M3FB..LX..

Modulating control valve for hot gas control

Three-way or straight-through valve with magnetic actuator for modulating capacity control of refrigeration units, and for heat recovery. May be used as a hot gas diverting or straight-through valve.

Suitable for safety refrigerants such as R22, R134a, R404A, R407C, R507, etc.

- Short positioning time
- High resolution
- High rangeability
- Hermetically sealed
- Versatile electrical interface
- Friction-free
- Port 1 → 3 closed when de-energised
- Robust and maintenance-free

1) Only admissible with low voltage (SELV, PELV)

M3FB..LX.. with ZM..

Technical data

Electrical interface:	
Control signals:	ZM101/A : DC 0 ... 10 V or DC 0 ... 20 V phase cut ZM121/A : DC 4 ... 20 mA or DC 0 ... 20 V phase cut ZM111 : DC 0 ... 20 V phase cut
Supply voltage 1)	AC 24 V +15/–10 % for DC 0 ...10 V and DC 4 ... 20 mA
Nominal power	See table, page 2
Operating pressure, $p_{e\,max}$	3.2 MPa (32 bar)
Pressure differential $\Delta p_{v\,max}$:	1 → 3 See table, page 2 1 → 2 0.8 MPa (8 bar)
Leakage:	1 → 3 max 0.05% k_{vs} (to VDI/VDE2174) 1 → 2 Max 0.05% k_{vs}
Temperature of medium	– 40 ...120 °C
Valve characteristic (stroke, k_v)	Linear, optimised in low opening range
Resolution $\Delta H / H_{100}$	> 1 : 200 (H = stroke)
Type of operation	Modulating
Position when de-energised	1 → 3 closed
Orientation	Any
Positioning time	Approx. 1 s
Materials (valve body): Housing components Seat / inner valve	 Steel and copper Bronze / CrNi steel
Pipe connections	Extended female solder unions
Connection terminals	Screw terminals for 4 mm² wire
Protection standard	IP54 to IEC529
Ambient temperature	– 40 ... 50 °C
Weight	See 'Dimensions and weight', page 3
Conforms to	CE requirements

Ordering information

The ZM.. terminal housing must be ordered separately.

Ordering example

M3FB15LX/A (Control valve)
ZM101/A (Terminal housing)

See sheet S1-06.01 for a summary of refrigerant valve applications
See sheet S1-05.49 for information on the ZM.. and ZM../A terminal housing

Operating data

Valve type (without ZM..)	DN [mm]	k_{vs} $1 \rightarrow 3$ [m³/h]	Δp_{vmax} $1 \rightarrow 3$ [MPa]	[bar]	P_N [W]	P_{med} [W]
M3FB15LX06/A	15	0.6	2.2	22	26	6
M3FB15LX15/A	15	1.5	2.2	22	26	6
M3FB15LX/A	15	3.0	2.2	22	26	6
M3FB20LX/A	20	5.0	1.8	18	26	6
M3FB25LX/A	25	8.0	1.2	12	40	10
M3FB32LX	32	12.0	0.8	8	40	10

Δp_{vmax} = Max. admissible pressure differential
P_N = Nominal power
P_{med} = Mean operating power
k_{vs} = Flow rate to VDI / VDE2173, tolerance ±10 %

Selection table for hot-gas applications (approximate guide to valve size)

Note

Correct valve sizing (to ensure a sufficiently large pressure drop Δp_{v100} across the fully open valve) is the key to the correct operation of a refrigeration unit. All the components must be coordinated, and this can be ensured only by the refrigeration specialist. The application examples on pages 5 and 6 show the recommended pressure drop in each case.

Refrigeration capacity in kW

Nominal capacity in kW at evaporation temperature t_o = 5 °C

Δp_{v100}	Valve type	Refrigerant: R407C (R22)			R134a (R12)			R404A / R507		
		Condensation temperature t_c [°C]								
		50	40	30	50	40	30	50	40	30
0.5 bar	M3FB15LX06/A	4.5	4.0	3.6	3.8	3.3	2.9	3.7	3.3	2.9
	M3FB15LX15/A	11	10	8.9	9.5	8.3	7.2	9.2	8.1	7.2
	M3FB15LX/A	22	20	18	19	17	14	18	16	14
	M3FB20LX/A	37	33	30	32	28	24	31	27	24
	M3FB25LX/A	59	53	48	51	44	38	49	43	38
	M3FB32LX	89	80	72	76	67	57	74	65	58
1.0 bar	M3FB15LX06/A	6.2	5.6	4.9	5.3	4.6	3.9	5.1	4.5	4.0
	M3FB15LX15/A	16	14	12	13	11	10	13	11	10
	M3FB15LX/A	31	28	25	26	23	20	26	23	20
	M3FB20LX/A	52	46	41	44	38	33	43	38	33
	M3FB25LX/A	83	74	66	70	61	52	69	61	53
	M3FB32LX	125	111	99	106	92	78	103	91	80
4.0 bar	M3FB15LX06/A	11.4	9.9	8.4	9.2	7.5	5.8	9.6	8.3	7.0
	M3FB15LX15/A	28	25	21	23	19	15	24	21	18
	M3FB15LX/A	57	50	42	46	38	29	48	41	35
	M3FB20LX/A	95	83	70	76	63	48	80	69	58
6.0 bar	M3FB15LX06/A	13	11	8.9	10	7.6	5.8	11	9.4	7.7
	M3FB15LX15/A	33	28	22	25	19	15	28	23	19
	M3FB15LX/A	65	55	45	50	38	29	55	47	39
	M3FB20LX/A	108	92	74	83	63	48	92	78	64
8.0 bar	M3FB15LX06/A	14	11	8.9	9.8	7.6		12	9.9	7.7
	M3FB15LX15/A	35	28	22	24	19		30	25	19
	M3FB15LX/A	69	56	45	49	38		60	49	39
	M3FB20LX/A	115	94	74	81	63		100	82	64

Δp_{v100} = Pressure drop across the fully open valve

Principle of operation / Construction

The control signal is converted in the ZM../A terminal housing into a phase cut signal, which generates a magnetic field in the coil. This causes the only moving part, the armature, to change its position in accordance with the interacting forces (magnetic field, counter-spring, hydraulics etc.). The armature responds rapidly to any change in signal, transferring the corresponding movement directly to the control disc, enabling fast changes in load to be corrected quickly and accurately.

The force of the counter-spring closes the valve automatically (control path ports 1 → 3) if the power is switched off or fails.

The armature or magnetic core is designed as a floating component within the pressure system, so that no external shaft gland is required. The leakage losses common with moving parts are thus avoided.

The valve cross-section allows for easy flow whether the valve is fully or only partially open. This reduces pressure losses and ensures quiet operation.

The valves are fitted with extended female solder unions, making pipe connection easy.

Mounting

Mounting instructions (Ref. 35548 and 35541) are enclosed with the valve.

The refrigerant valves can be mounted in any orientation, but upright mounting is preferable.

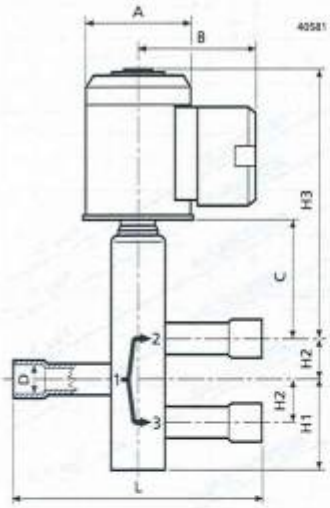
The pipes should be fitted such that the alignment does not distort the valve connections.

Before soldering the pipes, ensure that the direction of flow through the valve is correct.

The pipes must be soldered with care. The flame should be large enough to ensure that the junction heats up quickly and the valve does not get too hot. The flame should be directed away from the valve. Cool the valve body with a wet cloth while soldering.

Port 2 must be sealed off when the valve is used in a straight-through application.

Always switch off the power supply before connecting or disconnecting the ZM../A terminal housing.



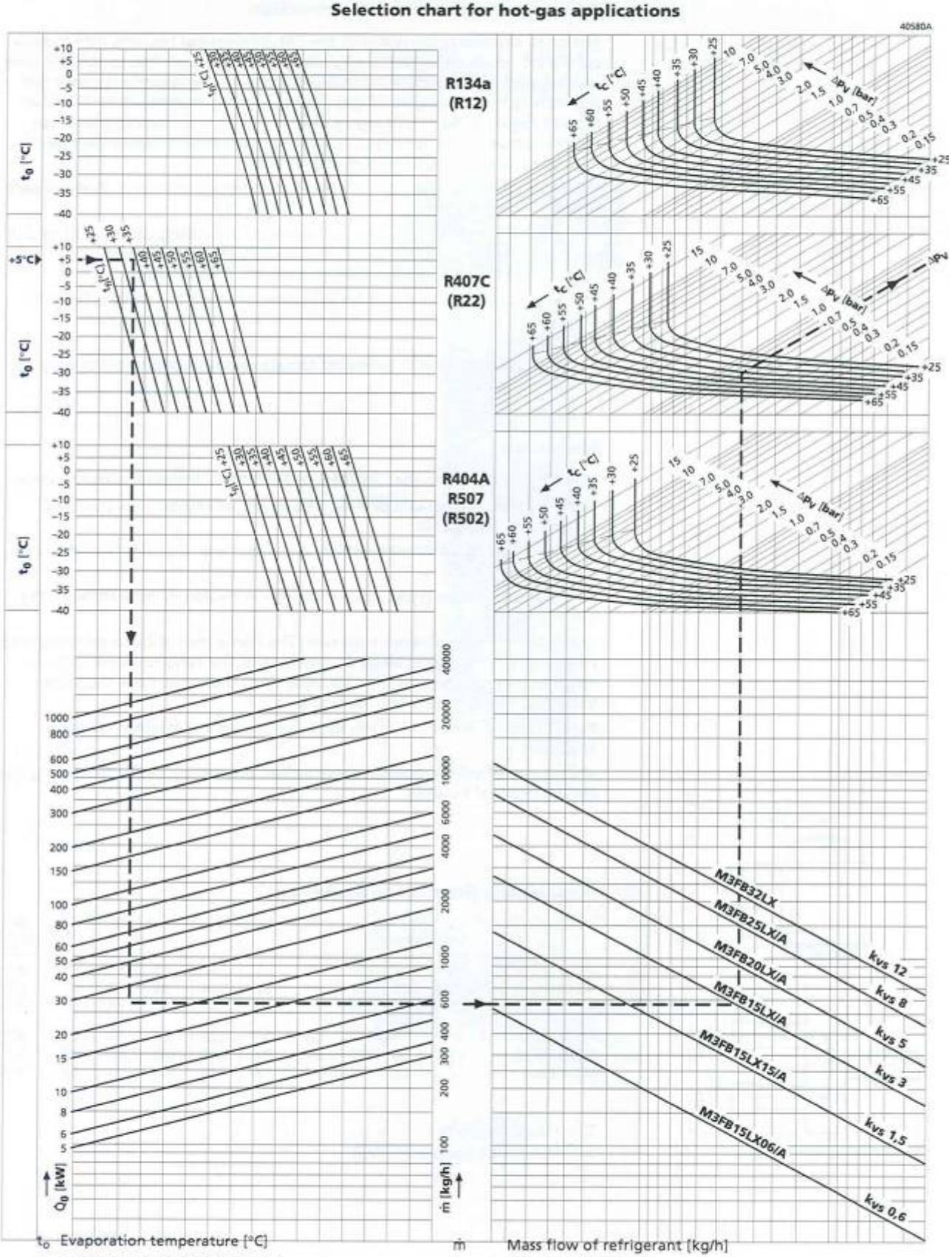
Dimensions [mm] and weight [kg]

Valve type	DN [mm]	Ø D [inches]	L	H_1	H_2	H_3	A	B	C	W [kg]
M3FB15LX06/A	15	5/8	150	65	25	184	80	84	67	4.3
M3FB15LX15/A	15	5/8	150	65	25	184	80	84	67	4.3
M3FB15LX/A	15	5/8	150	65	25	184	80	84	67	4.3
M3FB20LX/A	20	7/8	170	69	30	238	100	94	84	8.9
M3FB25LX/A	25	1 1/8	200	72	36	248	100	94	94	9.5
M3FB32LX	32	1 3/8	250	91	43	245	100	94	98	11.4

D : Pipe connections

W : Weight (including packaging)

Selection chart for hot-gas applications



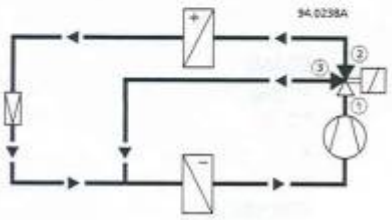
t_o Evaporation temperature [°C]
t_c Condensation temperature [°C]
t_{fl} Liquid temp. (t_c – degree of sub-cooling) [°C]
Q_o Refrigeration capacity [kW]

$\dot{m}$ Mass flow of refrigerant [kg/h]
k_{vs} Flow rate [m³/h]
Δp_v Admissible pressure differential [bar]

Application example

(Diagrams show principles only without installation-specific details)

3-way hot-gas bypass control



For accurate control of evaporators, from 0 ...100% refrigeration capacity.

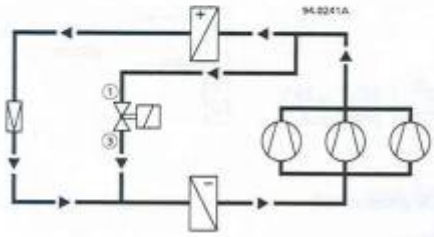
- Suitable for test rooms, laboratory systems, small chilled water units and DX evaporators with a refrigeration capacity of up to approx. 40 kW.

Recommended presure drop Δp_{v100} across the fully-open valve (control path 1 → 3): between 0.5 and 1 bar (see selection chart)

Example:

Refrigeration capacity Q_o	24 kW
Refrigerant	R22
Condensation temperature t_c	40 °C
Evaporation temperature t_o	+ 5 °C
Liquid temperature t_{fl}	35 °C
Selected valve:	**M3FB15LX/A**
Pressure differential Δp_v across valve	0.7 bar

Indirect hot-gas bypass



The control valve throttles the capacity of a compressor stage. The hot gas is injected directly into the evaporator allowing capacity control from 100 % to approximately 0 %.

- Suitable for use in large refrigeration systems in air conditioning applications, to prevent unacceptable fluctuations in temperature between compressor stages.

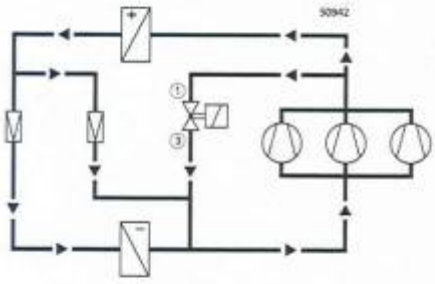
The pressure differential Δp_{v100} across the fully-open valve is determined by the condensation pressure at low load minus the pressure upstream of the evaporator.

If no details are provided, the pressure differential Δp_{v100} can be assumed to be 4 bar.

Example:

Refrigeration capacity Q_o of one compressor stage	30 kW
Refrigerant	R22
Condensation temperature, full load / low load	45 / 35 °C
Evaporation temperature, full load / low load	5 / 15 °C
Liquid temperature t_{fl}	40 / 30 °C
Pressure differential Δp_v (from R22 vapour table)	5.6 bar
Selected valve:	**M3FB15LX/A**
Actual capacity Approx.	40 kW

Direct hot-gas bypass



The control valve throttles the capacity of a compressor stage. The gas is fed to the suction side of the compressor and cooled by a re-injection valve. Capacity control range from 100 % to approx. 10 %.

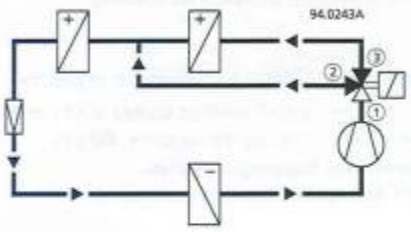
- Suitable for large refrigeration systems for air conditioning, with several compressors or compressor stages, and where the evaporator and compressor are some distance apart (attention must be paid to oil return).

The pressure differential Δp_{v100} across the fully-open valve is determined by the condensation pressure at low load minus the suction pressure.

If no details are provided, the pressure differential Δp_{v100} can be assumed to be 6 bar.

Example:

Refrigeration capacity of one compressor stage	40 kW
Refrigerant	R22
Condensation temperature Full load / low load	45 / 35 °C
Evaporation temperature Full load / low load	2 / 10 °C
Liquid temperature t_{fl}	40 / 30 °C
Pressure differential Δp_v (from R22 vapour table)	6.5 bar
Selected valve:	**M3FB15LX/A**



Heat recovery

The hot-gas diverting valve may be used for modulating recovery of the heat from the condenser, even in the event of high pressure differentials.

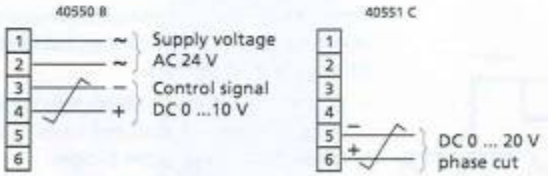
Recommended pressure drop Δp_{v100} across the fully-open valve (control path 1 → 3): between 0.5 and 1 bar.

Example:

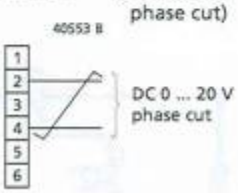
Refrigeration capacity Q	67 kW
Refrigerant	R134a
Condensation temperature t_c	50 °C
Evaporation temperature t_o	2 °C
Liquid temperature t_{fl}	45 °C
Selected valve:	**M3FB32LX**
Actual pressure drop	0.7 bar

Terminal layout

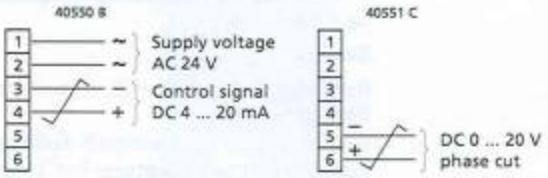
ZM101/A (DC 0 ...10 V or DC 0 ... 20 V phase cut)



ZM111 (DC 0 ... 20 V phase cut)



ZM121/A (DC 4 ... 20 mA or DC 0 ... 20 V phase cut)



Twisted pairs

See sheet S1-05.49 for connection diagrams for the ZM.. and ZM../A terminal housing.

⚠ Warning

Do not connect AC24 V when the ZM../A is used with DC 0 ... 20 V signals.

Note:
ZM../A terminal housing used with DC 0 ... 20 V signals:
Do not connect AC 24 V to Terminals 1 and 2.
Connect Terminal 5, (marked " − ")

- to the appropriate Y output terminal on *staefa unico, klimo* and *multireg* (type 9 controllers)
- to Terminal 2 on type NKOA terminal modules.