NCS series industrial water chiller user guide

about us

Experience.

Our team is comprised of and supported by individuals spanning all disciplines from research & development, engineering & manufacturing, marketing & sales and service & support. Our backgrounds are in air and gas purification and our experience in this field spans a wide range of industries. We combine this knowledge and experience to ensure our products and services are designed and provided to meet the objectives and expectations of you - our Customer.

Customer.

We recognize that our Customers are not only our valuable distribution partners who sell and support our products or the machine builders who depend on them as protection for their equipment. They are the contractors who install them, the manufacturers who use them in their processes and the service people who maintain them. At nano we have developed our products, packaging and support materials to ensure they exceed all of our Customers' expectations.

Service.

At nano we recognize that world-class customer service is the most important component to any successful business. Your business needs to exceed your customers' expectations to stand out from your competitors and our service must positively impact your business so you can be successful in doing so. Our commitment is simple… we will stand behind our products and ensure that our customer service is unrivaled in the industry.

Experience. Customer. Service.

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1.1 general information

range: C¹ industrial water chillers
models: NCS 0002 - 1502
doc no: 17-110-8007
issue: 002

1.2 manufacturers details and support

nano-purification solutions llc
address: 5509 david cox road
charlotte, nc 28269
usa
telephone: 704.897.2182
fax: 704.897.2183
internet: www.n-psi.com
e-mail: support@n-psi.com

nano-purification solutions ltd
address: dukesway
team valley trading estate
gateshead
ne11 opz
united kingdom
telephone: +44 (0) 191 497 7700
internet: www.n-psi.co.uk
e-mail: enquiries@n-psi.co.uk

nano-purification solutions
address: unit 8b
188 bunting road, unit 8B
st catharines, ontario
l2m 3y1
canada
telephone: 704.897.2182
internet: www.n-psi.com
e-mail: support@n-psi.com

MEMBER OF CAGI Compressed Air & Gas Institute

LLOYD'S REGISTER · LRQA ISO 9001 001 UKAS MANAGEMENT SYSTEMS

annotations

CAUTIONS: indicate any situation or operation that may result in potential damage to the product, injury to the user, or render the product unsafe.

NOTES: highlight important sections of information where particular care and attention should be paid.

1.3 document introduction

This manual is meant for anyone who uses or works on the industrial water chiller, mainly the operators. The industrial water chiller and this manual are protected by copyright. Any reproduction of the same shall be liable for prosecution. All rights reserved by **nano-purification solutions**, particularly the rights of reproduction and distribution, as well as translation, including those relating to charges of copyright infringement. Any reproduction, processing, duplication, distribution of this document using electronic or mechanical means without the prior written authorization of **nano-purification solutions** is strictly prohibited. This document may have errors and is likely to be modified with respect to technical features.

1.4 warranty guidelines

All products are supplied with a 18 month manufacturer's warranty from the date of shipment from the factory or 12 months from date of installation/start up, whichever occurs first and installed and maintained in accordance with the manufacturers guidelines.

1.5 general warnings

Read the contents of this manual carefully before starting the units.

This service and maintenance manual describes the design, operation and the instructions for use and maintenance of the units manufactured by **nano-purification solutions**.

nano-purification solutions shall not be liable for any damage caused due to non-compliance with the instructions of this manual.

For any doubts or clarifications that may be required, our qualified **nano-purification solutions** technicians are available to provide all the necessary information.

In order to make it easier to identify the units, it is important to always specify the technical features, especially the serial number, which are printed on the label on the outside of the units.

The unit should not be operated, even for a short period of time, under conditions other than ideal conditions.

A part that does not guarantee safety should not be installed.

WARNING: This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and/or birth defects or other reproductive harm. For more information, go to www.P65Warnings.

1.6 basic safety rules

The installer must provide an emergency stop button on the unit. They should ensure that this is done before the unit is started.

The unit is equipped with protective covers for the components. If the unit is installed outdoors, it is important to arrange for a canopy to protect it from the snow, which could constitute a risk while using the unit if the fan blades freeze.

Replace all the supply lines of different power sources which are damaged or missing.

The refrigerant fluid used is R410A. It is not harmful if inhaled. It only becomes dangerous if it saturates the environment. Refer to the specifications on the safety data sheet at the end of the manual.

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The compressor lubricant is not hazardous. However, it is always compulsory to wear safety gloves while working with it. Do not swallow the lubricant.

For any operations relating to the installation, commissioning, fitting, use, modifications of the conditions of use and methods, routine maintenance, inspection and scheduled maintenance, follow the procedures given in the corresponding chapters of this manual. Keep this manual at hand for quick reference.

The unit must be used under the conditions specified in this service and maintenance manual.

There are some recommendations given below for the **USER** that should help to avoid abnormal operating conditions. Avoid any operating conditions other than those expressly described in this manual.

- Do not climb on the unit;
- Operate the unit after it is properly installed in the recommended position;
- Operate the unit after it is properly installed in the recommended position;
- Do not start the unit without protective panels properly in place;
- Do not remove the protective panels while the unit is functioning;
- Do not remove the protective panels when the unit is switched on;
- Do not clean the unit when it is in operation;
- Do not install the unit in corrosive or explosive places;
- Do not disconnect or remove the safety devices and parts;
- It is prohibited to operate the unit under conditions other than those specified in this manual.

nano-purification solutions shall not be held responsible for any possible damage caused, directly or indirectly, by persons or elements that are not non-compliant with these instructions.

Any assembling/removal carried out by THE USER, which is not provided for in this manual or not authorized by “nano-purification solutions”, will be considered as an inappropriate operation, thereby damaging safety functions, and will lead to the cancellation of the warranty.

1.7 qualified operators

Only the professionals stated below are authorized to operate the unit after having received all the necessary instructions from this manual:

Specialized maintenance electrician
The electrician should have a general knowledge about electrical appliances as well as specific experience working with control boxes and the electrical components of cooling units or similar equipment from the domain of air-conditioning.
The electrician is authorized to carry out only the specific operations stated in this manual by meticulously following the associated instructions.

Maintenance technician
The maintenance technician should have a general experience working with mechanical elements and a specific experience with cooling units or similar equipment from the domain of air-conditioning.
The maintenance technician is authorized to carry out only the specific operations stated in this manual by meticulously following the associated instructions.

Refrigeration technician
The refrigeration technician should be a refrigeration certified from a technical institution for similar equipment or interventions under the authority of competent personnel.
The refrigeration technician is authorized to carry out only the specific operations stated in this manual by meticulously following the associated instructions.

Transport operator
The transport operator can carry out only the specific operations stated in this manual by meticulously following the associated instructions.

Staff allocated for the start-up and shut-down of the unit
(Basic operator and engineer operator)
After having understood the information contained in this manual, the basic operator will be authorized to manually operate the unit at the level of the following functions: start-up, shut-down, display of alarms.
In this case, this operator can carry out only the specific operations stated in this manual by meticulously following the associated instructions.

Safety officer
The safety officer is responsible for protection and the prevention of occupational risks as set forth in **OSHA Directive** (Safety in the workplace).
The safety officer shall make certain that all the persons who operate the unit have received all applicable instructions which are contained in this manual, including the initial installation and commissioning operation.

1.8 safety

Essential safety rules

! WARNING **Read this paragraph carefully and understand it before operating or servicing this machine. The machine is connected to hazardous power circuits (electricity, pneumatic circuit, etc.) and should be used with great care. This paragraph explains what needs to be understood in terms of safety before operating or servicing the machine. Non-compliance with these safety instructions risks causing injuries or fatal accidents, break-down of the machine, products (plates) or installations, or a serious incident.**

Operator

• Prior training about the operation and maintenance of the device is a prerequisite for the use and maintenance of the chiller.
• Use and maintain the chiller with the consent of the system manager.
• It is very dangerous to let a person, with poor knowledge and poor understanding about the system and how the machine functions, use it and carry out maintenance operations in an improper or negligent manner.

Before operating the chiller:

• Anyone using the chiller or carrying out its maintenance operations must read this manual carefully and understand its contents. Pay special attention to explanations with the heading “Danger”, “Warning” and “Caution” and understand them thoroughly. Follow the instructions and avoid predictable hazards when you use the chiller or carry out its maintenance operations.
• Before operating or carrying out a maintenance operation, read and understand the safety instructions stated in this manual and the safety labels affixed, on the device, and follow the instructions. Failing the above, you risk suffering facial injuries or even fatal injuries. You also run the risk of the chiller, the products (plates) or the installation breaking down or causing a serious incident.
• Other safety instructions are provided in the other paragraphs.

Warning labels (Warning)

• Warning labels are very important. Do not remove them deliberately.
• If they become dirty or illegible, or they get removed inadvertently or are lost, stick new labels in the place of the earlier ones.

Danger warning

When you use the chiller or carry out a maintenance operation on it, pay attention to the three warning levels below. Understand their content and act accordingly.
The warning messages appear on the warning labels placed on the chiller and given in the safety instructions paragraph of this manual.

! DANGER **The “danger” messages provide warning about real dangers and indicate the risks of fatal accident or serious injuries for the operator who does not strictly adhere to the safety instructions provided to avoid such dangers. They also provide warning about the risks of an accidental gas leakage or fire due to improper handling.**
The content of the messages is identical to the warning messages, except for indicating a higher level of severity. Danger labels generally have a red background.

! WARNING **The “warning” messages provide warning about real dangers and indicate the risks of serious injuries or fatal accident for the operator who does not strictly adhere to the safety instructions provided to avoid such dangers. They also provide warning about the risks of an accidental gas leakage or fire due to improper handling. Warning labels generally have an orange background.**

! CAUTION **The "caution" messages provide warning about real dangers and indicate the risks of minor injuries for the operator, or damage to the system, products and installations, if they do not strictly adhere to the safety instructions provided to avoid such dangers.**
Caution labels generally have a yellow background.

1.9 storage

Keep away from:

- Direct sunshine, rain, wind and sand.
- Temperature: max. 122°F/min. 14°F
- Max. relative humidity: 90%
- Do not in any way stack other objects on the chiller unit.

1.10 transport and handling

The carrier is always liable for any damage caused to the products entrusted to them during transport. Thus, before preparing the unit for its installation and commissioning, it is necessary to carry out a complete visual inspection in order to check that the packing cases are intact and the unit has no apparent damage and that there is no oil or refrigerant leakage. It is also important to verify that the units are the ones that have been ordered.

Any damage or complaints must be reported to **nano-purification solutions** and declared to the carrier (or shipper) before the carrier leaves premises when product is delivered.

If there is damage to one or more components, do not start the unit but inform **nano-purification solutions** about the problem to find a mutually agreeable course of action.

Preferably, remove the packaging at the actual place of installation.
The unit should be handled with great care on the premises. Do not use any of its components as a grip. In order to avoid any damage, it is imperative that, during their handling, the units always remain in the position set for their operation.

Do not leave the units in their packaging on premises that are exposed to strong sunshine because the ambient temperatures can affect the limit values of the safety devices.

The water circuit should be completely drained before the unit is handled.

The equipment should be preferably lifted using a forklift truck. Use a spreader bar if belts or slings are used and ensure that there is no pressure on the external edges of the units or the packing case.

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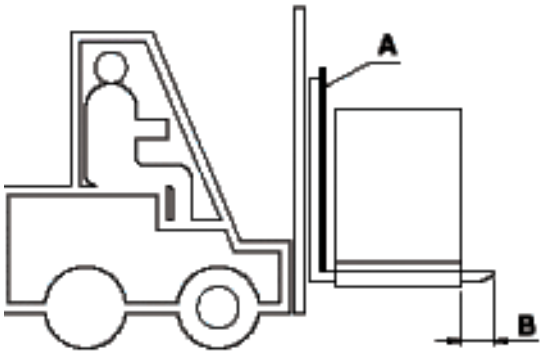
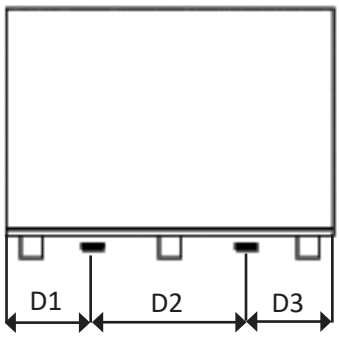
Example of lifting using a forklift truck:

- **Insert the protection for the external structure of the unit, e.g. polystyrene or board sheet (A).**
- **Ensure that the forks of the truck extend out min. 2 inches (B) from the other side of the unit.**



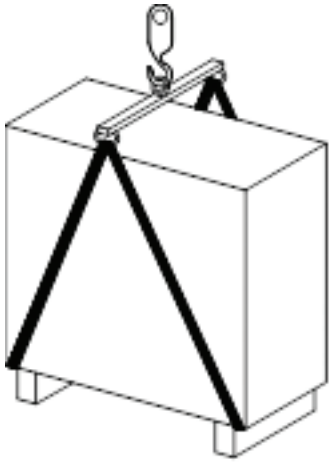


NCS model	0002-0006	0015-0020	0031-0051	0061-0151	0201-0251	0351-0401	0502-0652
D1	6.7 in	8.5 in	7.5 in	11.4 in	22.2 in	35.0 in	53.5 in
D2	15.7 in	15.7 in	23.6 in	27.6 in	31.5 in	31.5 in	31.5 in
D3	6.7 in	8.5 in	7.5 in	11.4 in	22.2 in	35.0 in	53.5 in

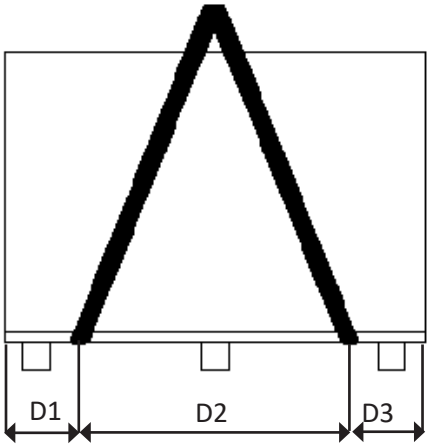
Round slings lifting example:

Example of lifting using slings:

- Place the slings as shown.
- Place the rigid structures on the upper sides of the unit in order to avoid damaging it (only when there is a point on which the pressure acts).
- Tighten the slings **gradually**, while ensuring that they remain in the correct position.
- Start lifting the unit.



When using straps or ropes to the harness, use a sling bar to ensure that there is no pressure being put on the upper edges of the machines or packaging. Place the straps lifting points as shown in figure.
Tighten the belts lifting gradually, making sure of their correct position and check that the straps do not crush the top of the unit, despite the presence of rigid structure.



NCS model	0015-0020	0031-0051	0061-0151	0201-0251	0351-0401	0502-0652	0802-1002	1202-1502
D1	3.0 in	3.0 in	4.5 in	4.5 in	4.5 in	4.5 in	20.5 in	46.5 in
D2	26.8 in	32.7 in	41.3 in	66.9 in	92.5 in	129.5 in	98.8 in	118.1 in
D3	3.0 in	3.0 in	4.5 in	4.5 in	4.5 in	4.5 in	20.5 in	46.5 in

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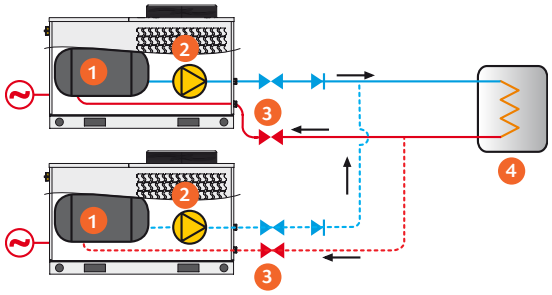
2.1 installation principle

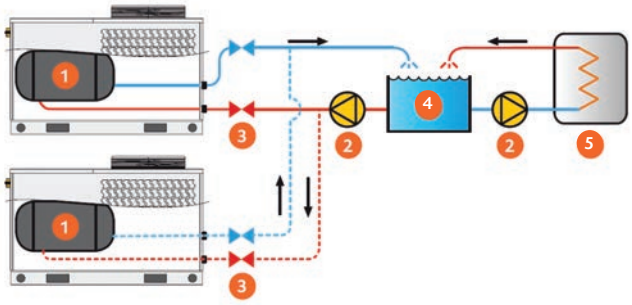
A backup wrench must be used when tightening water inlet and outlet pipework connections. Failure to properly tighten inlet and outlet pipework without use of a backup wrench could result in damage to the chiller and void warranty.

closed circuit installation (standard)



1. accumulation tank
2. pump
3. isolation valve
4. user process

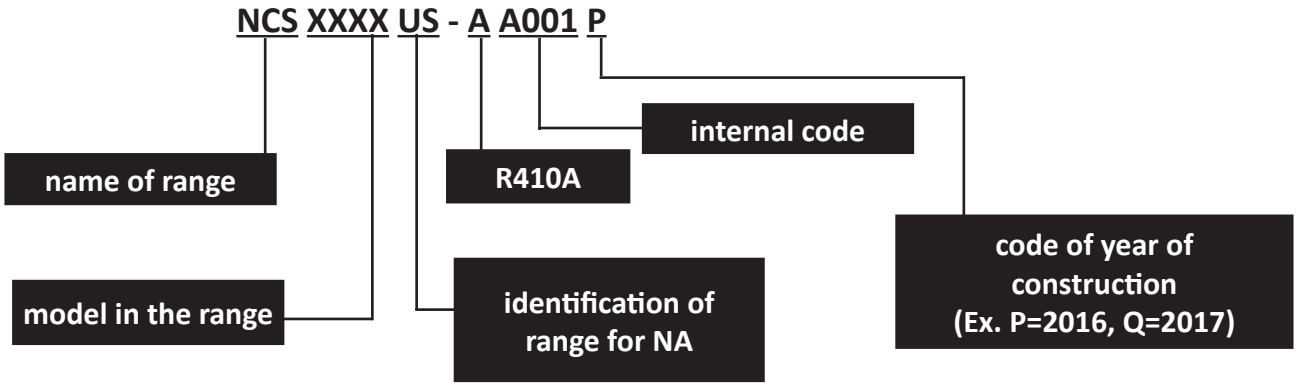
open circuit installation (optional)



1. accumulation tank
2. pump
3. isolation valve
4. open tank
5. user process

2.2 machine code identification

The model of the machine is written on the rating plate. It's very easy to recognize it by the name (see example).



2.3 description

The process water chillers of NCS range have been made to meet the needs of industrial processes or plants where the production of chilled water is required.

A variety of models and powers are available to cover a vast range of applications, with inlet water temperatures between 40°F and +70°F.

2.4 refrigerant cycle description

The refrigeration cycle uses the principle according to which a fluid has the capacity to absorb the heat when subjected to a change of state, such as a condensation or evaporation.

The evaporation temperature and the condensation of a fluid vary with the pressure at which they occur.

This characteristic is common to all fluids, but between them there are more suitable methods to be used in the form of a refrigeration cycle.

The refrigerant used is R410A.

The cooling water (or mixture of water and glycol) takes place in a heat exchanger which is referred to as an evaporator.

The heat that the R410A has absorbed in the exchange with the liquid in the evaporator must then be transferred by condensing the gas itself. The condensation takes place via a heat exchanger, referred to as the condenser, which is achieved via ambient air by a fan. To dispose of the heat absorbed by the gas, ambient air is used in the normal range of 95°F, it is necessary to condense at about 125°F, which corresponds to a pressure of 465 PSI absolute. To accomplish this you need to allow the vapor coming from evaporator into the compressor that feeds the system by compressing the gas and causing the pressure rise required.

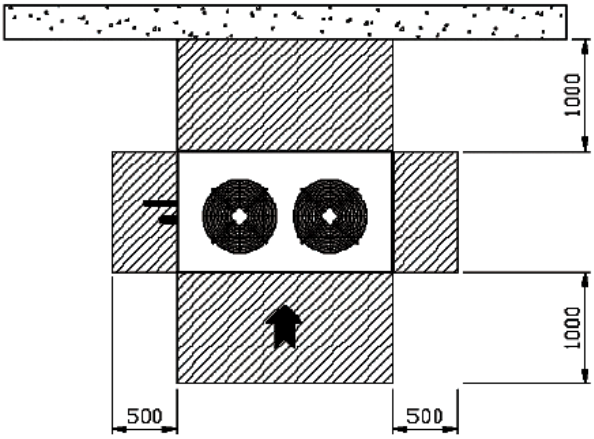
The refrigeration cycle is repeated by converting the gas to a liquid via an evaporator to a low temperature by lowering the pressure. This is accomplished by utilizing an expansion device which is usually a thermostatic valve.

The accessories that complete the refrigerant circuit are varied and differ depending on the operating conditions of the specific model.

2.5 operating space

The customer should check that the strength of the supporting surface is suitable for the weight of the unit.

It is unnecessary to fix the unit to the floor for correct operation. If the floor is rough, to ensure a level surface and prevent even the smallest of vibrations, it is advisable to insert a continuous rubber sheet the same size as the base supports. It is also advisable to make sure the unit is level. Should this be impossible or difficult to accomplish, the unit must not tilt more than 0.5°.



For correct operation and for maintenance accessibility, install the chiller with the appropriate free space as indicated in illustration. Numbers are expressed in mm.

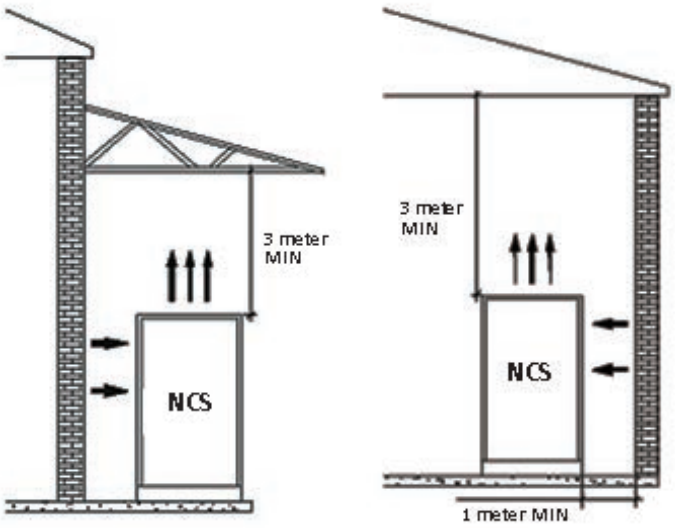
Dimensions in (mm)
197 in (500 mm)
394 in (1000 mm)

2.6 installation

The units must be installed without obstructing the air intake or exhaust.

When installing under a canopy roof, this roof must be **at least 118 ins (3 meters)** above the top of the unit.

Examples of correct installations are shown below.



2.7 water connections

Authorized personnel: **Professional pipe fitter** or **Maintenance mechanic**

Before carrying out the water connections to the user locations on the water circuit, the installed piping must be flushed out to eliminate machining residue and to identify any leaks in the system. **It is recommended the system piping be properly supported and constructed of the appropriate material for the application. Consult your local pipe fitter for recommended system pipe to meet local regulations and application parameters.**

WATER DRAIN
This outlet is fitted with a hose connecting tap suitable for attaching and securing with a hose clamp, a plastic hose with an inside diameter of **0.51 in (13 mm)**. It allows the filling of the tank connecting it to the water system. During drainage of the inside tank (if present), this fitting allows the user to drain the water from the system.

WATER OUTLET
This connection is male and has a diameter that changes by the size of the unit (see table on page 16). Connect the **outlet pipe** of the chilled water to the plant. **The diameter of the pipe must be equal or higher of the diameter of the outlet connection.**

WATER INLET
This connection is male and has a diameter that changes by the size of the unit (see table on page 16). Connect the **inlet pipe** of the water from the plant. **The diameter of the pipe must be equal or larger than that of the diameter of the outlet connection.**

CONDENSATE DRAIN
NCS chillers have a special condensate water collection tray positioned under the air condenser (models NCS 0002 – NCS 0004 – NCS 0006 excluded). Since the tray collects rainwater it is not compulsory for the outlet to be connected to a drain. In any case the water may be drained off with a plastic hose secured with a hose clamp, the size of the hose diameter is given in the table shown on page 16.

NCS range	hydraulic connection dimensions				
model	water drain	air purge	water outlet	water inlet	condensate drain
0002-0006	0.51 in	0.51 in	½"	½"	7.5 in
0015-0020					
0031-0061			1"	1"	11 in
0081-0151			1¼"	1¼"	
0201-0251			1½"	1½"	
0351-0402			2"	2"	
0502-0652			3"	3"	
0802-1502			4"	4"	

DRAIN VALVE INSTALLATION

All the units are fitted with a drain valve on the water side. The purpose of this valve is to drain to the outside through a pipe. It is therefore advisable to connect the valve to a pipe of at least the same diameter in order to convey any discharge from the valve to the outside. This pipe must be located so that the discharge can cause no damage to property or injury to persons. The pipe must also be suitably supported so that it does not stress on the valve.

The installation must be in conformity with current safety regulations.

If units are not used during the winter, fully drain the water system of any units installed outdoors. If operation is also in this period or with low ambient temperatures, antifreeze mixtures must be used. With indoor installations, drainage is necessary when the room temperature falls to below 32°F.

For installation diagrams, refer to the examples given in the section "Installation". Always fit ball shut off valves on the water inlet and outlet. If it is possible that the water may be dirty, also install a "Y" filter on the water inlet. For more information please contact support at nano-purification solutions.

DO NOT USE deionized water as it will void the unit warranty.

The standard unit is a carbon steel circuit. As a result, the unit must be filled with 10% rust inhibited glycol or the warranty will be void. For low ambient temperatures refer to the factory for glycol % required.

If the USER needs to disassemble some parts for which the procedure is not given in this manual, it is required to request permission and the relevant procedure from **nano-purification solutions.** Any assembly/disassembly carried out by the USER that is not communicated in this manual or authorized by **nano-purification solutions**, will be considered as tampering, thereby jeopardizing the safety functions and invalidating the warranty of the unit During construction of the unit all necessary measures are taken to ensure cleanliness in all the parts. After installation, clean the unit removing the protective substances. Use soft cloths and harmless detergent substances for cleaning, which do not damage the surfaces. The unit is always tested and inspected in the factory prior to delivery and requires no further controls.

2.8 electrical connections

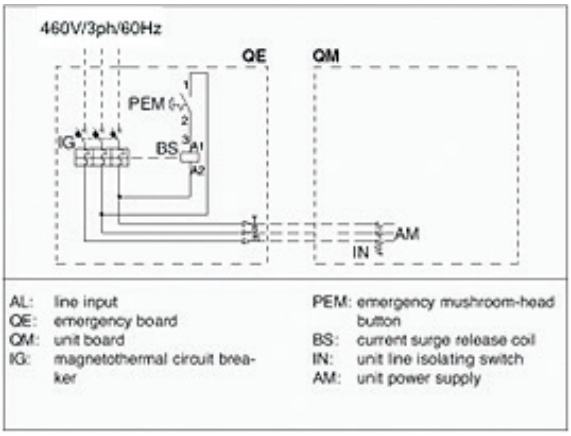
SAFETY SYSTEM CONNECTIONS

Authorized personnel: **Maintenance electrician**

The unit must be fitted with an emergency stop, which the installer must put in an easily accessible location. Should just one activation point be considered insufficient, several emergency stops in various points may be installed.

This device is available as an accessory from **nano-purification solutions**.

There is just one version for all models.



POWER SUPPLY

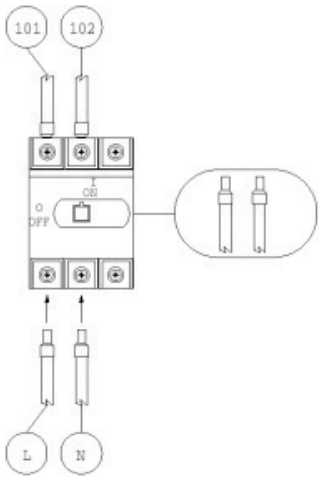
Authorized personnel: **Maintenance electrician**

Carry out all the electrical connections, carefully observing the wiring diagrams supplied with the units.

The components on board the unit are protected by the equipment inside the switchboard. It is the end user's responsibility to ensure the correct size and capacity of the power supply cable of the unit in relation to the total input indicated on the wiring diagram and the length of the cable. This cable must also be protected by a safety device installed on the user's electrical system.

SINGLE PHASE 115/1/60 or 230/1/60 power supply connection (models NCS 0002 - NCS 0006):

- Connect the line to terminal **L** on the circuit breaker.
- Connect the neutral to terminal **N**. The earth wire (yellow-green) is connected to a special terminal inside the electrical panel.



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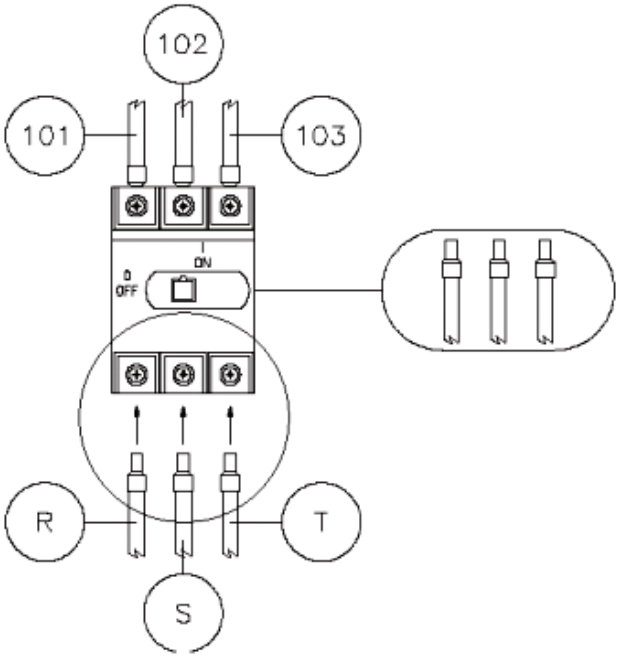
THREE PHASE 460/3/60 power supply connection (models NCS 0015 - NCS 1502):

- Connect the power to the unit's circuit breaker, respecting the sequence of the phases L1 L2 L3.
- The **neutral** is not needed.
- The earth is connected to the special terminal inside the electrical panel.
- The picture to the side shows an example of connection of the cables.
- Power supply from below.



Check protective devices and unit operations before switching on.
Authorized personnel: **Safety officer**

Should any abnormality be found when checking the unit, inform **nano-purification solutions** and do not operate the unit.

Before switching on for the first time, the unit must be visually inspected, checking:

No electrical wires are loose, especially at connection points and that there is no possibility of poor contacts.

The fluid circuit connections have been carried out correctly and show no visible leaks or damage.

The air intake and outlet sides have no obstructions of any kind whatsoever that could jeopardize efficient operation.

The fluid circuit connections present no obstructions such as: clogged filters, closed manual or automatic shut off valves, etc.

Check that all the fixed guards are mounted and properly bolted in position and that the mobile protective elements are closed.

FILLING THE WATER CIRCUIT

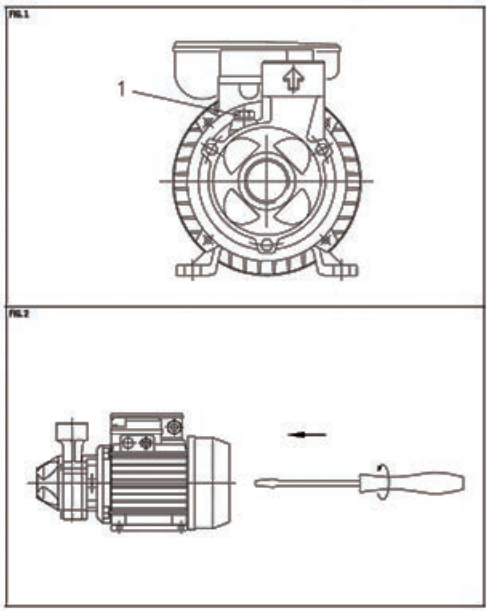
Before starting the unit, it is necessary to fill the water circuit.

Water temperature for filling = MAXIMUM 77°F

Filling with water Models NCS 0002 - NCS 0006

PUMP FILLING

Operation to be performed with the electric motor terminal box sealed and closed.



Unscrew hex plug (Fig. 1), in front on top of the pump body;

With the aid of a funnel fill with water until the pump body over flows.

Screw the hex plug until it locks to prevent air infiltration.

To start up the pump you need to follow the following guidelines:

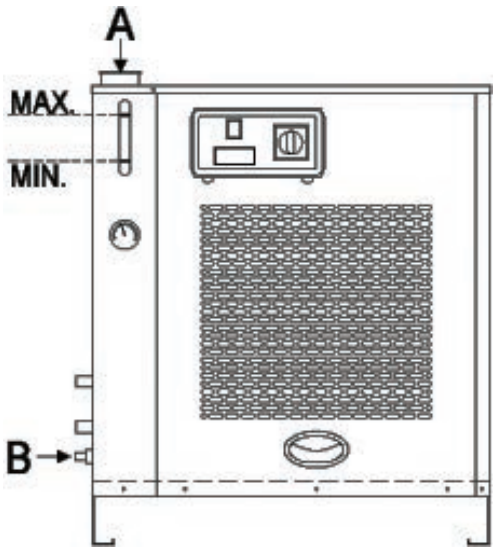
Insert a flat-head screwdriver through the fan cover (Fig. 2), in the rear of the pump until it coincides with the notch on the end of the rotor shaft.

Turn the screwdriver in both directions for a couple of full turns.

Open the tap **(A)** positioned on the upper part of the unit.

Connect the water drain outlet **(B)** to the water circuit. Open it to fill the unit from your water source.

The level of the water in the tank is visible through the indicator on the front of the unit; **when the level reaches "MAX" close and turn off the water source**.



After having filled the circuit and after the pump is running, check the water level to en sure it does not fall under "MIN" level; in this case it's necessary to fill it again with water using the manual fill tap A up to "MAX" level.

The unit can run in "open vessel" mode (circuit without pressure). The unit is also designed for use with "closed vessel" mode (circuit under pressure): in this case it's necessary to close the 2 ball valves positioned inside the unit close to the tank and to install a closed expansion vessel and the pressure reducing valve.

FILLING WITH ANTIFREEZE MIXTURE (Models NCS 0002 - NCS 0006)

It is necessary to use antifreeze mixtures, filling must be carried out with a solution prepared according to the water temperature, as specified in the section "Conditions of Use". If a pre-mix solution is unavailable, it must be prepared in a container to be connected to the unit water outlet as described on page 19.

WATER FILLING (Models NCS 0015 - NCS 1502)

Open the air valve (and connect it to a drain using a plastic hose) so that any air present in the circuit will be discharged during filling. Take care that any water that sprays out when the circuit has been filled does not create a hazardous situation. If there are any points in the system circuit higher than the unit air valve, another air valve (if possible automatic) must be inserted at the highest point to ensure complete filling of the circuit.

Connect the unit water outlet tap to the main water system. Open the main water supply to fill the circuit. **When water comes out of the hose connected to the air valve, the circuit has been filled.**

Once the system has been filled and after having the pump circulate for some time, check for residual air. If there is still air present, the circuit must be bled and filled up with water. With the system inoperative, it is also necessary to ensure that the pressure in the circuit is a static pressure of 7-10 psi. This indication is visible through the pressure gauge mounted on the unit.

WHEN FILLING IS FINISHED YOU HAVE TO CLOSE THE WATER DRAIN TO AVOID PRESSURE IN THE CIRCUIT FROM INCREASING.
(Not for versions with closed vessel, which is equipped with pressure reducing valve).

FILLING WITH RUST INHIBITED GLYCOL

Use rust inhibited glycol, filling must be carried out with a solution prepared according to the water temperature, as specified in the section "Conditions of Use".

If a pre-mix solution is unavailable, it must be prepared in a container to be connected to the unit water outlet, as described above.

Closed or open tank filling kits, as shown in the following diagrams, are available on request by the customer.

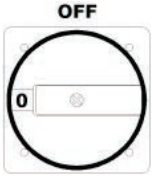
For more information please contact the Support Department of **nano-purification solutions**.

2.9 starting and use

CONTROLS

The professionals involved in this section are:
The **Operator**, who must always operate with the fixed guards correctly mounted and check that under no circumstances have they been tampered with.
The **Maintenance Personnel**, who must always operate with the unit at a standstill and after having carried out the required operations, check that all the protective devices are correctly remounted, closed and in proper working order.
The **Safety officer**, who must check that the **Operator** and the **Maintenance Personnel** have received all the necessary information as per this manual. Check in particular that all the fixed guards have been correctly mounted, are in proper working order and have not been tampered with.

Door interlock.

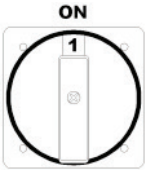


Microprocessor for unit start and control.

Check compliance with instructions up to this point. It is only possible to operate the unit or its parts with the front panel closed and the power on/off switch put to on.
Check that the compressor ON/OFF switch is put to off.
Put the door interlock switch to on.

UNIT START-UP

- Check the compressor ON/OFF switch is off **(position "0")**.
- Turn the door interlock in position "1" **(ON)**.



Units from NCS 0015 and above come with built in crankcase heaters as standard. When switching on for the first time the compressor oil must be warmed by the crankcase heater before starting the chiller. The crankcase heater is automatically powered when the power is brought to the chiller. It is thermostatically controlled. It is recommended to have power to the unit for 4 hours before starting the compressor. This allows the oil to rise to an acceptable temperature.

C1
industrial water chiller

Put to ON. Working from the microprocessor, press the button ↓ for **3 seconds**.

(please see dedicated manual)

2

The water pump (if present) starts.

When starting for the first time, check the correct direction of rotation of the pump. To do this, close the ball valve fitted at the unit water inlet and outlet, as described in the paragraph “water connections” in the section “Commissioning”. Fully open the by-pass. Using the pressure gauge on the unit check that the circuit is pressurized. If it is not, switch off the unit using the power on/off switch and invert the connection phases at the on/off switch input, paying attention to the possible presence of current. Then check the working pressure with the pressure gauge on the unit. Make sure that there are no automatic valves, which could reduce the flow, and that the circuit shut off valves are fully open. Use the handle of the by-pass valve to adjust the pressure until the liquid pressure gauge indicator is in the appropriate sector. This sector is specific for each type of pump (standard or uprated) and for each model.

The tables below indicates the operating range for each combination.

NCS model	standard P3 pump (psi)	high pressure P5 pump (PSI)
NCS 0002	43.5	-
NCS 0004	43.5	-
NCS 0006	43.5	-
NCS 0015	43.5	72.5
NCS 0020	43.5	72.5
NCS 0031	43.5	72.5
NCS 0051	43.5	72.5
NCS 0061	43.5	72.5
NCS 0081	43.5	72.5
NCS 0101	43.5	72.5
NCS 0121	43.5	72.5
NCS 0151	43.5	72.5
NCS 0201	43.5	72.5
NCS 0251	43.5	72.5
NCS 0351	43.5	72.5
NCS 0401	43.5	72.5
NCS 0502	43.5	72.5
NCS 0602	43.5	72.5
NCS 0652	43.5	72.5
NCS 0802	43.5	72.5
NCS 1002	43.5	72.5
NCS 1202	43.5	72.5
NCS 1402	43.5	72.5
NCS 1502	43.5	72.5

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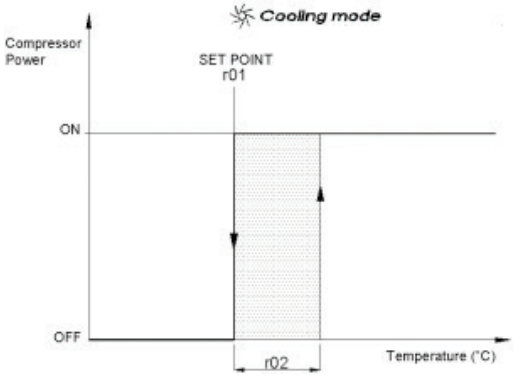
industrial water chiller

COOLING mode – **all versions**
If the temperature of the water (see value of the display) is lower than **r01** (Summer/cooling set point) value (default is 45°F), the compressor is OFF.
The water pump (if present) runs.

If the temperature of the water (see value of the display) is higher than **r01 + r02** (differential) value (default is 48°F), the compressor is ON and the cooling starts and runs value of set point **r01**.



FOR SET POINT MODIFICATION (r01) SEE CHAPTER “CONTROL PANEL”

For units with SCROLL compressor (standard machine from NCS 0015 to 0051), it is also necessary to check the direction of rotation of the compressor. An accentuated noise level and almost total lack of efficiency are signs of reverse rotation. Two of the compressor power supply phases must therefore be inverted to obtain the correct direction of rotation, which is evident by a lower noise level and correct efficiency. Once the phases have been switched, restart.

Do not continue to operate with reverse rotation or the compressor could be irreparably damaged.

CHECK COOLING

The chiller normally works with a difference of approx. 9°F between the evaporator water inlet and outlet (with by-pass valve closed), which may be checked with surface thermometers.

Check for any alarm warnings.

CHECKING THE SAFETY DEVICES

The unit, connected as described in the section “Commissioning” under the paragraph “Connection of Safety Devices”, must guarantee safety functions in an emergency. The emergency stop button must therefore be pressed to check that all the motors stop. If operation is correct, reset the emergency button and continue with the switching on procedure as described previously.

STANDBY

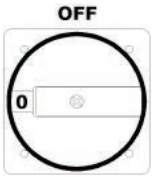
Press button ↓ for 3 seconds.
(please see dedicated manual)

Since the compressor and the pump are timed and work together, before stopping they finish the cycle in progress. A certain interval may therefore be necessary before the unit comes to a total stop. In this condition the unit is in stand-by and may be restarted by just pressing the button ▲ for 5 seconds.

SWITCHING OFF

This operation should always be carried out after having put the unit in stand-by and after all the components have come to a stop.

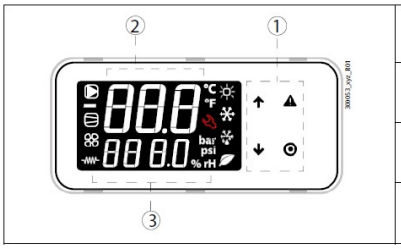
Put the door interlock switch to OFF.



When contacting your service provider be sure to provide the part number and serial number of your chiller, this can be found on the rating plate.

2.10 control panel

NCS water chillers are fitted with a compact electronic control (µChiller), it is roughly the size of a typical thermostat, for complete control of the unit.



Key	
1	Keypad
2	Main field
3	Device status and operating mode icons

For controller manual please refer to the following documents:

No. **99980501-Microchiller - User Manual - 20210122**

2.11 routine maintenance

GENERAL SAFETY RULES

Before carrying out inspections, maintenance and controls, strictly comply with all that is specified below:
- check that the power on/off switch is put to off (position '0') and padlocked in that position;
- check that there are no moving parts;
- observe the accident-prevention regulations in force;
- put on adequate personal protective equipment (gloves, goggles, etc.) before carrying out any operation.

Except for visual inspections, all the operations are to be carried out solely by specialized and expert personnel, otherwise the warranty is rendered invalid.
For operations not specified in this manual, contact **nano-purification solutions**.
For constant efficiency and a long working life of the unit, it must be periodically controlled and maintained.
A thorough visual inspection of the equipment and general cleaning are always of the utmost importance for trouble-free operation.

Relatively simple, inexpensive operations and checks fall within this category of work, which on the one hand ensures good operation over a period of time and on the other allows possible faults to be avoided that, if neglected, could become considerably problematic.

2.12 maintenance

Various risks (electric shock, explosion...): The following operations must only be carried out by qualified personnel.

maintenance	authorized personnel	after visual inspection	monthly	year 1 (12 months)
CHECKING THE CONDENSING COIL Visually check from outside the unit if there is any dirt, such as paper, dry leaves or simply dust, on the coil. The presence of such deposits causes a reduction in the air flow with a consequent reduction of efficiency and the possibility that the high pressure switch could trip resulting in the unit stopping.	maintenance mechanic		✓	
CHECKING THE ELECTRICAL EQUIPMENT Check the wiring to ensure that there are no loose wires at connection points and no possibility of worn contacts. For the check, proceed as follows:- • switch off the unit by putting the switch to '0'; • check that there are no moving parts; • once the unit has stopped, open the electrical panel; • gently tug the wires of the contacts to check that the wiring is secure; • if necessary tighten the screws using a screwdriver.	maintenance electrician		✓	
CIRCULATING PUMPS PRIMARY AND SECONDARY CIRCUITS (FOR INTEGRATED VERSION MODELS) Check the proper functioning paying attention to the possible occurrence of abnormal noise and vibration and leakage from the mechanical seal.	maintenance mechanic		✓	
CLEANING THE COIL • switch off the unit by putting the on/off switch to '0' and padlock it in that position; • once the unit, including all its parts, has stopped, remove the perforated protective panel from the coil; • clean the fins using a bristle (not wire) brush, proceeding vertically in the direction of the fins and taking care not to exert too much pressure, which could otherwise damage the fins. In the event of stubborn dirt, use detergent products or compressed air, blowing the latter in the reverse direction to the normal airflow; • replace the panel; • restart the unit, following the starting procedure.	maintenance mechanic	if necessary		✓
CIRCULATING PUMPS PRIMARY AND SECONDARY CIRCUITS (FOR INTEGRATED VERSION MODELS) • Check if necessary to replace of the mechanical seal. • Check if necessary the replacement of the sealing rings • Verify if needed the replacement of the bearings.	maintenance mechanic			✓

2.13 pump trouble shooting

displayed fault	cause	solution
THE PUMP DOES NOT WORK. The motor doesn't turn.	No electricity.	Check the electrical supply meter.
	Automatic switch triggered or fuses blown.	Reset the switch or replace the fuses and verify the cause.
	Thermal protection activated (single phase).	It reactivates automatically (single phase only.)
THE PUMP DOES NOT WORK. The motor turns.	Decrease in line voltage.	Wait for voltage to return to normal.
	Suction filter/hole blocked.	Clean the filter/hole.
	Pump not primed.	Prime the pump. Check any delivery non-return valves. Check the liquid level.
THE PUMP WORKS. With a reduced flow rate.	System undersized.	Re-examine the system.
	System dirty.	Clean the piping, valves, filters.
	Incorrect rotational direction (three phase only.)	Switch two phases.
	Leaks from piping.	Check the joints.
	Pressure too high.	Recheck the system.
THE PUMP STOPS AFTER WORKING BRIEF PERIODS. Thermal protection intervention.	Liquid temperature too high.	The temperature exceeds the technical limits of the pump.
THE PUMP VIBRATES or is too noisy during operation.	Flow rate too high.	Reduce the flow rate.
	Cavitation.	Contact the supplier.
	Noisy bearing.	Contact the supplier.
	Foreign body sliding along the fan motor.	Remove the foreign body.
	Incorrect priming.	Bleed the pump and/or fill it again.

2.14 pump maintenance

frequency of maintenance	authorized personnel	after visual inspection	monthly	year 1 (12 months)
SEASONAL STOP • Close the water circuit water supply valve; • If the system risks being exposed to freezing temperatures during the period of inactivity, fully drain the water circuit; • Disconnect from the electric supply by means of the power on/off switch, ensuring that the switch cannot be put to "on" again during the period of inactivity of the system.	maintenance mechanic and electrician			✓
SEASONAL START • Open the water supply tap; • If the system has been drained, refill the water circuit; • Carry out all checks and procedures as with the first time of starting.	maintenance mechanic and electrician			✓

2.15 shutting down and disposal

Authorized personnel: **maintenance mechanic** and **electrician**, **refrigeration technician**.

The decommissioning of the chiller must be performed only by authorized and qualified personnel.

- Electrically isolate the unit by disconnecting the main power supply;

TAKING OUT OF SERVICE FOR AN EXTENDED PERIOD OF TIME

If the chiller is not used for a prolonged period of time (more than 6 months) the liquid circuit (water + ethylene glycol) will have to be emptied to avoid the possibility that the concentration of antifreeze liquid may vary in function of the possible evaporation of water present in the circuit. A possible increase in the concentration of glycol may result in damaging the seal of the circulation pump.

- Electrically isolate the unit by disconnecting the main power supply and make sure that the power supply cannot be accidentally switched on again.
- Disconnect the connections of the liquid circuit.
- Drain the liquid circuit.
- When disposing of the liquid circuit (water and glycol mixture) to comply with applicable regulations to protect water from pollutants.

DECOMMISSIONING AND DISPOSAL

Danger for the environment! The deliberate discharge of coolant is strictly prohibited. The coolant should be disposed of properly.

- Disconnect the electrical connections and hydraulic connections to the process chiller.
- Drain the liquid circuit.
- When disposing the collected water and glycol mixture ensure that you comply with applicable regulations to protect water from pollutants and dispose of properly.
- For the proper disposal of the chiller contact your dealer or our service center nearest you.

Note: If a system is changed or taken out of service for more than two years, it will have to be inspected again and be accompanied by a new certification. Possible re-charging of the refrigerant circuit, moving to a new location, upgrading or expansion of an existing plant.

2.16 trouble shooting

Authorized personnel: **maintenance mechanic**, **electrician** and r**efrigeration technician.**

The controller manages three types of alarms, depending on the reset mode:

- **A - automatic**: the alarm is reset and the device restarts automatically when the alarm condition is no longer present;
- **R - semi-automatic**: if the alarm occurs several times, reset becomes manual and an operator needs to physically restart the device.
- **M - manual**: an operator an operator needs to physically restart the device.

Alarms that require technical service are shown on the display with the ashing spanner icon. If the spanner icon is on, it means that a device has reached the programmed operating hour threshold, and maintenance is required (the alarm code indicates which device is a ected).

For some alarms, the reset mode can be configured by parameter. The configurable alarms are:

- High pressure switch
- Low pressure switch
- Frost protection alarm

For complete information, please check controller manual. Refer to the following document:

No. **99980501-Microchiller - User Manual - Chapter 8, page 78**

TROUBLESHOOTING CHART

LOW PRESSURE ALARM LP1 (CIRCUIT 1) LP2 (CIRCUIT 2)	**DESCRIPTION** The alarm is activated with the compressor on or off and leads to the immediate stop of the compressor or it will not restart. The audible alarm and the alarm relay activate and the display blinks.

cause	check	authorized personnel
No water.	Check the water circuit for closed valves, obstructed filters or obstructions of any kind. Check the pump for the direction of the rotation and correct operation.	Refrigeration technician.
Faulty thermostatic valve.	Check the sensor bulb and its capillary for leaks and if it is empty. Check the external equalizer for obstruction or crushing and that overheating is within correct values. Replace if necessary.	Refrigeration technician.
Thermostat valve out of calibration.	Check the overheating values and re-calibrate if necessary.	Refrigeration technician.
Condensation pressure too low.	Check operation of the condensation control systems.	Refrigeration technician.
No gas in refrigerant circuit.	Search for any gas leaks. Repair and restore correct gas load.	Refrigeration technician.
Obstructed filter on liquid line.	Replace the filter.	Refrigeration technician.
Faulty low pressure switch operation.	Check correct operation; check the connecting capillary for obstruction or crushing and if necessary replace.	Refrigeration technician.

OVERLOAD ALARM tP (GENERAL) tC1-tC2 (CIRCUIT 2)	**DESCRIPTION** The alarm leads to the immediate stop of the compressor and the fan, activation of the audible, alarm relay and blinking of the display.

cause	check	authorized personnel
Intervention of the magnetothermal protection of the compressor.	Test the winding resistance of the motor and if abnormal replace the compressor. The compressor is mechanically jammed or has gripped. Replace the compressor. The amp draw is too high. Check operating conditions (water temperature, evaporating pressure, condensing pressure, superheating, subcooling, etc.) Check the power supply voltage and correct electrical connection. Check the continuity of the single windings.	Maintenance technician.

TROUBLESHOOTING CHART

FLOW SWITCH ALARM PUMP THERMAL CUT-OUT FL	DESCRIPTION The alarm is detected irrespective of the pump and compressor status. The compressor, pump and fan stop, activating the audible, alarm relay and the display blinks.

cause	check	authorized personnel
No water.	Check the water circuit for any closed valves, obstructed filters or obstructions of any kind. Check the pump for the direction of rotation and correct operation.	Refrigeration technician.
Pump winding short-circuited.	Test the winding resistance and if abnormal replace the pump. The pump is mechanically jammed or has locked up. Replace the pump.	Maintenance electrician.
Pump current amp draw too high.	Check operating conditions in terms of flow rate and delivery pressure. If necessary re-calibrate pump operation using the by-pass valve.	Maintenance electrician.
Pump motor operating with single-phase instead of three-phase power supply. (ver. NCS 0002 – NCS 0004 excluded)	Check the power supply voltage and correct electrical connection. Check the continuity of the single winding.	Maintenance electrician.
Incorrect calibration of flow switch or mechanical failure.	Check instrument calibration and operation and replace if necessary.	Refrigeration technician.

PROBE ALARM E1---E8	DESCRIPTION These alarms are also detected with the unit in stand-by. The values read by a sensor are outside normal values. The presence of a sensor alarm leads to deactivation of the compressor, the condensing fans and the pump. The audible and alarm relay activate and the display blinks.

cause	check	authorized personnel
Probe damaged or fault.	Check the wiring between the sensor and the microprocessor for breaks or faults.	Maintenance electrician.

EEPROM ERROR DURING OPERATION EPr	DESCRIPTION The microprocessor continues to perform the control of the unit with the data present in the random memory (RAM). After the first power supply failure the configuration will be lost.

cause	check	authorized personnel
Microprocessor error.	Turn OFF the unit. Wait for a few seconds. Turn ON the unit. If after the auto control the alarm activates again, replace the regulator.	Maintenance electrician.

TROUBLESHOOTING CHART

EEPROM ERROR AT THE START-UP EPb	DESCRIPTION At the start-up of the µchiller it blocks and an indication appears on the display.

cause	check	authorized personnel
Microprocessor error.	Turn OFF the unit. Wait for some seconds. Turn ON the unit. If the alarm activates again, replace the regulator.	Maintenance electrician.

COMMUNICATION ERROR WITH EXPANSION CARD (Models NCS 0502-0602-0652-0802)	DESCRIPTION If the control µchiller loses communication with the expansion card, the entire system will be stopped to avoid affecting the unit. The alarm leads to the immediate stop of the compressor and the fan, activation of the audible, alarm relay and blinking of the display.

cause	check	authorized personnel
Communication data error.	Turn OFF the unit. Wait for a few seconds. Turn ON the unit. If the alarm activates again, contact **nano-purification solutions**.	Maintenance electrician.

ANTIFREEZE ALARM A1	DESCRIPTION The alarm is detected through the water sensor in the tank when the evaporator outlet water temperature is below the set antifreeze threshold. The compressor and the condensing fans stop immediately, the audible, alarm relay activate and the display blinks.

cause	check	authorized personnel
No water.	Check the water circuit for closed valves, obstructed filters or obstructions of any kind. Check the pump for the direction of rotation and correct operation.	Refrigeration technician.
Water temperature too low.	Check operating set point calibration.	Refrigeration technician.

C1 industrial water chiller

3.1 technical specifications

The unit in standard version (gas R410A) has been designed for operation according to the following parameters:

3

specifications	
refrigerant	R410A
liquid	water + rust inhibited propylene glycol
power supply	230V/1Ph/60Hz (Models NCS 0002 - NCS 0006) 460V/3Ph/60Hz (Models NCS 0015 - NCS 1502)
inlet water temperature range	32 - 86°F
outlet water temperature range	32 - 68°F for standard version
acceptable temperature (outdoor)	23 - 105°F

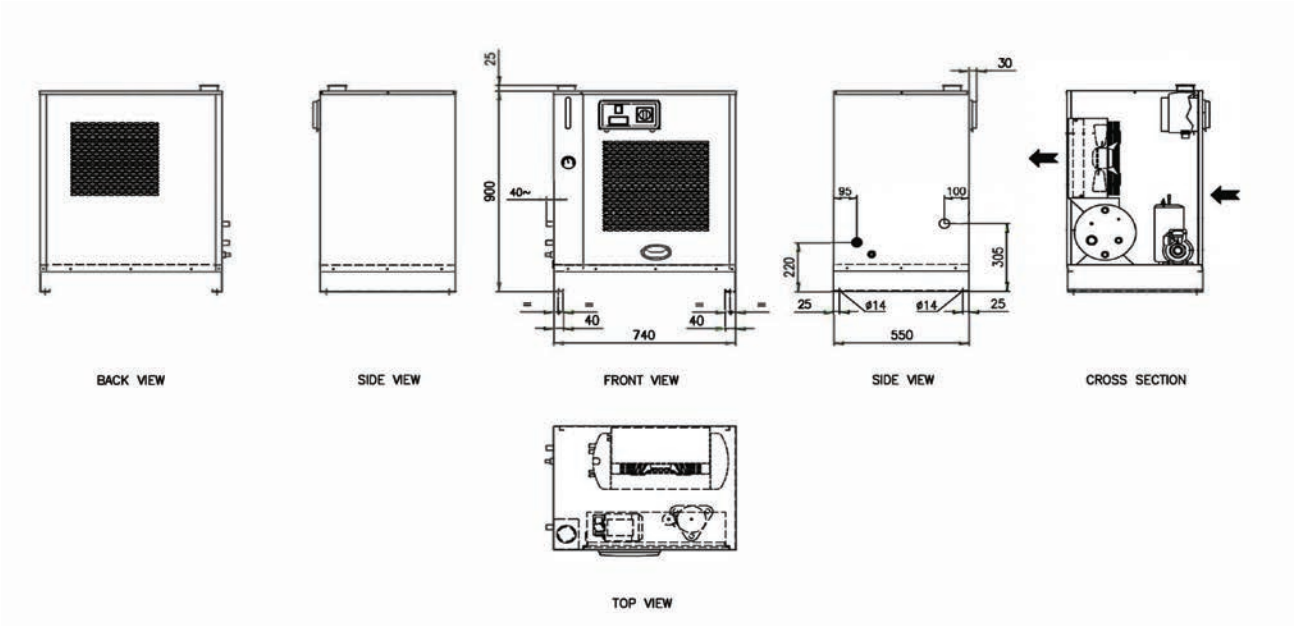
mixture temperature	% rust inhibited propylene glycol
(standard version (R410A)	
+68°F	-
+59°F	-
+50°F	5% (suggested)
+41°F	10%
+32°F	15%

NOTE: All units must have a minimum of 10% rust inhibited propylene glycol to maintain warranty.

Under normal conditions the working life of the unit is estimated to be approx. 25,000 hours of operation and in most cases up to ten years. At the end of this time a general overhaul is recommended to refurbish the unit so that it may still be used safely.

3.2 arrangement drawings

NCS 0002 to NCS 0006



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 0002	30	740	22	550	37	900
NCS 0004	30	740	22	550	37	900
NCS 0006	30	740	22	550	37	900

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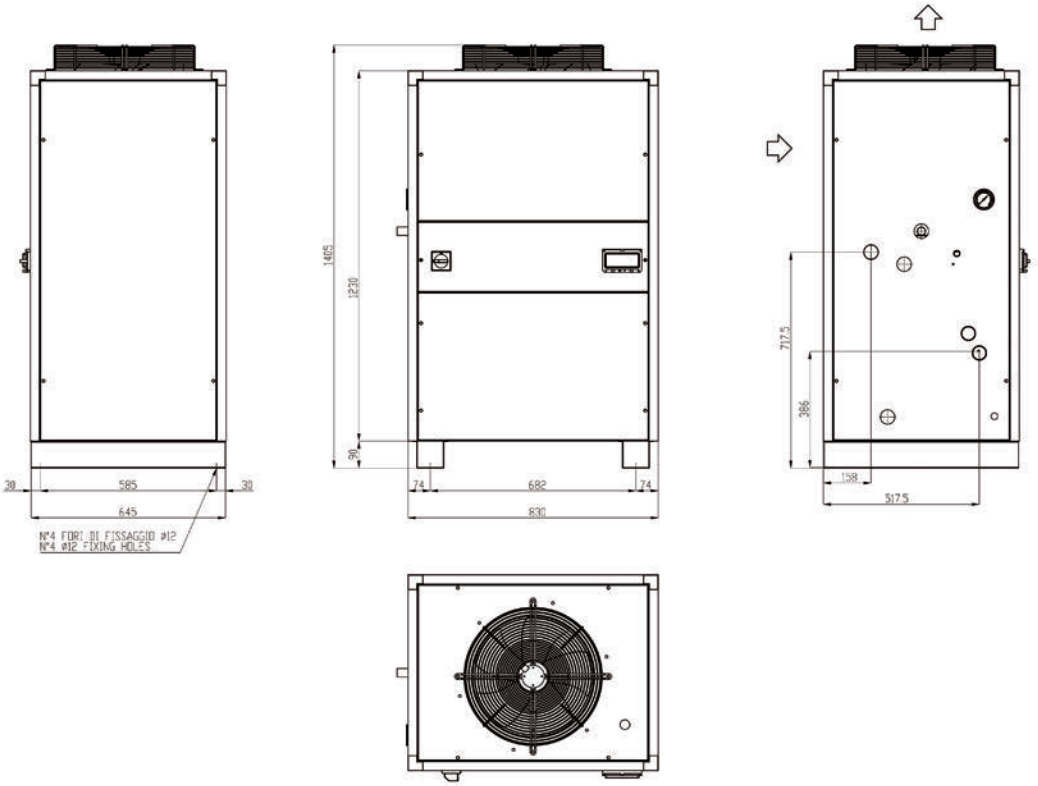
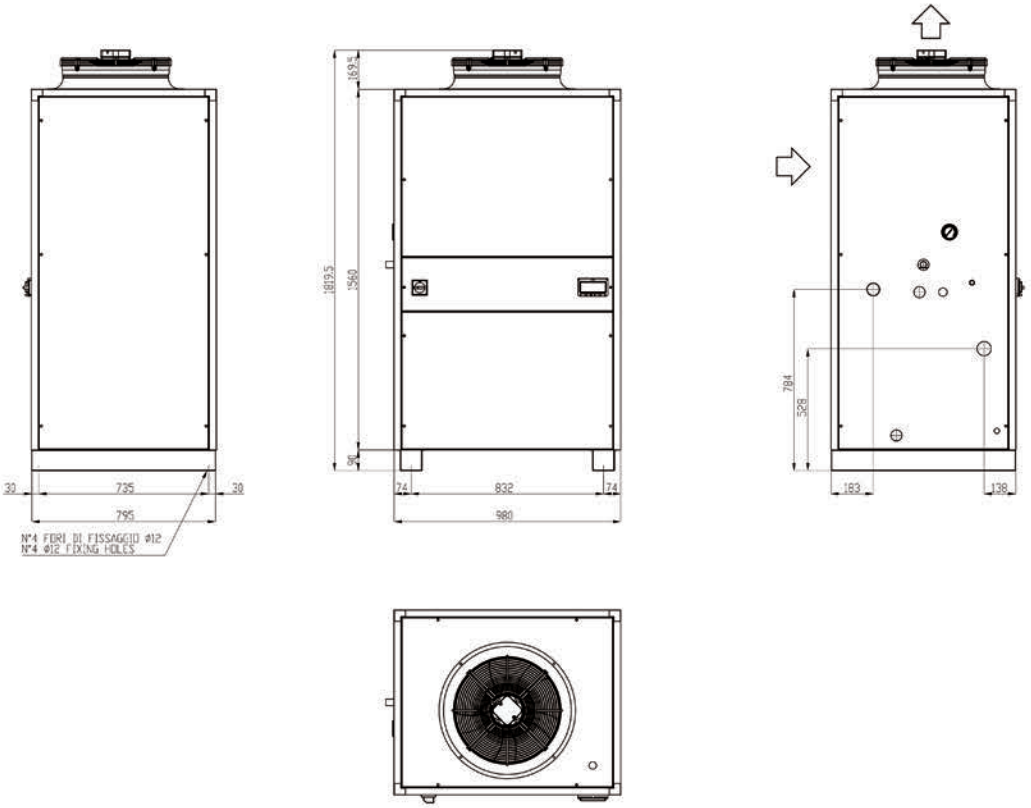
industrial water chiller

NCS 0015 to NCS 0020



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 0015	33	830	26	645	56	1405
NCS 0020	33	830	26	645	56	1405

NCS 0031 to NCS 0051



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 0031	39	980	32	795	72	1829
NCS 0051	39	980	32	795	72	1829

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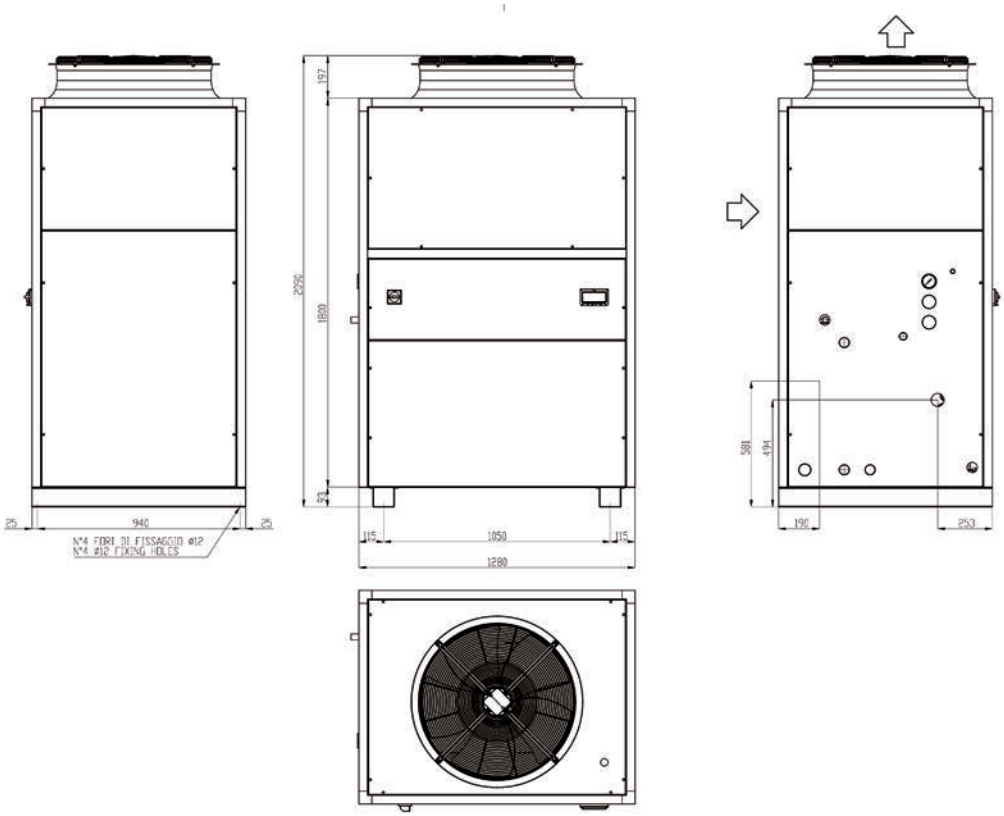
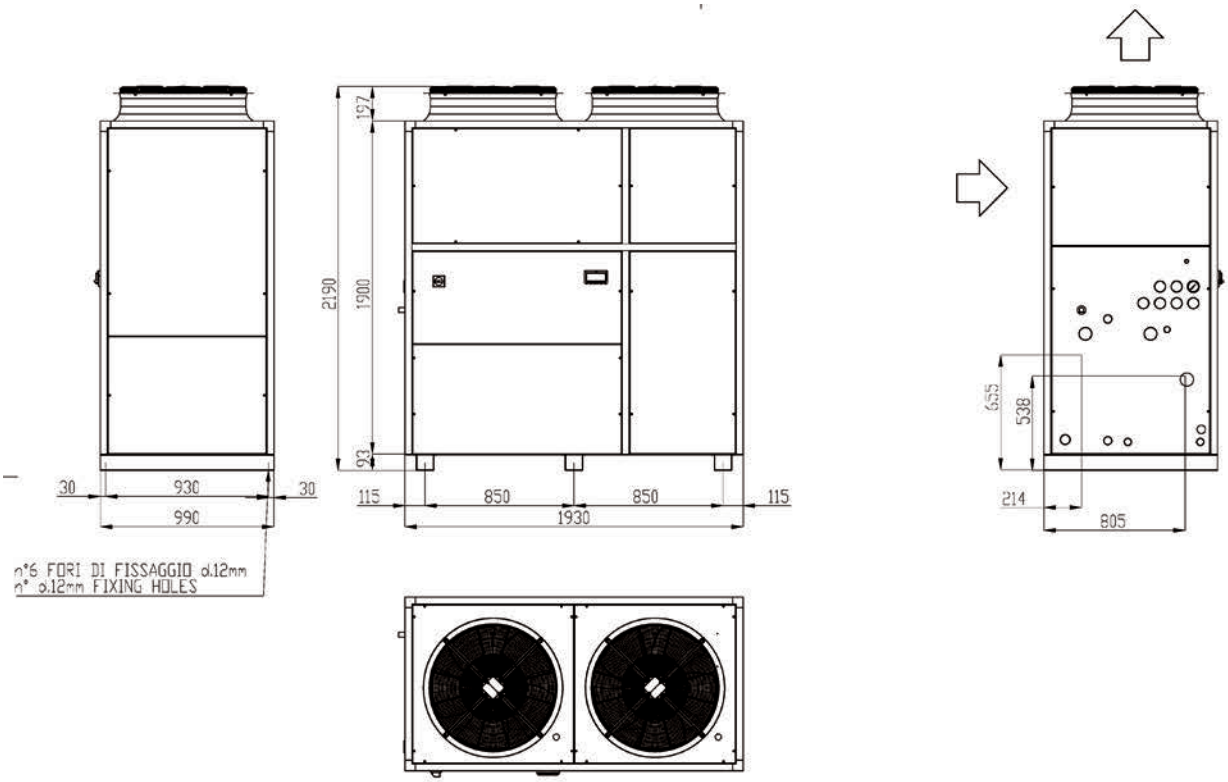
industrial water chiller

NCS 0061 to NCS 0151



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 0061	51	1280	39	940	83	2108
NCS 0081	51	1280	39	940	83	2108
NCS 0101	51	1280	39	940	83	2108
NCS 0121	51	1280	39	940	83	2108
NCS 0151	51	1280	39	940	83	2108

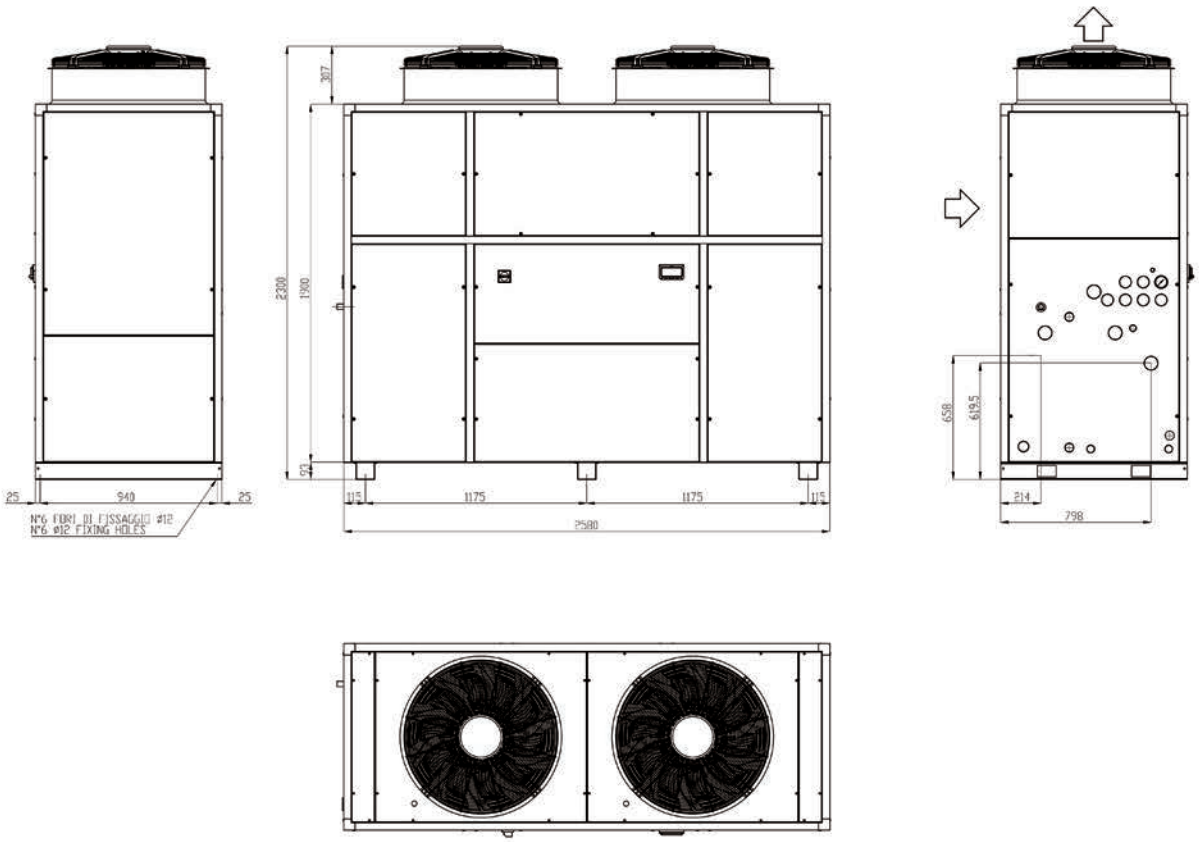
NCS 0201 to NCS 0251



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 0201	76	1930	39	940	87	2210
NCS 0251	76	1930	39	940	87	2210

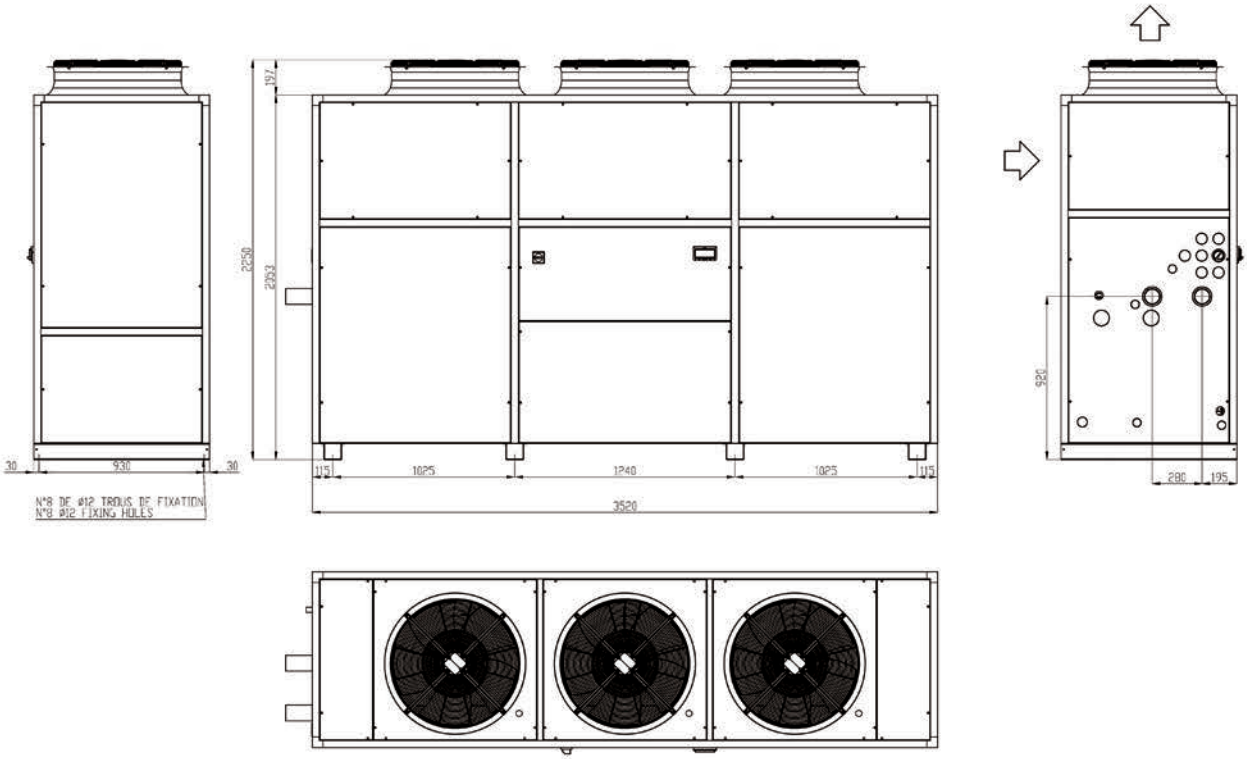
C¹
industrial water chiller

NCS 0351 to NCS 0401



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 0351	102	2580	39	940	91	2311
NCS 0401	102	2580	39	940	91	2311

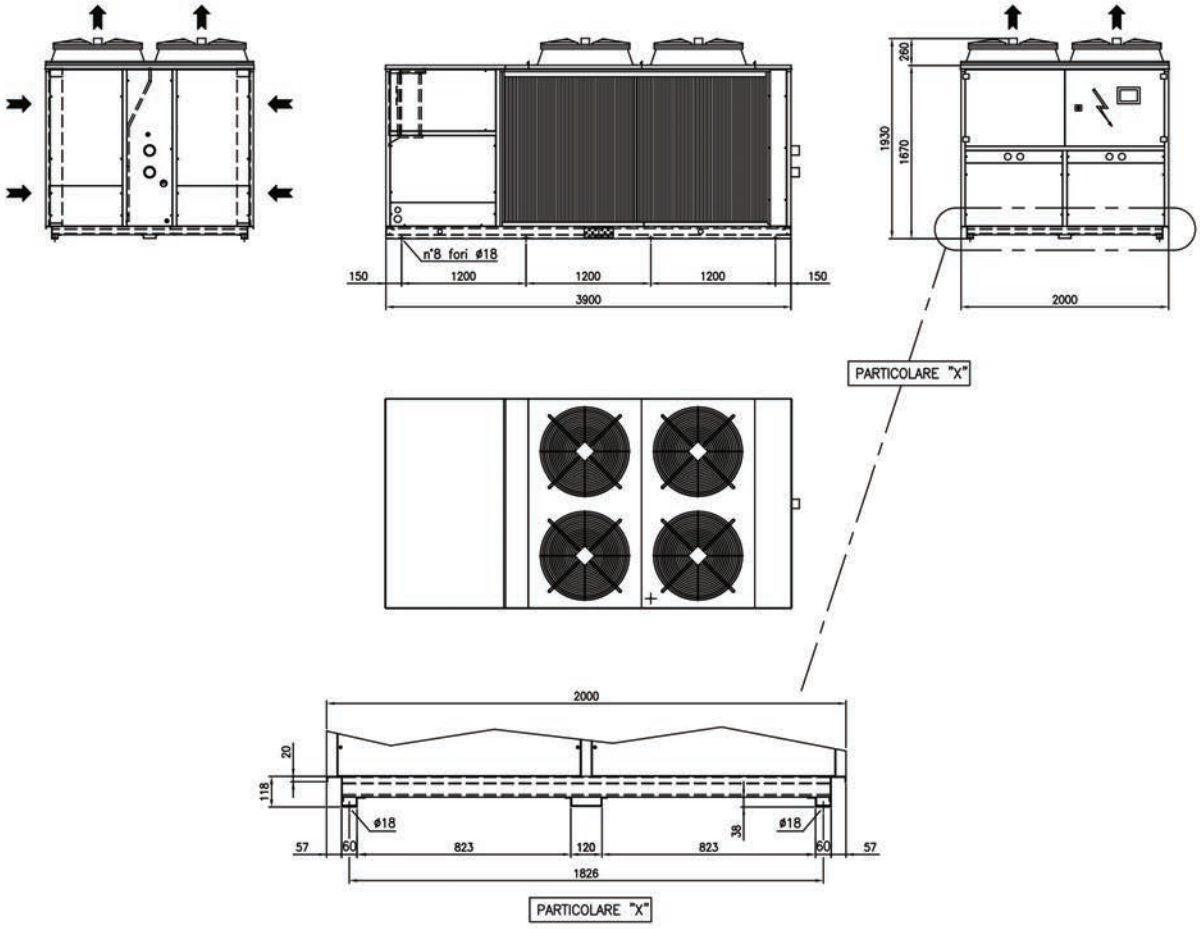
NCS 0502 to NCS 0652



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 0502	139	3520	39	990	89	2245
NCS 0602	139	3520	39	990	89	2245
NCS 0652	139	3520	39	990	89	2245

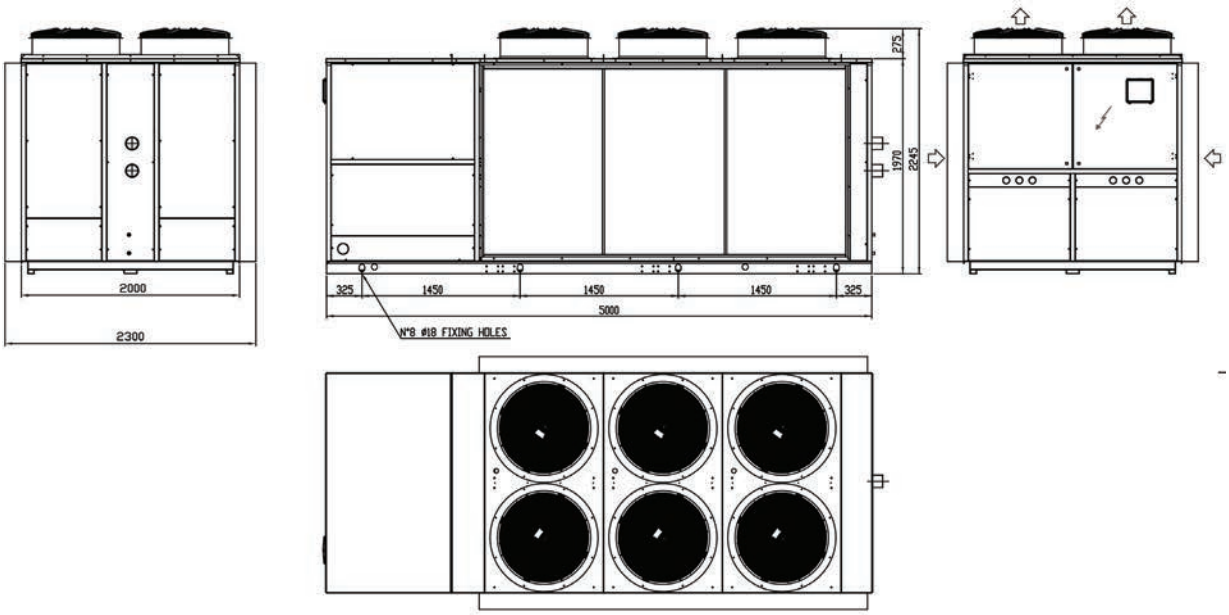
C1
industrial water chiller

NCS 0802 to NCS 1002



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 0802	154	3900	79	2000	76	1930
NCS 1002	154	3900	79	2000	76	1930

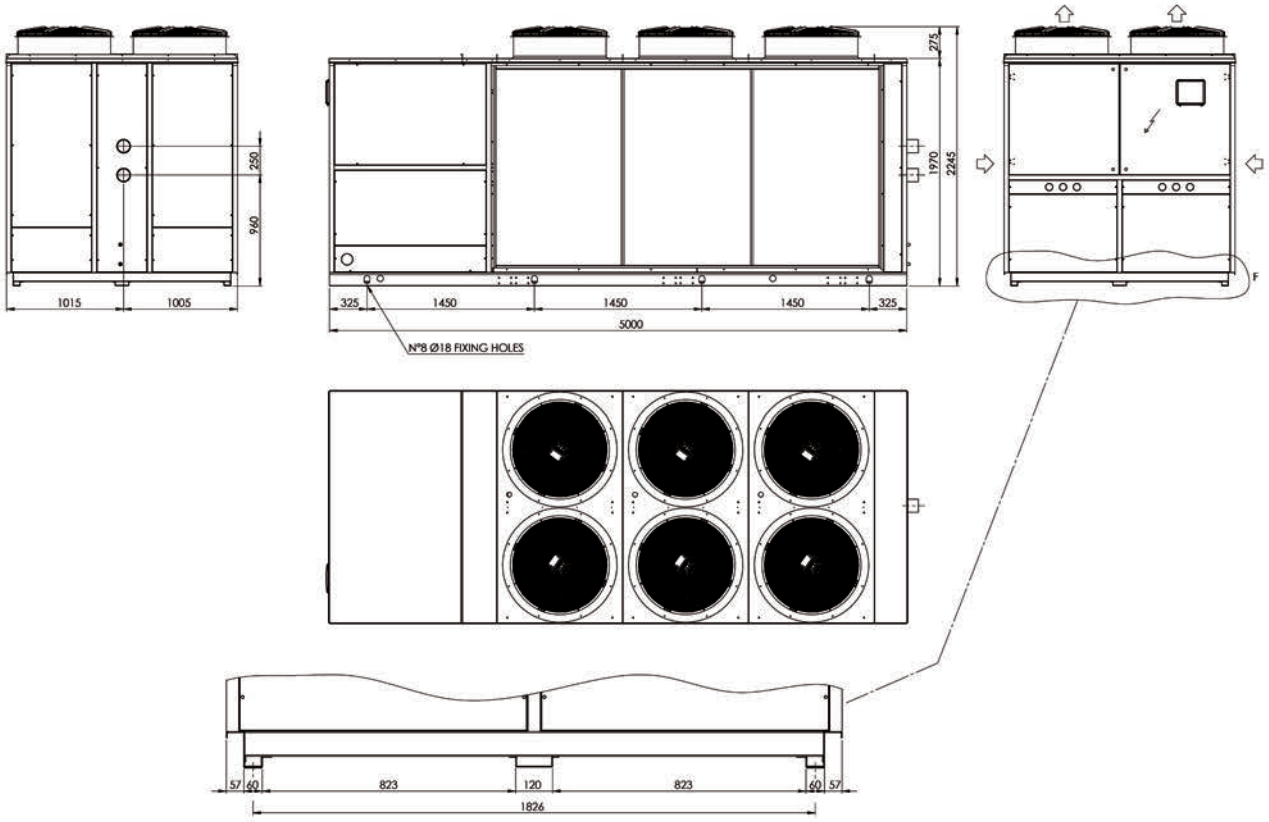
NCS 1202



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 1202	197	5004	79	2000	89	2245

C¹
industrial water chiller

NCS 1402 to NCS 1502



model	dimensions					
	length		depth		height	
	in	mm	in	mm	in	mm
NCS 1402	197	5000	80	2020	89	2245
NCS 1502	197	5000	80	2020	89	2245

3.3 electrical wirings

CONTACT nano-purification solutions TECHNICAL SUPPORT FOR ELECTRICAL WIRING DIAGRAMS VIA EMAIL AT SUPPORT@N-PSI.COM OR PHONE AT 704.897.2182.

C1 industrial water chiller

3.4 appendixes

model	water inlet & outlet	cooling capacity (1)		total installed power (2)	full load amps	water pump	refrigerant	tank capacity	approx. weight	
									no water	with water
	NPT	BTU/h	tons	kW	A	hp		gal	lbs	lbs
NCS 0002 US	½"	6,824	0.6	1.3	7.6	0.5	R10A	6.1	187	238
NCS 0004 US	½"	12,966	1.1	2.3	11.5	0.5	R10A	6.1	220	271
NCS 0006 US	½"	19,108	1.6	3.0	15.7	0.5	R10A	6.1	238	288
NCS 0015 US	½"	23,885	2.0	6.6	9.7	0.8	R10A	7.9	352	418
NCS 0020 US	½"	32,893	2.7	7.2	11.0	0.8	R10A	7.9	374	440
NCS 0031 US	1"	43,675	3.6	9.3	13.1	0.7	R10A	15.9	550	682
NCS 0051 US	1"	56,983	4.7	10.7	18.1	0.7	R10A	15.9	594	726
NCS 0061 US	1"	65,854	5.5	11.7	18.1	0.7	R10A	42.3	990	1342
NCS 0081 US	1½"	73,702	6.1	12.6	20.0	1.5	R10A	42.3	1078	1430
NCS 0101 US	1½"	100,999	8.4	16.8	26.7	1.5	R10A	42.3	1122	1474
NCS 0121 US	1½"	123,520	10.3	20.6	36.1	1.5	R10A	42.3	1144	1496
NCS 0151 US	1½"	146,040	12.2	23.3	39.1	1.5	R10A	42.3	1177	1529
NCS 0201 US	1½"	201,999	16.8	32.1	50.5	2.9	R10A	76.6	1562	2200
NCS 0251 US	1½"	247,039	20.6	41.1	71.8	2.9	R10A	76.6	1892	2530
NCS 0351 US	2"	292,079	24.3	46.0	76.9	2.9	R10A	121.5	2222	3234
NCS 0401 US	2"	335,755	28.0	55.6	88.2	4.0	R10A	121.5	2464	3476
NCS 0502 US	3"	379,430	31.6	63.7	97.0	4.0	R10A	132.1	3960	5060
NCS 0602 US	3"	477,700	39.8	77.6	116.0	5.4	R10A	132.1	4136	5236
NCS 0652 US	3"	552,767	46.1	87.4	140.5	5.4	R10A	132.1	4224	5324
NCS 0802 US	3"	671,510	56.0	107.8	162.7	5.4	R10A	243.0	4840	6864
NCS 1002 US	3"	758,860	63.2	115.2	181.6	10.1	R10A	243.0	4840	6864
NCS 1202 US	3"	955,400	79.6	150.9	224.4	10.1	R10A	264.2	5676	7876
NCS 1402 US	4"	1,105,534	92.1	177.5	265.5	10.1	R10A	264.2	5940	8140
NCS 1502 US	4"	1,255,668	104.6	198.5	299.3	10.1	R10A	264.2	6028	8228

specifications			0002	0004	0006	0015	0020	0031	0051	0061	0081	0101	0121	0151
compressor(s)	quantity	-	1	1	1	1	1	1	1	1	1	1	1	1
	absorbed power [2]	kW	0.8	1.8	2.4	4.6	5.2	7.3	8.7	9.9	10.4	13.9	17.7	20.4
	absorbed power [2]	A	4.4	8.3	12.0	6.6	7.9	10.0	15.0	15.0	16.2	21.6	31.0	34.0
fan(s)	quantity	-	1	1	1	1	1	1	1	1	1	1	1	1
	power (total)	kW	0.1	0.1	0.2	0.7	0.7	1.1	1.1	0.9	0.9	1.6	1.6	1.6
	power (total)	A	0.4	0.4	0.9	1.2	1.2	1.6	1.6	1.6	1.6	2.9	2.9	2.9
water pump	power	hp	0.5	0.5	0.5	0.8	0.8	0.7	0.7	0.7	1.5	1.5	1.5	1.5
water pump	power	A	2.8	2.8	2.8	1.9	1.9	1.5	1.5	1.5	2.2	2.2	2.2	2.2
total unit	full load	A	7.6	11.5	15.7	9.7	11.0	13.1	18.1	18.1	20.0	26.7	36.1	39.1
power supply	voltage / phases [3]	V/Ph		230V/1Ph/60Hz						460V/3Ph/60Hz				
refrigerant	circuits	-	1	1	1	1	1	1	1	1	1	1	1	1
	type	-						R410A						
inlet water temperature	minimum	°F	32	32	32	32	32	32	32	32	32	32	32	32
	maximum	°F	86	86	86	86	86	86	86	86	86	86	86	86

specifications			0201	0251	0351	0401	0502	0602	0652	0802	1002	1202	1402	1502
compressor(s)	quantity	-	2	2	2	2	2	2	2	4	4	4	4	4
	absorbed power [2]	kW	27.8	35.4	40.8	47.3	53.8	66.6	76.4	94.6	102.0	133.2	154.2	175.2
	absorbed power [2]	A	43.2	62.0	68.0	74.0	80.0	97.0	113.9	144.4	158.8	194.0	227.8	261.6
fan(s)	quantity	-	2	2	3	3	4	4	3	4	4	6	6	6
	power (total)	kW	1.8	3.2	2.7	4.9	6.5	6.5	6.5	8.7	8.7	13.2	13.2	13.2
	power (total)	A	3.2	5.7	4.8	8.6	11.4	11.4	19.0	15.2	15.2	22.8	22.8	22.8
water pump	power	hp	2.9	2.9	2.9	4.0	4.0	5.4	5.4	5.4	10.1	10.1	10.1	10.1
water pump	power	A	4.1	4.1	4.1	5.6	5.6	7.6	7.6	7.6	7.6	7.6	14.9	14.9
total unit	full load	A	50.5	71.8	76.9	88.2	97.0	116.0	140.5	167.2	181.6	224.4	265.5	299.3
power supply	voltage / phases [3]	V/Ph						460V/3Ph/60Hz						
refrigerant	circuits	-	1	1	1	1	2	2	2	2	2	2	2	2
	type	-						R410A						
inlet water temperature	minimum	°F	32	32	32	32	32	32	32	32	32	32	32	32
	maximum	°F	86	86	86	86	86	86	86	86	86	86	86	86
outlet water temperature	minimum	°F	32	32	32	32	32	32	32	32	32	32	32	32
	maximum	°F	68	68	68	68	68	68	68	68	68	68	68	68
ambient temperature	minimum	°F	23	23	23	23	23	23	23	23	23	23	23	23
	maximum	°F	106	106	106	106	106	106	106	106	106	106	106	106

4.1 R410A gas chemical safety data sheet

PRODUCT NAME: REFRIGERANT GAS R410A

COMPOSITION/INFORMATION ON INGREDIENTS

CAS No.:	133023-17-3	EEC No.:	206-557-8

HAZARDOUS INGREDIENT(S)

Pentafluoroethane	(50%)	CAS No.: 354-33-6	EEC No.:	206-557-8
Difluoromethane	(50%)	CAS No.: 75-10-5	EEC No.:	200-839-4

HAZARDS IDENTIFICATION

Emergencies overview: Colorless, volatile liquid with eterea and faint sweetish odor. Nonflammable material. Overexposure may cause dizziness and loss of concentration. At higher level, CNS depression and cardiac arrhythmia may result from exposure. Vapor displace air and can cause asphyxiation in confined space. At higher temperature, (>250°C), decomposition products may include Hydrofluoric Acid (HF) and carbonyl Halides.

POTENTIAL HEALTH HAZARDS

Skin: Irritation would result from a defatting action on tissue. Liquid contact could cause frostbite.

Eyes: Liquid contact can cause severe irritation and frostbite. Mist may irritate.

Inhalation: R-410A is low in acute toxicity in animals. When oxygen levels in air are reduced to 12-14% by displacement, symptoms of asphyxiation, loss of coordination, increased pulse rate and deeper respiration will occur. At high levels, cardiac arrhythmia may occur.

Ingestion: Ingestion is unlikely because of the low boiling point of the material. Should it occur, discomfort in the gastrointestinal tract from rapid evaporation of the material and consequent evolution of gas would result. Some effects of inhalation and skin exposure would be expected.

Delayed Effects: None known.

FIRST AID MEASURES

Skin: Promptly flush skin with water until all chemical is removed. If there is any evidence of frostbite, bathe (do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. Get medical attention if symptoms persist.

Eyes: Immediately flush eyes with large amounts of water for at least 15 minutes (in case of frostbite water should be lukewarm, not hot) lifting eyelids occasionally to facilitate irrigation. Get medical attention. Do not give epinephrine (adrenaline).

Inhalation:	Immediately remove to fresh air. If breathing has stopped, give artificial respiration. Use oxygen as required, provided a qualified operator is available. Get medical attention. Do not give epinephrine (adrenaline).
Ingestion:	Ingestion is unlikely because of the physical properties and is not expected to be hazardous. Do not induce vomiting unless instructed to do so by a physician.
Advice to physician:	Because of the possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be used with special caution and only in situations of emergency life support. Treatment of overexposure should be directed at the control of symptoms and the clinical conditions.

FIRE-FIGHTING MEASURES

Flammable properties	
Flash point:	Gas, not applicable per DOT regulations
Flash point method:	Not applicable
Autoignition temperature:	> 750°C
Upper flame limit:	None by ASTM D-56-82
Lower flame limit:	None by ASTM E 681
Flame propagation rate:	Not applicable
OSHA flammability class:	Not applicable

Extinguishing media:	Use any standard agent – choose the one most appropriate for type of surrounding fire (material itself is not flammable).

Unusual fire and explosion hazards:
R 410A is not flammable at ambient temperatures and atmospheric pressure. However, this material will become combustible when mixed with air under pressure end exposed to strong ignition source. Contact with certain reactive metals may result in formation of explosive or exothermic reactions under specific conditions (e.g. very high temperatures and/or appropriate pressures).

Unusual firefighting precautions/instruction:
Firefighters should wear self-contained, NIOSH-approved breathing apparatus for protection against possible toxic decomposition products Proper eye and skin protection should be provided. Use water spray to keep fire exposed containers cool.

HANDLING AND STORAGE

Normal handling:	Avoid breathing vapors and liquid contact eyes, skin or clothing. Do not puncture or drop cylinders, expose them to open flame or excessive heat. Use authorized cylinders only. Follow standard safety precautions for handling and use of compressed gas cylinders. R 410A should not be mixed with air above atmospheric pressure for leak testing or any other purpose.

Storage recommendations:
Store in a cool, well ventilated area of low fire risk and out of direct and out of direct sunlight. Protect cylinder and its fittings from physical damage. Storage in subsurface locations should be avoided. Close valve tightly after use and when empty.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering control: Provide local ventilation at filling zones and areas where leakage is probable. Mechanical (general) ventilation may be adequate for other operating and storage areas.

Personal Protective Equipment

Skin protection: Skin contact with refrigerant may cause frostbite. General work clothing and gloves (leather) should provide adequate protection. If prolonged contact with the liquid or gas is anticipated, insulated gloves constructed of PVA, neoprene or butyl rubber should be used. Any contaminated clothing should be promptly removed and washed before reuse.

Eye protection: For normal conditions, wear safety glasses. Where there is reasonable probability of liquid contact, wear chemical safety goggles.

Respiratory protection: None generally required for adequately ventilated work conditions. For accidental release or non-ventilated situations, or release into confined space, where the concentration may be above the PEL of 1,000 ppm, use a self-contained, NIOSH-approved breathing apparatus or supplied air respirator. For escape: use the former or a NIOSH-approved gas mask with organic vapor canister.

Additional recommendations:
Where contact with liquid is likely, such as in a spill or leak, impervious boots and clothing should be worn. High dose-level warning signs are recommended for area of principle exposure. Provide eyewash stations and quick-drench shower facilities at convenient locations.

Exposure guidelines
Pentafluoroethane : UK [ppm] : 1000

Symbology:

PHISICAL AND CHEMICAL PROPERTIES

Appearance:	clear, colorless liquid and vapor
Physical state:	gas at ambient temperatures
Molecular weight:	72,6
Chemical formula:	CH2F2, CHF2CF3
Odor:	Faint etereal odor
Specific gravities:	1.08 @ 21.1°C
Solubility in water:	Unknown
pH:	Neutral
Boiling point:	-48,5°C
Freezing point:	Not determined
Vapor pressure:	215.3 psia @ 70°F 490.2 psia @ 130°F
Vapor density (air=1.0):	3.0
Evaporation rate:	> 1
% Volatiles:	100
Flash point:	Not applicable

STABILITY AND REACTIVITY

Stability an reactivity: The product is stable. Do not mix oxygen or air above atmospheric pressure. Any source of high temperature, such a lighted cigarettes, flames, hot spots or welding may yeld toxic and/or corrosive decomposition products.

Incompatibilities: (under specific conditions: e.g. very high temperatures and/or appropriate pressure) – Freshly abraded aluminium surfaces (may cause strong exothermic reaction). Chemically active metals: potassium, calcium, powdered aluminium, magnesium and zinc.

Hazardous decomposition products: Halogens, halogen acids and possibly carbonyl halides.

Hazardous polymerization: Will not occur

TOXICOLOGICAL INFORMATION

Immediate (acute) effects :	Difluoromethane:	LC50 : 4 hr. (rat) - ≥ 520,000 ppm
	Pentafluoroethane:	Cardiac Sensitization threshold (dog) ≥ 100,000 ppm
Delayed effects : (subchronic and chronic)		Teratology - negative Subchronic inhalation (rat) NOEL - 50,000 ppm
Other data:		Not active in four genetic studies

ECOLOGICAL INFORMATION
Degradability (BOD): R 410A is a gas at room temperature; therefore, it is unlikely to remain in water.
Octanol Water Partition Coefficient: Log P0w = 1.48 (pentafluoroethane), 0.21 (difluoromethane)

DISPOSAL CONSIDERATION
RCRA: Is the unsed product a RCRA hazardous waste if discarded ? – Not a hazardous waste
If yes, the RCRA ID number is: – Not applicable

Other disposal consideration: Disposal must comply with federal, state, and local disposal or discharge laws.

TRANSPORT INFORMATION

No. ONU:	3163
H.I. n°:	20
Shipping Name:	LIQUEFIED GAS N.O.S. (Pentafluorethane, Difluoromethane (R32)
Classe ADR/RID:	2
Codifica classifica ADR/RID:	2 A
Hazard class:	2.2

Other transport information: Avoid transport on vehicles where the load space is not separated from the driver. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in case of an accident or emergency.
Before transporting product:
- Ensure that containers are firmly secured
- Ensure that the cylinder valve is closed and not leaking.
- Ensure that the valve protection device, if provided, is correctly fitted.
- Ensure valve, if supplied, is correctly fitted.
- Ensure there is adequate ventilation.
- Compliance with applicable regulations.

REGULATORY INFORMATION.

- EC Labelling: Not classified as dangerous
- Symbol(s): None
- R Phrases: None
- S Phrases: None

OTHER INFORMATION

In high concentrations may cause asphyxiation.
Keep container in a well-ventilated place.
Do not breathe the gas. The hazard of asphyxiation is often overlooked and must be stressed during operator training.
Pressure vessel.
Ensure compliance with all national and regional regulations.
This safety data sheet has been compiled in accordance with the applicable European Directives and applies to all countries that have translated the Directives in their national legislation.
Before using this product in any new process or experiment, a thorough study should be conducted on the safety and compatibility of the product with the materials.
The information contained in this document is believed to be correct at time of printing. The company is not liable for any damage caused by the use of incorrect product and / or under conditions other than the one provided.

GLOSSARY

OES:	Occupational Exposure Standard (UK HSE EH40)
MEL:	Maximum Exposure Limit (UK HSE EH40)
COM:	The company aims to control exposure in its workplace to this limit
TLV:	The company aims to control exposure in its workplace to the ACGIH limit
TLV-C:	The company aims to control exposure in its workplace to the ACGIH Ceiling limit
MAK:	The company aims to control exposure in its workplace to the German limit
Sk:	Can be absorbed through skin
Sen:	Capable of causing respiratory sensitization
Bmgv:	Biological monitoring guidance value (UK HSE EH40)
ILV:	Indicative Limit Value (UK HSE EH40)

additional nano products

F-series industrial filters

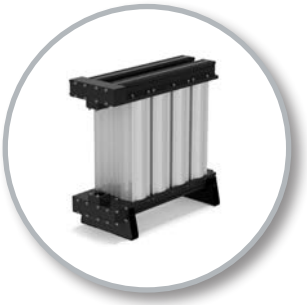
D-series desiccant dryers

B-series breathing air purifiers

GEN_2-series nitrogen generators

R-series refrigerated dryers

V-series oil vapor removal systems



S-series oil water separators

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