



CLARKSON SLURRY KNIFE GATE VALVES

KGD

Installation and maintenance instructions for KGD wafer style slurry knife gate valve.
 Before installation these instructions must be fully read and understood



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1 GENERAL INFORMATION

1. The KGD is a packingless, slurry knife gate valve. All the sealing is accomplished by the elastomeric sleeves in the valve housing. The sleeves also form the wear section for the valve. The gate is removable for inspection or replacement while the valve is in service. The secondary seal prevents atmospheric leakage from around the gate.
2. The KGD is a BI-DIRECTIONAL (two-way shut-off) product and can be installed without concern over direction of flow. Since they will shut-off equally in either direction, you will find no arrows or other indicators of a direction of flow or seat side.
3. The KGD is suitable for on-off service only. It is not to be used in a throttling application.
4. The style, size, pressure rating and material selection are the responsibility of the piping system designer.
5. All valves should be operated within the design pressure and temperature ranges. Under no circumstances should the valves be operated at conditions outside these parameters. Do not exceed 100% of the maximum pressure rating of the valve at any time during its operation. Pressure spikes beyond the valve's pressure rating are solely the responsibility of the user.
6. This manual is applicable to three generations of KGD sleeves.
 - A) KGD with secondary seal, equipped with Mark III sleeves (Mark III, Figure 6).
 - B) KGD with secondary seal, equipped with Mark II sleeves (Mark II, Figure 6).
 - C) KGD with secondary seal, equipped with Mark I sleeves (Mark I, Figure 6).

2 INITIAL INSPECTION

1. Examine entire valve and report any damage or discrepancies immediately.
2. Sleeves: visually examine the sleeves interior, looking for chunking, irregularities or other damage.
3. Operators: standard manual handwheels may be shipped loose for field installation, be sure to fully tighten.
4. Valves are normally shipped with gate in open position, the recommended position for installation. Valves supplied with spring to extend (fail close) cylinder actuators are shipped with the gate in the closed position. Gate should be actuated to the open position prior to installation, exercise extreme caution when applying air to open this valve and then ensure that it gate locked in the open position for installation. Refer to lockouts Section 5 for additional cautions on spring cylinders.
5. Accessories: if provided, including solenoids, limit switches, positioners, etc., are tested for functionality prior to shipment. Examine carefully for damage which may occur during shipment.

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3 INSTALLATION

Please take note of the specific installation tags provided with each valve.

1. The KGD is installed with the gate in the fully open position with the sleeves inserted into the body housings.
2. Standard mating flanges NPS 2 - 24 (DN 50 - 600) match ASME B16.5/150, (see Table 1). Other flange drillings including PN10, PN16, AS2129 Tables D and E are available.
3. Table 2 states the maximum flange bolt tightening torques for standard flange patterns. While the KGD is provided with flange bolt patterns that match ASME B16.5/150 flange bolt patterns, they are not designed to handle the same torque requirements as an all-metal Class 150 gate valve. The KGD are specialty valves with a specified maximum flange torque. Exceeding recommended torque values will reduce overall valve performance and may permanently damage the sleeves and or other components.
4. The KGD is configured for installation in conventional bolted flange connections. Slip on or weld flanges can be used. The pipeline companion flanges should be raised or flat face type to insure full sleeve support and a continuous, unvarying I.D. If slip-on flanges are used, the pipe should be cut square and welded in position with the pipe end matched evenly with the flange face. Studded flanges are not compatible with these valves. Use of other flange connections should be reviewed and verified by the factory for compatibility prior to installation.

5. The mating line flanges must be properly aligned prior to attempting installation. Never try to make up for misaligned pipe flanges by the line bolting.
6. Listed in Table 1 are the fasteners required for installation.
7. Pipe supports and/or expansion joints should be used to minimize pipe loads on valves.
8. The face of the Mark III sleeves function as the gasket for installation into the pipeline, no additional gaskets are required (refer to Table 2 notes if not using a Mark III sleeve).
9. Valve is suitable for use in either vertical or horizontal lines. The valve can be installed in any position in vertical or horizontal pipelines. However, valves installed in an orientation with the actuator below horizontal may require flushing to prevent the buildup of solids in the housing and may require additional actuator support.

CAUTION

Valves are normally shipped with gate in open position, the recommended position for installation. Valves supplied with spring to extend (fail close) cylinder actuators are shipped with the gate in the closed position. Gate should be actuated to the open position prior to installation, exercise extreme caution when applying air to open this valve and ensure that gate is locked in the open position for installation. Refer to lockouts Section 5 for additional cautions on spring cylinders.

TABLE 1 - BOLTING DIMENSIONS

Valve size		ASME B16.5/150 flange details					Through bolt hole for bolts or studs				DT* bolt hole for studs	
		Flange diameter	Bolt circle diameter		Bolt size/	Number of thru holes per valve	Installed face-to-face		Number of DT holes per side of valve	DT bolt hole depth		
NPS	DN	inch	mm	inch	mm		thread	inch		mm	inch	mm
2	50	6	152.4	4¾	120.7	5/8 - 11	0	2½	54.0	4	0.56	14.2
3	80	7½	190.5	6	152.4	5/8 - 11	0	2¼	57.2	4	0.56	14.2
4	100	9	228.6	7½	190.5	5/8 - 11	4	2¼	57.2	4	0.56	14.2
6	150	11	279.4	9½	241.3	¾ - 10	4	2½	63.5	4	0.56	14.2
8	200	13½	342.9	11¾	298.5	¾ - 10	4	3	76.2	4	0.56	14.2
10	250	16	406.4	14¼	362.0	7/8 - 9	4	3	76.2	8	0.62	15.7
12	300	19	482.6	17	431.8	7/8 - 9	4	3¼	82.6	8	0.69	17.5
14	350	21	533.4	18¾	476.3	1 - 8	4	3¼	82.6	8	0.69	17.5
16	400	23½	596.9	21¼	539.8	1 - 8	4	3¼	95.3	12	0.69	17.5
18	450	25	635.0	22¾	577.9	1½ - 7	4	3¼	95.3	12	0.91	23.1
20	500	27½	698.5	25	635.0	1½ - 7	4	4¾	120.7	16	1.26	32.0
24	600	32	812.8	29½	749.3	1¼ - 7	4	4¾	120.7	16	1.19	30.2

* DT = Drill and tapped

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TABLE 2 - MAXIMUM TIGHTENING TORQUE

Valve size		Standard flanging		FRP flanges (see note)	
NPS	DN	ft-lb	N-m	ft-lb	N-m
2	50	37	50	25	34
3	80	37	50	25	34
4	100	37	50	25	34
6	150	69	94	40	54
8	200	69	94	40	54
10	250	113	153	65	88
12	300	113	153	65	88
14	350	169	229	100	135
16	400	169	229	100	135
18	450	238	323	140	190
20	500	238	323	140	190
24	600	238	323	200	271

NOTE

Mark II sleeves require the use of a soft elastomer gasket in FRP flange installations. Gaskets are not required or recommended on Mark I or Mark III sleeves.

Installation notes

- A) All slurry knife gate valves are designed and manufactured to be installed in applications where no more than 1 g of force in excess of gravity is applied to the valve in any direction. This 1 g force can be an effect of traffic, wind, or earthquake, etc. Valves should not be used in applications that exceed 1 g.
- B) If valve stem or topworks protrude into walkways or work areas, valve should be flagged per company safety policy.
- C) All piping systems should contain independent support mechanisms and should not utilize the valve as a sole means of support.
- D) Do not install valve over walkways, electrical or other critical equipment without the use of a splash guard device (refer to Section 14) or similar considerations.

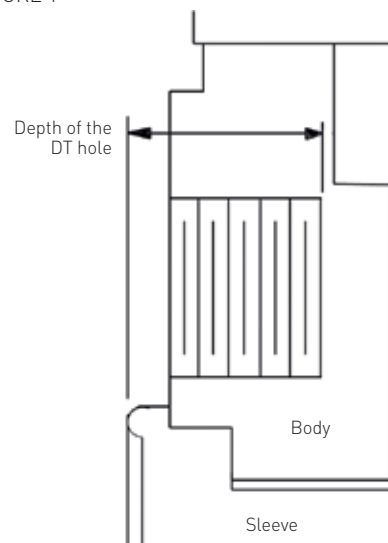
CAUTION

Valves are normally shipped with gate in open position, the recommended position for installation. Valves supplied with spring to extend (fail close) cylinder actuators are shipped with the gate in the closed position. Gate should be actuated to the open position prior to installation, exercise extreme caution when applying air to open this valve and then ensure that gate is locked in the open position for installation. Refer to Section 8 storage for additional information.

NOTES

- Flange dimensions per ASME B16.5/150.
- The KGD Body is provided with a combination of through bolt holes and drilled and tapped (DT) mating flange bolt holes.
- Length of studs for use in DT holes can be determined by adding the depth of the DT hole (includes allowance for height of compressed sleeve face) shown in chart to the thickness of the mating flange along with any used washers.
- While studs are recommended in DT holes, if bolts are used, be sure the length does not exceed the DT bolt hole depth.
- Length of bolts or studs for use in through holes can be determined by adding the installed face-to-face (includes allowance for height of compressed sleeve face) shown in chart to the thickness of the mating flange along with any used washers. (For studs, add both flanges and two sets of nuts and washers).
- Flange drilled and tapped holes in body over 1 inch (25 mm) diameter are normally provided with coarse thread.

FIGURE 1



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FIGURE 2 - OPEN POSITION



Open position:

- A) Gate positioned above seals.
- B) Tight fit between sleeves and the internal sleeve profile contain the line pressure.
- C) No metal parts in contact with slurry.
- D) Unobstructed port area eliminates turbulence, minimizes pressure drop across valve.
- E) No seat cavity where solids can collect and prevent full gate closure.

FIGURE 3 - CLOSED POSITION



Closed position:

- A) Gate travels through sleeves to provide blind flange shut-off, allowing opportunity for media to expel to atmosphere.
- B) 100% Isolation-bubble tight shut-off results in absolutely zero downstream leakage.
- C) Double-seated design provides bi-directional flow and shut-off.
- D) Controlled stroke prevents gate from penetrating too far, minimizing stress on sleeve.

4 OPERATION

1. The KGD is suitable for on-off service only. It is not to be used in a throttling application.
2. To close the valve and provide isolation, the actuator (handwheel, bevel gear, air/hydraulic cylinder or electric motor actuator) moves the metal gate in a linear motion between the elastomeric sleeves to shut off the flow. To open, reverse the operation and the gate moves up and out from between the sleeves, opening the valve port.
3. Matching elastomer sleeves seal against each other under a high compression load when the valve is open, creating the valve pressure vessel. When the valve is closed, the sleeves seal against the gate face, isolating upstream from downstream. See Figures 2 and 3.
4. As the gate strokes, a gap is created between the facing sleeves, allowing any media that could potentially clog or jam the valve to be purged out from between the sleeves, and potentially expelled outside the valve housing to atmosphere.
5. The KGD valve incorporates a built-in clean-out area at the base of the housing assembly. The clean-out area may be enclosed by an optional, removable drain plate. This drain plate will allow controlled drainage of any accumulated solids that may

prevent full gate closure. Flush water can be used to improve the drainage efficiency. With the drain plate in place, any solids, slurry, or flush water ejected from the valve can be handled in a controlled manner. DO NOT plug or otherwise restrict both ports of the drain plate as this will prevent proper operation of the KGD valve. See Section 14 for drain plate installation instructions.

6. All valves should be operated within the design pressure and temperature ranges. Under no circumstances should the valves be operated at conditions outside these parameters.

NOTE: Actuated Clarkson valves have a maximum recommended stroke speed of 1 inch (25 mm) per second. Exceeding this speed can shorten sleeve life and may void warranty. Optional speed controls provided by factory will require adjustment in the field to obtain proper stroke speed against actual operating conditions. Refer to Section 14 for additional information on discharge.

CAUTION

It is normal for the KGD to discharge media during opening and closing cycles. Some additional discharge may continue for a time after completion of the open cycle. This helps prevent any solids from building up between the sleeves that would prevent a tight seal when the valve is fully open or closed. Discharge can be controlled with the use of a splash guard device (drain plate, refer to Section 14). Do not install valve over walkways, electrical or other critical equipment without the use of a splash guard device or similar considerations.

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7. The operator of any valve should have an understanding of the effects of opening/closing the valve with regards to its role in the overall piping system. Operators of valves under pressure should take caution to ensure that the valve is in good operating condition prior to operating it under pressure.
8. Certain processes contain hazardous and/or otherwise unstable media. Care should be taken in these circumstances to ensure the operator is aware of the specific health and safety risks associated with that medium.
9. When operating the valve stand clear of any moving parts such as the stem and/or gate assembly, use of gloves is suggested when operating manual valves to minimize the risk of injury.
10. All manual handwheel operated valves are designed for hand input. Do not apply excessive input torque via pipe wrenches, 'cheater bars', or other devices. If a manual handwheel actuated valve is difficult to operate due to torque requirements, it is recommended that the valve be supplied with or converted to a bevel gear, air/hydraulic cylinder or electric motor actuator.
11. Electric motor actuated valves should be left in their factory set condition, unless the system operating parameters dictate a change. If changes are necessary, they should be performed in small increments using the lightest/lowest setting possible to achieve the desired performance and then the valve/actuator function inspected. Excess torque and/or thrust in the motor settings may damage or lockup the valve.
12. Clarkson KGD valves are position seated and should never be torque seated. Do not use the motor torque settings to seat the valve.
13. Care should be taken to ensure that electrical motors are wired correctly. Incorrect phasing of 3-phase wiring may cause valve/motor damage.

5 LOCKOUTS

Open and closed gate lockout positions are standard on the KGD NPS 2 - 16 (DN 50 - 400), optional on the larger sizes. Optional lockout pins may be supplied by Emerson or customer may use their own suitable pin. (Contact factory for pin specifications).

CAUTION

If lockout pins are used on automated valves, the open and closed lockout brackets are designed to resist the normal valve operating thrust. In order to assure complete lockout compliance, any double acting air cylinder, hydraulic cylinder or electric motor actuated valve must be placed in a ZERO ENERGY STATE by isolating all potential energy sources including electricity, operator air supply or hydraulic fluids.

In the case of a single acting spring to close or spring to open cylinder with the spring compressed, the mechanical energy cannot be placed in the ZERO ENERGY STATE. When compressed, the spring will cause unwanted gate movement if inlet air pressure is not maintained on the non-spring side of the actuator. Specific care must be taken to insert or remove lockout pins

- Spring extended (uncompressed): isolate air supply from cylinder actuator.
- Spring retracted (compressed): maintain air pressure on the non-spring side of the actuator.

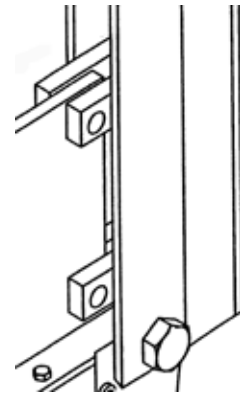
Take great care when inserting and removing the lockout pin. If the gate moves during the insertion or removal process, injury may occur

6 GENERAL MAINTENANCE

We recommend that all Clarkson products be inspected at least every 60 days. The following points should be examined and corrected as required:

1. Exterior overview: piping system components are subject to certain levels of erosion and corrosion. Periodic inspections should be made as valves/components may wear over time. Regular inspection of the housing assembly and gate should be performed, check for general signs of corrosion, component wear and/or damage caused by process media. Severe applications may require additional inspection types and/or frequency.
2. Valve stems, extension stems, and stem nut: look for excessive corrosion, galling or lack of lubrication. If valve stem requires lubrication, utilize the grease fitting provided and pump standard bearing grease through the yoke hub to lubricate the stem and stem nut assembly. Additional lubrication may be applied directly onto stem or stem threads. (Use material which meets ASTM 4950 GBLB).

FIGURE 4



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3. If possible stroke the valve through the full open and closed position to make sure it is functioning properly.
NOTE: It is normal for the KGD valve to discharge media during opening and closing cycles. Some additional discharge may continue for a time after completion of the open cycle.
4. Sleeve lubrication:
 - A) Sleeves: the KGD valve has no body or sleeve lubrication fittings. Lubrication is provided to the gate by the secondary seal. When it is replaced or inspected, it should be lubricated as stated in Section 10.
 - B) The gate may also be lubricated by applying lubricant directly onto the exposed gate surface.
 - C) As a minimum, the Clarkson KGD valves should be lubricated every 100 strokes for NPS 2 - 10 (DN 50 - 250) sizes and every 50 strokes for NPS 12 - 24 (DN 300 - 600) sizes. An individual application may require more or less frequent lubrication depending on the process and chemistry. If a valve cycles very infrequently, less than once per month, lubrication prior to each stroke is recommended. (See adjacent table for approved lubrication).
 - D) Sleeve wear can be minimized if the valve gate is scraped or wiped clean occasionally.
 - E) For dry material handling service, the secondary seal will not be provided and liquid or grease type lubricants should not be used.

NOTE: Failure to use the recommended type of lubricant will considerably reduce the life of both the sleeves and secondary seal. Under no circumstances should a hydrocarbon-based lubricant be used. The use of improper lubrication will void any remaining warranty.

7 RECOMMENDED SPARE PARTS

Valves:

- 2-Replacement sleeves
- 1-Replacement secondary seal
- 2-Body gaskets

Cylinder operator (if applicable):

- 1-repair kit

APPROVED SILICON BASED LUBRICANTS

- | | |
|-------------------------------|---------------------|
| Dow III - Dow corning | Complex 821 - NFO |
| Dow 44 - Dow corning | Dow 7 - Dow corning |
| Rhodorsil 111 - Rhone-poulenc | Compound G661 - G E |
| Sil glyde - AGS Company | |
- For compatibility of other lubricants, consult Emerson.

1. When ordering replacement parts for a Clarkson product or cylinder operator, please include valve or cylinder size and complete description including serial number with your request.
2. Additional replacement parts such as handwheels, stem nut assemblies, retainers, frames (yoke), stems and gates are available from factory. Again, please provide complete description with serial number when ordering.
3. Spare sleeve storage: molded elastomer sleeves have a practical recommended shelf-life. Genuine Clarkson sleeves are laser etched on the outside surface with date of manufacture to use in calculating estimated shelf-life.
 - Natural rubber - 2 years
 - EPDM - 4 years
 - NBR/HNBR - 4 yearsContact factory for additional elastomers.

The shelf life listed is guideline data and is not a substitute for examination of cured material at the time of intended use.

To maintain shelf-life, spare sleeves should be stored in accordance with the following.

1. Store at ambient temperature up to 80°F (27°C), with 60 - 90% relative humidity away from direct sunlight and at a minimum distance of 15 feet (5 m) away from electric motors is mandatory.
2. Care must be taken to avoid storage in a stressed condition such as piled too high or on a plain pallet overhanging a sharp edge.
3. First in - first out inventory control should be practiced.
4. The above elastomer shelf life guidelines are for components that are not already installed in a valve.

NOTE: Emerson recommends customers always use genuine Clarkson OEM sleeves, secondary seals and other replacement parts to maintain the expected, superior, performance of their KGD. Genuine Clarkson sleeves and secondary seals from Emerson are easily recognized by the laser etched identifying marks found on the outside surface. These marks include the size, part number, applicable patent number, elastomer batch compound and date of manufacture; all of which allow complete traceability of the part. Clarkson replacement sleeves, secondary seals and other parts from Emerson are the only ones authorized for use and offer the best fit and continued performance that non-OEM parts simply cannot give. The use of copycat parts may invalidate any remaining warranty. If valve requires further repair, please contact our office for an estimate of feasibility and cost of repair.

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8 STORAGE

The following are the factory's recommendations for storage procedures to retain maximum product integrity during long term storage of 1 to 5 years.

1. Valves are normally shipped with gate in open position, the recommended position for storage. During storage, the gate should always be in the open position. Storage should be in an area out of direct sunlight, away from heat, ozone and extreme weather conditions. Freezing is not considered detrimental as long as the valve is kept dry. High voltage rectifiers and other ozone generating equipment and sources should not be near the storage area.

CAUTION

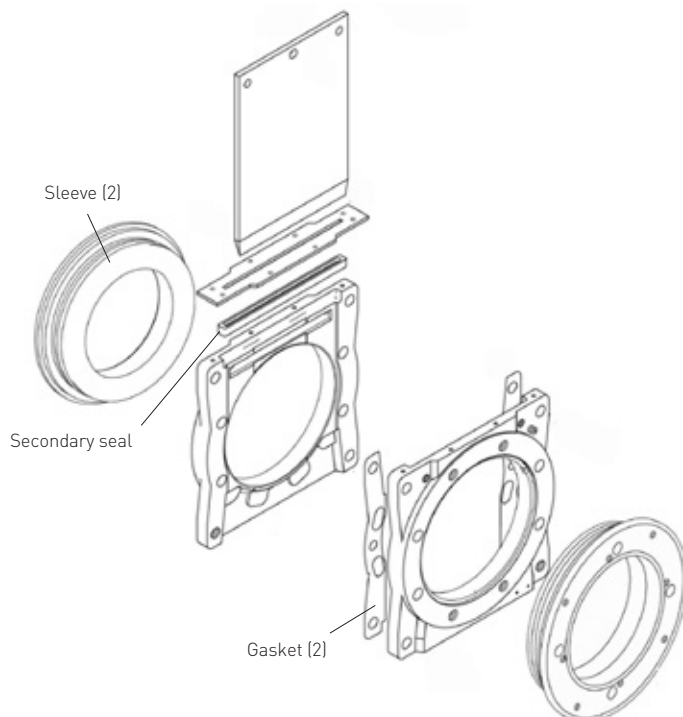
Valves supplied with spring to extend (fail close) cylinder actuators are shipped with the gate in the closed position. DO NOT store a KGD with a spring to extend (fail close) in the open position. This would put the spring in a compressed, fully energized position. For storage, it is recommended the valve sleeves be removed from the valve housing and stored separately from the valve. Reinsert sleeves prior to installation.

2. The preferred storage location is a clean, dry protected warehouse. If valves are to be stored outside, precautions should be taken to keep valves clean and dry. Standard packaging materials provided in valve shipment cannot be considered sufficient for outdoor storage.

3. If outdoor storage is required, the equipment should be totally covered with a heavy, light colored, plastic covering. It is essential that the plastic be opaque to eliminate sunlight, and light colored to minimize heat buildup. The covering should be spread in a manner that allows underside ventilation. To insure proper ventilation the equipment should be elevated 2 - 4 inches (50 - 100 mm) above the ground.
4. Manual actuated valves may be stored in the vertical or horizontal position. For air or hydraulic actuated valves, the preferred orientation for optimum protection is with the valve fully opened and the cylinder in the vertical position. This position gives the best support to the cylinder rod and helps reduce the chance of a 'flat spot' developing on the cylinder seals. An acceptable alternate position for valves with cylinder diameters of less than 6 inches (150 mm) is with the cylinder in the horizontal position. Motor actuated valves should be oriented in the direction as preferred by the actuator manufacturer.
5. Valves with cylinder or motor actuators should be stored in accordance with actuator manufacturer's recommendations. Access ports or panels should be secured to prevent unauthorized entry and prevent contamination.
6. Where auxiliary equipment is included, such as limit switches, solenoid valves, etc., care must be taken to avoid moisture and condensation conditions on the equipment.

7. Storage Inspection: visual inspection shall be performed on a semiannual basis and results recorded. Inspection as a minimum shall include reviewing the following:
 - Packaging
 - Flange covers
 - Dryness
 - Cleanliness
8. Maintenance shall consist of correcting deficiencies noted during inspection. All maintenance shall be recorded. Contact factory prior to performing any maintenance if valve is still covered under warranty.

FIGURE 5



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9 SLEEVE INSTALLATION

Clarkson has produced three generations of sleeve designs for KGD valve products; the Mark I, Mark II and Mark III; the Mark III is the most current design. All new valve assemblies with standard natural rubber and EPDM elastomers are provided with the Mark III. Older KGD valve bodies can be retrofitted with the new Mark III sleeve design. Information on the Mark I and Mark II is provided for reference.

Inspection of components

1. Verify that for each valve there are two (2) sleeves.
2. Visually inspect each sleeve for damage to surfaces resulting from shipping or post-shipping handling. The sealing surfaces (nose) must be free of depressions, slits or gouges.

Disassembly

1. Before working on the KGD valve, verify that the valve is in the open position. If it is not, move it to the open position.

CAUTION

Assure line is not pressurized before removing valve. Valve assembly and parts may be heavy, use proper lifting and support techniques. See Section 15, Lifting.

2. Remove the valve from the piping.
3. Visually inspect and verify that the sleeve bore is clear of all debris, scale and elastomer residue.
4. Remove the two elastomer sleeves by simply pulling each sleeve out of the housing assembly. (Sometimes a putty knife, large screwdriver or pry bar is necessary to pry the sleeve from the valve body).
5. Check the bore diameter of valve housing for unusual or excessive wear. If found, valve housing may require replacement.

Installation

1. Sleeves may be installed with valve in either vertical or horizontal orientation, whichever is easier for valve handling.

2a. Applicable to Mark III sleeves

1. Apply lubricant to the seal surface and a thin film on the outside diameter of each sleeve.
2. Press sleeves into the valve housing, one from each side.
3. The Mark III sleeve can be installed in any orientation, sleeves can be rotated to prolong service life.

2b. Applicable to Mark II sleeves

1. Apply lubricant to the seal surface and a thin film on the outside diameter of each sleeve.
2. Press sleeves into the valve housing, one from each side.
3. While there are no alignment tabs or notches, the sleeves must be mounted so the scallops are aligned with the bolt holes, see Mark II illustration. Sleeves can be rotated to prolong service life.

2c. Applicable to Mark I sleeves

1. Apply lubricant to the seal surface and a thin film on the outside diameter of each sleeve.
2. Ensure that all the plastic sleeve plugs are installed into the sleeve.

NOTE: If the plastic sleeve plugs are discarded or missing, the valve will not operate at its optimum performance. Ensure that all the plastic sleeve plugs are installed into the sleeve.

3. Align the sleeve so that the I.D. groove is at the bottom and the white plug is at the top.
4. Verify that the two sleeve orientation lugs match-up to the two sleeve orientation notches located in the housing. Then gently push the sleeve into the housing. (Note, newer valve housings do not have the alignment notches, in this case, orient the sleeve as noted in Paragraph 3 and press in place. The fit will be more snug but performance is not compromised).

3. Do not cycle valve with only one sleeve in place.

FIGURE 6

Mark III



Mark II

Scallops on outside edge



Mark I

Orientation notches in housing

White plug

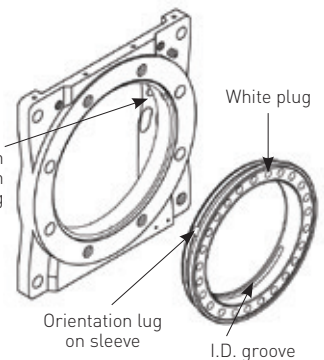
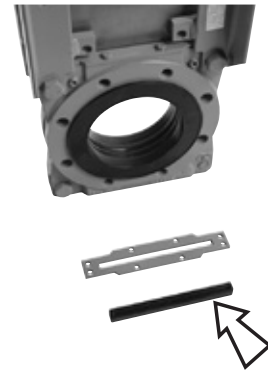


FIGURE 7



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10 FIELD REPLACEMENT OF THE SECONDARY SEAL

CAUTION

This procedure may be performed with the valve in an active pipeline. If it is suspected that either one or both of the elastomer sleeves have failed, or if any continual weeping or discharge from valve housing is apparent, isolate the pipeline valve and or remove the valve from the line or before secondary seal removal. Use of personal protective equipment, tag out or other plant standard safety procedures must be followed. Procedure MUST NOT be done with valve in closed position. If valve is removed for this service, assure line is not pressurized before removing valve. Valve assembly and parts may be heavy, use proper lifting and support techniques, refer to Lifting, Section 15.

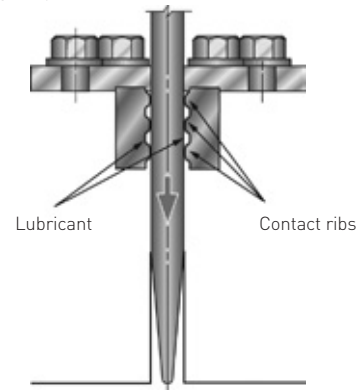
Disassembly

1. Open the valve, so the gate is in the fully raised position.
2. For ease of reassembly, using a permanent marker, draw a line on the gate face along the top of the secondary retainer plate. If marking gate is not an option, make note of the dimension from top of valve housing to top of gate in full open position.
3. Remove the cotter pin from the clevis pin and remove the clevis pin from the gate. It may be necessary to actuate the valve down slightly in order to relieve pressure on the clevis pin to facilitate removal.
4. Actuator assembly removal:
Smaller valves (valves with one bolt used on frame leg): remove the frame to housing bolts of one side except for the lowest bolt on the opposite side of the frame. This bolt will act as a pivot point for the frame / actuator assembly. While supporting the actuator assembly, pivot the frame / actuator assembly away from the valve. Continue to provide support while actuator is in this position.
Larger valves (valves with more than one bolt used on frame leg): remove the frame to housing bolts. Lift the frame and actuator assembly off the housing assembly to allow secondary seal and gate removal.
5. Loosen the secondary seal retainer plate bolts.
6. Remove the gate by lifting it out of the secondary seal.
7. Remove all fasteners and lockwashers that retain the secondary seal retainer plate in position.
8. Remove the secondary seal retainer plate by lifting it up.
9. Remove the secondary seal by inserting a flat blade screwdriver midway along the outside of the seal, between the seal and the valve housing. Pry the seal up and remove.
10. Inspect the gate for sharp edges or excessive damage. Refer to 'Gate inspection' of Paragraph 11.

Reassembly

1. If valve has been removed from pipe, lift valve to vertical position, refer to Lifting, Section 15.
2. Using DOW III or approved alternate, completely fill all internal cavities of the new secondary seal.
3. Paying attention to the top and bottom of the secondary seal, insert the new lubricated secondary seal into the valve housing assembly. (The bottom of the seal has radiused edges).
4. Place the secondary seal retainer plate into position.
5. Replace and hand tighten all the retainer plate fasteners and lockwashers.
6. Apply a small amount of recommended lubricant to the two tapered faces of the 'sharp end' of the gate.
7. Press the gate firmly through the secondary seal into the valve housing assembly until the mark drawn on the gate reaches the top of the retainer plate or gate reaches previously recorded dimension.
8. Fully tighten all the retainer plate fasteners.
9. Reinstall the actuator / frame assembly with the housing / frame fasteners loosely.
10. Reconnect the gate to the actuator. (In order to facilitate installation and future removal, a coating or anti-seize compound should be applied to the outside of the clevis pin over the yoke contact area).
11. 'Stretch' the frame / actuator assembly with respect to the housing by pulling (not lifting) the frame / actuator assembly to its maximum movement away from the housing assembly (holding housing in place if valve is removed from pipeline). Tighten the frame / housing bolts and verify the tightness of the actuator to frame bolts.
12. Cycle valve to full open position and check the gate position.
13. Rattle the gate. It should be mostly disengaged from the sleeves. The outboard edges of the gate should be free and the center still partially engaged in between the sleeves.
14. Cycle gate full closed and full open.
15. Inspect gate for pieces of rubber. If significant amount of rubber is present, a sharp edge(s) on the gate may be causing seal damage or the gate is extending too far on the up stroke. The ends of the gate should be free and the center still engaged. If the sleeve / gate is misaligned, loosen the frame actuator bolts and / or adjust the yoke until the proper position, open and closed, is obtained.
16. If out of pipeline, reinstall the valve; refer to Lifting, Section 15.

FIGURE 8



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11 DISASSEMBLY AND ASSEMBLY INSTRUCTIONS

Disassembly

1. Before working on the KGD valve, verify that the valve is in the open position. If it is not, move it to the open position.
2. Remove the valve from the piping.
3. For ease of reassembly, using a permanent marker, draw a line on the gate face along the top of the secondary retainer plate. If marking gate is not an option, make note of the dimension from top of valve housing to top of gate in full open position.
4. Visually inspect and verify that the sleeve bore is clear of all debris, scale and elastomer residue.
5. Remove the two elastomer sleeves by simply pulling each sleeve out of the housing assembly. (Sometimes a putty knife, large screwdriver or pry bar is necessary to pry the retainer flange away from the sleeve and the sleeve from the valve flange).
6. Remove the cotter pin from the clevis pin and remove the clevis pin from the gate. It may be necessary to actuate the valve down slightly in order to relieve pressure on the clevis pin to facilitate removal.
7. Remove the actuator/frame subassembly at one time by removing the frame bolts that fasten the frames to the housing and pulling it away from the housing assembly.
8. Loosen the secondary seal retainer plate bolts.
9. Remove the gate by lifting it out of the secondary seal.
10. Remove all fasteners and lockwashers that retain the secondary seal retainer plate in position.
11. Remove the secondary seal retainer plate by lifting it up.
12. Remove the secondary seal by inserting a flat blade screwdriver midway along the outside of the seal, between the seal and the valve housing. Pry the seal up and remove.
13. Remove housing bolts, and pull halves apart.
14. Remove old housing gaskets (two).
4. Examine sleeves for signs of wear, cracking, chunking, deep cuts, severe abrasion or chemical attack (softening or gumming). Replace if in doubt; sleeves must be replaced as a set.
5. Examine secondary seal for signs of wear or cracking, severe abrasion or chemical attack (softening or gumming). Replace if in doubt.
6. Gate Inspection; inspect the gate for sharp edges or excessive damage. Some scoring will occur in normal use. Check the gate for flatness as follows: place a straight edge across one face of the gate. If there is a gap between the straight edge and the surface of the gate greater than 0.030" (0.76 mm) for valves up to and including NPS 8 (DN 200), or 0.090" (2.29 mm) for all other sizes, the gate should be straightened before reinstallation. The gate can be straightened by supporting the outside edges of the gate and with the 'dished face' of the gate pointing up, apply sufficient force to the center of the gate using a hydraulic press. If straightening is performed, use considerable care to minimize marks on gate surface. Scores or other distress marks may be cleaned up with a belt sander. Machining the gate surface is not recommended. Light scale buildup may be removed with a putty knife or gasket scraper. Inspect the gate for wear and roughness. Use a disc grinder or belt sander to remove rough surfaces. Take particular care on the leading and beveled edge to remove burrs and other sharp edges.
7. Examine frame for signs of corrosion, damage or other potential problems.
8. Check all bolting hardware for thread integrity, signs of corrosion, straightness, etc. Replace as required.
9. For valves with purge control assemblies, examine major components; look for signs of corrosion and material build-up. Clean any visible build-up, replace if necessary. Examine gasket and replace if necessary.
10. Examine actuator assembly.
 - A) **Manual valves:** check stem for corrosion, straightness, etc. Look for signs of wear on brass stem nut.
 - B) **Air or hydraulic:** check for seal leaks around cylinder rod seal, heads and caps. Examine cylinder rod for signs of corrosion, straightness, etc. Service per manufacturer's instructions.
 - C) **Electric motor:** service per manufacturer's instructions.

Visual inspection of parts prior to reassembly

1. Check and ensure all housing interior surfaces and drain ports are free and clear of hardened slurry or other obstructions. Clean as required.
2. Inspect the valve housing to ensure that all mating surfaces are clean and free from slurry build-up or severe corrosion. Replace if there are signs of excessive or unusual wear.
3. Examine exterior housing surfaces for buildup of hardened slurry or other contamination, clean as required.

CAUTION

Assure line is not pressurized before removing valve. Valve assembly and parts may be heavy, use proper lifting and support techniques, see Section 15.

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NOTE: Emerson recommends customers always use genuine Clarkson OEM sleeves, secondary seals and other replacement parts to maintain the expected, superior, performance of their KGD. Genuine Clarkson sleeves and secondary seals from Emerson are easily recognized by the laser etched identifying marks found on the outside surface. These marks include the size, part number, applicable patent number, elastomer batch compound and date of manufacture; all of which allow complete traceability of the part. Clarkson replacement sleeves, secondary seals and other parts from Emerson are the only ones authorized for use and offer the best fit and continued performance that non-OEM parts simply cannot give. The use of copycat parts may invalidate any remaining warranty. If valve requires further repair, please contact our office for an estimate of feasibility and cost of repair.

Reassembly

1. Lay the first housing half face down on a suitable flat surface.
2. Carefully lay two new housing gaskets on face of housings. Gaskets may be held in place with a small amount of silicone lubricant placed between gasket and housing.
3. Take second housing and place into position on the first housing, and properly align bolt holes making gaskets remain in place.
4. Insert most of the housing bolts, leaving out the top bolts that are used to hold the actuator assembly to the housing and loosely tighten. Tap the edges of the housings to align the internal sleeve bores to within $\frac{1}{16}$ " (1.5 mm), at the same time maintaining bolt hole alignment in the square flanges.
5. Lift the valve assembly to vertical position. Refer to Lifting, Section 15.
6. Install Secondary Seal per Section 10, Reassembly, Paragraph 2-8.
7. Reinstall the actuator / frame assembly with the housing / frame fasteners loosely.
8. Reconnect the gate to the actuator. (In order to facilitate installation and future removal, a coating or anti-seize compound should be applied to the outside of the clevis pin over the yoke contact area).
9. 'Stretch' the frame / actuator assembly with respect to the housing by pulling (not lifting) the frame / actuator assembly to its maximum movement away from the housing assembly (holding housing in place if valve is removed from pipeline). Tighten the frame / housing bolts and verify the tightness of the actuator to frame bolts.
10. Install new sleeves per instruction in Section 9, Sleeve installation.
11. Cycle valve to full open position and check the gate position.
12. Rattle the gate. It should be mostly disengaged from the sleeves. The outboard edges of the gate should be free and the center still partially engaged in between the sleeves.
13. Cycle gate full closed and full open.
14. Inspect gate for pieces of rubber. If significant amount of rubber is present, a sharp edge(s) on the gate may be causing seal damage or the gate is extending too far on the up stroke. The ends of the gate should be free and the center still engaged. If the sleeve / gate is misaligned, loosen the frame actuator bolts and / or adjust the yoke until the proper position, open and closed, is obtained.
15. Reinstall the valve, refer to Section 15, Lifting.

12 ACTUATOR ADJUSTMENT

1. Prior to installing the valve, adjustment of the gate may be required. This is only necessary on sizes NPS 2 - 16 (DN 50 - 400) when pneumatic or hydraulic actuators are used. Larger valves do not require this adjustment.
2. Actuate the valve so that it is in the fully open position.
3. Adjust the yoke by screwing into or out of the actuator rod to achieve the correct dimension as measured from Figure 9.
4. Tighten jam nut to maintain correct position.
5. Reinstall valve and tighten flange bolts to the correct torque value as shown in Table 2.
6. For NPS 18 - 24 (DN 450 - 600), the yoke is screwed into the rod end fully without a jam nut.

13 BODY FLUSHING AND DISCHARGE MANAGEMENT

It is normal for the KGD to discharge media during opening and closing cycles. This helps prevent any solids from building up between the sleeves that would prevent a tight seal when the valve is fully open or closed.

FIGURE 9

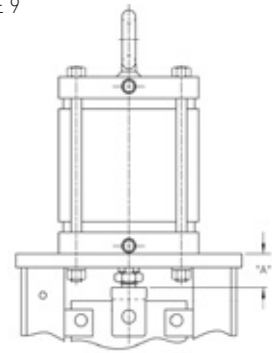


TABLE 3 - DIMENSIONS

Valve size		'A'	
NPS	DN	inch	mm
2	50	1.49	37.9
3	80	1.49	37.9
4	100	1.58	40.1
6	150	1.82	46.2
8	200	1.82	46.2
10	250	1.85	47.0
12	300	1.67	42.4
14	350	1.96	49.8
16	400	1.96	49.8

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Discharge can be managed (not contained) with the use of a splash guard drain plate. The splash guard drain plate can be connected to a customer supplied piping system to provide a means of carrying the discharge away, to a permanent drain or other collection point. Any additional piping system must not be capped or otherwise prevented to flow freely as this may cause eventual clogging of valve. The use of body flush ports will assist in purging body housing of build-up. A splash guard drain plate is recommended if valve body is flushed.

General recommendations for discharge control:

- Take care to avoid splash of discharge onto personnel at all times.
- Wear appropriate personal protective equipment as required.
- When operating a manual valve, beware of and avoid the splash of the discharge.
- Do not install valve over walkways, electrical or other critical equipment without the use of a splash guard device or similar considerations.
- Do not cap or close-off both ends of the splash guard drain plate. This can result in valve failure.
- One end of splash guard drain plate can be used as a flush inlet.
- Additional drain piping may be attached to the splash guard device to direct discharge to collection or drain point. Use of non-collapsible, rigid, pipe is recommended. Using a hose or other collapsible type of pipe extensions is not recommended.
- Keep pipe extensions clear of build-up by regular flushing or cleaning.

14 INSTALLATION INSTRUCTIONS FOR SPLASH GUARD DRAIN PLATE

1. Verify that the proper number of mounting bolts, washers and nuts, along with the plate and gasket material are present.
2. Clean the flat machined surface of the splash guard plate so that there is no dirt, grit, grease, or other debris present.

3. Clean mating surface of body housing so that there is no dirt, grit, grease, or other debris present.
4. Remove the adhesive backing from the gasket material and apply to the splash guard drain plate on the machined flat mating surface (adhesive back strip). If a cut sheet gasket is used, it should be attached to the splash guard drain plate with an RTV type adhesive compound to hold it during installation. Attach gasket material to the flat surface along the edge of the housing slot.
5. Position the splash guard drain plate and loosely fit the fasteners.
6. Verify the position of the gasket material and the bottom of the housing and tighten the installed fasteners.
7. Connect drain piping (if used) to NPT port as required. If desired, one NPT port may be used to flush and one to drain. If both NPT ports are to be used as drains, make sure they do not clog and are cleaned of build-up regularly

15 LIFTING

CAUTION

Valve assembly and parts may be heavy, use proper lifting and support techniques. DO NOT attempt to lift valve together with any adjoining pipe or other equipment. DO NOT attempt to lift valve if full of media. Lifting techniques may vary depending on valve size/weight. Some Clarkson KGD air and or hydraulic actuated valves may be equipped with eyebolts located on the cylinder head. DO NOT attempt to lift valve assembly with this eye.

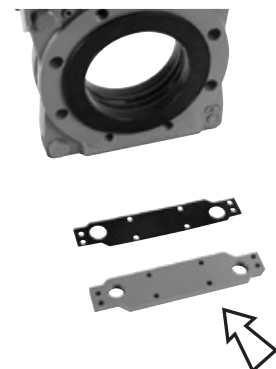
For shipment, large KGD valves are normally palletized in the flat or horizontal position with the bore oriented vertically, flange faces down on pallet. The palletized valves are loaded on to trucks with a forklift. It is recommended unloading should also be done with a forklift. A crane can be used; however the weight must be supported by the pallet and not the valve.

All valves can be lifted using the frame (yoke) assembly as the lift point. **DO NOT USE LOCKOUT BRACKETS TO LIFT VALVE.** Insert properly rated straps under the frame top plate, one for each leg, and lift, taking care as center of gravity shifts. Do not drag the base of the valve during lifting.

TABLE 4 - STANDARD VALVE ASSEMBLY WEIGHTS

Valve size		MH		BG		AC		HC	
NPS	DN	lbs	kg	lbs	kg	lbs	kg	lbs	kg
2	50	43	19.2	-	-	62	27.7	52	23.2
3	80	55	24.5	-	-	84	37.5	68	30.3
4	100	75	33.5	-	-	93	41.5	86	38.4
6	150	89	39.7	-	-	144	64.3	96	42.8
8	200	142	63.4	-	-	190	84.4	145	64.7
10	250	196	87.5	-	-	325	145.0	225	100.4
12	300	-	-	373	166.5	493	220.0	316	141.0
14	350	-	-	438	195.5	655	292.3	377	168.3
16	400	-	-	525	234.3	736	328.5	535	238.8
18	450	-	-	569	253.9	840	374.9	634	283.0
20	500	-	-	730	325.8	1163	519.1	751	335.2
24	600	-	-	1050	468.6	1613	719.9	1150	513.3

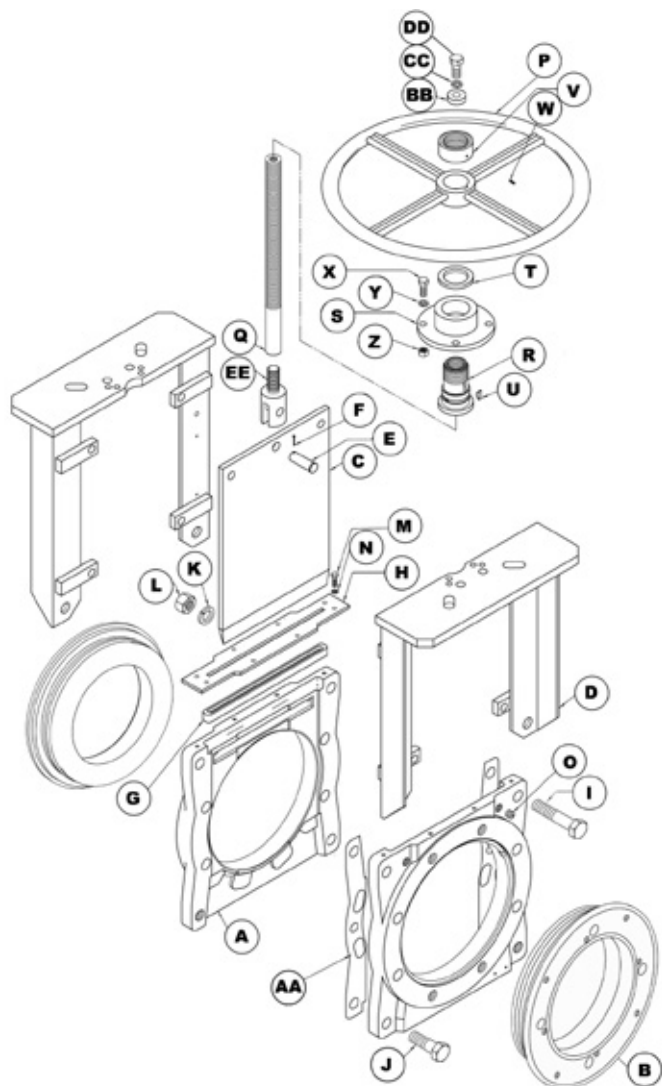
FIGURE 10



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FIGURE 11 - KGD-MH EXPLODED VIEW



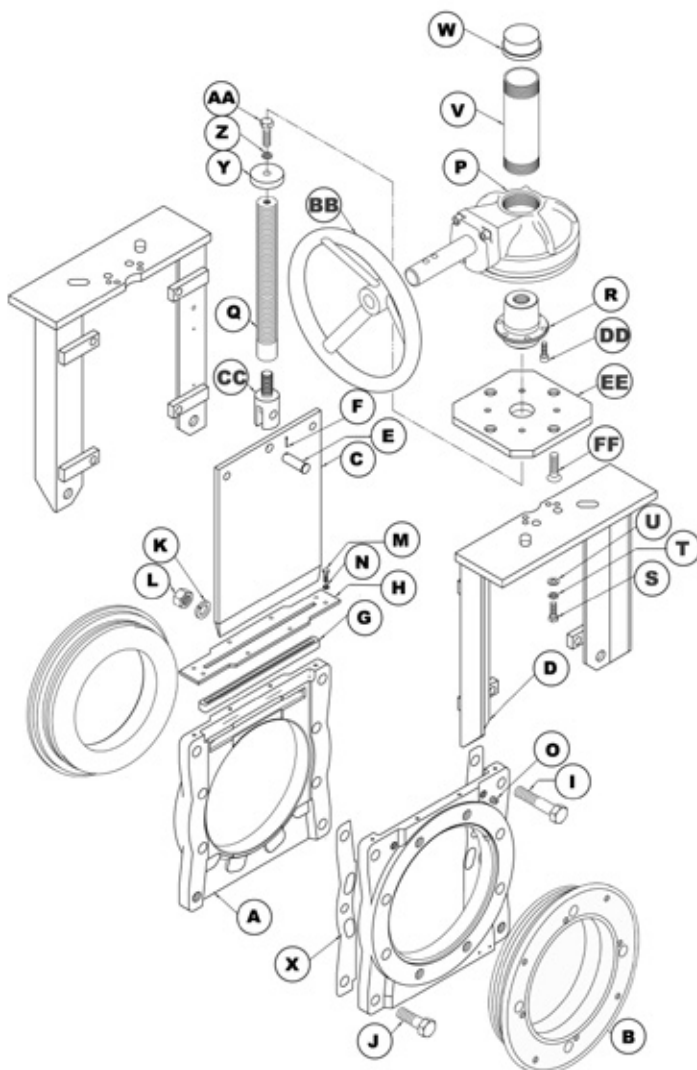
KGD-MH PARTS LIST

Item	Description	Qty req	Item	Description	Qty req
A	Housing	1	O	Flush plug	4
B	Mark III sleeve	2	P	Handwheel	1
C	Gate	1	Q	Stem assembly	1
D	Actuator frame	2	R	Yoke sleeve	1
E	Clevis pin	1	S	Handwheel base	1
F	Cotter pin	1	T	Thrust washer	1
G	Secondary seal	1	U	Woodruff key	1
H	Secondary seal retainer plate	1	V	Cap nut	1
I	Frame mounting hex screw	NPS 2 - 16 (DN 50 - 400) NPS 18 - 24 (DN 450 - 600)	W	Set screw	1
J	Housing hex screw	NPS 2 - 16 (DN 50 - 400) NPS 18 - 24 (DN 450 - 600)	X	Base mounting hex screw	4
K	Frame mounting lockwasher	NPS 2 - 16 (DN 50 - 400) NPS 18 - 24 (DN 450 - 600)	Y	Base mounting lockwasher	4
L	Frame mounting nut	NPS 2 - 16 (DN 50 - 400) NPS 18 - 24 (DN 450 - 600)	Z	Base mounting hex nut	4
M	Retainer mounting hex screw	-	AA	Body gasket	2
N	Retainer mounting lockwasher	-	BB	Travel limiter	1
			CC	Lockwasher	1
			DD	Travel limit screw	1
			EE	Yoke	1

CLARKSON SLURRY KNIFE GATE VALVES

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FIGURE 12 - KGD-BG EXPLODED VIEW



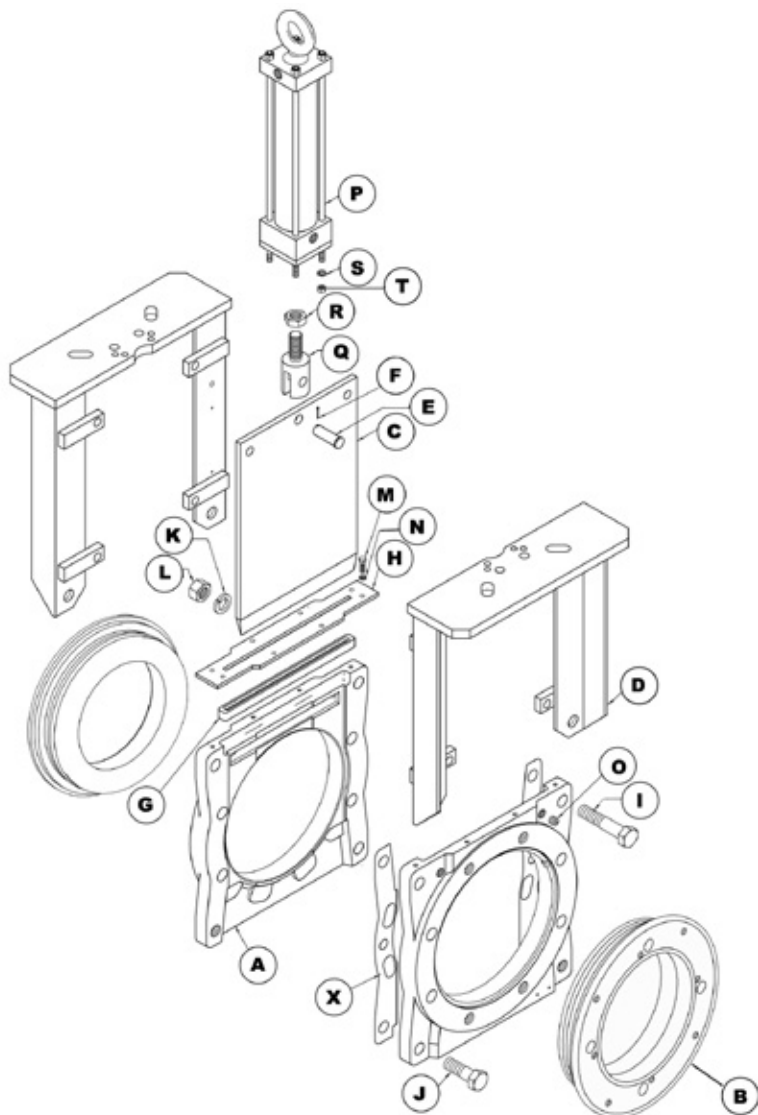
KGD-BG PARTS LIST

Item	Description	Qty req	Item	Description	Qty req
A	Housing	1	P	Bevel gear	1
B	Mark III sleeve	2	Q	Stem assembly	1
C	Gate	1	R	Stem nut	1
D	Actuator frame	2	S	Base mounting hex screw	4
E	Clevis pin	1	T	Base mounting lockwasher	4
F	Cotter pin	1	U	Base mounting flat washer	4
G	Secondary seal	1	V	Stem cover	1
H	Secondary seal retainer plate	1	W	End cap	1
I	Frame mounting hex screw	2	X	Body gasket	2
J	Housing hex screw	2	Y	Travel limiter	1
K	Frame mounting lockwasher	2	Z	Lockwasher	1
L	Frame mounting nut	2	AA	Travel limit screw	1
M	Retainer mounting hex screw	-	BB	Handwheel	1
N	Retainer mounting lockwasher	-	CC	Yoke	1
O	Flush plug	4	DD	Stem nut mounting screw	6
			KGD4 alternate mounting		
			EE	Adapter plate	1
			FF	Adapter plate mounting screw	4

CLARKSON SLURRY KNIFE GATE VALVES

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FIGURE 13 - KGD-HC EXPLODED VIEW



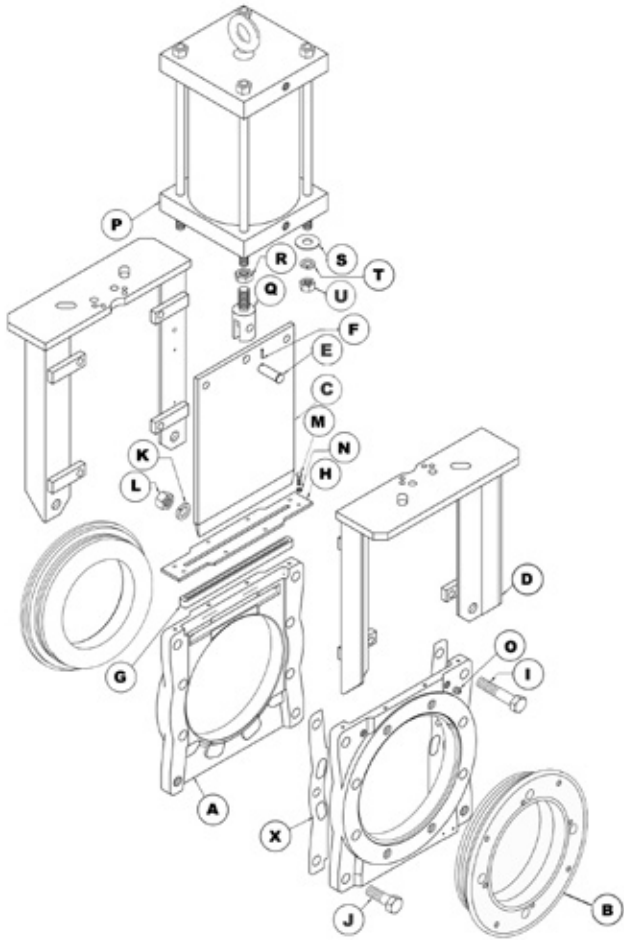
KGD-HC PARTS LIST

Item	Description	Qty req	Item	Description	Qty req
A	Housing	1	K	Frame mounting lockwasher	NPS 2 - 16 (DN 50 - 400) 2
B	Mark III sleeve	2			NPS 18 - 24 (DN 450 - 600) 4
C	Gate	1	L	Frame mounting nut	NPS 2 - 16 (DN 50 - 400) 2
D	Actuator frame	2			NPS 18 - 24 (DN 450 - 600) 4
E	Clevis pin	1	M	Retainer mounting hex screw	-
F	Cotter pin	1	N	Retainer mounting lockwasher	-
G	Secondary seal	1	O	Flush plug	4
H	Secondary seal retainer plate	1	P	Hydraulic cylinder	1
I	Frame mounting hex screw	NPS 2 - 16 (DN 50 - 400) 2	Q	Yoke	1
		NPS 18 - 24 (DN 450 - 600) 4	R	Jam nut	1
J	Housing hex screw	NPS 2 - 16 (DN 50 - 400) 2	S	Cylinder mounting lockwasher	4
		NPS 18 - 24 (DN 450 - 600) 4	T	Cylinder mounting nut	4

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FIGURE 14 - KGD-AC EXPLODED VIEW



KGD-AC PARTS LIST

Item	Description	Qty req	Item	Description	Qty req
A	Housing	1	K	Frame mounting lockwasher	NPS 2 - 16 (DN 50 - 400) 2
B	Mark III sleeve	2			NPS 18 - 24 (DN 450 - 600) 4
C	Gate	1	L	Frame mounting nut	NPS 2 - 16 (DN 50 - 400) 2
D	Actuator frame	2			NPS 18 - 24 (DN 450 - 600) 4
E	Clevis pin	1	M	Retainer mounting hex screw	-
F	Cotter pin	1	N	Retainer mounting lockwasher	-
G	Secondary seal	1	O	Flush plug	4
H	Secondary seal retainer plate	1	P	Air cylinder	1
I	Frame mounting hex screw	NPS 2 - 16 (DN 50 - 400) 2	Q	Yoke	1
		NPS 18 - 24 (DN 450 - 600) 4	R	Jam nut	1
J	Housing hex screw	NPS 2 - 16 (DN 50 - 400) 2	S	Cylinder mounting flatwasher	4
		NPS 18 - 24 (DN 450 - 600) 4	T	Cylinder mounting lockwasher	4
			U	Cylinder mounting nut	4

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