VELAN

HIGH PERFORMANCE KNIFE GATE VALVES

MAINTENANCE MANUAL

Bolted Bonnet and Bonnetless, 2–36” (50–900 mm)

Bolted Bonnet
Tappi Metal or Resilient Seated

Bolted Bonnet, Electric, Air or Hydraulic Actuated

Bonnetless, Tappi, Metal
or Resilient Seated

Bonnetless, Electric, Air
or Hydraulic Actuated

Bonnetless, Through-Bolted
Flanged, Metal or Resilient Seated

Maintenance Manuals

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I INTRODUCTION

1.1 ESSENTIAL FEATURES OF VELAN VALVES

Bolted Bonnet and Bonnetless Knife Gate Valves

Type of Connection	Size of connection*		Class	Type		Face-to-Face style		Body,Knife,Stem Material		Seat Material	
A	B		C	D		E		F		G	
L	1	4	— 0	3	1	0	C	— 1	3	S	L

e.g.:is a Lugged (Wafer) 6" Metal Seated Knife gate

A TYPE OF CONNECTION

A – SPECIAL **B –** Butt Weld **F –** Flanged **L –** Lug (Wafer)

B *SIZE OF CONNECTION

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

EXAMPLES: L16-0310C-13SL (valve size is part of figure number)
10" L-0310C-13SL (valve size is shown separately)

08 - 2" (50 mm)	**13** - 5" (125 mm)	**18** - 12" (300 mm)	**22** - 20" (500 mm)	**28** - 28" (700 mm)	**36** - 36" (900 mm)
09 - 2½" (65 mm)	**14** - 6" (150 mm)	**19** - 14" (350 mm)	**23** - 22" (550 mm)	**30** - 30" (750 mm)	**99** - SPECIAL
10 - 3" (80 mm)	**15** - 8" (200 mm)	**20** - 16" (400 mm)	**24** - 24" (600 mm)	**32** - 32" (800 mm)	
12 - 4" (100 mm)	**16** - 10" (250 mm)	**21** - 18" (450 mm)	**26** - 26" (650 mm)	**34** - 34" (850 mm)	

C CLASS

0 – 150 psi **A –** SPECIAL

D TYPE

31 – Knife Gate Metal Seat **33 –** Throttling Stock Valve **35 –** Horizontal Swing Check Valve **37 –** V-Port Knife Gate
32 – Knife Gate Resilient Seat **34 –** Tilting Disc Check Valve **36 –** Sampling Valve **99 –** SPECIAL

E FACE-TO-FACE STYLE

0 – Tappi Standard (Wafer) **1 –** ASME Standard (flanged) **2 –** Regular (flanged) **3 –** SPECIAL
B – Bolted Bonnet C – Cast F – Fabricated

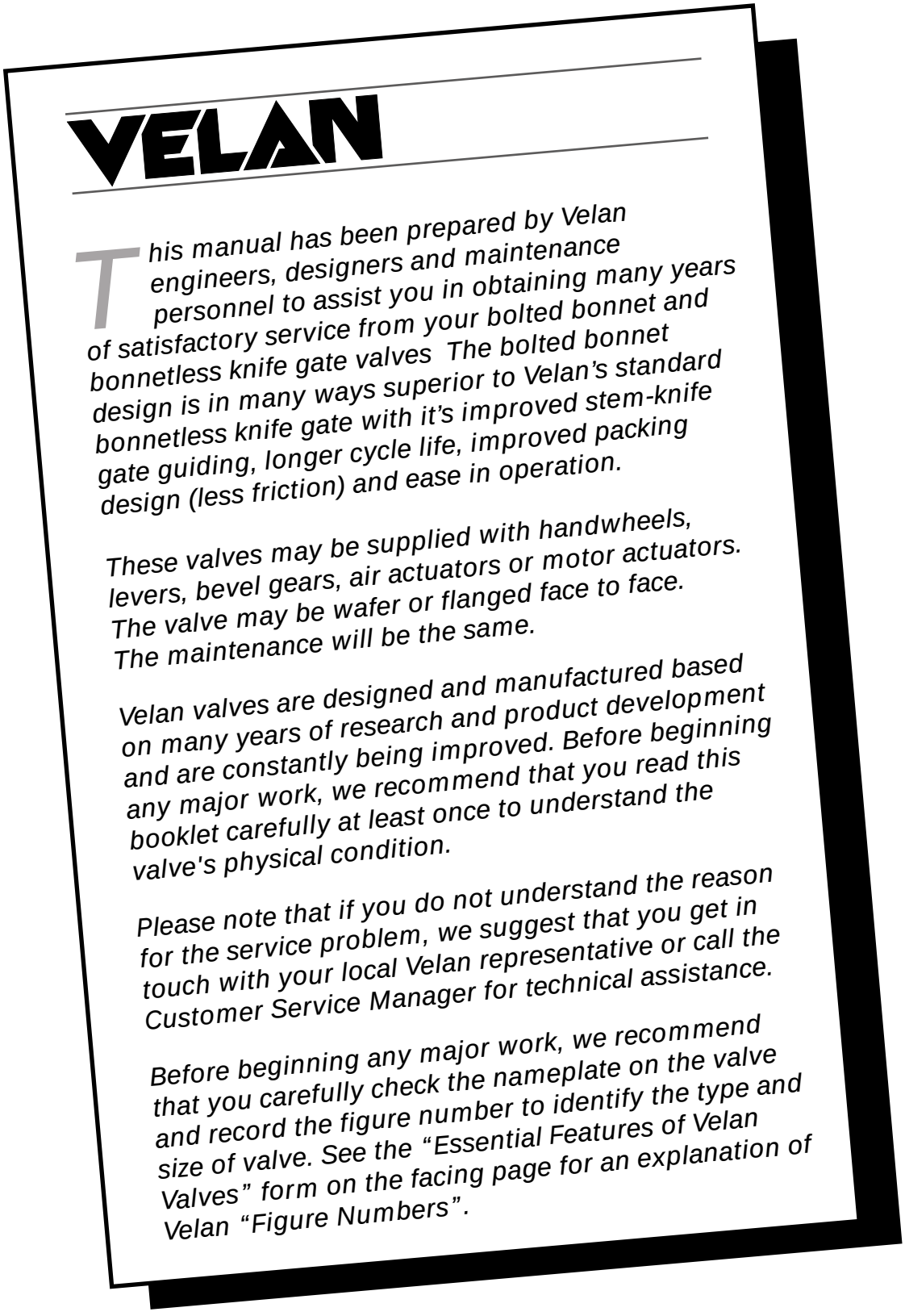
F BONNET - BODY SEAT MATERIAL

Code	Body-Seat Ring	Knife	Stem
01	SPECIAL	SPECIAL	SPECIAL
02	A105, WCB	316	410
11	F304, CF8	304	316 or 304
12	F304L, CF3	304L	316 or 304
13	F316, CF8M	316	316 or 304
14	F316L, CF3M	316L	316 or 304
23	Alloy 20	Alloy 20	316 or Alloy 20
28	F317, CG8M	317L	316 or 317L
29	F317L, CG3M	317L	316 or 317L
35	254 SMO	254 SMO	316 or 254 SMO

G SEAT MATERIAL

Code	SEAT
SL	Integral
BL	Viton
CL	Black Neoprene
CW	White Neoprene
FL	PTFE
EP	EPDM
MS	Stellite faced
PL	Polyurethane
ST	Stellite 6
AA	SPECIAL

1.2 GENERAL INTRODUCTION



VELAN

This manual has been prepared by Velan engineers, designers and maintenance personnel to assist you in obtaining many years of satisfactory service from your bolted bonnet and bonnetless knife gate valves The bolted bonnet design is in many ways superior to Velan's standard bonnetless knife gate with it's improved stem-knife gate guiding, longer cycle life, improved packing design (less friction) and ease in operation.

These valves may be supplied with handwheels, levers, bevel gears, air actuators or motor actuators. The valve may be wafer or flanged face to face. The maintenance will be the same.

Velan valves are designed and manufactured based on many years of research and product development and are constantly being improved. Before beginning any major work, we recommend that you read this booklet carefully at least once to understand the valve's physical condition.

Please note that if you do not understand the reason for the service problem, we suggest that you get in touch with your local Velan representative or call the Customer Service Manager for technical assistance.

Before beginning any major work, we recommend that you carefully check the nameplate on the valve and record the figure number to identify the type and size of valve. See the "Essential Features of Velan Valves" form on the facing page for an explanation of Velan "Figure Numbers".

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 DOCUMENTATION

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. Nylon slings should be used and placed around the valve, 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 valve end connection must be cleaned properly with a suitable solvent such as acetone or alcohol. Do not use solvents containing chloride or fluoride.

2.5 INSTALLATION

1. Install the valve so that the higher pressure is pushing the knife against the seat. This means that the valve must be installed so that the arrow, *(Ref. Fig. 2.5A)* which is cast on the body, is in the direction of the pressure differential, when the valve is in a closed position

2. Although knife gate valves may be mounted in different orientations around the pipe line, the preferred orientation is with the stem placed vertical. Installation upside down is not recommended for high consistency applications, because of possible fiber and dirt build-up in the bonnet. Care must be taken when tightening the flange bolts so that the valve is not distorted. On all wafer knife gate valves, there are blind tapped holes. Care must be taken so that you do not over tighten and distort the body chest. See flange bolt torque *Table 2.7A*.

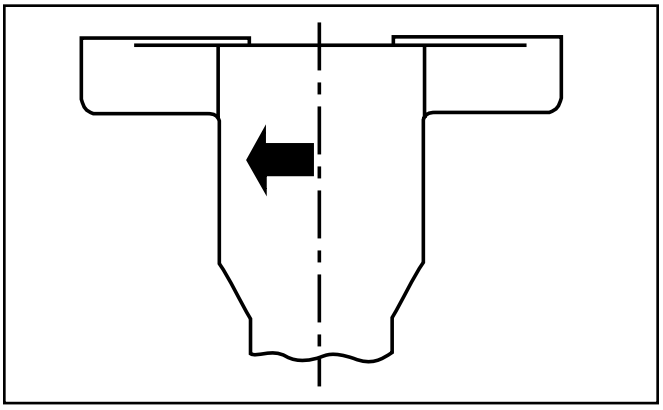


Figure 2.5A *Cast arrow on both sides of body indicating direction of pressure when valve is closed.*

3. If valves are supplied with air actuators or motor actuators, additional support for the actuators is required. This support should be a brace from the floor or some method of suspension. The additional supports should be at the base of the actuators (i.e. top of valve yoke).

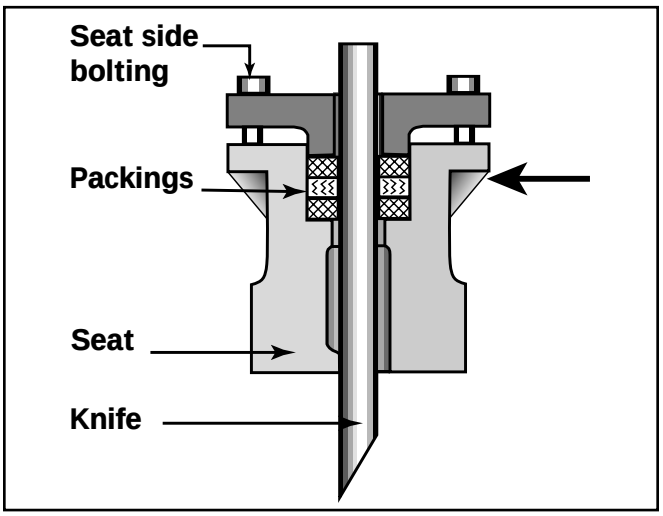


Figure 2.5B *Bonnetless knife gate*

4. Once the valve has been installed in the pipeline, it is recommended that the body- bonnet and packing flange bolts be retightened. The original factory bolt torque might be lost due to vibration and relaxation of material caused by frequent temperature and pressure fluctuations. Bolts must be torqued evenly (crossed torqued). See packing torque *Table 2.6A* for bonnetless, *Table 2.6B* for bolted bonnet and *Table 2.6C* for body-bonnet gasket bolting torques for bolted bonnet valves.

NOTE: For bonnetless valves, if more torque is applied on seat side bolting, the knife is subjected to move away from the seat and the valve may leak under low flow *(see Fig. 2.5B)*.

5. Proper mounting is essential to the performance of any knife valve. It is very important that you do not squeeze the valve between the two flanges because this could cause distortion in the valve body.

WARNING: It is important that you do not use the valve to pull the pipe flange to close the gap between valve and flange as shown in *Fig. 2.5C.* The best installation is to see that pipeline does not squeeze or pull on the body and pipeline flanges are parallel. For the same reason, the valve and the pipeline must be well supported *(see Fig.2.5D)*.

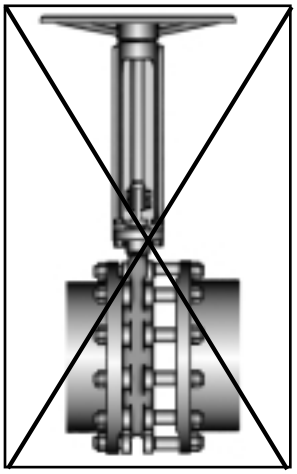


Figure 2.5C

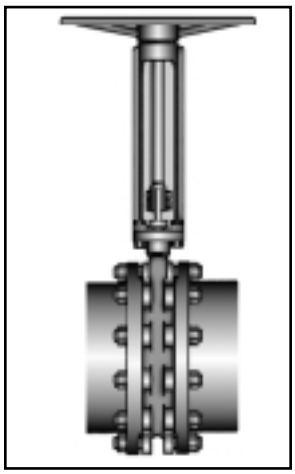


Figure 2.5D

2.6 PACKING & GASKET BOLT TORQUES

Table 2.6A *Packing gland bolt torque for bonnetless knife gate valves*

VALVE SIZE		TORQUE	
in	mm	lbf·ft	N·m
2	50	9	12
3	80	10	14
4	100	18	25
6	150	10	14
8	200	15	20
10	250	22	30
12	300	26	36
14	350	19	26
16	400	28	30
18	450	28	39
20	500	31	42
24	600	36	49
30	750	28	39
36	800	46	62

Table 2.6B *Packing gland bolt torque for bolted bonnet knife gate valves*

VALVE SIZE		TORQUE	
in	mm	lbf·ft	N·m
4	100	9	12
6	150	13	18
8	200	13	18
10	250	18	25
12	300	18	25
14	350	18	25
16	400	18	25
18	450	18	25
20	500	18	25
24	600	18	25
30	750	50	68

Table 2.6C *Body-bonnet gasket bolt torque for bolted bonnet knife gate valves*

VALVE SIZE		TORQUE	
in	mm	lbf·ft	N·m
4	100	15	20
6	150	35	47
8	200	35	47
10	250	35	47
12	300	35	47
14	350	35	47
16	400	35	47
18	450	35	47
20	500	35	47
24	600	70	95
30	750	70	95

2.7 TORQUE PROCEDURE *(see Table 2.7A)*

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 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. 2.7A*. This sequence depends on the quantity of bolts used. The drawing illustrates the logical progression one should follow.

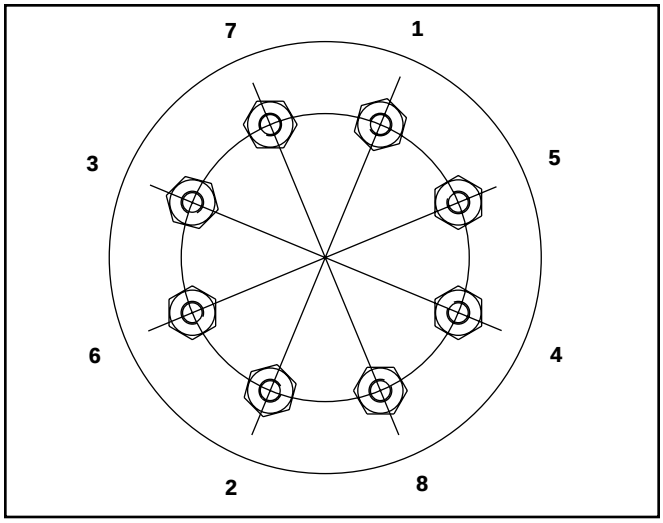


Figure 2.7A *Bolt tightening sequence*

Table 2.7A *Maximum flange bolt torque for bolted bonnet and bonnetless knife gate valves*

VALVE SIZE in	mm	MAX. TORQUE lbf·ft	N·m	VALVE SIZE in	mm	MAX. TORQUE lbf·ft	N·m
2	50	30	41	12	300	90	122
2.5	65	30	41	14	350	100	136
3	80	30	41	16	400	100	136
4	100	30	41	18	450	150	203
6	150	70	95	20	500	150	203
8	200	70	95	24	600	200	271
10	250	90	122				

Table 2.7B *Dimensions for flange bolting of standard bonnetless and bolted bonnet knife gate Valve*

VALVE SIZE		STUD DIAMETER	LUG THICKNESS (INCL. R/F STEP)	BLIND HOLES DEPTH (INCL. R.F.)	QUANTITY OF BLIND HOLES BOTH SIDES
in	mm	(in)	STEP (in)		
2	50	5/8–11 UNC	9/16	0.50	4
3	80	5/8–11 UNC	9/16	0.50	4
4	100	5/8–11 UNC	5/8	0.50	4
6	150	3/4–10 UNC	3/4	0.54	4
8	200	3/4–10 UNC	11/16	0.73	4
10	250	7/8–9 UNC	13/16	0.56	8
12	300	7/8–9 UNC	13/16	0.71	8
14	350	1–8 UNC	7/8	0.56	8
16	400	1–8 UNC	15/16	0.75	12
18	450	1-1/8–7UNC	7/8	0.66	12
20	500	1-1/8–7UNC	1	1.00	16
24	600	1-1/4–7UNC	1 1/16	1.03	16
30 (Wafer type)	750	1-1/4–7UNC	—	1.25	28
36 (Wafer type)	900	1-1/2–6UNC	—	1.44	32

Note:
On blind holes, studs must be used: Hole depth + gasket + companion flange thickness + one time and a half x stud nominal diameter. The length of the cap screws shall be : Hole depth + gasket thickness + companion flange thickness + 1/4" (0.25 mm).

FOR SAFETY REASONS,

it is important to take these precautions before removing a valve from a line.

- *Personnel making any adjustments on the valves should wear safety equipment normally used to work with fluid in the line where the valve is installed.*
- *Before removing a valve from a line, line pressure must be relieved with no exception.*
- *Velan valves can be equipped with a variety of manual gear, electric motor, hydraulic or pneumatic actuators. Generally, all pressure must be relieved from both sides of the valve before the actuator is removed.*
- *Before removing packing gland bolts for inline packing replacement, line pressure must be relieved with no exception.*

IV GENERAL MAINTENANCE

4.1 TROUBLE SHOOTING CHART

AREA	GENERAL PROBLEMS	PROCEDURE FOR REPAIR
PACKING CHAMBER LEAKAGE	• Packing compression • Gland bushing binding	• Packing chamber leakage *Section VI, para. 6.3.1 &* *Section VII, para. 7.3.1* *Pages 16 & 20*
	• Packing worn • Stem, packing chamber Knife Gate damage	• Repacking procedure *Section VI, para. 6.1.3 & 7.1.4* *Pages 13 &19*
BODY-BONNET JOINT LEAKAGE	• Gasket damaged • Body or bonnet damaged	• Replacement of gasket *Section VII, para. 7.3.6* *Page 21*
	• Tightness of bolting	• Body-bonnet stud torquing *Section II, para. 2.6 & 2.7* *Pages 4& 5*
SEAT LEAKAGE	• Lack of seating torque	• Closing torque *(bolted bonnet knife gate valve only)*
	• Damaged seat faces • Seat • Knife Gate	• Seat repair *Section VI & VII, para. 6.3.3, 6.3.4 & 7.3.3, 7.3.4* *Pages 16, 17 & 20, 21*
	• Fiber build-up	• Disassembly required *Section VII, para. 7.2* *Pages 19*
OPERATIONAL SMOOTHNESS	• Lubrication	• Lubrication *Section IV, para. 4.2.2,* *Table 4.3A* *Pages 8*
	• Packing compression	• Packing torque *Section II & IV, para. 2.6 & 4.2.2* *Table 2.6A & 2.6B* *Pages 4 & 8*
	• Stem thread • Yoke nut thread	• Smoothness of operation • Disassembly and reassembly *Section IV, para. 4.2.2*

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 *Section 4.3, Table 4.3A*, Recommended lubrication. 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 in *Section II, para. 2.6 Table 2.6A & 2.6B).*
3. Faulty or damaged valve parts.
4. Faulty installation (flange bolt torque)

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., bonnet to body, knife gate to body, seat to body etc.)

4.3 RECOMMENDED LUBRICATION

Table 4.3A *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.

V TYPES OF ALL STAINLESS STEEL KNIFE GATE VALVES

5.1 STANDARD BONNETLESS KNIFE GATE VALVES

PARTS DESCRIPTION

01	Body	07	Packing flange	13	Yoke Bushing
02	Knife	08	Stem nut	14	Handwheel thrust spacer
03	Seat ring	09	Bolt	15	Handwheel
04	O-ring	10	Nut	16	Handwheel nut
05	Yoke	11	Packing	17	Grease fitting
06	Stem	12	Thrust Bearing	18	Bottom lugs

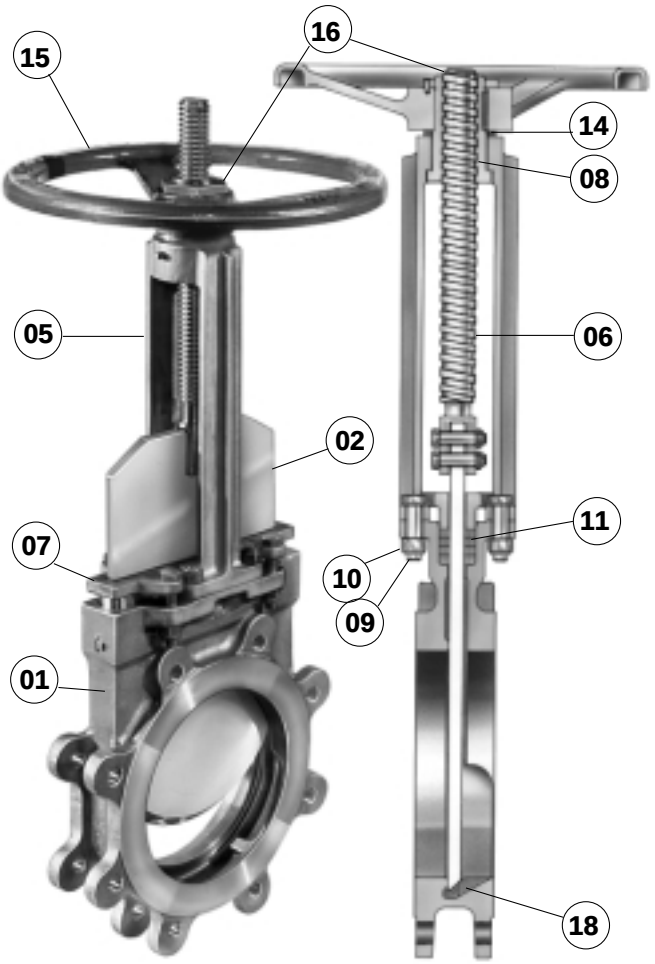
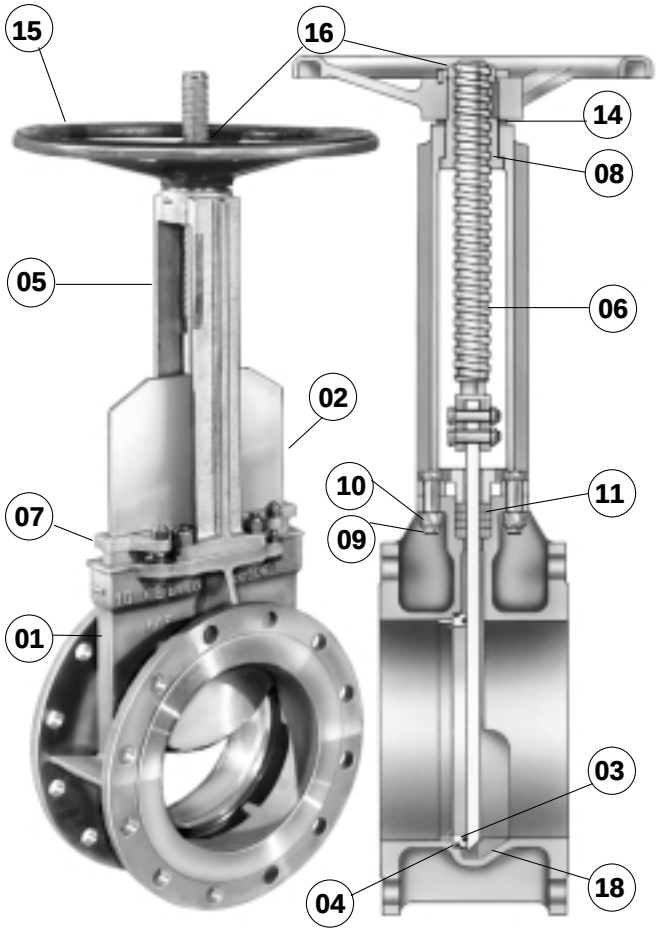


Figure 5.1A *Wafer-type, metal seat 2-36" (50-900 mm)*



NOTE: Integral metal seats also available

Figure 5.1B *Through-bolted flanges, resilient seat, 2-36" (50-900 mm)*

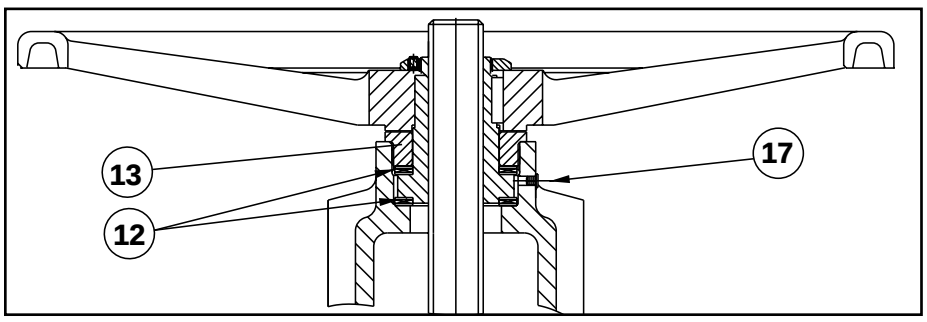


Figure 5.1C *Thrust Bearing 14"- up (350 mm - up)*

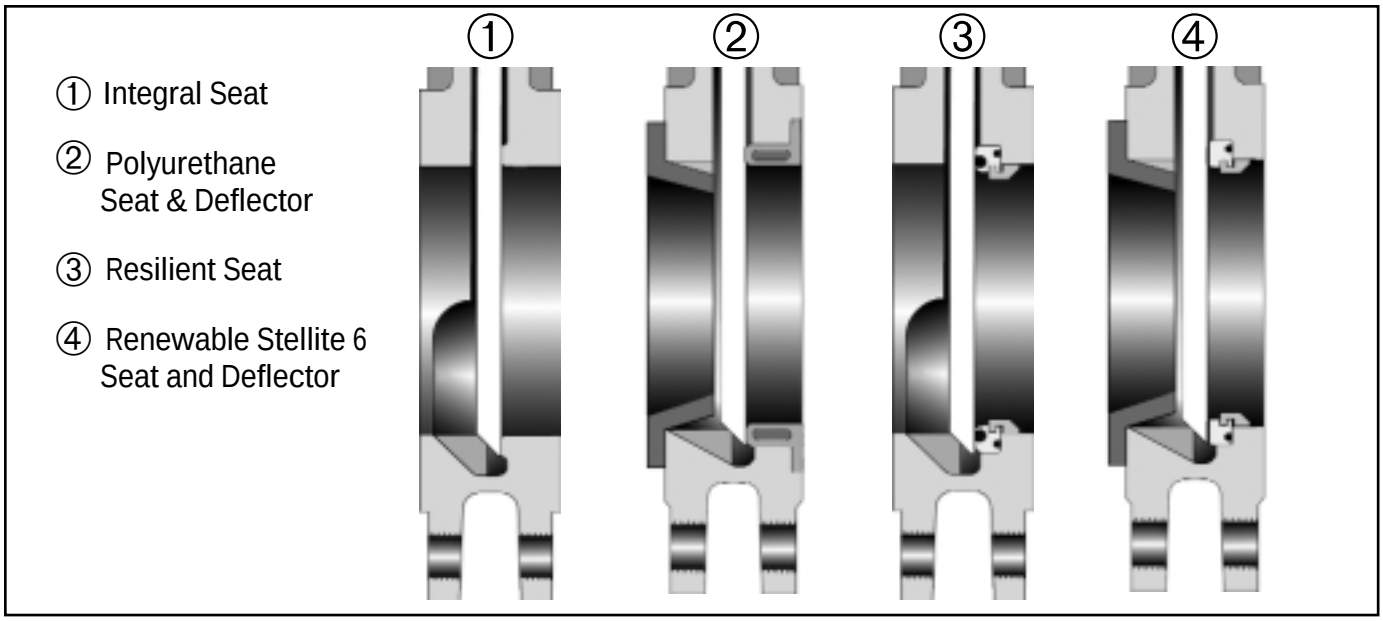


Figure 5.1C *Alternative seat designs. Types 1 is an integral seat. Types 2, 3 & 4 are renewable seats.*

5.1.1 Principal of Operation for Bonnetless Knife Gate Valves

The wafer and flanged type body has an integral circular raised seating face the groove around the seat permits the knife to push particles aside and prevents clogging. The internal configuration of the body is designed to prevent collection of pulp fibers.

The valve can be equipped with renewable, resilient or hardfaced Stellite 6 seat. The renewable stainless steel ring has a specially shaped elastometer insert on the working face and a similar o-ring on the outside diameter of the seat ring, providing a bubble-tight shut-off from 1–150 psi when flow is in the main direction (*See Section VI, Fig. 6.2A & 6.2B)*. Tightness, however, in the opposite direction, is extremely limited and only applies to very low pressures.

The knife (02) and stem (06) connection is held in place by hex. head bolts (09) allowing the stem to be detached without having to remove the knife gate. A large gap between the knife and stem head prevents possible knife gate offset.

Handwheel torque or actuator force provides positive seat-knife closure. During closure, the stem (06) slides down pushing the knife (02) into contact with the two bottom lugs (18) then transfers a vertical closing force to a lateral force. The valve packing chamber-packing (11) is offset (larger gap seat side) this creates a slight lateral force from the opposite side packing as the packing flange (07) is being torqued down. The combination of line pressure and bottom lugs lateral forces, positively seats the knife gate.

> **NOTE:** If more torque is applied on the seat side gland bolts (09) it will cause the knife gate to be pushed away from the seat, that may result in seat leakage.

V TYPES OF ALL STAINLESS STEEL KNIFE GATE VALVES

5.2 BOLTED BONNET KNIFE GATE VALVES

PARTS DESCRIPTION

01	Body	08	Gland bushing	14	Gasket	20	Tie rod (post)
02	Bonnet	09	Packing flange	15	Handwhee	21	Tie rod bolt & nut
03	Seat ring	10	Body-bonnet bolt	16	Handwheel nut	22	Gland stud & nut
04	Knife	11	Hex. nut	17	Handwheel thrust spacer	23	Bottom lugs
05	Seat O-ring	12	Packing	18	Adapter flange	24	Seat retainer clamp
06	Stem	13	Cam follower	19	Handwheel key		
07	Stem nut						

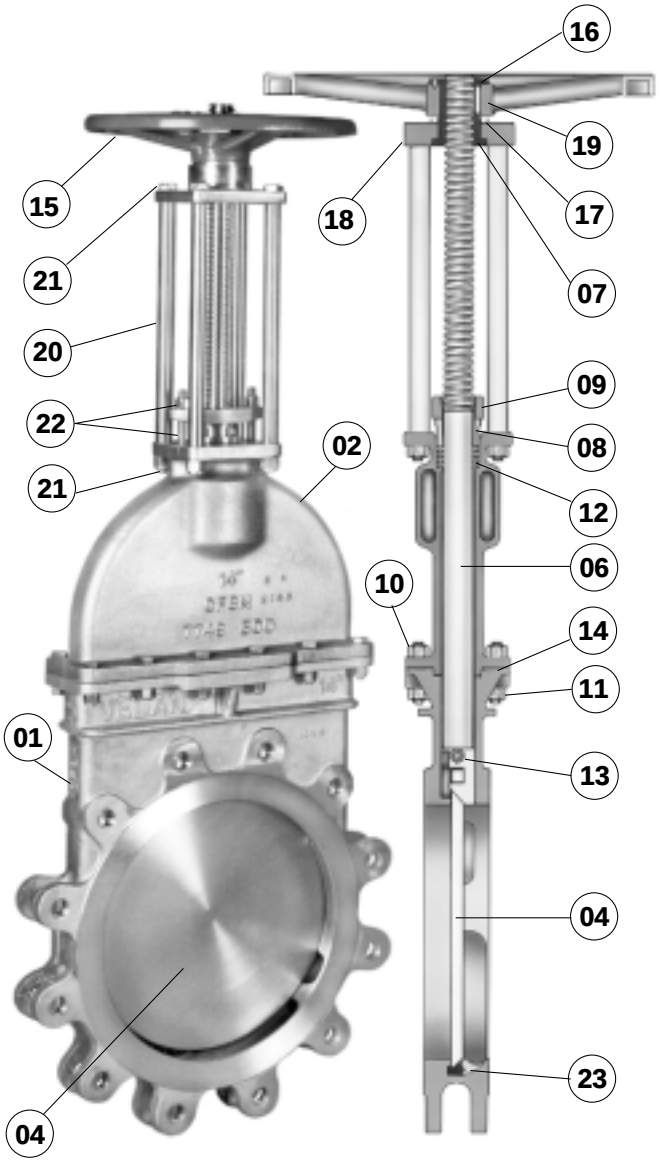
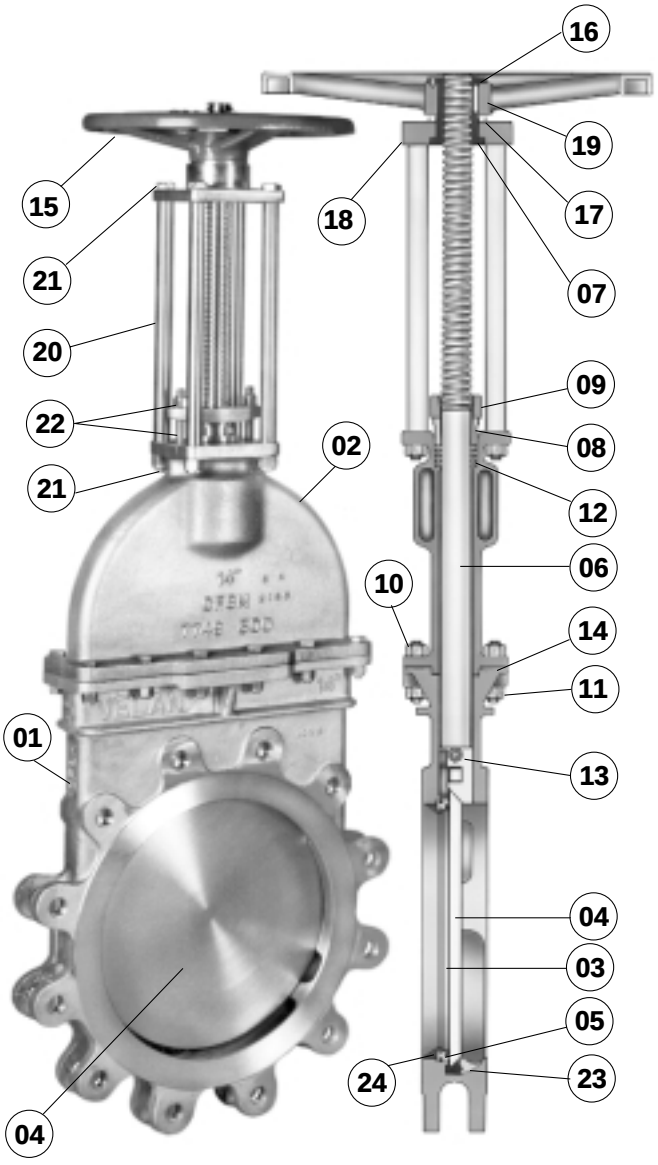


Figure 5.2A *Full port, metal seat 4-24" (100-600 mm)*



NOTE: Integral metal seats also available

Figure 5.2B *Full port, resilient seat 4-24" (100-600 mm)*

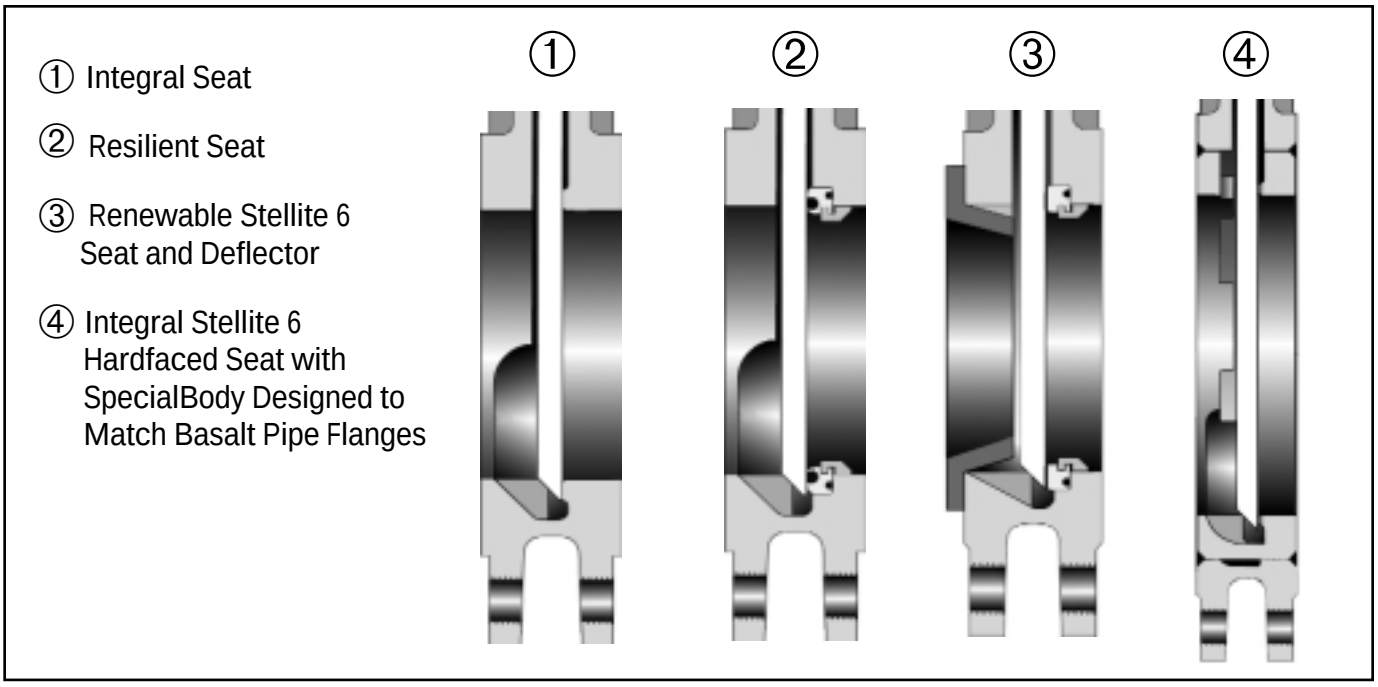


Figure 5.2C *Alternative seat designs. Types 1 & 4 are integral seats. Types 2 & 3 are renewable seats.*

5.2.1 Principal of Operation for Bolted Bonnet Knife Gate Valve

The wafer-type valve body (01) has an integral circular seating face (03) and is bolted (10) to a bonnet (02). The body-bonnet joint gasket (14) is reinforced fiber or Teflon.

The internal configuration of the body is designed to prevent collection of pulp fibers. The flow of pulp entering the body is directed into the wide passages (01), then into the bonnet (02). A cavity at the top of the bonnet ensures good circulation of the pulp around the stem guide, preventing clogging and pulp accumulation.

The knife (04) and stem (06) connection is unique and the design is subject to patent protection. Unlike any other design, the stem head slides inside a circular cavity on the stem guides in the body and bonnet, and is connected to the knife blade by a taper slot. A cam follower sliding in a slot prevents the stem from rotating.

Handwheel torque or actuator force provides positive seat-knife closure. During closure, the stem (06) slides down pushing the knife (04) into contact with the two bottom lugs (23). The taper stem head then transfers a vertical closing force to a lateral force which positively seats the knife (04)

against the seat face (03). Stem force, and not line pressure alone, maintains seating contact in this unique design, ensuring tight seating in both directions (see alternative seat designs above). During the opening and closing cycle, the guides ensure proper alignment of the knife

In this design, sealing to the environment is due to a conventional packing chamber around the stem, and not to a large rectangular packing around the knife (which is difficult to seal). A gland bushing (08), loaded and held in place by a packing flange (09) compresses the narrow packing rings (12).

The Velan bonnetted knife gate valve provide extraordinary two-way tightness of the resilient seat and packing chamber, without leakage or contamination of the environment.

5.2.1.1 Beveled Stem-knife Connection

When the valve is closed, the knife makes contact with the two lugs at the bottom of the body and the taper stem head at the top converts the vertical closing force into lateral closing force which positively seats the knife against the seat. Sealing contact is maintained by stem force and not by line pressure.

5.2.1.2 Bolted Bonnet Knife Gate Options

The bolted bonnet knife valve can come with any of these options: Double packing, Lantern ring live-loading and leak-off. Stem protectors are available upon request.

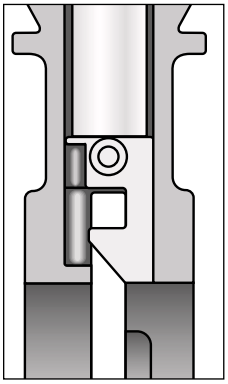


Figure 5.2.D
Beveled stem-knife connection.

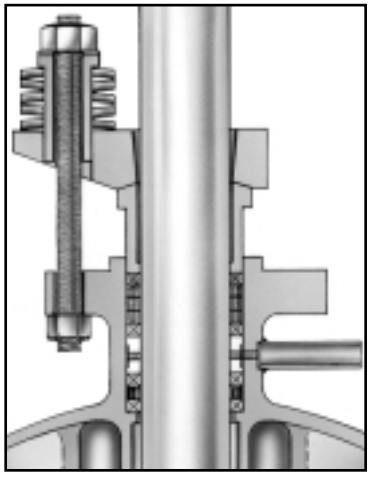


Figure 5.2.E
Double packing, Lantern ring live-loading and leak-off.

6.1 PACKING

6.1.1 Number of Packing Rings Required
(see Fig. 6.1A and 6.1B)

All Velan standard bonnetless knife gate valves require four rectangular type packing rings made of PTFE-impregnated synthetic yarn. The packing rings can be butted ends or scarf cut as shown in *Fig. 6.1A*.

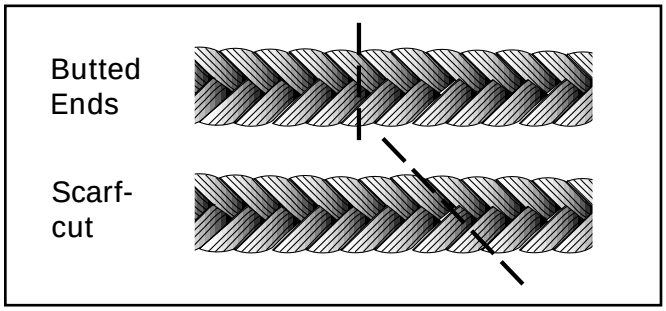


Figure 6.1A *Types of packing rings*

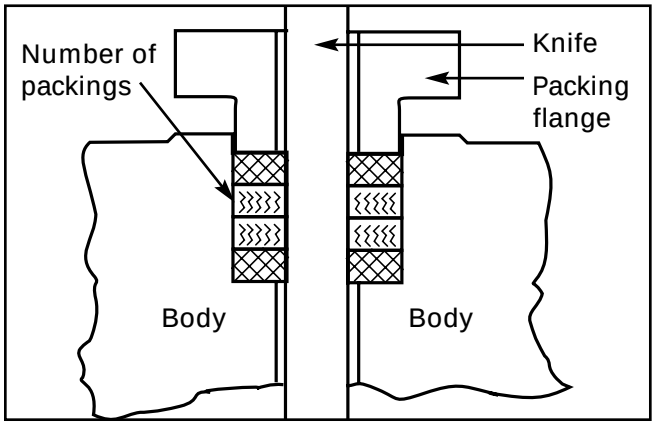


Figure 6.1B *Rectangular type packing rings, PTFE-impregnated synthetic yarn*

6.1.2 In-line Packing Ring Replacement (Partial Disassembly Required)

Follow warning instructions in *Section III* before replacing packing rings on-line.

1. Close the valve fully, but do not over tighten. Remove the four yoke to body bolts.
2. Turn the handwheel clockwise. This will cause the yoke to rise and disengage from the valve stem. Lift the yoke away from the valve stem and secure.
3. Remove the bolts connecting stem head and the knife gate and remove the stem.
4. Remove all packing flange bolts and lift out the packing flange.
5. Remove old packings using the flexible packing removal tools cork screw type. Screw into the packing rings and pull out of the packing chamber. Care must be taken not to scratch the walls of the packing chamber and the knife gate.
6. After the packings have been removed, inspect the packing chamber wall and knife gate surface for damage. Damages no greater than 0.020" (0.5 mm) can be repaired by machining or surface grinding and lapping, provided the packing chamber-knife gate minimum maximum tolerances are maintained *(see Fig. 6.1C and Table 6.1.4A).*

6.1.3 Repacking with New Packing Rings

1. Before placing new packings, check to ensure that the packing chamber offset seat side (downstream) is greater than the upstream side. This can be easily verified by pushing the knife gate downward to fully close and laterally pressing lightly against the seat. Next, measure the downstream and the upstream side gap for offset *(see Table 6.1.4A)*.

   NOTE: Min. offset of .005" (0.12 mm) is required to enable packing lateral force to seat the knife gate against the body seat.

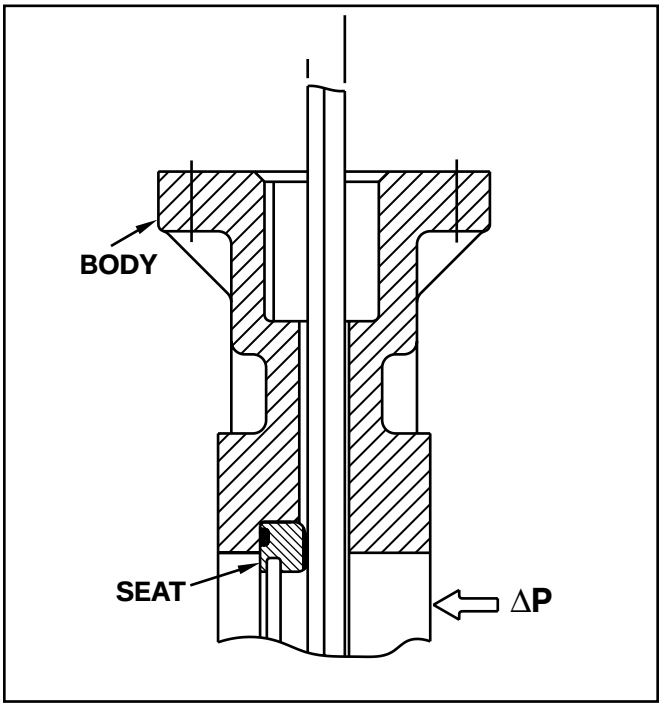


Figure 6.1C *Packing chamber detail*

2. Insert the first packing ring into the packing chamber*(Fig 6.1D)* push down as deep as possible with the packing flange, and by using a flat bar, push all the way down to the bottom of the packing chamber. Tap the packing with the flat bar and hammer at approx. a 45° angle starting from the upstream side (*Fig. 6.1E)*. This will cause the packing ring to spread out and push the knife gate against the seat.

NOTE: The first packing ring butt end or scarf cut should be on the downstream side and the following packing rings should be staggered approximately 120° degrees apart.

3. Follow Step 2 above for the second, third and fourth packing ring.
4. Position the packing flange, ensure there is a sufficient gap between the knife gate and packing flange. Lubricate the packing flange bolts and bolt nut flats.
5. Torque in sequence starting from the upstream bolt and in increments of 20% of the final torque *(see Packing Torque Table 2.6A)*. Ensure that the bolt torque on the downstream is not greater than the upstream. This may cause the knife gate to be pushed away from the seat.
6. Cycle the valve for approximately the length of the packing chamber. first open then close and retorque in sequence to the final bolt torque. Do this for approximately 3-4 times. This will cause the packing to fully consolidate (no more loss of torque).

Table 6.1.4A *Minimum-maximum offset table*

VALVE SIZE in mm	OFFSET min.	OFFSET max.	KNIFE STD. THICKNESS
2	0.010	0.020	0.350
50	0.25	0.51	8.9
3	0.010	0.020	0.350
80	0.25	0.51	8.9
4	0.010	0.020	0.350
100	0.25	0.51	8.9
6	0.010	0.020	0.350
150	0.25	0.51	8.9
8	0.010	0.020	0.475
200	0.25	0.51	12.06
10	0.010	0.020	0.475
250	0.25	0.51	12.06
12	0.010	0.020	0.600
300	0.25	0.51	15.24
14	0.020	0.030	0.600
350	0.51	0.76	15.24
16	0.020	0.030	0.688
400	0.51	0.76	17.48
18	0.020	0.030	0.828
450	0.51	0.76	21.03
20	0.030	0.040	0.938
500	0.76	1.02	23.82
24	0.040	0.050	0.938
600	1.02	1.27	23.82
30	0.050	0.060	1.188
750	1.27	1.52	30.16
36	0.050	0.060	1.250
900	1.27	1.52	31.75

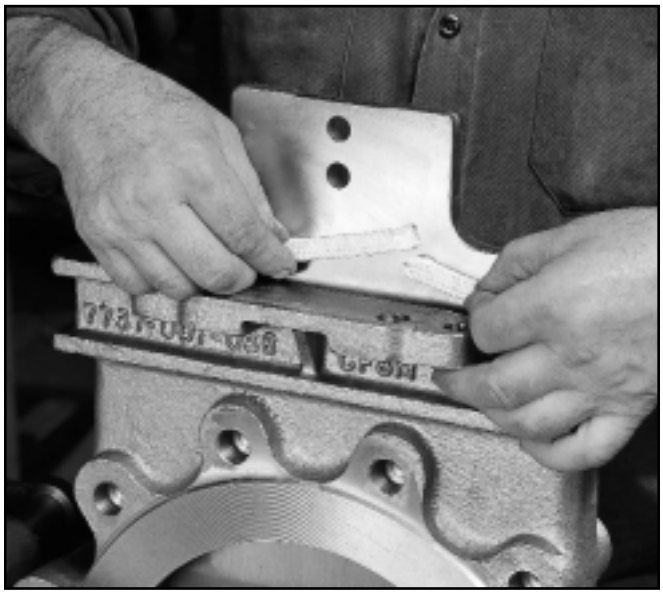


Figure 6.1D *Packing installation*

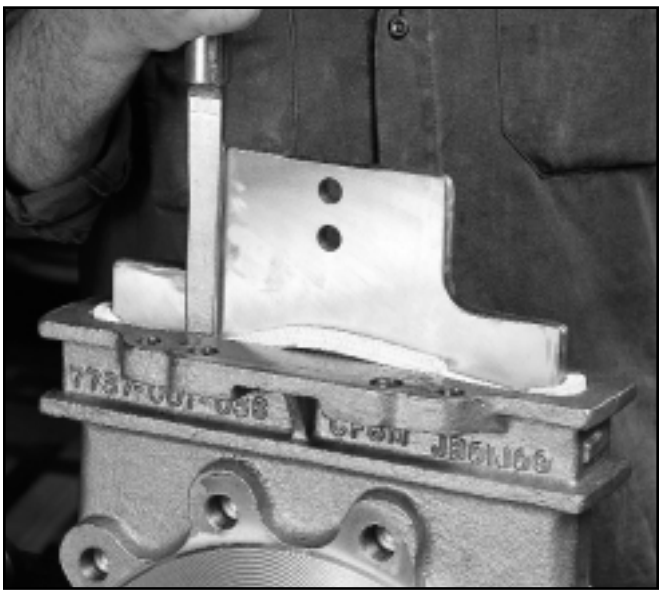


Figure 6.1E *Spreading out of packing*

6.1.4 Minimum–Maximum Offsets

6.1.4.1 Formula for Calculating Minimum Knife Thickness

$$t = d\sqrt{\frac{.3\,P}{S}}$$

T = plate thickness (in)
d = seat bore (in)
P = nominal pressure (150 psi)
S = allowable stress
(SS 316 – 18,000 psi)

Source: ASME, *Section VIII*, Div. 1, UG-34

6.2 TOTAL DISASSEMBLY

Follow warning instructions in *Section III* before any on-line disassembly work is started.

6.2.1 Valve with Integral Hardfaced or Metal Seat *(see Fig. 5.1A and 5.1C)*

1. Remove the valve from pipe line and place match marks on parts as they are removed.
2. Remove the yoke-body hex. head bolts (09) and the packing flange bolts (09-10).
3. Turn the handwheel clockwise until disengaged from the valve stem (06). Lift and remove the entire yoke-handwheel assembly.
4. Remove the handwheel nut (16), handwheel (15), handwheel spacer (14) and the stem nut (08)

   NOTE: The stem nut must come out underneath the yoke. For valves 14" and up, grind off yoke bushing tack welds and unscrew counter clockwise the yoke bushing (13). Remove the stem nut (08) and bearings (12).

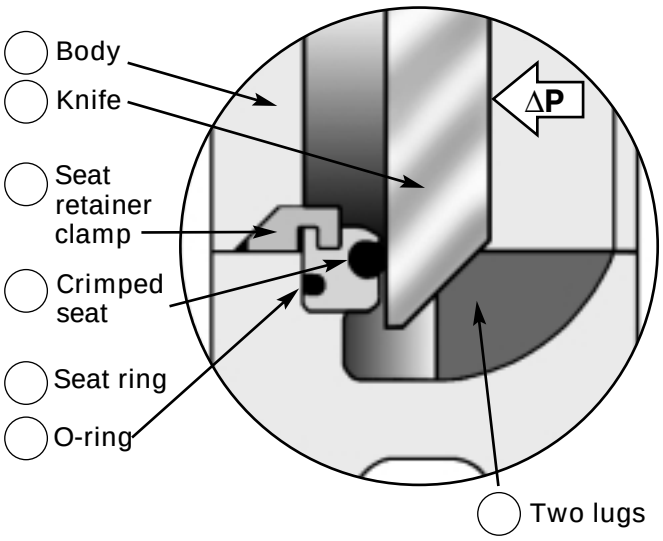


Figure 6.2A *Detail of seat area for disassembly*

5. Disconnect the stem (06) by removing bolts and nuts (09-10) from the stem knife gate connection.
6. Remove the packing flange (07) and packing (11).
7. Lift out of the body the knife gate (02) match mark and inspect the knife gate and body seat for damages.

   NOTE: If the valve is equipped with an electric motor or pneumatic actuator, remove the actuator first and follow steps as described above in *Section 6.2.1*

6.2.2 Valve with Renewable Resilient or Hardfaced Seat *(see Fig. 5.1B, 5.1C & 6.2A)*

After the valve has been disassembled as described in *Section 6.2.1* follow the steps below.

1. Grind off the tack weld of the seat retainer clamps (*Fig. 6.2A*).
2. Push the seat out of the body seat recess towards the center of the body and lift out through the stuffing box (*Fig. 6.2B*).
3. Prepare and clean the body seat recess for new seat replacement.

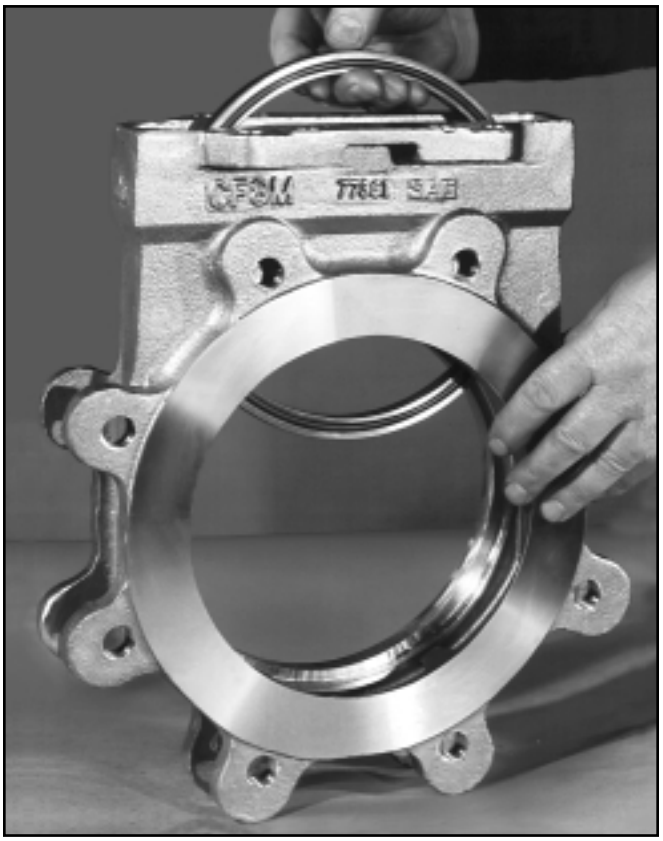


Figure 6.2B *Removal of renewable seats*

6.3 DETAILED MAINTENANCE

6.3.1 Packing leakage

If moisture or dripping occurs around the knife gate or the packing flange and chamber, the following should be investigated before removing the packings.

1. Check if the packing flange nuts are torqued down to the correct torque as shown in *Table 2.6A*. Retorque in sequence starting from the upstream packing bolt. Cycle the valve approximately the length of the packing chamber, first open then close and retorque. Do this until the packings are fully consolidated. If the leakage still persists, it must be assumed that the knife gate and or packing rings are damaged, in which case the valve must be disassembled and checked as described in *Section 6.2.1* Steps 1, 2, 3, 6 and 7.

6.3.2 Seat leakage (General)

1. An indication of a valve leak after the valve has been properly closed is pressure loss in the upstream pressure line side and or slow pressure build-up in the downstream line. In case of hot liquid, note whether the down-stream pipe remains hot beyond the usual length of time. This type of leak maybe the result of a distorted or damaged seat and or knife gate.

Leaks can also develop as a result of fiber build-up in the body cavity restricting full knife gate closure. In any case, the valve must be disassembled and inspected as described in *Section 6.2.1 and 6.2.2*, Steps 1, 2, 3, 6 and 7.

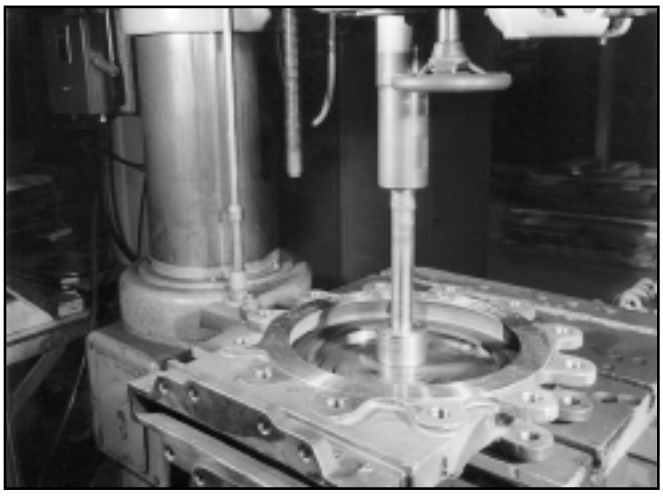


Figure 6.3A *Seat Lapping with a flat plate mounted on a drill press*

6.3.3 Seat repairs

1. Disassemble the valve as described in *Section 6.2.1, 6.2.2* and inspect the body seat and knife gate for scratches or damage.

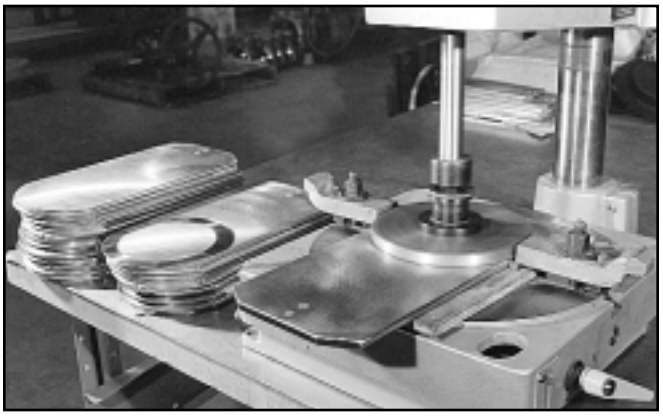


Figure 6.3B *Knife Gate Lapping with a flat plate mounted on a drill press*

2. If the seat face has minor damage such as scratches etc., it can sometimes be polished with a fine emery cloth with a perfectly flat plate.

3. For major seat damage, a flat plate, preferably cast iron, should be used with abrasive paper or lapping compound mounted on a drill press or lapping machine as shown in *Fig. 6.3A and 6.3B* . For best results, it is important to apply slight pressure and rotate in reciprocal movement. The lapping plate should be lifted frequently to prevent accumulation of particles in one area.

NOTE: The amount that can be removed by lapping should not exceed the minimum offset (*Fig. 6.1C and Table 6.1.4A*).

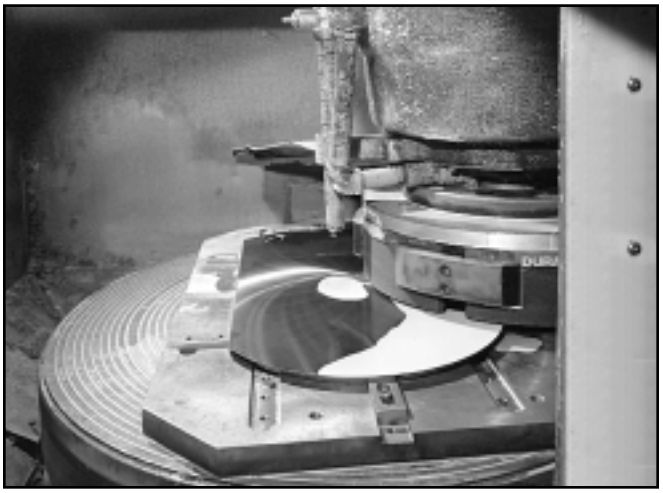


Figure 6.3C *Grinding of entire knife gate surface with horizontal surface grinder.*

6.3.4 Knife Gate Repairs

1. Inspect the knife gate for damage, scratches and flatness.

2. If knife gate flatness over seat area is not within 0.005" (0.12 mm) it will be difficult to obtain a bubble-tight shut-off at low pressure across the seat. If the knife gate is not flat, it should be reground *(refer to Fig. 6.3C)* or replaced.

3. If the knife gate is only scratched across the seating area, you can relap or polish using the same procedure as described in seat repairs.

NOTE: The maximum amount that can be removed by lapping is 0.005" (0.12 mm). If a greater amount must be removed, the entire knife gate surface must be ground as shown in *Fig. 6.3C.*, but should not exceed the min. offset required (see *Fig. 6.1C and Table 6.1.4A*).

6.3.5 Replacement Resilient or Hardfaced Seat

1. After the valve has been disassembled as described in *Section 6.2.1 and 6.2.2*, install the new seat through the top of the valve and into the seat recess. Be sure it is behind the lugs at the bottom before pushing the top into place *(See Fig. 6.2A and 6.2B)*.

2. Lower the knife gate into the valve, care must be taken while lowering to avoid damage to the resilient seat. Push down the knife gate and at the same time apply lateral force against the seat. Position the seat retainer clamps and tack weld.

NOTE: Temperature must be controlled during tack welding in order to prevent o-rings from being burned.

6.4 REASSEMBLY

6.4.1 General

1. The reassembly procedures are not as detailed as the disassembly procedures, since in most cases, the reverse procedure of the disassembly is required.

a) The most important fact to be considered is the cleanliness of all parts.

b) All threaded parts (cap screws, nuts, bolts) must be well re-lubricated. the stem and yoke nut threads should be clean of old grease before a new application of grease is applied to the threads. Refer to *Table 4.3A*, for Recommended Lubrication.

2. Seat and knife repair procedures must be completed as described in *Section 6.3.3*, Seat Repairs and *Section 6.6.4*, Knife Repairs.

3. All repacking must be completed as described in the repacking section.

4. After the valve has been reassembled, cycle opened and closed, check if alignment of knife to seat and knife to packing flange is good so that it does not cause scratching on knife. If it does, you have an alignment problem or the stem to the knife bolting is over torqued. You must check the clearance between knife and packing flange, and knife and stem head. There must be sufficient clearance to allow the knife to move freely and this must be checked when the valve is in the closed position and in the open position.

5. Pressure test valve to check for packing leakage and seat leakage. In most cases, packing will require re-tightening after valve has been cycled under pressure.

VII INFORMATION PERTINENT TO BOLTED BONNET KNIFE GATE VALVES

7.1 PACKING

7.1.1 Number of Packing Rings Required
(Fig. 7.1A and 7.1B)

All Velan bolted bonnet knife gate valves require four standard type packing rings made of PTFE impregnated synthetic yarn (*See Fig. 5.2A*). The packing rings split ends at 45° degree angle and staggered as shown in *Fig. 7.1A and Fig. 7.1B.*

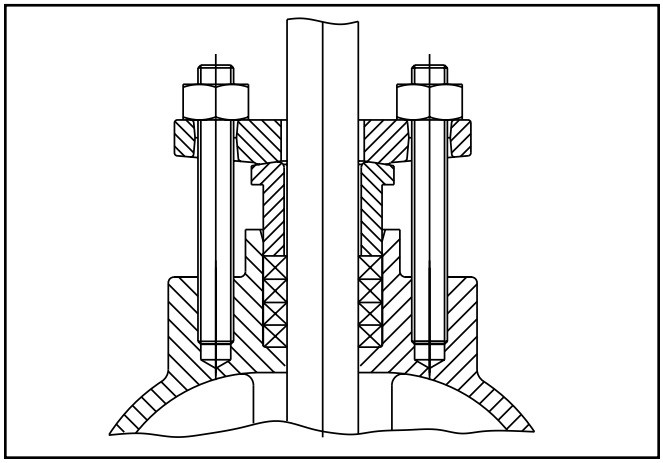


Figure 7.1A *Packing rings stagger*

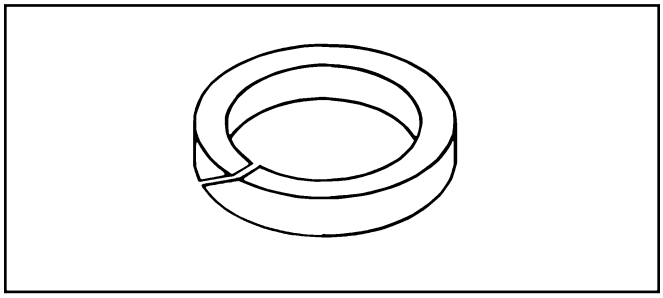


Figure 7.1B *Braided packing ring 45° degree split end*

7.1.2 In-line Packing Ring Replacement

Follow warning instructions in *Section III* before replacing packing rings on-line.

1. The valve should be partially open. Remove packing flange nuts and lift packing flange and gland bushing as high as possible and secure.

2. Using a flexible cork screw type packing puller *(see Fig. 7.1C),* pull out and remove all packing rings individually. During this operation care must be taken not to damage the stem or packing chamber wall.

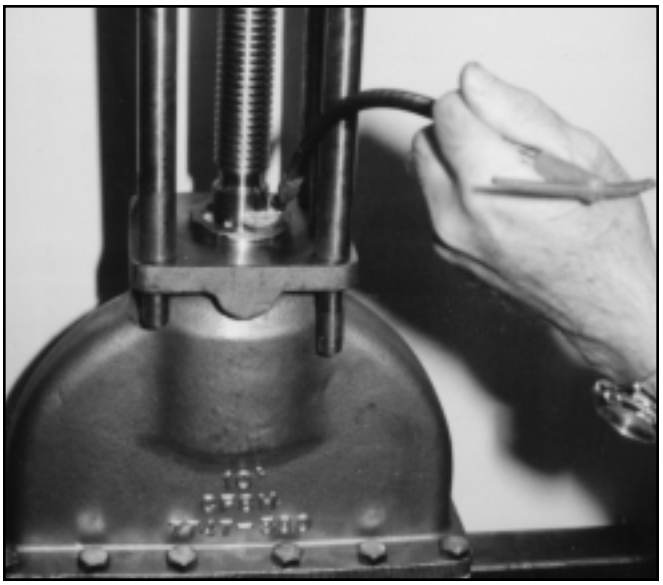


Figure 7.1C *Flexible cork screw packing puller*

3. After the packings have been removed, inspect the stem and packing chamber wall for damage. Damages no greater than 0.020" (0.5 mm) can be repaired by machining. Remove by machining the whole length of the stem smooth portion. Machine or buff the whole length of the packing chamber.

7.1.3 Partial Disassembly

1. To facilitate packing removal and removal/replacement of stem nut, packing flange, gland bushing and adaptor flange. Follow warning instructions in *Section III* and refer to *Fig. 7.1D*.

2. The valve should be in a partially open position. Remove the tie-rod nut (21).

3. To disengage the stem nut (07) from stem threads, turn the handwheel clockwise until disengaged. Lift and remove the entire upper works.

4. Remove the packing flange stud/nut (22), packing flange (09) and gland bushing (08).

5. Remove the packing rings as described in *Section 7.1.2* Step 2.

6. Thoroughly clean and inspect the stem, packing chamber and upper works and prepare valve for repacking and reassembly.

7.1.4 Repacking with new Packing Rings

1. With the valve partially open, insert the first

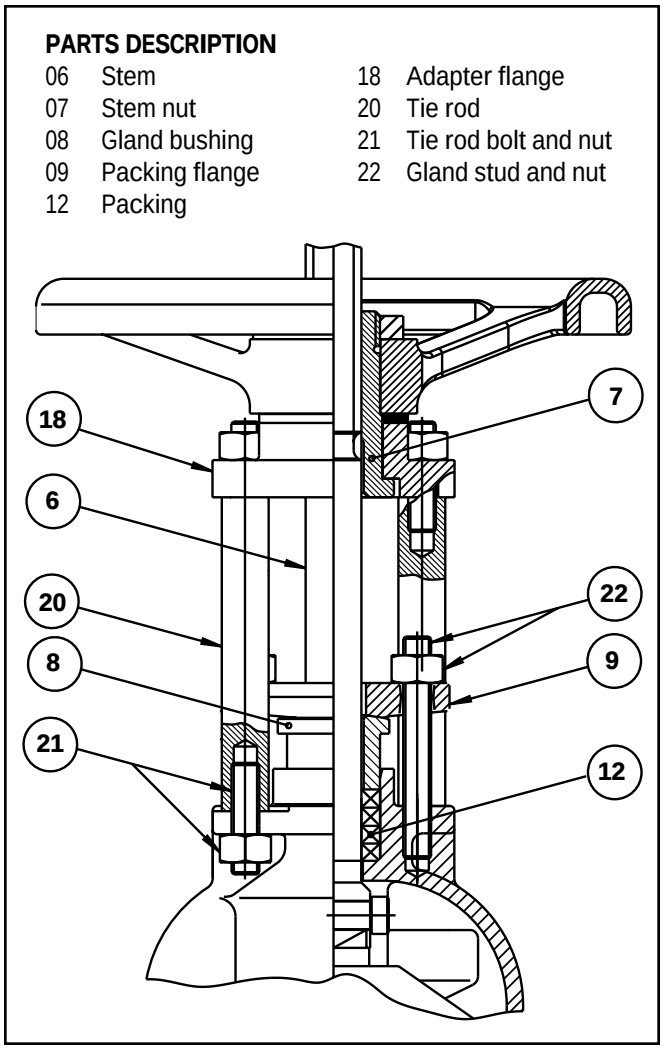


Figure 7.1D *BB knife gate mid section & upper works*

packing ring into the packing chamber push down as deep as possible using the gland bushing.

2. Follow Step 1 above for the second, third and fourth packing ring.

NOTE: Ensure the packing rings are staggered approximately 120° degrees apart and the gland bushing engagement is min. 1/8" to 1/4" in the packing chamber (see *Fig. 7.1A*).

3. Position the packing flange and lubricate with an anti-seize compound the gland bolts and nut flats.

4. Torque in sequence and increments of 20% of final torque *(see Packing Torque Table 2.6B)*.

5. Using the consolidation method, cycle for approximately the length of the packing chamber. First open then close and retorque in sequence until the final gland bolt torque. Do this until the packings are fully consolidated (no more torque loss) for approximately 3-4 times.

7.2 TOTAL DISASSEMBLY

(See Fig. 5.2A and 5.2B)

Follow warning instructions in *Section III* before any on-line disassembly work is started.

7.2.1 Valve with Integral Hardfaced or Metal Seat

(See Fig. 5.2A and 5.2C)

1. The valve should be in a partially open position.

2. If possible remove the valve from pipe line and place match marks on parts as they are removed.

3. Remove body-bonnet bolts/nuts (10), (11).

4. Place a nylon sling in between the tie Rods and stem and lift the entire bonnet (02) of the body using a hoist, care must be taken when lifting the bonnet assembly that the knife gate does not slip off the stem head.

NOTE: If only gasket and or revewable resilient or hard faced seat must be replaced, no further disassembly is required.

5. Remove the glanstud / nuts (22), turn the handwheel clockwise until disengaged from the valve stem.

6. Pull out the stem (push out) through the bottom of the packing chamber and remove the packing flange (09), the gland bushing (08) and the packing rings (12).

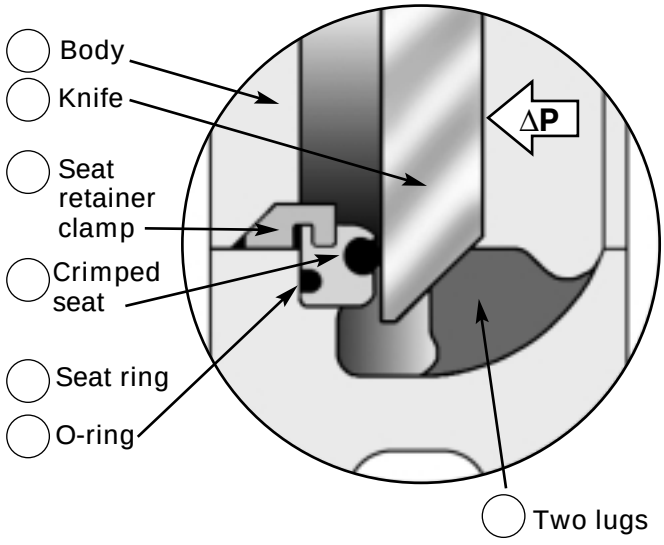


Figure 7.2A *Detail of seat area for disassembly*

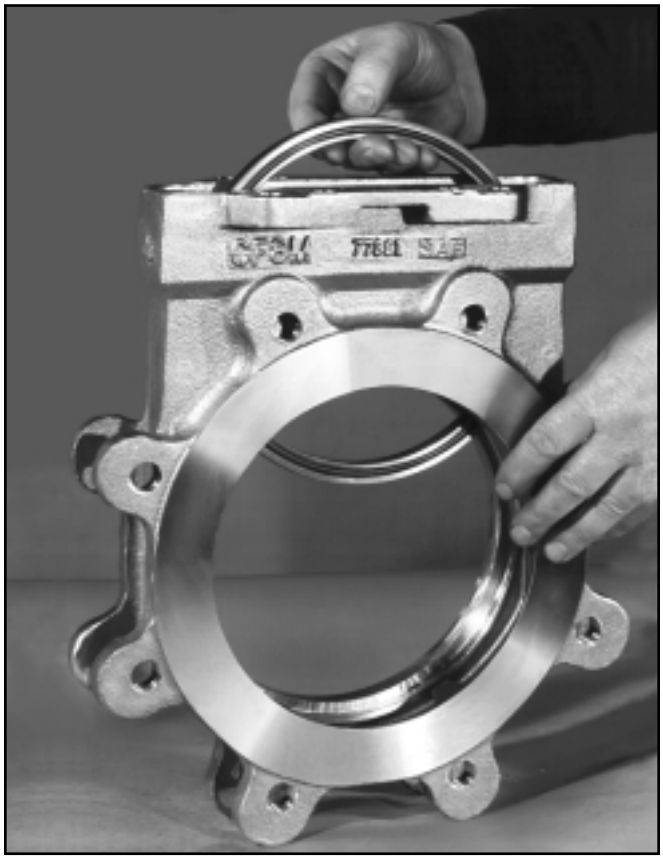


Figure 7.2B *Removal of renewable seats*

7. Remove the handwheel nut (16), the handwheel (15), key (19), thrust spacer (17).

8. Remove the stem nut (07) through bottom of adopter flange.

NOTE: If it becomes necessary to remove the adopter flange (18) and tie rods (20) remove top and bottom tie rod bolt nuts (21).

9. The valve is now ready for inspection, repair and parts replacement.

NOTE: If the valve is equipped with an electric motor or pneumatic actuator it may be necessary to remove the actuator first and follow Steps as described in *Section 7.2.1.*

7.2.2 Valves with Renewable Resilient or Hardfaced Seat *(see Fig. 5.2B and 5.2C)*

1. Grind off the tackwelds of the seat retainer clamp *(Fig. 7.2A)*, (3 clamps per valve)

2. Push out the seat towards the center of the valve body and remove (see *Fig. 7.2B)*.

3. Prepare and clean the body seat recess for new seat replacement.

7.3 DETAILED MAINTENANCE

7.3.1 Packing Leakage

If moisture or dripping occurs around stem, gland bushing and packing chamber. The following should be investigated before replacing the packings.

1. Check if the packing flange nuts are torqued down to the correct torque value as shown in *Table 2.6B*. If necessary retorque the packing bolts, cycle the valve approximately the length of the packing chamber, first open then close and retorque. Do this until the packings are fully consolidated. If the leakage still persist, it must be assumed that the packing rings and or stem might be damaged, in which case the valve should be disassembled and inspected as described in *Section 7.2.1*, Steps 1, 3 ,4, 5 and 6.

7.3.2 Seat Leakage (General)

An indication of a valve leak after the valve has been properly closed is a pressure loss in the upstream pressure line side and or slow pressure build-up in the downstream line. In case of hot liquid, note whether the downstream pipe remains hot beyond the usual length of time. This type of leak may be the result of a distorted or damaged seat and or knife gate.

Leaks can also develop as a result of fiber build-up in the body cavity restricting full knife gate closure. In any case, the valve must be disassembled and inspected as described in *Section 7.2.1, and 7.2.2* Steps 1, 2, 3 & 4.

7.3.3 Seat Repairs (valve with integral seat)

1. Disassemble the valve as described in *Section 7.2.1* and inspect the body seat and knife gate for scratches or damage.

2. If the seat face has minor damage, scratches etc., it can sometimes be polished with fine emery cloth with a perfectly flat plate.

3. For major seat damage, a flat plate, preferably cast iron, should be used with abrasive paper or lapping compound mounted on a drill press or lapping machine as shown in *Fig. 7.3A and 7.3B*. For best results, it is important to apply

Figure 7.3A *Seat Lapping with a flat plate mounted on a drill press*

slight pressure and rotate in reciprocal movement. The lapping plate should be lifted frequently to prevent accumulation of particles in one area.

NOTE: Seat refinishing removal allowance max. 0.025" (0.63 mm) for amounts exceeding 0.025" (0.63 mm) check with Velan service department.

7.3.4 Knife Gate Repairs

1. Inspect the knife gate for damage, scratches and flatness.
2. If knife gate flatness over seat area is not within 0.005" (0.12 mm) it will be difficult to obtain a bubble-tight shut-off at low pressure across the seat. If the knife gate is not flat, it should be reground or replaced. *Refer to Fig. 7.3C*.
3. If the knife gate is only scratched across the seating area, you can relap or polish using the same procedure as described in seat repairs.

   NOTE: Max amount that can be removed by lapping or grinding is 0.030" (0.76 mm) amounts greater than 0.030" (0.76 mm) check with *Velan Service Department*.

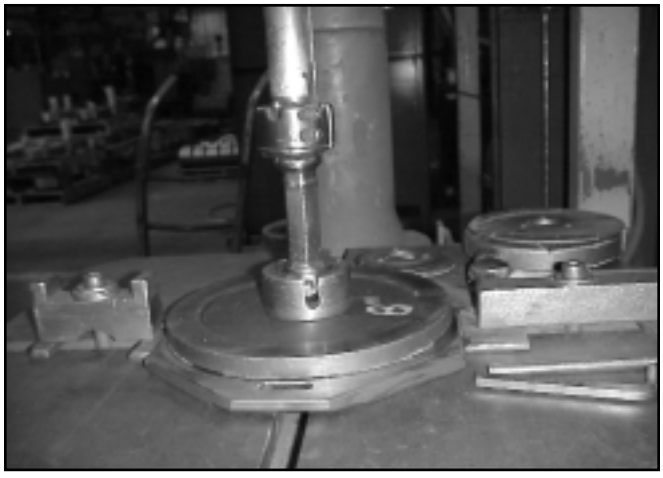


Figure 7.3B *Knife gate lapping wiht a flat plate mounted on a drill press*

Figure 7.3C *Grinding of entire knife gate surface with horizontal surface grinder*

7.3.5 Stem Repairs

Stem damage can sometimes occur when hardened matter particles fall in between the packing flange and the stem and during a close cycle can be drawn-in causing stem scratch and galling. Scratches no deeper than 0.020" (0.5 mm) can be repaired by machining. The stem should be checked and centered in a lathe machine and repaired. Do not remove more than 0.020" (0.5 mm) per side. If the damage is greater, Velan recommends replacing with a new stem.

NOTE: The whole stem surface smooth portion, starting from stem head up to the threads must be machined. The stem finish should be 16 rms or better.

When stem damage occurs, in most cases the associated parts (e.g. gland bushing, bonnet stem bore) will become damaged as well. It is important to repair the damage, by buffing/grinding off all high spots.

7.3.6 Gasket Leakage / Gasket Replacement

1. If retorquing in accordance with gasket bolt torque procedure in *Table 2.6C* does not stop the leakage, disassemble as per *Section 7.2,* Step 1, 3 and 4.
2. Remove the old gasket, clean thoroughly the body-bonnet gasket surface and replace with new gasket.
3. Follow gasket bolt torque procedure in *Section 2.6 Table 2.6C.*

7.3.7 Renewable Resilient or Hard Faced Seat Replacement

1. After the valve has been disassembled as described in *Section 7.2.1 & 7.2.2* install the new seat through the top of the valve bvody and into the seat recess. Ensure it is behind the lugs at the bottom before pushing the top in to place see *Fig. 7.2A & 7.2B*.
2. Lower the entire bonnet assembly, complete with the knife gate, care must be taken while lowering to avoid damage to the resilient seat.
3. Place and tighten in sequence four body to bonnet bolts. Close the valve firmly.
4. Position the seat retainer clamps (3 per valve) and tack weld see *Fig. 7.2A*.

   NOTE: Temperature must be controlled during tack welding in order to prevent o-rings from being burned.
5. Remove the four body-bonnet bolts. Lift the entire bonnet assembly out of the valve body. Inspect the resilient seat to ensure it has not been affected during the tack welding process.
6. Thoroughly clean the valve body and the knife gate of all foreign matter such as weld spatters etc. and continue with Ressembly.

7.4 REASSEMBLY

7.4.1 General

The reassembly procedures are not as detailed as the disassembly procedures, since in most cases, the reverse procedure of the disassembly is required.

1. The most important fact to be considered is the cleanliness of all parts.
2. All threaded parts (caps screws, nuts, bolts) must be well re-lubricated. The and yoke nut threads should be clean of old grease before a new application of grease is applied to the threads. *Refer to Table 4.3* .
3. Seat and knife repair procedures must be completed as described in Seat Repairs and Knife Repairs. *Section 7.3.3 & 7.3.4* .

   All repacking must be completed as described in the Repacking *Section. 7.1.4.*
4. After the valve has been reassembled, cycle once, open and close and check to ensure there is no misalignment, e.g. stem packing flange, stem upper works.
5. In case of electric motor actuator, ensure that it is properly mounted and the close and open limit switches are properly adjusted.
6. In case of air actuated, ensure that stroke adjustment has been correctly set.
7. Pressure test valve to check for packing leakage and seat leakage. In most cases, packing will require re-tightening after valve has been cycled under pressure.