



Set Up Instructions for DVFP

Inspect the packaging of the equipment to confirm that nothing was damaged during shipping.

Remove the system from the packaging. Make sure everything is included and without damage. Below is a checklist with everything you should have received. The system will already be assembled and should arrive in one piece.

- _____ 1) Pump (Figure 1)
- _____ 2) Variable Frequency Drive (VFD) (Figure 2)
- _____ 3) Pressure Tank (Figure 3)
- _____ 4) Plumbing



Figure 1: Pump



Figure 2: VFD



Figure 3: Pressure Tank

Call Diamond H2O right away if anything is missing. Contact the freight company **immediately** if anything is damaged. Diamond H2O will not be liable for any damage received after shipping.

Packaged By: _____

Date: _____

Received By: _____

Date: _____

Table 1: System Specifications

Model Number	Motor (HP)	Suction	Discharge	Input Voltage	Wire Size ¹	Circuit Breaker ²	Generator (kVA) ³
					Input (AWG)		
DVFP-10	1	2	1 ½"	460 V	14	15	3.4
DVFP-20	2	2	1 ½"	460 V	12	25	5.5
DVFP-30	3	2	1 ½"	460 V	12	25	5.5
DVFP-50	5	2	1 ½"	460 V	10	50	12.6

1. AWG will change depending on length of wire (values are for a max 300ft from input).
14 AWG wire can be used for any system using less than 100ft of wire from power supply.
2. With properly-sized circuit breakers, the Drive is protected from short circuit on the input and the output.
3. Minimum 240V generator size.

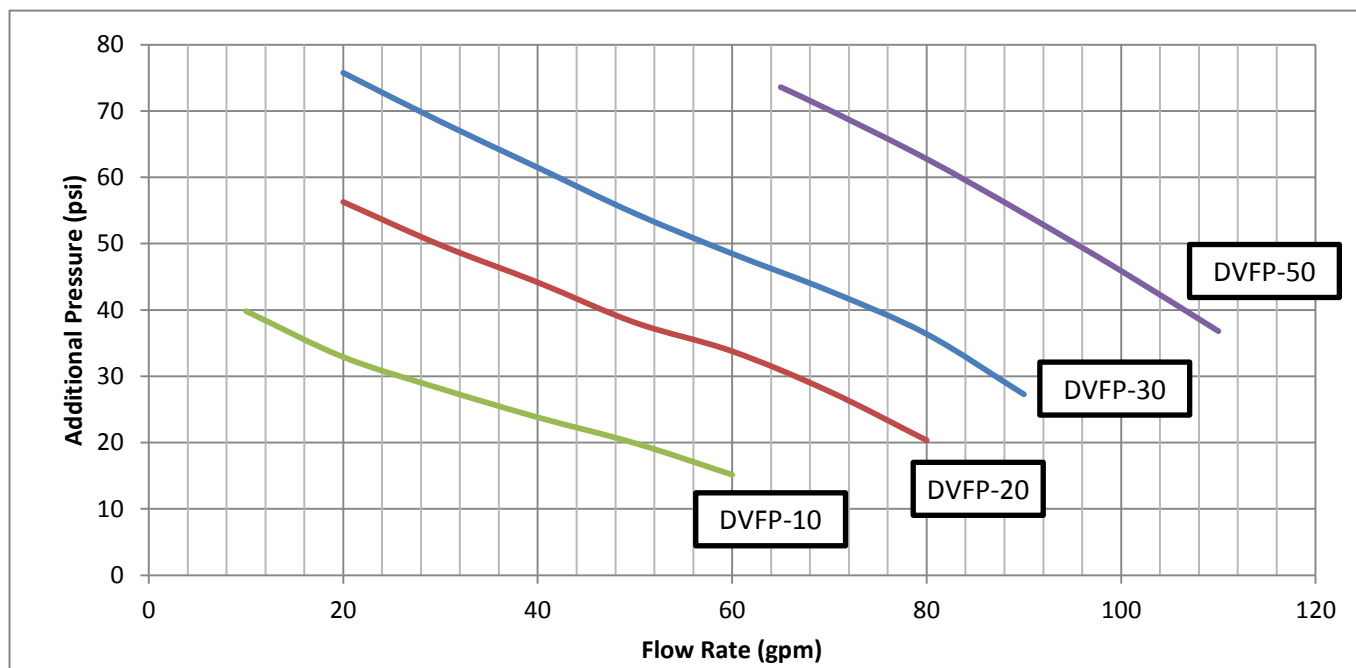


Figure 4: DVFP Sizing Recommendations

Warnings

- All installation, service work, and inspections must be done by a **qualified electrician**. Risk of high-voltage electrical shock from EMI/RFI filter inside drive. Can shock, burn or kill if the front cover of the PENTEK INTELLIDRIVE is open or removed while power is connected to the Drive or the Drive is running. The front cover of the Drive must be closed during operation.
- Make all wiring connections, then close and fasten the cover before turning on power to drive.
- NEVER open the box when power is connected to Drive.
- **Before doing any service or maintenance inside Drive or when connecting or disconnecting any wires inside Drive:**
 - A. DISCONNECT power.
 - B. WAIT 5 minutes for retained voltage to discharge.
 - C. Open box.
- Before starting any wiring or inspection procedures, check for residual voltage with a voltage tester.
- **NEVER...**
 - connect power wiring to Drive before mounting the box.
 - handle or service Drive with wet or damp hands. Always make sure hands are dry before working on Drive.
 - reach into or change the cooling fan while power is applied to Drive.
 - touch the printed circuit board when power is applied to Drive.



Warnings continued...

- Do not modify equipment.
- Do not use power factor correction capacitors as they will damage both motor and PENTEK INTELLIDRIVE.
- Do not remove any parts unless instructed to do so in Owner's Manual.
- Do not use a magnetic contactor on Drive for frequent starting/stopping.
- Do not install or operate Drive if it is damaged or parts are missing.
- Before starting Drive that has been in storage, always inspect it and test operation.
- Do not carry out a megger (insulation resistance) test on the control circuit of the Drive.
- Do not allow loose foreign objects which can conduct electricity (such as screws and metal fragments) inside Drive box at any time. Do not allow flammable substances (such as oil) inside Drive box at any time.
- Ground Drive according to the requirements of the National Electrical Code Section 250, IEC 536 Class 1, or the Canadian Electrical Code (as applicable), and any other codes and ordinances that apply.

Setup Instructions

1. Place the System near a water source and a power source.

Decide where you would like to place the system. Ideally, it should be very close to the water source and within 25 feet of a circuit breaker. The VFD should be mounted on the wall with a few inches of clearance on every side of the VFD. This will allow free air flow to the unit.

2. Connect the Pump to the Water Source

System piping should be at least one commercial pipe size larger than pump connections and flow velocity should not exceed eight (8) feet per second. In pool installation, flow velocity should not exceed six (6) feet per second. The inlet of the pump is shown in Figure 4.

Follow all local codes.

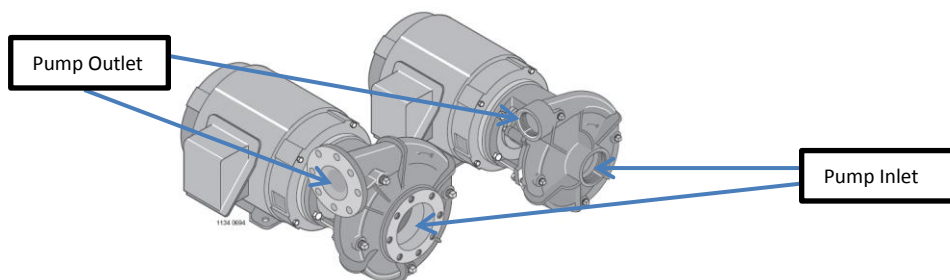


Figure 5: Pump Diagram

- A. Pipe or tube a line from the Water Source to the Pump Inlet.
 - a. Take Care to align piping with pump case. Misalignment or excessive pipe strain can cause distortion of pump components resulting in rubbing, breakage, and reduced pump life.
- B. Make sure there is no pressure on the connections.
 - a. Support the pipe so it doesn't affect the connection to the pump.
 - b. Check the pump alignment.
- C. Follow the recommendations in Figure 6 when attaching the piping.

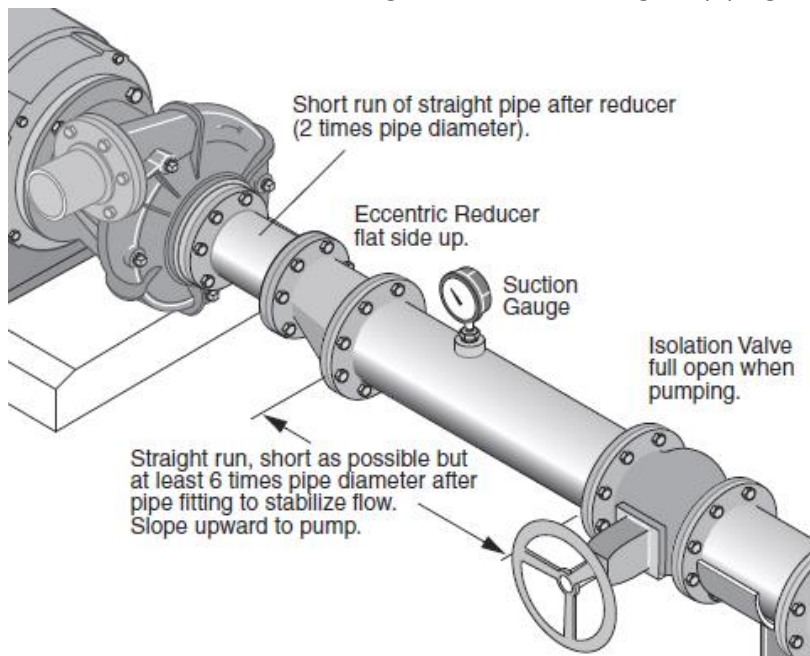
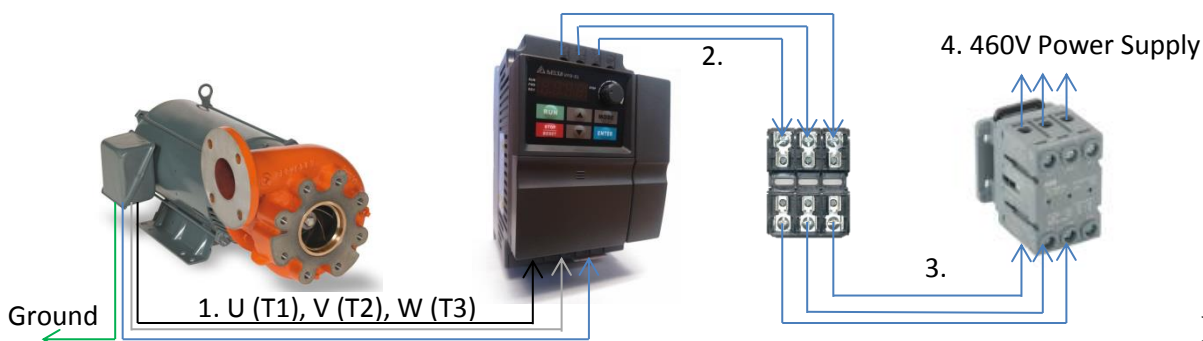


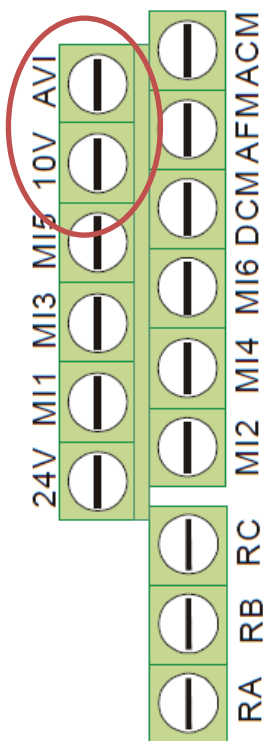
Figure 6: Plumbing recommendations

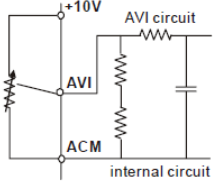
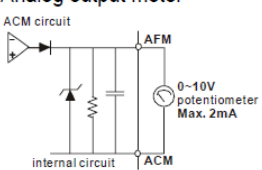
3. Connect the variable frequency drive (VFD) to the circuit breaker.

- A. Carefully remove the cover from the VFD Enclosure
- B. Inspect the system to verify the wiring is set up correctly.
 1. Check that the pump is wired to the U, V, and W lines of the VFD controller.
 2. Check that three wires are connected from the R, S, and T lines of the VFD Controller to the Fuse block.
 3. Check that three wires are connected from the fuse block to the rotary disconnect.
 4. Check that input voltage is 460V 3-Phase and is connected to the rotary disconnect.



- C. Connect the positive (red, DIN terminal 1) wire of the pressure transducer to the 10V terminal of the VFD, the negative (black, DIN terminal 2) wire to the AVI terminal of the VFD, and the ground wire of the pressure transducer to a ground.
- D. Set the AVI/ACI switch to ACI.



Terminal Symbol	Terminal Function	Factory Settings (NPN mode) ON: Connect to DCM
MI1	Forward-Stop command	ON: Run in MI1 direction OFF: Stop acc. to Stop Method
MI2	Reverse-Stop command	ON: Run in MI2 direction OFF: Stop acc. to Stop Method
MI3	Multi-function Input 3	Refer to Pr.04.05 to Pr.04.08 for programming the Multi-function Inputs.
MI4	Multi-function Input 4	
MI5	Multi-function Input 5	ON: the activation current is 5.5mA. OFF: leakage current tolerance is 10 μ A.
MI6	Multi-function Input 6	
+24V	DC Voltage Source	+24VDC, 50mA used for PNP mode.
DCM	Digital Signal Common	Common for digital inputs and used for NPN mode.
RA	Multi-function Relay output (N.O.) a	Resistive Load: 5A(N.O.)/3A(N.C.) 240VAC 5A(N.O.)/3A(N.C.) 24VDC Inductive Load: 1.5A(N.O.)/0.5A(N.C.) 240VAC 1.5A(N.O.)/0.5A(N.C.) 24VDC Refer to Pr.03.00 for programming
RB	Multi-function Relay output (N.C.) b	
RC	Multi-function Relay common	
+10V	Potentiometer power supply	+10VDC 3mA
AVI	Analog voltage Input 	Impedance: 47k Ω Resolution: 10 bits Range: 0 ~ 10VDC/4~20mA = 0 ~ Max. Output Frequency (Pr.01.00) Selection: Pr.02.00, Pr.02.09, Pr.10.00 Set-up: Pr.04.14 ~ Pr.04.17
ACM	Analog control signal (common)	Common for AVI= and AFM
AFM	Analog output meter 	0 to 10V, 2mA Impedance: 47 Ω Output current: 2mA max Resolution: 8 bits Range: 0 ~ 10VDC Function: Pr.03.03 to Pr.03.04 NOTE The voltage output type for this analog signal is PWM. It needs to read value by the movable coil meter and is not suitable for A/D signal conversion.

NOTE: Control signal wiring size: 18 AWG (0.75 mm²) with shielded wire.



E. Connect the power to the VFD.

1. The VFD only accepts 460V three phase input power. Have a qualified electrician alter the supply voltage to 460V/3Ph before connecting the input power to the drive.

4. Set the Pressure Tank Pressure

The pressure tank should be set to 70% of the desired line pressure. For example, if the desired pressure was 60psi, the pressure tank should be set to 42psi.

5. Program the DVFP



1 Status Display

Display the driver's current status.

2 LED Display

Indicates frequency, voltage, current, user defined units and etc.

3 Potentiometer

For master Frequency setting.

4 RUN Key

Start AC drive operation.

5 UP and DOWN Key

Set the parameter number and changes the numerical data, such as Master Frequency.

6 MODE

Change between different display mode.

7 STOP/RESET

Stops AC drive operation and reset the drive after fault occurred.


The VFD for the DVFP is programmed using a set of parameters. Each parameter is represented with a group and a number separated by a decimal. There are 11 groups of parameters. Each group is listed on the next page.

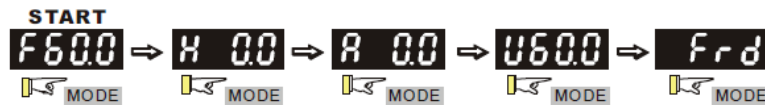






Parameter Groups

Group 0:	User Parameters
Group 1:	Basic Parameters
Group 2:	Operation Method Parameters
Group 3:	Output Function Parameters
Group 4:	Input Function Parameters
Group 5:	Multi-Step Speed Parameters
Group 6:	Protection Parameters
Group 7:	Motor Parameters
Group 8:	Special Parameters
Group 9:	Communication Parameters
Group 10:	PID Control Parameters











The VFD has 6 display modes. You can cycle through these modes by pressing the  button.




The display modes from left to right are the AC drive Master Frequency (F), the output frequency at terminals U/T1, V/T2, and W/T3 (H), the output current at terminals U/T1, V/T2, and W/T3 (A), the User Defined Unit (where $U = F \times \text{Pr.00.05}$) (U), the forward/reverse display (Frd), and the parameter setting display.

The  and  keys can be used to adjust the each display. For example, in the Master Frequency display mode, you may increase or lower the master frequency.

To program a parameter:

- Hit  from any display mode
- Use the  and  keys to select the parameter group, then hit 
- Use the  and  keys to select the parameter number, then hit 
- Use the  and  keys to select the parameter value, then hit 
- The display will either show “End” for success or “Err” for error.



To Exit programming, hit  until you reach the display mode.



The program guide in section 6 defines all of the parameters. Only a few will need to be changed for the DVFP Series. This section will show what needs to be programmed from factory settings. The programming guide in Table 2 shows which parameters will need to be changed.

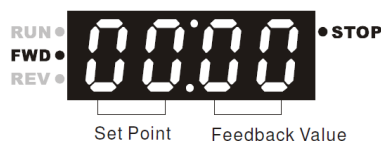


Table 2: Parameters for DVFP set to 60psi

Group	Number	Explanation
00.03	3	Start-up display is the content of user-defined unit.
00.04	8	User-defined: Simultaneous display of PID set-point and feedback signal.
00.13	1000 (100.0)	It is used to set the position of decimal point of Pr00.13 (user-defined value 1 which corresponds to max. frequency). Set Pr00.13 to 1000 and Pr00.14 to 1, 100.0 will be displayed (Corresponding to 100 psi).
00.14	1	
1.00	60Hz	Berkley 5HP, 3600 RPM, 230/460 V, 3Ph, 1-1/2" out x 2" NPT in
1.01	60Hz	
1.02	460V	
1.09	0.5s	Acceleration Time 1, adjust according to system requirement. Set as short as possible without OC.
1.10	5.0s	Deceleration Time 1, adjust according to system requirement. Set as short as possible without OV.
1.12	5.0s	<u>Deceleration Time 2</u> When the pressure reaches the set point (deviation <Pr10.22 for Pr10.23 time), the AC Motor Drive will decelerate to stop and this deceleration time is the setting of Pr01.12. Do not set shorter than Pr01.10! See also Pr10.22 and Pr10.23.
2.00	0	Frequency source command is digital keypad UP/DOWN.
2.01	0	Operation command by digital keypad RUN/STOP keys.
10.00	1	PID set point is set by the digital keypad (set Pr02.00=0 or 4).
10.01	3	Negative PID feedback from external terminal ACI (4~20 mA).
10.02	1.2	Adjust according to application requirement.
10.03	0.7s	
10.04	0s	
10.10	1.0	Because the feedback pressure sensor is 0~100psi but used in the 0~100psi range, the gain must be 100/100=1.0.
10.12	50.0%	When the pressure feedback value is less than 10psi (absolute value 60psi-100psi*50%) for longer than 15s, the AC Motor Drive will act according to Pr10.20.
10.13	15.0s	
10.18	99.9	PID control detection signal reference is set to 100psi. For display purpose only.
10.19	1	Parallel PID calculation mode is suitable for constant pressure water supply control.
10.20	3	Due to water supply suspension or in case of an abnormal feedback value, the pump will ramp to stop and restart after 1800sec=30min. This action is repeated until the feedback value is normal again.
10.21	1800s	
10.22	10%	<u>Constant pressure control parameters</u>
10.23	10s	When the deviation (difference between feedback value and set point) exceeds 5% of the set-point, in this case 60psi*10%=6psi, or when the feedback value is >54psi for longer than 10s, the AC Motor Drive will decelerate to stop with the deceleration time acc. to Pr01.12. When the feedback value becomes <54psi again, the AC Motor Drive will start to run.
10.24	20%	<u>Liquid leakage control parameters</u>
10.25	4%	
10.26	2s	



Once all of the parameters have been updated, the target pressure needs to be set. Cycle through the display modes until the user display is reached (shown below). The set point (in psi) will be shown on the left, and the feedback value (in psi) will be shown on the right. Here, you can adjust the target pressure to your value by using the  and  keys. The system has been set to read between 0-100psi. Use the arrow keys to set the value to 60.





6. Start up the system for the first time.

Prime the Pump

The pump must be primed (completely filled with water) before it is turned on. Running the pump without water could cause the pump to overheat and get damaged. The DVFP was designed to be added to a pressurized water line. To prime the pump:

- A. Open the air vent (or pipe plug) in the highest tapped opening in the pump case.
- B. Open the inlet isolation valve, allowing water to fill the pump slowly and completely to force all the air out through the vent.
- C. Rotate the shaft slowly to allow any trapped air in the impeller to escape.
- D. Close the vent opening when water without air emerges.

7. Start the system

- A. Once the system has been programmed and installed correctly, press the  button to start the system.
- B. Once the system is running, very little maintenance should be required. Press the  button if anything does not run correctly.



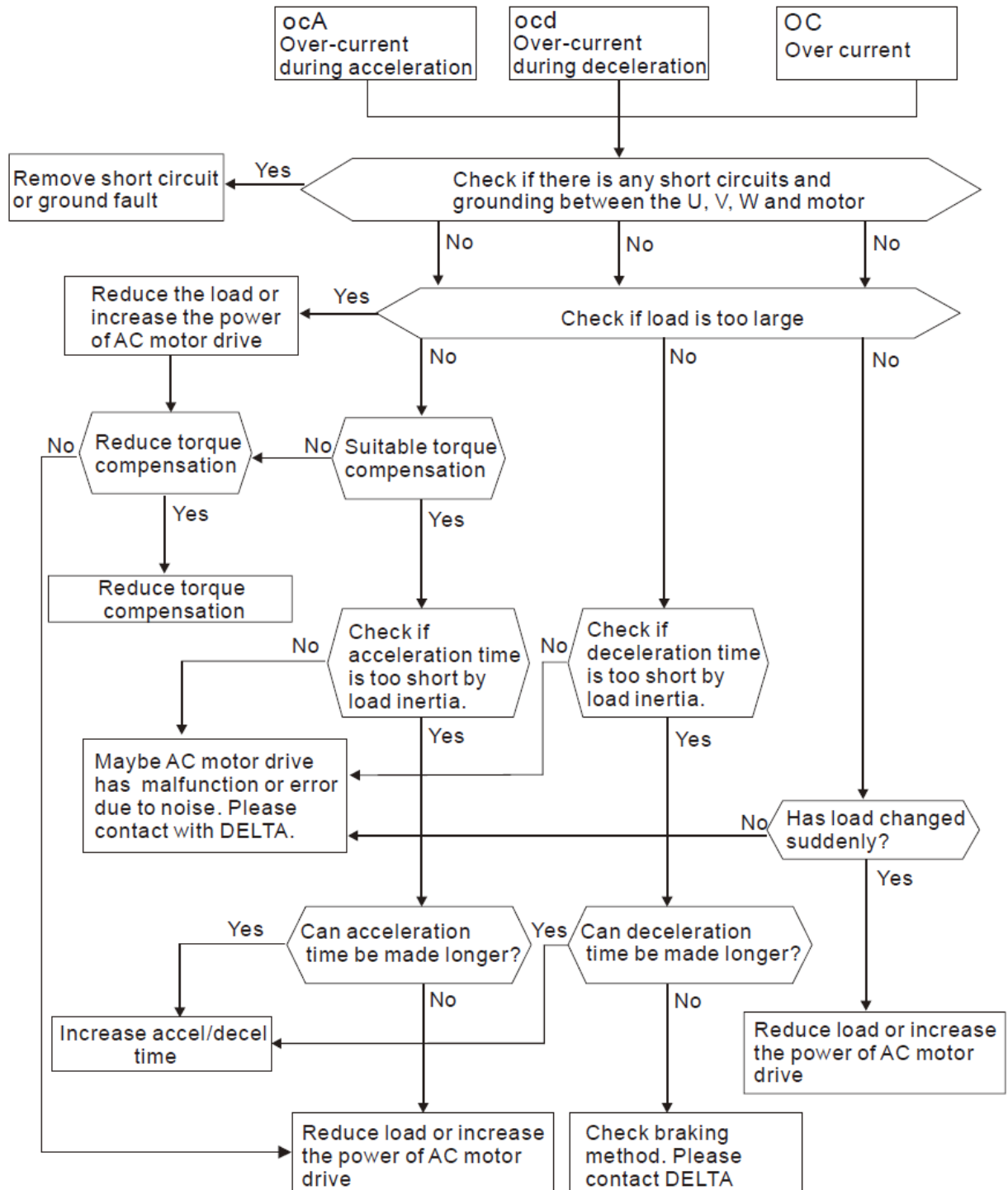
Troubleshooting Pump

SYMPTOM	PROBABLE CAUSE																	
	GROUP I ELECTRICAL									GROUP II MECHANICAL					GROUP III SYSTEM			
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	A	B	C
Pump runs, but no water delivered										X		X				X	X	
Not enough water delivered			X	X					X	X	X		X			X	X	
Not enough pressure			X	X					X	X	X		X			X	X	
Excessive vibration									X	X	X			X			X	X
Abnormal noise										X	X	X		X	X		X	X
Pump stops	X	X	X	X	X	X	X	X										
Overheating		X	X	X					X		X		X	X	X			X

CAUSE	CORRECTIVE ACTION
I. ELECTRICAL	
A. No voltage in power system	Check phase-to-phase on line side of starter contactor. Check circuit breaker or fuses.
B. No voltage on one phase (Three Phase Units)	Check phase voltage on line side of starter contactor. Isolate open circuit (circuit breaker, fuse, broken connections, etc.)
C. Low voltage at motor	Running voltage across each leg of motor must be $\pm 10\%$ of nominal voltage shown on nameplate.
D. Motor leads improperly grouped for voltage	Refer to lead grouping diagram on motor nameplate.
E. Control failure	Check control device, starter contactor, H-O-A selector switch, etc., for malfunction.
F. Thermal overload switch open	Check phase-to-phase on line side of starter contactor.
G. Installation failure	Check motor or windings to ground with megohmmeter.
H. Open windings	Check leg-to-leg with ohmmeter.
I. Frequency variation	Check frequency of power system. Must be less than 5% variation from motor nameplate rating.
II. MECHANICAL	
A. Flow through pump completely or partially obstructed	Locate and remove obstruction. Refer to Repair Instructions for disassembly.
B. Wrong direction of rotation	Reverse rotation of three phase motor by interchanging any two leads. See manufacturer's Instructions for reversing single phase motor.
C. Pump not primed	Reprime. Inspect suction system for air leaks.
D. Internal leakage	Check impeller for wear of controlled clearances (See Repair Instructions).
E. Loose parts	Inspect. Repair.
F. Stuffing box not properly adjusted	Adjust gland.
III. SYSTEM	
A. Pressure required by system at design flow rate exceeds pressure rating of pump	Compare pump pressure and flow rate against pump characteristic curve. Check for closed or partially closed valve in discharge piping system. Reduce system pressure requirement. Increase pressure capability of pump.
B. Obstruction in suction piping	Locate and remove obstruction.
C. Pressure rating of pump exceeds pressure requirement of system at design flow rate	Compare pump pressure and flow rate against pump characteristic curve. Inspect discharge piping system for breaks, leaks, open by-pass valves, etc. If necessary, reduce flow rate by partially closing discharge valve.

Error Codes/Overcurrent

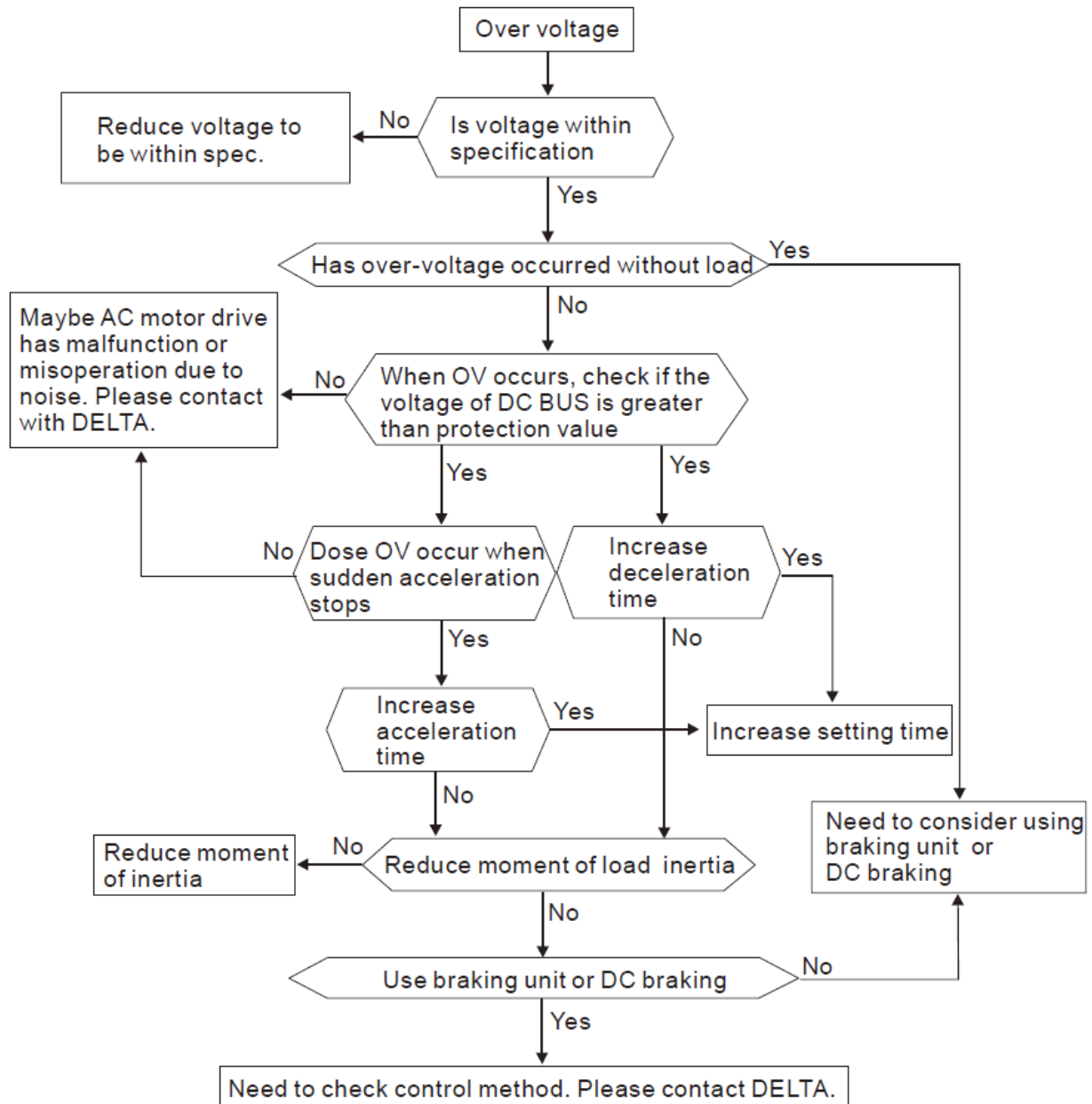
OC	Overcurrent – Abnormal increase in current
ocA	Overcurrent during acceleration
ocd	Overcurrent during deceleration
ocn	Overcurrent during constant speed operation



Error Codes/Overvoltage

OU

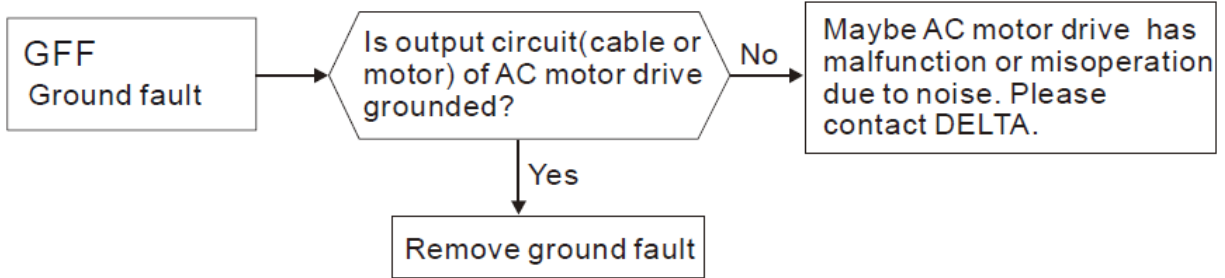
Overvoltage – The DC bus has exceeded its maximum value





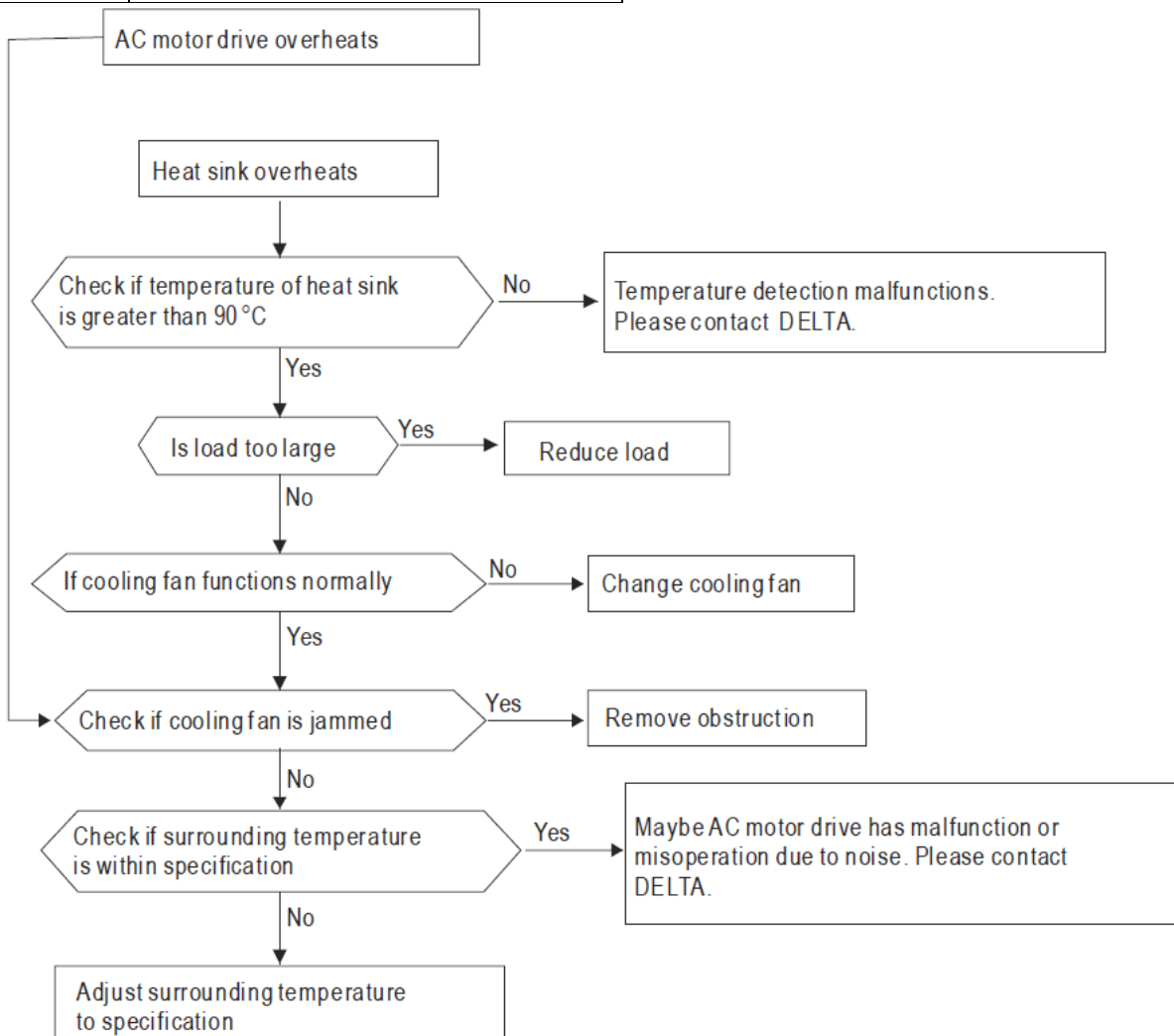
Error Codes/Ground Fault

GFF	Ground Fault
-----	--------------



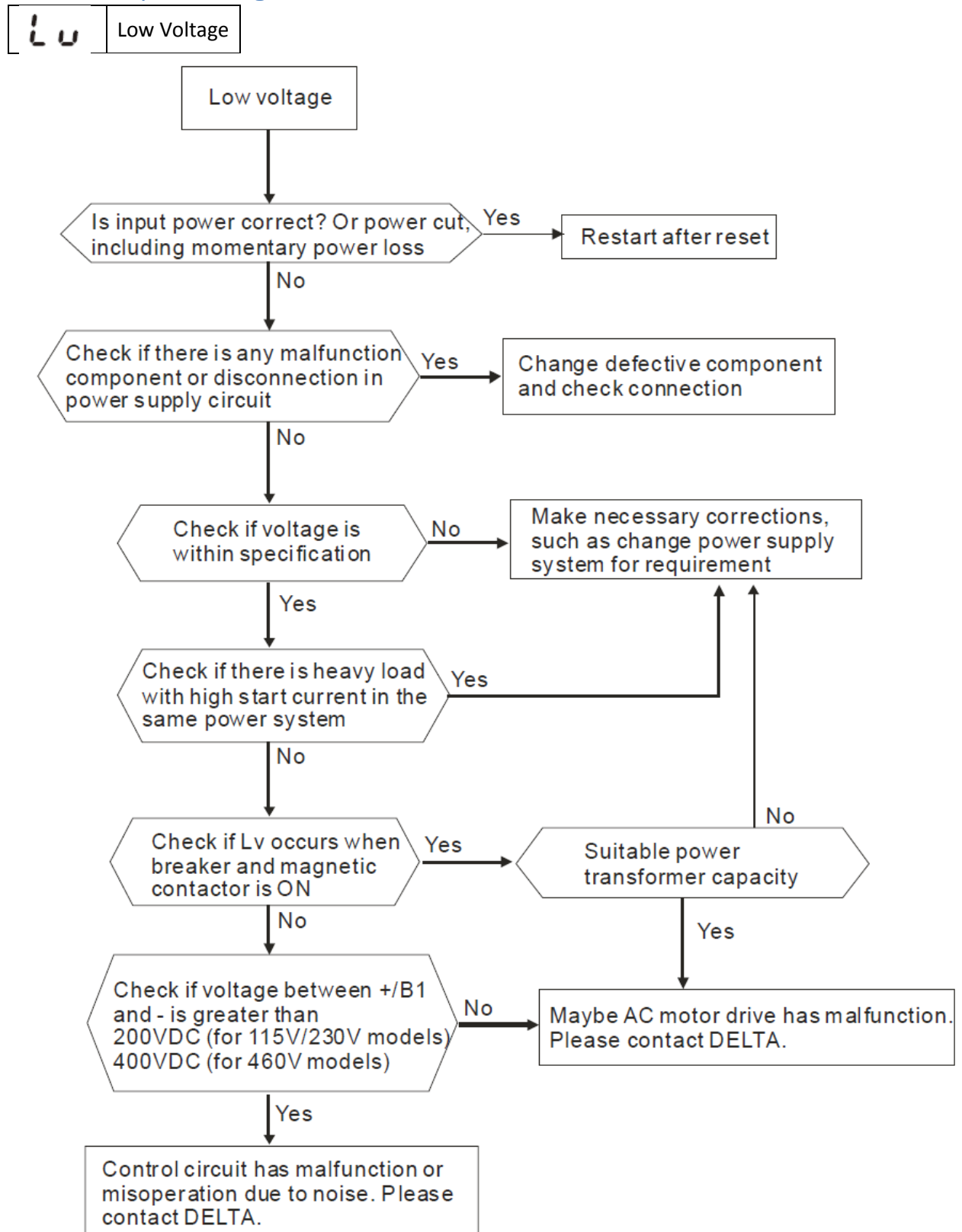
Error Codes/Overheating

OH1	Overheating – Heat Sink Temp too high
-----	---------------------------------------





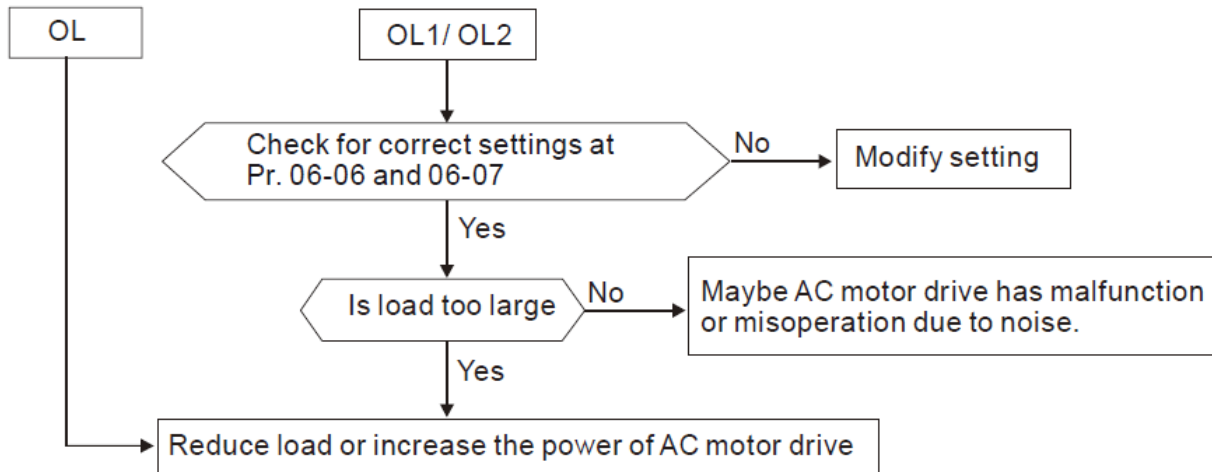
Error Codes/Low Voltage





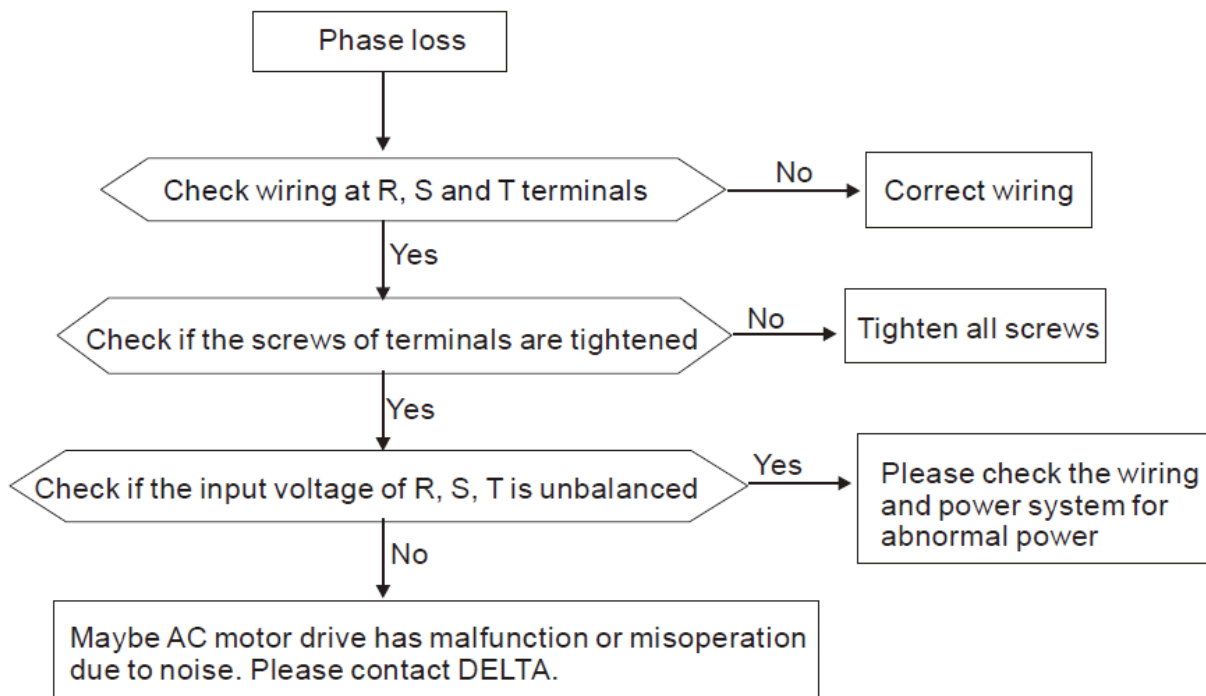
Error Codes/Overload

OL	Overload – Excessive Drive Output Current
-----------	---



Error Codes/Phase Loss

PHL	Phase Loss
------------	------------





Error Codes/Misc.

HPF 1	CC (current clamp)	Return to the factory.
HPF 2	OV hardware error	
HPF 3	GFF hardware error	
HPF 4	OC hardware error	
bb	External Base Block. (Refer to Pr. 08.07)	<ol style="list-style-type: none"> 1. When the external input terminal (B.B) is active, the AC motor drive output will be turned off. 2. Deactivate the external input terminal (B.B) to operate the AC motor drive again.
EF	External Fault	<ol style="list-style-type: none"> 1. When multi-function input terminals (MI3-MI9) are set to external fault, the AC motor drive stops output U, V and W. 2. Give RESET command after fault has been cleared.
cF 10	Internal EEPROM can not be programmed.	Return to the factory.
cF 11	Internal EEPROM can not be programmed.	Return to the factory.
cF 20	Internal EEPROM can not be read.	<ol style="list-style-type: none"> 1. Press RESET key to set all parameters to factory setting. 2. Return to the factory.
cF 2.1	Internal EEPROM can not be read.	<ol style="list-style-type: none"> 1. Press RESET key to set all parameters to factory setting. 2. Return to the factory.
cF 3.0	U-phase error	Return to the factory.
cF 3.1	V-phase error	
cF 3.2	W-phase error	
cF 3.3	OV or LV	
cF 3.4	Temperature sensor error	



<i>cFR</i>	Auto accel/decel failure	<ol style="list-style-type: none"> 1. Check if the motor is suitable for operation by AC motor drive. 2. Check if the regenerative energy is too large. 3. Load may have changed suddenly.
<i>cE--</i>	Communication Error	<ol style="list-style-type: none"> 1. Check the RS485 connection between the AC motor drive and RS485 master for loose wires and wiring to correct pins. 2. Check if the communication protocol, address, transmission speed, etc. are properly set. 3. Use the correct checksum calculation. 4. Please refer to group 9 in the chapter 5 for detail information.
<i>codE</i>	Software protection failure	Return to the factory.
<i>RErr</i>	Analog signal error	Check the wiring of ACI
<i>FbE</i>	PID feedback signal error	<ol style="list-style-type: none"> 1. Check parameter settings (Pr.10.01) and AVI/ACI wiring. 2. Check for possible fault between system response time and the PID feedback signal detection time (Pr.10.08)