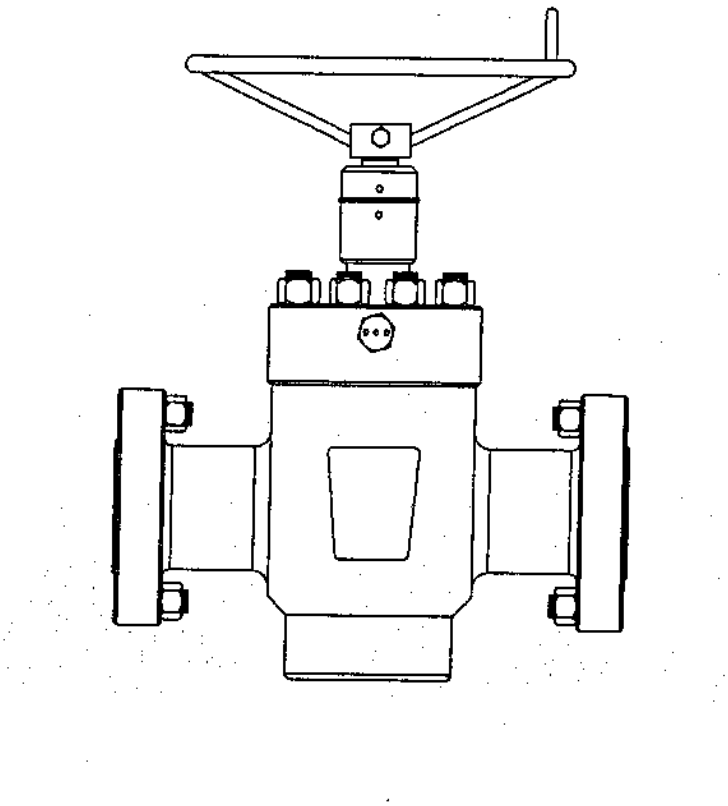
QUALITY OIL TOOLS, INC.

P.O. BOX 718
1927 HWY 90 WEST
JENNINGS, LA 70546
P 337.616.3300
F 337.616.3299

MAINTENANCE AND OPERATION MANUAL

TYPE 'QFC' GATE VALVES



DISCLAIMER

Any recommendations for use, oral or written, shall be considered advisory in content and as such, Quality Oil Tools, Inc. shall not be held liable under any warranty, expressed or implied, should this product not perform under conditions other than its intended use as a fluid gate valve device.

Quality Oil Tools, Inc. shall in no way be liable for damages incurred while using this product.

PRECAUTIONS

This product is designed for use under high pressure conditions, and as such, extreme caution should always be taken when servicing, operating or testing this equipment

Never attempt to disassemble a gate valve assembly until all pressure has been released from the body cavity.

Always be sure when pressure testing any product that all air has been purged from the system.

Do not approach any equipment for visual inspection until a suitable pressure stabilization period has been allowed.

Always use suitable protective equipment when performing any maintenance or testing.

Always use caution when servicing this equipment as the retained fluid may present a H2S gas hazard.

INTRODUCTION

The 'QFC' Type Gate Valve is a full-bore through conduit non-rising stem gate valve. It is designed and manufactured in accordance with American Petroleum Institute-API-6A, NACE MR-01-75 for H2S Service, and all applicable industry standards at the time of manufacture.

As with any pressure containing equipment, the Type 'QFC' Gate Valve is subject to wear and eventual failure. Periodic disassembly and inspection is required and should be left to a qualified technician.

Every precaution has been taken to ensure that the highest quality product has been provided for use. Any question or correspondence should be directed to:

Quality Oil Tools, Inc.
P. O. Box 718
Jennings, Louisiana 70546
Telephone: (337) 616-3300
Fax: (337) 616-3299
E-mail: garyc@qualityoiltools.com

Table of Contents

I. PERIODIC MAINTENANCE

A. Lubrication

For normal operation (-20ºF to 250ºF) use Chemola Desco 960 or equivalent in the body cavity and stem bearing cap.

For continuous service below 0ºF use low temperature grease such as "arctic grease" LL1600A or equivalent in the body cavity and stem bearing cap.

These grease formulations are available from:

Quality Oil Tools, Inc.
P. O. Box 718
Jennings, Louisiana 70546
Telephone: (337) 616-3300
Fax: (337) 616-3299
E-mail: garyc@qualityoiltools.com

B. Lubrication Chart

Bore Size (in)	Pressure Rating	Lubricant Weight (lb.)
2-1/16	All	2.1
2-9/16	To 10,000	3.4
2-9/16	15,000	5.4
3-1/16	To 10,000	5.3
3-1/16	15,000	8.0
4-1/16	To 5,000	10.8
4-1/16	10,000	11.4
5-1/8	5,000	18.2
5-1/8	10,000	20.8

C. Body Cavity Lubrication

Normal Operating Conditions

Quality Oil Tools, Inc., recommends lubricating gate valves during assembly. When the gate valve has been in service for one month, ten (10) operating cycles (one cycle equals opening and closing the valve one time), or is removed from service, the body cavity should be lubricated as follows:

1. Remove the grease fitting cap located on the bonnet flange outside diameter.
2. Using either a bucket-type or handheld grease gun, connect it to the grease fitting.
3. Pump an appropriate amount of lubricant into the body cavity (see Lubrication Chart in Item B above).

Unusual Temporary Operating Conditions

If the valve has been subjected to cementing or acidizing through the bore, the following procedure should be performed:

1. Lubricate the valve body prior to placing it into service.
2. Flush the valve with an appropriate neutralizing fluid after it is removed from service.
3. Operate the valve with fresh water or an appropriate neutralizing fluid in the line.
4. Lubricate the valve cavity.

D. Thrust Bearing Lubrication

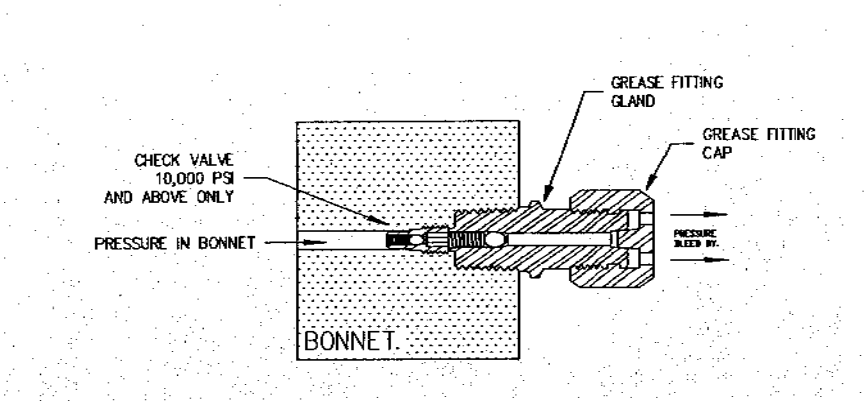
Lubricate thrust bearings once a month or as often as required to ensure smooth operation.

1. Connect the grease gun coupler to the grease fitting on the bearing cap.
2. Pump lubricant into the fitting until grease runs out of the bleed hole on the opposite side of the bearing cap under the O-ring trash seal.

II. BONNET GREASE FITTING REPLACEMENT

A. Valves 5,000 psi Working Pressure and Below

1. Backseat the valve.
    a. Completely close the valve.
    b. Loosen the bearing cap four complete counterclockwise turns using a 24” pipe wrench.
    c. Turn the hand wheel clockwise (closing direction) until the gate firmly contacts the cavity bottom and the stem moves outward, contacting the internal backseat shoulder.
    d. Bump the hand wheel clockwise.



2. Test the effectiveness of the backseat.
    a. Remove the cap on the grease fitting.
    b. Trip the ball in the grease fitting check valve by inserting a 1/8” diameter by 3/4” long pin into the run of the fitting.
    c. Replace the grease cap and slowly turn it until the ball in the fitting is unseated and the backseating pressure is released.
    d. If pressure escapes quickly then stops, the backseat is effective. Proceed to step 3.
    e. If pressure continues to escape, the backseat is ineffective. Repeat steps 1 and 2. If the backseat will not seal then the grease fitting cannot be changed without isolating and removing all pressure from the valve.
3. Remove the grease fitting from the valve bonnet.
4. Install a new grease fitting.

B. Valves 10,000 psi Working Pressure and Above

Note: These valves have a check valve beneath the bonnet grease fitting.

1. Remove the grease fitting cap.
2. Trip the ball into the grease fitting check valve by inserting a 1/8" diameter by 3/4" long pin into the run of the fitting.
3. Replace the grease cap and slowly turn it until it is unseated by the pin.
4. If pressure escapes quickly then stops, the check valve is holding pressure. The grease fitting can be removed and a new grease fitting can be installed.
5. If pressure continues to escape, the check valve is leaking. DO NOT remove the grease fitting. Backseat the valve. If the backseat will not seal, the grease fitting cannot be changed without removing all pressure from the valve.

a. Backseat the valve.
    1) Close the valve.
    2) Loosen the bearing cap four complete turns with a 24" pipe wrench.
    3) Turn the hand wheel clockwise (closing direction) until the gate contacts the cavity bottom and the stem moves outward contacting the internal backseat shoulder.
    4) Bump the hand wheel clockwise.

b. Tighten the grease fitting cap to unseat the grease fitting check valve ball and release trapped pressure.
c. Remove the grease fitting from the valve bonnet outside diameter.
d. Replace the buried check valve using 1/4" Allen wrench.
e. Clean the female check valve and grease fitting threads.
f. Install a new check valve.
g. Install a new grease fitting.

III. Stem Shear Pin and Thrust Bearing Replacement

Note: Stem thrust bearings can be replaced while valve is under pressure.

A. Removal of Thrust Bearings

1. Loosen the bearing cap using a 24" pipe wrench. After two or three turns the cap should rotate freely by hand.

CAUTION: If the cap does not rotate freely after three turns, the packing gland may be moving outward with the bearing cap. DO NOT remove cap. Tighten it and contact a Quality Oil Tools, Inc., representative.

2. If the bearing cap rotates freely, remove it from the bonnet.
3. Use a punch to remove the stem shear pin from the stem adapter, ensuring the adapter is not damaged.
4. Remove the adapter from the stem.
5. Remove both sets of bearings and bearing races from the stem adapter.
6. Discard pitted or damaged bearings and/or races.
7. Replace the stem adapter if either bearing surface on the adapter shoulder is damaged.

B. Installation of New Thrust Bearings

1. Remove bearings from the protective package.
2. Pack bearings with grease.
3. Place each bearing between a pair of carefully cleaned races.
4. Carefully clean the stem adapter.
5. Install one set of bearings and races over the bottom of the adapter and one set over the top of the adapter. The adapter O-ring may be removed temporarily to allow the installation of the top bearing and race assembly.
6. Insert the steam adapter over the end of the stem and align the adapter pin hole with the stem hole.
7. Use a punch to drive the stem pin inward. Ensure it does not protrude over outside diameter of the adapter shoulder. DO NOT strike bearings, races or stem adapter with hammer or punch.
8. Replace the stem adapter O-ring if necessary.
9. Inspect the bearing cap to ensure that an extra race is not held inside.
10. Clean the bearing cap and lubricate threads.
11. Install the cap using a 24” pipe wrench.
12. Rotate the stem adapter counterclockwise until the gate is not touching the body bottom. This will confirm that the stem backseating shoulder is not contacting the bonnet shoulder.
13. Inject grease through the bearing cap grease fittings with a handheld grease gun until grease passes through the bleed port.

IV. Stem Packing Replacement with Pressure in Valve

A. Removal of Stem Packing

1. Backseat the valve.
    a. Fully close the valve.
    b. Loosen the bearing cap four counterclockwise turns using a 24" pipe wrench.

Caution: If the bearing cap does not rotate freely after three (3) turns, the packing gland may be moving outward with the cap. DO NOT remove the cap. Tighten it and contact a Quality Oil Tools, Inc., representative.

    c. Turn the hand wheel clockwise (closing direction) until the gate contacts the cavity bottom and the stem moves outward, touching the internal backseat shoulder of the bonnet. Force the gate against the cavity bottom several times to remove debris from between the stem backseat and bonnet.
    d. Bump the hand wheel clockwise.
2. Test backseat effectiveness.
    a. Valves 5,000 psi working pressure and below.
        1) Remove the bonnet grease fitting cap on the bonnet cap outside diameter.
        2) Trip the ball in the grease fitting check valve by inserting a 1/8" diameter by 3/4" long pin into the run of the fitting.
        3) Replace the cap slowly until the ball is unseated and trapped pressure is released.
        4) If pressure quickly escapes then stops, the backseat is effective. Proceed to step 3, "Remove hand wheel."
        5) If pressure continues to escape, the backseat is ineffective. Repeat steps 1a-d and 2a above. If the backseat will not seal, the stem packing cannot be changed without isolating and removing all valve pressure.
    b. Valves 10,000 psi and above.

NOTE: These valves have a "buried" check valve beneath the bonnet grease fitting.

1) Remove the grease fitting cap on the bonnet flange outside diameter.
2) Trip the ball in the grease fitting check valve by inserting a 1/8" diameter by 3/4" long pin into the grease fitting and slowly screw on the grease cap.
3) If pressure quickly escapes then stops, the "buried" check valve is holding pressure. Proceed to step 5.
4) If pressure continues to escape, the "buried" check valve is leaking and the backseat is ineffective. Repeat steps 1 and 2. If pressure continues to escape, the stem packing cannot be changed without removing all valve pressure.
5) Remove the grease fitting.
6) Remove the protective collar from the check valve unseating tool.
7) Install the check valve unseating tool in the bonnet grease fitting preparation.
8) Slowly turn the tool clockwise until the ball in the "buried" check valve is unseated and trapped pressure is released.
9) If pressure escapes quickly then stops, the backseat is effective. Proceed to step 12.
10) If no pressure escapes, the backseat is effective but the "buried" check valve is defective. Proceed to step 12.
11) If pressure continues to escape, the backseat is ineffective. Close the check valve by turning the unseating tool counterclockwise. Remove it and repeat steps 1 and 2. If pressure continues to escape, the stem packing cannot be changed without removing all valve pressure.
12) Remove the check valve unseating tool.
13) If the "buried" check valve is defective, replace it using a 1/4" Allen wrench.
14) Reinstall the grease fitting.

3. Remove the hand wheel.
4. Remove the bearing cap from the bonnet in a clockwise direction.
5. Using a punch, drive the stem shear pin from the stem adapter without damaging it.
6. Remove the adapter from the stem.
7. Remove both sets of bearings and bearing races from the stem adapter without damaging it.
8. Loosen the packing gland (clockwise direction) with a 24" pipe wrench.

9. Ensure the bonnet neck's outside diameter threads are not damaged.
10. Remove the packing gland.
11. Remove the stem packing by pumping grease through the bonnet grease fitting. Pull the packing with a corkscrew if necessary. Do not damage the stem or packing bore.

B. Installation of New Packing

1. Clean the bonnet packing bore.
2. Inspect the stem, packing bore and packing to ensure surfaces are free of burrs, pits and damage.
3. Apply a light coat of grease to the stem, packing bore, inside and outside diameters of the stem packing.
4. Install a new packing over the end of the stem so that the rounded Teflon nose faces the valve body.
5. Push the packing into the packing bore with the packing gland.
6. Remove the packing gland and lubricate the outside diameter of the stem.
7. Install the packing gland with a 24" pipe wrench. Apply approximately 200 ft-lb of torque, ensuring the bonnet threads are not damaged.
8. Inspect bearings and bearing races on the stem adapter for pits, scores and cracks. Replace damaged parts.
9. Pack the bearing with grease.
10. Place each bearing between a pair of carefully cleaned races.
11. Carefully clean the stem adapter.
12. Install one set of bearings and races over the bottom of the adapter and another set over the top of the adapter. The adapter O-ring may be temporarily removed to install the top bearing and race assembly.
13. Insert the stem adapter over the end of the stem and align the adapter pinhole with the stem hole.
14. Using a punch, drive in the stem pin and ensure it does not protrude over the outside diameter of the adapter shoulder. DO NOT strike bearings, races or stem adapter with hammer or punch.
15. Replace the stem adapter O-ring if necessary.
16. Inspect the bearing cap to ensure that an extra race is not held inside.
17. Clean the bearing cap and lubricate threads.
18. Install the bearing cap with a 24" pipe wrench, using 50-100 ft-lb of torque.

19. Rotate the adapter counterclockwise to lift the gate off the body bottom. This will confirm that the stem backseating shoulder is not contacting the bonnet shoulder.
20. Inject grease through the bearing cap grease fittings until excess grease passes through the bleed port.
21. Lubricate the body cavity per Part I.

V. GATE AND SEAT REPLACEMENT

A. Gate and Seat Disassembly – Manual Valve

1. Isolate the valve from line pressure and release all pressure from the body cavity. Open and close the valve several times to release pressure.
2. Open the valve to ensure the stem is completely within the gate neck.
3. Remove bonnet nuts.
4. Turn the hand wheel clockwise to raise the bonnet from the body until the bonnet face clears the body.
5. Place bonnet nuts as spacers on each side of the body cavity between the bonnet and body.
6. Turn the hand wheel counterclockwise to pull out the gate.
7. Lift up on the bonnet assembly to remove the gate from the body cavity. If the gate cannot be easily removed, repeat steps 4 through 7.
8 The gate may be removed from the stem with clockwise motion.
9. Remove seats, retainer plates and gate guides from the body cavity.
10. Remove body bushings, prying them with a screwdriver if necessary.
11. Clean the body cavity and all parts thoroughly with a suitable solvent, then wipe them clean.

B. Gate and Seat Assembly – Manual Valve

1. Inspect all parts for damage.
    a. Check retainer plates to ensure they are not bent, twisted or distorted. Solid material should not be built up on the ends.
    b. Check seals for cuts or damage.
    c. Check sealing surfaces on the gate, body bushings, seats, stem and valve body. Determine which parts need to be replaced.
    d. Ensure the body cavity is free of foreign matter.
2. Replace damaged and worn parts with original parts.
3. Clean and lightly lubricate all parts and both body bushing cavities.

4. Install body bushings with new seal rings into the cavities with seal rings against the valve body.
5. Replace seat seal rings and install one seat in each retainer plate. The rings must face toward the body bushings and away from the gate.
6. Place retainer plate assemblies in the valve body with the beveled edges on the retainer plates facing the valve body seat pockets and the seal rings touching the body bushing faces. Retainer plates should not protrude above the body face. When installed, retainer plates must be square with seats and body installation for the gate to slide freely.
7. Grease the gate and slide it into the body between the retainer plate assemblies. Do not pinch seat-to-body seals or apply impact loads to parts. Tap lightly on top of the gate to prevent seat ring damage. Tap the gate down until the top of the threaded neck is 1/2" above the body bonnet face.
8. Install gate guides.
9. Pack the body cavity with grease.
10. Remove the bonnet gasket from the bonnet groove.
11. Clean grooves and sealing surfaces of the body and bonnet.
12. Apply a thick film of grease to the bonnet gasket and sealing groove.
13. Install a new bonnet gasket in the bonnet groove. Install new stem packing.
14. Install the bonnet over body studs.
    a. On valves 5,000 psi working pressure and below, rotate the bonnet so that bonnet locating pins in the body align with bonnet pin holes.
    b. On valves 10,000 psi working pressure and above, rotate the bonnet until the grease fitting is 90° from the gate valve bore.
15. Turn the hand wheel counterclockwise to fully thread the stem into the gate and pull the bonnet down over the studs.
16. Hand-tighten bonnet nuts.
17. Ensure the gate is not touching the valve cavity bottom. Rotate the hand wheel counterclockwise to move the gate away from the bottom.
18. Evenly tighten bonnet nuts. The raised bonnet on valves 10,000 psi and above will fully contact the body face when bonnet nuts are tight.
19. Lubricate the stem thrust bearing by pumping grease through the fitting on the bearing cap until grease returns from the bleed hole on the opposite side of the bearing cap under the O-ring trash seal.
20. Lubricate the body cavity. Remove the grease fitting cap on the bonnet flange outside diameter. Connect a grease pump and inject grease.

C. Gate and Seat Disassembly - Hydraulically Actuated

1. Bleed off pressure in the valve body.

CAUTION: To prevent risk of injury, ensure there is no pressure in the valve before it is removed from the line or disassembled.

2. Turn the hand wheel and locking screw (manual override stem) counterclockwise until they stop.
3. Apply 250-300 psi actuator pressure to the OPEN port to open the valve.
4. Bleed the actuator and open and close hoses to 0 psi.
5. Remove hydraulic lines from the valve.
6. Remove the valve hand wheel.
7. Remove bonnet nuts.
8. Pull straight up on the bonnet and actuator assembly to remove the gate. Light tapping with a hammer on the outside diameter of the bonnet can help break the bond between the bonnet face and valve body.
9. Place the bonnet and actuator assembly horizontally in a clean area.
10. Connect the hydraulic hose to the CLOSE port of the actuator and apply 200-300 psi to extend the gate and stem.
11. Bleed the actuator to 0psi.
12. Remove the gate from the stem by rotating the gate clockwise.
13. Remove seats, guides and retainer plates from the valve body.
14. Remove body bushings. Pry with a screwdriver if necessary.
15. Thoroughly clean the body cavity and parts.

D. Gate and Seat Assembly – Hydraulically Actuated

1. Inspect parts for damage.
    a. Check retainer plates to ensure they are not bent, twisted or distorted. Solid material should not be built up on ends.
    b. Check seals for cuts or other damage.
    c. Check sealing surfaces on the gate, body bushings, seats, stem and valve body. Determine which parts need to be replaced.
    d. Ensure the body cavity is free of all foreign matter.
2. Replace damaged or worn parts.
3. Clean and lightly lubricate all parts and body bushing cavity.

4. Install body bushings with new seal rings into the body cavity with seal rings against the valve body.
5. Replace seat seal rings and install one seat in each retainer plate. Each ring must face toward the body bushing and away from the gate.
6. Place each retainer plate assembly in the valve body with the seal ring touching the body bushing face. Retainer plates must not protrude above the bonnet face. If they do, remove retainer plates, inspect valve cavity for foreign matter and reinstall. Beveled edges on the retainer plate must face toward the seat pockets of the valve body.
7. If the balance stem is scratched or damaged, it must be replaced. Use a punch to remove the pin attaching it to the gate.
8. Install a new balance stem on the gate.
    a. Align the holes in the lower gate neck and the lower stem.
    b. Insert a pin into the hole to hold the stem in place.
9. Grease and carefully install the gate between retainer plate assemblies. Lightly tap on top of the gate if necessary without damaging it until the top of threaded neck is 1/2" above the bonnet face of the body.
10. Install guides.
11. Pack the body cavity with grease.
12. Remove the bonnet gasket.
13. Clean gasket sealing surfaces on the body and bonnet.
14. Apply a thin film of oil to the bonnet gasket and sealing surfaces.
15. Install a new gasket on the valve body sealing surface. Install new stem packing.
16. Install the bonnet and actuator assembly on the valve body.
    a. Lift the bonnet and actuator assembly over the valve body.
    b. Install the stem into the gate by rotating the bonnet assembly counterclockwise until the stem shoulder stops on top of the gate neck. If necessary, remove bonnet studs to position the stem.
    c. Align the bonnet assembly with the valve body.
        1) For valves 5,000 psi working pressure and below, rotate the bonnet counterclockwise until pin holes in bottom of the bonnet are aligned with pins in the valve body. Next, rotate the bonnet 1/8" counterclockwise, then rotate the stem and bonnet assembly 1/8" clockwise so the stem shoulder is not touching the top of the gate.

2) For valves 10,000 psi working pressure and above, rotate bonnet counterclockwise until bolt holes in the bonnet are in alignment with bonnet studs or stud holes. Next, rotate bonnet 1/8" counterclockwise, then rotate stem and bonnet assembly 1/8" clockwise so the stem shoulder is not touching the top of the gate.

17. Bleed pressure from the hydraulic close line. Disconnect it from the actuator.
18. Push down on the actuator assembly until bonnet studs extend through the bonnet flange.
19. Hand-tighten bonnet nuts onto bonnet studs.
20. Evenly tighten bonnet nuts. The bonnet face should contact the valve body.

VI. HYDRAULIC PISTON AND ASSEMBLY

A. Disassembly of Hydraulic Piston and Cylinder Assembly

1. Bleed off pressure in the valve body.
2. Turn the hand wheel and manual locking screw (override stem) counterclockwise until they stop. This will allow full piston travel.
3. Apply 250-300 psi actuator pressure to the OPEN port to open the valve.
4. Bleed the actuator and hydraulic open and close lines to 0 psi.
5. Remove hydraulic lines from valve.
6. Remove the hand wheel from the manual locking screw.
7. Remove the two set screws from the upper cylinder head.
8. Using a pipe wrench, turn the adjusting nut counterclockwise with the locking screw in place and remove the nut from the actuator.
9. Using a box wrench, remove nuts from cylinder head studs.
10. Remove the upper cylinder head by lifting straight up to clear the studs.
11. Using a wrench, turn cylinder head studs counterclockwise to remove them.
12. Remove the cylinder from the actuator assembly by lifting it straight up. DO NOT damage the inside cylinder surface.
13. Unscrew the set screw and remove the centering pin from the gate stem.
14. Remove the piston lock nut with counterclockwise rotation.
15. Remove the piston with counterclockwise rotation.
16. Remove the lower cylinder head with counterclockwise rotation.
17. Remove the packing gland with counterclockwise rotation.

18. Stem packing can be pushed out by injecting grease into the grease fitting on the bonnet flange. If stem packing is removed with a sharp object, do not scratch the stem or packing seal area of the bonnet.

B. Assembly of Hydraulic Piston and Cylinder Assembly

1. Clean all parts for inspection.
2. Inspect all parts for any damage or wear, including sealing surfaces for scratches and seals for cuts.
3. Replace damaged or worn parts with new parts.
4. Replace stem packing by applying a light coat of oil to the stem and stem packing, then push packing onto the stem past bonnet threads with the rounded end of packing facing the valve body.
5. Tap the top of the stem with a rubber hammer until the balance stem seats in the bottom of the valve cavity and stem movement stops. DO NOT damage the top of stem.
6. Rotate the stem counterclockwise until it contacts the top of the gate and rotation stops, then turn the stem 1/8" clockwise.
7. Keep the stem from turning while performing steps 8 through 17.
8. Apply a light film of oil on the stem.
9. Install O-rings on the packing gland.
10. Install the packing gland using clockwise rotation, applying 100-150 ft-lb of torque to the seat retainer.
11. Apply a light film of oil to the outside surface of the packing gland and the inside diameter of the lower cylinder head.
12. Install the lower cylinder head on the bonnet with clockwise rotation, applying 150-200 ft-lb of torque to seat the cylinder head.
13. Install the O-ring on the outside diameter of the lower cylinder head.
14. Install the O-ring on the outside diameter of the piston.
15. Install the piston onto the stem with clockwise rotation until the piston contacts the top of the packing gland, then rotate the piston 1/4" clockwise to lift the gate or balance stem off the bottom of the valve cavity.
16. Install the piston lock nut on the stem with clockwise rotation, applying 50-100 ft-lb of torque to seat the lock nut.
17. If the stem turned during assembly, remove the piston and repeat steps 6 through 17.
18. Install the centering pin on top of the stem.
19. Install the set screw in the centering pin and tighten with clockwise rotation to lock the centering pin in place. Keep the piston from rotating.

20. Apply a light film of oil on the inside diameter of the cylinder. Install the cylinder onto the lower cylinder head. Keep the piston from rotating.
21. Install cylinder head studs into the lower cylinder head with clockwise rotation. Stud bottoms should be flush with the cylinder flange bottom.
22. Install the upper cylinder head over cylinder head studs.
23. Install cylinder head nuts on cylinder head studs with clockwise rotation, applying 100-150 ft-lb torque.
24. Install O-rings on the outside diameter of the adjusting nut.
25. Apply a light film of oil on the outside diameter of the adjusting nut and inside diameter of the upper cylinder head.
26. Install the adjusting nut and align the gate and seat assembly.

a. Valves with manual locking screws or override stem.

1) Install the adjusting nut into the upper cylinder head with eight clockwise rotations.
2) Install adjusting nut set screws into the upper cylinder head. Do not tighten set screws.
3) Turn the locking screw counterclockwise until rotation stops.
4) Connect hydraulic lines to actuator.
5) Apply no more than 300 psi hydraulic pressure to the OPEN port until the piston moves out and stops.
6) Maintain pressure and turn the locking screw clockwise into the adjusting nut until it contacts the piston/centering pin.
7) Reduce hydraulic opening pressure to 0 psi.
8) Turn the locking screw clockwise until the gate bore is aligned with the body bore.
9) Turn the locking screw counterclockwise until it is fully retracted.
10) Turn the adjusting nut clockwise until it contacts the piston.
11) Tighten set screws to lock the adjusting nut in place.

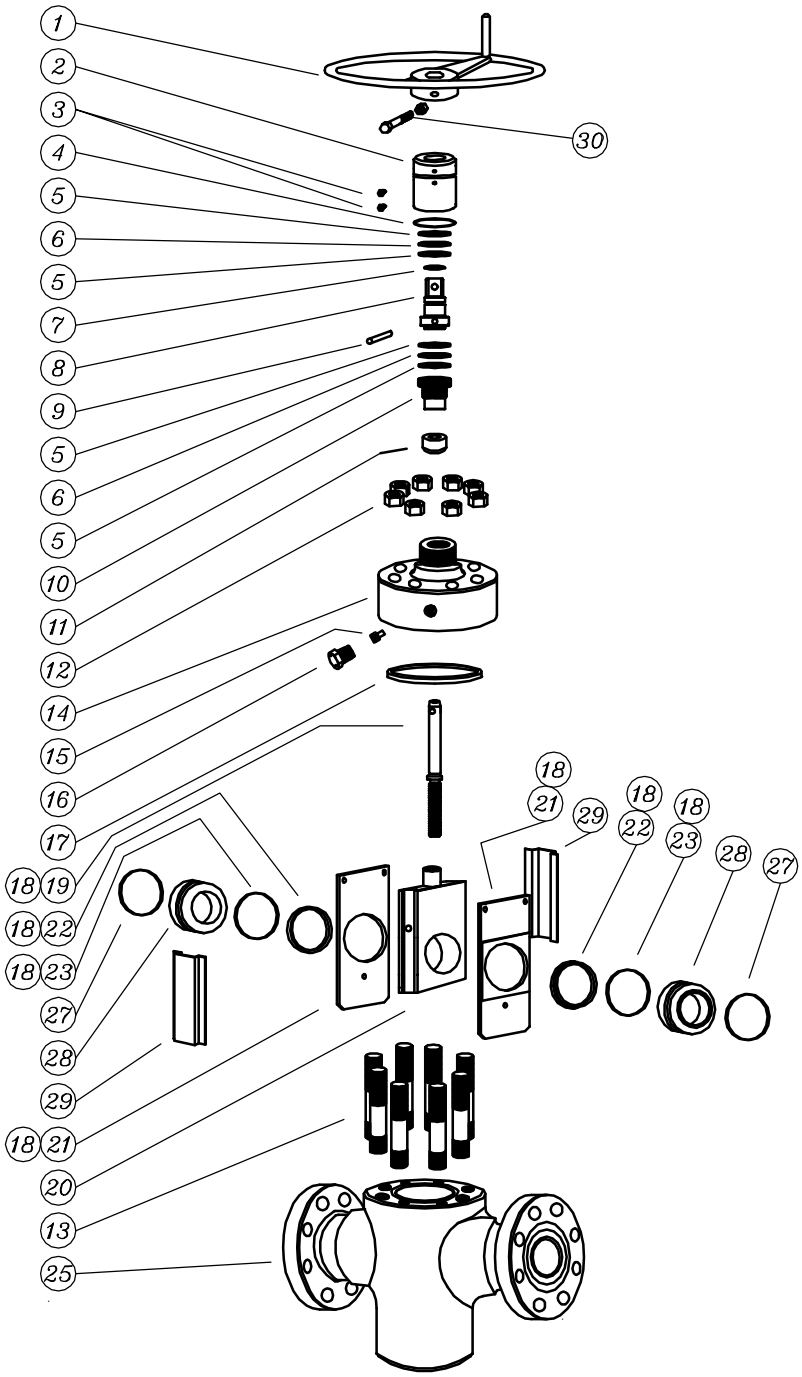
b. Valves without manual locking screws.

1) Install the adjusting nut into the cylinder head by rotating it clockwise until it stops.
2) Install adjusting nut set screws. Do not tighten them.
3) Connect hydraulic lines to actuator.
4) Apply up to 300 psi hydraulic pressure to the OPEN port until the piston moves out and stops.
5) Ensure the gate bore is aligned with the body bore.
6) If bores align, proceed to step 8.

7) If bores do not align, reduce OPEN pressure to 0 psi; turn the adjusting nut 1/4" counterclockwise; reapply 300 psi hydraulic pressure to the OPEN port. If bores align, proceed to step 8, else repeat step 7.
8) Tighten set screws to lock the adjusting nut in place.

VII. TROUBLESHOOTING

Problem	Cause	Solution
Fluid leaks past the gate and seat assembly	Gate and seat assembly is worn. Hand wheel is not backed off.	Replace the gate and seat assembly. Back hand wheel off ¼ turn
Fluid leaks around the valve stem.	Stem packing is worn.	Replace the stem packing.
Fluid leaks at the bonnet flange.	Bonnet seal ring is worn. Loose bonnet nuts. Bonnet or body ring groove is damaged.	Replace the bonnet seal ring. Retighten. Return valve to QOT for repair.
Fluid leaks at the bonnet flange.	Check valve inside the grease fitting is worn.	Replace the grease fitting.
Handwheel is hard to turn.	Thrust bearings have lost lubricant. Thrust bearings are corroded. Gate and stem threads have lost lubricant. Stem shear pin is sheared.	Lubricate the thrust bearings. Replace the thrust bearings. Lubricate the gate and stem through the bonnet grease fitting. Replace the stem shear pin.
Hand wheel turns but valve does not open or close.	Stem shear pin is sheared.	Replace the stem shear pin.



ITEM	QTY	DESCRIPTION
1	1	HANDWHEEL, 18"
2	1	BEARING CAP
3	2	GREASE FITTING
4	1	O-RING
5	4	BEARING RACE
6	2	THRUST BEARING
7	1	O-RING
8	1	STEM ADAPTER
9	1	PIN, STEM ADAPTER
10	1	PACKING GLAND
11	1	PACKING, STEM
12	8	NUT, BONNET
13	8	STUD, BONNET
14	1	BONNET
15	1	CHECK VALVE
16	1	BODY GREASE FITTING
17	1	BONNET SEAL
18	*	GATE & SEAT ASSY
19	1	OPERATING STEM
20	1	GATE
21	2	RETAINER PLATES
22	2	SEAT RING
23	2	SEAL, SEAT RING
24	1	LOCATING PIN
25	1	BODY
26	1	NAME PLATE
27	2	SEAL, BODY BUSHING
28	2	BODY BUSHING
29	2	GATE GUIDES
30	1	HANDWHEEL BOLT ASSY

MATERIAL	DATE 1-06-05	QUALITY OIL TOOLS, INC. JENNINGS, LA	THIS DOCUMENT IS THE CONFIDENTIAL PROPERTY OF QUALITY OIL TOOLS, INC. AND IS SUBMITTED FOR RESTRICTED USE ONLY. NO PART MAY BE COPIED WITHOUT THE EXPRESS WRITTEN CONSENT OF THE OWNER.
	DR. BY TE		
ALL DIMENSIONS IN INCHES	APPR. BY DS	DESCRIPTION PARTS DIAGRAM TYPE 'QFC' MANUAL GATE VALVE	
UNLESS NOTED: X.X ±.02 X.XX ±.010 X.XXX ±.005 BREAK CORNERS .030 MAX. RAD. .062 FRACTIONAL ±1/32	REV. NO.		
	PART NO. QFC DIAGRAM		

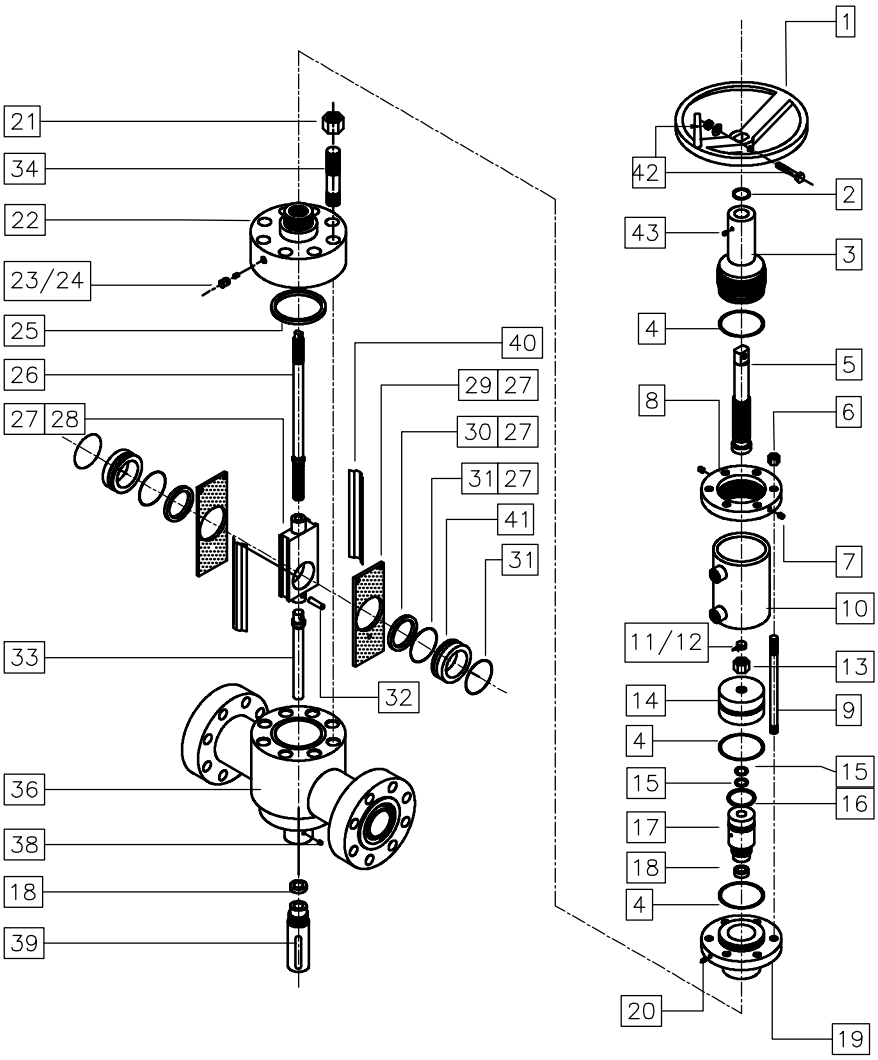
TYPE 'QFC' MANUAL GATE VALVE PARTS

ITEM	QTY	SPARES	DESCRIPTION	2-1/16" 5M	2-1/16" 10M	2-1/16" 15M	3-1/8" 5M	3-1/16" 10M	3-1/16" 15M	4-1/16" 5M	4-1/16" 10M	4-1/16" 15M
1	1		HANDWHEEL	19937-01	19937-01	19937-01	19937-03	19937-03	19937-03	19937-03	19937-03	20774-02
2	1		BEARING CAP	19106-01	19106-01	19106-01	19106-01	19106-01	678472-01	19106-01	19312-01	681111-01
3	1		FITTING, GREASE (BEARING	5929-05	5929-05	5929-05	5929-05	5929-05	5929-05	5929-05	5929-05	5929-05
4	1		O-RING, BEARING CAP	6227-43-38-50	6227-43-38-50	6227-43-38-50	6227-43-38-50	6227-43-38-50	6227-56-38-50	6227-43-38-50	6227-46-38-50	-
5	4		BEARING RACE, 1" STEM	19108-01	19108-01	19108-01	19108-01	19108-01	19310-02	19108-01	19310-01	19310-02
6	2		BEARING, 1" STEM THRUST	5931-09	5931-09	5931-09	5931-09	5931-09	5931-22	5931-09	5931-10	5931-22
7	1		O-RING, STEM ADAPTER	6227-27-01-70	6227-27-01-70	6227-27-01-07	6227-27-01-70	6227-27-01-70	6230-08-01-70	6227-27-01-70	6230-02-01-70	6854-48
8	1		ADAPTER, STEM	20871-01	20871-01	20871-01	20871-01	20871-01	654130-01	20871-01	20873-01	681112-01
9	1		PIN, STEM	21812-14	21812-14	21812-14	21812-14	21812-14	21812-60	21812-14	21812-15	21812-60
10	1		GLAND, PACKING	20874-01	20874-01	20874-01	20874-01	20874-01	677509-01	20874-01	690169	690164
11	1		PACKING, STEM	686598-01	686598-01	686598-01	686598-01	686598-01	686598-12	686598-01	686598-02	686598-12
12	8		NUT	5926-09-10	5926-25-10	5926-23-10	5926-25-10	807-039-04	18573-06-10	5926-23-10	5926-27	5926-28-10
13	8		STUD (BONNET)	5912-67-10	5914-18-10	5915-67-10	5914-21-10	793-3905-4	5914-95-10	5915-67-10	6306-22-10	6/10/7311
14	1		BONNET	33297-01-01	33297-04-01	33297-05-01	33297-09-01	33297-10-01	677513-02-01	33297-14-01	33298-02-01	682254-01
15	0		CHECK VALVE	-	678627-01-99	-	-	678627-01-99	-	-	678627-01-99	-
16	1		FITTING, GREASE	5929-55	5929-55	HP-12S9-FO	5929-25	5929-55	HP-12S9-FO	5929-55	5929-55	HP-12S9-FO
17	1	*	GASKET, BONNET	21793-11	19141-07	19141-07	21793-27	19141-10	44671-04	21794-03	19141-11	19141-15
18	*	*	GATE & SEAT ASSY	21353-02-13	21353-02-13	21353-02-13	21353-03-07	21353-03-07	21353-25-34	21353-04-11	21353-04-12	21353-04-42
19	1		STEM, OPERATING	29381-01-99	29381-01-99	29381-01-99	29381-03-99	29381-03-99	688590-01-99	29381-04-99	38228-01-99	682564-01-99
20	1	*	GATE	23042-02	23042-02	23042-02	23247-02	23247-02	23247-02	23248-01	23249-01	682255-02
21	2		RETAINER PLATE	611404-01	611404-01	611404-01	611404-03	611404-03	611404-15	611404-05	611404-17	682257-01
22	2	*	SEAT RING	44844-06	44844-06	44844-06	44783-06	44783-06	678353-01	610482-03	610978-02	611535-02
23	2	*	SEAL RING, PTFE	610500-23	610500-23	610500-23	610500-50	610500-50	610500-55	610500-47	610500-47	610500-58
24	2		PIN, BONNET LOCATING	21813-06	-	-	21813-06	-	-	21813-06	-	-
25	1		BODY	694812-01-01	235000-01-01	610591-02	694812-02-01	694480-01	44737-01	31081-01	694405-01	611288-03
26	1		NAME PLATE	19052-01	19052-01	19052-01	19052-01	19052-01	19052-01	19052-01	19052-01	19052-01
27	2	*	SEAL, BODY BUSHING	610500-23	610500-23	610500-23	610500-50	610500-50	610500-55	610500-47	610500-67	610500-58
28	2	*	BODY BUSHING	630691-01	630691-01	630691-01	630690-01	630469-03	630471-02	630472-02	610774-02	630706-02
29	2		GATE GUIDE	694811-01	694811-01	694811-01	694482-01	694482-01	44640-01	694816-01	694406-01	611045-01
30	1		HANDWHEEL BOLT ASSY	001-0204	001-0204	001-0204	001-0204	001-0204	001-0204	001-0204	001-0204	001-0204
31	1		PACKING, BACK-UP	-	-	691889-01	-	-	691889-03	-	-	691889-03
32	16		SCREW, SOCKET HEAD CAI	-	-	-	-	-	067-34019-042	-	-	-
33	1		O-RING, STEM EXTENSION	-	-	-	-	-	702645-21-81	-	-	-
34	1		PIN, STEM EXTENSION	-	-	-	-	-	21812-61	-	-	-

35	1		EXTENSION, STEM	-	-	-	-	-	654129-01	-	-	-
36	1		SCREW, GREASE, AUTOCL/	-	-	-	-	-	-	-	-	HP-1259-F0

* INCLUDES (1) #20, (2) #21, (2) #22, (2) #23

18	*	*	GATE & SEAT ASSY



ITEM	QTY	DESCRIPTION
1	1	HANDWHEEL
2	1	O-RING
3	1	ADJUSTING NUT
4	3	O-RING
5	1	LOCKING SCREW
6	6	NUT, CYLINDER HEAD
7	2	SET SCREW
8	1	CYLINDER HEAD, UPPER
9	6	STUD, CYLINDER HEAD
10	1	CYLINDER
11	1	CENTERING PIN
12	1	SET SCREW
13	8	NUT, PISTON LOCK
14	1	PISTON
15	1	O-RING
16	1	O-RING
17	1	GLAND
18	2	STEM PACKING
19	1	CYLINDER HEAD, LOWER
20	1	RELIEF VALVE
21	8	NUT, BONNET
22	1	BONNET
23	1	GREASE FITTING
24	1	CHECK VALVE
25	1	BONNET GASKET
26	1	STEM
27	*	GATE & SEAT ASSEMBLY
28	1	GATE
29	2	RETAINER PLATE
30	2	SEAT RING
31	2	SEAL RING
32	1	PIN
33	1	LOWER (BALANCE) STEM
34	8	STUD, BONNET
35	2	LOCATING PIN, BONNET
36	1	BODY
37	1	NAME PLATE
38	1	PLUG, PIPE
39	1	STEM PROTECTOR
40	2	GATE GUIDE
41	2	BODY BUSHING
42	1	HANDWHEEL BOLT ASSY

MATERIAL	DATE 1-06-05	QUALITY OIL TOOLS, INC. JENNINGS, LA	THIS DOCUMENT IS THE CONFIDENTIAL PROPERTY OF QUALITY OIL TOOLS, INC. AND IS SUBMITTED FOR RESTRICTED USE ONLY. NO PART MAY BE COPIED WITHOUT THE EXPRESS WRITTEN CONSENT OF THE OWNER.
	DR. BY TE		DESCRIPTION
ALL DIMENSIONS IN INCHES	APPR. BY DS		PARTS DIAGRAM
UNLESS NOTED: X.X ±.02 X.XX ±.010 X.XXX ±.005 BREAK CORNERS .030 MAX. RAD. .062 FRACTIONAL ±1/32	REV. NO.		TYPE 'QFC'
	PART NO. QFC HYD DIAG		HYDRAULIC GATE VALVE

TYPE 'QFC' HYDRAULIC GATE VALVE PARTS

ITEM	QTY	SPARES	DESCRIPTION	2-1/16" 5M	2-1/16" 10M	2-1/16" 15M	3-1/8" 5m	3-1/16" 10M	3-1/16" 15M	4-1/16" 5M	4-1/16" 10M	4-1/16" 15M
1	1		HANDWHEEL	19937-01	19937-01	19937-01	19937-03	19937-03	19937-03	19937-03	19937-03	20774-02
2	1	1	O-RING, STEM ADAPTER	6227-27-01-70	6227-27-01-70	6227-27-01-70	6227-27-01-70	6227-27-01-70	6227-28-20-70	6227-27-01-70	6227-27-01-70	6227-28-20-70
3	1		ADJUSTING NUT	22936-01	22936-01	22936-01	22937-01	22948-01	689724-01	22938-01	22850-01	44611-01
4	3	3	O-RING	6227-48-01-70	6227-48-01-70	6227-48-01-70	6227-48-01-70	6227-51-13-90	6227-61-20-70	6227-48-01-70	6227-61-20-70	702640-44-31
5	1		LOCKING SCREW	18597-01	18597-01	18597-01	18597-03	18597-03	18597-06	18597-04	18597-04	18597-07
6	6		NUT, CYLINDER HEAD	5926-08	5926-08	5926-08	5926-08	5926-08	5926-10-10	5926-08	5926-10	5926-25-10
7	2		SET SCREW	5940-06	5940-06	5940-06	5940-06	5940-06	38710-03	5940-06	5940-06	5811-01
8	1		CYLINDER HEAD, UPPER	22939-01	22939-01	22939-01	22939-01	22945-01	690173-01	22939-01	22410-01	44614-01
9	6		STUD, CYLINDER HEAD	5911-48	5911-48	5911-48	5911-49	5911-49	34863-57-01-35	5911-47	5913-30	34732-58-01-67
10	1		CYLINDER	20459-04	20459-04	20459-04	20459-14	20459-08	689723-01	20459-03	20459-07	6897-23-01
11	1		CENTERING PIN	18596-01	18596-01	18596-01	18596-01	18596-01	18598-01	18596-01	18598-01	18598-01
12	1		SET SCREW	5940-01-04	5940-01-04	5940-01-04	5940-01-04	5940-01-04	5940-01-04	5940-01-04	5940-01-04	5940-01-04
13	8		LOCKNUT, PISTON	5953-05	5953-05	5953-05	5953-05	5953-05	5953-06	5953-05	5953-06	5953-07
14	1		PISTON	20582-01	20582-01	20582-01	20582-01	20946-01	20828-01	20582-01	20828-01	44612-01
15	1	2	O-RING	6227-19-01-70	6227-19-01-70	6227-19-01-70	6227-19-01-70	6227-19-01-70	6227-23-20-70	6227-19-01-70	6227-23-20-70	6227-28-20-70
16	1	1	O-RING	6227-36-13-85	6227-36-13-85	6227-36-13-85	6227-36-13-85	6227-36-13-90	6227-39-20-70	6227-36-13-85	6227-40-01-80	6227-40-01-80
17	1		PACKING GLAND, HYD.	20454-02	20454-02	20454-02	20454-02	20943-02	689722-02	20454-02	20827-02	44635-01
18	2	2	STEM PACKING	686598-01	686598-01	686598-01	686598-01	686598-01	686598-12	686598-01	686598-02	686598-12
19	1		CYLINDER HEAD, LOWER	20583-01	20583-01	20583-01	20583-01	20938-01	689721-62-0766	20583-01	20553-01	446178-01
20	1		RELIEF VALVE	5929-10	5929-10	5929-10	5929-10	5929-10	5929-10	5929-10	5929-10	5929-10
21	8		NUT, BONNET	5926-09-10	5926-25-10	5926-23-10	5926-25-10	5926-24-10	18573-06-10	5926-23-10	5926-27-10	5926-28-10
22	1		BONNET	33297-01-01	33297-04-01	33297-05-01	33297-09-01	33297-10-01	677513-02-01	33297-14-01	33298-02-01	44630-01
23	1	1	GREASE FITTING	5929-55	5929-55	HP-12S9-FO	5929-55	5929-55	HP-12S9-FO	5929-55	5929-55	HP-12S9-FO
24	1	1	CHECK VALVE	-	678627-01-99	-	-	678627-01-99	-	-	678627-01-99	-
25	1	1	BONNET GASKET	21793-11	19141-07	19141-07	21793-27	19141-10	44671-04	21794-03	19141-11	19141-15
26	1	1	STEM, HYD. OPERATING	34272-01	34272-01	34272-01	34272-02	34272-04	689720-02-99	34272-03	38638-01	44613-02-99
27	1	1	GATE & SEAT ASSEMBLY	21353-02-12	21353-02-12	21353-02-12	21436-03-04	21436-03-04	611612-13	21436-04-07	21436-04-05	415HGSA
28	1		GATE , HYDRAULIC	29786-01	29786-01	29786-01	29399-01	29399-01	610768-01	679632-01	34273-01	44618-01
29	2		RETAINER PLATE	611404-01	611404-01	611404-01	611404-03	611404-03	611404-15	611404-05	611404-17	682257-01
30	2		SEAT RING	44844-06	44844-06	44844-06	44783-06	44783-06	678353-01	610482-03	610978-02	611535-02
31	2		SEAL RING, PTFE	610500-23	610500-23	610500-23	610500-50	610500-50	610500-55	610500-47	610500-47	610500-58
32	1		PIN, BALANCE STEM	21812-52	21812-52	21812-52	21812-52	21812-52	20712-20	21812-52	21810-80	21610-98
33	1		STEM, LOWER	34271-02	34271-02	34271-02	34271-03	34271-03	610929-04	34271-04	28360-03	44603-02-99
34	8		STUD, BONNET	5912-67-10	5914-18-10	5915-67-10	5912-67	5917-33-10	5914-95-10	5915-67-10	6306-22-10	7311-06-10

TYPE 'QFC' HYDRAULIC GATE VALVE PARTS

ITEM	QTY	SPARES	DESCRIPTION	2-1/16" 5M	2-1/16" 10M	2-1/16" 15M	3-1/8" 5m	3-1/16" 10M	3-1/16" 15M	4-1/16" 5M	4-1/16" 10M	4-1/16" 15M
35	2		PIN, BONNET LOCATING	21813-06	-	-	21813-06	-	-	21814-05	-	-
36	1		BODY, HYDRAULIC	20465-01	20465-28	20465-03	697730-02	694480-01	610466-12	20465-02	140-6044-02	610138-01
37	1		NAME PLATE	19052-01	19052-01	19052-01	19052-01	19052-01	19052-01	19052-01	19052-01	19052-01
38	1		PLUG, PIPE	5930-01	5930-01	5930-01	5930-01	5930-01	-	5930-01	5930-01	-
39	1		STEM PROTECTOR	20460-02	20460-02	20460-02	20953-01	20953-01	689716-02	20461-01	20849-02	44615-01
40	2		GATE GUIDE	694811-01	694811-01	694811-01	694482-01	694482-01	44640-01	694816-01	694406-01	611045-01
41	2		BODY BUSHING	630691-01	630691-01	630691-01	630690-01	630469-03	630471-02	630472-02	610774-02	630706-02
42	1		HANDWHEEL BOLT ASSY	001-0204	001-0204	001-0204	001-0204	001-0204	001-0204	001-0204	001-0204	001-0204

* INCLUDES (1) #28, (2) #29, (2) #30, (2) #31, (1) #32, (1) #32

Note: 4-1/16" 15M uses (2) HP-12S9-FO, Grease Screw

Quality Oil Tools, Inc.
P. O. Box 718
Jennings, Louisiana 70546
Telephone: (337) 616-3300
Fax: (337) 616-3299
E-mail: sales@qualityoiltools.com

API-6A-0607
Q1-0036
ISO 9001:2008-0308