INSTALLATION, OPERATION & MAINTENANCE MANUAL

CHECK VALVES
SWING, TILTING DISC & PISTON

API594/API6D/
BS1868/B16.34

API 6FD & ISO 10497
Firesafe Certified
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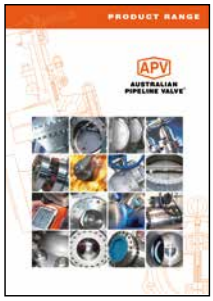

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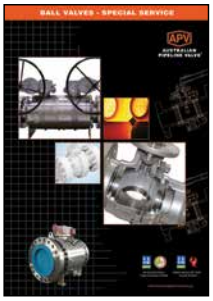

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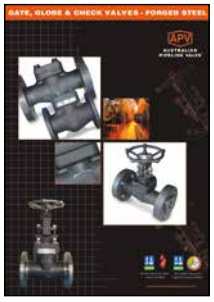

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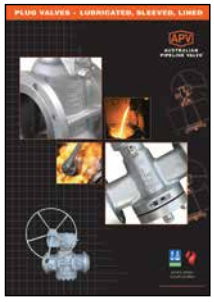

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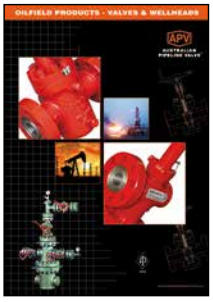

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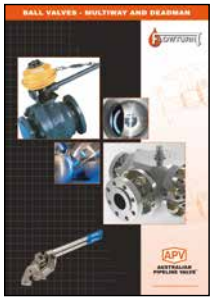

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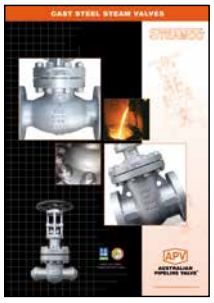

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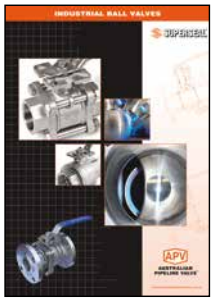

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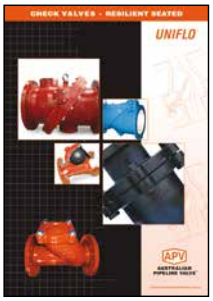

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IOM Installation Operation Maintenance

INTRODUCTION

The majority of this information is common knowledge to experienced valve users. When properly installed in applications for which they were designed, Australian Pipeline Valve (APV) valves will give long reliable service under normal conditions. This instruction manual is only a guide for installation and operation on standard service and covers general maintenance and minor repairs. An APV approved valve reconditioner should be used for reconditioning and major repairs.

We recommend 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. The user is responsible for ensuring APV Valves are selected and installed in conformance with the correct pressure rating and design temperature requirements. Prior to installation, the valves and nameplates should be checked for proper identification to ensure the valve is of the proper type, material and is of a suitable pressure class and temperature rating to satisfy the applications requirements of the service application.

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, leakage, valve failure.

RECEIVING INSPECTION AND HANDLING

Valves should be inspected upon receipt to ensure:

- Conformance with all purchase order requirements.
- Correct type, pressure class, size, body and trim materials and end connections.
- Any damage caused during shipping.

The User is advised that specifying an incorrect valve for the application may result in injuries or property damage. Selecting the correct valve type, rating, material and connections, in conformance with the particular performance requirements is important for proper application and is the sole responsibility of the user.

SAFETY INFORMATION

The following general safety information should be taken into account in addition to the specific warnings and cautions specified in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered in this I.O.M.

Caution

To avoid injury, never attempt disassembly while there are pressures either upstream or downstream. Even when replacing gaskets, caution is necessary to avoid possible injury. Disassemble with caution in case all pressures are not relieved.

Caution

To prevent valve bending, damage, 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.

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

APV and it's resellers refuse 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 user to ensure the valve type and materials are correctly specified.

DURING OPERATION TAKE INTO ACCOUNT THE FOLLOWING WARNINGS:

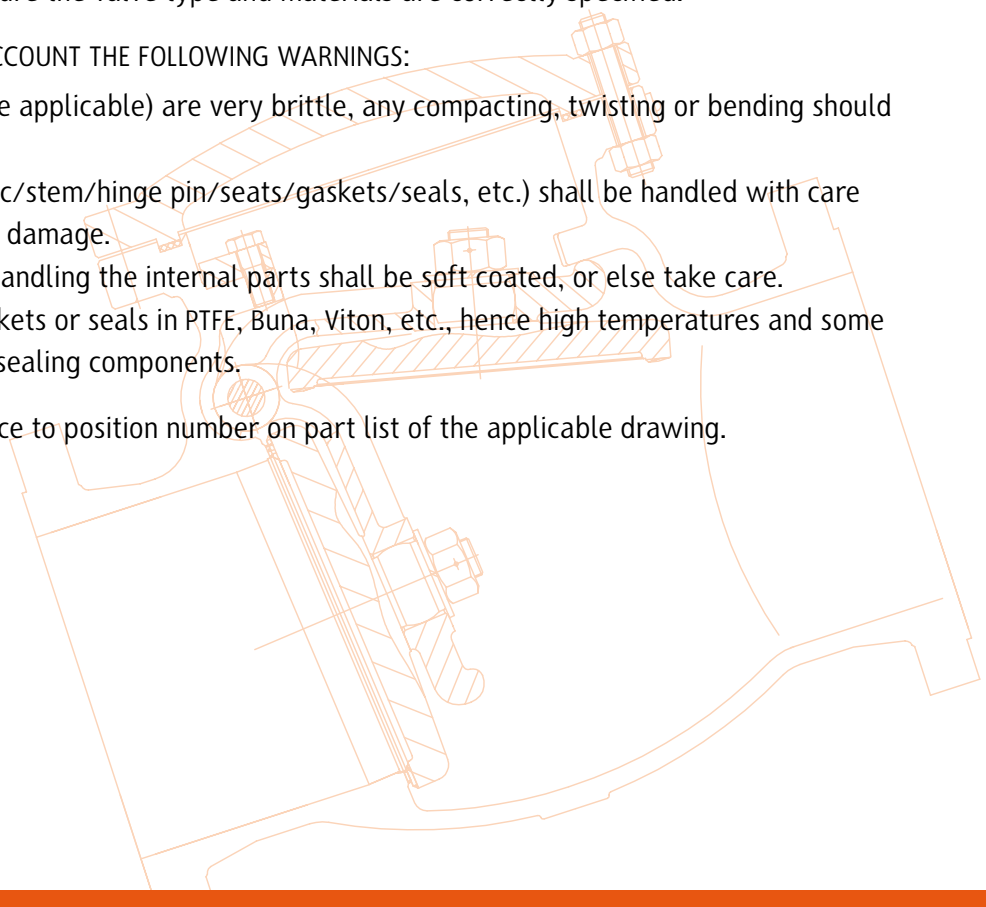
a- Graphite body gaskets (where applicable) are very brittle, any compacting, twisting or bending should be avoided.

b- The valve's internal parts (disc/stem/hinge pin/seats/gaskets/seals, etc.) shall be handled with care avoiding scratches or surface damage.

c- All tools and equipment for handling the internal parts shall be soft coated, or else take care.

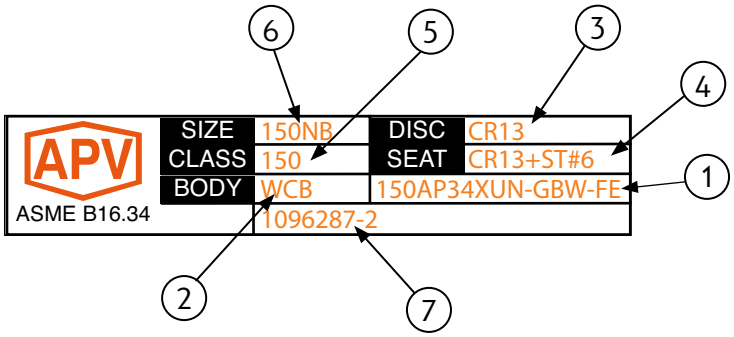
d- Valves can be fitted with gaskets or seals in PTFE, Buna, Viton, etc., hence high temperatures and some cleaning fluids may damage sealing components.

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



VALVE IDENTIFICATION

Each APV valve is identified with a nameplate. Below is an example.



ITEM	DESCRIPTION
1	APV valve figure number which delineates the as-built valve type, body, trim, features, packing, NACE, etc. Refer Figure Number System Appendix C
2	Shell material (e.g. body, bonnet)
3	Closure member material
4	Seat material
5	Rated pressure class as per ASME B16.34. Section 2
6	Nominal pipe size
7	Serial/batch number

When performing any work, ordering spare parts, or requesting technical support, please refer to this tag. The serial number, the part number and numbers cast on the side of the valve body are keys to proper valve identification.

1.0 INSTALLATION

Caution

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

1.1 INSTALLATION POSITIONS

Check valves are unidirectional and have the direction of flow indicated on the valve body. Australian Pipeline Valve **swing or tilting disc check valves** may be installed in horizontal lines or vertical lines where the direction of flow as indicated on the valve body is upwards.

Australian Pipeline Valve **piston check valves** are only for use in horizontal lines with bonnet facing up. Check valves must be fitted in horizontal pipe runs with the cover facing vertically upward. Variance to either side of the vertical axis must not exceed five (5) degrees. Swing-check valves and spring-loaded check valve designs can be positioned in vertical pipe runs with upward flow.

Note

Check valves must not be installed in a vertical down flow pipe run or in a horizontal pipe run with the cover in the vertical down position. Always install valves in the direction indicated by the flow arrow stamped on the body.

Caution

Flow disturbances caused by the system components (e.g. pipe fittings, discharge of pumps, etc.) can lead to valve chatter, which can cause rapid wear of seats and trim and ultimately lea to valve malfunction. APV recommends that a sufficient distance be maintained between the check valve and any component that can cause flow disturbance as follows:

a) System components that create flow disturbance - examples are pumps, fittings and valves. When installing a check valve near system components, APV recommends a minimum of 10 pipe diameters of straight pipe between the upstream system components and the inlet of the check valve and a minimum of 2 pipe diameters of straight pipe between the downstream system components and the outlet of the check valve.

b) Pipe bends and transitions - examples are elbows, tees, branch connections and reducers. APV recommends a minimum of 6 pipe diameters of straight pipe between the upstream system component and the inlet of the check valve and a minimum of 3 pipe diameters of straight pipe between the downstream component and the outlet of the check valve.

Spring loaded piston check valves are recommended for reciprocating compressor service in which a history of noisy check valve operation has been experienced.

1.2 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.

1.3 END CONNECTIONS

1.3.1 Flanged Ends

Check to see that mating flanges are dimensionally compatible with the flanges on the valve body and 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. See Appendix A, Table A.

1.3.2 Buttweld Ends

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

1.3.3 Valve Installation by Welding

Leave valves assembled during installation, welding and post-weld heat treatment. This will prevent the valve seat from floating or distorting during the process. After welding completion, open the valve and flush line to clean out any foreign matter.

Remove the bonnet and bonnet gasket and match mark each component during disassembly for proper reassembly.

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.

1.4 POST-INSTALLATION PROCEDURES

After installation, the line should be cleaned by flushing to remove any foreign material. When caustics are to be used to flush the line, additional flushing with clean water is required. The valve should be opened and closed after installation to ensure proper operating function.

With the line pressurised, check the valve end connections, body to bonnet/cover joints and external plugs for leaks.

2.0 OPERATION

Refer to Appendix A, Table C, D, E, F to ensure the Cv is as required and there is enough cracking pressure to open to disc.

The check valve operation is automatic and requires no assistance. When the flow exerts sufficient pressure against the disc to overcome the disc's weight, the disc allows the flow to continue through the piping system. As pressure decreases, the disc lowers until it's own weight forces it to seat. This prevents the possibility of a reversal in the flow. Piston and ball check valves should not be used in applications where rusting or rust particles are present or anticipated. Swing check valves are more tolerant for applications of this nature.

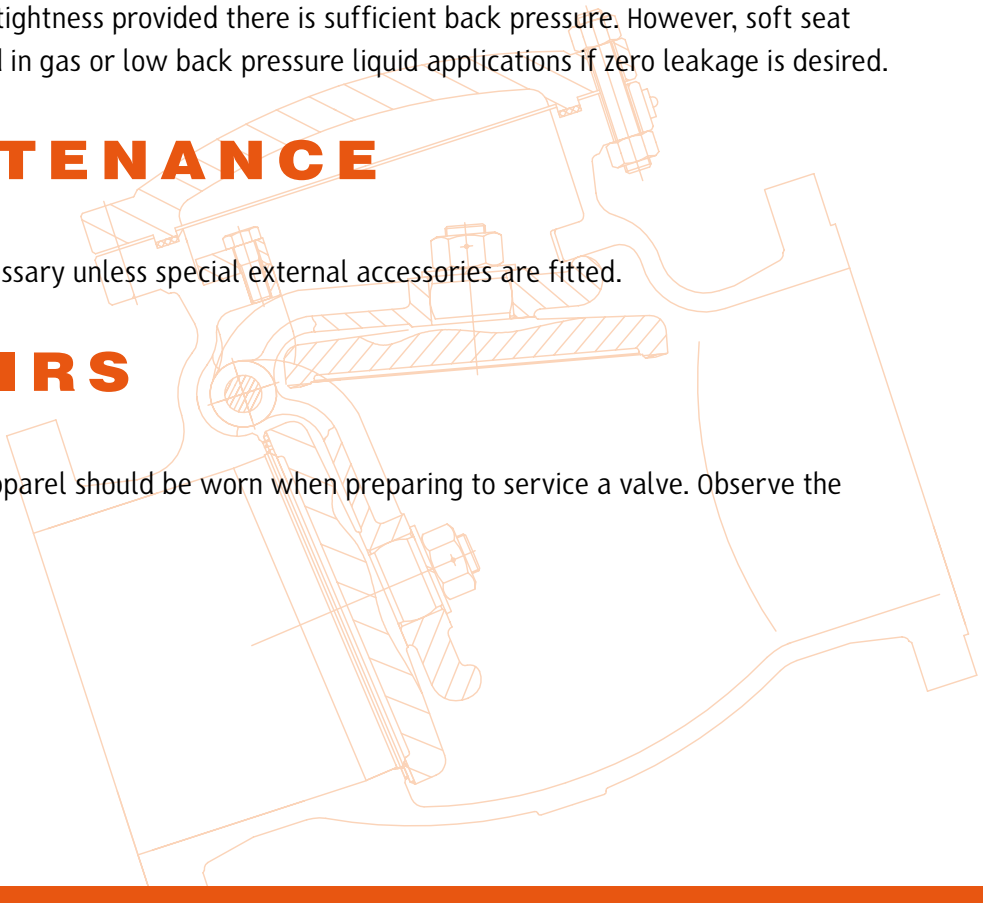
Metal seated check valves (piston, lift, tilt and swing) are not zero leak devices and will "seep" in service. This type of valve should always be backed up with an isolation valve (either gate or ball valve). Check valves are designed to prevent reverse flow. Leakage rates for check valves with metal-to-metal seats are dependant on the amount of back pressure and the viscosity of the flowing medium. Soft seat check valves can offer improved leak tightness provided there is sufficient back pressure. However, soft seat check valves should not be used in gas or low back pressure liquid applications if zero leakage is desired.

3.0 MAINTENANCE

No periodic maintenance is necessary unless special external accessories are fitted.

4.0 REPAIRS

Proper safety equipment and apparel should be worn when preparing to service a valve. Observe the following general warnings:



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

4.1 REPAIR INSTRUCTIONS

Due to the relatively low replacement cost of small diameter standard carbon steel valves especially under 100 NB (4"), it is usually less expensive to replace the complete valve than to have maintenance personnel effect repairs. Generally, the only viable repairs are replacement of bonnet gasket. However, see Section 4.2 and 4.3 below for further extraordinary repairs.

Always replace the bonnet gasket whenever a valve is disassembled. Gasket seating surfaces should be scraped clean (avoid radial marks). Bonnet bolts should be tightened in a diagonal pattern at several different increasing torque settings in accordance with the recommended torque value (see table Appendix A, Tables A & B).

4.2 DISASSEMBLY & GASKET REPLACEMENT

Before disassembling:

1. Check that the line is in a complete shut down phase, then remove the valve from pipeline.
2. Pre-order all necessary spare parts and joining gaskets.
3. Put identification markings on valve body, disc and bonnet. This helps to avoid mismatching of parts at the time of re-assembly.
4. If the bolts and nuts are too tight, apply deep penetrating oil and then unscrew.

Disassembly:

1. Disassemble all cover bolts and nuts.
2. For check valves, lifting lugs are generally provided. Lift up the cover utilising lifting lugs. For smaller and lower class valves the bonnet should be easy to remove without the aid of a mechanical lifting device. In both cases gently break the seal with a lever, gradually lifting the bonnet flange at intervals 360° around the bonnet.
3. Clean gasket surface areas, replace gasket and refit bonnet as detailed in 4.1 above.
4. 'Pressure seal' valves use a proprietary graphite gasket.

4.3 VALVE INTERNALS DISASSEMBLY INSPECTION AND REPAIR

1. Check that the (where applicable) hinge, nut and pin are in good condition and firmly connected. Replace damaged parts as necessary.
2. For ***swing and tilt check valves***, remove the pin then lift and remove the disc hinge assembly. If

necessary, remove the spot weld on the disc nut, then remove the disc nut, pin, swing arm and disc in sequence. Movement should be free and not hindered by any malfunction of the hinge pin. Where disc travel is not sufficiently smooth, remove plugs or blind flanges and then remove hinge pin. Check surface for seizure or scraping marks. If marks are deeper than 1.5mm (1/16"), re-machine hinge pin and reassemble hinge pin and re-assemble. If defect depth is greater than 1.5mm (1/16"), a new hinge pin is necessary. When reassembling hinge pin, it is recommended that the disc be removed by loosening the nut. For ***piston/lift check valves***, if there is a spring ensure it is functioning properly and is sufficiently energised. The spring should hold the disc/ball tightly against the seat no matter what position the valve is in.

3. When leakage is due to deterioration of seal surfaces caused by corrosion, erosion or foreign substances, it must be determined whether the disc or seal seat are the cause. Where special soft seat inserts are supplied, consult APV.

a) Deterioration of disc surfaces:
Swing check valves: - Disassemble disc by removing nut and washer. (Ball/Piston check valves have a free floating disc). Repair surface by grinding and relapping using a fine grade abrasive paste.

b) Deterioration of seat seal surfaces:
When seal surfaces are damaged and defects are confined to a small area but are not deeper than 0.4mm the seal surface can be relapped. For smaller sizes the recommended method is to use a cast iron strap with an outside diameter matching the valve's raceway. If the seat surfaces cannot be relapped an APV approved repairer will decide if the surface has to be reground/re-machined or replaced. When defects are deeper than 0.4mm and found on the entire surface, re-metallising or a new seat is required. For threaded-in seats it is recommended that an anti seizure compound be used when installing the replacement seat to make threading it in the body easier.

Always be sure that the valve is de-pressurised and isolated prior to performing any maintenance work. Remove any dangerous fluids from valve before commencing maintenance.

4.4 BOLTED BONNET SWING/LIFT CHECK VALVE REASSEMBLY

a) Refer to Appendix A, Tables A & B for bolting torques.

b) To assure the valve is sealing properly, perform the required pressure testing per recognised and applicable design standards.

4.4.1

When re-assembling the valve, inspect and ensure that all components are thoroughly clean before installing into the valve body. All rust and dirt should be removed with a wire brush or emery cloth. Oil solids and grease adhered to the valve internals should be removed with approved solvents.

4.4.2

Apply a thing layer of light oil on the sealing surface to avoid any scratches that may occur during the assembly process.

4.2.3

Install the hinge in to the disc, install the disc nut on to the disc hinge assembly and tighten.

4.2.4

Install the hinge pin into the swing arm and hinge.

4.2.5

Install the disc/swing arm/hinge (or piston in the case of piston check) assembly into the body, ensure that bolt holes on the swing arm are aligned with valve body boss bolt holes, install the hex nuts and washers, tighten them and spot weld.

4.2.6

Install new body gasket and bonnet in to the body. Install the bolts/nuts.

4.2.7

Ensure that all studs and nuts are clean and free of rust, corrosion, burrs and previous lubricants. APV recommends installing new bolting when assembling body and bonnet connections. APV recommends coating the stud threads and surface under the nut with the molybdenum disulfide. All tightening of the bolting should be by hand; followed by the appropriate tightening sequences outlined in Appendix A, Table A Bolt Tightening Torque Chart & Appendix A Figure 2 Bolt Tightening Sequence. It is important to follow proper torque procedures. Each bolt should be torques in steps of approximately 20% of final torque. Recheck all bolting once completed.

4.2.8

Over torque can cause deformation of the body/bonnet flange causing leakage. Failure to properly follow the tightening sequence will result in the gasket not being compressed evenly, resulting in gasket leakage.

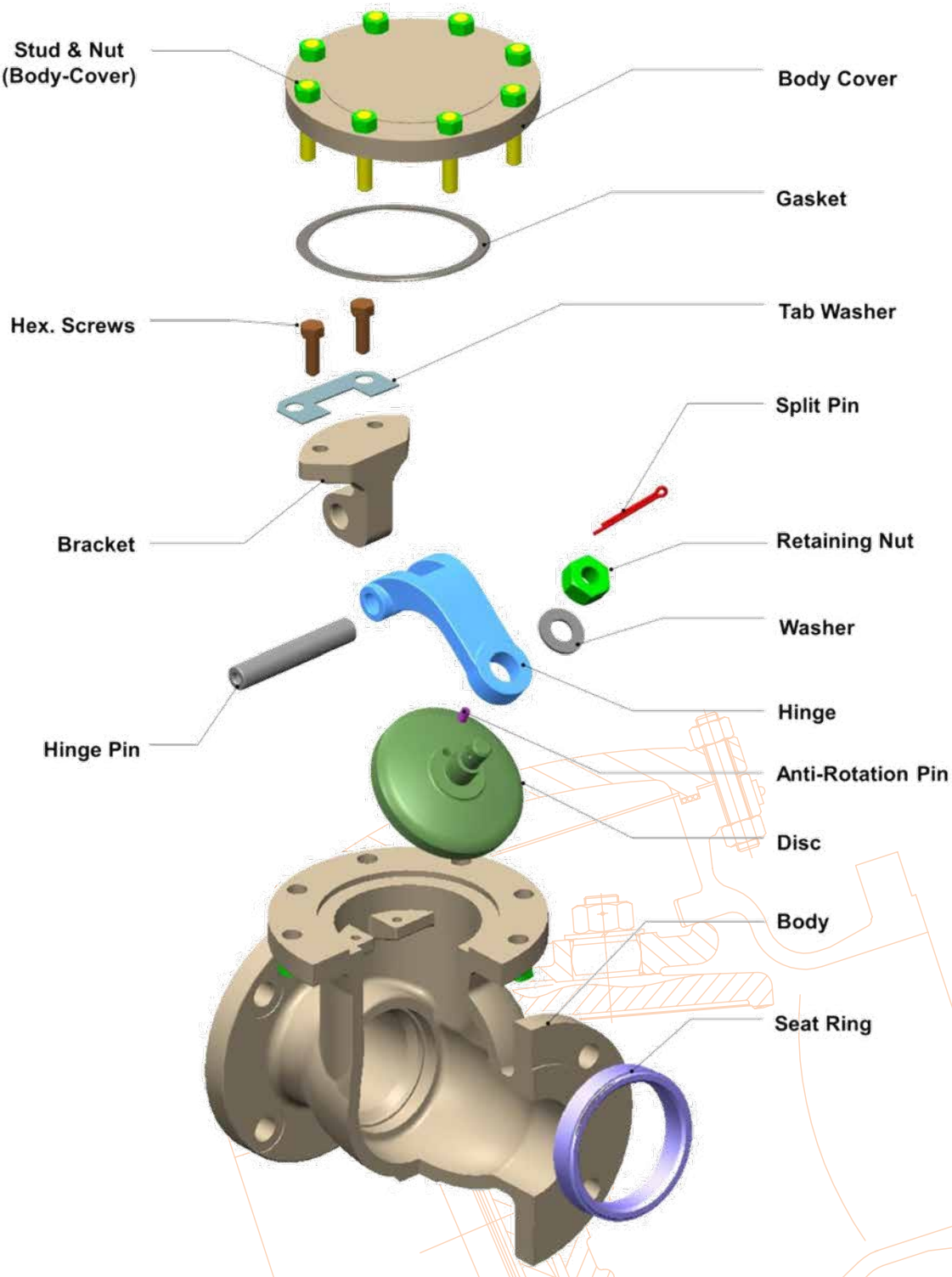
4.2.9

Never use impact devices to tighten the bolting on the body/bonnet connections. Use suitable designed mechanical devices such as hand torque wrenches for tightening and refer to Appendix A, Table A.

Torque wrenches and standard wrenches may be used in combination when performing tightening sequences.

Typical Bolted Swing Check Valve Exploded View

FIGURE 1



* Sample only refer to as built drawing as there are numerous designs depending on size & class.
See Appendix C for examples of other designs.

5.0 TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	REMEDY
Leakage at sealing surface	Dirt on the sealing surface	Clean the sealing surface
	Sealing surface is damaged	Repair the sealing surface
Cannot operate normally	Dirt debris may be trapped between Hinge/ Swing Arm/Hinge Pin	Remove dirt or debris
Bonnet gasket leakage	Loosen flange bolt/nut	Re-torque the flange bolt/nut
	Bonnet gasket failed	Replace with new gasket
Valve body and bonnet both damaged and valve leaks	Corrosion over time. Wall thickness may be below minimum required	Regularly check the wall thickness, replace the valve ahead of time.
Disc will not operate normally	Hinge Pin may be deformed and jammed	Replace valve Hinge Pin

6.0 WARRANTY AND SERVICE

6.1 VALVE WARRANTY PERIOD

6.1.1

In the event the end user encounters an issue of quality, please notify APV immediately. APV reserves the right to investigate and settle all issues of quality concerns directly with the end user. Refer to APV's standard warranty policy at the end of this I.O.M for questions or concerns regarding warranty.

6.1.2

Addressing a valve quality issue within the warranty period:
APV reserves the right to review and respond to all requests for warranty repair or replacement, prior to making any replacement or repairs by the end user.

6.1.3

APV will not be held responsible for any damage due to natural disaster, such as earthquake, hurricane, etc. during valve shipment.

6.1.4

APV must be consulted about any warranty issue before being held responsible for any repairs or valve replacement.

WARRANTY

1. **LIMITED WARRANTY:** Subject to the limitations expressed herein, Seller warrants that products manufactured by Seller shall be free from defects in design, material and workmanship under normal use for a period of one (1) year from installation but in no case shall the warranty period extend longer than eighteen months from the date of sale. This warranty is void for any damage caused by misuse, abuse, neglect, acts of God, or improper installation. For the purpose of this section, "Normal Use" means in strict accordance with the installation, operation and maintenance manual. The warranty for all other products is provided by the original equipment manufacturer.

2. **REMEDIES:** Seller shall repair or replace, at its option, any non-conforming or otherwise defective product, upon receipt of notice from Buyer during the Manufacturer's warranty period at no additional charge. SELLER HEREBY DISCLAIMS ALL OTHER EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OR FITNESS FOR A PARTICULAR PURPOSE.

3. **LIMITATION OF LIABILITY:** UNDER NO CIRCUMSTANCES SHALL EITHER PARTY BE LIABLE TO THE OTHER FOR INCIDENTAL, PUNITIVE, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND.BUYER HEREBY ACKNOWLEDGES AND AGREES THAT UNDER NO CIRCUMSTANCES, AND IN NO EVENT, SHALL SELLER'S LIABILITY, IF ANY, EXCEED THE NET SALES PRICE OF THE DEFECTIVE PRODUCT(S) PURCHASED DURING THE PREVIOUS CONTRACT YEAR.

4. **LABOR ALLOWANCE:** Seller makes NO ADDITIONAL ALLOWANCE FOR THE LABOR OR EXPENSE OFREPAIRING OR REPLACING DEFECTIVE PRODUCTS OR WORKMANSHIP OR DAMAGE RESULTING FROM THE SAME.

5. **RECOMMENDATIONS BY SELLER:** Seller may assist Buyer in selection decisions by providing information regarding products that it manufacturers and those manufactured by others. However, Buyer acknowledges that Buyer ultimately chooses the product's suitability for its particular use, as normally signified by the signature of Buyer's technical representative. Any recommendations made by Seller concerning the use, design, application or operation of the products shall not be construed as representations or warranties, expressed or implied. Failure by Seller to make recommendations or give advice to Buyer shall not impose any liability upon Seller.

6. **EXCUSED PERFORMANCE:** Seller will make a good faith effort to complete delivery of the products as indicated by Seller in writing, but Seller assumes no responsibility or liability and will accept no back-charge for loss or damage due to delay or inability to deliver, caused by acts of God, war, labor difficulties, accidents, inability to obtain materials, delays of carriers, contractors or suppliers or any other causes of any kind whatever beyond the control of Seller. Under no circumstances shall Seller be liable for any special, consequential, incidental, or indirect damages, losses, or expense (whether or not based on negligence) arising directly or indirectly from delays or failure to give notice of delay.

APPENDIX A

INDICATIVE BONNET BOLTING (BOLTED BONNET) TORQUE NM*

TABLE A

STUD SIZE inch-TPI	Bolting Material		
	B7/B7M/B16/L7/L7M/ L43/660 Cl.A/UNS N07718/UNS 09925	B8 Cl.2/B8C Cl.2/B8M Cl.2/B8T Cl.2/XM-19	UNS N06625 Gr 1
1/4-20 UNC	7	7	5
5/16-18 UNC	15	15	10
3/8-16 UNC	25	25	15
7/16-14 UNC	40	40	25
1/2-13 UNC	60	60	40
9/16-12 UNC	90	90	60
5/8-11 UNC	120	120	80
3/4-10 UNC	215	215	145
7/8-9 UNC	345	315	230
1-8 UNC	520	475	345
1.1/8-8 UN	725	625	510
1.1/4-8 UN	1000	880	715
1.3/8-8 UN	1460	975	975
1.1/2-8 UN	1925	1285	1285
1.5/8-8 UN	2480	1655	1655
1.3/4-8 UN	3140	2090	2090

* Consult APV for pressure seal bonnet

Note:

(1) Torque tolerance ±10%.
(2) For temperatures above 750°F (400°C) use 75% of the torque values. In high temperature services, there is a possibility of creep in the bonnet studs. Regular checking of the bonnet - studs for tightness, would help prevent leakage through the bonnet gasket.
(3) Above torque values are with the bolts lubricated.
(4) 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.
(5) Do not exceed by more than 25% of values stated when emergency torquing is required.
(6) All bolts shall be torqued in the pattern as shown in Figure 2 on next page to ensure uniform gasket loading.
(7) Optimum torque can vary depending on type of body gasket but do not increase torque more than 10% above those shown.
(8) Consult us for other bolt material.
(9) Most B8M and B8 bolts are class 1 so do not assume class 2 unless you are sure.

Note

For 'pressure seal' bonnet consult APV for torques (where bolting is applicable). 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 sizes & classes, etc., will have different torque requirements. Furthermore, other stud grades can have much lower torques depending if class 1 or class 2 and or above variables.

APPENDIX A - CONT.

BOLT TIGHTENING SEQUENCE EXAMPLE

FIGURE 2

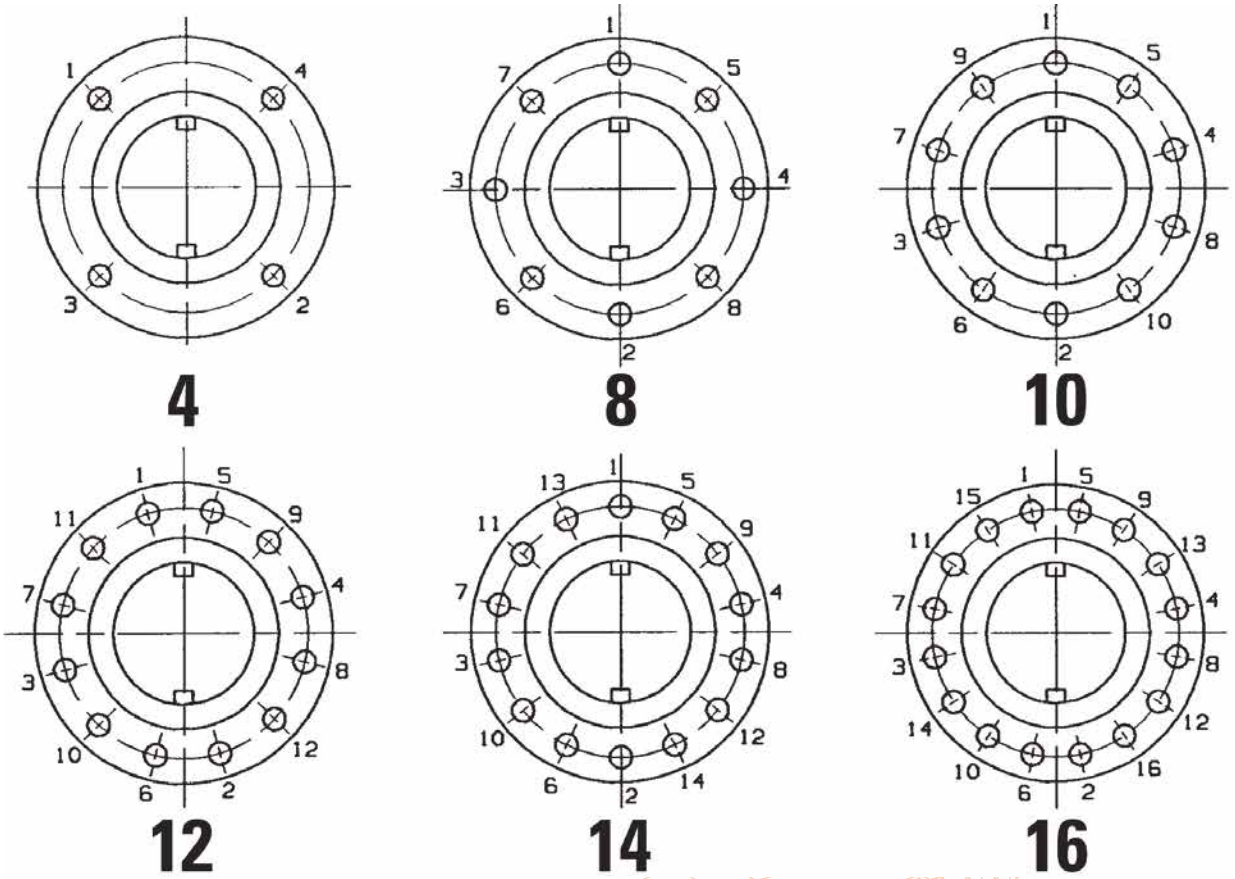


TABLE B

When torque wrenches are not available or suitable, the use of standard wrenches and guidelines will apply to avoid over torque or damage to the valve. (Never use impact wrench)

UNC BOLT SIZE	LENGTH OF WRENCH
3/8”	125mm (5”)
1/2”	150mm (6”)
9/16”	225mm (9”)
5/8”	300mm (12”)
3/4”	450mm (18”)
7/8”	600mm (24”)
1”	750mm (30”)
1 1/8”	900mm (36”)
1 1/4”	1050mm (42”)

APPENDIX A - CONT.

TABLE C

Cv Value for API 594/BS 1868 Swing Check Valve

Size		Units (gal/min)/(lbf/in²)^0.5					
mm	inch	150LB	300LB	600LB	900LB	1500LB	2500LB
50	2	123.9	123.9	123.9	105.0	105.0	68.1
80	3	281.8	281.8	281.8	259.3	239.4	159.6
100	4	524.1	524.1	521.4	482.7	425.5	267.1
150	6	1234.6	1234.6	1234.6	1140.7	988.2	259.3
200	8	2281.5	2281.5	2213.5	2021.0	1751.1	1180.7
250	10	3573.7	3573.7	3404.3	3137.6	2729.9	
300	12	5340.4	5340.4	5104.7	4569.4	3975.9	
350	14	6511.0	6511.0	6142.9	5565.3	4794.4	
400	16	8624.9	8624.9	8068.6	7268.9	6267.6	
450	18	11472.8	11155.6	9575.4			
500	20	14304.0	13964.2	12884.7			
600	24	20866.1	20419.8	18682.8			
750	30	33735.6					

TABLE D

Cracking Pressure for API 594/BS 1868 Swing Check Valve

Size		Units kPa (Psi)					
mm	inch	150LB	300LB	600LB	900LB	1500LB	2500LB
50	2	1.93 (0.28)	2.00 (0.29)	2.20 (0.32)	4.75 (0.69)	5.10 (0.74)	7.10 (1.03)
80	3	2.27 (0.33)	2.48 (0.36)	2.82 (0.41)	3.17 (0.46)	4.34 (0.63)	8.54 (1.24)
100	4	1.79 (0.26)	1.93 (0.28)	1.72 (0.25)	2.76 (0.40)	4.48 (0.65)	7.10 (1.03)
150	6	1.24 (0.18)	1.17 (0.17)	2.07 (0.30)	3.58 (0.52)	3.72 (0.54)	8.54 (1.24)
200	8	1.52 (0.22)	1.52 (0.22)	2.27 (0.33)	3.93 (0.57)	4.82 (0.70)	10.54 (1.53)
250	10	1.31 (0.19)	1.31 (0.19)	2.14 (0.31)	4.13 (0.60)	5.79 (0.84)	
300	12	1.45 (0.21)	1.45 (0.21)	2.82 (0.41)	4.00 (0.58)	6.13 (0.89)	
350	14	2.07 (0.30)	2.14 (0.31)	3.31 (0.48)	3.86 (0.56)	9.78 (1.42)	
400	16	1.72 (0.25)	1.72 (0.25)	3.24 (0.47)	4.96 (0.72)	9.65 (1.40)	
450	18	1.65 (0.24)	2.14 (0.31)	3.58 (0.52)	5.51 (0.80)		
500	20	1.86 (0.27)	2.27 (0.33)				
600	24	1.79 (0.26)	2.89 (0.42)				

APPENDIX A - CONT.

TABLE E

Cv Value for API 6D Swing Check Valve

Size		Units (gal/min)/(lbf/in²)^0.5					
mm	inch	150LB	300LB	600LB	900LB	1500LB	2500LB
50	2	124	124	124	124	124	101
80	3	282	282	282	282	282	200
100	4	523	523	523	523	523	398
150	6	1236	1236	1236	1236	1141	947
200	8	2283	2283	2283	2283	2085	1815
250	10	3574	3574	3574	3574	3217	2804
300	12	5347	5347	5347	5347	4801	4098
350	14	6528	6528	6528	6034	5813	4969
400	16	8609	8609	8609	8084	7533	6451
450	18	11478	11478	11478	10807	9960	8459
500	20	14307	14307	14307	13386	12441	10605
600	24	20898	20898	20898	19576	17968	

TABLE F

Cracking Pressure for API 6D Swing Check Valve

Size		Units kPa (Psi)					
mm	inch	150LB	300LB	600LB	900LB	1500LB	2500LB
50	2	2.55 (0.37)	2.55 (0.37)	2.55 (0.37)	2.27 (0.33)	3.79 (0.55)	4.82 (0.70)
80	3	1.72 (0.25)	1.72 (0.25)	2.69 (0.39)	2.00 (0.29)	2.82 (0.41)	5.37 (0.78)
100	4	1.72 (0.25)	1.72 (0.25)	1.45 (0.21)	2.55 (0.37)	2.82 (0.41)	3.58 (0.52)
150	6	0.96 (0.14)	0.96 (0.14)	1.58 (0.23)	2.89 (0.42)	2.82 (0.41)	4.82 (0.70)
200	8	1.31 (0.19)	1.31 (0.19)	1.86 (0.27)	3.24 (0.47)	3.86 (0.56)	
250	10	1.10 (0.16)	1.10 (0.16)	1.65 0.24)	3.17 (0.46)	4.48 (0.65)	
300	12	1.10 (0.16)	1.10 (0.16)	2.34 (0.34)	2.27 (0.33)	4.48 (0.65)	
350	14	1.65 (0.24)	1.38 (0.20)	2.48 (0.36)			
400	16	1.38 (0.20)	1.72 (0.25)	2.76 (0.40)			
450	18	1.72 (0.25)	2.55 (0.37)	2.55 (0.37)			
500	20	2.55 (0.37)	1.72 (0.25)	2.69 (0.39)			
600	24	1.72 (0.25)					

APPENDIX B

FIGURE NUMBER SYSTEM

EXAMPLE 150AP125QTISN-9PBWG-FA

150	AP125	QTI	S	N	-	9	PL	BW	G	-	F	A

A *Bonnet gasket:* **Blank** *Standard:-* SS + GRP (BB), Pressure Seal Ring (PSB). *N/A:-* (WB). **A** SS + PTFE **B** S31803 Spiral **C** PTFE **D** SS + PTFE + GRP **E** Ring **L** Live Loaded **Z** Special

F *Stem packing:* **Blank** *Standard:-* Graphite. *N/A:-* (Check Valves) **L** Graphite + PTFE **T** PTFE **F** Fugitive Emission GRP **I** Fugitive Emission PTFE **J** Special

- Denotes special suffix - Packing/Gasket

G *Operator:* **Blank** Handwheel or N/A **A** Actuator **G** Gear **H** Hammer Blow Handwheel

BW *End connection:* **Blank** RF (B16.5) **BA** RF B16.47A (MSS SP44) **BB** RF B16.47B (API 605) **RJ** RTJ **BW** Buttweld **FF** Flat Face **SP** is special drilling **UD** Undrilled **UM** Unmachined for RF/RJ

PL *Bonnet:* **Blank** Bolted **C** Cryogenic **H** Pillar & Bridge **L** Low Temperature **P** Pressure Seal **S** Bellows Sealed **W** Welded

9 *Body material:* - see page 5. (WCB is Blank)

- Denotes special suffix - Body/Bonnet/Ends/Operator

N **Blank** Non NACE **N** NACE

S **Blank** Standard Configuration (Example Solid Wedge) **A** S Bend Globe **D** Globe-Stop Check **DG** Globe - Stop Check Guided **F** Flexible Disc Gate **J** Slab Gate **K** Expanding Gate **L** Lever (Swing Check) **P** Full Opening Swing Check (API 6D) **Q** Full Opening Piston Check (API 6D) **R** Right Angle **S** Parallel Slide **Y** Inclined Bonnet **Z** c/w Spring

QTI Denotes trim - Code & Modifier (see below)

AP125 Basic identifier number denoting valve class and valve type (As shown in catalogue)

150 Valve Size

TRIM CODES

		BODY SEAT SURFACE	DISC SURFACE	STEM	BACK SEAT (STUFFING BOX)
TRIM CODE(1)	B	Bronze	Bronze	Bronze	Bronze
	C	AL-Bronze	AL-Bronze	AL-Bronze	AL-Bronze
	D	Monel(1)	Monel(1)	Monel	Monel
	E	F51(1)	F51(1)	F51	F51
	G	F55(1)	F55(1)	F55	F55
	H	Hastelloy B(1)	Hastelloy B(1)	Hastelloy B	Hastelloy B
	L	F316(1)(6)	F316(1)(6)	F316(6)	F316(6)
	M	F316L(1)	F316L(1)	F316L	F316L
	N	Alloy 20(1)	Alloy 20(1)	Alloy 20	Alloy 20
	P	F304(1)	F304(1)	F304	F304
	Q	F304L(1)	F304L(1)	F304L	F304L
	R	Alloy 625(1)	Alloy 625(1)	Alloy 625	Alloy 625
	V	F53(1)	F53(1)	F53	F53
	W	F347(1)	F347(1)	F347	F347
	Blank	F6a/F6/410	F6a/F6/410	F6a/F6/410	F6a/F6/410
	Z	Special(1)	Special(1)	Special	Special
MODIFIER	EN	ENP	ENP	(2)	(2) (3)
	GE(5)	Stellite #6	Stellite #12	17-4 PH	Stellite #6
	I	-	-	17-4 PH	-
	M	-	-	Monel	-
	T	+PTFE Seat	-	-	-
	U	Stellite	Stellite	(2)	(2) (3)
	X	(4)	(4)	(4)	(4)
	XU	Stellite	(2)	(2)	(2) (3)
	Z	-	-	Special	-

(1) Add modifier below if applicable. **(2)** As per trim code above. **(3)** Or Integral as per body. **(4)** API trim code #1 only. (5) Geothermal trim. (6) Can be dual certified 316/316L.

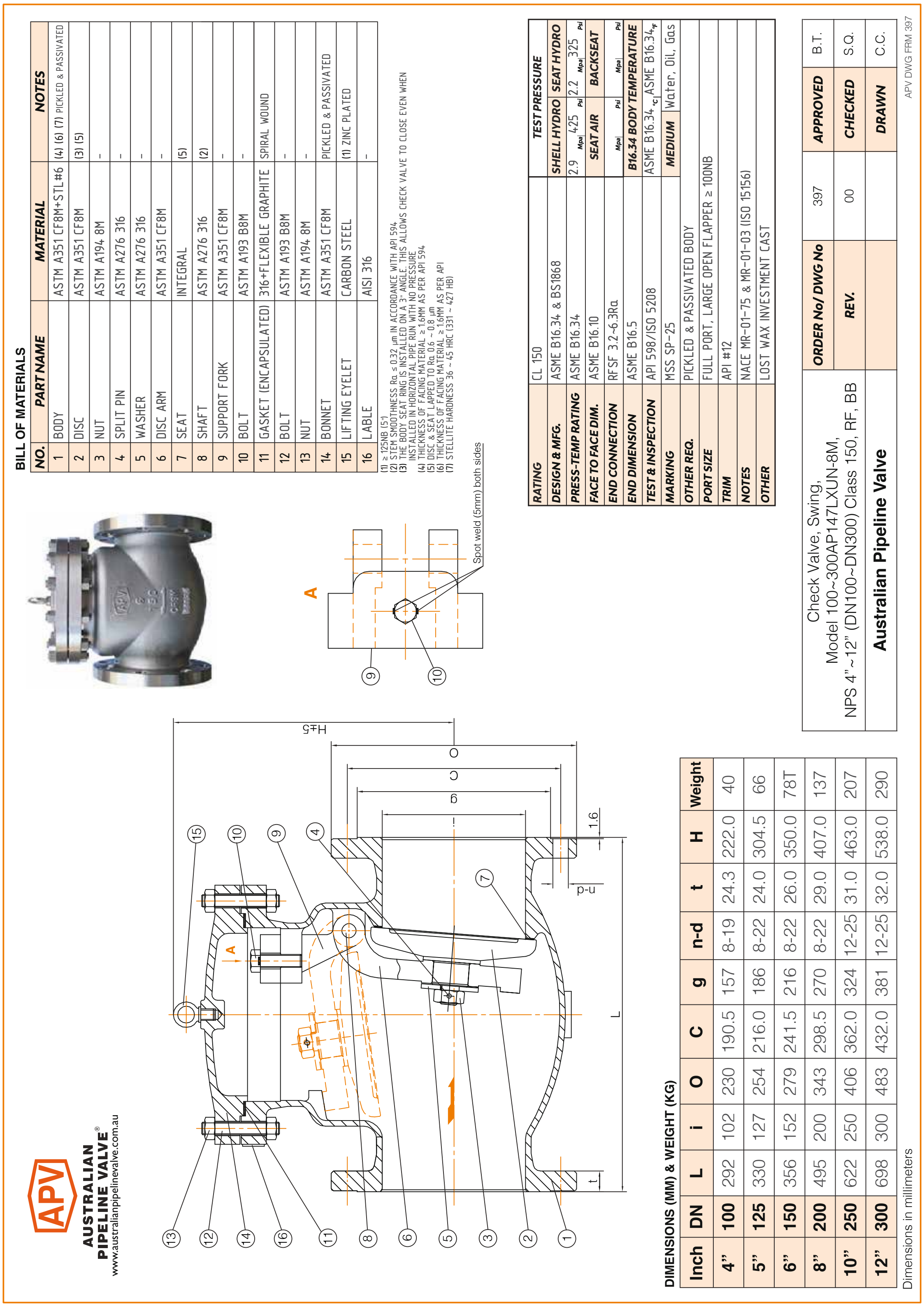
APPENDIX B - CONT.

FIGURE NUMBER SYSTEM - BODY MATERIAL CODE • BODY/BONNET MATERIALS

Suffix	ASTM Spec.	Material
None	A216 WCB	Carbon Steel
1	A216 WCC	Carbon Steel
1A	A217 WC1	Carbon Moly 1/2% Mo
2	A352 LCC	Low Carbon Steel
2B	A352 LCB	Low Carbon Steel
4	A351 CF3M	Stainless with Molybdenum (low carbon)
5	A217 Gr. C5	5% Cr, 1/2% Mo
6	A217 Gr. WC6	1-1/4% Cr, 1/2% Mo
7	A217 Gr. WC9	2-1/4% CR, 1% Mo
8	A351 CF8	Stainless 18% Cr, 8% Ni
8A	A351 CF3	Stainless 18% Cr, 8% Ni (low carbon)
8D	A351 CF8C	Stainless 18% Cr, 10% Ni & Cb
8M	A351 CF8M	Stainless with Molybdenum
9	A217 Gr. C12	Chrome Moly 9% Cr, 1% Mo
10	A352 LC1	Carbon Moly 1/2% Mo
11	A352 LC3	Low Carbon Steel (-101^{0}C)
13	A351-CN7M	Alloy 20
14	A890/A995-4A/CD3MN	Duplex (F51)
15	A995-6A/CD3MWCuN	Super Duplex (F55)
19	Bronze	Bronze B62/LG2/B148
20	AL-Bronze	Aluminium Bronze
21	A995-5A/CE3MN	Super Duplex (F53)
22	A296 M-35	Monel
23	A296 CW-12M	Hastelloy C
24	A484 CU-5M CUC	Inconel 825
25	A494 CY40	Inconel 600
26	A494 CW6MC	Inconel 625
27	B367 GR.C2	Titanium (F2)
28	B367 GR.C3	Titanium (F3)
29	A358 LC4	Low Temp. 4-1/2% Nickel Steel
30	A358 LC9	9% Nickel Steel
31	A358 CA6NM	18-1/2% Chromium, Nickel-Molybdenum Steel
32	A217 WC4	Nickel Chromium Molybdenum
33	A217 WC5	Nickel Chromium Molybdenum
34	A217 WC11	Chromium Molybdenum
35	A217 C12	Chromium Molybdenum
36	A217 C12A	Chromium Molybdenum Vanadium
37	A217 CA15	Chromium Steel
0	SPECIAL	

APPENDIX C

EXPLODED B.O.M. SWING CHECK



BILL OF MATERIALS

NO.	PART NAME	MATERIAL	NOTES
1	BODY	ASTM A351 CF8M+STL#6	(4) (6) (7) PICKLED & PASSIVATED
2	DISC	ASTM A351 CF8M	(3) (5)
3	NUT	ASTM A194 8M	-
4	SPLIT PIN	ASTM A276 316	-
5	WASHER	ASTM A276 316	-
6	DISC ARM	ASTM A351 CF8M	-
7	SEAT	INTEGRAL	(5)
8	SHAFT	ASTM A276 316	(2)
9	SUPPORT FORK	ASTM A351 CF8M	-
10	BOLT	ASTM A193 B8M	-
11	GASKET (ENCAPSULATED)	316+FLEXIBLE GRAPHITE	SPIRAL WOUND
12	BOLT	ASTM A193 B8M	-
13	NUT	ASTM A194 8M	-
14	BONNET	ASTM A351 CF8M	PICKLED & PASSIVATED
15	LIFTING EYELET	CARBON STEEL	(1) ZINC PLATED
16	LABLE	AISI 316	-

(1) ≥ 125NB (5")
(2) STEM SMOOTHNESS Ra ≤ 0.32 μm IN ACCORDANCE WITH API 594
(3) THE BODY SEAT RING IS INSTALLED ON A 3° ANGLE. THIS ALLOWS CHECK VALVE TO CLOSE EVEN WHEN INSTALLED IN HORIZONTAL PIPE RUN WITH NO PRESSURE
(4) THICKNESS OF FACING MATERIAL ≥ 1.6MM AS PER API 594
(5) DISC & SEAT LAPPED TO Ra 0.6 ~ 0.8 μm
(6) THICKNESS OF FACING MATERIAL ≥ 1.6MM AS PER API
(7) STELLITE HARDNESS 36 ~ 45 HRC (331 ~ 427 HB)

RATING	CL 150	TEST PRESSURE	
DESIGN & MFG.	ASME B16.34 & BS1868	SHELL HYDRO	SEAT HYDRO
PRESS-TEMP RATING	ASME B16.34	2.9 Mpa 425 Psi	2.2 Mpa 325 Psi
FACE TO FACE DIM.	ASME B16.10	SEAT AIR	BACKSEAT
END CONNECTION	RFSF 3.2~6.3Ra	Mpa Psi	Mpa Psi
END DIMENSION	ASME B16.5	B16.34 BODY TEMPERATURE	
TEST & INSPECTION	API 598/ISO 5208	ASME B16.34 °C	ASME B16.34 °F
MARKING	MSS SP-25	MEDIUM	Water, Oil, Gas
OTHER REQ.	PICKLED & PASSIVATED BODY		
PORT SIZE	FULL PORT, LARGE OPEN FLAPPER ≥ 100NB		
TRIM	API #12		
NOTES	NACE MR-01-75 & MR-01-03 (ISO 15156)		
OTHER	LOST WAX INVESTMENT CAST		

DIMENSIONS (MM) & WEIGHT (KG)

Inch	DN	L	i	O	C	g	n-d	t	H	Weight
4"	100	292	102	230	190.5	157	8-19	24.3	222.0	40
5"	125	330	127	254	216.0	186	8-22	24.0	304.5	66
6"	150	356	152	279	241.5	216	8-22	26.0	350.0	78T
8"	200	495	200	343	298.5	270	8-22	29.0	407.0	137
10"	250	622	250	406	362.0	324	12-25	31.0	463.0	207
12"	300	698	300	483	432.0	381	12-25	32.0	538.0	290

Dimensions in millimeters

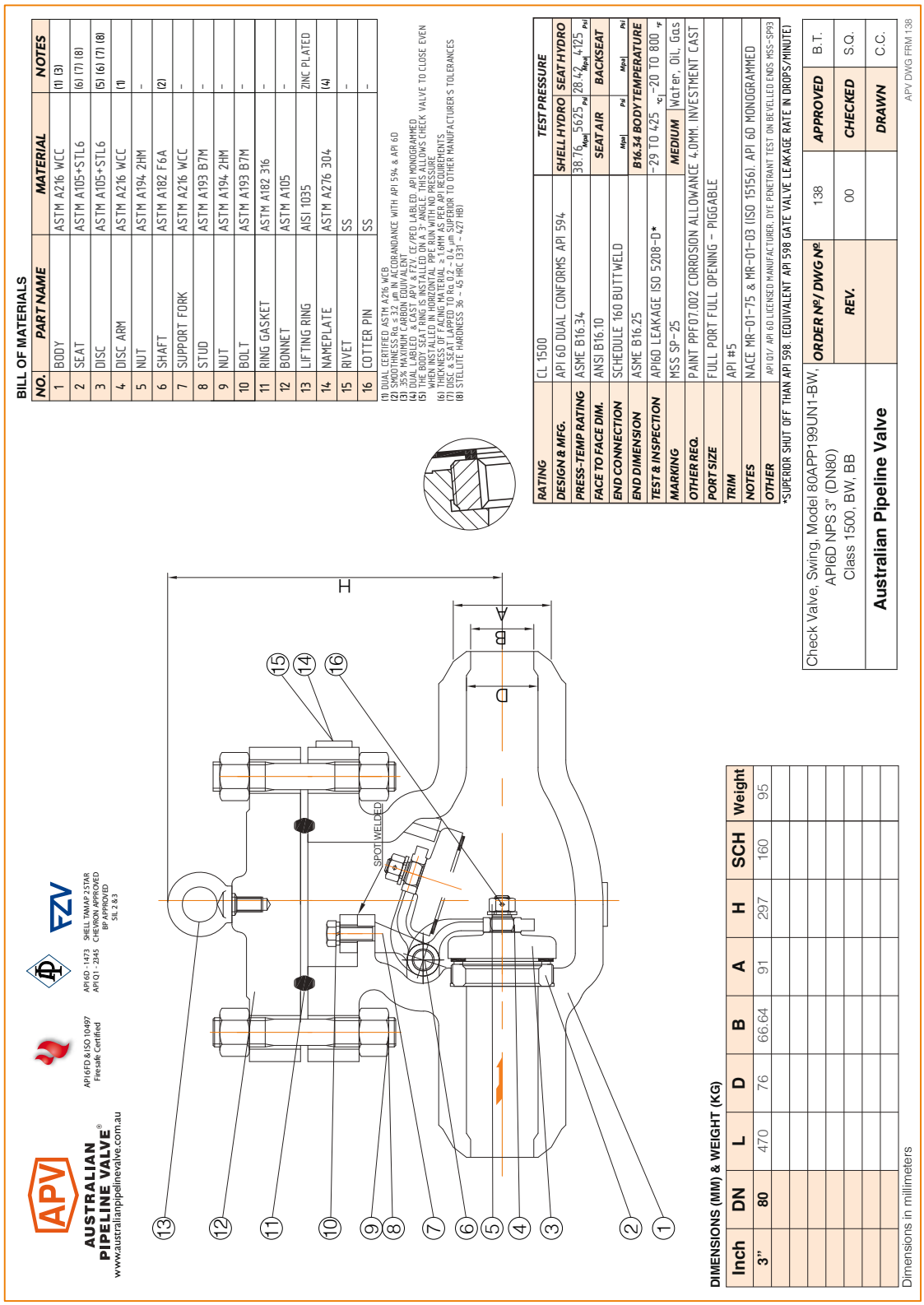
Check Valve, Swing,
Model 100~300AP147LXUN-8M,
NPS 4"~12" (DN100~DN300) Class 150, RF, BB
Australian Pipeline Valve

ORDER No/ DWG No	397	APPROVED	B.T.
REV.	00	CHECKED	S.Q.
		DRAWN	C.C.

Example only, refer to as-built drawing.

APPENDIX C - CONT.

EXPLODED B.O.M. SWING CHECK



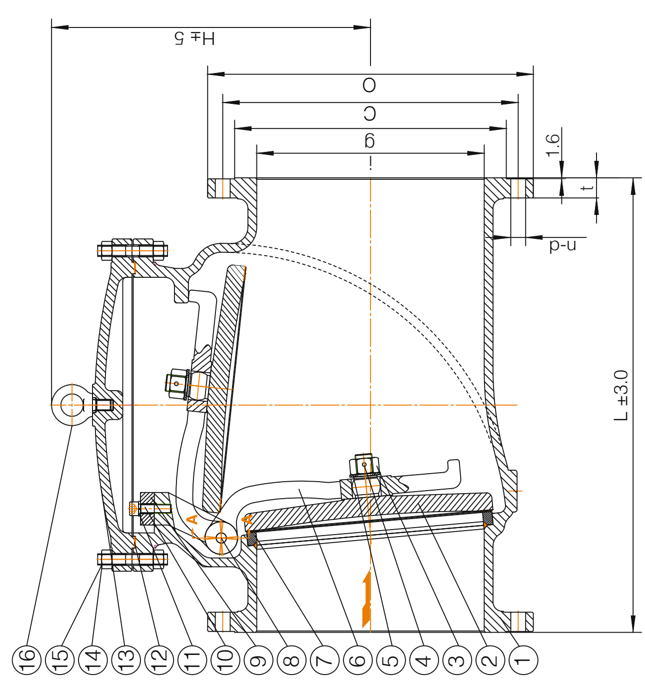
Example only, refer to as-built drawing.

APPENDIX C - CONT.

EXPLODED B.O.M. SWING CHECK

AUSTRALIAN PIPELINE VALVE®
www.australianpipelinevalve.com.au

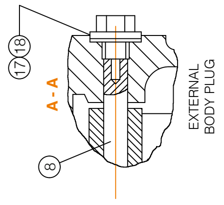
API 6FD & ISO 10497 Firesafe Certified



BILL OF MATERIALS

NO.	PART NAME	MATERIAL	NOTES
1	BODY	ASTM A216 WCB	(4)
2	DISC	ASTM A216 WCB+CR13	(2) (3) (5)
3	LOCK NUT	ASTM A194 8	-
4	SPLIT PIN	ASTM A276 316	-
5	WASHER	ASTM A276 316	-
6	DISC ARM	ASTM A216 WCB	-
7	SEAT	ASTM A105+ST#6	(3) (5) (6)
8	HINGE PIN	ASTM A276 410	(1)
9	SUPPORT FORK	ASTM A216 WCB	-
10	BOLT	ASTM A193 B7M	-
11	SPRING WASHER	65Mn	ZINC PLATED
12	GASKET (ENCAPSULATED)	SS316+FLEXIBLE GRAPHITE	SPIRAL WOUND
13	BONNET	ASTM A216 WCB	(4)
14	STUD	ASTM A193 B7M	-
15	NUT	ASTM A194 2HM	-
16	LIFTING EYELET	AISI 1035	ZINC PLATED
17	SCREW PLUG	ASTM A276 410	-
18	GASKET	316SS	-

(1) STEM SMOOTHNESS Ra ≤ 3.2 μm IN ACCORDANCE WITH API 594
(2) THE BODY SEAT RING IS INSTALLED ON A 3" ANGLE. THIS ALLOWS CHECK VALVE TO CLOSE EVEN WHEN INSTALLED IN HORIZONTAL PIPE RUN WITH NO PRESSURE
(3) THICKNESS OF FACING MATERIAL ≥ 1.6MM AS PER API REQUIREMENTS
(4) API 20A & API Q1 GROUP B (CSL1~4) LICENSED FOUNDRY
(5) DISC & SEAT LAPPED MINIMUM SMOOTHNESS Ra 0.4 ~ 0.8 μm
(6) STELLITE HARDNESS 36 ~ 45 HRC (331 ~ 427 HB)



EXTERNAL BODY PLUG

RATING	CL 150	**TEST PRESSURE**	
DESIGN & MFG.	API 6D DUAL CONFORMS API 594	**SHELL HYDRO**	**SEAT HYDRO**
PRESS-TEMP RATING	ASME B16.34	3.1 Mpa 450 Psi	2.2 Mpa 325 Psi
FACE TO FACE DIM.	ASME B16.10	**SEAT AIR**	**BACKSEAT**
END CONNECTION	RFSF 3.2~6.3 Ra	Mpa Psi	Mpa Psi
END DIMENSION	ASME B16.5	**B16.34 BODY TEMPERATURE**	
TEST & INSPECTION	API 6D/ISO 5208 RATE G	-29 TO 425 °C	-20 TO 800 °F
MARKING & PAINT	MSS SP-25, PAINT WF07.002	**MEDIUM**	Water, Oil, Gas
OTHER REQ.	NACE MR-01-75 & MR-01-03 (ISO 15156)		
PORT SIZE	FULL		
TRIM	API #8		
NOTES	CORROSION ALLOWANCE 4.0MM		
OTHER	ISO 5208 RATE G (EQUIVALENT SEAT LEAKAGE TO API598)		

DIMENSIONS (MM) & WEIGHT (KG)

Inch	DN	L	i	O	C	g	n-d	t	H	Weight
10"	**250**	622	51.0	406.0	362.0	324	12-25	31.0	457	202
12"	**300**	698	76.0	485.0	431.8	381	12-25	32.0	478	320
14"	**350**	787	535.0	535.0	476.3	413	12-29	35.4	515	390
16"	**400**	864	595.0	595.0	539.8	470	16-29	37.0	595	585
18"	**450**	978	438.0	635.0	577.9	533	16-32	40.0	680	850

Dimensions in millimeters

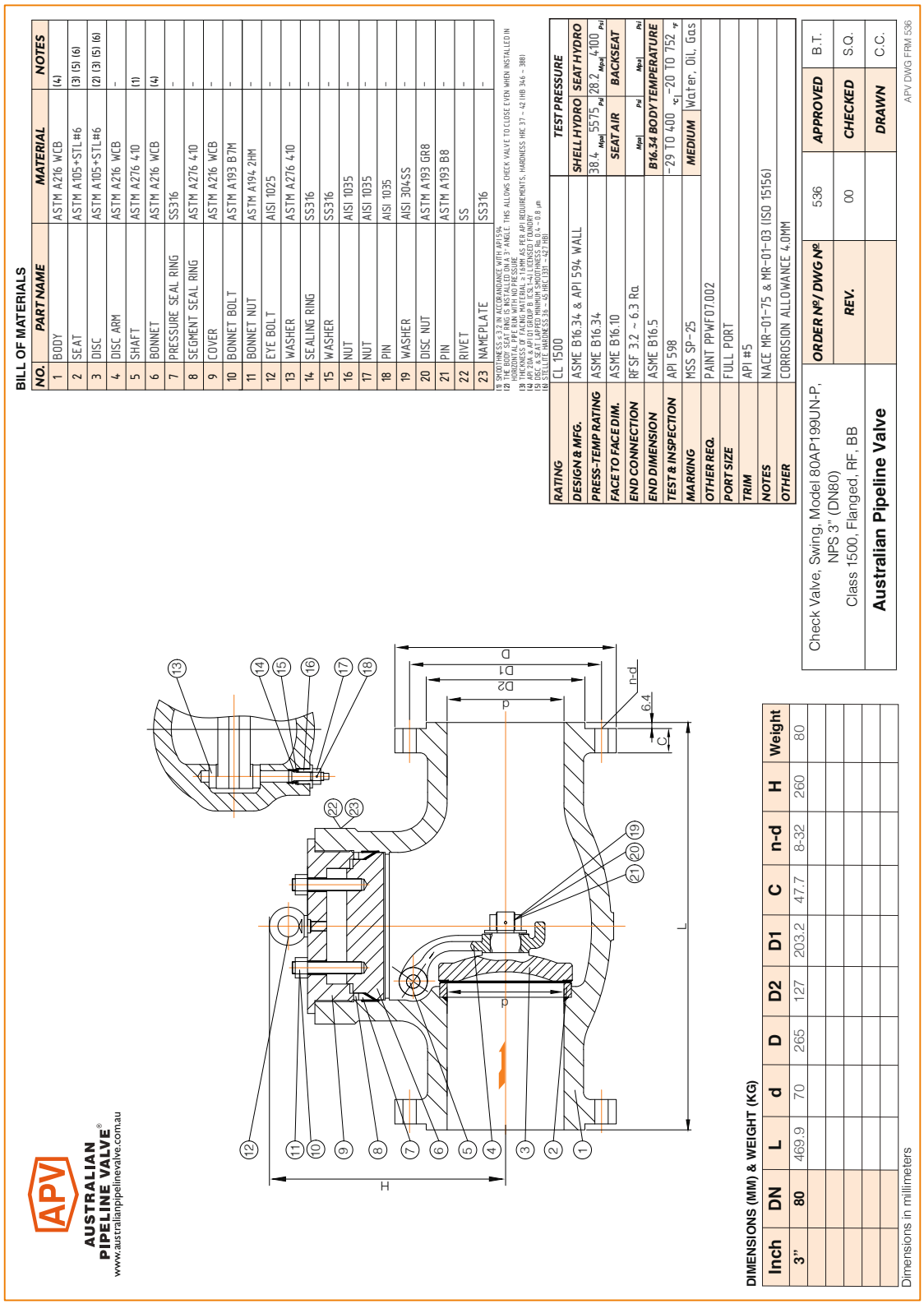
Check Valve, Swing, Model 250~450AP147XUPN, NPS 10"~18" (DN250~DN450) Class 150, RF, BB, Piggable API 6D	**ORDER Nº/ DWG Nº**	544	**APPROVED**	B.T.
	REV.	00	**CHECKED**	S.Q.
Australian Pipeline Valve			**DRAWN**	C.C.

APV DWG FRM 544

Example only, refer to as-built drawing.

APPENDIX C - CONT.

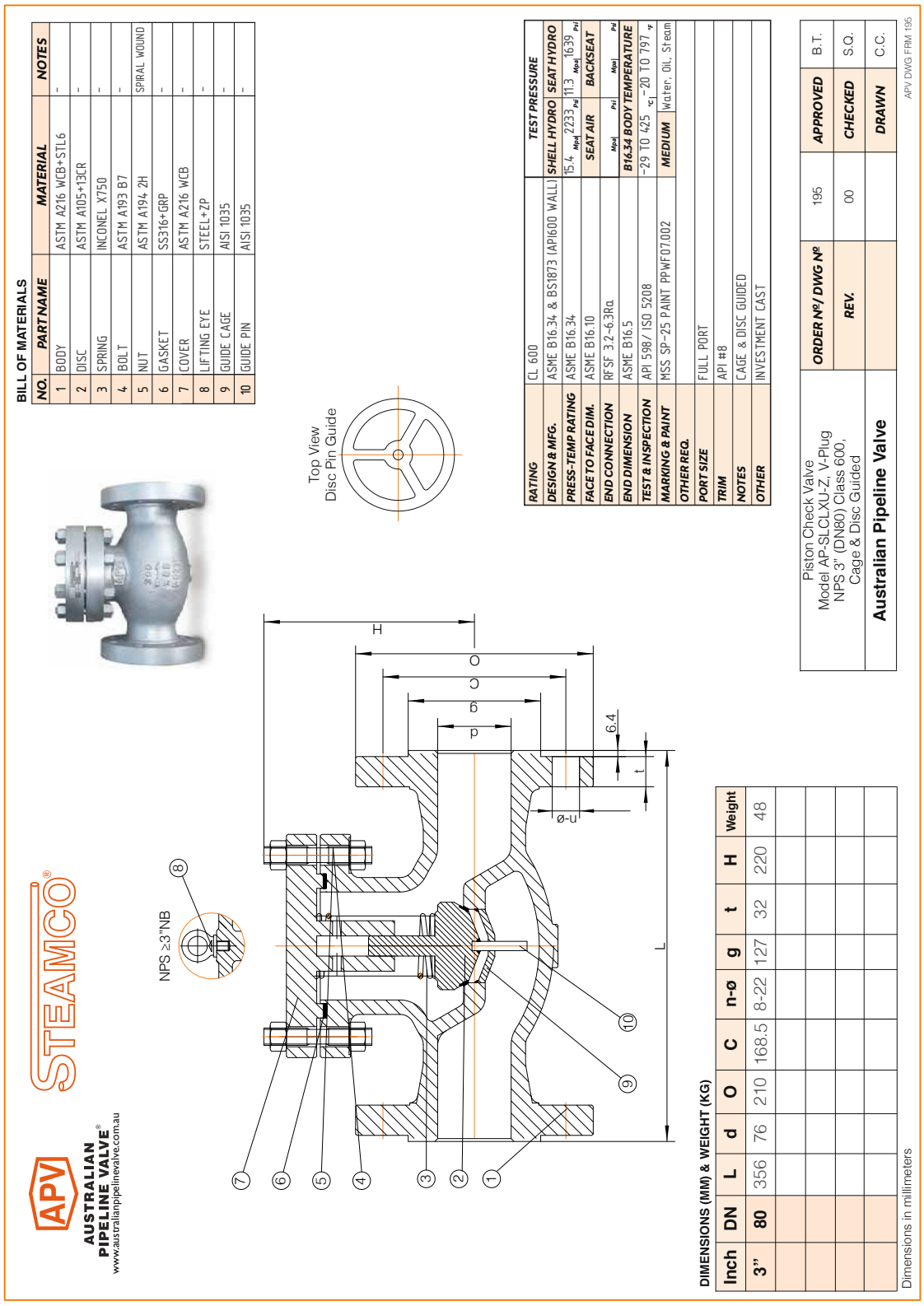
EXPLODED B.O.M. SWING CHECK



Example only, refer to as-built drawing.

APPENDIX C - CONT.

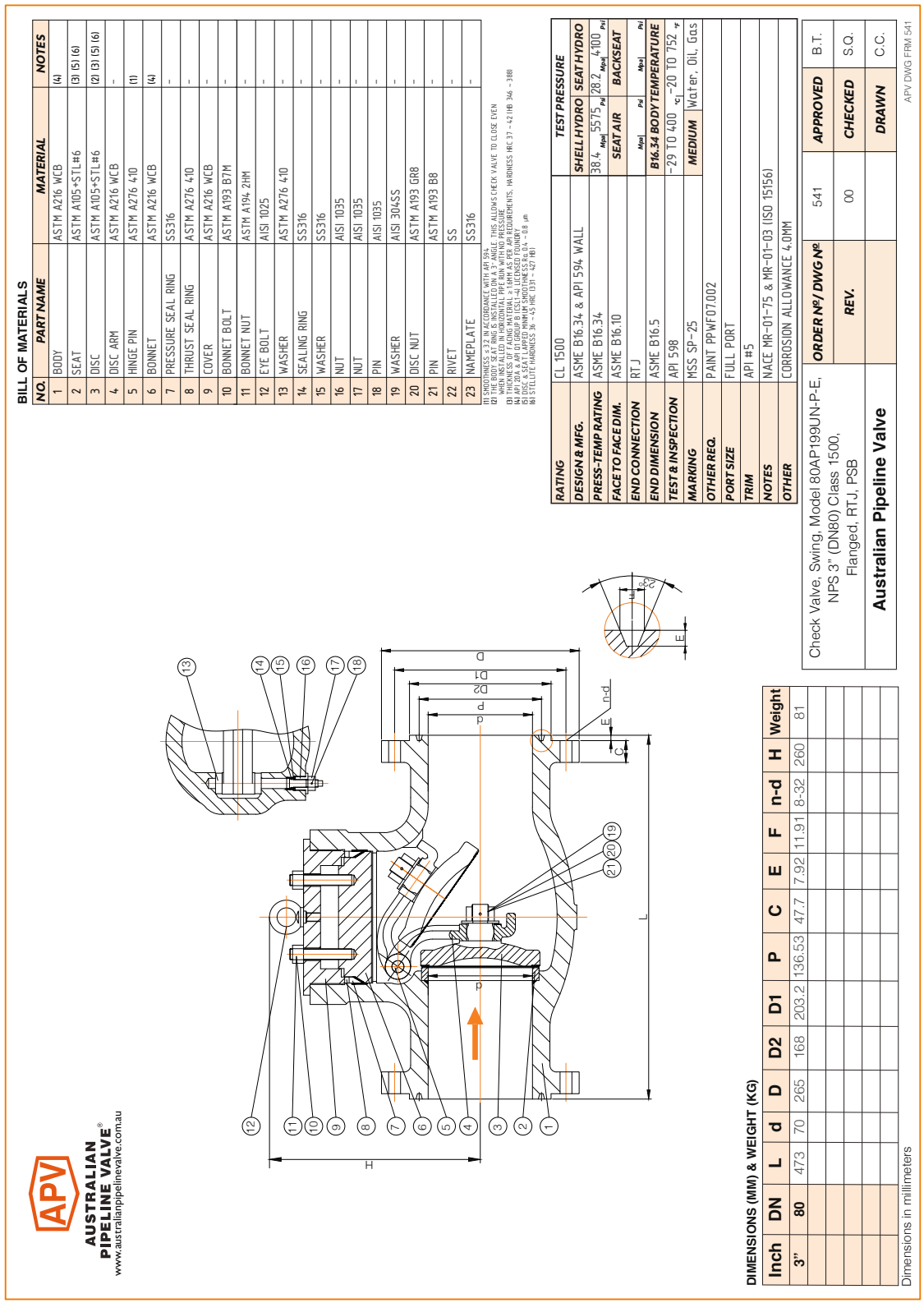
EXPLODED B.O.M. PISTON CHECK



Example only, refer to as-built drawing.

APPENDIX C - CONT.

EXPLODED B.O.M. SWING CHECK - PRESSURE SEAL BONNET



Example only, refer to as-built drawing.

AUSTRALIAN PIPELINE VALVE®

ADELAIDE • BRISBANE • PERTH

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