MIRAI COLD 10 T (MC 10 C/W/T) – DATASHEET

MIRAI Cold 10 T – AIR CYCLE REFRIGERATION MACHINE

MIRAI Cold 10 T – a refrigeration machine designed to provide and maintain ultra-low temperatures from -40 °C down to -110 °C, in cooling processes. While the refrigerant is natural air – it is flame-proof and non-toxic. MIRAI Cold T variants come with a factory equipped heat-exchanger for the secondary working fluid.

AIR CYCLE TECHNOLOGY

The technology is based on the heating capability of air during compression and cooling down during the expansion process at the turbo-expander. Repetition of compression and expansion cycles allows to reach and maintain ultra-low temperatures down to -110 °C. A key technological feature is that the turbo-expander and the compressor are located on the same shaft. The energy produced during the expansion process is transferred through the shaft to the compressor, which allows us to reduce energy consumption up to 30 % in comparison to standard vapor compression systems. MIRAI Cold refrigeration machines use air bearings, which eliminates the need for oil management systems, and ensures a safe and worry less experience to our clients.

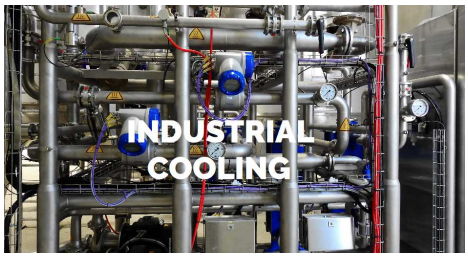
ADVANTAGES OF THE SYSTEM

Using MIRAI Cold will help you cut down energy costs, ensure reliability, safety and compliance with any further legislation, as well as other major benefits. The system has stable loads on the cooling water and the electrical grid, even when you put it in the most demanding conditions

- **AIR AS REFRIGERANT**
- **NO VIBRATION OR NOISE**
- **SAFE SOLUTION**
- **TEMPERATURE ACCURACY OF 0.5°C**
- **OIL FREE**
- **CONTROL SYSTEM**
- **ENERGY EFFICIENCY**
- **REDUCED OPERATING COSTS**
- **LEGISLATION COMPLIANCE**

APPLICATIONS

MIRAI Cold refrigeration machines are the most environmentally friendly, energy efficient and safest solutions for a range of industries where ultra-low temperatures are required. MIRAI Cold 10 T is designed for cooling of processes in numerous industries, especially in the freeze-drying/lyophilization application.



MIRAI COLD REFRIGERATION MACHINES ARE CERTIFIED

CE certification by respected European certification organisation. The CE certification covers:

- **Pressure equipment directive** (PED) 2017/68/EU, Module A2 Certificate
- **Electromagnetic compatibility directive** (EMC) Directive 2014/30/EU Certificate
- **Low voltage directive** (LVD) 2014/35/EU Certificate
- **Machinery directive** (MD) 2006/42/EC

PROFESSIONAL EVALUATION

Performance of MIRAI Cold machines was tested by **Prof. Dr. Ing. Michael Kauffeld** (Karlsruhe University of Applied Sciences). The final report confirms the quality of MIRAI Cold refrigeration machines:

- High isoentropic efficiency of turbo module around 0,75
- Service cost is approx. 10 times lower than cascade vapour systems
- Higher COP in comparison with 3- stage cascade system for ULT

The report was published in book **„Natürliche Kältemittel – Anwendungen und Praxiserfarungen“**

COMPANY MIRAI INTEX IS A MEMBER OF

Institut International du Froid
International Institute of Refrigeration

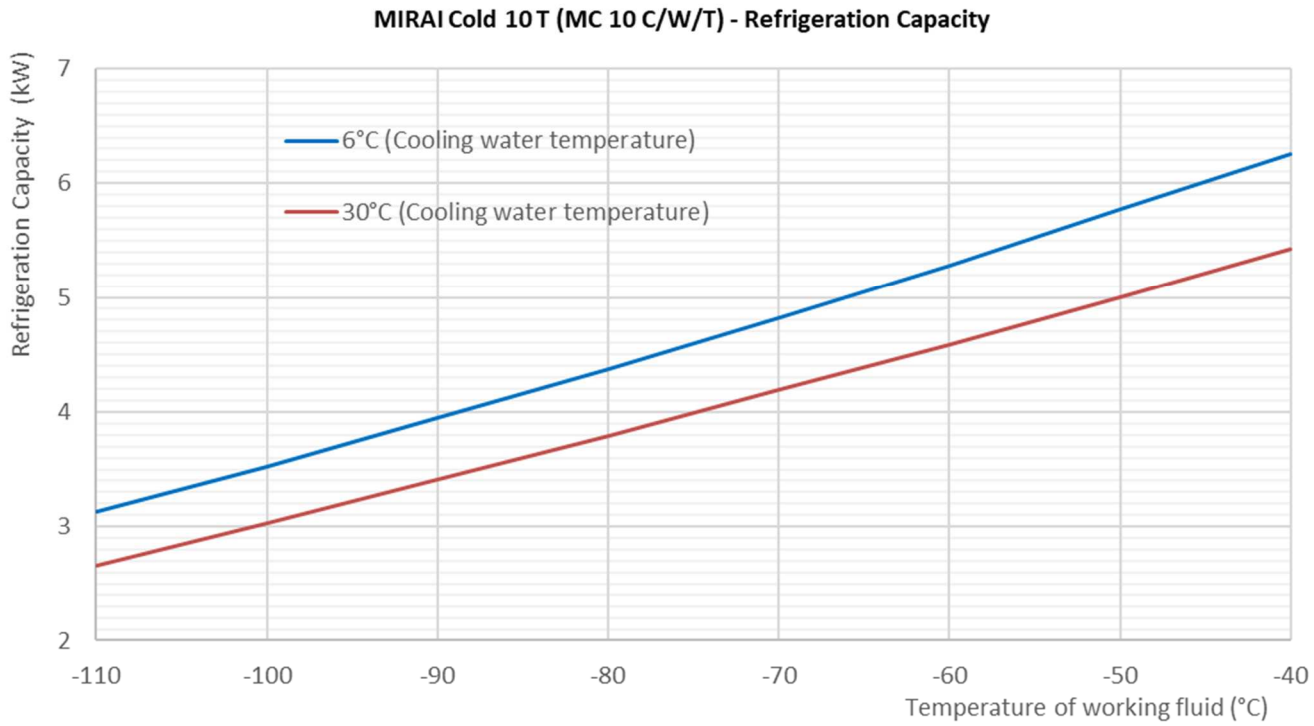
TECHNICAL SPECIFICATIONS

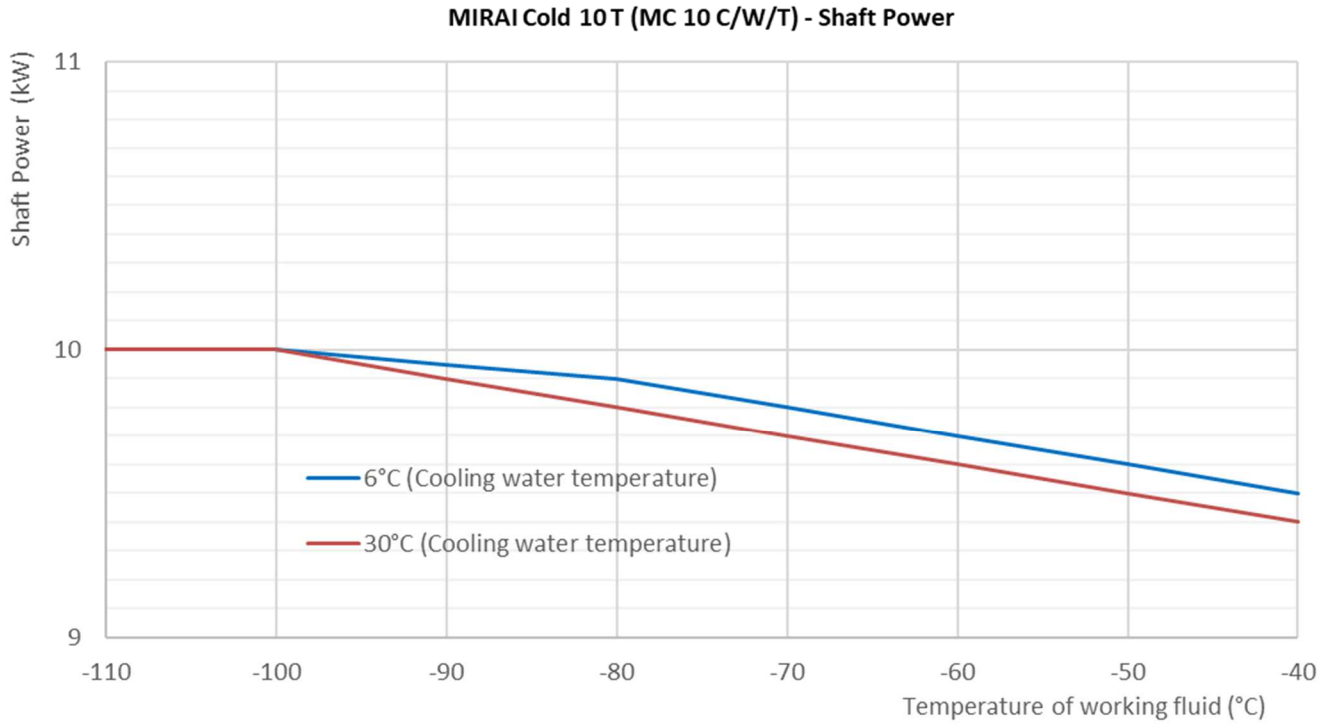
MIRAI Cold 10 T operates in a closed cycle as an indirect refrigeration system with Air as a refrigerant. The machine comes with a factory equipped heat-exchanger for the secondary cooling medium. The heat-exchanger is optimized to work with silicon oil and is compatible with various working fluids. The system is a stand-alone unit that requires minimum servicing and maintenance while providing the user with minimal operating costs.

MODEL		**MIRAI Cold 10 T (MC 10 C/W/T)**
REFRIGERANT		Natural Air
COMPRESSOR		MIRAI TURBOCOMPRESSOR (water-cooled)
MAXIMUM ROTATION SPEED		82 000 rpm
COOLING WATER		2.0 m3/h
CONNECTION SIZE - Cooling Water	in	DN15
	out	DN15
CONNECTION SIZE - Secondary heat-exchanger	in	DN40
	out	DN40
TEMPERATURE RANGE		from -40°C to -110°C
REFRIGERATION CAPACITY (at 6°C / 30 °C of cooling water)	-40°C	6.3 kW / 5.4 kW
	-60°C	5.3 kW / 4.6 kW
	-80°C	4.4 kW / 3.8 kW
	-110°C	3.1 kW / 2.7 kW
RATED MOTOR POWER		10 kW
MAXIMUM OPERATING PRESSURE		3 bar
POWER SUPPLY		400 V, 50 Hz
NOMINAL CURRENT		23 A
NOISE LEVEL		70 dB (60 dB optional)
OPERATION PANEL		7" colour touch screen display, Data record, temperature control
CONTROL SYSTEM		Optional - ProfiNET, EtherCAT, EtherNET/IP, Powerlink
REFRIGERATION ACCESSORY		System pressurization unit, Remote monitoring system
SAFETY PROTECTION		High pressure protection; water supply cut-off protection; over-current protection; sequential and phase failure protection; High temperature protection; Sensor Failure protection
PIPING MATERIAL		Stainless steel
CASE MATERIAL		Composite
DIMENSIONS (LxWxH)		94x140x180 cm
WEIGHT		740 kg
TECHNICAL REQUIREMENTS FOR INSTALLATION		Connection to Air compressor, pressure 2-4 bar, cat. 2
		Connection with a cooling water circuit, pressure 2 bar, 2.0 m3/h

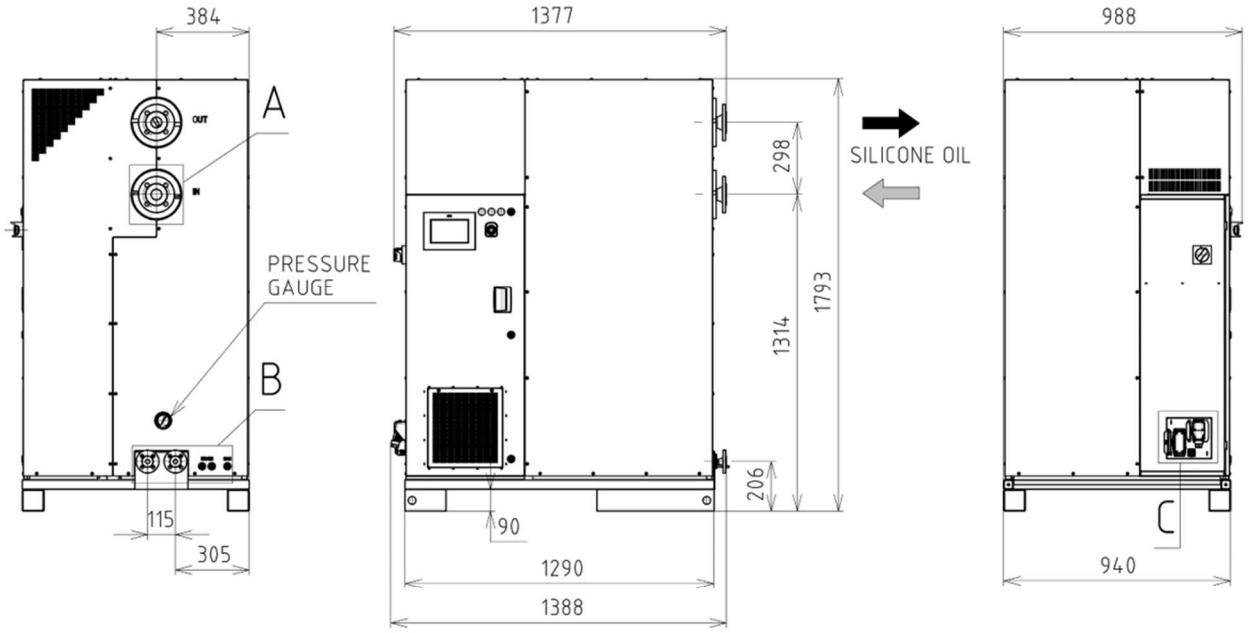
TECHNICAL PARAMETERS

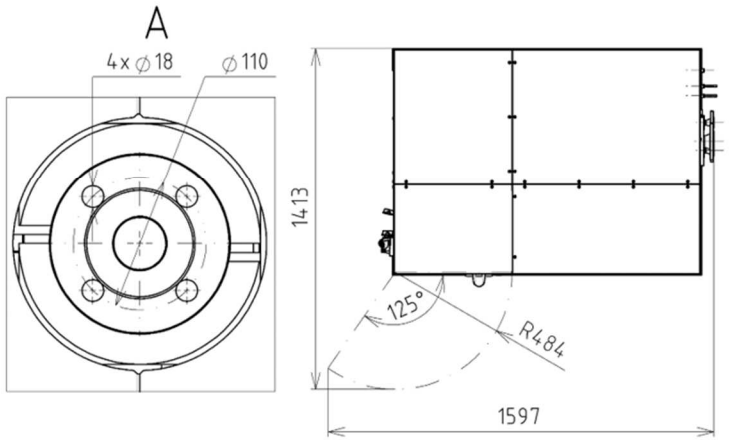
Refrigeration machine MIRAI Cold 10T is designed for various applications in process cooling, as well as freeze drying. During operation it has a stable load on the electrical grid (no peaks during starting and continuous running). It provides stable heat load on (cooling) water (no peaks). The machine can achieve the operation mode in the freeze-drying process for temperature -90°C very quickly.

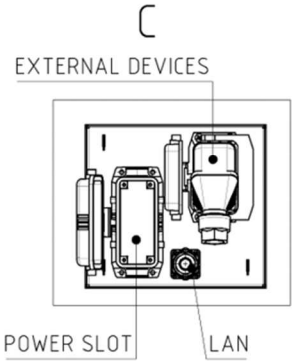


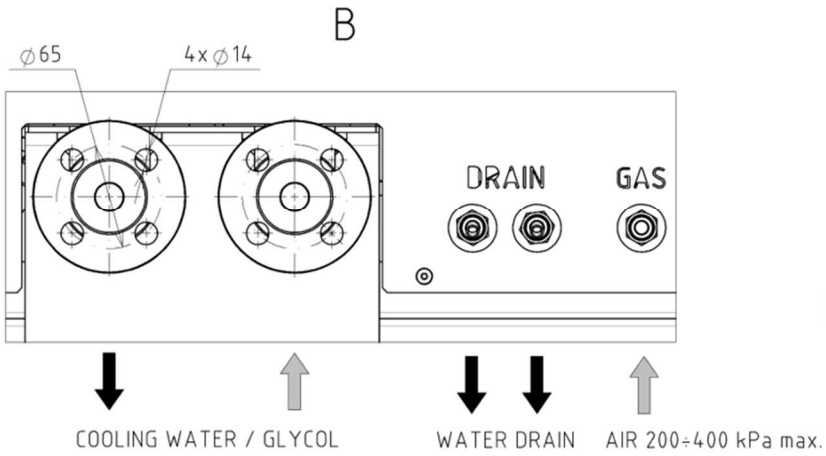


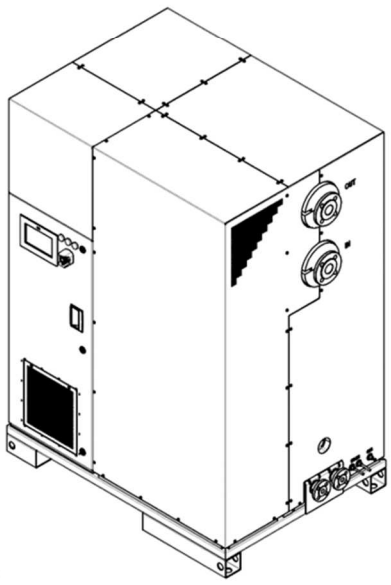
DIMENSIONS


384
1377
988
A
OUT
IN
PRESSURE GAUGE
B
SILICONE OIL
298
1793
1314
206
90
115
305
1290
1388
C
940


A
4x ∅18
∅110
1413
125°
R484
1597


C
EXTERNAL DEVICES
POWER SLOT
LAN


B
∅65
4x ∅14
DRAIN
GAS
COOLING WATER / GLYCOL
WATER DRAIN
AIR 200÷400 kPa max.



THE MAIN ADVANTAGES OF TECHNOLOGY IN MIRAI COLD REFRIGERATION MACHINES

	Value to the customer	Reason
Turbo Compressor	• Low operating costs • Low noise emissions • Low vibration	• Compressor design allows part and full load operation • No contacting pairs • No friction inside the system
Oil-Free	• Clear, Compact machine design • Low space requirement • Simple positioning • Low operating costs • High level of operational safety and on-site safety	• No components required for oil return needed • No oil change or refill required • In the case of leakages: no flammable oil, no hazard to groundwater
Frequency converter on every machine	• Low operating costs • Stepless power regulation	• Efficient in part load • 20-100% power control • Temperature accuracy down 0.5 K
Various refrigeration cycles available	• Closed-cycle refrigeration	• Closed cycle systems use compressed air, thus eliminating the risk of reactions with cooled substances.
Durable, High-Quality Fitting and sensors	• Low maintenance & servicing costs • Minimal servicing needs	• Easy servicing and air filter change • Low susceptibility to errors or failures.
Control with PLC	• Adaptation to individual customer requirements	• Available control options by third party master control systems (Master/slave) controls adaptation
Made in Europe	• Reliable and quality production	• Produced in the Czech Republic, according to all European standards