

CRN-H MAGdrive for Refrigerants

60 Hz, North America

Installation and operating instructions



English (US) Installation and operating instructions

Original installation and operating instructions

These installation and operating instructions describe Grundfos CRN-H MAGdrive.

Sections 1-6 give the information necessary to be able to unpack, install and start up the product in a safe way.

Sections 7-11 give important information about the product, as well as information on service, fault finding and disposal of the product.

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1. Limited warranty

Products manufactured by Grundfos Pumps Corporation (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges that may arise in connection with a warranty claim.

Products which are sold, but not manufactured by Grundfos, are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty.

Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions and accepted codes of good practice. The warranty does not cover normal wear and tear.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of Grundfos' products from which it was purchased together with proof of purchase and installation date, failure date and supporting installation data. Unless otherwise provided, the distributor or dealer will contact Grundfos or an authorized service station for instructions. Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

Grundfos will not be liable for any incidental or consequential damages, losses, or expenses arising from installation, use, or any other causes. There are no express or implied warranties, including merchantability or fitness for a particular purpose, which extend beyond those warranties described or referred to above. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

Products which are repaired or replaced by Grundfos or authorized service center under the provisions of these limited warranty terms will continue to be covered by Grundfos warranty only through the remainder of the original warranty period set forth by the original purchase date.



Prior to installation, read this document. Installation and operation must comply with local regulations and accepted codes of good practice.

2. General information

2.1 Target group

These installation and operation instructions are intended for professional installers.

2.2 Symbols used in this document



WARNING

If these safety instructions are not observed, it may result in personal injury.



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

3. Safety instructions

WARNING



Installing, commissioning, operating and servicing of refrigerant pumps can be associated with risks for life and health of the persons involved, damage to the pump and damage to other property. Therefore these tasks must only be carried out by persons having the competencies required by national rules and regulations for refrigeration systems or similar systems.

WARNING



The tasks of designing, installing, commissioning, operating and servicing a refrigeration system may be individually covered by national and international rules and regulations. Similar rules and regulations may exist for other types of systems using refrigerant pumps. These rules and regulations must always be observed.

WARNING



The pump must be connected to an external power supply located close to the pump and to a motor-protective circuit breaker or a CUE frequency converter.

It must be possible to lock the power supply in position OFF (isolated). Type and requirement are as specified in National Electrical Code and all local codes.

CAUTION



Only pumps in perfect technical condition must be operated. If the pump has visible defects, or if internal defects are suspected, the pump must not be operated. Follow the guidelines for maintenance and service to inspect the pump for defects, or contact your local Grundfos company.

CAUTION



A refrigeration system is a pressurized system containing refrigerants which may be flammable and/or toxic. In addition, components and parts of the system may have extreme temperature - both high and low.

In addition to these requirements, we strongly recommend that all persons involved in installation, starting and servicing the pump have the required competencies, protective equipment and adequate knowledge of the following:

- safe handling of refrigerants
- safe handling of machines and machine parts
- use of protective clothing and other personal safety equipment
- accident prevention
- emergency procedures
- evacuation routes
- the contents of this instruction.

WARNING



Persons with pacemaker or other magnet-sensitive medical devices must not handle this pump. They must keep a distance of at least 3 ft. from the pump, as there is a risk of influence from the magnetic fields of the pump.

Credit cards, computers, watches and other magnet-sensitive objects must not be kept close to the pump.

WARNING



The pump contains powerful magnets that may pose a risk of personal injury when servicing the pump. The pump must therefore only be dismantled and assembled by authorized persons.

If Grundfos is requested to service such a pump, we must be contacted with details about the pumped liquid, etc. before the pump is returned for service. Otherwise, we can refuse to accept the pump for service.

Possible costs of returning the pump are paid by the customer.

4. Receiving the product

WARNING



Generally, a refrigeration system is a pressurized system containing refrigerants which may be flammable and-or toxic. In addition, components and parts of the system may have extreme temperatures, both high and low. Operation and servicing of the pump can therefore be associated with risks for life and health of the persons involved, damage to the pump and damage to other property.

WARNING



Persons with pacemaker or other magnet-sensitive medical devices must not handle this pump. They must keep a distance of at least 3 feet from the MAGdrive, as there is a risk of influence from the magnetic fields of the pump.

Credit cards, computers, watches and other magnet-sensitive objects must not be kept close to the pump.

WARNING



The pump contains powerful magnets that may pose a risk of personal injury when servicing the pump. The pump must therefore only be dismantled and assembled by authorized persons.

WARNING



Electrical work: All electrical work must be performed by a qualified electrician in accordance with the latest edition of national, state, and local codes and regulations.

WARNING



Shock Hazard: A faulty motor or wiring can cause electrical shock that could be fatal, whether touched directly or conducted through standing water. For this reason, proper grounding of the pump to the power supply's grounding terminal is required for safe installation and operation. In all installations, the above-ground metal plumbing must be connected to the power supply ground as described in Article 250-80 of the National Electrical Code.

4.1 Transporting the product

WARNING



When taking out a pump in a system with refrigerant, The pump may be partially filled with refrigerant. If the pump part is in a closed room, the flow of vapor from the pump results in elevated concentrations of refrigerant (above atmospheric level).

This can influence the respiration rate of the occupants and cause nausea and discomfort - even death.

Before transportation or storage of the pump, ensure that it is completely empty (filled with air).

4.1.1 Transportation

During transportation by road, rail, water or air, the equipment must be thoroughly fixed to prevent spontaneous movement.

WARNING



Before attempting to lift or otherwise handle the pump, observe any local regulations that set limits for the weight of components to be lifted manually by individuals; i.e., handled without the use of lifting equipment.

WARNING



Make sure that the lifting bracket is tightened before attempting to lift the pump. Tighten, if necessary. Carelessness during lifting or transportation may cause injury to persons or damage to the pump.

All lifting equipment must be rated for the purpose and checked for damage before any attempts to lift the pump are made. The lifting equipment rating must under no circumstances be exceeded

4.1.2 Delivery



WARNING

A damaged pump must not be installed.

On delivery, the pump and any accessories supplied with it must be checked for transport damage. This also applies when the pump is delivered to the installation site.

If the pump, or any of the pump accessories, has been damaged, contact and inform your local Grundfos company before continuing to install the pump. Do not dismantle a damaged new pump for further inspection, unless instructed by your local Grundfos company.

The packaging material must be disposed of according to local regulations.

4.1.3 Storage

Before storing a pump, make sure that the pump is empty, that is, no liquid is visible in the pump inlet and outlet. If the pump has recently been removed from the refrigeration system, oil and/or water condensate may be present in the pump. If so, remove the appropriate plastic covers or blanking flanges.

Store the pump under the storage conditions specified in the table below:

Transport and long-term storage conditions			
	t [°F]	t [°C]	RH [%]
Minimum	-40	-40	10
Maximum	158	70	95

5. Installing the product

The Grundfos CRN-H MAGdrive pump is completely assembled and tested at the factory. Proper installation assures long life of the pump. Proper installation includes pump mounting, system layout and adequate pump protections. The refrigerant supplied to the pump is to be liquid refrigerant free of vapors and solids.

The pump must be installed horizontally on a plane surface with the outlet connection pointing straight up. Fix the pump so it cannot be moved during startup and operation. Install the pump with easy access for inspection, maintenance and service.

The chamber stack is removed from the pump sleeve as one unit (back pull-out). When selecting the pump location and orientation, ensure that there is enough space behind the pump to allow pump replacement.

In addition, consider the following installation issues:

- Use a drip tray for collection of water condensate from the pump surface if the refrigerant temperature is below the dew-point temperature of the surrounding air. The drip tray is to have a drain connection.
- Clearance or room for buildup of frost (ice) on the pump surface of non-insulated pumps when refrigerant temperatures are below 32 °F (0 °C).

5.1 Foundation

The foundation and installation must be carried out in accordance with the following instructions



The pump must be placed as close to the liquid source as possible. Adequate space for operation and maintenance must be taken into consideration.

We recommend to install the pump on a concrete foundation which is heavy enough to provide permanent and rigid support to the entire pump. The foundation must be capable of absorbing any vibration, normal strain or shock. As a rule of thumb, the weight of the concrete foundation must be 1.5 times the weight of the pump and base plate. The concrete foundation must have an absolutely level and even surface.

Place the pump and base plate assembly on the foundation, and fasten it. The base plate must be supported on the whole area.

See fig. 1.

5.2 Mechanical installation



WARNING

Incorrect or inappropriate installation of the pump may lead to personal injury or death.



We recommend that you always use Grundfos accessories to avoid malfunction due to incorrect installation.



CAUTION

Material damage may occur due to inappropriate mounting of the pump.

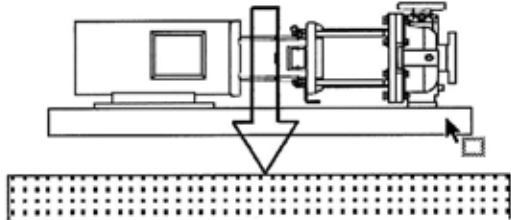


Fig. 1 Correct installation

The foundation must be at least 3 to 6 inches longer and wider than the base plate. The mass of the foundation must be at least 1.5 times the total mass of the pump and base plate assembly. In installations where noiseless operation is particularly important, we recommend a foundation with a mass up to 5 times that of the pump and base plate assembly. The pump may be fastened directly to an existing concrete floor if the floor meets the criteria of a foundation.

To properly hold the base plate to the foundation, proper anchor bolts are required. For proper holding of the base through the foundation, the bolt length must extend from in the foundation, the base height, and 0.25" - 0.50" above the nut. These anchor bolts are embedded in the concrete floor or foundation, and must be positioned according to the bolt manufacturer's instructions. To assist in the proper location of the bolts, a template can be formed. The bolt locations must be double-checked with drawings and base.

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Bolt sleeves can be used to allow final positioning of the bolts. The sleeves are a minimum of 3 times larger than the bolt, and have a length of at least 10 times the diameter. Figure 2 (b) shows the anchor bolt and the bolt sleeve in which it is installed.

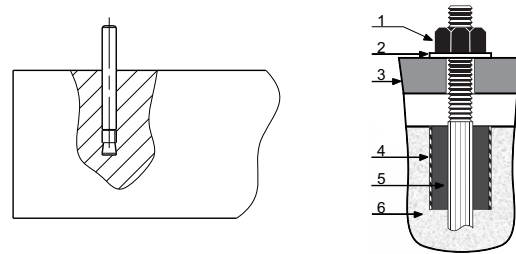


Fig. 2 Bolt in position (a) and bolt sleeve detail (b)

Pos.	Description
1	Nut
2	Washer
3	Base plate
4	Bolt sleeve
5	Non-bonding fill
6	Concrete

When the anchor bolts are in position, the pump can be placed on the foundation. The base plate can now be leveled using shims, if necessary, so that it is completely horizontal. See fig. 3.

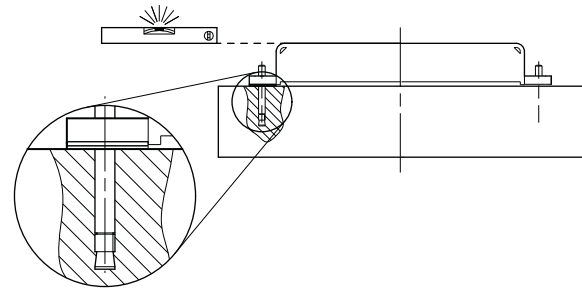


Fig. 3 Alignment with shims

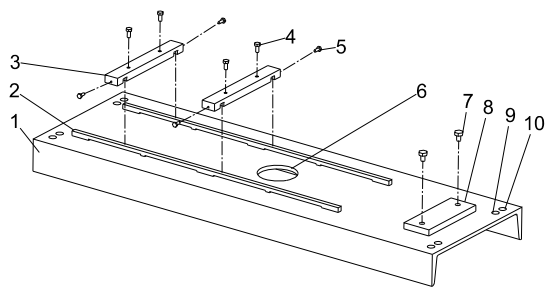
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Mounting on a Grundfos base plate

Check that the Grundfos base plate will fit to your pump model. The base plate is made with adjustable motor mount sliders to accommodate a range of Grundfos CRN-H pumps. See fig. 4. The sliders make it possible to separate the motor from the pump end if service is required. To mount the pump to the base plate, proceed as follows:

1. Install the base plate (1) on the foundation in accordance with the instructions above.
2. If the base plate is grouted, allow grouting sufficient time to dry.
3. Set the motor mount sliders (3) in position on the base plate rails (2).
4. With a hoist, lower the pump until it is almost on the sliders. Make all necessary adjustments to line up all bolts and bolt holes and hand-tighten all bolts.
5. Lower the pump completely onto the base plate, and tighten all bolts to the proper torque (see bolt table).



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Fig. 4 Grundfos base plate

Pos.	Description
1	Base plate
2	Base plate rail
3	Motor mount slider
4	Motor mounting bolt
5	1/4" bolt
6	Grouting hole
7	5/8" bolt
8	Volute mounting pad
9	Hole for lifting hook
10	ANSI mounting hole

5.3 Bolt torques

Motor frame	Bolt size	Bolt torque	
		[ft-lbs]	[Nm]
N/A	1/4" - 20 UNC	7	9.5
56C	5/16" - 18 UNC	14	19
182/184TC	3/8" - 16 UNC	25	34
213/215TC	3/8" - 16 UNC	25	34
254/256TC	1/2" - 13 UNC	62	84
284/286TSC	1/2" - 13 UNC	62	84
324/326TSC	5/8" - 11 UNC	109	148
364/365TSC	5/8" - 11 UNC	109	148

Outdoor installation

When installed outdoors, we recommend that you provide the motor with a rain cover or other shelter.

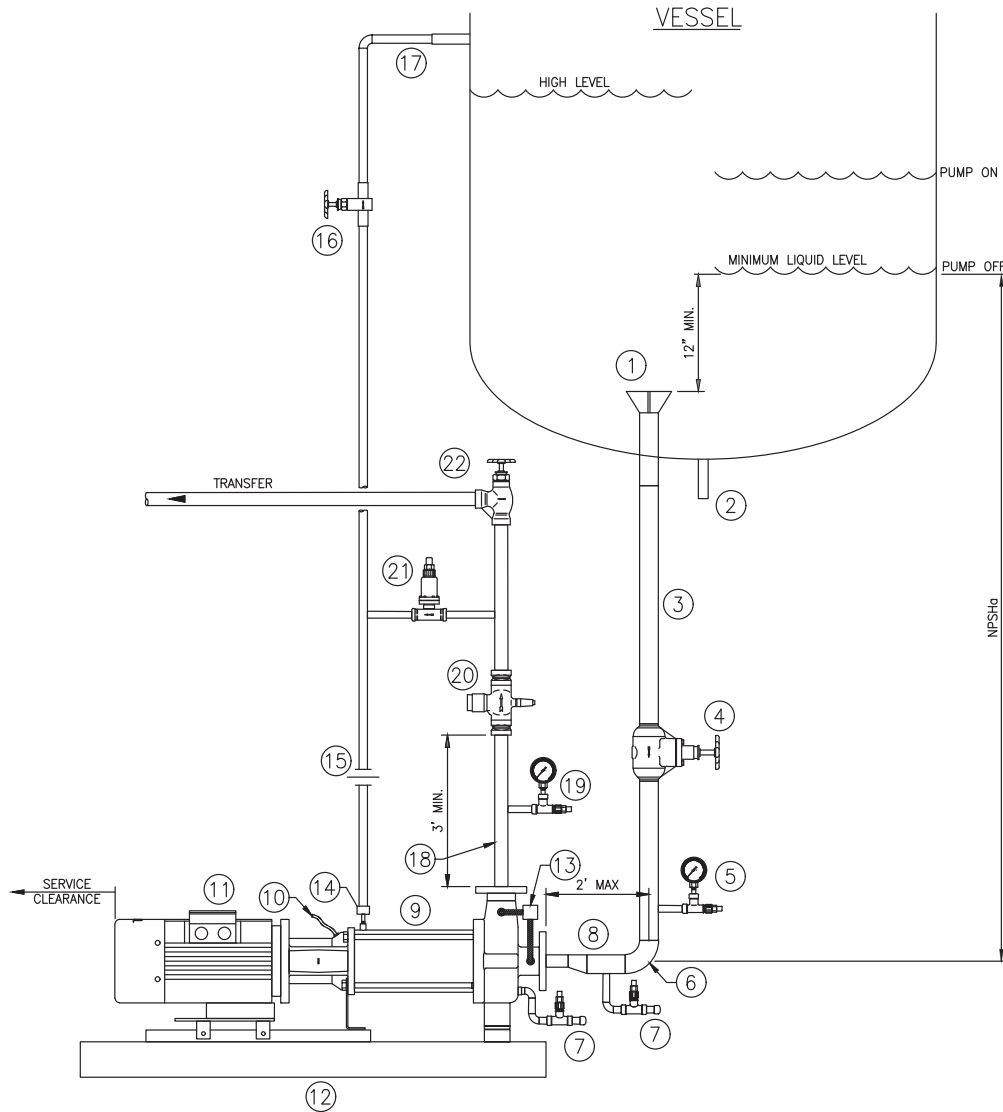
Tightening torques

The table below shows the recommended tightening torques for bolts in flanges.

CR, CRN-H	Torque	
	[ft-lbs]	[Nm]
1s to 5	37-45	50-60
10 to 20	45-52	60-70
32 to 90	52-59	70-80

5.4 System layout

The system designer is ultimately responsible for the system layout.



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Pos.	Description
1	Baffle plate and vortex breaker
2	Vessel - oil drain
3	Inlet pipe
4	Isolation valve
5	Pressure gauge
6	Pipe elbow
7	Drain valve
8	Eccentric reducer
9	Pump
10	Heat tape
11	Motor
12	Base plate
13	Pressure sensors
14	Bypass and Vent adapter
15	Orifice
16	Isolation valve

Pos.	Description
17	Bypass and Vent pipe
18	Outlet pipe
19	Pressure gauge
20	Check valve
21	Pressure relief regulator
22	Isolation valve

The supply of refrigerant to the pump must come directly from a reservoir (separator/receiver/vessel) with a bottom outlet. Do not supply refrigerant through the top or side of the reservoir connected to an internal stem tube.

Supply of refrigerant to pump must not come directly from a pipeline with flow originating from other processes or supplying other types of components.

The location of the drop leg must be placed in an undisturbed section of the reservoir to avoid disturbances to the pump.

The available NPSH in an installation is defined below. It is quantified as the difference in height between the minimum liquid level in the reservoir to the inlet connection of the pump. The reservoir minimum liquid level is 12 inches above the drop leg connection.

The pump requirement for NPSH must be evaluated at the nominal flow rate as a minimum. See example in section [10.1.2 NPSH curve chart](#).

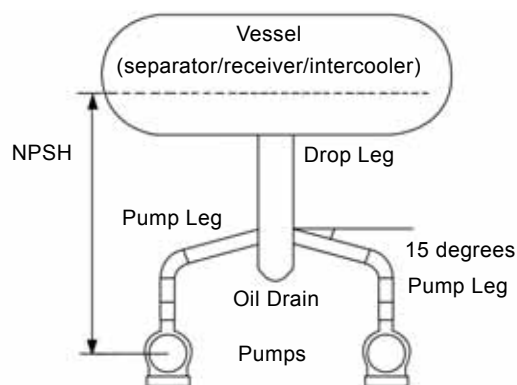


Fig. 5 Preferred design for inlet pipe system, drop leg with one or more pump legs

The lightweight pump design is not suitable for carrying heavy loads from the pipe system. Large temperature and pressure variations are to be expected during startup, operation and service, and the pipe system must be designed for this. Loads from the pipe system must not generate any resulting axial load along the pump axis or any resulting torque around the pump axis.

Allowable flange loading imposed by the piping must be in accordance with HI 9.6.2. Ensure that the maximum allowable forces and torques for the pipe connections are not exceeded.

The pipe system must be designed according to the special requirements for pipe transport of refrigerants that may exist either as a liquid or as a liquid/vapor mixture. Vapor bubbles may form in the pump and in the inlet pipe system during standstill and operation, and they must travel freely away from the pump and back to the reservoir. Avoid designs that prevent back-flow of vapor or can trap vapor.

The following issues must always be considered when designing the pipe system:

- Possibility for sealing off the pump section for service and replacement.
- Possibility for pump evacuation, safe discharging and charging of refrigerant. We recommend that you use the pump drain connection for discharging the refrigerant. The drain has internal thread (1/4" NPT).

All piping is to be flushed before operating the pump.

5.4.1 Inlet pipe

In a single-pump setup, the length of the pipeline from the reservoir to the pump must be as short as possible.

For multiple pumps, the drop-leg and the pump-leg are the two sections of the pipeline, where the drop-leg is shared between all pumps. Make sure that the pump-leg length is as short as possible so that most of the length of the pipeline from the vessel to the pump is made up by the drop-leg. For standby or simultaneous operation, a design with a single large main drop-leg and individual pump-legs is optimal. See [fig. 6](#)

Alternatively, consider individual drop-legs for each pump operating simultaneously. See [fig. 7](#).

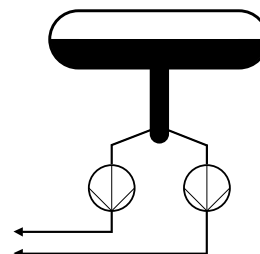


Fig. 6 Piping of pumps in parallel for alternating (standby) or simultaneously operation

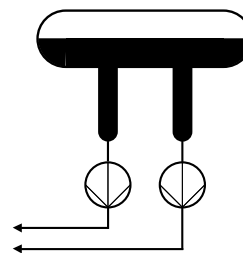


Fig. 7 Piping of pumps in parallel for simultaneous operation

Drop-leg(s) must always include a vortex breaker and horizontal baffle plate in the reservoir outlet.

The continuation of the piping from the drop-leg to multiple individual pump legs must be symmetrical to avoid differences in flow rates/pressure drops and ability for allowing back-flow of vapor.

The dimensioning flow rate must always be the nominal flow rate of the pump or larger. For multiple pumps in parallel, simultaneous operation, the dimensioning flow rate for the common drop-leg is the sum of the individual nominal pump flow rates or larger.

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Drop-leg

Choose the pipe diameter of the drop-leg so that the mean liquid velocity at the dimensioning flow rate is the following:

- 1.0 ft/s for installations with a single pump or multiple pumps that do not operate simultaneously (e.g. standby pumps).
- 0.5 ft/s for installations with multiple pumps operating simultaneously connected to the same drop-leg.
- The velocities listed above allow the entrained bubbles to rise in the drop leg.
- Oil is to be collected from the drop leg or the vessel.

Pump-legs

Select the pipe diameter of the individual pump-legs so that the mean liquid velocity at nominal pump flow rate is the following:

- 1.0 ft/s for HFC's
- 1.6 ft/s for R717 (NH3)

The velocities listed above allow the entrained bubbles to rise in the pump leg.

This prevents the bubbles from entering the inlet port of the pump.

Pump Size	Pump Leg R717	Pump Leg HFCs	Drop Leg (1 pump operating)
CRN-H 3	2.5"	3.5"	3.5"
CRN-H 5	3.5"	4.5"	4.5"
CRN-H 10	4.5"	6.0"	6.0"
CRN-H 15	6.0"	7.0"	7.0"
CRN-H 20	7.05"	8.0"	8.0"

Pipe elbow

Avoid horizontal sections in the drop-leg and the pump-leg(s) by inclining the pipe sections by minimum 15 °F so that the vapor always can flow backwards towards the separator. In case of pipe elbows, the minimum bending radius is 2 times the pipe diameter.

Isolation valves

Place isolation valve(s) in the individual pump-leg(s) that have the same or a larger diameter as the pump-leg. Use valves with a very low flow restriction in fully open position. Place stop valves as close to the pump inlet as possible.

Pump inlet

The reduction of the pipe diameter from pump-leg to the pump inlet must be as smooth as possible and placed as close to the pump inlet as possible. The horizontal run must not exceed 1.5 ft. The reducer installed in the inlet line must be eccentric and must be installed with the flat side on top.

Do not install strainers or filters in the drop-leg or in the pump-leg(s) as they will reduce the available NPSHA and can increase the level of turbulence in the pump inlet. Consider installing strainers or filters on the outlet side of the pump. The inlet pipe is to be insulated along with the reservoir.

Drain valving assists in pump service. The drain valves assist in evacuating system oil and refrigerant.

An inlet pressure gauge is valuable when analyzing proper pump performance.

5.4.2 Outlet pipe

Install a check valve downstream of the pump to prevent back flow and reverse rotation of the pump. Install an isolation valve (for service of pump) downstream of the check valve. Place a pressure relief regulator in between the check valve and the isolation valve.

Pumps installed in parallel must have a check valve in the outlet pipeline. The minimum pressure differential at which the check valve is completely open must be less than 2.2 psi. Place the check valve at least 3 ft. from the pump outlet. Place the outlet isolation valve after the check valve. Place a pressure relief regulator in between the check valve and the isolation valve.

An outlet pressure gauge is valuable when analyzing proper pump performance.

5.4.3 Bypass and vent line

All pumps must have a bypass and vent line from the pump head back to the reservoir.

The bypass and vent line must include an isolation valve that can close the bypass and vent line in case of service. This isolation valve is to be tagged in the open position. Only close this isolation valve during pump service.

Installations with multiple pumps must have individual bypass and vent lines.

The bypass and vent line must be connected to the vapor zone in the inlet tank.

Do not install a check valve on the bypass and vent line. The bypass and vent line must be continuously rising to the inlet tank. The orifice plate must be installed in the vertical line.

The bypass and vent line is required for each pump. Never combine these lines.

The bypass and vent pipe size is listed below for CRN-H pumps with 2 pole motors for refrigerants.

Grundfos pump model	Bypass and vent pipe size
CRN-H 3	3/4"
CRN-H 5	3/4"
CRN-H 10	3/4"
CRN-H 15	1"
CRN-H 20	1"

5.5 Instrumentation

The pipe system must include suitable instrumentation for establishing adequate pump protection. In addition, we recommend that you include the instrumentation required for on-site observation of pump operation and performance.

An outlet and inlet pressure gauge is valuable when analyzing proper pump performance. Furthermore, the pressure gauge can be used to verify that the pump section is not pressurized when beginning service procedures.

If you require pump performance control or remote monitoring of the operating conditions, more instrumentation may be necessary.

CRN-H MAGdrive pumps have stubs for the connection of pressure sensors.

Both the inlet and the outlet have connection pieces for a pressure sensors. These connection pieces have internal threads (1/4" NPT).

5.6 Electrical installation

WARNING



The safe operation of this pump requires that it is grounded in accordance with the National Electrical Code and local codes and regulations. Connect the ground conductor to the grounding screw in the terminal box and then to the ACCEPTABLE grounding point. All electrical work must be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code and local codes and regulations.

WARNING



Check that the supply voltage and frequency correspond to the values stated on the pump nameplate.

The pump must be connected to a motor-protective circuit breaker or a Grundfos CUE frequency converter.

WARNING



The pump must be connected to an external power supply located close to the pump and to a motor-protective circuit breaker or a CUE frequency converter.

It must be possible to lock the power supply in position OFF (isolated). Type and requirements as specified in National Electrical Code and all local codes.

5.7 Motors

Grundfos CRN-H MAGdrive pumps are supplied with heavy-duty, 2-pole or 4-pole (3600 rpm or 1800 rpm), TEFC (totally enclosed fan cooled), NEMA C frame motors.

Motors with other enclosure types and for other voltages and frequencies are available on a special-order basis.

Pumps with 2-pole motors of 18.5 and 22 kW and 4 pole-motors as from 1.1 kW must be started via a soft starter or VFD.

5.8 Field wiring

Conductor sizes must be based on the current carrying properties of conductors required by the latest edition of the National Electrical Code or local regulations. Direct-on-line (DOL) starting is approved due to the extremely short run-up time of the motor and the low moment of inertia of the pump and motor. If DOL starting is not acceptable and reduced starting current is required, use an autotransformer, resistance starter or soft starter. We suggest to use a fused disconnect for each pump in case standby pumps are installed.

5.9 Motor protection

Three-phase motors

CRN-H MAGdrive pumps with three-phase motors must be used with the proper size and type of motor-protective circuit breaker to ensure the motor is protected against damage from low voltage, phase failure, current unbalance and overloads.

Use a properly sized circuit breaker with manual reset and ambient-temperature compensated extra-quick trip in all three phases. The overload protection must be set and adjusted to the full-load current rating of the motor. Under no circumstances must the overload protection be set to a higher value than the service factor current shown on the motor nameplate. This will void the warranty.

Set overload protection for autotransformers and resistance starters in accordance with the recommendations of the manufacturer.

Three-phase motors with a CUE (variable frequency drive) require only fuses as a circuit breaker. They do not require a motor-protective circuit breaker. Check for phase unbalance.



CAUTION

Standard allowable phase unbalance is 5 %.

5.10 Frequency converter operation

The Grundfos CRN-H MAGdrive pumps are designed for operation with variable speed for pump performance control.

If variable-speed operation is desired, we recommend that you use a Grundfos CUE frequency converter. In addition to variable-speed control, CUE has special features that can be used to perform all of the protective tasks required for CRN-H MAGdrive pumps (see section 7.1 Pump operation protection). Contact your local Grundfos company for more information about the use of CRN-H MAGdrive pumps with CUE frequency converters.

The use of frequency converters may result in increased acoustic noise from the motor. Furthermore, it may expose the motor to detrimental voltage peaks. Both these disturbances can be eliminated by fitting a filter between the frequency converter and the motor.

The wires in the terminal box must be as short as possible. The exception is the ground wire which must be so long that it is the last wire to be disconnected in case the cable is inadvertently pulled out of the cable entry.

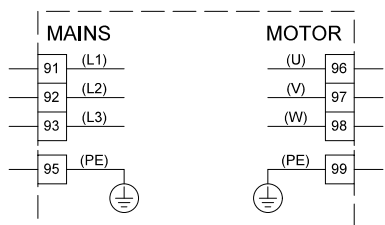


Fig. 8 Wiring diagram, three-phase mains connection

Terminal	Function
91 (L1)	Three-phase supply
92 (L2)	
93 (L3)	
95/99 (PE)	Ground connection
96 (U)	Three-phase motor connection, 0-100 % of mains voltage
97 (V)	
98 (W)	

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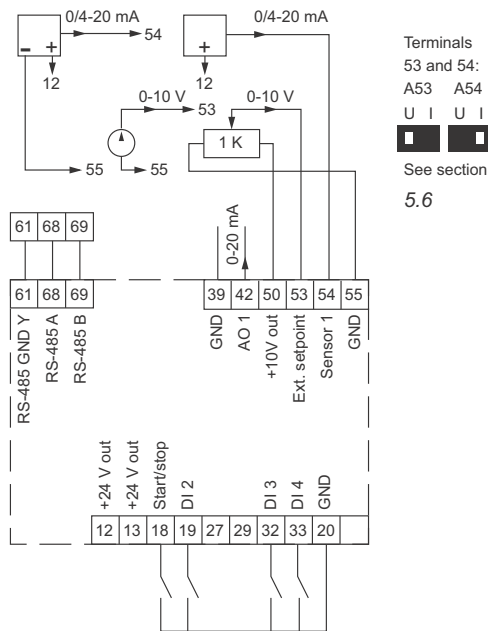


Fig. 9 Wiring diagram, signal terminals

Terminal	Type	Function
12	+24 V out	Supply to sensor
13	+24 V out	Additional supply
18	DI 1	Digital input, start-stop
19	DI 2	Digital input, programmable
20	GND	Ground for digital inputs
32	DI 3	Digital input, programmable
33	DI 4	Digital input, programmable
39	GND	Ground for analog output
42	AO1	Analog output, 0+20 mA
50	+10 V out	Supply to potentiometer
53	AI 1	External setpoint, 0-10 V / 0/4-20 mA
54	AI 2	Sensor input, sensor 1, 0/4-20 mA
55	GND	Ground for analog inputs
61	RS-485 GND Y	GENibus, GND
68	RS-485 A	GENibus, signal A (+)
69	RS+485 B	GENibus, signal B (-)

Note: Terminals 27, 29 and 37 are not used.

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Operation is only possible when terminals 18 and 20 are connected, for instance by means of an external on/off switch or a short wire.

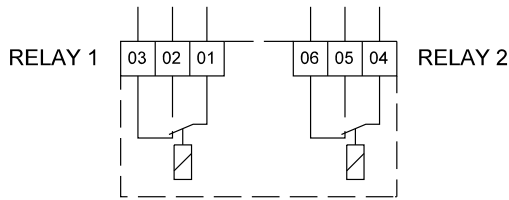
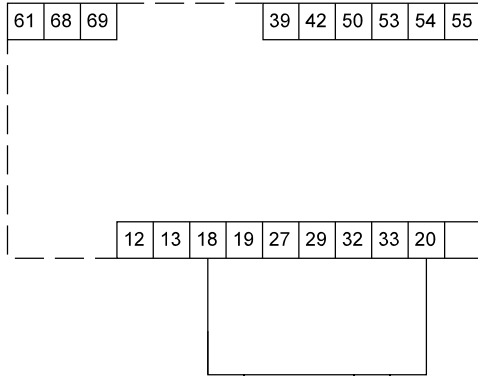


Fig. 10 Terminals for signal relays in normal state (not activated)

Terminal	Function
C 1 C 2	Common
NO 1 NO 2	Normally open contact
NC 1 NC 2	Normally closed contact

5.10.1 Wiring diagram, MCB 114

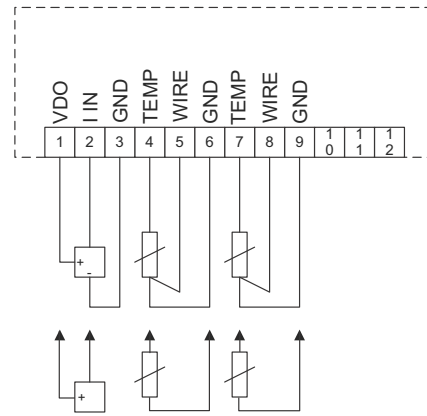


Fig. 11 Wiring diagram, MCB 114

Terminal	Type	Function
1 (VDO)	+24 V out	Supply to sensor
2 (I INVDO)	AI 3	Sensor 2, 0/4-20 mA
3 (GND)	GND	Ground for analog input
4 (TEMP)	AI 4	Temperature sensor 1, Pt100 / Pt1000
5 (WIRE)		
6 (GND)	GND	Ground for temperature sensor 1
7 (TEMP)	AI 5	Temperature sensor 2, Pt100 / Pt1000
8 (WIRE)		
9 (GND)	GND	Ground for temperature sensor 2

Terminals 10, 11 and 12 are not used.

A liquid level switch is to be connected to terminals 18 and 20. The pump will turn on when the contact is closed.

Relay 1 is pump running: Terminals 1 and 2

Relay 2 is Alarm: Terminals 4 and 5

Outlet pressure sensor: Terminals 12 (brown wire) and 54 (black wire) inlet pressure sensor: Terminals 1 (brown wire) and 2 (black wire) of the MCB114. Terminal A54 set to I prior to power connection to CUE. See power supply to CUE and motor above.

For further information, see the separate installation and operating instructions supplied with the Grundfos CUE frequency converter.

5.11 Self regulating heat tape

Connect 1/60/120 power to the Danfoss self regulating heat tape.

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TM03 8801 2607

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6. Starting up the product

During the process of welding or brazing the refrigerant pipe system, impurities in the form of welding beads, burrs and grinder disc fibers may be caught inside the pipes.

Clean the pipe system thoroughly from all impurities before installing and starting the pump. Impurities can cause bearing damage.

Always evacuate an installed pump before charging with refrigerant. The pump must be completely filled with liquid refrigerant before it is started. Do not allow dry running of the pump, even for a few seconds.

6.1 Initial startup



Motors must not be run unloaded or uncoupled from the pump at any time. Damage to the motor bearings may occur.

The initial startup procedure for the CRN-H MAGdrive pump with liquid refrigerant is detailed below. The pump is to be properly installed and all electrical work completed (but not powered up). Repeat this procedure for standby pumps.

1. Check for refrigerant leaks by pressurizing the pump and piping.
2. Open the valve in the vent bypass line and the pump inlet valve.

The pump outlet valve is to remain closed. The refrigerant level in the inlet tank must be above the minimum liquid level.

Liquid refrigerant will fill the pump from the inlet pipe. The ammonia vapors will rise through the vent bypass line.

Allow the pump to frost over. It may take over an hour.

The pump is designed to pump liquid refrigerant not vapors. Pump damage will occur if the pump is not properly supplied with liquid refrigerant.



3. Verify the variable frequency drive is not powered up. Remove the coupling guard from the pump and confirm the motor shaft spins freely. Replace the coupling guard. The motor shaft must spin freely before proceeding to the next step.
4. Follow the wiring diagram on the motor nameplate for the correct motor wiring combination which matches your supply voltage. Once this has been confirmed, connect the power supply wiring to the motor.
5. Connect power to the frequency converter. Follow the frequency converter setup process (including the basic parameter setting and correct direction of rotation) which is guided. The frequency converter will typically test both directions of rotation and automatically determine the right one. The pump family for the refrigerant pump is RC. The direction of rotation is determined by the resulting phase order of the power supply wiring. The CRN-H MAGdrive pumps rotate counterclockwise when viewed from the fan of the motor. If the pump is noisy, remove the power from the motor immediately. The outlet pressure will fluctuate initially and then remain steady. After programming CUE, copy the settings to the Grundfos local control panel. Test the pump protections (section [6.2 Pump protection](#)) while operating on the bypass line, before proceeding to step 6.
6. Continue operating the pump and slowly open the pump outlet valve. The outlet line will fill with liquid refrigerant.

The pumps are refrigerant-lubricated and do not require any external lubrication or inspection.

The motors may require periodic lubrication as noted in section [8. Servicing the product](#).

Under no circumstances must the pump be operated for any prolonged periods of time without flow through the pump. This can result in motor and pump damage due to overheating.

6.2 Pump protection

All pump protection functions must be verified before you complete the startup. The best method for testing the protection functions must be determined depending on the installation. The following general guidelines for testing the protection functions.

- Too low flow - close the outlet isolation valve and let the pump operate on its bypass alone. Note the motor supply frequency and the pump differential pressure. Use the pump performance curve to verify that the operating condition falls inside the acceptable operating envelope.
- Too low head - Close the inlet isolation valve to force operation with too low head. Verify that the pump is stopped after about 20 seconds from the time the valve is closed.

Manually stop the pump, if the pump does not turn off in about 20 seconds.

- Too low NPSH - activate the liquid level switch and verify that the pump stops immediately.

In case other protection functions have been established they must also be tested before the pump is put in regular operation.

7. Product introduction

Grundfos CRN-H MAGdrive is a 100 % leakage-free, sealless pump. The motor torque is transmitted to the pump shaft by means of magnetic force.

The Grundfos CRN-H MAGdrive pumps are designed for operation with the most common refrigerants in modern refrigeration systems.

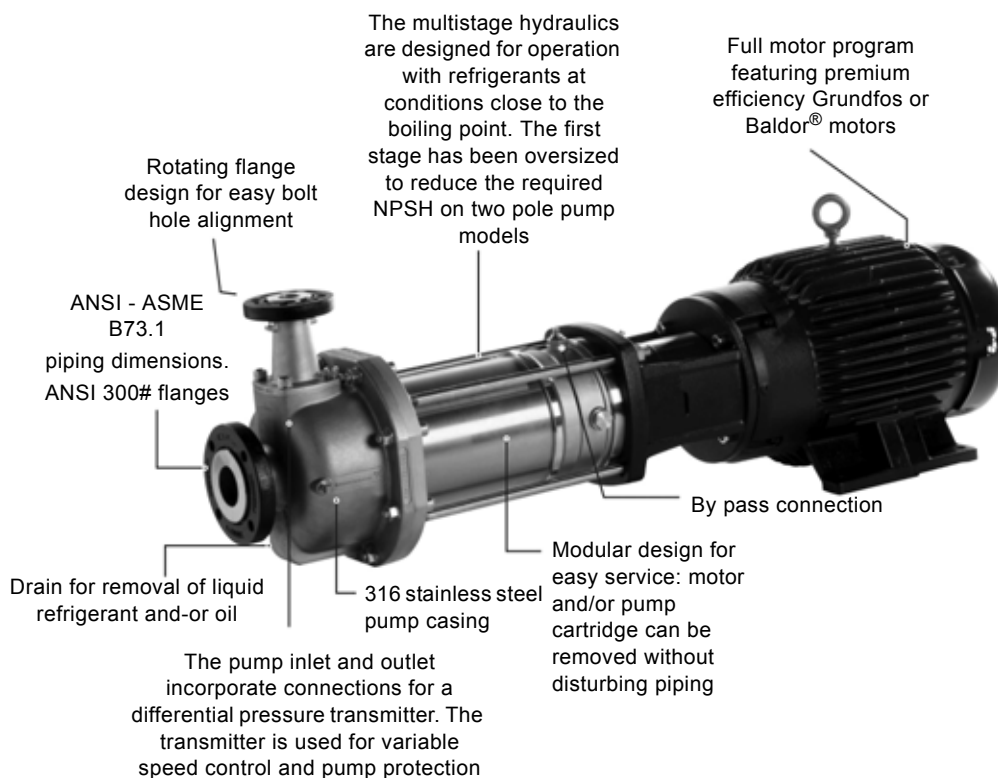
The approved refrigerants are as follows:

- R717 (NH₃, ammonia),
- R134a
- R290
- R404A
- R407C
- R410A
- R507A
- R22.

R744 (CO₂, carbon dioxide) is not an approved refrigerant for the CRN-H MAGdrive pump.

Each pump is individually tested at the factory prior to shipment.

Main characteristics of the CRN-H MAGdrive pump design:



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7.1 Pump operation protection

CR-H MAGdrive pumps must not operate at conditions outside the operating range. Protection functions will either control operation or stop the pump if the limits for the operating conditions are exceeded.

7.1.1 Low flow (bypass) protection

Minimum flow rate through the pump is 10 % of the nominal flow rate. Protect the pump against operation with too low flow by installing a bypass and vent line. The bypass and vent line must be connected in the following way:

- to the pump head
- to a reservoir using a dedicated bypass connection.

Install a flow restriction of permanent (orifice) type in the bypass and vent line. The pressure drop of the flow restriction must allow the minimum pump flow rate through the bypass and vent line:

- For variable speed pumps, the pressure drop is the differential pressure setpoint.

The bypass and vent line flow is not to be controlled with a solenoid valve. The bypass and vent line vents the pump when the pump is not operational.

7.1.2 Low head protection

Generally, the minimum differential pressure is to be 10 psi below the setpoint differential pressure. The absolute minimum differential pressure is 20 % of the closed-valve pressure at 60 hz.

The maximum pump head can be found on the pump performance curve.

Stop the pump if the pressure difference becomes lower than the minimum pressure difference allowed for a maximum of 20 %. Automatic restarts are allowed after a stand still period of minimum 90 %. Limit the number of consecutive automatic restart attempts to five.

7.1.3 Available NPSH protection

Ensure that the required NPSH (NPSHR) is available under all operating conditions. Install a liquid level switch or transmitter in the separator at a minimum liquid column height corresponding to the NPSHr plus 2 ft. Add the switch function of this device to the pump safety chain (terminals 18 and 20). Stop the pump immediately if the liquid level becomes too low.

7.1.4 High motor current protection

Protect the pump motor from operating with too high motor current during startup or during regular operation. Program the variable frequency drive to stop the pump immediately if the motor current is too high.

In order to ensure the optimum protection of the MAGdrive motor, the motor protection must be set in accordance with the following guidelines:

1. Set the overload protection to the rated service factor current of the motor.

7.1.5 High/Low motor speeds protection

When operating the pumps with variable speed using a frequency converter, limit the minimum and maximum motor supply frequencies.

For pumps designed for 60 Hz operation the motor supply frequency must be between 30 Hz and 60 Hz.

When controlling the pump speed according to constant differential pressure, the minimum motor supply frequency must be above 30 Hz.

7.1.6 Other relevant protection functions

Other special protection functions may be required to prevent operation of pumps at conditions that can damage the pump. The need for further pump protection must be evaluated according to the application.

Maintain a stable reservoir or vessel pressure by limiting the maximum pull-down rate.

Limit the temperature pull-down rate of the reservoir or vessel during pump operation to 1.1 F/min. Prevent pumps from operating when the separator pressure is more than 9 °F above the system setpoint.

Dry running

Prevent pumps from operating at conditions where there is a risk of dry running.

7.1.7 Operation

During regular operation the pump protection functions will keep the pump within its acceptable range. If one or more of the protection functions are activated the root cause must be investigated and found. Failure to find the root cause for the pump stop may result in damages to the pump.

For some new system types it is customary to inspect strainers and components after the first 100 hours of operation and clean the strainers to prevent them from reducing or blocking the flow.

Depending on the conditions and operating time, make the following checks at regular intervals:

- Check that the pump meets the required performance and is operating smoothly and quietly.
- Check that there are no leaks.
- Check that the motor is not overheating.
- Remove and clean all strainers or filters in the system.
- Check that the tripping function of the motor overload protection works.
- Check the operation of all controls.

The pump shaft must be manually rotated or run for short periods of time at monthly intervals if the pump is out of service.

7.2 Applications

The Grundfos CRN-H MAGdrive pumps have been designed for the circulation or distribution of liquid refrigerant to evaporators in commercial and industrial refrigeration systems. In addition, the pumps can be used for liquid pressure boosting (LPB) in systems operating with low condensing pressures. The pumps can also be used for the transfer of liquid refrigerant between vessels.

Main applications

- Liquid distribution (LD) to a network of liquid overfeed or direct expansion (DX) evaporators.
- Liquid pressure boosting (LPB) in the liquid line of refrigeration systems.
- General liquid transfer (LT) in refrigeration systems.

7.3 Benefits

The benefits of the CRN-H MAGdrive pumps are:

Easy integration into the existing system design

The back-pull-out design of the pump reduces the requirement for free space around the pumps. Stack assembly can be removed without disturbing piping.

- ANSI/ASME B73.1 piping dimensions. ANSI 300# flanges
- Due to the low requirement for NPSH, it is easy to integrate the pump into existing system designs.
- Rotating flange design for easy bolt hole alignment.

The most energy efficient solution

- Full motor program featuring premium efficient Baldor motors.
- Variable speed performance control to match the pump performance to the actual demand.
- Differential pressure sensor connected to pump inlet and outlet.
- No need for the loss generating Q-MAX orifice.

Very reliable and robust

- Designed for use with R717 (NH₃) and selected HFCs in various types of commercial and industrial refrigeration systems.
- 316 stainless steel pump casing.
- Drain for removal of liquid refrigerant and/or oil.

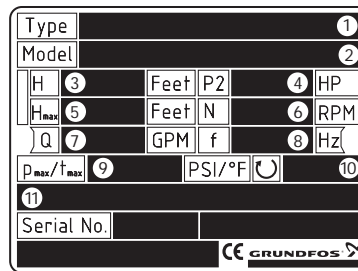
Low service cost

- Fast replacement with the Stack concept.

Further significant benefits can be achieved when using the pump together with a Grundfos CUE frequency converter. In addition to variable speed performance control, the CUE frequency converters also establish all the required pump protection functions. See section [7.1 Pump operation protection](#).

7.4 Identification

7.4.1 Nameplate



Example of nameplate CR, CRI, CRN, CRT

Pos.	Description
1	Type designation
2	Model, material number, production number
3	Head in feet at rated flow rate
4	Rated motor hp
5	Head at zero flow
6	Rated rpm
7	Rated flow rate
8	Rated frequency
9	Maximum pressure and maximum liquid temperature
10	Direction of rotation
11	Production country

Specification of the model line in nameplates:

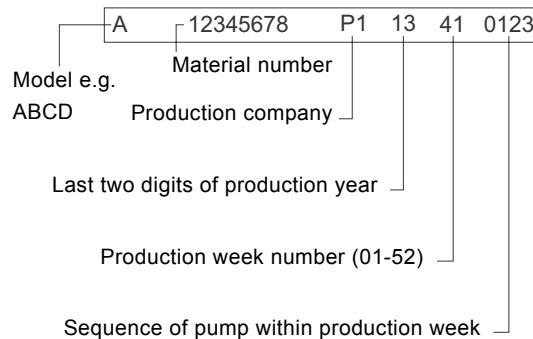


Fig. 12 Key to model line in nameplates

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7.4.2 Type key

Type key for CR, CRN 1s, 1, 3, 5, 10, 15 and 20 H

Example	CR	3-	10	H-	X-	X-	X-
Pump range: CR, CRN							
Rated flow rate in m ³ /h (x5 = GPM)							
Number of impellers							
Code for pump version H: Horizontal pump							
Code for pipe connection							
Code for materials							
Code for rubber pump parts							

Type key for CR, CRN 32, 45, 64 and 90 H

Example	CR	32	-2	-1	H-	X-	X-	X-
Pump range: CR, CRN								
Rated flow rate in m ³ /h (x5 = GPM)								
Number of stages								
Number of impellers with reduced diameter								
Code for pump version H: Horizontal pump								
Code for pipe connection								
Code for materials								
Code for rubber pump parts								

Codes

Example	H	-GA	-A	-E
Pump version				
A				
B				
E				
F				
H				
I				
J				
K				
M				
N				
P				
T				
X				
Pipe connection (inlet x outlet)				
GA				
GB				
GC				
G05				
G10				
G20				
G30				
G40				
G50				
G60				
G70				
G22				
G33				
G44				
Materials				
A				
D				
G				
GI				
I				
II				
K				
S				
X				
Rubber pump parts				
E				
F				
K				
V				

* If a pump covers more than two pump versions, the code for the pump version is X. X also indicates special pump versions not listed above.

8. Servicing the product

8.1 Maintaining the product



WARNING

Switch off the power supply and lock the power supply in position OFF before starting maintenance work on the pump.

WARNING

The system must be evacuated before dismantling the pump.

Before dismantling the pump, close the stop valves on either side of the pump.



Do not close valves that seal off a pipe section unless that section is protected by a pressure-limiting device (e.g. a safety valve). Expansion of trapped liquid refrigerant in a pipe section without pressure-limiting devices can lead to bursting of pipes or components. Refrigerants can be flammable and/or toxic and must be recollected.

CAUTION



O-rings in contact with refrigerants often change dimensions and therefore will not fit correctly into the O-ring grooves. When dismantling a pump that has been in contact with refrigerants, the O-rings must be replaced.

WARNING



When emptying and evacuating a system containing a liquid refrigerant, the refrigerant boils and absorbs heat from the parts it is in contact with. As heat is absorbed, the temperature of these parts drops significantly. Once the evacuation is completed, the temperature of the parts can remain low for a period of time. If a pump is to be removed from a system that has just been evacuated, use extreme caution, protective clothes (e.g. thermal gloves, safety glasses), and avoid touching the internal parts until the temperature is close to the ambient temperature.

WARNING



Elevated concentrations of refrigerants (above atmospheric level) can influence the respiration rate of persons and cause nausea and discomfort. Transportation and-or storage of a pump, motor and chamber stack or pump sleeve containing refrigerant-in a closed environment (e.g. the cabin of an automobile) must be avoided.

The CRN-H MAGdrive pump is essentially maintenance-free. During operation, there is no need to dismantle the pump to inspect the pump parts as long as no problems have occurred. If it becomes necessary to dismantle and inspect or replace the pump, the operation is easy, as the pump volute can remain connected to the pipe system. There is no need to open the flange connections between the volute and the inlet and outlet pipes. The only reasons for dismantling the pump are the following:

- impeller is blocked.
- replacement of chamber stack or MAGdrive components.

In case of mechanical or electrical failure, contact your local Grundfos company for ordering replacement parts.

8.2 Motor inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every three months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps must be performed at each inspection:

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper, pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use an ohmmeter ("Megger") periodically to ensure that the integrity of the winding insulation has been maintained. Record the ohmmeter readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight. In the case of seasonal operation (motor is idle for more than six months of the year), we recommend that you grease the motor when the pump is taken out of operation.

8.3 Motor lubrication

Electric motors are pre-lubricated from factory and do not require additional lubrication before startup.

Motors with grease fittings must only be lubricated with approved types of grease (see table below). Do not overgrease the bearings. Overgreasing will cause increased bearing heat and may result in bearing and motor failure. Do not mix petroleum grease and silicon grease in motor bearings.

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the following:

- The type of grease.
- The size of the bearings.
- The speed at which the bearings operate.
- The severity of the operating conditions.

Good results can be obtained if you use the following recommendations in your maintenance program. It must also be noted that pumps with more stages, pumps running to the left of the performance curve and certain pump ranges may have higher thrust loads. Pumps with high thrust loads must be greased according to the next service interval level.

Severity of service	Maximum ambient temperature	Environment
Standard	+104 °F (+40 °C)	Clean, little corrosion
Severe	+122 °F (+50 °C)	Moderate dirt, corrosion
Extreme	> +122 °F (+50 °C) or class H insulation	Severe dirt, abrasive dust, corrosion

8.4 Motor lubrication schedule for motors with grease fittings

New motors that have been stored for a year or more must be regreased.

NEMA/ (IEC) Frame size	Service interval			Grease to add	
	Standard	Severe	Extreme	Weight	Volume
	[hrs]	[hrs]	[hrs]	[OZ./g]	[In ³ /tsp]
Up through 210 (132)	5500	2750	550	0.3/8.4	0.6/2
Over 210 through 280 (180)	3600	1800	360	0.61/ 17.4*	1.2/3.9*
Over 280 up through 360 (225)	2200	1100	220	0.81/ 23.1*	1.5/5.2*
Over 360 (225)	2200	1100	220	2.12/ 60.0*	4.1/13.4*

* The grease outlet plug must be removed before adding new grease.

8.5 Procedure

CAUTION



To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact Grundfos, the motor manufacturer or an authorized service center for additional information. Mixing dissimilar grease is not recommended.

1. Clean all grease fittings. If the motor does not have grease fittings, the bearings are sealed and cannot be greased externally.
2. If the motor is equipped with a grease outlet plug, remove it. This will allow the old grease to be displaced by the new grease.
3. If the motor is stopped, add the recommended amount of grease. If the motor is to be greased while running, a slightly greater quantity of grease will have to be added.

If new grease does not appear at the shaft hole or grease outlet plug, the outlet passage may be blocked. At the next service interval, the bearings must be repacked.



Add grease slowly taking approximately one minute until new grease appears at the shaft hole in the end plate or grease outlet plug.

Never add more than 1-1/2 times the amount of grease shown in the lubrication schedule.

4. For motors equipped with a grease outlet plug, let the motor run for 20 minutes before replacing the plug.

8.6 Dismantling, preparation and assembly of pump

Before dismantling the pump, check that the following is available:

- A copy of these installation and operating instructions and the manuals below.

L-SM-DR-103	CRN-H 1s, 1, 3 / 5 Dismantling / Reassembly
L-SM-DR-102	CRN-H 10, 15 / 20 Dismantling / Reassembly
96752461	CRN MAGdrive Service Instructions

- Correct tools:
 - Extra set of O-rings
 - Safety equipment (e.g. protective gloves and glasses) according to the refrigerant and local regulations for service of refrigeration equipment.

8.7 Spare parts and accessories

Grundfos offers an extensive parts list for each CR pump model. A parts list typically covers the following items:

- a diagram of pump parts which we recommend to have on hand for future maintenance
- a list of prepacked service kits covering the pump components most likely to be exposed to wear over time
- complete chamber stacks needed to replace the rotating assembly of each model.

These parts lists are available separately from the Grundfos literature warehouse or as a set with extensive service instructions in the Grundfos CR Service Manuals.



Fig. 13 Prepacked chamber stack kits



Fig. 14 Prepacked flange kits

Grundfos offers an extensive list of spare parts for CR pumps. For a current list of these parts, see Grundfos All Product Spare Parts/Service Kits Price List, part number L-SK-SL-002.

8.8 Contaminated products

WARNING



Minor or moderate personal injury
Flush the pump thoroughly with clean water and rinse the pump parts in water after dismantling.

The product will be classified as contaminated if it has been used for a liquid which is injurious to health or toxic.

If you request Grundfos to service the product, contact Grundfos with details about the liquid before returning the product for service. Otherwise, Grundfos can refuse to accept the product for service.

Any application for service must include details about the liquid. Clean the product in the best possible way before you return it. Costs of returning the product are to be paid by the customer.

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9. Fault finding the product

Observation	Description	Possible causes
1. The available differential pressure is lower than anticipated.	The pump is operating, it builds up a differential pressure > 3 psi (0.2 bar), but it is unable to build up a differential pressure to the anticipated level.	<ul style="list-style-type: none"> a) The direction of rotation is wrong. b) Insufficient pressure drop in pipe system. c) Pump performance reduced due to vapor bubbles (gas) in inlet. d) Pressure drop in outlet pipe, fittings and check valve. e) The speed is too low (variable-frequency operation). f) The pump is filled with oil (low temperature, especially in NH₃ systems). g) Electrical failure (working on only two phases). h) Mechanical failure (noise is heard).
2. The available differential pressure is higher than anticipated.	The pump is operating, but it builds up a differential pressure much higher than anticipated.	<ul style="list-style-type: none"> a) The outlet stop valve is closed. b) The pipe system to evaporators is blocked, and the bypass does not open (similar to no refrigeration demand).
3. The pump cuts out due to low differential pressure.	The pump is operating, but cuts out due to low differential pressure. Restarting gives similar result.	<ul style="list-style-type: none"> a) Setting for minimum differential pressure is too high for the system. b) The pump performance is reduced due to vapor bubbles (gas) in inlet. c) Defective differential pressure switch or transmitter.
4. The pump cuts out due to too high current power consumption (motor protection).	The pump is operating, but the motor protection switches it off.	<ul style="list-style-type: none"> a) The speed is too high. b) The flow rate is too high. c) Too much oil in refrigerant (low temperature). d) Electrical failure (short-circuiting of windings). e) Mechanical failure (mechanical wear).
5. Noise.	The pump is operating, but an unexpected noise is heard.	<ul style="list-style-type: none"> a) Cavitation. b) The inlet filter is blocked. c) Inadequate lubrication of bearings (strong mechanical noise and vibrations). d) Variable-frequency operation (high pitch noise). e) Mechanical failure (grinding noise).
6. Leakage.	If the pump is operating, it must be stopped.	<ul style="list-style-type: none"> a) Leakage from pipe connections. b) Leakage from seal.

The table above is not exhaustive for the faults and observations possible. Please contact your local Grundfos company in case of questions or in case of fault situations not described.

10. Technical data

10.1 Operating conditions

The operating envelope of a refrigerant pump is generally limited by a number of different factors related to the operation close to the boiling point of the refrigerant and the specific properties of the refrigerant.

Avoid dry running at all times. Even a few seconds of dry running may damage the bearings. Avoid also operation at conditions with constant cavitation.

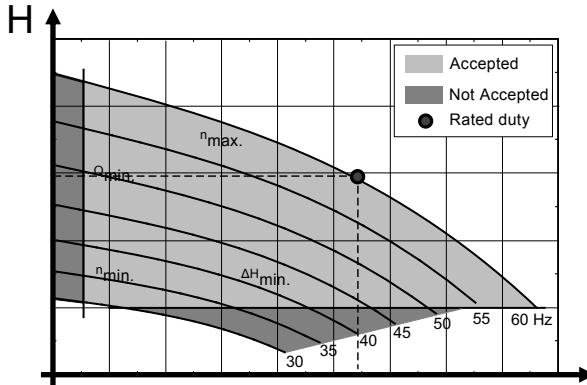


Fig. 15 General operating envelope for CRN-H MAGdrive pumps

The individual limits are described in the table below:



CAUTION

The limits below must always be observed and respected. Operation outside the envelope will invalidate the warranty.

Abbreviation	Description
$Q_{min.}$	The minimum flow rate is 10 % of the nominal flow rate of the pump.
$n_{max.}$	Too high speed for mechanical design. If $n_{max.}$ is exceeded, vibrations will occur, wear of bearings will increase, and the power consumption of the motor will be too high. Maximum speed 60 hz.
$n_{min.}$	Too low bearing surface speed. If $n_{min.}$ is exceeded, the lubrication of bearings will be inadequate. Minimum speed 30 hz.
$\Delta H_{min.}$	The minimum differential pressure is to be 7 psi below the setpoint differential pressure. The absolute minimum differential pressure is 20 % of the closed-valve pressure at 60 hz.

Maximum operating pressure: 362 psi

Refrigerant temperature range: -40 °F to 248 °F

Viscosity: 0.15 cP to 300 cP.

10.1.1 NPSH (Net Positive Suction Head)

If the pressure in a hydraulic circuit drops below the vapor pressure of the circulating liquid, boiling will occur, typically at the pump inlet, resulting in vapor bubbles appearing in the flow. When the mixture of liquid and vapor bubbles enters the first pump impeller, the pressure will increase, and the bubbles will collapse, resulting in noise, vibrations and sometimes also damage to the impeller and bearings. The process of bubbles collapsing in a liquid is called cavitation.

Generally, the higher the flow rate, the higher the required NPSH.

In closed hydraulic circuits where a risk of cavitation is present, it is possible to reduce or prevent cavitation as follows:

- Shorten the pipe from the separator or receiver to the pump inlet, and hereby reduce friction losses.
- Increase the cross-section of the pipe from the separator or receiver to the pump inlet to reduce the velocity of the liquid, and hereby reduce friction losses.
- Minimize the number of pipe bends, and use pipe bends that have a bending radius of more than 1.5 times the pipe diameter. The number of other fittings, for example for a change in diameter, must be minimized.
- Lower the liquid temperature to reduce the saturated vapor

10.1.2 NPSH curve chart

The NPSH required (NPSHr) is defined as the NPSH at which the pump total head has decreased by 3 % due to low suction head. The result is cavitation within the pump.

The NPSHr for one of the CRN-H MAGdrive pumps is shown in fig. 16.

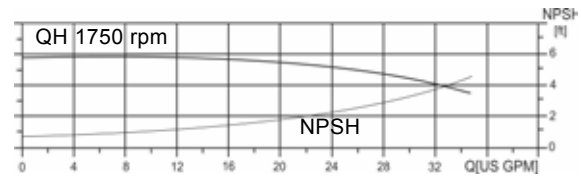


Fig. 16 Required NPSH

The margin in which the NPSH available (NPSHa) is to exceed the NPSHr is 2 ft. The 2 ft. margin is needed to protect the pump from damage caused by cavitation.

Example

In an application where the maximum flow rate is 23 gpm (see fig.16 above), the NPSHa must exceed 2 ft. plus a 2 ft. margin which equals 4 ft.

The NPSHa is to exceed 4 ft.

NPSHa is typically defined as the refrigerant liquid height above the centerline of the pump inlet.

10.1.3 Maximum flow rate

See pump performance curve in Grundfos Product Center. For all refrigerants, please observe the increased values for NPSH at flow rates higher than the rated flow rate.

10.1.4 Minimum flow rate

The minimum flow rate is 10 % of the nominal flow rate of the pump.

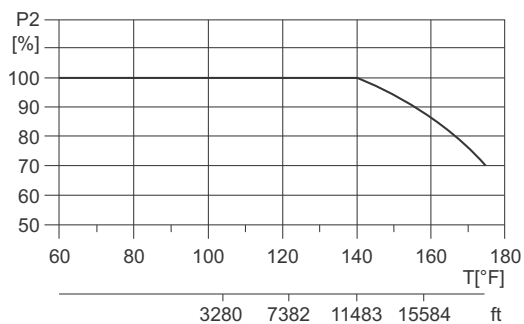
10.1.5 Minimum differential pressure

Generally, the minimum differential pressure is to be 10 psi below the setpoint differential pressure. The absolute minimum differential pressure is 20 % of the closed-valve pressure at 60 hz.

10.1.6 Ambient temperature and altitude

If the ambient temperature exceeds the maximum temperature limits of the pump or the pump is installed at an altitude exceeding the altitude values in the chart below, the motor must not be fully loaded due to the risk of overheating.

Overheating may result from excessive ambient temperatures or the low density and consequently low cooling effect of the air at high altitudes. In such cases, it may be necessary to use a motor with a higher rated output (P_2).



TM06 8471 0217

Fig. 17 Relationship between motor output (P_2) and ambient temperature/altitude

Example:

From fig. 17 it appears that P_2 must be reduced to 88 % when a pump with a NEMA premium-efficiency motor is installed 15,584 feet above sea level.

In cases where both the maximum temperature and the maximum altitude are exceeded, the derating factors must be multiplied.

Example: $0.89 \times 0.89 = 0.79$.

10.2 Motor data

TEFC Premium Efficient Motors for CRN-H MAGdrive Pumps 2 pole								
Hp	Phase	Frame	Safety Factor	Voltage	Motor Efficiency	Insulation Class	Full Load Current	Starting Current
5	3	184TC	1.15	208-230/460	88.5	F	12-11.8/5.9	57.2
7.5	3	213TCZ	1.15	208-230/460	89.5	F	19.4-18/9	68.4
10	3	213TCZ	1.15	208-230/460	91	F	24.8-23.8/11.9	112
15	3	254TC	1.15	208-230/460	91	F	38-35/17.5	110
20	3	256TC	1.15	208-230/460	91	F	50-46/23	-
25	3	284TSCZ	1.15	230/460	91.7	F	58/29	-

Note: The Baldor motors use standard bearings and have a closed shaft keyway. The motors are horizontally mounted with feet.

11. Disposing of the product

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

Subject to alterations.

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