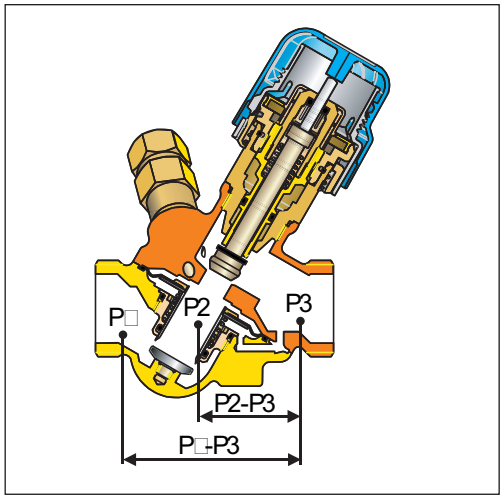
Tech note

Automatically balanced combination valves AB-QM

- Calculation, flow confirmation & pump optimisation

Flow confirmation



AB-QM with test plugs

The AB-QM is available with test plugs. These test plugs can be used for two purposes:

- For checking the flow through the valve
- For minimizing the setpoint (pump head) of a pressure controlled pump.

Note: *It is not possible to mount test plugs on a standard AB-QM.*

Flow confirmation in an installation

Because of the working principles of the AB-QM it is only necessary to measure one valve in a system: The differential pressure controller throttles all excess pressure in order to keep a constant differential pressure across the control part and the valve will work correctly as long as there is sufficient differential pressure, refer to table 1. Because valves closer to the pump (hydronically) will have a higher differential pressure available (see figure 2), it is only necessary to measure the valve that is the furthest from the pump (i.e. the one that is mounted in the control circuit with the highest resistance critical circuit). Once the flow on this valve is verified, all other valves in the system are certain to work. This way considerable effort and time can be saved.

Flow confirmation on a valve

The test plugs can be used to measure the available differential pressure across the control valve (p2 - p3) and confirm the flow through the valve.

To check the flow, follow these steps:

1. Measure the differential pressure on the plugs, differential pressure (p2-p3) across the control valve part.
   Note: *Due to the compact design of the AB-QM the measurements across the measuring points are influenced by turbulences, flow pattern and internal tolerances. The measurements will not be very precise and deviations should be expected. The measurements should therefore only be used as an indication.*
2. Read the setting on the valve
3. Compare the measurements with table 2. If the differential pressure is the same or higher as specified in the table, the actual flow corresponds with the setting.

table 2 (p2 - p3) **for testing**

Setting	DN 10, 15, 20	DN 25, 32
100 %	7.5 kPa	5 kPa
60 %	12 kPa	8 kPa
20 %	15 kPa	12 kPa

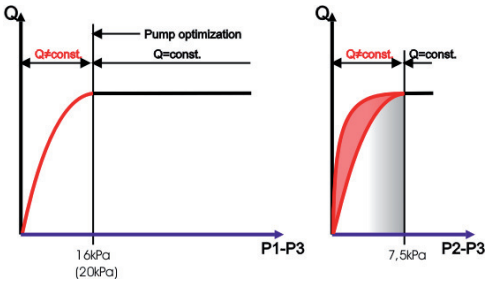


figure 1

Calculation

Calculation of required pump head

To calculate the required differential pressure to be provided by the pump, first calculate the differential pressure needed for the worst control circuit (usually the one furthest from the pump) without AB-QM. Next, 16 kPa (p1-p3) should be added for an AB-QM DN 10, DN 15 or DN 20. If an AB-QM DN 25 or 32 is mounted add 20 kPa to the required pump head (table 1).

table 1 (p1 - p3) **for pump calculation**

Setting	DN 10, 15, 20	DN 25, 32
p1-p3	16 kPa	20 kPa

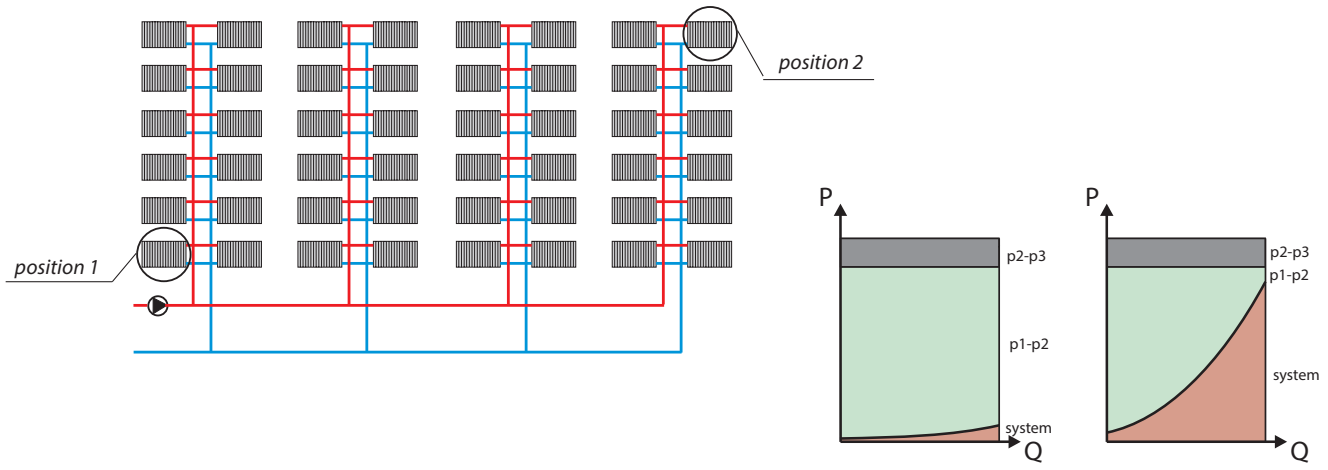


figure 2

pressure drop in a system with AB-QM

Pump optimisation

AB-QM with test plugs can also be used to optimise the setting of a pressure-controlled pump. By reducing the setting (pump head), savings can be expected because of a lower energy use of the pump.

As measuring the differential pressure on an AB-QM is subject to turbulences, mounting position and internal flow pattern, it is not possible to use the absolute value to find out whether the pump has the optimal setting or not. In order to optimise the pump head the following steps should be taken:

1. Open all control valves - actuators have to be fully open (All terminal units have to achieve design flow).
2. Set the pump to the maximum value.
3. Locate the AB-QM that is furthest away (i.e. which is in the control circuit with the highest resistance, calculated from the pump) and measure the differential pressure on the test plugs. If the differential pressure is oscillating, use an averaged value.
4. Reduce the pump head in steps, for example 90%, 80%, 70%…. till 30% of the maximum pump head, while measuring the differential pressure on the AB-QM at each pump setting.
5. Use the measurements to draw a graph with the differential pressure as a function of the pump head. (figure 3)
6. The pump head where the line breaks sharply is the optimal pump head for the system.

If no test plugs are mounted on the AB-QM any installation component (measuring orifice, heat exchanger or balancing valve for example) in the system can be used, provided it is fitted with test plugs and it is mounted in the right control circuit (the one with the highest resistance).

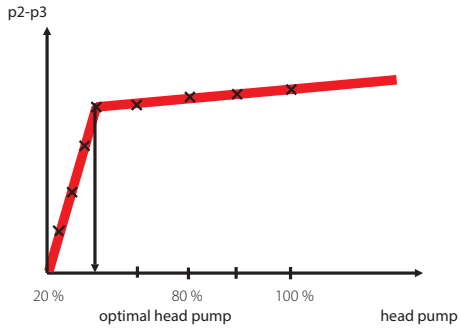


figure 3

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