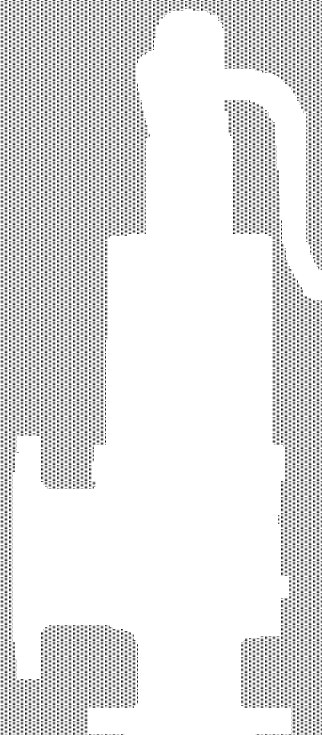
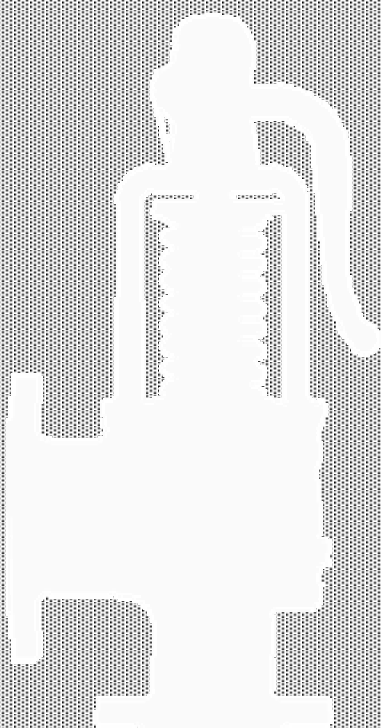
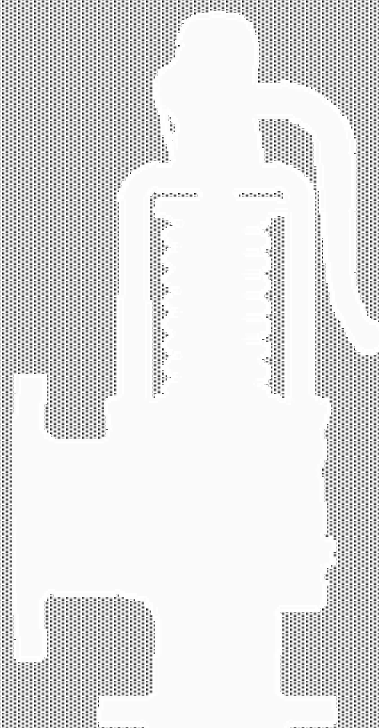
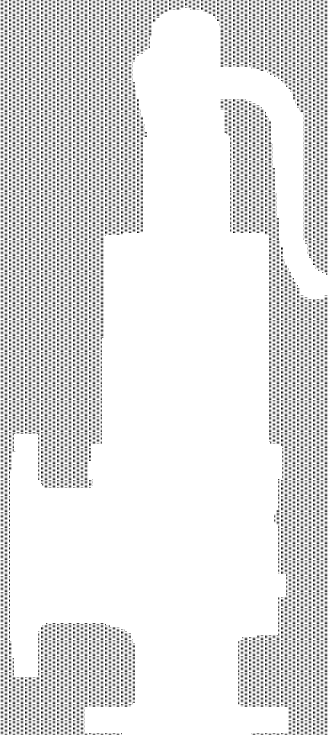




# I N S T R U C T I O N S

For installing and servicing safety spring valves  
series CS types 50 - 51 80 - 91



**CARRARO S.R.L.**  
VALVOLE E STRUMENTAZIONE

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# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

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# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 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 50** - with open (unsealed) frame, flanged ends (Fig.1)

CS 50 valves are always fitted with a lever and may have a resilient tightness disc.

**CS 51** - with closed (sealed) frame, flanged ends (Fig.2)

CS 51 valves may be with or without a lever and may have a resilient tightness disc.

**CS 80** - with open (unsealed) frame, flanged or welded ends (Fig.3)

CS 80 valves are always fitted with a lever and may have a resilient tightness disc.

**CS 91** - with closed (sealed) frame, flanged ends (Fig.4)

CS 91 valves may be with or without a lever and may have a resilient tightness disc.

Each valve is marked with the following alphanumeric code:

CS = Carraro Sicurezza

50-80 = Valve with unsealed frame

51-91 = Valve with sealed frame

D-E-F-G-H-J = Orifice

G = Valve with cast iron body

A = Valve with carbon steel body

I = Valve with stainless steel body

L = Valve with steel alloy bodies

F = Valve with flanged ends

1-2-3 = Version

L = Valve with lifting lever

E = Resilient gasket

Example: **CS 91 M / AF1 L**

CS 91 valve with M orifice, carbon steel body and frame, threaded ends, standard version, with lifting lever.



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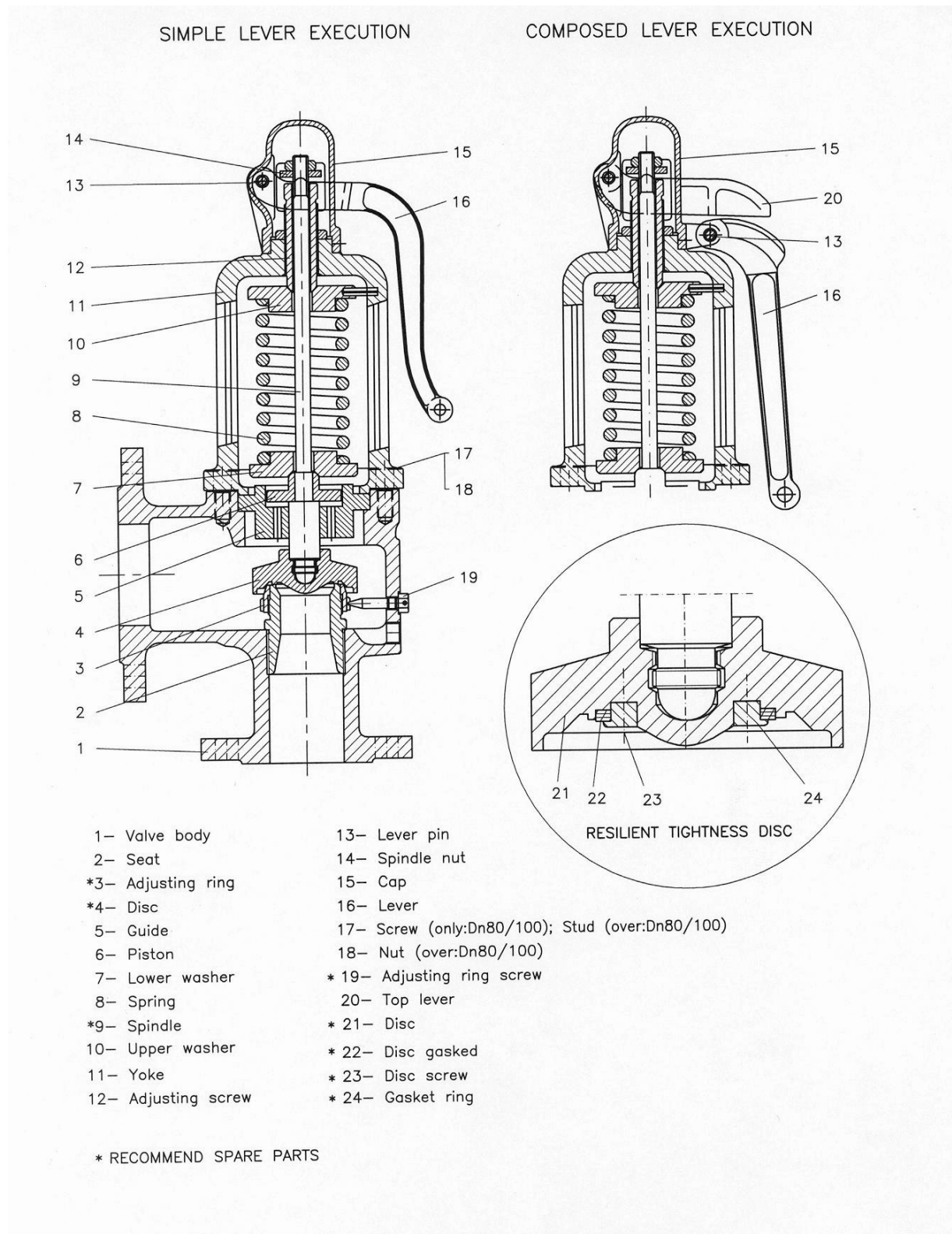
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# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

**Fig.1 – CS 50 safety valve**



N.B.: Items (29, 30, 31 and 32) are only available as a set

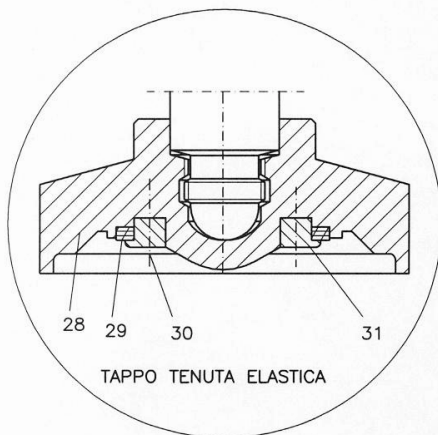
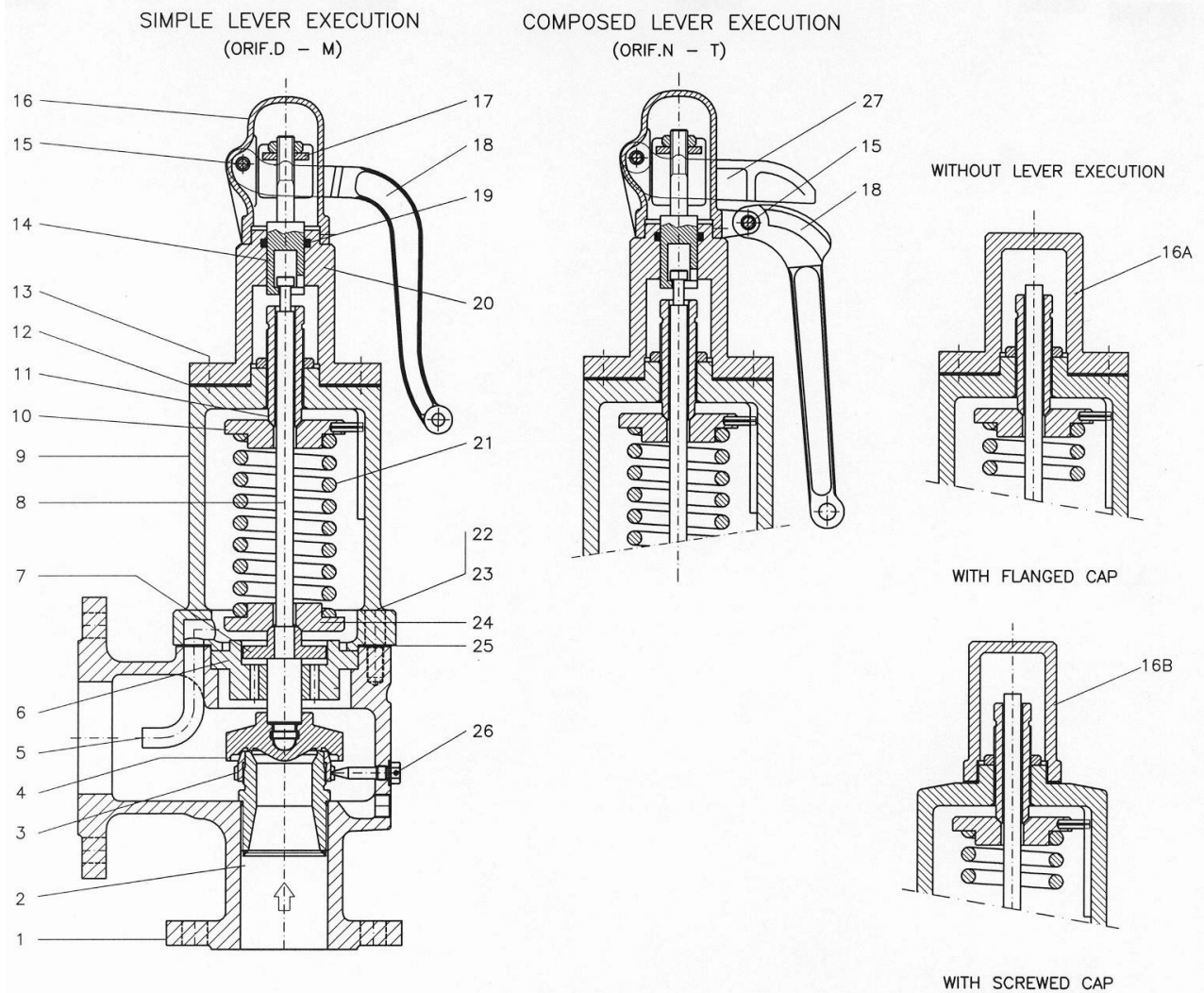




# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

**Fig.2 – CS 51 safety valve**



- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>1 – Valve body</li> <li>2 – Nozzle</li> <li>* 3 – Adjusting ring</li> <li>* 4 – Disc</li> <li>5 – Eductor tube</li> <li>6 – Guide</li> <li>7 – Piston</li> <li>* 8 – Spindle</li> <li>9 – Yoke</li> <li>10 – Upper washer</li> <li>11 – Adjusting screw</li> <li>12 – Gasket</li> <li>13 – Screw</li> <li>14 – Top pin</li> <li>15 – Lever pin</li> </ul> | <ul style="list-style-type: none"> <li>16 – Cap</li> <li>17 – Spindle nut</li> <li>18 – Lever</li> <li>* 19 – O-ring</li> <li>20 – Cap support</li> <li>21 – Spring</li> <li>22 – Stud</li> <li>23 – Nut</li> <li>24 – Lower washer</li> <li>* 25 – Gasket</li> <li>26 – Adjusting ring screw</li> <li>27 – Top lever</li> <li>* 28 – Disc</li> <li>* 29 – Disc gasket</li> <li>* 30 – Disc screw</li> <li>* 31 – Gasket ring</li> </ul> |
|--|--|

\* RECOMMENDED SPRE PARTS

N.B.: Items (39, 40, 41 and 42) are only available as a set



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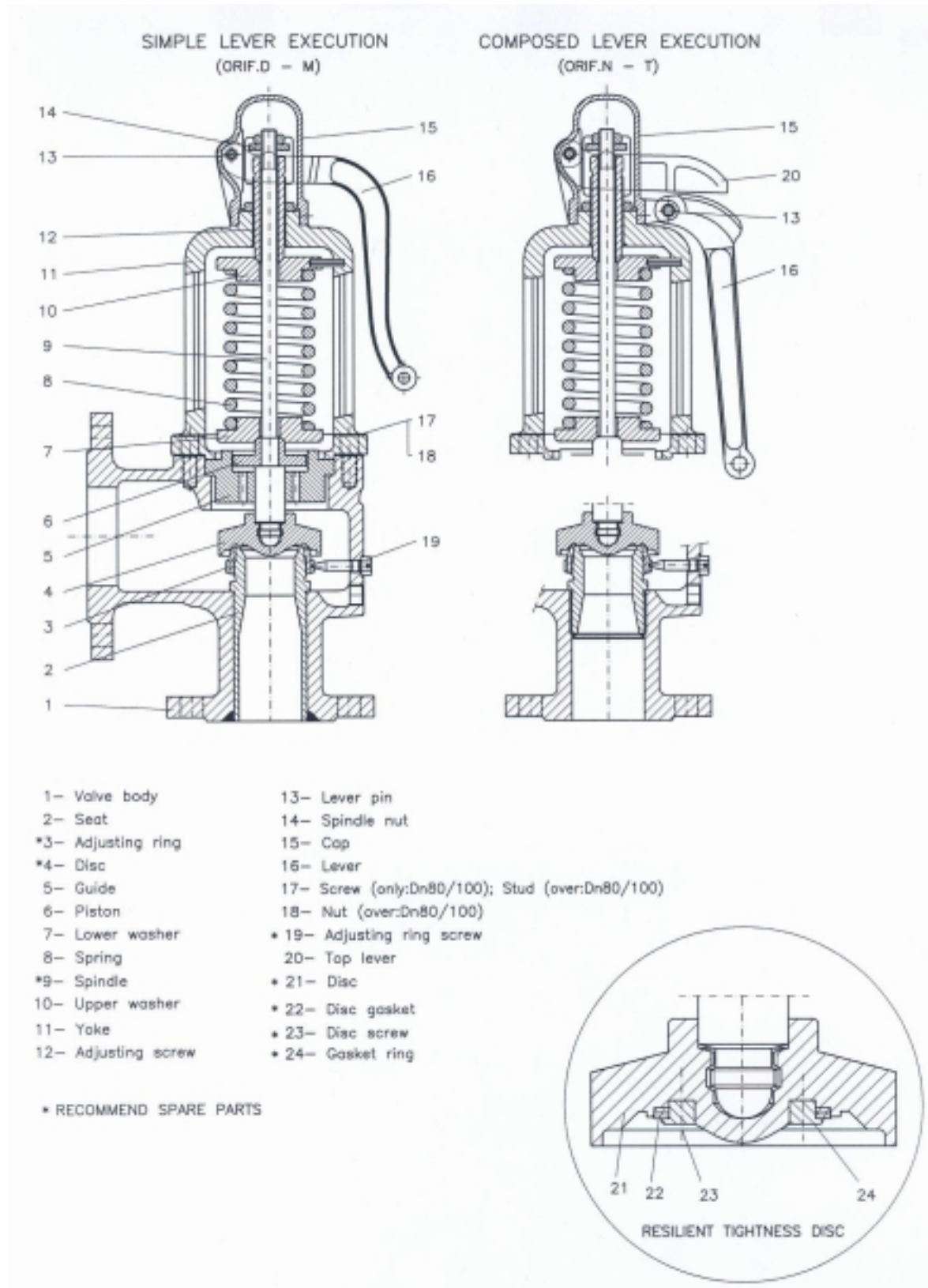
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# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

**Fig.3** – CS 80 safety valve



N.B.: Items (31, 32, 33 and 34) are only available as a set



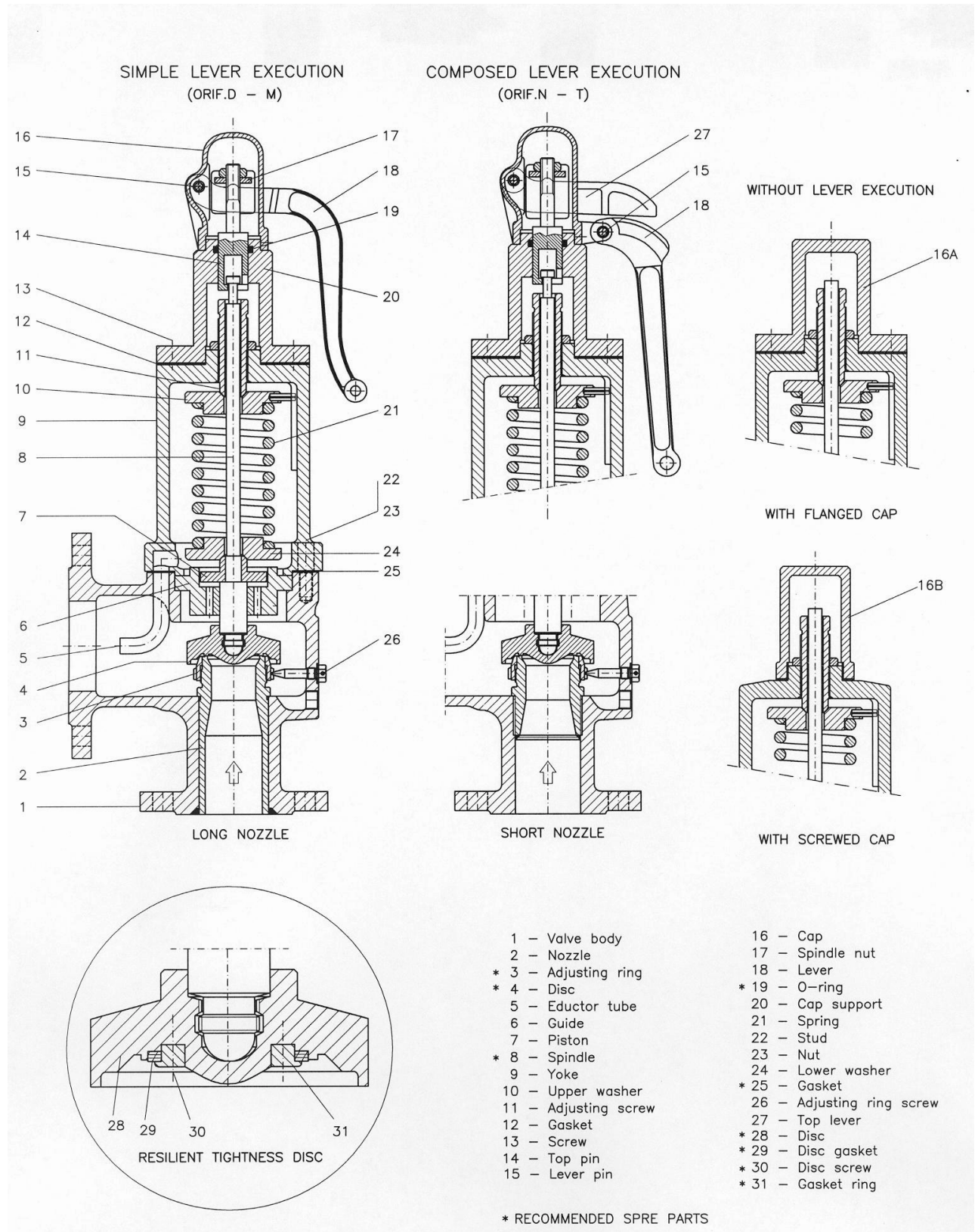




# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

**Fig.4 – CS 91 safety valve**



N.B.: Items (41, 42, 43 and 44) are only available as a set



# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 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 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	2	3	4
<b>! DANGER</b>	<b>! WARNING</b>	<b>! CAUTION</b>	<b>! ATTENTION</b>
			
Do not loosen the bolts if the pipes are pressurised as this may cause serious injury or death.	Mark all possible discharge or leak points to prevent the risk of serious injury or death.	Wear safety clothing or equipment to prevent the risk of injury.	Do not knock or drop the valves.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 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.

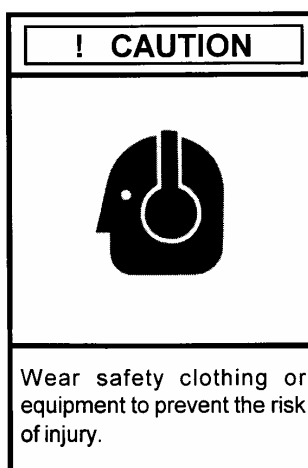
Testing, installing or dismantling the valves or accessories may cause you to come into contact with fluids at very high pressures or temperatures and/or corrosive or erosive.

Therefore, take all safety precautions while testing, installing or dismantling 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 related to the product, especially the ones contained in this manual.



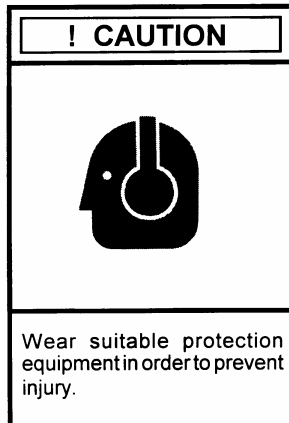


# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 6. SAFETY PRECAUTIONS

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



- 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 scald you and overheated steam is invisible.
- When dismantling 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.
- 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.
- Inspect/service the safety valve at least once a year.
- Please consult CARRARO before working on valve parts.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 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 - ISPESEL).

**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 connector 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 which keeps the valve closed.

**11 - Orifice** – In Collection E of ISPESEL, 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.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

**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 (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 the disc at an inlet static pressure which is lower than popping pressure and with a non-measurable rate of flow.





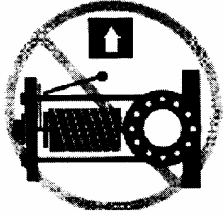


# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 8. TRANSPORT, STORAGE AND HANDLING

**! ATTENTION**



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

#### 8.1 Transport

Depending on their size, safety valves can be transported loose, packed in cardboard boxes or in wooden crates.

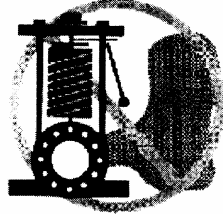
All the valve ends are fitted with covers to prevent dirt from entering. Packs can be placed on pallets if required. Follow all and any indications written on the packaging.



**ATTENTION!**

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

**! ATTENTION**



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

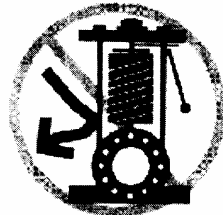
#### 8.2 Storage

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.

**! ATTENTION**



Handle with care.  
Do not drop or knock.

#### 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**





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

Unpacked valves must be moved by hand 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.



### **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; for large valves, use a forklift truck.

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.**





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 9. LIMITS TO USE

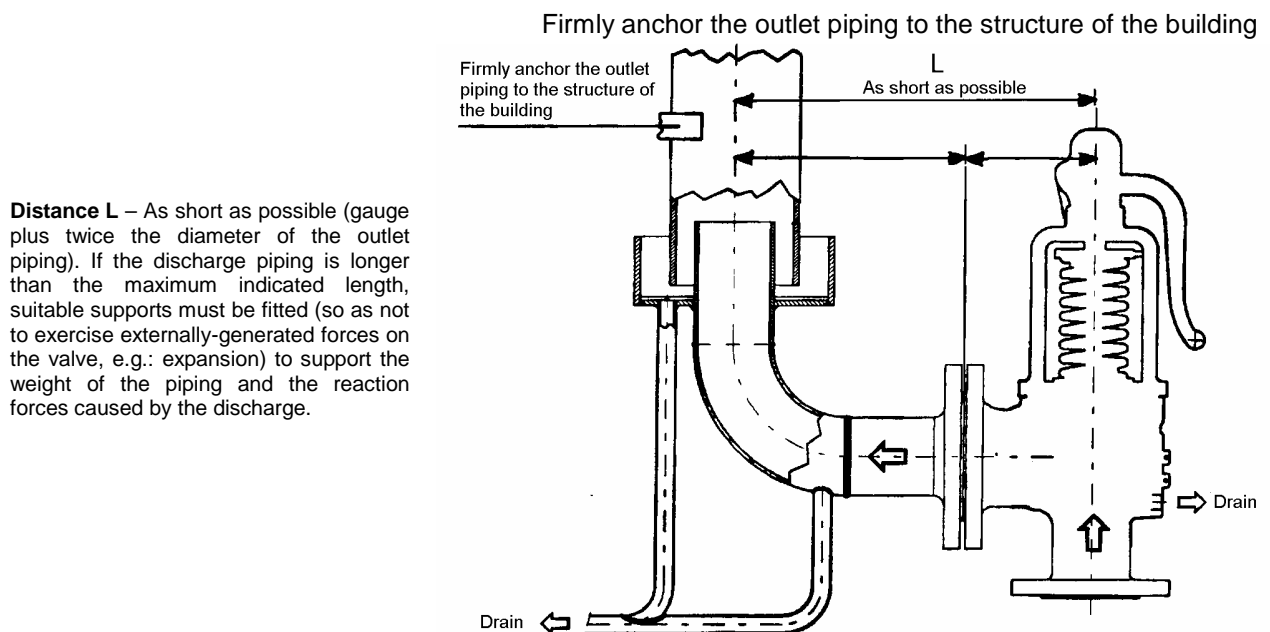
- 9.1 The Carraro CS 50-51 80-91 safety valves were not designed for use with cyclical loads.
- 9.2 Valves in non-alloy or low-alloy steel, for service in excess of 371 °C, and valves in alloy steel for service in excess of 510 °C have been used without faults at temperature gradients of up to 150°C/h; for higher values, please contact the CARRARO technical department.
- 9.3 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 designed for a working life of not more than 100,000 hours.

### 10. INSTALLATION RECOMMENDATIONS

1 – Valves can be used to:

- Protect steam generators
- 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. 5



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.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

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 a year.  
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.







# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

When the inlet connection of a valve requires welding, the whole valve can be installed; it is not necessary to dismount 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 as 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 valve 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.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

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.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 11. DETERMINING REACTION FORCES

The figure on the left shows a safety valve in its various operating modes. When the valve is closed (Fig. 1), an upward force is exercised on the valve collar by 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.

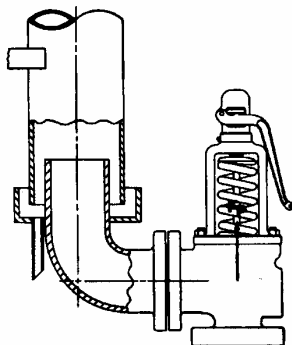


Fig.1 - Valve closed

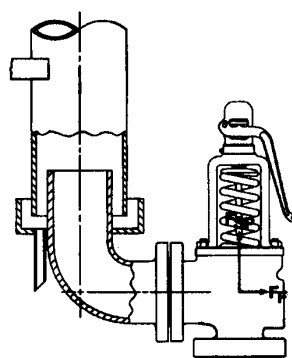


Fig.2 - Valve opening

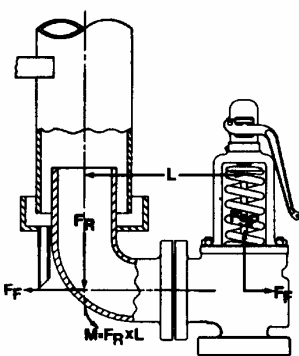


Fig.3 - Valve open flow stabilised at full capacity

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 (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.

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<sup>2</sup>]

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.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 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 – For CS 50-80, protect the valve against bad weather both as regards the spring (spring cover) and to prevent water or snow entering the valve body.

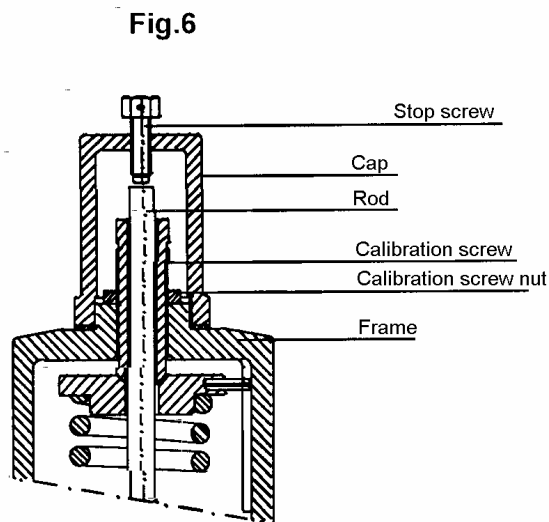
### 13. USING THE STOP SCREW

Safety valves protecting steam generators may have to undergo a hydraulic test.

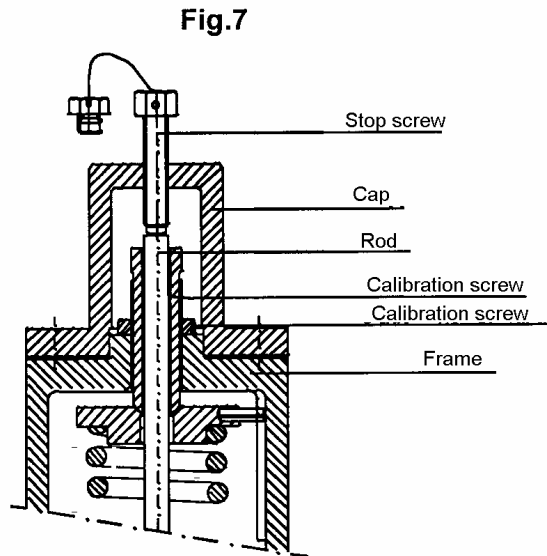
Hydraulic test pressure is always higher than the calibration pressure of the safety valve.

As it is best not to alter the valve calibration, before performing the hydraulic test block the disc with the stop screw with bracket (see Figs.6-7-8).

#### FITTING THE STOP SCREW



For Cs 51-91 with lever  
(see figs. 2-4)



For Cs 51-91 without lever  
(see figs. 2-4)



#### **ATTENTION!**

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



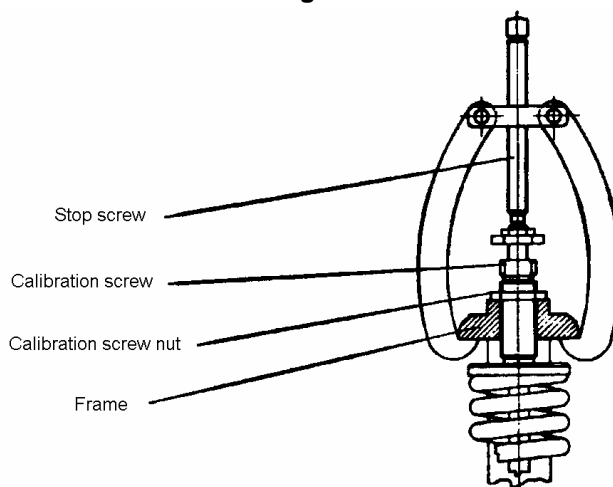




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For installing and servicing safety spring valves  
series CS types 50 - 51 80 - 91

Fig.8



For CS 50-80 (figs.1-3)

Fit the stop screw as follows:

#### CS 51 – 91 with lever Figs.2-4

1. Remove the seal and the split pin,
2. Pull out the pin (15) and the lever (18).
3. Loosen the cap screw,
4. Pull out the cap (16)
5. Remove the screw (13) and pull out the cap support (20)
6. Screw on the cap with the stop screw (Fig.6)

#### CS 51 – 91 without lever Figs.2-4

1. Remove the seal
2. Remove the screw in the upper part of the cap (16A-B)
3. Screw in the stop screw and tie the above screw to it (Fig.7)

#### CS 50 - 80 (Figs.1-3)

1. Remove the seal and the split pin.
2. Pull out the pin (13) and the lever (16)
3. Loosen the cap screw
4. Pull out the cap (15)

Then fit the stop screw with bracket to the frame (11) (Fig.8)





# I N S T R U C T I O N S

For installing and servicing safety spring valves  
series CS types 50 - 51 80 - 91

## 14. STARTING SYSTEM



### ATTENTION!

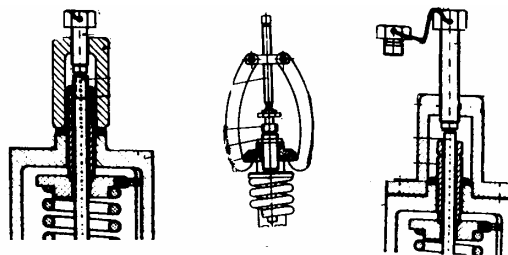
The valve was factory-calibrated with compressed air at ambient temperature and atmospheric counterpressure, as established by ISPESL regulations, paragraph E.1.D.2, point 11.3. If the temperature is different from ambient temperature, recalibrate the valve to real operating conditions.



### 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.

### ! WARNING



Block the valve with the stop screw when adjusting the rings in order to eliminate serious risks of injury or death





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 15. CALIBRATION

#### 15.1 – Calibrating CS 50 valves with lever (Fig.1).

Remove the seal, if present, pull out the pin (13) and remove the lever (16), loosen the screw and remove the cap (15).

Loosen the nut and turn the calibration screw (12) clockwise to increase pressure and anti-clockwise to decrease calibration pressure.

Carry out the above in reverse order to reassemble the cap and lever. Make sure the lever does not push against the nut (14); play between the two parts must be about 1.5 mm.

#### 15.2 – Calibrating CS 51 valves with lever (Fig.2).

Remove the seal, if present, pull out the pin (15) and remove the lever (18)

Remove the cap (20). Remove the cap support (20) by unscrewing the screws (13). Loosen the nut and adjust the calibration screw as indicated in point 15.1

Check the gaskets (12) and (19) are in perfect condition. Carry out the above in reverse order to reassemble and check as indicated in point 15.1

#### 15.3 – Calibrating CS 51 valves without lever (Fig.2).

Remove the cap (16);

Proceed as indicated in point 15.2.

#### 15.4 – Calibrating CS 80 valves with lever (Fig.3).

Remove the seal, if present, pull out the pin (13) and remove the lever (16), loosen the screw and remove the cap (17) or (26).

Loosen the nut (12) and turn the calibration screw (13) clockwise to increase pressure and anti-clockwise to decrease calibration pressure.

Carry out the above in reverse order to reassemble the cap and lever. Make sure the lever does not push against the nut (14); play between the two parts must be about 1.5 mm.

#### 15.5- Calibrating CS91 valves with a simple-acting or double-acting lever (Fig.4).

Remove the seal, if present.

Remove the split pin; pull out the pin (15) and the lever (18).

Pull out the screw and remove the cap (16).

Remove the nuts (17), remove the screws (13) and the support (20).

Loosen the nut and adjust the calibration screw (13); turn it clockwise to increase calibration pressure and vice-versa. Then tighten the nut and reassemble the parts.

Check the play of the lever (1.5 mm).

Check the adjustment in operating conditions.

#### 15.6 – Calibrating the CS91 valves without lifting lever (Fig.4).

Remove the seal, if present.

Remove the cap (16), adjust and check as indicated above.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 16. 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.

For example:

Calibration pressure: 10.0 bar

Calibration pressure: 9.5 bar

**CLOSING DROP 0.5 bar**, that is, a closing pressure drop of 5%.

The procedure for correcting the drop is identical to that used for CS 50-51 80-91

Remove the seal, if present, and the adjusting ring nut (19) for CS 50-80 and (26) for 51 -91

Use a pointed tool to turn the adjusting ring (3) by one or two 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 (3) 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.

### 17. 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.

#### 17.1 – Fluid leaks.

##### 17.1.1 – Fluid leaks in valves with lifting lever: types CS 50-80 (Figs.1 and 3)

Normal working 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 (13-16-20). 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 (14) and the lever (13-16-20), deformation of the valve body due to the incorrect installation of the outlet pipe, both of which exert harmful stress on the valve.

##### 17.1.2 - Fluid leaks in valves with airtight lifting lever, types CS 51-91 : (Figs.2-4)

The contents of paragraph 13, also apply to these valves.

##### 17.1.3 - Fluid leaks in valves without lifting lever, types CS 51-91 : (Figs.2-4)

Normal working 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.







# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 17.2 - 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.
- 6) – obstruction of the ejector pipe (5) in Figs.2÷4 for CS 51-91 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.

### 17.3 - 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.

### 17.4 - Drop in calibration pressure.

Drops in calibration pressure are often attributed to the loss of elasticity of the spring.

Except in exceptional cases, 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.

## 18. 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.**





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 19. TROUBLESHOOTING<sub>hyu</sub>

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





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 20. MAINTENANCE

#### 20.1 - 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 dismantling and servicing the valve make sure it is not pressurised.**

### 20.2 - DISMOUNTING SAFETY VALVES.

#### 20.1 Dismounting safety valves with lifting lever, types CS 50-80 (Figs.1-3)

- Remove the seal, if present, and the split pin.
- Pull out the lever pin (13) and the lever (16).
- Pull out the cap (15)
- Turn the calibration screw (12) anti-clockwise, counting the number of turns (only until the spring 8 releases.
- Unscrew the screws or nuts (17-18)
- Remove the frame 10, spring (8) and washers (7-10)
- Unscrew the disc (4) from the rod (9) by turning it anti-clockwise to catch the internal thread.

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 adjusting ring is higher than the surface of the seat, mark the position and after dismantling the stop screw (19), turn the ring clockwise until it is lower than the surface of the seat of the nozzle.

#### 20.2.2- Dismounting safety valves with lifting lever, types CS 51-91 (Figs. 2 - 4).

- 1) Remove the seal, if present.
- 2) Remove the split pin; pull out the pin (15) and the lever (18) or (27).  
Pull out the screw and remove the cap (16)  
Unscrew the nuts (17).  
Unscrew the screws (13) and remove the support (20).  
Release the pin (14).
- 3) Loosen the nut (17) and release the spring by turning the calibration screw (11) clockwise, counting and noting down the number of turns.
- 4) Remove the nuts (23) and pull off the frame (9).
- 5) Remove the upper washer (10), the spring (21) and the lower washer (24).
- 6) Remove the rod assembly (8), guide (6) and disc (4).
- 7) To separate the disc from the rod catch the internal thread by turning the disc anti-clockwise.
- 8) Do not change the position of the adjusting ring (3) unless repairs have to be made to the seat of the nozzle (2).





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

If the upper part of the adjusting ring is higher than the surface of the seat, mark the position and after dismantling the stop screw (26), turn the ring clockwise until it is lower than the surface of the seat of the nozzle.

### 20.2.3 - Dismounting safety valves without lifting lever, types CS 51-91 (Figs.2-4).

- 1) Remove the seal, if present.
- 2) Remove the flanged (16A) or threaded (16B) cap.
- 3) Proceed by carrying out the instructions indicated in paragraph 20.2.2 from point 3 on.

### 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 contrast 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 tetrachloride 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.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

ABRASIVE PASTE:

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

Supplier PAMPADO V.le Espinasse, 8 Milan.

LAPPING RINGS:

Orif.	Code
D	70 01 T0650
E	70 01 T0651
F	70 01 T0652
G	70 01 T0653
H	70 01 T0654
H1	70 01 T0655
J	70 01 T0656
K	70 01 T0657
K1	70 01 T0658
L	70 01 T0659
M	70 01 T0660
N	70 01 T0661
P	70 01 T0662
P1	70 01 T0663
Q	70 01 T0664
Q1	70 01 T0665
R	70 01 T0666
R1	70 01 T0667
T	70 01 T0668

Two lapping rings should be used for each orifice.

### 20.5 - RESILIENT TIGHTNESS DISCS.

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 by means of a simple and clear operation (See details in Figs. 1 and 4).







# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 20.6 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 presumed 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 that is subject to temperature variations with consequent possibility of humidity in the internal surfaces, or those that come 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.





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 21 - REASSEMBLING SAFETY VALVES.

#### 21.1 Reassembling valves with lifting lever, type CS 51-91 (Figs.2-4)

After cleaning the threads of the ring (3) and seat (2), lubricate with Molicote or a similar type and tighten the ring until it returns to its original position.

Lubricate the threads and ball joints on the rod (8) and calibration screw (11). Make sure the rod-disc joint (8-4) is perfectly clean and lubricated before joining the two parts together. Carefully clean the guide (6) and piston (7) and mount them on the rod (8), followed by the lower washer (24), the spring (21) and the upper washer (10).

Make sure that the contact surfaces between the body (1) and frame (9) are perfectly clean and that the gasket (25) is in good condition (replace if necessary). Fit the rod (8) into the calibration screw (11) and mount the whole frame assembly, including the internal components, onto the valve body: uniformly tighten the nuts (23) onto the studs (22). Restore the compression of the spring (21) by turning the compression screw (11) clockwise by the same number of turns used to release it during dismounting. (see paragraph 20.2.2 pos. 3).

Then reassemble the lever assembly by performing the operations indicated in 20.2.2 points 1 and 2 in reverse order.

**21.2** Assembly valves without lifting lever by carrying out the operations indicated in paragraphs 20.2.3 pos.1 and 2 in reverse order.

#### 21.3 Checking the gaskets.

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





# I N S T R U C T I O N S

## For installing and servicing safety spring valves series CS types 50 - 51 80 - 91

### 22. REPAIRS

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

**22.2** 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.

**22.3** Rating plate (example)

○ Type of valve ..... Series n° ..... Ends ..... Cal..... Bar..... Q.....Mc/h Fluido.....Temp..... ○ <b>CARRARO</b> tel.02/269912.1 ○
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**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.

