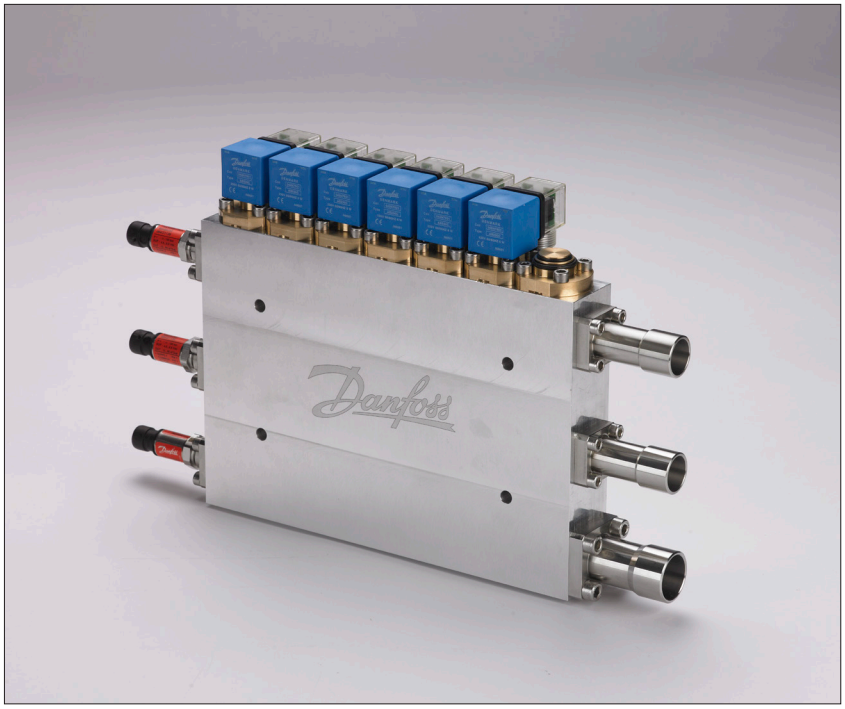
ENGINEERING TOMORROW

Data sheet

Multi Ejector Solution™ for R744 (CO_2)
Type - CTM 6 High Pressure (HP)



Danfoss Multi Ejector Solution™, consists of a CTM 6 High Pressure valve and an AK-PC 782A controller. This solution makes CO_2 refrigeration systems economically competitive with the HFC systems at all ambient temperatures by improving COP in comparison to standard parallel compressor systems.
CO_2 systems with Multi Ejector Solution™ can be installed in any climate delivering lower energy consumption than i.e. R404A. It removes the CO_2 equator entirely.
CTM 6 HP is designed for CO_2 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 CO_2 packs due to lower swept volume of compressors. (i.e. smaller compressors or less number of compressors).*

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.*

- 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.
- MBS 8250 pressure transmitters integrated.
- Brings first cost savings.
  - High pressure valve becomes redundant
  - Enables 15 - 35 % savings on compressor swept volume, compared to booster systems.

- Fast payback – lower energy consumption
  - Less compressors and higher efficiency on the systems, leads to payback time of less than 2 years on avarage 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.

Approvals

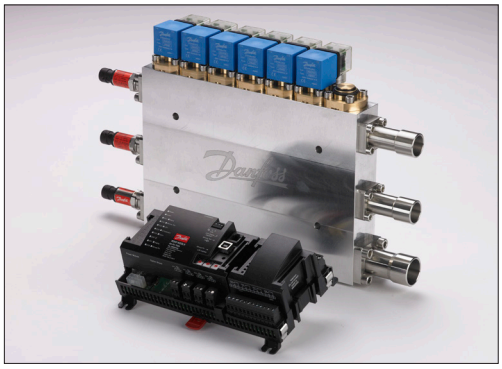
- Pressure Equipment Directive 2014/68/EU (PED)
- UL Recognized

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).

WARNING!

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



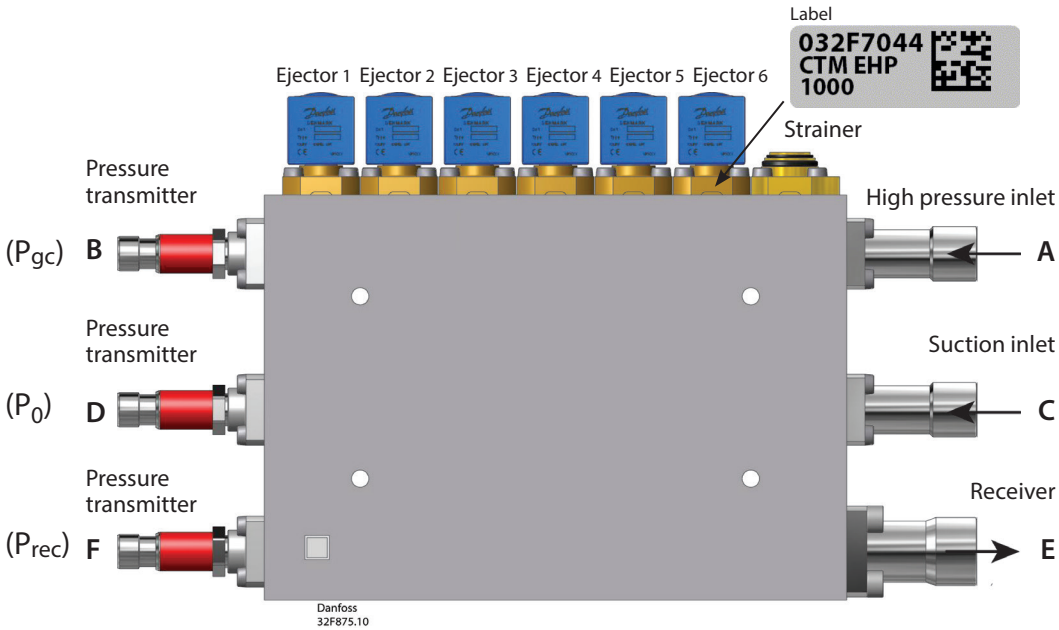
DISCLAIMER

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.

Connector positions

Can be interchanged (see drawing below)



For mounting / service of ejectors

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.

Pressure transmitter
MBS 8250 (064G1136)

A: Gas cooler outlet - Ball valve - inlet connector
Combi brazing $^{7}/_{8}$ inch ODF - weld $^{3}/_{4}$ inch (EN10220)

B: Inlet measurement port G $^{7}/_{16}$ inch - 20 UNF

C: Suction connector. MT evaporator outlet - Ball valve - suction connector.
Combi brazing $^{7}/_{8}$ inch ODF - weld $^{3}/_{4}$ inch (EN10220)

D: Suction measurement port G $^{7}/_{16}$ inch - 20 UNF

E: Common outlet connector - Ball valve - Receiver
Combi brazing 1 inch ODF - weld $1^{1}/_{8}$ inch (EN10220)

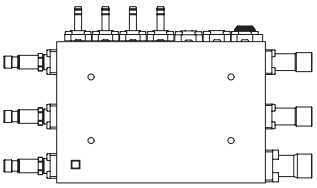
F: Outlet measurement port G $^{7}/_{16}$ inch - 20 UNF

Ordering Multi Ejector

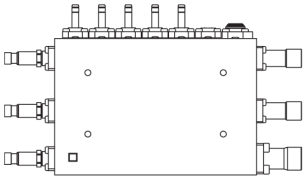
Multi Ejector CTM 6

Type	Capacity - Mass flow [1] [kg/h]	Capacity - Mass flow [2] [lb/h]	Code no. Single pack
CTM 6 HP 1875	1875	4134	032F5673
CTM 6 HP 2875	2875	6340	032F5698
CTM 6 HP 3875	3875	8543	032F5674

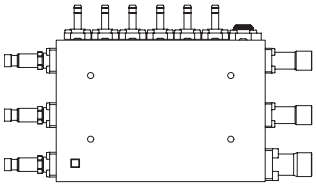
[1]) R744 at 90 bar / 35 °C
[2]) R744 at 1305 psi /95 °F
(HP = High Pressure lift)
(The above code numbers are without coils which should be ordered separately – see coil ordering below).



CTM 6 HP 1875



CTM 6 HP 2875



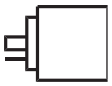
CTM 6 HP 3875

Approvals (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)

Ordering coils / accessories

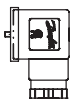


DIN spade connection

Type	Voltage [V]	Frequency / Power consumption [Hz]	[W]	[Hz]	[W]	Code no. Single pack 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 mm^2.

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

Type	Voltage [V]	Frequency	Code no. Single pack
DIN plug (LED)	230	50 / 60	042N0265 [2]
DIN plug	Max. 250	50 / 60	042N0156

[2]) Only for AS230CS.

Coolselector®2

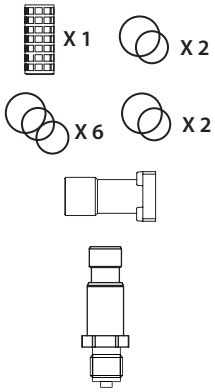
Valve sizing using calculation software

It is strongly recommended to use **Coolselector®2** to find the correct valve for your application. The software can be downloaded from the Danfoss website.

You can download it from http://coolselector.danfoss.com

Spare parts

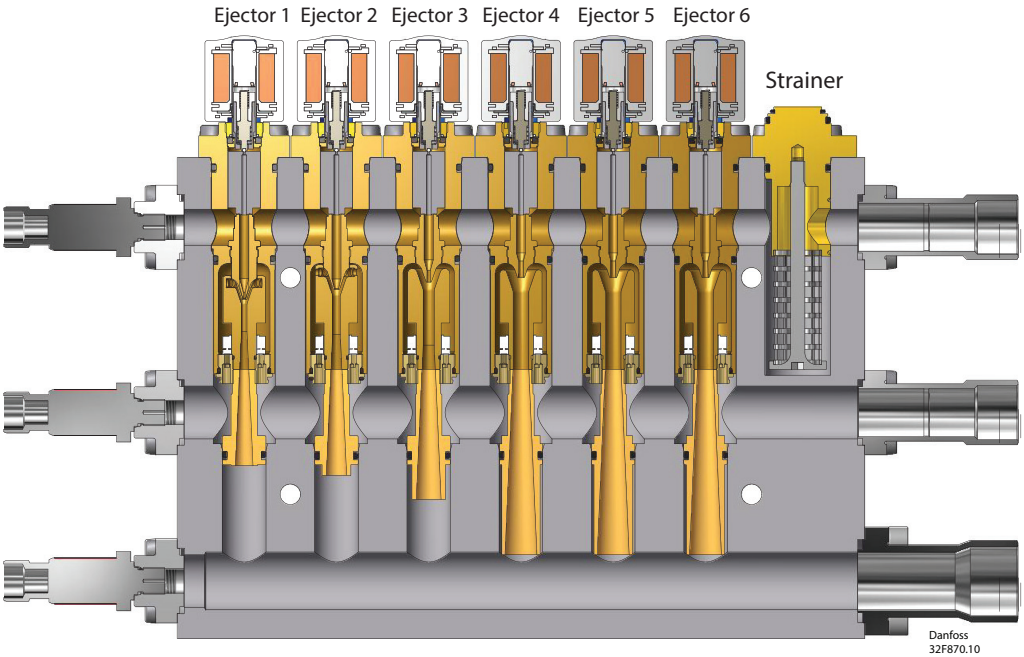
Part	Type	Capacity - HP Mass flow [1]		Description	Code no. Single pack
		[kg/h]	[lb/h]		
Ejectors	CTM EHP 125	125	275.5	1. Completely assembled ejector with O-rings already mounted	032F9102
	CTM EHP 250	250	551.0	1. Completely assembled ejector with O-rings already mounted	032F9103
	CTM EHP 500	500	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



Part	Type	Description	Code no. Single pack
Strainer	CTM strainer	1. Mesh only 2. 2 sets of 2 O-rings	032F9113
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

Pressure transmitter	MBS 8250	Pressure transmitter with O-ring	064G1136
Cable	–	10 meter cable for pressure transmitter	064G0950

Design and function

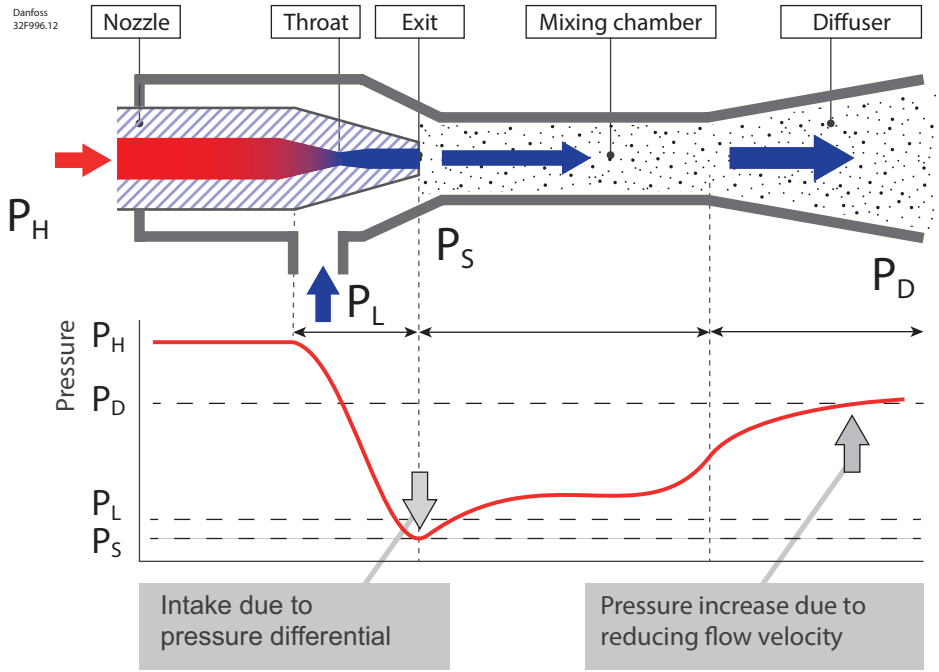


Valve configuration

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

Function

The Multi Ejector function is shortly described below.

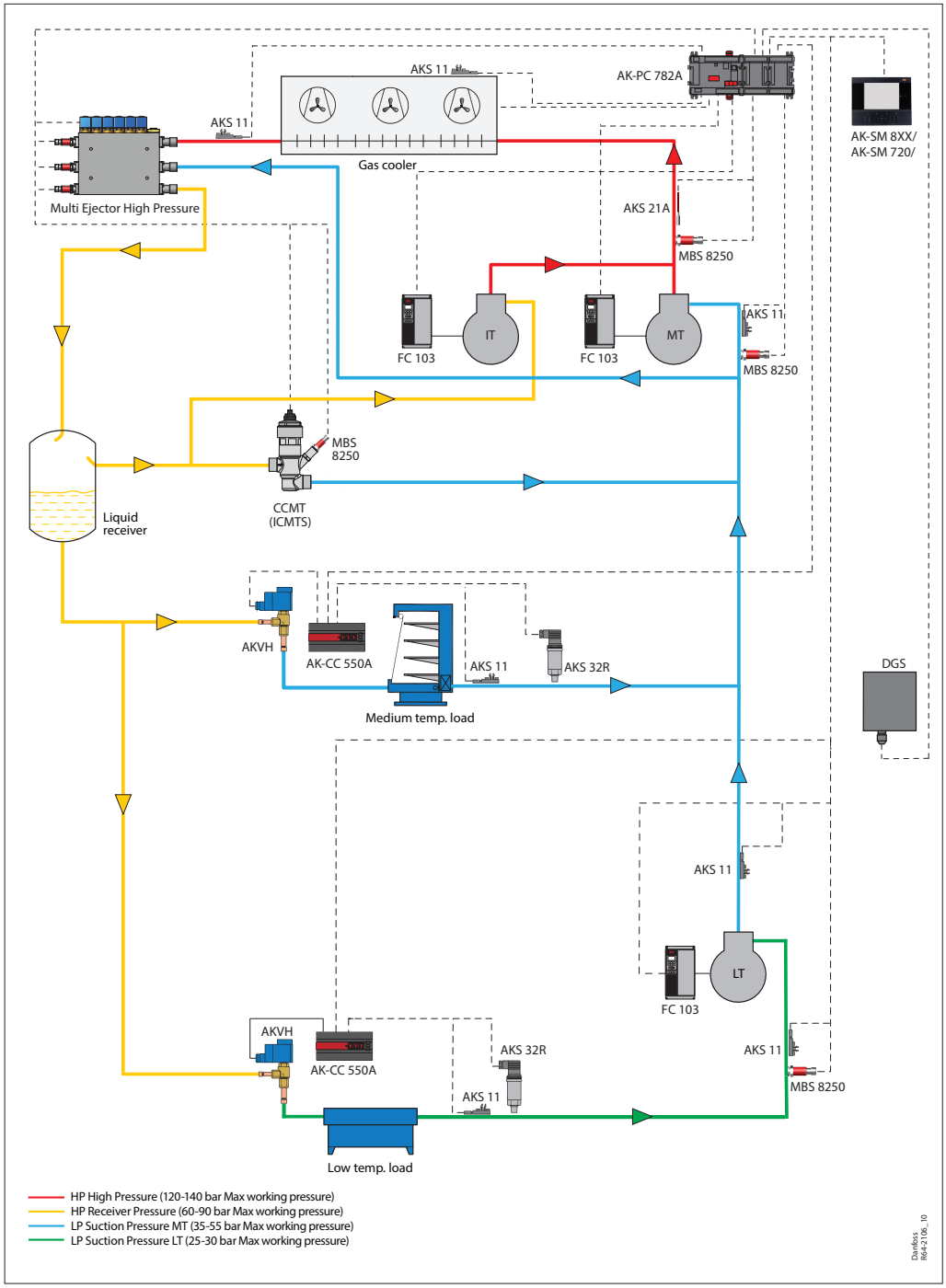


An ejector is a device that uses expansion energy to compress another fluid. In this case with the transcritical system there is up to 20% of the compressor work that can theoretically be recovered in the expansion.

In this case with the Multi Ejector system the work is coming from the CO_2 leaving the gas cooler. The high pressure CO_2 (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.

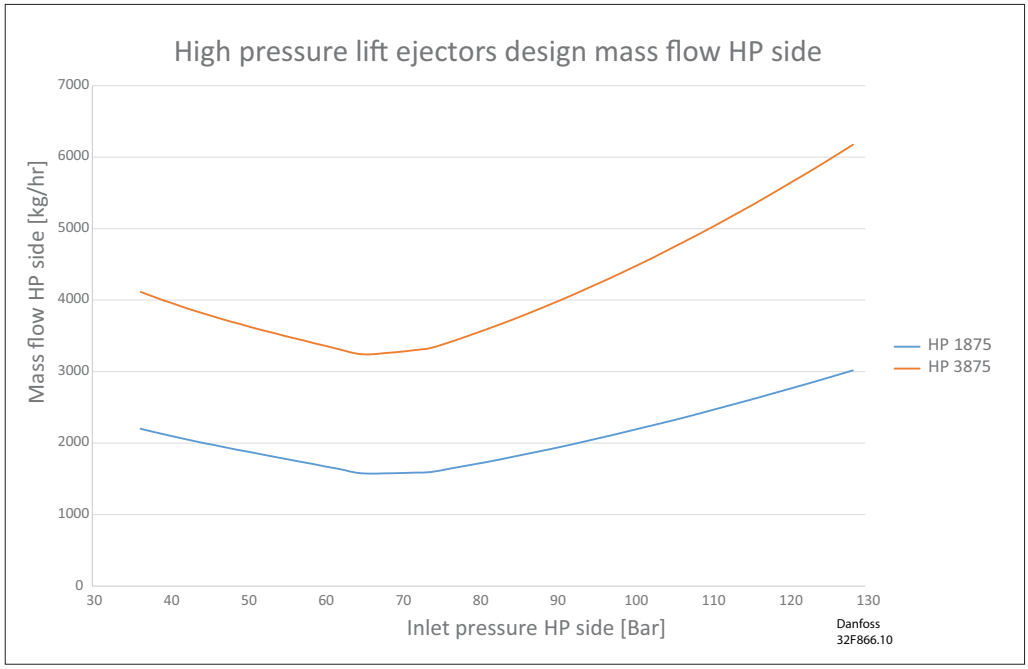
This low pressure is used to drag vapour from the MT suction (PL).
From there the two flows are mixed in the mixing chamber where the pressure will be lower than at the drive inlet due to the mixing of vapour from a higher pressure.
After the mixing the flow enters the diffuser where the flow is slowed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

Application



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.

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



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 CO_2 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:

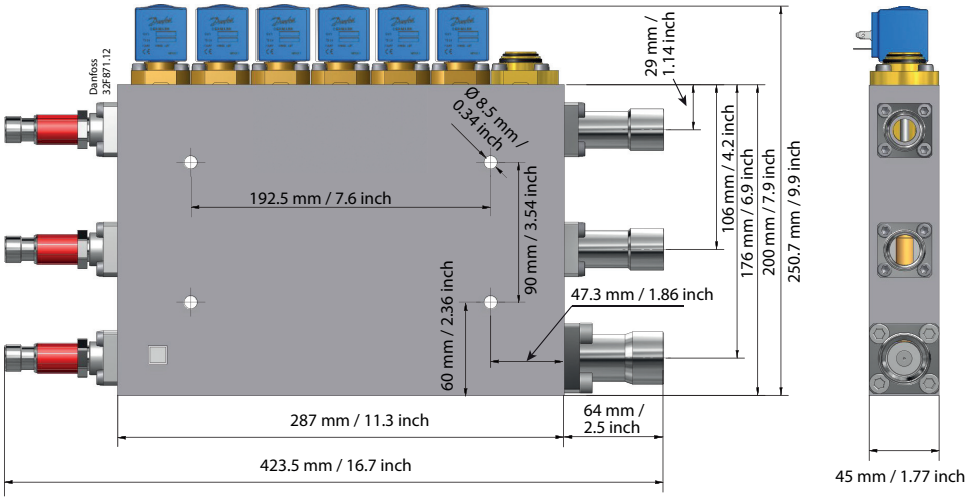
- Long term reliability minimize system downtime.
- Robust construction protects against mechanical shock and vibration.
- Temperature sensor design ensures fast response time and precise measurement.
- Hermetically sealed pressure element ensures no leakage.
- Pressure transmitter output calibrated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

Material specification

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

Dimensions and weights

CTM 6



Weight: 9.1 Kg / 20.1 lb