SOCLA

Technical manual

Pressure reducing valve

Bronze range

DN10 - 100 mm

Desbordes

Summary

Applications and main characteristics

Pressure reducing valves are designed to maintain in the pipe work a reduced outlet pressure which is noticeably constant in flow and flow rate.
They guarantee comfort and security.

Applications :

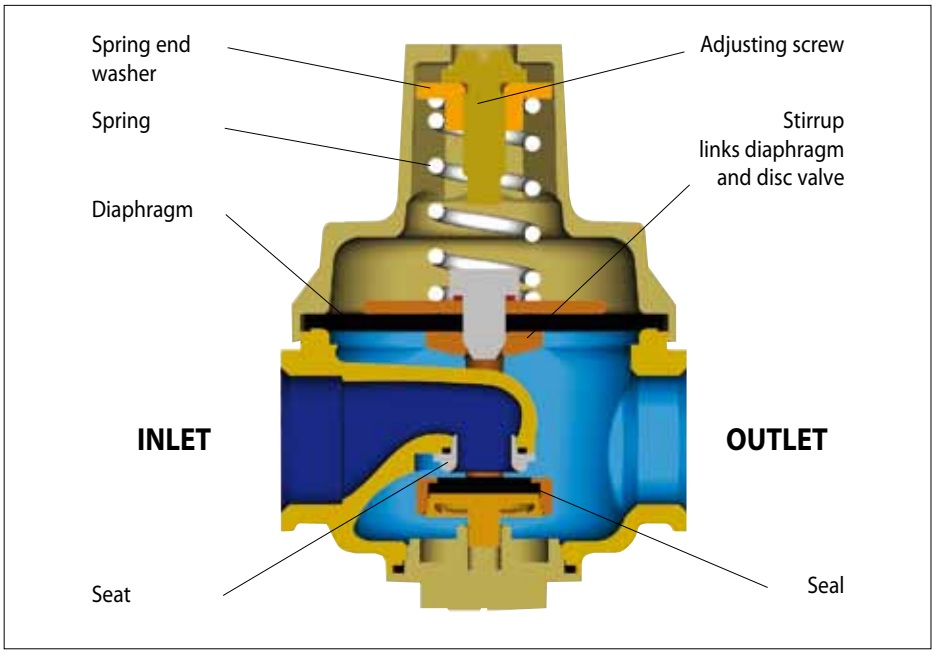
- For water distribution, domestic and individual :
  Protection of the whole sanitary installation (cold and hot water)
- Industrial applications such as :
  Machines and work stations, laundries, greenhouses, boiler rooms, compressed 'air pipe works, fuel oil
- Very low pressure, irrigation, farming

Performances of bronze types:

- Can be installed in any position
- Not affected by scale or dirt
- No maintenance
- No filter
- Excellent hydraulic and acoustic performances
- Upstream pressure up to 25 bar or 16 bar (see product range)
- Precise and permanent setting
- All types of connections
- A single model hot and cold water
- Can be fitted on air, neutral gases and fuel oil

Data sheets and instruction notices are available on our web site **www.socla.com** or on request by our sales department..

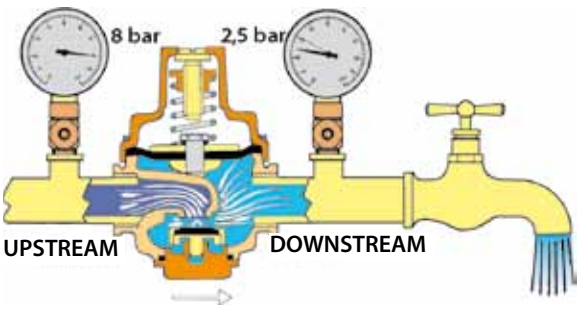
Working principle



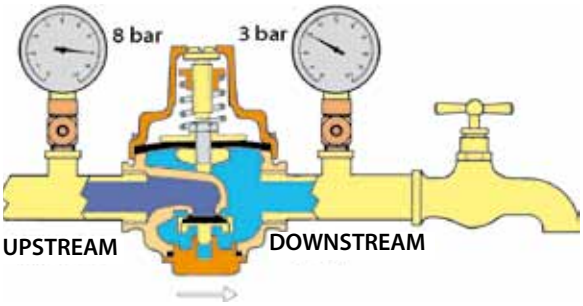
The outlet pressure acts on the bottom face of the diaphragm, compressing the spring when it exceeds the pre-set value and thus closing the valve.
As long as no water is drawn off the downstream side (no-flow condition), the outlet pressure is thus kept at the pre-set value.

When water is drawn off the DOWNSTREAM side, the outlet pressure decreases and the spring pushes against the diaphragm, opening the valve.

Under prolonged flow conditions, a self-damping effect occurs in the valve opening instead of a series of jerky opening and closing movements.



FLOW DOWNSTREAM
Outlet pressure drops. Spring pushes against the diaphragm and disc and opens the valve.
The downstream pressure becomes for example 2,5 bar compared to 3 bar at the beginning. The 0,5 bar difference is the head loss.



NO FLOW DOWNSTREAM
Outlet pressure goes up again.
When it corresponds to the setting, diaphragm and disc push against the spring and thus close the valve.

Definition

PRESSURE REDUCING OR PRESSURE REGULATOR VALVE ?

Pressure **reducing and regulator** valves are both used.
This product range with direct action differs from regulation valves or from more complex stabilizers which are often of bigger size and equipped with an actuation device which means-better accuracy, but also slower regulation and need of maintenance.

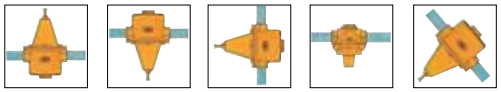
The word "*reducing valve*" conforms to the Standard terminology of the valves for buildings but our devices are regulating valves as well :
they control the downstream pressure WETHER THERE IS A FLOW OR NOT. When there is flow, the downstream pressure cannot vary more than the head loss value. A low value shows the hydraulic quality of a good regulator.

In addition, the upstream pressure affects slightly the outlet : an increase of upstream pressure lets the outlet decrease a bit (the outlet pressure cannot vary more than 7 or 8 % of the upstream pressure when there is no flow*). This is of no effect on the user.

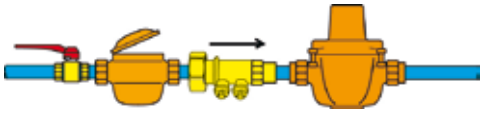
** Example : a pressure reducing valve is set up at 3 bar without flow for 8 bar upstream pressure. If the upstream pressure increases to 12 bar, i.e. + 4 bar, the outlet will noticeably increase of 4 x 7% = 0,28 bar, which is a very low value, without any consequence for the user.*

Mounting

In domestic water supply, pressure reducing valves are generally fitted just after the water meter and thus protect the whole installation.
However, in particular cases, such as **individual water supply**, the valve is often placed after the pipe connection to the garden taps which requires a maxi pressure.



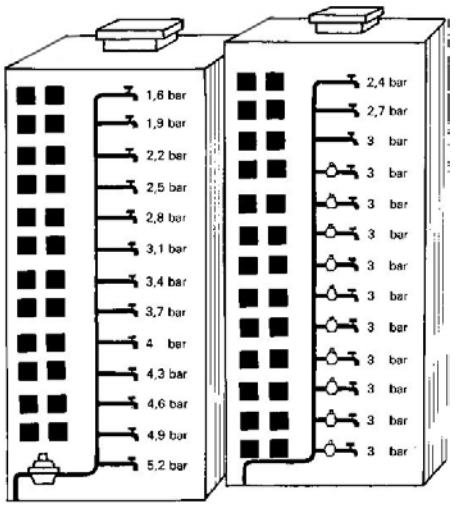
They can be installed **in any position** if flow direction stipulated by the arrow is respected.
If there is a frost risk, they should be drained.



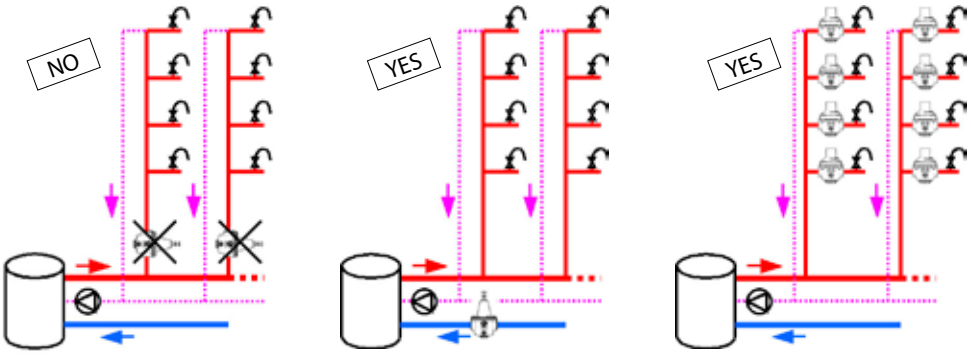
Reducing the pressure in buildings :
In high buildings, a water pressure reducing valve is installed at each floor to obtain a suitable pressure **at each floor**. *(On cold as well as warm water network, when collective). Upper floors with a pressure under 3 bar can be exempt.*

Mounting a water pressure reducing valve **in big diameter** *at the bottom of a building is not very satisfying, in terms of comfort and noise : over pressure at low floors in order to supply pressure to the high levels which then can be short of pressure.*

Please note that **closing a collective hot water pipe work** *means «no reducing valve in the closed pipe work, for example at the bottom of each column. In that case, , you have to mount one valve per floor, at each level, outside the closed pipe, or a sole pressure reducing valve at the entry, before the closed pipe, if the size of the building requires it.*



Two examples to reduce the pressure in buildings

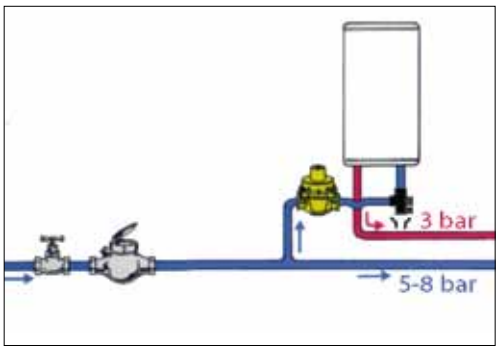


Closing a collective hot water pipe work means «no reducing valve at the bottom of each column. Mount a single reducing valve at the entry or at each connection outside the closed pipe.

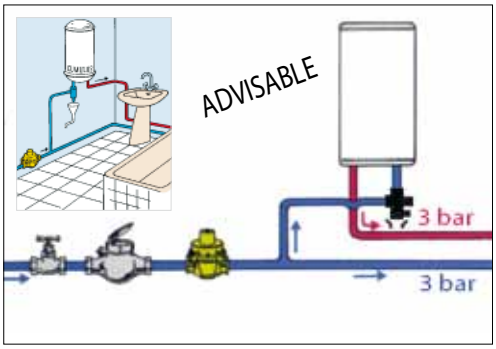
How to reduce the pressure in domestic circuits :

In domestic circuits, the installation of a pressure reducing valve on the sole sanitary production of hot water protects the tank and its safety valve against leakage due to overpressure, but creates also an unsteadiness between the hot and cold water pressures and makes it difficult to set the temperature of mixed water.

The one and only solution is fitting a **DESBORDES** *pressure reducing valve* **at the beginning of the system** *:*
It ensures a substantially uniform pressure in hot and cold water systems when water is drawn. It will protect every tap and sanitary installations.



The installation of a pressure reducing valve on a sole sanitary production of hot water creates an unsteadiness between hot and cold water pressures.



The installation of a pressure reducing valve at the beginning of the system ensures steadiness between hot and cold water pressures.

Commission Settings

Water hammers can damage the reducing valve. **When commissionning**, open slowly and gradualy the valve at the upstream side.

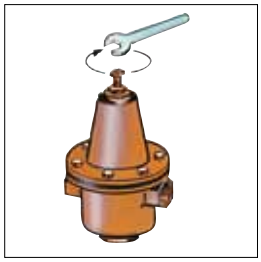
A booster unit with a sudden start close to the pressure reducer requires the safety of an absorption tank.

Just like by any intervention on the pipe work, the circuits must be **rinsed** beforhand.

The Pressure reducing valves DESBORDES are always **set** under «no flow», i.e. all downstream taps closed. The pressure gauge thus shows a “static” pressure.

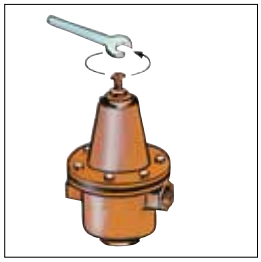
To increase outlet pressure :

Tighten adjusting screw
(clockwise)



To decrease outlet pressure :

. Slacken the adjusting screw (anti-clockwise)
. Release the pressure by slightly opening a tap on the outlet side. Close the taps.
. Set the adjusting screw again to obtain required pressure.
. A slight pressure drop on the outlet side is normal : it corresponds to the head loss of the valve itself.



By domestic applications, a 3 bar pressure is recommended: It is the pressure required for flow and acoustic tests of sanitary taps in conformity with the Standard. .

The setting must be adapted when there is an important length of pipe between the pressure reducing valve and the first flow point or when higher or lower levels must be supplied.

For example, remember that 10 m higher means less1 bar.

Defects :
Breakdown causes

Anomalies	Origins	Solutions
Insufficient downstream pressure	Bad selection of product	Request our sales Department
	Wrong setting	«Set the adjusting screw again »
	Ball valve partly closed	Open the ball valves upstream and downstream
	Reducing valve or pipe work under-dimensioned	Check upstream pressure under flow. Dimension again
	Broken spring	Replace the spring
	Mobile parts blocked	Clean the guiding in the pressure gauge at the bottom of the casing
Excessive downstream pressure	Bad selection of product	Select a compensating spring
	Spring too compressed (10 series only)	Unscrew slightly the adjusting screw
	Back pressure from downstream and blocked by the reducing valve	Place an absorption tank downstream or a safety valve, to absorb the dilatation generated by hot water, for example.
	Tightness seal/valve seat faulty.	Repair the seal
	Mobil stirrup broken (frost, water hammer)	Replace the set stirrup/membrane
Leakage out of the cap	Membrane damaged.	Replace the set stirrup/membrane
		Place a device against excessive backpressure (safety valve, absorption tank, non-return valve)
Noise by flow	The pipe and/or reducing valve are under-dimensioned for the flow rate	If the pipe work is correct, select a reducing valve of bigger size
	Too much pressure reduction in the valve.	Request our sales Department
	There is air in the pipe work	Check upstream devices
Noise when opening or closing the flow rate	Water hammer	Select check valve with more progressive closing or place absorption tank
	Flapping/bounce of check valve or safety valve	

Anomalies of downstream pressure

An **EXCESS OF PRESSURE** means possible defect at the reducing valve.

Due to **leakage at the seat**, *the upstream pressure passes to the outlet : at zero flow rate; we can see an equality between upstream and downstream pressure. The frost or a water hammer could have twisted internal parts. It could be also a deterioration of the seal or of the seat due to overspeed, i.e.* **cavitation** *or* **abrasion** *through particles. The reducing valve needs to be repaired.*

The setting is defect : the **spring is totally compressed** *and there is « direct passage ». Unscrew the setting in order to go back into the functioning range. Please note that most of the valves designs do not show this defect.*

The pipe work can also be affected by a connection at the upstream of the reducing valve : forgotten, ignored or loose connection , which works as **by-pass**. *This situation often occurs in old pipe works.*

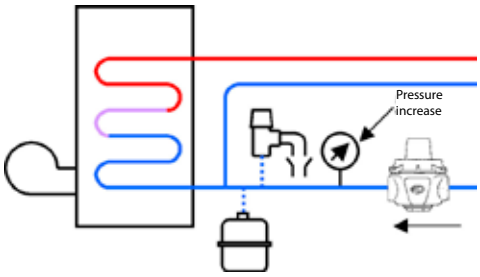
Other cause : a supply of hot and cold water at different pressure, with a reducing valve on hot water only, a parasite intercommunication cold/hot occurs through **un-tight non-return valves**, *even if it is on a mixing valve or on a security group. Due to the high backpressure, the security group may « spit » continuously, and thus the pressure after the reducing valve increases over its setting. The non-return valve must be repaired.*

But the most frequent cause for an excess of pressure despite the installation of a **reducing valve which works** perfectly is due to the **PRODUCTION OF HOT SANITARY WATER** (**electric tank, boiler…**). During th warming of the electric tank, the **dilatation** brings an **increase of pressure** which cannot escape if there is no leakage or flow (the reducing valve works as non-return valve).

Electric tanks : , *the compulsory electric group lets drop the excess of water over 7 bar (for ex. when the temperature of an electric tank of 100 litres increases from 15°C to 60°C, about 2 litres will drop.). The hot water pipe work will reach 7 bar. On the cold pipe work, if the non-return valve of the security group or of the thermostatic mixing valves is not tight, the pressure will also reach 7 bar pressure, and will decrease to the setting value of the reducing valve only if there is flow.The pressure reducing valve is not faulty.*

Boilers *and especially* **wall instantaneous boilers** *:the thermal inertia, which can be very high after stopping to get hot water create a dilatation and thus a pressure increase. As the boiler is not equipped with any device against overpressure, it is necessary to protect the reducing valve by fitting a group of security, a safety valve set 6-7 bar, or a sanitary absorption tank, if water cannot be evacuated to the drain.*

Such a situation can occurs on a cold water pipe work without flow, where the temperature increases in summer or because of the nearness of heating pipes.



The pressure increase of domestic water due to its dilatation is limited by a safety valve or an absorption tank.

A **SHORTAGE OF PRESSURE** can have many origins :

A **blockage of the mechanism**. *The seal does not rise up enough from the seat. The principle of a DESBORDES reducing valve in bronze, with direct action, without stem or sliding seal reduces this risk even when there is scale or dirt.*

Breakdown of the spring. *The reducing valve does not open anymore. The risk is very small as the springs are anti-corrosion coated and tested in salted mist.*

An **under-dimensionning** *of the device or of the pipe work in comparison to required flow rate.*

An important **de-crease of the upstream pressure** *as soon as there is flow. Check if the upstream pipe work is not blocked or under-dimensioned.*

However, it is normal that the downstream pressure decreases when there is flow.
It is the head loss of the device itself (see head loss 2).

How to choose a diameter

Many solutions exist to select the size of a reducing valve :

There is no precise hydraulic calculations of the flow rate; that is the reason why, for practical purposes, the pressure reducing valve should be chosen with same diameter as the pipe. This is often the case.

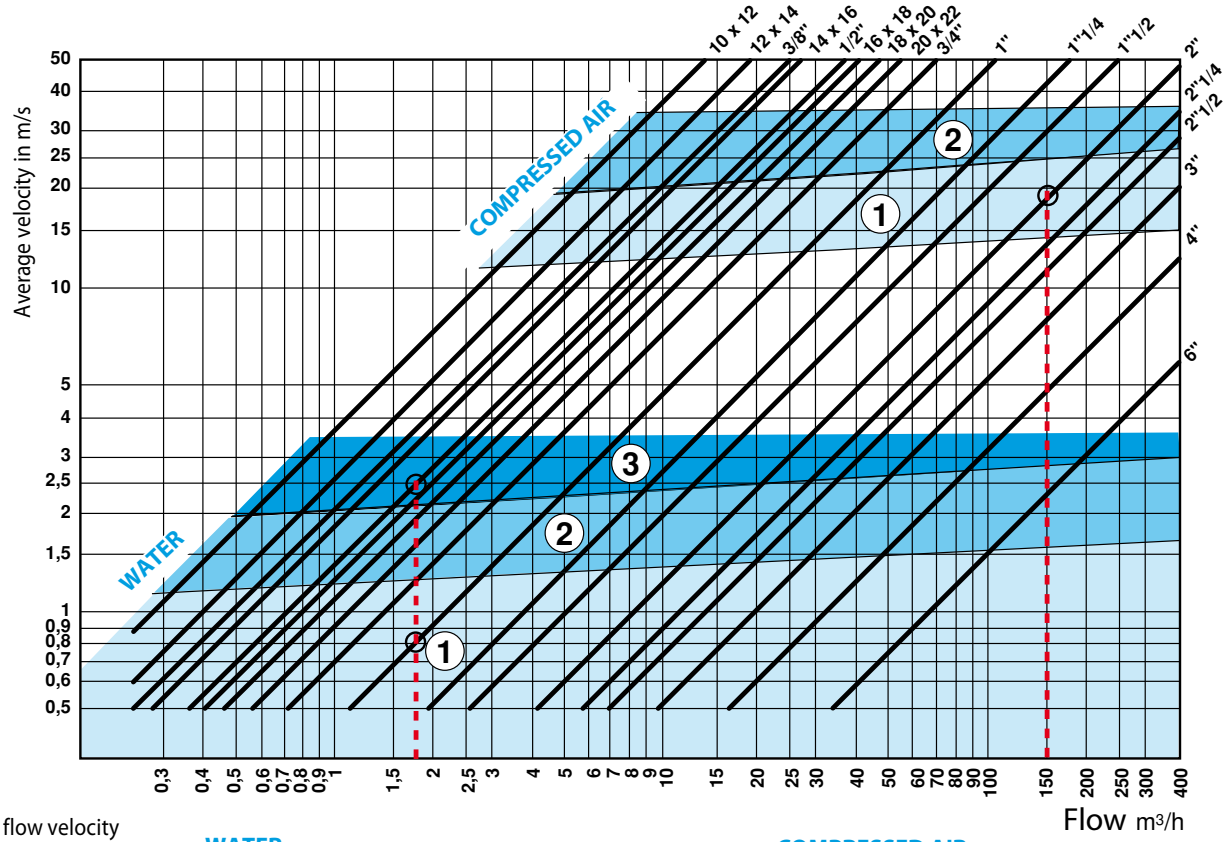
However, when the pipe size is not correct or to optimize the choice, the same rules as for the pipes can be applied. These rules are based on the respect of limit speeds : see chart below. In that way, the size of the reducing pipe can be different from the one of the pipe.

In addition, if the pressure by flow should not decrease under a certain value, the choice of the reducing valve can be made according to its head loss. This value is given on head loss chart 2 or 3.

Head loss chart to determine the dimension of the pipe work

This chart which is used to choose the pipe size, cannot replace precise hydraulic calculations, but it is often used to choose the diameter of the reducing valves when it is the same as the pipe.

Note : according to the Technical Document Unified of plumbing, (DTU P40-202) about 2m/s is required for pipe in basement and about 1,5 m/s in ascending columns.



Head loss 1 :

The choice of a flow velocity in the pipe work and therefore of an acoustic comfort area, determines the diameter of the pipe work which will thus guarantee acceptable head loss. It can therefore be used for dimensionning the reducing valve.

WATER

(1) **Recommended AREA for domestic or similar use (big acoustic comfort).**

(2) **Middle AREA.**

(3) **AREA for industrial use, and, if need be, for domestic use when acoustic comfort is not required.**

On a hot or cold pipe work for domestic use, how to choose the dimension in order to ensure a flow rate of 1,8 m³/h ?
Draw a vertical line above 1,8 m³/h. It will intersects the diagonal straight line for the 1" reducing valve which is required for this application.
For a similar installation, in industrial environment, a reducing valve of 1/2" would suit (area 3).
This is the most current way of choosing the diameter of the reducing valve.

COMPRESSED AIR

(1) **Current use AREA**

(2) **Extreme use AREA.**

On a 2 bar compressed air pipe work, how to choose a reducing/regulating valve in order to ensure a flow rate of 450 Nm³/h ?
The symbol Nm³ (normo-cubic meters or standard cubic meters) is the volume occupied by the gas in «normal» conditions of use, 20 °C for the temperature, and 1013 mbar absolute for the pressure. This value rounded to 1 bar place, for calculating purpose, is the standard reference pressure at sea-level, (760 mm mercury height at the barometer). It corresponds to the atmospheric pressure, or a relative pressure of 0 bar at the barometer. As air is compressible, the higher the pressure on the reducing valve is, the lower will be the volume occupied by a certain air quantity (for example, by a pressure of 2 bar read at the manometer, or 3 bar absolute, the compressed volume of air will be thrice lower).

In the calculation for compressed air, the outlet pressure will be decisive (and not the inlet one).Neither the inlet pressure nor the pressure difference between inlet and outlet will be taken into account.

$$\text{Volume to take into account for calculation} = \frac{\text{volume in "normals" conditions}}{\text{Downstream relative pressure} + 1}$$

Selection procedure (450 Nm³/h at 2 bar downstream) :

1. Determinate actual flow rate in the reducing valve.

The air is compressed at a pressure of 2 bar, as read at the manometer.

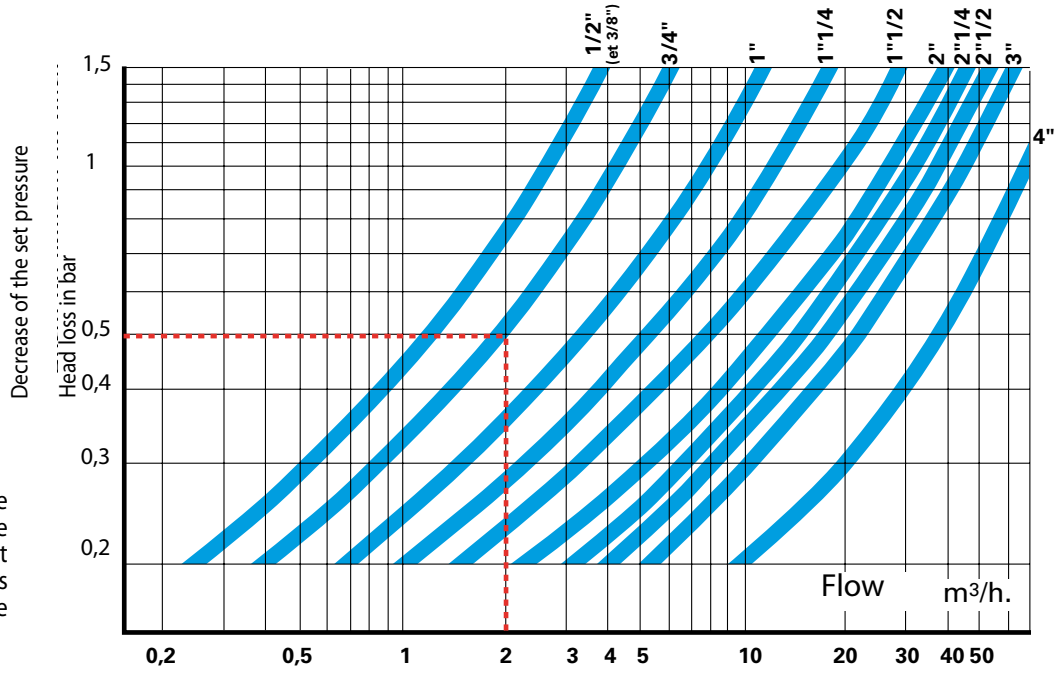
$$\text{Flow rate to take into account for calculation} = \frac{450\ Nm^3/h}{2+1} = 150 m^3/h$$

2. Draw the vertical line through 150 m³/h ; select the reducing valve 2 (area 1 - air compressed)

Remark :

Compressed air application areas have been definied for flow rates 10 times those recommended for water systems. The factor 10 is an average, as compressed air to water flow ratios commonly used vary from 5 to 15.

Chart to estimate the head loss against the flow rate



Head loss 2 :

Can be used for the full range of reducing valve in bronze ref. 9, 10 et 11 and similar; it shows the average head loss for each size, according to the flow rate.

This above chart can be use in all the usual adjustment applications.

The head loss causes **a pressure drop downstream when water flows** through the valve.

In DESBORDES pressure reducing valve, **the drop is VERY SLIGHT**. This characteristic shows the abilty of the DESBORDES reducing valve to maintain adequate downstream pressure even with several taps open at the same time and to give the right flow to everybody.

When comparing several brands of pressure reducing valves, always check them against their head loss curves.

Example :

What is the head loss of a 3" DESBORDES reducing valve at a flow of 2 m³/h ? Draw a vertical line through 2 m³/h. Where it intesects with 3/4", the head loss is approx. 0,5 bar.

Initially preset at 3 bar without flow, this reducing valve will still add 2,5 bar to this flow rate, (provided that the upstream pressure does not fall down).

Kv factor definition

Any valve or fitting will reduce water flow velocity. This is called the friction loss or pressure drop. Pressure drop magnitude varies with the flow characteristics of the valve or fitting. Product flow characteristics are compared by measuring flow rate at 1 bar of pressure drop

This flow rate in m^3/h is called Kv.

In particular cases as for reducing valve, the headloss drop of 1 bar is measured regarding the initial downstream setting of the pressure at zero flow rate and not between inlet and outlet.

Please note that unlike the domestic pressure reducing valves, the regulating valves for water supply are characterised by its flow rate under 1 bar upstream/downstream diffential, in''wide open'' position.

Simplified head loss to estimate the flow rate capacity

On every data sheet about pressure reducing valves, you will find a head loss chart with the capacities of flow rate in 3 different conditions :

At conventional velocity of 2 m/s, which is mentioned in the Standard for Pressure reducing valves.

Under a head loss of 1 bar, (downstream pressure drop). It is the KV factor of the Pressure reducing valves.

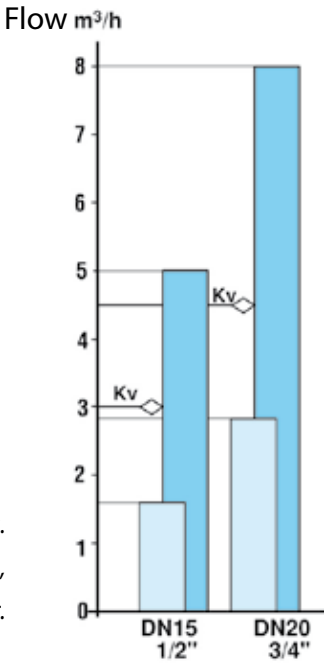
In the limit situation when downstream side is "wide open" and the outlet pressure is "zero" (at 8 bar upstream pressure). The reducing valve is then no more in the regulation area. This is a limit situation.

Example -
Reading of the head loss beneath, the flow rate of a reducing valve ref. 11 DN 20 is :

2,8 m^3/h at 2 m/s.

4,4 m^3/h under head loss of 1 bar (Kv),

8 m^3/h at 8 bar upstream, direct flow in the open air.



Head loss 3 :
Flow rates of types
11 & 11 bis

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