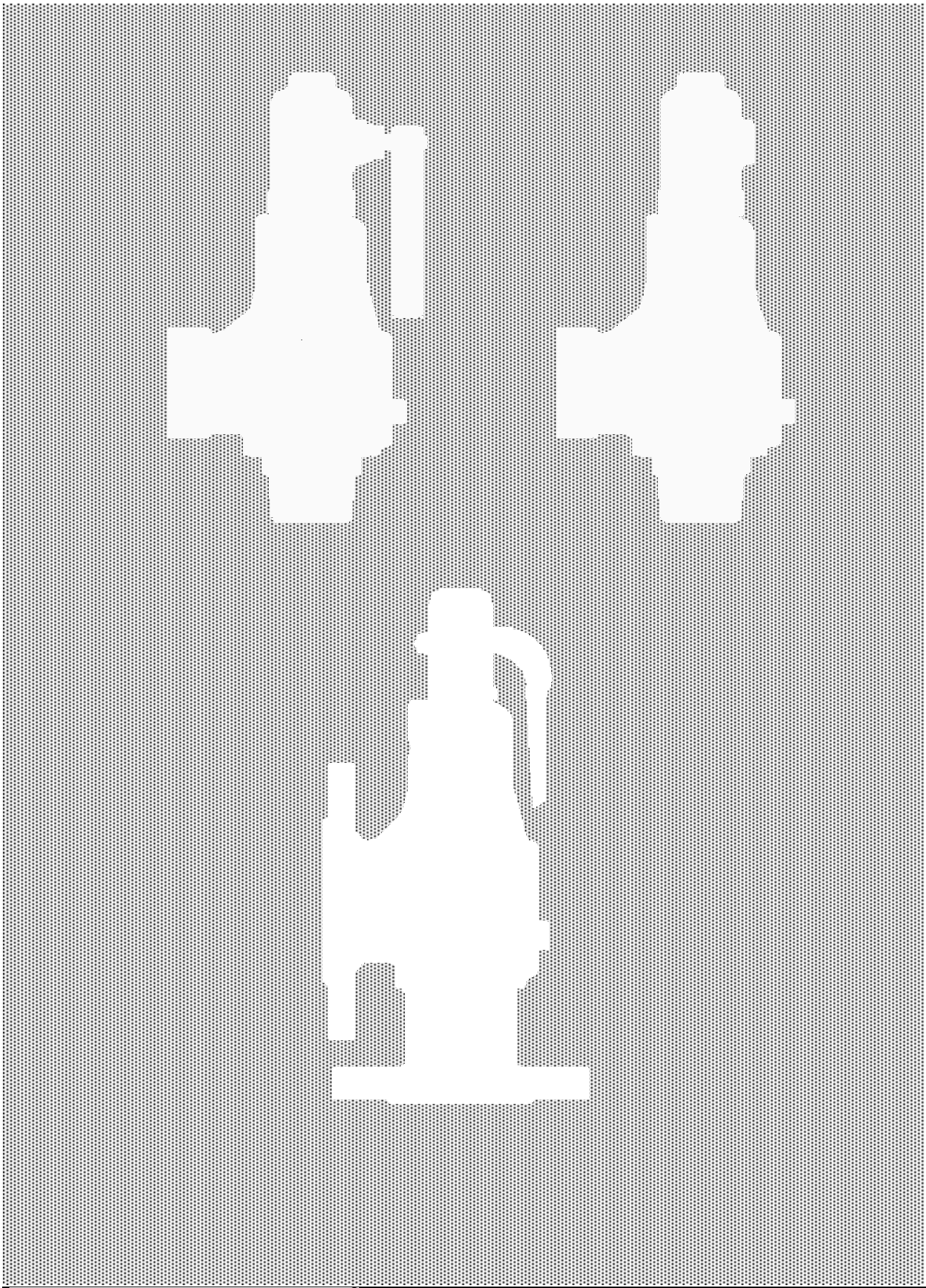
I N S T R U C T I O N S
For installing and servicing safety spring valves series CS type 70 - 71



20090 SEGRATE (MI)- via E.Fermi
EMAIL: info@carrarovalvole.it
TEL. +39 (02) 269912.1 - FAX. +39 (02) 2692.2452

CONTENTS

Page

1. GENERAL INFORMATION

1.1 RIGHT OF MODIFICATION AND COPYRIGHT

The regulations, standards, etc. mentioned in these instructions are valid at the time of preparation of this document and are not subject to modification. It is the duty of the user to take full responsibility for applying the most up-to-date version of the standards and regulations in question.
The supplier reserves the right to make changes and technical improvements to data and information whenever it sees fit to do so. The user shall on no account be entitled to claim a right of modification or improvement in relation to valves already supplied.

2. WARRANTY

The extent and duration of the warranty are defined in the manufacturer's "General Conditions of Sale".
The applicable conditions are those stipulated in the most up-to-date version in existence at the time of delivery.

The warranty does not cover, amongst other cases, damage to valves caused by the following:

° Ignorance of or non-compliance with these instructions for use.
° The work of personnel insufficiently qualified to undertake fitting, use or maintenance.
° Normal wear.
° Erroneous or negligent use of the valves.

The warranty shall not be valid and the manufacturer shall accept no responsibility in the event of:

° Non-compliance with regulations for the prevention of accidents and/or safety standards.
° Imperfect installation, poor commissioning and incorrect use.
° Improper or incorrect use, inappropriate application or work conditions differing from those agreed.
° The user shall bear sole responsibility in the event of physical and/or material damage deriving from failure to observe the above.

3. SCOPE OF THESE INSTRUCTIONS

These instructions refer to the following types of safety valves:

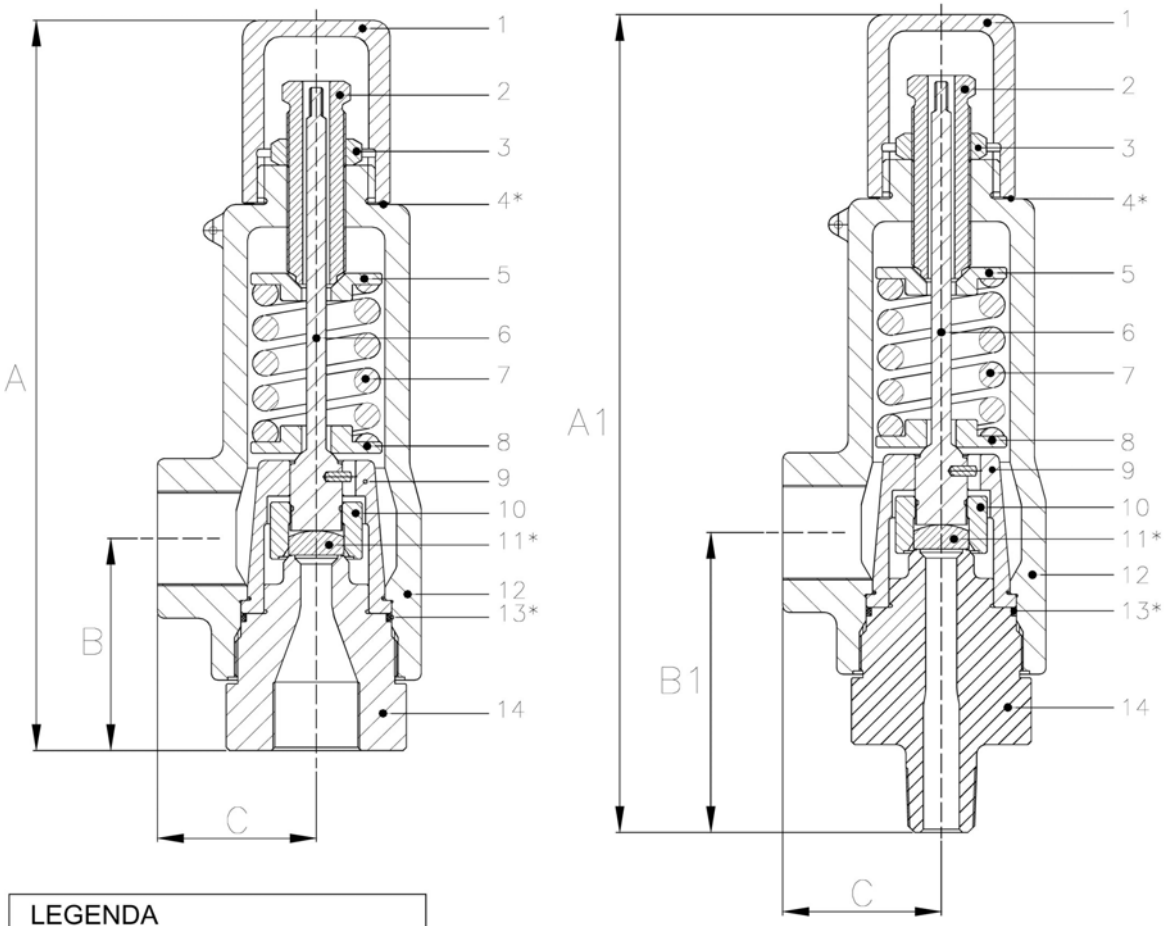
Type CS 70 - Open yoke (not sealed) with flanged or threaded ends.
CS 70 valves are always fitted with a lever and a disc with a metal or resilient gasket.
Type CS 71 - closed yoke (sealed).
- Flanged with lever or without lever.
- Threaded with lever or without lever.
Disc with a metal or resilient gasket.

Each valve is marked with an alphanumeric code consisting of the following letters and numbers:

CS	= Carraro Safety
70/71	= Open yoke valve / Closed yoke valve
B1-C-D	= Orifice
A/I	= Valve with carbon steel yoke/ Valve with stainless steel yoke
S/F	= Valve with threaded ends / Valve with flanged ends
1-2	= Variable number depending on version
L	= Valve with lifting lever
E	= Resilient gasket

Example: **CS 71 D / AS1**
CS 71 valve with D orifice, carbon steel yoke, threaded ends, standard version.

Valvola tipo: / *Valve type:* " CS 71 "



LEGENDA

1 - Cappello / *Cap*
2 - Vite taratura / *Adjusting screw*
3 - Dado / *Nut*
*4 - Guarnizione / Gasket
5 - Piattello superiore/ *Upper washer*
6 - Asta / *Stem*
7 - Molla / *Spring*
8 - Piattello inferiore / *Lower washer*
9 - Guida / *Guide*
10 - Anello regolazione / *Adjusting ring*
*11 - Pastiglia / *Disc*
12 - Incastellatura / *Yoke*
*13 - O-Ring / *O-Ring*
14 - Corpo - Sede / *Body - Nozzle*

Ø Attacchi femmina / Ø *Female connections*		A	B	C	Orifici previsti *Provided orifices*
Entrata / *Inlet*	Uscita/ *Outlet*				
1/2"	1"	225	65	48.5	B1, C, D
3/4"	1"	225	65	48.5	B1, C, D
1"	1"	225	65	48.5	B1, C, D

Ø Attacchi maschio / Ø *Male connections*		A1	B1	C	Orifici previsti *Provided orifices*
Entrata / *Inlet*	Uscita/ *Outlet*				
1/2"	1"	252	92	48.5	B1, C, D
3/4"	1"	252	92	48.5	B1, C, D
1"	1"	252	92	48.5	B1, C, D

Orif.	B1	C	D
cm²	0,31	0,503	0,709

* RICAMBI CONSIGLIATI / *RECOMMENDED SPARE PARTS*

Fig.1 - CS 71 without lever

4. PRODUCT SAFETY SIGN AND LABEL SYSTEM

If and when required, appropriate safety labels have been affixed to the valves (see rectangular panels at bottom of page).
The safety labels are vertically oriented rectangles consisting of four panels containing messages which communicate:

- Level of hazard
- Nature of the hazard
- The consequences of human or product interaction with the hazard
- Instructions, if necessary, on how to avoid the hazard

The top panel contains a warning word (DANGER - WARNING - CAUTION - ATTENTION), which indicates the level of seriousness of the hazard.

The central panel contains a drawing indicating the nature of the hazard and the possible consequences, for personnel or property, of interaction with the hazard. In some cases of hazards to personnel, the drawing may suggest what preventive measures can be taken, such as wearing protective clothing, for example.

The bottom panel may contain a message with instructions on how to avoid the hazard. In the case of hazard to personnel, the message may also contain a more precise definition of the hazard and its possible consequences.

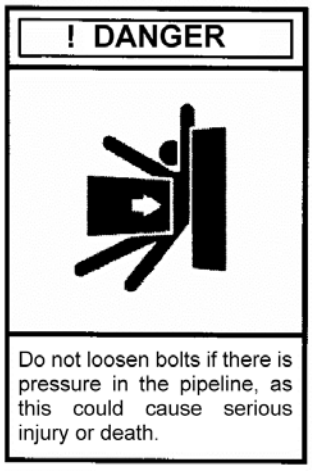
1) DANGER - Immediate hazards which will result in severe personal injury or death.

2) WARNING - Hazards or unsafe practices which could result in severe personal injury or death.

3) CAUTION - Hazards or unsafe practices which could result in minor personal injury.

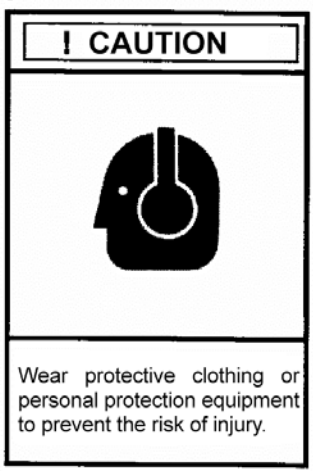
4) ATTENTION - Hazards or unsafe practices which could result in equipment or property damage.

1

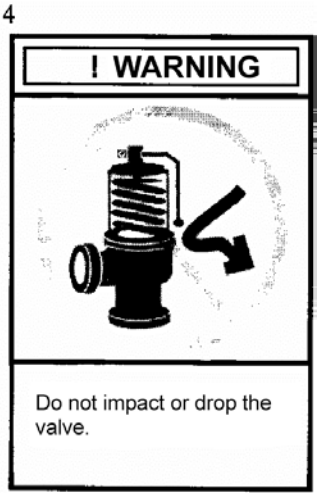


2

3



4

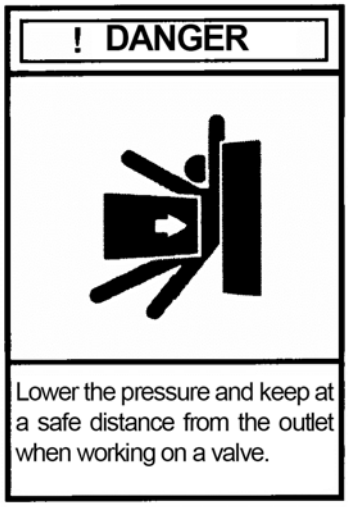


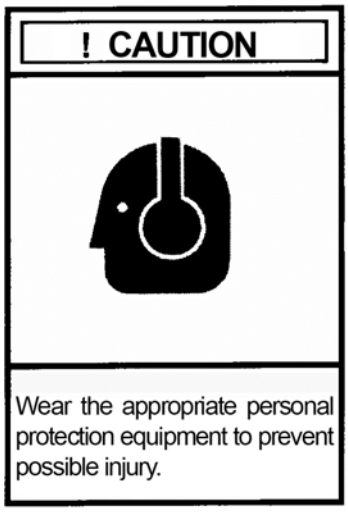
5. SAFETY NOTICE

Thorough checking and maintenance play a key role in ensuring the safe, reliable operation of all valves.
The relevant procedures recommended by CARRARO and described in this manual, are effective methods of performing the required tasks. Some of these procedures require the use of tools specifically designed for an intended purpose. These special tools should be used when, and as, recommended. It is important to note that this manual contains various safety messages which should be carefully read in order to minimise the risk of personal injury, or the possibility that improper procedures will be followed which may damage the product, or render it unsafe.
It is also important to understand that these safety messages are not exhaustive.
CARRARO is not in a position to know, assess and warn customers or users of all the conceivable methods with which servicing may be carried out, or the potentially hazardous consequences of each way.
Therefore anyone using a service procedure or tool not recommended by CARRARO must make certain that neither their own safety nor that of other people, nor the safety or correct operation of the valve will be put at risk by the chosen work method.
If in doubt about a given procedure, contact CARRARO for advice.
The testing, installation or disassembly of valves or accessories may involve proximity to fluid at extremely high pressure or temperature and/or corrosive or erosive fluid, and fluid capable of generating a potentially explosive atmosphere.
Consequently, every precaution must be taken to prevent injury to personnel during testing, installation or removal. This includes, but is not limited to: the use of ear defenders, protective goggles, protective clothing such as gloves, etc., regardless of whether the persons in question are located directly in the work zone or in the surrounding area.
Due to the various conditions in which these operations may be performed on CARRARO products, and of the possible hazardous consequences of each way, CARRARO can not possibly evaluate all conditions that might cause personal injury or property damage. Nevertheless, CARRARO does offer the following safety precautions for information only.
It is the responsibility of the user of CARRARO products to adequately train all personnel assigned to their use.
It is imperative that such personnel become thoroughly familiar with the instructions relating to the product and the contents of this manual.

6. SAFETY PRECAUTIONS

Always follow the safety regulations applicable to the plant and in particular observe the following precautions:





° Always lower the working pressure before making any valve adjustments.

° Do not stand in front of the discharge side of a safety valve when operating or testing.

° Use ear defenders when testing or operating a valve.

° Wear protective clothing. Hot water causes burns and superheated steam is invisible.

° When disassembling safety valves, stand clear and/or wear protective clothing to prevent exposure to splashes of any process medium that may have been trapped inside the valves. Bear in mind that such fluid could generate a potentially explosive mixture.
Before starting disassembly, make certain that the valve is isolated from any source of pressure that may exist within the system.

° Exercise caution when checking a safety valve for leakage. Leaking fluid could generate a potentially explosive mixture.

° Before each actuation, ensure that no personnel are near the valve. Even small quantities of steam escaping during actuation may cause serious injury and generate a potentially explosive mixture.

° When actuating a safety valve for the first time, or after servicing, always be prepared to actuate the valve with the lever while standing at a safe distance from the valve.
This can be done by actuating the valve via a wire attached to the lever.

° Striking a pressurised valve may cause premature actuation. Never strike a valve when system pressure is near the valve set pressure.

° The outer surfaces of valves reach temperatures approximately equal to the temperature of the fluid flowing through them. For this reason, if fitting a valve in a potentially explosive atmosphere, check that the explosion point of the atmosphere surrounding the valve is sufficiently higher than the temperature of the fluid handled by the system, and prevent deposits of dust from forming on the outside of the valve.

° In the connection between the valve and line, ensure the equipotentiality of the system in order to prevent the accumulation of electrostatic charges on the outer surfaces of the plant, which could act as an effective trigger in a potentially explosive atmosphere.

° Before carrying out any work on valve components, consult CARRARO.

7. SAFETY VALVE TERMINOLOGY

1 - Back pressure - Back pressure is the static pressure at the outlet of a safety device due to pressure in the discharge system.

2 - Blowdown - This is the difference between the set pressure of a valve and the actual closing pressure, expressed as a percentage of set pressure.

3 - Bore area - This is the minimum net cross-sectional area of the valve orifice or inlet (see point E.1.D.2, 1.7, Collection E - ISPESL).

4 - Bore diameter - This is the minimum flow diameter of the valve inlet (see point E.1.D.2, 1.8, Collection E - ISPESL).

5 - Chatter - An abnormal rapid reciprocating motion of the moveable parts of a safety valve, in which the disc contacts the seat.

6 - Closing pressure - The value of inlet static pressure at which the valve disc re-establishes contact with the seat, thereby closing the valve.

7 - Disc - The disc or plug is the moveable part of a safety valve which closes the valve and opens it when the operating pressure exceeds the set pressure.

8 - Inlet diameter - This is the nominal diameter of the inlet of a safety valve (unless otherwise specified).

9 - Lift - The lift is the actual travel of the disc away from the closed position when the valve is relieving.

10 - Manual operating device (lever) - This is a device which 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 is the minimum flow area of the line from the valve inlet connection to the sealing surface.

12 - Outlet diameter - This is the nominal diameter of the outlet passage of a safety valve (unless otherwise specified).

13 - Overpressure - This is a pressure increase over the set pressure, usually expressed as a percentage of set pressure.

14 - Popping pressure - This is the inlet pressure at which a safety valve disc rapidly opens to full lift. The pop action applies only to safety valves on compressible fluid service.

15 - Pressure containing member - This is any part of the safety valve which acts as a pressure vessel.

16 - Pressure retaining member - This is any part of the safety valve which is stressed due to its function in holding one or more pressure containing members in position.

17 - Rated lift - This is the design lift at which a valve attains its rated relieving capacity.

18 - Safety valve - This is a pressure relief device actuated by inlet static pressure and characterised by rapid opening or pop action.

19 - Set pressure - This is the value of increasing inlet static pressure at which the safety valve is set to open, thereby restoring the desired pressure in the system being protected.
This pressure value is indicated on the rating plate.

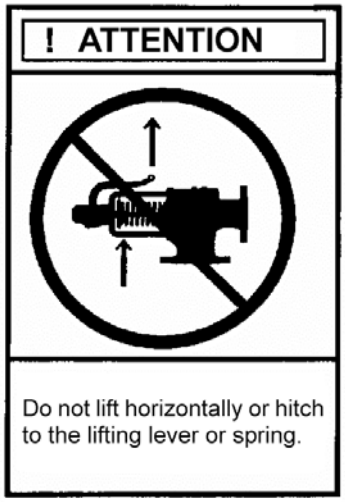
20 - Seat - The seat is the pressure containing part of a valve which holds the fluid under pressure.

21 - Seat tightness pressure - This is the specific inlet static pressure at which a quantitative seat leakage test is performed in accordance with a standard procedure.

22 - Seat diameter - This is the smallest diameter of contact between the fixed and moving members of the pressure containing elements of a valve.

23 - Simmer - This is the audible or visible escape of fluid between the seat and disc at an inlet static pressure below the popping pressure and at no measurable capacity.

8. TRANSPORT, HANDLING AND STORAGE



8.1 Transport

Depending on their size, the valves can be transported without packaging, in cardboard boxes or wooden crates.
The connections of all valves are protected to prevent the entry of dirt. To facilitate handling, the package can be secured to a pallet. Follow any directions marked on the packaging.

ATTENTION!

Personnel assigned to load-handling activities must take all the necessary safety precautions.

8.2 Storage

The valves must be stored in a dry environment and protected against atmospheric conditions. They must not be removed from their crates or packaging until immediately before installation.
The protective materials on the flanges and the closure plugs must be left in place until the last minute. Either packed or unpacked, the valves must not be subject to violent impacts.
Either packed or unpacked, the valves must always be stored in an upright position, i.e. never laid on one side, in order to prevent misalignment and damage to internal components.

8.3 Handling

When unpacking the valves and removing the flange protectors, immediately prior to installation, meticulous care should be exercised to prevent dirt from entering the valve inlet or outlet while securing them to their connections.

ATTENTION!

When handling valves, keep the work area clear in order to prevent injury to personnel and damage to property.

Unpacked valves must be moved by hand or lifted by wrapping a chain or sling around the discharge neck and then around the upper yoke structure so as to ensure that the valve is in a vertical position during lifting and is never horizontal.

ATTENTION!

Never lift the full weight of 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 in the case of large valves.
When hoisting to the installation point, care should be exercised to prevent bumping 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. LIMITATIONS OF USE

9.1 Carraro CS70 / CS71 safety valves are not designed for use with cyclical loads.

9.2 CS70 / CS71 valves are designed for use at temperatures below the limits at which viscous flow phenomena occur.

10. INSTALLATION

1 - The valves can be used to:

a) Protect steam generators
b) Protect steam or gas distribution networks or tanks, generally downstream of pressure reducing valves.
In both cases, please refer to the installation diagram in *Fig. 2A - 2B - 2C - 2D*

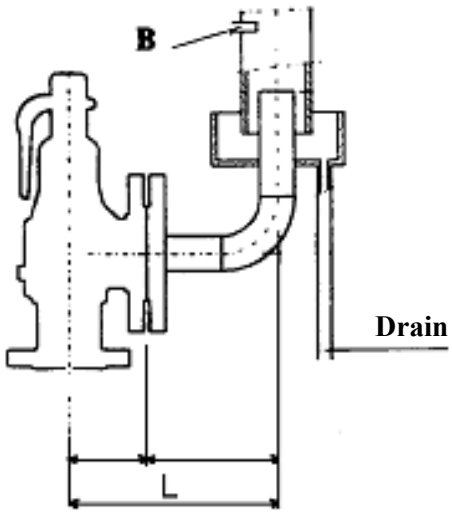


Fig. 2A
CS70 valves used with condensable vapours or gases.

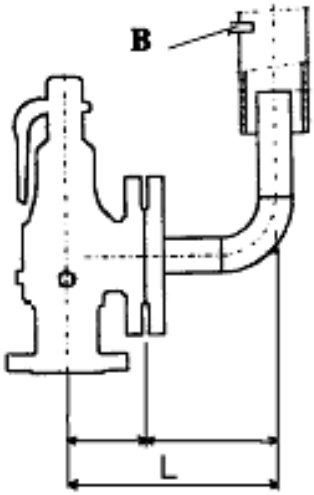


Fig. 2B
CS70 and 71 valves used with non-condensable vapours or gases.

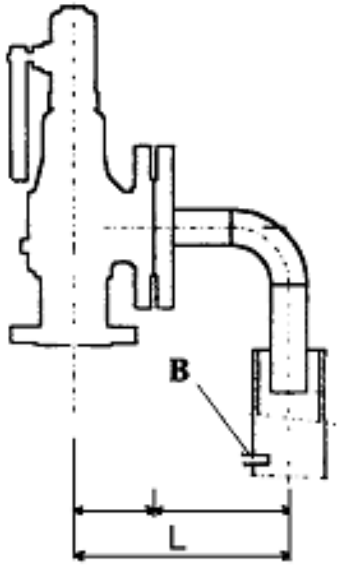


Fig. 2C
CS71 valves used with liquids or hot or superheated water.

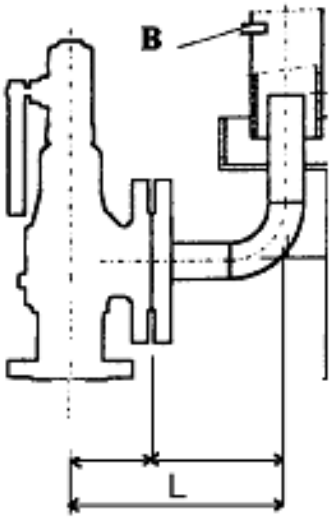


Fig. 2D
CS71 valves used with condensable vapours or gases.

PRECAUTIONS FOR DISCHARGE PIPING

Dimension 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, i.e.: expansion) to withstand the weight of the piping and the reaction forces caused by the discharge.
Detail B - Firmly anchor to the structure of the building.

2 - The valves must be installed vertically, directly on the equipment or on the pipe being protected

3 - No valve of any type should be installed between the safety valve and the header, or on the discharge pipe between the safety valve and the atmosphere.

4 - In no case may the inlet piping to the valve have a smaller diameter than the nominal size of the valve inlet and it must be no longer than three times its diameter to prevent limitation of the discharge capacity (due to thickening of the boundary layer along the pipe wall). To maintain the maximum discharge capacity of the valve, fit an inlet pipe with a suitable connection (as in *Fig.3*) to prevent restriction of the effective flow area.

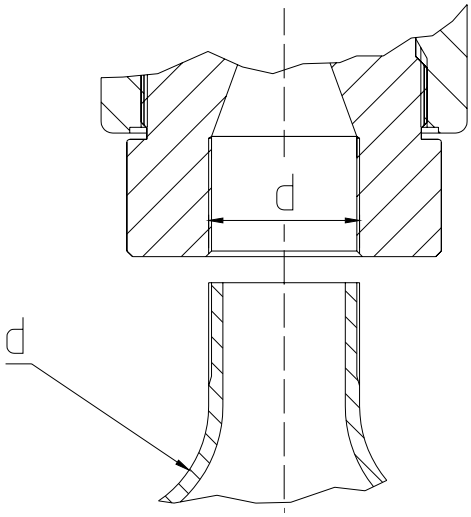


Fig.3 - Inlet pipe-valve inlet joint

5 - Excessive pressure loss at the valve inlet will cause extremely rapid opening and closing of the valve, which is known as "chatter".
This may result in reduced discharge capacity and may also damage the seating surface of the valve.
Severe and prolonged chatter may also cause damage to other parts of the valve. The following recommendations will help to eliminate the factors that produce chatter:

a) Header nozzle corners must be rounded with a radius of not less than 1/4 of the opening diameter.

b) Pressure drops due to friction flow to the valve inlet should not be greater than the expected blowdown of the valve.

To reduce the effects of the phenomenon known as “sonic vibrations”, the following recommendations apply:

a) Safety valves should be installed at least 8 - 10 pipe diameters downstream of any bend in the pipework line. This distance should be increased when the valve is installed in a horizontal section of the line which is preceded by an upward section.
b) Safety valves should not be installed closer than 8 - 10 diameters either upstream or downstream of a diverging or a converging “Y” fitting.
c) In cases where a piping configuration renders the above two recommendations impractical or impossible, the corners downstream of the stub connection should be rounded to a greater extent than the upstream corners.
The radius at the downstream corner should be equal to a minimum of 1/4 of the bore diameter. The radius should be reduced gradually, leaving only a small portion of the upstream corner with a smaller radius.
d) Safety valves should never be installed in pipework in a position directly opposite a branch line.

Excessive line vibrations are known to produce inconsistencies in safety valve set pressures. Vibrations may possibly induce chatter, causing damage to the valve and reducing its capacity. This vibration also contributes to increased incidents of seat leakage.
Considerations should be given to eliminating this problem prior to installing the valve on the unit.

Steam flowing vertically from a discharge elbow causes a downward reaction on the elbow. Bending stress in the valve is determined by the product of this reactive force and the moment arm between the point of steam exhaust and the section which is deemed to be subject to bending stress.

When designing the valve system, the effects of reaction force, vibration and seismic loads on all valve components and discharge piping should be taken into account.

To ensure optimum performance, safety valves must be checked and serviced at regular intervals, *at least twice per year* and whenever irregular operation occurs.
So that servicing can be performed effectively, valves should be located so as to allow for easy access.

Sufficient working space should be provided around the valve to permit access to the adjusting ring.
If two or more valves are located close together, the outlets should be parallel so as to offer as much protection as possible to maintenance personnel working close to them.

The safety valves must be installed vertically.
Nominal tolerance is 1 degree.

The discharge area of the outlet piping from a safety valve must be at least equal to the area of the outlet connection. If more than one valve is connected to a common outlet pipe, the area of the pipe must be at least equal to the combined area of the outlet connections to the safety valves.

All safety valve discharges should be piped so that the effluent is discharged clear from running boards or platforms and should be conveyed in a suitably inert environment compatible with the service fluid in the system. There must be ample provision for gravity drainage in the discharge pipe at, or near, each safety valve where water or condensation may collect.

If a silencer is used on a safety valve, it should have sufficient outlet area to prevent back pressure having a value higher than 25% of the set pressure, to prevent it interfering with the discharge capacity of the valve.
The silencer or any other components should be constructed so as to avoid the possibility of restricting the discharge passages due to build-up of corrosion deposits.

Discharge and drainage pipes must be installed so that they will not exert undue stresses on the safety valve. Any such stresses can produce body distortion and leakage.
Therefore bear in mind the following recommendations:

a) Discharge piping should not be supported by the valve.
The maximum mass on the outlet of the valve should not exceed the mass of a flange.
b) Clearances between the valve exhaust piping and the discharge piping should be sufficient to avoid contact due to thermal expansion of the header, valve and discharge piping. Movements due to vibration, temperature changes and valve reaction forces should also be considered.
c) Flexible metal hoses are not generally recommended, but if used to connect valve outlets to discharge piping, they must be of sufficient length and be designed/installed in such a manner, that they will not become rigid in any one configuration.

Safer results are obtained if the hoses are installed so that they will permit movement by bending, rather than by stretching and compressing along their length.
When lifting a valve, the valve should always remain in a vertical position. The valve may be lifted by means of a sling around the valve yoke and the neck of the outlet flange.

Under no circumstances should the valve be lifted by the lifting lever. The valve should not be bumped or dropped during installation. If the valve is dropped, an inspection for damage should be made, and the set pressure of the valve rechecked.

At the time of installation, all protective covers on the valve should be removed. The internals of the valve should be checked for cleanliness. No foreign matter is permitted in the valve inlet or outlet, since it may damage the valve components or fall into the header. All face surfaces which require gaskets to seal pressure should be inspected for cleanliness, or any defects that can cause leakage. Burrs, scoring, uneven surfaces, etc. are all defects which may cause leakage.
Before installing the valve, check that the gaskets meet the requirements for the sizes and pressure ratings involved.
It is essential that the gaskets used are dimensionally correct for the specific flange, and that the valve inlet and outlet openings are completely clear. Gaskets, sealing surfaces and threaded fasteners should meet the requirements for the pressure and temperature involved.

Other recommendations for valve installation include:

a) Install the inlet gasket, if required, on the header mounting flange. Check for cleanliness, etc. When possible, the studs on the mounting flange should be used to guide the valve onto the flange. The studs should be lubricated with suitable lubricant.

b) When installing flanged valves, the flange bolts must be tightened evenly to prevent body distortion, misalignment and leakage.

c) With the valve in position, fit the nuts and turn until finger tight. Then tighten them alternately. As an extra precaution, check the gap between the two mating flanges during the tightening process to ensure that the flanges are being pulled together evenly. Callipers may be used for this check. A final inspection should be performed to ensure that all of the requirements have been implemented.

d) The outlet piping may now be installed in the same way. First perform a complete inspection of the components and ensure that they are clean. Bolts should be suitably lubricated.

e) Install the outlet gasket with the corresponding bolts and nuts. Tighten the nuts by hand, then proceed as indicated in step c).

This line must also be flexible so that it will not create forces on the valve under operating conditions.
For valves with threaded ends, screw in and tighten the nuts on the inlet stub connection using belt or chain wrenches, gripping the valve on the cylindrical part of the yoke.
During this operation, do not suddenly tighten the valve or strike it. Do not use lever or pipe wrenches during tightening operations. 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.

11. DETERMINING REACTION FORCES

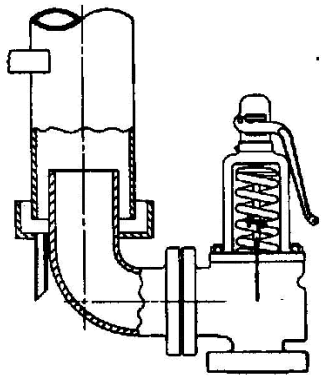


Fig. 4 – Valve closed

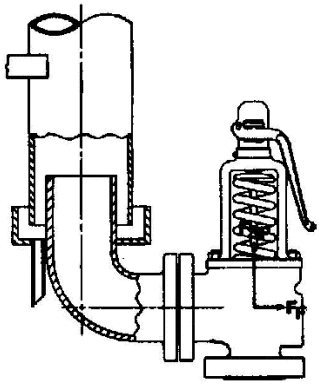


Fig. 5 – Opening transition

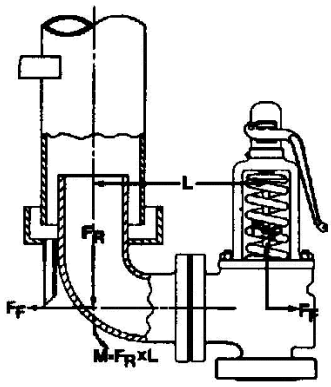


Fig. 6 – Valve open, flow stabilised at full capacity

The figure on the left shows a CS70/71 safety valve in its various operating modes. When the valve is closed (*Fig. 4*), an upward force is exercised on the valve collar due to the pressurised fluid pushing against the plug. Valve collars are built in such a way as to withstand the force (F_p) and tangential stress caused by internal valve pressure.

When the balance is broken for pressure values slightly above the set pressure (*Fig. 5*), the force (F_p) remains constant until significant overpressure occurs.
The combined force of set pressure plus overpressure (F_{sp}) must be balanced by the opposing forces in the valve collar.

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

After the flow has stabilised (*Fig. 6*), the impact of the fluid on the discharge bend cancels out the force (F_F), and the fluid flows up towards the outlet; a downward force (F_R) is created along the centre line of the discharge bend.

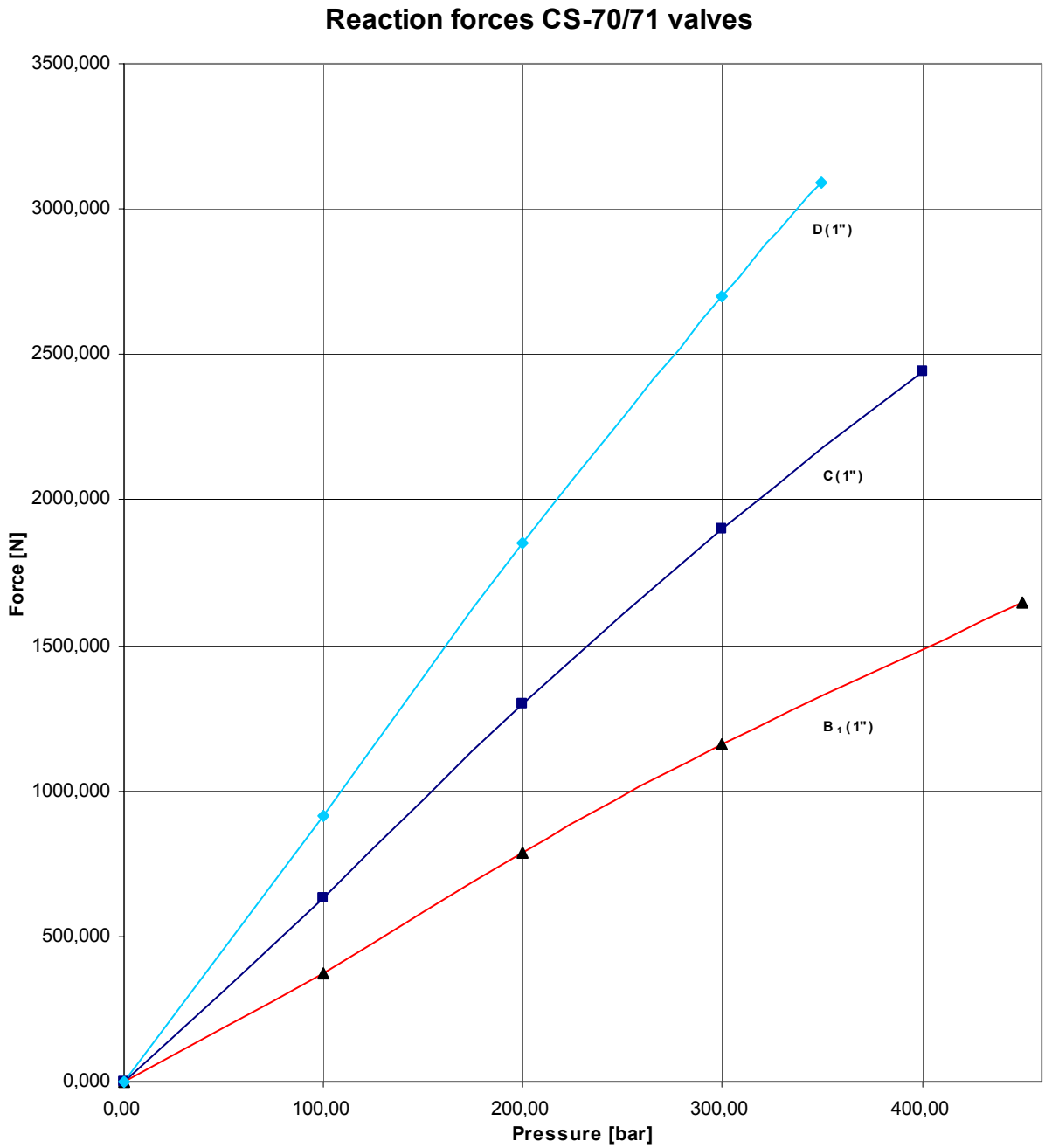
This force, associated with the arm (*L*) produces a bending moment in the valve collar. It also produces an unbalanced downward force on the header to which the valve is connected; this force must be offset by the spring bracket or another system.

The force F_R is calculated according to the *API 520* formula for gases:

$$F_R = 129 \cdot Q \cdot \sqrt{\frac{kT}{(k+1) \cdot M}} + 0{,}1 \cdot A \cdot p$$

A= outlet area [mm^2]
Q= rate of flow in mass [kg/s]
P= static pressure at the discharge area [barg]
T= Temperature at the discharge area [K]
M= Molecular mass of the process medium
k = Adiabatic expansion coefficient of the process medium

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


Reaction forces CS-70/71 valves
3500,000
3000,000
2500,000
2000,000
1500,000
1000,000
500,000
0,000
Force [N]
0,00
100,00
200,00
300,00
400,00
Pressure [bar]
D(1")
C(1")
B1(1")

12. START-UP

ATTENTION!

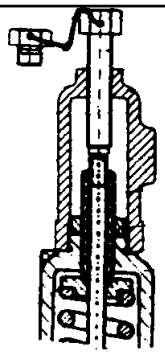
The valve has been factory-calibrated with compressed air at ambient temperature and atmospheric back pressure, as established by ISPESL regulations, paragraph E.1.D.2 point 11.3 and by EN ISO 4126 paragraph 3.2.1 and paragraph 7. If the temperature is different from ambient temperature, recalibrate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

ATTENTION!

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

ATTENTION!

Gag the valve when adjusting the rings, to prevent risk of injury or death.



13. CALIBRATION

13.1 Calibrating safety valves without lifting lever, type: CS 71 (*Fig.1*)

To adjust the set pressure, proceed as follows:

a) Remove the seal, if present, and unscrew the cap (1).
b) Loosen the lock nut (3) and turn the adjusting screw (2) in a clockwise direction (tightening it) to increase the set pressure, or in an anticlockwise direction (loosening it) to lower the set pressure.
c) Tighten the lock nut (3) and refit the cap (1).

14. ADJUSTING THE BLOWDOWN

When the reason for the safety valve opening has been eliminated, the pressure in the protected equipment starts to fall. The valve always closes at a lower pressure than the set pressure.
The difference between closing pressure and set pressure is defined simply as BLOWDOWN and is expressed as a percentage of the set pressure.

For example:
Set pressure: 10.0 bar
Closing pressure: 9.5 bar
BLOWDOWN 0.5 bar i.e. a closing pressure drop of 5%.

To adjust the blowdown, remove the locking screw from the adjusting ring and use a pointed tool to turn the adjusting ring 1 or 2 notches at a time. Turn the ring anticlockwise to lift it and increase the blowdown; turn the ring clockwise to obtain the opposite effect. If the adjusting ring is difficult to move due to dirt deposits in the thread, release it by lightly hitting the yoke near the ring.
After completing calibration operations make sure that the seal, if present, is applied.

15. OPERATING PROBLEMS

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

15.1 - Fluid leakage

15.1.1 Fluid leakage in valves without lifting lever, type CS 71 (*Fig.1*)

Normal operating pressure must always be at least 10% lower than set pressure, otherwise the sealing force exercised by the spring on the disc and that exerted by the fluid on the sealing surface will be so weak that a slight pressure fluctuation is sufficient to cause a leak.
If there is a very slight leak of fluid (indicated by simmer in the sealing area) when the pressure has almost reached the set opening point, this is not a problem and merely indicates that the seat sealing surfaces are slightly irregular.
However a larger leak indicates that the seat is damaged and must be repaired.
Continuous leakage may also occur at operating pressures which are considerably lower than the closing pressure of the valve. These leaks may be caused by deposits of dirt damaging the seats.

15.2 Chatter

Chatter is caused by the disc rapidly opening and closing on the seat and must be eliminated immediately to prevent breakage of the seats, which may compromise the performance of the valve.
Chatter can be caused by:

1) - insufficient blowdown
2) - inlet pipe too long or diameter of inlet end too small
3) - insufficient flow
4) - excessive back pressure due to the outlet pipe being too long or its cross-section being too small

If the valve is fitted with a lever, chatter can be stopped by keeping the valve open with the lever until the pressure falls by about 7-8% below set pressure.
If the valve has no lever, lower the pressure by adjusting the system upstream of the valve. In both cases, immediately identify the cause of the chattering and eliminate it.

ATTENTION!

The lever must be actuated with the operator standing a safe distance from the valve, by means of a length of cord attached to the hole on the lever.

15.3 Blocking

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

1) - incorrect blowdown
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 clockwise by one or two notches. When the ring lifts, the problem is eliminated.

15.4 Drop in set pressure

Drops in set pressure are often attributed to loss of elasticity in the spring.
However, except in exceptional circumstances, it is actually due to damage to the seats caused by foreign bodies, chatter or uneven heat distribution in the internal parts of the safety valve between one discharge and another. Therefore carefully check for leaks before adjusting the set pressure. Do not repeat tests at brief intervals but first allow the valve to cool.

16. PERIODIC SAFETY VALVE INSPECTIONS

To make sure the safety valves maintain their operating efficiency over time, they must be checked and serviced at regular intervals, *at least twice per year* and whenever irregular operation occurs, by Carraro or Authorised Service Centre technicians.

In the case of scheduled service interruption of the protected structure, we recommend carrying out checks immediately prior to shutdown in order to use this downtime to carry out any servicing operations which may be necessary.

17. TROUBLESHOOTING

PROBLEM	POSSIBLE REASON	CORRECTIVE ACTION
VALVE DOES NOT LIFT COMPLETELY	ADJUSTING RING TOO HIGH	LOWER THE RING
	FOREIGN BODIES TRAPPED BETWEEN PLUG AND GUIDE	DISSASSEMBLE THE VALVE AND ELIMINATE FAULTS MAKE SURE THE SYSTEM IS CLEAN
INCORRECT CALIBRATION VALUE	ADJUSTING SCREW INCORRECTLY SET	ADJUST THE CALIBRATION VALUE
OPENING SIMMER	RING TOO HIGH	LOWER THE RING
	LINE VIBRATIONS	INVESTIGATE AND ELIMINATE CAUSES OF VIBRATION
VALVE LEAKS OR POPS OPEN IRREGULARLY	SEATS DAMAGED	DISASSEMBLE THE VALVE, LAP THE SEATS AND REPLACE THE PLUG IF NECESSARY
	BADLY ALIGNED COMPONENTS	DISASSEMBLE THE VALVE AND INSPECT THE MATING SURFACES OF THE SEAT AND PLUG, LOWER SPRING GUIDE WASHER AND STEM, ADJUSTING SCREW, CONCENTRICITY OF THE STEM
	OULTET PIPING FORCES THE VALVE OUTLET	CORRECT AS NECESSARY
VALVE BLOCKS WHEN OPENING OR DOES NOT CLOSE COMPLETELY	RING TOO LOW	TURN THE RING TO THE LEFT 1 NOTCH AT A TIME AND TRY AGAIN. REPEAT UNTIL THE PROBLEM HAS BEEN ELIMINATED
	FOREIGN BODIES	DISASSEMBLE THE VALVE AND ELIMINATE FALUT CHECK THE SYSTEM IS CLEAN
	INCORRECT TOLERANCE BETWEEN PLUG AND GUIDE	CHECK TOLERANCE
EXCESSIVE BLOWDOWN	RING TOO LOW	TURN THE RING TO THE LEFT 1 NOTCH AT A TIME AND TRY AGAIN. REPEAT UNTIL THE PROBLEM HAS BEEN ELIMINATED
	EXCESSIVE BACK PRESSURE	REDUCE DISCHARGE PRESSURE BY INCREASING THE DIAMETER OF THE OUTLET PIPING
CHATTER OR BLOWDOWN TOO SHORT	RING TOO HIGH	TURN 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 TO LESS THAN HALF THE REQUIRED BLOWDOWN
	INCORRECT VALVE DIAMETER	CHECK VALVE SIZE

20090 SEGRATE (MI)- via E.Fermi
EMAIL: info@carrarovalvole.it
TEL. +39 (02) 269912.1 - FAX. +39 (02) 2692.2452

18. MAINTENANCE

18.1 Routine and/or preventive maintenance

In order to guarantee correct operation of the valves they must undergo *checks at least twice per year*, except when irregular operation occurs, during which it is necessary to replace all gaskets which are essential for preventing communication between the valve interior and the external environment (a dangerous situation for personnel both due to the high operating pressure and temperature of the service medium and because leaking fluid may generate a potentially explosive atmosphere).

18.2 Replacement parts

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

ATTENTION!

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

19. DISASSEMBLING SAFETY VALVES

19.1 Dismantling safety valves without lifting lever, type CS 71 (*Fig.1*)

- Remove the seal, if present, and unscrew the cap (1).
- Remove the seal, if present, and unscrew the ring locking screw.
- Turn the adjusting ring (10) to the right until it reaches the limit stop. Count and write down the number of notches the ring was moved by, since it must be returned to its initial position during reassembly.
- Loosen the lock nut (3) and unscrew the adjusting screw (2) (anti-clockwise), counting the number of turns before the spring is completely released.
- Tighten the valve body (14) in a clamp and loosen the connection between the valve body and the yoke (12) using only a belt wrench (never use pipe wrenches, or any other plumber's wrench, as these could damage the yoke).
- Unscrew and remove the yoke (12) from the valve body (14).
- Remove the washer-spring assembly, then the guide (9), keeping the stem (6) in a vertical position.
- Lift out the stem (6)-adjusting ring (10) assembly, taking care not to let the disc (11) drop.

19.2 Lapping the seats

To true the sealing surfaces of the disc (11) and nozzle (14), 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-mentioned smooth cast-iron ring.

1) Keep the parts clean;
2) Frequently reapply abrasive paste to 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) When lapping the seat, make sure that the lapping ring does not fall and dent the seat;
5) Proceed with lapping by moving the ring alternately in all directions, pressing it uniformly onto the seat and rotating it slowly. 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 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.

ABRASIVE PASTE

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

Two lapping rings are recommended for each orifice.

19.3 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 indications given in 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.

20. 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 with non-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. 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 which are 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.

21. REASSEMBLING SAFETY VALVES.

21.1 Reassembling safety valves without lifting lever, type CS 71 (*Fig.1*)

- Lubricate the spring washers (5 and 8) on the conical section (in contact with the stem and adjusting screw respectively) and the lower inner part of the adjusting screw (2).
- Secure the body-seat (14) assembly in a clamp with the nozzle pointing upward.
- Rest the disc (11) and then the stem (6)-adjusting ring (10) assembly on the body-seat (14) then, keeping the unit together, lower the guide (9) and insert it in the appropriate fitting.
- Insert, also from above, the washer (5 and 8) - spring (7) assembly.
- Fit the O-ring (13) in the appropriate housing on the seat. Tighten the yoke (12) onto the body-seat (14), ensuring that the guide (9) is not positioned so as to reduce the actual discharge area of the valve. Then tighten the complete assembly.
- Refit the adjusting ring (10) in its original position as follows:

a) Use a sharp tool to slowly turn the ring to the right until the limit stop.
b) Turn the ring to the left counting the same number of notches previously counted when disassembling the valve, in order to return it to its original position.

- Tighten the ring locking screw equipped with corresponding gasket and put back the seal, if present.
- Tighten the adjusting screw (2) until all play has been eliminated and add the same number of turns used to loosen the screw when disassembling the valve.
- Tighten the lock nut (3) and refit the cap (1) until it is snug against the gasket (4).

21.2 Checking the gaskets.

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

ATTENTION!

Should it be necessary to weld the pipes, avoid connecting the earth connection to the valve, as this could cause damage to important sliding parts.

22. REPAIR

22.1 If it is not possible to solve a problem, send the faulty valve to the supplier/manufacturer accompanied by a report outlining the problem.

22.2 When requesting replacement parts and information, always quote the serial number marked on the data plate affixed to the valve or stamped on the outer surface of the flange.

22.3 Data plate (example)

22.4 In order to ensure correct operation of the valves indicated in this manual, they should be *serviced by Carraro or Authorised Service Centre technicians using original replacement parts.*

ATTENTION:

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

ATTENTION!

The manufacturer accepts no responsibility if modifications to the product or operations not envisaged in this manual are carried out.