CR, CRI, CRN, CRT

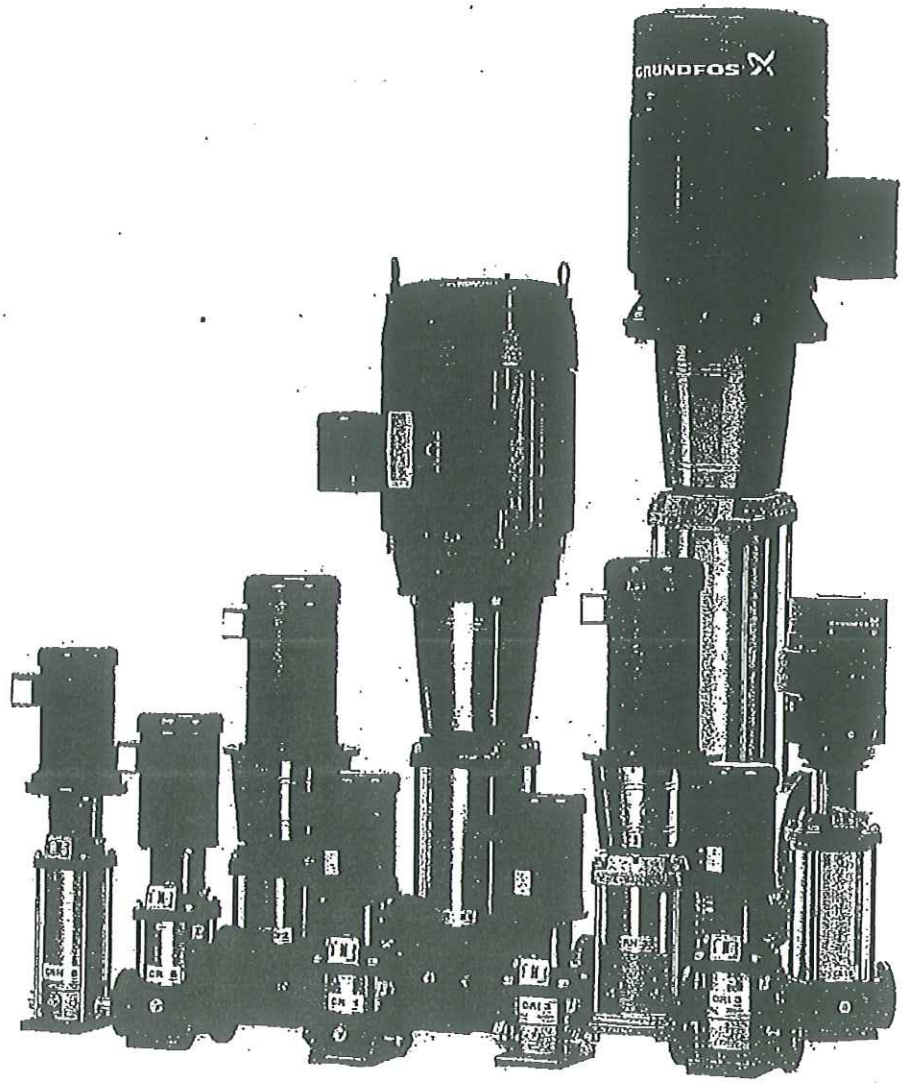
CR1S-27

PO 560/401882

Installation and operating instructions

(US)

732 223 3222



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Warning

Electrical Work: All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, 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 should be connected to the power supply ground as described in Article 250-80 of the National Electrical Code.

1. General

The CR range is based on the inline multistage centrifugal pump first pioneered by Grundfos. CR is available in four basic materials and over one million configurations. CR is suitable for pumping water and water-like liquids in industry, petrochemical, water treatment, commercial buildings; and many other applications. Some of CR's outstanding characteristics are:

- superior efficiency
- reliability
- ease of maintenance
- compact size and small footprint
- quiet operation.

2. Shipment inspection

Examine the components carefully to make sure no damage has occurred to the pump during shipment. Care should be taken to ensure the pump is NOT dropped or mishandled.

2.1 Ensure you have the right pump

US

Read the pump nameplate to make sure that it is the one you ordered.

- **CR**
  Centrifugal pump with standard cast iron and 304 stainless steel construction
- **CRI**
  Centrifugal pump; all parts in contact with water are 304 stainless steel construction
- **CRN**
  Centrifugal pump; all parts in contact with water are 316 stainless steel construction
- **CRT**
  Centrifugal pump; all parts in contact with water are titanium construction
- **CRE**
  Centrifugal pump with a Grundfos MLE VFD motor attached.

2.2 Checking the condition of the pump

The shipping carton in which your pump arrived is specially designed around your pump during production to prevent damage during shipment. As a precaution, the pump should remain in the carton until you are ready to install it. Examine the pump for any damage that may have occurred during shipping. Examine any other parts of the shipment as well for any visible damage.

Note: If the pump is shipped as a complete unit (motor attached to pump end), the position of the coupling (that connects the pump shaft to the motor shaft) is set at factory specifications. No adjustment is required. If the unit is delivered as a pump end only, follow the adjustment procedures in the section on replacing the motor.

Pump without Motor (CR(I)(N) 1s, 1, 3, 5, 10, 15, and 20 Only): If you purchased a pump without a motor, the shaft seal has been set by the factory. Do not loosen the three set screws on the shaft seal when attaching the motor.

Pump without Motor (CR(N) 32, 45, 64, 90, 120, and 150 Only): If you purchased a pump without a motor, you must install the seal. The seal is protected in its own sub boxing within the pump packaging crate. To protect the shaft and bearings during shipment, a shaft holder protective device is used. This device must be removed prior to installation of the seal. Read the seal installation instructions which are included in the pump package.

2.3 Verifying electrical requirements

Verification of the electrical supply should be made to be certain the voltage, phase and frequency match that of the pump motor. The proper operating voltage and other electrical information can be found on the motor nameplate. These motors are designed to run on –10 % / + 10 % of the nameplate-rated voltage. For dual-voltage motors, the motor should be internally connected to operate on the voltage closest to the 10% rating, i.e., a 208 voltage motor wired per the 208 volt connection diagram. The wiring connection diagram can be found on either a plate attached to the motor or on a diagram inside the terminal box cover. If voltage variations are larger than –10 % / + 10 %, do not operate the pump.

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3.1 Understanding codes

Example
Pump version: U FGJ A E HQQE

A	*Basic pump version
U	*NEMA Version Pump
B	Oversize motor, one flange size bigger
F	CR pump for high temperatures (Cool-Top®)
H	Horizontal version
HS	High pressure pump with over-synchronous speed and reversed direction of rotation
I	Different pressure rating
K	Low NPSH
M	Magnetic drive
P	Undersize motor
R	Horizontal version with bearing bracket
SF	High pressure pump with reversed chamber stack and direction of rotation
T	Oversize motor, two flange sizes bigger
X	**Special version

Pipe connection

A	Oval flange
B	NTP thread
C	Clamp coupling
CA	FlexiClamp
CX	TriClamp
F	DIN flange
G	ANSI flange
J	JIS flange
N	Changed diameter of ports
O	Externally threaded, union
P	PJE coupling
X	Special version

Materials

A	Basic version
A	Carbon-filled graphite PTFE (bearings)
G	Stainless steel parts of 316 SS
GI	Base plate and flanges of 316 SS
I	Stainless steel parts of 304 SS
II	Base plate and flange of 304 SS
K	Bronze (bearings)
S	SIC bearing ring + PTFE neck ring (only CR, CRN 32 to 90
T	Titanium
X	Special version

Code for rubber parts

E	EPDM
F	FXM (Flouraz®)
K	FFKM (Kalrez®)
V	FKM (Viton®)

H Q Q E

Shaft seal

A	O-ring with fixed driver
B	Rubber bellows seal
D	O-ring seal, balanced
E	Cartridge seal with O-ring
H	Balanced cartridge seal with O-ring
K	Cartridge shaft seal with metal bellows
O	Double seal, back to back
P	Double seal, tandem
R	O-ring seal with reduced face
X	Special version

B	Carton, synthetic resin-impregnated
H	Cemented tungsten carbine, embedded
Q	Silicon carbide
U	Cemented tungsten carbide

E	EPDM
F	FXM (Flouraz®)
K	FFKM (Kalraz®)
V	FKM (Viton®)

* In August 2003 the NEMA pump code was discontinued for all material numbers created by GRUNDFOS manufacturing companies in North America. The NEMA version pump code will still remain in effect for existing material numbers. NEMA version pumps built in North America after this change will have either an A or U as the pump version code depending on the date the material number was created.

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

US

5.4 Maximum operating pressures

at +250 °F (194 °F for CRN-SF)

Pump type/ connection	50 Hz stages	60 Hz stages	Max. psi/bar
CR, CRI, CRN 1s			
Oval flange	1 to 23	1 to 17	232 / 16
FGJ, PJE	1 to 36	1 to 27	362 / 25
CR, CRI, CRN 1			
Oval flange	1 to 23	1 to 17	232 / 16
FGJ, PJE	1 to 36	1 to 27	362 / 25
CR, CRI, CRN 3			
Oval flange	1 to 23	1 to 17	232 / 16
FGJ, PJE	1 to 36	1 to 27	362 / 25
CR, CRI, CRN 5			
Oval flange	1 to 22	1 to 16	232 / 16
FGJ, PJE	1 to 36	1 to 24	362 / 25
CR, CRI 10			
Oval flange CR		1 to 6	145 / 10
Oval flange, CRI	1 to 16	1 to 10	232 / 16
FGJ, GJ, PJE	1 to 16	1 to 10	232 / 16
FGJ, GJ, PJE	17 to 22	12 to 17	362 / 25
CRN 10			
All	1 to 22	1 to 17	362 / 25
CR, CRI 15			
Oval flange	1 to 7	1 to 5	145 / 10
FGJ, GJ, PJE	1 to 10	1 to 8	232 / 16
FGJ, GJ, PJE	12 to 17	9 to 12	362 / 25
CRN 15			
All	1 to 17	1 to 12	362 / 25
CR, CRI 20			
Oval flange	1 to 7	1 to 5	145 / 10
FGJ, GJ, PJE	1 to 10	1 to 7	232 / 16
FGJ, GJ, PJE	12 to 17	8 to 10	362 / 25
CRN 20			
All	1 to 17	1 to 10	362 / 25
CR, CRN 32			
	1-1 to 7	1-1 to 5	232 / 16
	8-2 to 14	6-2 to 11-2	435 / 30
CR, CRN 45			
	1-1 to 5	1-1 to 4-2	232 / 16
	6-2 to 13-2	4-2 to 8-1	435 / 30
CR, CRN 64			
	1-1 to 5	1-1 to 3	232 / 16
	6-2 to 8-1	4-2 to 5-2	435 / 30
CR, CRN 90			
	1-1 to 4	1-1 to 3	232 / 16
	5-2 to 6	4-2 to 4-1	435 / 30
CR, CRN 120			
		1-1 to 3	232 / 16
	1-1 to 5-2	4-2 to 5-2	435 / 30
CR, CRN 150			
		1-1 to 3	232 / 16
	1-1 to 4-2	4-1 to 4-2	435 / 30
CRT 2	2 to 26	2 to 18	305 / 21
CRT 4	1 to 22	1 to 16	305 / 21
CRT 8	1 to 12	1 to 8	232 / 16
	14 to 20	10 to 16	362 / 25
CRT 16	1 to 8	1 to 8	232 / 16
	10 to 16	10 to 12	362 / 25

Consult Grundfos for other working conditions.

US

6.3 Pump mounting

Warning

CR, CRI, CRN pumps are shipped with covered suction and discharge. The covers must be removed before the final pipe flange to pump connections are made.

6.3.1 Recommended installation torques

Model	Recommended foundation torque (ft - lbs)	Recommended flange torque (ft - lbs)
CR, CRI, CRN 1s/1/3/5, and CRT 2/4	30	37 - 44
CR, CRI, CRN 10/15/20, and CRT 8/16	37	44 - 52
CR, CRN 32/45/64/90/ 120/150	52	52 - 59

6.4 Suction pipe

The suction pipe should be adequately sized and run as straight and short as possible to keep friction losses to a minimum (minimum of four pipe diameters straight run prior to the suction flange). Avoid using unnecessary fittings, valves or accessory items. Butterfly or gate valves should only be used in the suction line when it is necessary to isolate a pump because of a flooded suction condition. This would occur if the water source is above the pump; see fig. 5 and fig. 6. Flush piping prior to pump installation to remove loose debris.

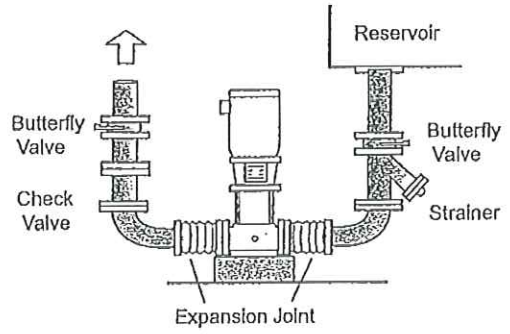

Fig. 5 Flooded suction

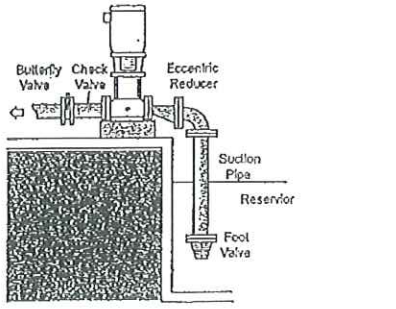

Fig. 6 Suction lift*

*The suction pipe should have a fitting on it for priming. CRN-SF pumps cannot be used for suction lift.

6.5 Minimum suction pipe sizes

The following recommended suction pipe sizes are the smallest sizes which should be used with any specific CR pump type.

The suction pipe size should be verified with each installation to ensure good pipe practices are being observed and excess friction losses are not encountered.

High temperatures may require larger diameter pipes to reduce friction and improve NPHSA.

Model	Min. suction pipe size	
CR(I)(N) 1s, 1, 3; CRT 2	1"	Nominal diameter sch 40 pipe
CR(I)(N) 5; CRT 4	1-1/4"	Nominal diameter sch 40 pipe
CR(I)(N) 10, 15, 20; CRT 8, 16	2"	Nominal diameter sch 40 pipe
CR(N) 32	2-1/2"	Nominal diameter sch 40 pipe
CR(N) 45	3"	Nominal diameter sch 40 pipe
CR(N) 64, 90	4"	Nominal diameter sch 40 pipe
CR(N) 120, 150	5"	Nominal diameter sch 40 pipe

6.6 Discharge piping

It is suggested that a check valve and isolation valve be installed in the discharge pipe.

Pipe, valves and fittings should be at least the same diameter as the discharge pipe or sized in accordance with good piping practices to reduce excessive fluid velocities and pipe friction losses.

Note: Pipe, valves and fittings must have a pressure rating equal to or greater than the maximum system pressure.

Before the pump is installed it is recommended that the discharge piping be pressure checked to at least the maximum pressure the pump is capable of generating or as required by codes or local regulations.

Whenever possible, avoid high pressure loss fittings, such as elbows or branch tees directly on either side of the pump. The piping should be adequately supported to reduce thermal and mechanical stresses on the pump.

Good installation practice recommends the system be thoroughly cleaned and flushed of all foreign materials and sediment prior to pump installation. Furthermore, the pump should never be installed at the lowest point of the system due to the natural accumulation of dirt and sediment. If there is excessive sediment or suspended particles present, it is advised a strainer or filter be used. Grundfos recommends that pressure gauges be installed on inlet and discharge flanges or in pipes to check pump and system performance.

Warning

To avoid problems with waterhammer, fast closing valves must not be used in CRN-SF applications.

14. Startup for Cool-Top®

Caution *Do not start the pump until it has been filled with liquid and vented.*

Warning

Pay attention to the direction of the vent hole and take care to ensure that the escaping liquid does not cause injury to persons or damage to the motor or other components. In hot-liquid installations, special attention should be paid to the risk of injury caused by scalding hot liquid. It is recommended to connect a drain pipe to the 1/2" air vent in order to lead the hot water/steam to a safe place.

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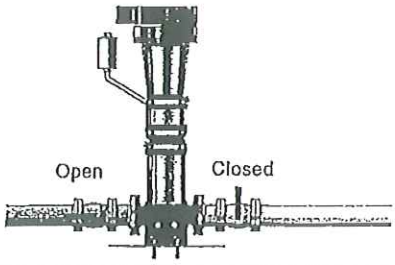
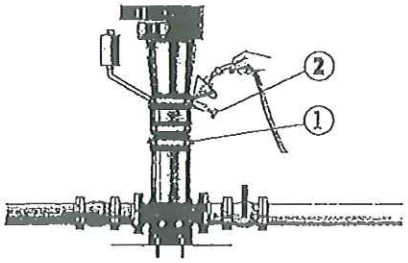
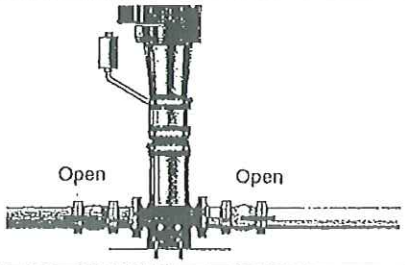
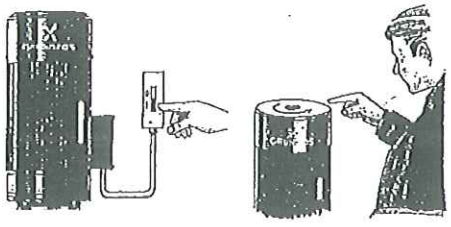
Step		Action
1	 TM02 4151 5001	**Note:** The air-cooled top should only be started up with cold liquid. Close the isolation valve on the discharge side and open the isolation valve on the suction side of the pump.
2	 TM02 4153 1503	Remove the priming plug from the **air-cooled chamber (2)** and slowly fill the chamber with liquid. When the chamber is completely filled with liquid, replace the priming plug and tighten securely.
3	 TM02 5907 4002	Open the isolation valve on the discharge side of the pump. Valve may have to be partially closed when pump is started if no back pressure is present (i.e. boiler not up to pressure).
4	 TM01 4140 6 3702 TM01 1405 4497	Start the pump and check the direction of rotation. See the correct rotation of the pump on the motor fan cover. If the direction of rotation is wrong, interchange any two of the incoming supply wires. After 3 to 5 minutes, the air vent has been filled with liquid. **Note:** During startup of a cold pump with hot liquid, it is normal that a few drops of liquid are leaking from the sleeve.

US

6.9 Minimum continuous duty flow rates

Pump Type	min °F to 176 °F (min °C to 80 °C)	at 210°F (at 99°C)	at 248°F (at 120°C)	at 356°F (at 180°C)
CR, CRI, CRN 1s	0.5	0.7	1.2	1.2*
CR, CRI, CRN 1	0.9	1.3	2.3	2.3*
CR, CRI, CRN 3	1.6	2.4	4.0	4.0*
CR, CRI, CRN 5	3.0	4.5	7.5	7.5*
CR, CRI, CRN 10	5.5	8.3	14	14*
CR, CRI, CRN 15	9.5	14	24	24*
CR, CRI, CRN 20	11	17	28	28*
CR, CRN 32	14	21	35	35*
CR, CRN 45	22	33	55	55*
CR, CRN 64	34	51	85	85*
CR, CRN 90	44	66	110	110*
CR, CRN 120	60	90	N/A	N/A
CR, CRN 150	75	115	N/A	N/A
CRT 2	1.3	2.0	3.3	N/A
CRT 4	3.0	4.5	7.5	N/A
CRT 8	4.0	6.0	10	N/A
CRT 16	8.0	0.7	20	N/A

* Grundfos Cool-Top® is only available in the following pump types.

Pump Type	CR 1s	CR 1	CR 3	CR 5	CR 10	CR 15	CR 20	CR 32	CR 45	CR 64	CR 90
Standard (CR)								•	•	•	•
I Version (CRI)	•	•	•	•	•	•	•				
N Version (CRN)	•	•	•	•	•	•	•	•	•	•	•

6.10 Check valves

A check valve may be required on the discharge side of the pump to prevent the pump's inlet pressure from being exceeded.

For example, if a pump with no check valve is stopped because there is no demand on the system (all valves are closed), the high system pressure on the discharge side of the pump will "find" its way back to the inlet of the pump.

If the system pressure is greater than the pump's maximum inlet pressure rating, the limits of the pump will be exceeded and a check valve needs to be fitted on the discharge side of the pump to prevent this condition. **This is especially critical for CRN-SF applications because of the very high discharge pressures involved. As a result, most CRN-SF installations require a check valve on the discharge piping.**

6.11 Temperature rise

It may sometimes be necessary to stop the flow through a pump during operation.

At shut-off, the power to the pump is transferred to the pumped liquid as head, causing a temperature rise in the liquid.

The result is risk of excess heating of and consequent damage to the pump. The risk depends on the temperature of the pumped liquid and for how long the pump is operating without flow; see the following temperature rise chart.

Pump type	Time for temperature rise of 18 °F (10 °C)	
	Seconds	Minutes
CR 1s, 1, 3	210	3.5
CR 5	240	4.0
CR 10	210	3.5
CR 15	150	2.5
CR 20	120	2.0
CR 32, 45, 64, 90, 120, 150	60	1.0

6.12 Conditions/Reservations

The listed times are subject to the following conditions/ reservations:

- No exchange of heat with the surrounding.
- The pumped liquid is water with a specific heat of 1.0 $^{Btu}/_{lb.}$ °F (4.18 $^{kJ}/_{kg}$ °C).
- Pump parts (chambers, impellers and shaft) have the same thermal capacity as water.
- The water in the base and the pump head is not included.

These reservations should give sufficient safety margin against excessive temperature rise.

The maximum temperature must not exceed the pump maximum rating.

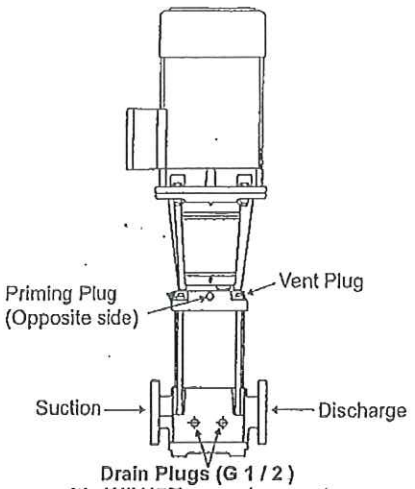


Fig. 14 Plug/valve locations CR(N) 32, 45, 64, 90, 120, 150

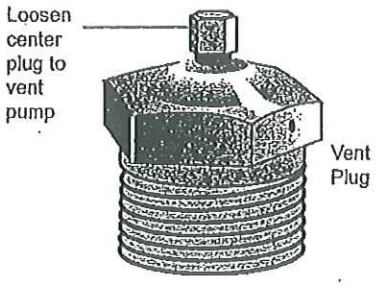


Fig. 15 Vent plug

Gradually open the isolation valve in the suction line until a steady stream of airless water runs out the priming port. Close the plug and securely tighten. Completely open the isolation valves.

In open systems where the water level is below the pump inlet, the suction pipe and pump must be filled and vented of air before starting the pump. Close the discharge isolation valve and remove the priming plug. Pour water through the priming hole until the suction pipe and pump are completely filled with water. If the suction pipe does not slope downward from the pump toward the water level, the air must be purged while being filled. Replace the priming plug and securely tighten. For pumps with Cool-Top®, see *14. Startup for Cool-Top®.*

Follow these steps:

1. Switch power off.
2. Check to make sure the pump has been filled and vented.
3. Remove the coupling guard and rotate the pump shaft by hand to be certain it turns freely.
4. Verify that the electrical connections are in accordance with the wiring diagram on the motor.
5. Switch the power on and observe the direction of rotation. When viewed from the top, the pump should rotate counter-clockwise (clockwise for CRN-SF).
6. To reverse the direction of rotation, first switch OFF the supply power.
7. On three-phase motors, interchange any two power leads at the load side of the starter. On single-phase motors, see connection diagram on nameplate. Change wiring as required.
8. Switch on the power and again check for proper motor rotation. Once rotation has been verified, switch off power again. Do not attempt to reinstall the coupling guards with the motor energized. Replace the coupling guard if the rotation is correct. After guards are in place the power can be reapplied. **Note:** CR, CRI, CRN 1s to 5: For these pumps, it is advisable to open the bypass valve during start-up; see fig. 13. The bypass valve connects the suction and discharge sides of the pump, thus making the filling procedure easier. When the operation is stable, the bypass valve must be closed.

US

Caution

Motors should not be run unloaded or uncoupled from the pump at any time; damage to the motor bearings will occur.

Do not start the pump before priming or venting the pump; see fig. 15. Never operate the pump dry.

7.2 Operating Parameters

CR multi-stage centrifugal pumps installed in accordance with these instructions and sized for correct performance will operate efficiently and provide years of service. The pumps are water-lubricated and do not require any external lubrication or inspection. The motors may require periodic lubrication as noted in *9. Maintaining the pump's motor.*

Under no circumstances should 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. A properly sized relief valve should be installed to allow sufficient water to circulate through the pump to provide adequate cooling and lubrication of the pump bearings and seals.

7.3 Pump Cycling

Pump cycling should be checked to ensure the pump is not starting more than the following.

Grundfos ML motors:

- 200 times per hour on 1/3 to 5 hp models
- 100 times per hour on 7 1/2 to 15 hp models
- 40 times per hour on 20 to 30 hp models.

Baldor motors:

- 20 times per hour on 1/3 to 5 hp models
- 15 times per hour on 7 1/2 to 15 hp models
- 10 times per hour on 20 to 100 hp models.

Rapid cycling is a major cause of premature motor failure due to increased heat build-up in the motor. If necessary, adjust controls to reduce the frequency of starts and stops.

7.4 Boiler-feed installations

If the pump is being used as a boiler-feed pump, make sure the pump is capable of supplying sufficient water throughout its entire evaporation and pressure ranges. Where modulating control valves are used, a bypass around the pump must be installed to ensure pump lubrication (see "Minimum Continuous Duty Flow Rates").

7.5 Freeze Protection

If the pump is installed in an area where freezing could occur, the pump and system should be drained during freezing temperatures to avoid damage. To drain the pump, close the isolation valves, remove the priming plug and drain plug at the base of the pump. Do not replace the plugs until the pump is to be used again. Always replace the drain plug with the original or exact replacement. Do not replace with a standard plug. Internal recirculation will occur, reducing the output pressure and flow.

9.4 Motor lubrication schedule (for motors with grease nipples)

New motors that have been stored for a year or more should be regreased according to the following:

NEMA (IEC) Frame Size	Standard Service Interval	Severe Service Interval	Extreme Service Interval	Weight of grease to add [oz (grams)]	Volume of grease to add [in^3 (teaspoons)]
Up through 210 (132)	5500 hrs	2750 hrs	550 hrs	0.30 (8.4)	0.6 (2)
Over 210 through 280 (180)	3600 hrs	1800 hrs	360 hrs	0.61 (17.4)*	1.2 (3.9)
Over 280 up through 360 (225)	2200 hrs	1100 hrs	220 hrs	0.81 (23.1)*	1.5 (5.2)
Over 360 (225)	2200 hrs	1100 hrs	220 hrs	2.12 (60.0)*	4.1 (13.4)

Warning
The grease outlet plug MUST be removed before adding new grease.

9.5 Lubrication 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 bearing is 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. 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. **Note:** 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.
3. Add grease SLOWLY taking approximately one minute until new grease appears at the shaft hole in the endplate 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.

10. Replacing the motor

If the motor is damaged due to bearing failure, burning or electrical failure, the following instructions detail how to remove the motor for replacement.

Caution

It must be emphasized that motors used on CR pumps are specifically selected to our rigid specifications. Replacement motors must be of the same frame size, should be equipped with the same or better bearings and have the same service factor. Failure to follow these recommendations may result in premature motor failure.

10.1 Disassembly

For disassembly, proceed as follows:

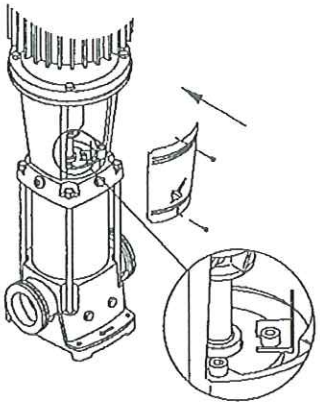
1. Turn off and lock out power supply. The power supply wiring can now be safely disconnected from the motor wires. Remove the coupling guards. **Note:** CR 1s, 1, 3, 5, 10, 15, and 20: do not loosen the three shaft seal securing allen screws.
2. Using the proper metric Allen wrench, loosen the four cap screws in the coupling. Completely remove coupling halves. On CR1s-CR20, the shaft pin can be left in the pump shaft. CR(N)32, 45, 64, 90, 120, and 150 do not have a shaft pin.
3. With the correct size wrench, loosen and remove the four bolts which hold the motor to the pump end.
4. Lift the motor straight up until the shaft has cleared the motor stool.

10.2 Assembly

For assembly, proceed as follows:

1. Remove key from motor shaft, if present, and discard.
2. Thoroughly clean the surfaces of the motor and pump end mounting flange. The motor and shaft must be clean of all oil/grease and other contaminants where the coupling attaches. Set the motor on the pump end.
3. Place the terminal box in the desired position by rotating the motor.
4. Insert the mounting bolts, then diagonally and evenly tighten:
   - for 3/8" bolts (1/2 to 2 hp), torque to 17 ft-lb
   - for 1/2" bolts (3 to 40 hp) torque to 30 ft-lb
   - for 5/8" bolts (50 - 100 hp) torque to 59 ft-lb
   - follow instructions for particular pump model in sections *10.2.1 Torque specifications for CR 1s, 1, 3, and 5* through *10.2.4 CR(N) 32, 45, 64, 90, 120, and 150.*

4. Lubricate the coupling screws with an anti-seize and lubricating compound. Tighten the coupling screws (finger tight) while keeping the coupling separation equal on both sides and the motor shaft keyway centered in the coupling half as shown in fig. 16.
5. When the screws are tight enough to keep the couplings in place, then torque the screws evenly in a crisscross pattern.
6. Torque coupling screws to 62 ft.-lbs (75 and 100 hp motors to 74 ft-lbs). Remove the adjustment fork from under the cartridge seal collar and replace it to the storage location; see fig. 21.



TM04 3915 0409

Fig. 21 Adjustment fork storage
CR(N) 32, 45, 64, 90, 120, and 150

7. Check to see that the gaps between the coupling halves are equal. Loosen and readjust, if necessary.
8. Be certain the pump shaft can be rotated by hand. If the shaft cannot be rotated or it binds, disassemble and check for misalignment.
9. Prime the pump.
10. Follow the wiring diagram on the motor label for the correct motor wiring combination which matches your supply voltage. Once this has been confirmed, reconnect the power supply wiring to the motor.
11. Check the direction of rotation, by bump-starting the motor. Rotation must be left to right (counter-clockwise) when looking directly at the coupling.
12. Shut off the power, then re-install the coupling guards. After the coupling guards have been installed the power can be turned back on.

11. Parts List

For each CR pump model Grundfos offers an extensive Parts List and diagram of part used in that pump and is recommended to have on hand for future maintenance. In addition, the listings also provide information about prepackaged Service Kits for those pump components most likely to exhibit wear over time, as well as the complete Impeller Stack needed to replace the "guts" 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 (for a small charge).

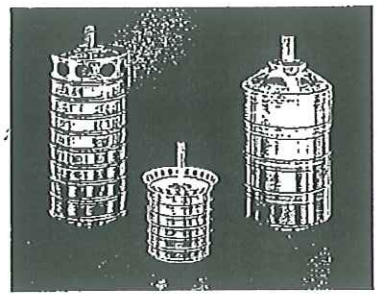


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Fig. 22 Prepackaged impeller stack kits

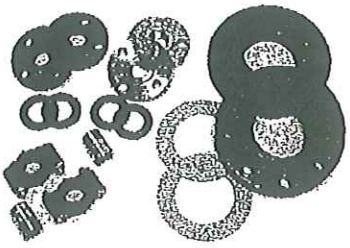

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Fig. 23 Prepackaged flange kits

12. Spare Parts

Grundfos offers an extensive list of spare parts. For a current list of these parts, refer to: "All Product Spare Parts/Service Kits" Price List, Form #L-SK-SL-002.

US

Problem		Possible cause	Remedy
Pump cycles too much	1.	Pressure switch is not properly adjusted or is defective.	Check pressure setting on switch and operation. Check voltage across closed contacts. Readjust switch or replace if defective.
	2.	Level control is not properly adjusted or is defective.	Check setting and operation. Readjust setting (refer to level control manufacturer's data). Replace if defective.
	3.	Insufficient air charging or leaking tank or piping.	Pump air into tank or diaphragm chamber. Check diaphragm for leak. Check tank and piping for leaks with soap and water solution. Check air to water volume. Repair as necessary.
	4.	Tank is too small.	Check tank size and air volume in tank. Tank volume should be approximately 10 gallons for each gpm of pump capacity. The normal air volume is 2/3 of the total tank volume at the pump cut-in pressure. Replace tank with one of correct size.
	5.	Pump is oversized.	Install pressure gauges on or near pump suction and discharge ports. Start and run pump under normal conditions, record gauge readings. Convert psi to feet (Measured psi x 2.31 ft/psi = ____ ft) Refer to the specific pump curve for that model, ensure that total head is sufficient to limit pump delivery within its design flow range. Throttle pump discharge flow if necessary.
Fuses blow or circuit breakers or overload relays trip	1.	Tank is too small.	Check voltage at starter panel and motor. If voltage varies more than –10 % / + 10 %, contact power company. Check wire sizing.
	2.	Motor overloads are set too low.	Cycle pump and measure amperage. Increase heater size or adjust trip setting to a maximum of motor nameplate (full load) current.
	3.	Three-phased current is imbalanced.	Check current draw on each lead to the motor. Must be within –5 % / + 5 %. If not, check motor and wiring. Rotating all leads may eliminate this problem.
	4.	Motor is shorted or grounded.	Turn off power and disconnect wiring. Measure the lead-to-lead resistance with an ohmmeter (RX-1). Measure lead-to-ground values with an ohmmeter (RX-100K) or a megaohm meter. Record values. If an open or grounded winding is found, remove the motor, repair and/or replace.
	5.	Wiring or connections are faulty.	Check proper wiring and loose terminals. Tighten loose terminals. Replace damaged wire.
	6.	Pump is bound.	Turn off power and manually rotate pump shaft. If shaft does not rotate easily, check coupling setting and adjust as necessary. If shaft rotation is still tight, remove pump and inspect. Disassemble and repair.
	7.	Defective capacitor (single-phase motors).	Turn off power and discharge capacitor. Check with ohmmeter (RX-100K). When the meter is connected to the capacitor, the needle should jump towards 0 ohms and slowly drift back to infinity (∞). Replace if defective.
	8.	Motor overloads at higher ambient temperature than motor.	Use a thermometer to check the ambient temperature near the overloads and motor. Record these values. If ambient temperature at motor is lower than at overloads, especially where temperature at overloads is above +104 °F (+40 °C), ambient-compensated heaters should replace standard heaters.

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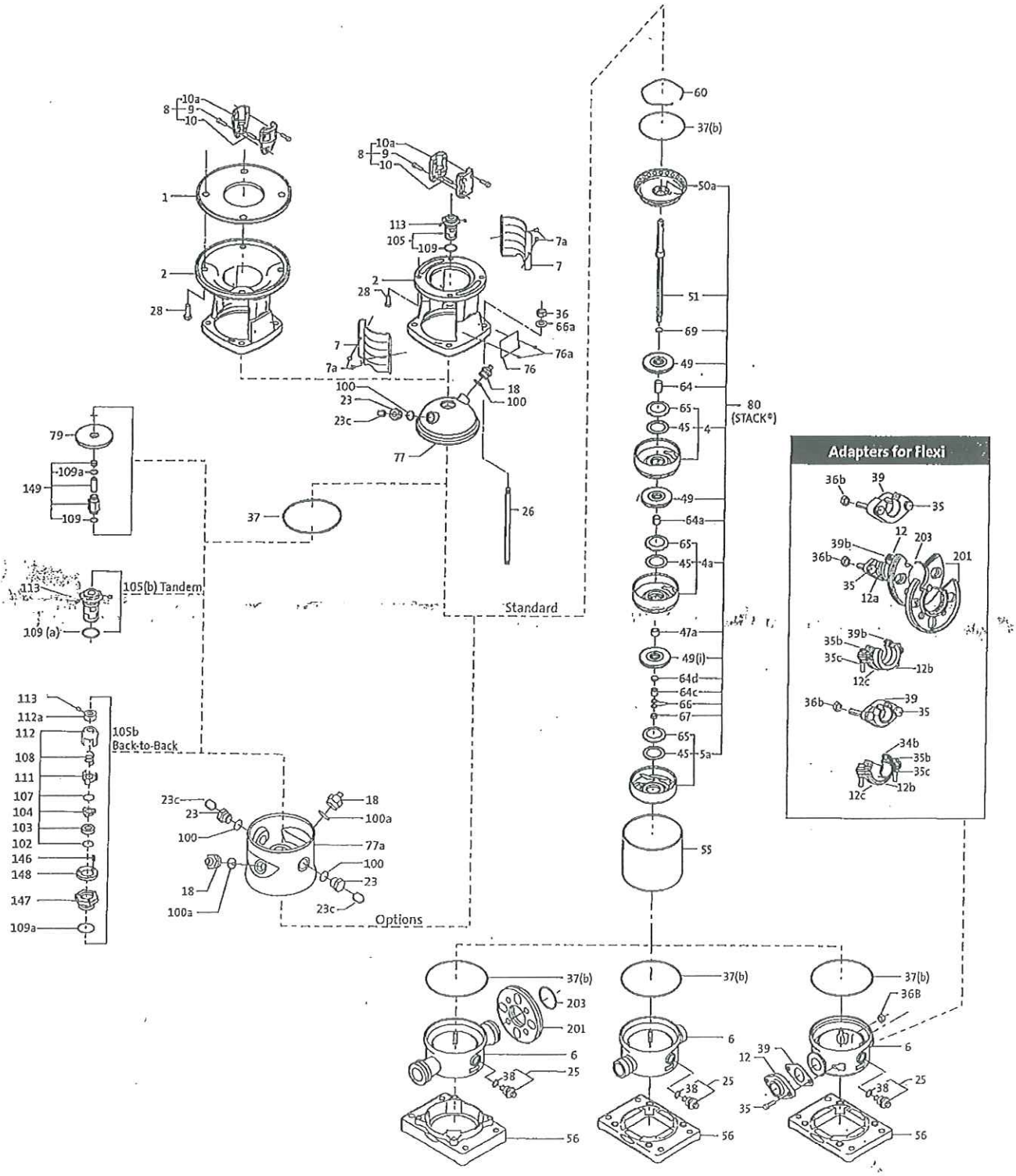

Parts List

Pos. No.	Part Description	Model	Stages	No. Used	Comments/Dimensions	Material Number	Included in Kits?
1	Adapter for Motor Stool				For NEMA, 213/215TC, 7.5 - 10HP	96476208	NO
2	Motor Stool		3/2-27	1	NEMA, 56C, 1/3 - 2HP	96436510	NO
					NEMA, 182/184TC, 3 - 5HP	96436511	NO
					Add Pos. 1, NEMA, 213TC, 7.5 - 10HP	96436511	NO
			3/2-19	1	IEC, F85, MG 71, .37 - .55kW	96436506	NO
			21-36	1	IEC, F100, MG 80, .75 - 1.1kW	96436507	NO
					IEC, F115, MG 90, 1.5 - 2.2kW	96436508	NO
					IEC, F130, MG 100/112, 3.0 - 4.0 kW	96436509	NO
					IEC, F265, MG132, 5.5 - 7.5kW	96436514	NO
4	Chamber, Complete with Pos.45 & 65		3/2-36	^^^	PTFE Pos.45	96439481	NO
4a	Chamber Cpl. w/Pos.45 & 65 & Bearing		3/2-36	^^^^	Silicon Carbide Bearing, PTFE Pos.45	96439476	Yes
	Chamber Cpl. w/Pos.45 & 65 & Brg. (option)		3/2-36	^^^^	Graflon Bearing, PTFE Pos.45	96440615	Yes
5a	Chamber, Bottom Complete with Pos.45 & 65		3/2-36	1	PTFE Pos.45	96439485	NO
6	Base		3/2-17	1	Flexi -Clamp / Oval, Stainless (max 232 PSI)	96438394	NO
			3/2-36	1	For Flanges JIS, FGJ, ANSI, Stainless (Max 362 PSI)	96438328	NO
			3/2-36	1	Victualic (PJE) 1.25", Stainless (Max 362 PSI)	96436851	NO
7	Coupling Guard			2	IEC, F85-F100	96438136	NO
				2	NEMA-56C, IEC-F115,130, & 265	96438137	NO
					NEMA, 182-215TC	96438138	NO
7a	Screw for Coupling Guard		3/2-36	4	M4 x 8mm	96488481	NO
9	Allen Screw		3/2-27	4	M6 x 20mm, Delta Seal	00ID7899	Yes
				4	M8 x 25mm, Delta Seal	00ID7900	Yes
					M10 x 25mm, Delta Seal	00ID7901	Yes
10	Shaft Pin		3/2-36	1	ø5 x 26mm	310192	Yes
10a	Coupling Half		3/2-27	2	NEMA, 56C, 1/3 - 2HP. ø15.8 / ø12	410108	Yes
				2	NEMA, 182/184TC, 3-5HP. ø28.5/ø12	410109	Yes
					NEMA, 213TC, 7.5-10HP. ø34.9/ø12	96472175	Yes
			3/2-19	2	IEC, F85, MG71, .37-.55kW. ø14/ø12	410041	Yes
			21-36	2	IEC, F100, MG80,.75-1.1kW. ø19/ø12	410043	Yes
				2	IEC, F115, MG 90, 1.5-2.2kW. ø24/ø12	410045	Yes
					IEC, F130, MG100/112, 3-4 kW.ø28/ø12	410047	Yes
					IEC, F265, MG132, 5.5-7.5kW. ø38/ø12	410115	Yes
12	Oval Flange for Flexi Base		3/2-17	2	Stainless, 1" -11.5 NPT (max 232 PSI)	96468336	Yes
			3/2-23	2	Stainless, RP 1" BSP DIN (max 232 PSI)	96437814	NO
12a	Adapter Flg. for ANSI pos.201/Flexi Base (option)		3/2-17	2	Stainless, (max 232 PSI)	96437818	Yes
12b	Pipe Stub for Clamp/Flexi Base (option)		3/2-17	2	Stainless, Internal 1" -11.5 NPT (max 232 PSI)	400182	Yes
			3/2-17	2	Stainless, Internal 1.25" -11.5 NPT (max 232 PSI)	410279	Yes
			3/2-17	2	Stainless, External 2" -11.5 NPT (max 232 PSI)	96468338	Yes
12c	Clamp for Flexi Base & pos,12b (option)		3/2-17	4	Stainless, (max 232 PSI)	00ID7194	Yes
18	Priming/Vent Plug		3/2-36	*	G 1/2A, NV24 with NV9 x M8 stem	405150	NO
23	Plug		3/2-36	**	G 1/2A, w/1/4"port, NV24	91120659	NO
	Plug (option)		3/2-36	**	G 1/2A, Solid no port, NV24	370025	NO
23c	Pipe Plug for Pos.23 & 25 with hollow stem		3/2-36	**	1/4" NPT,SS SQHD	00ID7216	NO
25	Drain/Priming Plug Cpl. with O-rings		3/2-36	1	G 1/2A, NV24 w/NV9 x M8 stem, EPDM	96440611	NO
			3/2-36	1	G 1/2A, NV24 w/NV9 x M8 stem, FKM	96446891	NO
	Drain/Priming Plug Cpl. with O-rings (option)		3/2-36	1	G 1/2A, NV24 w/NV9 x M8 stem, FXM	96460009	NO
			3/2-36	1	G 1/2A, NV24 w/NV9 x M8 stem, FFKM	96475474	NO
	Dr./Pr. Plug Cpl. for gauge, w/O-rings (option)		3/2-36	1	G 1/2A, NV24 w/NV9 x M8 hollow stem, EPDM	96527050	NO
			3/2-36	1	G 1/2A, NV24 w/NV9 x M8 hollow stem, FKM	96527051	NO
			3/2-36	1	G 1/2A, NV24 w/NV9 x M8 hollow stem, FXM	96549174	NO
			3/2-36	1	G 1/2A, NV24 w/NV9 x M8 hollow stem, FFKM	96527052	NO
26	Staybolt		3/2-3	4	M12 x 151mm	96487020	NO
			4	4	M12 x 169mm	96442055	NO
			5	4	M12 x 187mm	414103	NO
			6	4	M12 x 209mm	404135	NO
			7	4	M12 x 227mm	414134	NO
			8	4	M12 x 241mm	414105	NO
			9	4	M12 x 259mm	96459210	NO
			10	4	M12 x 281mm	414136	NO
			11	4	M12 x 295mm	414107	NO
			12	4	M12 x 313mm	96463414	NO
			13	4	M12 x 335mm	414138	NO
			15	4	M12 x 367mm	96459214	NO
			17	4	M12 x 403mm	414111	NO
			19	4	M12 x 439mm	96442118	NO
			21	4	M12 x 475mm	414143	NO
			23	4	M12 x 511mm	414115	NO
			25	4	M12 x 547mm	96442119	NO
			27	4	M12 x 587mm	404156	NO
			30	4	M12 x 637mm (50Hz.)	96461557	NO
			33	4	M12 x 691mm (50Hz.)	96442122	NO
			36	4	M12 x 745mm (50Hz.)	96442123	NO
26	Staybolt (Cool Top®, Back-to-Back & Tandem Seal option)		3/2-3	4	M12 x 263mm	404138	NO
			4	4	M12 x 281mm	414136	NO
			5	4	M12 x 295mm	414107	NO

Due to part changes over time, all position numbers (1-203) may not be used.

This column indicates which pump model uses the spare part. If blank, the part is used in all models.

Parts List

Pos. No.	Part Description	Model	Stages	No. Used	Comments/Dimensions	Material Number	Included in Kits?
26	Staybolt (Cool Top®, Back-to-Back & Tandem Seal option)		6	4	M12 x 317mm	404141	NO
			7	4	M12 x 335mm	414138	NO
			8	4	M12 x 349mm	414109	NO
			9	4	M12 x 367mm	96459214	NO
			10	4	M12 x 385mm	96458503	NO
			11	4	M12 x 403mm	414111	NO
			12	4	M12 x 425mm	404147	NO
			13	4	M12 x 439mm	96442118	NO
			15	4	M12 x 475mm	414143	NO
			17	4	M12 x 511mm	414115	NO
			19	4	M12 x 547mm	96442119	NO
			21	4	M12 x 587mm	404156	NO
			23	4	M12 x 619mm	414119	NO
			25	4	M12 x 659mm	414160	NO
			27	4	M12 x 691mm	96442122	NO
			30	4	M12 x 745mm (50Hz.)	96442123	NO
			33	4	M12 x 799mm (50Hz.)	414155	NO
			36	4	M12 x 853mm (50Hz.)	96458507	NO
28	Motor Bolt		3/2-27	4	NEMA, 56C, 1/3 - 2HP. UNC 3/8" x 25mm	00ID1839	NO
					NEMA, 182/184TC, 3 - 5HP.UNC1/2" x 25mm	00ID1840	NO
					NEMA, 213TC, 7.5 -10HP. UNC 1/2" x 1.25"	91128631	NO
			3/2-19	4	IEC, F85, MG71, .37-.55kW. M6 x 20mm	00ID8022	NO
			21-36	4	IEC, F100, MG80, .75-1.1kW. M6 x 25mm	00ID8023	NO
					IEC, F115, MG 90, 1.5-2.2kW. M8 x 20mm	00ID8024	NO
					IEC, F130, MG100/112, 3-4 kW. M8 x 25mm	00ID8025	NO
					IEC, F265, MG132, 5.5-7.5kW. M12 x 45mm	00ID7914	NO
35	Hexagon Head Screw for Oval "CI" Flange (Flexi option)		3/2-17	4	M10 x70mm, 8.8, A4, DIN931	96447227	Yes
	Hexagon Head Screw for Oval "N" Flange (Flexi option)		3/2-17	4	M10 x 60mm, A4, DIN931	96447228	Yes
35b	Screw for Clamp Pos.12c (Flexi option)		3/2-17	4	M8 x 40mm - A2, RR DIN933	00ID7188	Yes
35c	Nut for Screw Pos.35b for Clamp Pos.12c (Flexi option)		3/2-17	4	M8, 304SS	00ID7187	Yes
36	Staybolt Nut		3/2-36	4	19mm x M12, 316SS	00ID0876	NO
36b	Nut for Screw Pos.35 Oval Flange (Flexi option)		3/2-17	4	M10, 316SS w/Delta Seal	96438757	Yes
37	Sleeve O-ring		3/2-36	◆◆	EPDM, ø137.5 x 3.3mm	96438743	Yes
			3/2-36	◆◆	FKM, ø137.5 x 3.3mm	96438744	Yes
37b	Sleeve O-ring (option)		3/2-36	◆◆	FXM, ø137.5 x 3.3mm	96458109	Yes
	Sleeve O-ring (option)		3/2-36	◆◆	FFKM, ø136.12 x 3.53mm	96466718	Yes
38	Drain Plug O-ring		3/2-36	1	EPDM, ø16.3 x 2.4mm	00ID1288	Yes
			3/2-36	1	FKM, ø16.3 x 2.4mm	00ID2231	Yes
	Drain Plug O-ring (option)		3/2-36	1	FFKM, ø16.3 x 2.4mm	96428162	Yes
	Drain Plug O-ring (option)		3/2-36	1	FXM, ø16.3 x 2.4mm	96442869	Yes
39	Gasket for Oval Flange		3/2-17	2	95 x 55 x ø35 x 2mm, KLINGERSIL C4430	400189	Yes
39b	O-ring for Clamp,Thread stub-Union-& FGJ Flange (option)		3/2-17	2	EPDM, ø44.45 x 3.53mm	96407726	Yes
	O-ring for Clamp,Thread stub-Union-& FGJ Flange (option)		3/2-17	2	FKM, ø44.45 x 3.53mm	96411713	Yes
45	Neck Ring		3/2-36	# stgs	ø41.3 x ø30.6 x .75mm, PTFE	400003	Yes
47a	Bearing Ring/Spacer		3/2-36	^^^^	SiC 150, ø17.37 x ø13.10 x ø10.9 x 13mm	96437488	Yes
	Brg. Ring/Spacer (option for Graflon Pos.4a)		3/2-36	^^^^	TC, ø15.92 x ø13.10 x ø10.9 x 9.7mm	400041	Yes
49	Impeller		3/2-36	# stgs	ø73.0 x ø30.6 x 9.0mm (back-plate .5mm)	96433166	NO
50a	Top Guide Vane		3-36	1		96457638	NO
	Top Guide Vane Plate (option for destaging)		3/2	1		96478562	NO
51	Shaft, Complete		3/2-3	1	ø12 x 160.5mm	96439607	NO
			4	1	ø12 x 180.5mm	96440386	NO
			5	1	ø12 x 196.5mm	96440387	NO
			6	1	ø12 x 214.5mm	96440388	NO
			7	1	ø12 x 234.5mm	96440389	NO
			8	1	ø12 x 250.5mm	96440390	NO
			9	1	ø12 x 268.5mm	96440391	NO
			10	1	ø12 x 288.5mm	96440392	NO
			11	1	ø12 x 304.5mm	96440393	NO
			12	1	ø12 x 322.5mm	96440394	NO
			13	1	ø12 x 342.5mm	96440395	NO
			15	1	ø12 x 376.5mm	96440396	NO
			17	1	ø12 x 412.5mm	96440398	NO
			19	1	ø12 x 450.5mm	96440400	NO
			21	1	ø12 x 484.5mm	96440401	NO
			23	1	ø12 x 520.5mm	96440403	NO
			25	1	ø12 x 556.5mm	96440405	NO
			27	1	ø12 x 592.5mm	96440406	NO
			30	1	ø12 x 646.5mm (50Hz.)	96440408	NO
			33	1	ø12 x 700.5mm (50Hz.)	96440410	NO
			36	1	ø12 x 754.5mm (50Hz.)	96440411	NO
51	Shaft, Cpl. (Cool Top®, Back-to-Back & Tandem Seal option)		3/2-3	1	ø12 x 265.5mm	96457560	NO
			4	1	ø12 x 285.5mm	96457561	NO
			5	1	ø12 x 301.5mm	96457562	NO
			6	1	ø12 x 319.5mm	96457563	NO
			7	1	ø12 x 339.5mm	96457564	NO
			8	1	ø12 x 355.5mm	96457565	NO
			9	1	ø12 x 373.5mm	96457566	NO

Due to part changes over time, all position numbers (1-203) may not be used.

This column indicates which pump model uses the spare part. If blank, the part is used in all models.

Parts List

Pos. No.	Part Description	Model	Stages	No. Used	Comments/Dimensions	Material Number	Included in Kits?
51	Shaft, Cpl. (Cool Top®, Back-to-Back & Tandem Seal option)		10	1	ø12 x 393.5mm	96457567	NO
			11	1	ø12 x 409.5mm	96457568	NO
			12	1	ø12 x 427.5mm	96457569	NO
			13	1	ø12 x 447.5mm	96457570	NO
			15	1	ø12 x 481.5mm	96457571	NO
			17	1	ø12 x 517.5mm	96457573	NO
			19	1	ø12 x 555.5mm	96457575	NO
			21	1	ø12 x 589.5mm	96457576	NO
			23	1	ø12 x 625.5mm	96457578	NO
			25	1	ø12 x 661.5mm	96457580	NO
			27	1	ø12 x 697.5mm	96457581	NO
			30	1	ø12 x 751.5mm (50Hz.)	96457583	NO
			33	1	ø12 x 805.5mm (50Hz.)	96457585	NO
			36	1	ø12 x 859.5mm (50Hz.)	96457586	NO
55	Outer Sleeve		3/2-3	1	ø138 x 44.6mm	96439996	NO
			4	1	ø138 x 62.6mm	96440025	NO
			5	1	ø138 x 80.6mm	96441528	NO
			6	1	ø138 x 98.6mm	96440014	NO
			7	1	ø138 x 116.6mm	96441529	NO
			8	1	ø138 x 134.6mm	96441531	NO
			9	1	ø138 x 152.6mm	96440015	NO
			10	1	ø138 x 170.6mm	96441532	NO
			11	1	ø138 x 188.6mm	96441534	NO
			12	1	ø138 x 206.6mm	96440016	NO
			13	1	ø138 x 224.6mm	96441535	NO
			15	1	ø138 x 260.6mm	96440017	NO
			17	1	ø138 x 296.6mm	96441538	NO
			19	1	ø138 x 332.6mm	96441539	NO
			21	1	ø138 x 368.6mm	96440019	NO
			23	1	ø138 x 404.6mm	96441542	NO
			25	1	ø138 x 440.6mm	96441543	NO
			27	1	ø138 x 476.6mm	96440021	NO
			30	1	ø138 x 530.6mm (50Hz.)	96440022	NO
			33	1	ø138 x 584.6mm (50Hz.)	96440023	NO
			36	1	ø138 x 638.6mm (50Hz.)	96439997	NO
56	Base Plate (Low) for PJE / Flexi-clamp Pos.6		2-36	1	Cast Iron	96438133	NO
	B. P. (High) for Flexi-clamp w/ANSI/DIN/JIS Pos.6		2-36	1	Cast Iron	96438132	NO
	Base Plate N (low) for PJE / Flexi-clamp Pos.6		2-36	1	Cast Stainless	96437870	NO
	B. P. N (High) for Flexi-clamp w/ANSI/DIN/JIS Pos.6		2-36	1	Cast Stainless	96437868	NO
60	Stack Compression Spring		3/2-36	1	ø136 x 3.5mm	96439662	NO
64	Spacing Pipe		2-36	^^^	ø15.85 x ø12.85 x 17.52mm	400035	NO
64a	Spacing Pipe		3/2-36	^^^^	ø15.85 x ø12.85 x 4.5mm	96440292	Yes
	Spacing Pipe (option for Graflon Pos. 4a)		3/2-36	^^^^	Use with TC Pos.47a, ø15 x ø12.7 x 7.8mm	400016	Yes
64c	Clamp, Splined		3/2-36	1	ø15 x ø13.10 x ø10.9 x 13mm	96439668	Yes
65	Neck Ring Retainer		3/2-36	# stgs	ø43.5 x ø34.0 x 3.6mm	96438746	Yes
66	Lock Washer Set for Shaft		3/2-36	1	ø13.5 x ø8.2 x 2.6mm	96417297	Yes
66a	Washer for Staybolt		3/2-36	4	DIN 125A, ø24 x ø13 x 2.5mm	00ID3103	NO
67	Lock Nut for Shaft		3/2-36	1	13mm x M8	00ID2061	Yes
69	Spacing Pipe		3/2	1	ø15.85 x 12.85 x 18.0mm	400125	NO
76	Nameplate		3/2-36	1	304SS, 60 x 45mm	96439820	NO
76a	Rivet for Nameplate		3/2-36	2	304SS, ø3 x 5mm	96022882	NO
77	Pump Head Cover for Motor Stool Pos.2		3/2-36	1	Cast Stainless	96436340	NO
77a	Pump Head Cover for Back-to-Back & Tandem Seal		3/2-36	1	Cast Stainless	96456293	NO
77a	Pump Head Cover for Cool Top® (option)		3/2-36	1	Cast Stainless	96456294	NO
79	Disc / Plate for Cool Top®		3/2-36	*	Stainless	96456296	NO
100	Priming/Vent Plug O-ring		3/2-36	*	EPDM, ø16.3 x 2.4mm	00ID1288	Yes
			3/2-36	*	FKM, ø16.3 x 2.4mm	00ID2231	Yes
100a	Priming/Vent Plug O-ring (option)		3/2-36	*	FFKM, ø16.3 x 2.4mm	96428162	Yes
	Priming/Vent Plug O-ring (option)		3/2-36	*	FXM, ø16.3 x 2.4mm	96442869	Yes
102	O-ring for Pos.105b Back-to-Back		3/2-36	1	EPDM, ø18 x 2.5mm	00ID2041	Yes
			3/2-36	1	FKM, ø17.86 x 2.62mm	00ID2187	Yes
	O-ring for Pos.105b Back-to-Back (option)		3/2-36	1	FFKM, ø17.86 x 2.62mm	96440281	NO
	O-ring for Pos.105b Back-to-Back (option)		3/2-36	1	FXM, ø17.86 x 2.62mm	96472584	NO
103	Stationary Seal Ring for 105b Back-to-Back		3/2-36	1	TC, 12mm	980190	NO
	Stationary Seal Ring for 105b Back-to-Back (option)		3/2-36	1	SiC,12mm	980746	Yes
104	Rotating Seal Ring for 105b Back-to-Back		3/2-36	1	TC, 12mm	980163	NO
	Rotating Seal Ring for 105b Back-to-Back (option)		3/2-36	1	SiC, 12mm	980733	Yes
105(b)	Shaft Seal HQBE		3/2-36	***	SiC, Carbon with resin-impregnated, EPDM	96441879	Yes
	Shaft Seal HQBV		3/2-36	***	SiC, Carbon with resin-impregnated, FKM	96441880	Yes
	Shaft Seal HQBK (option)		3/2-36	***	SiC, Carbon with resin-impregnated, FFKM	96489537	Yes
	Shaft Seal HQQE		3/2-36	***	SiC, SiC, EPDM	96441877	Yes
	Shaft Seal HQQV		3/2-36	***	SiC, SiC, FKM	96441878	Yes
	Shaft Seal HQQF (option)		3/2-36	***	SiC, SiC, FXM	96472620	Yes
	Shaft Seal HQQK (option)		3/2-36	***	SiC, SiC, FFKM	96464381	Yes
	Shaft Seal HUBE		3/2-36	***	TC, Carbon with resin-impregnated, EPDM	96441873	Yes
	Shaft Seal HUBV		3/2-36	***	TC, Carbon with resin-impregnated, FKM	96441874	Yes
	Shaft Seal HUBF (option)		3/2-36	***	TC, Carbon with resin-impregnated, FXM	96481464	Yes
	Shaft Seal HUBK (option)		3/2-36	***	TC, Carbon with resin-impregnated, FFKM	96481463	Yes

Due to part changes over time, all position numbers (1-203) may not be used.

This column indicates which pump model uses the spare part. If blank, the part is used in all models.

Parts List

Pos. No.	Part Description	Model	Stages	No. Used	Comments/Dimensions	Material Number	Included in Kits?
105 (b)	Shaft Seal HUUE		3/2-36	***	TC, TC, EPDM	96441875	Yes
	Shaft Seal HUUV		3/2-36	***	TC, TC, FKM	96441876	Yes
	Shaft Seal HUUF (option)		3/2-36	***	TC, TC, FXM	96475542	Yes
	Shaft Seal HUUK (option)		3/2-36	***	TC, TC, FFKM	96467885	Yes
105b	Shaft Seal/inboard for Back-to-Back OQQE		3/2-36	1	SiC, SiC, EPDM	985200	Yes
	Shaft Seal/inboard for Back to Back OQQV		3/2-36	1	SiC, SiC, FKM	985760	Yes
	Shaft Seal/inboard for Back-to-Back OUUE		3/2-36	1	TC, TC, EPDM	985189	NO
	Shaft Seal/inboard for Back-to-Back OUUV		3/2-36	1	TC, TC, FKM	985190	NO
107	O-ring for Pos.105b Back-to-Back		3/2-36	1	EPDM, ø11.5 x 4.3mm	00ID2040	Yes
			3/2-36	1	FKM, ø11.5 x 4.3mm	00ID2186	Yes
	O-ring for Pos.105b Back-to-Back (option)		3/2-36	1	FFKM, ø11.5 x 4.3mm	96440282	NO
	O-ring for Pos.105b Back-to-Back (option)		3/2-36	1	FXM, ø11.5 x 3.18mm	96472618	NO
108	Spring for Pos.105b Back-to-Back		3/2-36	1	12mm	980195	Yes
109(a)	O-ring for Shaft Seal Pos.105		3/2-36	1	EPDM, ø21.3 x 3.0mm	00ID1798	Yes
			3/2-36	1	FKM, ø21.2 x 3.0mm	00ID2339	Yes
109b	O-ring for Shaft Seal Pos.105 (option)		3/2-36	1	FXM, ø22 x 2.75mm	96458111	Yes
	O-ring for Shaft Seal Pos.105 (option)		3/2-36	1	FFKM, ø23.47 x 2.62mm	96464384	Yes
111	Seal Driver (small) for Pos.105b Back-to-Back		3/2-36	1		980192	Yes
112	Seal Driver (large) for Pos.105b Back-to-Back		3/2-36	1		980191	Yes
112a	Seal Drv threaded for 112, Pos.105b Back-to-Back		3/2-36	1		400203	Yes
113	Set Screw for 112a, for Pos.105b Back-to-Back		3/2-36	1	3mm x M5 x 6mm	00ID7392	Yes
117	Pipe for Air Vent (option)		3/2-36	1	R 1/2", 316 Stainless	330272	Yes
118	Automatic Air Vent (option)		3/2-36	1	Type AE50S 1/2" BSP, Stainless	96498508	Yes
146	Allen Bolt for 147/148, for Pos.105b Back-to-Back		3/2-36	1	2.5mm x M3 x 5mm	96462639	Yes
147	Stationary Seal Retainer - Pos.105b Back-to-Back		3/2-36	1	NV36, 316SS	96457354	NO
148	Seal Retainer Washer - Pos.105b Back-to-Back		3/2-36	1	316SS, ø36.0 x ø21.6 x 5.0mm	96457355	NO
149	Connecting Pipe for Cool Top®		3/2-36	1	NV36, 316SS, FXM & EPDM	96460414	NO
			3/2-36	1	NV36, 316SS, FXM & FKM	96460415	NO
201	Flange		3/2-36	1	ANSI, DIN, JIS PN40/30K, Cast Iron	96439203	Yes
			3/2-36	1	ANSI, DIN, JIS PN40/30K, Stainless	96439492	Yes
203	Lock Ring for Flange		3/2-36	1	Stainless	96439718	Yes

Due to part changes over time, all position numbers (1-203) may not be used.

This column indicates which pump model uses the spare part. If blank, the part is used in all models.

NOTES:

^^^ 3/2 to 9 stage= # of Stages less 2
10 to 19 stage= # of stages less 3
21 to 27 stage = # of stages less 4
29 to 36 stage = # of stages less 5

^^^^ 3/2 to 9 stage= use 1
10 to 19 stage= use2
21 to 27 stage = use 3
29 to 36 stage = use 4

* Standard use 1. Back-to-Back or Tandem pump version use 3

** Standard use 1. Back-to-Back or Tandem pump version use 3

*** 1 used in Hxxx (Standard), 2 used in Pxxx (Tandem) pump version

◆◆ Standard use 2. Back-to-Back or Tandem pump version use 3

■ Standard use 2. Back-to-Back or Tandem pump version use 6

Cool Top® is a registered trademark of Grundfos Pumps

Key to Symbols

KITS ..... Recommended spare part
ø ..... Diameter
ANSI ..... American National Standards Institute
CPL ..... Complete Assembly – these parts consist of more than one component
EPDM ..... Ethylene Propylene (also known as EPR and EPT) – an elastic substance similar to rubber
FFKM ..... Kalrez Elastomer made by DuPont
FKM ..... Fluoro Elastomer (generic for Viton)
FXM ..... Fluoraz Elastomer made by Greene Tweed
M ..... International standard thread size designation (thread diameter in mm)
mm ..... Millimeter
MG ..... Identifies Grundfos motor type/size
N ..... Stainless
NBR ..... Buna - N (also known as Nitrile) – an elastic substance similar to rubber
NEMA ..... National Electrical Manufacturers Association
PTFE ..... Teflon
SiC ..... Silicon Carbide
TC ..... Tungsten Carbide
UNC ..... Unified National Coarse – a standard for threads on bolts

Spare Part Kits

Since certain pump parts can be expected to exhibit wear at the same time as related pump parts, they have been grouped into the following kits for your convenience. The numbers indicate the quantity of the part within each kit. Please order these kits using the kit material number at the top of the columns.

CR(I, N)1S-1, & 3 SiC Bearing						
WEAR PARTS KIT 2-9	Kit No.	96455095				
WEAR PARTS KIT 10-19	Kit No.	96455092				
WEAR PARTS KIT 20-27	Kit No.	96455093				
WEAR PARTS KIT 28-36	Kit No.	96455094				
Pos. No.	Description	Material No.	Qty. Included in each Kit			
4a	Chamber N CpL w/Pos.45 & 65 & SIC Bearing	96439476	1	2	3	4
39	Gasket for Oval Flange, 95 x 55 x ø35 x 2mm	400189	2	2	2	2
45	Neck Ring, ø41.3 x ø30.6 x .75mm, PTFE	400003	8	17	24	32
47a	Bearing Ring/Spacer, SIC 150, 13mm	96437488	1	2	3	4
64a	Spacing Pipe, ø15.85 x ø12.85 x 4.5mm	96440292	1	2	3	4
64c	Clamp, Splined, ø15 x ø13.10 x ø10.9 x 13mm	96439668	1	1	1	1
65	Neck Ring Retainer, N, ø43.5 x ø34.0 x 3.6mm	96438746	8	17	24	32
66	Lock Washer Set of 2, ø13.5 x ø8.2 x 2.6mm	96417297	1	1	1	1
67	Lock Nut, 13mm x M8	00ID2061	1	1	1	1

CR(I, N)1S-1, & 3 Grafion Bearing						
WEAR PARTS KIT 2-9	Kit No.	96460140				
WEAR PARTS KIT 10-19	Kit No.	96455110				
WEAR PARTS KIT 20-27	Kit No.	96455111				
WEAR PARTS KIT 28-36	Kit No.	96455112				
Pos. No.	Description	Material No.	Qty. Included in each Kit			
4a	Chamber N CpL w/Pos.45 & 65 & Grafion Brg.	96440615	1	2	3	4
39	Gasket for Oval Flange, 95 x 55 x ø35 x 2mm	400189	2	2	2	2
45	Neck Ring, ø41.3 x ø30.6 x .75mm, PTFE	400003	8	17	24	32
47a	Bearing Ring/Spacer, TC, 9.7mm	400041	1	2	3	4
64a	Spacing Pipe, ø15.85 x ø12.85 x 7.8mm	400016	1	2	3	4
64c	Clamp, Splined, ø15 x ø13.10 x ø10.9 x 13mm	96439668	1	1	1	1
65	Neck Ring Retainer, N, ø43.5 x ø34.0 x 3.6mm	96438746	8	17	24	32
66	Lock Washer Set of 2, ø13.5 x ø8.2 x 2.6mm	96417297	1	1	1	1
67	Lock Nut, 13mm x M8	00ID2061	1	1	1	1

STACK KITS	
Model	Material No.
CRN1S-3/2	96479078
CRN1S-3	96479079
CRN1S-4	96479080
CRN1S-5	96479081
CRN1S-6	96479082
CRN1S-7	96479083
CRN1S-8	96479084
CRN1S-9	96479085
CRN1S-10	96479086
CRN1S-11	96479087
CRN1S-12	96479088
CRN1S-13	96479089
CRN1S-15	96479090
CRN1S-17	96479091
CRN1S-19	96479092
CRN1S-21	96479093
CRN1S-23	96479094
CRN1S-25	96479095
CRN1S-27	96479096
*** CRN1S-30	96479097
*** CRN1S-33	96479098
*** CRN1S-36	96479099

***For 50 Hz operation only.

GASKET KIT (EPDM)	Kit No.	96455090							
GASKET KIT (FKM)	Kit No.	96455091							
GASKET KIT (FXM)	Kit No.	96463944							
GASKET KIT (FFKM)	Kit No.	96533328							
GASKET KIT (EPDM)-Double Seal option	Kit No.	96533362							
GASKET KIT (FKM)-Double Seal option	Kit No.	96533363							
GASKET KIT (FFKM)-Double Seal option	Kit No.	96533364							
GASKET KIT (FXM) & EPDM)-Cool Top* option	Kit No.	96533329							
Pos. No.	Description	Material No.	Qty. Included in each Kit							
37	Sleeve O-ring, EPDM, ø137.5 x 3.3mm	96438743	2				3			1
	Sleeve O-ring, FKM, ø137.5 x 3.3mm	96438744		2				3		
37b	Sleeve O-ring, FXM, ø137.5 x 3.3mm	96458109			2				2	
	Sleeve O-ring, FFKM, ø136.12 x 3.53mm	96466718				2				2
38, 100(a)	Drain Plug O-ring, EPDM, Ø16.3 x 2.4mm	00ID1288	3				7		3	
	Drain Plug O-ring, FKM, Ø16.3 x 2.4mm	00ID2231		3				7		4
38, 100a	Drain Plug O-ring, FXM, ø16.3 x 2.4mm	96442869			3				7	
	Drain Plug O-ring, FFKM, ø16.3 x 2.4mm	96428162				3				3
109(a)	O-ring for Pos.105(b) &149, EPDM, Ø21.3 x 3.0mm	00ID1798	1				1			
	O-ring for Pos.105(b) &149, FKM, Ø21.2 x 3.0mm	00ID2339		1				1		
109b	O-ring for Pos.105(b) &149, FXM, Ø22.0 x 2.75mm	96458111			1				2	
	O-ring for Pos.105(b) &149, FFKM, Ø23.47 x 2.62mm	96464384				1		2		2

STANDARD SHAFT SEAL KIT, BALANCED CARTRIDGE	Kit No.	96455088							
(Maximum allowed working PSI is 435)	Kit No.	96455089							
(Tandem Seal option Pumps require 2 of each Seal Kit)	Kit No.	96455086							
	Kit No.	96455087							
	Kit No.	96455082							
	Kit No.	96455083							
	Kit No.	96455084							
	Kit No.	96455085							
Pos. No.	Description	Material No.	Qty. Included in each Kit							
105	HQBE	96441879	1							
	HQBV	96441880		1						
	HQQE	96441877			1					
	HQQV	96441878				1				
	HUBE	96441873					1			
	HUBV	96441874						1		
	HUUE	96441875							1	
	HUUV	96441876								1
N/A	Grinding Device Tool for Emery Cloth	370711	1	1	1	1	1	1	1	1
N/A	Emery Cloth	370712	1	1	1	1	1	1	1	1

Spare Part Kits *(continued)*

OPTIONAL SHAFT SEAL KIT, BALANCED CARTRIDGE									
(Maximum allowed working PSI is 435)		Kit No.	96491375						
(Tandem Seal option Pumps require 2 of each Seal Kit)		Kit No.		96533327					
		Kit No.			96533326				
		Kit No.				96533323			
		Kit No.					96533322		
		Kit No.						96533325	
		Kit No.							96533324
Pos. No.	Description	Material No.	Qty. Included in each Kit						
105	HQ8K	96489537	1						
	HQQF	96472620		1					
	HQQK	96498109			1				
	HUBF	96481464				1			
	HUBK	96481463					1		
	HUUF	96475542						1	
	HUUK	96498108							1
N/A	Grinding Device Tool for Emery Cloth	370711	1	1	1	1	1	1	1
*N/A	Emery Cloth	370712	1	1	1	1	1	1	1

INBOARD SHAFT SEAL & Gasket KIT, Back to Back OQQE	Kit No.	96533360	
INBOARD SHAFT SEAL & Gasket KIT, Back to Back OQQV	Kit No.		96533361
(An HQQx seal kit must also be used for a seal repair)			
Pos. No.	Description	Material No.	Qty. Included in each Kit
37	Sleeve O-ring, EPDM, ø137.5 x 3.3mm	96438743	3
	Sleeve O-ring, FKM, ø137.5 x 3.3mm	96438744	3
38, 100(a)	Drain Plug O-ring, EPDM, Ø16.3 x 2.4mm	00ID1288	7
	Drain Plug O-ring, FKM, Ø16.3 x 2.4mm	00ID2231	7
102	O-ring, EPDM, ø18 x 2.5mm	00ID2041	1
	O-ring, FKM, ø17.86 x 2.62mm	00ID2187	1
103	Stationary Seal Ring, SiC,12mm	980746	1
104	Rotating Seal Ring, SiC, 12mm	980733	1
107	O-ring, EPDM, ø11.5 x 4.3mm	00ID2040	1
	O-ring, FKM, ø11.5 x 4.3mm	00ID2186	1
108	Spring, 12mm	980195	1
109a	O-ring, EPDM, ø21.3 x 3.0mm	00ID1798	1
	O-ring, FKM, ø21.2 x 3.0mm	00ID2339	1
111	Driver for pos.104	980192	1
112	Driver for pos.111	980191	1
112a	Driver for pos.112	400203	1
113	Set Screw for pos.112a	00ID7392	2
146	Allen Bolt for pos.147 & 148, 2.5mm x M3 x 5mm	96462639	3

IEC COUPLING KIT							
ø14/ø12	Kit No.	415060					
ø19/ø12	Kit No.		415061				
ø24/ø12	Kit No.			415062			
ø28/ø12	Kit No.				415063		
ø38/ø12	Kit No.					415065	
Pos. No.	Description	Material No.	Qty. Included in each Kit				
9	Allen Screw, M6 x 20mm, Delta Seal	00ID7899	4				
	Allen Screw, M8 x 25mm, Delta Seal	00ID7900		4	4	4	
	Allen Screw, M10 x 25mm, Delta Seal	00ID7901					4
10	Shaft Pin, ø5 x 26mm, Stainless	310192	1	1	1	1	1
10a	Coupling Half, F85, MG71, .37-.55kW. ø14/ø12	410041	2				
	Coupling Half, F100, MG80,.75-1.1kW. ø19/ø12	410043		2			
	Coupling Half, F115, MG 90, 1.5-2.2kW. ø24/ø12	410045			2		
	Coupling Half, F130, MG100/112, 3-4 kW.ø28/ø12	410047				2	
	Coupling Half, F265, MG132, 5.5-7.5kW. ø38/ø12	410115					2

NEMA COUPLING KIT					
ø15.8/ø12	Kit No.	415314			
ø28.5/ø12	Kit No.		415315		
ø34.9/ø12	Kit No.			96478700	
Pos. No.	Description	Material No.	Qty. Included in each Kit		
9	Allen Screw, M6 x 20mm, Delta Seal	00ID7899	4		
	Allen Screw, M8 x 25mm, Delta Seal	00ID7900		4	4
	Allen Screw, M10 x 25mm, Delta Seal	00ID7901			
10	Shaft Pin, ø5 x 26mm, Stainless	310192	1	1	1
10a	Coupling Half, 56C, 1/3 - 2HP. ø15.8 / ø12	410108	2		
	Coupling Half, 182/184TC, 3-5HP. ø28.5/ø12	410109		2	
	Coupling Half, 213TC, 7.5-10HP. ø34.9/ø12	96472175			2

Spare Part Kits *(continued)*

FLEXI FLANGE KIT FOR SMALL CRI1S, 1, & 3
1" Threaded Stainless (232 PSI Max.) — Kit No. 964680850

Pos. No.	Description	Material No.	Qty. Included in each Kit
12	Flange, Stainless, 1" - 11.5 NPT	96468336	2
35	Hex Head Bolt, M10 x 60mm, A4, DIN931	96447228	4
36b	Nut, M10, 316SS w/Delta Seal	96438757	4
39	Gasket , 95 x 55 x ø35 x 2mm, KLINGERSIL C4430	400189	2

FLEXI FLANGE KIT FOR SMALL CRI1S, 1, 3, & 5
1-1/4" Threaded Stainless (232 PSI Max.) — Kit No. 96480851

Pos. No.	Description	Material No.	Qty. Included in each Kit
12	Flange, Stainless, 1" - 11.5 NPT	96468337	2
35	Hex Head Bolt, M10 x 60mm, A4, DIN931	96447228	4
36b	Nut, M10, 316SS w/Delta Seal	96438757	4
39	Gasket , 95 x 55 x ø35 x 2mm, KLINGERSIL C4430	400189	2

FLEXI CLAMP FLANGE KIT FOR SMALL CRI(N)1S, 1, 3, & 5
1-1/4" Stainless Flange — EPDM Kit No. 96480858 — FKM Kit No. 96480859
(Conversion max. allowable operating pressure 232)

Pos. No.	Description	Material No.	Qty. Included in each Kit	
12a	Adapter Flg. for ANSI pos.201/Flexi Base (232 PSI)	96437818	2	2
35	Hex Head Bolt, M10 x 60mm, A4, DIN931	96447228	4	4
36b	Nut, M10, 316SS w/Delta Seal	96438757	4	4
39b	O-ring, EPDM, ø44.45 x 3.53mm	96407726	2	
	O-ring, FKM, ø44.45 x 3.53mm	96411713		2
201	Flange, ANSI, DIN, JIS PN40/30K, Stainless	96439492	2	2
203	Lock Ring, Stainless	96439718	2	2

FLEXI CLAMP KIT FOR SMALL CRI1S, 1, & 3
1" Internal Threaded SS Pipe Stub (232 PSI Max.) — EPDM Kit No. 96480854 — FKM Kit No. 96480855

Pos. No.	Description	Material No.	Qty. Included in each Kit	
12b	Stainless, Internal 1" -11.5 NPT	400182	2	2
12c	Clamp for Flexi Base & pos.12b	00ID7194	4	4
35b	Screw for Pos. 12c, M8 x 40mm - A2, RR DIN933	00ID7188	4	4
35c	Nut for Pos. 35b, M8, 304SS	00ID7187	4	4
39b	O-ring, EPDM, ø44.45 x 3.53mm	96407726	2	
	O-ring, FKM, ø44.45 x 3.53mm	96411713		2

FLEXI CLAMP KIT FOR SMALL CRI1S, 1, 3, & 5
1-1/4" Internal Threaded SS Pipe Stub (232 PSI Max.) — EPDM Kit No. 96480856 — FKM Kit No. 96480857

Pos. No.	Description	Material No.	Qty. Included in each Kit	
12b	Stainless, Internal 1-1/4" -11.5 NPT	410279	2	2
12c	Clamp for Flexi Base & pos.12b	00ID7194	4	4
35b	Screw for Pos. 12c, M8 x 40mm - A2, RR DIN933	00ID7188	4	4
35c	Nut for Pos. 35b, M8, 304SS	00ID7187	4	4
39b	O-ring, EPDM, ø44.45 x 3.53mm	96407726	2	
	O-ring, FKM, ø44.45 x 3.53mm	96411713		2

FLEXI CLAMP KIT FOR SMALL CRI1S, 1, 3, & 5
2" External Threaded SS Pipe Stub (232 PSI Max.) — EPDM Kit No. 96480852 — FKM Kit No. 96480853

Pos. No.	Description	Material No.	Qty. Included in each Kit	
12b	Stainless, Internal 2" -11.5 NPT	96468338	2	2
12c	Clamp for Flexi Base & pos.12b	00ID7194	4	4
35b	Screw for Pos. 12c, M8 x 40mm - A2, RR DIN933	00ID7188	4	4
35c	Nut for Pos. 35b, M8, 304SS	00ID7187	4	4
39b	O-ring, EPDM, ø44.45 x 3.53mm	96407726	2	
	O-ring, FKM, ø44.45 x 3.53mm	96411713		2

AIR VENT FOR SMALL CR — Kit No. 91128708

Pos. No.	Description	Material No.	Qty. Included in each Kit
117	Pipe for Air Vent, R1/2", 316SS	330272	1
118	Automatic Air Vent, Type AE50S 1/2" BSP, SS.	96498508	1

Accessories

ANSI COMPANION FLANGES FOR SMALL CR
1-1/4" Threaded Stainless, 300 Lb. Class — Kit No. 91129013

Pos. No.	Description	Material No.	Qty. Included in each Kit
N/A	Nut, HEX 5/8"-11 UNC, 18-8SS	0ID00164	8
N/A	Bolt, HEX 5/8" x 2-3/4", UNC 18-8SS	00ID7241	8
N/A	Flange 1-1/4" Stainless, ANSI, DIN, JIS PN40/30K,	00ID7239	2
N/A	Gasket Full Face Flange, 1-1/4", 300#, Cut Ring	400201	2

VICTAULIC TYPE COMPANION CONNECTIONS FOR SMALL CRI(N) — EPDM Kit No. 4013010 — FKM Kit No. 0ID00118

Pos. No.	Description	Material No.	Qty. Included in each Kit	
N/A	Victaulic Type Coupling, 1-1/4", EPDM	0ID17810	2	
N/A	Victaulic Type Coupling, 1-1/4", 77 FKM	0ID00112		2
N/A	1-1/4" Stainless NPT Nipple	4000011	2	2