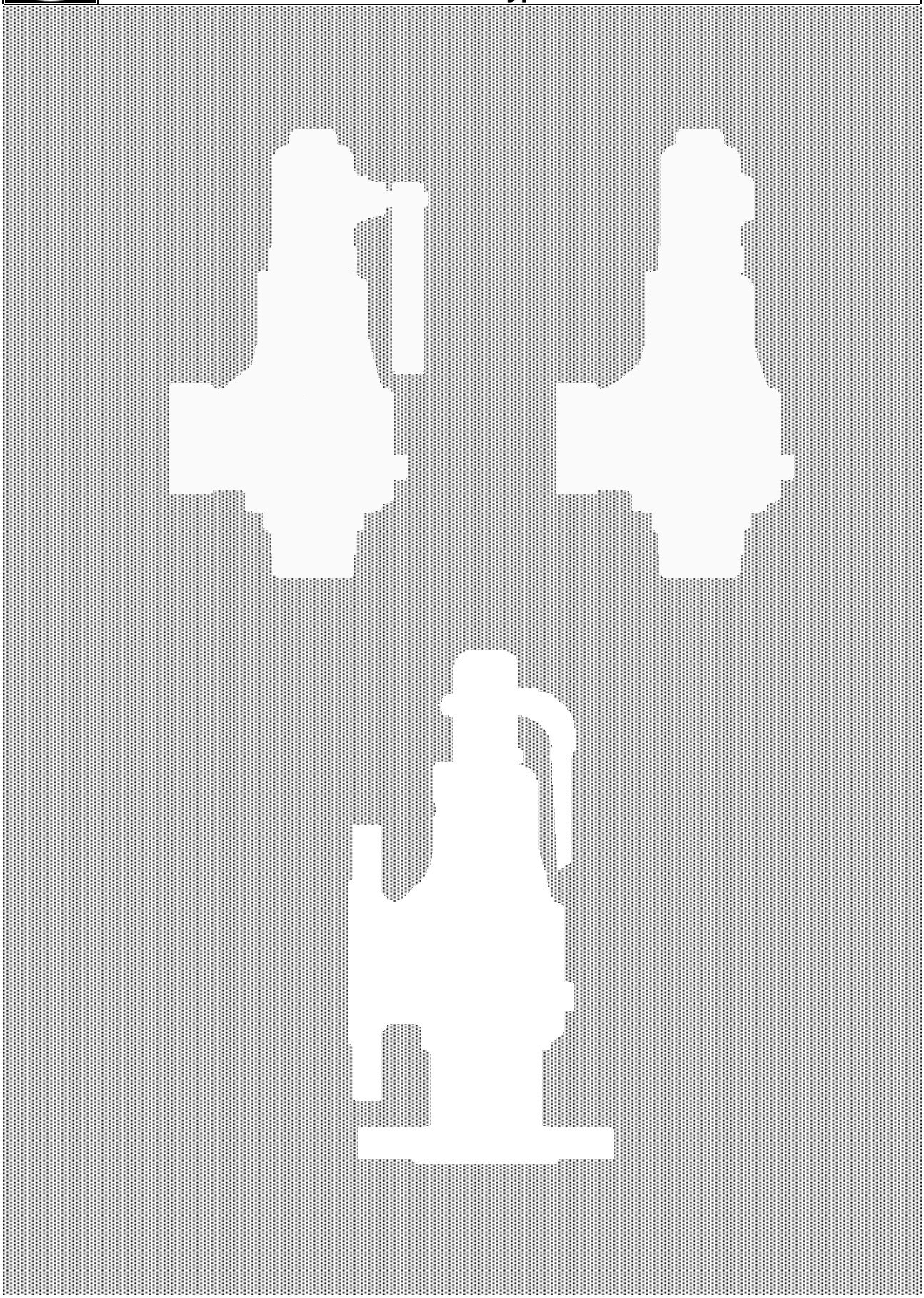
I N S T R U C T I O N S
For installing and servicing safety spring valves series CS types 30 - 31



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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 Conditions of Sale".
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:

CS 30 – with open frame (not sealed). Flanged (Fig.1) or threaded (Fig.2).
The CS 30 valves are always fitted with a lever and a disc with a metal or resilient gasket.
CS 31 - with closed frame (sealed).
- Flanged with lever (Fig.3) or without lever (Fig.4),
- Threaded with lever (Fig.5) or without lever (Fig.6).
Disc with a metal or resilient gasket.

Each valve is marked with the following alphanumerical code:
CS = Carraro Safety
30 = Valve with unsealed frame
31 = Valve with sealed frame
D-E-F-G-H-J = Orifice
G = Valve with cast iron frame
A = Valve with carbon steel frame
I = Valve with stainless steel frame
S =Valve with threaded ends
F =Valve with flanged ends
1-2-3 = Version
L = Valve with lifting lever
E = Resilient gasket
Example: **CS 31 F / G S 1 L**
CS 31 valve with F orifice, cast iron frame, threaded ends, standard version, lever.

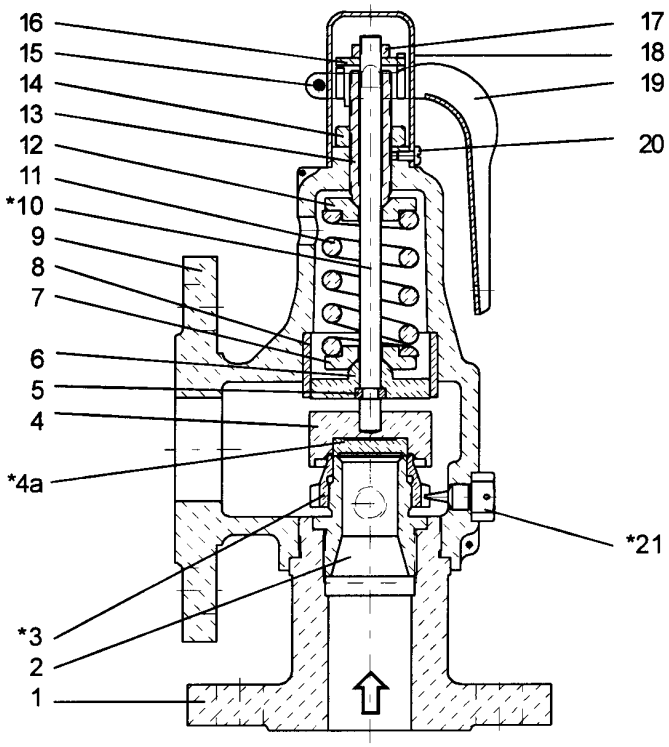


Fig.1 - Valvola tipo CS 30 (Attacchi flangiati)
CS 30 type valve (Flanged ends)

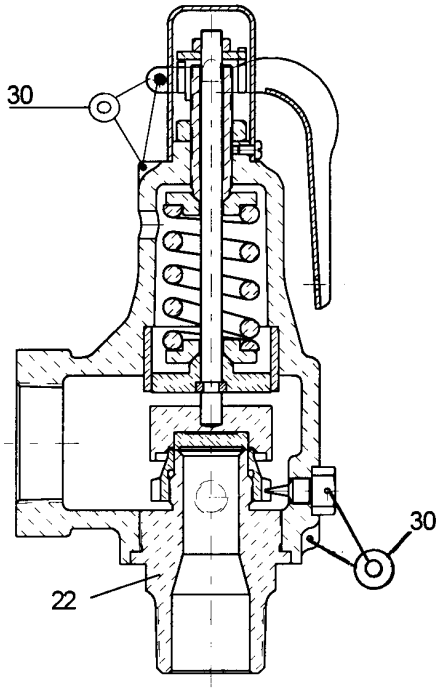
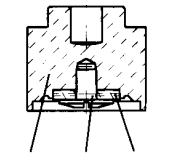
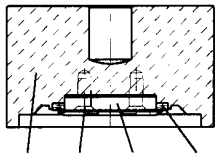


Fig.2 - Valvola tipo CS 30 (Attacchi filettati)
CS 30 type valve (Screwed ends)

PART. "A" - TAPPI A TENUTA ELASTICA
RESILIENT TIGHTNESS DISC



Per orifici tipo:
For orifice type:
" D - E - F "



Per orifici tipo:
For orifice type:
" G - H - J "

1 - Corpo valvola / *Valve body*
2 - Sede / *Nozzle*
*3 - Anello regolazione / *Adjusting ring*
4 - Portatappo / *Holder*
*4a - Tappo / *Disc*
5 - Anello per asta / *Stem ring*
6 - Pistone / *Piston*
7 - Piattello inferiore / *Lower washer*
8 - Guida / *Guide*
9 - Incastellatura / *Bonnet*
*10 - Asta / *Stem*
11 - Molla / *Spring*
12 - Piattello superiore / *Upper washer*
13 - Vite di taratura / *Compression screw*
14 - Controdado / *Lock nut*
15 - Perno leva / *Lever pin*
16 - Dado per asta / *Stem nut*
17 - Dado / *Nut*
18 - Cappello / *Cap*
19 - Leva / *Lever*
20 - Vite / *Screw*
*21 - Vite anello regolaz. / *Adjusting ring*
22 - *pin*
*23 - Corpo-Sede / *Nozzle-body*
*24 - Tappo / *Disc*
*25 - Vite guarnizione / *Gasket screw*
*26 - Guarnizione / *Gasket*
*27 - Tappo / *Disc*
*28 - Vite / *Screw*
*29 - Piattello guarnizione / *Gasket plate*
30 - Sigillo

* RICAMBI CONSIGLIATI / *RECOMMENDED SPARE PARTS*
N.B.:I gruppi di partic.(23, 24, 25) e (26, 27, 28, 29) sono fornibili in unico set.
Note: *Part units (23, 24, 25) and (26, 27, 28, 29) are supplied in one set only.*

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TEL.(02) 269912.1 - FAX.(02) 2692.2452

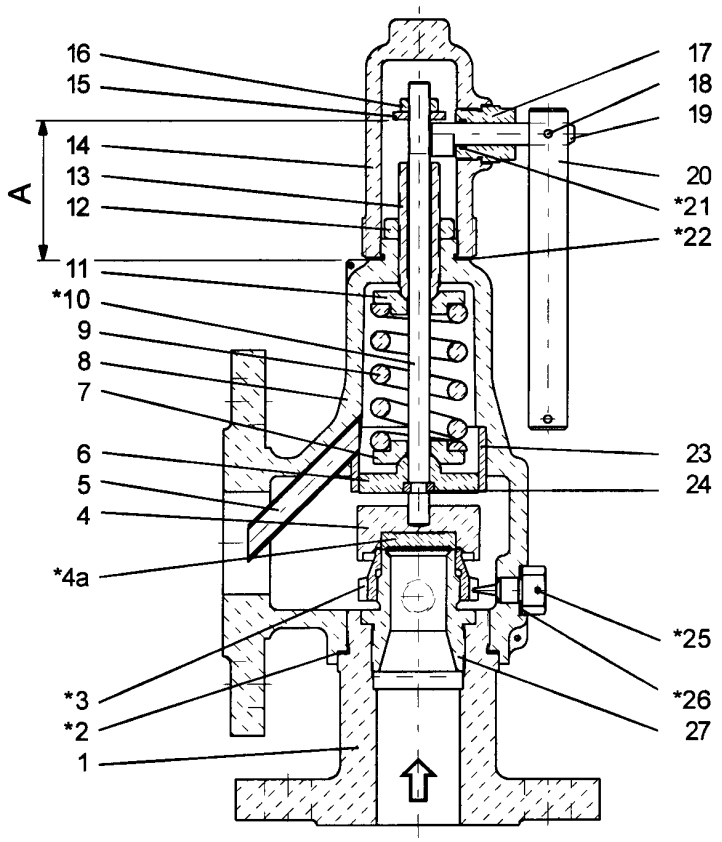


Fig.3 - Valvola tipo CS 31 (Con leva)
CS 31 type valve (With lever)

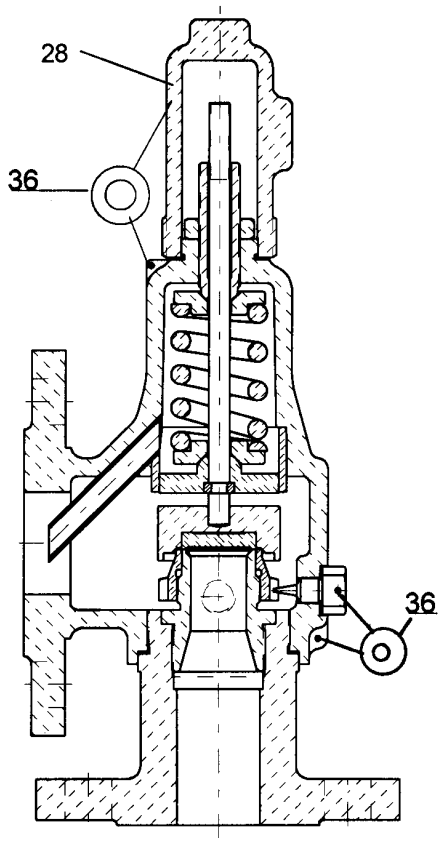


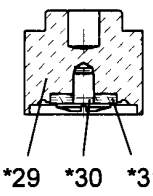
Fig.4 - Valvola tipo CS 31 (Senza leva)
CS 31 type valve (Without lever)

1 - Corpo valvola / *Valve body*
*2 - Guarnizione / *Gasket*
*3 - Anello regolaz. / *Adjusting ring*
4 - Portatappo / *Holder*
*4a - Tappo / *Disc*
5 - Tubo eiettore / *Eductor tube*
6 - Pistone / *Piston*
7 - Piattello infer. / *Lower washer*
8 - Incastellatura / *Bonnet*
9 - Molla / *Spring*
*10 - Asta / *Stem*
11 - Piattello superiore / *Upper washer*
12 - Controdado / *Lock nut*
13 - Vite di taratura / *Compression screw*
14 - Cappello / *Cap*
15 - Dado per asta / *Stem nut*
16 - Dado / *Nut*
17 - Manicotto / *Sleeve*
18 - Perno leva / *Lever pin*
19 - Albero comando / *Control shaft*
20 - Leva / *Lever*
*21 - Guarnizione / *Gasket*
*22 - Guarnizione / *Gasket*
23 - Guida / *Guide*
24 - Anello per asta / *Stem ring*
*25 - Vite anello regol. / *Adj. ring pin*
*26 - Guarnizione / *Gasket*
27 - Sede / *Nozzle*
28 - Cappello / *Cap*
*29 - Tappo / *Disc*
*30 - Vite guarniz. / *Gasket screw*
*31 - Guarnizione / *Gasket*
*32 - Tappo / *Disc*
*33 - Vite / *Screw*
*34 - Piattello guarn. / *Gasket plate*
*35 - Guarnizione / *Gasket*
36 - Sigillo

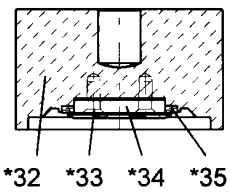
* RICAMBI CONSIGLIATI / *RECOMMENDED SPARE PARTS*
N.B.: I gruppi di partic.(29, 30, 31) e (32, 33, 34, 35) sono fornibili in unico set.
Note: *Part units (29, 30, 31) and (32, 33, 34, 35) are supplied in one set only.*

PART."A" - TAPPI A TENUTA ELASTICA
RESILIENT TIGHTNESS DISC

Per orifici tipo:
For orifice type:
" D - E - F "



Per orifici tipo:
For orifice type:
" G - H - J "



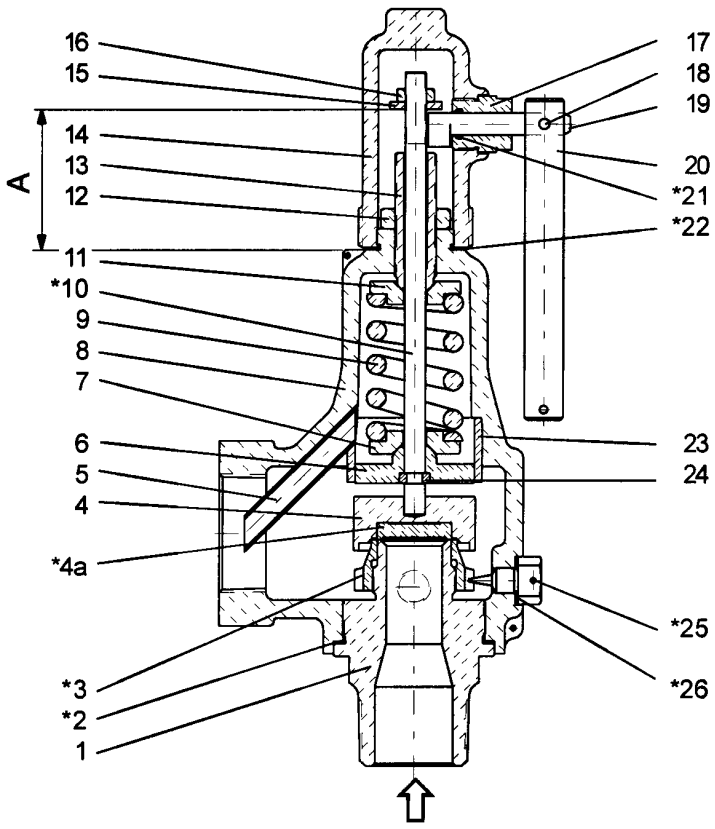


Fig.5 - Valvola tipo CS 31 (Con leva)
CS 31 type valve (With lever)

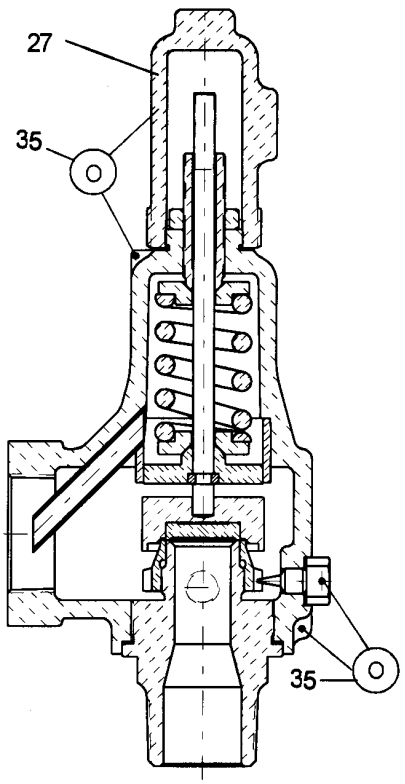


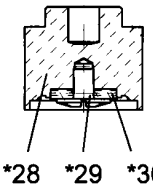
Fig.6 - Valvola tipo CS 31 (Senza leva)
CS 31 type valve (Without lever)

1 - Corpo-Sede / *Nozzle-body*
*2 - Guarnizione / *Gasket*
*3 - Anello regolaz. / *Adjusting ring*
4 - Portatappo / *Holder*
*4a - Tappo / *Disc*
5 - Tubo eiettore / *Eductor tube*
6 - Pistone / *Piston*
7 - Piattello infer. / *Lower washer*
8 - Incastellatura / *Bonnet*
9 - Molla / *Spring*
*10 - Asta / *Stem*
11 - Piattello superiore / *Upper washer*
12 - Controdado / *Lock nut*
13 - Vite di taratura / *Compression screw*
14 - Cappello / *Cap*
15 - Dado per asta / *Stem nut*
16 - Dado / *Nut*
17 - Manicotto / *Sleeve*
18 - Perno leva / *Lever pin*
19 - Albero comando / *Control shaft*
20 - Leva / *Lever*
*21 - Guarnizione / *Gasket*
*22 - Guarnizione / *Gasket*
23 - Guida / *Guide*
24 - Anello per asta / *Stem ring*
*25 - Vite anello regolazione / *Adjusting ring pin*
*26 - Guarnizione / *Gasket*
27 - Cappello / *Cap*
*28 - Tappo / *Disc*
*29 - Vite guarniz. / *Gasket screw*
*30 - Guarnizione / *Gasket*
*31 - Tappo / *Disc*
*32 - Vite / *Screw*
*33 - Piattello guarnizione / *Gasket plate*
*34 - Guarnizione / *Gasket*
35 - Sigillo

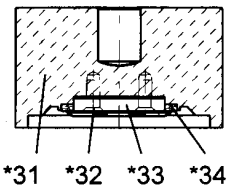
* RICAMBI CONSIGLIATI / *RECOMMENDED SPARE PARTS*
N.B.: I gruppi di partic. (28, 29, 30) e (31, 32, 33, 34) sono fornibili in unico set.
Note: *Part units (28, 29, 30) and (31, 32, 33, 34) are supplied in one set only.*

PART."A" - TAPPI A TENUTA ELASTICA
RESILIENT TIGHTNESS DISC

Per orifici tipo:
For orifice type:
" D - E - F "



Per orifici tipo:
For orifice type:
" G - H - J "



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 the event of risks for people, the drawing may suggest what preventive measures can be taken, such as wearing safety clothing.

The box at the bottom may contain 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.

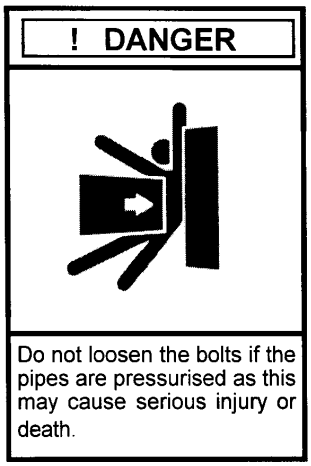
1) DANGER – Immediate risk which will certainly cause serious injury or death.

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



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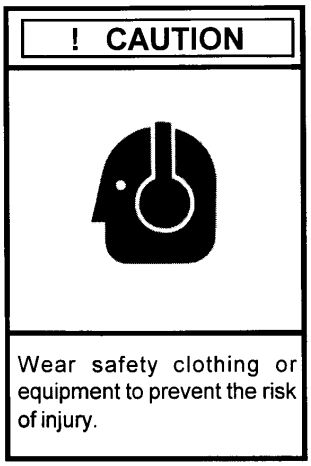

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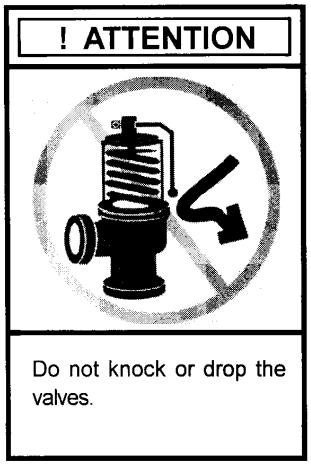

5. SAFETY WARNINGS

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.
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 extremely 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 observe the current plant safety regulations together with the following indications:

° Always decrease operating pressure before adjusting the valve.

° 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 scald 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.

° Take care when examining a safety valve 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.

° Please consult CARRARO before working on valve parts.

7. SAFETY VALVE TERMINOLOGY

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 effective pop opening pressure of a valve and the effective 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, 1.6, 1.7 1.8 Collection E - ISPESL).

4 - Diameter of the minimum cross-section – This is the minimum diameter of the valve inlet.

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 mobile part of a safety valve which closes the valve and limits the pressure.

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

9 – Rise – The rise is the effective 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 that 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 effective contact with the pressurised fluid inside the protected container.

16 – Pressure retaining device – This is any part of the safety valve which exercises 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 (rated 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 mobile 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 mobile parts of the pressure limiting devices of a valve.

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

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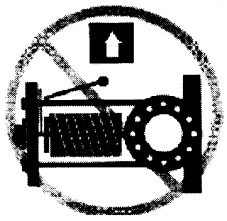
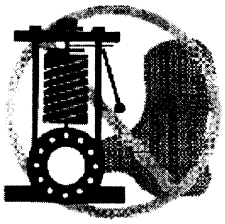
8. TRANSPORT, STORAGE AND HANDLING

! ATTENTION



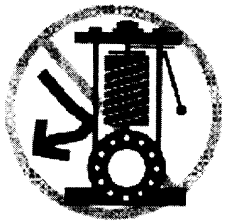
Do not lift horizontally or attach to the lifting lever or the spring.

! ATTENTION



Do not allow foreign bodies to entering the valve inlet and outlet.

! ATTENTION



Handle with care.
Do not drop or knock.

8.1 Transport

Depending on their size, safety valves can be transported loose, packed in cardboard boxes or in wooden crates.
All the valve ends are fitted with covers to prevent dirt from entering. Packs can be placed on pallets if required. Follow all and any indications written on the packaging.

ATTENTION!

Operators moving loads must take all necessary precautions to prevent accidents.

8.2 Storage

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 knocks.
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.

8.3 Handling

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.

ATTENTION!

When handling the valve, make sure the work area is kept clear in order to prevent injury to people and damage to property

Unpacked valves must be moved by hand or lifted by winding a chain or hemp rope around the neck of the outlet end and then around the upper part of the frame so as to make sure that the valve remains vertical during lifting and is never horizontal.

ATTENTION!

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

Use a hand-held trolley to move and position the valve inside the work area, or a forklift truck for large valves.
During lifting to the installation point, take care not to knock the valve against the metal structure or other objects.

ATTENTION!

If the valve is knocked violently, have it checked by CARRARO before installing it.

9. LIMITS TO USE

9.1 The Carraro CS30 / CS31 safety valves were not designed for use with cyclical loads.

9.2 The CS30 / CS31 valves were designed for use at temperatures below the limits at which viscous flow phenomena occur.

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 diagram in Fig. 7A – 7B – 7C – 7D

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 – An elevated 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.

Fig. 7A
CS30 valves used with condensable vapours or gas.

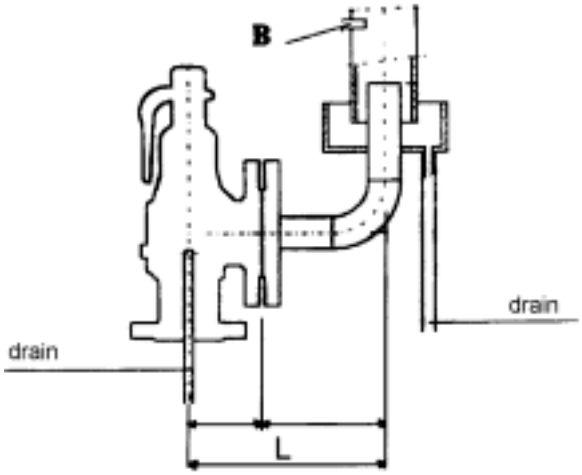


Fig.7B
CS30 and 31 valves used with non-condensable vapours or gas.

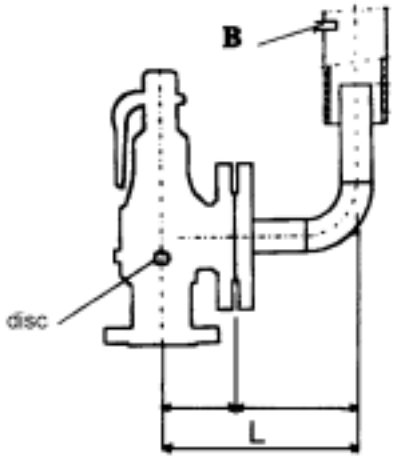


Fig. 7C
CS31 valves used with liquids or hot or overheated water.

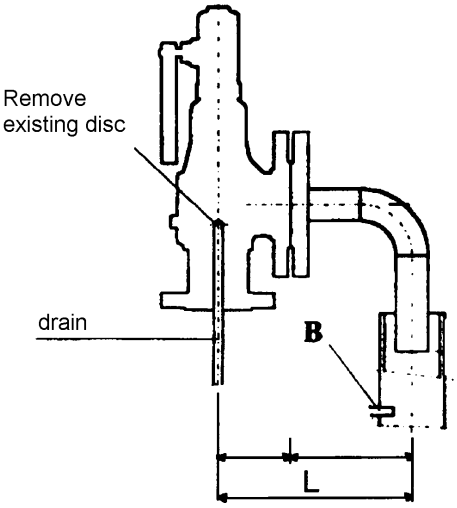
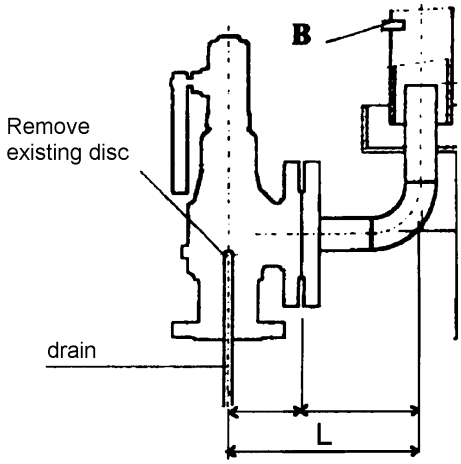


Fig.7D
CS31 valves used with condensable vapours or gas.



PRECAUTIONS FOR OUTLET 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.
Detail B – Firmly anchor to the structure of the building.

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 a regular control and maintenance service must be performed.
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.

The 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 valve discharges must be conveyed along 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 exceeding 25% of calibration pressure so as not to interfere with the 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 with 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 be inside 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 the 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 to adapt to 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.
For valves with threaded ends, screw in and tighten the nuts on the inlet stub pipe using belt or chain wrenches, gripping the valve on the cylindrical part of the frame.
Never suddenly tighten the valve or knock it. Never use lever or pipe wrenches. Any gaskets or products used to improve the seal of the inlet end threads must not obstruct or deposit in the valve inlet duct. The same applies when tightening the discharge pipe.

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11. DETERMINING REACTION FORCES

The figure on the left shows a CS30/31 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.

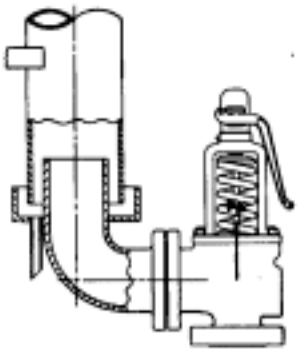


Fig.1 - Valve closed

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.

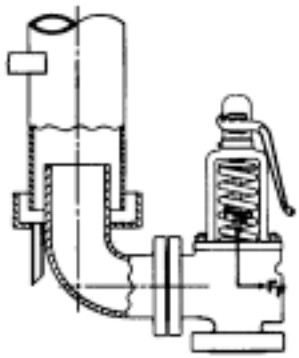


Fig.2 - Valve opening

After the valve opens and before the fluid starts flowing through the outlet curve, a reaction force (FF) 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 FR.

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

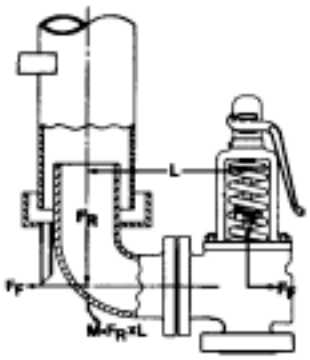


Fig.3 - Valve open flow stabilised at full capacity

This force, associated with the arm (L), produces a bending moment in the valve collar. It also produces an unbalanced downward force on the manifold (if present) to which the valve is connected; this force must be compensated by the spring bracket or another system.

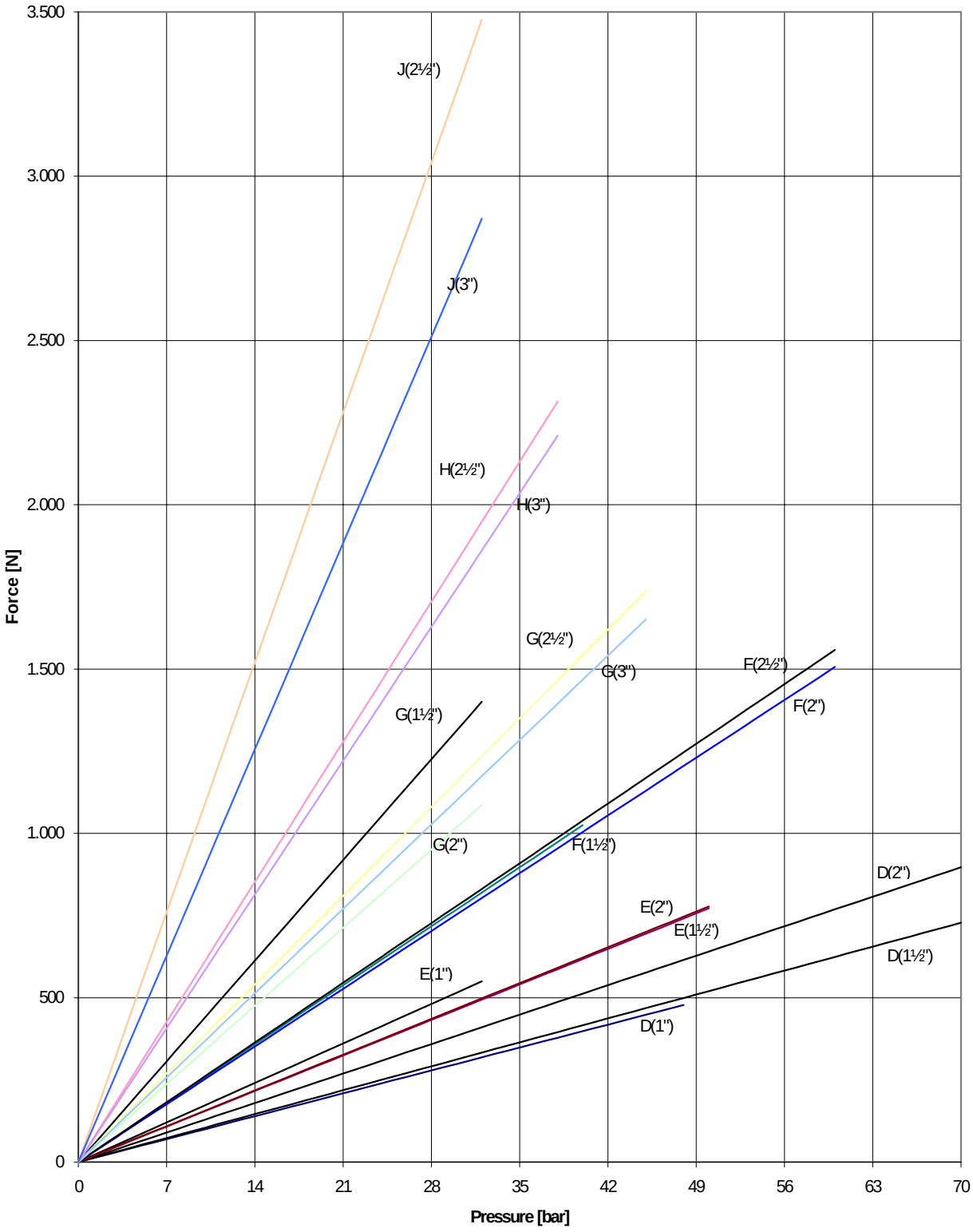
The force FR is given by the equation:

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

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 CS 30/31 valves

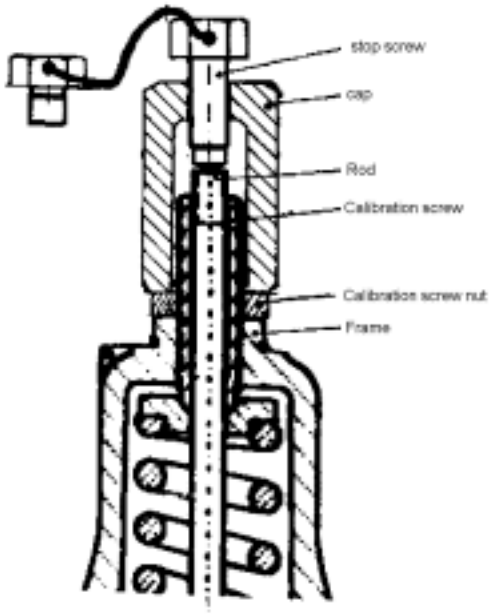


12. USING THE STOP SCREW

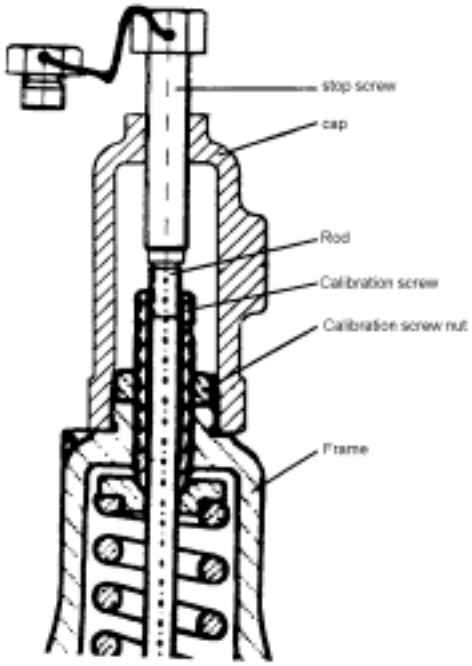
Safety valves protecting steam generators may have to undergo a hydraulic test.
Hydraulic test pressure is always higher than the calibration pressure of the safety valve.
As it is best not to alter the valve calibration, before performing the hydraulic test block the disk with the stop screw with bracket (see Figs.9-10).

ATTENTION

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



CS 30 **Fig.9**



CS 31 **Fig.10**

Fit the stop screw as follows:

CS 30 Figs.1 e 2
1. Remove the seal 30 and the split pin,
2. Pull out the pin 15 and the lever 19.
3. Loosen the cap screw 20,
4. Pull out the cap 18
5. Screw the cap onto the calibration screw until it touches the calibration screw nut
6. Tighten the stop screw.(Fig.9)

CS 31 Fig.3-5
1. Remove the seal
2. Pull out the pin 18 and dismount the lever 20
3. Pull out the sleeve 17 with the related gasket 21
4. Remove the drive shaft 19
5. Screw up the cap 14
6. Mount the cap with the stop screw. (Fig.10)

CS 31 Fig.4-6
1. Remove the seal
2. Dismount the cap 28
3. Mount the cap with the stop screw. (Fig.10)

ATTENTION

Tightening the stop screw by hand is sufficient to ensure the valve does not leak even when the pressure rises above the calibration point.

13. STARTING SYSTEM

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. If the temperature is different from ambient temperature, recalibrate the valve to real operating conditions.

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.

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14. CALIBRATION

14.1 Calibrating safety valves with lifting lever, type: CS 30 (Figs.1-2)

To adjust calibration pressure, proceed as follows:
a) Remove the seal, if present, and the split pin on the lever pin.
b) Pull out the lever pin (15) and the lever (19).
c) Unscrew the screw from the cap (20).
d) Loosen the lock nut (14) and turn the calibration screw (13) clockwise to increase calibration pressure and anti-clockwise to decrease calibration pressure.
e) Tighten the lock nut (14) and reassemble the various pieces.
f) Make sure the lever (19) does not push against the nut (16); play between the two parts must be about 1.5 mm.

14.2 Calibrating safety valves with airtight lifting lever, type: CS 31 (Figs.3-5)

To adjust calibration pressure, proceed as follows:
a) Remove the seal, if present, and the pin (18).
b) Pull off the lever (20).
c) Unscrew the sleeve (17) and remove the drive shaft (19).
d) Pay attention to the gasket (21).
e) Loosen the lock nut (12) and turn the calibration screw (13) clockwise to increase calibration pressure and anti-clockwise to decrease calibration pressure.
f) Tighten the lock nut (12).
g) Screw up the cap (14) until it comes to rest against the gasket (22)
h) (make sure it is not damaged) positioning it so that the threaded hole for the lever is on the opposite side to the valve discharge.
i) Reassemble the various parts of the lever (17÷20), making sure that the gasket (21) is not damaged, that the cam of the drive shaft is facing downwards with a play of about 1.5 mm with the nut (15). The above is easy to check as the lever must move freely for a short distance. If this does not happen, adjust the nut and lock nut (15 and 16).

14.3 Calibrating safety valves without lifting lever, type: CS 31 (Figs.4-6)

To adjust calibration pressure, proceed as follows:
a) Remove the seal, if present, and unscrew the cap (28) in Fig.4 or (27) in Fig.6.
b) Loosen the lock nut (12) and turn the calibration screw (13) clockwise to increase calibration pressure and anti-clockwise to decrease calibration pressure.
c) Tighten the lock nut (12) and reassemble the cap (28) in Fig.4 or (27) in Fig.6.

15. ADJUSTING THE CLOSING PRESSURE DROP (BLOW-DOWN).

When the reason why the safety valve opened has been eliminated, the pressure in the protected equipment starts decreasing. 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 modify blow-down, remove the lock nut from the adjusting ring (21) in Figs.1 and 2, or (25) in figures 4-6 and use a pointed tool to turn the adjusting ring 1 or 2 notches at a time. Turn the ring anti-clockwise to lift it and increase the closing pressure drop; turn the ring clockwise to obtain the opposite effect. If the adjusting ring (4) is difficult to move due to impurities that have deposited in the thread, release it by lightly hitting the frame near the ring.
After completing calibration operations make sure that the seal, if present, is applied.

16. OPERATING PROBLEMS.

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

16.1 – Fluid leaks.

16.1.1 Fluid leaks in valves with lifting lever, type: CS 30

Normal operating pressure must always be at least 10% lower than calibration pressure, otherwise the sealing force exercised by the spring on the disc will be so weak that a slight pressure peak is sufficient to cause a leak. If there is a very slight leak of fluid (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. 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 (19). If this does not eliminate the problem, 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 nut (16) and the lever (19), deformation of the valve body due to the incorrect installation of the outlet pipe, both of which exert harmful stress on the valve.

16.1.2 Fluid leaks in valves with airtight lifting lever, type CS 31 : (Figs.3-5)

The contents of paragraph 14.1.1, referring to (20) for the lever and (15) for the nut (Figs.3 and 5), also apply to these valves.

16.1.3 Fluid leaks in valves without lifting lever, type CS 31 : (Figs.4-6)

Normal operating pressure must always be at least 10% lower than calibration pressure, otherwise the sealing force exercised by the spring on the disc will be so weak that a slight pressure peak is sufficient to cause a leak. If there is a very slight leak of fluid (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. Continuous leakage may also occur at normal operating pressure which is considerably lower than the closing pressure of the valve.

16.2 Hammering.
Hammering is caused by the disc rapidly opening and closing on the seat and must be eliminated immediately to prevent the seats from being ruined. Hammering can be caused by:
1) - insufficient closing pressure drop.
2) - inlet pipe too long or diameter of end too small.
3) - insufficient flow.
4) - excessive counterpressure due to the outlet pipe being too long or its cross-section being too small.
5) - obstruction or clogging of the external discharge hole on the frame of CS 30 type valves.
6) - obstruction of the eductor tube (5) in Figs.3÷6 for CS 31 type valves.
If the valve is fitted with a lever, hammering can be stopped by keeping the valve open with the lever until the pressure falls by about 7÷8% below calibration pressure.
If the valve has no lever, lower the pressure by adjusting the system upline from the valve. In both cases, immediately identify the reason for hammering and eliminate it.

16.3 Blocking.
Blocking with the valve partially open can occur 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, check for friction and eliminate it. If there is no friction, turn the adjusting ring to the left (clockwise) by one or two notches. When the ring lowers, the problem is eliminated.

16.4 Drop in calibration pressure.
Drops in calibration pressure are often attributed to the loss of elasticity of the spring.
Except in exceptional circumstances, it is 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. Carefully check for leaks before adjusting calibration. Do not repeat tests at brief intervals but first allow the valve to cool.

17. PERIODIC SAFETY VALVE INSPECTIONS.

To make sure the safety valves continue to work correctly, they must be tested at regular intervals. Do this by opening them manually with the lifting lever; during testing, the pressure in the system must be at least 80% of the calibration pressure of the valve; open the valve just once for a brief period.
Testing frequency depends on the conditions of the system (greater or lesser probability of the valve getting dirty); for systems that are cleaned approximately every three months.
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.
For valves without levers, the system operator must periodically check valve operation by increasing the pressure on the valve, depending on system availability.

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.

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18. TROUBLESHOOTING

PROBLEM	POSSIBLE REASON	CORRECTIVE ACTION
THE VALVE DOES NOT RISE COMPLETELY	ADJUSTING RING TOO LOW	LIFT UP THE 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)	RING TOO LOW	LIFT UP THE 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	RING TOO HIGH	LOWER THE 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)	RING TOO HIGH	LOWER THE RING TO THE LEFT 1 NOTCH AT A TIME AND TRY AGAIN. REPEAT UNTIL THE PROBLEM HAS BEEN ELIMINATED
	EXCESSIVE COUNTERPRESSURE	REDUCE OUTLET PRESSURE BY INCREASING THE DIAMETER OF THE OUTLET PIPING
HAMMERING OR CLOSING PRESSURE DROP TOO SMALL	RING TOO LOW	LIFT UP THE RING TO THE RIGHT 1 NOTCH AT A TIME AND TRY AGAIN. REPEAT UNTIL THE PROBLEM HAS BEEN ELIMINATED
	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

19. MAINTENANCE

19.1 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.

20. DISMOUNTING SAFETY VALVES.

20.1 Dismounting safety valves with lifting lever, type:
CS 30 (Figs.1-2)

- Remove the seal, if present, and the split pin.
- Pull out the lever pin (15) and the lever (19).
- Pull out the screw (20) and remove the cap (18).
- Release the lock nut (17) and remove from the rod (10).
- Unscrew the nut (16).
- Remove the seal, if present, and unscrew the lock nut (21).
- Turn the adjusting ring (3) to the right until its touches the disc (4). Count and write down the number of notches the ring was moved by as it must be returned to its initial position when reassembling it.
- Loosen the lock nut (14) and unscrew the calibration screw (13) (anti-clockwise) counting the number of turns before the spring is completely released.
- Tighten the valve body in a clamp and loosen the connection between the valve body and the frame only using a belt wrench (never use pipe wrenches, or any other plumber's wrench as these could damage the frame).
- Unscrew and remove the frame from the valve body.
- Remove the disc (4a) and disc holder (4).
- Pull out the rod-washers-spring assembly. Take care not to lose the two half-rings (5) as they may leave their seat when the spring is released.
- Remove the adjusting ring (3) from the seat assembly (1) (Fig.1) or (22) (Fig.2).

20.2 Dismounting safety valves with airtight lifting lever, type:
CS 31 (Figs.3-5)

- Remove the seal, if present, and the spring pin (18). Pull off the lever (20).
- Unscrew the sleeve (17) and remove the drive shaft (19). - Pay attention to the gasket (21).
- Unscrew the cap (14).
- Release the lock nut (16) and remove it from the rod (10).
- Unscrew the nut (15).
- Remove the seal, if present, and unscrew the lock nut (25).
- Turn the adjusting ring (3) to the right until its touches the disc (4). Count and write down the number of notches the ring was moved by as it must be returned to its initial position when reassembling it.
- Loosen the lock nut (12) and unscrew the calibration screw (13) (anti-clockwise) counting the number of turns before the spring is completely released.
- Tighten the valve body (1) in a clamp and loosen the connection between the valve body and the frame (8) only using a belt wrench (never use pipe wrenches, or any other plumber's wrench as these could damage the frame).
- Remove the frame (8) from the valve body (1).
- Remove the disc (4a) and disc holder (4).
- Pull out the rod-washers-spring assembly. Take care not to lose the two half-rings (24) as they may leave their seat when the spring is released.
- Remove the adjusting ring (3) from the seat assembly (1).

20.3 Calibrating safety valves without lifting lever, type:
CS 31 (Figs.4-6)

- Remove the seal, if present, and unscrew the cap (28) in Fig.4 or (27) in Fig.6.
- Remove the seal, if present, and unscrew the lock nut (25).
- Turn the adjusting ring (3) to the right until its touches the disc (4). Count and write down the number of notches the ring was moved by as it must be returned to its initial position when reassembling it.
- Loosen the lock nut (12) and unscrew the calibration screw (13) (anti-clockwise) counting the number of turns before the spring is completely released.
- Tighten the valve body (1) in a clamp and loosen the connection between the valve body and the frame (8) only using a belt wrench (never use pipe wrenches, or any other plumber's wrench as these could damage the frame).
- Unscrew and remove the frame (8) from the valve body (1).
- Remove the disc (4a) and disc holder (4).
- Pull out the rod-washers-spring assembly. Take care not to lose the two half-rings (24) as they may leave their seat when the spring is released.
- Remove the adjusting ring (3) from the seat assembly (1).

20.4 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) proceed with lapping by pressing the ring uniformly onto the seat in all directions and rotating 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, light oil or carbon tretrachloride 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.

LAPPING RINGS

Orif.	Code
D	70 01 T0650
E	70 01 T0651
F	70 01 T0652
G	70 01 T0653
H	70 01 T0654
J	70 01 T0656

ABRASIVE PASTE

Type	Grain	Function
Tetrabor	400	General
Tetrabor	800	Finishing
Tetrabor	1000	Polishing

Two lapping rings are recommended for each orifice.

20.5 Discs with resilient gaskets

When the discs are fitted with resilient gaskets the metal seats on the body remain in a better state. If they are marked or worn, the contents of the previous paragraph apply.
If the resilient gaskets of the disc are marked, hollowed or in any way deteriorated, replace them. This is a quick and easy operation.

21. 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.
Springs housed inside a closed cover subject to temperature variations with the consequent possibility of humidity in the internal surfaces, or springs coming into contact with the liquids they contain, are more likely to suffer damage and must therefore be checked more frequently.
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.

22. REASSEMBLING SAFETY VALVES.

22.1 Reassembling safety valves with lifting lever, type:
CS 30 **(**Figs.1-2)

- Screw the adjusting ring (2) into the seat assembly (1) in Fig.1 or (22) in Fig.2 (the head of the ring must be flush with the seat).
- Lubricate the spring washers (7 and 12) on the conical section (in contact with the piston and calibration screw respectively), the lower tip of the rod (10) in contact with the disc (4) and the lower inner part of the screw (13).
- Insert the rod-washers-spring assembly taking care that the two half-rings (5) are firmly fitted in their seat.
- Mount the disc (4a) and disc holder (4) on the rod (10).
- Screw up the seat assembly (1) on the frame (9) and secure
- Tighten the calibration screw (13) until all play has been eliminated and add the same number of turns used to lift the screw when the valve was dismounted.
- Tighten the lock nut (14).
- Move the adjusting ring (3) to its original position as follows:

a) Use a sharp tool to slowly turn the ring to the right until it touches the disc (4).
b) Turn the ring to the left counting the same number of notches previously counted when dismounting the valve in order to return it to its original position.

- Tighten the reference screw (21) and put back the seal, if present.
- Mount the nut (16) and the lock nut (17).
- Temporarily mount the cap (18) and lever (19) making sure that there is a play of about 1.5 mm between the nut (16) and the lever.
- After checking the above, secure the nut and lock nut (16 and 17).
- Secure the cap, lever, pin (15) and split pin.
- Put back the seal, if present, to guarantee calibration.

22.2 Reassembling safety valves with airtight lifting lever, type:
CS 31 (Figs.3-5)

- Screw the adjusting ring (3) into the seat assembly (the head of the ring must be flush with the seat).
- Lubricate the spring washers (7 and 11) on the conical section (in contact with the piston and calibration screw respectively), the lower tip of the rod (10) in contact with the disc (4) and the lower inner part of the screw (13). Insert the rod-washers-spring assembly making sure that the two half-rings (24) are firmly fitted in their seat.
- Mount the disc (4a) and disc holder (4) on the rod (10).
- Screw the seat assembly into the frame (8) and secure it.
- Tighten the calibration screw (13) until all play has been eliminated and add the same number of turns used to lift the screw when the valve was dismounted.
- Tighten the lock nut (12).
- Move the adjusting ring (3) to its original position as follows:

a) Use a sharp tool to slowly turn the ring to the right until it touches the disc holder (4).
b) Turn the ring to the left counting the same number of notches previously counted when dismounting the valve in order to return it to its original position.

- Tighten the reference screw (25) and put back the seal, if present.
- Mount the nut (15) and the lock nut (16) so that the lower surface of the nut is flush with the surface of the frame (see distance A, Figs.3 and 5), as follows:
  Orifices D - E: distance A = 36 mm
  Orifices F - G: distance A = 52 mm
  Orifices H - J: distance A = 60 mm

- Screw up the cap (14) until it comes to rest against the gasket (22) (make sure it is not damaged) positioning it so that the threaded hole for the lever is on the opposite side to the valve discharge.

- Reassemble the various parts of the lever (17÷21), making sure that the gasket (21) is not damaged, that the cam of the drive shaft is facing downwards with a play of about 1.5 mm with the nut (15).
  The above is easy to check as the lever must move freely for a short distance.
- Put back the seal, if present, to guarantee calibration.

22.3 Reassembling safety valves without lifting lever, type:

CS 31 (Figs.4-6)

- Screw the adjusting ring (3) into the seat assembly (the head of the ring must be flush with the seat).
- Lubricate the spring washers (7 and 11) on the conical sections (in contact with the piston and calibration screw respectively), the lower tip of the rod (10) in contact with the disc (4) and the lower inner part of the screw (13).
- Insert the rod-washers-spring assembly making sure that the two half-rings (24) are firmly fitted in their seat.
- Mount the disc (4) on the rod (10).
- Screw the seat assembly into the frame (8) and secure it.
- Tighten the calibration screw (13) until all play has been eliminated and add the same number of turns used to lift the screw when the valve was dismounted.
- Tighten the lock nut (12) and reassemble the cap until it comes to rest against the gasket.
- Move the adjusting ring (3) to its original position as follows:

a) Use a sharp tool to slowly turn the ring to the right until it touches the disc holder (4).
b) Turn the ring to the left counting the same number of notches previously counted when dismounting the valve in order to return it to its original position.

- Tighten the reference screw (25) and put back the seal, if present.

22.4 Checking the gaskets.

When reassembling, check the existing gaskets are in perfect working order and replace if necessary.

ATTENTION

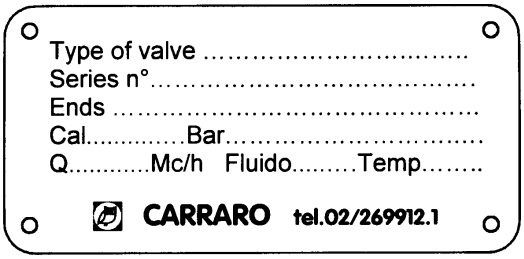
When welding piping, do not attach the earth connector to the valve as this may damage important sliding parts.

23. REPAIRS

23.1 If it is not possible to eliminate the problems, send faulty valves to the supplier/manufacturer, together with a description of the problem.

23.2 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.

23.3 Rating plate (example)



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.

When ordering spare parts, always quote the series number punched on the rating plate attached to the valve.