

MT-232-I

ENGLISH

PRESSURE
REGULATOR

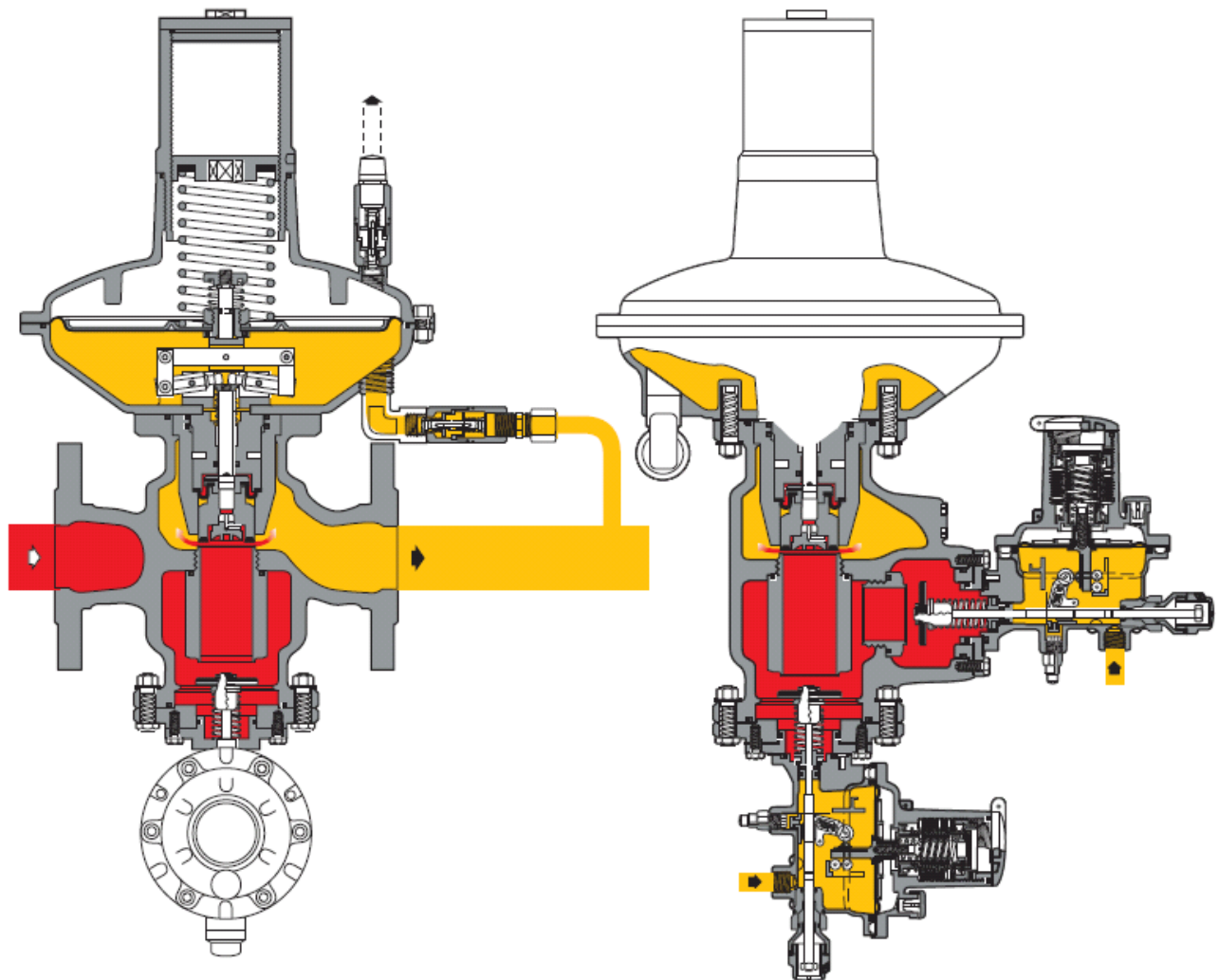
TRIAS



TECHNICAL MANUAL

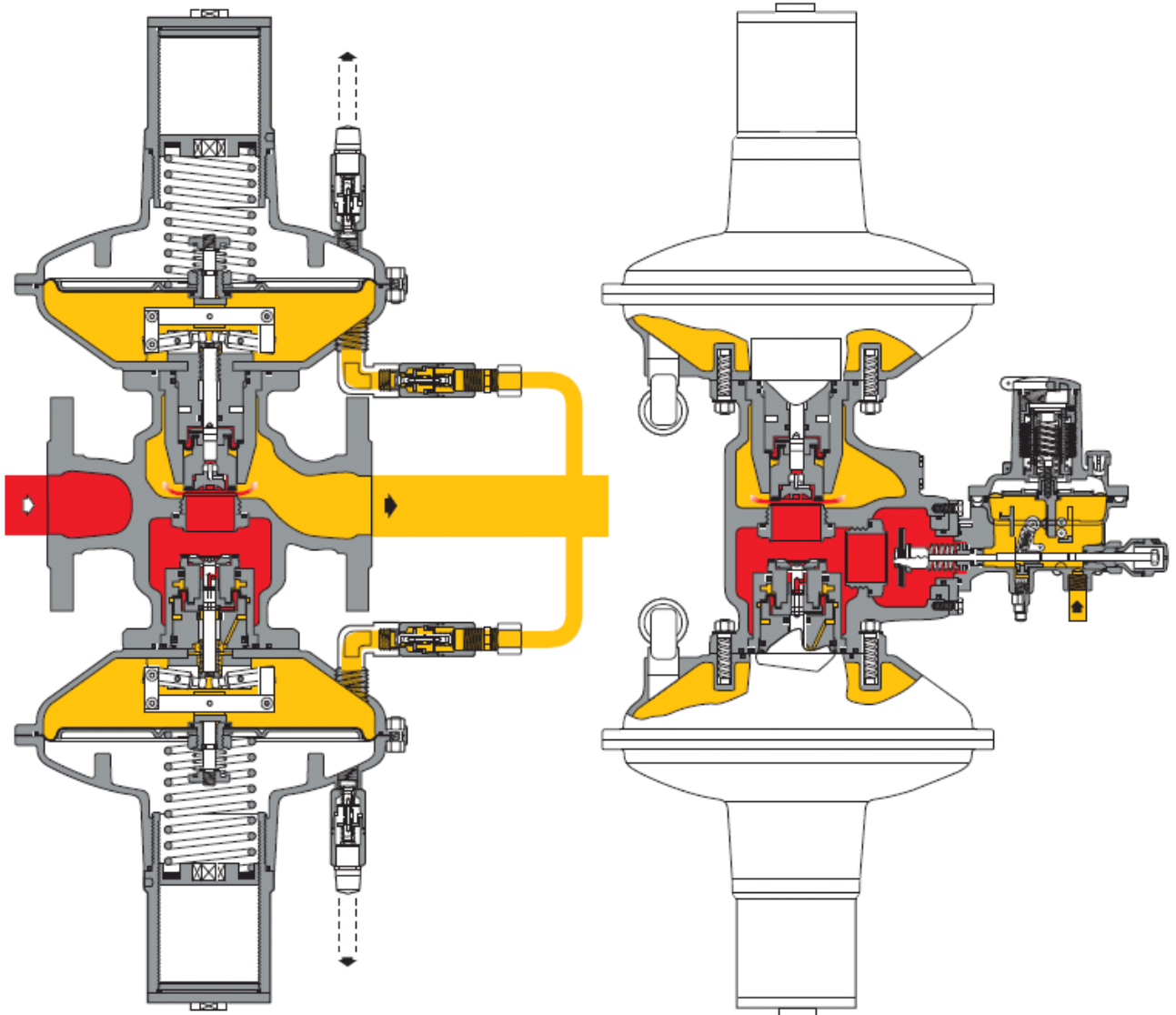
INSTRUCTIONS FOR INSTALLATION,
COMMISSIONING AND MAINTENANCE


TRIAS/BB



- Pressione d'entrata, *Inlet pressure.*
 Eingangsdruk. *Pression amont.*
 Presión de entrada, *Pressão de entrada.*
- Pressione d'uscita, *Outlet pressure.*
 Ausgangdruck. *Pression aval.*
 Presión de salida, *Pressão de ajustante.*

TRIAS/BM



 Pressione d'entrata. *Inlet pressure.*
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Pressione d'uscita. *Outlet pressure.*
Ausgangdruck. *Pression aval.*
Presión de salida. *Pressão de ajustante.*

WARNINGS

GENERAL WARNINGS

The equipment described in this manual is a device subject to pressure installed in pressurized systems.

The equipment in question is normally installed in systems which transport flammable gases (for example natural gas).

WARNINGS FOR OPERATORS

Before installation, commissioning or maintenance, operators must:

- take note of the safety regulations applicable to the installation in which they must work;
- obtain the necessary permits to operate when required;
- acquire the necessary personal protection (helmet, goggles, etc.);
- ensure that the area in which they operate is equipped with the required collective protection and the necessary safety information.

PACKAGING

The packaging for transporting the equipment and related spare parts have been specifically designed and manufactured in order to prevent damage during normal transportation, storage and handling activities. Therefore the equipment and spare parts must be kept in their respective original packaging until their installation in the final site. On opening the packaging, the condition of the materials contained within should be checked. In the event of damage, report the damage to the supplier keeping the original packaging for inspection.

HANDLING

The equipment and its components must be handled after ensuring that the lifting means are adequate for the loads to be lifted (lifting capacity and functionality).

The equipment must be handled, when required, using the lifting points provided on the equipment itself. The use of motorized means is reserved for the persons in charge.

INSTALLATION

The installation of the pressure regulator must comply with the regulations (laws or standards) in force in the place of installation.

In particular, systems for natural gas must possess characteristics in accordance with the legal requirements or regulations in force at the installation site or at least in accordance with EN 12186 or EN 12279; in particular paragraphs 6.2, 7.5.2, 7.7 and 9.3 of EN 12186 and 6.2, 7.4, 7.6 and 9.3 of EN 12279 must be adhered to. Installation in accordance with these standards minimizes the risk of a fire hazard and the formation of potentially explosive atmospheres.

The equipment is without internal pressure limiting devices, therefore, it must be installed making sure that the operating pressure of the unit on which it is installed never exceeds the maximum permissible pressure value (**PS**).

The user should therefore provide, when it is deemed necessary, for the installation on all adequate pressure limiting systems; he must also set up the system with appropriate venting or drainage systems in order to discharge the pressure and the fluid contained in the system before carrying out any inspection and maintenance activities.

If the installation of the equipment requires the field application of compression fittings, these must be installed in accordance with the instructions of the manufacturer of the fittings themselves. The choice of the fitting must be compatible with the use specified for the equipment and with the specifications of the system when provided for.

COMMISSIONING

Commissioning must be carried out by **properly trained personnel**.

During the commissioning activities, personnel who are not strictly necessary must be kept at a distance and the forbidden area must be suitably marked (signs, barriers, etc.).

Make sure that the equipment settings are those requested; if necessary, reset them to the required values in accordance with the procedures indicated in this manual.

During commissioning the risks associated with any discharges to the atmosphere of flammable or noxious gases must be evaluated.

For installation on distribution networks for natural gas you must consider the risk of formation of explosive mixtures (gas / air) inside the piping.

COMPLIANCE WITH DIRECTIVE 97/23 / EC (PED)

The **TRIAS** regulator, in both the **B/B** and **B/M** versions, is classified as a pressure accessory according to Directive 97/23/EC (PED).

The **TRIAS** regulator, in both the **B/B** and **B/M** versions, having the shut-off device incorporated with a pressure switch for maximum tripping is defined as a pressure accessory as well as a safety accessory always according to the PED Directive.

The **TRIAS B/M** version, having the built-in Monitor regulator, is defined as a safety accessory according to the PED directive. In this case, the user must verify that the maximum admissible pressure (**PS**) of the pressure equipment to be protected is compatible with the calibration of the monitor regulator and with its lock up pressure class (**SG**).

Compliance with the PED directive of the regulator and associated CE-marked devices presupposes use in systems with requirements according to EN 12816.

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1.0 INTRODUCTION

The purpose of this manual is to provide essential information for the installation, commissioning, disassembly, re-assembly and maintenance of the **TRIAS** regulators.

It is also considered appropriate to provide a brief illustration of the main features of the regulator and its accessories.

1.1 MAIN FEATURES

TRIAS is a pressure regulator for gaseous fluids after being purified, suitable for low and medium pressure.

The **TRIAS** regulator is normally open and consequently opens in case of:

- breakage of main diaphragm;
- no regulated pressure signal.

The main features of this regulator are:

- Design pressure **PS**: up to 20 bar (note 1)
- Operating temperature: -20 °C to + 60 °C;
- Ambient temperature: -20 °C to + 60 °C;
- Inlet pressure range **bpu**:
0.2 to 10 bar for version B/B Ø 275/BP;
0.2 to 20 bar for version B/B Ø 275/MP and Ø 195;
0.2 to 8 bar for B/M version;
- Possible regulation range **Wd**:
16 to 120 mbar for head Ø 275/BP;
110 to 320 mbar for head Ø 275/MP;
300 to 4000 mbar for head Ø 195;
- Minimum differential pressure: 0.1 bar;
- Accuracy class **AC**: up to 5 (depending on outlet pressure range).
- Lock up pressure class **SG**: up to 10 (depending on outlet pressure range).

Note 1: the maximum permissible pressure is however limited by the rating pressure of the flanged connections.

1.2 TRIAS REGULATOR OPERATION (Fig. 1)

In depressurised conditions, the plug (3) is kept in an open position by the spring (43) (fig. 1)

The outlet pressure P_d is controlled by comparing the spring load 43 and the push which the outlet pressure exerts on the diaphragm 19.

The weight of the mobile unit and the dynamic residual thrusts on the plug affect this comparison.

The inlet pressure, even if variable, has no influence on the equilibrium of plug 3, since it, due to the presence of hole A, is between two equal pressures acting on equal surfaces.

Diaphragm movement 19 is transmitted to rod 9 and then to plug 3 by means of the lever system 13. The plug has a vulcanised rubber gasket to provide perfect sealing when the required flow rate is zero.

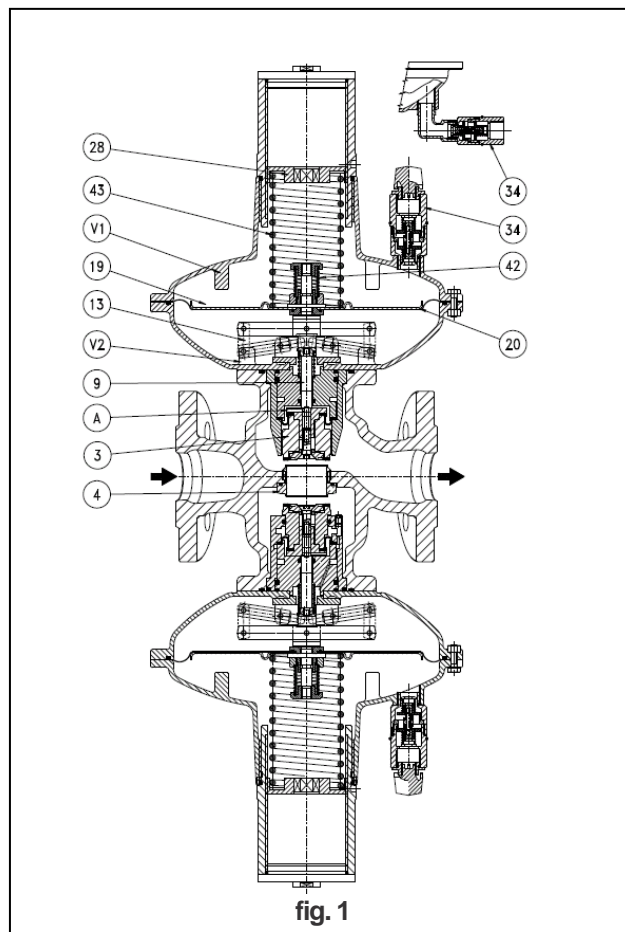
When, during operation, the outlet pressure P_d decreases, the thrust which it exerts on the diaphragm 19 becomes less than the load of the spring 43; therefore the diaphragm lowers and, by means of the levers 13, moves the plug 3 away from the valve seat 2. This increases the gas flow rate to restore the initial calibration pressure value.

If, on the other hand, the outlet pressure starts to increase, the force exerted on the diaphragm 19 exceeds the spring load 43. The plug is thus moved to the closed position, returning the outlet pressure to the preset value.

In normal operating conditions, the plug 3 positions itself so as to keep the pressure P_d around the pre-selected calibration value. To adjust the calibration pressure, turn the internal regulation ring nut 28 clockwise to increase it and anticlockwise to decrease it.

The regulator is equipped with two anti-pumping devices 33 and 34 (fig. 1), which have the function of slowing down the inflow/outflow of gas/air into the head in the transient phases only, to eliminate possible oscillation phenomena in the regulated pressure.

There are also two limit switches V1 and V2, which are intended to eliminate the damaging effects that could arise from accidental overpressure below the diaphragm 19 or overloading of the spring 43.

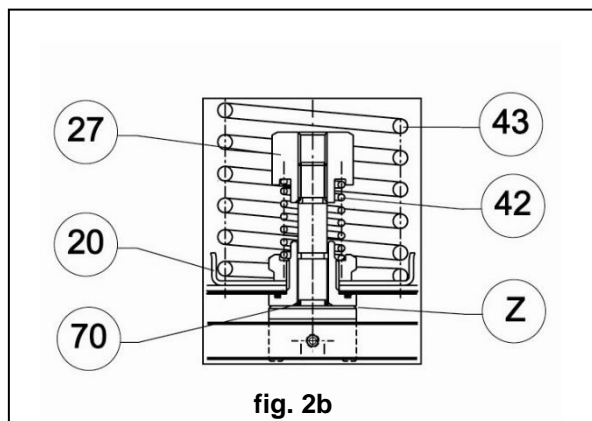
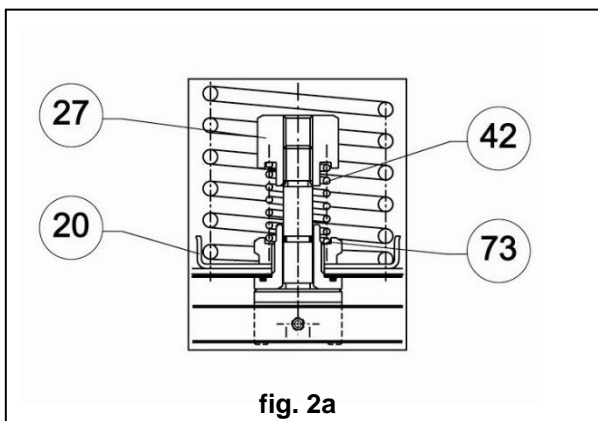


The solution described in fig. 2a is taken in order to protect the plug from damage resulting from sudden increases of the regulated pressure.

In fact this solution allows the diaphragm protective disc 20 to rest on the upper limit switch V1, overcoming the load of the spring 42, and thus relieving the plug from the load determined by the sudden pressure increase.

In order to prevent small leaks at zero flow rate or sudden, temporary overpressures resulting, for example, from rapid manoeuvring or overheating of the gas, from triggering the slam-shut valve, the solution in fig. 2a can be transformed, on request, into a built-in relief valve by removing the o-ring 73 and introducing the o-ring 70 (fig. 2b).

Its operation is as follows: with regulator closed, any overpressures lift the diaphragm protective disc 20 overcoming the load of the springs 42 and 43. This way a certain amount of gas is exhausted through seat Z of the relief valve



1.3 Tab. 1 SETTING SPRINGS

Table 1 displays the setting fields of the different supplied springs.

TRIAS SPRINGS FEATURES						
Code	Colour	d	Lo	De	Setting field (mbar)	HEAD
2701345	YELLOW	3.5	180	65	16 - 23	275/BP
2701620	ORANGE	4	180	65	24 - 35	
2701860	RED	4.5	180	65	36 - 57	
2702190	GREEN	5	180	65	58 - 76	
2702370	BLACK	5.5	180	65	75 - 120	
2701345	YELLOW	3.5	180	65	12 - 18	275/BP INVERTED
2701620	ORANGE	4	180	65	19 - 30	
2701860	RED	4.5	180	65	31 - 53	
2702190	GREEN	5	180	65	54 - 74	
2702370	BLACK	5.5	180	65	57 - 120	

TRIAS SPRINGS FEATURES						
Code	Colour	d	Lo	De	Setting field (mbar)	HEAD
2702540	BLUE	6	180	65	110 - 191	275/MP
2702950	BROWN	7	180	65	191 - 320	
2702540	BLUE	6	180	65	110 - 190	275/MP INVERTED
2702950	BROWN	7	180	65	191 - 320	

TRIAS SPRINGS FEATURES						
Code	Colour	d	Lo	De	Setting field (mbar)	HEAD
2702940	SKY BLUE	7	150	65	300 - 600	195
2701620	WHITE/YELLOW	7.5	150	65	601 - 900	
2701860	WHITE/ORANGE	8	150	65	901 - 1100	
2702190	WHITE/GREEN	9	150	65	1101 - 1900	
2702370	WHITE/BLACK	10.5	147	65	1901 - 4000	
2702940	SKY BLUE	7	150	65	310 - 600	195 INVERTED
2701620	WHITE/YELLOW	7.5	150	65	601 - 900	
2701860	WHITE/ORANGE	8	150	65	901 - 1100	
2702190	WHITE/GREEN	9	150	65	1101 - 1900	
2702370	WHITE/BLACK	10.5	147	65	1901 - 4000	

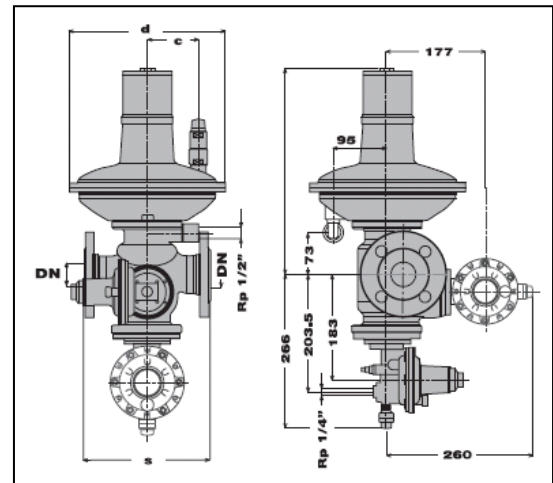
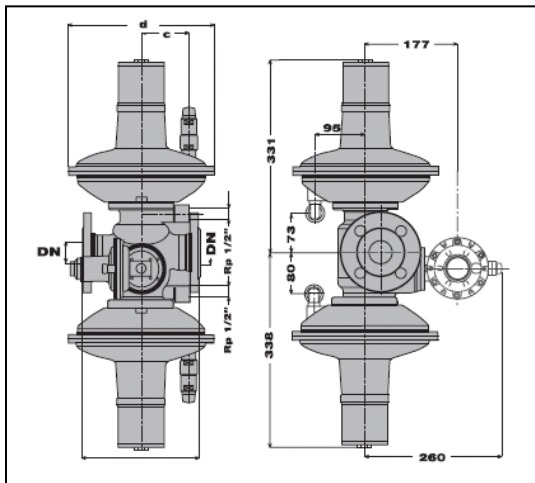
d = wire Ø Lo = Length * = springs for built-in relief De = external Ø

2.0 INSTALLATION

2.1 GENERAL INFORMATION

The regulator does not require any further safety device at the inlet to protect against possible overpressures respect to its admissible pressure **PS** when, for the inlet reduction station, the maximum incidental outlet pressure

MI Pd ≤ 1,1 PS.



Before installing the regulator, you must ensure that:

- the regulator can be inserted in the space provided and is sufficiently accessible for subsequent maintenance operations (see dimensions in table 2a);
- the inlet and outlet pipes are at the same level and are capable of bearing the weight of the regulator (see table 2b);
- the inlet/outlet flanges of the pipe are parallel;
- the inlet/outlet flanges of the regulator are clean and the regulator did not undergo any damage during transport;
- the inlet piping has been cleaned in order to expel residual impurities such as welding slag, sand, paint residues, water, etc.

The normally intended layout is that indicated in figure 3; other possible installations are indicated in figure 4.

Tab. 2a: Overall dimensions in mm

DN	NPS	S	d		c	
40	1"1/2	222	275	195	90	60
50	2"	254	275	195	90	60
			BP/MP	TR	BP/MP	TR

Tab. 2b: Weights in KGF

DN	NPS	TRIAS B/M	TRIAS B/B
40	1"1/2	27	20
50	2"	30	23

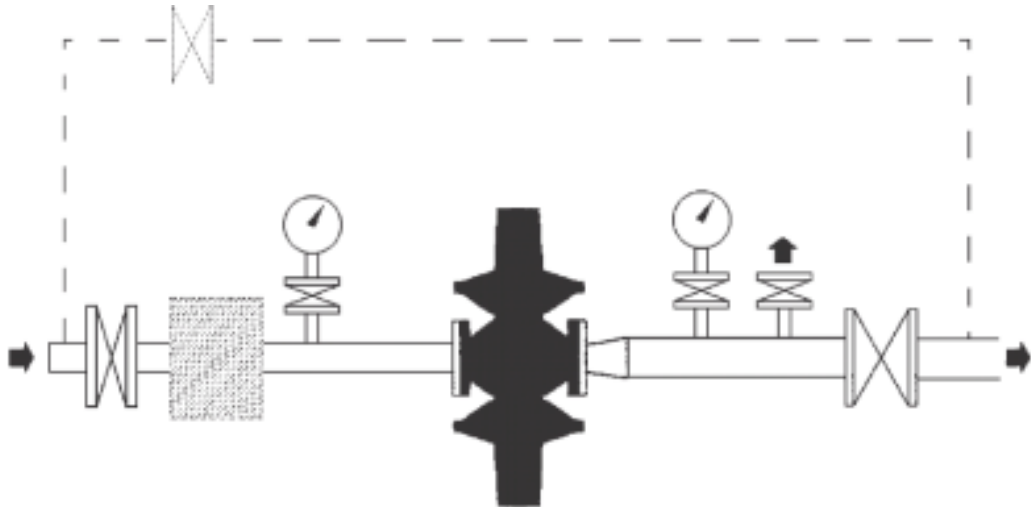


fig. 3a TRIAS B/M standard installation

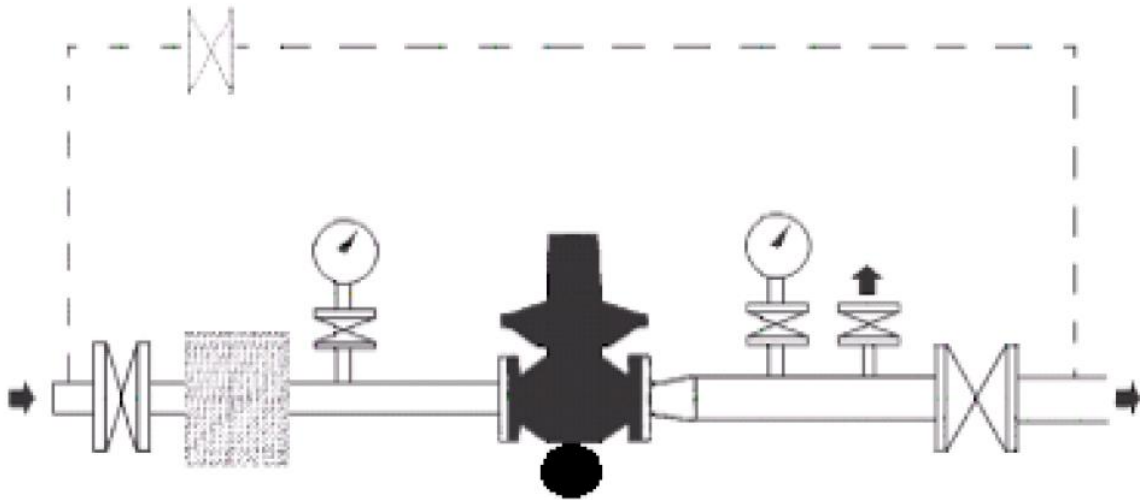
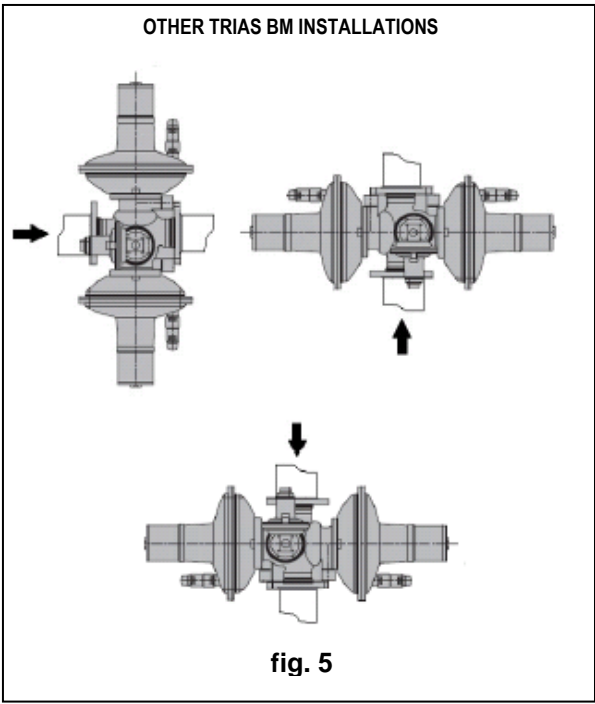
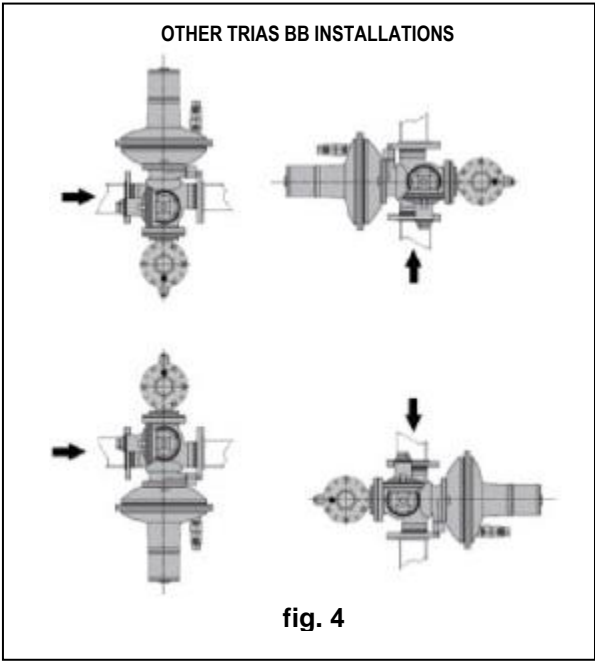
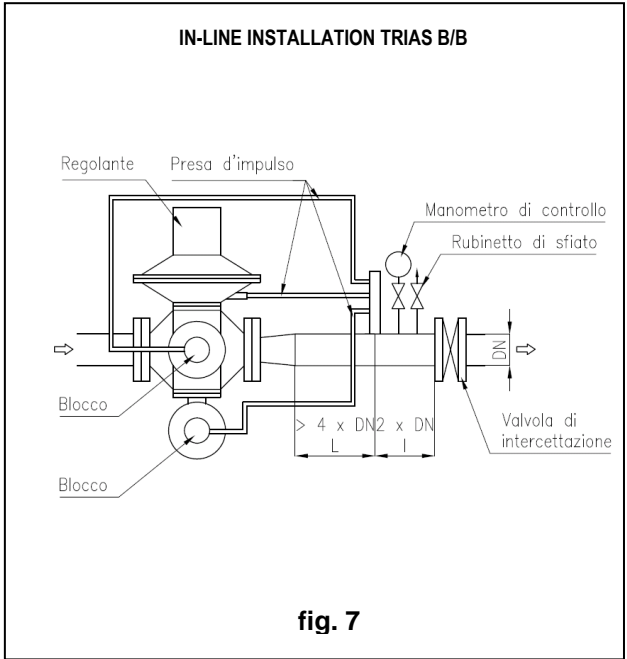
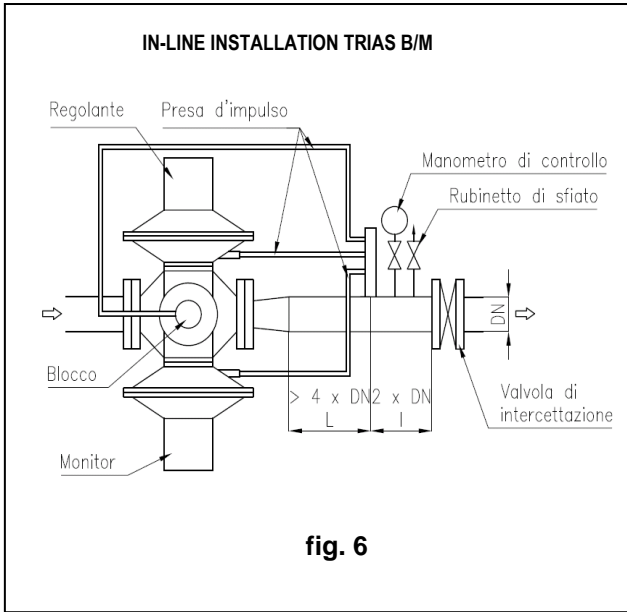


fig. 3b TRIAS B/B standard installation



2.2 CONNECTION OF THE EQUIPMENT

The connections between the equipment and the pipes must be made with a stainless steel or copper pipe, with a minimum inside diameter of 8mm.



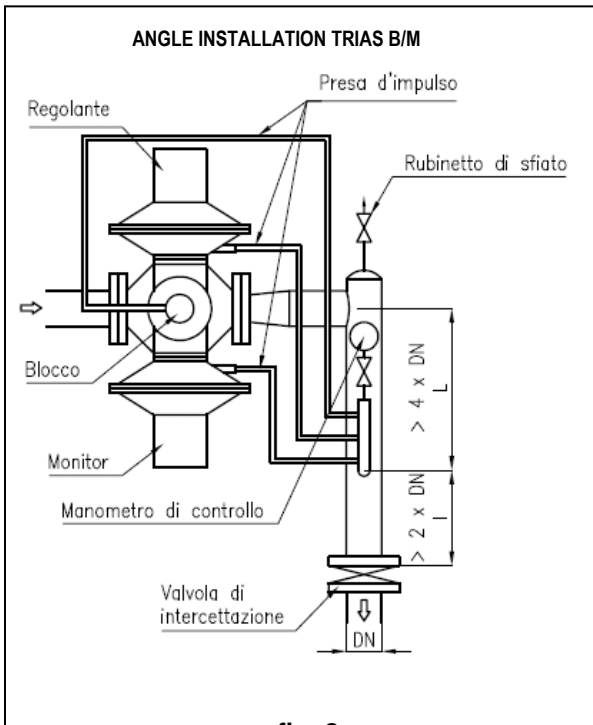


fig. 8

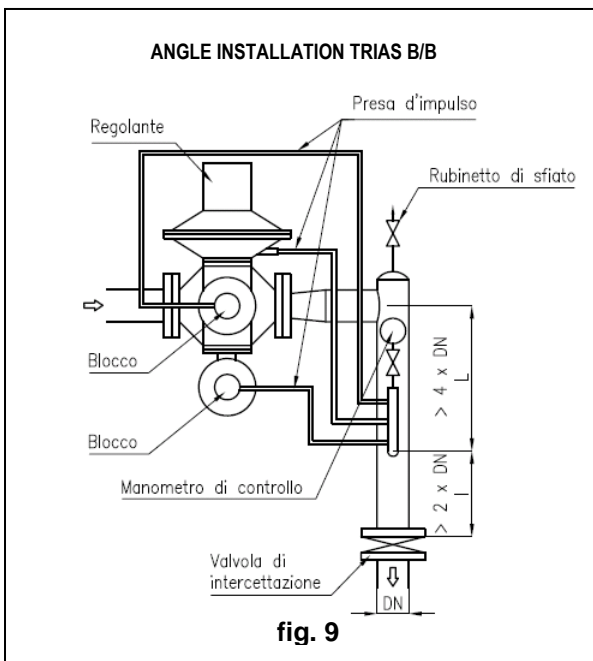


fig. 9

Tab.3: Multiple sensing point detail

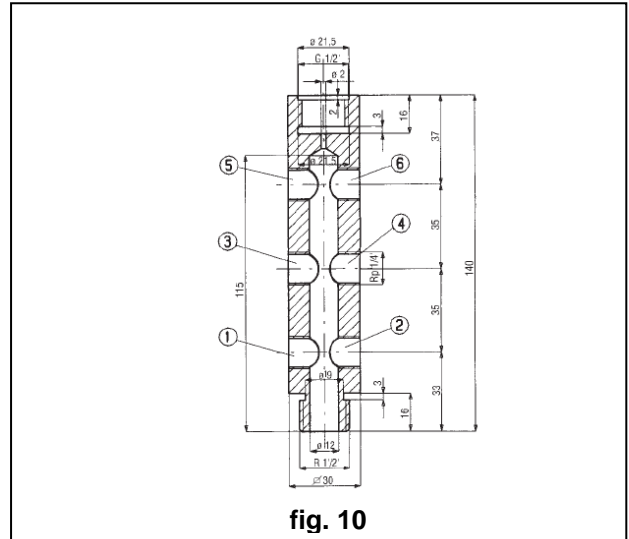


fig. 10

Installing a multiple sensing point on a system has the purpose of deriving all pressure pulse signals coming from the different reduction and safety equipment and their accessories from a unique point.

The regulator must be installed on the line, directing the arrow on the body in the direction of the gas flow.

To achieve proper regulation, it is essential that the position of the pressure sensing points and of the gas rate respects the values indicated in table 4. When used in gas pressure reduction stations, the regulator must be installed at least according to the requirements of standards EN 12186 or EN 12279. All the outlets of possible gas venting due to breakage of sensors/diaphragms must be ducted according to the standards EN 12186 or EN 12279.

In order to avoid the build up of impurities and condensation in the pipes of the pressure sensing points, it is recommended:

- a) that the pipes always be in descent towards the outlet pipe connection with a slope of approximately 5 - 10%;
- b) that the pipe connections always be welded at the top of the piping itself and that the hole on the pipe has no burrs or protrusions towards the inside.

N.B. IT IS RECOMMENDED NOT TO INTERPOSE SHUT-OFF VALVES ON SENSING LINES

Table 4
In the outlet piping of the regulator, the gas velocity must not exceed the following rate:
$V_{max} = 25 \text{ m/s for } 1.5 < P_d < 5 \text{ bar}$
$V_{max} = 20 \text{ m/s for } 0,5 < P_d \leq 1.5 \text{ bar}$
$V_{max} = 15 \text{ m/s for } P_d \leq 0.5 \text{ bar}$

2.3 DOWNSTREAM VOLUME NECESSARY FOR INSTALLATION

When the regulator is used with ON-OFF service (to stop or start burners), keep in mind that though the **TRIAS** device is classified as “quick reaction” type, it requires a gas volume between the device and the burner, appropriately dimensioned, in order to partially dampen the pressure excursions caused by quick flow rate variations.

3.0 MODULARITY

The modular design of the **TRIAS** regulators makes it possible to apply the slam-shut valve to the same body without changing the face-to-face dimension.

3.1 INCORPORATED SLAM-SHUT VALVE LA/...

This is a device (fig. 8-9) which immediately shuts the gas flow if, due to a failure, the outlet pressure reaches the preset value for its triggering, or if it is operated manually.

For the **TRIAS** pressure regulator, there is the option of having the slam-shut valve incorporated on both the **TRIAS B/M** and **TRIAS B/B** versions. Three versions (LA/BP, LA/MP and LA/TR) are available depending on the tripping pressure ranges.

The main features of this slam-shut device are the following:

- maximum admissible pressure **PS**: up to 20 bar;
- triggering due to pressure increase and/or decrease;
- **AG** accuracy: up to $\pm 5\%$ of calibration value per pressure increase (depending on setting pressure);
up to $\pm 15\%$ for pressure decrease (depending on the setting pressure);
- internal bypass device;
- manual button release device

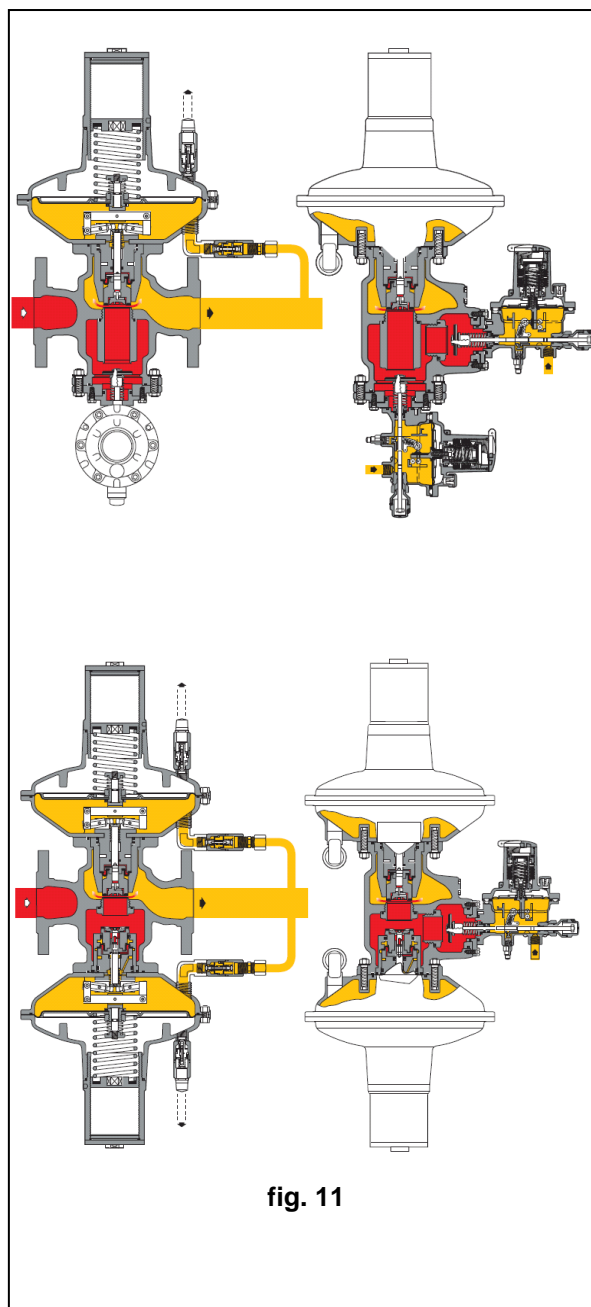
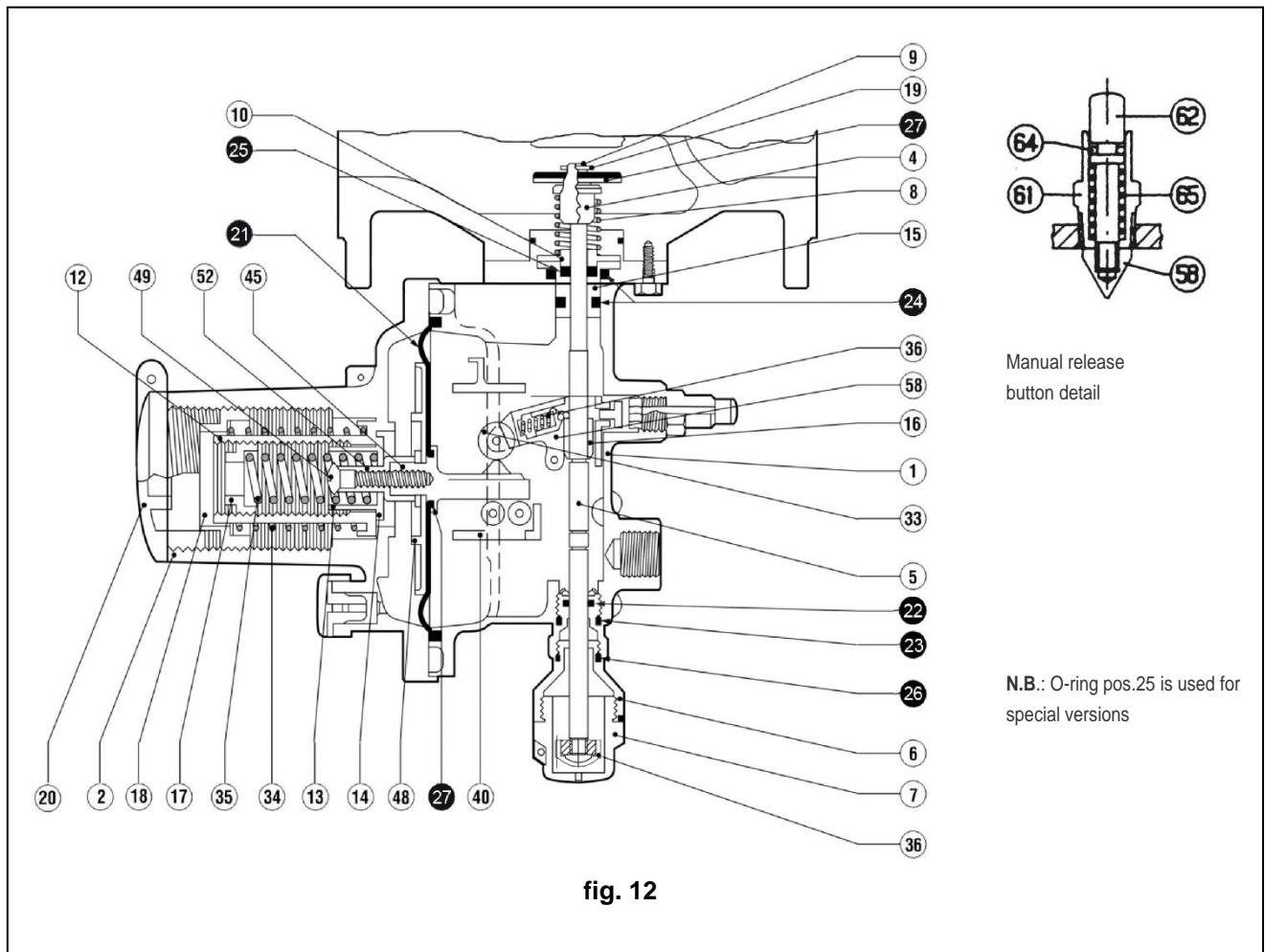


fig. 11



The slam-shut valve LA/.. (fig. 12) for minimum and maximum pressure triggering mainly consists of a plug mounted on a rod, a release lever, a control head and a manual reset system. In the chamber C of the control head, the pressure to be controlled P_d acts on the diaphragm 21, which is joined to the shaft supplied with cam 45. The pressure load P_d on the diaphragm is contrasted by the springs 34 and 35, which, respectively, determine triggering for pressure increase or decrease. The device is calibrated by turning ring nuts 17 and 18. A clockwise rotation of the ring nuts causes an increase in the triggering value; vice versa for an anticlockwise rotation.

When triggered for pressure increase, when the pressure P_d exceeds the calibration value, the load on the diaphragm 21 increases until it overcomes the resistance of the spring 34. This causes the shaft 45 to move to the left, which by means of the cam moves the sensor 33 by disengaging the linkage 29. This frees rod 5 with plug 19, which is brought to closure by spring 8. Instead, the pressure drop intervention takes place as follows.

As long as the pressure value P_d remains above the calibration load of spring 35, spring support 13 keeps resting on support 12.

If the pressure P_d decreases below the preset value, spring 35 causes support 13 and consequently shaft 45 to move to the right.

The cam then moves the sensor 33 causing the linkage 29 to disengage.

The slam-shut device is reset by pulling bush 7 downwards until linkage 29 is re-engaged.

In the first operating phase, you must wait for the upstream pressure to go downstream the plug and to balance it, by means of the internal bypass valve. After resetting, bush 7 must be pressed into its seat.

The open or closed condition of the slam-shut valve can be detected from the outside by observing the position of the coloured cap 36 through bush 7, as shown in fig. 12.

Table 5 shows the triggering fields of the available pressure switches.

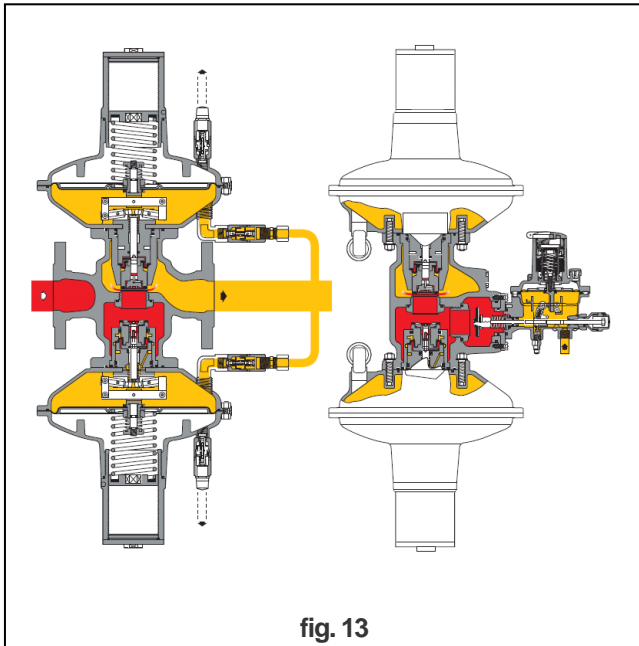
3.2 Tab. 5 SETTING SPRINGS OF THE SLAM-SHUT DEVICE LA/...

Spring features					LA/BP SLAM-SHUT DEVICE
Code	Colour	De	Lo	d	SETTING FIELD in mbar
					Maximum pressure triggering
64470112 RO	RED	34	43	2.2	30 - 50
64470115GR	GREY		42	2.8	50 - 180
					Minimum pressure triggering
64470024BI	WHITE	15	45	1.3	6 - 60
					LA/MP SLAM-SHUT DEVICE
					Maximum pressure triggering
64470115GR	GREY	34	42	2.8	140 - 180
64470116GI	YELLOW		40	3.2	180 - 280
64470051BI	WHITE		50	3.2	280 - 450
					Minimum pressure triggering
64470024BI	WHITE	15	45	1.3	10 - 60
6470038GI	YELLOW		40	2	60 - 240
					LA/TR SLAM-SHUT DEVICE
					Maximum pressure triggering
64470116GI	YELLOW	34	40	3.2	250 - 550
64470051BI	WHITE		50	3.2	550 - 850
64470057BL	BLUE		50	3.5	850 - 1500
64470058AR	ORANGE		50	4	1500 - 2500
64470059AZ	SKY BLUE		50	4.5	2500 - 4000
64470060NE	BLACK		50	5	4000 - 5500
					Minimum pressure triggering
64470038GI	YELLOW	15	40	2	100 - 500
64470045MA	BROWN		41	2.4	500 - 1000
64470046BL	BLUE		40	3	1000 - 2000
64470149NE	BLACK		43	3.2	2000 - 3500

Od = outside Ø d = Ø wire Lo = Length

3.3 TRIAS WITH MONITOR OPERATION (TRIAS B/M)

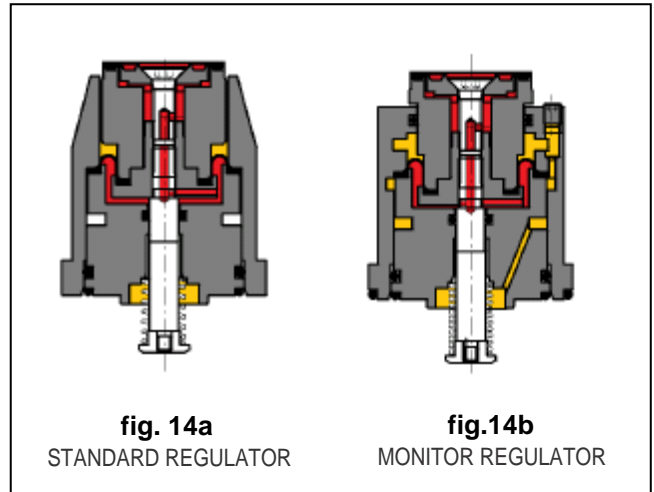
The monitor is an emergency regulator which is activated in place of the main regulator when this, due to a fault, allows the outlet pressure to reach the calibration value set for triggering of the monitor. For this emergency device, PIETRO FIORENTINI has a solution for installations with built-in monitor (B/M version).



3.3.1 FEATURES

In the TRIAS B/M version, the head that functions as a monitor is a regulator that, in addition to the regulating head, has a mobile unit balancing device that guarantees a higher precision of the regulated pressure and thus an equally precise triggering pressure value without the danger of interference with the main regulator.

In this configuration, the monitor controller has a construction variant, which is illustrated in fig. 14.



4.0 ACCESSORIES

4.1 RELIEF VALVE

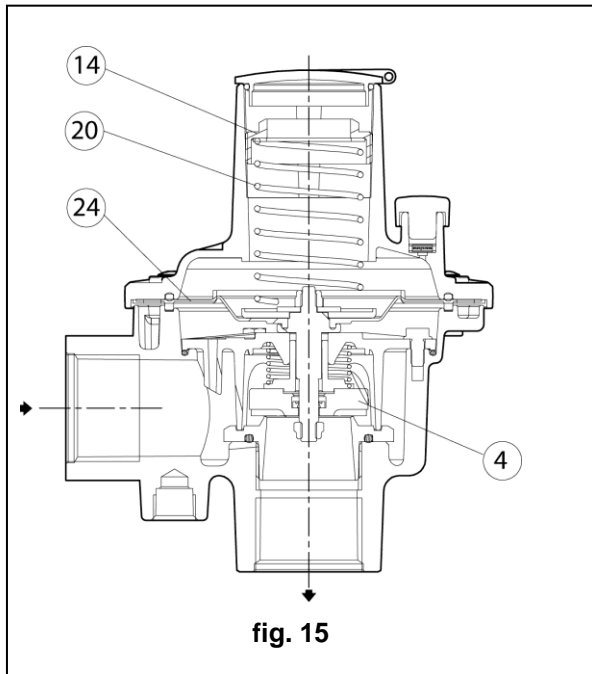
The relief valve is a safety device which discharges a certain amount of gas outside when the pressure at the control point exceeds the calibration value due to short-term events, such as for example, closing of the shut-off valves for a very short amount of time and/or overheating of gas with required flow rate zero. Discharging the gas outside can, for example, avoid triggering of the slam-shut device due to transient causes not deriving from damage to the regulator. Obviously the amount of gas discharged depends on the extent of the overpressure respect to the calibration.

The different relief valve models available are all based on the same operating principle, illustrated below, referring to the valve VS/AM 65 (fig. 15).

It is based on a comparison between the thrust on the diaphragm 24 resulting from the pressure of the gas to be controlled and the thrust resulting from the setting spring 20. The weight of the mobile unit and the static and dynamic residual thrusts on the plug 4 also affect this comparison.

When the thrust deriving from the gas pressure exceeds that of the setting spring, the plug 4 is raised and a certain amount of gas is discharged. As soon as the pressure drops below the set value, the plug re-closes.

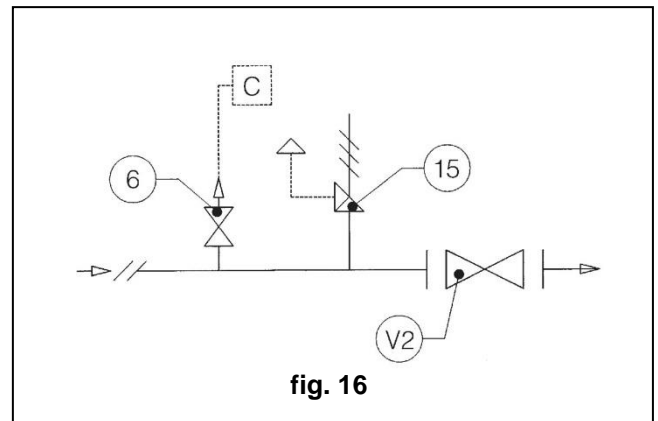
Triggering of the relief valve can be controlled and adjusted by following the procedures below.



4.1.1 INSTALLATION DIRECTLY ON LINE (fig. 16).

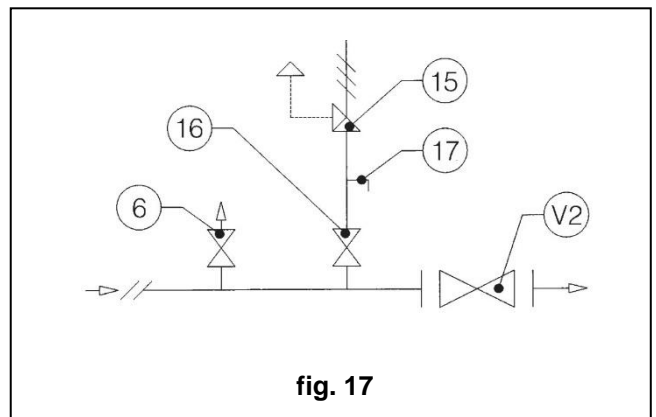
When the relief valve is installed directly on the line, namely without interposing a shut-off valve, proceed as follows:

- 1) Make sure that the outlet shut-off valve V2 and the pressure relief valve 6 are closed;
- 2) Connect a controlled auxiliary pressure to the valve 6 and stabilise it at the desired triggering value of the relief valve. Open the pressure relief valve 6 thus increasing the pressure in the outlet segment;
- 3) Check triggering of the relief valve and, if needed, adjust it by turning the internal adjustment ring nut 14 appropriately (clockwise to increase the setting and anticlockwise to decrease it).



4.1.2 INSTALLATION WITH SHUT-OFF VALVE (fig. 17)

- 1) Close the shut-off valve 16;
- 2) Connect a controlled auxiliary pressure to the outlet 17 and slowly increase it to the intended triggering value of the relief valve;
- 3) Check triggering of the relief valve and, if needed, adjust it by turning the internal adjustment ring nut 14 appropriately (clockwise to increase the setting and anticlockwise to decrease it).



5.0 COMMISSIONING

5.1 GENERAL INFORMATION

After installation, check that the inlet/outlet shut-off valves, the bypass valve, if any, and the pressure relief valve are closed.

It is recommended to check, before commissioning, that the conditions of use conform to the features of the equipment.

These features are shown with symbols on the equipment's rating plates (fig. 18).

It is recommended to operate the opening and closing valves very slowly. Too quick manoeuvres could damage the regulator.

Please note that the regulator with monitor function is labelled "MONITOR".

EQUIPMENT RATING PLATES

fig. 18

The following is a list of the symbols used and their meaning.

CE = Conformity with Directive 97/23/CE PED

Purnax= maximum operating pressure at equipment inlet

bpu= variation range of inlet pressure of the pressure regulator in normal operating conditions

PS= maximum admissible pressure that can be supported in safe conditions by the structure of the body of the equipment

Wds= calibration range of the pressure regulator/pilot/pre-reducer which can be obtained by using the parts and setting spring mounted at the time of testing (namely without changing any component of the equipment).

Wd= calibration range of the pressure regulator/pilot/pre-reducer which can be obtained by using the setting springs indicated in the specific tables and possibly by changing some other part of the device (reinforced gasket, diaphragms, etc.).

Cg and KG = experimental critical flow rate coefficient

AC= regulation class

SG= lock up pressure class

AG= triggering accuracy

Wdo= triggering range due to 17slam-shut valve overpressure, which can be obtained by using the setting spring mounted the time of testing.

Wdo= triggering range due to 17slam-shut valve overpressure, which can be obtained by using the setting springs indicated in the tables.

Wdsu= triggering range due to slam-shut valve pressure decrease, which can be obtained by using the setting spring mounted the time of testing.

Wdu= triggering range due to slam-shut valve pressure decrease, which can be obtained by using the setting springs indicated in the tables.

Fail safe mode= fail open regulator or fail closed regulator.

Strength type= type of strength (IS or DS).

5.2 GAS FEEDING, EXTERNAL SEALING CHECK AND CALIBRATION

The equipment must be pressurised very slowly. If an inerting procedure is not applied, it is recommended, during the pressurisation stage, to keep the gas rate in the load pipes below a value of 5 m/sec. To prevent any type of damage to the equipment, the following must be absolutely avoided:

- Pressurisation through a valve at the outlet of the equipment.
- Depressurisation through a valve at the inlet of the equipment.

The outer seal is guaranteed when sprinkling the pressure element with a foaming agent and no bubbles form.

The regulator and possibly other equipment (slam-shut valve, monitor) are normally supplied already calibrated at the required value.

It is also possible that for several reasons (e.g. vibrations during transport), calibrations could undergo changes, in any case remaining within the range allowed for the springs used. It is therefore recommended to check the settings according to the following procedures.

Tables 6 and 7 show the recommended setting values of the units provided for the different installation philosophies. The data in these tables can be useful both when verifying existing settings and in the event of changes to them becoming necessary at a later date.

For systems consisting of two lines, it is recommended to commission one line at a time, starting with the one with the lower setting, so called "reserve". For this line, the device setting values will obviously deviate from those given in Tables 6 and 7.

Before commissioning the regulator, check that all the shut-off valves (inlet, outlet, bypass, if any) are closed and that the gas is at a temperature which does not cause malfunctions.

5.3 COMMISSIONING OF THE TRIAS B/B REGULATOR

If there is also a relief valve on the line, see par. 4.1 for its verification.

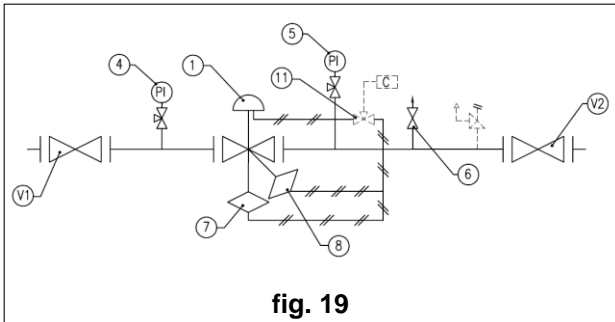
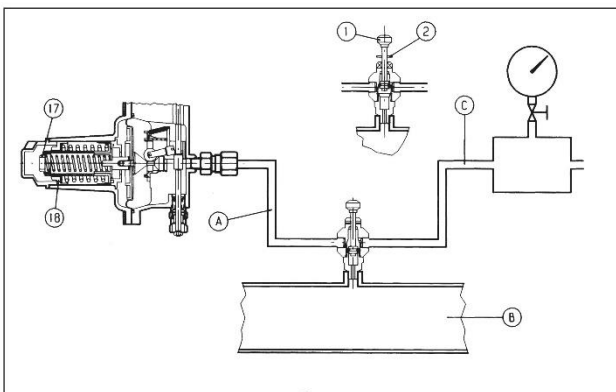


fig. 19

Check and adjust triggering of the slam-shut device 7 as follows:

- A) For slam-shut devices connected to the downstream pipework via the "push" three-way diverter valve 11 proceed as follows (fig. 20):
- connect a controlled auxiliary pressure to way C;
 - stabilise this pressure at the calibration value set for the regulator;
 - press knob 1 of the "push" three-way valve completely;
 - re-arm the slam-shut device with the appropriate bush;
 - keep knob 1 pressed and:
 - For safety devices triggering due to maximum pressure: slowly increase the auxiliary pressure and check the triggering value. If necessary, increase the triggering value by turning the regulation ring nut 18 clockwise or anticlockwise to decrease it.
 - For safety devices designed for pressure increase and decrease: slowly increase the auxiliary pressure and adjust the triggering value. Restore pressure at the regulator calibration value and reset the slam-shut device. Check triggering for pressure decrease by slowly reducing the auxiliary pressure. If necessary, increase the triggering values to increase or decrease pressure by turning the respective ring nuts 18 or 17 clockwise. Act vice-versa to decrease the triggering values.
 - **repeat the interventions at least 2-3 times to make sure they work properly**

Repeat the above steps to check and adjust the triggering of slam-shut device 8.



- B) For devices without the "push" valve (fig. 21), it is advisable to connect the control head separately to a controlled auxiliary pressure and repeat the steps described above.

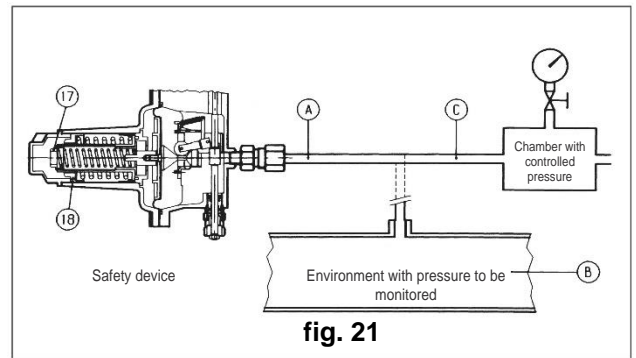


fig. 21

CAUTION

At the end of the operation reconnect the control head to the downstream pressure outlet.

N.B.: It is recommended to repeat the triggering tests at least every 6 months.

When you have finished checking the slam-shut device, proceed as follows:

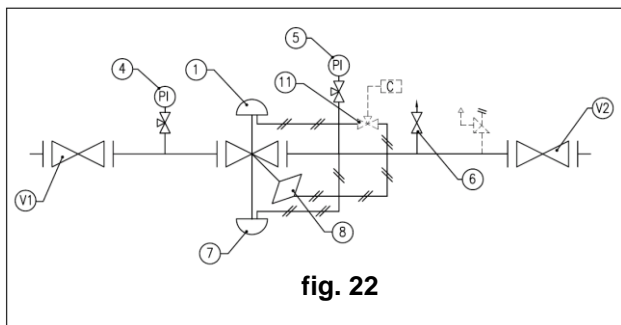
- 1) make sure that the slam-shut device is in the closed position;
- 2) open the inlet shut-off valve V1;
- 3) open the slam-shut valve very slowly, pulling the specific bush;
- 4) partially open the pressure relief valve 6 on the outlet pipe;
- 5) using the pressure gauge 5, check that the downstream pressure has the desired calibration value of the regulator. If not, adjust calibration by turning the specific internal ring nut clockwise to increase pressure and anticlockwise to decrease it;
- 6) close the pressure relief valve 6 and check the lock up pressure value;
- 7) using a foaming agent, check sealing of all the junctions between shut-off valves V1 and V2;
- 8) open the outlet shut-off valve V2 very slowly until the pipe fills completely;
- 9) it is advisable to check that, by manually triggering the slam-shut valve, the line flow rate stops

Tab. 6 Equipment calibration of a line consisting of Trias B/B type regulator

Regulator Calibration (Pds) mbar	Relief Calibration	Max BLOCK Calibration	Min BLOCK Calibration
10 < Pds ≤ 15	Pds x 1,7	Pds x 2	Block not available
15 < Pds ≤ 19			10 mbar
19 < Pds ≤ 24	Pds x 1,55	Pds x 1,77	Pds x 0,56
24 < Pds ≤ 35			Pds x 0,57
35 < Pds ≤ 40	Pds x 1,4	Pds x 1,52	Pds x 0,6
40 < Pds ≤ 70			
70 < Pds ≤ 80	Pds x 1,3	Pds x 1,4	Pds x 0,7
80 < Pds ≤ 100			
100 < Pds ≤ 750	Pds x 1,16	Pds x 1,46	Pds x 0,7
750 < Pds ≤ 1000			
1000 < Pds ≤ 2500	Pds x 1,2	Pds x 1,5	Pds x 0,7
2500 < Pds < 4400			

5.4 COMMISSIONING OF THE TRIAS B/M REGULATOR

If there is a relief valve on the line, see par. 4.1 for its verification.



Check and adjust triggering of the slam-shut device 8 as follows:

- A) For slam-shut devices connected to the downstream pipework via the "push" three-way diverter valve 11 proceed as follows (fig. 20):
- connect a controlled auxiliary pressure to way C;
 - stabilise this pressure at the calibration value set for the regulator;
 - press knob 1 of the "push" three-way valve completely;
 - re-arm the slam-shut device with the appropriate bush;
 - keep knob 1 pressed and:
 - For safety devices triggering due to maximum pressure: slowly increase the auxiliary pressure and check the triggering value. If necessary, increase the triggering value by turning the regulation ring nut 18 clockwise or anticlockwise to decrease it.
 - For safety devices designed for pressure increase and decrease: slowly increase the auxiliary pressure and adjust the triggering value. Restore pressure at the regulator calibration value and reset the slam-shut device. Check triggering for pressure decrease by slowly reducing the auxiliary pressure. If necessary, increase the triggering values to increase or decrease pressure by turning the respective ring nuts 18 or 17 clockwise. Act vice-versa to decrease the triggering values.
 - **repeat the interventions at least 2-3 times to make sure they work properly.**
- B) For devices without the "push" valve (fig. 21), it is advisable to connect the control head separately to a controlled auxiliary pressure and repeat the steps described above.



CAUTION

At the end of the operation reconnect the control head to the downstream pressure outlet.

N.B.: It is recommended to repeat the triggering tests at least every 6 months.

When you have finished checking the slam-shut device, proceed as follows:

- 1) make sure that the slam-shut device is in the closed position;
- 2) partially open the pressure relief valve 6 on the outlet pipe;

- 3) disconnect the sensing line of the main regulator 1 and plug the fitting on the outlet section accordingly;
- 4) open the shut-off valve V1 very slowly;
- 5) open the slam-shut valve very slowly pulling the specific bush;
- 6) using the pressure gauge 5, check that the outlet pressure has the set calibration value for the monitor regulator 7. If not, adjust calibration by turning the specific internal ring nut clockwise to increase pressure and anticlockwise to decrease it;
- 7) close the pressure relief valve and check the lock up pressure of the monitor regulator 7;
- 8) manually have the slam-shut valve trigger and partially open the pressure relief valve 6;
- 9) connect the sensing line of the main regulator;
- 10) open the slam-shut valve very slowly pulling the specific bush;
- 11) using pressure gauge 5, check that the outlet pressure has the set calibration value for the main regulator 1. If not, adjust calibration by turning the specific internal ring nut clockwise to increase pressure and anticlockwise to decrease it.
- 12) close the pressure relief valve and check the lock up pressure value of the main regulator 1;
- 13) using a foaming agent, check sealing of all the junctions between shut-off valves V1 and V2;
- 14) open the outlet shut-off valve V2 very slowly until the pipe fills completely;
- 15) it is advisable to check that, by manually triggering the slam-shut valve, the line flow rate stops;

Tab. 7 Equipment calibration of a line consisting of regulator type Trias B/M					
Regulator Calibration (Pds) mbar	MONITOR calibration	Calibration RELIEF	Calibration Max pressure SLAM-SHUT DEVICE	Calibration Min pressure SLAM-SHUT DEVICE	
10<Pds≤15	Pds + 5 mbar	Pds x 1,7	Pds x 2	Block not available	
15<Pds≤19				10 mbar	
19<Pds≤24				Pds x 0,56	
24<Pds≤35		Pds x 1,55	Pds x 1,77	Pds x 1,7	Pds x 0,57
35<Pds≤40					Pds x 1,52
40<Pds≤70		Pds x 1,3	Pds x 1,4	Pds x 1,4	Pds x 0,6
70<Pds≤80					
80<Pds≤100					
100<Pds≤750	Pds x 1,15	Pds x 1,3	Pds x 1,46	Pds x 0,6	
750<Pds≤1000					
1000<Pds≤2500	Pds x 1,07	Pds x 1,16	Pds x 1,5	Pds x 0,7	
2500<Pds<4400			Pds x 1,2		

6.0 FAULTS AND INTERVENTIONS

Different types of malfunctions could occur over time are highlighted below. These situations depend on the conditions of the gas and obviously on the natural aging and wear of materials.

We remind you that all interventions on the equipment **must be carried out by technically qualified personnel with suitable knowledge on the matter.**

Tampering with the equipment by unsuitable personnel relieves Pietro Fiorentini SpA from any and all liability.

6.1 Tab. 8 TRIAS REGULATOR (fig. 23, 24, 25, 26 and 27)

PROBLEM	POSSIBLE CAUSES	INTERVENTION
Lack of sealing at Q=0	Valve seat [4] damaged	Replace
	Plug [3] damaged	Replace
	O-ring [67] damaged	Replace
	O-ring [68] damaged	Replace
	O-ring [63] damaged	Replace
	O-ring [42] damaged	Replace
	Diaphragm [6] damaged	Replace
	Filth or foreign bodies in sealing area	Clean
Pumping	Abnormal friction of plug rod unit	Clean and/or possibly replace sealing and/or guide elements
	Anti-pumping valves locking	Cleaning and possible replacement
	Reduced downstream volumes	Increase volume
Pa increase with Q>0	Diaphragm breakage [19]	Replace
	Diaphragm breakage [6]	Replace

6.2 Tab. 9 SLAM-SHUT DEVICE LA/... (fig. 23 and 28)

PROBLEM	POSSIBLE CAUSES	INTERVENTION
Slam-shut plug does not close	Breakage of measuring head diaphragm [3b]	Change diaphragm
Loss of slam-shut plug	Plug gasket [43b] worn	Change gasket
	O-ring [42] deteriorated	Replace
	Plug seat [4 or 5] eroded or tarnished (fig.23)	Change the seat
Incorrect release pressure	Incorrect max and/or minimum spring calibration	Repeat calibration by acting on the ring nuts [17] and/or [18]
	Lever mechanisms with friction	Change the box containing the entire unit
Impossible to reset	Persistence of the cause that led to downstream pressure increase or decrease	Drop or increase the downstream pressure
	Lever mechanism broken or chipped	Change the standard box containing the unit outside the regulator

N.B. If the slam-shut valve triggered, before any other operation, close the inlet and outlet valves (V1 and V2) of the line and discharge the pressure.

Eliminate the causes which triggered it before reactivating.

If an operating fault occurs and qualified personnel are not available for the specific intervention, call our service centre closest to you. For information, contact our SATRI service at the facility in Arcugnano (VI).

7.0 MAINTENANCE

7.1 GENERAL INFORMATION

Operation, checks and maintenance must be carried out according to relevant regulations in force in the place where the equipment is installed (type and frequency). Before performing any intervention, you must make sure that the regulator inlet and outlet has been shut off and pressure discharged in the duct sections between the regulator and cut-off valves. Maintenance interventions are closely related to the quality of the transported gas (impurities, humidity, gasoline, corrosive substances) and to filtering efficiency.

Preventive maintenance is therefore always recommended, the intervals of which, if not established by regulations already in force, depend on:

- the quality of the transported gas;
- the state of cleanliness and conservation of the piping downstream of the regulator: in general, for example, after the first start-up of the plants, they require more frequent maintenance due to the precarious state of cleanliness inside the piping;
- the level of reliability required by the reduction system.

Before beginning disassembly of the equipment, make sure to:

- Have a set of recommended spare parts. Use only original Pietro Fiorentini spare parts, knowing that the most important parts, such as the diaphragms, are marked.
- Have a series of spanners as referred to in table 10.

For correct maintenance, the recommended spare parts are unambiguously identified with tags indicating:

- The number of the assembly drawing SR of the equipment in which they are used,
- The position displayed in the assembly drawing SR of the equipment.

It is recommended to replace all rubber parts; for this purpose, use the specific Spare parts kit highlighted with black circled dots in figures 23, 24, 25, 26, 27, 28.

N.B. The use of non-original spare parts relieves Pietro Fiorentini S.p.A. of any liability.

Depressurisation must be carried out making sure to discharge the vents to the drains in a safe area; to avoid the risk of creating sparks due to blows of impurity particles inside the discharge lines, it is recommended to maintain a fluid speed of less than 5 m/sec.

We also recommend applying reference signs on parts which could pose problems of direction or mutual positioning when reassembling them.

Lastly remember that o-rings and mechanical sliding parts (rods, etc.) must be lubricated with a thin coat of silicone grease before reassembling them. Before reactivating the equipment, its external sealing must be checked at an adequate pressure which guarantees the absence of outside leaks.

The inside sealing of the slam-shut and monitor devices, when used as safety accessories according to the PED directive, must be checked at an adequate pressure which guarantees internal sealing at the maximum intended operating pressure.

These checks are essential to guarantee safe use at the intended operating conditions; they must however comply with national regulations in force.

7.2 MAINTENANCE PROCEDURE OF THE TRIAS B/B REGULATOR

SCHEDULED PREVENTIVE MAINTENANCE

Procedure for disassembly, complete replacement of spare parts and reassembly of the TRIAS B/B pressure regulator

PRELIMINARY OPERATIONS

- A. Put the regulator in safe conditions.
- B. Make sure that the upstream and downstream pressure is 0.

DISASSEMBLY AND REASSEMBLY

Regulating head

- 1) Disconnect the fittings between the regulator and the downstream outlet.
- 2) Unscrew cover (29) and completely unscrew adjustment ring nut (28) for head $\varnothing 275$ (fig.24); completely unscrew adjustment screw (29) and cap (30) and then remove spring support (28) for head $\varnothing 195$ (fig.25).
- 3) Remove the spring (43)(fig. 24-25).
- 4) Remove the screws (47) that fasten the covers (17) and (18) together (fig. 24-25).
- 5) Loosen the nut (27)(fig.27) and remove the spring (42)(fig.24-25).
- 6) Unscrew the ring nut (52)(fig 27) to remove the protection disc (20) and diaphragm (19)(fig24-25) from the diaphragm support (22)(fig27).
- 7) Unscrew nuts (30) and separate the lower cover (17) from the body (1) (fig23).
- 8) Remove the balancing unit, consisting of the plug guide (4) and the parts contained therein (fig26), from the body (1)(fig.23).
- 9) To disassemble the above components, unscrew the nut (81) and screw (12); the rod guide (8), diaphragm (6) and plug (3) can then be removed (fig. 26).
- 10) Unscrew the valve seat (4)(fig.23) from the body, taking great care not to damage the sealing edges.

To reassemble the regulator, the operations described for disassembly can be carried out in reverse order, paying particular attention to the orientation of the lower cover (17) (fig.24-25). Before refitting the sealing elements (o-rings, diaphragms, etc.) check their integrity and replace them if necessary. You must also make sure that the diaphragm (6)(fig26) is perfectly inserted in its housing and that the rod-plug unit movement is not impeded.

We reiterate the utmost care that must be taken when handling the valve seat (4) (fig.23), in order not to damage the sealing edges.

Slam-shut valve LA(fig.28)

- 1) Make sure that the slam-shut device is in the closed position;

- 2) Disconnect the fittings between the slam-shut valve and the downstream pressure outlet;
- 3) Remove the screws securing the slam-shut device to the body;
- 4) Unscrew the cap (20) and the adjustment ring nuts (17) and (18), and then remove the setting springs (13) and (14) and the spring supports (12) and (11);
- 5) Remove the screws (22) and take off the cover (2);
- 6) Remove the diaphragm unit from the body (1) consisting of the parts (3a), (3b), (3c), (3d), (3e), and (3f), to separate them unscrew the screw (3f) from the shaft (3a);
- 7) Remove the nut (25) and completely unscrew the ring nut (6a) and the threaded bush (7);
- 8) Pull the shaft unit consisting of the parts (43c), (43b), (5d), and (5g), the bushes (5e) and (5f) and the shaft (5a) from the top. Then unscrew the shaft (5a), the plug support (5d) and the nut (48c) to remove the plug (43b);
- 9) Remove screws (24) and dismantle the anchor unit consisting of parts (4a), (4b), (4c), (4d), (4e), (4f), (4g), (4h), (4i) and (4j);
- 10) Remove the screws (42) to dismantle the flange (41);
- 11) Finally, to remove the release button unit, unscrew the part (21a), then unscrew the nut (21c) from the pin (21b).

To reassemble the slam-shut valve, perform the operations described for disassembly in reverse order.

Before refitting the sealing elements (o-rings, diaphragms, etc.) check their integrity and replace them if necessary.

7.3 MAINTENANCE PROCEDURE OF THE TRIAS B/M REGULATOR

SCHEDULED PREVENTIVE MAINTENANCE

Procedure for disassembly, complete replacement of spare parts and reassembly of the TRIAS B/M pressure regulator

PRELIMINARY OPERATIONS

- A. Put the regulator in safe conditions.
- B. Make sure that the upstream and downstream pressure is 0.

DISASSEMBLY AND REASSEMBLY

Regulating head:

- 1) Disconnect the fittings between the regulator and the downstream outlet.
- 2) Unscrew cover (29) and completely unscrew adjustment ring nut (28) for head $\varnothing 275$ (fig.24); completely unscrew adjustment screw (29) and cap (30) and then remove spring support (28) for head $\varnothing 195$ (fig.25).
- 3) Remove the spring (43)(fig. 24-25).
- 4) Remove the screws (47) that fasten the covers (17) and (18) together (fig. 24-25).
- 5) Loosen the nut (27)(fig.27) and remove the spring (42)(fig.24-25).
- 6) Unscrew the ring nut (52)(fig 27) to remove the protection disc (20) and diaphragm (19)(fig24-25) from the diaphragm support (22)(fig27).
- 7) Unscrew nuts (30) and separate the lower cover (17)(fig.24-25) from the body (1)(fig23).
- 8) Remove the balancing unit, consisting of the plug guide (4) and the parts contained therein (fig26), from the body (1).

- 9) To disassemble the above components, unscrew the nut (81) and screw (12); the rod guide (8), diaphragm (6) and plug (3) can then be removed (fig. 26).

- 10) Unscrew the valve seat (4)(fig.23) from the body, taking great care not to damage the sealing edges.

To reassemble the regulator, the operations described for disassembly can be carried out in reverse order, paying particular attention to the orientation of the lower cover (17). Before refitting the sealing elements (o-rings, diaphragms, etc.) check their integrity and replace them if necessary. You must also make sure that the diaphragm (6) is perfectly inserted in its housing and that the rod-plug unit movement is not impeded.

We reiterate the utmost care that must be taken when handling the valve seat (4), in order not to damage the sealing edges.

Monitor Head:

To service the monitor, follow the same instructions as described above for the regulating head.

Slam-shut valve LAV...

- 1) Make sure that the slam-shut device is in the closed position;
- 2) Disconnect the fittings between the slam-shut valve and the downstream pressure outlet;
- 3) Remove the screws securing the slam-shut device to the body;
- 4) Unscrew the cap (20) and the adjustment ring nuts (17) and (18), and then remove the setting springs (13) and (14) and the spring supports (12) and (11);
- 5) Remove the screws (22) and take off the cover (2);
- 6) Remove the diaphragm unit from the body (1) consisting of the parts (3a), (3b), (3c), (3d), (3e), and (3f), to separate them unscrew the screw (3f) from the shaft (3a);
- 7) Remove the nut (25) and completely unscrew the ring nut (6a) and the threaded bush (7);
- 8) Pull the shaft unit consisting of the parts (43c), (43b), (5d), and (5g), the bushes (5e) and (5f) and the shaft (5a) from the top. Then unscrew the shaft (5a), the plug support (5d) and the nut (48c) to remove the plug (43b);
- 9) Remove screws (24) and dismantle the anchor unit consisting of parts (4a), (4b), (4c), (4d), (4e), (4f), (4g), (4h), (4i) and (4j);
- 10) Remove the screws (42) to dismantle the flange (41);
- 11) Finally, to remove the release button unit, unscrew the part (21a), then unscrew the nut (21c) from the pin (21b).

To reassemble the slam-shut valve, perform the operations described for disassembly in reverse order.

Before refitting the sealing elements (o-rings, diaphragms, etc.) check their integrity and replace them if necessary.

7.4 REPLACEMENT OF ANTI-PUMPING VALVES (fig.24-25)

While holding the part closest to the cover, unscrew the VAP body(34), pull out the unit inside and replace it.

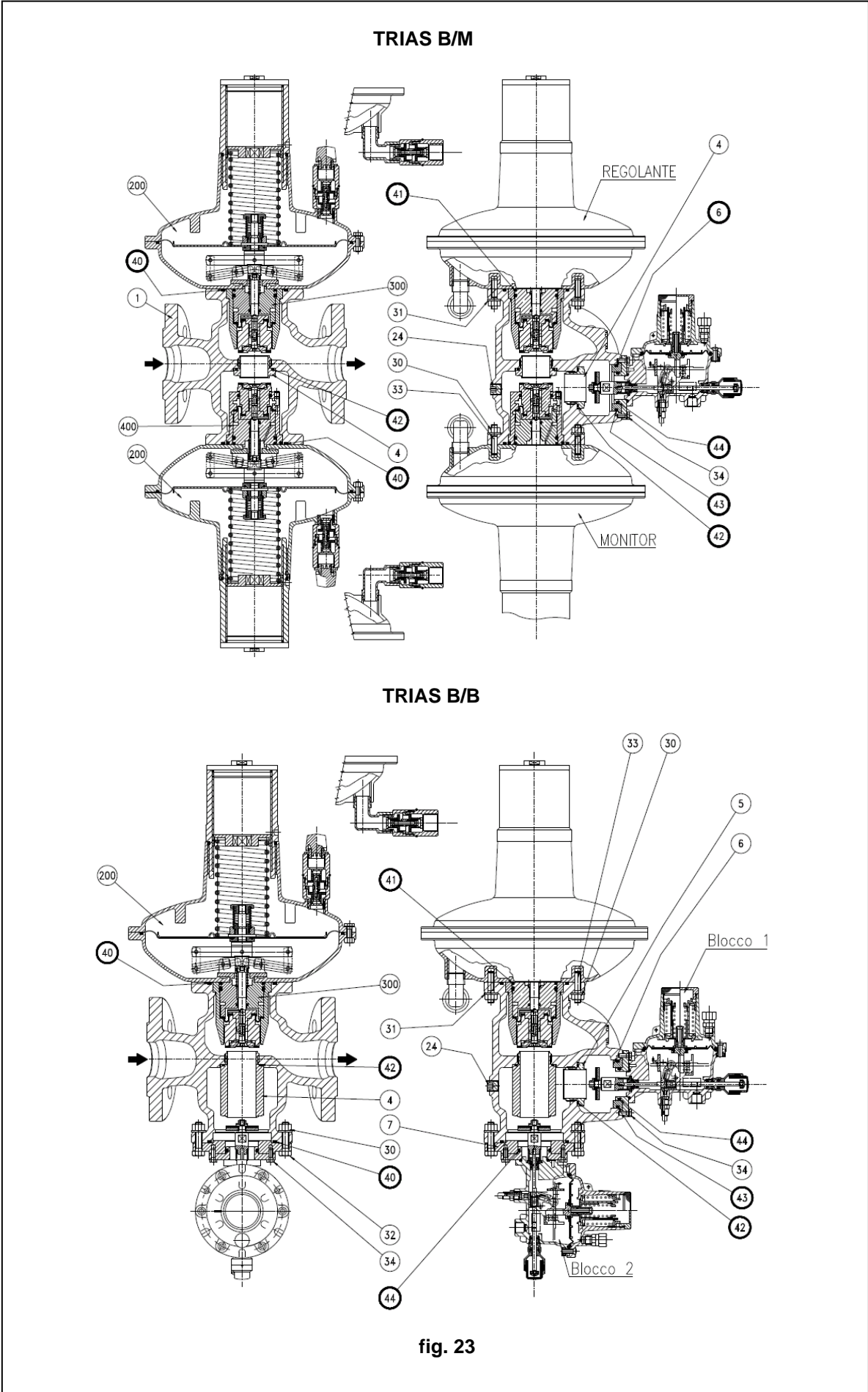


fig. 23

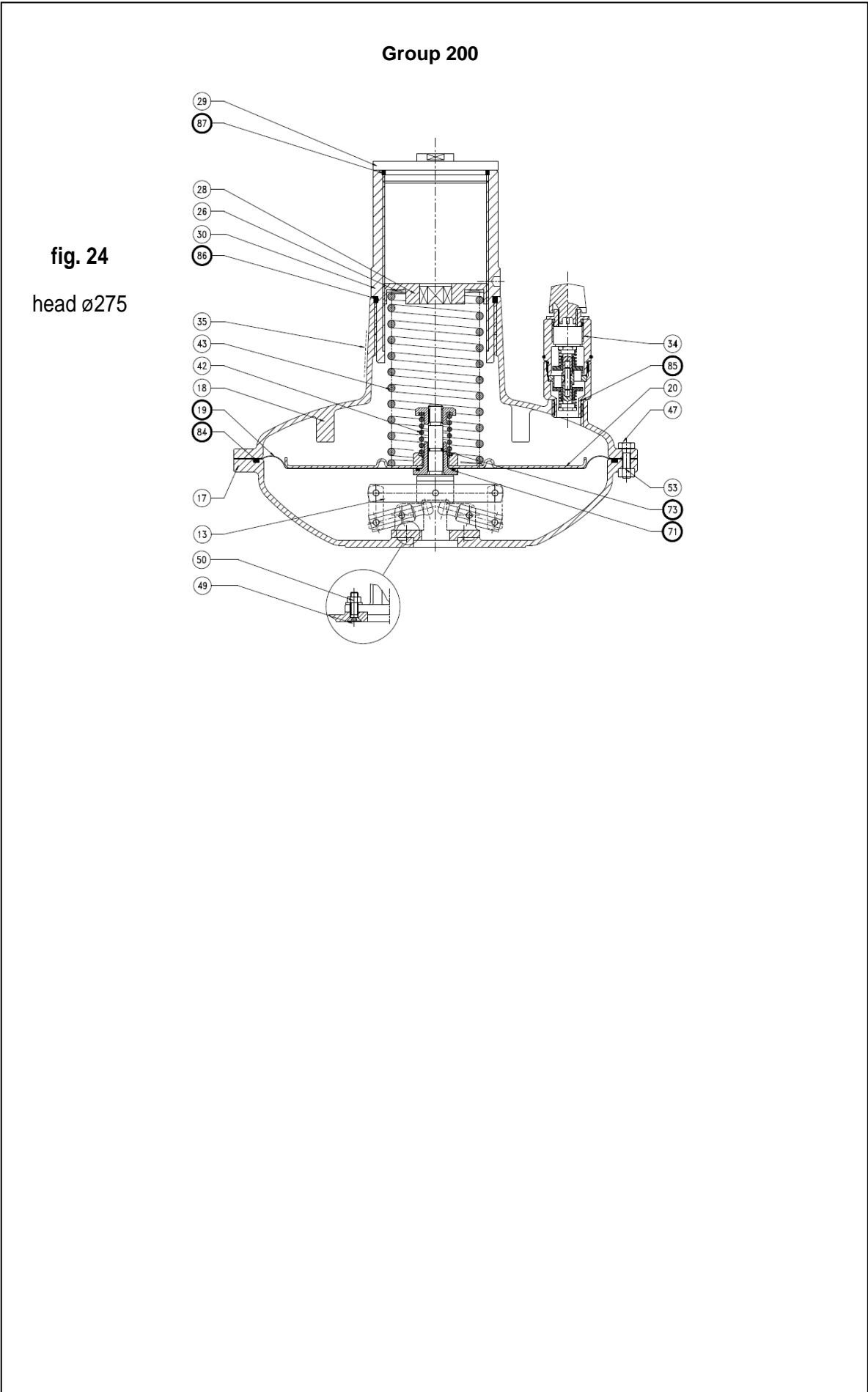
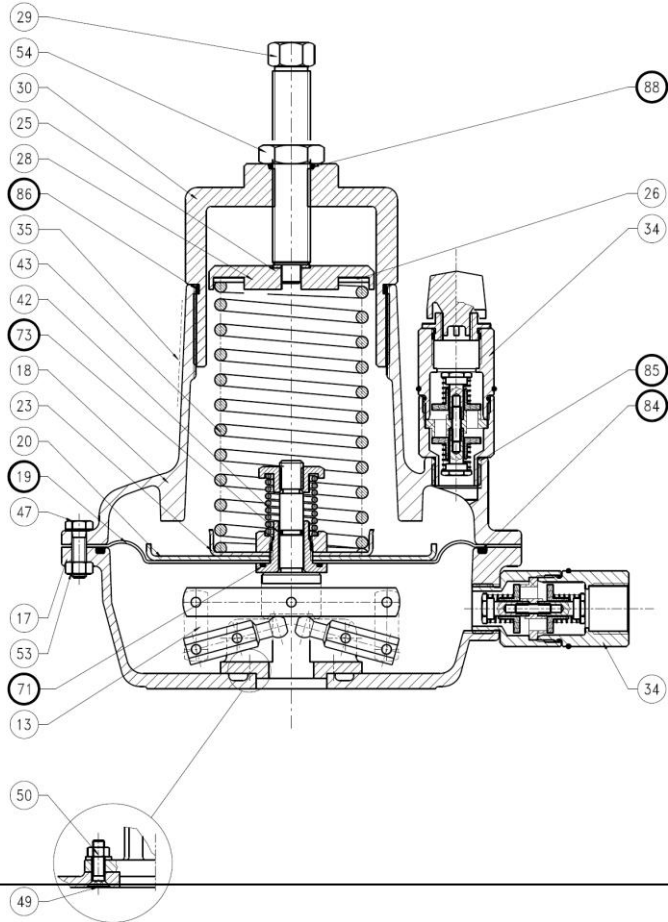
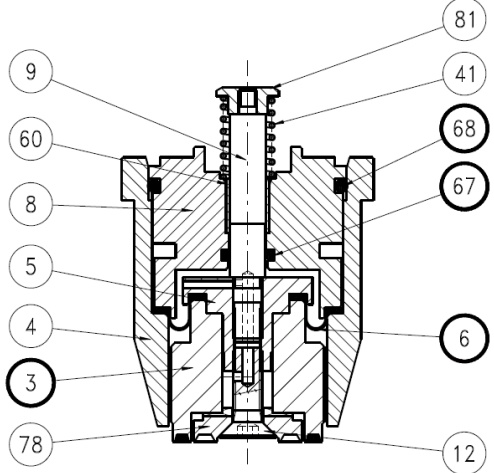


fig. 25
head ø195



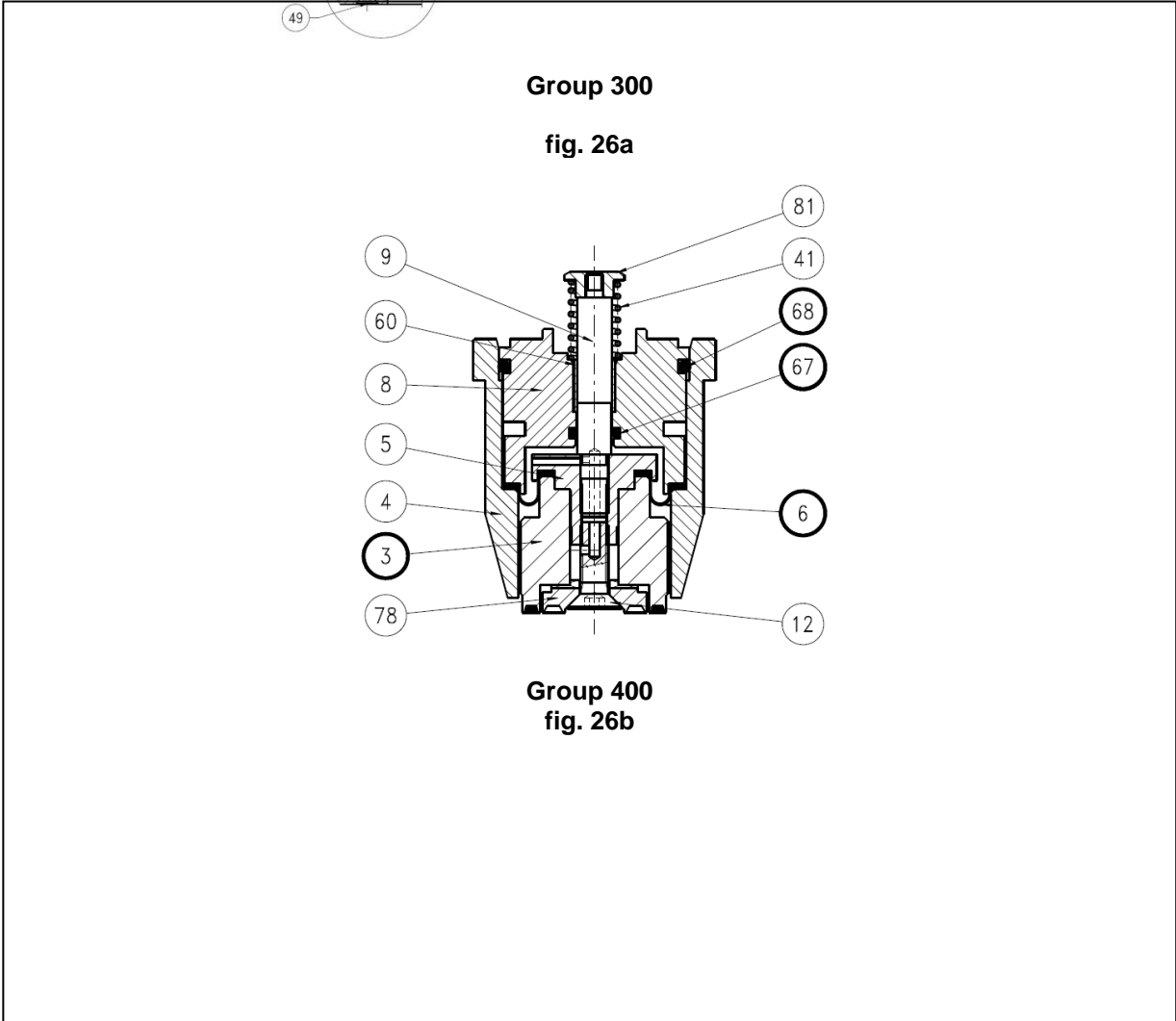
Group 300

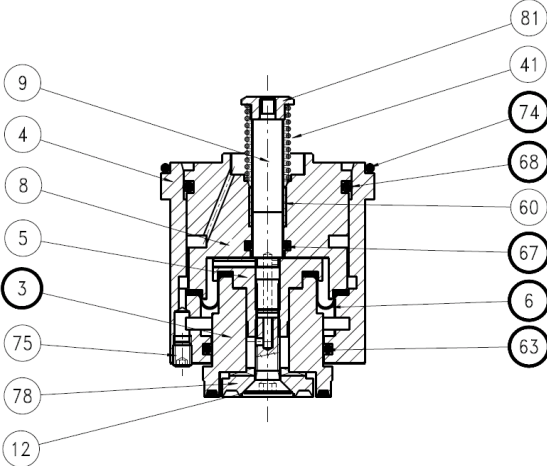
fig. 26a



Group 400

fig. 26b





Lever group

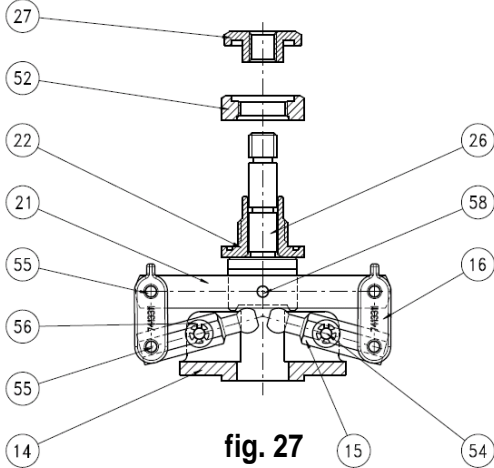


fig. 27

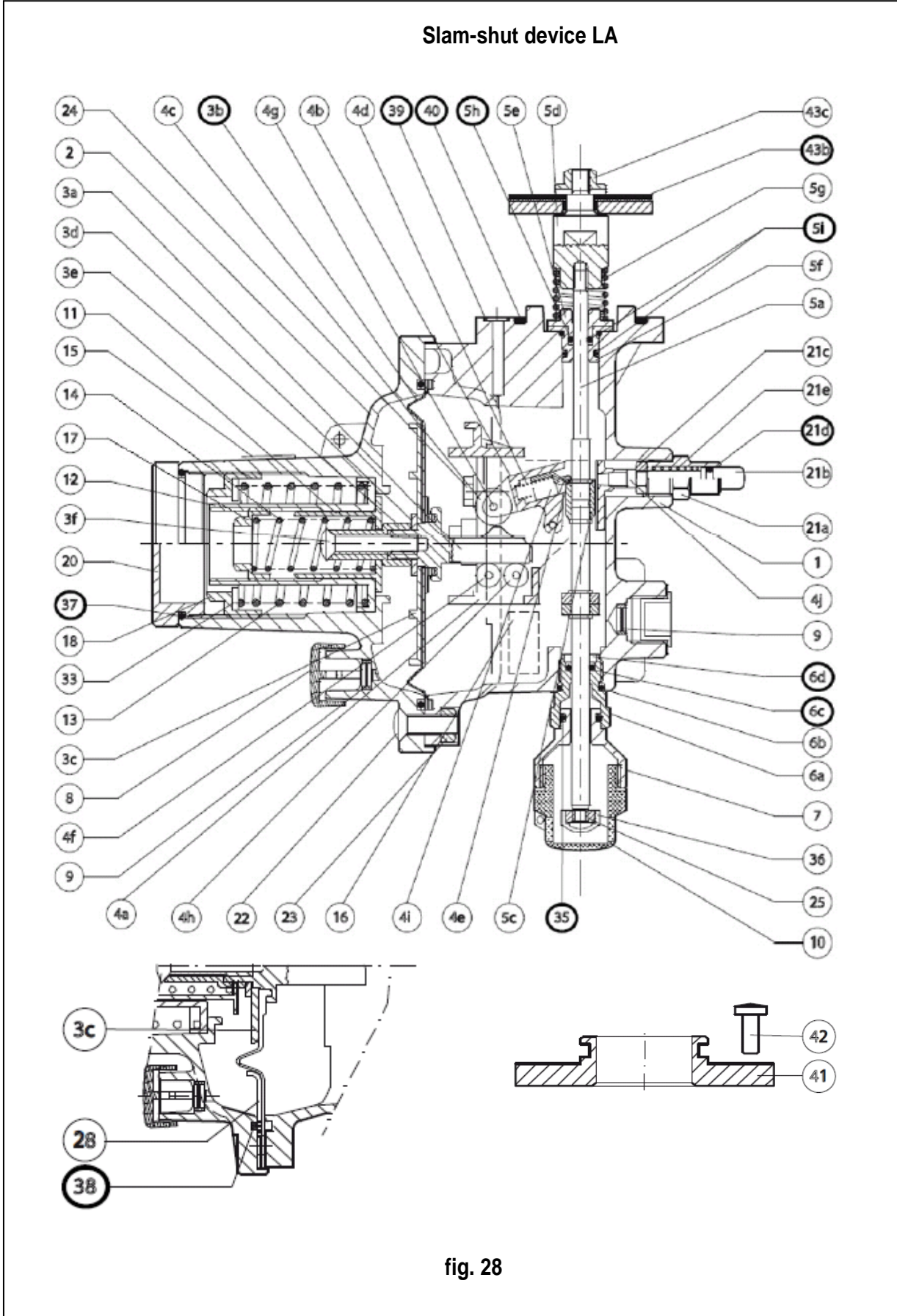


fig. 28

8.0 FINAL OPERATIONS








8.1 LEAK TESTS AND CALIBRATIONS

- 1) Open the inlet shut-off valve of the regulator very slowly and check using a foaming agent or similar:
 - sealing of the outside surfaces of the regulator;
 - sealing of the slam-shut valve;
 - sealing of the inside surfaces of the regulator;
- 2) Operating very slowly, pull the specific bush pos.(7) of the slam-shut valve until only the internal bypass is open. Then pull until it reaches the coupling position;
- 3) Check sealing of the reinforced gasket of the regulator;
- 4) Open the outlet pressure relief valve of the regulator to create a small gas flow rate;
- 5) Screw in the internal adjustment ring nut pos.(28) for head $\varnothing 275$ or adjustment screw pos.(29) for $\varnothing 195$ version, until the desired setting value is reached;
- 6) Close the pressure relief valve to the atmosphere.

8.2 COMMISSIONING

- 1) Open the outlet shut-off valve very slowly and, if necessary, adjust the calibration value of the regulator by acting on the adjustment ring nut for $\varnothing 275$ head or the adjustment screw for $\varnothing 195$ head;
- 2) Attach the cap (29) for $\varnothing 275$ head or the locking nut (54) for $\varnothing 195$ head.

Tab. 10 TOOLS FOR MAINTENANCE OF TRIAS B/B – TRIAS B/M PRESSURE REGULATORS

		
Combination wrench	Adjustable wrench	Double ended bi-hex tubular socket wrench
Ch. 8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-41	L. 30	Ch. 8-9-10-11-12-13-14-15-16-17-18-19-20-24-26-27-36-46
		
Male hex key	Philips screwdriver	Flat headed screwdriver
Ch. 3-4-5-6-7-8-19	Ex.Ch PH 0 x 100 - PH 1x125 - PH 2x150	0.5x3x75 1.2x6.5x125
		
Circlip pliers		
Code 10÷25 19÷60		



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