F.A.Q. PICV

GENERAL VALVE QUESTIONS

SYSTEM AND DESIGN QUESTIONS

COMMISSIONING QUESTIONS

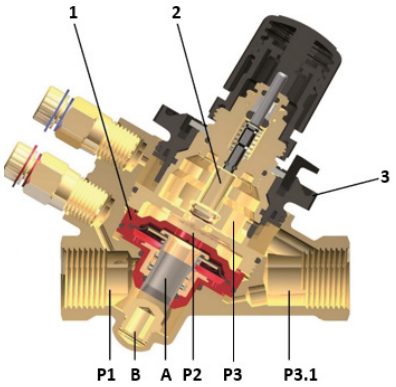
PETTINAROLI RANGE QUESTIONS

GENERAL VALVE QUESTIONS

1. What is a PICV?

A Pressure Independent Control Valve is the combination of a differential pressure regulator (1), a 2-way control valve (2) and a settable flow rate adjustment (presetting) (3). It results in a self-balancing control valve. The differential pressure regulator maintains constant the differential pressure across the control valve, resulting in the highest authority (close to 100%). The presetting adjusts the maximum flow rate across the valve. The control valve modulates the flow rate according to system requirements if an actuator is mounted; in case the control valve is characterized, it can be called PICCV; in case the control valve has a standard linear or quick acting characteristic, it is generally called PICV. It is suitable for treated water. In order to provide maximum energy efficiecy and whole system pressure independency, a PICV must be fit on every terminal unit. Further information about Pettinaroli PICV range are available in the technical manual of PICV (click here).

BACK



2. What is a PICV used for?

A PICV is a control and balancing valve. When installed on a terminal unit, it ensures every time the right flow rate, when required, irrespective of the pressure fluctuation in the water distributor networks. Balancing is always guaranteed, maximising the energy efficiency. It saves 70% pump energy consumption compared to 4-way control valves.

BACK

3. Why should I use a PICV?

PICV are the state-of-the-art of the technology of hydronic balancing and control valves. They make the water distribution network pressure independent (if installed on every terminal unit). They are self-balancing valves and allows for fully variable flow systems, always dynamically balanced irrespective of the thermal load. They reduce designing time and costs: control valve authority calculation and branch pressure drop calculation are not needed anymore. Designer can focus on total system pressure (pump head) calculation. As they are self-balancing valves, commissioning operation are reduced to one main action: technicians just adjust the presetting dial n suitable value. Then, differential pressure across each valve should be checked. The client gets exceptional energy savings and perfect thermal comfort: the PICV provides the required flow rate to each terminal unit every time, minimizing the flow rate and pumping costs. Especially with Equal Percentage PICV, overflow, overcooling/heating and Low DeltaT syndrome disappear. PICV save 70% pump energy consumption with respect to constant flow systems and 30% with respect to DPCV.
Further information about system designing with PICV are available in the Definite Guide of PICV (click here).

BACK

4. What is the start-up pressure and why is it important?

The start-up pressure is the minimum differential pressure across the PICV (P1-P3.1) which is required to keep the flow rate constant. Over the start-up pressure, the PICV maintains the flow rate constant; under the start-up pressure, the PICV works as a standard 2-way valve. It is important because it is the parameter to check whether the valve is properly working

BACK

5. What is the hysteresys and how can it affect the system performance?

The hysteresis is the maximum difference of flow rate between the downward (differential pressure decreasing) and the upward (differential pressure increasing) curves within the minimum and maximum working differential pressure. It affects the readings of flow rate during the commissioning and, moreover, it influences the real flow rate flowing through terminal units. Smaller the hysteresys, more stable and precise the flow rate through units.

BACK

6. What is the Differential Pressure Regulator and which types are there?

The differential pressure regulator (1) is the dynamic component of a PICV. It is made by a rubber membrane, a spring and sleeve. The differential pressure on membrane faces and the spring provide with a balance, resulting in constant differential pressure across the control valve. Pressure fluctuations are absorbed by the membrane: it drives the sleeve opening or closing a window, which limits the flow rate. There is also cartridge type differential pressure regulator (also called insert) which are similar to automatic balancing valve cartridge.

BACK

7. What is the PICV presetting and how can PICV be set to correct flow?

The presetting dial of a PICV is a device, with a numbered scale, which adjusts the maximum flow rate of a PICV. It can limit the control valve stroke or a dedicated passage. The presetting is internal in case the actuator or the manual adjusting cap covers the dial or external if it is accessible even with the actuator or the cap onto the valve. The PICV is set by turning the presetting dial to the suitable position, according to table or calculation settings.

BACK

8. Are PICV suitable for dirty water and is there any PICV which endure with dirty water?

Water quality affects PICV performances. Debris and impurities which come from installation and corrosion, are carried around the system by the water and they gather around moving parts and O-Rings. Accumulation of such material blocks the free motion of the differential pressure regulator. In case the differential pressure regulator gets stuck, the PICV works as a standard 2-way control valve and it cannot maintain constant the flow rate anymore. All national standards regulate the water quality, limiting the content of impurities, specifically iron oxide. For these reasons, several actions are strongly suggested: installation of flushing by-pass to flush out the system before operation; installation of magnetic dirt separators; installation and maintenance of water treatment plants. Alternatively, Fratelli Pettinaroli has developed a PICV which is able to work in very demanding conditions, with high concentration iron oxide (tested).

BACK

9. How can I maintain a PICV?

A PICV can be maintained if its internal components can be replaced or cleaned without removing the valve from pipes or damaging the valve. Components that should be maintainable in PICV are the differential pressure regulator and the control valve.

BACK

10. How can I size a PICV?

All PICV must be selected based on terminal unit design flow rate firstly. The right PICV should have the closest higher flow rate with respect to the terminal unit design flow rate. The PICV should work with the highest presetting position possible. In order to reduce the minimum differential pressure, a small safety margin (5-10%) can be taken into consideration while selecting the PICV.

BACK

11. Can I install electric actuators on PICV?

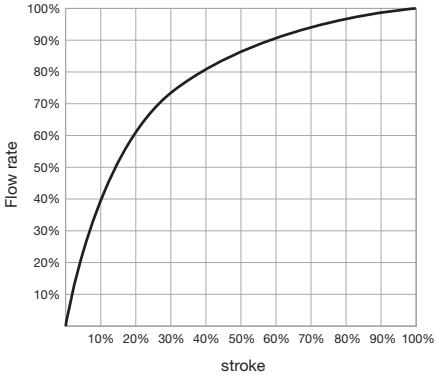
Definitely yes. A PICV is a water flow rate control valve and every valve has a connection for installing an actuator. Axial valves must work with axial actuator (thermoelectrical and electromechanical) while rotary valves must work with rotary actuators. Actuator stroke should always match control valve stroke to enhance modulation accuracy.

BACK

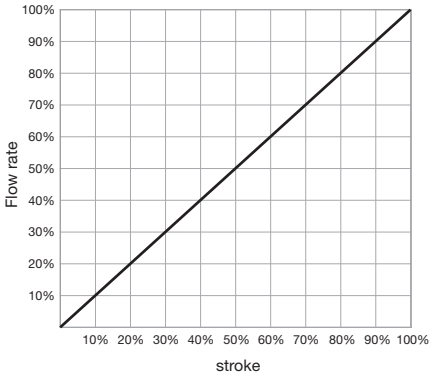
12. What is the flow rate control characteristic of a PICV?

The flow rate control characteristic of a PICV is the correlation between the valve opening position and the flow rate flowing through the valve. Both parameters can be normalized referring to maximum valve opening position and maximum flow rate (control valve fully open) at given presetting. The valve opening position is directly proportional to a modulating control signal sent to an electric actuator. Available characteristics are: QUICK OPENING, LINEAR, EQUAL PERCENTAGE.

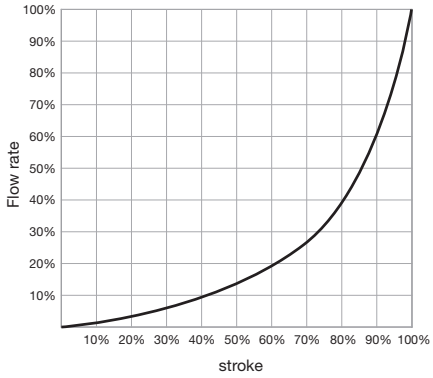
QICK ACTING valve characteristic curve (PICV)



LINEAR valve characteristic curve (PICV)



EQUAL PERCENTAGE **EvoPICV** control valve characteristic curve (PICCV)

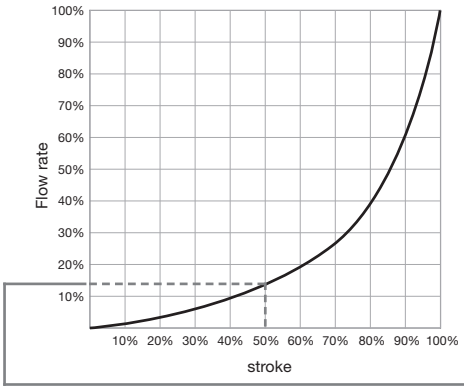


BACK

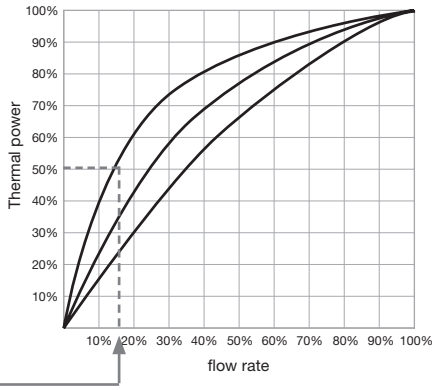
13. Which kind of control characteristic is advisable for FCU and AHU?

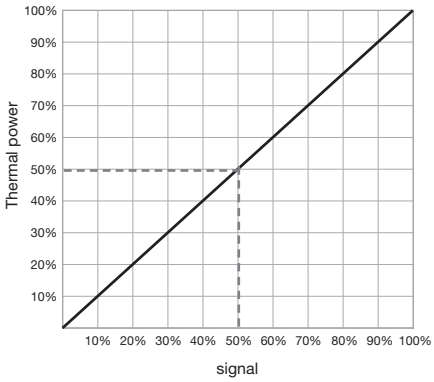
Considering that all coils (water-to-air heat exchangers) have a parabolic characteristic (correlation between water flow rate across the coil and thermal power output), the better flow rate control characteristic is the one mirroring the coil characteristic. This characteristic is the EQUAL PERCENTAGE one. Thanks to this, the whole air temperature control system which includes sensors, the controller, the actuator, the PICCV and the coil is linear. A linear system is the most general and easiest to control.

Equal Percentage PICV



Fan Coil





Controller asks for 50% thermal power, it sends a 5V control signal to actuator, actuator closes 50% the control valve.

BACK

14. What do full stroke and reduced stroke mean?

Full stroke control valve means that the PICV control valve does not change its stroke (travel length) whatever the presetting is. The maximum flow rate limitation (presetting) is carried out by limiting the passage of a dedicated window. Reduced stroke means that the PICV control valve limits the stroke in order for the presetting. Full stroke control valve has better control ability whatever the presetting is and copes every time with suitable actuators.

BACK

15. What are the available certifications for PICV?

Unfortunately, there is no international certification body which developed a certification standard for PICV. The CE marking on PICV is regulated by the Pressure Equipment Directive of the European Union. At the time, the only activity conducted by a certified institute is the performance testing by BSRIA: it can verify and prove the PICV accuracy, the leakage rate, the hysteresis and, above all, the control characteristic. Therefore, BISRIA can verify for instance if the equipercentage characteristic is always provided by the control valve whatever the flow setting is.

BACK

SYSTEM AND DESIGN QUESTIONS

16. Do I have to install other balancing and control valve along with PICV?

No, you do not. The PICV dynamically balances the loop where it is installed: if all the terminal units (FCU, AHU, by-passes, Heat Exchangers, radiators, future loops) have a PICV, all terminals are always balanced; therefore, risers, main pipes and branches are consequently balanced. Additional DRV and DPCV should not be installed. Similarly, additional control valves should not be installed, except for water recirculation on end of lines (if required).

BACK

17. Should I install Double Regulating Valves DRV at risers?

No, you do not. Balancing is provided by the PICV. DRV generates higher pressure drop only and it can affect the start-up pressure.

BACK

18. Can PICV be installed in series?

No, you cannot. Each PICV is designed to maintain the flow rate constant. Each PICV needs at least the start-up differential pressure to work properly. On specific conditions, both PICV can work and affect each other. Sometimes the upstream PICV can potentially limit the total flow rate so that the downstream one cannot regulate the flow rate.

BACK

19. Can I install a 4-port control valve as end-of-line by-pass with no PICV?

No, you should not. In case a 4-port control valve is install on end-of-line for water recirculation, a PICV must be install upstream the control valve as dynamic flow limiter. This way, both terminal unit and by-pass are always dynamically balanced. The PICV should never be install between the 4-port control valve and the terminal unit: indeed, the by-pass loop would be unbalanced and this would affect the start-up pressure of PICV nearby.

BACK

20. Can a PICV be used with 2-port control valve?

The flow rate control must be done by the PICV. In case the flow rate control is carried out by another 2-way control valve and the PICV is placed as flow limiter, the authority of the 2-way control valve is very low: the PICV keeps constant the flow rate and limits flow rate variations. The control is almost ON-OFF.

BACK

21. Why control characteristic is important for energy saving?

The flow characteristic influences the system performances and the comfort. The control valve flow characteristic must match the terminal unit power characteristic in order to minimize the flow rate at every load level. The load level is determined by the system controller through different sensors. The controller logic is commonly linear: so the control valve characteristic should always mirror the terminal unit power characteristic, minimizing the flow rate and consequently maximizing the energy consumption.

BACK

22. Should strainer be fitted upstream a PICV?

Yes. It is highly recommended in order to avoid any big particle through the PICV. A standard mesh FM028 is enough. Fratelli Pettinaroli recommends the installation of a Filterball valve upstream the PICV: it is a ball valve with integrated strainer which protects the PICV and beside it works as an isolation valve.

BACK

23. Should I install a flow measurment device to each terminal unit?

Yes, it is highly recommended. A flow measurement device like a Venturi allows very accurate (±3%) and repeatable flow readings. Any flow measurement through PICV test point is not accurate.

BACK

24. Can PICV be backflushed/reverse flushed?

No, it cannot. Any flush through the PICV must be avoided: the flushing would bring dirt and debris inside the PICV, getting movable components stuck. Moreover, reverse flushing can also fill channels and holes with debris, making the valve unusable.

BACK

25. Where is the best location for the differential pressure transducer?

The best location of the differential pressure transducer to achieve the highest energy performance is the index circuit. It should be set in order to keep the start-up pressure across the PICV located at the index. In case of multi riser system and unpredictable pressure layout, a transducer should be put on the least favoured loop of each riser.

BACK

26. How can I calculate the pressure drop across a PICV?

As the PICV is a dynamic balancing valve, the differential pressure across the valve cannot be prior calculated: it can change time by time according to instantaneous system configuration. For pump head calculation, the differential pressure to be considered at the index circuit is the start-up pressure of the selected PICV plus a small safety margin.

BACK

27. How can I calculate the valve authority?

The definition of control valve authority is the ratio between the differential pressure across the control valve and the differential pressure of the whole section controlled by the valve. As per PICV design, the control valve of a PICV controls the flow rate over a differential pressure which is kept constant by the differential pressure regulator. So, the ratio is always almost 1.

$$a = \frac{\Delta p_{cv}}{\Delta p_{dpr}}$$

BACK

28. Can I install PICV on drinking water systems and open circuits?

No, you cannot. Pressure Independent Control Valves are specifically designed to control and balance closed circuits for HVAC purposes, where water is properly treated. Uncontrolled water hardness can affect moving parts of the valve. Moreover, some materials in the valves could release substances into the water: no migration test has been carried out.

BACK

COMMISSIONING QUESTIONS

29. What are the two test points for on a PICV?

Typically, the two test points on a PICV are for measuring the differential pressure across the PICV. The reading can be compared to the start-up pressure at the selected presetting (given by the PICV manufacturer). Through this, the technician can know if the valve is working as a pressure independent valve.

BACK

30. How do I know if a PICV is working?

Through the pressure ports. By using a differential pressure manometer, the differential pressure across the entire PICV can be checked: in case the DeltaP is higher than the start-up pressure at the given presetting, the PICV is working and keeping constant the flow rate.

BACK

31. Can I optimise pump operating speed with a PICV?

Yes, you can with Pettinaroli PICV. The most efficient max pump speed is the one ensuring the start-up pressure at the index circuit and full load condition (all terminal units open). While measuring the DeltaP across the index PICV, the max pump speed can be set by reducing step by step the speed until the start-up pressure (plus a safety margin) is reached at index. Then, the differential pressure transducer, placed at the index, shall be set accordingly.

BACK

32. Can I measure the flow rate across a PICV?

Usually not. Few PICV in the market allow flow rate measurement through the pressure ports but the stated accuracy is very low. It is not possible on Pettinaroli PICV. Pettinaroli suggests the installation of a Venturi flow measurement device with a calibrated orifice: the overall pressure drop is extremely limited and the measurement accuracy extremely high (±3%).

BACK

PETTINAROLI RANGE QUESTIONS

33. What PICV range has Fratelli Pettinaroli?

Fratelli Pettinaroli has a full range of PICV. The range covers all different applications and technologies. There are axial-Equal Percentage-full stroke-externally adjustable PICV, including 91, 91X, 93. There are rotary-Equal Percentage PICV such as 81, 83 (DZR brass) and 83 (ductile iron). There are axial-Equal Percentage-smart PICV with flanges 94F. There are axial-Linear-reduced stroke-internally adjustable-DIRT RESISTANT PICV such as 92 Dynasty.

BACK

34. What is the best Pettinaroli PICV for FCU and AHU?

In case the flow rate control is modulating type, the best Pettinaroli PICV for FCU and AHU are the Equal Percentage ones, like 91, 93, 83 and 94F. In case the control type is ON-OFF, the linear range Dynasty 92 is suitable, especially because of its high resistance against impurity in the water.

BACK

35. What is the best Pettinaroli PICV for heat exchangers?

For heat exchanger applications, such as Heat Interface Units and district heating/cooling networks, we suggest the linear range, such as Dynasty 92 and 94F (linear mode).

BACK

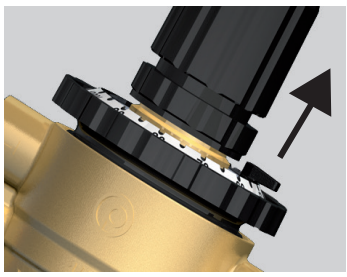
36. Can I do maintance on Pettinaroli PICV?

Yes, you can. All Pettinaroli PICV can be maintained. Differential pressure regulator (diaphragm) of 91 and 91X series can be replaced through a tools kit available upon request and the control valve is replaced by using a standard spanner. To watch the dedicated video, click here. On 93 series, diaphragm and control valve are replaceable with a standard spanner. The new Dynasty 92 allows complete diaphragm-control valve block replacement and, moreover, the diaphragm itself can be removed, cleaned with fresh water and put back in place. 81 and 83 series (DZR brass) allow diaphragm replacement by using a standard spanner. 83 DN40 and DN50 have an option to open a full bore ball and block the diaphragm to allow flushing through it.

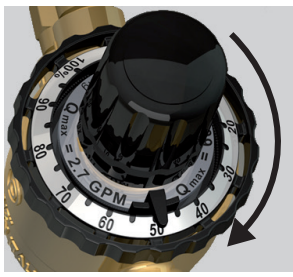
BACK

37. How can I do the presetting on 91-93 series?

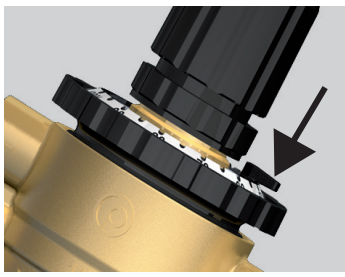
The presetting on 91 and 93 series is externally adjustable and it can be done whenever needed (even if the actuator is on). The presetting is done by unlocking the presetting dial and turning it to the proper percentage; the locking pin is also the indicator. Then it can be fixed by pushing down again the locking pin.



Lift the lock pin to unlock the selector



Turn the selector to the target position



Press the lock pin to lock the selector in the final position

BACK

38. How can I do the presetting on 94F series?

The presetting on 94F series is electronic and it is done by adjusting the parameter SET4 to the required flow rate.

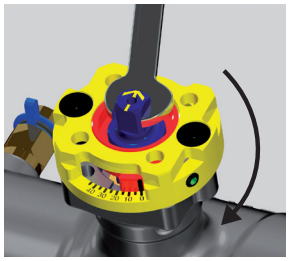
BACK

39. How can I do the presetting on 83 series?

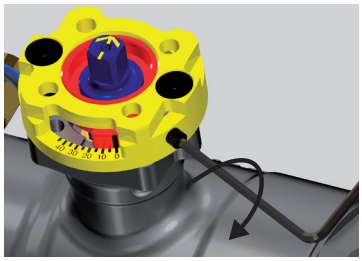
The presetting on 83 series is done by limiting the rotation angle of the characterised ball through the device 081PR1 (included on 83_PR1 series). To watch the video, click here. Strictly follow the following procedure:

1. Close the valve by turning the stem clockwise. The arrow on the stem must be directed on the side with pressure ports
2. Unscrew and release the 2 locking screws with a 3mm Allen key.
3. Move the indicator to the required presetting percentage.
4. Lock again the screws. Do not overtighten, max 2-3 Nm. The stem cannot open fully 90° anymore: it stops to the required presetting position.

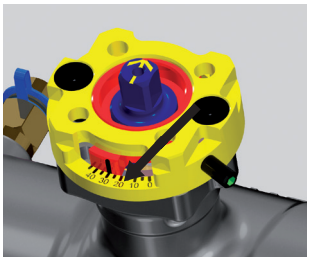
In order to install the actuator, we suggest keeping the valve closed and manually close the actuator to exactly match operating position. To watch the dedicated video, click here.



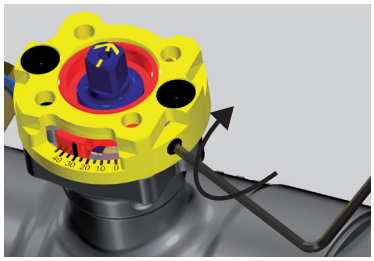
Close the valve, turning the stem clockwise



Release locking device



Set maximum flow rate

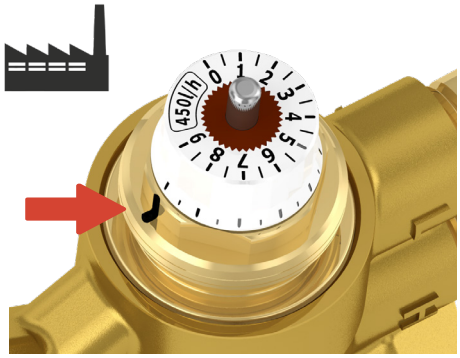


Lock again.
Don't overtighten. Could seriously damage the device.
Torque 2÷3 Nm

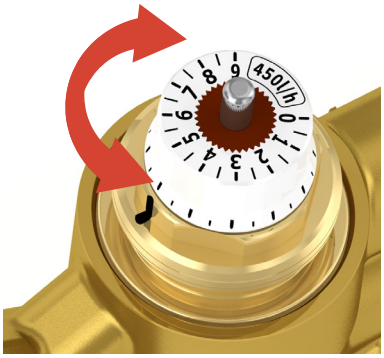
BACK

40. How can I do the presetting on 92 series?

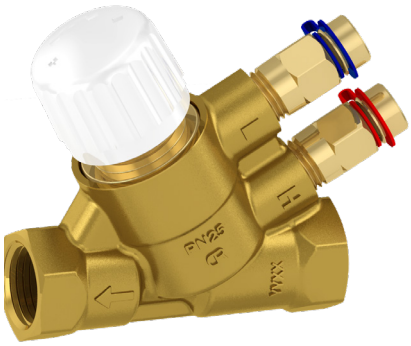
The presetting on Dynasty 92 series is internally adjustable. The presetting is done by removing the actuator or the cap. The default position is full open, which means position 9. Turn the presetting dial to the proper position; then, re-assembly the cap or the actuator.



Remove the handwheel or the actuator. default setting: pos. **9**



Turn the selector to the target position to set the flow rate



Re-assembly the handwheel or the actuator

BACK

41. Is thermal insulation available for Pettinaroli PICV?

Yes, it is. As whole thermal insulating items from Pettinaroli, the PICV insulation is made of 2 layers of soft cross linked polyethylene foam resulting into 2 moulded shells. Shells are shaped upon every valve and they are closed by Velcro. Thermal tape shall always be put sealing the linking points (line between shells, holes for pipe and actuator): it is then 100% condensation proof.

BACK

Fratelli Pettinaroli Spa
Via Pianelli, 38 - 28017 San Maurizio d'Opaglio (NO) - Italy
Tel. +39 0322 96217 - +39 0322 96545 - Fax +39 0322 96546
info@pettinaroli.com - www.pettinaroli.com