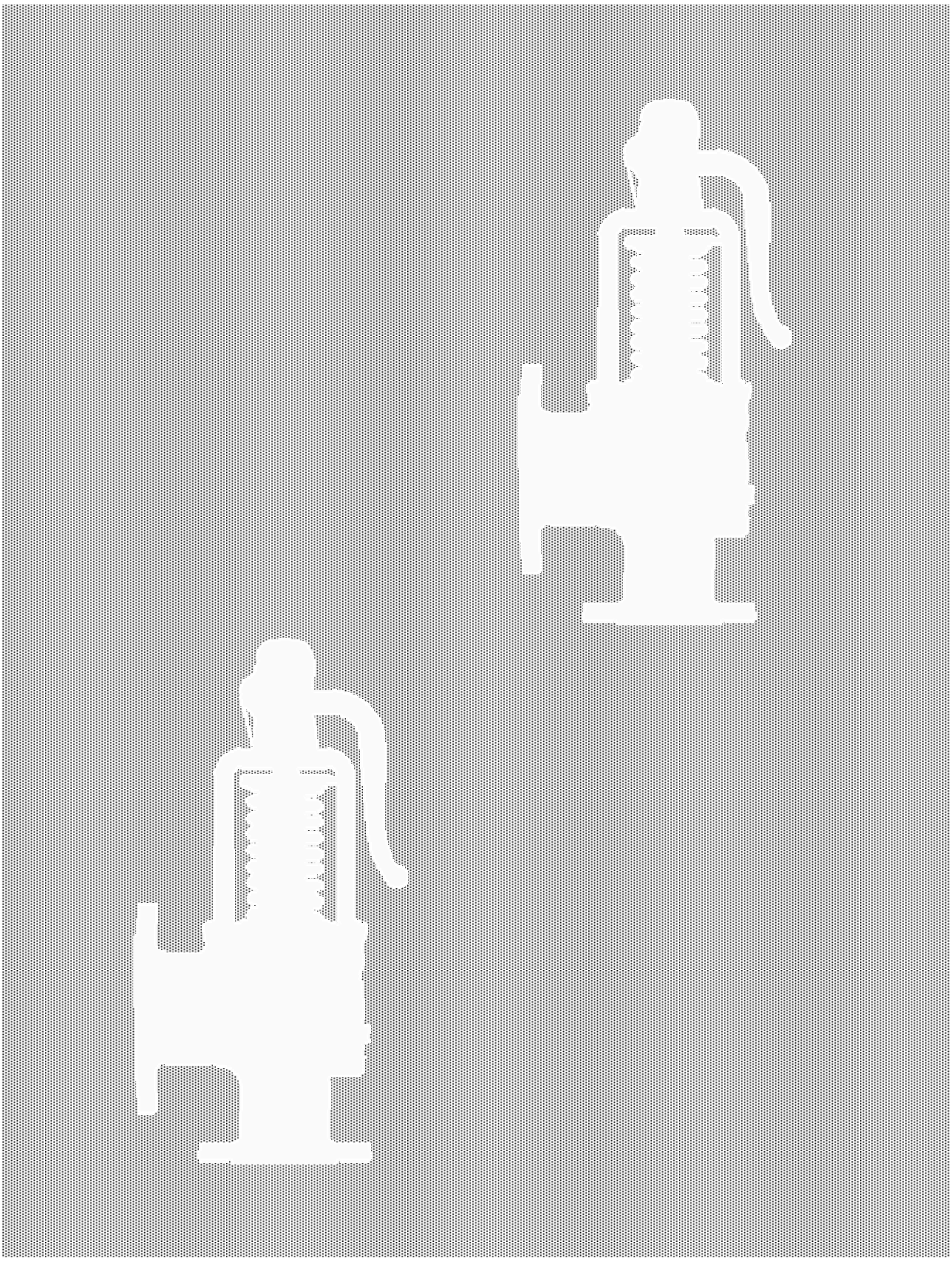
I N S T R U C T I O N S
For installing and servicing safety spring valves types CSV55 and CSV88



CARRARO® VALVOLE E STRUMENTAZIONE

20090 SEGRATE (MI)- via E.Fermi
E-MAIL: info@carrarovalvole.it
TEL.(02) 269912.1 - FAX.(02) 2692.2452

MAIN INDEX

1. GENERAL INFORMATION:

1.1 – RIGHT TO MAKE MODIFICATIONS AND "COPYRIGHT"

The regulations, standards, etc. mentioned in these operating instructions are based on the knowledge that was available when they were drawn up and are not subject to modification. Users are responsible for applying the latest versions of these.
The supplier reserves the right to make modifications and technical improvements to data and information whenever it sees fit. Under no circumstances may users require modifications or improvements to be made to valves that have already been delivered.

2. GUARANTEE

The scope and duration of the guarantee are indicated in the manufacturer's "General Sales Terms ".
The applicable conditions are those that were in force at the moment of delivery.

Amongst other things, the guarantee does not cover damage to valves deriving from the following:

° Ignorance or non-observance of these operating instructions!
° Insufficiently trained fitters, operators or maintenance men;
° Normal wear and tear;
° Incorrect or negligent use of the valves.

The manufacturer declines all liability for the following which are not covered by the guarantee:

° Non-observance of accident prevention regulations and/or safety legislation;
° Incorrect assembly, start-up or use;
° Improper or incorrect use, inappropriate use or different working conditions from those agreed.

Users are solely liable for physical injury and/or damage to property if the above is not observed.

3. VALIDITY OF INSTRUCTIONS

These instructions refer to the following types of safety valves:

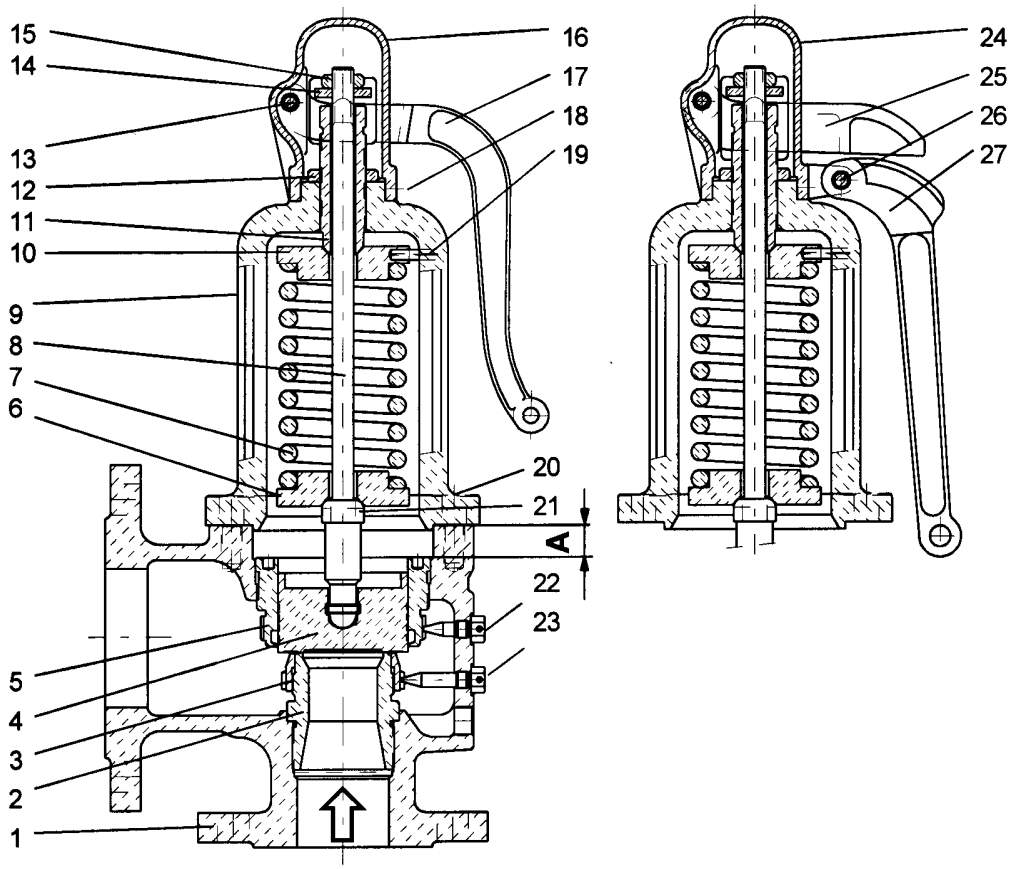
CSV55 - with cast-iron body - see Fig.1;
CSV88 - with steel body - see Fig.2.

The main difference between the two types is the nozzle which for CSV55 is threaded, screwed into the body and locked, while for CSV88 it is welded to the body at the inlet flange.
In both cases, the two pieces are a single component and cannot be separated; for major repairs to the nozzle, the valve must be sent to Carraro.
As regards installation and servicing, the two versions (CSV88 - CSV55) are similar and the regulations and suggestions apply to both.

Fig. 1 - *CSV55 Valve*

SINGLE-ACTING LEVER
(Orif. F-G-H-J-K-L-M)

DOUBLE-ACTING LEVER
(Orif. N-P-Q)



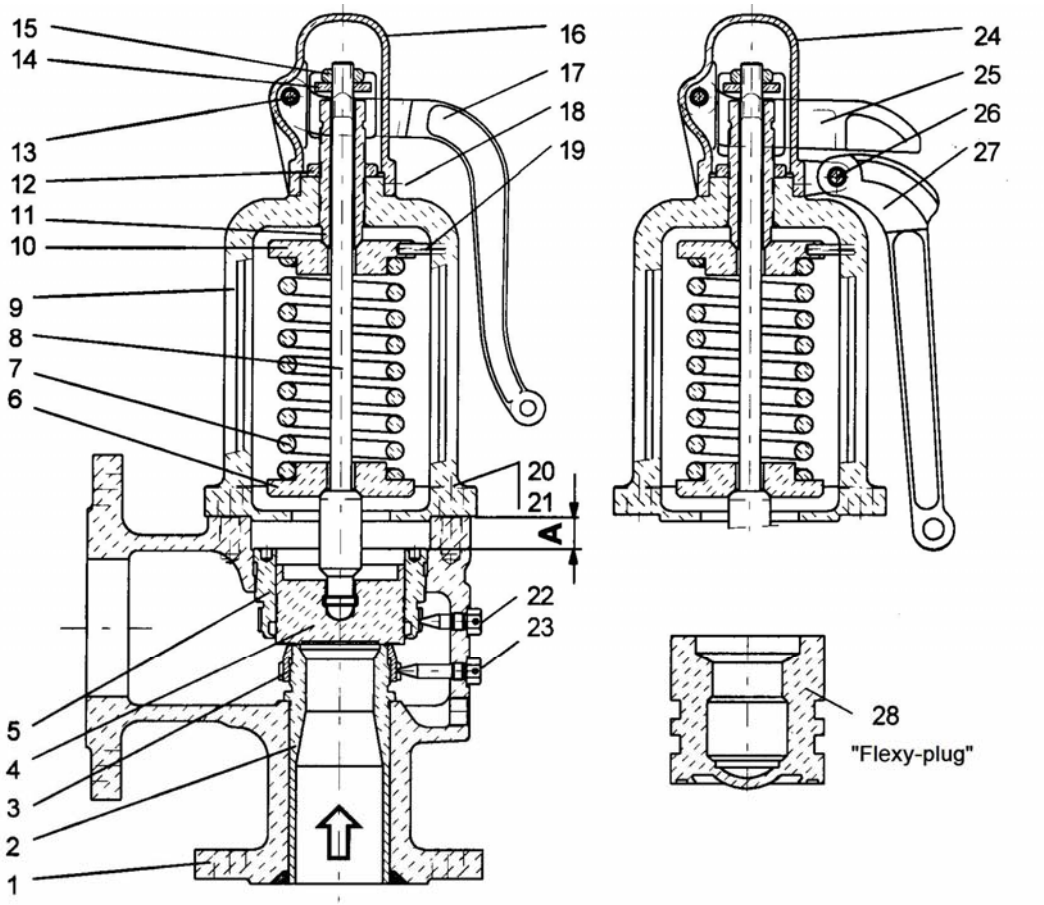
1 – Valve body
2 – Seat
**3 – Lower adjusting ring*
**4 – Disc*
5 – Upper adjusting ring
6 – Lower washer
7 – Spring
8 – Rod
9 – Frame
10 – Upper washer
11 – Calibration screw
12 – Calibration screw nut
13 – Pin for lever
14 – Nut for rod
15 – Lock nut
16 – Cap
17 – Lever
18 – Cap screw
19 – Pin
20 – Screw
**21 – Collar*
**22 – Upper adjusting ring screw*
**23 – Lower adjusting ring screw*
24 – Cap
25 – Intermediate lever
26 – Pin for lever
27 – Lever

* RECOMMENDED SPARE PARTS

Fig. 2 - *CSV88* Valve

SINGLE-ACTING LEVER
(Orif. F-G-H-J-K-L-M)

DOUBLE-ACTING LEVER
(Orif. N-P-Q)



1 – Valve body
2 – Seat
**3 – Lower adjusting ring*
**4 – Disc*
5 – Upper adjusting ring
6 – Lower washer
7 – Spring
**8 – Rod*
9 – FRame
10 – Upper washer
11 – Calibration screw
12 – Calibration screw nut
13 – Pin for lever
14 – Nut for rod
15 – Lock nut
16 – Cap
17 – Lever
18 – Cap screw
19 – Pin
20 – Stud
21 – Nut
**22 – Upper adjusting ring screw*
**23 – Lower adjusting ring screw*
24 – Cap
25 – Intermediate lever
26 – Pin for lever
27 – Lever
28 – "Flexy-plug"

* RECOMMENDED SPARE PARTS

4. PRODUCT SAFETY INDICATIONS AND TAG SYSTEM

If and where appropriate, safety indications have been put inside tags on the sides of the pages of this manual.
These rectangular tags are placed vertically (as shown in the following examples) and contain four different messages communicating:

- The level of risk;
- The nature of the risk;
- The effects of the risk on people or products;
- Instructions, if necessary, on how to avoid the risk.

The box at the top contains a warning word (DANGER – WARNING – CAUTION – ATTENTION) which indicates the level of risk.

The box in the middle contains a drawing indicating the nature of the risk and its possible effects on people and property. In some cases, the drawing may suggest what preventive measures can be taken, such as wearing safety clothing.

The box at the bottom may contains a message with instructions on how to avoid the risk. In the event of risks for people, the message may also contain a more precise definition of the risk and its effects on people.

1) DANGER – Immediate risk which will certainly cause serious injury or death.

2) WARNING – Risk or hazardous behaviour which may cause serious injury or death.

3) CAUTION – Risk or hazardous behaviour which may cause minor injury.

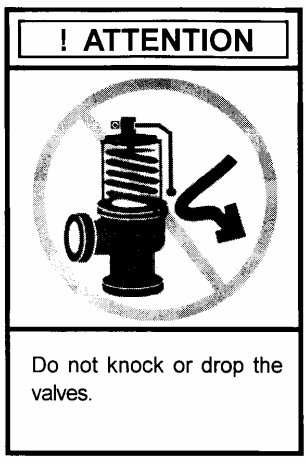
4) ATTENTION – Risk or hazardous behaviour which may cause damage to property.

1

2

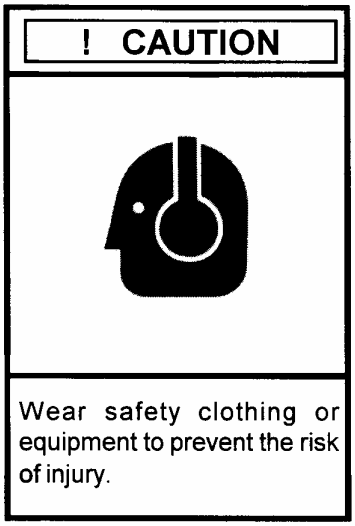
3

4



5. SAFETY WARNINGS

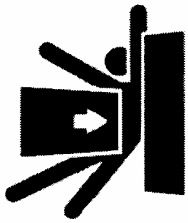
Thorough maintenance operations and overhauls are important for the safe and reliable operation of all valves.
The service procedures recommended by CARRARO and described in this manual are effective methods for carrying out maintenance operations. Some of these operations require the use of equipment that has been especially designed and built for this specific purpose. This equipment must be used as and when recommended.
Please note that this service manual contains various warning and caution notices which should be read carefully in order to minimise the risk of injury to people or the possibility of using incorrect work methods which may damage the valves or make them unsafe. It is important to realise, however, that these warnings cannot be exhaustive.
CARRARO is unable to know, assess and inform customers or users of all the conceivable methods of performing maintenance operations and all the risks deriving from the use of such methods.
Consequently, CARRARO has not even attempted to start such a task. Therefore, whoever uses a service method or piece of equipment which is not recommended by CARRARO must make sure that neither his own or other people's safety, nor valve safety and performance are jeopardised by the chosen method.
In case of doubt about the method used, please contact CARRARO.
Testing, installing or dismounting the valves or accessories may cause you to come into contact with fluids at very high pressures or temperatures and/or corrosive or erosive and able to trigger potentially explosive atmospheres.
Therefore, take all safety precautions while testing, installing or dismounting the product; these include, wearing ear plugs, goggles and safety clothing, such as gloves, both in or near the work area.
Given the large number of conditions and circumstances that may arise while working on the products and the consequent risks deriving from the way this is done, CARRARO is not able to prevent all risks of injury to people and damage to property and can only help by asking you to take the utmost care and giving you the following safety suggestions.
Users of CARRARO products are responsible for training the staff that will use the product.
It is most important for these people to acquire a thorough knowledge of the instructions of the product, especially the ones contained in this manual.



6. SAFETY PRECAUTIONS

Always meet the current plant safety regulations together with the following indications:

! DANGER

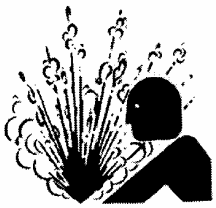


Decrease pressure and keep away from the discharge side when operating a valve in order to prevent serious injury or death.

! CAUTION

Wear suitable protection equipment in order to prevent injury.

! WARNING



Mark all possible discharge or leak points in order to prevent serious injury or death.

° Always decrease operating pressure before adjusting the valve. Always fit the stop screw before adjusting the rings. After adjustment, do not forget to remove the stop screw.

° When operating or testing a valve never remain on the discharge side of it.

° Use ear plugs when testing or operating a valve.

° Wear safety clothing. Hot water can burn you and overheated steam is invisible.

° When dismounting a safety valve, keep at a suitable distance from it and/or wear safety clothing to prevent being sprayed by any process fluid that may have accumulated inside.
Make sure the valve is isolated from any pressure source in the system before starting to dismount it.

° When examining a safety valve check for leaks.

° Before operating a valve, make sure no-one is in the vicinities. Even small quantities of steam escaping during operation may cause serious injury to people.

° When operating a safety valve for the first time, or after servicing, always be ready to release it with the lever, remaining at a distance in a sheltered place.
This can be done by pulling the lever with a suitably fixed piece of wire.

° Hitting a pressurised valve may cause it to release too early. Never hit a valve when the pressure of the system is near the calibration pressure of the valve.

° Inspect/service the safety valve *at least once every two years unless there is loss of fluid between the seats*.

° Please consult CARRARO before working on valve parts.

7. SAFETY VALVE TERMS

1 – Counterpressure – Counterpressure is the static pressure at the outlet of a safety device caused by the pressure existing (or formed) in the discharge system.

2 – Pressure drop (blow-down) - This is the difference between the actual pop opening pressure of a valve and the actual closing pressure. It is expressed as a percentage of calibration pressure, or in pressure measurement units.

3 - Minimum cross-section - This is the minimum net cross-section of the valve orifice or inlet (see points E.1.D.2, 1.7 Collection E - ISPESL).

4 - Diameter of the minimum cross-section – This is the minimum diameter of the valve inlet (see points E.1.D.2, 1.8 Collection E - ISPESL).

5 - Beating- Beating or hammering is an abnormal rapid and alternative movement of the moving parts of a safety valve, with the disc hitting the seat.

6 – Closing pressure – This is the decreasing static pressure value at the inlet at which the disc restores contact with the seat, thereby reducing valve lift to zero.

7 – Disc – The disc or shutter is the moving part of a safety valve which closes the valve and limits the pressure.

8 – Inlet diameter – This is the rated diameter of the inlet connector of a safety valve (unless otherwise specified).

9 – Rise – The rise is the actual movement of the disc with respect to the closing position when the valve discharges.

10 – Manual operating device – This is a device that is used to manually open a safety valve by applying a force which reduces the load of the spring which keeps the valve closed.

11 - Orifice – In Collection E of ISPESL, this is defined as the valve inlet (see E.1.D.2, 1.6) and it is the pressurised part comprising the inlet line up to (and including) the fixed part of the closing seats.

12 – Outlet diameter – This is the rated diameter of the outlet connector of a safety valve (unless otherwise specified).

13 – Overpressure – This occurs when pressure exceeds calibration pressure and is normally expressed as a percentage of calibration pressure.

14 - Popping pressure – This is value of increasing static inlet pressure at which the disc opens at a much higher speed than at higher or lower pressures. Popping only occurs in safety valves applied to compressible fluids.

15 – Pressure limiting device – This is any part of the safety valve which comes into contact with the pressurised fluid inside the protected container.

16 – Pressure retaining device – This is any part of the safety valve which exerts and undergoes stress while keeping one or more pressure limiting devices in position.

17 – Total rise – This is the rated rise at which a valve reaches its rated discharge capacity (flow).

18 – Popping safety valve – This is a safety device operated by inlet static pressure, featuring rapid opening or popping.

19 – Calibration pressure – This is the value of the inlet static pressure at which a popping safety valve performs the characteristic function described under the heading "popping pressure".
This pressure value is stencilled on the rating plate.

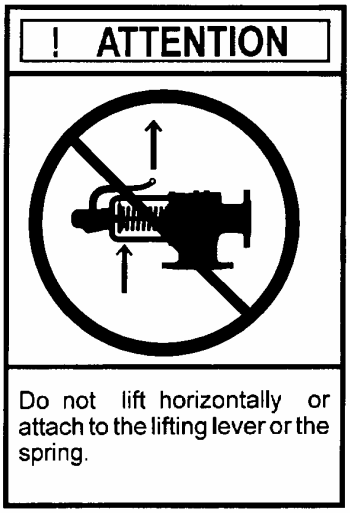
20 - Seat – The seat is the contact between the fixed and moving parts of the pressure limiting devices of a valve.

21 – Sealing pressure of the seat – This is the specified inlet static pressure at which a quantitative measurement test of the loss is made according to a standardised procedure.

22 – Seat diameter – This is the smaller diameter of the annular contact surface between the fixed and moving parts of the pressure limiting devices of a valve.

23 - Simmer – This is the audible or visible leak of fluid between the seat and the disc at an inlet static pressure which is lower than popping pressure and with an non-measurable rate of flow.

8. HANDLING, STORAGE AND OPERATIONS PRIOR TO INSTALLATION



Safety valves must be kept in a dry place to protect them from atmospheric conditions. They may only be removed from their crates or packing immediately prior to installation.

The flange protections and covers must be kept on until the last moment. Safety valves, whether packed or not, must not be subject to violent bumps.

This may occur if the safety valve is dropped when being loaded and unloaded from a lorry, or while being moved by mechanical equipment.
During lifting to the installation point, take care not to knock the valve against the metal structure or other objects.

Valves, whether packed or not, must always be kept upright, that is, never lying on one side, in order to prevent distortion and damage to internal parts.
Unpacked valves must be moved or lifted by winding a chain or hemp rope around the neck of the outlet connector and then around the upper part of the frame so as to make sure that the valve remains vertical during lifting and never horizontal.

Never lift the valve using the lever.
Never hook the spring to lift the valve.
Lift packed valves with the inlet flange at the bottom.

When unpacking the valves and removing the flange protectors immediately prior to installation, take great care to make sure that foreign bodies do not enter the valve inlet and outlet holes while it is being connected.

9. LIMITS TO USE

9.1 The Carraro *CSV55-CSV88* safety valves were not designed for use with cyclical loads.

9.2 Valves in non-alloy or low-alloy steel, for service in excess of 371 °C, and valves in alloy steel for service in excess of 510 °C have been used without faults at temperature gradients of up to 150°C/h; for higher values, please contact the CARRARO technical department.

9.3 The ***useful life*** of the safety valves Carraro CSV88 series is *20 years* from supply to final customers, except issues that may arise under specific environmental conditions and / or working unpredictable conditions and therefore not envisaged at the design stage. Useful life is guaranteed as long as the valves:1) are installed and maintained in accordance with the requirements outlined in this manual and maintenance; 2) pass the audit for verification of integrity (dimensional analysis and non destructive examination of pressure parts) at 10 years from supply to final customers. Of course if you detect a leakage of fluid (fluid loss through the sealing of the valve) for pressure less than 90% of set pressure, contact the manufacturer or its authorized centers to agree on a revision to restore the optimum conditions of operation.

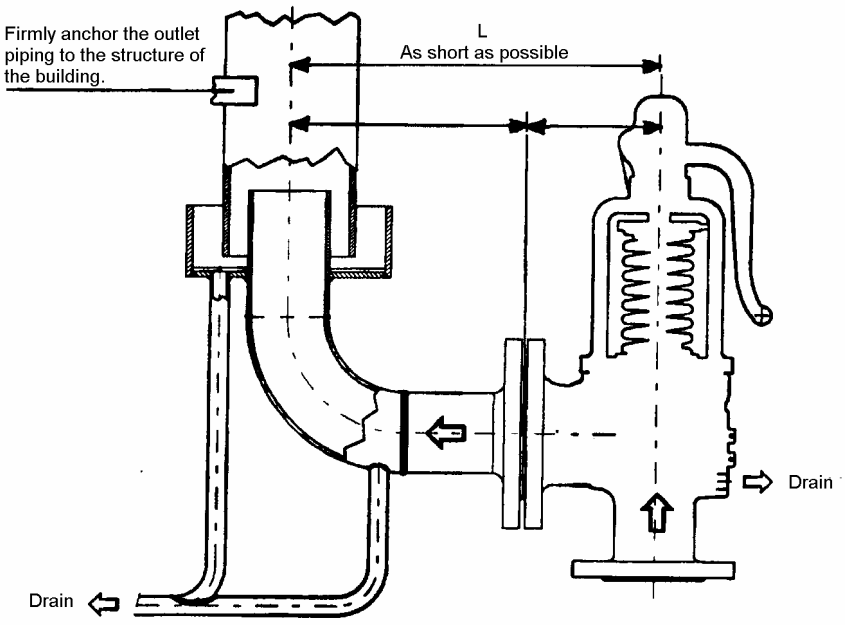
10. INSTALLATION RECOMMENDATIONS

1 – Valves can be used to:
a) Protect steam generators;
b) Protect steam or gas distribution networks or tanks, generally downline from the pressure reduction valves.

In both cases, please refer to the installation sketches in Fig. 3.

Fig. 3
INSTRUCTIONS FOR DISCHARGE PIPING

Distance L – As short as possible (gauge plus twice the diameter of the outlet piping). If the discharge piping is longer than the maximum indicated length, suitable supports must be fitted (so as not to exercise externally-generated forces on the valve, e.g.: expansion) to support the weight of the piping and the reaction forces caused by the discharge.



2 – The valves must be mounted vertically, directly on the equipment or piping being protected.

3 – No valve of any type must be installed between the safety valve and the manifold, or on the outlet pipe between the safety valve and the atmosphere.

4 – In no case may the valve inlet pipe have a smaller diameter than the rated dimension of the valve inlet and it must be no longer than three times its diameter.

5 – A high pressure drop at the valve inlet will cause rapid opening and closing which is known as "beating".
This may both reduce discharge capacity and damage the surface of the valve seats.

Very strong and prolonged beating may also cause damage to other parts of the valve. The following tips will help to eliminate the factors which cause beating:

a) The corners of the stub pipe on the manifold must be rounded with a radius not less than 1/4 of the diameter of the opening.

b) Pressure drops due to friction up to the valve inlet must not exceed half the rated closing pressure drop (Blow-down) for the valve.

To decrease the effects of this phenomenon, known as "resonance", proceed as follows.

a) install the valve at a distance of at least 8 - 10 diameters after a curve in the piping. This distance must be increased when the valve is installed in a horizontal section of the line preceded by a vertical section.

b) a safety valve must never be installed at less than 8 - 10 diameters both upline and downline from a Y-branch, whether converging or diverging.

c) If the layout of the piping makes it impossible or impractical to follow the above instructions, the corners downline from the stub pipe must be rounded more than the upline corners.
The radius of rounding of the downline corner must be equal to at least 1/4 of the flow diameter and will be gradually reduced so that a small part of the upline corner remains with a small rounding radius.

d) Never fit safety valves to the line directly opposite a branch.

Strong vibrations in the piping can modify the calibration of a safety valve. Vibrations can cause beating and therefore damage the valve and reduce its discharge capacity. They also contribute towards increasing the frequency of leaks from the seats.
Take great care to eliminate this problem before operating the valves on the system.

Steam flowing vertically from a discharge elbow causes a downward reaction on the elbow. Bending force on the valve is determined by the product of the reaction force multiplied by the arm of the moment between the steam outlet point and the section that is considered to be subject to bending.

When designing the overall system of a safety valve, the effects both of the reaction forces and of the vibrations and seismic loads on all the valve components and outlet piping must be considered.

To ensure perfect performance, regularly inspect and service the valve *at least once every two years unless there's loss of fluid between the seats.*
In order to do the above effectively, the valves must be easy to access.
There must be enough free space around the valve to allow access to the adjusting rings.
If one or two valves are mounted nearby, the outlets should be parallel in order to minimise the risk of injury to maintenance men.

Given that the foreign bodies entering and passing through a valve may cause serious damage, the entire system to which the valve is connected and tested must be inspected.
New systems may contain welding waste, slivers and fragments of pipes and other foreign bodies trapped inside the pipes during construction work. These are capable of destroying the seats the first time the valves open.
The system must therefore be carefully cleaned before starting to install safety valves.

When the inlet connection of a valve requires welding, the whole valve can be installed; it is not necessary to dismounts parts of it before welding. The valve neck, however, must be insulated during welding in order to reduce heat stress.
During the expansion process, insulation can also be used to reduce heat stress. During operation, the valve neck must be insulated at least as far its the connection point with the valve body.

Safety valves must be installed vertically.
Rated tolerance is 1 degree.

The cross-section of the outlet pipe of a safety valve must be at least equal to the cross-section of the outlet connection of the valve. If more than one valve is connected to one outlet pipe, its cross-section must be at least equal to the sum of the cross-sections of all the outlet connections of the valves in question.

All safety valves discharges must be conveyed piping that does not obstruct walkways or platforms. The outlet piping must be fitted with drains near the safety valves where water or condensate may collect. Each valve body is fitted with a service connector under the seat which is connected to a pipe conveying the discharge to a safe outlet area.

If a silencer is used on a safety valve, it must have a sufficient cross-section to prevent counterpressure from interfering with the performance and discharge capacity of the valve.
Silencers or any other pieces of equipment must be built in such a way as to prevent the outlet lines from being clogged by scale deposits.

The discharge and drain pipes must be installed in such a way as not to apply force on the safety valve as this could distort the body and cause leakage.
Please bear in mind the following points:

a) The outlet piping must not be supported by the valves.
The maximum weight applied to the valve outlet must be no more than that of a flange.
b) There must be enough air between the outlet pipe and the discharge line to avoid interference due to movements of the manifold, the valve and the outlet piping caused by heat expansion.
Movements due to vibrations, temperature variations and reaction forces on the valve must also be considered.
c) Metal hoses are not generally recommended; if they are used to connect the valve to the outlet line, they must be long enough and must be designed and installed in such a way as to never become rigid no matter how they are laid.
Safer results are obtained if hoses are installed to allow movements by bending rather than by stretching or axial compression.

Valves must always be lifted vertically. Valves may be lifted by tying a sling around the frame and the neck of the outlet flange.
Never lift a valve from its control lever. Do not hit or drop the valve during installation. If the valve drops, make sure it has not been damaged and check it is still correctly calibrated.

Immediately prior to installation, remove the protective covers on the valve inlet and outlet. Make sure that the inside of the valve is clean. No foreign bodies must enter the valve inlet and outlet as these may damage the valve components or fall into the manifold. Check all the seats to make sure they are clean and have no defects which could cause leaks. Burrs, scores, unevenness, etc. are all possible reasons for faulty seals.

Before mounting a valve, make sure that the gaskets are of the right size and pressure rating.
It is extremely important for the gaskets to be of the right size for the flanges and that the valve inlet and outlet remain perfectly unobstructed. The gaskets, sealing surfaces and hardware must be of the right pressure and temperature rating.

Please also bear in mind the following points:

a) Mount the inlet gasket, if present, to the manifold flange. Check it is clean, etc.. Where possible, use the flange studs to adapt the valve to the flange. Oil the studs with a suitable lubricant.

b) When mounting flanged valves, tighten the nuts of the bolts uniformly to prevent distortion, misalignment and imperfect seals.

c) After the valve has been positioned correctly, mount the nuts and tighten by hand. Then tighten each one little by little. As an extra precaution, while tightening the bolts, check the distance between the two flanges to make sure they remain parallel while being tightened against one another. Use a compass gauge to do this. Then carry out a general check to make sure that all the above requirements have been satisfied.

d) Now mount the outlet pipe. First, carefully check all the parts to make sure they are perfectly clean. Lubricate the bolts.

e) Mount the nuts on the outlet gasket. Tighten them by hand and then proceed as indicated in point c).

After checking the valve has been correctly mounted, connect the valve body drain pipe.
This pipe must also be perfectly flexible so as not to apply force on the valve under any operating conditions.

Before completing installation, make sure nothing obstructs the movement of the lifting lever.
Flanged valves can be installed without the need for insulation.

11. DETERMINING REACTION FORCES

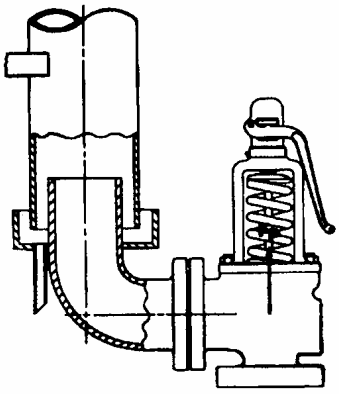


Fig. 1 - Valve closed

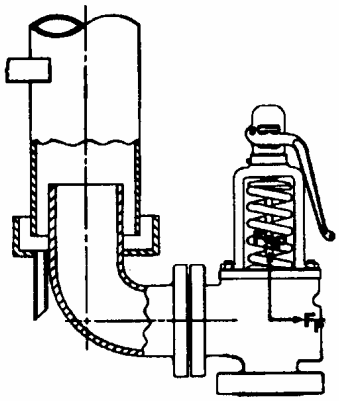


Fig. 2 - Valve opening

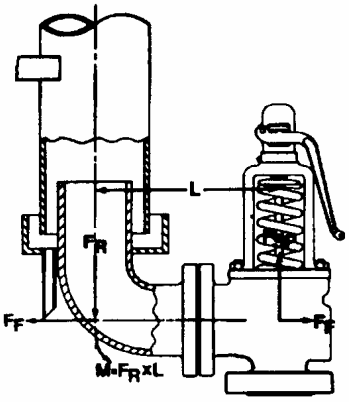


Fig. 3 - Valve opened and flow stabilised at full capacity

The figure on the left shows a *CSV88* safety valve in its various operating modes. When the valve is closed (*Fig. 1*), an upward force is exercised on the valve collar by to the internal pressure of the valve. Valve collars are built in such a way as to withstand the force (*Fp*) and tangential stress caused by internal valve pressure.

When the valve opens (*Fig. 2*), the force (*Fp*) remains constant until overpressure occurs.
The combined force of calibration pressure plus overpressure (*Fsp*) must be balanced by the opposing forces in the valve collar.

After the valve opens and before the fluid starts flowing through the outlet curve, a reaction force (F_F) acts laterally to the valve outlet. If the valve were not connected to the outlet line by a curve but discharged horizontally, this force would continue throughout the cycle and would be equivalent to F_R.

After stabilising the flow (*Fig. 3*), the impact of the fluid on the outlet curve cancels the force (F_F) and the fluid flows up towards the outlet; a downward force (F_R) is created along the centre line of the outlet curve.

This force, applied at a distance (*L*) from the centerline of the inlet connection, produces a bending moment in the valve collar and an axial force downward; this force must be compensated by a suitable clamping of valve to avoid that it weights on valve collar.

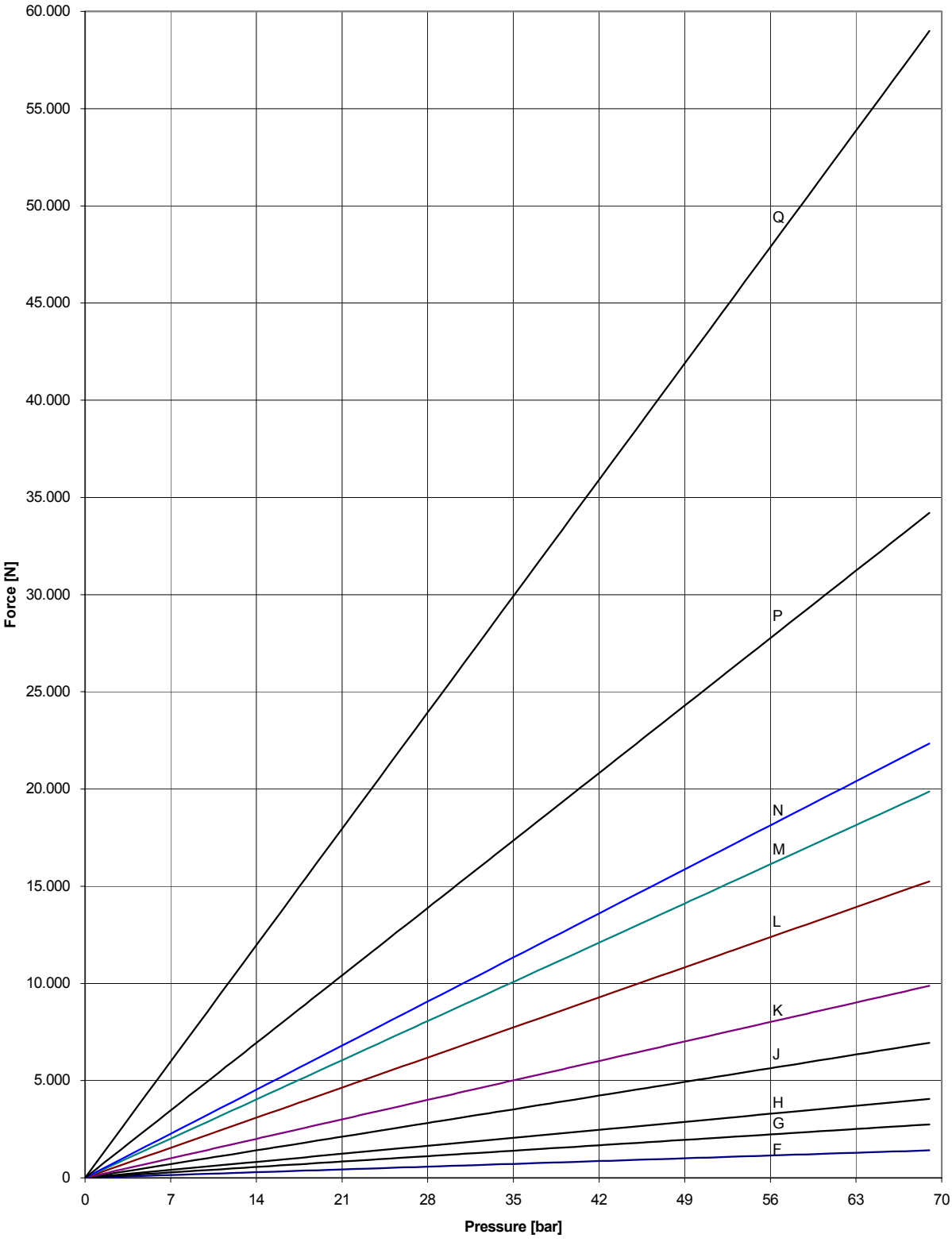
The force F_R is given by the equation:

$$FR = \frac{Q}{3600} \cdot V + 10PA$$

A= outlet area [cm^2]
Q= rate of flow in mass [Kg/h]
P= static pressure [bar]
V= speed [m/s]

In addition to the effective flow of the valve, the reaction force values are based on pressure, temperature and valve configuration.
When developing the table, we presumed that the valves discharged into an open system such as the atmosphere or curves with a drip collector. Therefore, for valves which discharge into a closed area or outlet lines with fixed pipes, variations in the reaction forces and the effects on nozzles, manifolds and outlet lines must be considered. The values of the forces indicated refer to valves installed according to this CARRARO use and maintenance manual.

Reaction forces for *CSV88* valves



12. VALVES INSTALLED OUTDOORS

Safety valves working in the best operating margin conditions, with a relatively stable ambient temperature, absence of dirt and relatively still ambient air, will provide the highest level of safety, sealing continuity and guarantee of good performance.
When a safety valve is installed outdoors, it is exposed to wind, rain, snow, ice, dirt and temperature variations.
The following operations are recommended in order to suitably protect the valve and ensure operative safety remains at similar levels to that of valves installed in perfect conditions.

1 – Insulate the valve body, including the inlet flange up to the lower part of the frame.
This will stabilise the temperature of the valve body and prevent variations in calibration pressure.

2 – Protect the valve against bad weather both as regards the spring (spring cover) and to prevent water or snow entering the valve body.

13. USING THE STOP SCREW

Safety valves protecting steam generators may have to undergo a hydraulic test.
Hydraulic test pressure is always higher than the calibration pressure of the safety valve.
As it is best not to alter the valve calibration, before performing the hydraulic test block the disk with the stop screw with bracket (see Fig.4).
To do this (see Figs.1 and 2), remove the seal and split pin, pull out the pin (13) and the lever (17 or 25), loosen the cap screw (18) and pull out the cap (16 or 24); then fit the stop screw with bracket to the frame (9) see Fig.4.
When blocking the safety valve, do not apply excessive force on the stem so as not to damage the seats of the disk and nozzle. Tightening the stop screw by hand is sufficient to ensure the valve does not leak even when the pressure rises above the calibration point.

ATTENTION!

Only use the stop screw when testing pressure is not less than 80% of calibration pressure.

FITTING THE STOP SCREW

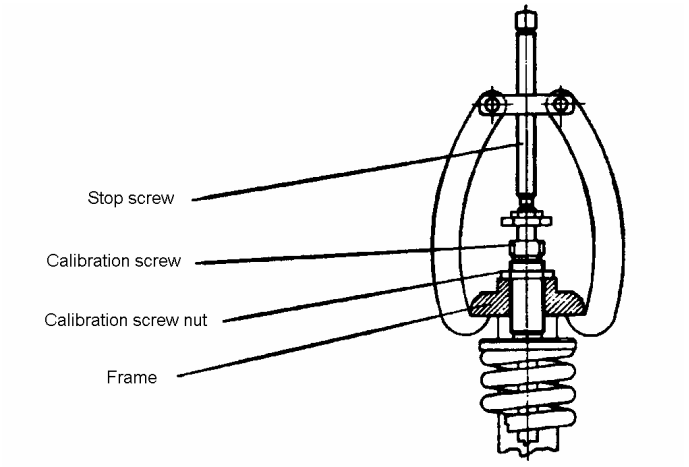


Fig.4

14. START-UP

ATTENTION!

The valve was factory-calibrated with compressed air at ambient temperature and atmospheric counterpressure, as established by ISPESL regulations, paragraph E.1.D.2, point 11.3, and by EN ISO 4126 point 3.2.1 and point 7. If the temperature is different from ambient temperature, recalibrate the valve to real operating conditions.

14.1 – CALIBRATION

To modify the calibration pressure of a safety valve, proceed as follows: (see Figs.1 and 2), remove the seal and split pin, pull out the pin (13) and the lever (17 or 25), loosen the cap screw (18), pull out the cap (16 or 24), loosen the safety nut (12) and turn the calibration screw (11) clockwise to increase calibration pressure.
Tighten the safety nut (12) and reassemble the various pieces.
Make sure that the lever (17 or 25) does not force the fork support nut (14) when this is near a column of the frame (9).
Play between the parts must be about 2 mm.
When calibration pressure is increased, the closing pressure drop will increase too, and vice-versa.
Wait (at least 30 minutes) between one test and the next to allow the spring to cool down.

14.2 – ADJUSTING THE CLOSING PRESSURE DROP (BLOW-DOWN)

When the reason why the safety valve opened has been eliminated, the pressure in the protected equipment begins to decrease. The valve always closes at a lower pressure than calibration pressure.
The difference between closing pressure and calibration pressure is simply defined as the CLOSING PRESSURE DROP (BLOW-DOWN) and is expressed as a percentage of the calibration pressure.

E.g.:

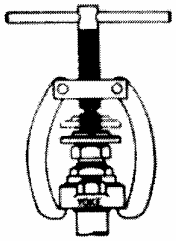
Calibration pressure: 10.0 bar
Closing pressure: 9.5 bar
CLOSING DROP 0.5 bar

That is, a closing pressure drop of 5%.
To correct or modify the size of the closing pressure drop, remove the upper reference screw (22) and use a screwdriver to turn the upper adjusting ring (4) by 10 or 20 notches at a time.
Turn the ring to the right to lift it and decrease the closing pressure drop.
Turn the ring to the left to obtain the opposite effect.
The closing pressure drop must be adjusted using the upper adjusting ring (4).
If the upper adjusting ring (4) is difficult to move due to impurities that have deposited in the thread, release it by lightly hitting the valve body. The lower adjusting ring (3) is factory calibrated and rarely requires recalibration.
After completing calibration operations make sure that the lower and upper reference screws (22 and 23) are blocked.

ATTENTION!

Before calibrating the valve, make sure that the operating pressure is less than the blow-down pressure so that the valve is completely closed.

! WARNING



Gag the valve while adjusting the rings in order to eliminate all risks of serious injury or death.

20090 SEGRATE (MI)- via E.Fermi
E-MAIL: info@carrarovalvole.it
TEL.(02) 269912.1 - FAX.(02) 2692.2452

15. OPERATING PROBLEMS

The most common problems are: leaks, hammering and blocking with the valve partially open.
Some problems are caused by wear or damage to internal components.

15.1 – STEAM LEAKS

If there is a very slight leak of steam (a hissing sound can be heard) when the pressure has almost reached the opening point, this is not a problem but just indicates that the sealing surfaces of the seats are slightly irregular.
A larger leak, instead, indicates that the seat is damaged or that the lower adjusting ring (3) is too low.
Try to eliminate the problem by lifting the lower adjusting ring (3); do this by moving it to the right just one notch at a time. Continuous leakage may also occur at normal operating pressure which is considerably lower than the closing pressure of the valve. These leaks may be caused by deposits of foreign bodies damaging the seats.
Discharge the valve a few times using the manual opening lever (17 or 27).
If this does not eliminate the problem, fit the stop screw with bracket for a few minutes as described for hydraulic testing in paragraph 11.
If the leak continues after the stop screw with bracket has been removed, get the valve repaired as soon as possible in order to prevent the seat from being seriously eroded.
Leaks can sometimes be caused by mechanical problems such as:
- insufficient play between the fork support nut (14) and the lever (17 or 25);
- deformation of the valve body due to uneven tightening of the inlet flange bolts or incorrect installation of the outlet pipe, both of which exert harmful stress on the valve.

15.2 – HAMMERING

Hammering is caused by the disc vibrating on the seat and must be eliminated immediately to prevent the seats from being ruined.
To eliminate hammering, keep the valve open with the manual opening lever (17 or 27) until the pressure has reached about 7-8% under the calibration value.
Hammering can be caused by:

1) insufficient closing pressure drop;
2) excessive counterpressure due to the outlet pipe being too small;
3) insufficient inlet flow.

15.3 – BLOCKING

Blocking with the valve partially open occurs during the closing phase.
The main reasons for this phenomenon are:

1) incorrect closing pressure drop;
2) mechanical friction.

If a valve blocks when it is partially open, turn the lower adjusting ring (3) to the left by one or two notches. When the ring lowers, the problem is eliminated.

15.4 - DROP IN CALIBRATION PRESSURE

Drops in calibration pressure are attributed, incorrectly in many cases, to the loss of elasticity of the spring.
Instead, it is invariably due to damage to the seats caused by foreign bodies, hammering or uneven heat distribution in the internal parts of the safety valve between one discharge and another.

16. PERIODIC SAFETY VALVE INSPECTIONS

A regular check and maintenance are referred in order to assure a perfect functional efficiency of the safety valves, *every two years unless there's loss of fluid between the seats.*

If the protected equipment is shut down, carry out the test immediately prior to shut-down in order to be able to perform any maintenance operations required.

ATTENTION!

Move the lever at a safe distance from the valve; do this by using a piece of string tied to the hole of the lever.

17. TROUBLESHOOTING

PROBLEM	POSSIBLE REASON	CORRECTIVE ACTION
THE VALVE DOES NOT RISE COMPLETELY	UPPER RING TOO HIGH	LOWER THE UPPER RING
	FOREIGN BODIES TRAPPED BETWEEN THE SHUTTER AND THE GUIDE	DISMOUNT THE VALVE AND ELIMINATE FAULTS. MAKE SURE THE SYSTEM IS CLEAN
INCORRECT CALIBRATION VALUE	CALIBRATION SCREW INCORRECTLY ADJUSTED	ADJUST THE CALIBRATION VALUE
OPENING HISS (SIMMER)	LOWER RING TOO LOW	LIFT UP THE LOWER RING
	LINE VIBRATIONS	INVESTIGATE AND ELIMINATE THE REASONS
THE VALVE LEAKS OR POPS OPEN IRREGULARLY	SEATS DAMAGED	DISMOUNT THE VALVE, LAP THE SEATS AND REPLACE THE SHUTTER IF NECESSARY
	BADLY ALIGNED COMPONENTS	DISMOUNT THE VALVE, INSPECT THE CONTACT AREA OF THE SEAT AND THE SHUTTER, LOWER SPRING GUIDE WASHER AND ROD. CALIBRATION SCREW, ROD CONCENTRICITY
	THE OUTLET PIPING FORCES THE VALVE OUTLET	CORRECT AS NECESSARY
THE VALVE BLOCKS WHEN OPENING OR DOES NOT CLOSE COMPLETELY	LOWER RING TOO HIGH	MOVE THE LOWER RING TO THE LEFT 1 NOTCH AT A TIME AND TRY AGAIN. REPEAT UNTIL THE PROBLEM HAS BEEN ELIMINATED
	FOREIGN BODIES	DISMOUNT THE VALVE AND ELIMINATE FAULTS. CHECK THE SYSTEM IS CLEAN
	INCORRECT PLAY BETWEEN SHUTTER AND GUIDE	CHECK TOLERANCE
EXCESSIVE OPENING PRESSURE DROP (BLOW-DOWN)	UPPER RING TOO LOW	LIFT THE UPPER RING
	EXCESSIVE COUNTERPRESSURE	REDUCE OUTLET PRESSURE BY INCREASING THE DIAMETER OF THE OUTLET PIPING
HAMMERING OR CLOSING PRESSURE DROP TOO SMALL	UPPER RING TOO HIGH	LOWER THE UPPER RING
	EXCESSIVE PRESSURE DROP IN THE INLET PIPING	REDUCE THE INLET PRESSURE DROP BY LESS THAN HALF THE REQUIRED BLOW-DOWN
	INCORRECT VALVE DIAMETER	CHECK THE SIZE OF THE VALVE

20090 SEGRATE (MI)- via E.Fermi
E-MAIL: info@carrarovalvole.it
TEL.(02) 269912.1 - FAX.(02) 2692.2452

18. MAINTENANCE

18.1 – SPARE PARTS

When ordering spare parts, quote the series number, type, size and calibration pressure of the valve and whether it is used with saturated or overheated steam, or another fluid.
Each cross-section drawing of the valves shows which spare parts should be kept in stock in order to carry out rapid repairs.

ATTENTION!

Before dismounting and servicing the valve make sure it is not pressurised.

18.2 – DISMOUNTING SAFETY VALVES

Remove the seal and the spit pin, pull out the pin (13) and the lever (17 or 25), loosen the cap screw (18), pull out the cap (16 or 24), unscrew the safety nut (12) and turn the calibration screw (11) anti-clockwise counting the number of turns (only until the spring (7) has released), loosen the screws or nuts (20), remove the frame (9), spring (7) and washers (6 and 10), unscrew the disc (4) of the rod (8) by turning it anti-clockwise to catch the internal thread. Remove the seal, loosen the upper reference screw (22) and before unscrewing the upper adjusting ring (5) identify its position by measuring the distance **"A"** (see Figs.1 and 2) between the upper surface of the upper adjusting ring and the valve body (1).
It is not necessary to change the position of the lower adjusting ring (3) unless repairs have to be made to the seat of the nozzle (2).
If the upper part of the lower adjusting ring (3) is higher than the surface of the seat of the nozzle (2), mark the lower adjusting ring (3) at the position of its reference screw (23) and turn it clockwise by one complete turn so that the lower adjusting ring (3) is lower than the surface of the seat of the nozzle (2).

18.3 – LAPPING THE SEATS

To true the sealing surfaces of the disc (4) and nozzle (2), use a smooth cast-iron ring (available from Carraro on request) and abrasive paste.
Never use the disc to lap the seat but always the above smooth cast-iron ring.

1) - keep the pieces clean;
2) - frequently apply new abrasive paste on the lapping ring;
3) - apply a very thin layer of abrasive paste on the lapping ring. This will prevent the edge of the seat from rounding;
4) - take care not to hit and dent the seat with the lapping ring;
5) - press the lapping ring uniformly onto the seat and rotate slowly in alternate directions.
When lapping the disc, keep the ring still and move the disc as described above;
6) - apply new paste frequently after removing the old paste;
7) - to check the lapping on the seat, remove all the abrasive paste from the seat and from the lapping ring. Polish the seat with the perfectly clean lapping ring using the above-described movements.
If there are any depressions in the sealing surface, they will appear matt in contract with the polished part. In this case, further lapping is required.
Bear in mind that for successful lapping, always use a lapping ring with perfectly flat surfaces; to remove shading, just a few minutes of lapping are required;
8) - any radial lines appearing after lapping can be removed by turning the lapping ring around its axis, after removing all the abrasive paste.
Carefully wash the seats with kerosene or the like and clean with tissue paper or a non-frayed cloth.
If the indentations in the seat or the disc are such as to require lapping deeper than 0.25 mm, return the valve to Carraro for repairs unless you have a workshop fitted out for this kind of work.
Bear in mind that when turning, all the profiles must be perfectly reproduced, otherwise the safety valve will not work correctly.

ORIFICE	Code	ORIFICE	Code
F	70 10 T0194	M	70 10 T0200
G	70 10 T0195	N – P	70 10 T0201
H	70 10 T0196	Q	70 10 T0202
J	70 10 T0197		
K	70 10 T0198		
L	70 10 T0199		

TYPE	GRAIN	FUNCTION
Tetrabor	400	GENERAL
Tetrabor	800	GENERAL FINISHING
Tetrabor	1000	POLISHING

* 2 lapping rings are recommended for each orifice

* Supplier PAMPADO V.le Espinasse, 8 Milan

18.4 – CHECKING AND SERVICING THE SPRINGS MOUNTED ON SAFETY VALVES

The surfaces of safety valve springs are protected by a treatment or lining that is suitable for the environmental conditions indicated by customers in their requests and orders.
If no specific indications are given, the installation environment is presume to be standard for factories without aggressive atmospheres, power stations or normal civil installations.
If they are installed outdoors, the valves are presumed to have been protected from bad weather.
The springs are normally aluminium coated or protected with aluminium paint.
They can be used for many years without being damaged or attacked.
During routine system maintenance, carefully check the surface of the springs.
If the surface protection is damaged, carefully brush the area in question and restore the protection.
Carboline paint N° 4631 (APSA - Milan) can be used for this.
If experience shows that the local atmosphere tends to rapidly attack the protection, further protect the painted surface with a layer of heat-proof protective grease.
Bear in mind that, in the long term, rust or corrosion can reduce the resistance of the spring and can form localised concentrations of force which may create breakage points that can cause the spring to yield.
It is therefore essential to check and service the surface of the spring in order to keep the safety valve in perfect working order.

19. REMOUNTING

19.1 – Check the adjusting rings to make sure they rotate freely.
To free the adjusting rings (3 and 5), pour solvent oil or boiling water into the thread and hit it with a piece of hard wood.
After freeing the adjusting rings and cleaning the threads, put them back in their original positions and restore the distance "A" Figs. 1 and 2.
Lubricate the threads and ball joints on the rod (8) and the compression spring (11) with Molikote paste or the like.
Keep the rod-disc joint (8-4) perfectly clean and lubricated with a thin layer of Molikote.
Make sure that the support surfaces of the frame and the body are perfectly clean. Uniformly tighten the screws or nuts (20).
Restore the compression of the spring (7) by tightening the calibration screw (11) by the same number of turns used to decompress it during dismounting.
When remounting the manual lifting mechanism, make sure that the lever (17 or 25) does not force the fork support nut (14) when this is near a column of the frame.
Clearance between the parts must be about 2 mm.

ATTENTION!

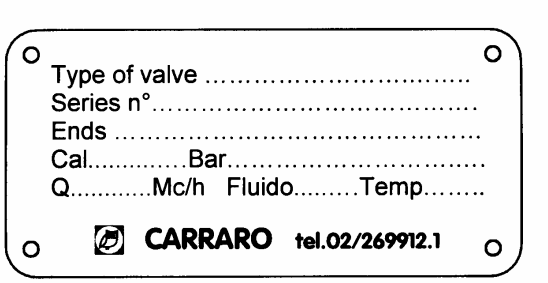
When welding piping, do not attach the earth connector to the valve as this may damage important sliding parts.

20. REPAIRS

20.1 If the table in point 17 does not allow you to eliminate the problems, send faulty valves to the supplier/manufacturer, together with a description of the problem.

20.2 In order to receive spare parts or information, always quote the series number shown on the rating plate attached to the valve or punched on the outer surface of the flanges.

20.3 Name plate (*example*)



20.4 To ensure the valves treated in this manual work correctly, *they should be serviced by Carraro engineers or by Carraro-authorised Service Centres using original spare parts*.

ATTENTION!

The external adjustment devices of all safety valves are sealed. Immediately prior to delivery, the valves are sealed by CARRARO or the control body. These seals must be applied so that the valves cannot be adjusted without breaking them. The unauthorised breakage of seals will make the guarantee null and void.

ATTENTION!

The maker declines all liability for modifications to the product or operations that are not contemplated in this manual.