7.)

3.27 major cone: An imaginary cone which would bound the crest of an external taper thread or the roots of an internal taper thread.

3.28 major diameter: The crest diameter of the external thread and the root diameter of the internal thread.

3.29 manufacturer: As used throughout this recommended practice, includes pipe manufacturers, processors,

threaders, and manufacturers of couplings, pup joints, and connectors, as applicable.

3.30 may: Used to indicate that a provision is optional.

3.31 mill end: The end of the pipe to which the coupling is applied at the mill. Referred to as the box end of the integral joint pipe.

3.32 minor cone: An imaginary cone which passes over the root of the external thread and crest of internal thread.

3.33 minor diameter: The root diameter of the external thread and the crest diameter of the internal thread.

3.34 perfect thread length: The last perfect thread location on external threads shall be L_4 -g for tubing and line pipe, L_7 for buttress, and last scratch (last thread groove) – 0.500 in. for casing round threads. The last perfect thread location on internal threads is $J + 1p$ measured from the physical center of the coupling or from the small end of the box for integral joint tubing.

3.35 pin end: The externally threaded end of pipe without a coupling applied.

3.36 pitch: See *lead*.

3.37 pitch cone: An imaginary cone which passes through the thread profile at approximately the thread center.

3.38 pitch diameter: On a taper thread, the pitch diameter at a given position on the thread axis is the diameter of the pitch cone at that position. On buttress threads, this is midway between the major and minor diameter.

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

3.40 recess: The counter-bored section at the end of line pipe and casing and tubing round thread coupling. It facilitates stabbing the threads.

3.41 right-hand thread: A thread that winds in a clockwise receding direction when viewed axially.

3.42 root: The bottom of the thread.

3.43 root truncation: The distance between the sharp root (root apex) and the finished root.

3.44 runout (buttress threads): Intersection of the thread root and the pipe outside surface.

3.45 shall: Used to indicate that provision is mandatory.

3.46 should: Used to indicate that a provision is not mandatory, but recommended as good practice.

3.47 standoff: A distance from coupling face to pipe thread vanish point on line pipe and round casing and tubing

threads; and from coupling face to the base of the triangle on buttress threads.

3.48 taper: For round threads and line pipe threads, taper shall be defined as the increase in the pitch diameter of the thread, in inches per inch of thread. For buttress threads, taper is defined as the change in diameter along the minor cone of the external threads and the major cone of the internal threads. On all threads, taper tolerances are expressed in terms of “inch-per-inch of thread” and taper deviation shall be determined accordingly. The measurements are made for the specific interval lengths and the observed deviation shall be calculated to the inches-per-inch basis.

3.49 thread axis: The axis of the pitch cone, the longitudinal central line through the threads. In the basic thread design, all length measurements are related to the thread axis.

3.50 thread form: The form of thread is the thread profile in an axial plane for a length of one pitch.

3.51 threads per inch: The theoretical number of threads in one inch of thread length.

3.52 tolerance: The permissible deviation from the specified value.

3.53 torque: A force that tends to produce rotation—the force causing a threaded connection to make up.

4 API Threaded Connections

A threaded connection consists of two members: a pipe or pin member and a coupling or box member. The externally threaded member is called the pipe or pin member. The internally threaded member is called the coupling or box member. Two pin members are connected together by means of a coupling, which is a short segment of pipe slightly larger in diameter than the pipe, but threaded internally from each end (Figure 2). The pins may be the same thickness as the pipe body (non-upset) or thicker than the pipe body (upset). All API threaded and coupled (T&C) casing and line pipe are non-upset.

Tubing is manufactured with either non-upset or external upset ends. The approximate internal diameter of the pipe ends is equal to that of the pipe body (Figure 2). However, the outside diameter (OD) at the upset ends is larger than the pipe body (Figure 2). API integral joint tubing connections are upset on both ends.

Threads, as applied to tubular connections, are used to mechanically hold two pieces of pipe together in axial alignment. The threads may or may not be required to act as a leak resistant element.

API tubular good specifications cover four styles of threads, namely line pipe threads (Figure 3); round threads (Figure 4); buttress threads (Figures 5 and 6); and extreme-line threads (Figure 7). Line pipe, round, and buttress threads

are required to fit together in made-up assembly such that with sealant they will resist leakage through the threads. The threads in extreme-line casing are not designed to be leak tight. Leak resistance of the extreme-line connection is accomplished by the use of a metal-to-metal seal (Figure 7).

On a threaded connection, the stab or front flank of a thread is the radial surface facing the nearest end of the pipe (Figures 3, 4, 5, and 7). The load or back flank is the radial surface facing toward the pipe body. The top and bottom of a thread are designated as crest and root, respectively (Figures 3, 4, 5, and 7). On a pipe member, the crest is the largest diameter of a thread and the root is the smallest diameter, with the coupling member, the largest diameter is called the root, and the crest is the smaller diameter (Figures 3, 4, 5, and 7).

4.1 LINE PIPE THREAD

The thread is a 60° Vee-type thread with the included angle between flanks being 60° (Figure 3). The crests and roots are truncated on a cone parallel with the taper. When the joint is assembled, the crest and root clearance will be 0.005 in. radially. This void can be a leak path unless a suitable thread compound is used. The stab and load flanks are interference-bearing surfaces when the connection is properly made up, and unless these flank surfaces are damaged or malformed, they will prevent leakage from crest to root (or vice versa). If such a thread is made up with insufficient interference between pin and coupling members, the coupling (or box) member will not retain enough contact load on the thread flanks to resist high internal pressure. Leakage will then occur radially over the thread flanks.

4.2 ROUND TUBING AND CASING THREADS

This thread is basically the same thread form as used on line pipe except that the thread crests and roots are truncated with a radius (Figure 4). The purpose of the round top (crests) and round bottom (roots) is to: (a) improve the resistance of the threads from galling in makeup, (b) provide a controlled clearance between made-up thread crest and root for foreign particles or contaminants, and (c) make the crests less susceptible to harmful damage from minor scratches or dings.

If insufficient interference is applied during makeup, the leak path through this connection could be through the annular clearance between mated crest and roots. Again, proper thread compound is necessary to ensure leak resistance.

The clearance (radially) between an assembled thread crest and root is approximately 0.003 in., but unlike line pipe, the round thread clearance is a crescent shape (Figure 4).

Superficial scratches, minor dings, and surface irregularities on the thread surface are occasionally encountered and may not necessarily be detrimental. Because of the difficulty in defining superficial scratches, minor dings, and surface irregularities, the degree to which they affect thread performance can not be established. As a guide to acceptance, the

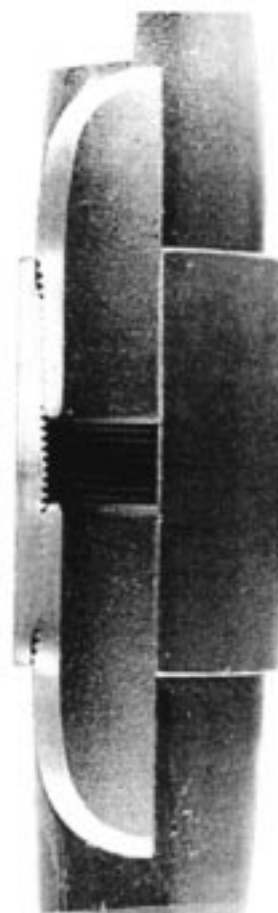


Figure 2—Typical Pipe Coupling

most critical consideration is to ensure that there are no detectable protrusions on the threads to peel off the protective coating on the coupling threads or score mating surfaces. Cosmetic repair of thread surfaces by hand is permitted.

4.3 BUTTRESS THREAD-CASING (THREADED AND COUPLED)

Buttress threads are designed to resist high axial tension or compression loading in addition to offering resistance to leakage.

For sizes 4¹/₂ in. through 13³/₈ in. (Figure 5), the threads are 5 pitch (pitch = 0.200 in.) per in. on a 3/4-in. taper per ft on diameter. The stab flank is 10° from radial, and the load flank is 3° from radial. The crests and roots are conical and parallel with the taper. The stab flank radius at the crest is large (0.030 in. *R*) as compared to the load flank radius at the crest (0.008 in. *R*). This is to aid in stabbing and running. The threads are full-form fit when assembled resulting in a maximum thread crest-to-root clearance of 0.002 inch. Inherent machining variations in threading may cause the threads to

bear on one thread flank at one end of the thread element of the connection and on the opposite thread flank at the other end of the element. In any event, leak resistance is again accomplished with use of the proper thread compound and/or thread coating agent. Leak resistance is controlled by proper assembly (interference) within the perfect thread length only.

The thread root of this connection runs out on a continuous cone to the OD of the pipe body, and the coupling (box) member engages the root diameter of the imperfect threads which extend from the last full thread (on the pin) to the vanishing point or from the last imperfect thread on the pipe OD.

The 3° load flank offers resistance to disengagement under high axial tension loading, while the 10° stab flank offers

resistance to high axial compressive loading. Attempted repair by hand dressing should be done with discretion and limited to a small part of the perfect thread length. Discretionary repair to the imperfect thread area of the pin does not affect leakage control.

Buttress casing threads on sizes 16-in. diameter and larger have five threads per inch on a 1-in. taper per ft on diameter and have flat crests and roots parallel to the pipe axis (Figure 6). This is to aid in stabbing and running casing. All other dimensions and thread radii are the same as those for 13³/₈ in. and smaller sizes.

The application of proper thread compound and a suitable thread coating are essential for assurance of leak resistance.

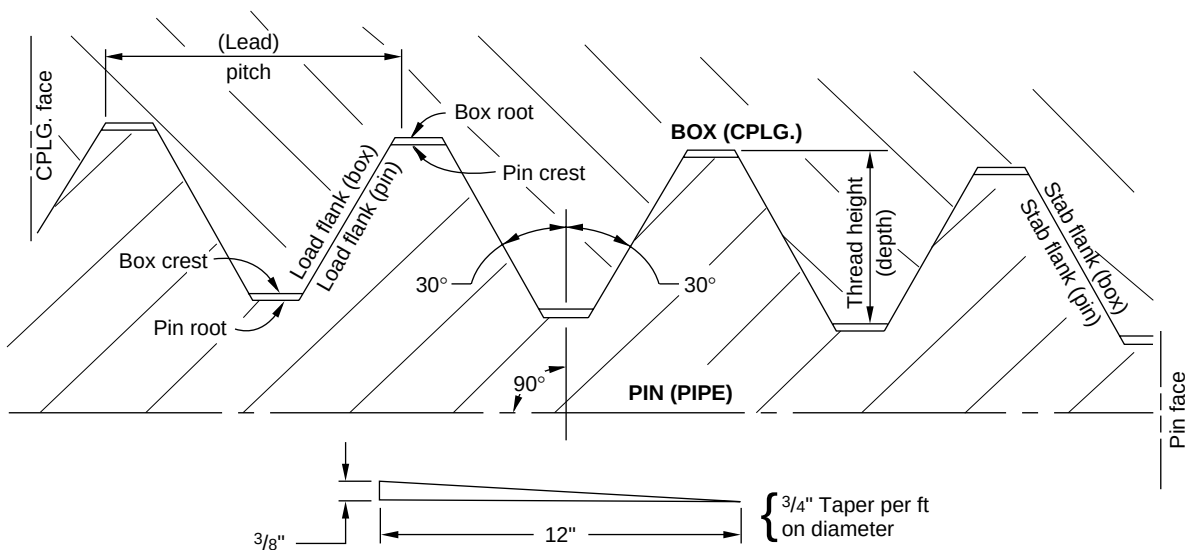


Figure 3—Line Pipe Thread Configuration

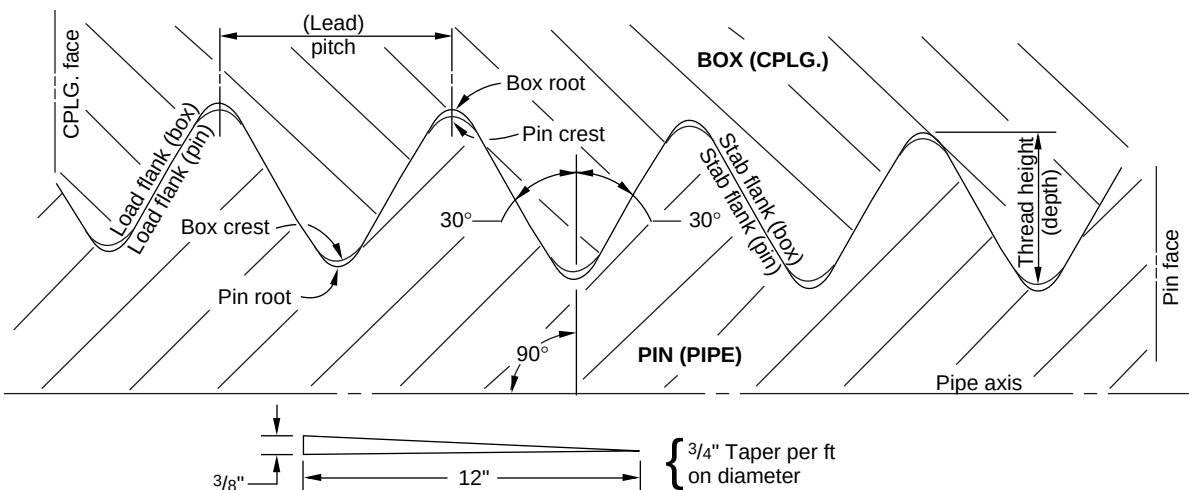


Figure 4—Round Thread Casing and Tubing Thread Configuration

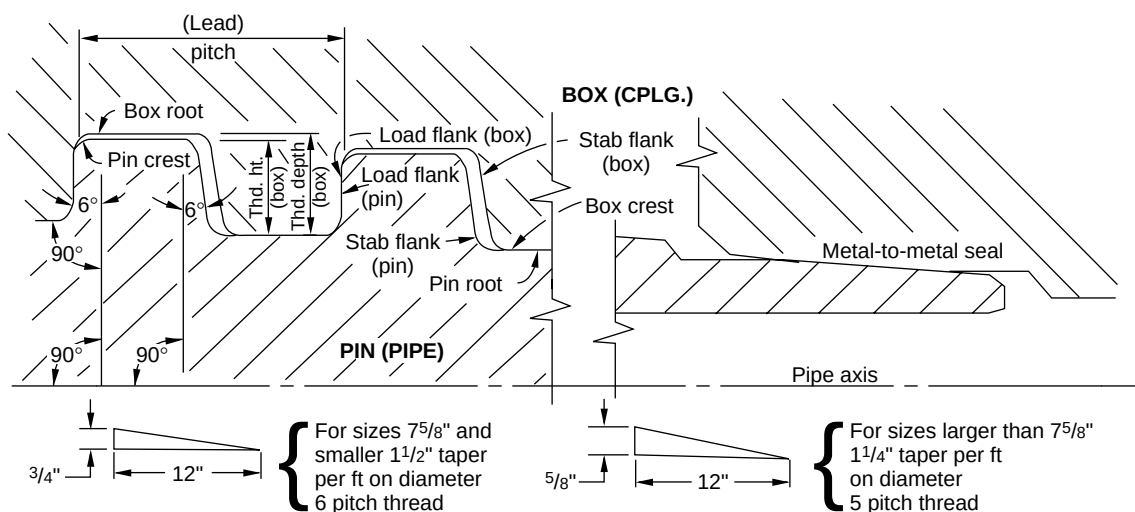
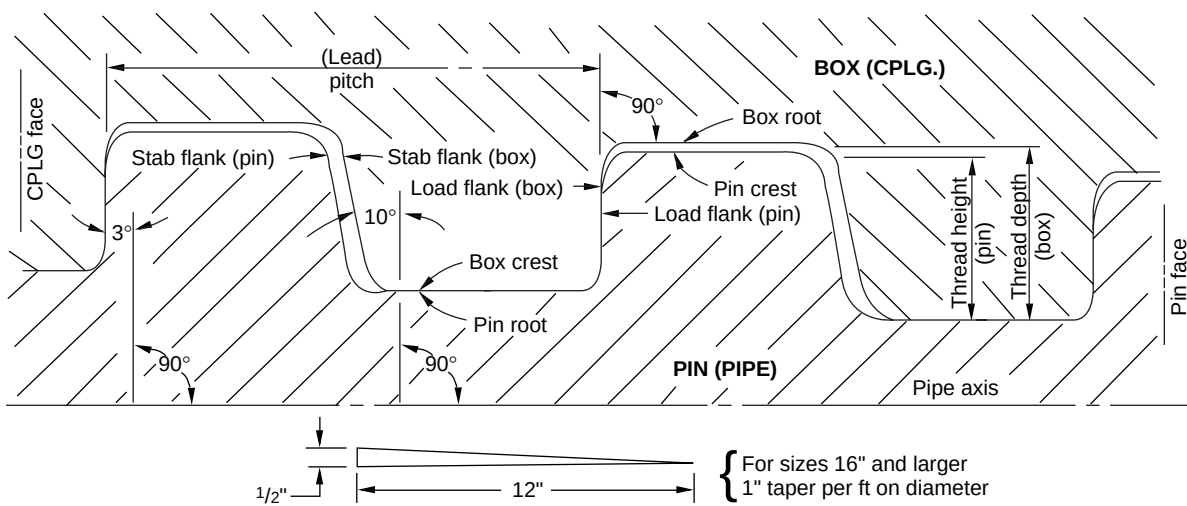
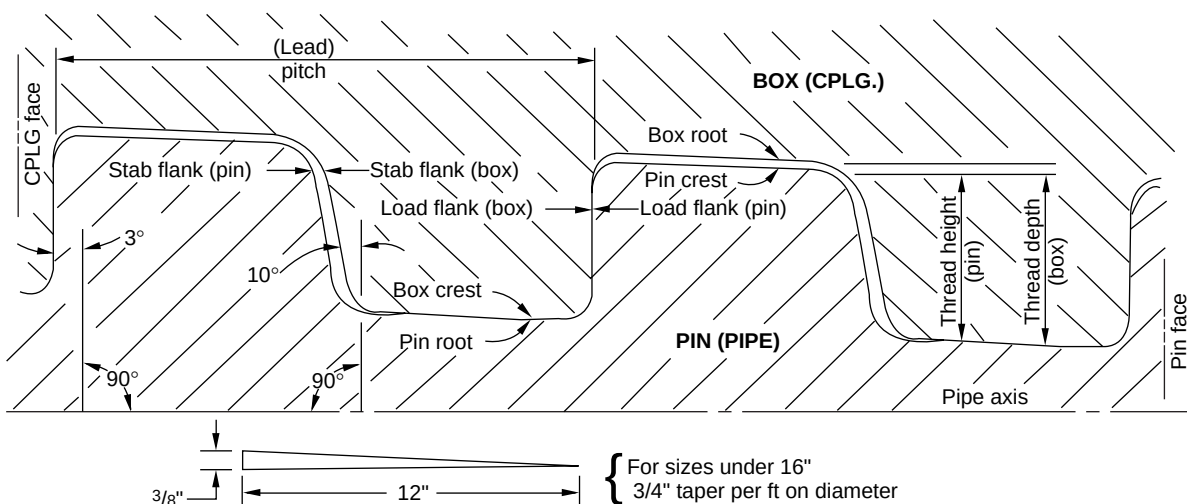


Figure 7—Extreme-Line Casing Thread Configuration

4.4 EXTREME-LINE THREAD (INTEGRAL CONNECTION)

Extreme-line casing in all sizes uses a modified Acme-type thread having a 12° included angle between stab and load flanks, and all threads have crests and roots flat and parallel to the pipe axis (Figure 7). For sizes 5 in. through $7\frac{5}{8}$ in., the threads are of 6 pitch (six threads per inch) on a taper of $1\frac{1}{2}$ in. per ft on diameter. For sizes $8\frac{5}{8}$ in. through $10\frac{3}{4}$ in., the threads are of 5 pitch (five threads per inch) on a taper of $1\frac{1}{4}$ in. per ft on diameter. For all sizes, the threads are not intended to be leak resistant when made up. Threads are used purely as a mechanical means to hold the joint members together during axial tension loading. The connection uses upset pipe ends for pin and box members that are an integral part of the pipe body. Axial compressive load resistance is primarily offered by external shouldering of the connection on makeup.

Box (or internal) member threads make up with the pin member threads by interference bearing between the box thread crests and pin thread roots. The pin crests and stab flanks of all threads have radial clearance ranging from 0.005 in. to 0.009 in. between crest of pin and root of box threads and 0.005 in. to 0.011 in. between mated stab flanks. Therefore, the load flanks and pin root to box crests are in bearing load contact makeup.

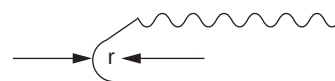
Leak resistance is obtained on makeup by interference of metal-to-metal seal between a long, radius curved seal surface on the pin member engaging a conical metal seal surface of the box member (Figure 7).

Thread compound is not necessarily a critical agent to ensure leak resistance but instead is used primarily as an anti-galling or antiseizure agent.

All threads, including partial depth threads, are functional in axial tension load resistance. Therefore, discretionary repairs for minor damage to threads only may be made without adversely affecting leak resistance of the connection. No hand dressing or repair to seal surfaces is advisable.

4.5 ROUNDED NOSE

In lieu of the conventional corner breaks on the threaded ends of tubing, the “round” or “bullet-nose” end may be supplied at the manufacturer’s option or may be specified by the purchaser. The modified end shall be rounded to provide for coatable service, and the radius transition shall be smooth with no sharp corners, burrs, or slivers on the ID or OD chamfer surfaces. See the following figure for an illustration and dimensions. It is recognized that the above dimensions are recommended values but are not subject to measurement to determine acceptance or rejection of the product.



Size	Radius, r, in inches (See Note 1)
$2\frac{3}{8}$	$\frac{3}{32}$
$2\frac{7}{8}$	$\frac{3}{32}$
$3\frac{1}{2}$	$\frac{1}{8}$
4	$\frac{1}{8}$
$4\frac{1}{2}$	$\frac{1}{8}$

Notes:

1. These dimensions are for reference only and are not subject to measurement for determining product acceptance.
2. See API Spec 5B for details.

5 Visual Thread Inspection

5.1 VISUAL THREAD INSPECTION (VTI)

Visual thread inspection is a procedure for locating thread imperfections without the use of magnetic particles or thread gauges other than a profile gauge. This inspection applies to exposed round threads on casing and tubing, and exposed buttress threads on casing. Visually evident manufacturing defects or mechanical damage to the threads are detected by this inspection.

Note: Extreme-line threads are excluded from these inspection procedures. For Extreme-line threads refer to API Spec 5B.

5.1.1 Evaluation Tools

Though imperfections may be visually located during this inspection, other tools may be used to evaluate the magnitude of the imperfections found:

5.1.1.1 A steel scale for accuracy determining the L_c area on the pin and perfect thread length of internal threads.

5.1.1.2 Mirror for inspection of load flanks and roots of internal threads.

5.1.1.3 Bright light resulting in 100 footcandles at the inspection surface for inspection of internal threads.

5.1.1.4 Profile gauge, a tool for detection of thread profile errors.

5.1.1.5 Flexible steel measuring tape for measuring circumferential non-full-crested or black-crested thread length on buttress threads.

5.1.1.6 Additionally, a copy of the latest edition of API Spec 5B and this RP shall be available on location.



Documents

Document Sharing Hub

5.1.2 Thread Repair

Repair of threads is not a part of this inspection. Cosmetic (minor) repair of threads may be done.

5.1.3 Thread Protectors

Remove the thread protectors and stack them out of the way so that they will not be a work hazard. From this step, until the thread protectors are reinstalled, great care shall be used to ensure that two lengths of pipe do not strike each other and damage the unprotected threads. Pipe should never be loaded, unloaded, or removed to another rack without thread protectors installed. Never leave threads exposed to moisture or condensation overnight. Use of light corrosion inhibitor is recommended.

Note: Martensitic Chromium Steels (9 Cr and 13 Cr, Spec 5CT, Group 2) are sensitive to galling. Special precautions may be necessary for thread surface treatment and/or lubrication to minimize galling.

5.1.4 Cleaning

Clean all exposed threads thoroughly. Ensure that no thread compound, dirt, or cleaning material remains on the threads.

CAUTION: Solvents and other cleaning agents may contain hazardous material. Solvents are normally volatiles and may build up pressure in containers. Material Safety Data Sheets should be read and the precautions observed when handling products of this type. Storage, transport, use, and disposal of excess materials and containers should be considered. Observe appropriate regulations relative to disposal of used solvents and generated waste materials.

5.1.5 Thread Inspection Areas of Round and Buttress Threads

5.1.5.1 Determine the L_c length of pin end threads.

Note: Internal threads do not have an L_c area. All of the threads within the interval from the counterbore to a plane located at a distance J plus one thread turn from the center of the coupling or small end of Integral Joint, are to be inspected to the L_c area requirements. This area is defined as the internal Perfect Thread length (PTL).

5.1.5.2 Thread classification depends on the location of an imperfection. Imperfections located in the L_c area of external threads or PTL of the internal threads have different criteria for acceptance and rejection than those outside these regions. Measurements may be required to determine if imperfections are in the L_c or box PTL.

5.1.6 Thread Examination

Slowly roll individual lengths at least one full revolution while examining the threads.

5.1.6.1 External Threads

Inspect for imperfections on the face, chamfer, L_c , and non- L_c area. The thread profile gauge may be applied to the threads to detect machining errors.

5.1.6.2 Internal Threads

Inspect for imperfections in the counterbore, PTL, and threaded area beyond the PTL. Seal-ring grooves shall be inspected for fins, wickers and ribbons that are loose or can become loose on each side of the groove. The profile gauge may be applied to the threads to detect machining errors. Caution shall be used when applying the profile gauge to avoid damaging thread coating. If the profile gauge bridges the ring groove, the metal moved in machining the groove may give a false indication of thread machining errors.

5.1.6.3 Prove-Up

Exploratory grinding or filing to determine the depth of an imperfection is not permitted in the L_c area of external threads or the total length of internal threads.

5.1.7 Categories of Imperfections

Types of imperfections that may cause thread rejection are listed in 5.1.7.1 through 5.1.7.4.

5.1.7.1 Threaded Area Imperfections

- a. Arc burns.
- b. Broken threads.
- c. Burrs.
- d. Cuts.
- e. Chattered threads.
- f. Cracks.
- g. Dents.
- h. Dinges.
- i. Fins.
- j. Galls.
- k. Grinds.
- l. Handling damage.
- m. Improper thread form.
- n. Improper thread height.
- o. Laps.
- p. Narrow threads (shaved threads).
- q. Pits.
- r. Seams.
- s. Shoulder or steps.
- t. Thick threads.
- u. Threads not extending to the center of the coupling (threads within the J -area may not be perfect).
- v. Threads not full-crested (including black-crested threads).
- w. Tool marks.

- x. Torn threads (tears).
- y. Wavy or drunken threads.
- z. Wicker (or whisker.)
- aa. Imperfections, other than those listed above, that break the continuity of the thread.

Note: Threads that are not full-crested have historically been and continue to be referred to as “black-crested threads” because the original mill surface has not been removed. Black-crested thread is a useful descriptive term; however, it should be pointed out that there can also be non-full-crested threads that may not be black.

5.1.7.2 Chamfer Area Imperfection

5.1.7.2.1 Chamfer Area (Conventional)

- a. Not present 360°.
- b. Thread running out on the face.
- c. Razor edge.
- d. Feather edge.
- e. Burrs.
- f. False starting thread engaging actual starting thread.
- g. Mashers.
- h. Cuts.

Note: The surface of the chamfer need not be perfectly smooth. Chamfers on the pipe ends have no effect on the sealing capability of the threads.

5.1.7.2.2 Round or Bullet Nose for Tubing

- a. Radius transition not smooth.
- b. Sharp corners.
- c. Burrs.
- d. Slivers.
- e. False starting thread engaging actual starting thread.
- f. Mashers.
- g. Cuts.

5.1.7.3 Pipe End Imperfections (Inside and Outside)

- a. Burrs.
- b. Fins.
- c. Dents/mashers.

5.1.7.4 Box Face and Counterbore Imperfections

- a. Tool marks.
- b. Mashers.
- c. Burrs.
- d. Arc burns.

5.2 PROCEDURE FOR EVALUATION OF VISUALLY LOCATED THREAD IMPERFECTIONS

Good judgment and discretion should be exercised in examination of exposed threads on line pipe, casing and tubing. Some surface irregularities will not affect the joint

strength or the pressure sealing performance unless they are large enough to act as a leak channel. Keep in mind that thread crests of round threads do not engage the roots of the threads of the mating piece. Therefore, minor chatter, tears, cuts, or other surface irregularities on the crest or roots of round threads may not be cause for rejection.

5.2.1 Some surface roughness may even be beneficial to proper makeup by holding thread compound in place as the thread is engaged during makeup.

5.2.2 Superficial scratches, minor dings, and surface irregularities on threads are occasionally encountered and may not necessarily be detrimental. Because of the difficulty in defining superficial scratches, minor dings, and surface irregularities, and because of the degree to which they can affect thread performance, no blanket waiver of such imperfections can be established. The thread flanks in the L_c area of round threads are the critical sealing elements.

5.2.3 Minor (cosmetic) field repair of threads and other repairs stated in 5.2 shall only be performed by agreement between the owner and the agency.

5.2.4 Arc burns are rejectable anywhere in the threaded areas.

5.2.5 Refer to Tables 1 and 2 to determine the length of specific thread areas (e.g., L_c and PTL).

5.2.6 Reject Criteria in the Non- L_c Area

5.2.6.1 Pits, seams, laps, cuts, and other imperfections are rejectable if they penetrate through the root of the thread, or if they exceed 12½% of the specified wall thickness body as measured from the projected pipe surface, whichever is greater.

5.2.6.2 Detectable protrusions on the threads are rejectable if they can peel off the protective coatings on the coupling threads or score mating surfaces.

5.2.7 Reject Criteria in the L_c Area

5.2.7.1 Threads shall be free of any visible imperfections, as listed in 5.1.7.1, that break the continuity of the threads.

5.2.7.2 Detectable protrusions on the threads are rejectable if they can peel off the protective coatings on the coupling threads or score mating surfaces.

5.2.7.3 On round threads, all threads within the L_c area shall have full crests or they are rejectable.

5.2.7.4 In buttress casing, a single thread showing the original outside surface of the pipe for more than 25% of the circumference is cause for rejection. If there are more than two threads showing the original outside surface of the pipe this is also cause for rejection.