CPE SYSTEMS
INCORPORATED

CPE Portable Pump Manual

How to care for your portable pump assembly

PUMPS
-
HOSES
-
HEAT EXCHANGERS
-
FLOW METERS
-
GASKETS
-
VALVES
-
FITTINGS
-
THERMOMETERS
-
PORTABLE SYSTEMS
-
and more

CONTENTS

1. INTRODUCTION

Thank you for purchasing a CPE Centrifugal Pump. Your pump comes completely set up, wired, and pre-programmed. Please read this manual front to back, it includes care instructions for your pump.

2. QUICK START GUIDE

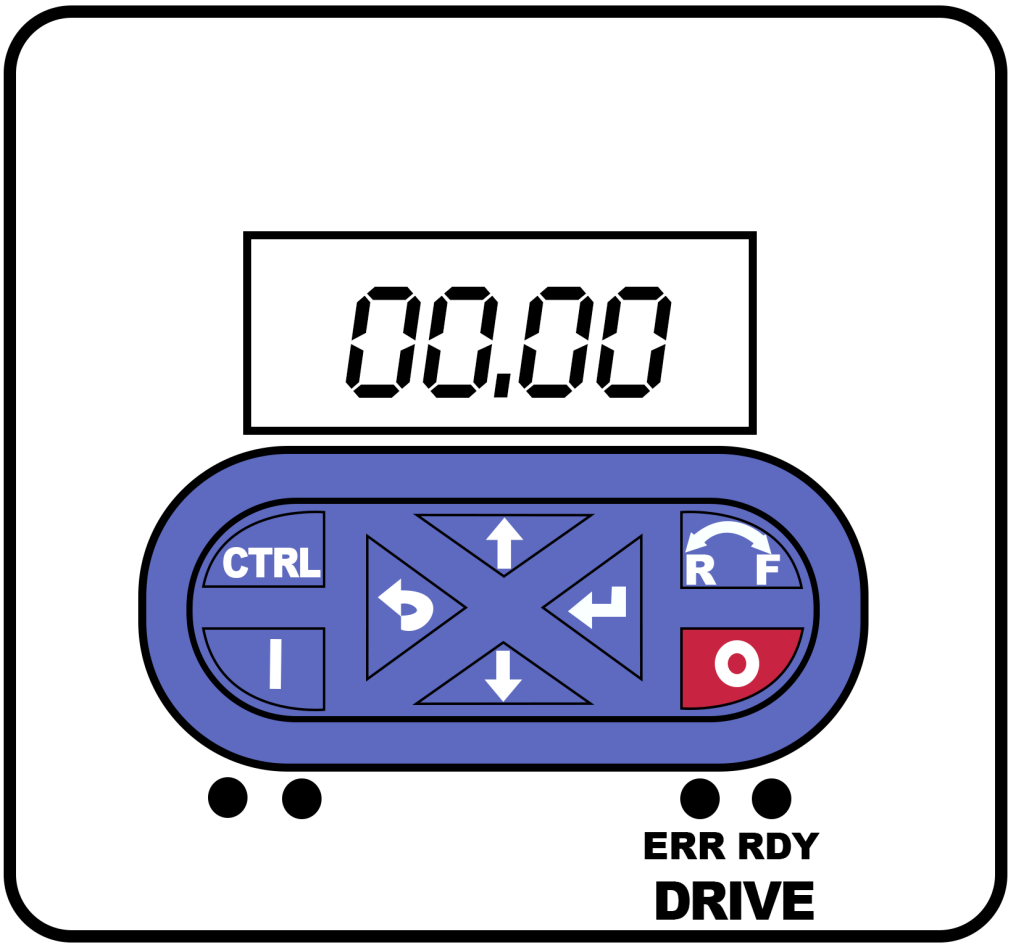
This pump was assembled, wired, programmed, and tested before shipping. It should be ready for use without any modifications or changes required on your part.

1. Connect inlet (suction) line to the Tri-Clamp fitting on the front of the pump using a new Tri-Clamp gasket and a heavy duty clamp. The inlet line should be at least the same diameter as the fitting on the pump. We recommend against clamping a valve or tee onto the inlet port.
2. Connect the discharger line to the Tri-clamp fitting on the top of the pump using a new Tri-clamp gasket and a heavy duty clamp.
3. Plug power cord into appropriate wall receptacle using the supplied plug. Do not change the plug or use an adapter, this will void the warranty.
4. Open valve on inlet line to the pump to allow liquid to flow to the pump.
5. Open valve on the discharge line if you have one installed.
6. If so equipped, adjust the potentiometer (speed control knob) on front of the digital pump controller to the midpoint so the indicator dot on the knob is at the top.
7. Press the run button  briefly to start the pump.
8. Adjust the speed of the pump by using the up and down arrows  or the potentiometer (if equipped) to obtain your desired flow.
9. When you are finished pumping. Stop the pump by pressing the stop button  . Do not stop the pump by simply turning down the speed to zero. This will still allow voltage to the motor and can cause damage and electrical shock.
10. Close both the inlet and discharge valves if equipped.

Note: Do not try to run your centrifugal pump in reverse. It will not operate in reverse; the forward/reverse button  has been disabled.

3. KEYPAD GUIDE

3.1 Layout

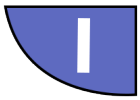
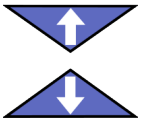


Caution:
Do not assume that your unit is in a power-off state because the LEDs or 4-digit display is off. This does not guarantee a power-off state. Be sure the pump is unplugged or that the main power switch or circuit breaker is in the "OFF" position before servicing the drive.

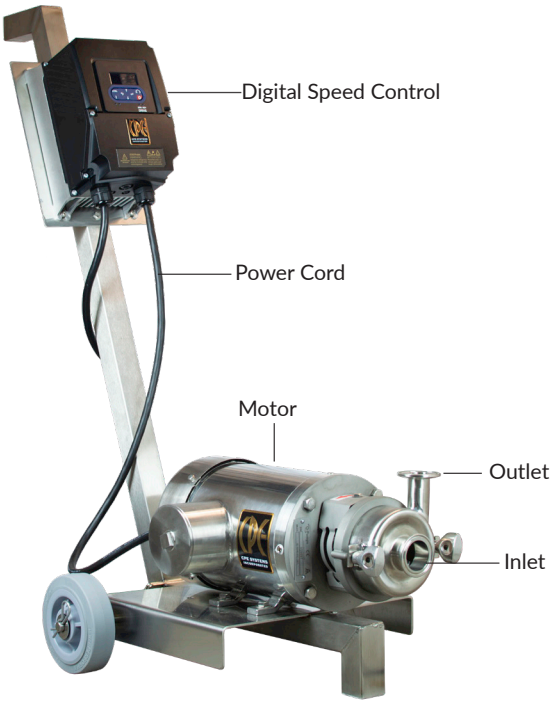
3.2 Drive Operation

Start-up procedure - Your variable frequency drive has been programmed and all the connections have been completed. To start the drive, press the run button  and use the up key  (or potentiometer, if so equipped) to achieve the desired speed. Use the up button  and the down button  to adjust the speed. To stop the pump, press the stop button  .

Table 1: Keypad Guide

Key	Actuation	Condition	Action
	Shortly	Local keypad control active Display "LOC"	Run Motor
		Remote control active Display "REM" Display "KSTOP"	Deactivate keypad triggered stop The motor remains at standstill Display changes from"KSTOP" to"STOP"
	Shortly	No jog operation	Stop motor Display "KSTOP"
	Shortly	Operating mode	Change to parameterization mode >keypad parameterization mode
	More than 3 s	None (anytime possible)	Save parameter settings in the user memory of the memory module
	Shortly	During operation	Scroll through information in the above status line
	Shortly	Manual setpoint selection via keypad active Display "MAN"	Change frequency setpoint
	Shortly	Operating mode	Activate full keypad control Display "ON?"→ Confirm with  Control and setpoint selection can now only be carried out via keypad Renewed clicking: Exit full keypad control Display "OFF?" → confirm with 
	Shortly	Local keypad control active Display "LOC"	Reversal of rotation direction Display "REV?"→ Confirm with 

4. LINE INSTALLATION



4.1 Inlet Line

The suction line should be short and follow a direct route with a minimum number of elbows and fittings. Elbows should be located as far as possible from the suction inlet to prevent head loss due to increased friction. Excessive friction losses in the suction line could result in pump cavitation, which causes poor performance, noise, vibration, damage to equipment, and possible damage to the product. Whenever practical the diameter of the line at the suction inlet should be increased in size. An eccentric tapered reducer should be used in lieu of a concentric tapered reducer to prevent air pockets from forming and impairing pump efficiency. The eccentric reducer may be placed at the inlet of the pump and should be positioned so the straight side is up. A horizontal suction line must have a gradual rise to the pump. A high point in the suction line will form an air pocket and prevent proper pump operation. All joints in the suction line should be airtight to prevent air leakage, which can reduce pump capacity and efficiency.

4.2 Outlet Line

Position the pump outlet line either vertical or top horizontal. The discharge line should be short and direct with a minimum number of elbows and fittings. Elbows should not be used at the discharge outlet as the friction encountered would be increased, resulting in head loss. It is advisable to increase the line diameter at the discharge outlet to prevent head loss. However, the use of a larger discharge line than recommended may reduce the total pump head while increasing the pump volume, which can cause pump vibration due to overload. Use of a discharge pipe smaller than the pump discharge outlet increases the total pump head but decreases the volume. If a reducer is required on the outlet port of the pump and the discharge is vertical, a concentric reducer should be used. If the discharge is horizontal, an eccentric reducer should be used, which should be positioned with the straight side down.

5. PUMP CLEANING

5.1 Clean In Place

Our centrifugal pumps are designed to be cleaned in place (CIP). No disassembly should be required for cleaning if a proper CIP procedure is followed.

5.2 Cleaning Stainless Steel

Cleaning of stainless steel (AISI 300 Series), manually or chemically, is dependent on the process environment the equipment is operated in. Typically, the cleaning regimen should be developed and reviewed by a plant sanitarian or a formulation representative of a reputable chemical supply company.
The following chemicals may be utilized to clean, passivate, and disinfect equipment prior to operation:

Alkaline Detergent: A blended alkaline detergent may be used to clean equipment. The detergent should be a blended sodium hydroxide/water detergent, designed for use with stainless steel equipment and used at initial concentrations of 1-3% w/w solution at a temperature of 160° F (70° C) to 195° F (90° C) (depending on the chemical supplier). The detergent should be formulated with a metal chelating agent, such as sodium gluconate or gluconic acid, to remove metal ions in the water (hardness dependent) and a surfactant to increase the rinse ability of the solution.

Acid: To neutralize any residual alkali and render a passive surface on the stainless steel, a 160°F (70° C) solution of citric acid and water at a concentration of 0.5-3% w/w can be used. Phosphoric acid may be used at concentrations of 0.5-1.5% w/w at 115° F (45° C). If phosphoric acid is used, corrosion inhibitors should be blended in prior to use.

Disinfectant (Food Plants): Caution should be used with the application of chemical disinfectants. Most chemical disinfectants are halogen or quaternary ammonium-based compounds and, in high concentrations, are very corrosive to stainless steel. Typically, the most common disinfectant, iodophor, can be used with a maximum concentration of 25 mg/l at a maximum temperature of < 80°F (25° C). Other common disinfectants, such as sodium hypochlorite and chloramine, are not recommended.

5.3 Preventing Corrosion

The corrosion resistance of stainless steel is greatest when a layer of oxidation is formed on the surface of the metal. If the protective surface is disturbed or destroyed, the metal can easily be corroded by contact fluids.

1. Regularly inspect stainless steel equipment for surface deposition and/or localized pitting corrosion. If deposition or discoloration is detected, disassemble equipment, remove components and soak in a mild alkaline-based detergent. Rinse using warm water. Allow equipment to air dry thoroughly before assembly.
2. Regularly check all electrical devices and verify all equipment is grounded to avoid any electrolytic-concentration corrosion.
3. Regularly inspect joints and gaskets in the system for crevice corrosion.
4. Regularly inspect equipment for trapped air pockets to avoid pitting caused by oxygen concentration corrosion.
5. Regularly inspect any areas of equipment using dissimilar metals connected by a mechanical joint to avoid galvanic corrosion.
6. Regularly inspect system components not manufactured with stabilized low carbon stainless steel (intergranular corrosion).

6. MAINTENANCE

Caution:
Before servicing pump, disconnect electrical power source, carefully relieve all pressure and drain all fluids from pump and connected piping.

For C-Series pumps equipped with the “Groove-In-Shaft” design (types D, DG, or F seals only), it is not necessary to disassemble if used in a Clean-In-Place installation. In some applications, it may be necessary to disassemble parts of the pump for cleaning and sanitizing. The extent of disassembly will depend on the application and the type of seal used in your pump. It is recommended that periodic inspection of all parts of the pump be made to prevent malfunctions caused by worn or broken parts. Disassembly for repair is the same procedure as for cleaning.

6.1 Disassembly

Disassembly of the pump wet end

1. Disconnect the inlet and outlet lines.
2. Remove seal guard assembly with a wrench of appropriate size.
3. Turn the wing nut on the clamp assembly until tension on the clamp saddle is relieved. (On a C100 pump remove the two wing nuts.
4. Open the clamp and remove the casing. (C114 and large pumps only)
5. Push back on the impeller and center the retainer pin in the stub shaft.
6. Slide the impeller forward and remove it. Do not try to remove the retainer before removing the impeller, as this will cause damage to the retainer, shaft, and impeller.
7. Rotate the backplate until the backplate pins clear the pins in the adapter and remove the backplate
8. Remove the casing gasket.
9. Remove the carbon seal, seal o-ring, seal cup, and spring.

Note: Protect the sealing surface of the backplate against nicks and scratches while removing, cleaning, and reassembling.

D & F Seal Service

1. For D and F seals, examine the backplate sealing surface carefully for any damage that will shorten seal life.
2. Remove the carbon seal, o-ring seal, cup, and spring. If your pump is equipped with a drive collar, remove it by loosening set screws and sliding the collar off the stub shaft.
3. Carefully inspect the seal o-ring and carbon seal for signs of abrasions, cuts or other wear that would cause leakage. When the extension of the carbon seal face extends less than 1/32” from the body, it is advisable that the carbon seal be replaced.
4. Remove the cascading water attachment, if included. Remove the rubber shaft deflector by prying it gently from the rear, while sliding it forward. Examine the deflector for tearing, loose fit, or other defects that would allow fluid leakage into the motor along the armature shaft.
5. Remove the bolts securing the adapter to the motor frame and remove the adapter. Loosen the 4 set screws securing the stub shaft to the motor armature. Remove the stub shaft by prying from the back with a flat bar. The stub shaft is a tight fit but can be removed by evenly applying pressure around the periphery of the shaft with a pry bar. (This step is not required for seal replacement)
6. Examine the stub shaft sealing surface for nicks or scratches which can cause excessive o-ring seal wear or leaking.
7. Inspect the casing clamp for damage or wear and replace as required.
8. Inspect the wheels, adapter, and casing; replace if necessary.

Note: The electric motor contains no field serviceable components; therefore, this manual does not cover the maintenance, repair, and wiring of the electric motor. For specific information contact CPE Systems.

DG Seal Service

1. Perform disassembly as above for the “D” seal
2. Remove the four bolts/screws from the backplate. Inspect DG seat insert, gland ring, and gaskets for damage or wear. Replace as required.

Note: 80P outboard and #80R inboard gaskets are not interchangeable. The #80R (thicker) gasket must be inboard between the backplate and seal seat. Care must be taken to protect the sealing face of the seal seat for DG seals from nicks and scratches.

3. Remove the carbon seal and seal o-ring. Examine and replace as necessary.

6.2 Reassembly

1. If it was removed, install the adapter to the motor with the drain holes at the bottom. Insert the four bolts securing the adapter to the motor; tighten the bolts securely.
2. Assemble the stub shaft to the motor armature shaft. Do not tighten set screws.
3. Install the backplate by rotating it until the pins in the backplate engage the pins in the adapter.
4. Rotate the shaft until the floating pinhole is in a horizontal position. Insert the floating retainer, center it in the shaft, and slide the impeller on the shaft. Hold the impeller tight against the shoulder of the shaft and rotate the shaft one-fourth turn until the floating retainer drops and engages the impeller.
5. Install the casing and secure it with the clamp or wing nuts.
6. Push the stub shaft onto the motor shaft until the impeller strikes the inside front face of the backplate. Locate the stub shaft on the motor shaft allowing 1/16th (1.5mm) maximum clearance between the rear face of the impeller and the inside face of the backplate. Tighten the set screws on the stub shaft. Remove casing, impeller, impeller pin, and backplate.
7. Slide the rubber deflector on the shaft until it sits in the groove in the shaft.
8. Slide drive collar onto stub shaft and locate per setting instructions in next section. Assemble the spring, seal cup, seal o-ring, and carbon seal, and install as a unit. Take care that the slot in the seal cup is aligned with the pin in the drive collar. Gentle finger pressure will overcome o-ring resistance on the shaft.
9. Install the backplate by rotating it until the pins in the backplate engage the pins in the adapter.
10. Rotate the shaft until the floating pin hole is in a horizontal position. Insert the floating retainer, center it in the shaft, and slide the impeller on the shaft. Hold the impeller tight against the shoulder on the shaft and rotate the shaft one-fourth turn until the floating retainer drops and engages the impeller.
11. Install gasket on backplate.
12. Place the casing in position and close and tighten the clamp or wing nuts while lightly tapping the clamp with a hammer to ensure even tightening. Assemble seal guard and tighten nuts.
13. Assemble the cascading water attachment, (F seal only) to the adapter.

14. Assemble the inlet and outlet lines to the pump. Check for strain on the casing. Adjust as necessary.

Note: Apply a small amount of food-grade lubricant to the o-ring prior to installation. Do not lubricate the carbon seal with any type of oil or grease. The seal faces are lubricated by the product being pumped.

6.3 Setting The Seal Drive

Setting The Seal Drive Collar By Position

1. Assemble the spring, seal cup, seal o-ring, and carbon seal onto the drive collar. Care must be taken so that the spring does not rest on the tab that is bent back. A portion of the spring is offset to provide clearance for this tab. Care must be taken to ensure that the pins on the drive collar are in line with the slot on the cup.
2. Install as a unit on the shaft.
3. Install the backplate and casing.
4. Install and tighten the casing clamp.
5. Slide the drive collar and seal assembly toward the backplate until the nose of the drive collar pushes the o-ring and carbon seal tight against the backplate.
6. Slide the drive collar away from the backplate 1/32" (.79mm) and secure the drive collar in this location with the set screws.
7. When the drive collar is properly positioned and seal components are properly installed, the pump shaft should rotate freely by hand. If excessive effort is required to rotate the shaft, check to be sure that all components are properly installed and the drive collar is properly positioned.

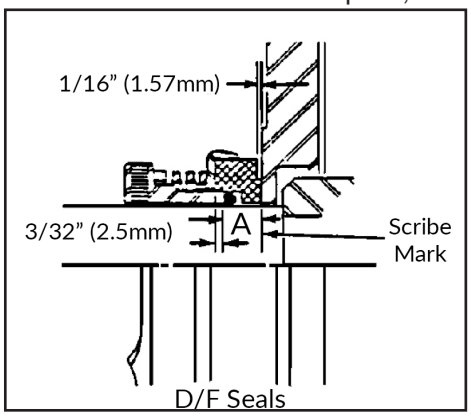
Note: Extra care should be taken when assembling C series pumps with type DG seal. Incorrect stub shaft settings will allow the impeller hub to contact the inboard face of the stationary seal seat. Interference of impeller hub and seal seat face will cause wear of impeller hub and damage the inboard or secondary seal face of the clamped-in-seat. Usual inspection is recommended after installation of the impeller, and before installation of casing, to ensure clearance between the impeller hub and seal face. If no clearance is visible, the pump should be disassembled and the stub shaft moved forward to provide at least 1/32 (.79) mm clearance between the impeller hub and seal seat face. Reset seal drive collar if necessary. Rotate freely by hand; if excessive effort is required to rotate the shaft, check to be sure that all components are properly installed and the drive collar is properly positioned.

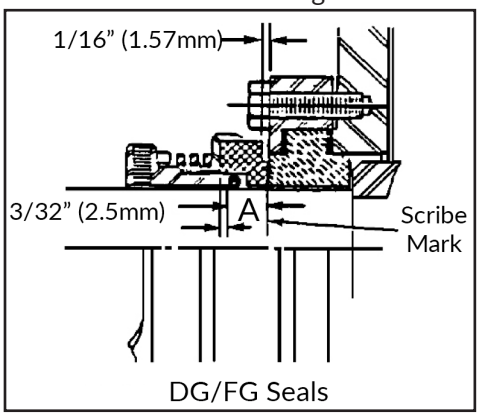
Setting The Drive Collar By Measurement

Note: Not applicable to the C100 model

1. Install the backplate, gasket, and casing.
2. Install and tighten casing clamp

3. At a location behind the backplate, scribe a mark on the shaft. See figures below.





4. Remove casing clamp, casing, and backplate.
5. Slide the drive collar onto the shaft.
6. Locate drive collar in relation to the scribe mark as shown in dimension A and secure to the shaft with the set screws. Drive collar location is critical.

Model	"A" Dimension
C114	1 ³⁄₃₂" (2.3 mm)
C216	1 ³⁄₃₂" (2.3 mm)
C218	1 ³⁄₃₂" (2.3 mm)
C328	1 ³⁄₃₂" (2.3 mm)
C4410	1 ³⁄₃₂" (2.3 mm)

7. Install the seal spring, seal cups, seal o-ring, and carbon onto the shaft.

7. VFD DIGITAL SPEED CONTROL

7.1 Standard Features

- Protection level of IP66 (NEMA 4X) with indoor and outdoor approval; hose-proof, dust-tight, and approved for use in rough environments.
- First decentral drive in the market with IO-Link Device Interface.
- Sensorless vector control for synchronous motors.
- Intuitive user interface for fast setup and easy navigation by parameter structure.
- Onboard display with built-in diagnostics.
- Micro USB interface for programming and diagnostics.
- Multiple digital and analog inputs for remote control and safety interlocks.
- Compatible with our wireless remote controls, pressure switches and run-dry protection.
- Full onboard PID programming for interfacing with flow meters, level controls, pressure sensors, and can/bottle fillers.
- Optional front-mounted potentiometer (speed control knob).
- IO-Link compatible.

Note: Your drive has been programmed with the correct settings for optimal performance. Do not change the parameter settings without contacting the manufacturer. This will void the warranty.

7.2 Protection Features

Degree of protection:

- IP66 (EN 60529)
- NEMA type 4X outdoor NEMA 250)
- UL type 4X outdoor (UL 50E)

Insulation resistance:

- Overvoltage category III (EN61800-5-1) - 0 ... 2000 m amsl
- Overvoltage category II (EN61800-5-1) - Over 2000 m amsl

Isolation of control circuits:

- Safe mains isolation via double/reinforced insulation (EN 61800-5-1)

Protective measures against:

- Short circuit
- Earth fault - earth-fault protected depending on operating status
- Overtemperature of motor - PTC or thermal contact
- Overvoltage
- Motor Stalling

Leakage Current: >3.5 mA AC, >10 mA DC (EN 1800-5-1)

Starting Current: ≤ 3 x rated mains current

7.3 Programming

Note: The VFD is factory set for optimal operational efficiency. If you need to make changes please contact our service department for assistance.

All parameters of the inverter can be accessed by means of the keypad for commissioning and diagnostics and are listed in Table 2.

- The keypad parameter list is sorted in ascending order in compliance with the "display code" (Pxxx).
- In order to provide quick access, all parameters of the inverter are divided into different groups according to their function.
- Group 0 contains the configurable "Favourites". In the default setting these are the most common parameters for the solution of typical applications.
- Based on the hundreds digit of the display code (Pxxx) you can quickly see in which group the parameter is to be found on the keypad.

Table 2: Keypad Parameter List

Parameter	Group - Name	Description
P1xx	Group 1 - Diagnostics	Diagnostic/display parameters for displaying device-internal process factors, current actual values, and status messages.
P2xx	Group 2 - Basic setting	Setting of the mains voltage, selection of the control and setpoint source, starting and stopping performance, frequency limits, and ramp times.
P3xx	Group 3 - Motor control	Configuration of the motor and motor control.
P4xx	Group 4 - I/O setting	Function assignment and configuration of the inputs and outputs.
P5xx	Group 5 - Network setting	Configuration of the network (if available).
P6xx	Group 6 - Process controller	Configuration of the process controller.
P7xx	Group 7 - Additional functions	Parameterizable additional functions.
P8xx	Group 8 - Sequencer	The "sequencer" function serves to define a programmed sequence of speed setpoints, PID setpoints or torque setpoints for the motor control. Switching to the next setpoint can be executed in a time-based or event-based manner.

Note: This table is provided for reference only. Please contact customer support before changing any parameters.

7.4 Specifications

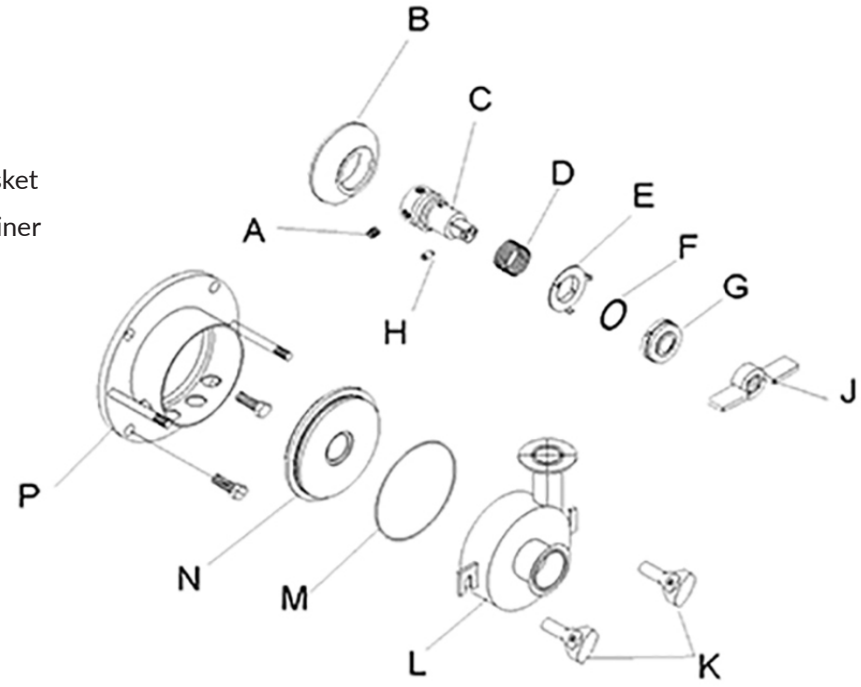
Table 3: Technical Data

i550 protec		
Mains	1 AC 120 V	0.37 ... 1.1 kW (0.5 ... 1.5 hp)
	1 AC 230 V	0.37 ... 2.2 kW (0.5 ... 3 hp)
	1/3 AC 230 V	0.37 ... 3 kW (0.5 ... 4 hp)
	3 AC 230 V	3 ... 22 kW (4 ... 30 hp)
	3 AC 400 V/480 V	0.37 ... 22 kW (0.5 ... 30 hp)
	3 AC 600 V	0.75 ... 3 kW (1 ... 4 hp)
Overload Behaviour		Mode S1: 150%, mode S6: 200%
Interfaces		Digital inputs/outputs (5/1), analog inputs/outputs (2/1) Relay
		External 24 V supply PTC/thermal contact HTL incremental encoder (100 kHz) USB onboard
		CANopen, EtherCAT, EtherNet/IP, Modbus RTU, Modbus TCP, PROFINET, IO-Link
		Integrated brake chopper DC bus connection
Conformity and Approvals		CE, UL, CSA, EAC, RoHS2, IE2 in accordance with EN 50598-2
Functions		V/f characteristic control linear/square-law (VFC plus) Sensorless vector control (SLVC) Energy saving function (VFC eco) Servo control (SC-ASM) with feedback Sensorless vector control for synchronous motors
		Vector control with feedback V/f V/f characteristic control with feedback
		DC-injection braking Brake management for brake control with low rate of wear
		Dynamic braking through brake resistor
		S-ramps for smooth acceleration and delay Flying restart circuit, PID controller
Safety Technology		Safe torque off (STO)

8. PUMP PARTS

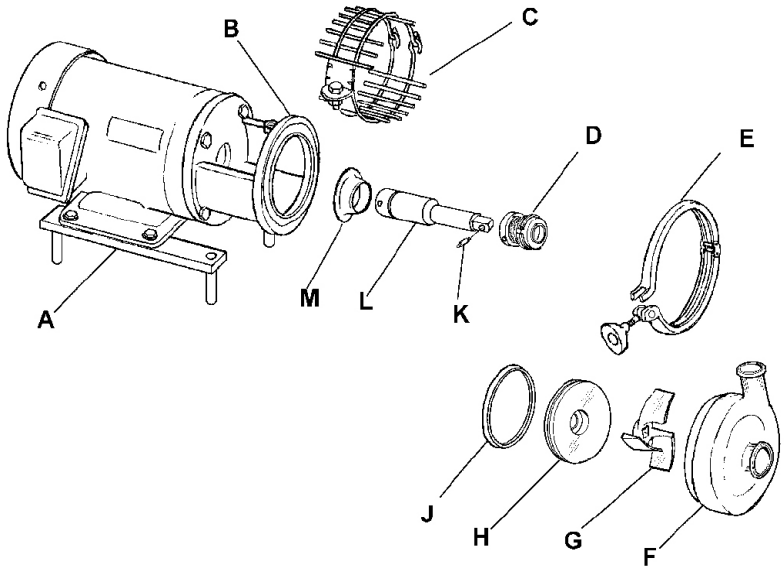
8.1 C-100 Pump Parts

A. Motor Leg Kit Assembly	G. Impeller
B. Adaptor	H. Backplate
C. Guard	J. Backplate Gasket
D. Type "D" Seal Assembly	K. Impeller Retainer
E. Clamp	L. Stub Shaft
F. Casing	M. Deflector



8.2 C-114 through C328 Pump Parts

A. Shaft Set Screw	H. Impeller Retainer
B. Deflector	J. Impeller
C. Stub Shaft	K. Wing Nut
D. Spring	L. Casing
E. Cup	M. Backplate Gasket
F. O-Ring	N. Backplate
G. Seat Seal	P. Adapter



9. TROUBLESHOOTING

CPE pumps are relatively maintenance-free with the exception of sanitizing and seal replacement. However, like any piece of machinery occasional problems can arise. This section provides a means of determining and correcting most of your pump problems. The motor manufacturer should be contacted for specific repair instructions on the motor. Table 4 and Table 5 has been prepared on the basis that the pump is properly-suited to its application. Should problems arise where the remedies listed in the following tables do not resolve them, pump cavitation may be the problem. Symptoms of pump cavitation, such as noisy operation, insufficient discharge, and vibration, can result when a pump is not properly applied. If these conditions are present, check the system and re-evaluate the application. If assistance is required, contact CPE Systems.

9.1 Pumping

Table 4: Pump Troubleshooting

Problem	Probable Cause	Remedy
1. No Discharge	a. Pump speed too low	a. Correct wrong or poor electrical connections
	b. Wrong direction of rotation	b. Reverse a three-phase motor by switching any two of the three power leads at the motor controller; reverse a single phase motor per motor manufacturer's instructions
	c. Closed valve; obstruction in discharge piping	c. Open gate valve; clear obstruction
2. Insufficient Discharge	a. Pump speed too low	a. See 1.a
	b. Wrong direction of rotation	b. See 1.b
	c. Valve partially closed; obstruction in discharge piping	c. See 1.c
	d. Impeller damaged	d. Replace Impeller
3. Excessive Power Consumption	a. Motor speed too high	a. Internal motor wiring is incorrect; replace motor
	b. Impeller is binding	b. Relieve strain on casing replace defective impeller
	c. Motor shaft is bent or worn	c. Replace shaft
4. Pump Is Noisy	a. Magnetic hum in motor	a. Consult motor manufacturer
	b. Motor Bearings are worn	b. Replace bearings
	c. Foreign matter is rotating with impeller	c. Remove casing and remove foreign matter
	d. Impeller is binding	d. See 3.b
	e. Cavitation	e. Improper sizing or piping, etc.
5. Excessive Vibration	a. Pump is not leveled properly	a. Level pump
	b. Impeller is damaged	b. Replace impeller
	c. Piping is not supported	c. Support discharge and suction piping
	d. Cavitation	d. Improper sizing or piping, etc.
6. Pump Leaks	a. O-ring seal is worn or defective	a. Replace o-ring seal
	b. Carbon seal is worn	b. Replace carbon seal
	c. Insufficient compression on seal assembly	c. Replace spring
	d. Damaged inlet or outlet	d. Replace casing
	e. Backplate gasket is worn	e. Replace gasket
	f. Clamp is loose	f. Tighten clamp

9.2 VFD Error Codes

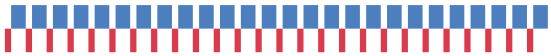
Table 5: VFD Error Codes

Error Code	Description	Classification	Remedy	Blocking Times	Reset Possible
2250	CiA: Continuous overcurrent (inside the device)	Fault	• Check motor and wiring for short circuit • Check brake resistor and wiring • Check motor circuit (delta connection, star connection) • Check setting of the motor	5	Yes
2320	Short circuit or earth leakage on the motor side	Fault	• Check motor cable • Check the length of the motor cable • Use shorter or lower-capacitance motor cable	5	Yes
2340	CiA: Short circuit (inside the device)	Fault	• Check motor cable for short circuit	5	Yes
2350	CiA: i^2*t overload (thermal state)	Fault	• Check drive sizing • Check machine/driven mechanics for excessive load • Check setting of the motor data • Reduce values for slip compensation (P315.01, P315.02) and oscillation damping (P318.01, P318.02)	5	Yes
2382	Error: Device utilisation (Ixt) too high	Fault	• Check drive sizing • Reduce maximum overload current of the inverter (P324.00) • In case of high mass inertias, reduce maximum overload current of the inverter (P324.00) to 150%	3	Yes
2383	Warning: Device utilisation (Ixt) too high	Warning	• Check drive sizing	0	Yes
3120	Mains phase fault	Fault	• Check wiring of the mains connection • Check fuses	0	Yes
3210	DC bus overvoltage	Fault	• Reduce dynamic performance of the load profile • Check mains voltage • Check settings for braking energy management • Connect brake resistor to the power unit and activate the integrated brake chopper (P706.01 = 0: Brake resistance)	0	Yes
3211	Warning: DC bus overvoltage	Warning	• Reduce dynamic performance of the load profile • Check mains voltage • Check settings for braking energy management • Connect brake resistor to the power unit and activate the integrated brake chopper (P706.01 = 0: Brake resistance)	0	Yes
3220	DC bus undervoltage	Trouble	• Check mains voltage • Check fuses • Check DC bus voltage (P105.00) • Check mains settings	0	Yes

Error Code	Description	Classification	Remedy	Blocking Times	Reset Possible
3221	Warning: DC bus undervoltage	Warning	• Check mains voltage • Check fuses • Check DC bus voltage • Check mains settings	0	Yes
3222	DC bus voltage too low for switch-on	Warning	• Check mains voltage • Check fuses • Check mains settings	0	Yes
4210	PU: Overtemperature fault	Fault	• Check mains voltage • Provide for sufficient cooling of the device (display of the heatsink temperature in P117.01) • Clean fan and ventilation slots. If required, replace fan • Reduce switching frequency (P305.00)	0	Yes
4281	Heatsink fan warning	Warning	• Clean fan and ventilation slots. If required, replace fan. The fans can be unlocked via locking hooks and can then be removed	0	Yes
4310	Error: Motor overtemperature	Fault	• Check drive sizing • Check motor thermal sensor and wiring (X109/T1 and X109/T2)	5	Yes
5112	24-V supply fault	Warning	• Check optional external 24-V voltage supply (terminal X3/24E), if connected • Check mains voltage	0	Yes
5180	24-V supply overload	Warning	• Check 24-V output and digital outputs for earth fault or overload	0	Yes
6280	Trigger/functions connected incorrectly	Trouble	• Check and correct the assignment of the triggers to the functions • With keypad or network control, the two functions "Inverter enable" (P400.01) and "Run" (P400.02) can also be set to "Constant TRUE{1}" to start the motor	0	Yes
7180	Motor overcurrent	Fault	• Check motor load • Check drive sizing • Adapt the set error threshold (P353.01)	1	Yes
9080	Keypad removed	Fault	• Plug on the keypad again or activate another control source	0	Yes
FF02	Error: Brake resistor overload	Fault	• Check drive sizing • Check settings for the braking energy management Note: The error will be reset if the thermal load falls below the error threshold (P70180) of - 20%	5	Yes
FF06	Motor overspeed	Fault	• Adapt the maximum motor speed (P322.00) and the error threshold (P350.01)	1	Yes
FF36	Warning: Brake resistor overload	Warning	• Check drive sizing • Check settings for the braking energy management Note: The warning will be reset if the thermal load falls below the warning threshold (P707.08) of - 20%	0	Yes
FF37	Automatic start disabled	Fault	• Deactivate start command and reset error	0	Yes
FF85	Keypad full control active	Warning	• To exit the control mode, press the control CTRL keypad key	0	Yes

Table 6: Diagnostics and Fault Elimination

The "RDY" and "ERR" LED status displays on the front of the inverter provide some quick information about certain operating states.

"RDY" LED (blue)	"ERR" LED (red)	Status/meaning
Off	Off	No supply voltage.
 On	 On	Initialization (inverter is started).
 Blinking (1 Hz)	Off	Safe torque off (STO) active.
	 Blinking fast (4 Hz)	Safe torque off (STO) active, warning active.
 Blinking (2 Hz)	Off	Inverter inhibited.
	 Blinking fast (4 Hz)	Inverter disabled, warning active.
	 On	Inverter disabled, error active.
	 Lit ever 1.5s for a short time	Inverter inhibited, no DC-bus voltage.
	 On for a short time every 1s	USB module is connected, 5-V supply voltage for the USB module is available.
 On	Off	Inverter enabled. The motor rotates according to the specified setpoint or quick stop active.
	 Blinking fast (4 Hz)	Inverter enabled, warning active. The motor rotates according to the specified setpoint or quick stop active.
	 Blinking (1 Hz)	Inverter enabled, quick stop as response to fault active.
 Both LEDS are blinking in a rapidly alternating mode		Firmware update active.
 Both LEDs are blinking in a very rapidly synchronous mode		"Visual tracking" function is active.