Sizing Expansion Automats

Basic Concepts for the Calculation of Expansion Automats

To select the right expansion automat it is necessary to understand the following principles:

- **Static height**
  This is the height of the system between the connection of the Flexcon expansion appliance and the highest point, measured in water column metres (1 wcm = 0.1 bar).

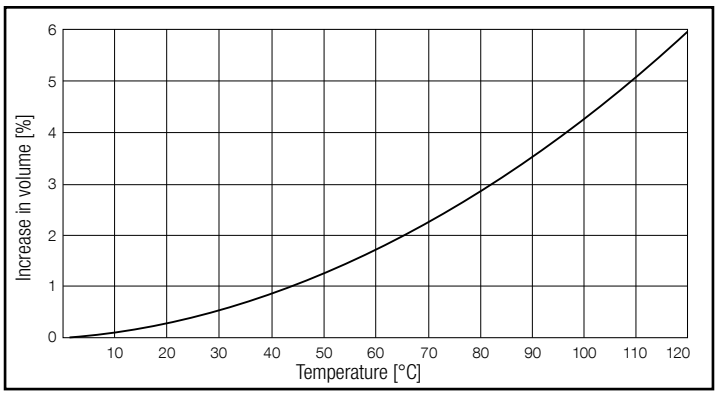
- **System water capacity**
  This is the total volume of water in the entire system including heat source, radiators, pipe work etc.

- **Increase in water volume (in %)**
  The table below shows the percentage volume increase of water as temperature increases from 10 °C to 110 °C.

- **Expansion volume**
  The expansion volume is determined in the following way: expansion volume = capacity x increase in volume at the average heating temperature.
  Example: heating temperature 90/70 °C (average 80 °C) = 2.89%.

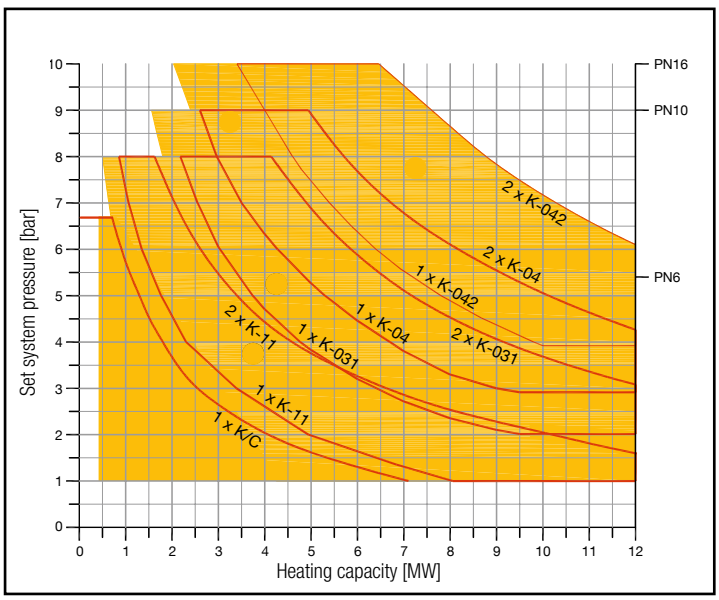
Increase in temperature [°C]	Increase in volume [%]
10 - 25	0.35
10 - 30	0.43
10 - 35	0.63
10 - 40	0.75
10 - 45	0.96
10 - 50	1.18
10 - 55	1.42
10 - 60	1.68
10 - 70	2.25
10 - 80	2.89
10 - 90	3.58
10 - 100	4.34
10 - 110	5.16

FLEXCON M-K / U



Flexcon M-K Compressor Curves

Flexcon M-K selection graph. Typical heating installation (nominal characteristics)



- **Heating/Cooling power**
  This is the sum of the nominal heating capacities.

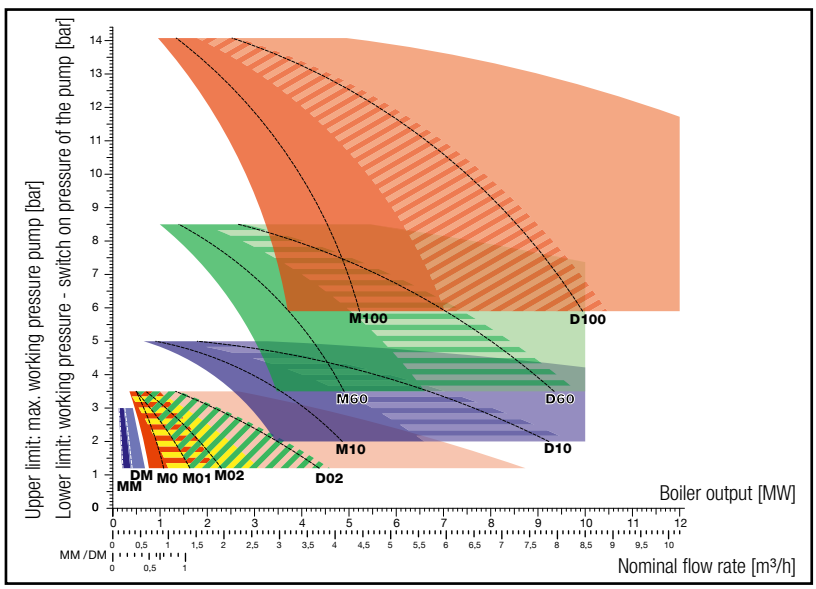
- **Capacity of the expansion automat**
  The capacity of a pump expansion automat is determined in the following way: capacity of expansion appliance = 1.3 x expansion volume (in the case of the Flexcon M-K / C the factor is 1.4).

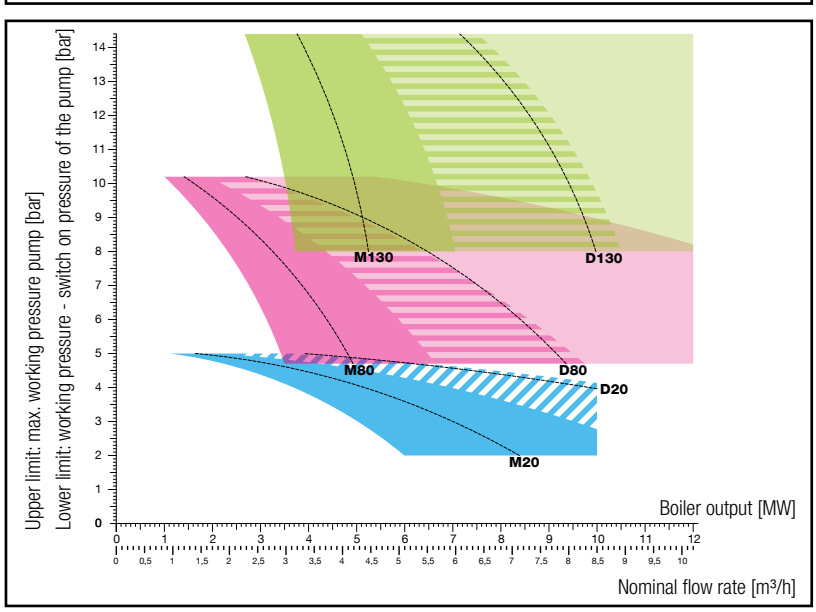
The factor of 1.3 is based on the following assumptions:

- The expansion vessel has to hold at least 10% more than the calculated expansion volume.
- The volume of the vessel allows for refilling and min./max. levels.
- Corrections to tolerances which, according to various standards, are admissible for parts of the system.

Flamcomat Pump Curves

Selection diagram Flamcomat. Typical heating installation (nominal characteristics)





For cooling systems other selection conditions apply.
For questions, please contact Flamco.
Pump specific charts can be found at the Flamcomat pumps later in this catalog.

FLAMCOMAT

Calculations for Expansion Automats in Heating Installations

EXAMPLE 1

DATA

- heating power = 1,500 kW
- average heating temperature (90/70 °C) = 80 °C
- static height = 20 metres
- system volume = 15,400 litres
- provision for expansion (vessel) situated at the bottom of the system.

CALCULATION OF VESSEL CAPACITY

Increase in volume in % = 2.89% ≈ 2.9%

$$\text{Expansion volume} = \frac{15{,}400 \times 2.9}{100} = 447 \text{ litres}$$

Required expansion reservoir capacity = 447 x 1.3 = 581 litres

YOUR CHOICE

Alternative I : Flamcomat GB 600.
Calculation - control unit with pump.
Nominal operating pressure = 2 + 1 = 3 bar.
The 1.5 MW - 3 bar point is under the M 02 pump curve
(see Flamcomat pump characteristics graph).
Selected: Flamcomat GB 600/M 02.

Alternative II: **M-K/U 600, 6 bar model,**
possibly in combination with an ENA 20 de-aeration appliance.

EXAMPLE 2

DATA

- heating power = 7,000 kW
- average heating temperature (70/40°C) = 55 °C
- static height = 37 metres
- system volume = unknown
- provision for expansion (vessel) situated at the bottom of the system.
- system components: mixed utility.

CALCULATION OF VESSEL CAPACITY

System capacity calculation = 7,000 x 10 = 70,000 litres
Increase in volume in % = 1.42%

$$\text{Expansion volume} = \frac{7{,}000 \times 1.42}{100} = 994 \text{ litres}$$

Required expansion reservoir capacity = 994 x 1.3 = 1,292 litres

YOUR CHOICE

Alternative I : Flamcomat GB 1600.
Calculation - control unit with pump.
Nominal operating pressure = 3.7 + 1 = 4.7 bar.
The 7 MW - 4.7 bar point is on the D 20 group curve
(see Flamcomat pump characteristics graph).
Selected: Flamcomat GB 1600/D 20.

Alternative II: **M-K/U 1600, 6 bar model,**
possibly in combination with an ENA 30 de-aeration appliance.

Calculation for Expansion Automats in Chilled Water Systems

EXAMPLE 1

DATA

- heating power	= 5,400 kW
- system volume	= 95,000 litres
- static height	= < 5 metres (with vessel above)
- temperature (6/12 ºC)	= 9 °C
- max. ambient temperature	= 30 °C
- no glycol	

CALCULATION OF VESSEL CAPACITY

Increase in volume at 30 °C, without glycol = 0.43%

$$\text{Expansion volume} = \frac{95{,}000 \times 0.43}{100} = 409 \text{ litres}$$

Required expansion reservoir capacity = 409 x 1.3 = 531 litres

YOUR CHOICE

Alternative I : **Flexcon M-K/U 600,**
6 bar model, possibly in combination with an ENA 10 de-aeration appliance.

Alternative II: Calculation - control unit with pump.
Nominal operating pressure = 0.5 + 1 = 1.5 bar.
As the selection table shows heat capacity, the aforementioned cooling capacity will have to be converted using a conversion factor of 0.412.
The selection point is then 5,400 kW x 0.412 = 2,225 kW (2.2 MW) and 1.5 bar.
The 2.2 MW - 1.5 bar point is on the M 02 pump curve
(see Flamcomat pump characteristics graph).
Selected: Flamcomat GB 600/M 02.