

MX SEMI

SUSTAINABLE SOLUTION FOR YOUR
SEMICONDUCTOR PRODUCTION

» CRYOGENIC ETCHING

» DEEP REACTIVE ION ETCHING

MIRAI XS CRYO 20

(MXS CRYO 20)

PRODUCT DATASHEET

- **ZERO GWP**

With the air cycle technology
Not a subject of F-Gas Regulation

- **THE WIDEST TEMPERATURE RANGE**

From -120 °C to +90 °C*

Accuracy ± 0.5 °C under changing load

Accuracy ± 0.02 °C after reaching setpoint

- **EASY CONNECTIVITY**

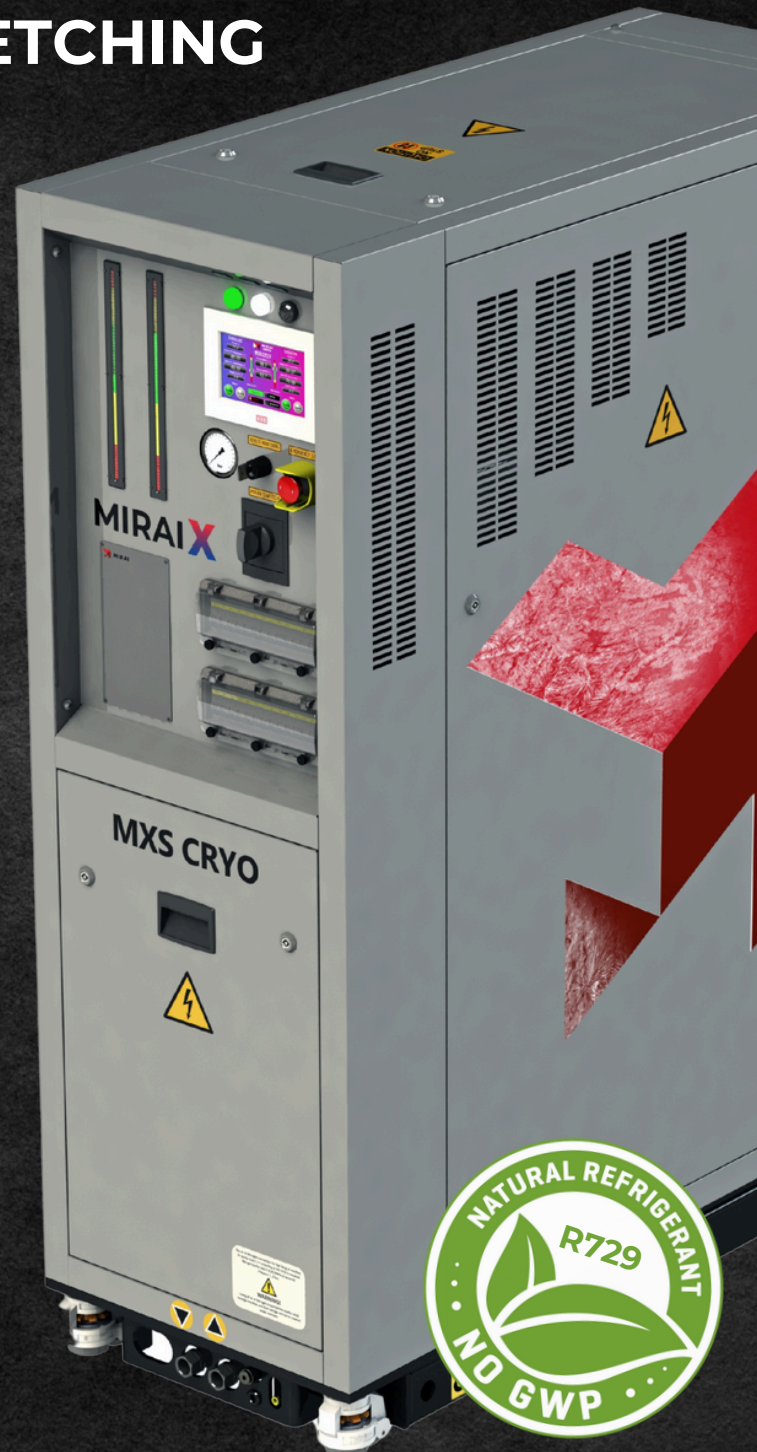
Plug & Play system, configurable connections

- **COMPACT AND NARROW DESIGN**

- **FAST RETURN OF INVESTMENT**

- **TWO SEPARATE WORKING LOOPS**

**The temperature range varies based on the type of HTF selected and will be confirmed during the ordering process.*



MIRAI

FEATURES

MIRAI XS CRYO 20 machine is ideal solution for the **semiconductor production**. It has **two separate working loops**.

In addition to safe and environmentally friendly cooling, it represents the latest solution in technology, providing highly-precise temperature and process control for dramatic changes in temperature and machine load.



AIR AS REFRIGERANT

0 GWP, 0 ODP, and 0 TFA
Environmentally friendly
Refrigerant free of charge



SUSTAINABLE SOLUTION FOR SEMICONDUCTOR PRODUCTION

Complies with all current and future international environmental standards



TWO SEPARATE WORKING LOOPS



MACHINE WHEELS

For convenient transport machine in production



ENERGY EFFICIENCY

High cycle efficiency
Inverter driven motor



NO VIBRATION

Turbo-compressor design eliminates vibration



LOW OPERATING COSTS

Long equipment lifecycle
Low maintenance



TEMPERATURE ACCURACY

± 0.5 °C under changing load
 ± 0.02 °C after reaching setpoint



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LOW OPERATING COSTS

Compared to existing semiconductor solutions, MIRAI INTEX offers an unparalleled system from both environmental and economic perspectives.

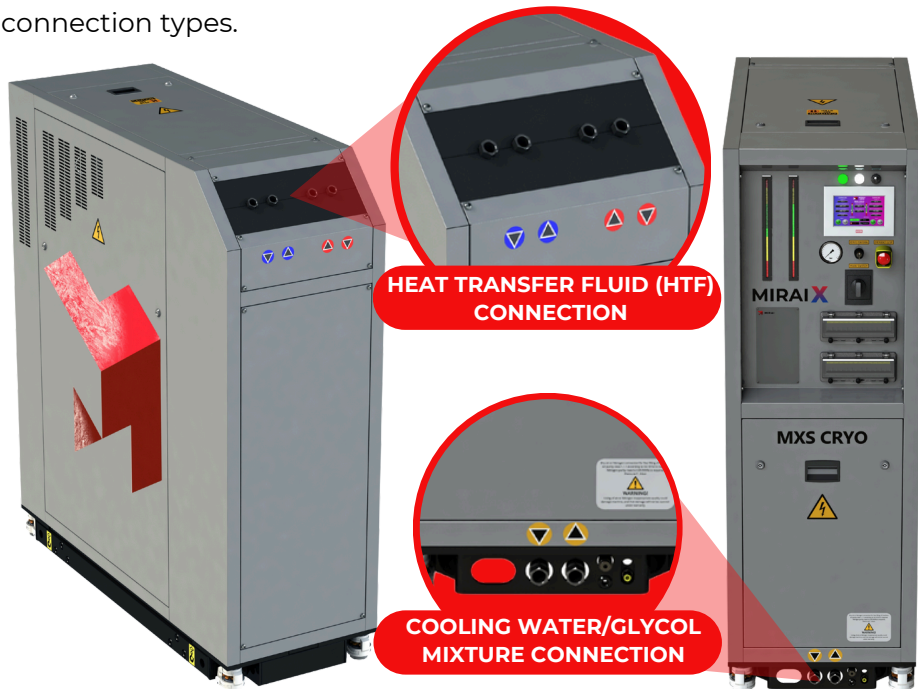
This is achieved through:

- » Free refrigerant
- » Exceptional performance at ultra-low temperatures, especially under partial load conditions
- » Zero additional costs related to safety and environmental compliance
- » Minimal service expenses

INSTALLATION

PLUG & PLAY SOLUTION

The **MIRAI XS CRYO 20** machine is the ideal solution for retrofitting in existing installation and is easy to implement in new projects due to its Plug & Play design, compatible with multiple industry standard connection types.



OPTIONS



EXTENDED WARRANTY

Up to 4 years total



REMOTE MONITORING

Available remote monitoring or remote access systems



VARIOUS HIGH-LEVEL COMMUNICATION PROTOCOLS



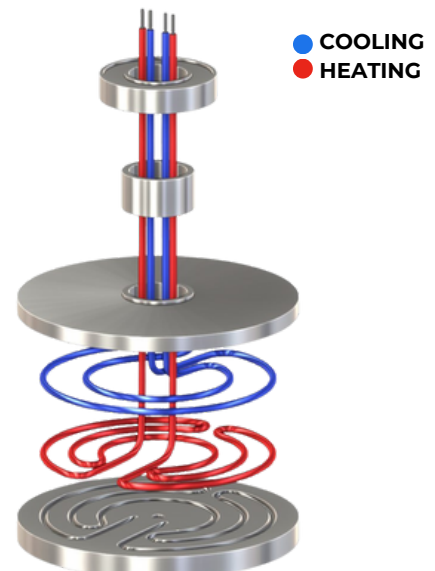
CUSTOMIZED WATER CONNECTION



MACHINE BODY OPTIONS

Special for Cleanroom application

LOOPS OPERATING EXAMPLE

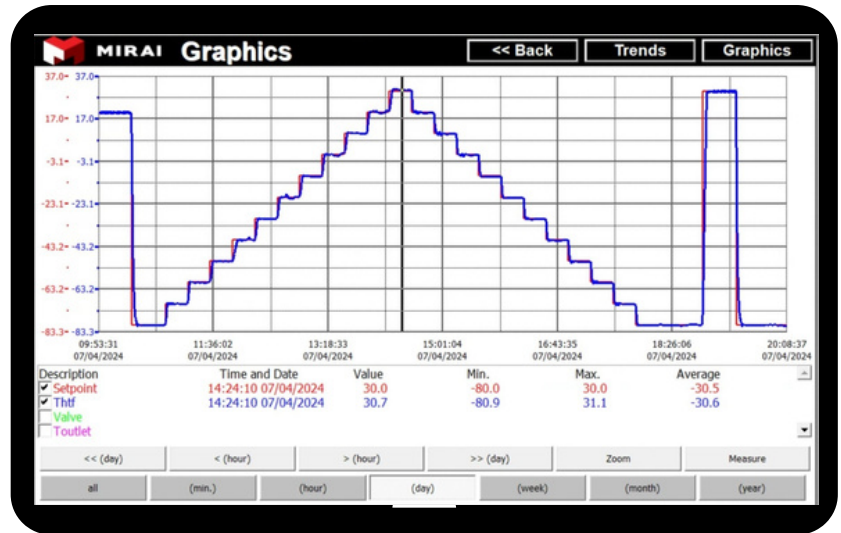


TESTS COLD LOOP

The following section focuses on the various tests of the **MIRAI XS CRYO 20** machine, which are very important and decisive for use in various applications in different markets. Temperature accuracy and machine control are very important aspects in selecting the right machine for production.

PROCESS CONTROL ACCURACY TEST

This screenshot from the machine's control system screen shows the results of a heat-up and cool-down process with high-precision temperature control, at 10 °C intervals every 20 minutes. This screenshot demonstrates that the temperature control accuracy of the **MIRAI XS CRYO 20** is very precise.

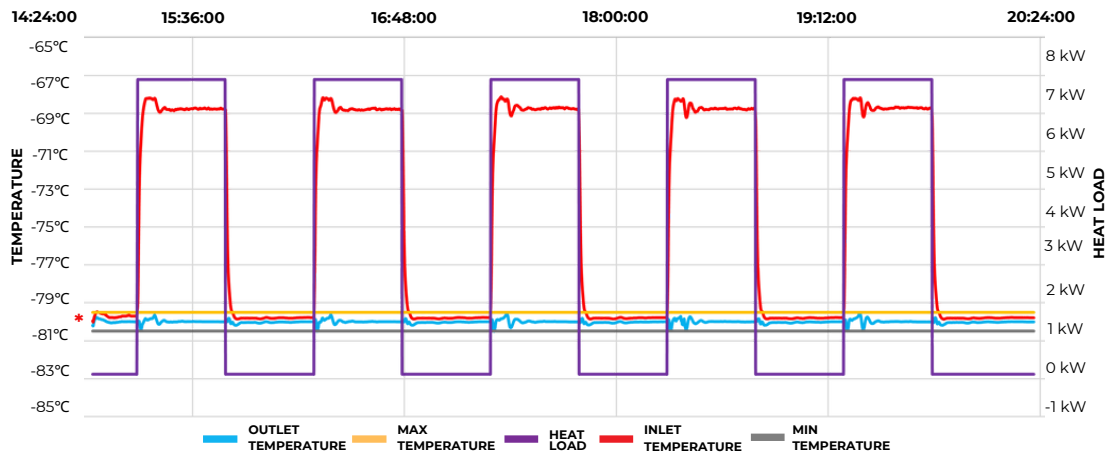


CHANGING LOAD TEST

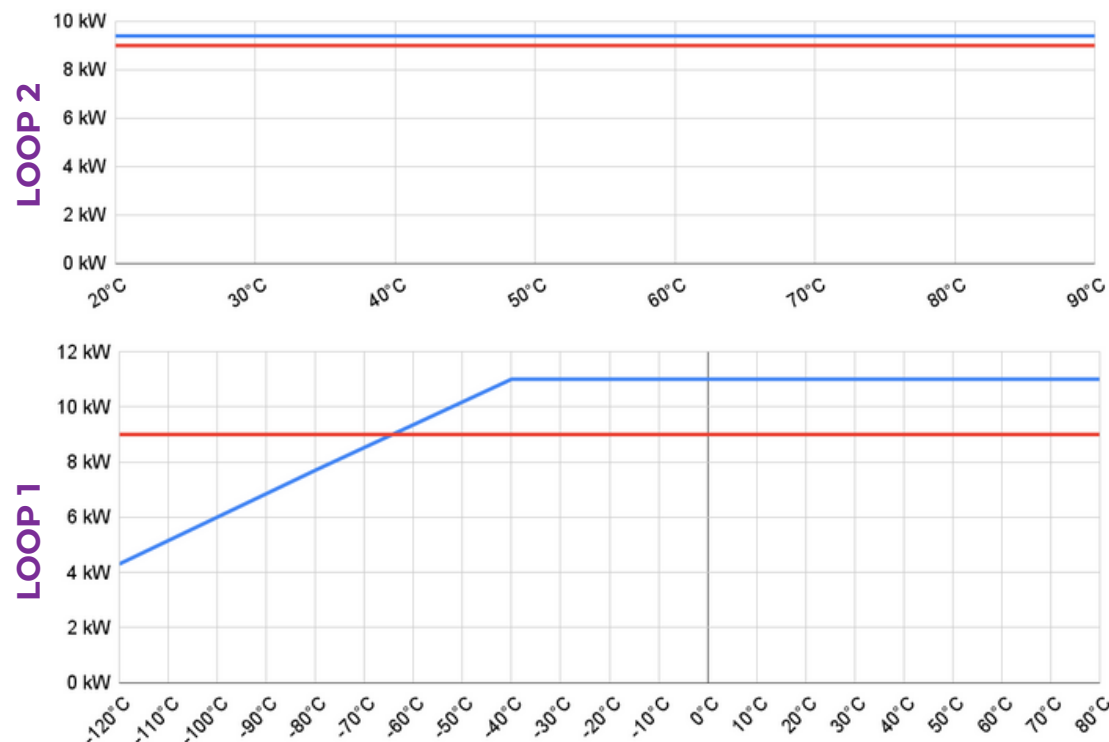
This test focuses on temperature maintenance when the heat load on the machine is changing. Specifically in this case, the test was conducted at a change from 0 kW to 7 kW. The results showed that **temperature control under changing load is ± 0.5 °C**.

Above the graph is the time interval when the test started and ended, how long the loads were measured for.

The mark [*] indicates the location where the temperature change was measured.

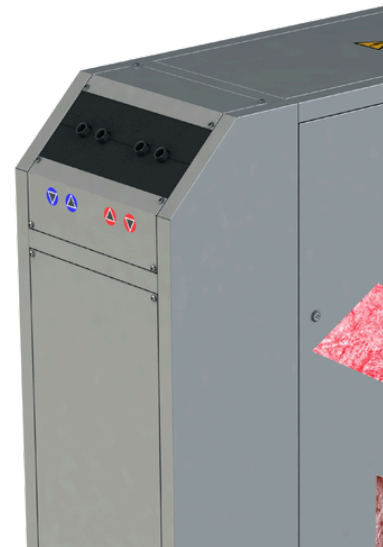


COOLING AND HEATING CAPACITY



Cooling and heating capacity of the **MIRAI XS CRYO 20** in loop 1 and loop 2 at cooling water temperature +10 °C.

● COOLING
● HEATING



SPECIFICATIONS

Performance is nominal and individual units may vary. The efficiency of each refrigeration unit will depend on the specific operating conditions.

TECHNICAL DATA

MIRAI XS CRYO 20

| Contour | LOOP 1 | LOOP 2 |
|----------------------------------------------|------------------------|-----------------------------------------|
| Cooling method | Air cycle | Customer water/glycol |
| Heating method | Electrical heater | |
| Temperature range ^{*1} | -120...+80 °C | +20...+90 °C (up to +120 °C on request) |
| Rated motor power (kW) | 20 | - |
| Compressor | Mirai Turbo-compressor | - |
| Refrigerant | Natural air (R729) | - |
| Nominal cooling capacity | 9.3 ^{*3} | 9.4 ^{*2} |
| Temperature accuracy under changing load | ±0.5 °C | |
| Temperature accuracy after reaching setpoint | ±0.02 °C | |

HTF PARAMETERS

| | | |
|-----------------------------------------------------------|-----------------------------------------------|----------|
| HTF tank volume, l | 26 | 26 |
| Inlet pressure (bar) ^{*4} | On customer request | |
| Max outlet pressure (bar) ^{*1} | 10 | 10 |
| Nominal/maximum allowed pressure drop (bar) ^{*1} | 0.2/10 | 0.2/10 |
| Min HTF flow (l/min) | Depending on customer process ^{*4*6} | |
| Nominal HTF flow (l/min) ^{*1*2*3} | 30 | 60 |
| Max HTF flow (l/min) | 60 | 60 |
| HTF connection | 3/4" NPT | 3/4" NPT |

WATER COOLING

| | |
|--------------------------------------------------------|---------------------------------|
| Water connection | (1" NPT) (Other on request) |
| Nominal pressure drop, bar | 1 |
| Max allowed pressure on water inlet, bar | 10 |
| Cooling water temperature range on inlet ^{*5} | +6...+30 °C (other on request) |
| Mass flow min (kg/h) | 4000 |
| Mass flow nominal (kg/h) ^{*2*3} | 5000 |
| Mass flow max (kg/h) | 6000 |
| Water quality | See specification ^{*7} |

GENERAL TECHNICAL SPECIFICATION

| | |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Safety protection | High pressure protection, water supply cut-off protection, over-current protection, high temperature protection, sensor failure protection, heater protection |
| Sound pressure, at a distance of 1m from <u>CM</u> (dB) | ~70 |
| Control system | KEB system compatible with digital communication protocols ProfiNET, EtherCAT, EtherNET/IP, and Powerlink. Another protocols by request |

POWER REQUIREMENTS

| | | |
|-------------------------------------|------------------------------------------------|-----|
| Power supply | ~3 PE+N/3PE, 400VAC / 440VAC / 480VAC, 50/60Hz | |
| Total consumption (kW) | 45 | |
| Max air cycle core consumption (kW) | 22 | |
| Heater power, (kW) | 9 | 9 |
| Pump power (kW) | 2.2 | 2.2 |
| Main circuit breaker | 80A@400VAC, 80A@440VAC, 70A@480VAC | |

DIMENSIONS

| | |
|--------------------|------------------|
| Dimensions (WxDxH) | 600x1600x1787 mm |
| Weight (kg) | 950 |

OTHER REQUIREMENTS

| | |
|--------------------------------|--------------------------------------------------------------|
| Air/nitrogen requirements | 6-10bar, -80 °C pdp, 20lpm ^{*8} |
| Installation room requirements | +5...+35 °C, RH 10-80% no condensation, altitude up to 1000m |

^{*1} - depending on the HTF used.

^{*2} - HTF - 3M™ Fluorinert™ Electronic Liquid FC-3283, water temperature +10 °C, water/glycol composition – pure water, HTF temperature setpoint +20 °C, HTF volume flow 60 l/min, water mass flow 1000kg/h, capacity will be decreased if temperature difference HTF setpoint – water/glycol inlet decreased.

^{*3} - HTF - 3M™ Fluorinert™ Electronic Liquid FC-3283, HTF setpoint -60 °C, HTF volume flow 30 l/min, water temperature +10 °C, water/glycol composition – pure water, direct connection heat load to machine, pressure drop on heat load <20kPa.

^{*4} - If customer equipment located above machine inlet/outlet - flow throttling on machine inlet is required to provide positive pressure on customer side. In case of throttling without regulation – minimum HTF flow calculated according to required pressure drop.

^{*5} - depending on the HTF setpoint and required cooling capacity on loop 2.

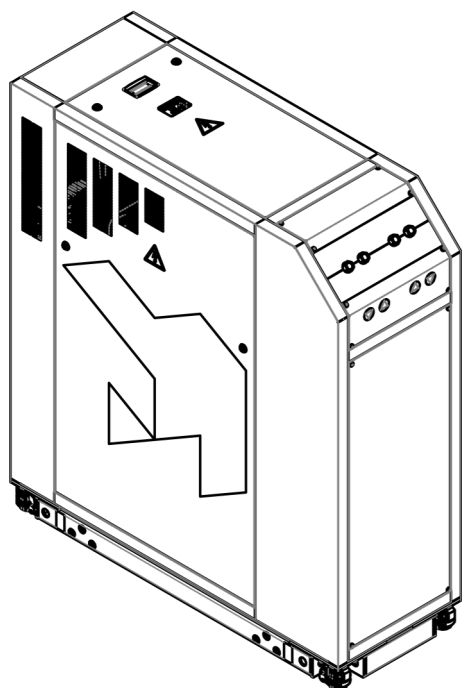
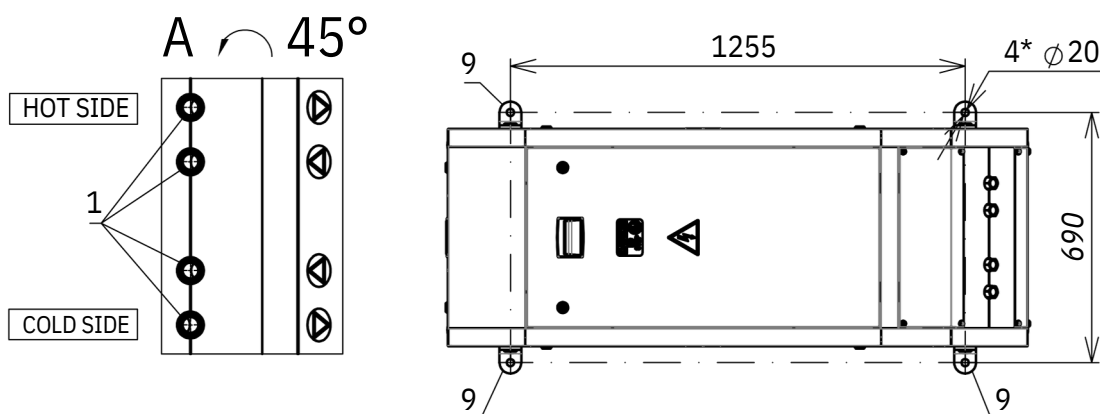
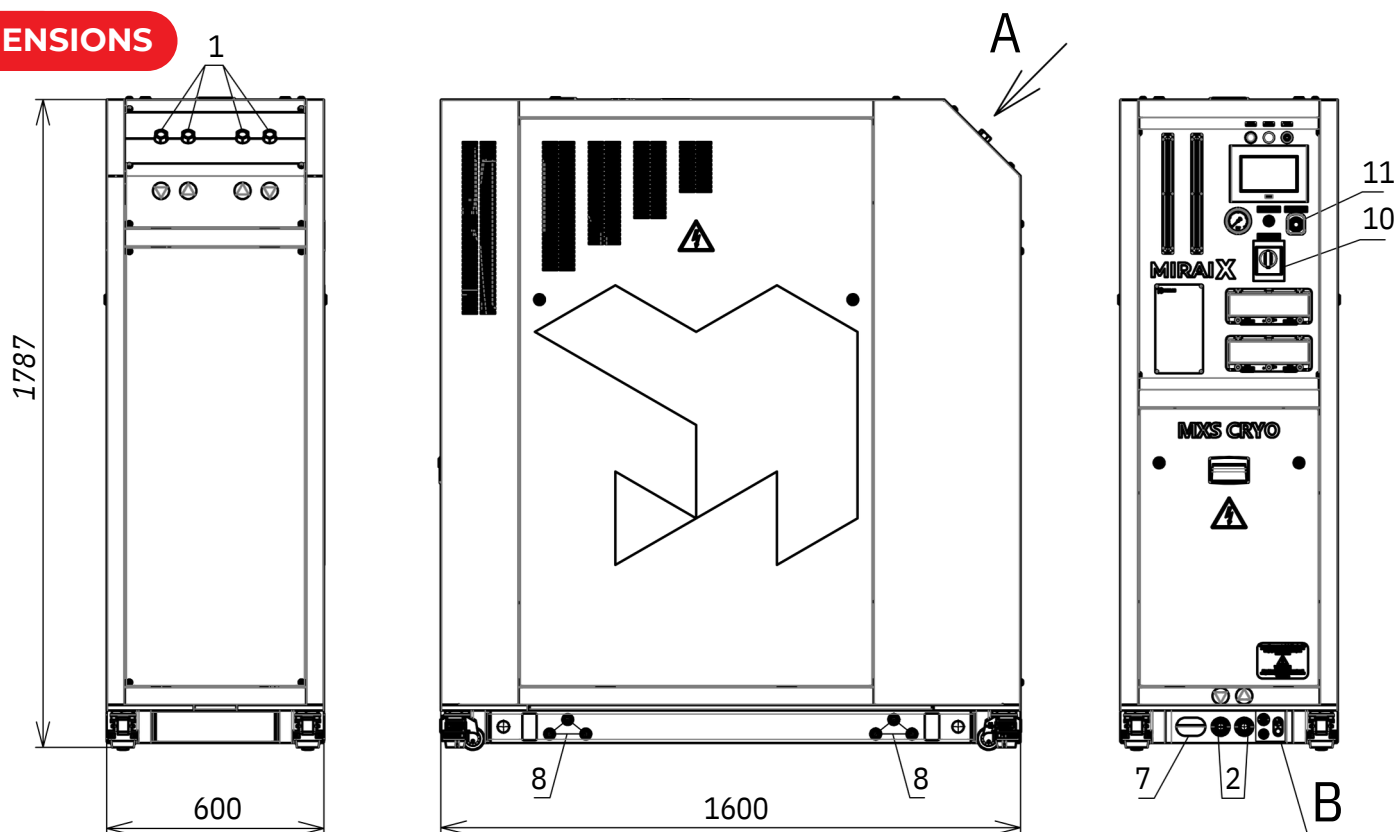
^{*6} - actual minimum value dependent on allowed temperature difference and cooling/heating capacity.

^{*7} - The water should contain a corrosion inhibitor that protects aluminum alloys and copper in the concentration recommended by the manufacturer (for detailed information contact MIRAI INTEX.)

^{*8} - For more information contact MIRAI INTEX.

CM - Cooling machine

DIMENSIONS



1. Heat transfer fluid (HTF), connection: 4x(3/4-14 NPT)
2. Cooling water/glycol mixture, connection: 2x(1-11.5 NPT)
3. Air/Nitrogen, Quick disconnect coupling DN 7.2 (Euro standard)
4. Reserve slot
5. Condensate drain, connection for plastic tube 8/6 mm
6. Grounding point (PE) - M12
7. Cables entry point
8. Sliding place
9. Fixing place to floor (optionally with brackets, possibility of fixation from any side)
10. Main switch
11. Emergency stop button

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