VKP

PILOT OPERATED PRESSURE REDUCING VALVE

TABLE OF CONTENTS

Warning: Injury or death can occur due to failure to completely isolate valve from all sources of pressure before beginning disassembly. Do not proceed until valve has been completely isolated from process stream and vented to atmosphere.

1. INTRODUCTION

The Class VKP pilot-controlled steam pressure reducing valve (figure 1) is a highly versatile valve for steam and other compressed fluid regulation.

The VKP is available in 112" to 4" configurations, with spring ranges from 3-20 psig to 20-150 psig. Class VKP regulation accuracy is 90 percent for pressure ranges above 20 psig, Inlet pressures range from 20 to 250 psig, with outlet pressures from 5 to 140 psi to provide a saturated steam flow of 90 to 49,165 pph.

The equipment's integral pilot controller is mounted on top of the unit and permits rapid reconfiguration of the VKP's performance specifications.

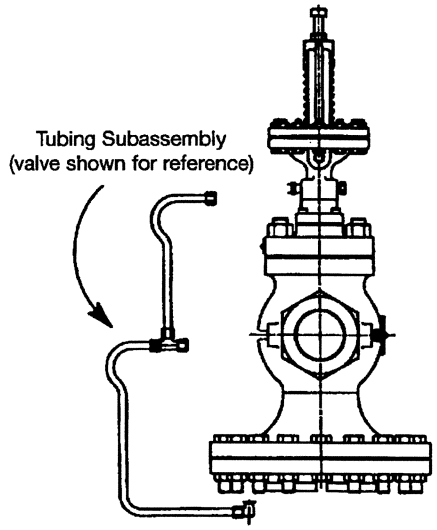


Figure 1 - Tubing Subassembly

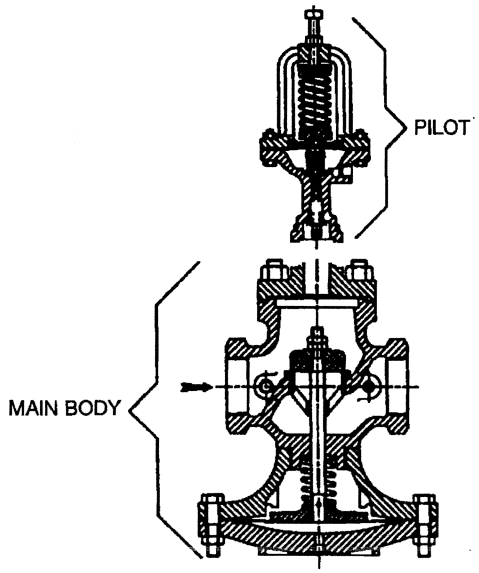


Figure 2 - Major Subassembly

CAUTION!

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

2. DESCRIPTION

The Class VKP is a low maintenance, economical regulator/reducing valve consisting of three major subassemblies (figure 2): pilot, main valve, and tube set.

Packing is eliminated in the VKP and all springs are protected from the flow path. Moving parts are reduced to a minimum.

Economies are realized through easy and quick exchange of the range spring in the integral pilot. Changing the configuration from a 3-20 psig range to 20-150 range is accomplished by changing the range spring.

3. SPECIFICATIONS

Material

Body .....cast iron

Seat .....hardened stainless steel

Diaphragm .....stainless steel

End connections

1/2" to 2" .....threaded

1" to 4" .....125# ANSI flanged

1" to 4" .....250# ANSI flanged

Spring range

psig/color .....3~20/silver, 5~50/orange,10~100/green, 50~150/black

Pressure drop .....10 psi minimum

Temperature .....to 250°F

Regulation accuracy .....>20 psig=90%, ≤20 psig=±2 psig

Capacity .....See Leslie Controls publication 30/8.1.1

4. INSTALLATION PREPARATION

The equipment is divided into three major subassemblies: main valve body, pilot, and tubing. Installation site procedures are limited to:

a. preparing supply (inlet) and distribution (outlet) piping

b. connecting VKP major subassemblies

c. connecting 1/4" tubing between the outlet pressure gauge and the VKP pilot.

The VKP is installed in a straight run of horizontal piping (figure 4). The installation site must provide sufficient space for the equipment and top, bottom, and side clearance as shown in table 1 and illustrated in figure 3.

Non-supplied equipment required for installation of the VKP is listed in table 2.

VKP installation procedures are given in table 3 (basic installation) and table 4 (tubing connections). Refer to figure 4 (basic installation) and figure 5 (tubing connections).

CLASS VKP SIZE AND CLEARANCE REQUIREMENTS

Valve Size	Height (H)	Base Width (B)	Top (CT)	Additional Clearance Bottom (CB)	Tubing (T)
1/2"	19 5/8"	5 7/8"	3"	5 1/2"	3"
1/4"	19 7/8"	6 1/2"	3"	5 1/4"	3"
1"	21 1/8"	7"	3"	6 1/2"	3"
1 1/4"	21 3/8"	7 7/8"	3"	6 1/4"	4"
1 1/2"	22 3/8"	8 1/4"	3"	7 1/2"	4"
2"	23 1/2"	9 7/8"	3"	8"	4"
2 1/2"	24 5/8"	10 7/8"	3"	8 1/4"	5"
3"	26 3/8"	11 1/4"	3"	9 1/2"	5"
4"	30 1/8"	14 1/4"	3"	12 1/4"	6"

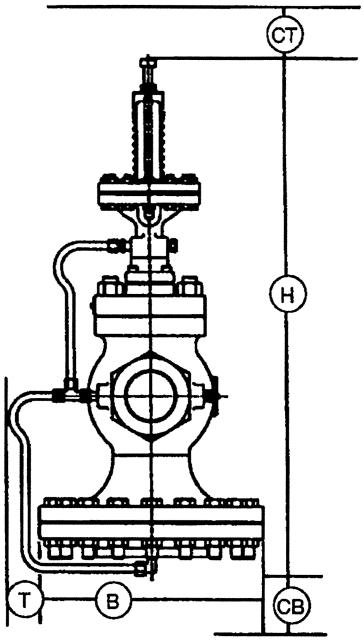


Figure 3 - Dimensions

ADDITIONAL EQUIPMENT REQUIREMENTS

Driptrap, 2
- upstream and downstream of pressure gauges

Pressure gauges, 2
- between supply (inlet) drip/trap and inlet stop valve
- between distribution (outlet) stop valve and outlet drip/trap (this gauge is installed on a control pipe)

Stop valves, 3
- between supply (inlet) drip/trap and VKP
- between VKP and distribution (outlet) drip/trap
- between distribution (outlet) pressure gauge and VKP

Strainer, 1
- between supply (inlet) stop valve and VKP

Tubing, copper, l/4", as necessary
- between VKP and distribution (outlet) pressure gauge

Bypass piping and globe valve
- option if bypass is installed

Unions, 2 (threaded end connector VKPs only)

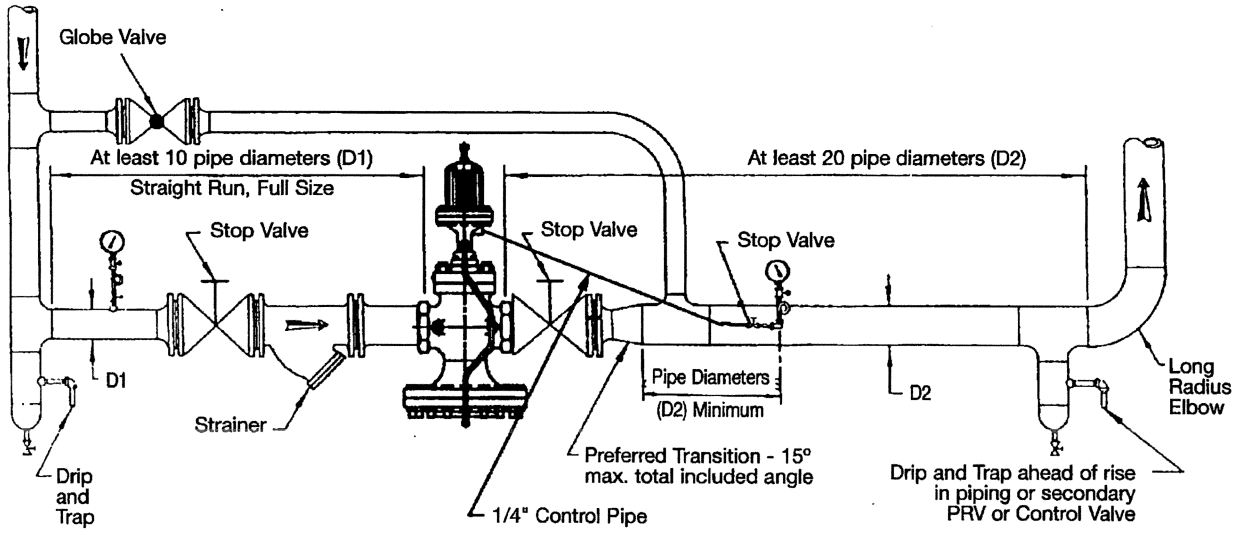


Figure 4 - VKP Installation

VKP INSTALLATION STEP BY STEP PROCEDURE

NOTES. Noise reduction is possible by avoiding (a) sharp pipe turns near the VKP, (b) avoiding bul~head connections to the low pressure main, and (c) installation of an expansion pipe between the VKP outlet and the distribution pipe.

General/Valve Body Installation

1. Install drip and trap at least 10 pipe diameters from the VKP inlet.
2. Install pressure gauge near inlet drip and trap.
3. Install stop valve downstream of inlet pressure gauge.
4. Install strainer downstream of inlet stop valve.
5. Flush piping system to clear pipe of welding beads, scale, sand, etc.

NOTE: Use unions to mount VKPs equipped with threaded end connections.

6. Install VKP. Note flow direction arrow. Assure that the arrow is pointing toward the distribution (outlet) pipe.
7. Install outlet stop valve at VKP outlet.

NOTE. The next step is recommended for noise reduction.

8. Install pipe expander at stop valve outlet.
9. Install bypass as shown in figure 4.
10. Install pressure gauge/control pipe downstream of bypass and at least 4 pipe diameters from the downstream side of the expansion pipe (if used) or VKP outlet (If expansion pipe is not used).
11. Install drip and trap at least 20 pipe diameters from the VKP outlet.

NOTE: Avoid bull-head connection to low pressure main to reduce noise level.

12. OPTIONAL. Insulation may be installed around the VKP from the bottom of the end connectors to the top of the unit. DO NOT INSTALL INSULATION BELOW THE BOTTOM OF THE END CONNECTORS.

Pilot Installation (figure 6)

13. Remove protective covering from base of pilot body (6) and top of valve top flange (34).
14. Place pilot assembly on top flange (34) and secure with cap screws (31).

Tubing Installation (figure 5)

15. Connect coupling 4B (42) to connector near bottom of cowl yoke (5).
16. Connect bleedport (48) to pipe plug (37) on valve body (18).
17. Connect elbow 8B (47) to bleedport (48).
18. Connect elbow 5B (49) at orifice at bottom of hood (22).
19. Connect restriction bend (46) to elbow 5B (49) as shown.
20. Connect free end of restriction bend (46) to elbow 8B (47).
21. Connect bleedport bend (45) to elbow 8B (47).
22. Connect free end of bleedport bend (45) to coupling 4B (42).

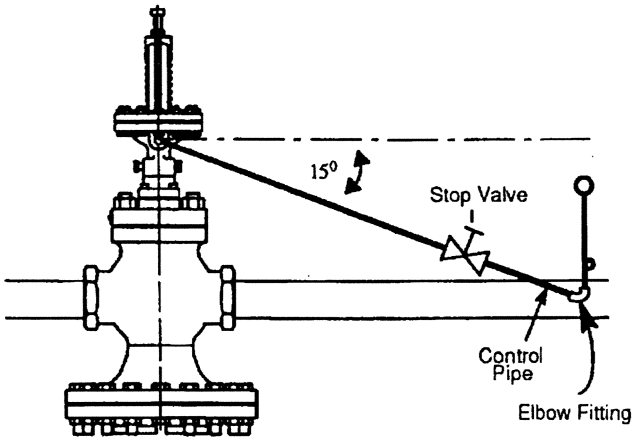


Figure 5 - Control Tubing Connections

CONTROL TUBING CONNECTIONS

1. Connect 1/2" tubing at outlet pressure gauge (figure 5).
2. Install stop valve in tubing line.
3. Run tubing at approximately 15 degree angle to port beneath pilot base. Connect tubing to VKP using (type connector/union)

5. START UP AND INITIAL ADJUSTMENT

Table 5 lists start up and initial adjustment procedures. All equipment parts (identified by numbers within parenthesis) are shown in figures 6 and 7.

1. Use bypass to fill the distribution system.
2. Raise pressure to slightly below normal requirement.
3. Turn pilot adjusting screw (1) counter-clockwise (ccw) to release pressure on the adjusting spring (25).
4. Open stop valve on l/4-inch control line (figure 5).
5. Crack VKP outlet stop valve (figure 5).

CAUTION: Confirm that there is a positive indication showing that the high side is clear of condensate before performing the next step.

6. Crack VKP inlet stop valve. Blow down strainer.
7. Crack VKP inlet stop valve. Blow down strainer.
8. Open VKP inlet stop valve.
9. Gradually compress adjusting spring (25) by turning the adjusting screw (1) clockwise (cw) until the VKP opens and the desired pressure registers on the outlet pressure gauge.
10. Alternately choke down on the bypass and open the outlet stop valve until the VKP is on line.

6. INSPECTION AND SCHEDULED MAINTENANCE

NOTE. Disassembling the valve is NOT required for inspection and scheduled maintenance procedures.

After the first few days of operation, and at least twice a year,

a. Inspect for dirt collected in the bleedport (item 48, figure 7) and restriction bend (item 46).
b. Inspect all joints for leakage. Tighten bolts as necessary.

7. TROUBLESHOOTING

Table 6 lists trouble symptoms and probable cause(s) of the symptoms. All referenced items are illustrated in figures 6 and 7.

Symptom	Probable Cause(s)	Suggested Remedy
Failure to open or delivery pressure sags	1. Adjusting spring (25) out of adjustment.	1. Adjust spring by turning adjusting screw (1).
	2. Inlet pressure reduced.	
	2a. Partially closed supply valve.	2a. Check; open if necessary.
	2b. Strainer clogged. Open and clean out strainer. Close strainer; open normal flow path.	2b. Use bypass to supply distribution system.
	3. Restriction bend (46) clogged.	3. Use bypass to supply distribution system. Disconnect and clear restriction bend. Connect restriction bend, open normal flow path.
	4. Open coupling substituted for bleedport (48) fitting	4. Use bypass to supply distribution system. Install fitting. Disconnect and clear restriction Connect restriction bend; open normal bend. flow path.
	5. Control path blocked.	5. Check for obstructions at stop valve and at entrance to delivery main.
	6. Main diaphragm (23) damaged.	6. Go to table 7.
Failure to close or over-riding delivery pressure.	1. Adjusting spring (25) out of adjustment.	1. Adjust spring by turning adjusting screw (1).
	2. Bleedport (48) is plugged. Connect tubing assembly.	2. Disconnect and clean out tubing assembly.
	3. Bypass valve leaking.	3. Check and repair using valve documentation.
	4. Go to table 8.	4. Foreign matter in pilot or main valve.

Main Diaphragm Test/Fail to Open

1. Reroute flow via bypass.
2. Disconnect tubing from elbow 8B (figure 7, Item 49).
3. Apply air or water pressure to valve at elbow 8B.
4. If main valve fails to open (indicated by increased downstream pressure), diaphragm may be damaged. Inspect and, if necessary replace, according to steps 1 through 16 of table 9.

Main Valve/Pilot Valve Test/Fail to Close

NOTE. Items 42 through 51 are found in figure 7.

1. Close inlet, outlet, and control stop valves.
2. Disconnect bleedport bend (45) from bleedport (48) so pilot exhausts to atmosphere.
3. Crack inlet stop valve. Steam escapes from pilot via bleedport bend (45).
4. Release compression on adjusting spring to determine if pilot closes tightly.
5. Open and close several times to wash seat.

NOTE: Steam blowing back from bleedport (48) indicates main valve disc is held open by foreign matter.

6. Reconnect bleedport bend (45) to bleedport (48).
7. Place equipment into operation.

NOTE: If steam blowback was observed in step 5, continue with step 8. If not, test is complete.

8. Slowly open and close outlet stop valve to clear obstruction. If the equipment fails to operate properly, disassemble equipment according to steps 1 through 3, inclusive, and steps 20 through 23, inclusive.

VKP DISASSEMBLY/ASSEMBLY

NOTES:

1. All item references are illustrated in figures 6 and 7.

2. Inspect each item as it is removed. Clean all serviceable items (paragraph 8J. Replace all damaged or worn items during reassembly.

3. Reassemble equipment in reverse order.

General

1. Reroute flow via bypass.
2. Close control stop valve.
3. Remove compression from pilot spring by
   a. loosening lock nut (2) and
   b. turning adjusting screw (1) counter-clockwise (ccw).

Tube Kit Disassembly

4. Remove coupling 4B (42) from bleedport bend (45).
5. Remove elbow 8B (47) from bleedport bend (45), restriction bend (47), and bleedport (48).
6. Remove elbow 5B (49) from restriction bend (46).

Pilot Disassembly/Top Section

7. Loosen and remove nuts (4). Remove cap screws (7).
8. Carefully lift off yoke cowl (5).
9. Remove, in order, lower spring button (3), adjusting spring (25), and uDDer spring button (3).

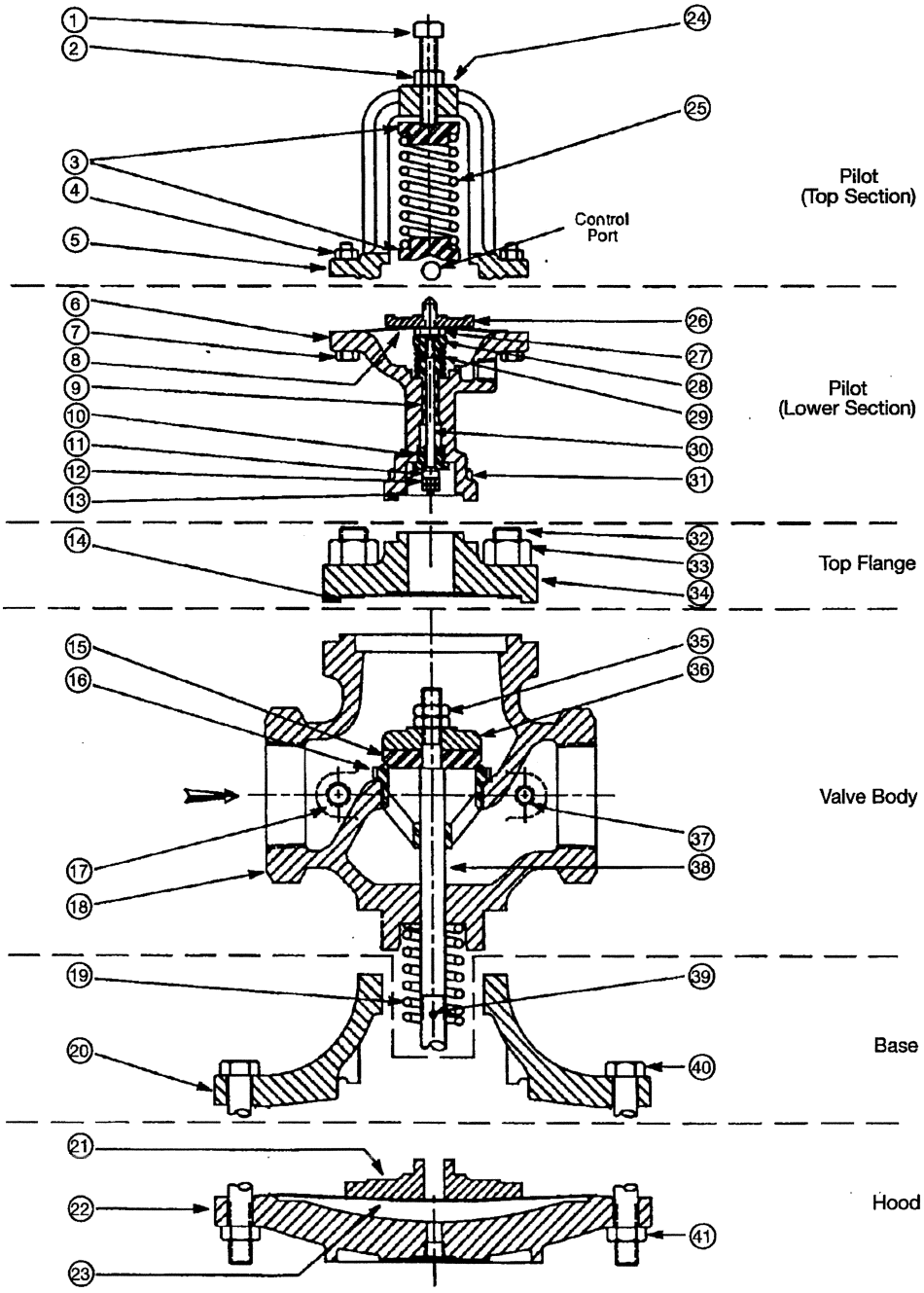


Figure 6 - VKP Parts Location

Pilot Disassembly/Lower Section

10. Unscrew adjusting screw (1). Remove lock nut (2).
11. Disconnect control tubing from pilot (CONTROL).
12. Loosen and remove coupling 4B (42).
13. Lift off pilot pressure plate (26) and pilot diaphragm (8).
14. Loosen and remove cap screws (31). Lift pilot body (6) from top flange (34).
15. Lift off pilot gasket (13) from top flange (34).
16. Place wrench on pusher plate (28). With a second wrench, loosen and remove diaphragm screw (27).
17. Lift off pusher plate (28), pilot spring (29), and pilot stem bushing (9).
18. Slide pilot stem (30) out bottom of pilot body (6).
19. Loosen and remove pilot stem nuts (12). Remove pilot disc (11) and pilot seat ring (10).

Top Flange Removal

20. Loosen hex nuts (33). Remove tap studs (32) and nuts.
21. Lift top flange (34) from valve body (18).
22. Lift off valve gasket (14) from valve body (18).

Hood Disassembly

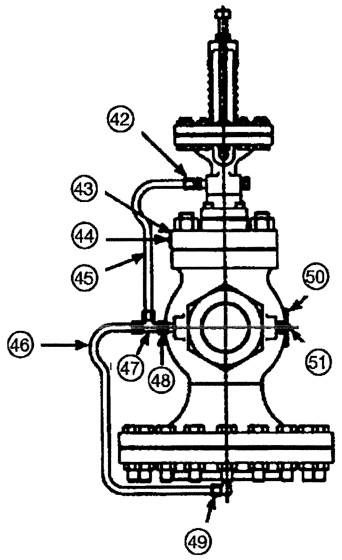
NOTE. Remove hood (22) before attempting to disassemble valve body (18).

23. Loosen and remove elbow 4B (49) from bottom of hood.
24. Loosen and remove hex nuts (41). Remove cap screws (40).
25. Lift base (21), complete with valve body (18) from hood (22).
26. Lift valve diaphragm (23) from hood (22).

Base Disassembly

NOTE. Disassemble base section before attempting to disassembly valve body (18).

27. Remove dowel pin (39) from valve stem (38).
28. Remove valve pressure plate (20) from valve stem (38).
29. Slide valve spring (19) from valve stem (38).



Valve Body/Valve Stem Disassembly

30. Pull valve stem (38), complete with valve stem nuts (35), muffling plate (36), and valve disc (15) from valve body (18).
31. Unscrew valve seat ring (16).
32. Unscrew valve body (18) from base (21).
33. Loosen and remove valve stem nuts (35).
34. Slide muffling plate (36) and valve disc (15) from valve stem (38).
35. Loosen and remove bleedport (48) from 1/8" NPT pipe port (37).

8. INSPECTION AND CLEANING

WARNING

Carbon tetrachloride and kerosene used for post-grinding cleaning are dangerous. Carbon tetrachloride emits poisonous fumes. Kerosene is flammable. Clean parts only in well-ventilated areas and away from open flames and "red hot" surfaces.

Inspect each part as it is removed during any partial or complete disassembly procedure. If the part is worn or damaged, replace it when reassembling the equipment. Clean all serviceable parts with an approved solvent.

9. GRINDING IN

CAUTION

Use only very fine (400 grit) grinding compound if grinding is required. Heavy grinding produces galling, wider searing surface, and a groove in the disc leading to leakage.

Seats and discs may require **light** grinding.
Remove valve spring before grinding.
Slip stem into its normal position. Apply compound to the disc.
Place disc on stem and tighten with one stem nut.

WARNING

Carbon tetrachloride and kerosene used for post-grinding cleaning are dangerous. Carbon tetrachloride emits poisonous fumes. Kerosene is flammable. Clean parts only in well-ventilated areas and away from open flames and "red hot" surfaces.

After grinding, disassemble and clean surfaces with carbon tetrachloride or kerosene.

10. VALVE SETTING

Pilot Valve Setting (figure 8)

Specifications :

Dimension "C" = II/64 inch

Dimension "A" = approximately 3/64 inch

Assemble all parts except spring.

Hold pilot disc (11) tightly against seat (10). Screw pusher plate (28) down until the "C" dimension is II/64 inch.

Grind off stem projection ("B") flush with upper face of pusher plate (28).

Check dimension "C". If correct, prick punch the thread at several points to lock the position. Scrape away all burrs.

The pusher plate upper face must be smooth and flat.

Disassemble, install spring, and reassemble as complete unit.

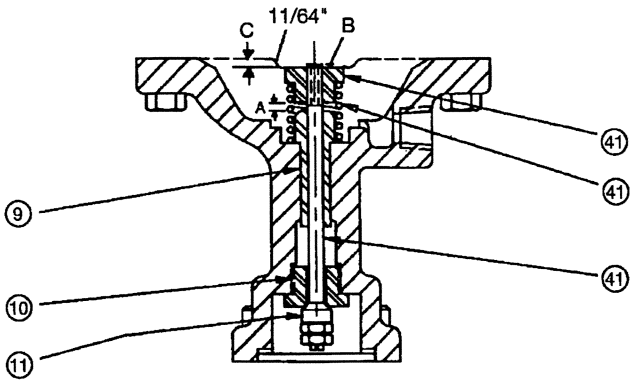


Figure 8 - VKP Pilot Setting

Main Valve Setting (figure 9)

Specifications: Dimension "K" = supplied with replacement stem.

Grind in new stem (38) bevel joint with disc (15).

Tightly secure disc (15) on stem (38) with stem nuts (35).

Insert stem and disc assembly into valve body (18).

Without the valve spring in place screw on valve pressure plate (20).

Hold disc (15) on seat ring (16) and adjust pressure plate (20) until dimension "K" is reached.

Push pressure plate (20) against pressure plate stops in base.

Remove disc (15), drop out pressure plate (20) and stem (38).

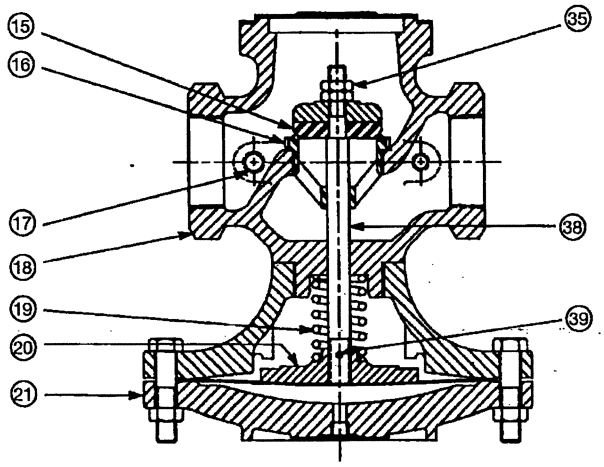


Figure 9 - VKP Main Valve Adjustments

Drill hole for the dowel pin (39) through the pressure plate (20) and stem (38) . Insert dowel pin (39) into hole to lock joint.

Grind off bottom of stem (38) flush with pressure place (20) face.

Disassemble, install spring, and reassemble as complete unit.

11. VKP BOLT TORQUE TABLES

TABLE 1

Minimum Bolt Torque (ft-lbs)

Bolt Size	Neverseez			No Lubrication		
	Yield Strength (psi)			Yield Strength (psi)		
	30,000 (S.S.)	60,000 (Ledloy)	92,000+ (B7)	30,000 (S.S.)	60,000 (Ledloy)	92,000+ (B7)
#8-32 UNC	11 in #	18 in #	25 in #	17 in #	24 in #	34 in #
#10-24 UNC	17 in #	27 in #	37 in #	27 in #	33 in #	49 in #
1/4-20 UNC	41 in #	64 in #	87 in #	62 in #	82 in #	10 ft #
1/4-28 UNF	45 in #	75 in #	97 in #	70 in #	98 in #	12 ft #
5/16-18 UNC	81 in #	10 ft #	14 ft #	10 ft #	13 ft #	20 ft #
5/16-24 UNF	89 in #	12 ft #	15 ft #	11 ft #	16 ft #	23 ft #
3/8-16 UNC	12 ft #	19 ft #	25 ft #	18 ft #	25 ft #	36 ft #
3/8-24 UNF	13 ft #	22 ft #	28 ft #	21 ft #	29 ft #	43 ft #
7/16-14 UNC	19 ft #	30 ft #	40 ft #	29 ft #	39 ft #	57 ft #
7/16-20 UNF	21 ft #	34 ft #	43 ft #	31 ft #	46 ft #	66 ft #
1/2-13 UNC	28 ft #	46 ft #	61 ft #	44 ft #	61 ft #	87 ft #
1/2-20 UNF	31 ft #	53 ft #	67 ft #	49 ft #	71 ft #	103 ft #
9/16-12 UNC	41 ft #	66 ft #	86 ft #	63 ft #	86 ft #	126 ft #
9/16-18 UNF	45 ft #	76 ft #	91 ft #	69 ft #	101 ft #	141 ft #
5/8-11 UNC	58 ft #	94 ft #	116 ft #	88 ft #	123 ft #	176 ft #
5/8-18 UNF	65 ft #	109 ft #	122 ft #	100 ft #	145 ft #	190 ft #
3/4-10 UNC	102 ft #	166 ft #	183 ft #	155 ft #	219 ft #	280 ft #
3/4-16 UNF	111 ft #	189 ft #	193 ft #	172 ft #	253 ft #	299 ft #
7/8-9 UNC	162 ft #	266 ft #	268 ft #	247 ft #	350 ft #	410 ft #
7/8-14 UNF	175 ft #	296 ft #	281 ft #	272 ft #	399 ft #	436 ft #

Yield Strength	Bolt Material Specification	Bolt Material Type
30000 psi	A582 (303), A276 (302,304)	S.S.
60000 psi	A108 GR12L30 (Ledloy)	Ledloy
92000+ psi	SA193-B7, SA574, SAE 429K GR5	B7

TABLE 2

TORQUE SETTINGS TYPE E VALVE

BLIND FLANGE BOLT TORQUE (FT - LBS)

Size	Class	Bolt Size	Type	Minimum Torque (Lubricated)
3/8	125, 250	5/16-18 UNC	B7	14
1/2	125, 250	5/16-18 UNC	B7	14
	300	5/16-18 UNC	B7	14
	600	3/8-16 UNC	B7	25
3/4	125, 250	5/16-18 UNC	B7	14
	300	5/16-18 UNC	B7	14
	600	7/16-14 UNC	B7	40
1	125, 250	3/8-16 UNC	Ledloy	19
	150, 300	3/8-16 UNC	B7	25
	600	7/16-14 UNC	B7	40
1¼	125, 250	7/16-14 UNC	B7	40
	150, 300	7/16-14 UNC	B7	40
	600	9/16-12 UNC	B7	86
1½	125, 250	1/2-13 UNC	Ledloy	46
	150, 300	1/2-13 UNC	B7	61
	600	9/16-12 UNC	B7	86
2	125, 250	5/8-11 UNC	Ledloy	94
	150, 300	5/8-11 UNC	B7	116
	600	3/4-10 UNC	B7	183
2½	125	5/8-11 UNC	Ledloy	94
	250	3/4-10 UNC	S.S.	102
	150, 300	5/8-11 UNC	Ledloy	94
	600	5/8-11 UNC	Ledloy	94
3	125	1/2-13 UNC	Ledloy	46
	250	5/8-11 UNC	Ledloy	94
	150, 300	1/2-13 UNC	B7	61
	600	5/8-11 UNC	Ledloy	94
4	125	5/8-11 UNC	Ledloy	94
	250	3/4-10 UNC	Ledloy	166
	150, 300	1/2-13 UNC	B7	61
	400, 600	3/4-10 UNC	B7	187
5	125	5/8-11 UNC	Ledloy	94
	250	3/4-10 UNC	Ledloy	166
	150, 300	5/8-11 UNC	B7	116
	400, 600	7/8-9 UNC	B7	268
6	125	5/8-11 UNC	Ledloy	94
	250	3/4-10 UNC	Ledloy	166
	150, 300	5/8-11 UNC	B7	116
	400, 600	7/8-9 UNC	B7	268
8	125	5/8-11 UNC	Ledloy	91
	250	3/4-10 UNC	Ledloy	166
	150, 300	5/8-11 UNC	B7	116
	400, 600	7/8-9 UNC	B7	268
10	125	5/8-11 UNC	B7	94
	250	7/8-9 UNC	Ledloy	266
	150	5/8-11 UNC	B7	116
	300, 400	3/4-10 UNC	B7	183
12	125, 250	7/8-9 UNC	Ledloy	266
	150, 300	7/8-9 UNC	B7	268

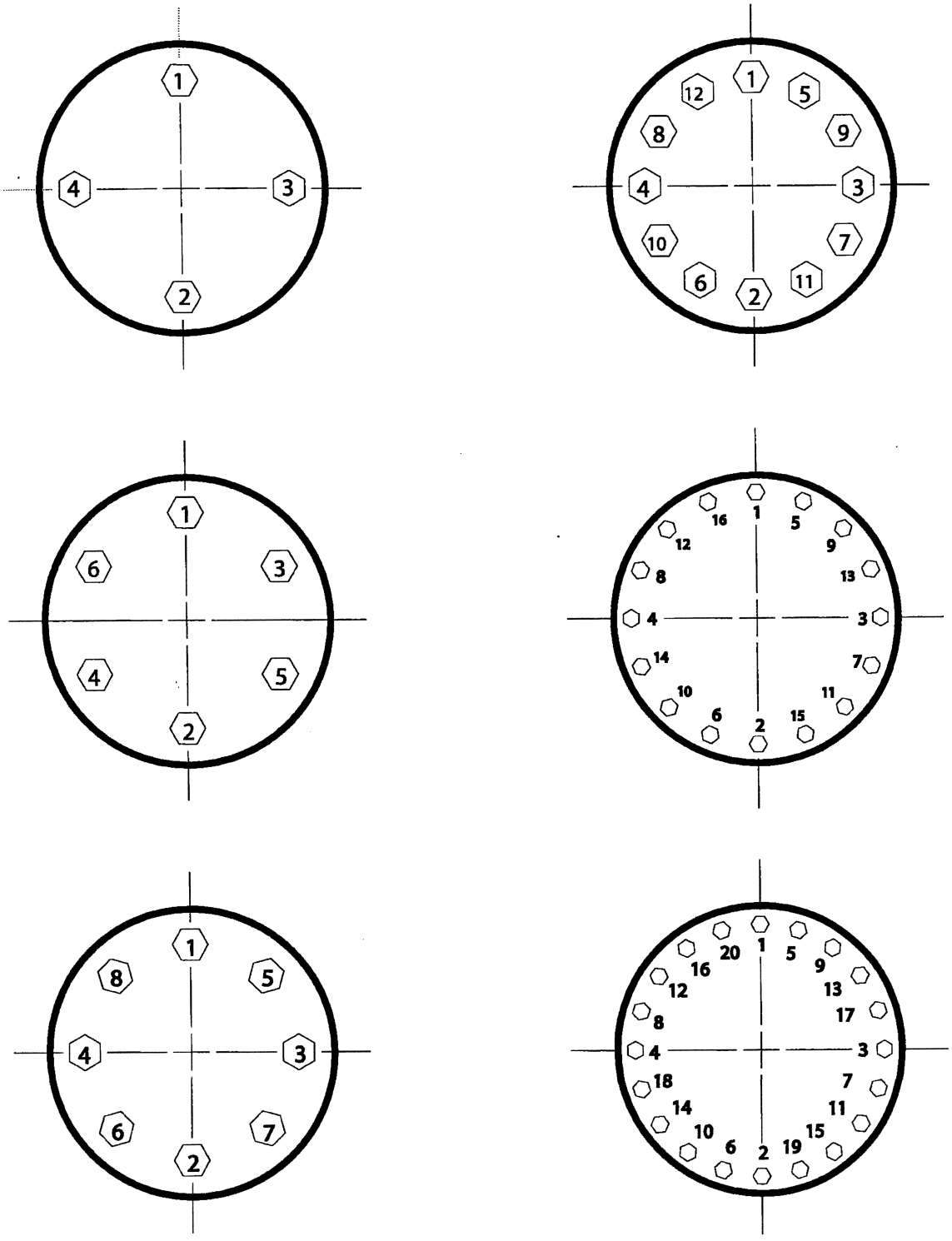


Figure 10 - Body-Bonnet Stud Nut Tightening Sequence

It is solely the responsibility of the system designer and the user to select products and materials suitable for their specific application requirements and to ensure proper installation, operation and maintenance of these products. Assistance shall be afforded with the selection of the materials based on the technical information supplied to Leslie Controls, Inc.; however, the system designer and user retain final responsibility. The designer should consider applicable Codes, material compatibility, product ratings and application details in the selection and application. Improper selection, application or use of the products described herein can cause personal injury or property damage. If the designer or user intends to use the product for an application or use other than originally specified, he must reconfirm that the selection is suitable for the new operating conditions.

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