

CNIM INDUSTRIAL SYSTEMS

ABSORPTION MACHINES





MAIN FEATURES



CUSTOMISATION

Machines designed according to customer's specific requirements

FUNCTIONING

- Simple or double effect
- Simple or Double Lift
- Specific cycles

MANUFACTURING

High quality materials and components

CONTROL SYSTEM

Safety system, anti
 crystallization, anti freeze
 systems
 Automatic vacuum system

OPERATIONS AND

MAINTENANCE Ergonomic and durable design

CODES AND STANDARDS

 Compliance with European standards and specific national requirements
 Certification by recognized third-party notifiers
 Extractible generator for periodic inspection



TAILORE-MADE MACHINES

CUSTOMIZED SOLUTION

- / Each project is specific
- / CNIM proposes customized machines at competitive prices thanks to standard technological modules
- / Each machine design is calculated and optimized according to the customer's case & data

THERMAL DESIGN

- / We take into account the temperatures and flow rates required in order to optimize the exchange surfaces.
- / We select the type of process that is adapted to the project:
 - simple or double effect
 - simple or double lift
 - other specific absorption cycle

FOOTPRINT

- / The machines are adapted to the available space and access for installation
- / The heat exchangers have a rectangular shape to limit their footprint
- / The two modules Evaporator/Absorber and Generator/Condenser can be delivered separately or positioned side by side (option)
- The piping can be positioned on the side or in front of the machines to allow free space under the exchangers (option)

SPECIFIC REQUIREMENTS

/ The machines can be adapted to specific environments : marine, petrochemical industry, nuclear industry...

Customisation

Fluid type

Available

space

Thermal

data



Cold capacity From 1 to 10 MW per unit





FUNCTIONING

SIMPLE EFFECT MACHINE





FUNCTIONING

DOUBLE EFFECT MACHINE



HNI



MANUFACTURING

HIGH RESISTANCE MATERIAL

- / Tubes are either in **Duplex stainless steel** (\$32205 – 1.4462) or in **Titanium** (option)
- / The Duplex stainless steel allows a much higher resistance to corrosion and abrasion than other stainless steels
- Tubes are manufactured by the French Company NEOTISS, using a level of quality control exceeding industry standards

HIGH QUALITY MANUFACTURING

- Manufacturing in CNIM workshop using CNIM quality system
- / CNIM is qualified by the most demanding industries (nuclear, thermal systems...)
- / Certification ISO 9001
- / Compliant with PED

EQUIPMENT TEST

- / Pressure test
- / Helium vacuum test
- / Functional tests









Page 6 | ABSORPTION MACHINES





1.01×10-8 Pz=2.5×11-2



COMPONENTS

PUMPS

- / The pumps are used to circulate the solution of absorbent (Lithium bromide) and refrigerant (water)
- CNIM uses the canned motor pump from Japanese supplier TEIKOKU
- / This guarantees a perfect leak tightness
- / The pumps can be actuated by a variable frequency drive in order to allow a longer lifetime and lower electrical consumption during partial load functioning.

PLATE HEAT EXCHANGERS

- / Plate heat exchangers are used for secondary heat exchangers
- / CNIM uses brazed plates heat exchangers, manufactured by leading European suppliers like SWEP
- / This type of heat exchangers has proven to be very reliable and resistant for absorption machines

VALVES

- Fully welded VEXVE valves are used in refrigerant and absorbent piping.
- This technology allows a perfectly durable leak tightness.
- All components are isolated by valves that allow maintenance operations without fully draining the machine.

INSTRUMENTATION

- / The machines are fully instrumented in order to monitor permanently all the important parameters for the functioning and protection of the machine.
- / European suppliers are selected (ENDRESS+HAUSER, WIKA, JUMO...)











FUNCTIONING

FUNCTIONING PRINCIPLE

The machines are controlled by regulating the hot source.

A control valves is installed in the hot source and allows to control the capacity of the machine, depending on the regulation values selected.



REGULATION MODES

The heat source is automatically controlled taking into account the following values that are set by the user :

- 1. Outlet temperature of the cooling circuit
- 2. Outlet temperature of chilled water
- 3. Maximum concentration of Lithium bromide



FUNCTIONING RANGE

The machines capacity can be lowered down to 25% without reduction the Coefficient of Performance..

Variations curves of the capacity depending on the inlet temperature of the chilled water or the cooling water can be provided.



PLC

The machines are provided with a SIEMENS PLC. Another PLC (Schneider, Allen Bradley...) can be used as an option.

The integration of the machine in a DCS is possible via a Profinet connection (other standard possible in option).

CONTROL SYSTEM

SAFETY SYSTEMS

ANTI CRYSTALLIZATION

- The Lithium Bromide concentration is permanently monitored through the temperature sensors
- / There is a three level control:
- 1. The PID controller reduces the heat input if the LiBr concentration exceeds the low threshold.
- 2. If the concentration exceeds the middle threshold, the dilution valve is opened, in order to transfer water from evaporator to absorber
- 3. If the high threshold is reached, the machine is in emergency stop



ANTI FREEZE SYSTEM

- / Monitoring of the chilled water temperature
- / Two level action
- Lower threshold : opening of dilution valve
- 2. High threshold : alarm and emergency stop



AUTOMATIC VACUUM SYSTEM

- / The vacuum is maintained by an automatic purging system
- / The non condensable gases are transferred from the absorber to the generator with an ejector (1). They are then caught in a cold trap (2), which is purged automatically (3)
- / The machines can function without vacuum pumps, except during maintenance operations.



OPERATIONS AND MAINTENANCE

ERGONOMICS - DURABILITY

USER INTERFACE

A control panel is provided on the electrical cabinet.

Different views are possible:

- Normal view: Complete PID and main parameters monitored. Possibility to change the settings
- 2. Monitoring view : view of all parameters monitored and calculated
- 3. Maintenance view : possibility to operate all actuators.

ERGONOMICS

The machines are designed for improved ergonomics:

- Easy access under the machine to the equipment : at least 1,5m under the machines
- / Isolation valves for each components
- / Non toxic fluids (LiBr, Li₂MoO₄)



- Internal piping and spraying system are in stainless steel 316L (distinctive feature)
- / Two type of filters for the solution circuit
- / Non toxic corrosion inhibitor (Lithium Molybdate)

PROTECTION AGAINST CLOGGING

- / Waterboxes can be equipped with a marine type opening (option). This allows to access easily to the heat exchangers and clean them if necessary.
- In case charged waters are used (seawater, river water), an automatic cleaning system can be proposed.









CODES AND STANDARDS

COMPLIANCE WITH CODES AND STANDARDS

PRESSURE EQUIPMENT DIRECTIVE

- / Each pressure vessel is classified according to the PED.
- $\scriptstyle /$ For heat exchangers in category IV, the notified body has a complete follow up of the design and manufacturing
- / The notified body delivers the CE certificate

PERIODIC INSPECTION OF GENERATOR

- / Some local regulations (France) require that any vapor generator shall be submitted to periodic inspection.
- CNIM design uses extractable tube bundle for the generators that are thus extractible for inspection.



ADDITIONAL REQUIREMENTS

- / Manufacturing according to ASME
- / ATEX
- / Lloyd's Register certificate for marine machine



Lloyd's Register



CNIM ABSORPTION MACHINES

SUMMARY OF TECHNICAL CHARACTERISTICS

	Standard	Option
Thermal design	Optimisation of exchange surfaces	Double effect Double lift
Mechanical design	Rectangular heat exchanger shell	Evaporator/Absorber and Generator/Condenser modules are split
Spraying system	Spraying plates	Spraying nozzles
Internal piping	Installed under the machine	Piping installed in a remote location
Tube material	Duplex stainless steel	Titanium grade 2
Shell and waterbox material	Steel SA516 grade 2	Duplex stainless steel
Internal piping material	Stainless steel 316L	
Cleaning of heat exchangers	Access to tubesheets for cleaning	Marine type waterboxesAutomatic cleaning system
Control System	 Control cabinet with Siemens PLC Profinet connection with DCS 	 Alternative PLC (Schneider, Allen Bradley) Alternative connection standard
Codes and standards	 CE certificate (PED) Follow up with notified body Manufacturing according to EN13445 standard Extractible generator for periodic inspection 	 Design and manufacturing according to ASME ATEX Lloyd's register certificate (marine)