INSTALLATION, USE AND MAINTENANCE MANUAL

Model: SAT/SAT CRIO
Metal Seated Trunnion Ball Valves

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0. INTRODUCTION

Manufacturer: **PENTA S.r.l.**
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For any further information, please contact our Customer Assistance Dept. at the above numbers.
PENTA S.r.l. does not guarantee the results of a maintenance developed in accordance with this manual due to operator ability. Best results are when maintenance is carried out at PENTA workshop.

PENTA S.r.l. has no responsibility on damages occurred during disassembling, maintenance and reassembling or during valve testing.
Operators involved in the storage, mounting, use and/or maintenance of our products are requested to have sufficient skill and experience in such a kind of equipments. It user responsibility to guarantee this skill is met.

1. TECHNICAL DATA

1.1 Valve Technical data

Service	ON-OFF
Fluids	liquids and gases group 1 (dangerous) in accordance to the EC Directive 68/EU/2014. Fluid classification according to Article 13 of Directive 68/EU/2014.
Degree of protection	II2G c IIC TX / II2D c IIC TX in accordance to the EC Directive 2014/34/UE
Marking conforming to ATEX Directive	Community marking for equipment intended to be installed in hazardous location for the presence of potentially explosive atmospheres. II Equipment group suitable for the surface industry. 2 Category 2 of an equipment suitable to be used in zone 2 G Gas, vapour or mist are the flammable substances concurring to the formation of potentially explosive atmosphere. D Explosive atmosphere with dust presence. c Method of protection adopted to reduce the ignition hazard: “c”, constructional safety according to EN13463-1 and EN13463-5 IIC Equipment suitable to zone classified for the presence of gas, vapour, mists in the group IIC TX Special conditions for safe use must be applied according to this instruction manual prior operating the actuator: that may regard the maximum surface temperature of the equipment (T1,T2, T3, T4, T5 or T6 depending on the special combination obtained applying the “special conditions for safe use” described in this manual”) CE Community marking CE of conformity to all applicable directives 20xx Year of production

FIRE-SAFE	ISO 10497 / API 607 V Ed. (certificate)
Emissions to atmosphere	1x10-4 mbar 1/s m (according to TA-LUFT requirements).
Tightness limits on brand new valve	
Hydrostatic Body Test	zero Leakage
Hydrostatic Seat Test	zero Leakage
Pneumatic Seat Test (6 bar Air)	zero Leakage
Design Specification	ASME B16.34 Ed. 04 / API 6D / EN 1983 / API 608
Pressure Class	PN6 To 420- ANSI 150 to 2500Lb.
End connections	Flanged ANSI B16.5/DIN/EN, butt weld ANSI B16.25 Socket weld ANSI B16.1 or threaded NPT ANSI B1.20.1
Suitable for	dangerous liquids group 1 to EC Directive 97/23/CE.
Min. Allowable Working Pressure	full vacuum
Max. Allowable Working Pressure and Design (PS)	see tab. 1
Min. Allowable Design Temperature (TS)	-100°C
Max. Allowable Design Temperature (TS)	700°C
Min. Allowable Working Temperature (TS)	Minimum working temperature to be limited –196°C or to specific material minimum working temperature (see table 2) whichever higher.
Max. Allowable Working Temperature (TS)	Maximum working temperature to be limited 700°C or to specific material maximum working temperature (see table 2) whichever lower.
Pressure testing specification	ANSI B16.104 / API 598 / EN 12266-1
Body Thickness	ASME B16.34 / ASME VIII div. 1
Bolt Design	ASME B16.34 / ASME VIII div. 1
Flange Design	ASME VIII div. 1
Simultaneous Loads	Internal Pressure + Bending + Axial Loads
Wind Loads	Negligible
Earthquake Loads	Valve and actuator assembly is calculated for earthquake magnitude incrementing 40% the dead weight of actuator and valve cover
WARNING! Valve operability is not guaranteed during and after an earthquake (actuated valves only) due to possible misalignment of valve stem/ actuator pinion connecting coupling.	

Fatigue Loads by start-ups	Not applicable according to ASME III div.1 subsect. NB.
Fatigue Loads by service fluctuations	Not applicable in accordance to ASME III div.1 subsect. NB.

Max. valve life	Function of actual working conditions but not longer than: • 100.000 hours with periodic inspection • 1.500 cycles of pressurisation and depressurisation for carbon steel bodies • 13.000 cycles of pressurisation and depressurisation for stainless steel bodies • 50.000 open-close cycles on liquid services • 10.000 Open-Close cycles on gas services
Available corrosion overthickness	2 mm (carbon steel only).
CREEP range	Not applicable in the range of temperature considered for material assumed as standards.

Table 1 – Allowable pressure/temperature ratings (°C)

Temperature	**-100ºC / Amb. (1) (3)**					***400ºC* (1) (3)**				
Body materials group / Press. Classes	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
PN 6 a 16 ANSI 150	19,6	20	19	15,9	19	6,5	6,5	6,5	6,5	6,5
PN 25 a 40 ANSI 300	51,1	51,7	49,6	41,4	49,6	34,7	36,5	29,4	24,3	36,5
PN 63 a 100 ANSI 600	102,1	103,4	99,3	82,7	99,3	69,4	73,3	58,9	48,6	73,3
PN 160 ANSI 900	153,2	155,1	148,9	124,1	148,9	104,2	109,8	88,3	72,9	109,8
PN 250 ANSI 1500	255,3	258,6	248,2	206,8	248,2	173,6	183,1	147,2	121,5	183,1
PN 420 ANSI 2500	425,5	430,9	413,7	344,7	413,7	289,3	304,9	245,3	202,5	282,6

Temperature	**500ºC (1) (3)**					**600ºC (1) (3)**					**700ºC (1) (3)**				
Body materials group / Press. Classes	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
PN 6 a 16 ANSI 150	2,8	2,8	2,8	0	2,8	0	1,4	1,4	0	1,4	0	0	1,4	0	1,4
PN25 a 40 ANSI 300	11,8	28,2	28,2	0	28,2	0	6,9	19,9	0	21,6	0	0	8,4	0	10,1
PN 63 a 100 ANSI 600	23,5	56,5	56,5	0	56,5	0	13,8	39,8	0	42,9	0	0	16,8	0	20
PN 160 ANSI 900	35,3	84,7	84,7	0	84,7	0	20,7	59,7	0	64,2	0	0	25,1	0	29,8
PN 250 ANSI 1500	58,8	140,9	140,9	0	140,9	0	34,4	99,5	0	107	0	0	41,9	0	49,7
PN 420 ANSI 2500	97,9	235	235	0	235	0	57,4	165,9	0	178,5	0	0	69,8	0	83

The values are above or beyond what is required by the ASME B16.34 Ed. 2004

Note: [1] For maximum and muinimum allowable working temperature for specific material see Tab. 2
Group 1 includes ASTM A105 / A350LF2
Group 2 includes A182 F5 Cl. 2 / A182 F22 Cl. 3 / A182 F5 / A182 F5a
Group 3 includes ASTM A182 o A479 Type 304 / 316 / 304H / 316H / A351 CF3 / CF8 / CF3M / CF8M

Group 4 includes ASTM A182 o A479 Type 304L / 316L
Group 5 includes ASTM A182 321 / 321h / 347H – A479 Type 321 / 321H / 347 / 347H

Table 2 – Maximum and Minimum Allowable continuous working temperatures

Body Material	Minimum Working Temp. °C(1) (3)	Maximum Working Temp. °C(2)	Body Material	Minimum Working Temp. °C(1) (3)	Maximum Working Temp. °C (2)
BODY MATERIALS					
A105	-29 1)	425 2	A182 / A479 304L / 316L	-196	425
A350 LF2	-46 1)	425 2	A182 / A479 304/316/304H/316H	-196	none
A182 F11 Cl.2	-29	595	A351 CF8 / CF8M	-196	none
A182 F22 Cl.3	-29	595	A351 CF3	-196	425
A182 F5a	-29	650	A351 CF3M	-196	455
A182 F5	-29	650	A182 / A479 Tp. 321 / 347	-196	538
			A182 / A479 Tp. 321H/347H	-196	none
			A182 F51/ A479UNS S31803	-100	350
			UNS S20910 (Nitronic 50)	-196	600
			A479 Tp.410 / A182 F6a	-29	350
			A564 Tp.630 (17/4PH)	-100	350
SEAT MATERIAL					
			PENTAFITE	-100	780
			STELLITE 6 (ST6)	-29	400
			TUNGSTEN CARBIDE (WC)	-29	400
			CHROME CARBIDE (CRC)	-29	700

Note

1) Test Temperature TR the verification of the Kv=27J impact test limit according 23/97/CE is calculated according I.S.P.E.S.L. Code Case M Tab. M.14.2. For further information please contact Penta Technical Department
2) Maximum working temperature to be limited to Product Maximum Working Temperature Table 1 or to Specific Material Maximum Working Temperature in Table 2 whichever lower. Please contact Penta Technical Dept. for pressure/temperature max. allowable simultaneous conditions
3) For CREEP limits see Table 3

Table 3 - CREEP Temperatures (ASME II Part D)

Materiale corpo	CREEP Temp.°C	Materiale corpo	CREEP Temp.°C
A105	399	A182 / A479 Tp.304L/316L	N/A
A350 LF2	399	A182 / A479 Tp.304	593
A182 F5	454	A182 / A479 Tp.316	620
A182 F11	482	A182 / A479 Tp.347H	620
A182 F22	482	A351 CF8 / CF8M	N/A
		A182 / A479 Tp.310	510
		A182 / A479 UNS S31803	N/A
		A182 / A479 Tp.321	N/A
		A182 F6a Cl.2 / A479 Tp.410	454
		A564 Tp.630 (17/4PH)	N/A

Note: the limit is considered Not Applicable (N/A), when maximum material working temperature as stated in table 2 is lower than CREEP limit.

WARNING!
Valve design for temperatures above the Creep limit in Table 3 are based on 100.000 hours for rupture properties. User should consider this limit to decide the time between inspections necessary to evaluate any damage due to Creep effects.

1.2 Operator technical data

Actuator type	
Manufacturer	
Model	
Supply	
Gear ratio	
Turns/stroke	
Cable entries	
Maximum allowable supply pressure	
Mounting flange	
Valve torques at differential pressure	Please ask to Penta technical dpt.

WARNING!
Mounting of actuators different than provided is not allowable without approval of Penta technical dpt.

2. INSTALLATION

2.1 Valve installation

The valve is designed to be assembled with stem axis in all possible positions.

WARNING!
During installation the valve should be in OPEN position (lever operated or gear operated valves only).
Remove end caps before assembling the valve to the line pipe.

3. USE

3.1 Stock

Do not remove end caps until valve installation and keep valve in a dry and covered stocking.

WARNING!
Removal of any valve part or their modification without prior notice can cause malfunction and can be dangerous for operators.

3.2 General use recommendation

When few operating of the valve for long time is expected, we recommend to make complete OPEN and CLOSE strokes every 3 months at least.

4. MAINTENANCE

4.1 Valve maintenance

4.1.1 Introduction

This manual has been developed to allow the maintenance of reference valve on site. Although this is considered possible without specific skill, Penta cannot warrant the same quality level available with a maintenance carried out in its workshop.

We recommend to make a complete valve verification every max 24 months from dispatch, also when valve has not been in use.

WARNING!
Shorter maintenance periods are possible function of real working conditions.

4.1.2 Disassembly

Between brackets you will find the Part Identification Number object of work with reference to the drawing.

WARNING!
Before to start to work, be sure the valve is not pressurised, operating it (full stroke) at least once. After this, leave the ball in OPEN position.

Remove the valve from the piping system.
Rotate the ball (4) in CLOSE position and then remove the actuator with the bracket, if any.
Unscrew the Upper Cover Bolts (35-2) and remove the Upper Cover (6) with the Stem (5).
Stem and Upper Cover are pre-assembled parts.

P.S.: For Cryogenic Valves remove the Body/Cryogenic Elongation Bolts (35-2) and extract the Cryogenic Elongation (6-1) with the Upper Cover (6) and the Cryogenic Stem (5). Cryogenic Elongation (6-1), Cryogenic Stem (5) and Upper Cover (6) are pre-assembled parts.
Remove the Adapter Ring (93-1 when present) with its own Stem Plain Bearing (43).

Remove now the Lower cover (7) unscrewing the Lower Cover Bolts (35-3).
Remove ball coupling (53), when present, from upper side of the valve body.
Proceed unscrewing the Connector Bolts (35-1), only on one side when two connector construction, noting that the Seat Spring (84), because loaded, will push away the Connector (2) from the body, making easier its removal. This operation is possible when valve axis is in vertical position only.
The Seat (12+13), Gasket (M), Compression Ring (14) and Seat Spring (84) should follow the Connector (2).
Remove Connector (2)and then remove the Ball (4).
It is now possible to remove the Body Seat (12+13) with relevant Gasket (M). Compression Ring (14) and Seat Spring (84) also.
To remove the Stem (5) from the Upper Cover (6), is necessary remove first the Stem Retaining Ring (92) pushing down (with a press) the Stem Plain Ring (31). Remove the Stem Retaining Ring (92 is in 2 half) and release the Stem Plain Ring (31). Remove it (31) with the Stem Spring (90), Gland (93), Secondary Gasket (II^). Take note of the order and position of Stem Spring (90). Now Stem (5) can be removed from lower side of the Upper Cover (6) with Primary Stem Gasket (I^).

P.S.: For Cryogenic Valves remove the Cryogenic Elongation/Upper Cover Bolts (35-3) and remove the Cryogenic Elongataion (6-1). To remove the Cryogenic Stem (5) from the Upper Cover (6), is necessary remove first the Stem Retaining Ring (92) pushing down (with a press) the Stem Plain Ring (31). Remove the Stem Retaining Ring (92 is in 2 half) and release the Stem Plain Ring (31). Remove it (31) with the Stem Spring (90), Gland (93), Secondary Gasket (II^). Take note of the order and position of Stem Spring (90). Now Cryogenic Stem (5) can be removed from lower side of the Upper Cover (6-1) with Primary Stem Gasket (I^).

Remove all the Grafoil Gaskets (M Cte CCe Te) from body.

4.1.3 Inspection

Examine to detect any damage the following:
- Seats and Seats Holders (12 -13)
- Ball (4)
- Stem (5)
- Plain Bearings (21) (43).

4.1.4 Re-assembly

WARNING!
Ball and seats are precision ground components which are individually inspected prior to dispatch. Handle with care.

Be sure all pieces are clean.
Proceed to Stem re-assembling inserting the Primary Seal (I^A) on the Stem (5) with the rounded side against the stem, and those two parts together into the Upper Cover (6), then load the Stem with a 1 Ton force for 30 seconds in order to press Primary Seal (I^A) for setting it up.
Insert now the Secondary Seal (II^A), the Gland (93) with relevant Stem Bearing (94) the Stem Spring (90) and the Stem plain ring (31) pushing it down enabling you to insert Stem Retaining Ring (92).
Test the stroke of the Stem (5)

P.S.: For Cryogenic Valves insert the Primary Gasket (I^) on the Cryogenic Stem (5) with the rounded side against the Cryogenic Stem (5), and insert the same in the Upper Cover (6), then load the Stem with a 1 Ton force for 30 seconds in order to press Primary Gasket (I^) and setting it.
Insert now the Secondary Gasket (II^), the Gland (93) with relevant Stem Bearing (94) the Stem Spring (90) and the Stem Plain Ring (31) pushing it down enabling you to insert Stem Retaining Ring (92 is in 2 half). Release the Stem Plain Ring (31). Assembled the Cryogenic Elongation (6-1) with the Upper Cover (6) using the own Bolts (35-3)
Test the stroke of the Cryogenic Stem (5)

Proceed now to the re-assembling of Connector (2) inserting the Spring (84), the Compression Ring (14) with square section ring, Gasket M, triangular section ring and then the Seat (13). Load the Seat (13) with a 1 Ton force for 30 seconds to set the Gasket (M).
Prepare the Body (1) inserting in order the Spring (84), the Compression Ring (14) with square section ring, Gasket M, triangular section ring and then the Body Seat (12+13). Load the Seat (13) with a 1 Ton force for 30 seconds to set the Gasket (M).
Insert the Ball (4) in the Body (1) in CLOSE position with great care and, after placed the Gasket (Cte) in the Body, assemble the Connector (2) with relevant Bolts (35-1) and tighten those bolts.
Insert the ball coupling (53), when applicable, and then , after placing Gasket (CCe) and Gasket (Te) assemble the Upper Cover with Bolts (35-2) and Lower Cover (7) with Bolts (35-3).

P.S.: For Cryogenic Valves insert the Adapter Ring (93-1 when present) with its own Stem Plain Bearing (94). Replace the Body/Cryogenic Elongation Gasket (CCe) and Body/Lower Gasket (CCi), mounted the Cryogenic Elongation (6-1) and Lower Cover (7) on the Body (1) using the own Bolts (35-2 / 35-3). Close all Bolts.

Reassemble the actuator if any.

4.1.5 Test

Before any pressure test, operate the ball at least once to check no problem occur during the movement.

WARNING!
If any pressure test is planned, the valve must be properly secured to avoid separation from pressure source resulting in possible injury.
IMPORTANT NOTE: PENTA S.r.l. has no responsibility in damages occurred to the valve or to operators during maintenance according to the present document.

a) Proceed with Body Hydraulic Test

With valve in half open position fill the body with clean water with.
Pressurise at 1.5 the maximum allowed working pressure of the valve (please contact Penta Technical department for any detailed information).
Detect for any leakage from body-closures connections

For cryogenic valves do not use water but NITROGEN.

b) Proceed with Seat Hydraulic Test

With valve in CLOSE position pressurise one side of the valve with clean water at max. 1.1 the maximum allowed working pressure, with the other side at ambient pressure.
Detect seat Leakage from downstream side of the valve.
Repeat the test on second seat.
Release all the water at end of tests.

For cryogenic valves do not use water but NITROGEN.

c) Proceed with Seat Pneumatic Test

With valve in CLOSE position pressurise one side of the valve with clean air at 6 bar pressure.
Detect seat Leakage from downstream side of the valve.
Repeat the test on second seat.

5. SPARE PARTS

Ordering spare parts it is essential to specify the Valve Identification Number stamped on the body.

6. WARNINGS AND USE RESTRICTIONS

6.1 HANDLE MEDIA

With exclusion of model SAT3, all our valves are designed to handle fluids without solid content.

WARNING!
Presence of solids can be detrimental for valve tightness and increase valve torque figures.
Please request to Penta SAT3 model on dirty services.

6.2 BODY MAXIMUM TEMPERATURE

WARNING!
Users should identify means to avoid of insulation of valve body against surface temperature.
To minimize the thickness of dust deposits providing to a periodic cleaning of the outer body of the valve and in particular the zones located in correspondence of the movable parts (stem). The frequency of these operations must be such as to avoid dust deposits above 5 mm thick.
Ambient temperature range: -__°C≤Tamb≤+__°C

The maximum surface temperature has been obtained following the rule:
TMax [°C] = 35[°C] + (Tamb, Max[°C] or Tair/process, Max [°C], whichever is greater)

The value to be reported on nameplate must be determined as in the following (clause 8.2 of EN13463-1):
If TMax [°C] ≤ 195°C then TSup [°C] = TMax [°C] + 5°C

If TMax [°C] > 195°C then TSup [°C] = TMax [°C] + 10°C

For gas, vapour, mist marking only the following switch case can be adopted to select the correct symbol

Temperature class	Maximum surface temperature °C
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

For dust marking report the symbol “T” followed by the effective values of Tsup in [°C].

6.3 CORROSION RESISTANCE

For working temperature above 500°C start of intergranular corrosion phenomena is possible in grade 304 and 316 s.s..

WARNING!

Users should establish a valve-monitoring programme to evaluate corrosion phenomena.

6.4 WATER HAMMER

WARNING!

Users should identify means for elimination of any “water hammer” effects.
Water hammers can be cause of valve leakage.

6.5 EROSION

Reduced port valves will have concentrated erosion at the area of valve port reduction.

WARNING!

Users should evaluate the minimum time between inspections, basing on actual operating conditions, to verify any damage in those areas due to erosion.

6.6 LOADS FROM PIPING

WARNING!

SAT valves are suitable for resisting reduced axial forces from the piping system.
Please request the maximum allowable axial load, if necessary, to Penta technical dpt.

6.7 EARTHQUAKE

WARNING!

Valve operability is not guaranteed during and after an earthquake (actuated valves only), due to possible misalignment of valve/connecting coupling and actuator pinion. Valve and actuator assembly is calculated for earthquake magnitude incrementing 40% the dead weight of actuator and valve cover.

6.8 VALVE LIFE

Valve life is strictly function of actual working conditions.

WARNING!

Users should establish valve-monitoring programme to evaluate actual life, especially for what available corrosion over thickness against expected corrosion rate for year concerns.

WARNING!

Above the temperatures showed in Table 2, where CREEP considerations are necessary, valve materials properties can be based on 100.000 hours for rupture properties. Users should evaluate the minimum time between inspections basing on this information.

6.9 Operation frequency

WARNING!

If not differently stated the maximum allowed frequency to guarantee T6 Atex temperature limitation is one operation each 10 seconds.

6.10 ACTUATORS

WARNING!

Use of unsuitable or wrongly sized actuators can be cause of valve malfunctions and system injuries.
Mounting of actuators different than provided is not allowable without approval of Penta technical dpt. Limitation in actuator weight is applicable. Please ask to Penta technical dpt for detailed information.

6.11 MAINTENANCE

WARNING!

Before the dismantling of the valve from the line open and close the valve to eliminate any residual pressure from body cavities. Pressure will relieve into line pipe.

6.12 END PIPE VALVE

WARNING!

When using this valve as an End Pipe Closure it is recommended the use of additional permanent closure member with independent vent connection (e.g. blind flange with vent plug).

WARNING!

The user must ensure equipotentiality between valve and piping system at of mounting the valve to avoid electric shocks.

WARNING!

In case of use in potentially explosive atmospheres for the purposes of Directive 2014/34/UE "ATEX", users must provide appropriate means to avoid shocks of metal parts against the valve body during assembly, operation and maintenance.

WARNING!

Users must make periodic inspections to remove any dust buildup of more than 5 mm in matching surfaces sliding stem / body and pivot actuator valve / actuator body. The maximum frequency eligible for manoeuvre in order to ensure the limitation of temperature in the case of ATEX T6 is 1 manoeuvre every 10 sec.

WARNING!

Users must establish an appropriate program of verification of grease lubrication of the manual gears.

6.13 DISPOSAL

The material of which is composed of the valve (steel) is fully recyclable. The valve at the end of its use, is a special waste: manage such waste in compliance with local regulations.