

Data Sheet

CTM High pressure valve
Type **CTM 6**

Improves COP and lowers swept volume of the MT compressors in CO₂ systems with parallel compressors



Danfoss Multi Ejector Solution™, consists of a CTM 6 High Pressure valve and an AK-PC 782A controller. This solution makes CO₂ refrigeration systems economically competitive with the HFC systems at all ambient temperatures by improving COP in comparison to standard parallel compressor systems.

CO₂ systems with Multi Ejector Solution™ can be installed in any climate delivering lower energy consumption than i.e. R404A. It removes the CO₂ equator entirely.

CTM 6 HP is designed for CO₂ systems with parallel compression to lift a part of the gas from MT suction and mix it with the gas coming from the gas cooler at medium pressure level.

Features

First Cost savings

- Lower cost compared to parallel compression transcritical CO₂ packs due to lower swept volume of compressors. (i.e. smaller compressors or less number of compressors).
- Reliable and robust design.
- Fully integrated solution not requiring any additional components like check valves or motorized ball valves.
- Fully serviceable - wide range of spare parts and accessories.
- Easily accessible strainer / filter for fast maintenance.
- Brings first cost savings.
 - High pressure valve becomes redundant
 - Enables 15 - 35 % savings on compressor swept volume, compared to booster systems.

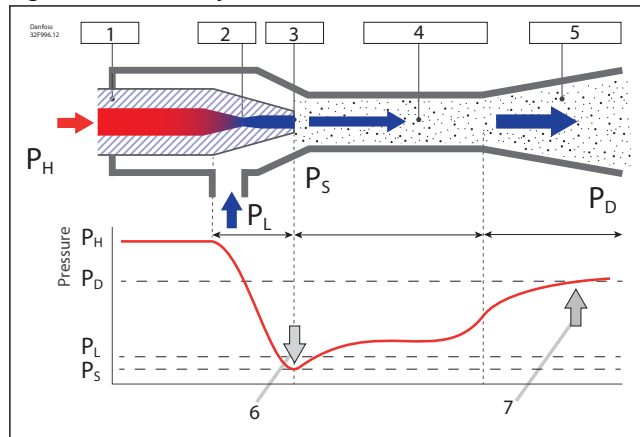
Fast Pay Back – Energy saving

- Improved COP, enhanced operation of parallel compressors and lower swept volume to the MT compressors , resulting in lower energy consumption.
- Savings for end users
- Fast payback – lower energy consumption
 - Less compressors and higher efficiency on the systems, leads to payback time of less than 2 years on average globally.
- The combination of CTM 6 High Pressure and the AK-PC 782A ensure an easy setup and commissioning, robust control of the system that ensures many years of problem free operation.

Functions

The Multi Ejector function

Figure 1: The Multi Ejector function



1	Nozzle
2	Throat
3	Exit
4	Mixing chamber
5	Diffuser
6	Intake due to pressure differential
7	Pressure increase due to reducing flow velocity

An ejector is a device that uses expansion energy to compress another fluid. In this case with the transcritical system there is up to 20% of the compressor work that can theoretically be recovered in the expansion.

In this case with the Multi Ejector system the work is coming from the CO₂ leaving the gas cooler. The high pressure CO₂(PH) is entering the nozzle where the expansion is taking place. At the exit of the nozzle the speed is very high and as a consequence of that the pressure is low.

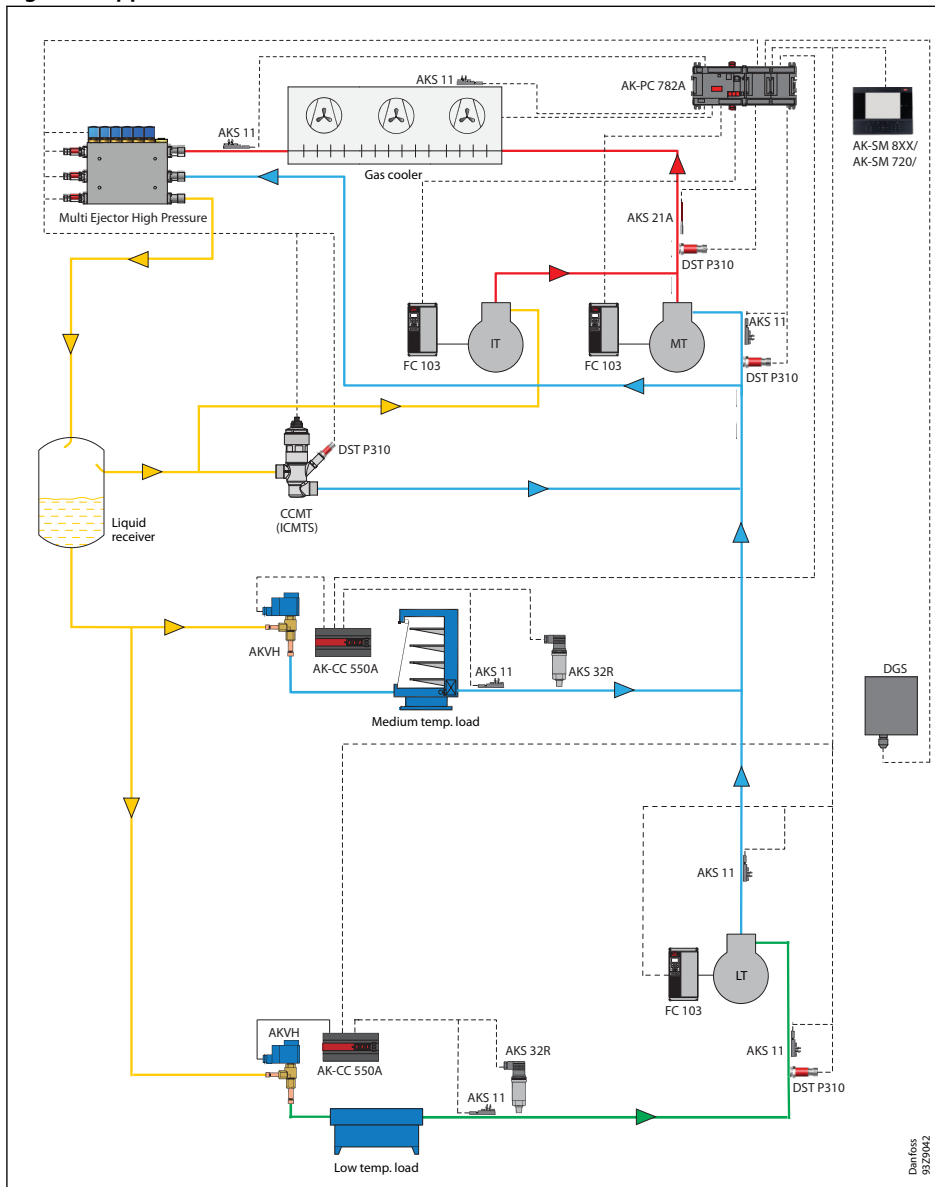
This low pressure is used to drag liquid from the MT suction accumulator (PL). From there the two flows are mixed in the mixing chamber where the pressure will be lower than at the drive inlet due to the mixing of vapour from a higher pressure.

After the mixing the flow enters the diffuser where the flow is slowed down. The shape of the diffuser enables the conversion from kinetic energy (velocity) to potential energy (pressure). After the diffuser the flow is returned to the receiver.

Applications

The Multi Ejector is designed to lift a part of the gas from MT suction and mix it with the gas coming from the gas cooler at medium pressure level. Pre-compressed gas is taken from the receiver to parallel compressor which works more efficiently due to lower pressure lift required.

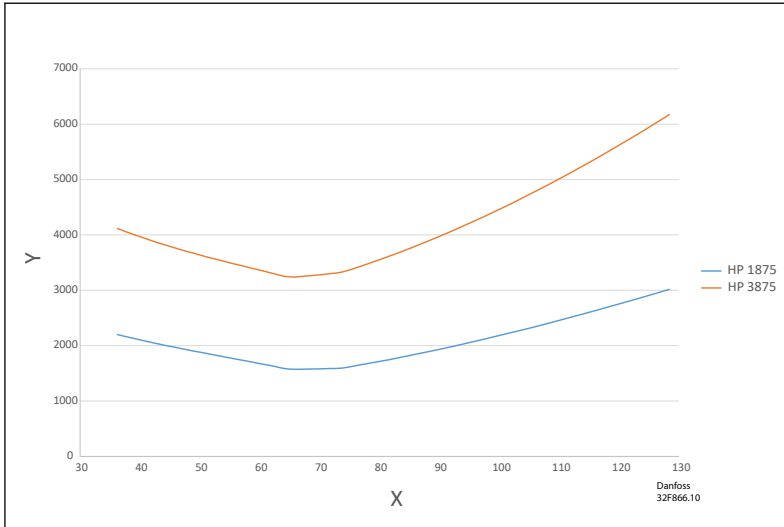
Figure 2: Application



	HP High Pressure (120-140 bar Max working pressure)
	HP Receiver Pressure (60-90 bar Max working pressure)
	LP Suction Pressure MT (35-55 bar Max working pressure)
	LP Suction Pressure LT (25-30 bar Max working pressure)

High pressure lift ejectors design mass flow HP side

Figure 3: High pressure lift ejectors design mass flow HP side



X	Inlet pressure HP side [Bar]
Y	Mass flow HP side [kg/hr]

Flow from the high pressure side (motive flow) for fully open ejector block as a function of temperature out of gas cooler.

Media**Technical data****Table 1: Technical data**

Refrigerant	R744 with oil
Maximum working pressure	140 bar / 2031 psi
Max. test pressure	1.43 x 140 bar / 1.43 x 2031 psi
Max. OPD	90 bar / 1305 psi (for single-voltage coil, 50 Hz)
Min. OPD	< 0.1 bar / 1.45 psi
Max. pres. dif. E and C connections	20 bar / 290 psi
Media temp. range	-10 °C – +50 °C / +14 °F – 122 °F
Ambient temp. range	-10 °C – +50 °C / +14 °F – 122 °F
Humidity	0 – 100% R.H. (0-97% R.H. non-condensation condition if IP level is below IPX5)

Product specification

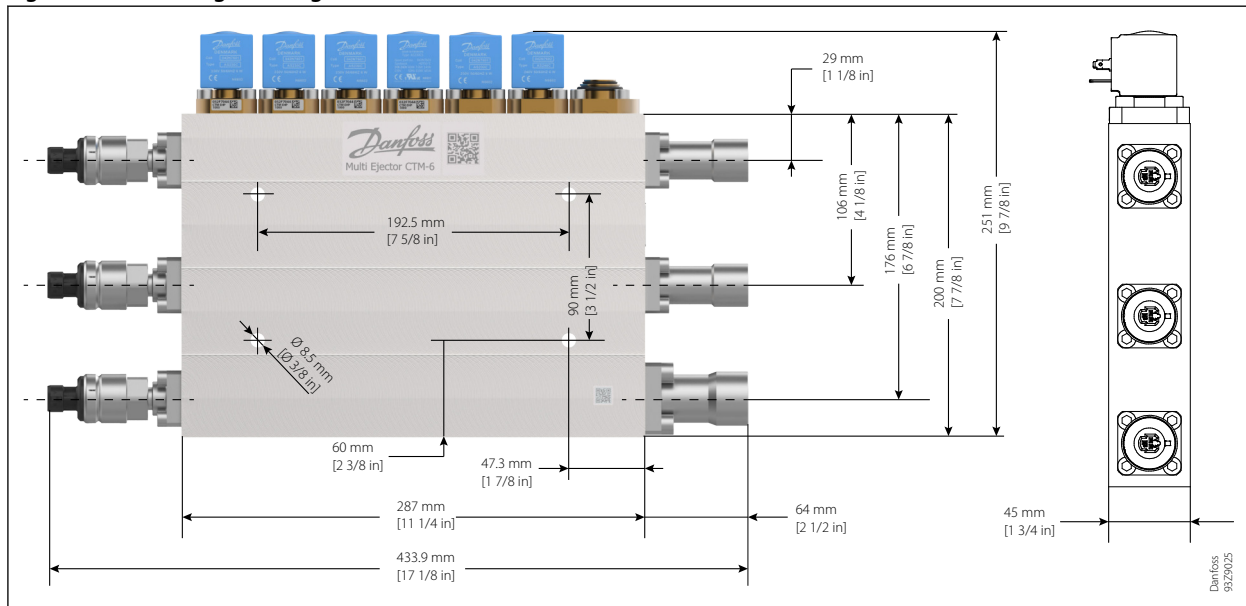
Material specification

Table 2: Material specification

Housing	Aluminium AW-6082 T6
Connections	Stainless steel AISI 304
Ejectors	Brass
Screws	Stainless steel A2-70

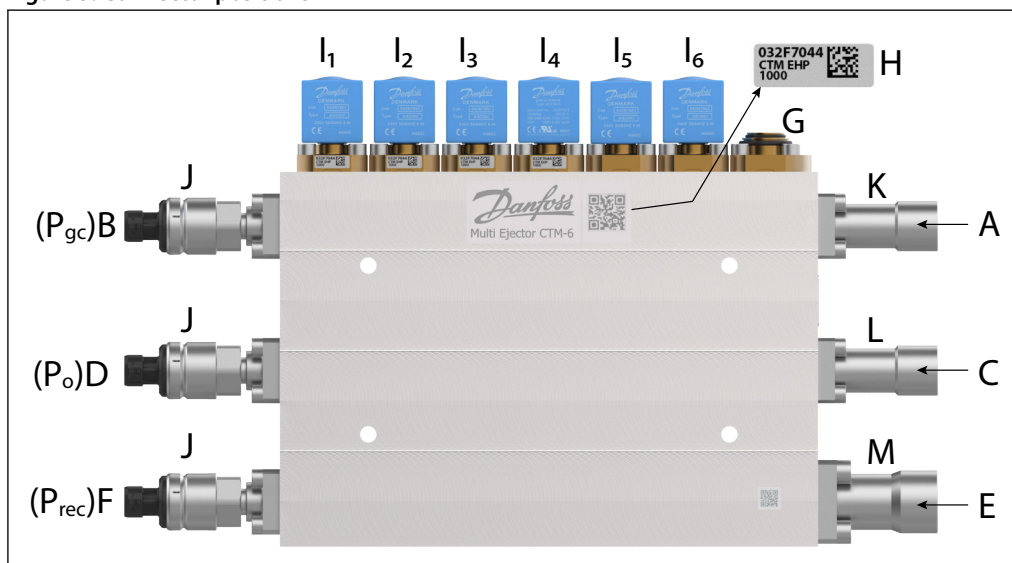
Dimensions and weights

Figure 4: CTM 6 (Weight: 9.1 Kg / 20.1 lb)



Connector positions

Figure 5: Connector positions



CTM High pressure valve, type CTM 6

A	Gas cooler outlet - Ball valve - inlet connector Combi brazing 7/8 inch ODF - weld 3/4 inch (EN10220)	F	Outlet measurement port G 7/16 inch - 20 UNF
B	Inlet measurement port G 7/16 inch - 20 UNF	G	Strainer
C	Suction connector. MT evaporator outlet - Ball valve - suction connector. Combi brazing 7/8 inch ODF - weld 3/4 inch (EN10220)	H	Label
D	Suction measurement port G 7/16 inch - 20 UNF	I	Ejector
E	Common outlet connector - Ball valve - Receiver Combi brazing 1 1/8 inch ODF - weld 1 inch (EN10220)	J	Pressure transmitter DST P310 (076G1021)
		K	High pressure inlet
		L	Suction inlet
		M	Receiver

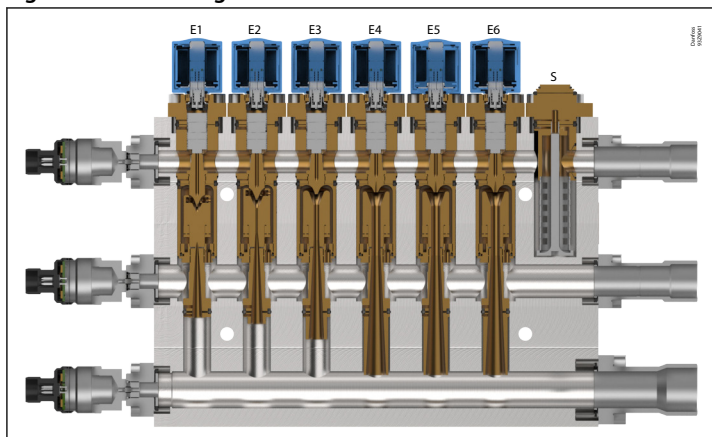
Mounting order of ejectors:

Ejectors with the highest capacities (longest ejectors) must be placed closest to the suction connector C. Any blank ejector should be placed after the ejectors.

Ordering

Valve configuration

Figure 6: Valve configuration



E	Ejector
S	Strainer

Table 3: Valve configuration

Type	Code no.	Product name	Ejector 1	Ejector 2	Ejector 3	Ejector 4	Ejector 5	Ejector 6
CTM 6	032F5673	CTM Multi Ejector HP 1875	CTM EHP 125	CTM EHP 250	CTM EHP 500	CTM EHP 1000	Blank ejector	Blank ejector
CTM 6	032F5698	CTM Multi Ejector HP 2875	CTM EHP 125	CTM EHP 250	CTM EHP 500	CTM EHP 1000	CTM EHP 1000	Blank ejector
CTM 6	032F5674	CTM Multi Ejector HP 3875	CTM EHP 125	CTM EHP 250	CTM EHP 500	CTM EHP 1000	CTM EHP 1000	CTM EHP 1000

Multi Ejector

Table 4: Multi Ejector

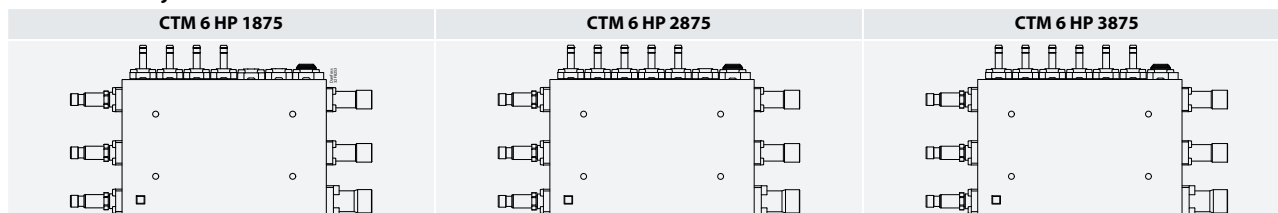


Table 5: Multi Ejector CTM 6

Type	Capacity - Mass flow ⁽¹⁾		Code no. Single pack
	[kg/h]	[lb/h]	
CTM 6 HP 1875	1875	4134	032F5673
CTM 6 HP 2875	2875	6340	032F5698
CTM 6 HP 3875	3875	8543	032F5674

⁽¹⁾ R744 at 90 bar / 35 °C

⁽²⁾ R744 at 1305 psi / 95 °F

(HP = High Pressure lift)

(The above code numbers are without coils which should be ordered separately – see coil ordering below).

Accessories

Spare parts

Table 6: Ejectors

Image	Part	Type	Capacity - HP Mass flow 1		Description	Code no. Single pack
			[kg/h]	[lb/h]		
	Ejectors	CTM EHP 125	125	275.5	1. Completely assembled ejector with O-rings already mounted	032F9102
		CTM EHP 250	250	551	1. Completely assembled ejector with O-rings already mounted	032F9103
		CTM EHP 500	500	1102	1. Completely assembled ejector with O-rings already mounted	032F9104
		CTM EHP 1000	1000	2204	1. Completely assembled ejector with O-rings already mounted	032F9105
		CTM Blank ejector	-	-	1. Completely assembled blank ejector with O-rings already mounted	032F9112

Table 7: Strainer, O-rings and connectors

Image	Part	Type	Description	Code no. Single pack
 X 1 X 2	Strainer	CTM strainer	1. Mesh only 2. 2 sets of 2 O-rings	032F9113
 X 6 X 2	O-rings	CTM O-rings	1. 2 sets of 2 O-rings for strainer 2. 6 sets of 3 O-rings for ejectors	032F9114
	Connectors	DN 20	Connector + O-ring	032F9116
		DN 25	Connector + O-ring	032F9117

Table 8: Pressure transmitter and Cable

Image	Part	Type	Description	Code no.
	Pressure transmitter	DST P310	Pressure transmitter with O-ring	076G1021
	Cable	-	10 meter cable for pressure transmitter	064G0950

Coils

Table 9: DIN spade connection

Image	Type	Voltage	Frequency / Power consumption				Code no. Single pack
		[V]	[Hz]	[W]	[Hz]	[W]	with DIN plug ⁽¹⁾
	AS230CS	230	50	8	60	7	042N7601
	AZ120CS	110 - 120	50	8.5	60	7	042N4202

⁽¹⁾ The three pins on the coil can be fitted with spade tabs, 6.3 mm wide (to DIN 46247). The two current carrying pins can also be fitted with spade tabs, 4.8. mm wide. Max. lead cross section: 1.5 mm². Voltage variation: V AC -15% - 10%, If DIN plug is used (DIN 43650) the leads must be connected in the socket. The socket is fitted with a Pg 11 screwed entry for 6 – 12 mm.

Plug for DIN spade connection

Table 10: Plug for DIN spade connection

Image	Type	Voltage [V]	Frequency	Code no. Single pack
	DIN plug (LED)	230	50 / 60	042N0265 ⁽¹⁾
	DIN plug	Max. 250	50 / 60	042N0156

⁽¹⁾ Only for AS230CS

Controller AK-PC 782A



Danfoss offers a wide range of market leading Pack Controllers. Being the flag ship and best in class controller for transcritical CO₂ packs controls, the AK-PC 782A offers the highest possible efficiency with the Multi Ejector, CTM.

The complete application control features:

- Complete booster pack control of up to 3 suction groups (max. 12 compressors) and high pressure system
- Significant savings with heat recovery for Tap Water and heat reclaim
- Extensive control of oil flow and pressurization
- Best in class safety monitoring and fail-safe functions
- Minimal energy consumption while ensuring optimal food quality
- Auto-configured, easy-to-use graphical representation with Danfoss System Manager
- Independent, customised control and monitoring of auxiliary function

Temperature sensors and pressure transmitters

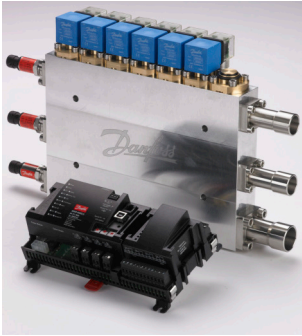


Danfoss offers a comprehensive range of sensors for temperature and pressure sensors developed to meet the requirements of the entire pack application.

The sensor range delivers the following key features and benefits:

- Long term reliability minimize system downtime.
- Robust construction protects against mechanical shock and vibration.
- Temperature sensor design ensures fast response time and precise measurement.
- Hermetically sealed pressure element ensures no leakage.
- Pressure transmitter output calibrated for perfect fit to the application.
- Pulse snubber ensures protection against liquid hammering, cavitation or pressure peaks.

Disclaimer



⚠ WARNING:

The CTM Multi Ejector valve is approved for use only with Danfoss pack controller type AK-PC 78x.

Danfoss expressly disclaims, and any responsibility or liability, whether based on contract, breach of warranty, tort, statute or otherwise, shall be excluded, if the CTM Multi Ejector valve is used with any controller other than a Danfoss controller type AK-PC 78x.

For further information on AK-PC, please see separate document.

Certificates, declarations, and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

Some approvals may change over time. You can check the most current status at danfoss.com or contact your local Danfoss representative if you have any questions.

Table 11: Certificates, declarations, and approvals

File name	Document type	Document topic	Approval authority
032F9627.AA	Manufacturers Declaration	PED	Danfoss
UL SA45046	Mechanical - Safety Certificate	-	UL

Coils:

AS230CS: LLC CDC TYSK; The Low Voltage Directive 2014/35/EU (LVD);
Electromagnetic Compatibility Directive 2014/30/EU (EMC)

AZ120CS: C UR US; LLC CDC TYSK; The Low Voltage Directive 2014/35/EU (LVD);
Electromagnetic Compatibility Directive 2014/30/EU (EMC)

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