INSTALLATION, OPERATION & MAINTENANCE MANUAL

LUBRICATED PLUG VALVES

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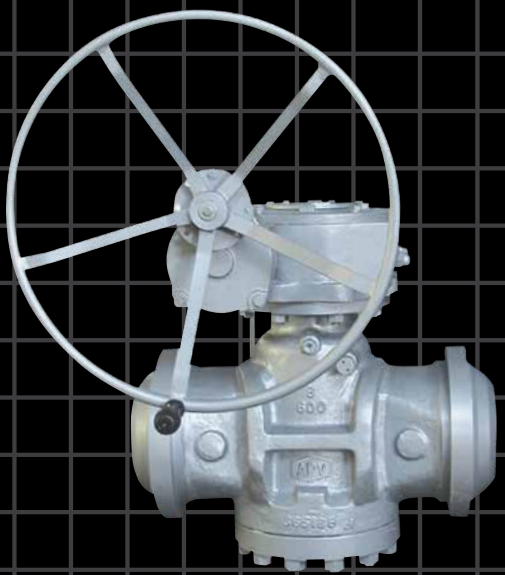

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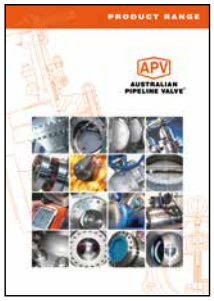

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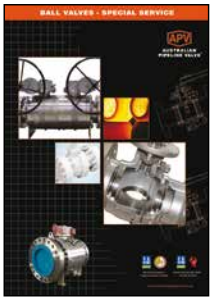

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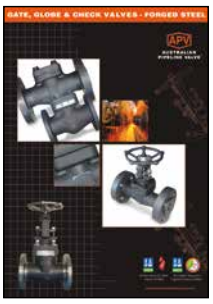

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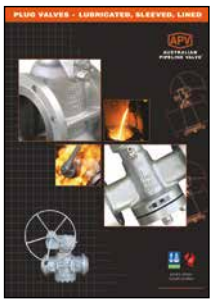

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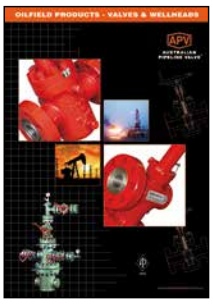

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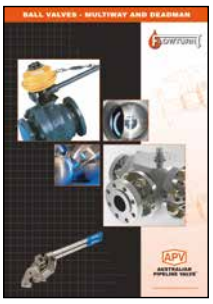

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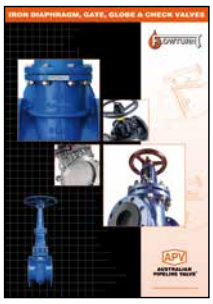

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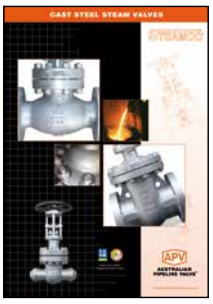

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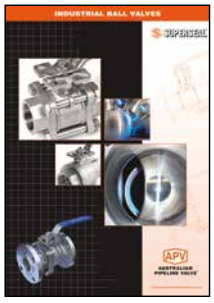

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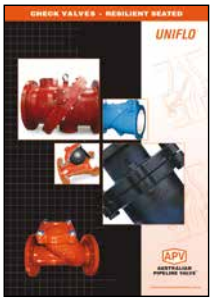

Uniflo Check Valves

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INTRODUCTION

The majority of this information is common knowledge to experienced steel valve users. When properly installed in applications for which they were designed, APV valves will give long trouble free service. This instruction is only a guide for installation, operation and minor maintenance. A professional APV approved valve engineering facility should be utilised for reconditioning and minor repairs.

We do recommend however that this entire document be read prior to proceeding with any installation or repair. Australian Pipeline Valve and it's parent company take no responsibility for damage or injury to people, property or equipment. It is the sole responsibility of the user to ensure only specially trained valve repair experts perform repairs under the supervision of a qualified supervisor.

RESPONSIBILITY FOR VALVE APPLICATION

The User is responsible for ordering the correct valves. APV Valves are to be installed in the observance of the pressure rating and design temperature. Prior to installation, the valves and nameplates should be checked for proper identification to be sure the valve is of the proper type, material and is of a suitable pressure class and temperature limit to satisfy the applications requirements.

Do not use any valve in applications where either the pressure or temperature is higher than the allowable working values. Also valves should not be used in service media if not compatible with the valve material of construction, as this will cause chemical attacks.

RECEIVING INSPECTION AND HANDLING

Valves should be inspected upon receipt to determine:

- Compliance to purchase order requirements.
- Correct type, pressure class, size, body and trim materials and end connections (this information may be found on the nameplate or may be stamped on the body of the valve).
- Any damaged caused during shipping and handling to end connections, hand wheel or stem.

The End User is advised that misapplication of the product may result in injuries or property damage. A selection consistent with the particular performance requirements is important for proper application and is the sole responsibility of the end user.

MATERIAL COMPATIBILITY

Valve structural materials and lubricants should be chemically compatible with other piping system components, line fluids, and the environment. If compatibility is a concern, guidance should be sought from appropriate sources (system engineers for example).

SAFETY INFORMATION

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein.

Do not attempt to disassemble a valve while there is pressure in the line. Make sure both upstream and downstream pressures are removed. Disassemble with caution in case all pressures are not relieved. Even when replacing packing rings, caution is necessary to avoid possible injury.

To prevent valve distortion, inefficient operation, or early maintenance problems, support piping on each side of the valve. Warning, certain gases and fluids could cause damage to human health, the environment or property, hence the necessary safety precautions to prevent risk should be taken.

- *A valve is a pressurised device containing energised fluids and should be handled with appropriate care.*
- *Valve surface temperature may be dangerously too hot or too cold for skin contact.*
- *Upon disassembly, attention should be paid to the possibility of releasing dangerous and or ignitable accumulated fluids.*
- *Adequate ventilation should be available for service*

This manual provides instructions for storing, general servicing, installation and removal of plug valves.

APV refuses any liability for damage to people, property or plant as well as loss of production and loss of income under any circumstances but especially if caused by: Incorrect installation or utilisation of the valve or if the valve installed is not fit for intended purpose. It is the sole responsibility of the client to ensure the valve type and materials are correctly specified.

FIRE SAFETY AND FIRE TEST

The terms “firesafe” and “fire tested’ are nebulous and should not be used without an accompanying specification of what exactly may be required. For example there may be a requirement for a specific test, or for limitations on the failure mode of the valve to be identified.

Examples include:

- Gross valve pressure boundary leakage caused by the destruction of elastomeric or polymeric materials.
- Leakage greater than a specific rate when the valve is closed caused by destruction of elastomeric or polymeric.
- Uncontrolled build up of pressure in the body cavity of a double-seated valve causing external heating of the valve.

Not as easy to define, other than by testing standardised procedures, are the requirement related to after-fire operability and seat tightness. Standards API607, ‘fire test for soft-seated quarter-turn valves’, and API 6FA ‘specification for fire test of valves’ cover post-fire valve operability simulation fire testing. Consult an APV customer representative or our website for information regarding qualification of valves to fire test standards.

PRESSURE BUILD-UP

Expansion or vaporisation of the liquid will increase the cavity when a closed valve containing liquid is heated (e.g. from process condition, radiation, or solar heating). Alternately, cooling an undrained cavity below freezing point may also result in expansion of the medium. These expansions can result in extremely high pressures in the valve. Consideration should be given to providing positive measures for the prevention of such pressurisation when these conditions are predicted.

A pressure-relief device is not provided to pressure balanced plug valves to protect them from excessive pressurisation from line pressure. The onus is on the user to provide a pressure relief device as part of the line system in which the valve will be used.

OTHER PRESSURISATION

Pressure balanced plug valves are not provided with a pressure-relief device to protect them from over pressurisation from line pressure. It is the user’s responsibility to provide a relief device as part of the line system in which the valve will be used.

CHANGES TO TEMPERATURE

Valve structural materials expand with rising temperatures and contract with falling temperatures. Increases in temperature cause a decrease of mechanical strength that is generally regained on return to a lower temperature. Significant thermal stresses or distortion, with possible adverse effect on valve performance, may be caused by non-uniform temperature in a structure.

Thermal stress fatigue is a possibility and should be considered in applications involving frequent

temperature cycling. One, or a combination, of the following, may increase the possibility:

- Increasing thickness of metal sections.
- Increasing rate of temperature change.
- Increasing thermal conductivity of the fluid.
- Increasing temperature level.
- Increasing temperature range.
- Increasing the number of cycles.

Thermal cycling may also increase the tendency for stem seal leakage.

1.0 STORAGE

1.1 TEMPORARY STORAGE

If valves are to be stored before installation, the following should be observed:

a) Keep the valves wrapped and protected as shipped from the manufacturer.
b) Do not remove the protective ends covering until the valve is ready for installation. This will reduce the possibility of foreign material damaging the internal valve components.
c) Valves stored outdoors should be positioned such that water does not accumulate in the valve body.

1.2 LONG TERM STORAGE

If valves are to be stored more than one year, they should be prepared in the following manner:

a) Remove the packing and apply a preservative to the packing chamber.
b) Do not remove the protective end covering.
c) Do not store the valves outdoors.

1.3 PREPARATION

a) Remove the valve end protection.
b) Prior to shipment from the manufacturer, a preservative may have been applied to the inner body of the valve. This preservative may have been removed with a solvent.
c) The inside of the valve should be inspected and blown out with compressed air. Adjacent piping must be clean and free from debris to prevent damage to the valve.
d) To prevent valve distortion, inefficient operation or early maintenance problems, support piping on each side of the valve.
e) Make sure the valve is positioned such that there is sufficient space so that the hand wheel is easily and safely reached and there is enough clearance for the stem when the valve is open.
f) Install the valve according to the flow indicator on the valve body where applicable.

2.0 OPERATION

DURING OPERATION TAKE INTO ACCOUNT THE FOLLOWING WARNINGS:

a- Graphite/Graphoil packing and body gasket is very brittle, any impacting, twisting or bending should be avoided.

b- The valve's internal parts such as plug, stem, seating area, seals, gaskets shall be handled with care avoiding scratches or surface damage.

c- All tools and equipment for handling the internal parts shall be soft coated.

d- Valves can be fitted with gaskets or seals in PTFE, Buna, Viton, etc., hence high temperatures will damage sealing components.

e- Never part open valve. Valve must be full open of full closed to avoid seat damage.

For all operations make reference to position number on part list of the applicable drawing listed.

2.1 MANUAL OPERATION

Valve adjustment is by clockwise turning of stem. Lever operated and gear operated valves have position indicator to indicate open or closed (see figure 1 & 2). Plug Valves must not be used for throttling. Valve must be full open or full closed.

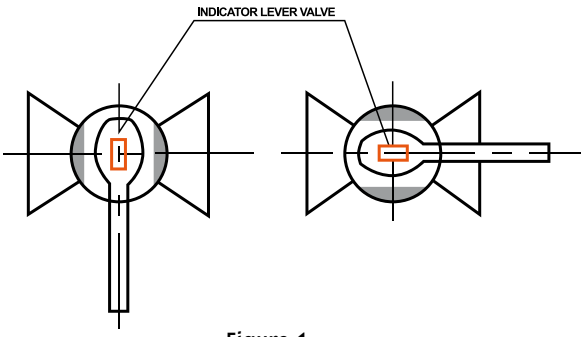


Figure 1

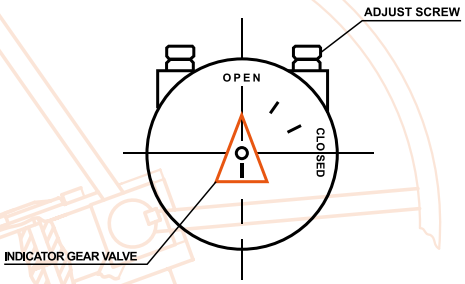


Figure 2

2.2 LOCK DEVICE

Where provided (optional) the valve has a locking lug that allows valve to be locked in full open or full closed position.

2.3 THROTTLING SERVICE

Valves used to regulate the rate of fluid flow may be subject to severe fluid turbulence. This turbulence can create a high-energy conversion within the valve and piping system. High noise levels indicate energy conversion either by the disturbance of liquids or by shock waves from gases. An example of low-level cavitation noise is the sound made by water in water pipes or a faucet. There is a possibility for mechanical damage to the valve and piping system when throttling of liquid flow results in severe and continuous cavitation conditions. Similarly, shock waves can result in damage to the system with gas flow

under severe throttling conditions. APV personnel should be consulted on proper valve selection for throttling applications.

2.4 PRESSURE SURGE

Closure of a valve in a flowing fluid line will cause the flow rate of the fluid to be reduced to zero. If the fluid relatively incompressible liquid, the inertia of an upstream column produces a pressure surge at the valve, the magnitude of which is inversely proportional to the time required for closure. The surge pressure is also proportional to the length of the upstream fluid column and the fluid velocity prior to closure initiation. If the application involves a long upstream line, a long downstream line, high velocity, and/or rapid closure, separately or in any combination, the possibility of an unacceptable pressure surge should be investigated.

Also to be considered is condensation-induced pressure surges that occur when a fluid's speed is changed by rapid condensation, or when a rush of water is accelerated by contact with stream. (For example, when condensation collects on one side of a closed valve that has steam on the other side, opening the valve will cause steam cavities to collapse, sharp pressure surges, and acceleration of condensation). Condensation-induced pressure waves can result in pressure pulses that are significantly higher than those produced by a sudden valve closure. In such events, non shock-rated grey iron valves installed in steel piping systems are particularly vulnerable to catastrophic failure. Traps are required to prevent the accumulation of condensation, and blow-off valves located at the low point in the system are needed to ensure condensation drainage. Personnel involved in operation and/or maintenance must be familiar with the function of both these devices in relation to the shutoff valve operation and how to keep these valves in proper working order.

3.0 INSTALLATION

3.1 INSTALLATION POSITIONS

Plug valves are usually bi-directional, and therefore may be installed in either direction. In some cases, plug valves may be unidirectional, in which case the direction of flow will be indicated on the valve body.

Piping should be properly aligned and supported to reduce mechanical loading on the end connections.

3.2 PREPARATION FOR INSTALLATION

- Remove protective end caps or plugs and inspect valve ends for damage to threads, socket weld bores or flange faces.

- Thoroughly clean adjacent piping system to remove any foreign material that could cause damage to seating surfaces during valve operation.
- Verify that the space available for installation is adequate to allow the valve to be installed and to be operated.

3.3 END CONNECTIONS

3.3.1 Threaded Ends

Check condition of threads on mating pipe.

Apply joint compound to the male end of joint only. This will prevent compound from entering the valve flow path.

3.3.2 Flanged Ends

Check to see that mating flanges are dimensionally compatible with the flanges on the valve body ensure sealing surfaces are free of debris.

Install the correct studs and nuts for the application and place the gasket between the flange facings.

Stud nuts should be tightened in an opposing criss-cross pattern in equal increments to ensure even gasket compression.

3.3.3 Socket weld Ends

Remove all debris, grease, oil, paint, etc., from the pipe that is to be welded into the valve and from the valve end connections.

Insert the pipe into the valve end connection until it bottoms out in the socket weld bore. Withdraw the pipe 1/16" so that a gap remains between the pipe and the bottom of the socket weld bore to prevent cracks (ASME B16.11). Tack the pipe into the valve and complete the fillet weld.

Welded end plug valves in smaller diameters should be lightly closed to prevent damage to the seating surfaces and stem caused by thermal expansion during the weld process.

3.3.4 Buttweld End Valves

Clean the weld ends as necessary and weld into the line using an approved weld procedure. Make sure the pipe and body material given on the nameplate or body is compatible with the welding procedure. (Refer our compatibility cross reference chart for equivalent pipe, valve & fittings grades).

3.3.5 Valve Installation by Welding

After welding completion, open the valve and flush line to clean out any foreign matter.

The responsibility for welding of the valves into piping systems is that of those performing the welding. Refer to ASME B31.1, B31.3 etc. Written welding procedures covering all attributes of the process and materials to be welded shall be in accordance with Section IX of the ASME Boiler and Pressure Vessel Code and any additional requirements from the applicable piping code including any possible necessary localised post weld heat treatment depending on material specifications.

Packing leakage could result in personal injury. Valve packing is tightened prior to shipping but may require readjustments to meet specific service conditions. Do not attempt to change packing or stem seals whilst the valve is inline under pressure.

Personal injury may result from sudden release of any process pressure. APV recommends the use of protective clothing, gloves and eyewear when performing any installation or maintenance.

Isolate the valve from the system and relieve pressure prior to performing maintenance.

Disconnect any operating line providing air pressure, control signals or electrical power to actuators.

Check the packing box for pressurised process fluids even after the valve has been removed from the pipeline, particularly when removing packing hardware or packing rings.

If a gasket seal is disturbed while removing or adjusting gasketed parts, APV recommends installing a new gasket while reassembling. A proper seal is required to ensure optimum operation.

4.0 MAINTENANCE

The main maintenance of a plug valve involves stroking, regreasing, packing adjustment and plug adjustment. Greasing is the most important activity as plug valves rely on grease to effect a seal on the seat. In summary the main maintenance activities are: -

- Injection of valve sealant to the plug/seating area (required routinely).
- Injection of stem packing compound (emergency feature).
- Adjustment of the plug loading screw (unlikely to ever be required).

4.1 VALVE SEAT LEAKAGE/PLUG ADJUSTMENT

1. One of the most common problems associated with seat leakage is the lack of sufficient sealant to adequately fill and pressurise the sealant system. Introduce the correct amount of sealant into the valve and again check for seat leakage.
2. An indication of a loose plug adjustment is that the valve opening torque is lower than normal. Operate the valve a number of times prior to adjusting the plug adjusting screw and make adjustments using the following procedures:

If a non-compressible fluid is trapped in the centre cavity of the plug, when the valve is in the closed position, injecting sealant at high pressures or high volumes can cause the plug to lock in place. This can also cause the cover bolts to yield, resulting in bonnet leakage.

a) Only if required, remove the plug adjusting screw cover or bolt (P/N 12) (see Appendix A, B and C) to expose the internal adjusting screw.
Note: - This should never be required early in the life of the plug valve.

<u>Never</u> remove the bottom flange itself as it is exposed to full line pressure.
During factory assembly, thread-locking compound is applied to the plug adjusting screw. Initially, the screw may be difficult to turn.
Over-adjusting the plug adjusting screw will lock the plug into the body taper.

b) Slightly tighten the plug adjusting screw, move the valve back and fourth through it's 90° operating range and simultaneously tighten the plug adjusting screw. This action will help disperse previously injected valve sealant. If operating conditions prevent rotating the plug completely through it's 90° operating range, rotate the plug through 20° arc to disperse the sealant. Continue to tighten the plug adjusting screw until a noticeable torque increase makes the plug harder to turn. This indicates metal-to-metal contact between the body and plug.
c) Loosen the plug adjusting screw 1/8 turn. The valve should be in the full open position for final plug adjustment.

d) Inject sealant. A higher pressure reading will appear on the gauge. If there is not a pressure increase on the gauge, repeat steps b and c. If a second attempt at plug adjustment is unsuccessful, it is possible there is a damaged area on the plug or body-seating surface. Refer to section 4.2
e) Replace the plug adjusting screw cover or bolt (P/N 18 Appendix A, B and C).

4.2 VALVE LUBRICATION OVERVIEW

The valve must be fully OPEN or fully CLOSED otherwise all four grooves on the supply channels will not be connected. Only an expert trained plug valve maintenance specialist should undergo maintenance. Sealant can be injected whist the valve is in-line and under full working pressure. The following is only an indicative summary of procedures.

APV lubricated plug valves are designed to be lubricated using two different methods

- Via built-in lubricant screw using grease sticks.
- With hydraulic lever gun.

Method 1 via hex lubricant fitting to stem (where applicable)

Refer to 4.2.4

Method 2 with hydraulic lever gun - stem (where fitted) and body

1. Charge the lever gun following manufacturers instructions.
2. Connect coupler of the lever gun to the universal button head of the lubricant screw.
3. Inject the grease by means of hand lever pumping.
4. Turn the plug for even distribution of lubricant.
5. Continue lubrication until lubricant is visible inside the valve body (body sealant fitting only. Refer P/N 15 Appendix B to B4).

Monitor the pressure gauge during the sealant injection process. For sealant to flow onto the valve seats, enough sealant at sufficient pressure has first to be injected to over come the line pressure, to fill any cavities in the sealant chamber and grooves, and to overcome the flow resistance through the valve sealant system.

It is desirable but not essential; to operate the valve either partially or fully after injecting sealant, to help spread the sealant over the entire seating surfaces.

4.2.1 Sealant injection equipment

To inject sealant, a high pressure sealant gun with a ‘giant button head’ coupler is required. There are three basic types:

a) Manual primed with screw feed guns - inexpensive for occasional use.
b) Hydraulic manual feed - recommended for servicing small groups of valves.
c) Pneumatic, using bulk lubricant in larger tins - recommended for large quantities of valves.

Do not attempt to use low pressure lubricant guns (e.g. those used to grease wheel bearings)

4.2.2 Valve sealants and lubricants

Only sealants recommended for TAPER plug valves should be used.
Do not use the following types of sealant:

a) Sealant supplied by cylindrical/parallel plug valve manufacturers. These are much higher viscosity than taper plug valves require and will substantially increase the valve torque.
b) Commercially available lubricating grease such as bearing grease. These greases do not have the chemical resistance, lubricating and sealing properties required by taper plug valves.

Do not use plug sealant grease for the stem packing where the design requires PTFE plastic packing (see below explanation). Where an allen key closure system is fitted on the stem sealant nipple, packing 'sticks' can be used as stated below. Mushroom head grease nipple may also be fitted.

For leaking valves it is common for operators to use a higher viscosity 'sealant' in the sealing grease channel in lieu of conventional sealant/lubrication. Some types are even laced with Teflon to help seal even very worn valves. However, special heavy sealants can eventually harden dramatically increasing torques and blocking grease supply channels preventing the replenishment of replacement lubricant reaching the critical seating areas. In addition, they can dramatically increase torque. This can happen due to higher temperatures, lack of maintenance, time, or just due to the nature of the media being handled. Some sealants can also block secondary check valves inside lubricant fittings. Flushing agents are available to attempt to clear hardened grease without having to remove the valve from the line. Lighter sealants (lubricants) are available which enjoy a longer life and tend to harden slower. However, on the down side these lighter sealants flush away quicker and provide a less effective seal on worn or corroded valves.

It is important to remember that in small sizes below 50 NB depending on class (typically those without a flanged top bolt gland) the stem packing is the primary seal and only stem packing compound should be used to top up the packing, not grease sealant. Grease sealant is only used for the plug/seat area. In smaller size and lower pressure plug valves, 'packing sticks' are used and can be screwed in through the top of the stem with a bolt in lieu of using a grease fitting. If there is no body grease fitting, then the sealant channel on top of the stem supplies sealant to the plug and the seat. Bolted style gland packed valves do usually (optionally in smaller sizes) have a separate stem sealant injector but this is only needed in an emergency to temporarily seal a damaged stem seal (refer to Appendix B to B4 and C).

The purpose of lubrication is for 3 reasons:-
- To protect the surface seal of the valve from corrosion and abrasion.
- To contribute to a good seal.
- To contribute to an easy action.

The frequency of re-lubrication depends upon the operating conditions from the required mode of sealing. Generally the valve should be regreased every 3 or 4 operations of the valve especially if used high pressure gas however it depends entirely on the period between each operation of the valve.

The following tables gives you the minimum frequency of re-lubrication according to the temperature range and service type. ANSI class 600 and above should be greased more frequency especially if the media is high pressure gas. Special grease should be used for low and high temperature.

The quantity of grease for re-lubrication also depends on the operating conditions, however the usual amount is about 2 gr/mm of passage.

TABLE 1

Frequency of lubrication using temperature as a guide

TEMPERATURE RANGE	TEMPERATURE RANGE
-28° to -1°C	18 months
0° to 100°C	16 months
-50° to 29°C	12 months
100° to 150°C	10 months
150° to 180°C	5 months
over 180°C	2 months

TABLE 2

Frequency of lubrication using service as a guide

SPECIAL CONDITIONS	FREQUENCY OF SEALANT INJECTIONS
Infrequent operation, valve either fully opened or fully closed. Non abrasive gases or liquids.	Every 20 operations, minimum twice per year. But, depends on media, temperature, etc.
Infrequent operation, valve either fully opened or fully closed. Abrasive gases or liquids.	Every 10 operations, minimum 4 times a year. But, depends on media, temperature, etc.
Throttling services and abrasive slurries.	Every 5 operations, minimum 8 times a year. But, depends on media, temperature, etc.

The choice of lubricant should be in accordance with the process medium and the service temperature range (see lubrication Table 1 & 2 above).

It is recommended that the valve be periodically stroked (at least partially) to ensure valve functions, and will aid to prevent seizure/galvanisation on any mating surfaces (or in the case of resilient seats). Duration depends on service, criticality, etc.

There are different types of lubricants available depending on temperature and service. Special lubricants for worn or corroded valves are available as well as flushing agents to remove old grease.

Use extreme caution when injecting sealant into a valve in the closed position with a non compacting fluid in the valve.

4.2.3 Sealant injection procedure plug/seat sealant

1. Ascertain if the valve is fully open or closed before injecting sealant into the valve. Although pressure balanced plug valves can be lubricated with the plug in any position, either full open or full close position allows the sealed port groove system to completely distribute the pressurised sealant to the valve seating surfaces.
2. Locate the sealant injection fitting situated on the side of the valve (for small sizes it may only be on the top of the stem). Attach the sealant injection device to the fitting. To inject sealant, follow the operating instructions for the injection equipment that you are using.
3. To help you establish if there are valve seat leakage problems, (referencing the pressure gauge on the grease injections gun will assist in providing feedback) different scenarios indicated by the gauge listed below (refer a), b), c), & d).

a) The gauge does not indicate a pressure increase above the initial pressure required to inject sealant into the valve.

There are three possible reasons:

- The seat is leaking. Leakage may be caused by to loose an adjustment or damage to the valve's seating areas.
- The sealant system is not full.
- Your grease gun or gauge is faulty

b) As sealant is injected, the gauge indicates a gradual increase in pressure until an initial level is reached, then the pressure increases to a higher level and then quickly falls back to a lower level. This indicates that the valve is receiving sealant properly, the valve sealant system has filled, and the plug has moved off the seat. Even though this shows that the plug has moved off the seat, it is still possible that the valve may be difficult to operate.

Causes of operation difficulties include:

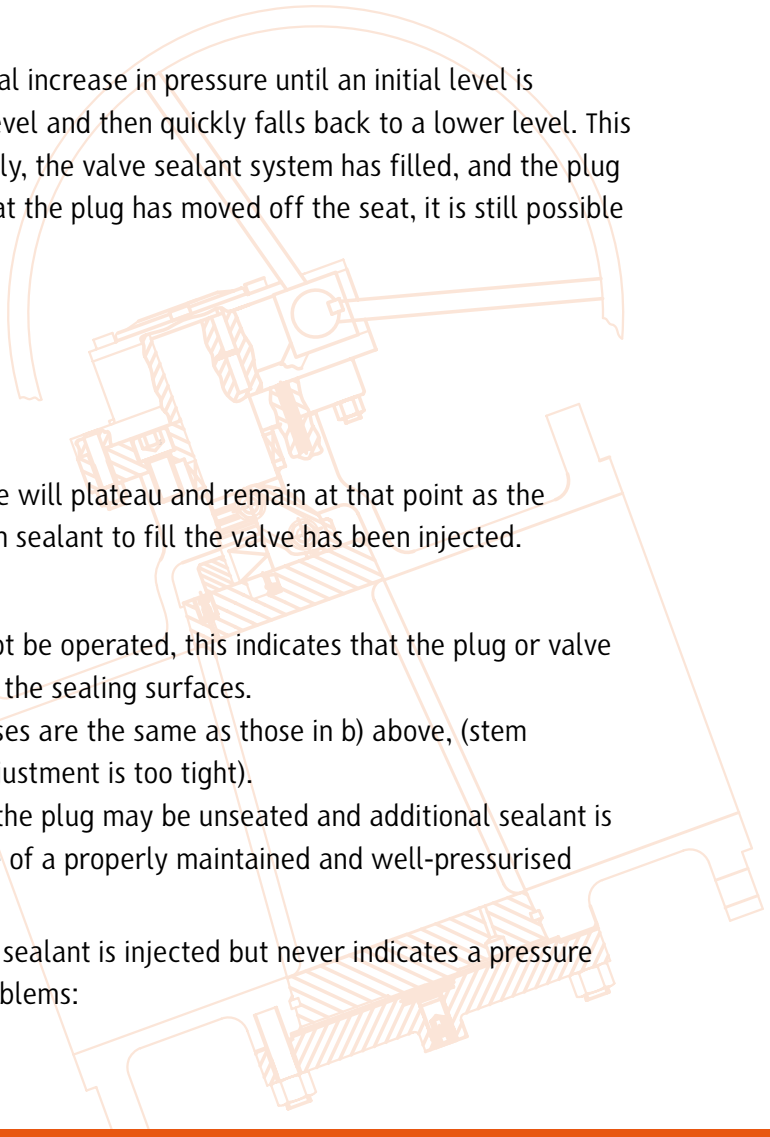
- Stem corrosion.
- Gearing or actuator problems.
- The adjustment is too tight.

c) As per b) above, except the sealant pressure gauge will plateau and remain at that point as the injection equipment is operated, even after enough sealant to fill the valve has been injected.

This signals one of the following:

- If the plug is locked in the body taper and cannot be operated, this indicates that the plug or valve body may be damaged and sealant is bypassing the sealing surfaces.
- If the valve is difficult to operate, the likely causes are the same as those in b) above, (stem corrosion, gearing or actuator problems, the adjustment is too tight).
- If the plug is not locked in the body taper, then the plug may be unseated and additional sealant is bypassing the plug. This is normal and indicative of a properly maintained and well-pressurised valve.

d) The gauge indicates a continual rise in pressure as sealant is injected but never indicates a pressure decrease. Where one of the following possible problems:



- The plug has seized in the body taper.
- The valve sealant fitting is faulty.
- The sealant system is blocked.

Attempt to resolve the problem by opening and closing the valve several times while continuing to inject sealant. If the valve cannot be fully opened or closed, rotate the plug back and forth 20° several times. After the sealant has been injected, relieve the pressure within the injection equipment and remove it from the sealant fitting.

4.2.4 Stem sealant injection procedure

A) STEM PACKING COMPOUND ADJUSTMENT

APV pressure balanced plug valves have an emergency stem packing compound injector unit (where fitted, typically 50NB (2") & over depending on class (Refer Appendix B to B4 and C). (see 4.2.2 for design variations). In the event of developing a stem leak, this fitting can be used to inject stem packing compound to reseal the valve stem. This can be done with the valve under pressure. Depending on the size of the valve, the stem packing consists of hexagonal shaped (fitting) that is screwed into the valve body. Inside it is a check valve, and stem packing compound is forced through it with a hexagonal socket or headed screw.

***Never** unscrew the stem packing compound injector out of the valve body while the valve is under pressure. On threaded stem APV valves, the injected stem packing compound is the primary seal in which case valves are supplied pre-loaded with packing. On the 'plain stem design' with a bolted top gland (smaller sizes see 4.2.2), it is an emergency feature to back up the main stem packing rings.*
Never attempt to replace the stem packing rings while the valve is under pressure.

B) CONFIRM SUSPECTED STEM LEAKAGE

The following methods can indicate stem leakage.

a) Gas services - applying a detergent solution around the stem area will produce soap bubbles if the stem is leaking. A bad leak may be heard as a hissing noise from the stem area.
b) Liquid services - stem leak on a liquid service will be visible as liquid flowing out from where the stem protrudes from the body.
c) Gear operated valves - the area where the stem protrudes from the body is hidden by the gear operator. Confirm stem leak by observing or applying a detergent solution around relief valve (where fitted) in the gear operator indicator plate, and the gear operator to the valve body mounting area.
d) Portable electronic hydrocarbon detectors - some are sensitive enough to detect stem leaks by placing the probe adjacent to the stem.

C) INJECTING STEM PACKING COMPOUND

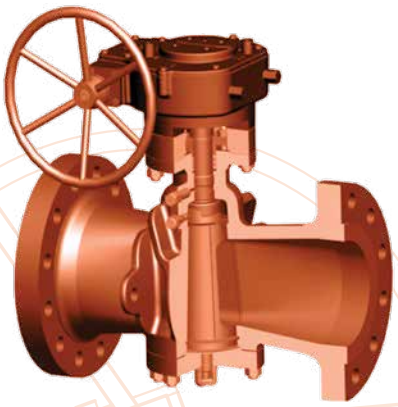
(Refer to 4.2.2 as smaller sizes do not have a seperate stem packing injection facility). Attach the allen

key/hexagon socket to the torque wrench and position the hex. Socket/headed screw in the centre of the injection fitting, and rotate it clockwise until the recommended torque is reached. Normally only 1-3 turns will be possible. The maximum recommended torque is dependant on the size of the injecting hexagon screw or hexagon set screw. The torque values are:

3/8" UNC (M10) torque required 20lb.ft (27Nm)
1/2" UNC (M12) torque required 24lb.ft (34Nm)
3/4" UNC (M20) torque required 45lb.ft (60Nm)

It is important that the torque values are not exceeded to avoid damage to the stem packing fitting. It should be noted that it is difficult to inject stem packing using a winding out tool; it is preferable to use a hexagon adaptor and a torque wrench. The injection screw must have a plain end. Operating the valve during the injection of stem packing compound can assist in the valve resealing.

If a hexagon socket/headed screw bottoms out inside the stem packing, and the stem is still leaking, then more stem packing compound needs to be loaded into the stem packing. This is done by removing the hex socket/headed screw and putting a new piece of stem packing compound into the injector unit and energising it with the hexagon socket/headed screw. Refer to the torque values listed above.



Always apply anti-seize to the stem packing before injection.

Never unscrew the stem packing compound injector out of the APV valve body while the valve is under pressure.

5.0 REPAIR

Only minor repair should be attempted. Major repairs should be undergone by an APV approved plug valve specialist repairer. This is a general guide. Refer to 4.2.2 regarding variations in design according to size and class.

5.1 DISASSEMBLY

During disassembly care must be taken to avoid damage to individual component surfaces. Similar care should be taken with gasket contact areas of flanges. For drawing refer to our as-built drawing for each item supplied with order. The below procedure is a general guide, parts vary according to size & class. Disassembly should be performed by an APV approved service centre. Refer Appendix A & B as a giuide but consult the as-built drawing as designs vary according to size, class & style.

1. Remove the valve from pipeline with plug in the OPEN position. Before removing valve bleed off residual pressure that may be in the body cavity.
2. Remove valve operator (gearbox or wrench).
3. Unscrew the lubricant screw from the stem and the check valve (where applicable).
4. Unscrew gland flange screws and remove gland flange, then the graphite packing.
5. Rotate the valve 180°, to access the cover.
6. Remove screw cap and remove plug loading screw and nuts.
7. Remove thrust seat from the cover.
8. Remove the two diaphragms (where applicable).
9. Remove spherical bearings from the plug.
10. Lift the plug using the eyebolt.
11. Remove equaliser ring (where applicable) and extract the stem using an eyebolt.
12. Carefully remove the bearing from stem.

5.2 INSPECTION & REPAIR

1. Degrease and clean all components of the valve. Particular attention should be paid to the cleanliness of the sealant grooves in the plug.
2. Clean and degrease the upper and lower chambers in the body and visually check for signs of damage or wear.
3. Visually examine the plug surfaces and the contacting surfaces of the valve body for damage or wear.
4. Visually examine the stem and equaliser ring for damage or wear and the contacting surfaces on valve body.
5. There should be no deformation or wear on cover.
6. Replace any worn or damaged parts such as: O-rings, thrust bearing, diaphragm, etc.

5.3 REASSEMBLY

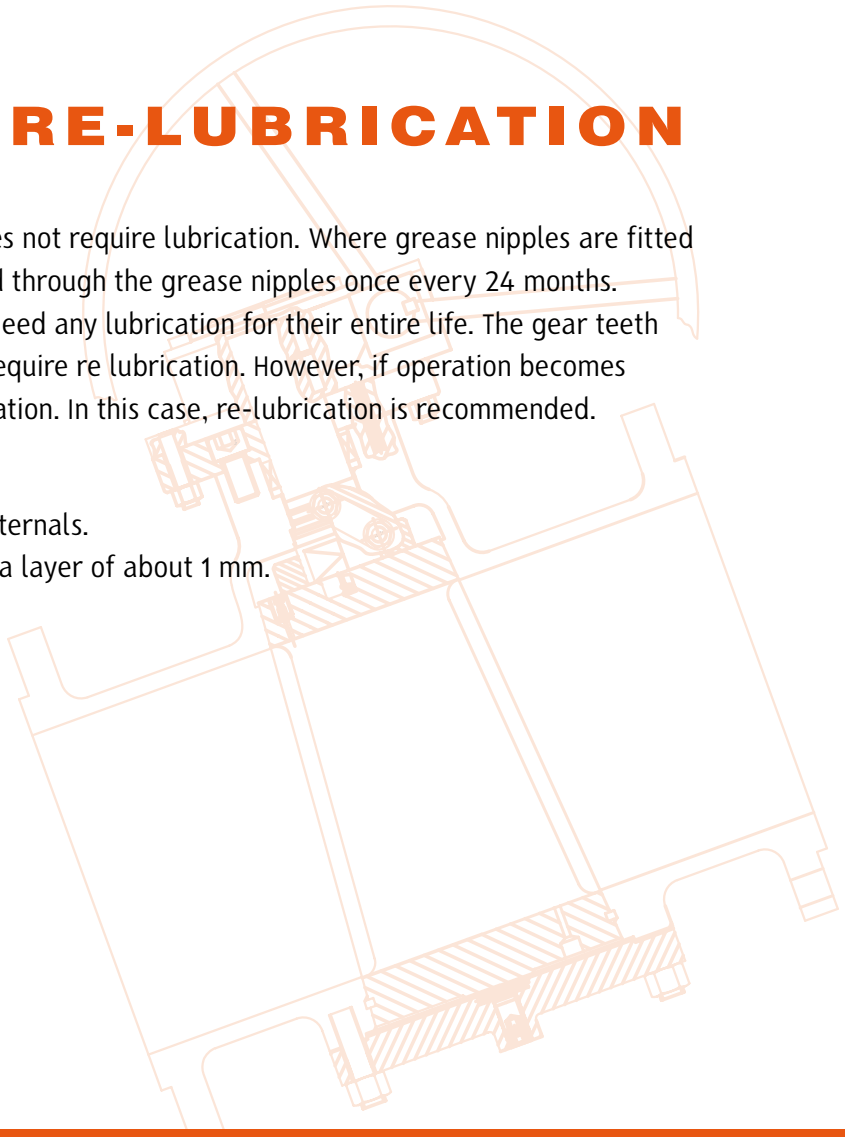
1. Place the bearing and the O-ring on the stem.
2. Carefully position the stem in valve body and assemble the equaliser onto the stem.
3. Position the plug carefully into the valve body taking care not to damage the contacting surfaces, and making sure the plug and equaliser ring are correctly aligned.
4. Position the thrust seats into the plug.
5. Position the two diaphragms in the body (where applicable).
6. Position the thrust seat into the cover.
7. Screw stud bolts into the body and place the cover over valve assembly tightening down the nuts. Refer to Appendix D and E for bolt tightening sequence and torques.
8. Thread plug loading screw and the screw cap onto the cover.
9. Rotate the valve of 180° to access the stem.
10. Install the graphite packing.
11. Place gland flange and tighten down using the gland flange screws (where applicable).
12. Install the check valve as far down the stem as possible (where applicable).
13. Screw the lubricant screw into the stem (where applicable).
14. Position the valve operator (gearbox or wrench).
15. Test to API6D.

6.0 GEARBOX RE-LUBRICATION

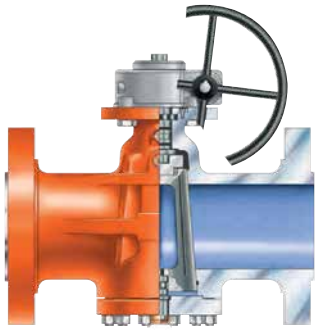
The gear unit is factory pre-lubricated and does not require lubrication. Where grease nipples are fitted (much larger sizes) then they can be lubricated through the grease nipples once every 24 months. However, most types of gear operator do not need any lubrication for their entire life. The gear teeth racks on worms and wheels do not normally require re lubrication. However, if operation becomes difficult of noisy, this indicates a lack of lubrication. In this case, re-lubrication is recommended.

The procedure is as follows:

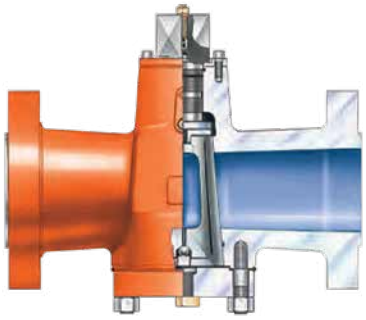
1. Remove the gear cover to access gearbox internals.
2. The lubricant is applied to all tooth racks in a layer of about 1 mm.



APPENDIX A

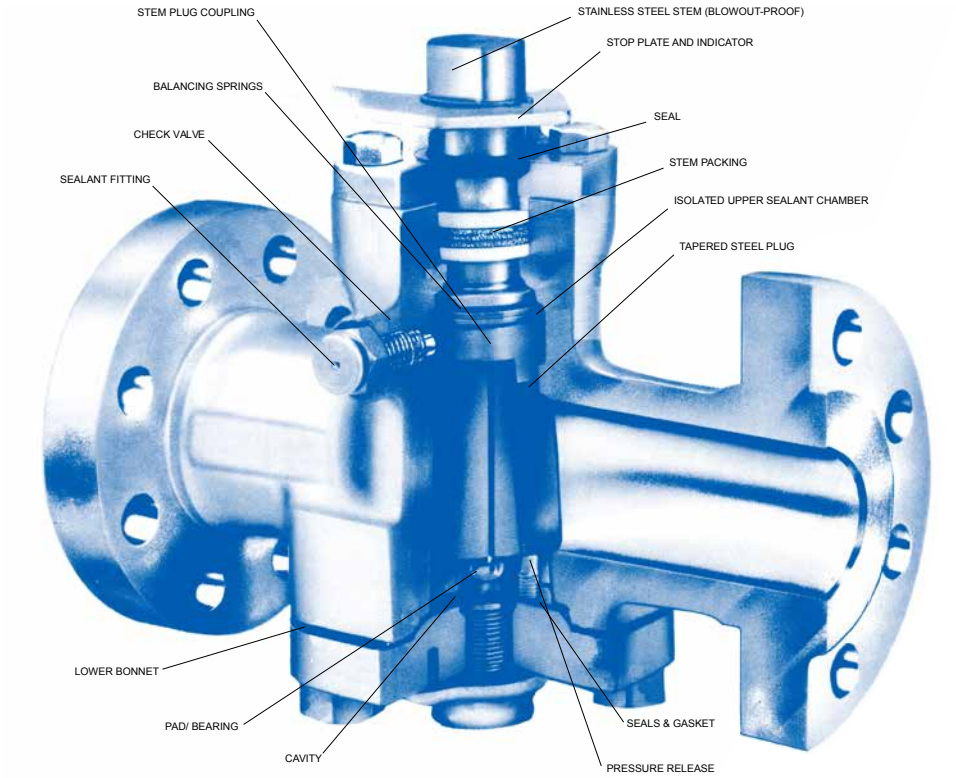


Gear operated*



Wrench operated*

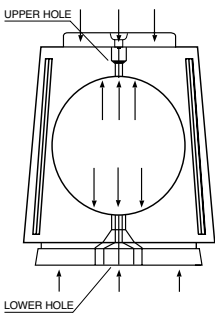
TYPICAL DESIGN*



*** The design varies in different sizes & classes.**

Plug Pressure Design

The Pressure Balanced Conical Inverted Plug contains 2 holes:



- The upper holes connects the plug port with the area above plug.
- The lower hole maintains pressure equalisation between the plug port and the area below the plug.

This prevents the plug from seizing against the body and permits predictable turning torque.

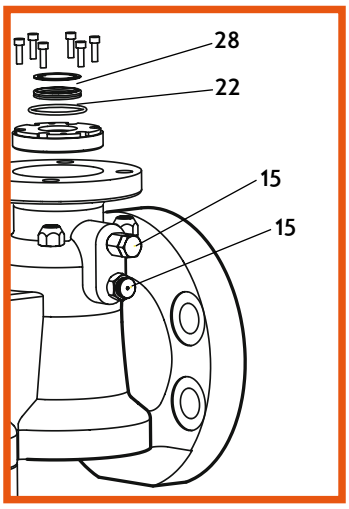
APPENDIX B

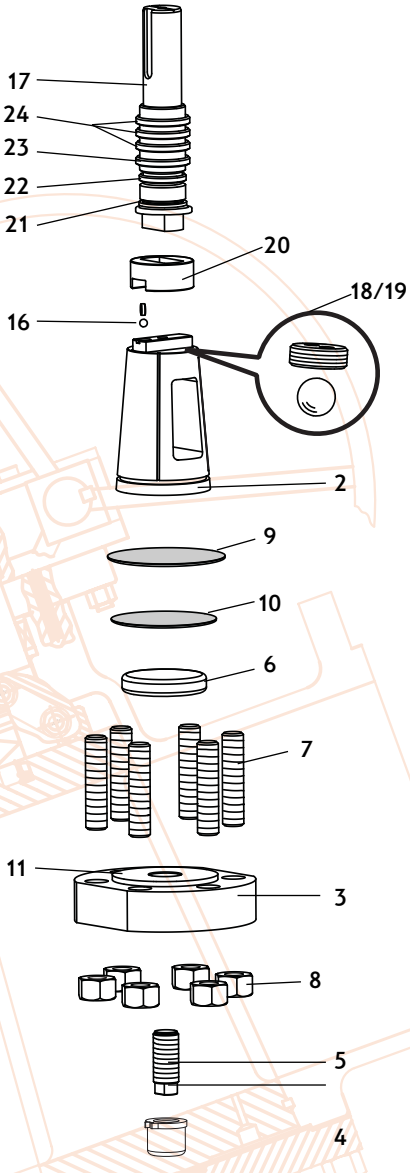
Exploded View - Typical* APV Pressure Balanced Plug Valve Style A

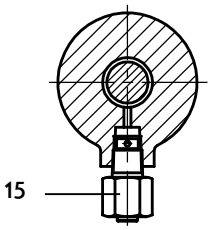
2. Plug: Metal-to metal seating, hardened
3. Bolted Cover
4. Protective Cap or Retaining Screw
5. Plug Loading Screw
6. Thrust Pad
7. Studs
8. Nuts
9. Diaphragm Plate
10. Diaphragm Plate
11. Spiral Wound Gasket
14. Inbuilt Check Valve
15. Sealant Fitting
16. Anti-static Device
17. Blow Out Proof Stem

18/19. Pressure Balanced Ball & Retainer

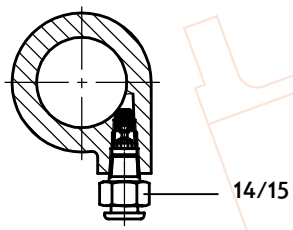
20. Articulated Equaliser Joint: for low torque and bubble tight sealing
21. Bearing/ Seal
22. O-ring
23. Packing Bush
24. Graphite 'Fire Safe' Packing







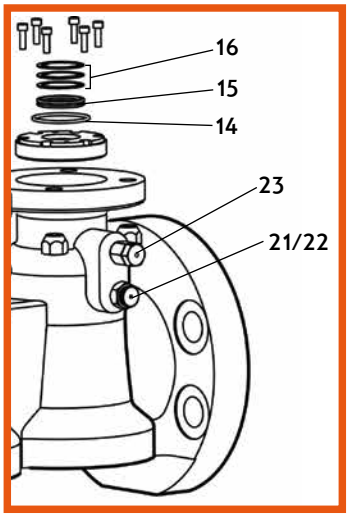
Stem Sealant Injection



Body/Seat Sealant Injection c/w Internal Check Valve

*Typical example only, refer to as-built drawing. Design varies according to size, class & customer preference.

APPENDIX B1

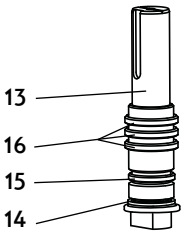


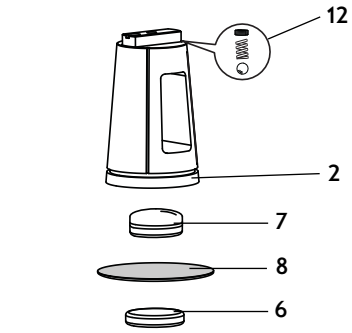
Exploded View - Typical* APV Pressure Balanced Plug Valve Style B

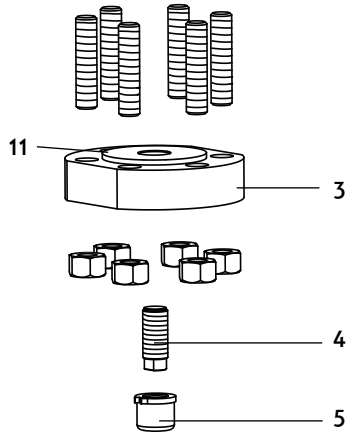
2. Plug: Metal-to metal seating, hardened
3. Bolted Cover
4. Plug Loading Screw
5. Protective Cap
6. Adjustable Thrust Pad
7. Adjustable Thrust Seat (Ball head)
8. Diaphragm Plate
11. Spiral Wound Gasket
12. Pressure Balance Anti-static Ball Check.
13. Blow Out Proof Stem
14. Thrust Bearing/ Stem Seal
15. Weather Seal O-Ring
16. Graphite 'Fire Safe' Stem Packing

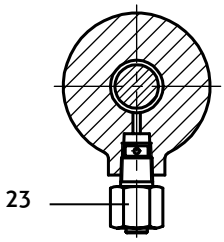
21/22. Seat Sealant Injection c/w internal Check Valve

23. Stem Packing Compound Injector

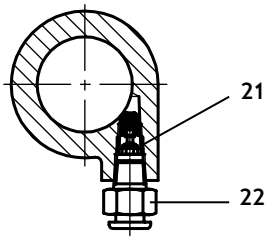








Stem Sealant Injection



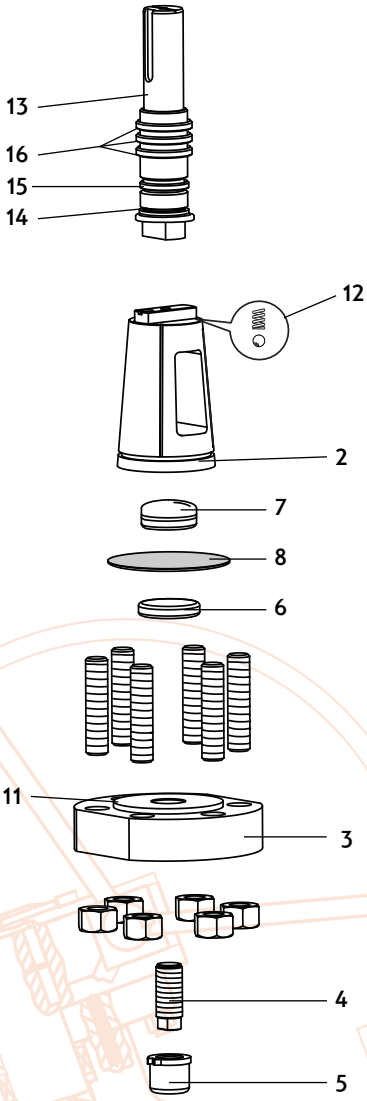
Body/Seat Sealant Injection c/w Internal Check Valve

*Typical example only, refer to as-built drawing. Design varies according to size, class & customer preference.

APPENDIX B2

Exploded View - Typical* APV Pressure Balanced Plug Valve Style C

2. Plug: Metal-to metal seating, hardened.
3. Bolted Cover
4. Plug Loading Screw
5. Protective Cap or Retaining Screw.
6. Adjustable Thrust Pad.
7. Adjustable (Ball head) Seat.
8. Diaphragm Plate
11. Spiral Wound Gasket
12. Pressure Balance Anti-static Ball Check.
13. Blow Out Proof Stem
14. Thrust Bearing Stem Seal
15. Weather Seal O-Ring
16. Graphite 'Fire Safe' Stem Packing.



*Typical example only, refer to as-built drawing. Design varies according to size, class & customer preference.

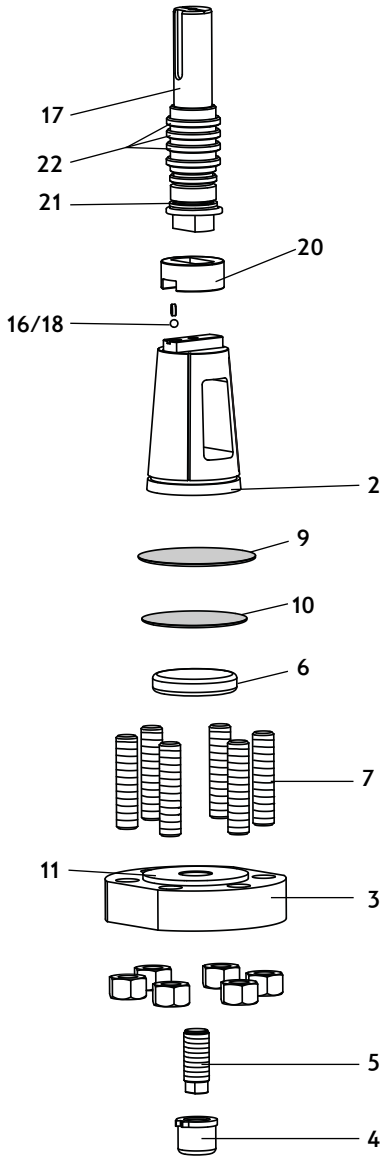
APPENDIX B3

Exploded View - Typical* APV Pressure Balanced Plug Valve Style D

2. Plug: Metal-to metal seating, hardened
3. Bolted Cover
4. Protective Cap or Retaining Screw
5. Plug Loading Screw
6. Thrust Pad
7. Studs
8. Nuts
9. Diaphragm Plate
10. Diaphragm Plate
11. Spiral Wound Gasket

16/18. Combination Anti-static Device & Pressure Balanced Ball

17. Blow Out Proof Stem
20. Articulated Equaliser Joint: for low torque and bubble tight sealing
21. Bearing/ Seal
22. Graphite 'Fire Safe' Packing



*Typical example only, refer to as-built drawing. Design varies according to size, class & customer preference.

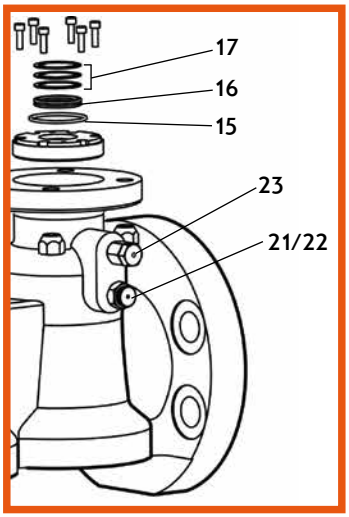
APPENDIX B4

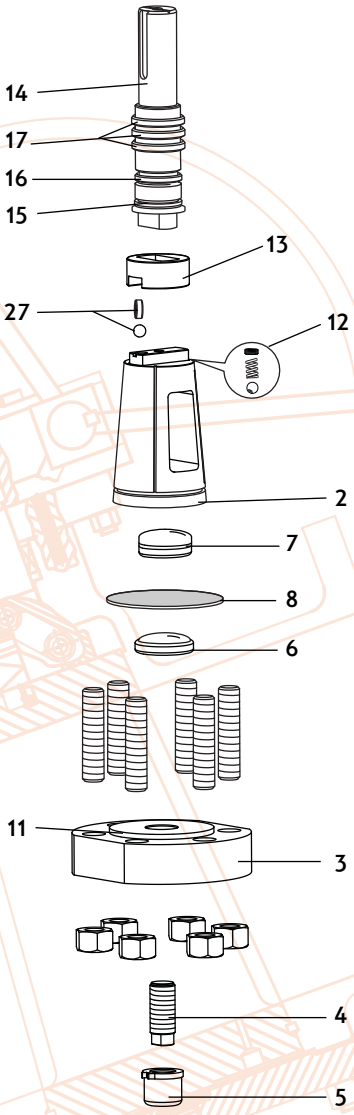
Exploded View - Typical* APV Pressure Balanced Plug Valve Style E

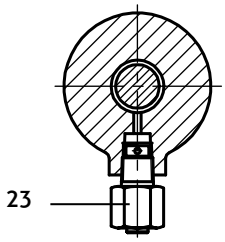
2. Plug metal-to metal seating, hardened
3. Bolted Cover
4. Plug Loading Screw
5. Protective Cap
6. Adjustable Thrust Pad (Ball Head)
7. Adjustable Hardened Thrust Seat (Ball Head)
8. Diaphragm Plate
11. Spiral Wound Gasket
12. Pressure Balance Ball Check
13. Articulated Equaliser Joint for low torque & bubble tight seating
14. Blow Out Proof Stem
15. Thrust Bearing/ Stem Seal
16. Weather Seal O-Ring
17. Graphite 'Fire Safe' Stem Packing

21/22. Seat Area Sealant Injector (c/w in built Check Valve)

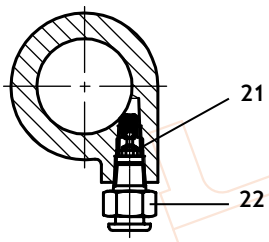
23. Stem Packing Compound Injector
27. Anti-static Device







Stem Sealant Injection



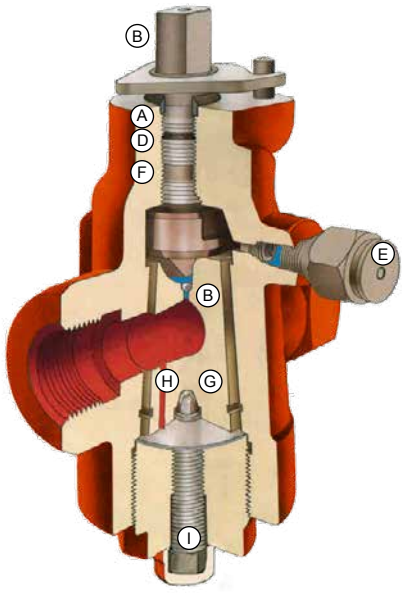
Body/Seat Sealant Injection c/w Internal Check Valve

*Typical example only, refer to as-built drawing. Design varies according to size, class & customer preference.

APPENDIX C

Typical Main Material Types

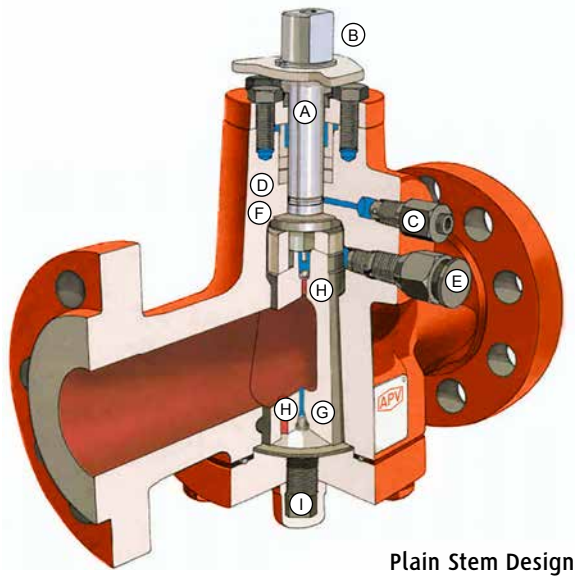
Category	Body/ Bonnet	Plug	Stem	Bolt/ Nut
Carbon steel	A105 A216 WCB/ WCC Max C 0.25%	A105 A216 WCB/ WCC	A29 Gr. 4140	A193-B7M A194-2HM
Low temperature carbon steel	A350-LF2 A352 LCB/ LCC Max C 0.23%	A350--LF2 A352 LCB/ LCC	A29 Gr. 4140	A320-L7M A194 Gr.7M
Duplex steel	UNS S31254 A351 CK3MCuN A182 F44 (6Mo)	UNS S31254 A182 F44	UNS S31254 A182 F44	A453 Gr. 660A
Duplex steel	UNS S31803 A890 A182 F51 (Duplex 22% Cr)	UNS S31803 A182 F51	UNS S31803 A182 F51	A453 Gr. 660A UNS S32760
Super duplex steel	UNS S32750 A890 A182 A182 F55 (Super Duplex 25% Cr)	UNS S32750 A182 F55	UNS S32750 A182 F55	UNS S32750
Alloy 20	UNS N08020 A351 CN7M	UNS N08020 A351 CN7M	UNS S32750 UNS S32760	A453 Gr. 660A UNS S32760



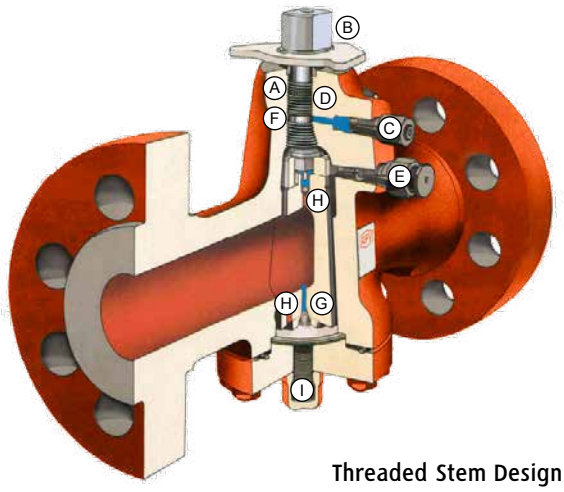
Threaded Stem & Cover Design

- **A** Weather seal
- **B** Blowout proof Stem ENP or Ni treated with Double D Drive for Wrench
- **C** Stem packing compound injector or grease fitting to assist sealing to atmosphere (optional)
- **D** Graphite Fireseal
- **E** Plug Sealant injector to renew sealing to down stream. (Location may be on stem in small sizes).
- **F** Stem Packing Compound
- **G** Plug with metal to metal seating, Hardened/ Nitrided treated
- **H** Pressure Balance Holes
- **I** Plug Loading Screw

Reference only, design varies according to size, class & customer preference. Refer to as-built drawing



Plain Stem Design



Threaded Stem Design

APPENDIX D

Indicative Body/bonnet bolting torque ft·lb (N·m)

Stud Size	Bolting Material			
	B7M/L7M	B7/B16/L7	B8/B8M CL.1	B8/B8M CL.2
3/8 - 16 UNC	15 (20)	20 (27)	15 (20)	20 (27)
7/16 - 14 UNC	25 (34)	30 (41)	22 (30)	25 (34)
1/2 - 13 UNC	40 (54)	50 (68)	35 (47)	45 (61)
9/16 - 12 UNC	55 (75)	70 (95)	55 (75)	65 (88)
5/8 - 11 UNC	75 (102)	100 (136)	70 (95)	85 (115)
3/4 - 10 UNC	135 (183)	170 (231)	125 (170)	150 (203)
7/8 - 9 UNC	200 (271)	270 (366)	170 (230)	200 (271)
1 - 8 UNC	350 (475)	400 (542)	219 (298)	350 (475)
1 1/8 - 8 UN	500 (678)	520 (705)	256 (398)	450 (610)
1 1/4 - 8 UN	675 (915)	850 (915)	321 (498)	650 (881)
1 3/8 - 8 UN	900 (1220)	1200 (1627)	384 (598)	900 (1220)
1 1/2 - 8 UN	1200 (1627)	1500 (2034)		1200 (1627)
1 5/8 - 8 UN	1600 (2170)	2000 (2712)		1501 (2035)
1 3/4 - 8 UN	2000 (2712)	2500 (3390)		1907 (2585)
1 7/8 - 8 UN	2500 (3390)	3100 (4204)		2357 (3195)
2 - 8 UN	3000 (4068)	3800 (5153)		2876 (3898)
2 1/8 - 8 UN	3600 (4882)	4500 (6102)		
2 1/4 - 8 UN	4400 (5966)	5400 (7322)		
2 1/2 - 8 UN	6000 (8136)	7500 (10170)		

Note:

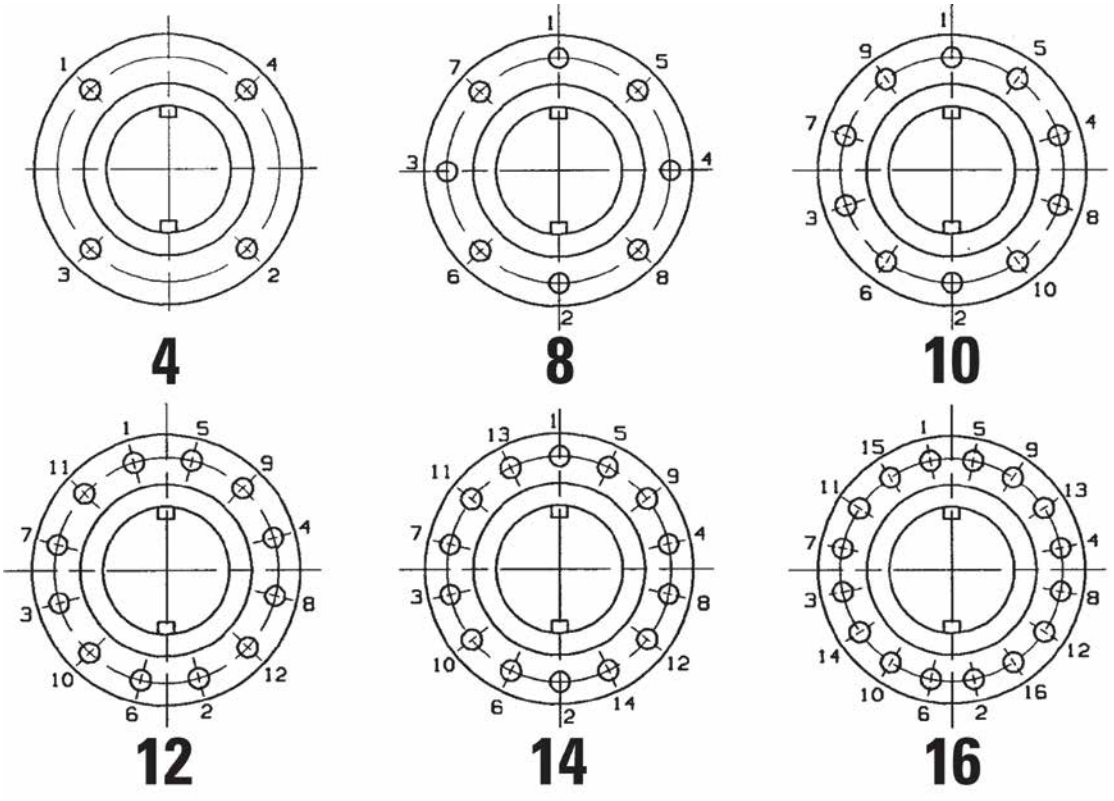
(1) Torques shown are for A193 B7/B7M/B8/B8M and A320 L7/L7M/B8/B8M.
(2) Torque tolerance ±10%.
(3) For temperatures above 750°F (400°C) use 75% of the torque values.
(4) Above torque values are with the bolts lubricated.
(5) Values above are based on 30,000 psi (206.85 Mpa) bolting stress and lubricated with heavy graphite and oil mixture or a copper based anti-seize grease.
(6) Do not exceed by more than 25% of values stated when emergency torquing is required.
(7) All bolts shall be torqued in the pattern as shown in Appendix E over page to ensure uniform gasket loading.
(8) Optimum torque can vary depending on type of body gasket but do not increase torque more than 10% above those shown.
(9) Consult us for other bolt material.
(10) Most B8M and B8 bolts are class 1 so do not assume class 2 unless you are sure.

Caution

Bolt tensions shown must be decreased by 25% when other or no lubrication used. Non lubricated bolts can have an efficiency of less than 50% the torque of values stated. Indicative torques are shown only, different body gasket systems, different seating styles, different sizes & classes, etc., will have different torque requirements. Furthermore, other stud grades can have much lower torque capabilities depending if class 1 or class 2 and or above variables.

APPENDIX E

Bolt Tightening Sequence



Torque chart - model SSCR

NPS		150Lb	300Lb	600Lb	900Lb	1500Lb
IN	mm	N.m				
2”	50	100	170	290	415	655
3”	80	118	219	380	546	865
4”	100	300	535	918	1259	2065
6”	150	626	1080	1815	2550	4023
8”	200	2030	3205	5115	7020	10850
10”	250	2165	3259	6090	8518	13388
12”	300	3120	5200	8595	11988	18795
14”	350	4845	8485	14405	20325	-
16”	400	6030	10695	18245	-	-
18”	450	9145	15940	27000	-	-
20”	500	12020	21040	35975	-	-
24”	600	19425	34480	58965	-	-

Torque is at maximum Delta P. Numerous factors can dramatically increase torque such as: - temperature, hardness of the grease over time, particulates in media, media type, grease type, etc.

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