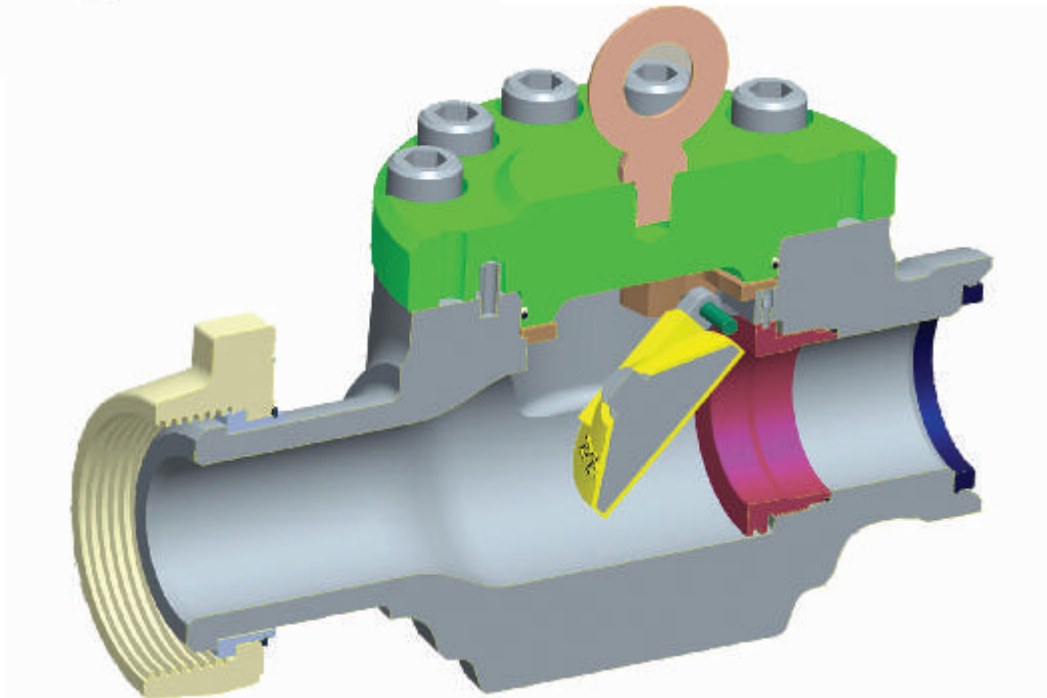
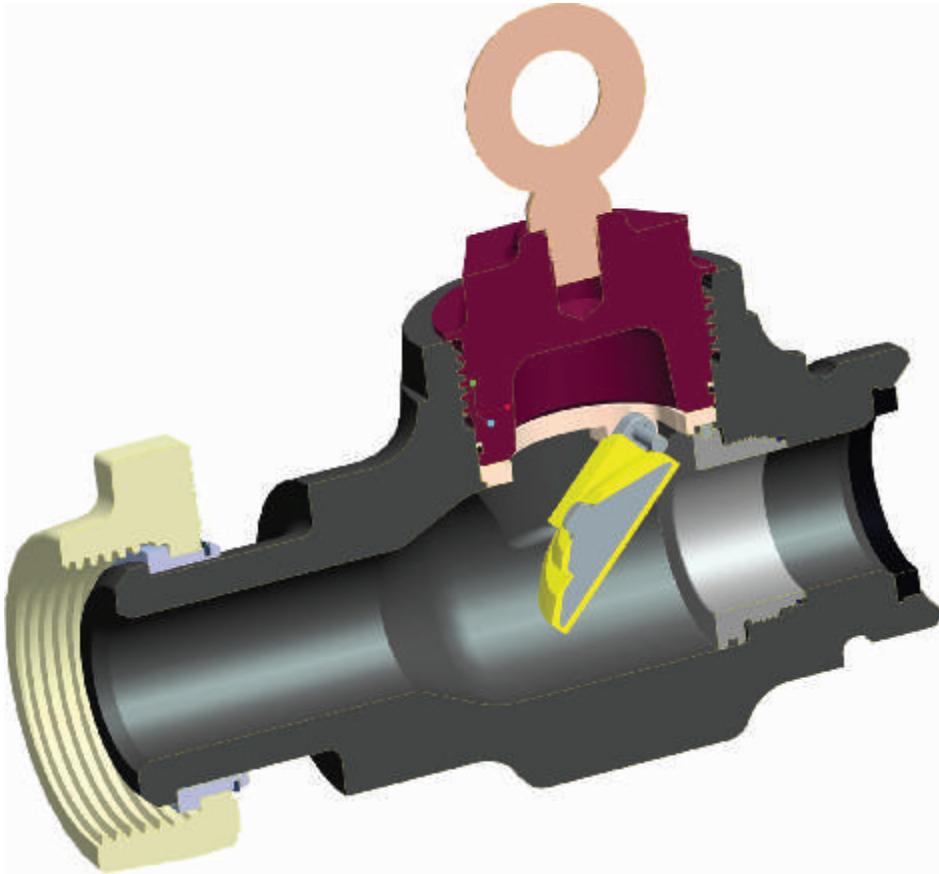




SD Clapper Check Valves

Operating and Maintenance Instructions



Models:

- 2", 3" and 4"
- 2" check valve comes with clapper not fully covered with polyurethane

I. Product Description:

Weir SPM's Clapper Style Check Valves are flow control devices that permit flow in one direction but stop flow in the opposite direction. Generally used in well service applications, the clapper check valve is placed in the treating line to allow flow to the well but isolates any back flow to go upstream in the valve. This provides a safety device at various locations in the flow line and assures that pressure and fluid cannot backup into the manifold area or into the pumps. Weir SPM clapper check valves are manufactured in 2", 3" and 4" sizes. Each size is offered with either Safety Iron® or hammer union end connections. In addition, the check valves with hammer union end connections are available in standard or reverse flow.

The check valves are available in pressure ranges from 6,000 psi to 20,000* psi for well service applications such as acidizing, cementing and fracturing. These valves are designed for fluids that are heavily laden with materials such as proppants, solids and ball sealers.

Clappers have a coating for high abrasion resistance (HAR). Manufactured to Weir SPM's stringent Quality Assurance System, all pressure bearing components are made from high quality material. The Weir SPM Clapper Style Check Valve is available for both standard service and sour gas (H₂S) environments.

SEVERE DUTY CHARACTERISTICS:

Weir SPM's new Severe Duty Check Valve is designed specifically to provide longer life and reliable operation in severe service environments. Ideal for the harsh pumping operations seen in the shale formations such as Haynesville, the SD Check Valve utilizes unique design features resulting in improved reliability and performance compared to other check valves currently available to the market.

Features & Benefits

Utilization of a Threaded Seat:

- Self-locking design prevents seat from becoming loose due to high vibration of flow line
- Machined from high erosion and high corrosion resistant NACE compliant stainless steel for longer life
- Features o-ring for excellent sealing performance

Enhanced Hanger:

- Flat machined into hanger matches flat machined into body preventing rotation during operation
- Removes hanger pin from assembly requiring fewer component parts

II. Pressure/Temperature Ratings:

The Weir SPM Clapper Check Valves are available in the following configurations:

Table 1. Weir SPM Severe Duty Clapper Check Valves.

Valve Size	End Connection (Upstream/Downstream)	NSCWP (PSI*)	Color	Type of Service	Temp. Range
2"	2" 1502 Male x 2" 1502 Female (Reverse Flow)	15000	Purple	Standard Service	-30°C - 100°C
2"	2" 1502 Female x 2" 1502 Male (Standard Flow)	15000	Red	Standard Service	-30°C - 100°C
2"	2" 1502 Safety Iron	15000	Red	Standard Service	-30°C - 100°C
3"	3" 1002 Female x 3" 1002 Male (Standard Flow)	10000	Blue	Standard Service	-30°C - 100°C
3"	3" 1502 Female x 3" 1502 Male (Reverse Flow)	10000	Sour Gas Green	Sour Gas Service	-30°C - 100°C
3"	3" 1502 Female x 3" 1502 Male (Standard Flow)	10000	Sour Gas Green	Sour Gas Service	-30°C - 100°C
3"	3" 1502 Female x 3" 1502 Male (Reverse Flow)	15000	Purple	Standard Service	-30°C - 100°C
3"	3" 1502 Female x 3" 1502 Male (Standard Flow)	15000	Red	Standard Service	-30°C - 100°C
3"	3" 1502 Safety Iron	15000	Red	Standard Service	-30°C - 100°C
1*3"	3" 2002 Female x 3" 2002 Male (Standard Flow)	20000	White	Standard Service	-30°C - 100°C
1*3"	3" 2002 Safety Iron	20000	White	Standard Service	-30°C - 100°C
4"	4" 602 Female x 4" 602 Male (Standard Flow)	6000	Black	Standard Service	-30°C - 100°C
4"	4" 1002 Female x 4" 1002 Male (Standard)	10000	Blue	Standard Service	-30°C - 100°C
4"	4" 1002 Safety Iron	10000	Blue	Standard Service	-30°C - 100°C
4"	4" 1502 Male x 4" 1502 Female (Reverse)	15000	Purple	Standard Service	-30°C - 100°C
4"	4" 1502 Female x 4" 1502 Male (Standard)	15000	Red	Standard Service	-30°C - 100°C
4"	4" 1502 Safety Iron	15000	Red	Standard Service	-30°C - 100°C

* Non-Shock Cold Working Pressure

1* Contact Engineering in regards to 20K psi product.

*****CAUTION*****

SINCE CHECK VALVES MAY BE REPAINTED IN DIFFERENT COLORS FOR VARIOUS APPLICATIONS, DO NOT USE FACTORY COLOR AS PRIMARY MEANS OF IDENTIFICATION.

Table 2. Recommended Flow Rates.

Valve Size	NSCWP (PSI)	Bore	Flow Rate*	
			GPM	BPM
2"	15000	1.75	315	7.5
3"	10000	2.75	778	18.5
3"	15000	2.75	778	18.5
3"	20000	3.00	925	22.0
4"	6000	3.75	1446	34.4
4"	10000	3.75	1446	34.4
4"	15000	3.75	1446	34.4

* Flow rate based on 42 fps

III. End Connections:

A. Hammer Union Connections

Weir SPM's Clapper Style Check Valves are available with the Weir SPM Wing Union Connections on the inlet and outlet sides (See Fig. 1a). The inlet side will have a female wing union connection if a standard flow is specified or a male wing union connection for a reverse flow. The outlet side will always have the opposite gender.

Each valve has a size and pressure code designated on the valve. The nameplate will indicate the cold working pressure allowable for each assembly. This working pressure corresponds to the maximum pressure acceptable for either end connection. Use this information for proper mating and pressure limits:

Wing union connections on the check valves are interchangeable with other union connections of the same size and figure (pressure rating). Caution must be taken to avoid mixing different ratings of wing connections. There are various sizes and figures that are capable of making marginal connections. These connections must also match the service of the designated string they are installed in. Failure to observe good judgment may lead to damage to components and danger to life and limb. Always verify working pressure ratings of each connection before use.

B. Safety Iron® Connections

Weir SPM's Clapper Style Check Valves are available with Safety Iron® connections (See Fig. 1b). Each Safety Iron® Check Valve includes the necessary parts to make-up one end connection. Most illustrations in this manual show a wing nut connection; however, they are equally applicable to the Safety Iron® version.

Safety Iron® products are designed as an alternative to the traditional hammer union products used within the oil and gas industry. Safety Iron® products eliminate the safety hazard of swinging a hammer to make up and break down a connection while providing stronger, more durable connections that are less strenuous for the user.

*****CAUTION***
DURING INSTALLATION CAUTION MUST BE TAKEN
IN ENSURING THE ARROW INDICATED ON
THE VALVE BODY AGREES WITH THE DIRECTION OF
FLOW. (See Fig. 1)

Safety Iron® products are permanently identified on each individual component. All metal components have full material traceability and are identified by their VENDOR ID (Weir SPM), PART NUMBER, SIZE, PRESSURE RATING, HEAT CODE, and unique SERIAL NUMBER.

Consult Safety Iron® Instructions and Safety Manual on how to properly assemble/disassemble Safety Iron®.

IV. Installation:

The following information is given in good faith and should aid in the safe use of your Weir SPM products. This information is not meant to replace any existing Company's safety policies or practices, which should be strictly followed.

The Weir SPM Clapper Check Valve should be installed in a branch where a flow control device is necessary to stop flow in one direction (See Fig. 1). For complete fluid shut-off, an isolator valve (such as Weir SPM's plug valve) should be installed in series with the clapper check valve.

Before assembly into a fluid line, check the direction of flow indicated by the arrow on the body and make sure the valve is properly oriented in the line. Improperly directed check valves will shut off fluid flow and can result in SERIOUS INJURY OR DEATH.

The valve should be mounted in a flat, horizontal position, as shown in Fig. 1, to allow for gravity to close the clapper when there is no flow. The clapper will close by itself, reseat and seal when sufficient backpressure is encountered. If a flat, horizontal installation is not possible, contact your Weir SPM representative about using a Weir SPM dart style check valve instead. Dart check valves utilize a spring to close and can be oriented in any position.

The clapper check valve is specifically designed to be used with liquid frac, acidizing, and cementing fluids. On jobs where nitrogen is introduced into the frac line, the clapper check valve should be used only in the co-mingled fluid. A dart style check valve is recommended for the nitrogen line.

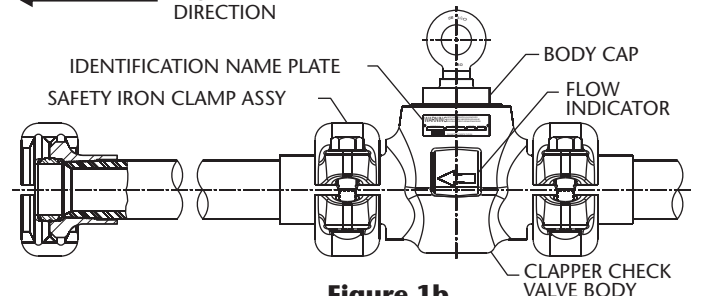
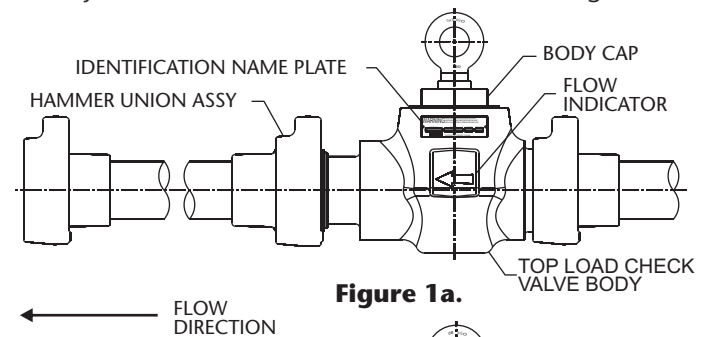


Figure 1. Typical Field Installation.

*****CAUTION***
CARE MUST BE TAKEN WHEN INSTALLING THE
CLAPPER STYLE CHECK VALVE SO THAT A HAMMER
NEVER STRIKES THE VALVE BODY. THE BODY IS NOT
INTENDED FOR SEVERE FORCES, SUCH AS A HAMMER
BLOW, AND THERE IS THE DANGER THAT THE VALVE
COULD CRACK UNDER SUCH CIRCUMSTANCES.

Materials used in Weir SPM's Standard Service Clapper Check Valves are designed for high strength. They are susceptible to stress corrosion and do not conform to NACE for use in sour gas (H₂S) environments. Only use Weir SPM's Sour Gas Service Clapper Check Valves for H₂S service.

Whenever Clapper Style Check Valves are installed on portable equipment, such as trucks or trailers, the operator must insure that the truck or trailer is positioned correctly in a flat horizontal position.

Do not attempt to work on or repair any equipment isolated by the clapper check valve while the check valve has energized fluid behind it. A positive shut off device (i.e. a plug valve) must be placed in the line to guarantee isolation from the system.

VI. Maintenance:

General:

Weir SPM's Clapper Check Valves are well designed, offering dependable components that should provide long term, reliable performance for the user. Like any device, however, they do require routine inspection and servicing to guarantee that they are fully functional.

Hammer union ends should be cleaned and lightly oiled prior to each use. Hammer union seals should be checked and replaced when worn or damaged.

For Safety Iron® products; care must be taken to ensure that threads on bolts & clamps, and all mating surfaces are lubricated, free of burrs, dents, gouges and dirt. Typical maintenance would include properly cleaning, greasing, or oiling the product after each use. Consult the Safety Iron® Instructions and Safety Manual for further information regarding maintenance, inspection, and replacements of parts.

Always flush valve with water, then oil after each use. If valves are used with acid services, they should be washed with fresh water as soon as possible. After washing, it is recommended that it is submersed in light oil for 5 minutes.

There are wear surfaces on this device and elastomer seals that require maintenance. For the valve to operate properly and safely, these items must be kept in good condition. Inspection and servicing should be conducted in accordance with a recognized program. In general the more severe the usage, the more often the maintenance should occur. It is recommended that a flow rate in excess of 42 feet per second be avoided. Rates above this will cause more rapid wear and erosion.

Inspection/Repair:

Check valves require maintenance. It is impossible to visually inspect components from the outside. Consequently, the valves should be disassembled and inspected often (at least every 90 days). Any signs of pitting or washing on the body and components require replacement. Clapper assemblies should be replaced regularly (approx. every 90 days or sooner depending the

type and amount of use). Clapper valve seats should be checked for wear. If such evidence exists, contact your nearest service center for valve seat replacement. Clapper check valve caps should be inspected for damage, deterioration or washing. Use only Weir SPM parts when repairing units.

REPLACEMENT PARTS ARE AVAILABLE THROUGH Weir SPM's COMPLETE LINE OF PARTS KITS.

Any check valve that has been exposed to high shock loads (i.e. overpressure, sandoffs, etc.) should be removed from service until ultrasonic checks and pressure testing can be performed. Valves used in areas of high acid concentrations require special attention to inspection and maintenance. NOTE: Some end users prefer to use ported caps to allow the installation of needle valves in the cap for bleed off. Weir SPM opposes that process and recommends installing an integral tee and torture plug valve in line with the check valve (for bleed off purposes).

WELDING, BRAZING OR HEATING CHECK VALVES IS PROHIBITED, MATERIAL DAMAGE WILL OCCUR.

VI. Pressure Testing

Weir SPM pressure tests all clapper style check valves prior to shipping. Every valve is vessel tested to 150% of its rating to ensure safety and reliability.

Field Testing:

When pressure testing, the pressure should be applied to the total body as well as the check system side. Pressure testing should be done with cold water. Personnel should wear proper safety equipment and avoid any area of danger while pressure is present. Prior to any pressure testing, all air must be evacuated from the system. Failure to do so could result in PERSONAL INJURY OR DEATH!

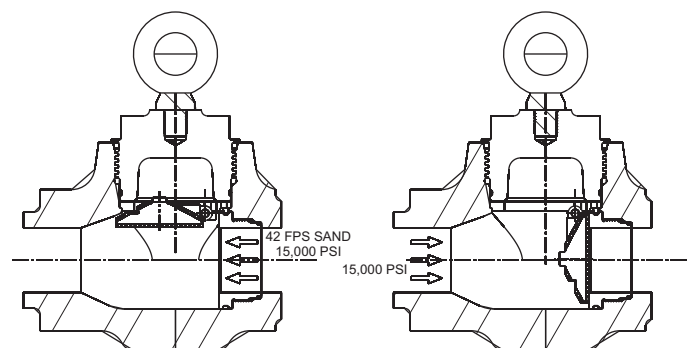


Figure 2. Typical Check Valve Action of 3" 15,000 NSCP.

***** CAUTION *****
THE RATED WORKING PRESSURE IS NEVER TO BE EXCEEDED DURING FIELD SERVICE OR FIELD TESTING.
(See Tables 1 and 2)

Pressure testing (and ultrasonic test) should be performed every 6 months or more frequently if service is "severe" or "low temperature". It is necessary to test each valve for leaks after they are refurbished. To test for leaks:

- Fill the valve with liquid (Water)
- Make sure that all air is out of the system
- **THIS IS EXTREMELY IMPORTANT**
- Pressure the system up to close to working pressure
CAUTION: DO NOT EXCEED WORKING PRESSURE
- With the valve near working pressure, carefully examine for leaks
 If no leaks are observed, the valve is now ready for service.

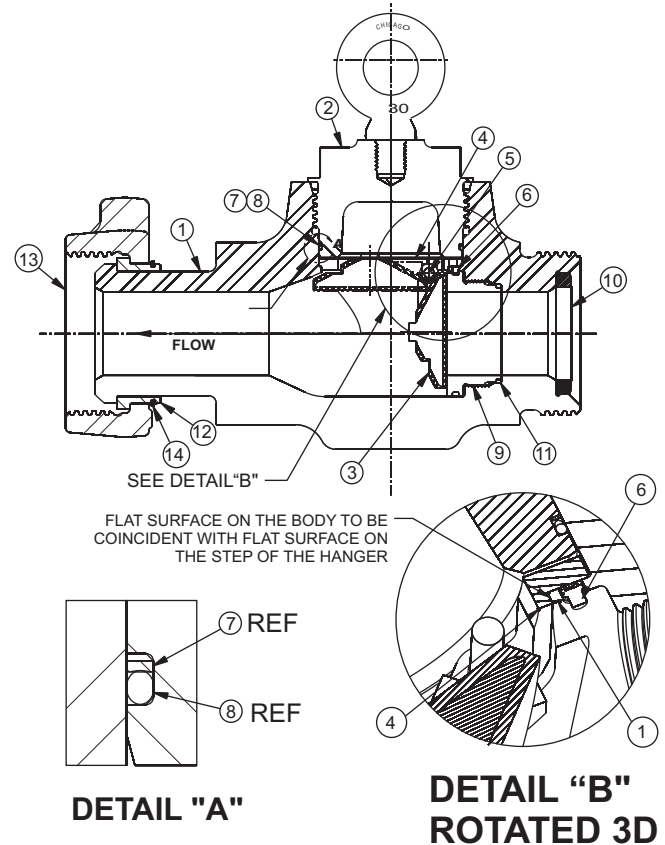
VII. Service

ALWAYS REMEMBER

1. **DISASSEMBLY UNDER PRESSURE CAN CAUSE SERIOUS INJURY OR DEATH.**
2. Always use a new parts kit for reassembly.
3. When working on Weir SPM check valves, always wear protective clothing and safety glasses.
4. Clean all components thoroughly prior to reassembly.
5. Check sealing surface on clapper seat, and valve body for pitting, erosion or other flaws. Failure in sealing can result if these areas are not smooth.
6. Use only Weir SPM clapper check valve parts on Weir SPM clapper check valves.
7. Pressure test in accordance with instructions outlined in Section VI, pressure testing, of this manual.

OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS BROCHURE. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

2" & 3" Severe Duty Clapper Style Check Valves (Does not include 3" 2002)



**Figure 3. Assembly of 2" & 3"
 Severe Duty Clapper Style Check Valves**

TOOLS REQUIRED

2" & 3" Check Valve (Does not include 3" 2002)

1. Vise
2. Large Pipe Wrench
3. Hammer
4. Anti-seize Lubrication
5. Hand and Eye Protection

DISASSEMBLY: (Fig.3)

2" & 3" Severe Duty Check Valves (Does not include 3" 2002)

MAKE SURE THAT THERE IS NO PRESSURE ON THE VALVE

1. Secure the valve in an upright position by clamping the valve body (1) in a vise.
2. Using a large pipe wrench start to unscrew valve cap, (2) from the body (1) by turning counterclockwise. Use hammer if necessary. Remove cap seal (8) and seal backup (7) from cap (2).
3. Remove the hanger (4), clapper (3), and clapper pin (5).
4. Do not remove set screw (6).
5. Remove seal (10).
 The valve is now completely disassembled.
6. Do not reuse old kit components.
7. Inspect condition of sealing surface of seat. Do not reuse body if surface is deteriorated. Contact your nearest Weir SPM's service center for seat replacement.

REPLACEMENT AND ASSEMBLY (Fig. 3)
2" & 3" Severe Duty Check Valve (Does not include 3" 2002)

- See **ALWAYS REMEMBER** Section before Assembly.
 - The reassembly of the valve is in approximate reverse order to the disassembly process.
1. Secure the valve in an upright position by clamping the valve body ① in a vise.
 2. Insert clapper pin ⑤ between clapper ③ and hanger ④. Orient clapper ③ so that flat side face is opposite to hanger.
 3. Insert hanger ④ into valve body ① bore and match flat surface on the body to the step on to the clapper ③ (Fig 3, detail "B"). The clapper ③ should be able to swing freely with no obstructions.
 4. Install cap seal ⑧ and seal backup ⑦ into groove of valve cap as shown in Detail "A".
 5. Install soft seal ⑩.
 6. Apply anti-seize lubrication to the valve cap ② threads and insert into body ①. Install by threading cap ② clockwise. The cap ② will shoulder against valve body ①. Tighten firmly using the large pipe wrench. **DO NOT OVER TIGHTEN.**
 7. The valve is now ready for testing as discussed in Section VI, Pressure Testing.

TOOLS REQUIRED
3" 2002 & 4" Check Valves

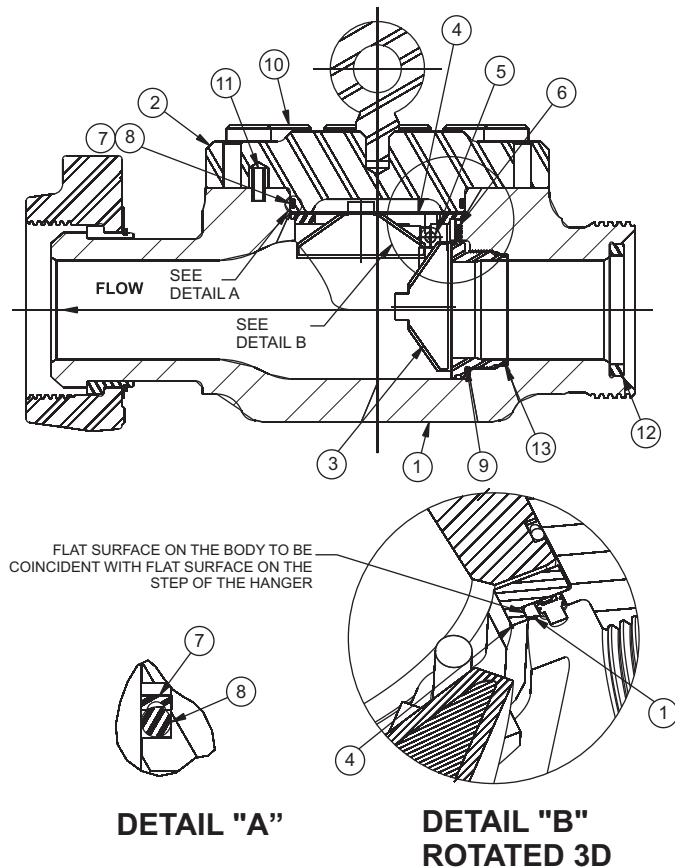
1. Vise
2. Hammer
3. Anti-seize Lubrication
4. Hand and Eye Protection
5. 3/4" Allen Wrench w/12" leg

DISASSEMBLY: (Fig. 4)
3" 2002 & 4" Check Valves

MAKE SURE THAT THERE IS NO PRESSURE ON THE VALVE

1. Secure the valve in an upright position by clamping the valve body ① in a vise.
2. Use a 3/4" Allen Wrench with 12" leg and hammer to unscrew the 10 or 12 SHCS from the body ① by turning counter-clockwise. Remove Cover ②. Remove cap seal ⑧ and seal backup ⑦ from cap.
3. Remove the hanger ④, clapper ③ and clapper pin ⑤.
4. Remove seal ⑫.
5. Do not remove pin ⑪ and set screw ⑥. The valve is now completely disassembled.
6. Do not reuse old kit components.
7. Inspect condition of sealing surface of seat. Do not reuse body if surface is deteriorated.

3" 2002 & 4" Severe Duty Clapper Style Check Valve



REPLACEMENT AND ASSEMBLY (Fig. 4)
3" 2002 & 4" Severe Duty Check Valves

- See "ALWAYS REMEMBER" Section before Assembly.
 - The reassembly of the valve is in approximate reverse order to the disassembly process.
1. Secure the valve in an upright position by clamping the valve body ① in a vise.
 2. Insert clapper pin ⑤ between clapper ③ and hanger ④. Orient clapper ③ so that flat side face is opposite to hanger.
 3. Insert hanger ④ into valve body ① bore and match flat surface on the body to the step on the clapper ③ and secure hanger with set screw ⑥ (Fig 4, detail "B"). The clapper ③ should be able to swing freely with no obstructions.
 4. Install cap seal ⑧ and seal backup ⑦ into groove of valve cap as shown in Detail "A".
 5. Install seal ⑫.
 6. Using set pin ⑪ for alignment, insert valve cover ② onto the body. This will position cover correctly. Install 10 or 12 SHCS ⑩ on the valve body by turning clockwise in an alternating pattern. Tighten firmly using a 3/4" Allen Wrench with 12" leg and hammer. **DO NOT OVER TIGHTEN.**
 7. The valve is now ready for testing as discussed in Section VI, Pressure Testing.

OBSERVE ALL INSTRUCTIONS, CAUTIONS AND WARNINGS AS NOTED IN THIS BROCHURE. FAILURE TO DO SO CAN LEAD TO EQUIPMENT DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

Figure 4. Assembly of 3" 2002 & 4" Severe Duty Clapper Style Check Valve.

PARTS LIST

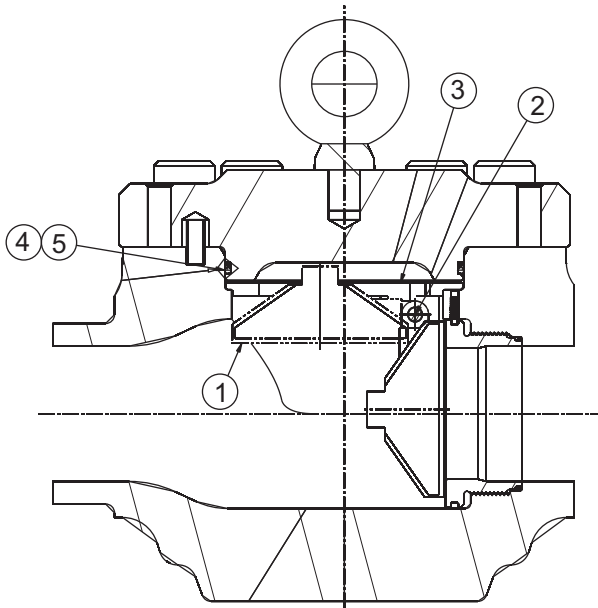


Figure 5a. 3''-20, 4''-6K, 4''10K, & 4''15K

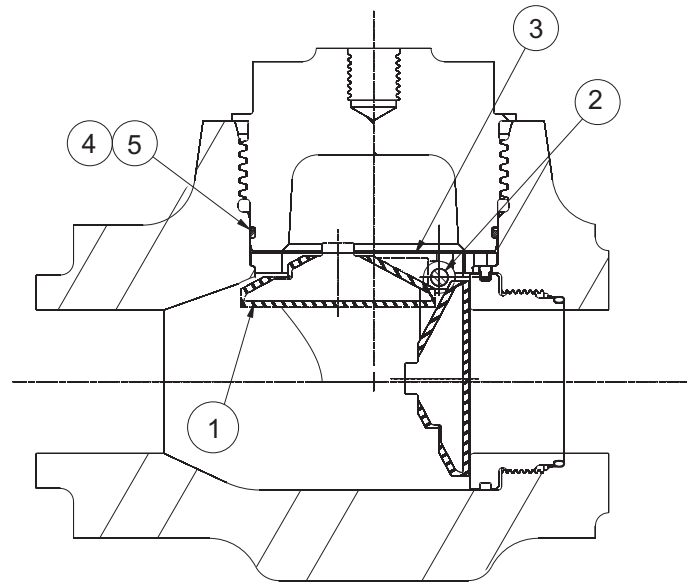


Figure 5b. 3''-10K & 3''-15K

Figure 5. Clapper Severe Duty Style Check Valve Kit List

		Parts List				
Part No.	Size	Item				
		1	2	3	4	5
		Clapper	Pin	Hanger	Seal Backup	Seal
2A29092	2''-15K (Clapper is not fully coated)	2P27168	P28911	2P29017	P25523	P101222
2A29093	2''-15K - VITON (H2S) (Clapper is not fully coated)	2P27168	P25520	2P29017	P25523	P102585
2A29477	3''-10K, 3'' 15K	2P29201	P28912	2P28564	P103859	P103860
2A29499	3'' 15K - VITON (H2S)	2P29201	P25143	2P28564	P103859	P20467
2A29478	3'' 20K, 4'' 6K, 4'' 10K, & 4'' 15K	2P29260	P28913	2P28741	P25150	P100367

TROUBLESHOOTING GUIDE

Always follow existing company procedure concerning identifying equipment for inspection, and removing equipment from service. The following is intended as a general guide in helping resolve most problems encountered in repairing clapper check valves. If problems are not covered here please contact Weir SPM for assistance at (817) 246-2461.

SYMPTOM	PROBLEM	SOLUTION
1. Valve leaks between cap and valve body.	a) Damaged cap seal or damaged seal & seal backup. b) Cap seal or seal & seal backup installed incorrectly.	a) Replace damaged seals. b) Reinstall seals correctly.
2. Valve leaks from clapper seal area (Valve does not seal or prevent back flow)	a) Clapper not seating correctly or clapper seal area is damaged.	a) Inspect clapper. If acceptable, reinstall correctly. If not acceptable, replace and install new clapper correctly. b) Remove valve from service. Replace with new valve assembly. c) Remove valve cap and clapper. Examine seal area on valve body and clapper. Remove all debris. Reassemble.
3. Severe clapper chatter when flowing nitrogen.	a) Wrong type of check valve is being used. Clapper check valve is mounted in nitrogen line prior to co-mingling the fluids. This produces clapper action instability.	a) Switch to Dart style check valves and move Clapper style check valves out of the path of full force Nitrogen.

SAFETY INFORMATION



IMPORTANT SAFETY INFORMATION ENCLOSED. READ THIS OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL BEFORE OPERATING PRODUCT.

IT IS THE RESPONSIBILITY OF THE EMPLOYER TO PLACE THE INFORMATION IN THIS MANUAL INTO THE HANDS OF THE OPERATOR. FAILURE TO READ, UNDERSTAND AND FOLLOW THE OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.

Weir SPM

7601 Wyatt Drive Tel: (817) 246 2461
 Fort Worth Fax (817) 246 6324
 TX 76108
 USA www.weiroilandgas.com

