ND4X series NEMA 4 direct expansion refrigerated air dryer 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

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models: ND4X 30 - 200
doc no: 17-110-8006
issue: 000

1.2 manufacturers details and support

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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 ND4X NEMA 4 direct expansion refrigerated air dryer, mainly the operators. The ND4X NEMA 4 direct expansion refrigerated air dryer 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 months 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. Pre-filters and non-corrosive upstream piping required. Only genuine service parts should be used and no modifications made.

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 the smallest doubts or any 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 the 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 the different power sources which are damaged or missing.

The refrigerant used is R134a. It is not harmful unless inhaled. They constitute a hazard only if they saturate the environment. Some fluids are flammable under certain conditions. 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 the protecting covers properly in place;
- Do not remove the protecting covers while the unit is functioning;
- Do not remove the protecting covers 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 dryer.
• Use and maintain the dryer 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 dryer:

• Anyone using the dryer 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 dryer 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 dryer, 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 dryer 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 stuck on the dryer 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 (plates) 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. 140°F/min. 14°F
- Max. relative humidity: 90%

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 triggering 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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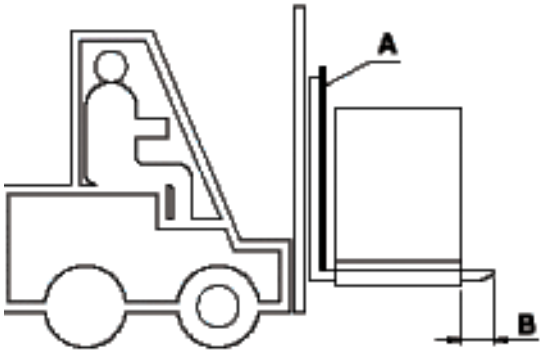
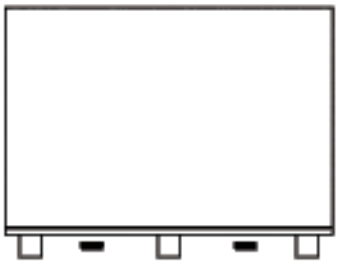
During transport, do not place the dryer on the ground, on the side, in order to avoid any possible problem.

Example of lifting using a forklift truck:

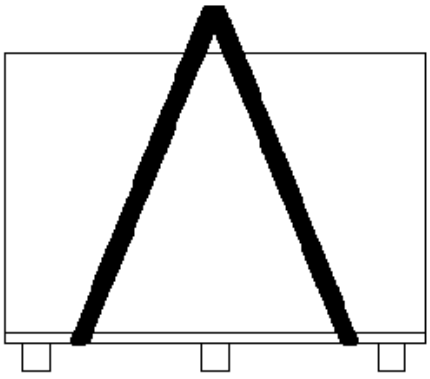
- Insert the protection for the external structure of the unit, e.g. polystyrene or board sheet (A).
- Ensure that the forks of the truck jut out min. 4 inches (B) from the unit.





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.



1.11 unpacking and inspection

All ND4X NEMA 4 direct expansion dryers are tested and operated before shipment. However, during shipment it can get damaged or certain parts might come loose. To ensure you have a smooth installation we recommend Immediately upon receipt of the unit, check carefully for external damage that may have occurred in shipping. In the event of any damage, immediately file a claim with the carrier and notify nano-purification solutions of the damage. The carrier is legally responsible for all damages. After you are assured the unit has not sustained any external shipping damage:

- ☐ Make sure you have received all the crates/packages that are indicated in the packing slip. Remove the crate and packaging.
- ☐ Inspect the unit for any internal damages. If you notice anything, follow the same procedure as above and notify the shipping agency and factory.
- ☐ Check the nameplate and make sure that it is the correct model that you had ordered.
- ☐ Note the equipment Capacity and Power Supply requirements and ensure that they are in accordance with your specifications. The rated conditions of the dryer are indicated on the data plate. If you notice any discrepancy, contact your **nano-purification solutions'** representative.
- ☐ Vibration during shipping can loosen the connections. So inspect all pipe and tubing and make sure they are all tightened and secured.
- ☐ Observe pressure of refrigerant analyzer gauge (suction) to determine if refrigerant has leaked out during transit. If the gauge reading does not match that mentioned on the data plate, immediately contact **nano-purification solutions**.
- ☐ All necessary adjustments are made before shipment.

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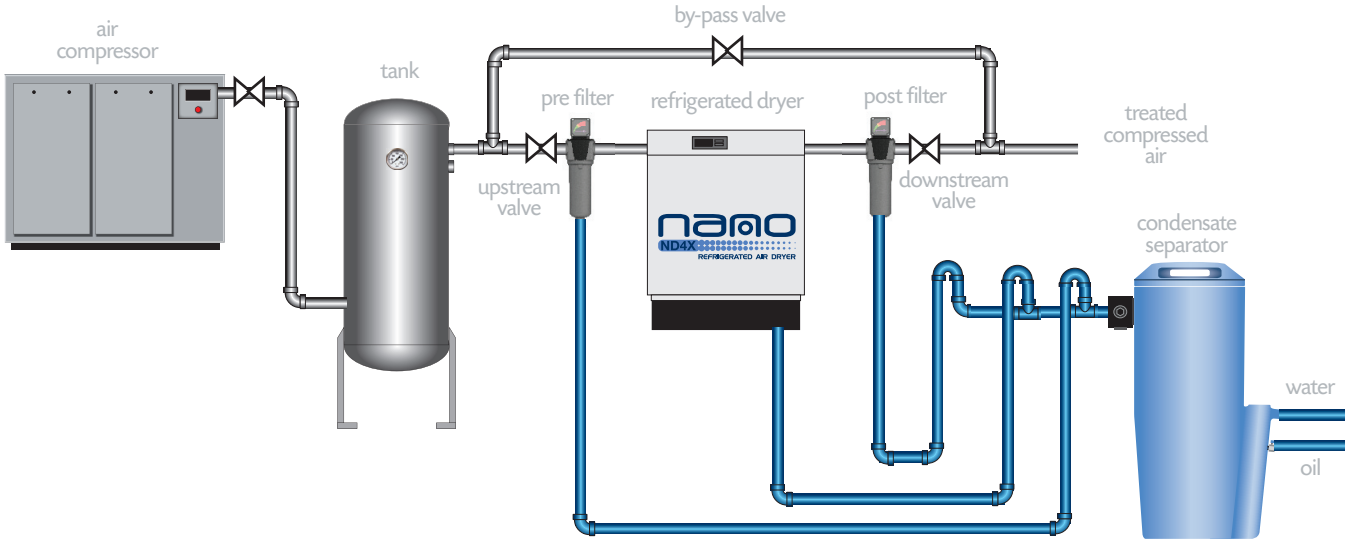
2.1 compressed air installation principle

A backup wrench must be used when tightening air 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 dryer and void warranty.



2.2 machine code identification

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

ND4X XXX - AAA/B/60Hz

- **ND4X** — name of range
- **XXX** — model in the range
- **AAA/B** — electrical supply
  - AAA: voltage in V
  - B: number of phases

2.3 operating principle

Refrigerant is cycled through a closed loop system commonly known as high pressure and low pressure. Refrigerant is compressed by the compressor to a gas with high temperature and high pressure, which then travels to the condenser (air/water cooled) to drop the temperature and change from gas to liquid. Liquid travels through to the evaporator (refrigerant-to-air part of the heat exchanger) and back to the compressor suction side and the process repeats itself. A hot gas by-pass valve is used on the no cycling dryers from the high side to low side as a freeze protector in low load conditions (½ hp and up).

The compressed air dryer circuit uses a specially designed air-to-refrigerant evaporator further reducing its temperature to a desired pressure dew point. As the air is cooled, moisture will be condensed, where it is then separated and discharged through the condensate drain. The cooled air then exit at air outlet to process line

2.4 location

1. Careful consideration should be given to the location of the dryer in order to assure optimum results. Ensure that the load bearing weight of the floor is adequate for the weight of the dryer.
2. The dryer should be located in an open area and a level ground. Dryer can be bolted to the floor to eliminate vibrations.
3. The ambient temperature should be between 40°F and 100°F. Low temperature could affect the dryer process and result in high outlet dew point.
4. In conditions where the ambient drops below freezing, nano-purification solutions recommends the use of heat trace for the equipment. For a nominal price, this feature will ensure that you have trouble free operation during the winter months (the dew point of the outlet air will be consistent)
5. Dryer and accompanying filters should be installed with at least 2~5 feet clearance from the adjoining walls to provide easy access for routine maintenance.

2.5 installation

Only qualified personnel should make electrical and mechanical connections.

FOUNDATION

Dryer should be mounted on a suitably structured flat and level floor or base that is free from vibration. Special care must be used when lifting the dryer to prevent tip-over.

MOUNTING

Bolt dryer to the foundation using the bolt holes provided in the frame.

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PIPING

Connect the inlet of the dryer to the moist gas from the compressor/receiver/inlet filter. Install the Inlet piping and the inlet shut-off valve, Install the Outlet piping and the outlet shut-off valve (a union with a valve by-pass can be installed at the inlet and outlet valves to accommodate isolation of the dryer for maintenance). Compressed air piping has to be at least the same size as that of the inlet and outlet connections of the dryer. Larger pipe sizes can be used with reducers.

BY-PASS

If the dryer is not supplied with optional by-pass valve it is highly recommended that by-pass valve be installed around the dryer and filters. These by-pass shut-off valves will permit the dryer and filters to be removed from the compressed air system for servicing without shutting down the entire compressed air system.

ELECTRICAL

Make all electrical connection to the dryer as shown on the wiring diagram. Special care must be taken in connecting the proper voltage as indicated on the specification sheet and wiring schematic.

NOTE

1. It is mandatory that the dryer be grounded. Use of your plants frame as a ground may cause problems with the control.
2. A fused disconnect is not supplied with this equipment therefore one must be supplied by customer. All electrical fuses, breakers, etc. should be sized correctly.
3. **nano-purification solutions** is not liable for any code violations; component damage, downtime or consequential damage related to customer supplied electrical components and connections by the customer.

2.6 equipment for installation

START-UP PROCEDURE

At any point during the process of start-up or shut down, if you notice anything unusual we recommend you refer to the operation manual immediately. If you cannot find the answer in the troubleshooting section, contact your **nano-purification solutions** representative or the factory at once.
Ensure that the dryer is connected to a suitable compressed air supply. Make sure that the pressure of the supply is equal to the normal operating pressure of the dryer.

BEFORE START-UP

After the installation has been completed, the following items should be checked.

1. Check the pressure reading of the suction gauge to assure that refrigerant has not leaked out.
2. Put “power” switch in the Off position.
3. Check the main electrical supply to insure correct voltage and fuse protection is provided.
4. Check the proper connection and support of compressed air lines to the dryer.
5. Check that inlet air temperature and pressure to the dryer meets the specified requirements.

INITIAL START-UP

1. For dryers up to and including 250 SCFM, turn on the main power switch to the dryer. The power indicating light will be on.
2. For dryers 300 SCFM, and larger, insure that the power switch is in the “off’ position, but the electrical service to the dryer must be energized. This dryer must be in this mode for at least TWO (2) hours to allow the compressor crankcase heater to energize,(DRYER WITH CRANKCASE HEATER ONLY) and evaporate the entire liquid refrigerant from the compressor. After the two (2) hours, turn ON the power switch of the dryer. The power indicating light should turn ON.
3. The dryer is designed to run continually and will not cycle ON/OFF.
4. The gauge readings are 60 - 100 psig.
5. The operation of the dryer is controlled by an automatic expansion valve or a thermostatic expansion valve / hot gas by-pass valve. The valves will open and close automatically depending on the amount of heat load to the evaporator, thus maintaining the desired pressure dew point.

NOTES

1. Models with the hot gas by-pass valves and expansion valves are preset at the factory for the desired dew point. Do not adjust without consulting with the factory.
2. The dryers are fully automatic and do not require any auxiliary controls.
3. The automatic drain trap supplied is standard on the separator and should open regularly and discharge any accumulated water into the drain line. The period between openings varies with the dryer and operating conditions (electronic type).

2.7 automatic drain valve adjustments

To minimize air losses, the timer should be adjusted to open the drain solenoid just long enough to discharge the accumulated condensate. Set the timer so that only air discharges at the end of the open period. Recommended initial settings are (10) seconds drain opening (on time) and a (5) minute close time (off time). If air discharges far more than (2) seconds from the separator discharge, set the timer for a longer cycle time. If liquid discharges as the solenoid is closing, set the timer for a shorter cycle or a longer open time.

FLOAT DRAIN MAINTENANCE

Remove FPT “push in” fitting drain tubing from bottom of float bowl. Using a 7/16”(12mm) wrench on thread flats, “hold” while turning nut counter¬clockwise to remove float from bowl. Wash the float mechanism in warm soapy water (liquid detergent).

Warning: Do not assemble or disassemble the drain mechanism in the filter by holding the float cover.

Warning: Dismantling or working on any component of the compressed air system that is under pressure may cause serious injury. Before dismantling separator/drain trap, filters or any part of the dryer or compressed air system, completely vent the internal pressure to atmospheric pressure.

2.8 operating procedure

After the initial start up, the dryer operation is completely automatic. To understand the details of the operation, we recommend you use the flow diagram and the timing sequence of the dryer.

FAN MOTOR ROTATION

For dryers with an air-cooled condenser, rotation should be in accordance with the fan rotation shown on the details located on top and back of the condenser. Cooling air is drawn through the condenser coils. If the motor rotation is not correct, turn off the power switch and put the main power supply disconnect in the “off” position; lock and tag; check the wiring; correct the wire lead locations; recheck for correct rotation.

COOLING WATER

Cooling water is required for water-cooled refrigerant condensers. The user is responsible for piping the water to and from the condenser; the required water flow rate depends on the water temperature. A water-regulating valve supplied with the dryer automatically adjusts the flow to compensate for variation in water temperature, water pressure, and dryer air load. Cooling water pressure below the temperatures listed in the table may reduce the drying capacity. The refrigerant discharge pressure control will shut down the refrigerant compressor if cooling is inadequate.

NOTE

Water Cooled condensers are pre-set at the factory for city water usage. Water regulating valve may need to be adjusted to other water supply conditions.

2.9 water cooled condenser requirement

refrigeration (hp)	70	80	85	90
½	0.7	1	1.25	1.5
¾	1.1	1.5	1.9	2.25
1	1.5	2	2.5	3
1½	2.2	3	3.75	4.5
2	3	4	5	6
3	4.5	6	7.5	9
4	6	8	10	12
5	7.5	10	12.5	15
6	9	12	15	18
8	12	16	20	24
10	15	20	25	30

NOTE

1. Minimum water pressure is 25 psig for city water and 35 psig for tower water.
2. Maximum water pressure is 125 to 150 psig.

2.10 air cooled condenser requirement

Cooling air must be drawn from a clean source to reduce dust and dirt accumulation on the condenser coils. Air temperature should not exceed 100°F (38°C).

refrigeration (hp)	cooling air flow - cfi (cubic feet of air intake)
⅓	350
½	500
¾	900
1	1125
1½	1300
2	1500
3	2050
4	4000
5	4400
6	6000
8	7650
10	7800

2.11 maintenance

Prior to performing any maintenance on the dryer, all personnel are strongly advised to familiarize themselves with the equipment by reading the entire contents of this operation manual. **nano-purification solutions** strongly recommends the strict adherence of all the safety procedures prior to performing any maintenance activity on the dryer. Refrigerated air dryers require very little maintenance for satisfactory operation. Good performance can be expected if the following routine maintenance steps are taken.

DAILY

1. Always check refrigerant gauges to insure refrigeration system is working properly.
2. Check condensate drain separator for proper condensate discharge. If no discharge is evident then depressurize the unit, dismantle and clean separator and/or drain line. Proper drain trap maintenance is the owner's responsibility. It is not covered by warranty.
3. Make certain airflow is directed through dryer only. Observe by-pass valves proper positions.

WEEKLY

1. Clean the condenser coils of accumulated dust and dirt with a soft brush and/or with air pressure from a compressed air nozzle (maximum 100 psig).
2. Check the gauge readings for good system operation.
3. Check oil removal filter (coalescer) indicator (if applicable), if it is red, then replace the filter.
    A. Depressurize the air system to release the compressed air from the air dryer. (NOTES: Shutting down the air compressor will not depressurize the air dryer unit. Close air line valves before and after dryer and then depressurize unit.)
    B. Remove the filter bowl by turning the bowl 1/4 turn counter clockwise, be sure the O-ring is in place on the top half of the oil filter housing and that the O-ring seats properly. Air leaks may occur if the O-ring is not secure (important).
    C. The same procedure applies when removing the filter separator for changing the element (if applicable).
4. Hot gas by-pass adjustment. Check the refrigerant suction pressure gauge for operation, if it requires adjustments do the following steps:
    A. Do not turn off the dryer. Adjust only when no air is passing though dryer.
    B. Open the top cover to reach the valve.
    C. If the refrigerant suction pressure is below 30 psig (R-134a). Turn the adjustment bolt clockwise (1/8 turn intervals) allow a few minutes for refrigerant to stabilize.
    D. If suction pressure is above 45 psig (R-134a) turn the adjusting bolt counter clockwise.
    E. Let the dryer operate for a few minutes and read the suction pressure gauge. Continue to adjust the valve unit the pressure reads between 30-40 psig for an R-134a unit.

If you are experiencing a problem with your nano-purification solutions refrigerated air dryer, or notice contamination downstream, you generally can identify the problem from one or more of four different sources.

- Electrical
- Refrigeration
- Condensate removal (drains)
- Other

2.12 electrical

A. Make certain that the dryer is connected to proper power supply in accordance with electrical diagram provided.
B. Check electrical breaker/fuse disconnect to determine if there is electrical power to the unit.
C. A quick check should determine if the power switch is turned on and the unit is running.
D. After you have determined that power is supplied to the unit, go to the next step.

CAUTION: Electrical work should always be performed by qualified electrical personnel.

2.13 refrigeration

Always observe refrigerant analyzer gauge(s) to determine if and how refrigeration is operating.

A. ND4X dryers with R-134a refrigerant should read 28¬-40 psig refrigerant suction pressures while unit is running with low or no load.
B. If the refrigerant gauge(s) reads more or less than the above pressures:

➔High refrigerant readings generally indicate:

- Dirty condenser - Clean immediately!
- Overloading - CFM flow more than dryer designed for.
- If high ambient temperature -Provide adequate ventilation for proper cooling.
- Condenser fan(s) not running - Call **nano-purification solutions** customer service.
- Refrigerant control too high - Adjust hot gas by-pass valve (or constant expansion valve) to lower refrigerant pressure to required settings.

➔Low refrigerant readings generally indicate:

- Low ambient temperature - Provide ambient temperatures above 32°F
- Refrigerant control Setting too low - Adjust hot gas by¬pass valve (or constant expansion valve) to raise refrigerant pressure to required settings.
- Loss of refrigerant- Call customer service or qualified refrigeration service

2.14 condensate removal

Your ND4X refrigerated air dryer uses refrigeration to cool the compressed air thus condensing the moisture. The moisture is separated from the dry air and purged out through an automatic drain.

1. If your unit is equipped with automatic drain override switch, push manual override button to test drain flow.
2. Make certain automatic electronic timer (if applicable) is functioning properly make certain moisture separator (and coalescer) drain lines are free from blockage.
3. If your unit is equipped with y-strainer, disassemble and clean.
4. If you notice oil downstream from the dryer:
   - Oil coalescer element is saturated
   - Dryer not turned on during air usage.

2.15 other

Sometimes a water or oil problem downstream from the dryer can be identified by an inadvertent action or inaction by the operator.

- Dryer not turned on before air usage.
- By-pass valves in wrong position.
- Air usage exceeding dryer capacity.
- Oil coalescer element not changed as needed.
- Automatic drains not maintained.

3.1 trouble shooting

The following section briefly discusses the various faults that can occur in the dryer, the reason of the fault and how it can be rectified. If you do not find the solution to your problem, contact your **nano-purification solutions** representative or the factory. All necessary safety and precautionary steps must be followed before attempting to perform any of the recommended measures to resolve any faults in the air dryer. Before any attempt is made to undertake any action, the machine must be shut down. Follow the shut down procedures.

1. Depressurize the unit
2. Check to make sure if the unit has been damaged externally or if any part is missing.
3. Check if there is proper power supply and if it corresponds to that mentioned on the data plate.
4. Check to see if there is power at all the electrical connections in the machine and if it's the required amount.
5. Check if control air is available in the right quantity at all pneumatically operated components
6. Make sure all shut-off valves are in the correct position.
7. Check the Airflow, inlet temperature and pressure and make sure it falls within the operating range .

The dryer consists of three basic systems: Air, Refrigerant, and Electrical.

An air leaks of 100 psig or higher will provide an audible signal indicating where there is a problem. The refrigerant R-134a has no color or odor; therefore a small refrigerant leak is difficult to find. However, it can be detected by the bubble test, halide torch (with a flame that changes from red-orange to blue when in contact with refrigerant) or an electric detector. The electrical system consists of a transformer and a starter for large units, switches, etc. The use of the volt-ohm meter or similar equipment is required for checking continuity, amperage and voltage.

3.2 corrective maintenance

Refer to the table below if your dryer malfunctions.

problem	symptom	cause	solution
Water downstream of dryer	No discharge from separator drain tap	Short-circuited timer	Replacement
		Short-circuited manual override	Replacement
		Defective Solenoid Valve	Replacement
	Liquid/water entering dryer	Cooler trap malfunction or receiver trap malfunction	Dismantle and clean or replace drain
	Compressor goes off/on and cannot maintain suction pressure	Leak in refrigerant system	Locate leak, repair and recharge
		Improper adjustment of hot gas bypass valve	See hot gas adjustment
		Air leaked into refrigeration system	Locate leak, repair and recharge
		High flow rate for small dryer	Check dryer capacity and flow rate
	Compressor stopped	Condenser is dirty	Clean condensing unit and ensure adequate ventilation of unit
		Compressor is overheated	Turn off and wait 20 to 40 minutes, turn on
		Compressor burned out	Replace the compressor
	Unit short cycle	Motor overload cutting out	Check circuitry against electrical wiring. Check for high pressure or for high ambient
		Defective overload protectors	Check cut outs. Replace if necessary
		Low voltage, or 3-phase imbalance	Voltage must be within 8-12% of data plate rating
		Refrigerant shortage	Check for leak, repair and recharge
		Low water flow and pressure to water cooled condenser	Check water pressure and flow
		Shorted motor winding	Check with ohmmeter and refer to motor schematic for correct value. Replace motor

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problem	symptom	cause	solution
Oil downstream of dryer	No discharge from coalescer oil filter trap	Failure of oil-drain trap	Dismantle and clean or replace oil drain
	Oil filter malfunction	Dirty oil filter element	Change filter
		Air compressor injecting too much oil	Check air compressor for oil leak to air system
	Compressor comes on/off and cannot remain at a constant suction pressure	Dryer undersized	Check airflow and dryer capacity. Reduce airlow or replace dryer for bigger size
Low air pressure downstream	High pressure drop	Filter element dirty	Replace element
		Suction pressure below set point. This causes freezing in the air system	Adjust expansion valve for small unit and hot gas bypass for large unit
			Low on refrigerant. Call for service
			To confirm freeze-up, shut off the unit for 20 minutes. Air should come back to line pressure
		Incorrect or restricted piping	Look for restrictions in lines. Check piping to see if it is too small. Replace if needed
Low air pressure downstream	Continuous air flow through the moisture drain line	Foreign material lodged on the solenoid valve seat	Pressure the manual override switch several times
			Disconnect the drain lines to the solenoid valve and blow compressed air from the outlet while pressing the manual override
			Remove and clean the solenoid valve
Noisy unit	Loose mounting of compressor	Dropped in shipping, caused vibrations	Check and tighten
	Loose or bent fan blade	Worn bearing in fan motor or compressor	Straighten, tighten or replace
	Noise from compressor	Flood back (refrigerant overcharged)	Carefully bleed off a little refrigerant until the crankcase is warm to the touch and noise is reduced
			Allow sufficient time for compressor to stabilize following each short bleed-off

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problem	symptom	cause	solution
High head pressure	Compressor is overloaded and gauge is reading out of range	Refrigerant is overcharged	Bleed refrigerant as explained before
		Condenser fouled and dirty	Use compressed air to clean
		Defective fan control	Repair or replace
		Dryer location too hot	Cool ambient air or relocate the unit
		Compressed air leak to refrigeration system	Repair or replace, evaporate and recharge with refrigerant
Low suction pressure	Compressor covered with ice	Hot gas bypass valve out of adjustment or defective	Adjust or replace
		Expansion valve does not feed enough refrigerant to the evaporator	Adjust expansion valve by turning knob counter clockwise for (TXV) and clockwise for automatic expansion valve
		Excessive pressure drop in high side	Check for any restrictions (plugged filter, dryer or receiver)
High suction pressure	Suction gauge reads out of range and water downstream	Hot gas bypass valve out of adjustment	Turn counter clockwise to lower suction pressure to desired reading
		Expansion valve out of adjustment	Turn clockwise to decrease suction pressure for (TXV) valve and counter clockwise for automatic valve
Low head pressure	Head pressure gauge reads below set point	Low ambient temperature	Increase ambient temperature
		Refrigerant shortage	Check for leaks in system, repair and recharge
		Faulty compressor	Repair or replace parts or replace compressor, if necessary
		Low inlet air temperature	Inlet air temperature must be more than 40°F. If it is lower, shut down the unit. Air may still be passed through the unit.

3.3 technical specification

specifications	
power supply	single phase
refrigerant	
type	R134a
chemical composition	HFC
maximum refrigerant pressure (psig)	150
maximum temperature (°F)	110
optimum gauge readings (psig)	28-20
optimum air inlet temperature (°F)	80-100
maximum air inlet temperature (°F)	100
minimum air inlet temperature (°F)	40
optimum ambient temperature (°F)	75
maximum air inlet temperature (°F)	100
minimum air inlet temperature (°F)	32
optimum suction gauge reading (psig)	30-50
maximum suction gauge reading (psig)	150
minimum suction gauge reading (psig)	25
optimum discharge gauge reading (psig)	150
maximum discharge gauge reading (psig)	350
minimum discharge gauge reading (psig)	80
optimum evaporator temperature (°F)	40-50
maximum evaporator temperature (°F)	60
minimum evaporator temperature (°F)	33

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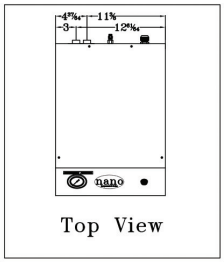
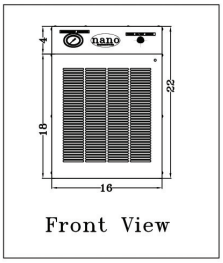
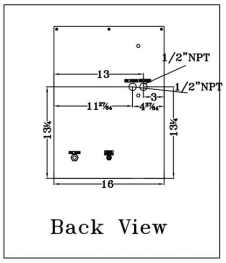
NEMA 4 direct expansion refrigerated air dryer

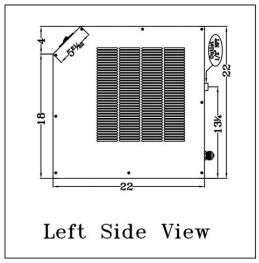
3.4 arrangement drawings

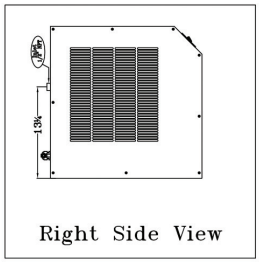
ND4X 30 to ND4X 100

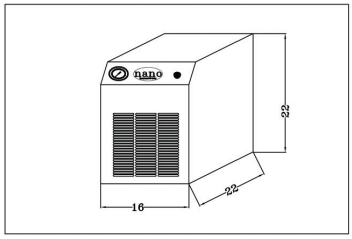








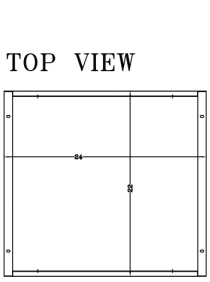


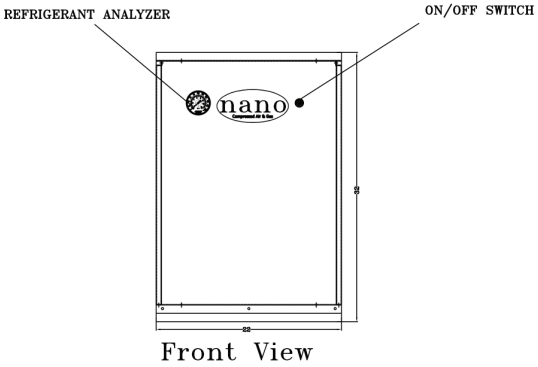


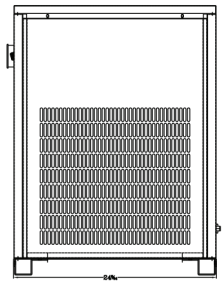
model	dimensions					
	width		depth		height	
	in	mm	in	mm	in	mm
ND4X 30	16	406.4	22	558.8	22	558.8
ND4X 40	16	406.4	22	558.8	22	558.8
ND4X 60	16	406.4	22	558.8	22	558.8
ND4X 80	16	406.4	22	558.8	22	558.8
ND4X 100	16	406.4	22	558.8	22	558.8

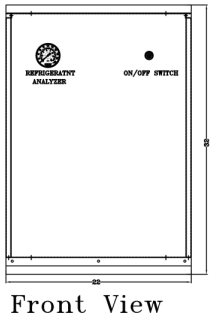
NEMA 4 direct expansion refrigerated air dryer

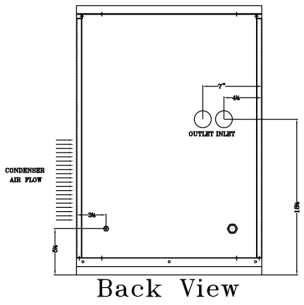
ND4X 125 to ND4X 200







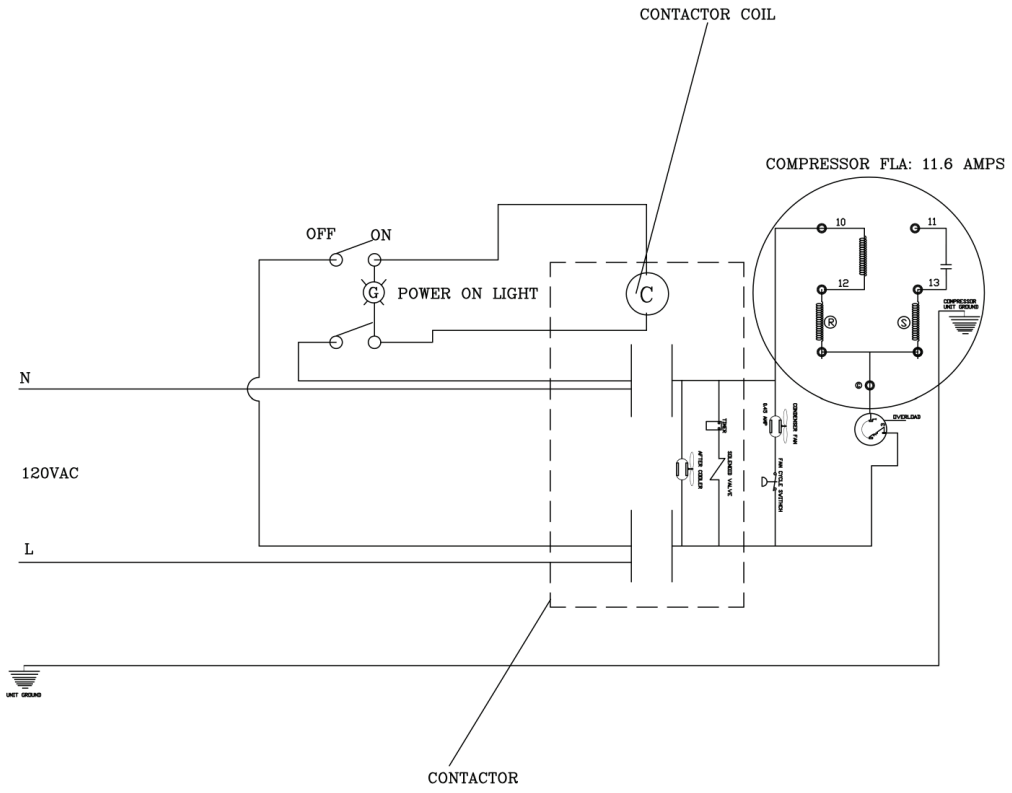




model	dimensions					
	width		depth		height	
	in	mm	in	mm	in	mm
ND4X 125	22	558.8	25	635	32	812.8
ND4X 150	22	558.8	25	635	32	812.8
ND4X 200	22	558.8	25	635	32	812.8

3.5 electrical wirings

ND4X 30 to ND4X 200



3.6 appendixes

reference	power supply	max power installed	full load amps	air connections/ pressure		refrigerant gas	weight
model	60 Hz only	(kW)	(A)	NPT (inch)	max working pressure (psi)	HFC	lbs
ND4X 30	1/115V/60Hz	0.15	7	½"	250	R134a	100
ND4X 40	1/115V/60Hz	0.19	10	½"	250	R134a	120
ND4X 60	1/115V/60Hz	0.25	12	½"	250	R134a	160
ND4X 80	1/115V/60Hz	0.25	12	½"	250	R134a	175
ND4X 100	1/115V/60Hz	0.38	15	1¼"	250	R134a	210
ND4X 125	1/115V/60Hz	0.56	18	1¼"	250	R134a	260
ND4X 150	1/115/260Hz	0.56	18	1¼"	250	R134a	290
ND4X 200	1/208/230/60	0.75	10	1½"	250	R134a	350

4.1 R134a gas chemical safety data sheet

PRODUCT NAME: REFRIGERANT GAS R134a

COMPOSITION/INFORMATION ON INGREDIENTS
CAS No.: 000811-97-2
EEC No.: 212-377-0

HAZARDOUS INGREDIENT(S) CAS No. Symbol R Phrases
1,1,1,2-tetrafluoroethane (HFC 134a) 000811-97-2

HAZARDS IDENTIFICATION
Low acute toxicity. High exposures may cause an abnormal heart rhythm and prove suddenly fatal. Very high atmospheric concentrations may cause anaesthetic effects and asphyxiation.
Liquid splashes or spray may cause freeze burns to skin and eyes.

FIRST-AID MEASURES
The first aid advice given for skin contact, eye contact, and ingestion is applicable following exposures to the liquid or spray. See also TOXICOLOGICAL INFORMATION.
Inhalation: Remove patient from exposure, keep warm and at rest. Administer oxygen if necessary. Apply artificial respiration if breathing has ceased or shows signs of failing. In the event of cardiac arrest apply external cardiac massage. Obtain immediate medical attention.

Skin Contact: Thaw affected areas with water. Remove contaminated clothing. Caution: clothing may adhere to the skin in the case of freeze burns. After contact with skin, wash immediately with plenty of warm water. If irritation or blistering occur obtain medical attention.

Eye Contact: Immediately irrigate with eyewash solution or clean water, holding the eyelids apart, for at least 10 minutes.
Obtain immediate medical attention.

Ingestion: Unlikely route of exposure.
Do not induce vomiting. Provided the patient is conscious, wash out mouth with water and give 200-300 ml (half a pint) of water to drink. Obtain immediate medical attention.

Further Medical Treatment
Symptomatic treatment and supportive therapy as indicated.
Adrenaline and similar sympathomimetic drugs should be avoided following exposure as cardiac arrhythmia may result with possible subsequent cardiac arrest.

FIRE-FIGHTING MEASURES
This refrigerant is not flammable in air under ambient conditions of temperature and pressure. Certain mixtures of this refrigerant and air when under pressure may be flammable. Mixtures of this refrigerant and air under pressure should be avoided.
Certain mixtures of HFCs and chlorine may be flammable or reactive under certain conditions. Thermal decomposition will evolve very toxic and corrosive vapors. (hydrogen fluoride)
Contains may burst if overheated.

Extinguishing Media:	As appropriate for surrounding fire. Water spray should be used to cool containers.
FIre FIghting Protective Equipment:	A self-contained breathing apparatus and full protective clothing must be worn in fire conditions. See Also EXPOSURE CONTROLS/ PERSONAL PROTECTION.

ACCIDENTAL RELEASE MEASURES
Ensure suitable personal protection (including respiratory protection) during removal of spillages. See Also EXPOSURE CONTROLS/PERSONAL PROTECTION.

Provided it is safe to do so, isolate the source of the leak. Allow small spillages to evaporate provided there is adequate ventilation.
Large spillages: Ventilate area. Contain spillages with sand, earth or any suitable adsorbent material. Prevent liquid from entering drains, sewers, basements and workpits since the vapor may create a suffocating atmosphere.

HANDLING AND STORAGE

HANDLING
Avoid inhalation of high concentrations of vapors. Atmospheric levels should be controlled in compliance with the occupational exposure limit. Atmospheric concentrations well below the occupational exposure limit can be achieved by good occupational hygiene practice.
The vapor is heavier than air, high concentrations may be produced at low levels where general ventilation is poor, in such cases provide adequate ventilation or wear suitable respiratory protective equipment with positive air supply.
Avoid contact with naked flames and hot surfaces as corrosive and very toxic decomposition products can be formed.
Avoid contact between the liquid and skin and eyes.
For correct refrigerant composition, systems should be charged using the liquid phase and not the vapor phase.

STORAGE
Keep in a well ventilated place. Keep in a cool place away from fire risk, direct sunlight and all sources of heat such as electric and steam radiators.
Avoid storing near to the intake of air conditioning units, boiler units and open drains.
Cylinders and Drums:
Keep container dry.
Storage temperature (Deg C): < 45

EXPOSURE CONTROLS/PERSONAL PROTECTION
Wear suitable protective clothing, gloves and eye/face protection. Wear thermal insulating gloves when handling liquefied gases.
In cases of insufficient ventilation, where exposure to high concentrations of vapor is possible, suitable respiratory protective equipment with positive air supply should be used.

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NEMA 4 direct expansion refrigerated air dryer

Occupational Exposure Limits

HAZARDOUS INGREDIENT(S)	TWA ppm	TWA mg/m3	STEL ppm	STEL mg/m3	
1,1,1,2- Tetrafluoroethane (HFC 134a)	1000	4240	-	-	OES

PHYSICAL AND CHEMICAL PROPERTIES

Form:	liquified gas
Color:	colorless
Odor:	slight ethereal
Boiling Point (Deg C):	-26.2
Vapor Pressure (mm Hg):	4270 at 20 Deg C
Density (g/ml):	1.22 at 20 Deg C
Solubility (Water):	insoluble
Solubility (Other): soluble in:	chlorinated solvents, alcohols, esters
Vapor Density (Air= 1):	3.66 at bubble point temperature

STABILITY AND REACTIVITY

Hazardous Reactions:	Certain mixtures of HFCs and chlorine may be flammable or reactive under certain conditions.
Incompatible materials:	finely divided metals, magnesium and alloys containing more than 2% magnesium. Can react violently if in contact with alkali metals and alkaline earth metals -sodium, potassium, barium.
Hazardous Decomposition Product(s):	hydrogen fluoride by thermal decomposition and hydrolysis.

TOXICOLOGICAL INFORMATION

Inhalation

High exposures may cause an abnormal heart rhythm and prove suddenly fatal. Very high atmospheric concentrations may cause anaesthetic effects and asphyxiation.

Skin Contact

Liquid splashes or spray may cause freeze burns. Unlikely to be hazardous by skin absorption.

Eye Contact

Liquid splashes or spray may cause freeze burns.

Ingestion

Highly unlikely - but should this occur freeze burns will result.

Long Term Exposure

A lifetime inhalation study in rats has shown that exposure to 50,000ppm resulted in benign tumors of the testis. The increased tumor incidence was observed only after prolonged exposure to high levels, and is considered not to be of relevance to humans occupationally exposed to HFC 134a at or below the occupational exposure limit.

ECOLOGICAL INFORMATION
Environmental Fate and Distribution
High tonnage material produced in wholly contained systems. High tonnage material used in open systems.

Vapor.Persistence and Degradation
Decomposed comparatively rapidly in the lower atmosphere (troposphere). Atmospheric lifetime is 13.6 year(s). Has a Halocarbon Global Warming Potential (HGWP) of 0.30 (relative to a value of 1 for CFC 11) or a Global Warming Potential (GWP) of 1300 (relative to a value of 1 for carbon dioxide at 100 years).

Effect on Effluent Treatment
Discharges of the product will enter the atmosphere and will not result in long term aqueous contamination.

DISPOSAL CONSIDERATIONS
Best to recover and recycle. If this is not possible, destruction is to be in an approved facility which is equipped to absorb and neutralise acid gases and other toxic processing products.

TRANSPORT INFORMATION

UN No.:	3159
AIR	
ICAO/IATA	
-primary:	2.2
SEA	
IMDG	
-primary:	2.2
Marine Pollutant:	Not classified as a Marine Pollutant
Proper Shipping Name:	1,1,1,2-TETRAFLUOROETHANE
ROAD/RAIL	
ADR/RID Class:	2
ADR/RID Item No:	2A
ADR Sin:	3159

REGULATORY INFORMATION
Not Classified as Hazardous to Users.

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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