MODULAR MANIFOLDS FOR HEATING AND COOLING SYSTEMS: VALIDATION TESTS

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1. SUBJECT

This test report describes the technical features, the raw materials used and the tests performed on the manifolds designed by Pres Block for the distribution of water in the underfloor, wall and ceiling heating / cooling systems.

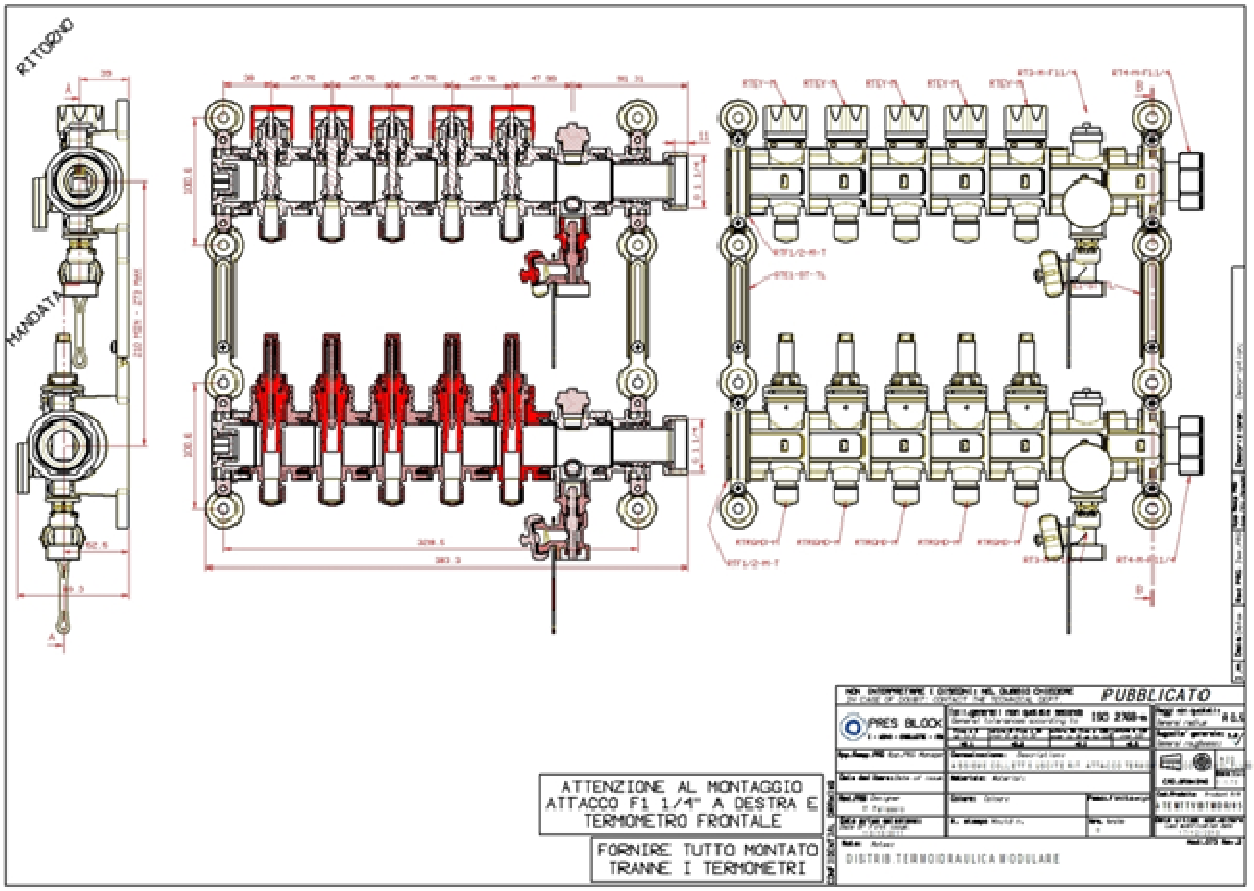
The technical standard for this product is the standard **EN 1264-4**, which does not require specific tests for the validation of the product described in this document.

As a consequence Pres Block has defined internally the tests to be performed, in order to verify the conformity to the technical features requested by the filed of application.

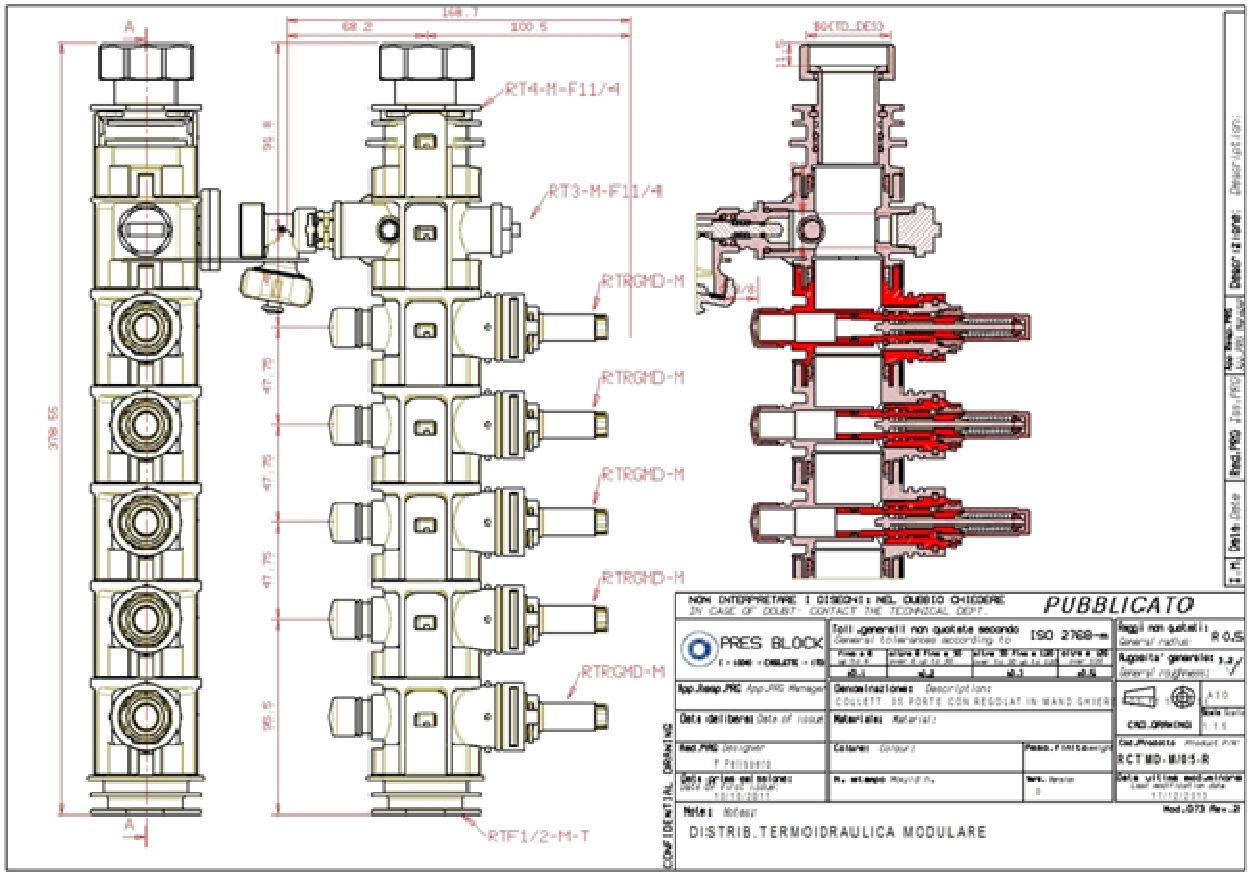
2. PRODUCT DESCRIPTION

The products described in this test report are the following:

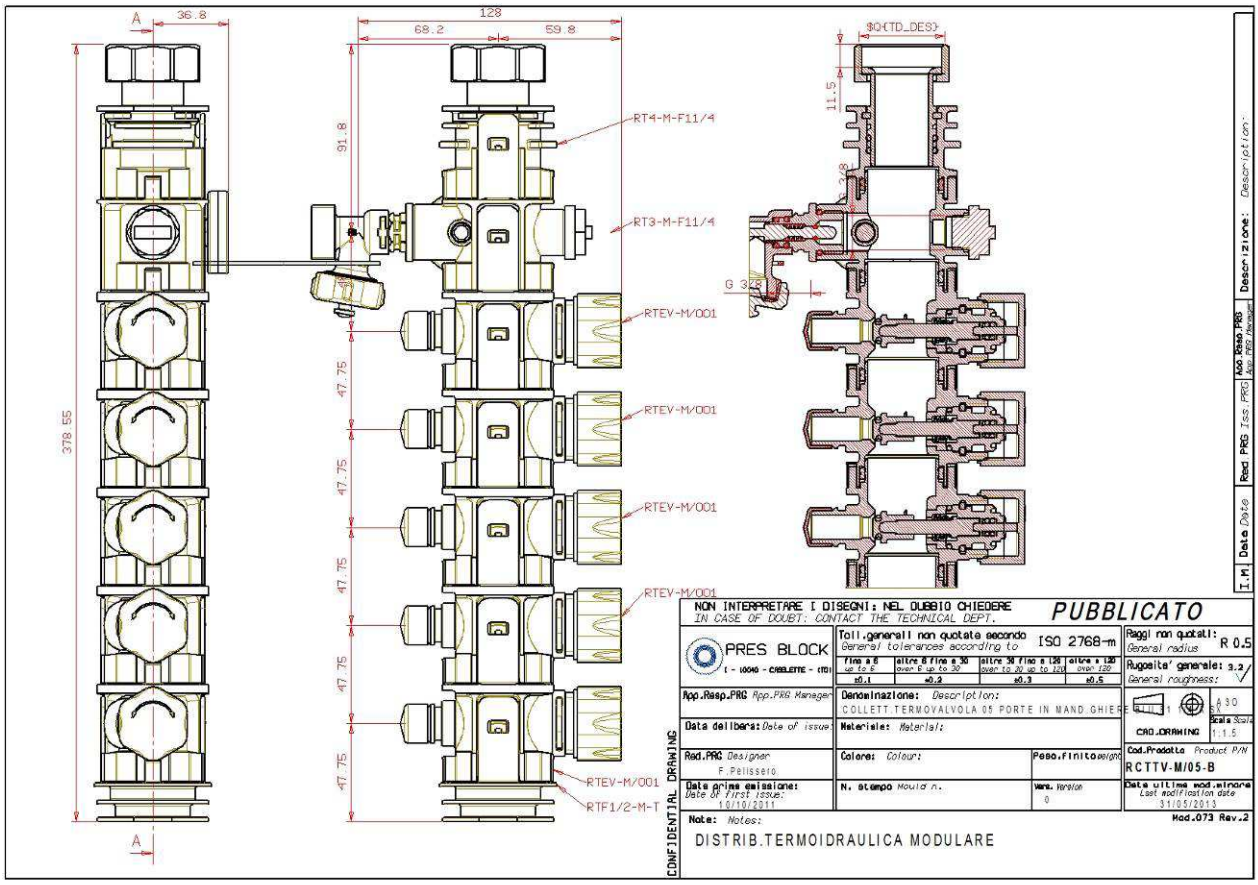
Complete manifold with
supply manifold with flow regulators and
return manifold for thermo actuators



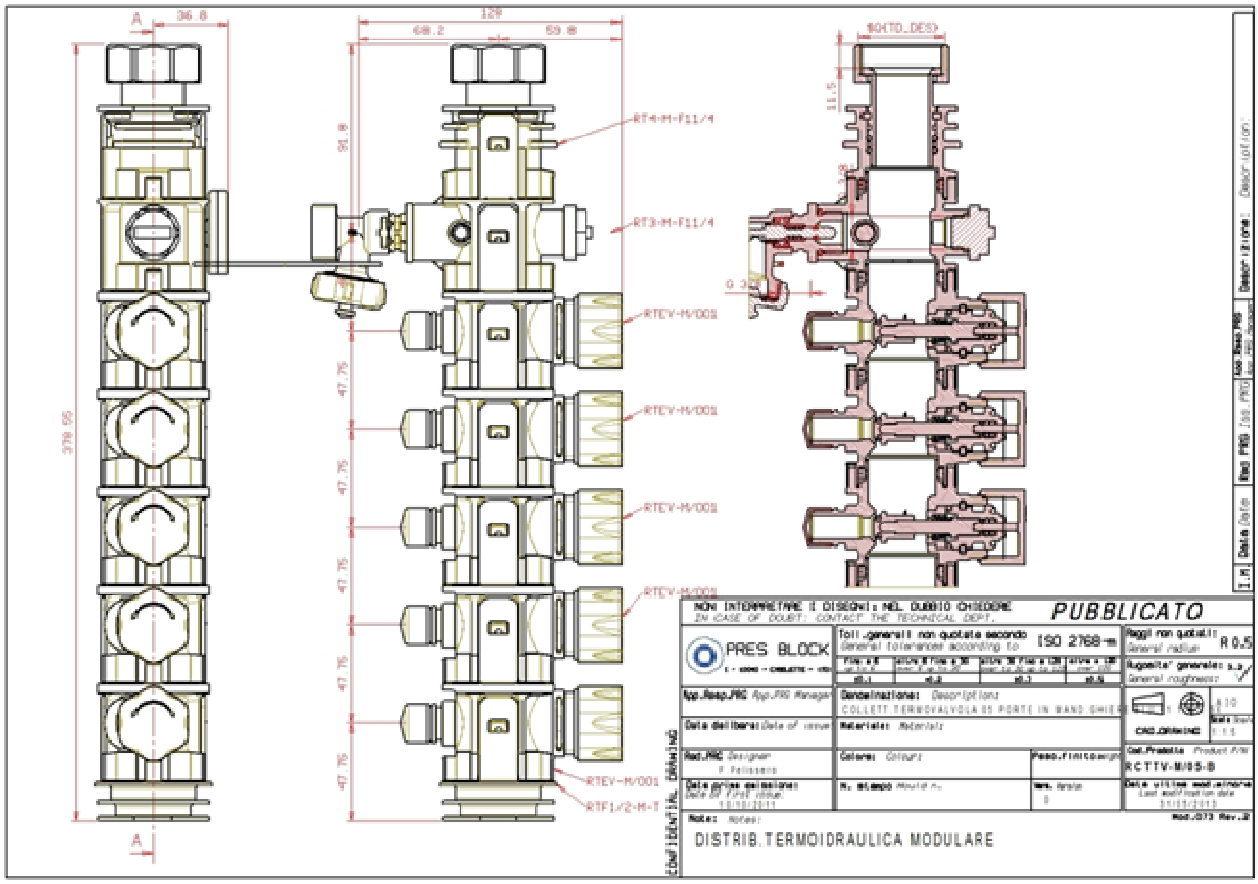
Supply manifold with flow regulators RCTMD-M



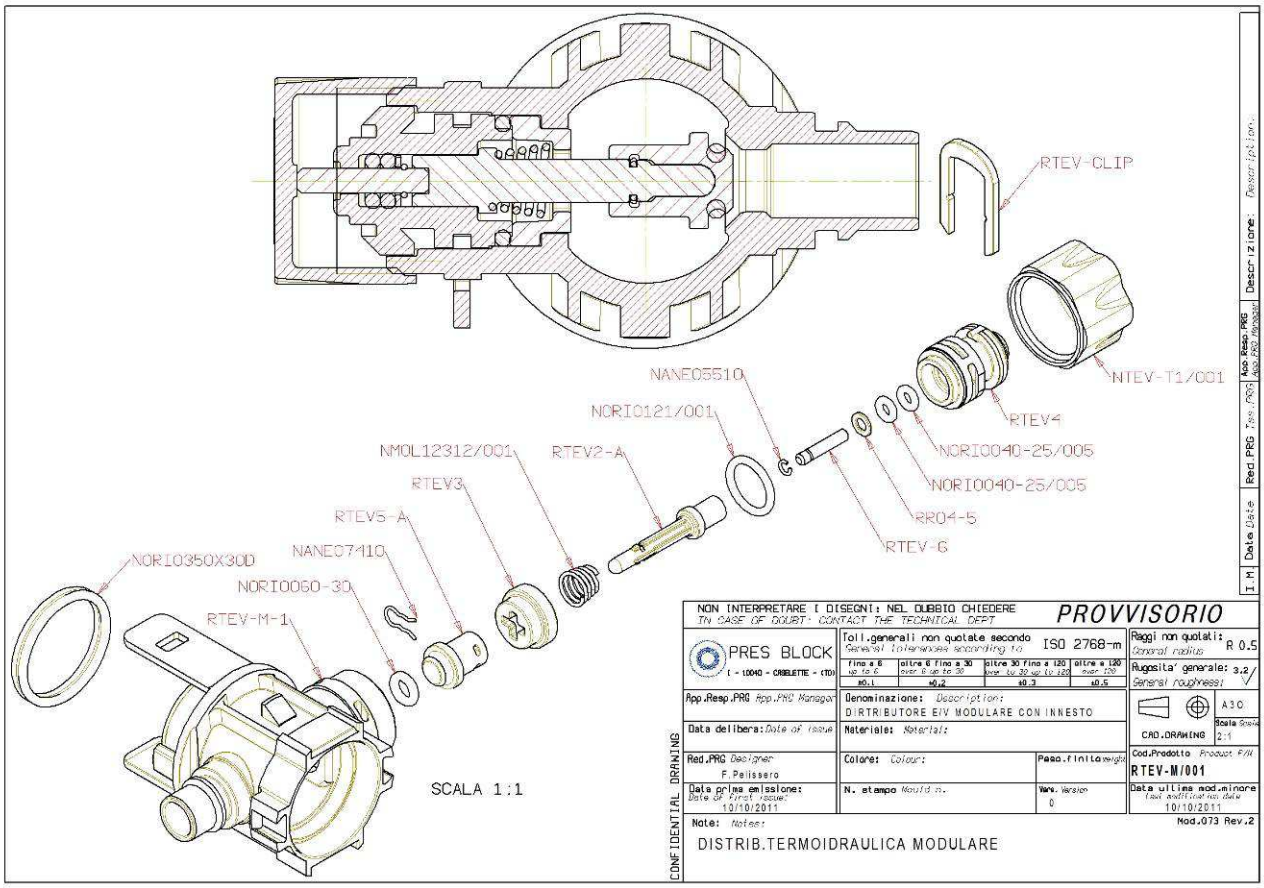
Details of supply manifold with flow regulators RCTMD-M



Return manifold for thermo actuators RCTTV-M



Details of return manifold for thermo actuators RCTTV-M



3. RAW MATERIALS

The manifolds described in this test report are made of the following raw materials:

- **PA12, 30% glass reinforced**;
- **PA12**;
- **PA6,6, 30% glass reinforced**;
- **PPO, 30% glass reinforced**;
- **POM**;
- **Grivory;**
- **brass EN 12164 – CW614N**;
- **stainless steel**;
- **peroxidic EPDM.**

4. PERFORMED TESTS

The following tests have been performed:

- burst pressure at room temperature;
- tightness with low and high pressure;
- life with pulsating pressure and temperature;
- life of the thermostatic valve;
- pressure drop of the manifold;
- pressure drop of one single port of the manifold;
- connecting force of the sliding quick connectors.

Tested samples, testing modalities and obtained results are described in the following pages.

4.1 BURST PRESSURE AT ROOM TEMPERATURE

Tested samples:

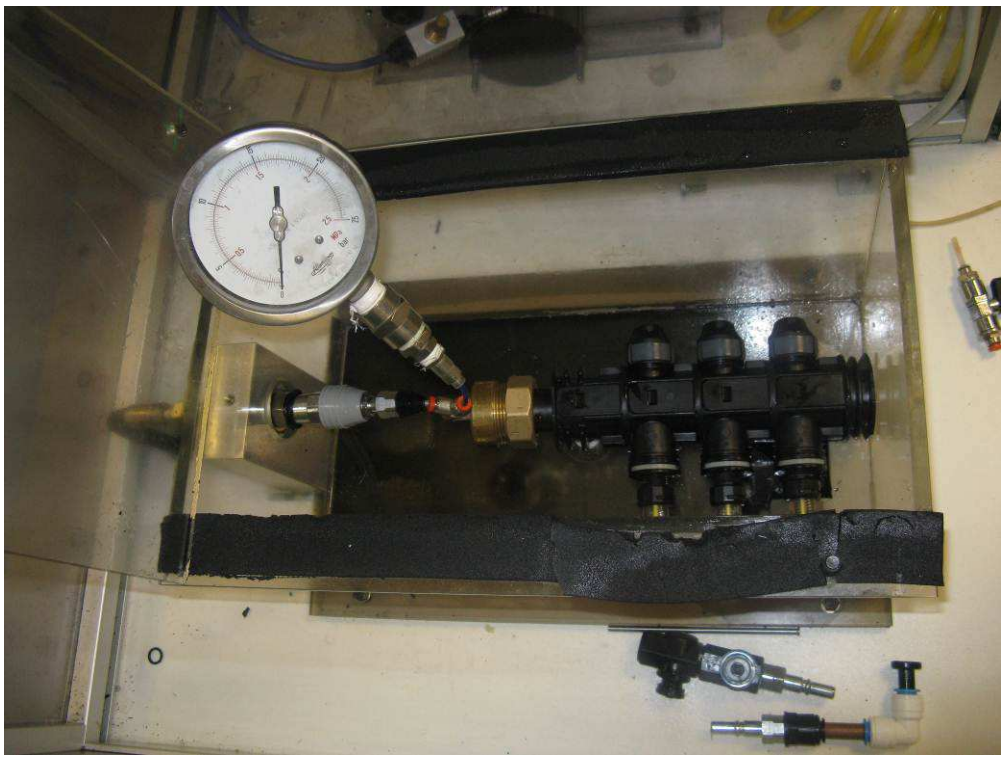
The following samples have been tested:

- n° 3 samples for every type of manifold;
- n° 3 samples for every type of sliding quick connector.

Testing modalities:

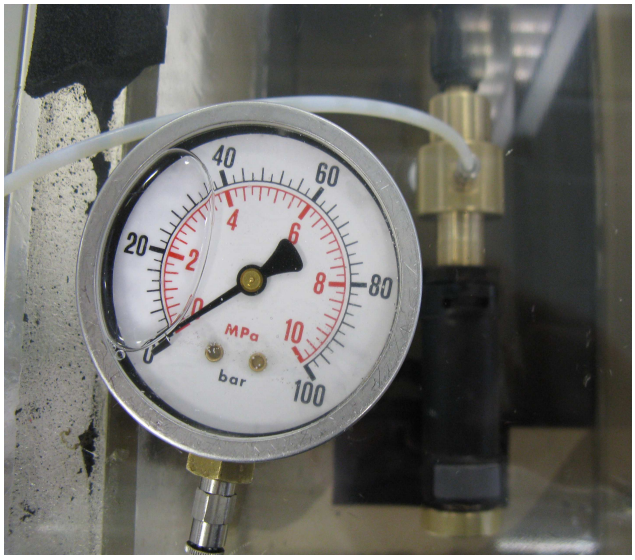
The samples have been connected with a test bench to a **oil** source, whose pressure has been increased up to the burst.

Picture n° 1
Manifolds burst pressure
- Testing modalities -



Picture n° 2

Quick connectors burst pressure
- Testing modalities -



Obtained results

The obtained results are synthesized in the following table:

Tested sample	Diameter [mm]	Minimum burst pressure
Manifold for thermo actuators RCTTV-M	40	> 24 bar
Manifold with flow regulators RCTMD-M	40	> 24 bar
Button operated connector RPLPUTERRB17	17	50 bar
Button operated connector RPLPUTERRB20	20	40 bar

All the manifolds burst with a pressure higher than 24 bar, due to the breakage of the modular connection between the different ports.

All the sliding quick connectors break on the bayonet connection, with a pressure of 40 bar or higher.

4.2 TIGHTNESS WITH LOW AND HIGH PRESSURE

Tested samples:

3 samples for every type of manifold have been tested.

Testing modalities:

The samples have been connected to a **hydraulic circuit**, whose pressure has been increased from 0,2 up to 10 bar.

During the test the absence of water leakages has been visually verified.

Picture n° 3
Tightness with high pressure
- Testing modalities -

Obtained results

For pressure of water from 0,2 up to 10 bar, the tightness is always granted.

4.3 LIFE WITH PULSATING PRESSURE AND TEMPERATURE

Tested samples:

3 manifolds with flow regulators RCTMD-M have been tested.

Testing modalities:

The samples have been connected to a **hydraulic circuit**, whose pressure has been regulated according to the following cycle:

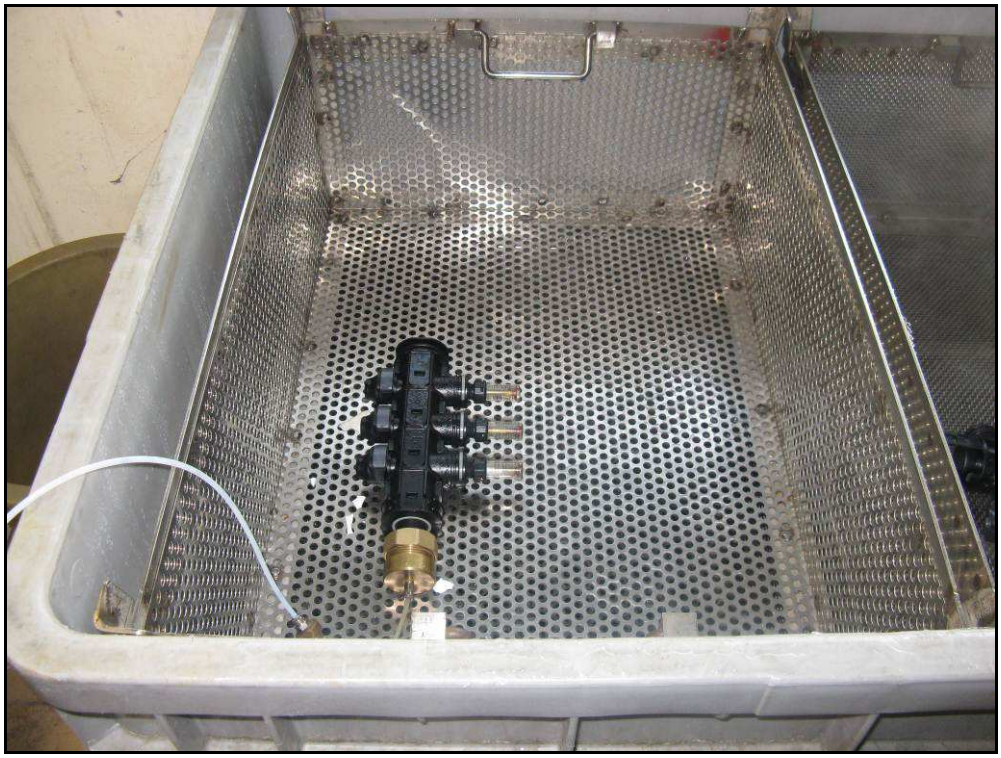
- 2 seconds with water at 6 bar;
- 1 second with water at 0 bar

for totally 1.000.000 cycles.

Also the temperature has been regulated during this test as follows:

- 12 hours at 90 °C;
- 12 hours at -2 °C.

Picture n° 4
Life with pulsating pressure and temperature: Steamer - Testing modalities -



Picture n° 5

Life with pulsating pressure and temperature: Fridge
- Testing modalities -

Obtained results

At the end of the test all the manifolds still grant the tightness and the technical performances.

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4.4 LIFE OF THE THERMOSTATIC VALVE

Tested samples:

3 thermostatic valves assembled on one manifold type ICTTV have been tested (different type of manifold, with the same thermostatic valve).

Testing modalities:

The samples have been tested with a temporized pneumatic cylinder, which simulated the movement of the thermostatic valve, according to the following cycle:

- 2 seconds with the thermostatic valves positioned at end of stroke;
- 2 seconds with the thermostatic valves free;

for totally 1.000.000 cycles.

Inside the manifold **water at 4 bar** was present.

Picture n° 6
Life of the thermostatic valve
- Tested sample -

Obtained results

At the end of the test the O-rings still grant their function.

4.5 PRESSURE DROP OF THE MANIFOLD

Tested samples:

A circuit with the following components has been tested:

- 1 supply manifold with 14 flow regulators RCTMD-M
- 1 return manifold for thermo actuators RTEV-M;
- button operated sliding connectors type RPLPUTERRB20/M.

Testing modalities:

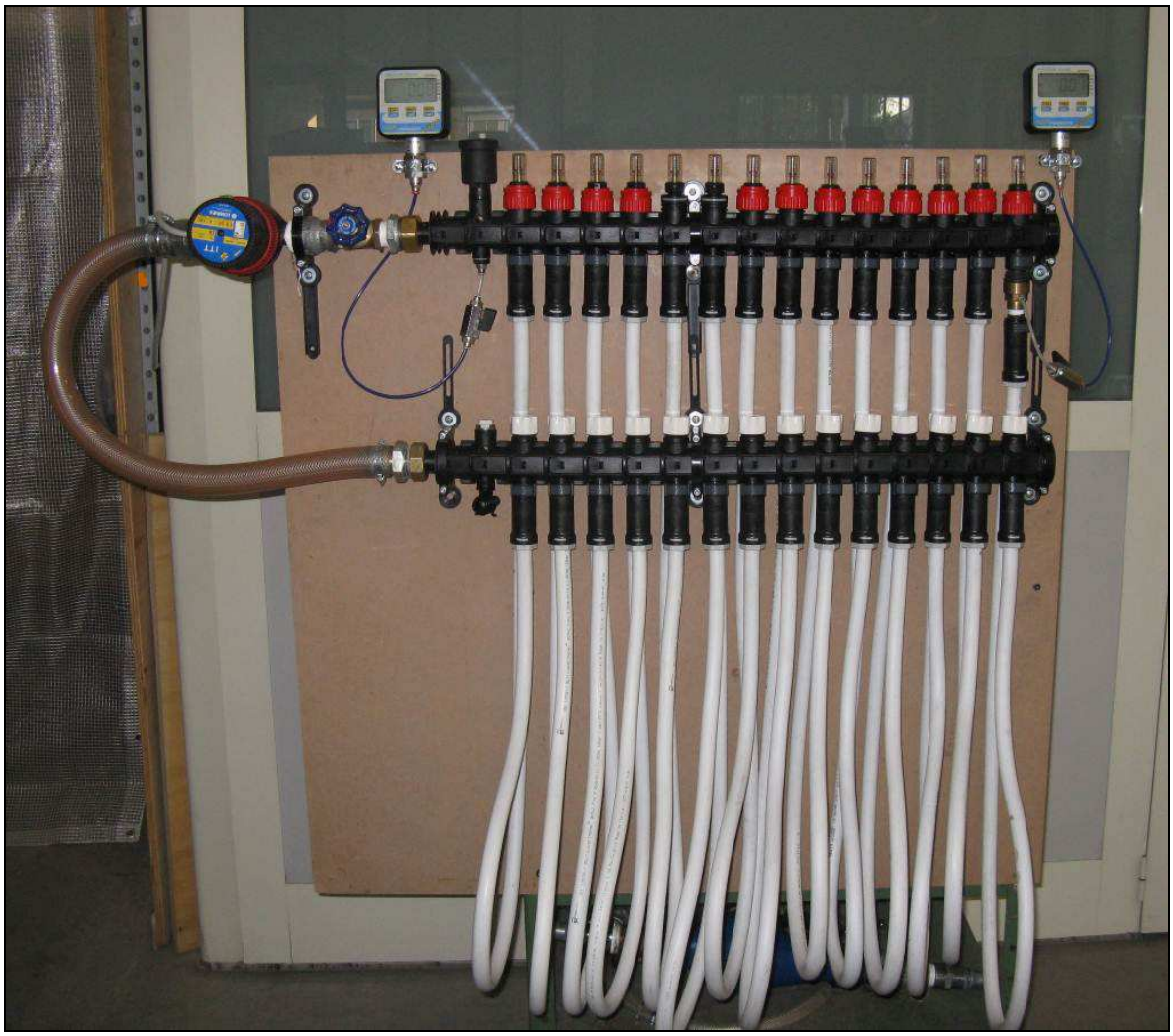
The circuit has been connected to a **hydraulic circuit**, made with a **LOWARA E A 20 6/130 pump and 20x2 multilayer hoses.** All the valves for the regulation of the flow were closed.

The pressure drop of the circuit has been measured, with 2 pressure gauges positioned upstream and downstream the supply manifolds with flow regulators.

In this same conditions also the flow rate has been measured

Picture n° 7

Pressure loss of the manifold
- Tested sample –



Obtained results

The pressure drop between the first and the final port of the manifold is lower than 0,1 bar.

The flow rate of the manifold, with all the n° 14 exits closed, is 2.460 l/h.

4.6 PRESSURE DROP OF THE SINGLE PORT OF THE MANIFOLD

Tested samples:

Following pieces have been tested:

- 1 supply manifold port with flow regulators RCTMD-M;
- 1 return manifold port for thermo actuators RTEV-M.

Testing modalities:

The pieces have been tested with a specific test bench.

Picture n° 8

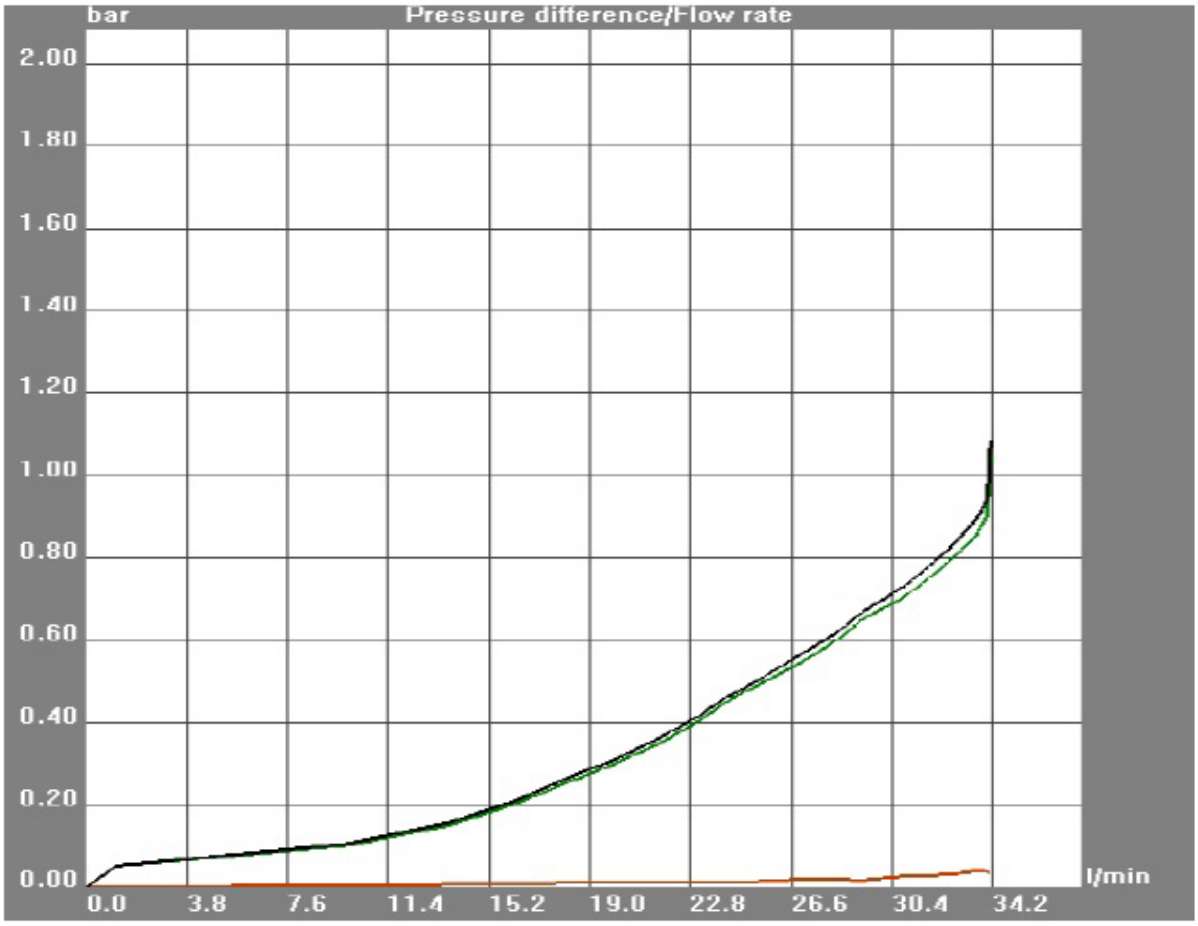
Pressure loss of the single port of the manifold
- Giussani Test Bench -

Obtained results

The results are synthesizes in the following graphics and tables.

SUPPLY MANIFOLD WITH FLOW REGULATORS RCTMD-M

Pressure Drop

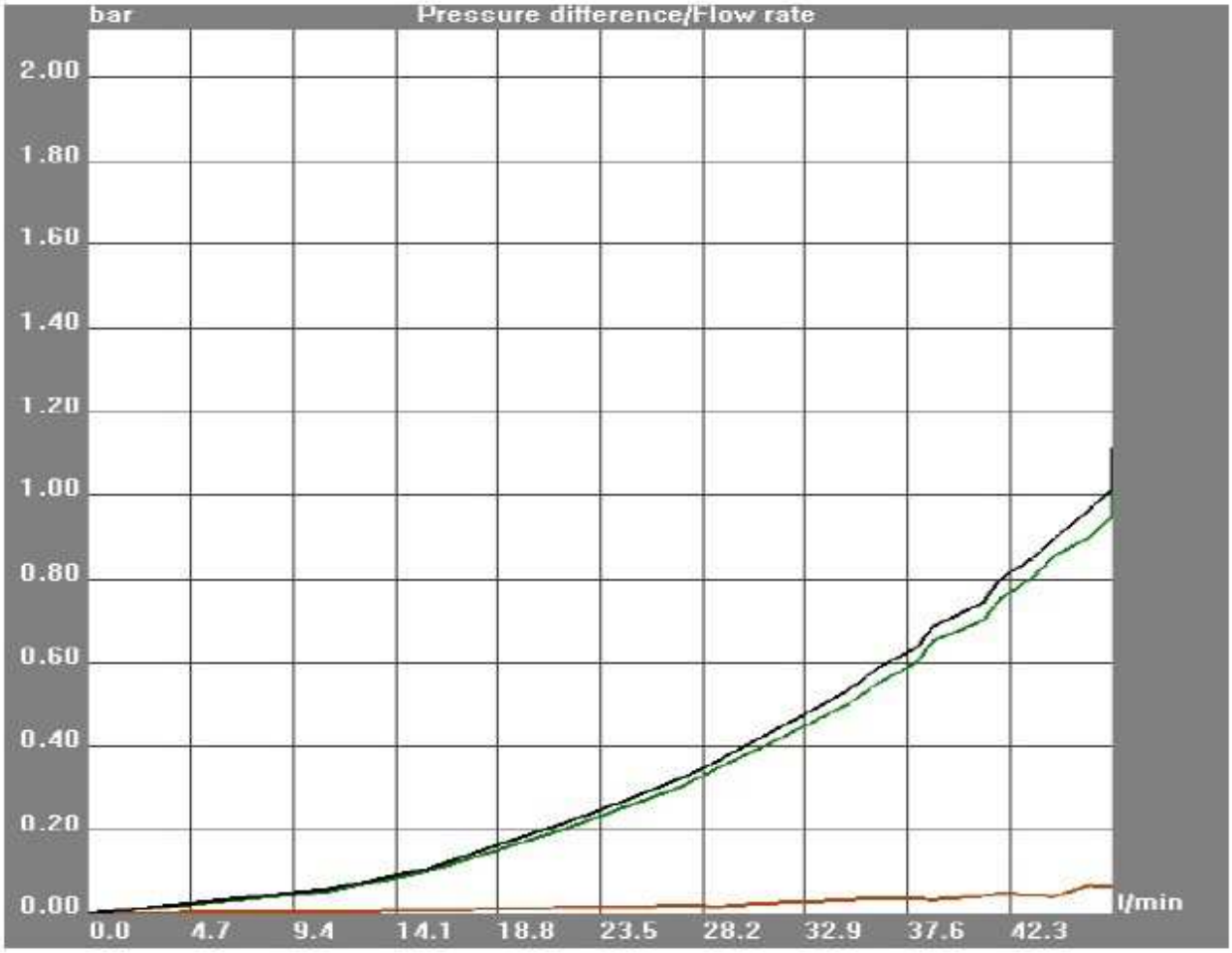


Pitch	Pressure difference (bar)			Flow rate COMPONENT		Speed Water COMPONENT (m/s)
	READ	TEST RIG	COMPONENT	(l/min)	(kg/min)	
1	0,052	0,000	**0,052**	**1,15**	**1,14**	**0,24**
2	0,106	0,004	**0,102**	**9,85**	**9,83**	**2,09**
3	0,156	0,006	**0,150**	**13,68**	**13,65**	**2,90**
4	0,208	0,008	**0,200**	**16,12**	**16,09**	**3,42**
5	0,262	0,010	**0,251**	**18,04**	**18,00**	**3,82**
6	0,311	0,010	**0,300**	**19,98**	**19,94**	**4,24**
7	0,364	0,013	**0,350**	**21,67**	**21,62**	**4,59**
8	0,413	0,012	**0,400**	**23,04**	**22,98**	**4,88**
9	0,465	0,011	**0,453**	**24,24**	**24,18**	**5,14**
10	0,514	0,014	**0,500**	**25,64**	**25,58**	**5,44**
11	0,571	0,020	**0,551**	**27,11**	**27,05**	**5,75**
12	0,620	0,019	**0,601**	**28,36**	**28,29**	**6,01**
13	0,669	0,017	**0,652**	**29,29**	**29,22**	**6,21**
14	0,728	0,027	**0,701**	**30,80**	**30,72**	**6,53**
15	0,781	0,029	**0,752**	**31,82**	**31,75**	**6,75**
16	0,832	0,031	**0,801**	**32,71**	**32,64**	**6,94**
17	0,892	0,039	**0,852**	**33,55**	**33,47**	**7,11**
18	0,939	0,038	**0,901**	**33,99**	**33,91**	**7,21**
19	0,986	0,035	**0,951**	**34,04**	**33,97**	**7,22**
20	1,035	0,035	**1,000**	**34,08**	**34,01**	**7,23**
21	1,085	0,034	**1,051**	**34,13**	**34,05**	**7,24**

Consequently Kv value, with flow regulator completly open, is 2,04.

RETURN MANIFOLD FOR THERMO ACTUATORS RTEV-M

Pressure Drop



Pitch	Pressure difference (bar)			Flow rate COMPONENT		Speed Water COMPONENT (m/s)
	READ	TEST RIG	COMPONENT	(l/min)	(kg/min)	
1	0,059	0,005	**0,053**	**11,04**	**11,02**	**0,81**
2	0,107	0,007	**0,100**	**15,53**	**15,51**	**1,14**
3	0,162	0,011	**0,150**	**18,62**	**18,59**	**1,37**
4	0,215	0,015	**0,200**	**21,74**	**21,71**	**1,60**
5	0,267	0,015	**0,252**	**24,45**	**24,41**	**1,79**
6	0,322	0,020	**0,302**	**27,15**	**27,10**	**1,99**
7	0,368	0,017	**0,351**	**29,01**	**28,96**	**2,13**
8	0,427	0,025	**0,401**	**31,06**	**31,01**	**2,28**
9	0,480	0,028	**0,452**	**33,01**	**32,96**	**2,42**
10	0,534	0,034	**0,501**	**34,87**	**34,82**	**2,56**
11	0,587	0,036	**0,551**	**36,24**	**36,18**	**2,66**
12	0,636	0,036	**0,600**	**38,03**	**37,97**	**2,79**
13	0,685	0,033	**0,652**	**38,73**	**38,67**	**2,84**
14	0,744	0,042	**0,701**	**41,08**	**41,02**	**3,01**
15	0,798	0,048	**0,750**	**41,80**	**41,73**	**3,07**
16	0,849	0,045	**0,803**	**43,33**	**43,26**	**3,18**
17	0,893	0,041	**0,852**	**44,28**	**44,21**	**3,25**
18	0,967	0,067	**0,901**	**45,96**	**45,89**	**3,37**
19	1,015	0,064	**0,951**	**47,00**	**46,92**	**3,45**
20	1,065	0,064	**1,001**	**47,00**	**46,92**	**3,45**
21	1,114	0,064	**1,050**	**47,00**	**46,92**	**3,45**
22	0,000	0,000	**0,000**	**0,00**	**0,00**	**0,00**

Consequently Kv value is 2,80.

FLOW RATE WITH DIFFERENT PORTS

Tested samples:

A circuit with the following components has been tested:

- 1 supply manifold with flow regulators RCTMD-M
- 1 return manifold for thermo actuators RTEV-M;
- button operated sliding connectors type RPLPUTERRB20/M.

Testing modalities:

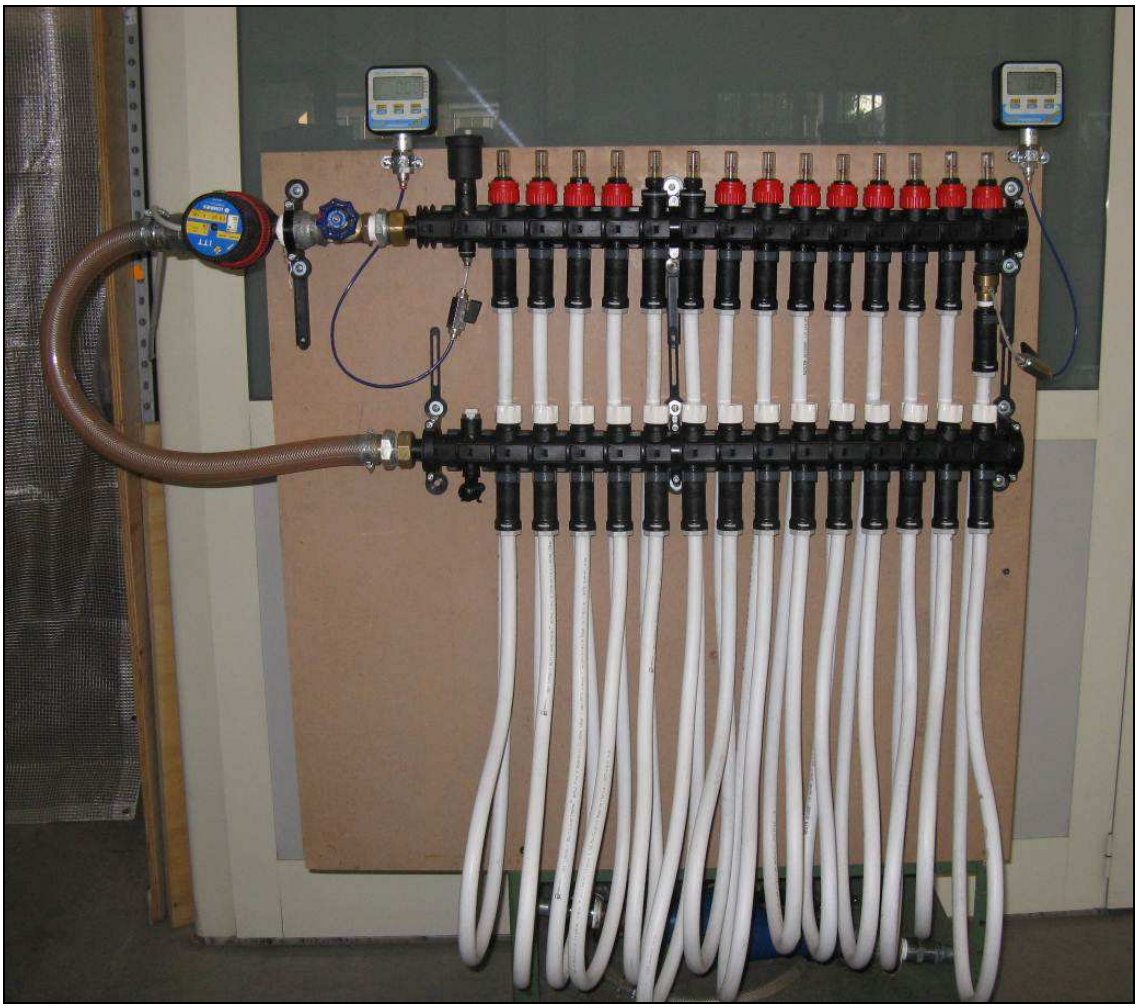
The circuit has been connected to a **hydraulic circuit**, made with a LOWARA E A 20 6/130 pump and 25 meters of 20x2 multilayer hoses.

The flow rate has been settled on the first flow regulator.

Opening progressively the flow regulators of the following ports, the number of ports granting the same flow rate has been established.

Picture n° 9

Flow rate on different ports
- Testing modalities –



Obtained results

Setting the flow rate of the flow regulators at 3 l/min, n° 14 regulators grant the same flow rate.

Setting the flow rate of the flow regulators at 4 l/min, n° 8 regulators grant the same flow rate.

These results depend on the pump characteristics, which influence the circuit.

4.8 CONNECTING FORCE OF THE SLIDING QUICK CONNECTORS

Tested samples:

1 button operated connector RPLPUTERRB17 has been tested.

Testing modalities:

The sample has been connected on the respective manifolds and PEX pipe, measuring the force applied for the connection, with a suitable a dinamometer.

Picture n° 10
Connecting force of the button operated connector – Testing modalities –

Obtained results

On the basis of the obtained results, the following values have been fixed to be considered during installation:

Sliding quick connector	Connecting force to the manifold	Insertion force of the PEX pipe
Button operated connector RPLPUTERR	≤ 11 kg	≤ 18 kg

5. CONCLUSION

On the basis of the obtained results, the manifolds are suitable for the intended use.