



# THE TS-300 SERIES

Operating and Service Manual

Series includes all variants of TS-300 and CYL-TS300

**Issue B**  
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## **1. Description**

The TS-300 is a two-stage diaphragm sensed pressure regulator, capable of a maximum 300bar inlet pressure (210bar with PCTFE seat), which can then be reduced down to a maximum 25bar outlet pressure. The first stage pressure let down is preset at the factory and locked to prevent alteration. The second stage regulator can be adjusted by the user between various outlet pressures within the range. The first pressure reduction acts as the supply to the second stage. As a result, the TS-300 regulator is able to provide a stable pressure control under decaying inlet conditions.

## **2. Installation**

Before system start-up, it is recommended that all systems be pressure tested, leak tested and purged with an inert gas such as nitrogen.

Prior to placing into service ensure that the regulator is in the fully closed position, with the adjusting mechanism turned completely anti-clockwise.

Check the model number reference to ensure that the pressure range complies with the installation requirements.

Visually inspect the regulator for any signs of damage or contamination. If any foreign materials are present and cannot be removed from the regulator, or if the threads on the regulator appear to be damaged, please contact the office immediately to arrange for the regulator to be returned for service.

The Inlet and Outlet ports are clearly marked. Select the correct size and type of connection fittings for these ports which are indicated in the regulators part number. National Pipe Thread (NPT) 'N' options are available as standard on this regulator. For NPT threads, ensure that PTFE tape is applied correctly to the fittings, applying two overlapping layers in the direction of the thread, taking care that the tape does not come into contact with the first thread. Any gauge ports on the regulator will be 1/4" NPT unless otherwise stated. If any gauge port is not required, ensure that the port is plugged prior to installation.

The media supplied to the regulator must be clean. Contamination can damage the seat which may cause the regulator to fail. Filtration suited to the application is recommended upstream of the regulator. Should further assistance or information be required in relation to installation of any Pressure Tech regulator please contact the office, giving reference to the regulators part number and/or serial number.

## **3. Operation**

Turning the adjusting mechanism clockwise compresses the spring, which in turn opens the main valve and allows the inlet pressure to pass through the seat orifice until the outlet pressure is equivalent to the loading forces set by the compressed spring. Increase the outlet pressure in this way until the desired pressure is achieved.

To reduce the outlet pressure, the adjusting mechanism should be turned anti-clockwise whilst the media is flowing, or whilst venting downstream of the regulator.

The desired outlet pressure should be set whilst increasing the pressure. Do not exceed the maximum inlet and outlet pressures of the regulator which are indicated on the regulator label.

#### **4. Special Conditions for Safe Use**

The TS-300 series are non-venting type regulators, therefore the outlet pressure shall be reduced by venting downstream of the regulator whilst simultaneously turning the adjusting mechanism anti-clockwise.

#### **5. Hazardous Location Usage**

This equipment has not been manufactured specifically for use in potentially explosive atmospheres and as such an ignition hazard assessment has not been carried out on this product. If the user should wish to use this product in such an environment where there may be a potentially explosive atmosphere then it is the responsibility of the user to conduct an ignition hazard assessment against 99/92/EC.

#### **6. Servicing and Maintenance**

Servicing and maintenance work on the TS-300 regulators should only be performed after fully reading and understanding the Operating and Servicing Manual. Due to the typical nature of the gases the regulator can be used with, the operator should not endanger himself/herself or others by working on this regulator without prior knowledge on the Health and Safety concerns relating to handling of technical gases. Any uncertainty should be clarified with Pressure Tech before working on the regulator.

Pressure Tech Ltd recommends the use of Krytox GPL 205 during servicing.

Prior to commencing service, please ensure that:

- The equipment has been de-pressurised
- The load spring has been de-compressed by turning the adjusting mechanism fully anti-clockwise
- Applications involving toxic, flammable or corrosive media have been fully purged

To ensure the best possible results from servicing, when re-assembling the regulator and any assemblies within it, ensure that all areas of the components and the regulator body are cleaned and free from contaminants which may result in failure of the regulator.

## 6.1. Servicing the TS-300

\*Note: Fig 1 should be used as a reference for the following set of instructions

### 6.1.1. Accessing the Main Valve Assembly 1<sup>st</sup> Stage

Please be aware that the first stage let down pressure will require re-setting after service.

To access the Main Valve Assembly (MVA):

- i. With the flats of the regulator body (25) secured in a vice, use a 13mm spanner to remove the dome nut (24)
- ii. Using a slotted screwdriver, turn the short adjusting screw (23) anti clockwise until the load from the spring (12) has been released
- iii. Loosen and remove the two stage bonnet (22) using a 47mm wrench
- iv. Remove the upper spring rest (16), 10mm ball bearing (1), load spring (12), diaphragm washer (15), lower spring rest (17) and diaphragm (11) from the assembly
- v. The seat nut (10) can then be removed using a 12mm socket
- vi. Remove the main valve (7, 8) and main valve spring (9) from the assembly
- vii. Visually inspect the seat nut (10) and soft seat (8) for damage under a microscope
- viii. Replace the main valve spring (9) and main valve (7, 8) and place into the regulator body (25)
- ix. Replace seat nut (10) fitted with new 5x1 mm o-ring (5) taking care not to damage its sealing face against the tip of the valve
- x. To ensure positive sealing, it is recommended that a new diaphragm (11) is placed centrally into regulator body (25) ensuring that the outermost convolutions are facing towards the bonnet (22)
- xi. Replace the 21x1 mm o-ring (6) on the lower spring rest (17), insert into the diaphragm washer (15) and place on top of the diaphragm (11)
- xii. Place the load spring (12), upper spring rest (16) and 10mm ball bearing (1) to the assembly
- xiii. Screw the two stage bonnet (22) onto the assembly and using a torque wrench with a 47mm open ended attachment, tighten to 160Nm

\*Note: The first stage will now require pressure setting before the regulator can be used (\*Ref. 6.1.3).

### 6.1.2. Accessing the Main Valve Assembly 2<sup>nd</sup> Stage

To access the Main Valve Assembly (MVA):

- i. With the flats of the regulator body (25) secured in a vice, loosen the bonnet (14) using a 47mm wrench ensuring that the hand wheel (20) is fully wound anti clockwise (\*Ref. 6.1.4)
- ii. Remove the upper spring rest (16), 10mm ball bearing (1), load spring (13), diaphragm washer (15), lower spring rest (17) and diaphragm (11) from the assembly
- iii. The seat nut (10) can then be removed using a 12mm socket

- iv. Remove the main valve (7, 8) and main valve spring (9) from the assembly
- v. Visually inspect the seat nut and soft seat (8) for damage under a microscope
- vi. Replace the main valve spring (9) and main valve (7, 8) and place into the regulator body (25)
- vii. Replace seat nut (10) fitted with new 5x1 mm o-ring (5) taking care not to damage its sealing face against the tip of the valve
- viii. To ensure positive sealing, it is recommended that a new diaphragm (11) is placed centrally into regulator body (25) ensuring that the outermost convolutions are facing towards the bonnet (14)
- ix. Replace the 21x1 mm o-ring (6) on the lower spring rest (17), insert into the diaphragm washer (15) and place on top of the diaphragm (11)
- x. Place the load spring (13), upper spring rest (16) and 10mm ball bearing (1) to the assembly
- xi. Screw the bonnet (14) onto the assembly and using a torque wrench with a 47mm open ended attachment, tighten to 160Nm

It is recommended that all parts in the repair kits are used. Any defect parts removed during the service should be disposed of. Parts should be kept clean in line with media requirements. Following re-assembly of the regulator, pressure tests should be made to both the inlet and outlet side of the regulator, to ensure there is no internal or external leakage across the regulator.

To ensure that the main valve assembly has been correctly and effectively installed it may be required to perform the appropriate seat leak test as per ANSI/FCI 70-2.

### **6.1.3. Re-setting the First Stage**

The following instruction should only be performed after complete reassembly of the regulator as per 6.1.1 and 6.1.2.

- i. Secure the regulator firmly in a vice and install correct tube fittings to the regulator inlet port and inter-stage port (relief port)
- ii. Connect upstream pipe work and connect a suitable pressure gauge to the inter-stage port
- iii. Ensuring that the hand wheel (21) of the first stage is completely wound off, apply inlet pressure up to the maximum working pressure allowed by the seat material (*\*Ref. 7.*)
- iv. Use a slotted screwdriver to increase the outlet pressure of the first stage by turning the short adjusting screw (23) (this will be seen on the pressure gauge via the inter-stage port)
- v. For second stage pressure ranges  $\leq 10$  Bar, increase until 22 Bar is achieved on the first stage. For second stage pressure ranges  $> 10$  Bar and  $\leq 25$  Bar, increase until 35 Bar is achieved on the first stage
- vi. When the pressure has been set, install the dome nut (24) onto the adjusting screw (23) to lock and set
- vii. Ensure that the relief port is plugged using the hex hollow plug (26) after re-setting

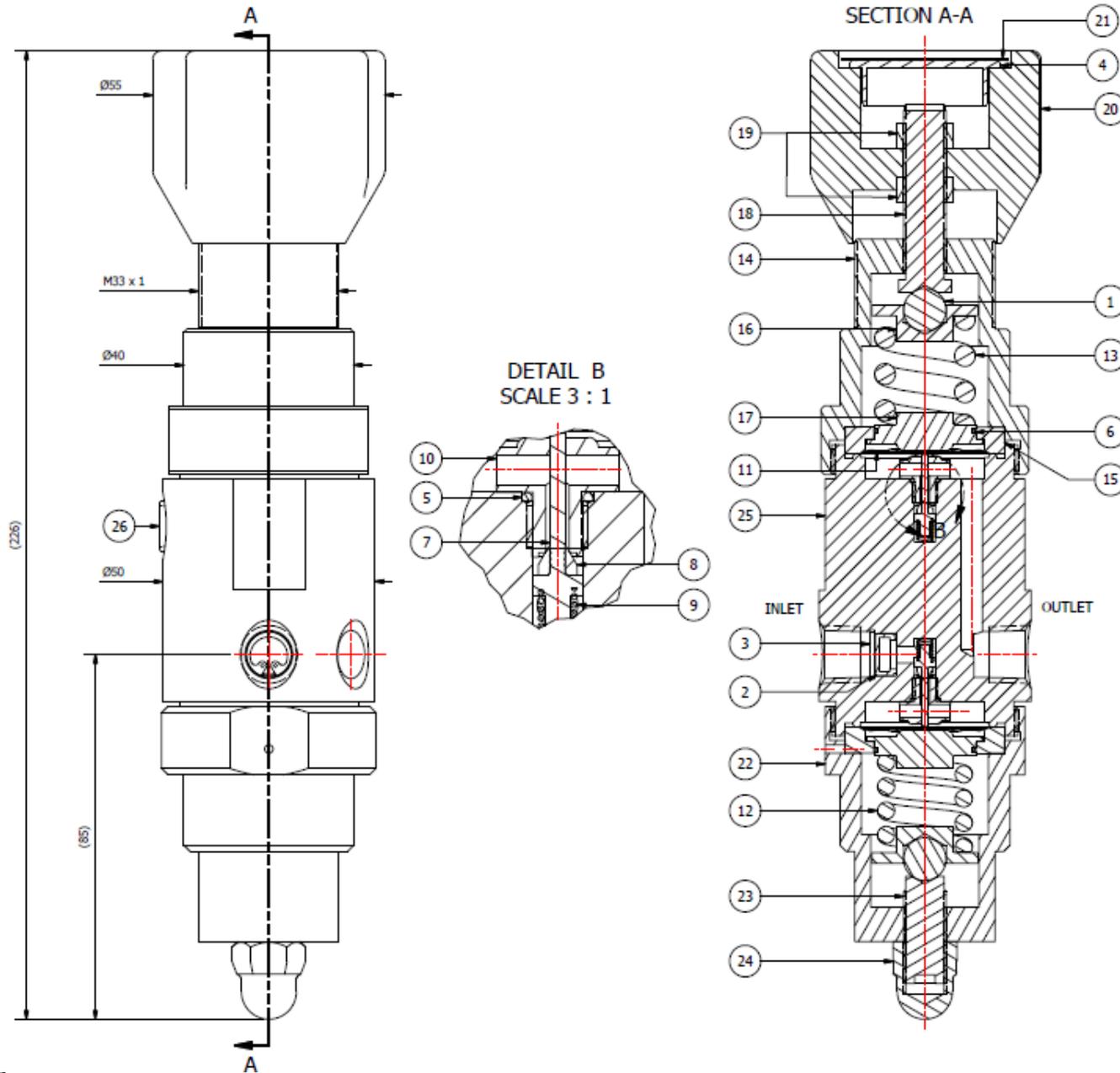
\*Note: It is recommended that where possible, a pressure relief valve is installed in the relief port. The relief valve should be set approximately 2 Bar higher than the set point of the first stage. This relief valve would protect the diaphragms in the event of failure.

#### **6.1.4. Adjusting the Set Point**

It is not recommended (or necessary) to remove the Hand Wheel during service as this will affect the set point of the regulator. Should it be required to adjust the set point please follow the instructions below:

- i. Remove the nameplate (21) and cap (4) from the hand wheel (20) and loosen the lock nut (19) such that the hand wheel is able to spin freely on the adjusting screw (18)
- ii. Connect the correct fittings to the Inlet and Outlet ports of the regulator. Ensure that any gauge ports are plugged or that the correct gauge is fitted
- iii. With the regulator body (25) secured in a vice apply the Maximum Working Pressure (MWP) to the Inlet of the regulator
- iv. Connect the Outlet port to a calibrated pressure test gauge appropriate to the required set pressure. As the regulator is non-venting, ensure that a ball/needle valve is fitted to allow pressure to be relieved downstream of the regulator
- v. Using a slotted screwdriver, turn the adjusting screw (18) clockwise until the desired set point has been reached
- vi. Ensure repeatability by allowing flow through the regulator using the ball/needle valve
- vii. With the outlet pressure set, screw the first lock nut (19) to the base of the adjusting screw (18) against the bonnet (14)
- viii. Position the hand wheel (20) onto the lock nut (19). Ensure that the lock nut and hand wheel become engaged
- ix. Fasten the second lock nut (19) against the hand wheel (20) and gently begin to tighten using a 13mm socket until it begins to secure itself
- x. At this point, whilst holding the hand wheel (20) continue to tighten whilst simultaneously turning slightly anti-clockwise to prevent it from locking against the bonnet (14)
- xi. Ensure that the lock nut (19) is sufficiently tightened, taking care not to adjust the set point
- xii. Turning of the hand wheel (20) should now also turn the adjusting screw (18) which will control the pressure
- xiii. Turn the hand wheel clockwise until it reaches its set point and check to make sure that the desired outlet pressure is correct.
- xiv. If the set point is not correct, repeat steps v. to xiii.
- xv. Reduce the pressure downstream by venting the pressure through ball/needle valve and then turning the hand wheel anti-clockwise until the regulator closes
- xvi. The cap (4) and nameplate (21) can now be placed into the hand wheel (20). Ensure that the information stated on the nameplate is in accordance with the set pressure of the regulator

6.1.5. Figure 1 – Sectional View of the TS-300



PARTS LIST		
ITEM	PART NUMBER	DESCRIPTION
1	BALL-010-SS-316	BALL BEARING
2	FILT-SCRM3104040S-A	10MM SCREEN FILTER
3	FIT-472011-SS-CIRCLIP	11MM CIRCLIP
4	FIT-CAP-4343092	NAMEPLATE CAP
5	OR-0050-10	O-RING STD
6	OR-0210-10	O-RING STD
7	PT-C-001-013	MAIN VALVE
8	PT-C-002-011	PCTFE SEAT NUT
9	PT-C-006-002	MAIN VALVE SPRING
10	PT-C-007-002	SEAT NUT
11	PT-C-010-002	DIAPHRAGM
12	PT-C-011-003	FIRST STAGE LOAD SPRING
13	PT-C-011-009	SECOND STAGE LOAD SPRING
14	PT-C-015	BONNET
15	PT-C-016	DIAPHRAGM WASHER
16	PT-C-017	UPPER SPRING REST
17	PT-C-018-002	LOWER SPRING REST
18	PT-C-019-003	ADJUSTING SCREW
19	PT-C-020	LOCK NUT
20	PT-C-021	SMALL HAND WHEEL
21	PT-C-022	NAMEPLATE
22	PT-TS-300-002	TWO STAGE BONNET
23	PT-TS-300-003	SHORT ADJUSTING SCREW
24	PT-TS-300-004	DOME NUT
25	PT-TS-300-X-SS	TWO STAGE BODY
26	SLOK-SS-4-HP	1/4" HEX HOLLOW PLUG

## 7. Technical Data

Fluid Media:	All gases and liquids compatible with materials of construction
Max Inlet Pressure*:	300 bar (4350 Psi) (with PEEK Seat) 210 bar (3000 Psi) (with PCTFE Seat)
Outlet Pressure Range:	0-25 bar
Operating Temperature:	-20°C to +80°C
Materials:	Body and Trim: 316 SS Diaphragm: Inconel X750 Seat: PCTFE / PEEK®
Flow Capacity (Cv):	0.06
Leakage:	Gas: Bubble tight Liquid: Zero drops of water at max inlet

\*Max Inlet Pressure determined by seat material and Cv of regulator.

## 8. Warranty Statement

Pressure Tech Ltd guarantee all products correspond with their specification at the time of delivery and, with exception to wear and tear, wilful damage, negligence, and abnormal working conditions, will be free from defects for a period of 12 months from date of delivery.

## Annex A. TS-310 – ‘Solid Disk’ Main Valve Design

### A.1. Description

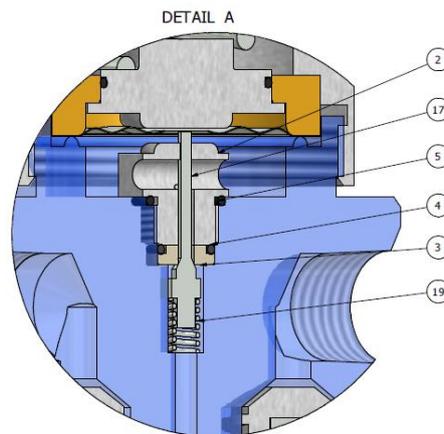
The ‘solid disk’ type main valve assembly was introduced as an alternative to the unique ‘cone type’ assembly and could be applied where greater resistance to both temperature and pressure were required. The new disk design allows for a wider range of seat material options as well as increased Cv and Pressure combinations.

The model number ‘310’ was assigned to denote the requirement for the new disk type main valve arrangement. The TS-310 ‘solid disk’ option allows for a Maximum Working Pressure of 300 Bar (4350 Psi) or 414 bar (6000 Psi) when fitted with a PEEK seat.

### A.2. Servicing

The servicing of the TS-310 regulator should be performed in line with the service instructions for the TS-300 as defined in Section 6 of this manual, taking account for the difference in valve assembly. The figures below detail the alternate main valve assembly for reference purposes only.

#### A.2.1. Figure 2 – Detail A: TS-310 ‘Solid Disk’ MVA (sectional)



#### A.2.2. Figure 3 – Exploded View of TS-310 ‘Solid Disk’ MVA

MAIN VALVE ASSEMBLY					
2	PT-C-007-015	SEAT RETAINER	5	OR-0090-10	O-RING STD
3	PT-C-205-003	SOFT SEAT (PEEK)	17	PT-C-001-023	MAIN VALVE PIN
4	OR-0070-10	O-RING STD	19	PT-C-006-002	MAIN VALVE SPRING