

September 2015

# Type C407-10 Internal Valves

## WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.

Fisher® equipment must be installed, operated and maintained in accordance with federal, state and local codes and manufacturer's instructions. The installation in most states must also comply with NFPA No. 58 and ANSI Standard K61.1.

Only personnel trained in the proper procedures, codes, standards and regulations of the LP-Gas industry shall install and service this equipment.

The internal valve must be closed except during product transfer. A line break downstream of a pump may not actuate the excess flow valve. If any break occurs in the system or if the excess flow valve closes, the system should be shutdown immediately.

## Introduction

### Scope of the Manual

This manual covers instructions for the Type C407-10 internal valves and the manual, cable or pneumatic actuators for the valve.

### Description

The Type C407-10 is intended as a main valve on small capacity pumping systems or in vapor return lines on trucks. It can also be used on in-line installations. Designed for propane, butane or NH<sub>3</sub> at ambient temperatures, the valve can be used on other



Figure 1. Type C407-10

compressed gases, but the user should check with the factory to make sure the valve is suitable for the particular service.

The following accessories for the Type C407-10 are also covered:

**Type P341** – Latch/remote release mechanism that permits remote valve closure. The valve is opened manually. A built in fusible element will release at 212°F / 100°C allowing the valve to close. Factory type number with the Type P341 installed is Type C407M10.

**Type P342** – Latch with bi-directional remote release mechanism that permits remote valve closure from two directions. The valve is opened manually. A built in fusible element will release at 212°F / 100°C allowing the valve to close. Factory type number with the Type P342 installed is Type C407MB10.

**Type P389** – Pneumatic actuator that allows remote opening and closing of the valve. Factory type number with the Type P389 installed is Type C407A10.

# Type C407-10

## Specifications

The Specifications section lists the specifications for Type C407-10 internal valve. Factory specifications for specific valve constructions are stamped on the nameplate fastened to either the main actuator or the pilot spring case.

### Body Size and End Connection Style

Inlet: NPS\* 1-1/4, MNPT

Outlet: NPS 1-1/4, FNPT

### Maximum Allowable Inlet Pressure

400 psig / 27.6 bar WOG

### Excess Flow Springs

TYPE	HALF COUPLING		FULL COUPLING	
	GPM	L/MIN	GPM	L/MIN
C407-10-04	40	152	25	95
C407-10-05	50	189	35	133
C407-10-08	80	303	65	246

\*Nominal pipe size.

### Temperature Capabilities

-20 to 150°F / -29 to 66°C

### Body Material

WCC Steel

### Approximate Weight

3 lbs / 1.4 kg

## Specifications

The Specifications section lists specifications for Type C407-10 internal valves.

### DOT Internal Self-Closing Stop Valve

**Requirement** – U.S. Department of Transportation (DOT) regulations 49 CFR§178.337-8(a)(4) require each liquid or vapor discharge outlet on cargo tanks (except for cargo tanks used to transport chlorine, carbon dioxide, refrigerated liquid and certain cargo tanks certified prior to January 1, 1995) to be fitted with an internal self-closing stop valve. “C” Series internal valves comply with the internal self-closing stop valve requirement under the DOT regulations.

## Installation

### Mounting and Piping

The internal valves can be installed in either a half or full coupling. Excess flow spring closing flow rates vary in half and full couplings, refer to specifications.



**Excess flow valve closing flow rates are not the same for half and full couplings. Verify the coupling for the desired excess flow rate.**

**Do not install the valve in any piping tending to restrict the valve inlet because this may prevent the excess flow valve from closing.**

**Do not install the valve with such extreme torque that the coupling can cut threads into the valve. This could cause valve distortion and affect the internal working parts.**

**Do not use Polytetrafluoroethylene (PTFE) tape as it may cause thread galling to occur.**

Use an appropriate pipe compound, on the male threads of the internal valve and pipeline. Pull the valve into the coupling hand tight and then wrench tighten it for approximately two additional turns. Larger size valves may require an additional amount of torque to obtain a leak free connection.

Keep piping from the valve outlet to the pump full size and as short as possible with a minimum number of bends. Reduction in pipe size to suit smaller pump inlets should be made as close to the pump as possible using forged reducers (swage nipples) or venturi tapers rather than bushings. This assures minimum flow resistance and efficient pump operation.

The valves have a break off section below the inlet pipe thread which is intended to permit the lower valve body to shear off in an accident, leaving the valve seat in the tank. **The break off section is designed for container installations and will probably not provide shear protection if the valve is installed in a pipeline.**

A hydrostatic relief valve does not need to be installed adjacent to the valve since the internal valve relieves excessive line pressure into the tank.

## Selectively Filling Manifolded Tanks

Fisher® internal valves provide positive shutoff only in one direction, from out of the tank to downstream of the valve. The internal valves are designed to allow gas to flow into a tank when the downstream line pressure exceeds tank pressure. If you want to selectively fill one or more of the other tanks in a tank manifold system, you must place a positive shutoff valve downstream of the internal valve, otherwise, all tanks will be filled at the same time and at about the same rate.

## Excess Flow Protection

The internal valve contains an excess flow function or “integral excess flow valve,” that will close when the flow exceeds the flow rating established by Fisher. Fisher integral excess flow valve installed on a bobtail truck or transport can provide protection against the discharge of hazardous materials during an unloading operation of a bobtail truck or transport in the event that a pump or piping attached directly to the internal valve is sheared off before the first valve, pump or fitting downstream of the internal valve, provided that the cargo tank pressure produces a flow rate greater than the valve’s excess flow rating. Likewise, if the internal valve is installed on a stationary tank or in the related downstream piping system, the integral excess flow valve can provide protection against an unintentional release of hazardous materials in the event that a pump or piping attached directly to the internal valve is sheared off before the first valve, pump or fitting downstream of the internal valve, provided that the flow of product through the internal valve reaches the rated flow specified by Fisher.



### EXPLOSION HAZARD

**Restrictions incorporated in the discharge system of a bobtail truck or transport or of a stationary tank (due to pumps, pipe and hose length and dimensions, branching, elbows, reductions in pipe diameter or a number of other in-line valves or fittings), low operating pressure as a result of ambient temperature or a partially closed valve downstream from the integral excess flow valve, can restrict the rate of flow through the internal valve below the level necessary to actuate the integral excess flow valve. Therefore, DO NOT USE the excess flow function of the internal valve for the purpose of providing protection against the discharge of hazardous materials in the event of a**

**rupture of hose or piping at a point in the discharge system downstream from the first valve, pump or fitting downstream of the internal valve.**

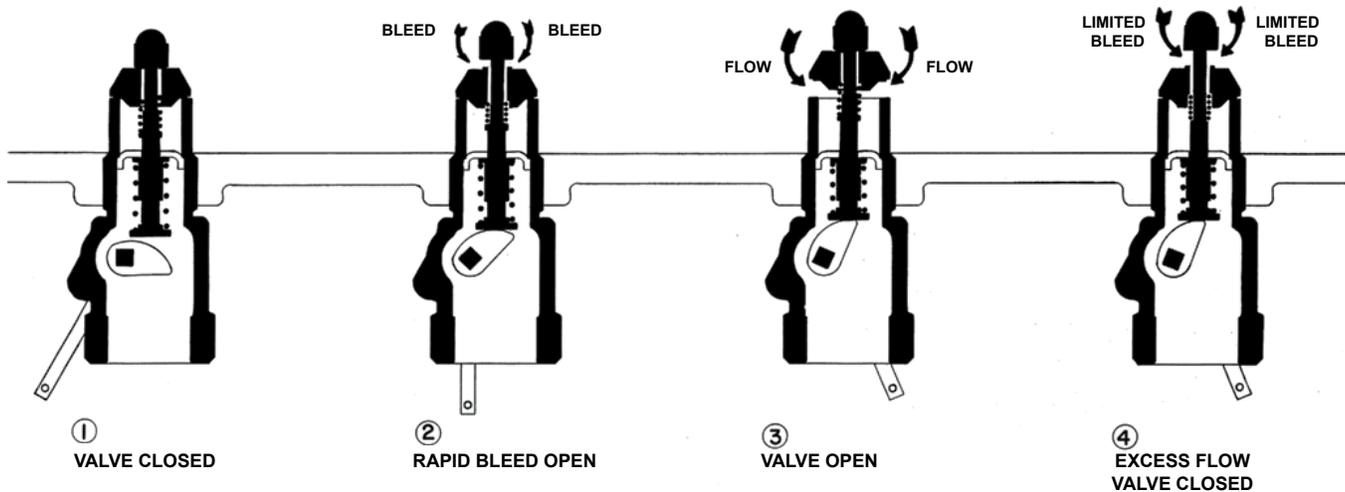
**The internal valve is designed with an internal bleed feature for equalization of pressure. After the integral excess flow valve closes, the leakage through the bleed must be controlled or a hazard can be created. For this reason the operator must be familiar with the closure controls for the internal valves and must close the internal valve immediately after the integral excess flow valve closes.**

**Failure to follow this warning could result in serious personal injury or property damage from a fire or explosion.**

**DOT Passive Shutdown Equipment Requirement –** DOT regulations 49 CFR§173.315(n)(2) require certain cargo tanks transporting propane, anhydrous ammonia and other liquefied compressed gases to be equipped with passive emergency discharge control equipment that will automatically shut off the flow of product without human intervention within 20 seconds of an unintentional release caused by complete separation of a delivery hose. The design for each passive shutdown system must be certified by a Design Certifying Engineer (DCE) and all components of the discharge system that are integral to the design must be included in the DCE certification. The DCE certification must consider any specifications of the original component manufacturer.

In the case of downstream ruptures in hose or piping, a variety of operating conditions routinely encountered during an unloading operation restrict the rate of flow through the integral excess flow valve and make such a valve unsuitable to serve as the means of passive shutdown required under 49 CFR§173.315(n)(2). Such variables include restrictions incorporated in the discharge system (due to pumps, pipe and hose length and dimensions, branching, elbows, reductions in pipe diameter or a number of other in-line valves or fittings), low operating pressure as a result of ambient temperature or a partially closed valve downstream from the excess flow valve. Due to the variety of conditions, in the case of a hose separation, that can restrict the rate of flow below the level necessary to activate the excess flow valves, the integral excess flow function of “C” Series internal valves or “F” Series excess flow valves cannot be used to satisfy the passive shutdown equipment requirement under/in 49 CFR§173.315(n)(2). Also, a Design Certifying Engineer cannot include the integral excess flow valve of “C” Series internal valve or “F” Series excess flow valve as a component of the discharge system in any DCE certification under 49 CFR§173.315(n)(2).

# Type C407-10



T40426

Figure 2. Operational Schematic



## EXPLOSION HAZARD

**DO NOT USE** the excess flow function incorporated into “C” Series internal valves or “F” Series excess flow valves to satisfy the passive shutdown equipment requirement in 49 CFR§173.315(n) (2). **DO NOT** include the excess flow function incorporated into “C” Series internal valves or “F” Series excess flow valves in a DCE certification under 49 CFR§173.315(n)(2). The cargo tank manufacturer must install some other equipment that satisfies the requirement for passive shutdown capability under 49 CFR§173.315(n)(2).

Failure to follow this warning could result in serious personal injury or property damage from a fire or explosion in the event of an unintentional release of product during an unloading operation.

## Actuators

The remote operating control system for the valve is extremely important and it must be installed to conform with the applicable codes. DOT MC331, for example, most generally applies for trucks.

Emerson Process Management Regulator Technologies, Inc. (Emerson™) offers both cable controls and pneumatic actuators systems to operate the Type C407-10 internal valves. It may also be possible to use cable controls from other manufacturers or to fabricate a linkage mechanism.

Any control system requires thermal protection (fuse links) at the valve, at the remote control point and, if necessary, near the hose connections. Emerson systems show how to install the fuse links.

The operating linkage must allow the operating lever to move from the fully closed position to within 2° of the fully open position. The linkage should not apply strong force to the lever past the fully open position or the valve could be damaged.



## CAUTION

The internal valve's closing spring is not designed to overcome drag in the control linkage in order to close the valve. Depending upon the control system used, an external spring (such as drawing number 1K4434) or positive closing linkage may be needed. Be sure the control system is installed to prevent binding that could cause the valve to stick in the open position.

**Cable Operation** – The operating linkage should stroke the valve operating lever from the fully closed position to within a minimum of 1/8 in. / 3.2 mm (2°) of the full open position. Too short operating lever stroke will result in premature excess flow valve closure. The cable control linkage can be attached through the hole in the operating lever (key 18) to provide remote valve operation. (See Figure 5.)



## WARNING

**If Type C407-10 valve is installed in a pressurized tank, ensure that the line pressure is 0 psi / 0 bar prior to beginning installation of Types P341, P342 and P389.**

**Remote Release** – To install the Type P341 or P342 latch mechanisms, first release the downstream pressure. **Failure to do so could result in personal injury.** Remove the operating lever and take off the cover plate (key 56) by removing the cap screws (key 17). The new cover plate/latch assembly can be attached to the valve with the same cap screws. Tighten the screws to 42 to 48 in-lbs / 4.7 to 5.4 N•m torque.

A cable must be run from the pull ring (key 7, Figure 3) on the Type P341 to the release handle (Type P650 or P651 can be used) located at a remote point. The Type P342 allows two cables to be run to two remote locations. The cable must be taut for proper operation and the hookup may require sufficient pulleys to keep the cable away from the side of the tank. Pulling the release handle allows the manual operating lever to return to the closed position. The fusible link in the mechanism will melt if exposed to fire, allowing the valve to close.

When closing the valve manually, pull back on the cable attached to the release mechanism to permit the valve lever to close. (See Figure 3.)



## WARNING

**Since there is strong spring force on the operating lever, avoid getting in the way of the lever as it moves to the closed position. Failure to do so could result in personal injury.**

**Air Operation** – Type P389 pneumatic actuators can be installed on the valves to provide remote air operation. Minimum operating pressure for the actuator is 60 psig / 4.1 bar; maximum actuator pressure is 250 psig / 17.2 bar.

To install the unit, first release the downstream pressure.

**Failure to do so could result in personal injury.** Remove the manual operating lever (key 18) and take off the cover plate (key 56) by removing the cap screws (key 17). Place the Type P389 actuator on the valve and secure it with the two cap screws, tightening them to 42 to 48 in-lbs / 4.7 to 5.4 N•m torque. Insert the operating lever through the clevis (between the roller and the clevis pin) and attach to the valve. (See Figure 4.)

## Principle of Operation

Refer to the schematic drawing, Figure 2. In view #1, the valve is held closed by both tank pressure and the valve's closing spring. There is no leakage past the resilient seats in the poppet to the valve outlet.

The valve is opened by moving the operating lever to approximately mid-point in its 70° travel (view #2). This allows the cam to place the rapid equalization portion of the valve stem in the pilot opening, permitting a larger amount of product to bleed downstream than if the operation lever were moved to the full open position. When tank and downstream pressure are nearly equal after a few seconds, the excess flow spring pushes open the main poppet (view #3) and the operating lever can be moved to the full open position.

If tank pressure is greater than the valve's outlet pressure, the main poppet will remain in the closed position. If valve outlet piping is closed off by other valves, however, product bleeding through the pilot will increase until it nearly equals tank pressure and the main poppet opens.

### Note

**The main poppet will not open if valve outlet piping is not closed off so that the outlet pressure can approach tank pressure.**

Once the main poppet opens, a flow greater than the valve's excess flow spring rating or a sufficient surge in flow forces the main poppet closed against the excess flow spring (view #4). The pilot valve allows a small amount of product to bleed, but much less than view #2 where the rapid equalization portion of the stem is placed in the pilot opening. When the operating lever is moved to the closed position, the valve closes completely and seals tightly (view #1).

## Operation

Since the Type C407-10 will not open unless the downstream pressure can buildup to equal the inlet pressure, an operating sequence that assures equalization is important.

Follow these points:

1. Type C407 on bobtails and transports should never be open when the truck is in motion. If the control system is not interlocked to prevent this, the operator is responsible to see that the valves are closed.
2. Always open the internal valve before opening any other valves in the line or starting the pump.

# Type C407-10

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3. Move the lever to the half-open position (Figure 2, view #2) to equalize pressure. When the main poppet clicks open, move the operating lever fully open.
4. Open other line valves slowly to avoid sudden surges which could slug the excess flow valve shut.
5. If the excess flow valve does close, stop the pump and close the nearest downstream valve. Move the internal valve's operating lever back to the rapid equalizing position and wait for the valve to click open. Then move the operating lever fully open and slowly open the downstream valve.
6. All valves should be completely open when pumping. **(Throttling type valves could prevent the excess flow valve from closing when required.)**
7. The operator must always be aware of where the remote closure controls are located and know how to operate the controls if any emergency requires valve closure. When pumping is finished, make a habit of closing the internal valve from the remote closure point, thus checking to see that the control actually is capable of closing the valve.
8. The valve should be open when back filling through the valve.

## Troubleshooting

**Internal Valve Will Not Open** – This could be due to leakage downstream, engaging the pump too soon or from excessive wear in the internal valve. If excessive volume is in the downstream system, a longer time is required to equalize the pressures (tank and downstream) before the pump can be engaged. To determine if the valve pilot seat is opening, install a gauge downstream of the valve, operate the valve actuator; if pressure does not buildup to the tank pressure, the valve pilot seat is not open. This test should be done with pump off. If the pilot is not opening, it may be plugged with dirt or some internal part may be broken. If by operating the lever manually it can be rotated past the fully open position, there is something wrong internally and the valve must be disassembled.

**Premature Valve Closure** – This can be caused from engaging the pump too soon, by an underrated excess flow valve spring or by an improperly connected internal valve operating lever which does not fully open the valve. The trouble could also be from a valve that has its inlet port obstructed or from sudden line surges.

In order to check the valve opening travel, operate the lever manually to the full travel, wait until valve opens (usually about 15 seconds), then engage the pump. If the excess flow closes, the points mentioned above should be investigated.

**Internal Valve Will Not Close** – The stub shaft could be binding or the stem could be bent in the valve. Before disassembling the valve, check the actuator mechanism to see that it operates freely by disconnecting it from the valve lever and cycling it several times. Also, operate the valve lever manually. If it sticks in the open position, the packing and bushings should be replaced. This should free the operating mechanism if the valve has not been damaged internally. Refer to the Maintenance section.

**Low Flow Capacity** – This could be caused by too small an internal valve, too small or long downstream piping, plugged screens, some other restriction in the downstream system or by the bypass valve sticking in the open position. The bypass valve could also be set too low and be opening prematurely.

## Maintenance

Refer to Figures 3, 4 and 5.



**Do not use these internal valves if they leak, fail to work properly or have been damaged or have missing parts. Prompt repairs should be made by a properly trained service person. Continued use without repair can create a hazardous or injurious situation.**

A simple preventative maintenance program for the valve and its controls will eliminate a lot of potential problems.

**Fisher® recommends these steps be conducted once a month:**

1. Regularly inspect the operating lever (key 18) to see that it operates freely and that there is no leakage around the stub shaft (key 15J). If there is leakage or sticking, the packing (keys 15F, G and H) should be replaced, see Disassembly section.
2. Check for tight closure of the seat discs. Any detected leakage, which is normally caused by disc wear or dirt, scale or debris embedded in the disc, requires that the internal valve be removed from service and repaired. Repair most often requires the replacement of valve discs. To check for leakage:

- a. Close the internal valve and exhaust downstream pressure. Close the first valve downstream from the internal valve and note any pressure buildup, using a pressure gauge, between the closed valve and the internal valve. If piping is cold allow it to warm to ambient temperature.
- b. Refer to CFR 49 Section 180 Appendix B for Meter Creep Test Methods.
3. All operating controls should be regularly inspected and cleaned and oiled. The controls should be checked to see that they fully open—but not over-travel—the internal valve and operate freely to close the valve.
4. Standard construction internal valves must be removed if the container is to be steam cleaned. Heat can damage the valve's seats and seals.
5. Standard construction internal valves are not designed for water service. Immediately after a container is hydrostatically tested, remove all water and allow the container to thoroughly dry out.
5. Pushing on the stub shaft will expose the gland parts including the spacer (key 15W) and packing (keys 15F, G and H).
6. Besides the packing, the liner bushings (key 15B) should be replaced.
7. Reassemble in reverse order. Replace cap screw (key 15R) using 30 to 35 in-lbs / 3.3 to 3.9 N•m torque.
8. Make sure the operating lever can move freely after the new parts are installed. Conduct a leak test under pressure with a soap solution.

## Disassembly



### WARNING

**Tank pressure must be released before removing the valve from the container. Failure to do so could result in personal injury.**

Numbers in parenthesis refer to key numbers in Figure 5.

### To Replace Packing

1. The packing can be replaced with product in the tank by closing the operating lever (key 16) and blowing down the downstream pressure in the system.
2. Remove the two cap screws (key 17) holding the gland assembly and cover plate to the body.
3. Rotate the entire gland assembly slightly counterclockwise and turn the assembly to the left as it is pulled out of the body.
4. Unscrew the cap screw (key 15R) from the stub shaft (key 15J) and remove the operating lever and cover plate by taking out the cotter pin (key 19).

### To Replace Seat Discs

1. Remove the valve from the tank and take out the gland assembly, refer to steps 2 and 3 above.
2. Holding the stem (key 2) with a 5/8 in. / 15.9 mm socket, unscrew bleed seat (key 13) from the stem.
3. Place the disc holder (key 6) into a vise with a shop towel over the vise. The vise must be tightened lightly and carefully so as not to bend the disc holder. Unscrew the disc retainer (key 8) to reach the main seat disc (key 4) and the bleed seat disc (key 11).
4. Examine both seat discs and replace if necessary. To ease installation place the bleed seat disc on top of the disc retainer before screwing the disc retainer into the disc holder.
5. If the excess flow spring (key 3) is changed, replace the nameplate or stamp the body with the new type number.
6. Reassemble in reverse order using 35 to 40 in-lbs / 4.0 to 4.5 N•m torque to install the disc retainer. Apply Loctite No. 242 or equivalent on the stem threads before installing the bleed seat (key 13).

## Parts Ordering

When corresponding about this equipment, always reference the equipment type number found on the nameplate. A replacement Parts List is available for the valves. When ordering replacement parts, reference the complete 11-character part number for each needed part.

# Type C407-10

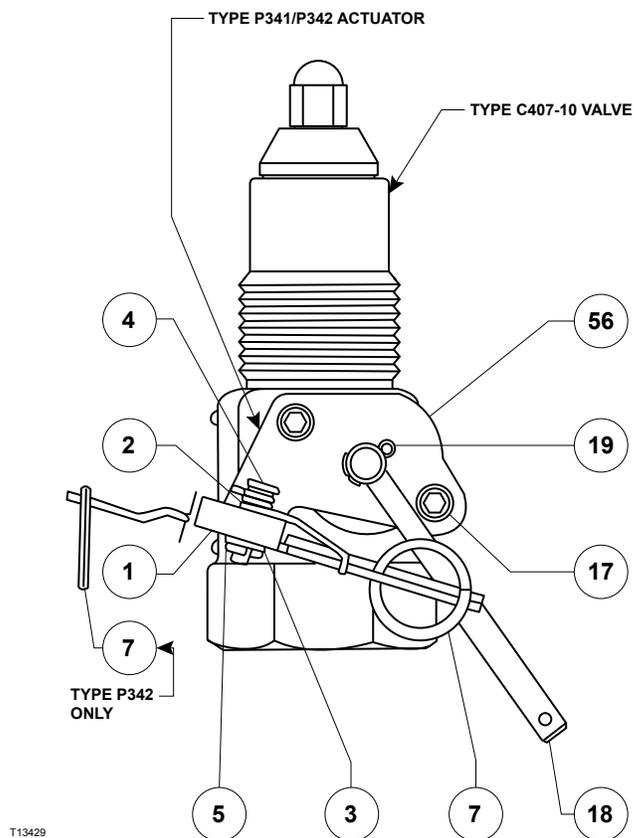


Figure 3. Type C407-10 with Latch and Remote Release

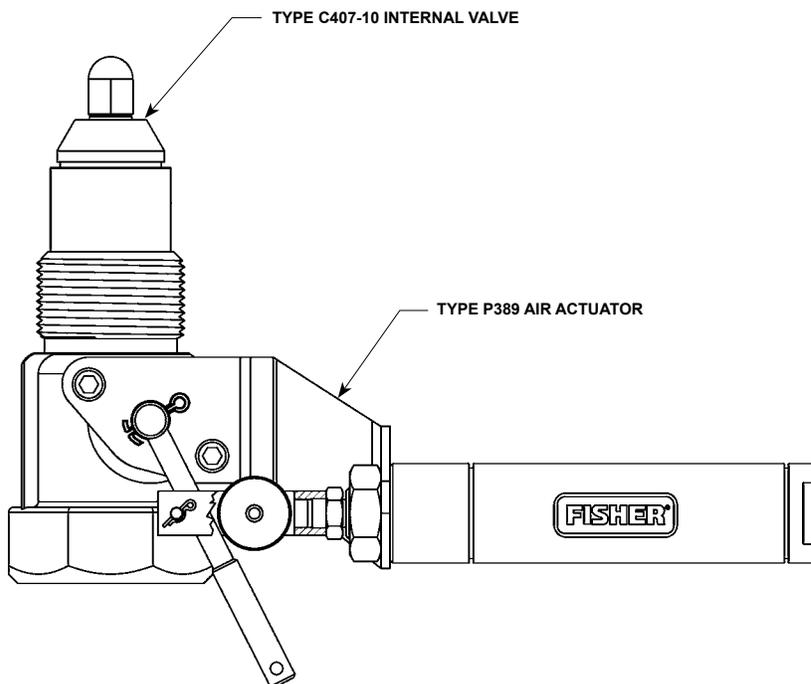
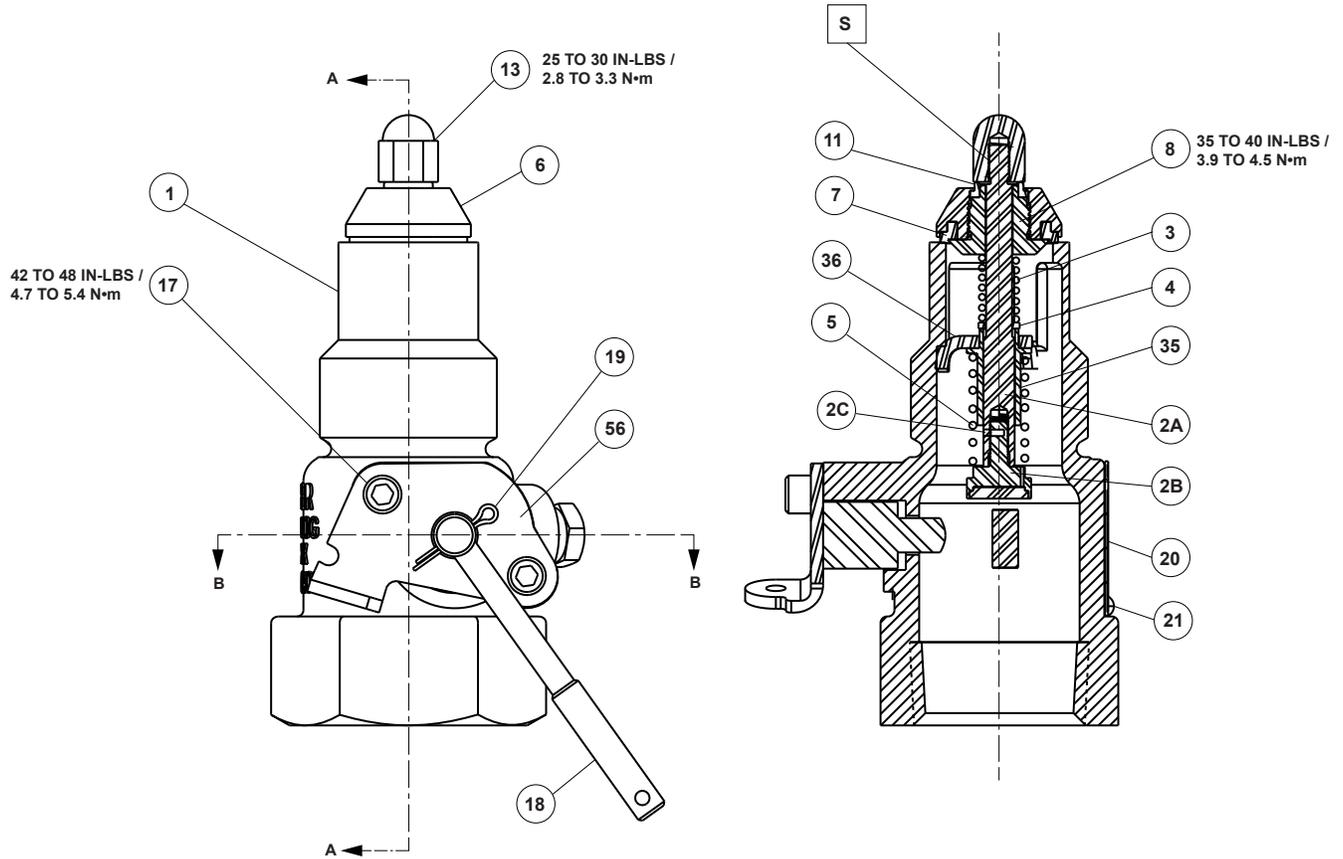


Figure 4. Type C407A-10



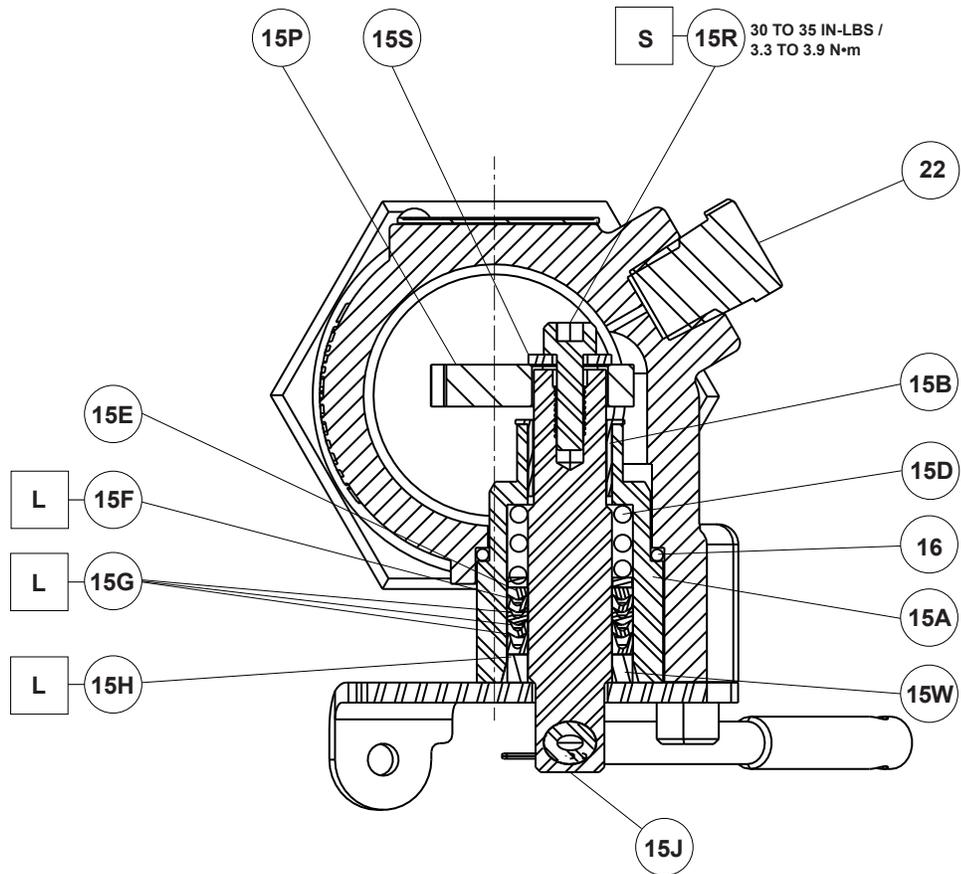
T80210

□ APPLY SEALANT (S)<sup>(1)</sup>  
 S = Medium Strength Threadlocker

1. Sealants must be selected such that they meet the temperature requirements.

**Figure 5. Type C407-10 Assemblies**

# Type C407-10



T80210

- APPLY LUBRICANT (L) OR SEALANT (S)<sup>(1)</sup>
- L = Magnalube®-G
- S = Medium Strength Threadlocker

Magnalube®-G is a registered trademark of Saunders Enterprises, Inc.

1. Lubricants and sealants must be selected such that they meet the temperature requirements.

**Figure 5. Type C407-10 Assemblies (continued)**

## Parts List

### Type P341/P342 Latch/Remote Release (Figure 3)

Key	Description	Part Number
1	Latch Type P341 Type P342	ERSA03889A0 ERSA03888A0
2	Spring	ERSA03852A0
3	Washer	T1173324152
4	Clevis Pin	ERSA03851A0
5	Cotter Pin	1A339328982
7	Pull Ring Type P341 Type P342 (2 required)	T13419T0012 T13419T0012
56	Cover Plate/Bracket	ERSA03861A0

Key	Description	Part Number
2	Stem Assembly	T13460T0012
2A	Stem	-----
2B	Follower	-----
2C	Groove Pin	-----
3	Excess Flow Spring, 302 SST 40 GPM / 151 L/min, Blue 50 GPM / 189 L/min, Green 80 GPM / 303 L/min, Orange	T13414T0012 T13413T0012 T13412T0012
4	Spring Seat, 302 SST	T13403T0012
5	Closing Spring, 302 SST	T13463T0012
6	Disc Holder, 303 SST	T13396T0012
7*	Main Disc, Nitrile (NBR)	T13397T0012
8	Disc Retainer, 303 SST	T13404T0012
11*	Bleed Disc, Nitrile (NBR)	T13395T0012
13	Bleed Seat, 303 SST	T13406T0012
15	Gland Assembly	T20850T0012
15A	Gland	T13399T0012
15B*	Liner Bushing	T13410T0012
15D*	Spring	ERSA03857A0
15E	Washer	T1207524082
15F*	Male Adaptor	T1207701012
15G*	Packing Ring (3 required)	T1207801012
15H*	Female Adaptor	T1207901012
15J	Stub Shaft	T20846T0012
15P*	Cam	ERSA04806A0
15R	Cap Screw	1D617032992
15S	Washer	T1173324152
15W*	Spacer	ERSA03858A0
16*	O-ring, Nitrile (NBR)	T13400T0012
17	Cap Screw, SST (2 required)	T13402T0012
18	Lever, 316 SST	T13428T0012
19	Cotter Pin, SST	T13405T0012
20	Nameplate	-----
21	Drive Screw, 18-8 SST (2 required)	1A368228982
22	Plug, Hex	T13718T0012
30	Fusible Link (Not Shown)	1J157443992
35	Stem Guide, 303 SST	T13462T0012
36	Guide Bracket, Steel	T20848T0012
56	Cover Plate, 304 SST	ERSA03861A0

### Type C407-10 Internal Valve (Figure 5)

#### Note

**Type C407-10 dated prior to April 1987, stem replacement parts include keys: 2 - stem assembly, 5 - closing spring and 35 - stem guide.**

**Type C407-10 dated after May 1987, stem replacement parts include key: 2 - stem assembly.**

Key	Description	Part Number
1	Replacement Kits <sup>(1)</sup> Gland Assembly Kit includes key 15A, 15B, 15D, 15E, 15F, 15G, 15H, 15J, 15P, 15R, 15S and 15W Soft Seals Kit (main and gland seals) includes key 7, 11, 15B, 15D, 15F, 15G, 15H, 15P, 15W, 16 and 51 Complete Repair Kit (main seals, gland seals and gland assembly) includes key 7, 11, 15A, 15B, 15D, 15E, 15F, 15G, 15H, 15J, 15P, 15R, 15S and 15W, 16, 17 and 51 Body, WCC Steel	T20850T0012* RC40710T042* RC40710T032* T40500T0012

\*Recommended spare part.

1. Replacement Kits can be used in older versions of Type C407-10, manufactured before December 1, 2014. Old Kit RC40710T012 is only for Type C407-10 manufactured before December 1, 2014.

# Type C407-10

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## LPG Equipment

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