I INTRODUCTION

1.2 ESSENTIAL FEATURES OF VELAN VALVES

Gate, Globe and Check Valves

Type of Connection	Size of connection			Class	Type		Body/Bonnet Style			Body Material		Trim Material	
A	B			C	D		E			F		G	
F	1	0	—	0	0	6	4	C	—	0	2	T	Y

A TYPE OF CONNECTION

A – Special
B – Butt weld
C – Combination
F – Flanged
R – Flanged, ring joint
S – Threaded
U – Undrilled flanges
W – Socket weld
X – Butt weld (intermediate class)

B *SIZE OF CONNECTION

Customers have the choice of specifying valve size as part of the valve figure number ("B") using the numbers below, or indicating valve size separately.

EXAMPLES: F**10**-0064C-02TY (valve size is part of figure number)
3" F-0064C-02TY (valve size is shown separately)

01–¼" (8 mm)	**05**–1" (25 mm)	**09**–2½" (65 mm)	**13**–5" (125 mm)	**18**–12" (300 mm)	**22**– 20" (500 mm)	**28**– 28" (700 mm)	**36**– 36" (900 mm)
02–⅜" (10 mm)	**06**–1¼" (32 mm)	**10**–3" (80 mm)	**14**–6" (150 mm)	**19**–14" (350 mm)	**23**– 22" (550 mm)	**30**– 30" (750 mm)	**42**– 42" (1050 mm)
03–½" (15 mm)	**07**–1½" (40 mm)	**11**–3½" (90 mm)	**15**–8" (200 mm)	**20**–16" (400 mm)	**24**– 24" (600 mm)	**32**– 32" (800 mm)	**48**– 48" (1200 mm)
04–¾" (20 mm)	**08**–2" (50 mm)	**12**–4" (100 mm)	**16**–10" (250 mm)	**21**–18" (450 mm)	**26**– 26" (650 mm)	**34**– 34" (850 mm)	**99**– Special

C CLASS

0– 150
1– 300
2– 600 or API 800 (as required)
3– 1500
4– 2500
5– 4500
6– 400
7– 900
8– 1690
9– 2680
X– Special

D TYPE

01 – Flow control
02 – Ball check
03 – Piston check
05 – Conventional port gate
06 – Full port gate
07 – Stop globe
08 – Stop check
09 – Needle
10 – Continuous blowdown
11 – Swing check
14 – Parallel slide
15 – Instrument
17 – IREB gate
18 – Extended body gate
21 – Boiler blowoff
22 – Pressure relief
23 – Double disc gate
34 - Tilting disc check
99 - Special

E BODY / BONNET STYLE

4 – Vertical
5 – Angle
6 – "Y" pattern (inclined)
A – Special
B – Bolted bonnet (forged)
C – Bolted bonnet (cast)
D – Diaphragm
E – Extended bonnet (cryogenic)
K – Pressure seal (cast)
P – Pressure seal (forged)
R – Forged bolted bonnet bellows seal
S – "Y" pattern bellows seal
T – All welded bellows seal
V – Cast bolted bonnet bellows seal
W – Welded bonnet
Y – Bonnetless (rotating stem)
Z – Bonnetless (non-rotating stem)

F BODY MATERIAL

01 – Special
02 – A105, WCB
03 – Carbon moly, F1, WC1
04 – Chr. moly, F5, C5
05 – Chr. moly, F11, WC6
06 – Chr. moly, F22, WC9
09 – Chr. moly, F9, C12
11 – Stainless steel, F304, CF8
12 – Stainless steel, F304L, CF3
13 – Stainless steel, F316, CF8M
14 – Stainless steel, F316L, CF3M
15 – Stainless steel, F347, CF8C
16 – Stainless steel, F304H
17 – Stainless steel, F430
18 – Stainless steel, F321
19 – Monel
20 – Inconel
21 – Hastelloy
22 – Titanium
23 – Alloy 20
24 – LF1
25 – LCB
26 – LF2
27 - LF3
31 - LCC
32 - Duplex stainless steel

G TRIM MATERIAL

CODE		WEDGE / DISC SEATING SURFACE [1]	SEAT SURFACE [1]	STEM
TY		13 CR (410 or CA15)	Stellite 6	13 CR (410)
TS		Stellite 6	Stellite 6	13 CR (410)
MY		CF8M or 316	Stellite 6	316
MS		Stellite 6	Stellite 6	316
MX		CF8M	SS 316	SS 316
XX		Monel	Monel	Monel
XY		Monel	Stellite 6	Monel
XS		Stellite 6	Stellite 6	Monel or Monel K
HC		Hastelloy C	Stellite 6	Hastelloy C
NACE H_2S SERVICE [2]	NA	13 CR (410 or CA15) HRC 22 max.	Stellite 6	13 CR (410) HRC 22 max.
	NB	Stellite 6 or CF8M	Stellite 6	SS 316
	NC	Monel	Stellite 6	Monel or Monel K
SX		CF8M	Integral CF8M	SS 316
AA		Special	Special	Special
BB		13 CR (410 or CA15) with Teflon insert[3]	13 CR	13 CR (410)

(1) Base material is either the same as the body or solid at manufacturer's option.
(2) NA, NB, and NC trims are for NACE service and are supplied with bolting with maximum hardness of RC 22. NS code is used for special NACE trim (details must be specified on order).
(3) Teflon insert may be in seat or wedge at manufacturer's option.

2.1 RECEIVING INSPECTION

All valves must be examined for signs of damage that may have occurred during transportation. Any damage should by analyzed and a report should be issued. Serious damage should be reported to your local Velan representative or to the Customer Service Manager so that a suitable arrangement for repairs can be made without delay.

2.2 QUALITY CONTROL INFORMATION

For valves purchased with Quality Control (QC) certification, check the package of documents to see that the Quality Control certificates are complete as per the purchase order.

2.3 STORAGE

Valves should be stored in a suitably sheltered place to prevent contamination by weather, dirt or dampness. The valve is shipped with end protectors on the inlet and outlet which should stay on the valve until it is ready for installation.

NOTE: If actuators are involved, please refer to the applicable manufacturer's instructions for storage.

2.4 HANDLING AND PREPARATION

On large valves, a hoist is needed to assist installation. A sling should be placed under the valve body or around the valve yoke so that the unit can be lifted vertically to its final destination. End protectors must be removed from all types of valves and connections must be checked for cleanliness. Any visible foreign matter must be removed from end connections on weld-end valves. The weld-end preparation must be cleaned properly with a suitable solvent such as acetone or alcohol. Do not use solvents containing chloride or fluoride.

WARNING: During installation, welding and construction stage the valve mid-section around the packing flange and stem should be protected at all times; as foreign debris from welding, grinding, etc. can fall in between the tapered area of the packing flange and stem that can cause extensive damage to stem and associated parts during valve cycling. In any case, prior to cycling, the area between the stem, packing flange and gland bushing must be thoroughly cleaned off of all foreign matter.

2.5 INSTRUCTIONS FOR GATE VALVES

The flow through gate valves can be from either end. There may be exceptions to this if bypass piping is welded to the valve body or if a pressure relief hole is drilled in one side of the valve gate. Check your piping layout drawing to ensure correct position and direction of flow. Gate valves should be installed and welded into the pipeline with the wedge or disc in the fully closed position. If the valve is left open or partially open, it could distort and leak during operation. Also, leaving the valve in a fully closed position helps prevent weld spatter from falling directly onto the mating faces of the seats.

The preferred orientation of a gate valve is upright. The valve may be installed in other orientations, but any deviation from vertical is a compromise. Installation upside down is not recommended because of possible dirt build-up in the bonnet. It is best to consult Velan Engineering department during quotation review process as to remedial measures required (hardfacing of guides) when valves over 12" (300 mm) are tilted beyond 45° from the stem vertical orientation.

NOTE: Gate valves should not be used for throttling to control the flow, they are normally fully open or fully closed. If left in partially open position could result in severe damage to body seats, wedge, stem & guide rails.

2.6 INSTRUCTIONS FOR GLOBE VALVES

Globe valves are usually installed with the inlet below the valve seat. This must be checked care fully to prevent incorrect installation. If throttling service is particularly severe, Velan recommends that the valve be installed so that the flow enters over the top of the seat and goes down through it. This maintains the valve in a more stable condition. The amount of wear is minimized and there is less external noise. Valve operation also becomes easier because less torque is required to close the valve.

Globe type valves should be installed and welded with the disc in a fully closed position to prevent damage to the valve during installation. Leaving the disc in a fully closed position also prevents weld spatter from falling directly onto the mating faces of the seat and disc.

The preferred orientation of a globe valve is upright. The valve may be installed in other orientations, but any deviation from vertical is a compromise. Installation upside down is not recommended because of possible dirt build-up in the bonnet.

PRECAUTION: Allow time for welding to cool before trying the valve for the first time in the pipeline.

2.7 INSTRUCTIONS FOR CHECK VALVES

All Velan inclined piston check and stop-check valves without springs, when installed in vertical or near vertical line, should have fluid flow upward and the angle of incline of the line not more than 5° past the vertical in the direction of the bonnet. When installed in horizontal or near horizontal lines, the valve bonnet should be up and the angle of incline of the line should be not more than 5° below the horizontal. See figure 2.7 for incline and roll angle allowable. Consult your Velan representative concerning installation other than that mentioned above.

CAUTION: Velan 90° piston check and stop check valves without springs should be installed with the bonnet up, and the angle of incline of the line should be no more than 45° from horizontal. Also, the roll angle of the valve bonnet should be no more than 45° from side to side.

NOTE: All check valves should be installed at least ten pipe diameters away from upstream pumps, elbows, fittings or equipment. If closer installation is required, please consult the Velan Customer Service Manager (see Fig. 2.7A & 2.8B).

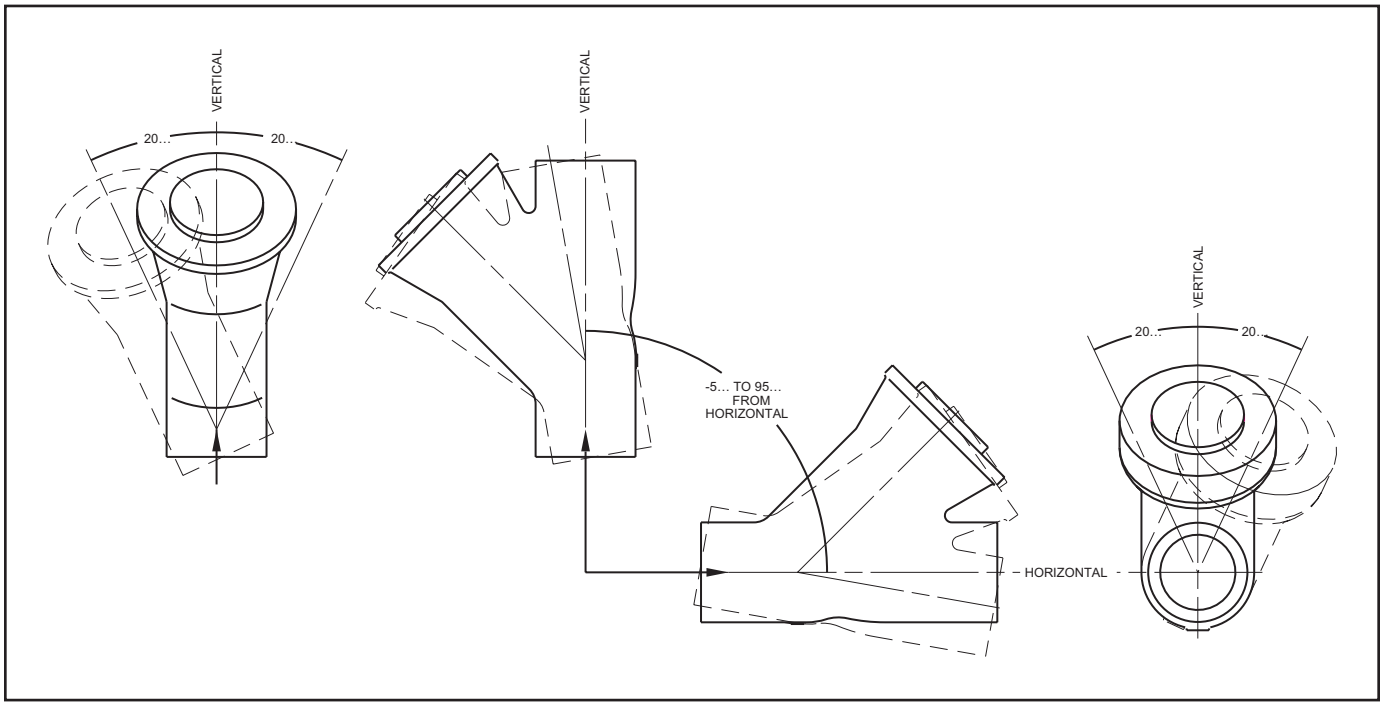

Figure 2.7A *Inclined check valve: Angle of incline and roll angle*

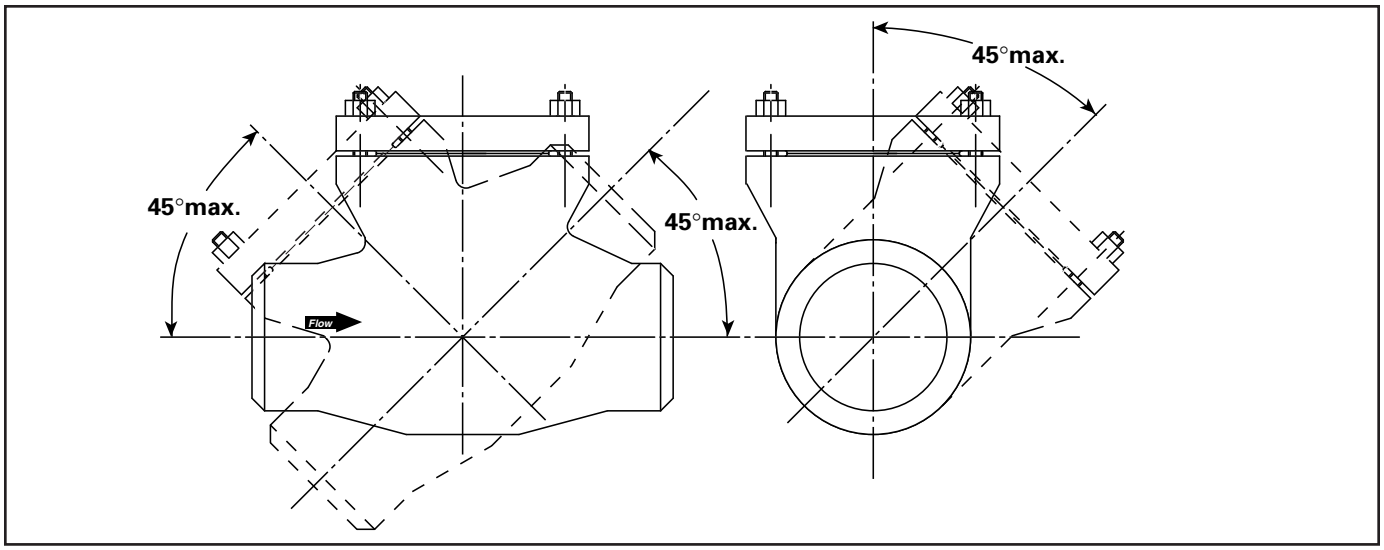

Figure 2.7B *90° check valve: Angle of incline and roll angle*

All check valves must be installed with the inlet in direction of arrow. This must be checked carefully before installing the valve. Placing a check valve in the opposite direction to the flow will prevent the disc from swinging free and will therefore prevent normal operation of the valve.

2.8 INSTRUCTIONS FOR TILTING DISC CHECK VALVES

Tilting disc check valves can be installed horizontally or vertically according to the design specifications and with the inlet in the direction of the arrow. Placing a check valve in the opposite direction to the flow will prevent the disc from swinging free and will therefore prevent normal operation of the valve

NOTE: All check valves should be installed at least ten pipe diameters away from upstream pumps, elbows, fittings or equipment. If closer installation is required, please consult the Velan Customer Service Manager.

2.9 RECHECK FOR BOLT TIGHTNESS WITH OR WITHOUT LINE PRESSURE

After valve installation, recheck and retighten the bolts including gland bolts as necessary to the values given as follows:

Gasket bolts: body-bonnet, use *Table 4.5A*
Packing bolts: gate and parallel slide valves, use *Table 5.1A* and for globe valves, use Table *5.1B*.
All other bolts: use *Table 5.3A*

The tightness of the joint bolt tension and gland bolts should be checked at approximately one year intervals thereafter. Use bolt tightening procedure as follows:

1. Remove one nut at a time, lubricate stud and nut flats thoroughly with an approved anti- seize compound and torque to recommended values shown in *Table 4.5A*.
2. Remove opposite nut and repeat procedure until all nuts have been retorqued.
3. Re-check bolt torque by going once around clockwise.

   NOTE: If gasket must be replaced, follow *Section 4.5 Body/Bonnet (or Cover) Torquing Procedure*.

2.9.1 Seat Cleaning-Flushing

After installation prior to system test and start-up, it is recommended to clean the valve by flushing line debris matter that may have accumulated inside the valve and between the valve seating surfaces during Plant construction and valve installation. Open the valve fully, flush as deemed necessary, then close and open the valve while flushing. If seat leakage is noted after flushing repeat the procedure. If the leakage still persists, it must be assumed the seating surface maybe damaged.

NOTE: If seat must be repaired, follow *Section 5.2.3 Seat Leakage*.

III WARNING

1. Warning on Over-Pressurization Relief

Under certain conditions, double-seated valves which have the integrate cavity filled with fluid and is subjected to increase in temperature can result in excessive buildup of pressure in the center cavity, leading to pressure boundary failure.

Such situations occur when liquid from condensation, testing fluid, leakage from upstream side, etc. accumulates in the center cavity. If this fluid is not relieved by some means, over-pressurization may occur. It is the responsibility of the purchaser to ensure that adequate precautions are taken against such an eventuality.

2. Warning on NACE Conversions

It is extremely important to ensure that valves, when converted to NACE trims in the field are done by Velan authorized service shops. Unauthorized conversions can result in failure to carry out post-weld heat treatment and result in severe stress cracks in non-stress relieved areas.

3. Warning on Conversion to Globe Stop Check

Velan globe valves cannot be automatically converted to glove stop check valves, without verifying design parameters in detail with Velan Engineering. Any unauthorized conversions may result in the jamming of the disc in the valve.

For further details on the above subjects, please contact the Customer Service Manager.

4.1 TROUBLE SHOOTING CHART

AREA	GENERAL PROBLEMS	PROCEDURE FOR REPAIR
PACKING CHAMBER LEAKAGE	• Packing compression • Gland bushing binding	• Packing chamber leakage Gate, globe & parallel slide: *Section 5.2.1*
	• Packing worn • Stem, packing chamber damaged	• Repacking procedure Gate, globe, parallel slide: *Section 5.1.3*
BODY-BONNET JOINT LEAKAGE	• Gasket damaged • Body or bonnet damaged	• Replacement of gasket Gate: *Section 6.3* Globe: *Section 7.4* Swing check: *Section 9.4*
	• Tightness of bolting	• Body-bonnet stud torquing Gate, globe, parallel slide, swing check & tilting disc: *Section 4.5*
SEAT LEAKAGE	• Lack of seating torque	• Closing torque Gate & Globe: *Section 5.2.4*
	• Damaged seat faces	• Seat repair (optional information available upon request)
	• Disc movement restricted	• Disassembly and reassembly Swing check valves
OPERATIONAL SMOOTHNESS	• Lubrication	• Lubrication Gate, globe, parallel slide, swing check & tilting disc: *Section 4.3*
	• Packing compression	• Packing torque Gate, globe & tilting disc: *Section 5.1.5*
	• Stem thread • Yoke nut thread	• Disassembly and reassembly Gate: *Sections, 6.3, 6.4, 6.5* Globe: *Sections, 7.5, 7.6, 7.7, 7.8* Parallel slide: *Sections, 8.3, 8.4, 8.5* *Swing Check, 9.4, 9.5, 9.7, 9.8, 9.10, 9.11, 9.12*

4.2 OPERATION

4.2.1 General

All valves require examination before being put into operation. Additionally, valves should be inspected regularly during operation and should receive prompt attention when trouble arises. As a general rule, valves should be subjected to scheduled maintenance.

4.2.2 Smoothness of Operation

Stem threads, gearing and other working components outside the fluid area should be lubricated frequently and at least once every six months. Specific lubricants and frequency of application are shown in the recommended lubrication *Table of Section 4.3*. Valves that are not operated frequently and which may remain open or closed for long periods of time should be worked (even if only partially) about once a month.

IMPORTANT: Excessive handwheel effort can indicate the following:

1. Improperly lubricated or damaged valve stem.
2. Valve packing compression too tight (check torque *Table 5.1A)* .
3. Faulty or damaged valve parts.
4. Foreign particle matter on threads and on stem-packing flange area.

4.4 GENERAL ASSEMBLY INFORMATION

1. The most important fact to be considered is the cleanliness of all parts. All rust and dirt should be removed from all parts with a wire brush or emery cloth. Oil and grease should be removed with suitable solvents.
2. All threaded parts (capscrews, nuts and studs) must be well relubricated. The stem and yoke nut threads should be cleaned of all old grease before new grease is applied to the threads. All recommended lubricants can be found in *Section 4.3*. Use correct lubricant for each individual part.
3. Repaired or replacement parts must be checked to see if all repair procedures have been done and that all replacement parts (e.g. packing rings, gasket, etc.) have been checked for size so that they will fit into the valve you are servicing.
4. All orientation marks assigned during disassembly must be observed so that correct orientation is maintained. Where applicable, orientation marks should be made on parts near the body serial number (e.g., wedge, disc, seat etc.)

4.3 RECOMMENDED LUBRICATION

Table 4.3 *Recommended lubrication*

PART	LUBRICATION	APPLICATION	FREQUENCY
Stem threads	Exxon: Ronex MP, Castrol MP or equivalent MP group (up to 650^{0}F) Ronex Extra duty 2 (above 650^{0}F)	Directly to threads	When threads appear dry
Yoke nut	Exxon: Ronex MP, Castrol MP or equivalent MP group (up to 650^{0}F) Ronex Extra duty 2 (above 650^{0}F)	Inject through grease fitting at hub of yoke	Concurrently with stem thread lubrication
All threaded parts except stem and yoke nut	- Anti-seize compound No. 425-A (Crane) or equivalent - Nickel Anti-Seize to MIL-A-90TE or MOLYKOTE P37	Thin coat on threads	On valve assembly only

Recommended lubricant subject to change without notice.

4.5 BODY/BONNET (OR COVER) TORQUING PROCEDURE

4.5.1 General

1. Clean all studs and nuts. Visually inspect all threads to ensure removal of all foreign matter, rust, corrosion, burrs and previous lubricants.
2. Liberally cover the stud threads and the surface under the nut head with FELPRO type C5A Hi-Temp Antiseize compound or approved equivalent. Also, lubricate the female threads of the nuts and nut flats, and wipe off any excess lubricant that may adhere to any of the stainless steel parts with recommended solvents.

   Recommended solvents for this work are:
   a) unused or redistilled acetone
   b) alcohol
3. After tightening bolts by hand, follow the bolt tightening sequence shown in *Fig. 4.5A.* This sequence depends on the quantity of bolts used. The drawing illustrates the tightening sequence of different size and class. The bolts should be torqued to the values in accordance with the table material for stud threads (see *Table 4.5A*).

4.5.2 Application of Torque

When applying the torque to the bolts, each bolt should be torqued in steps of approximately 20% of the final torque.

After the final torque has been applied in sequence. It is recommended that the bolts be rechecked once around in a clockwise rotation.

PRECAUTION:

1. If tightening sequence is not followed, it is possible that the gasket will not be compressed evenly, and may result in gasket leakage.
2. Over-torquing can cause deformation of the body or bonnet flange and can also cause joint leakage.
3. Do not use impacting devices to tighten up the bolting on the body/bonnet (cover). Use suitable mechanical devices for tightening.
4. Use hand torque wrenches. If torque wrenches are not suitable, use standard wrenches and the following guidelines will apply:

BOLT SIZE	LENGTH OF WRENCH inches	mm
3/8″	5″	125
1/2″	6″	150
9/16″	9″	225
5/8″	12″	300
3/4″	18″	450
7/8″	24″	600
1″	30″	750
1 1/8″	36″	900

On sizes of bolts larger than 1 1/8″, special torque multipliers with ratios 1:7 or 1:6 should be used for torquing.

Table 4.5A *Body/bonnet bolting torque ft·lb (N·m).*

Stud Size	Bolting Material					
	B7M/L7M	B7 / B16	660	630	B8M CL.1	B8M CL.2
⅜–16 UNC	15 (20)	20 (27)	20 (27)	20 (27)	15 (20)	20 (27)
7/16–14 UNC	25 (34)	30 (41)	25 (34)	35 (47)	25 (34)	25 (34)
½–13 UNC	40 (54)	50 (68)	40 (54)	55 (75)	35 (47)	45 (61)
9/16 – 12 UNC	55 (75)	70 (95)	60 (81)	80 (108)	55 (75)	65 (88)
⅝-11 UNC	75 (102)	100 (136)	80 (108)	100 (136)	70 (95)	85 (115)
¾–10 UNC	135 (183)	170 (231)	150 (203)	200 (271)	125 (170)	150 (203)
⅞–9 UNC	200 (271)	270 (366)	250 (339)	300 (407)	200 (271)	200 (271)
1–8 UNC	350 (475)	400 (542)	350 (475)	450 (610)	300 (407)	350 (475)
1⅛-8 UN	500 (678)	600 (814)	500 (678)	650 (881)	450 (610)	450 (610)
1¼-8 UN	675 (915)	850 (1153)	700 (949)	950 (1288)	650 (881)	650 (881)
1⅜-8 UN	900 (1220)	1200 (1627)	1000 (1356)	1300 (1763)	900 (1220)	900 (1220)
1½–8 UN	1200 (1627)	1500 (2034)	1300 (1763)	1700 (2305)	1200 (1627)	1200 (1627)
1⅝–8 UN	1600 (2170)	2000 (2712)	1700 (2305)	2200 (2983)	1500 (2034)	
1¾–8 UN	2000 (2712)	2500 (3390)	2100 (2848)	2800 (3797)	1900 (2576)	
1⅞–8 UN	2500 (3390)	3100 (4204)	2600 (3526)	3500 (4746)	2300 (3119)	
2–8 UN	3000 (4068)	3800 (5153)	3200 (4339)	4200 (5695)	2800 (3797)	
2⅛ – 8 UN	3600 (4882)	4500 (6102)	3800 (5153)	5000 (6780)	3400 (4610)	
2¼ – 8 UN	4400 (5966)	5400 (7322)	4600 (6238)	6100 (8272)	4100 (5560)	
2½ – 8 UN	6000 (8136)	7500 (10170)	6400 (8678)	8500 (11526)	5700 (7729)	

Note:
(1) Torque tolerance ±10%.
(2) Maximum temperature for 630 is 650°F.
(3) For temperatures above 750°F (400°C) use 75% of the torque values.
(4) Above torque values are with the bolts lubricated.