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*Danfoss*

Hydronic Balancing & Control

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The extended Hydronic Balancing  
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a solution for every water based  
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# WELL BALANCED & CONTROLLED SOLUTIONS

## Hydronic Balancing & Control

If you are dedicated to establish indoor climate solutions that provide optimal air quality, comfortable living and/or work conditions and maximum energy efficiency, then Danfoss Hydronic Balancing & Control is your ideal partner.

You already know that the most efficient heating or cooling installations can only be realised by ensuring optimal hydronic balance and perfect temperature control. We have many years of experience and a complete range of products in this area. We supply high quality products for innovative, energy saving and easy to use solutions. Our expertise is to create more comfort for less money.

And our expertise is everywhere. Everybody involved from R&D to after sales service are highly skilled professionals offering you knowledge, experience and deep customer and application understanding.

In this brochure we present a basic overview of our many products for different applications. Each has its own special features and benefits to make your daily work easier, faster or better. Find the products you need for your projects and let us help you to become your customer's preferred partner in realizing hydronic balancing solutions.



## 3 reasons for choosing Danfoss Hydronic Balancing & Control:



**Benefit from a complete product range**



**Gain knowledge from our highly skilled professionals**



**Feel confident about our products, support and service**

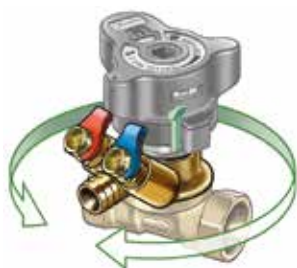
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# MANUAL BALANCING VALVES

Manual balancing valves provide a static, basic balancing solution for many applications. The valves limit the flow through different parts in heating, cooling and domestic hot water systems. Since manual balancing valves can not react to changing conditions the valves are recommended to be used in constant flow systems.



## LENO™ MSV-BD / MSV-B / MSV-O

Danfoss LENO™ range offers the latest technology in manual balancing. To save costs for often used shut-off valves the MSV-BD, MSV-B and MSV-O valves combine both a balancing and shut-off function. For that purpose the principle design is based on a ball valve, making sure the shut-off offers 100% watertight closure of the system. Using the shut-off ball valve, which has a red/white colored closed/open indication, will not influence the settings.

Furthermore the hand wheel can temporarily be removed for easier installation in narrow spaces. The numeric presetting indications can be viewed from different angles making the commissioning easier as well. All three types of LENO™ valves offer built-in measuring nipples for 3 mm needles. In case of the MSV-BD these can even be rotated over 360° to any preferred position. The MSV-O has a fixed venturi orifice.



## LENO™ MSV-S

MSV-S is a manual shut-off partner valve in the LENO™ range which can be used to close the system's return pipe in case the balancing valve is mounted in the supply pipe. It uses the same high quality ball valve and offers a high capacity drain.

## MSV-F2

The MSV-F2 has a range from size DN15 up to DN 400. The flanges are according to international standards. The valves have a position indicator, a stroke limiter and the settings can be locked.

Type	MSV-BD	MSV-B	MSV-O	MSV-S	MSV-F2
<b>Function</b>	Balancing Shut-off	Balancing Shut-off	Balancing Shut-off	Shut-off	Balancing
<b>Version</b>	Thread	Thread	Thread	Thread	Flange
<b>DN range</b>	15 – 50	15 –50	15-50	15 –50	15 - 400
<b>PN</b>	20	20	20	20	16/25
<b>Integrated ball valve</b>	Yes	Yes	Yes	Yes	No
<b>Measuring nipples</b>	Rotating	Fixed	Fixed	No	Fixed
<b>Drain tap</b>	Yes	No	No	Yes	No

# AUTOMATIC BALANCING VALVES

Where manual balancing valves are static in operation, automatic balancing valves provide a dynamic solution for balancing of heating and cooling systems. Under all possible system loads varying from 0 to 100% the automatic balancing valves provide a good balance by controlling the differential pressure. At partial loads the system flow is decreased by the control valves closing, causing a pressure increase and unbalance in the system. Because of the automatic pressure control which reacts instantly a neutral hydronic balance throughout the system is maintained.

Automatic balancing valves are e.g. used in variable flow systems as two-pipe heating systems for multi family houses and in combination with floor heating manifold systems. The valves also offer a good solution for renovation of old systems with manual or even without balancing valves.

Automatic balancing solutions require minimum commissioning efforts and provide a reliable heating system with improved indoor temperature control, energy savings and low noise emission.



## ASV differential pressure controllers & shut-off partner valves

Danfoss ASV range offers a complete mix of products to establish an automatic balancing solution.

Return pipe mounted differential pressure controllers are available with fixed setting (ASV-P) and adjustable setting (ASV-PV). In case of ASV-PV the setting is simply changed by using an Allen key. ASV-PV differential pressure controllers are available with different setting ranges to match any different application. For high volume systems also flanged versions ASV-PV are available.

In the supply pipe mounted shut-off partner valves are used to measure the differential pressure by a capillary tube connected to both valves. ASV-P and ASV-PV can be connected to ASV-M, ASV-I or ASV-BD partner valves. Flanged ASV-PV can be connected to MSV-F2 partner valves. Some partner valves can also be used for manual limitation of the maximum system flow.

Type	ASV-PV	ASV-P	ASV-M/I/BD	MSV-F2
Function	$\Delta P$ control	$\Delta P$ control	Shut-off	Shut-off
Version	Thread / Flange	Thread	Thread	Flange
DN range	15 – 100	15 – 40	15 – 50	15 – 400
$\Delta P$ Setting	<ul style="list-style-type: none"> <li>• 5 – 25 kPa</li> <li>• 20 – 40 kPa</li> <li>• 35 – 75 kPa</li> <li>• 60 – 100 kPa</li> </ul>	10 kPa	--	--

## AB-PM

Danfoss AB-PM takes automatic balancing to another level. Besides the differential pressure control function, this easy to install balancing valve adds two other functions to automatic balancing: automatic flow limitation and zone control via a mounted TWA-Z thermal actuator. Because of its small size and unique 3 combined functions the AB-PM is a perfect match for especially residential buildings with horizontal loops based heating systems. It will reduce heating costs, improve indoor climate and eliminate noise.

AB-PM is the recommended solution where there is a need for zone control function, such as in horizontal two-pipe heating systems in new multi family buildings where each apartment has a centrally placed manifold. A similar kind of application is to balance and control water based floor heating systems. In another important application the AB-PM solves the often occurring inefficiencies during partial load with condensing boilers. The built-in circulation pumps with high pump head cause huge differential pressure in partial load on the radiator valves resulting in noise, unbalance and low comfort. Installing an AB-PM in the boiler supply pipe avoids all these problems and equipped with a special QT thermostatic sensor even avoids high temperature return flow for an optimal condensing process. This makes the boiler work as economic and energy saving as possible. In all applications a MSV-S partner valve for return pipe mounting can be used to connect the capillary tube and shut-off function.



Type	AB-PM	MSV-S	TWA	QT
<b>Function</b>	<ul style="list-style-type: none"> <li>• <math>\Delta P</math> control</li> <li>• Flow limitation</li> <li>• Zone control</li> </ul>	Shut-off	Zone control	Temperature limitation
<b>Version</b>	Thread	Thread	24V / 230 V	--
<b>DN range</b>	15 – 25	15 – 25	--	--
<b>Settings</b>	300 – 1200 l/h at $\Delta P = 10$ kPa	Open – closed	--	35 – 50 °C 45 – 60 °C

## AQ

A special type of automatic balancing valve is provided by the AQ. The balancing occurs by means of a flow rate cartridge, in which the Kv value is changed with the differential pressure changing to keep a constant flow in a wide working pressure range. The flow is maintained at a constant level even under fluctuating pressure conditions. The AQ is mostly used to balance heating and cooling circuits in bigger constant flow systems.



Type	AQ
<b>Function</b>	Flow limitation
<b>DN range</b>	40 – 500
<b>Flow range</b>	1.02 – 1,652 m³/h

# PRESSURE INDEPENDENT BALANCING & CONTROL VALVES

Pressure Independent Balancing and Control Valves (PIBCV) represent the latest development in balancing and control solutions. Successfully introduced by Danfoss this has become a standard in lots of heating and cooling systems offering the lowest possible 'Total Cost of Ownership'. Combining the control function, pressure independency and flow limitation all in one valve saves in purchasing individual valves and reduces valuable time. PIBCV are mainly used to control and balance bigger sized systems in public and commercial buildings.



## AB-QM – Threaded versions

Danfoss AB-QM was the first of its kind: a control valves with automatic flow limitation and built-in differential pressure control functioning over the control valve. The result of this concept is a small sized high performing control valve with a unique valve authority of 100%. The flow can easily be set to the needed amount by using a 20-100% scale. The designed flow is set as a percentage of the nominal possible flow. Complicated and time consuming commissioning of a system has been replaced by simple flow setting. System designers no longer need to make Kv calculations for each single valve in the system. With AB-QM they simply can stop calculating once the design flow is determined. This is because AB-QM is selected on the necessary flow. The unique features of AB-QM benefit designers, installers and end-users. Optimized energy efficiency is achieved, and climate conditions and indoor comfort will never be better. The AB-QM with thread connections are used for e.g. climate ceilings, fan-coil units and other HVAC systems.



## AB-QM – Flanged versions

The AB-QM with flange connections extend the range of automatic balancing and control for volumes up to 442,000 litres per hour by one single valve. The biggest sized AB-QM valves are used for e.g. large air-handling units to ensure maximum energy efficiency and lowest possible operational costs.

Type	AB-QM thread	AB-QM flange
Function	<ul style="list-style-type: none"><li>• Control valve</li><li>• Flow limitation</li><li>• Balancing</li></ul>	<ul style="list-style-type: none"><li>• Control valve</li><li>• Flow limitation</li><li>• Balancing</li></ul>
DN range	10 – 50	50 – 250
Flow range	30 – 12,500 l/h	5,000 – 442,000 l/h

# ACTUATORS FOR PRESSURE INDEPENDENT BALANCING & CONTROL VALVES

For as long as no actuators are used, AB-QM functions as an automatic flow limiter. To take advantage of its unique combined balancing and control features, the AB-QM has to be equipped with an actuator controlled by a room thermostat or Building Management System (BMS). The best results in indoor climate control can be achieved by using the best possible actuators. The faster and more accurate the actuator responds to the control signal, the better the result.



## Thermal actuators for AB-QM

Thermal actuators provide a cost efficient solution to control temperature via AB-QM balancing and control valves. The basic principle of these actuators is based on thermal expansion of a wax element. TWA-Z and ABN A5 actuators are controlled by an On/Off signal of a temperature controller, either heating the wax or not. ABNM A5 actuators are controlled by a 0-10 Volt modulating signal of a temperature controller. The 0-10 V signal allows more accurate control possibilities.



## Gear actuators for AB-QM

To achieve best control performance gear actuators should be used. These actuators control the position of the valve opening in a very accurate way. AME gear actuators are controlled by 0-10V or 4-20mA signal. AMV actuators are controlled by 3-point signal (open/neutral/close). To achieve maximum control performance geared actuators for AB-QM are equipped with automatic valve stroke detection.



## Thermostatic actuator QT for AB-QM

For some applications the AB-QM can be controlled by a thermostatic actuator as well. An external surface temperature sensor determines whether the AB-QM needs to be opened or closed based on the set and measured temperature. This is e.g. valid to combine flow limitation and return pipe flow temperature control in one-pipe heating systems which AB-QM + QT convert into variable flow systems, delivering excellent reliability with significant energy savings.

Type	TWA-Z / ABN A5	ABN A5	AME/V	QT
Function	On/Off control	Modulating control	Modulating control	Temperature control
Version	Thermal	Thermal	Gear	Thermostatic
Control signal	On/Off	0-10 V	3-point 0-10V / 4-20 mA	--
AB-QM range	DN 10 – 32	DN 10 – 32	DN 10 – 250	DN 10 – 32



# MEASURING ORIFICES & MEASURING EQUIPMENT

Where there is hydronic balancing, there is a need for measuring. To establish an optimized energy efficient heating or cooling system the flows and pressures in a system need to be as designed. For systems balanced with manual balancing valves the commissioning process is fully based on measuring, adapting settings and re-measuring of the balancing valves. For systems with automatic balancing valves measuring is often only required to make a system report or perform random test measuring.



## Measuring orifices

For big flow pipe systems Danfoss offers stand alone measuring orifices. These are used to determine the flow by measuring the differential pressure across a fixed orifice with a fixed Kv value. Via a measuring device the measured differential pressure and used Kv value are calculated into a measured flow.



## Measuring equipment

To measure flow, differential pressure and in some cases even temperature, Danfoss offers 3 types of measuring equipment:

**PFM 5000** is used to measure the differential pressure between both sides of a valve. Flow and pressure can be displayed in various units. This equipment is for professionals that are looking for highly accurate and detailed information in any language. The device consists of a computing unit and a smart phone with a special Danfoss App. Projects can be calculated on-site just by using the smart phone and data can easily be transferred to a PC to prepare a thorough measuring reports.

The universal PFM 5000 contains data of all well-known balancing valve manufacturers. This allows it to be used for all types of systems, equipped with balancing valves of different brands.

**PFM 100** is a handheld solution for professionals who are interested in accurate measuring results of the flow. It also measures the differential pressure between both sides of a valve. Flow and pressure can be displayed in various units. It is possible to select one of the 10 available different languages, easy to operate and can be used for all well-known balancing valves.

**The Flow Indicator** is the best and most economical solution when having an indication of the flow is sufficient. It provides a simple solution with a differential pressure gauge and a slide ruler. The slide ruler is designed for Danfoss balancing valves.



Type	Orifices	PFM 5000	PFM 100	Flow indicator
Function	Measuring point	Measuring	Measuring	Measuring
Version	DN 50 – DN 400	Smartphone sensor (wireless)	Handheld sensor (wireless)	Gauge + slide ruler



# HOT WATER & MIXING VALVES

Not only heating and cooling systems should be balanced. Energy savings and safety increases can be achieved by balancing of domestic hot water systems. In these systems the best performance is realized by using temperature operated automatic balancing valves. Thanks to the stable water temperature and constant availability of it, also the end user's comfort increases significantly.



## MTCV Thermostatic circulation valves

Danfoss MTCV are Multifunctional Thermostatic Circulation Valves that are used in domestic hot water circulation systems. They provide a thermal balance by maintaining a constant temperature in all parts of the system. At the same time this provides a safe solution to help preventing the dangerous Legionella bacteria to multiply and become a danger for the public health. The solution is therefore often used in buildings for health care as hospitals and retirement pensions.

For extra safety the MTCV balancing valve can optionally be equipped with a disinfection module. This either self acting or electronically controlled process allows a temporary increase of the water temperature.

## TVM-H & TVM-W Thermostatic mixing valves

In some heating or domestic hot water systems a temperature controlled mixing valve can be a simple solution to maintain a constant temperature in a system. These thermostatic controlled mixing valves provide a constant water temperature at the outlet port. The desired outlet temperature can be set between 30 °C – 70 °C.

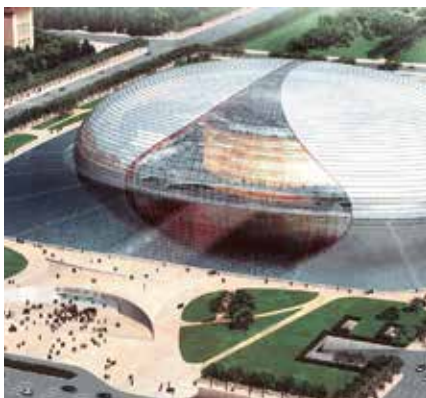
TVM-H is mainly for heating applications and can e.g. be used to establish a constant temperature for floor heating systems. It can be used for single outlets as a bath or shower, or small numbers of grouped outlets. TVM-W is mainly for domestic water systems and provides some extra safety features. In case the cold water connection fails the outlet is immediately shut-off to prevent hot water to enter the system. It is a great addition to MTCV valves in systems with a risk of water temperatures getting too high.

Type	MTCV	TVM-H	TVM-W
<b>Function</b>	Temperature based balancing	Constant temperature	Constant temperature
<b>Application</b>	Hot water	Heating	Hot water
<b>DN range</b>	DN 15 – 20	DN 20 – 25	DN 20
<b>Temperature range</b>	35°C - 60°C	30 °C – 70 °C	30 °C – 70 °C
<b>Disinfection options</b>	<ul style="list-style-type: none"> <li>• Thermostatic</li> <li>• Electronic</li> </ul>	--	--

# ALWAYS A SOLUTION

Danfoss has realized projects of all sorts over the entire world. With our local sales companies or agents and we can provide a unique level of experience and knowledge in hydronic balancing solutions. Below you can find a few of the many projects we have realized.

## International project references



### Grand National Theater, Beijing - China

**Project:** Grand National Theater  
**Location:** Beijing, China  
**Application:** AB-QM including actuators

The Grand National Theatre is an enormous 180,000 square meter glass and titanium tear-drop-like bubble structure surrounded by water. Danfoss supplied China's top art performance centre with a wide range of products, including 1200 AB-QM's that were installed in a combined heating and cooling system.



### Triumph Astana - Astana, Kazakhstan

**Project:** Triumph Astana  
**Location:** Astana, Kazakhstan  
**Application:** Manual balancing valves

The architectural landmark Triumph Astana contains offices, apartments, a sport centre, a theatre as well as restaurants. Danfoss has supplied manual balancing valves to a 4-pipe heating and cooling system.



### Obrucheva Street - Moscow, Russia

**Project:** Three buildings in Obrucheva Street  
**Location:** Moscow, Russia  
**Application:** Modernization of one-pipe heating systems

In this project thermostatic radiator valves without pre-setting are combined with automatic balancing of return temperature which ensures a pleasant indoor climate, resulting in fewer complaints and increased well-being among the residents.

# 1 provider

for hydronic balancing  
and control solutions  
across the globe.



## UMKC Student Union Building - Kansas City, USA

**Location:** Kansas City, USA

**Project:** UMKC Student Union Building

**Application:** AB-QM including actuators

The hydronic heating and cooling system in this 110,000 square feet building focuses on energy savings. Danfoss AB-QM pressure independent balancing and control valves were used on all the air-handling unit (AHU's) and Variable Air Volume (VAV) boxes throughout the facility.



## Prime Tower - Zurich, Switzerland

**Project:** Prime Tower

**Location:** Zurich, Switzerland

**Application:** AB-QM including actuators

The highest skyscraper in Switzerland is equipped with 6200 AB-QM valves with complementary AMZ motorized control valves to create optimal balance in heating and cooling. Danfoss designed an energy efficient solution with a 4-pipe system including radiant cooling and heating ceilings, manifolds for the pipes and 0-10 volt thermal actuators.



## Hospital – Bielsko Biala, Poland

**Project:** Hospital

**Location:** Bielsko Biala, Poland

**Application:** MTCV for domestic hot water system

In Bielsko Biala hospital Danfoss installed MTCV with the CCR module as a part of a modernization process of the domestic hot water system. This improved the hot water circulation and thus also significantly reduced the risk of legionella contamination.

# See you at **www.hbc.danfoss.com**

Danfoss Hydronic Balancing & Control's first point of contact can be found on the internet. At **www.hbc.danfoss.com** or one of the many local websites you can find a complete toolbox of supporting materials. These tools can help you to make the best product selection for each of your projects. Find the best suitable product with the right dimensions and prepare the right setting to make the job on site as easy as possible.

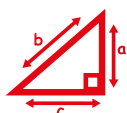
On the website you can find:



## Literature

Both commercial as technical literature help you to explain our products and solutions to your customers and help you find the best products for your projects.

You can find brochures, case stories, technical datasheets and instruction manuals.



## Tools

Videos and educational animations help you to understand our products better. Calculation tools and software help you prepare the commissioning on site.



## Social media

Besides visiting our websites you can also follow us on social media. At **www.youtube.com/DanfossHeating** you can find our videos. Just click on 'Hydronic Balancing & Control' at the right side of the menu. Or stay up to date by following us on Twitter at **www.twitter.com/DanfossBalance**

# 1

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