High Capacity Coolant Distribution Unit (CDU) Chiller

Jaguar Platform

Thermo Manual P/N U00918
Rev. 08/03/05

Troubleshooting

FRU Replacement

Thermo
ELECTRON CORPORATION

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Section V Controller Loops

Section VI Drawings

WARRANTY

After-sale Support

Thermo Electron Corporation is committed to customer service both during and after the sale. If you have questions concerning the CDU operation, contact our Sales Department. If your CDU fails to operate properly, or if you have questions concerning spare parts contact our Service Department.

(800) 258-0830

(603) 436-9444

Fax: (603) 436-8411

Before calling, *please* obtain the following information:

- CDU BOM number
- CDU serial number
- CDU software version
- voltage of power source

The CDU's BOM and serial number label are located on the label on the front-top of the CDU. See Service Manual for instructions on how to display the software version.

Warranty

CDUs have a warranty against defective parts and workmanship for 24 months from date of shipment. See back pages for more details.

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Warnings

Make sure you read and understand all instructions and safety precautions listed in this manual before installing or operating your CDU. If you have any questions concerning the operation of your CDU or the information in this manual, contact our Sales Department for assistance.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death. This signal word is limited to the most extreme situations.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Performance of installation, operation, or maintenance procedures other than those described in this manual may result in a hazardous situation and may void the manufacturer's warranty.

Transport the CDU with care. Sudden jolts or drops can damage the CDU.

Do not attempt to defeat any of the interlock switches or safety features built into the CDU.

Observe, and never remove, all warning labels.

Never operate damaged or leaking equipment.

Never operate the CDU without cooling fluid in the fluid reservoir.

Process fluid are subject to environmental regulatory restrictions. Do not dispose into the environment. In the United States use proper OSHA approved location for disposal.

Use remote lockout tag-out procedures prior to servicing the CDU. Make sure the CDU is off before connecting or disconnecting the power cord or other cables.

Always turn off the CDU and disconnect the power cord from the power source before performing any service or maintenance procedures, or before moving the CDU.

Always empty the fluid reservoir before moving the CDU.

Never operate equipment with damaged power cords.

Refer service and repairs to a qualified technician.

EMO Circuit

Each of the following safeties is part of the test system Emergency Off (EMO) circuit. The tripping of either of these safeties will cause power to be dropped to the CDU by the test system. The EMO circuit should not exceed 10A @ 24VDC.

High Air Temperature (TSH-101)
This safety opens the EMO circuit when the air temperature safety switch detects a temperature inside the CDU greater than 70°C. The temperature switch is self-resetting at a temperature of 54°C or below.

Lockout/Tagout (LOTO)

Before performing Chiller maintenance, the energy sources associated with the Chiller system must be lockout and tagged out (LOTO).

Since the CDU itself has no electrical LOTO, lock out power remotely.

Electrical LOTO can be provided by:

Disconnecting main power at the facility power source prior to the system controller cabinet.

The unit does not provide LOTO for the facility water flow. An external user-supplied device is required.

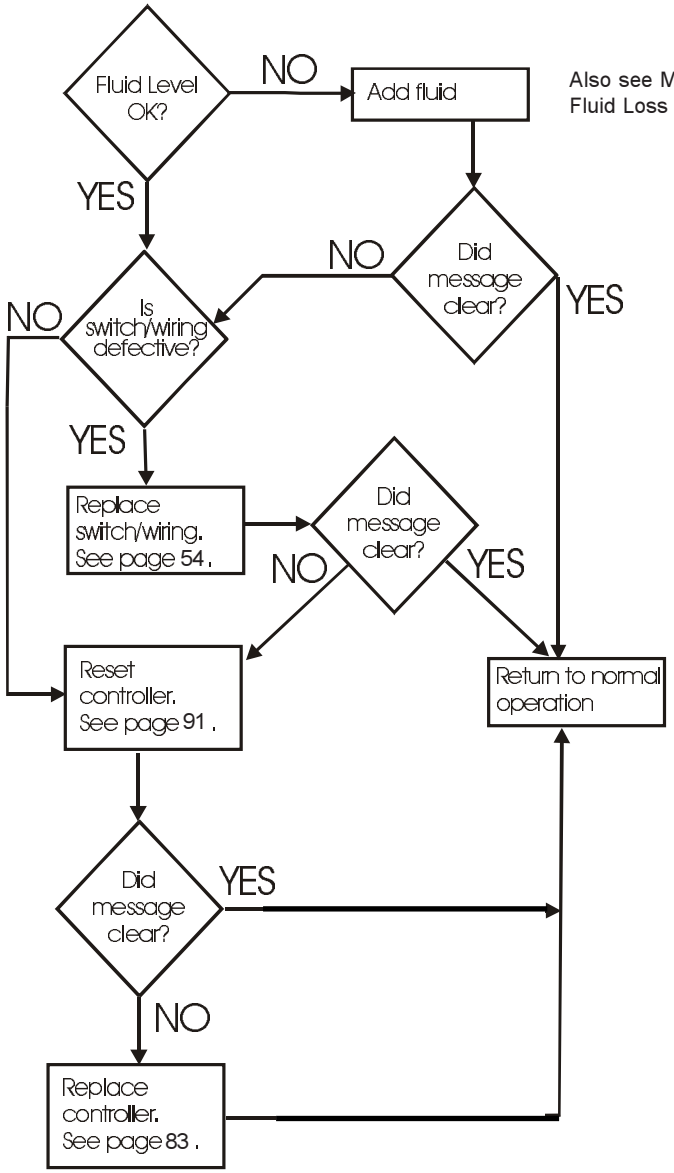
In addition, follow all local facility LOTO directives.

Error Code Troubleshooting

LEVEL WARN
LED

LEVEL WARN
Error Message

Cause:
Upper low level warning switch **closed** for at least 3 seconds.

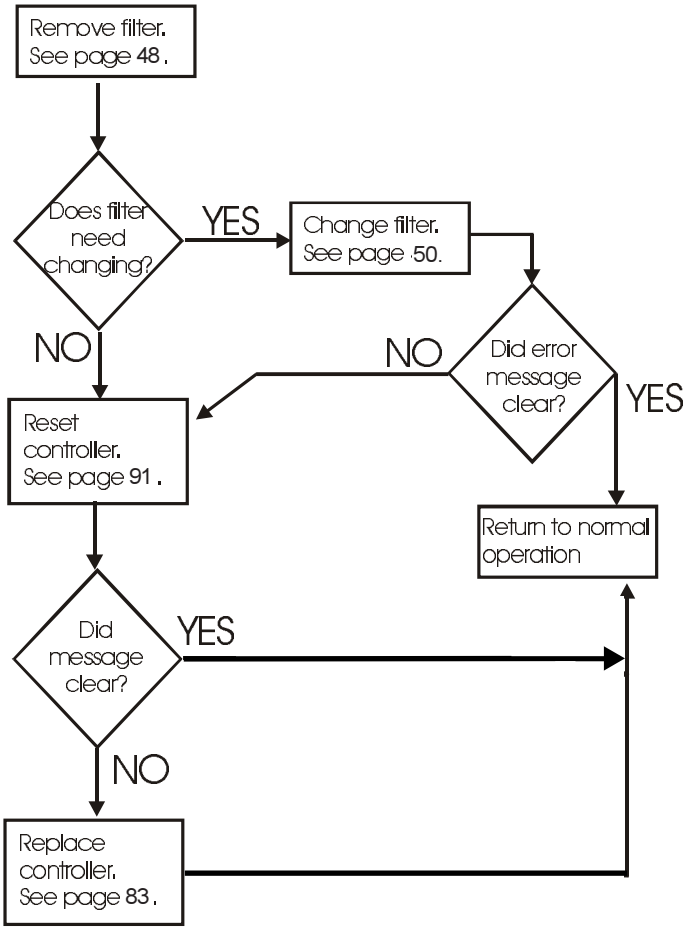


FILTER
LED

CHG FILTER

Error Message

Cause:
Return pressure greater than 10 psi for 1 minute.
NOTE: Normally indicates the filter in the reservoir needs changing.

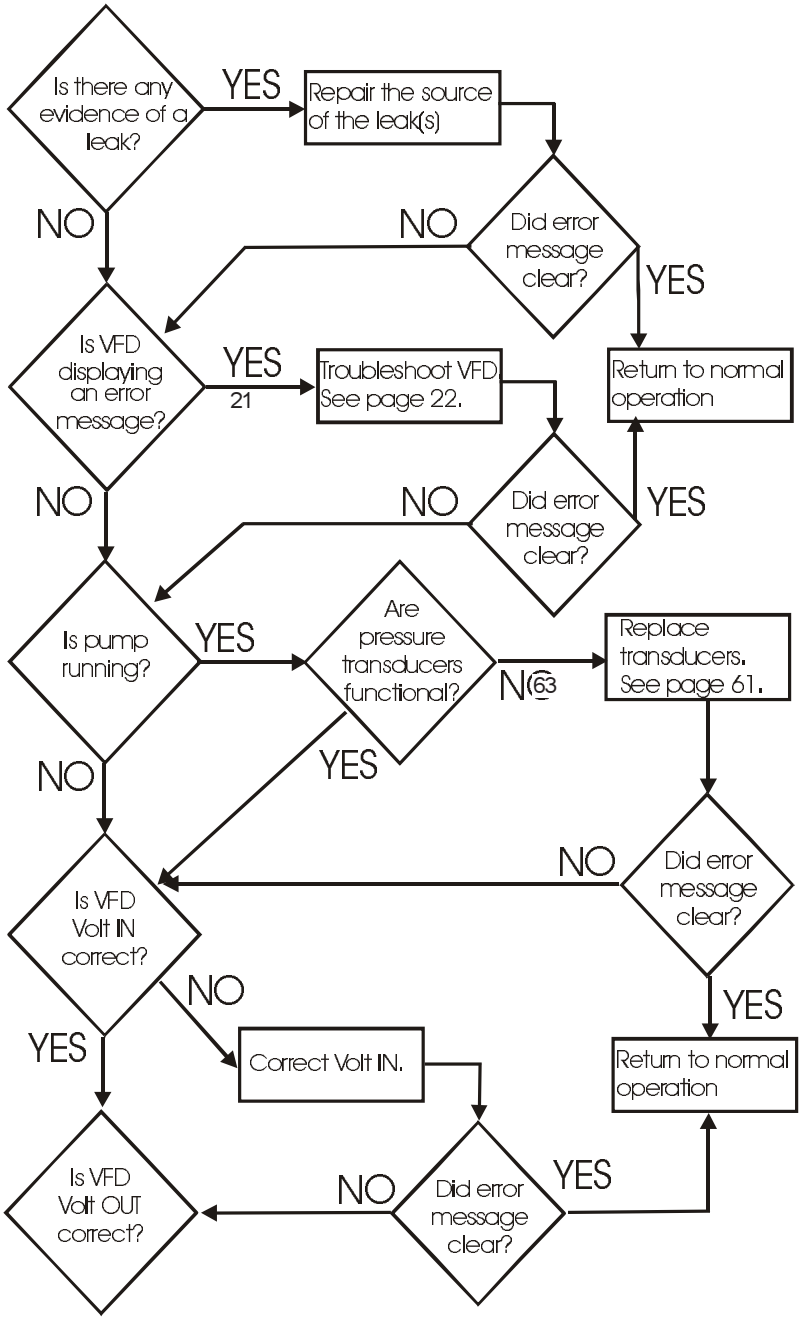


LOW HFE PRES ●
LED

LOW PRES
Error Message

Cause:
A major leak has developed or the unit supply pressure less than 20 psi for 30 seconds after pump / VFD start.

NOTE: I If a pump shut down due to an overload condition than the corresponding MOL error message will also be on. Otherwise, measure the amperage of each pump to determine if it is running.



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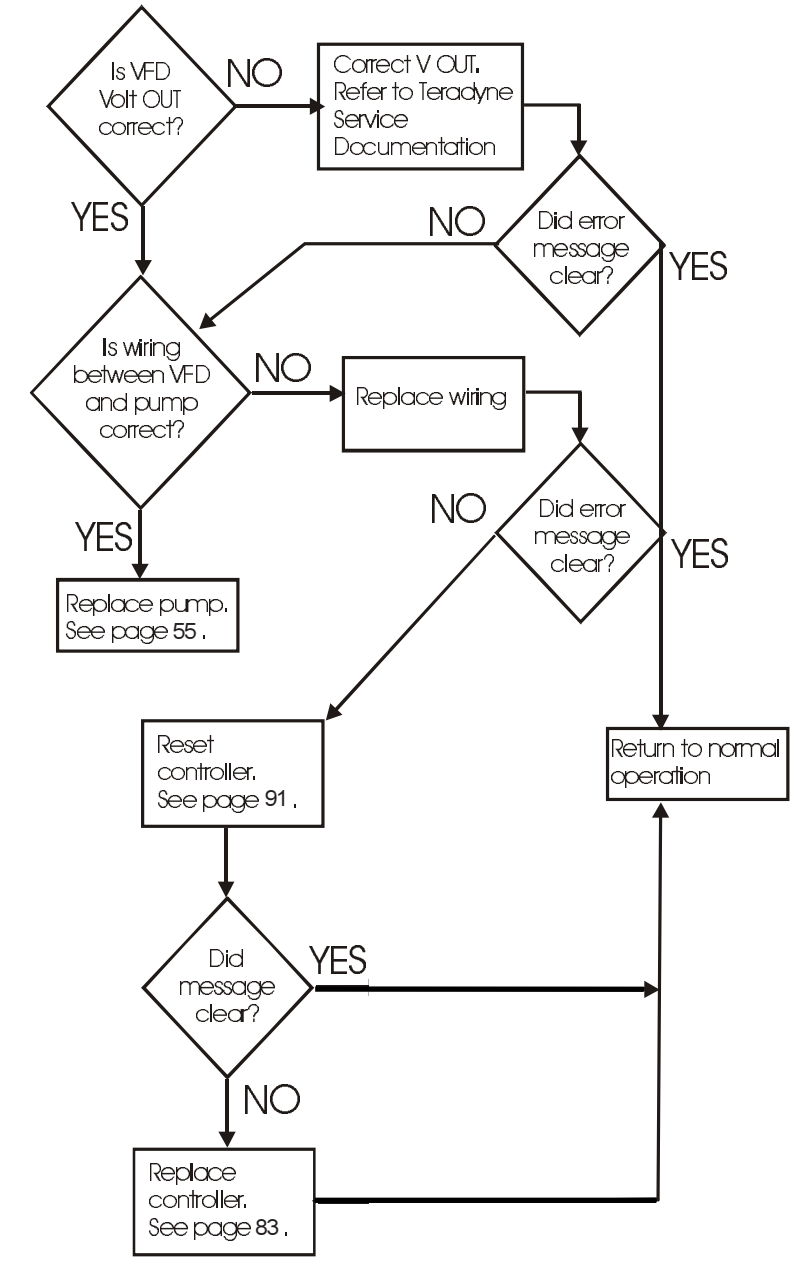
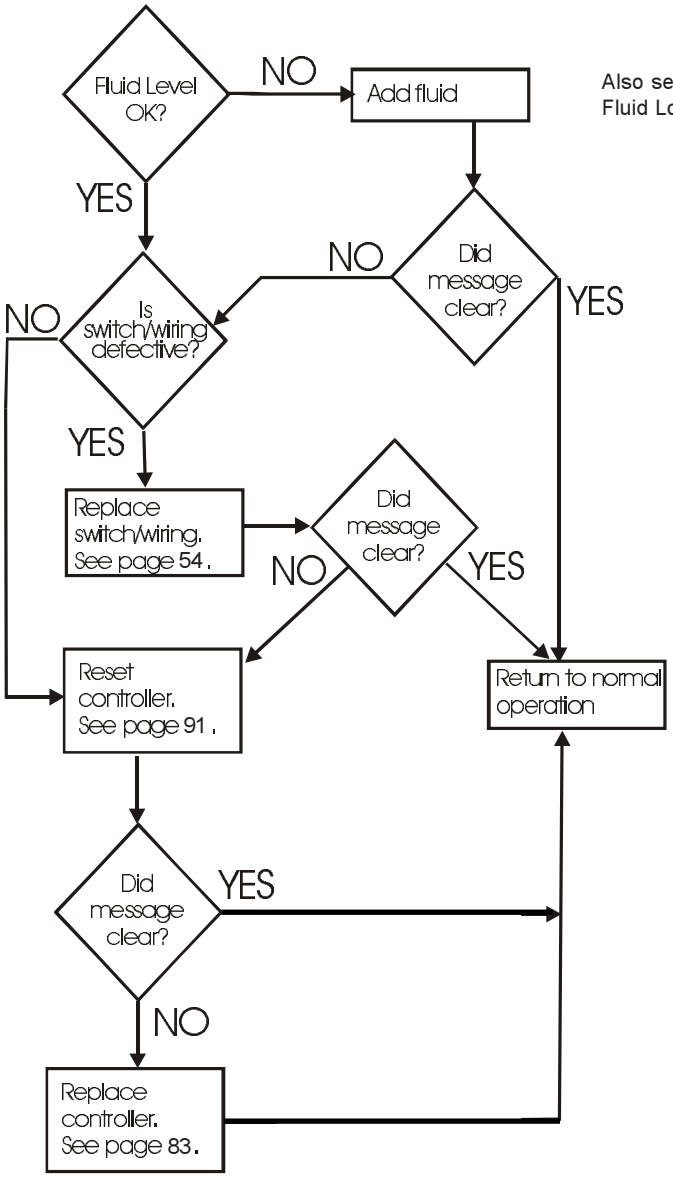


LVL FAULT
LED

LEVEL FAIL

Error Message

Cause:
Lower low **level** warning switch **open** for at least 3 seconds
NOTE: The LEVEL WARN LED should also be on, if not replace the level switch assembly



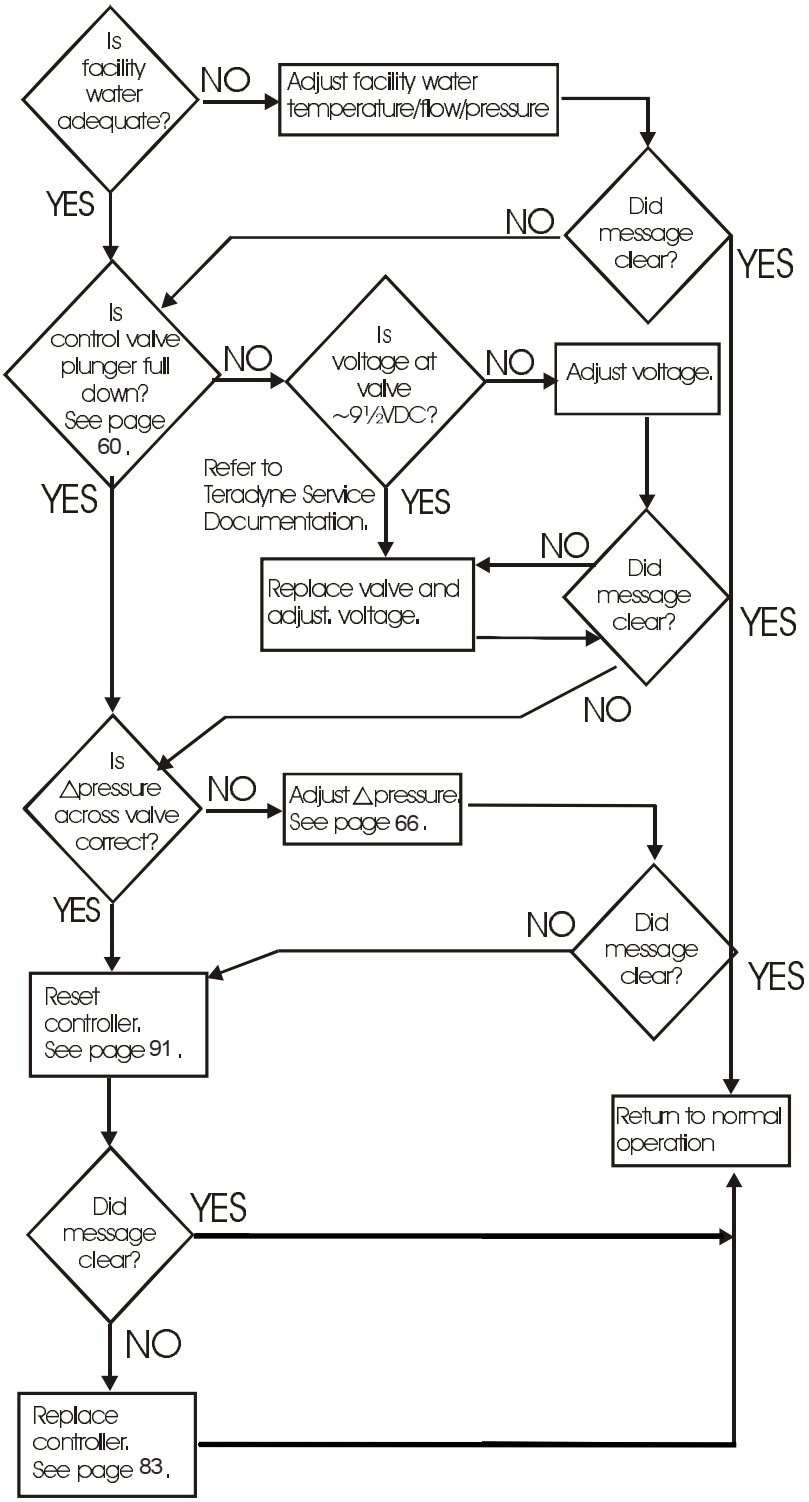
Also see Monitoring Fluid Loss on page 23.

TEMP FAULT
LED

HIGH TEMP

Error Message

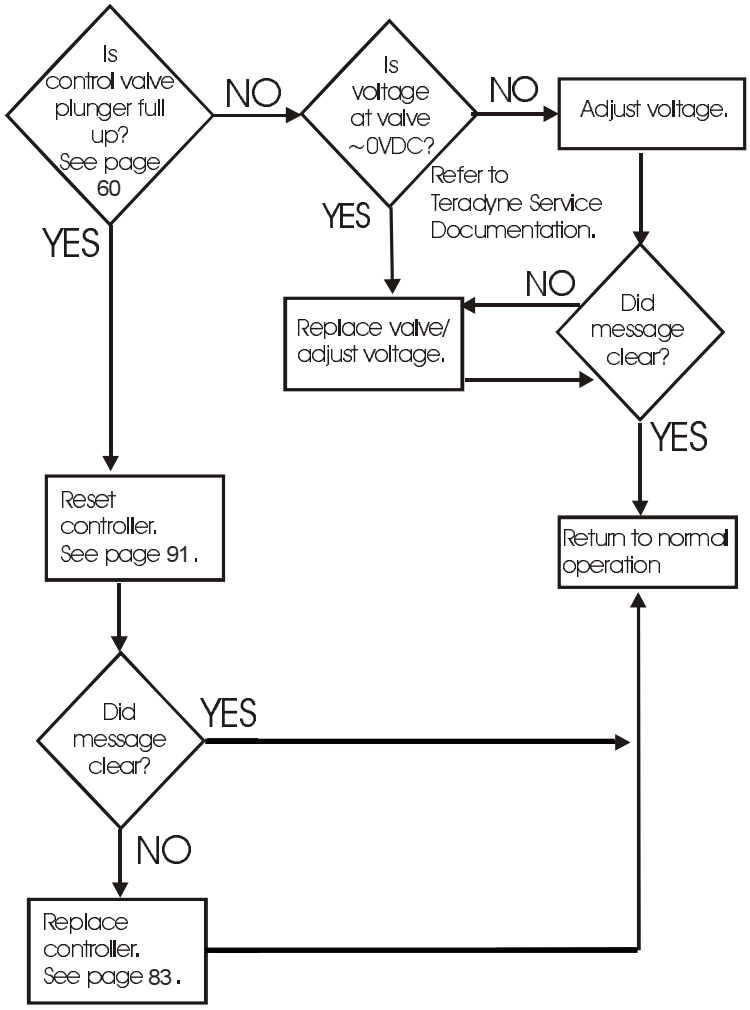
Cause:
Fluid temperature higher than alarm setpoint value in controller's setup loop.
NOTE: This is normally **not** a pump issue



TEMP FAULT
LED

LOW TEMP
Error Message

Cause:
Fluid temperature lower than alarm setpoint value in controller's setup loop.
NOTE: This is normally **not** a pump issue.

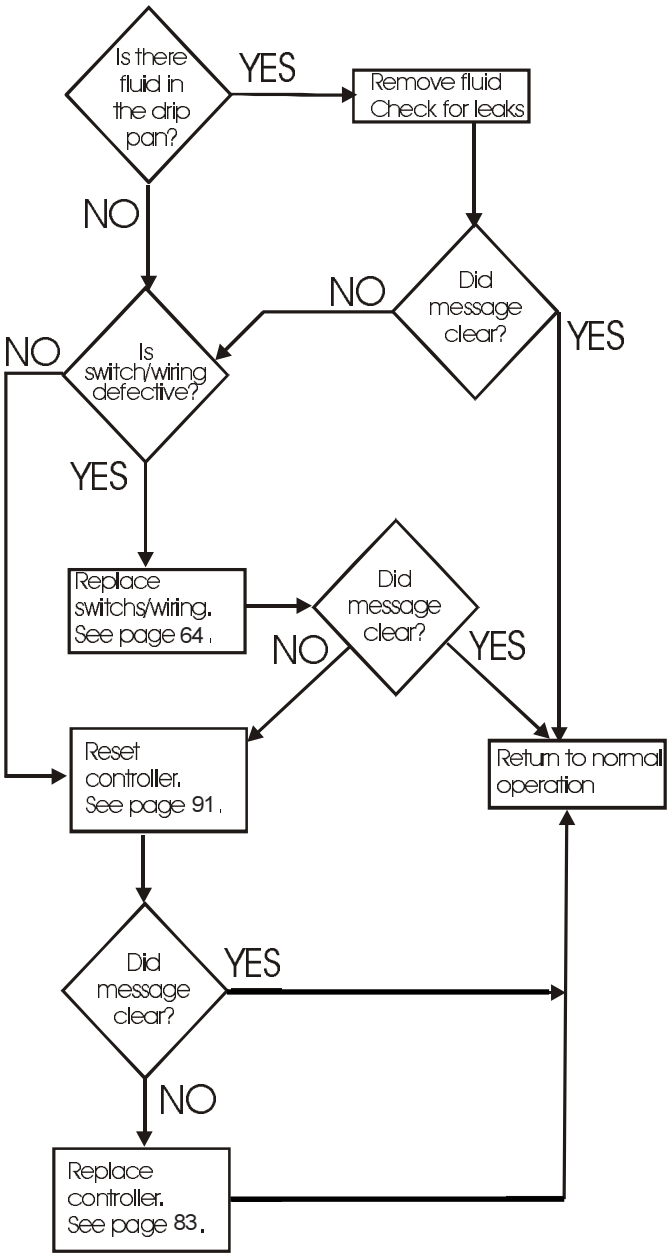


DRIP PAN
LED

DRIP FAULT

Error Message

Cause:
Drip pan level switch is **open.**

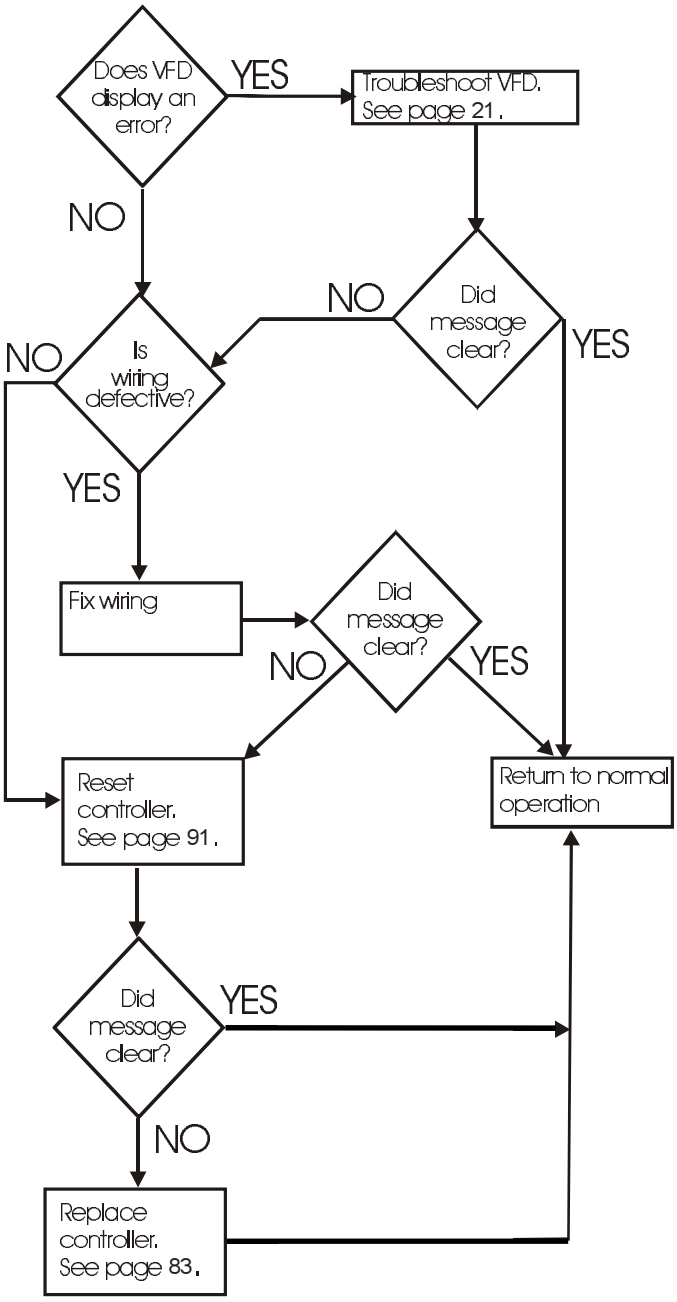


VFD FAULT
LED

VFD FAULT

Error Message

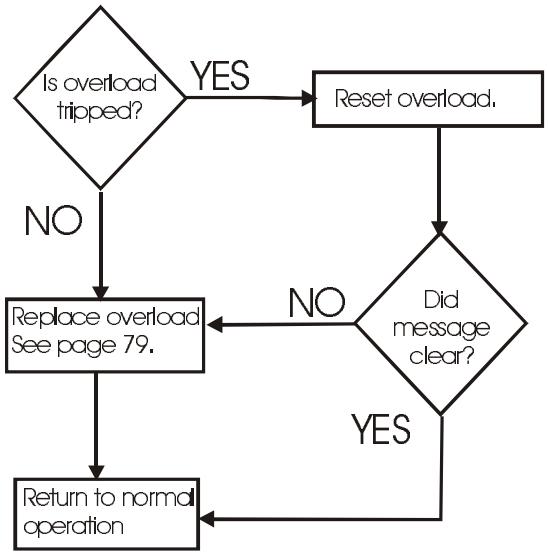
Cause:
Open relay on VFD.



MOL FAULT

Error Message

Cause:
Tripped pump motor overload.



These error messages require checking the applicable sensor and its associated wiring. If the error message does not clear reset and/or replace the controller.

SENSOR FAIL LED

RTD1 FAIL

Error Message

The reservoir fluid temperature probe RTD1 input is open or shorted, see page 69.

PRES 1

Error Message

The coolant return pressure sensor input is out of range, see page 65.

PRES 2

Error Message

The coolant supply pressure sensor input is out of range, see page 65.

HIGH PRES

Error Message

The supply pressure is greater than 110 psi.

NEG PRES

Error Message

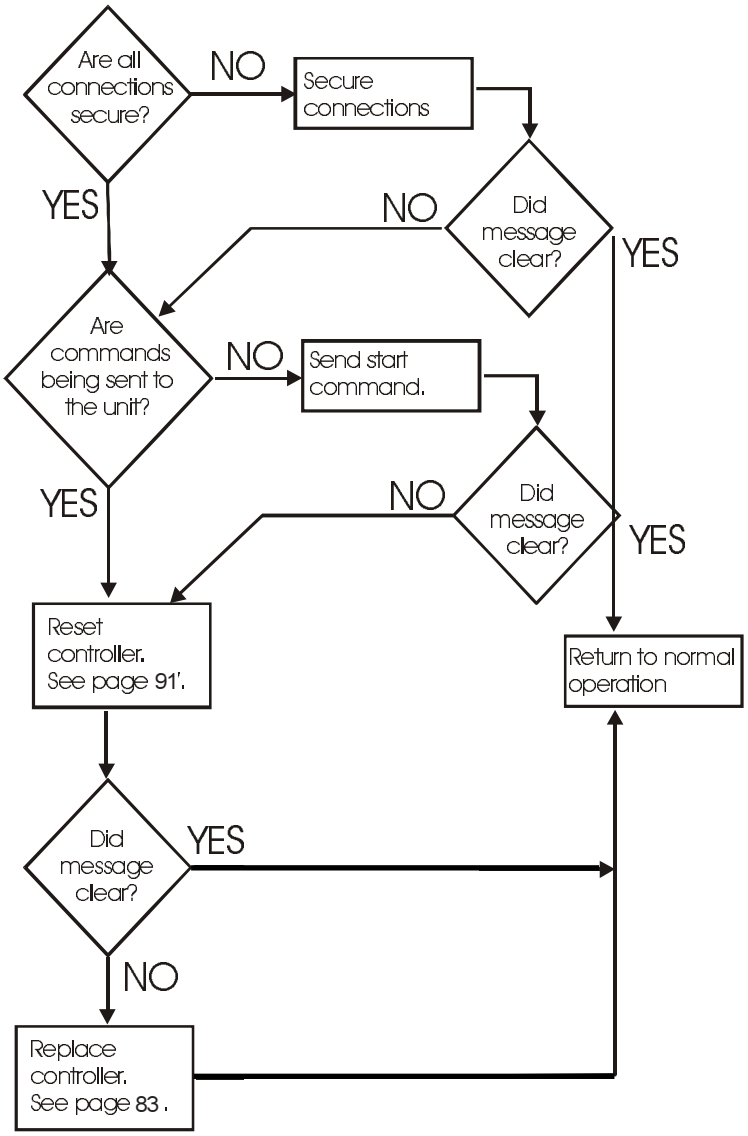
The differential pressure equals a negative value for at least 3 seconds.

COMM DISC ●
LED

COMM DISC

Error Message

Cause:
Communications lost for over 10 seconds while operating in the remote mode.



These error messages require controller chip replacement, see page 82.

RAM FAILED
Error Message

RAM CHECK
Error Message

ROM FAILED
Error Message

BAD OFFSET
Error Message

This error message requires replacing the control board or controller's chip, see pages 82 and 83.

BAD KEYPAD
Error Message

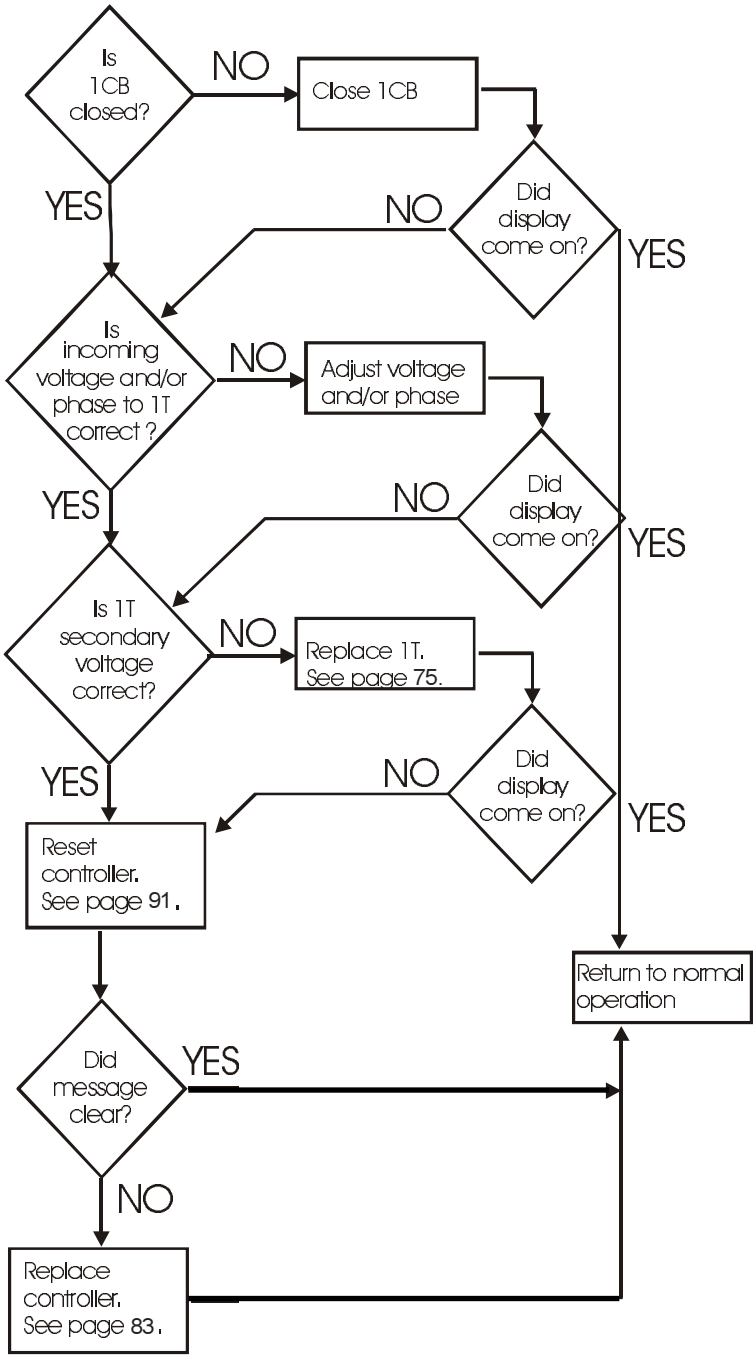
These error messages require checking user software/hardware.

PARITY
Error Message

FRAMING
Error Message

OVERRUN
Error Message

Unit will not start, no error message displayed.



VFD Faults

A fault is a condition that stops the VFD. There are two fault types:

Type 1 - The VFD attempts to automatically reset the fault. If the condition that caused the fault is no longer present, the fault will be reset and the VFD will be restarted.

Type 2- This type of fault may require VFD or motor repair, or is caused by wiring or programing errors. The cause of the fault must be corrected before the fault can be cleared.

For any other fault display contact Thermo.

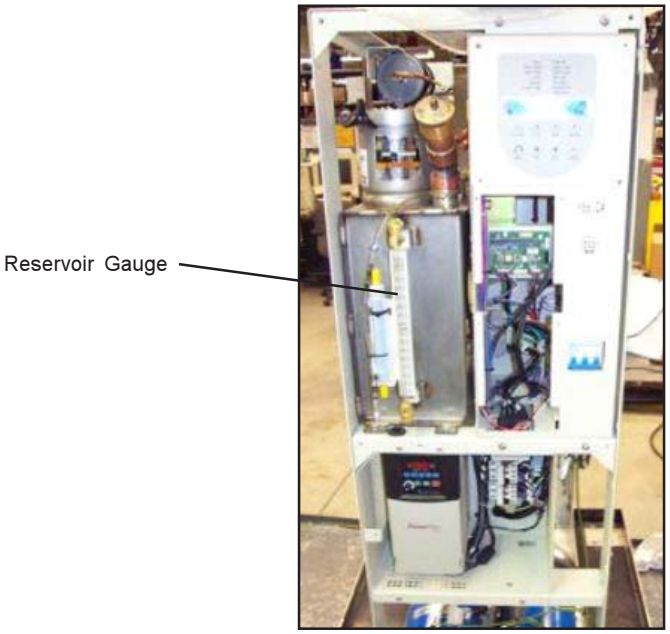
Display	*Fault*	*Type*	*Description*	*Action*
F003	*Power Loss*	*2*	*DC bus voltage remained below 85% of nominal.*	*1. Monitor the incoming AC line for low voltage or line power interruption.* *2. Check input fuses.*
F004	*Under Voltage*	*1*	*DC bus voltage fell below the minimum value.*	*Monitor the incoming AC line for low voltage or line power interruption.*
F005	*Over Voltage*	*1*	*DC bus voltage exceeded maximum value.*	*Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.*
F006	*Motor Stalled*	*1*	*Drive is unable to accelerate motor.*	*Check connections on VFD.*
F007	*Motor Overload*	*1*	*Internal electronic overload trip.*	*An excessive motor load exists. Contact Thermo.*
F008	*Heatsink OverTemp*	*1*	*Heatsink temperature exceeds a predefined value.*	*1. Check for blocked or dirty heat sink VFD fins. Verify ambient temperature has not exceeded 50°C(122°F)* *2. Check fan.*
F013	*Ground Fault*	*2*	*A current path to earth ground has been detected at one or more of the drive output terminals.*	*Check the motor and external wiring to the drive output terminals for a grounded condition.*

F038	*Phase U to Ground*	*2*	*A phase to ground fault has been detected between the drive and motor in this phase.*	*1. Check the wiring between the drive and motor.* *2. Check motor for grounded phase.* *3. Replace drive if fault cannot be cleared.*
F039	*Phase V to Ground*		*See F038*	
F040	*Phase W to Ground*		*See F038*	
F041	*Phase UV Short*	*2*	*Excessive current has been detected between these two output terminals.*	*1. Check the motor and drive output terminal wiring for a shorted condition.* *2. Replace drive if fault cannot be cleared.*
F042	*Phase UW Short*		*See F041*	
F043	*Phase VW Short*		*See F041*	
F070	*Power CDU*	*2*	*Failure has been detected in the drive power section.*	*1. Cycle power.* *2. Replace drive if fault cannot be cleared.*
F122	*I/O Board Fail*	*2*	*Failure has been detected in the drive control and I/O section.*	*1. Cycle power.* *2. Replace drive if fault cannot be cleared.*

Monitoring for Fluid Loss

Each line on the Reservoir Gauge represents approximately 1/10 of a gallon. On a routine basis check and record the fluid level. If the fluid level is dropping at a rate faster than indicated by the specification then perform the following:

1. Ensure the Tank Fill Port and the Tank Auxiliary Port Cap are properly installed and on hand tight.
2. Check all sanitary gaskets to insure that they are properly installed and are on according to the Torque Specification Sheet on page 86.
3. Look for signs of a leak at all connections and solder joints.
4. If none of the above yield any results, use a Halogen Leak detector on each connection and joint.
5. Check for leaks at the Test Equipment per your procedures.



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Description	Thermo	Teradyne
SYS HFE -30CDU	603099991707	873-612-00.
FRU CDU RETURN PIPE ASSY	093354	360-900-00
FRU CDU FILTER BAG	093355	360-900-01
FRU CDU FILTER O-RING	093385	360-900-02
FRU CDU PUMP W/ GASKETS	093356	360-900-03
FRU CDU PUMP SUCT LINE	093542	360-900-70
FRU CDU INLINE DRIER	093449	360-900-05
FRU CDU SUPPLY PIPE ASSY	093543	360-900-71
FRU CDU FILL PORT SCREEN	093386	360-900-07
FRU CDU PRESS REGULATOR	093359	360-900-08
FRU CDU FLOW XDUCER	093544	360-900-72
FRU CDU TEFLON PASTE	093387	360-900-10
FRU CDU FACIL INLET PIPE	093496	360-900-52
FRU CDU VALVE W/ACTUATOR	093497	360-900-53
FRU CDU VLV ACTUATOR ONLY	087774	360-900-13
FRU CDU INSUL TAPE	093388	360-900-14
FRU CDU TANK LVL SWITCH	087775	360-900-15
FRU CDU PRESS XDUCER	087782	360-900-16
FRU CDU DRIP PAN SWITCH	087820	360-900-54
FRU CDU RTD H2O SIDE	087777	360-900-18
FRU CDU DRIER TUBE	093362	360-900-19
FRU CDU RTD HFE SIDE	087821	360-900-55
FRU CDU FILL PORT CAP	093397	360-900-21
FRU CDU FILL PORT O-RING	093363	360-900-22
FRU CDU PETES PLUG	093384	360-900-23
FRU CDU CIRCUIT BREAKER	087835	360-900-74
FRU CDU CONTACTOR	087836	360-900-75
FRU CDU TRANSFORMER	087779	360-900-26
FRU CDU VAR FREQ DRIVE	087837	360-900-76
FRU CDU LON ADAPT BOARD	087786	360-900-28
FRU CDU TEMP OPTION BRD	087787	360-900-29
FRU CDU VFD FILTER	087838	360-900-77
FRU CDU EMO THERMOSTAT	087788	360-900-31
FRU CDU 1.5" SANIT GASKT	093380	360-900-32
FRU CDU 2" SANIT GASKET	093381	360-900-33
FRU CDU 1.5" SANIT CLMP	093382	360-900-34
FRU CDU 2" SANIT CLMP	093383	360-900-35
FRU CDU TC400 CNTRL BRD	087790	360-900-38
FRU CDU EPROM SOFTWARE	087791	360-900-39
FRU CDU PIPING TO MOD VLV	093499	360-900-59
FRU PRV CARTRIDGE	015779	360-900-41
FRU KEYPAD	015781	360-900-42
FRU CDU DRIP PAN PLUG	093498	360-900-57
FRU CDU ELECT BOX ASSY	087839	360-900-79
FRU VFD BOX ASSY	087840	360-900-80
FRU MOTOR OVERLOAD	087841	360-900-81

360-900-72 Transducer,Water Flow

360-900-13 Valve Actuator Only

360-900-15 Tank Level Switch

360-900-54 Sensor Kit, Drip Pan Level

360-900-18 RTD H2O Side

360-900-55 RTD HFE Side

360-900-26 Transformer

360-900-77 VFD Filter

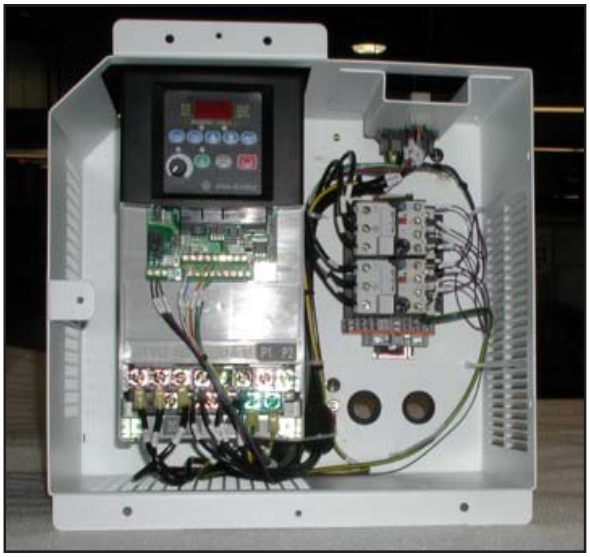
360-900-16 Pressure Transducer

360-900-74 Circuit Breaker

360-900-75 Contactor

360-900-76 Var Freq Drive
360-900-80 VFD Box Assembly
360-900-81 Motor Overload

NOTE: The VFD box, 360-900-80, consists of a VFD, two motor overloads, and the associated wiring.

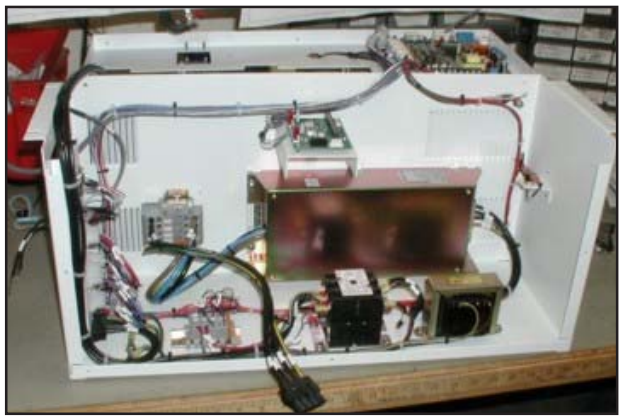


360-900-28 LON Adapter Board

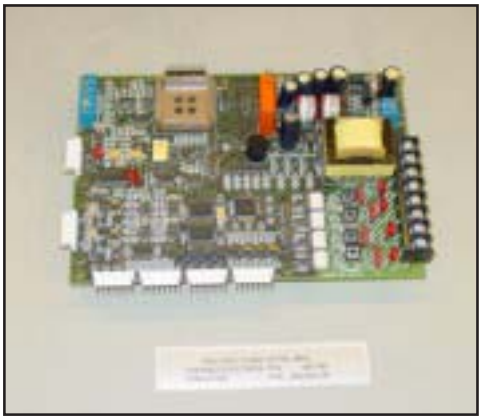
360-900-29 Temp Option Board

360-900-31 EMO Thermostat

360-900-79 Electrical Box Assembly



360-900-38 TC400 Control Board



360-900-00 Return Pipe Assembly, Process Flow

360-900-01 Filter Bag Kit

360-900-03 Pump with Gaskets

360-900-70 Pump Suction Line, with Gaskets

360-900-71, Supply Pipe Assembly

360-900-08 Pressure Regulator

360-900-52 Facility Inlet Pipe

360-900-53 Valve Assembly, Temperature Control

360-900-19 Drier Tube

360-900-32 Gasket 1½" / 360-900-33 Gasket 2"

360-900-34 Clamp, Sanitary Fitting 1½" / 360-900-35 Clamp, Sanitary Fitting 2"

360-900-23 Petes Plug

360-900-41 Pressure Relief Valve Cartridge

360-900-22 Service Kit, Fill Port Cap

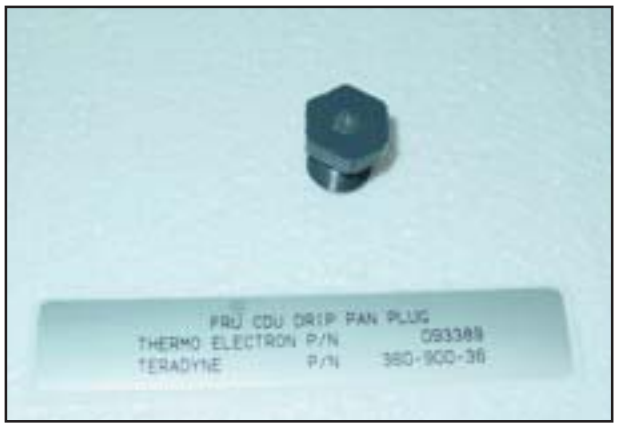
360-900-02 O-ring, Filter Housing

360-900-07 Fill Port Screen

360-900-10 Teflon® Paste

360-900-14 Tape, Insulating

360-900-57 Fitting, Drip Pan Plug



360-900-21 Fill Port Cap

360-900-59 Piping to Mod Valve

360-900-05 Pump Inline Dryer

360-420-00 Programmable Chip Extractor

360-900-42 Keypad

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CAUTION

For personal safety and equipment reliability, the following procedures should only be performed by a qualified technician. The following steps assume the technician is knowledgable of all Swagelok initial tightening and retightening procedures. Contact our Service Department for assistance.

WARNING

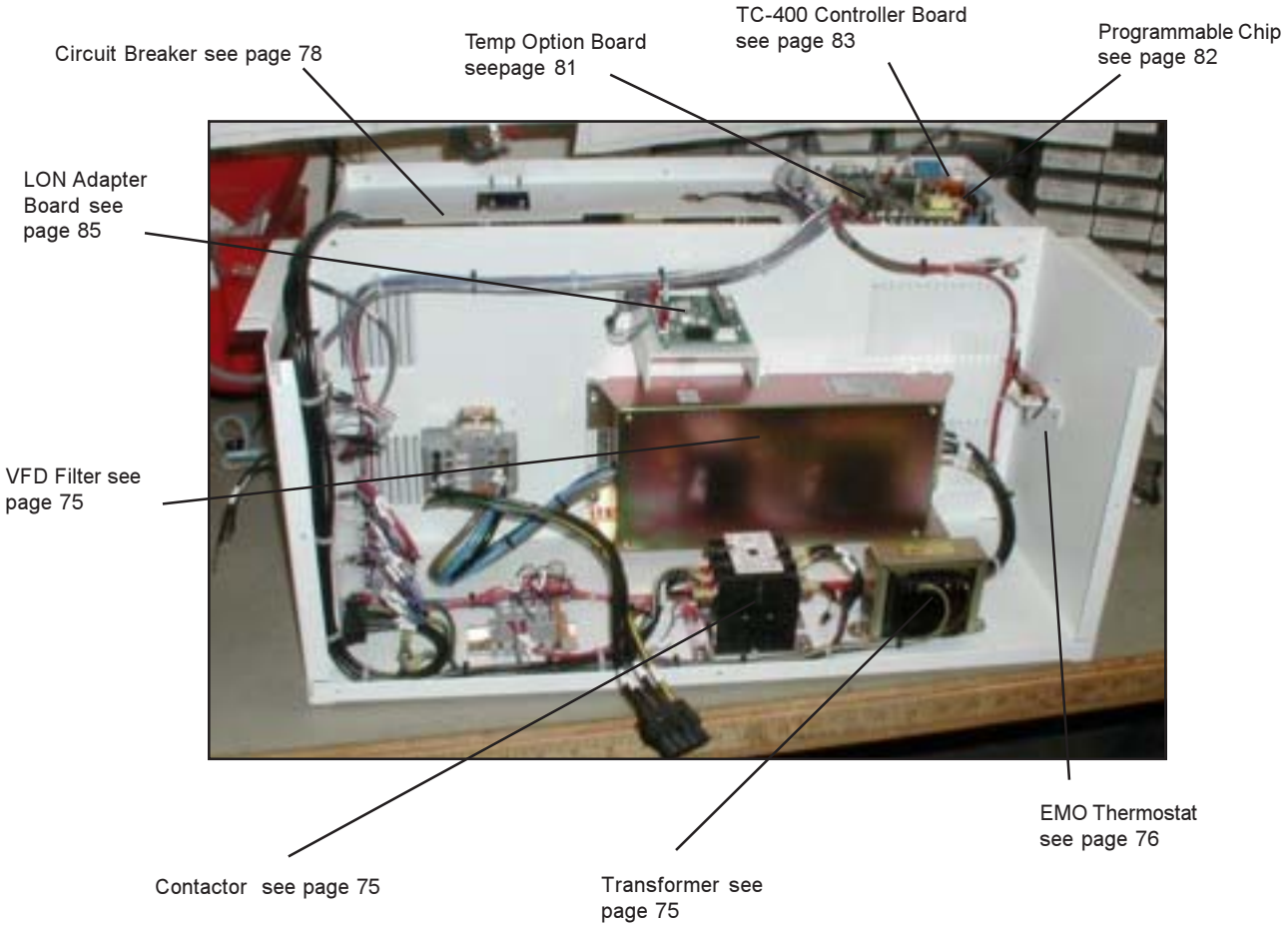
Contact with hazardous voltage inside the chiller can cause severe injury of death. Turn off and Lockout/Tagout (LOTO) power before servicing. Have a qualified technician verify that line voltage is no longer present within the unit after performing a LOTO procedure and before working on system.

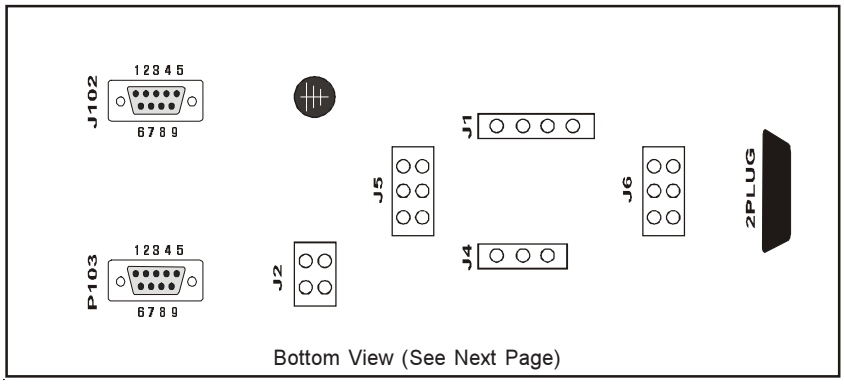
CAUTION

Performance maintenance and service procedures other than those described in this manual may result in a hazardous situation.

Electrical Components

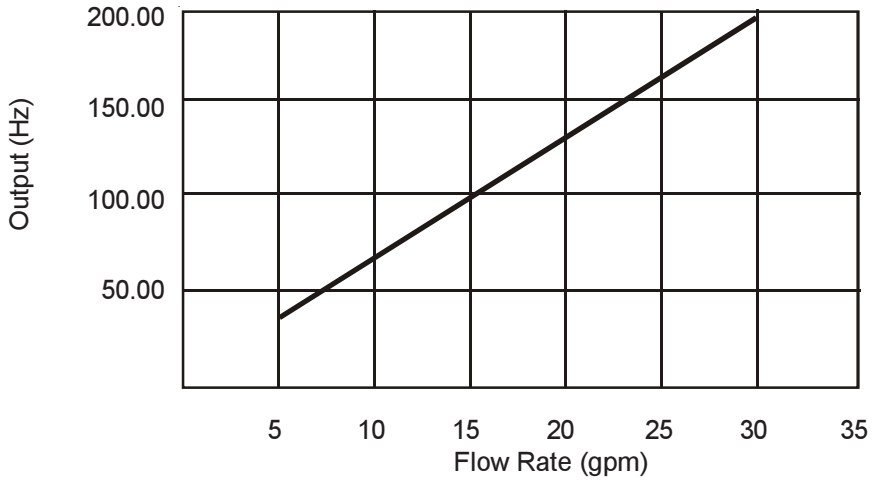
To access any of these electrical components you must remove the control box assembly and the side panel.





Bottom View (See Next Page)

Device	Connector	Action	Values
Coolant RTD	J102	Check resistance pins 1 and 7	100 Ohms @ 0°C ~110 Ohms @ room temp
Facility RTD	P103	Check resistance pins 1 and 7	100 Ohms @ 0°C ~110 Ohms @ room temp
Level Switches	J1	Check resistance Pins 1 and 2 warning Pins 3 and 4 shut down	0 Ohms = closed ∞Ohms = open
Drip Pan Switch	J2	Check resistance Pins 1 and 2	0 Ohms = closed ∞Ohms = open
Facility Flow Transducer	J4	Check Voltage Pins 1 and 2	See chart below
Motor Valve	J5	Measure Voltage Pins 1 and 2	100% open => 9.5 VDC 0% open = < 6.0 VDC
Pressure Transducers	J6	Measure voltage Pins 2 and 3 supply Pins 5 and 6 return	37.5 psi per volt plus 0.5 volts (example - 150 psi = 4.5 volts)



ElectricalBox Assembly (360-900-79)

WARNING

Turn off and Lockout/Tagout (LOTO) power before servicing.

Tools Required:
#2 Philips Head Screwdriver

11/32" wrench

Wiring Diagram

Procedure:

1. Using #2 Philips Head, remove the 4 screws securing the electrical box assembly to the front of the unit.

2. Remove the single screw securing the base of the control box to the unit's mid-frame.

3. Remove the 8 connectors at the bottom of the control box.

4. At the pump motor, remove the wiring running from the base of the control box.

5. Remove the 11/32 nut securing the ground wire at the rear of the unit.

6. Slide the control box assembly out from the unit.

7. Swap out the LON Adapter board from the replaced assembly into the new assembly, see page 85.

8. To reinstall, reverse the procedure.

Torque Control Box to Mid Pan, Bottom 14 - 16"-lbs
Torque Control Box to Mid Pan, Top 24 - 28"-lbs
Torque Control Box Assembly to Sides 24 - 28"-lbs

9. Rewire according to the wiring diagram.

10. Return the replaced assembly to Thermo Electron.

360-900-42 Keypad

Tools Required:
Screwdriver

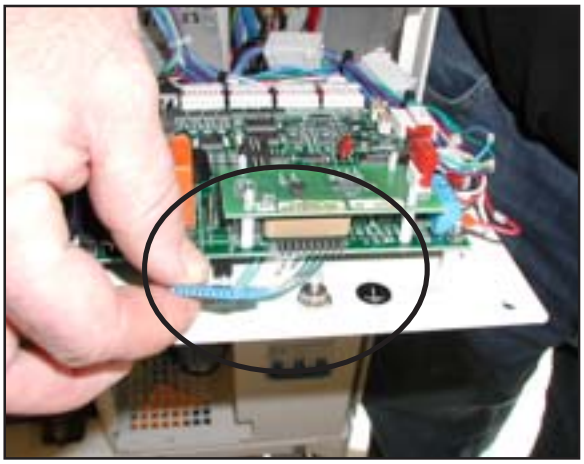
11/32" wrench

Procedure:

1. Remove the 4 screws securing the keypad panel to the front of the unit.

2. Disconect ribbon cable from control board.

3. Remove the 11/32 grounding nut.



4. Peal the keypad off the panel.

5. When reinstalling, tighten gounding nut 14-16"-lbs.

Drier Tube
(360-900-19)

When the cartridge color-change feature (blue to pink) reaches the bottom of the top cap, the dryer tube needs changing.

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
Tywrap cutter/scissors

Procedure:

1. Remove the top and bottom tubes from the dryer tube nipples.

2. Cut the ty-wrap.

3. Reverse the procedure to install a new dryer tube.

4. Once the unit is restarted check for leaks.

Fill Port Screen (360-900-07)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
None

Procedure:

1. Remove the fill port cap by turning counterclockwise.

2. Remove the screen.

3. Replace the screen.

4. Reinstall the fill cap.

5. Once the unit is restarted check for leaks.

HFE Filter Bag Kit (360-900-01)

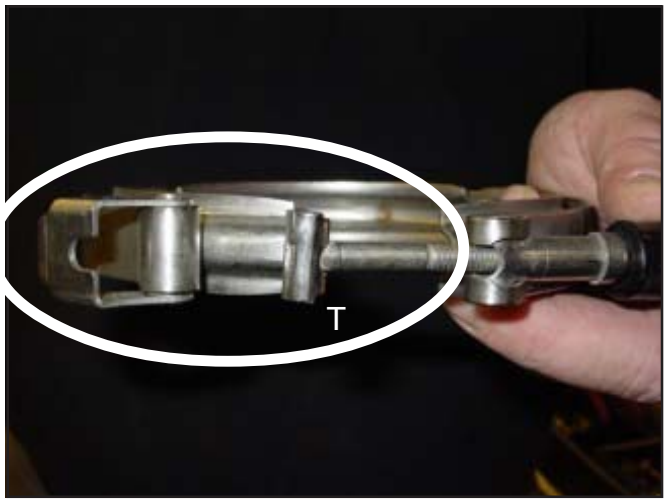
WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
None

Procedure:

1. Crack open the reservoir fill to allow air into the tank.
2. Locate and then loosen the black knob on the clamp at the top of the filter housing.

3. Remove the clamp. Note how the "T" is locked into position on the clamp.



4. Remove the lid and gasket.

5. Remove the spacer, handle up.

6. Pull out the old bag to remove it.

7. Install a new bag. **Ensure that the paper tag is removed from the bag.**

8. Reinstall the spacer, handle up.

9. Replace the lid gasket and reinsall the lid.

10. To reinstall a new bag push down on the lid and gasket when tightening the black knob. Hand tighten until the gap matches the other two gaps.

11. Once the unit is restarted check for leaks.

12. Ensure the LED and error message on the controller are both extinguished.

Pump Inline Drier (360-900-05)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
9/16" wrench

Procedure:

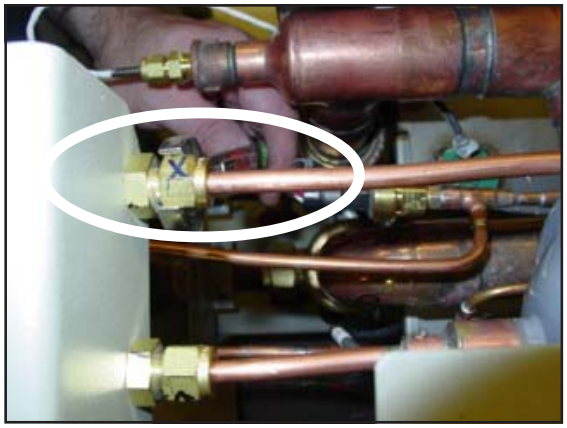
For easier access to the assembly remove the unit from the cabinet.

1. Note orientation of dryer assembly.

2. Crack open the reservoir fill to allow air into the tank.

3. Use the 9/16" wrench to remove the Swageloks securing the dryer assembly to the unit. To make removing the outer Swagelok easier, bend the inner dryer line down to get it out of the way.

Inner Swagelok



Dryer

Outer Swagelok

Top View

4. Undo the two Velcro straps and remove the dryer assembly.

5. Install a new dryer assembly. Secure the Velcro straps first to prevent bending the lines.

6. Connect the two ¼" lines and tighten the Swageloks per the tightening procedure on page 87.

7. Once the unit is restarted check for leaks.

Tank Level Switch (360-900-15)

WARNING

Turn off and Lockout/Tagout (LOTO) power before servicing.

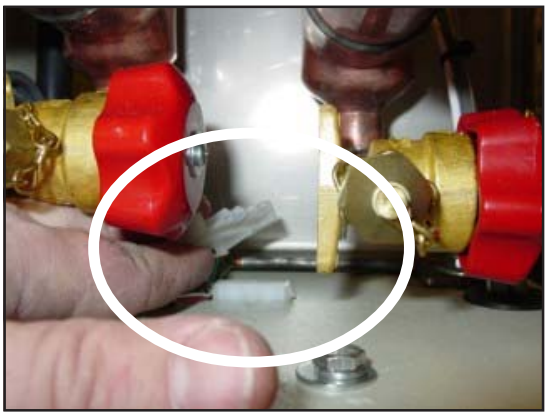
Tools Required:
Adjustable wrench

Tywrap cutter/scissors

Procedure:

1. For easier access to the switch, remove the electrical box assembly, see page 44.

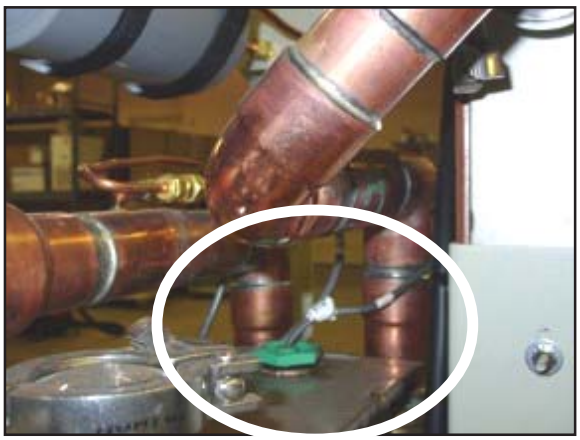
2. Undo the electrical "D" connector on the rear of the unit.



3. Remove the ty wraps.

4. Undo the green plastic fitting and remove the switch assembly from the reservoir.

5. To reinstall a new assembly reverse the procedure. **NOTE:** To prevent cross threading, install the new assembly into the reservoir only hand tight.



6. Once the unit is restarted check for leaks.

7. Ensure the LED and error message on the controller are both extinguished.

Pump (360-900-03)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

CAUTION **Crack the fill cap to relieve any tank/system pressure.**

Tools Required:
11/16" wrench

7/16" wrench

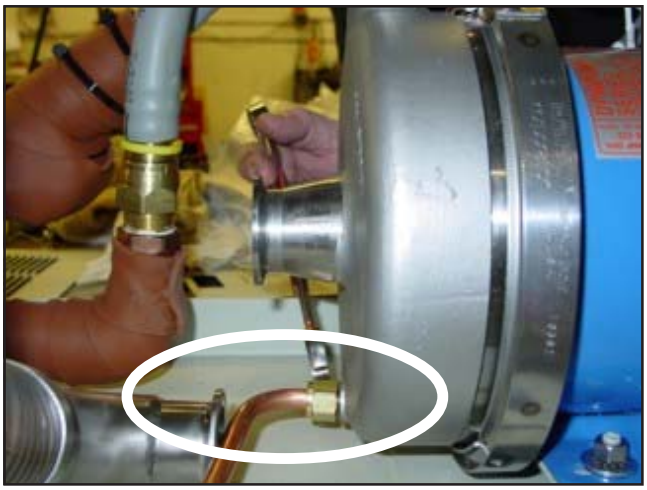
1/2" wrenchet.

Procedure:

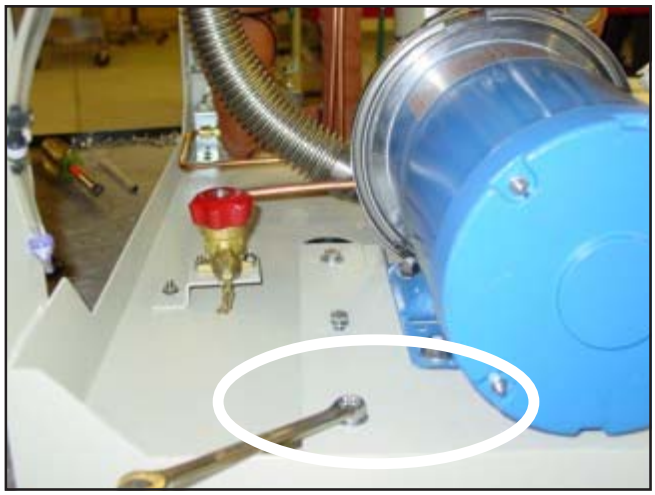
For easier access to the pump remove the unit from the cabin

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.
2. Remove the electrical box assembly, see page 44.
3. Remove sanitary clamps from both suction and discharge lines to the plate exchanger.

4. Using a 11/16" wrench, remove the fitting from the pump's drain line.



5. Using a 7/16" wrench, remove the 6 bolts securing the pump plate to the unit.



6. Remove the pump and plate from the unit.

CAUTION

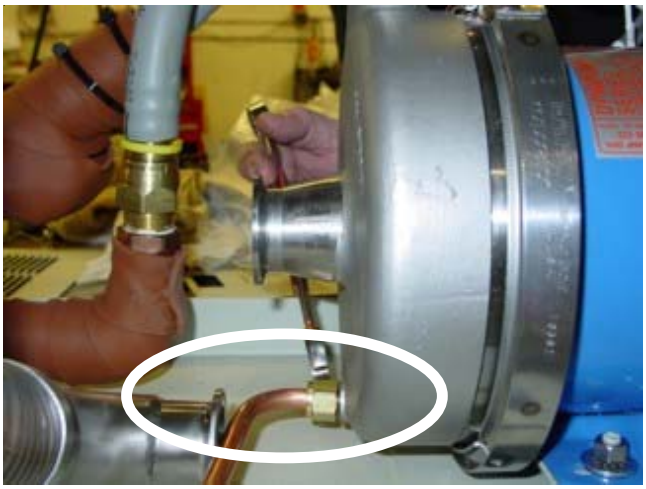
The pump weighs at least 80 pounds.

7. Using a 1/2" wrench, remove the nuts and washers securing the pump to the pump plate.

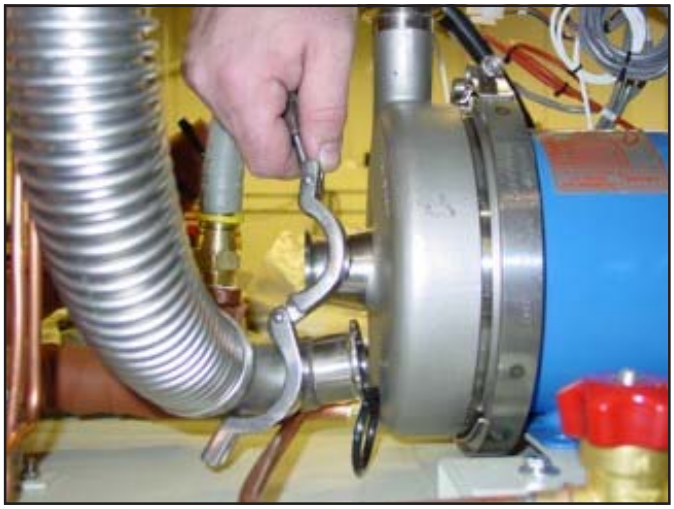
8. When reinstalling a new pump do not tighten any of the nuts, bolts, or clamps until all plumbing lines are properly aligned. Also, use new gaskets when reinstalling the sanitary clamps.

9. Reorrect pump discharge line to pump. Recheck the alignment.

10. Using a 11/16" wrench, install the fitting from the pump's drain line.



11. Install the sanitary clamps on the pump suction and discharge line.



12. Tighten all connections.

Torque Pump to Pump Plate	100-110"-lbs
Torque Pump Plate to Case	75"-lbs
Torque Sanitary Fittings	25"-lbs

13. Reconnect all the wiring.

Torque Pump Motor Ground Wires (3)	24 - 28"-lbs

14. Reinstall the electrical box assembly, see page 44.

15. Once the unit is restarted check for leaks.

16. Return the replaced pump to Thermo Electron.

Temperature Control Valve Assembly (360-900-53)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
1 3/4" wrench

Two 1 1/4" wrenches

Copper tubing cutting tool

Tywrap cutter/scissors

Tape, Insulating

Procedure:

For easier access to the valve remove the unit from the cabinet.

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove the insulation around the valve.

3. Use a 1 3/4" wrench to disconnect the Swageloks.

4. Unplug the 6-pin connector and disconnect the ground wire.

5. Open the clamp securing the valve to the unit.

6. To reinstall a new valve first connect the 1 3/4" Swageloks - finger tight.

7. Install the clamp.

8. Tighten the two Swageloiks. Refer to the Swagelok Installation on page 87.

Torque clamp	50"-lbs.

9. Reinstall the 6-pin connector and the ground wire.

Torque ground wire	24 - 28"-lbs.

10. Once the unit is restarted check for leaks.

11. Ensure the LED and error message on the controller are both extinguished.

12. Install insulation.

Temperature Control Valve Actuator (360-900-13)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
1 5/8" wrench

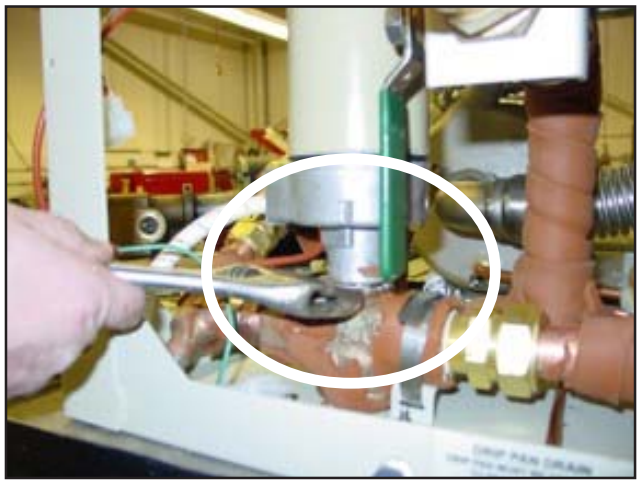
Tape, Insulating

Procedure:

For easier access to the actuator remove the unit from the cabinet.

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Use the 1 5/8" wrench to disconnect the actuator from the valve.



3. Unplug the 6-pin connector and disconnect the ground wire.

4. Reverse the procedure to install the actuator. Torque actuator to 20-25"-lbs.

5. Once the unit is restarted check for leaks.

6. Install insulation.

Water Flow Transducer (360-900-72)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
Adjustable wrenches

Teflon Sealant (FasSeal-ATS™)

Insulating Tape

Procedure:

For easier access to the assembly remove the unit from the cabinet.

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove the insulation.

3. Use a wrench to hold the bottom fitting in place and a second wrench to undo the top hose.

4. Remove the bottom Swagelok.

5. Unplug the wiring from under the electrical box.

6 The new flow transducer can be installed in either direction.

7. Connect both fittings, hand tight. **NOTE:** Use supplied thread sealant on upper connection.

8. Tighten the fittings, refer to the Swagelok Installation Sheet on page 87.

9. Connect the wiring to the control box.

10. Once the unit is restarted check for leaks.

11. Ensure the LED and error message on the controller are both extinguished.

12. Install insulation.

HFE Temp Sensor (rtd1)
(360-900-55)

Tools Required:

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

1/2" wrench

Tywrap cutters/Scissors

Procedure:

1. Use the 1/2" wrench to disconnect the sensor.
2. Slide the sensor down and through the unit's midpan.

3. Unplug the sensor from below the control box.
4. Reverse procedure to install new sensor. Refer to the Swagelok Installation Sheet on pages 87.
5. Once the unit is restarted check for leaks.

Pressure Transducers (360-900-16)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
5/8" wrench

Tywrap cutters/Scissors

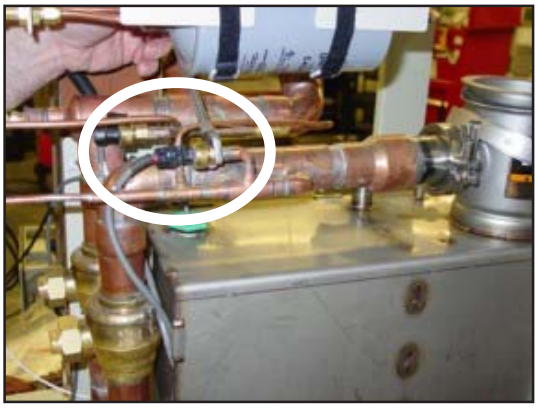
Procedure:

1. Unsnap the black plastic cap(s) on the transducer(s).

2. Use the 5/8" wrench to disconnect the transducer(s).

3. Unplug the wiring.

4. Reverse the procedure to install a new transducer. To tighten the fittings, refer to the Swagelok Installation Sheet on pages 87.



5. Once the unit is restarted check for leaks.

Drip Pan Level Switch Kit (360-900-54)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
3/8" wrench

Tywrap cutters/Scissors

Procedure:

1. Remove the 3/8" nut securing the kit to its bracket.

2. Undo wiring from below the electrical box.

3. To reinstall, reverse the procedure.

Pressure Regulator (360-900-08)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
Two 2 1/16" wrenches or adjustable wrenches

1/8" diameter test probe (Peterson Equip. Co. Inc. #500 Gauge Adapter or equivalent).

Insulating Tape

Procedure:

For easier access to the assembly remove the unit from the cabinet.

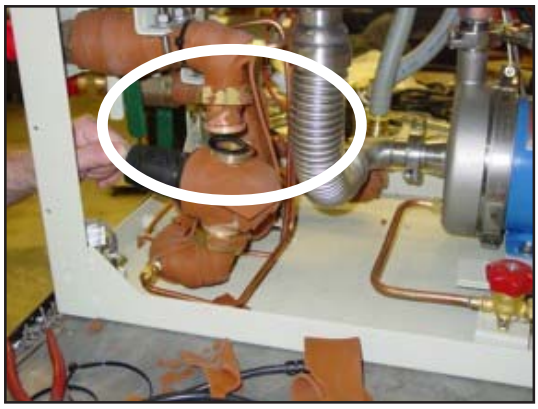
1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove insulation around the regulator.

3. Loosen top union fitting.

4. Undo bottom union fitting.

5. Undo top union fitting.



6. When installing new regulator and washers ensure the arrow on the side of the regulator points down.

7. Install both unions, hand tight.

8. Tighten both unions, one full turn past hand tight.

9. Install new insulation.

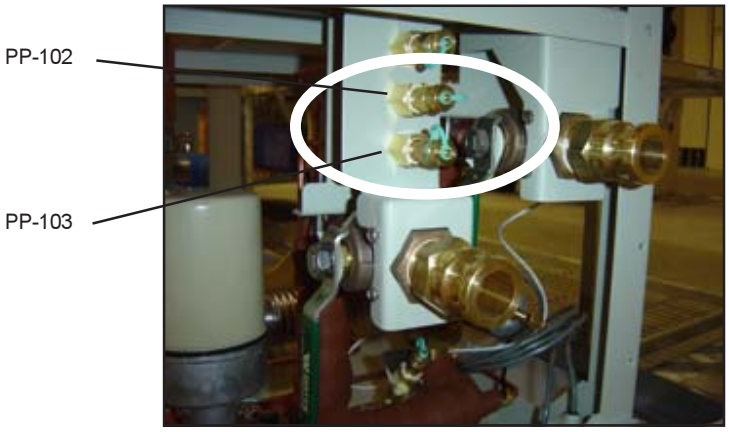
10. Once the unit is restarted check for leaks.

11. Ensure the LED and error message on the controller are both extinguished.

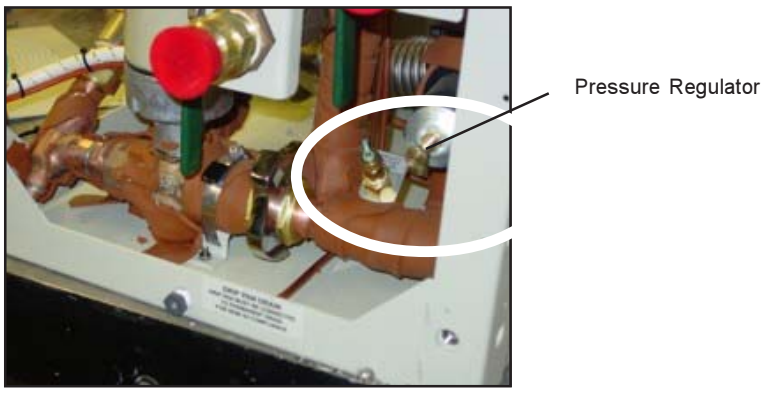
12. Adjust the pressure differential, see next page.

Using the test probe, verify the differential pressure across the temperature control valve using the two pressure test ports (Petes Plugs) PP-102 and PP-103.

With the unit off and facility water on, measure the pressure at PP-102. The pressure should match the facility water pressure. **NOTE:** If the pressure is 0 ensure that the facility water is on and that the facility supply valve is open. Next measure the pressure at PP-103. The difference between the two readings should be 30 - 33 PSI.



If adjustment is necessary loosen the locknut on the pressure regulator and then turn the adjustment bolt clockwise to increase the pressure, counterclockwise to decrease the pressure. Tighten the locknut.



13. Install insulation.

Plumbing, Pressure Regulator to Temperature Control Valve (360-900-59)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:

Two 2 1/16" wrenches or adjustable wrenches

One 1 3/4" wrench or adjustable wrench

Insulating Tape

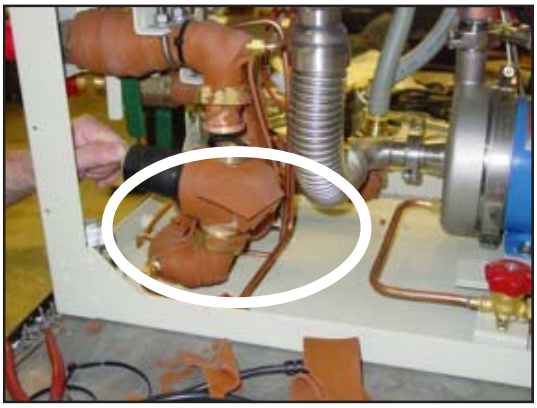
Procedure:

For easier access to the assembly remove the unit from the cabinet.

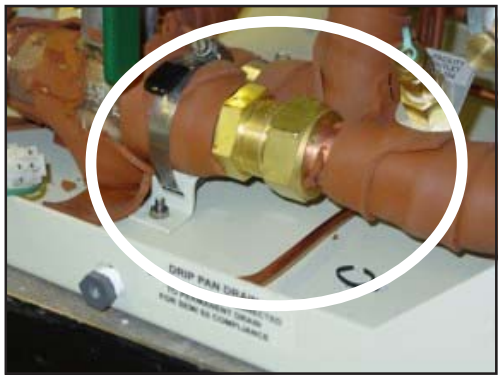
1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove insulation around the connections.

3. Undo the bottom union fitting on pressure regulator.



4. Use a 1 3/4" wrench to disconnect the Swagelok.



5. To reinstall tighten union, one full turn past hand tight.

6. Tighten the fitting, refer to the Swagelok Installation Sheet on page 87.

7. Once the unit is restarted check for leaks then install insulation.

Facility Inlet Pipe (360-900-52)

WARNING

Turn off and Lockout/Tagout (LOTO) power before servicing.

Tools Required:
Two 2 1/16" wrenches or adjustable wrenches

One 1 3/4" wrench or adjustable wrench

Insulating Tape

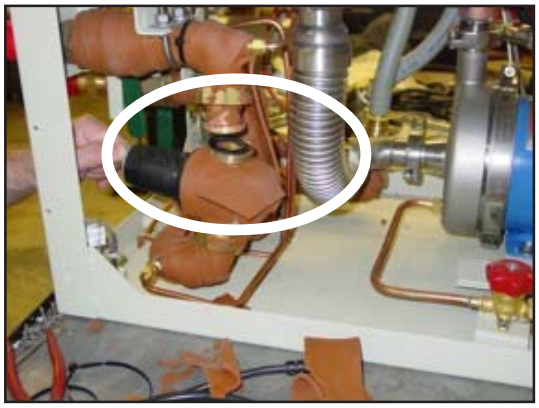
Procedure:

For easier access to the assembly remove the unit from the cabinet.

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove insulation.

3. Undo top union fitting on pressure regulator.



4. Undo the u-bolts securing the plumbing to the bottom of the unit's midpan.

5. To reinstall, reverse the procedure.

6. Tighten u-bolts until split washers on both sides are flat.

7. Once the unit is restarted check for leaks then install insulation.

H2O Side Temperature Sensor (rtd2) (360-900-18)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
Tywrap cutters/Scissors

Insulating Tape

Procedure:

1. Remove the electrical box assembly, see page 44.

2. Remove the insulation covering the sensor.

3. Cut the aluminum tape securing the sensor to the facility line.

4. Undo the wiring from below the electrical box.

5. Attach new sensor with hose clamp.

6. Install new tape and insulation.

7. Connect wiring.

8. Ensure the LED and error message on the controller are both extinguished.

9. Install insulation.

Return Pipe Assembly, Process Flow (360-900-00)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:

One 1/2" wrench or adjustable wrench

One 9/16" wrench or adjustable wrench

One 5/8" wrench or adjustable wrench

Procedure:

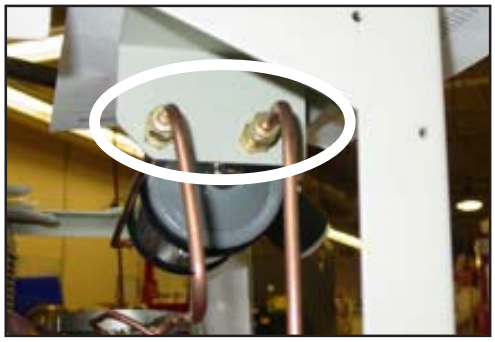
1. Drain the HFE. Refer to Teradyne Service Documentation for proper procedure.

2. Unsnap the black plastic cap on the transducer

3. Use the 5/8" wrench to disconnect the transducer.

4. Use the 1/2" and 9/16" wrenchs to disconnect the two process flow lines.

5. Use the 1/2" wrench to disconnect the process lines from the dryer.



6. Undo the u-bolts securing the line to the unit.

7. Undo the sanitary fitting at the tank.

8. Reverse the procedure to install a new line. Tighten all connection. Refer to the Swagelok Installation on page 87.

Sanitary Fitting	25"-lbs.
U-bolts	Hand tighten and 3 turns

9. Once the unit is restarted check for leaks.

Supply Pipe Assembly, Process Flow (360-900-71)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:

One 1/2" wrench or adjustable wrench

One 9/16" wrench or adjustable wrench

One 5/8" wrench or adjustable wrench

Procedure:

1. Drain the HFE. Refer to Teradyne Service Documentation for proper procedure.

2.Unsnap the black plastic cap on the transducer

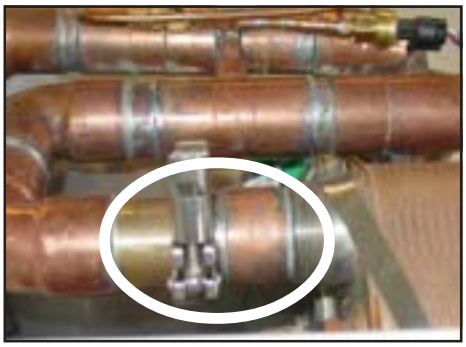
3. Use the 5/8" wrench to disconnect the transducer.

4. Use the 1/2" wrench to disconnect the temperature sensor.

5. Use the 1/2" and 9/16" wrenchs to disconnect the two process flow lines.

6. Undo the u-bolts securing the line to the unit.

7. Undo the sanitary fitting at the heat exchanger.



8. Reverse the procedure to install a new line. Tighten all connection. Refer to the Swagelok Installation on page 87.

Sanitary Fitting	25"lbs.
U-bolts	Hand tighten and 3 turns

9. Once the unit is restarted check for leaks.

PRV Cartridge (360-900-41)

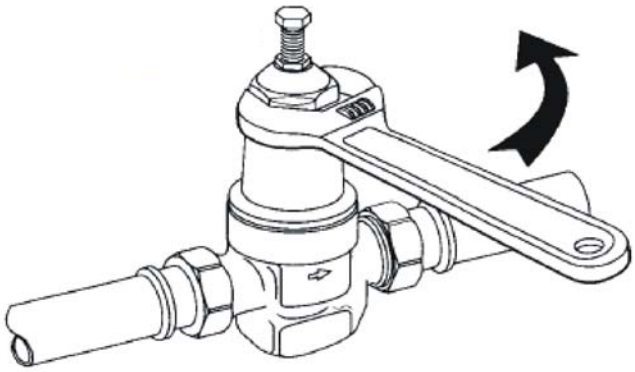
Tools Required:
Adjustable wrench

Two screwdrivers

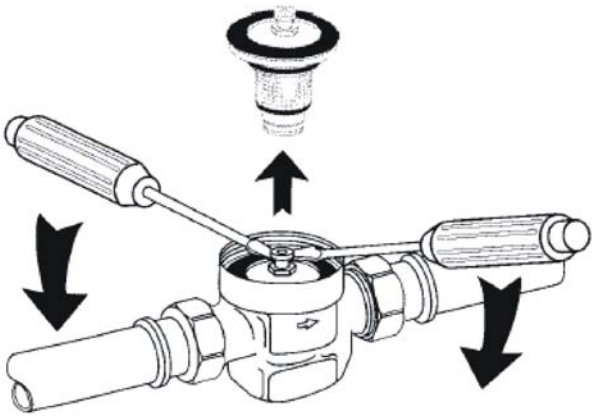
Procedure:

1. Loosen locknut and turn adjusting screw counterclockwise to remove the spring tension.

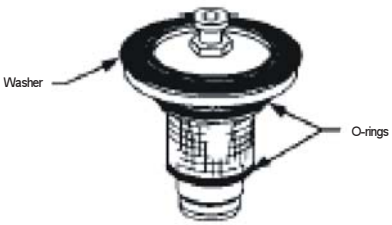
2. Remove the bonnet using the adjustable wrench.



3. Remove the cartridge using two screwdrivers as levers.



4. When installing new cartridge ensure the o-rings and washers are properly installed.



VFD Filter (360-900-77)
Contactor (360-900-75)
Transformer(360-900-26)

WARNING

Turn off and Lockout/Tagout (LOTO) power before servicing.

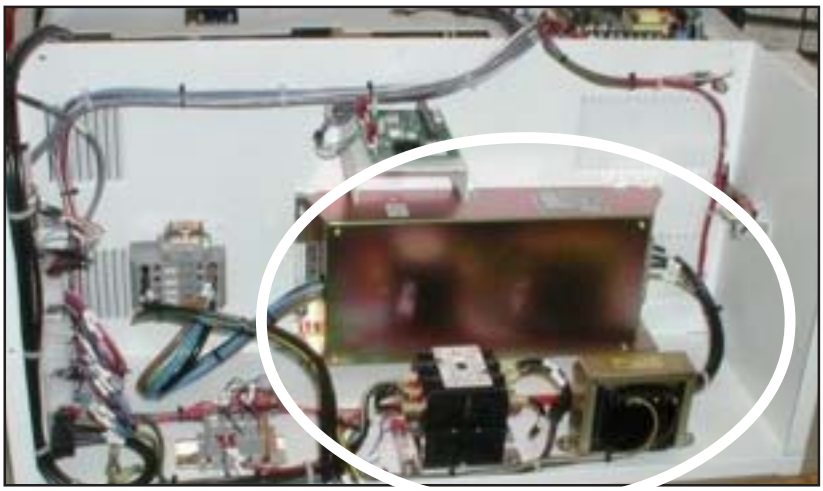
Tools Required:
McMaster Carr 8554A26, or equivalent torque screw driver

Wiring Diagram

Procedure:

1. Remove the electrical box assembly, see page 44.

2. Remove wiring and screws from transformer and contactor to access the RFI.



3. Remove wiring and screws securing RFI to the unit.

4 To reinstall components, reverse the procedure.

Torque Transformer Mounting Screws	14 - 16"-lbs
Torque Contactor/RFI Mounting Screws	24 - 28"-lbs

5. Reconnect wiring, refer to wiring diagram.

Torque RFI Wiring	15½"-lbs
Torque RFI Ground Wire	22 - 26"-lbs
Torque RFI Filter Wires to Contactor	25"-lbs

6. Ensure the LED and error message on the controller are both extinguished.

EMO Thermostat
(360-900-31)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
#6 Wrench or adjustable wrench

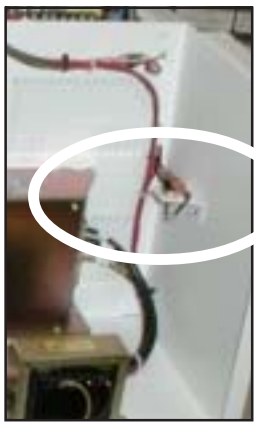
Loctite® threadlocker or equivalent

Procedure:

1. Remove the electrical box assembly, see page 44.

2. Remove the control box assembly side panel.

3. Locate the thermostat and remove the wiring and #6 nut.



4. To reinstall reverse the procedure. Hand-tight nut and secure with Loctite®.

Var Freq Drive VFD (360-900-76)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

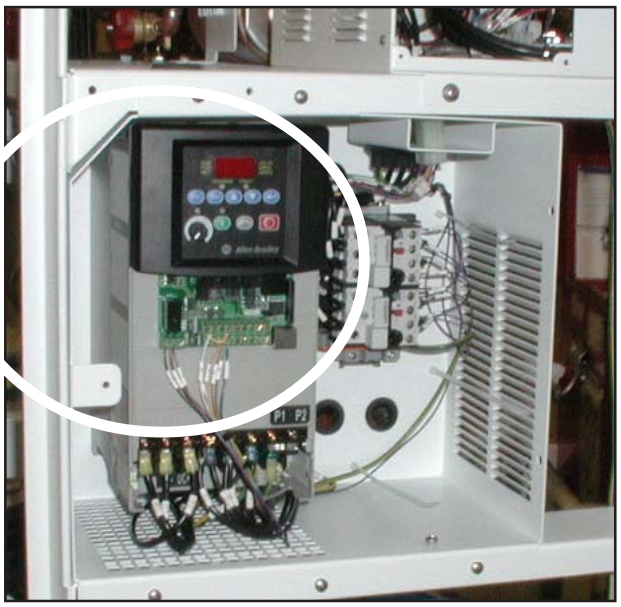
Tools Required:
McMaster Carr 8554A26, or equivalent torque screw driver

Wiring Diagram

Procedure:

1. Remove all wiring to the VFD.

2. Remove the four screws securing the VFD to the box assembly.



3. When installing, torque all four screws to 24 - 28"-lbs.

4. Reconnect all wiring. Refer to wiring diagram.

Torque VFD Wire Connection Screws	16 - 19"-lbs
Torque VFD Ground Nut	14 - 16"-lbs
Torque VFD Signal Wires	4.4 - 7"-lbs
Torque VFD Jumper Wires	4.4 - 7"-lbs
Torque VFD Power Wires	16 - 19"-lbs
Torque VFD Controller Panel	10 - 12"-lbs

5. Calibrate the VFD and install default settings, see next page.

6. Check for error codes on the VFD and controller.

VFD Settings

Viewing and Editing Parameter Steps.

1. When Power is applied, the last user-selected Display Group parameter number is briefly displayed with flashing characters. The display then defaults to that parameter's current value.

2. Press Esc once to display the Display Group parameter number shown on power-up. The parameter number will flash.

3. Press Esc again to enter the group menu. The group menu letter will flash.

4. Press the Up Arrow or Down Arrow to scroll through the group menu (d, P and A).

5. Press Enter or Sel to enter a group. The right digit of the last viewed parameter in that group will flash.

6. Press the Up Arrow or Down Arrow to scroll through the parameters that are in the group.

7. Press Enter or Sel to view the value of a parameter. If you do not want to edit the value, press Esc to return to the parameter number.

8. Press Enter or Sel to enter program mode to edit the parameter value. The right digit will flash and the Program LED will illuminate if the parameter can be edited.

9. Press the Up Arrow or Down Arrow to change the parameter value. If desired, press Sel to move digit to digit or bit to bit. The digit or bit that you can change will flash.

10. Press Esc to cancel a change. The digit will stop flashing, the previous value is restored and the Program LED will turn off.
    Or
    Press Enter to save a change. The digit will stop flashing and the Program LED will turn off.

11. Press Esc to return to the parameter list. Continue to press Esc to back out of the programming menu. If pressing Esc does not change the display, then d001 [Output Frequency] is displayed. Press Enter or Sel to enter the group menu.

Settings

Display Group and Number	Setting
P031	208
P033	29.4
P036	2
P038	2
A051	7
A052	5

Pump Motor Overloads
(360-900-81)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

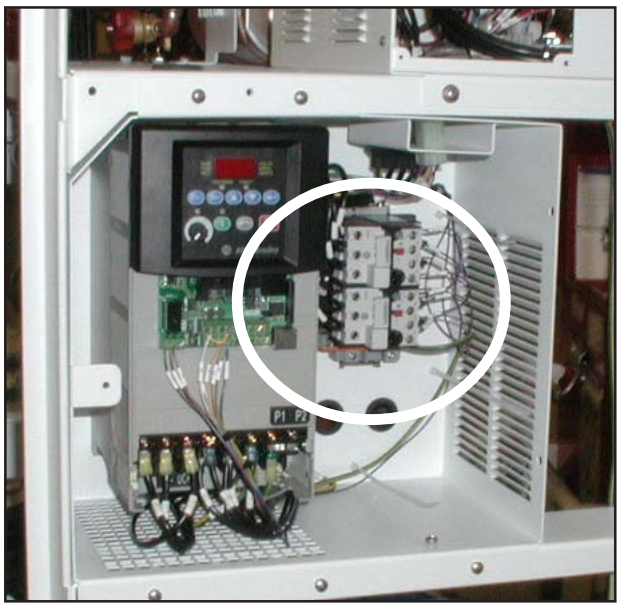
Tools Required:
McMaster Carr 8554A26, or equivalent torque screw driver

Wiring Diagram

Procedure:

1. Remove all wiring to the overload.

2. Remove the two screws securing the overload to the box assembly.



3. When installing, torque all screws to 24 - 28"-lbs.

4. Reconnect all wiring. Refer to wiring diagram.

5. Check for error codes on the controller.

Circuit Breaker (360-900-74)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
McMaster Carr 8554A26, or equivalent torque screw driver

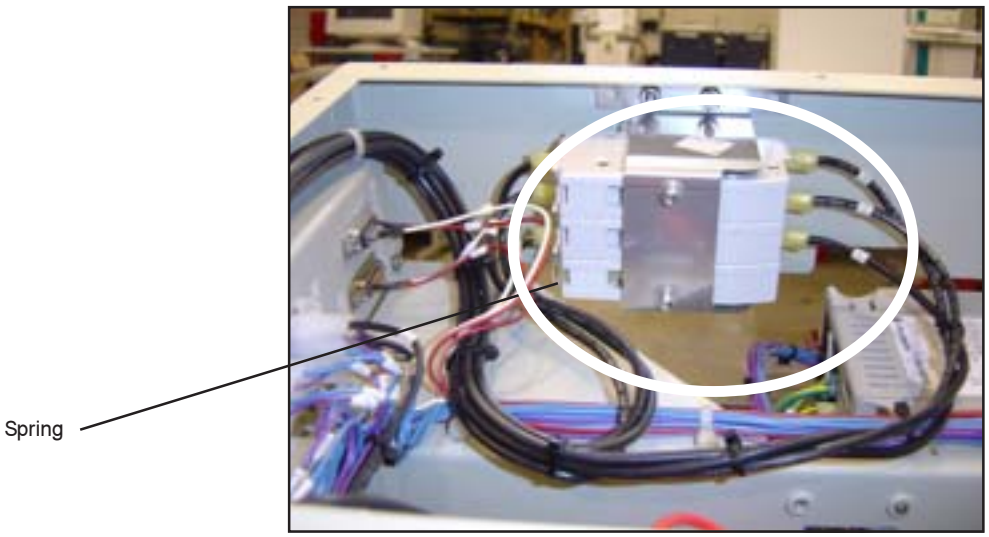
Wiring Diagram

Procedure:

1. Remove the electrical box assembly, see page 44.

2. Remove the four nuts securing the circuit breaker to the unit.

3. Remove all wiring to the circuit breaker.



4. Press the spring on the circuit breaker to separate it from the bracket.

5. To reinstall, reverse the procedure.

Torque Circuit Breaker 11/32 Mounting Nuts	14 - 16"-lbs

6. Reinstall wiring, refer to wiring diagram.

Torque Circuit Breaker Wire Connections	20"-lbs

Temp Option Board (TC-400 to LON Adapter) (360-900-29)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

WARNING **Use proper ESD (Electro Static Discharge) procedures when handling the chip and controller.** Typically a grounded wrist strap is used to ground the individual so static discharge is released prior to and during handling.

Tools Required:
Small pair of needle nose pliers

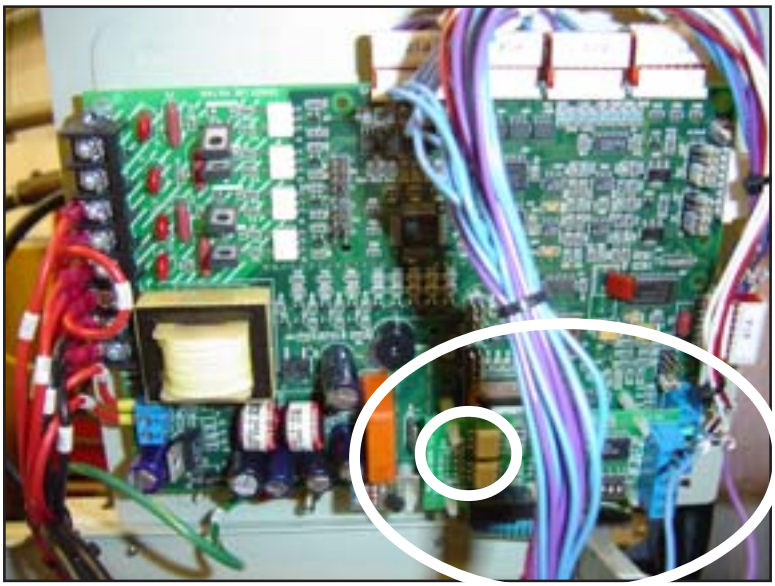
Wiring Diagram

Procedure:

1. Remove the electrical box assembly, see page 44.

2. Remove wiring

3. Using the pliers, press the "ears" on the four corners of the board and pull it out.



4. Snap new board back into position.

5. Install wiring, refer to wiring diagram.

6. Ensure the LED and error message on the controller are both extinguished.

Chip Replacement (390-900-39)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

WARNING **Use proper ESD (Electro Static Discharge) procedures when handling the chip and controller.** Typically a grounded wrist strap is used to ground the individual so static discharge is released prior to and during handling.

Tools Required

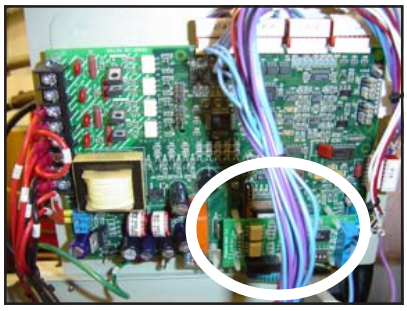
Plastic Leaded Chip Carrier (PLCC) extraction tool (not supplied) or equivalent.

Procedure

1. Remove electrical box assembly, see page 44.

2. The chip is located on the TC-400 Control Board, beneath the Communications Board. Remove the Communications Board.

3. Remove old programmed chip with the PLCC extraction tool. If one is not available a suitable tool is available from Thermo under part number 082166. Additional instructions are provided with the tool.

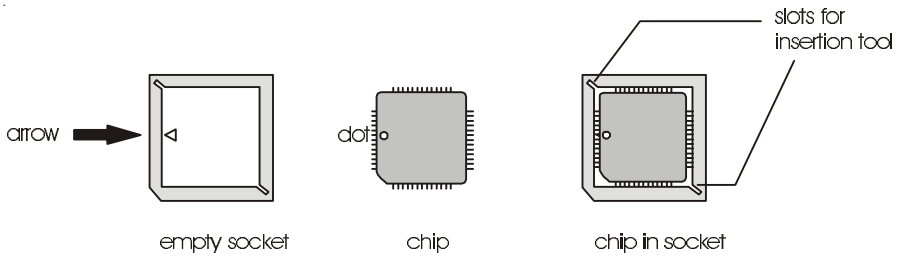


4. Insert new programmed chip by placing the chip over the socket with the orientation dot on the chip aligned with the orientation arrow on the board. Note that sometimes dot may be covered by a label, see below. Do not rely on the chip label since its orientation can be random. You may also notice that a corner of the chip and socket are slightly flattened. Press chip onto the socket by applying equal pressure to the chip until the chip completely snaps into the socket.

5. Replace the Communications Board and the control box assembly.

6. Start the unit and skip through any error messages using the controller's NEXT key. (Error 3 may appear when the new chip is powered up for the first time.)

7. Unit must be recalibrated for proper operation. Refer to Teradyne Service Documentation for proper procedure.



TC-400 Control Board
(360-900-38)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

WARNING **Use proper ESD (Electro Static Discharge) procedures when handling the chip and controller.** Typically a grounded wrist strap is used to ground the individual so static discharge is released prior to and during handling.

Tools Required:
Small pair of needle nose pliers

Screwdriver

Phillips Screwdriver

¼" Nut driver

Plastic Leaded Chip Carrier (PLCC) extraction tool (not supplied) or equivalent.

Wiring Diagram

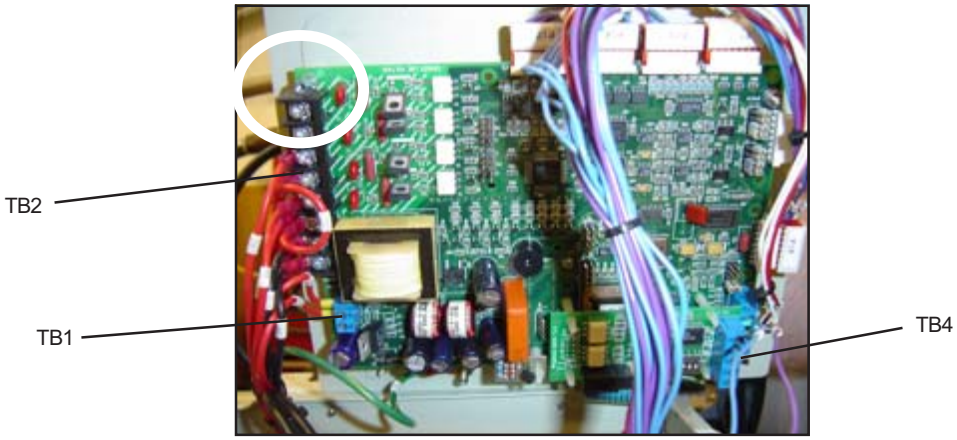
Procedure:

1. To allow the panel to fold down, remove the 4 screws securing the keypad panel to the front of the unit.

2. Remove all wiring to the board.

3. Remove the Temp Option Board and Programmable Chip, see previous two pages.

4. Undo the four corner mounting nuts securing the board to the unit.



5. To reinstall, reverse the procedure. Refer to wiring diagram. **NOTE:** Ensure jumper settings on new board match the settings on the wiring diagram.

Torque mounting nuts	6 - 8"-lbs
Torque 1TB/2TB Wires	8 -10"-lbs
Torque 4TB Wires	4.4 - 7"-lbs

6. Ensure the error message on the controller is extinguished.

LON Adapter Board (360-900-28)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

WARNING **Use proper ESD (Electro Static Discharge) procedures when handling the chip and controller.** Typically a grounded wrist strap is used to ground the individual so static discharge is released prior to and during handling.

Tools Required:
Small pair of needle nose pliers

Wiring Diagram

Procedure:

1. Remove the SMC Rider Board.

2. Remove the wiring to the LON.

3. Press the "ears" on all four corners of the board and pull it out.

4. To reinstall, reverse the procedure. Refer to wiring diagram.

5. Install the SMC Rider Board.

6. Calibrate the new board. Refer to Teradyne Service Documentation for proper procedure.

7. Ensure the LED and error message on the controller are both extinguished.

Torque Specification Sheet

Mechanical Assemblies

Pump Plate to Case	75"-lbs
Pump to Pump Plate	100-110"-lbs
Hose Clamps	50"-lbs
Unions (Pressure Regulator)	One full turn past hand tight
CAM Lock Fittings	70'-lbs
Sanitary Fittings	25"-lbs
Facility Water Outlet Assembly	75"-lbs
Process side U-bolts ¼-20 (084302)	Hand tighten and then 3 turns
Facility side U-bolts 3/8-16 (084292)	Hand tighten until split washers are flat on both sides
Temperature control valve actuator	20-25"-lbs

Electrical Assemblies

For phillips head screws we recommend using a McMaster Carr 8554A26, or equivalent

Float Switch	Hand tight
Motor Valve Ground Wire	24 - 28"-lbs
Pump Motor Ground Wires (3)	24 - 28"-lbs
Control Box Assembly to Mid Pan, Bottom	14 - 16"-lbs
Control Box Assembly to Mid Pan, Top	24 - 28"-lbs
Control Box Assembly to Sides	24 - 28"-lbs
Contactor Connecting Screws	25"-lbs
VFD Mounting Screws	24 - 28"-lbs
VFD Wire Connection Screws	16 - 19"-lbs
VFD Ground Nut	14 - 16"-lbs
VFD Signal Wires	4.4 - 7"-lbs
VFD Jumper Wires	4.4 - 7"-lbs
VFD Power Wires	16 - 19"-lbs
VFD Controller Panel	10 - 12"-lbs
Control Board Mounting #4 Nuts	6- 8"-lbs
1TB Wires	8 -10"-lbs
2TB Wires	8 -10"-lbs
4TB Wires	4.4 - 7"-lbs
Key Pad Ground 11/32 Nut	14 - 16"-lbs
RFI Filter Wires to Contactor	25"-lbs
RFI Filter Mounting Screws	24 - 28"-lbs
RFI Wiring	15½"-lbs
RFI Ground Wire	22 - 26"-lbs
Transformer Mounting Screws (8 - 32 x 1/4")	14 - 16"-lbs
Contactor Mounting Screws (10 - 32 x 3/8")	24 - 28"-lbs
Circuit Breaker 11/32 Mounting Nuts	14 - 16"-lbs
Circuit Breaker Wire Connections	20"-lbs

Swagelok Tube Fitting Instructions[1]

Installation

1. Insert tubing into the Swagelok tube fitting.

2. Make sure that the tubing rests firmly on the shoulder of the tube fitting body and that the nut is finger-tight.

3. Scribe the nut at the 6 o'clock position.

4. While holding fitting body steady, tighten the nut 11/4 turns to the 9 o'clock position. Note: For **1/16, 1/8,** and **3/16 in; 2, 3,** and **4 mm** tube fittings, tighten the nut 3/4 turn to the 3 o'clock position.

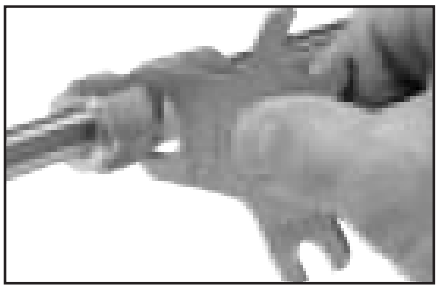
Installation in High-Pressure Applications and High Safety-Factor Systems

1. Follow steps 1 and 2 of the Swagelok Tube Fitting Instructions.

2. Tighten the nut until the tubing will not rotate freely by hand.

3. Follow steps 3 and 4 of the Swagelok Tube Fitting Instructions.

Gageability — On initial installation, the Swagelok gap inspection gauge assures the installer or inspector that a fitting has been sufficiently tightened.



Position the Swagelok gap inspection gauge next to the gap between the nut and body.

• If the gauge will not enter the gap, the fitting is sufficiently tightened.

• If the gauge will enter the gap, additional tightening is required.

Reassembly Instructions — You may disassemble and reassemble a Swagelok tube fitting, port connector, cap, and plug many times.

1. Insert tubing with pre-swaged ferrules into the fitting body until the front ferrule seats.

2. Rotate the nut with a wrench to the previously pulled-up position. At this point, a significant increase in resistance will be encountered.

3. Tighten slightly with a wrench. Note: Do not use the gap inspection gauge with reassembled fittings.

Do not mix or interchange parts with those of other manufacturers.

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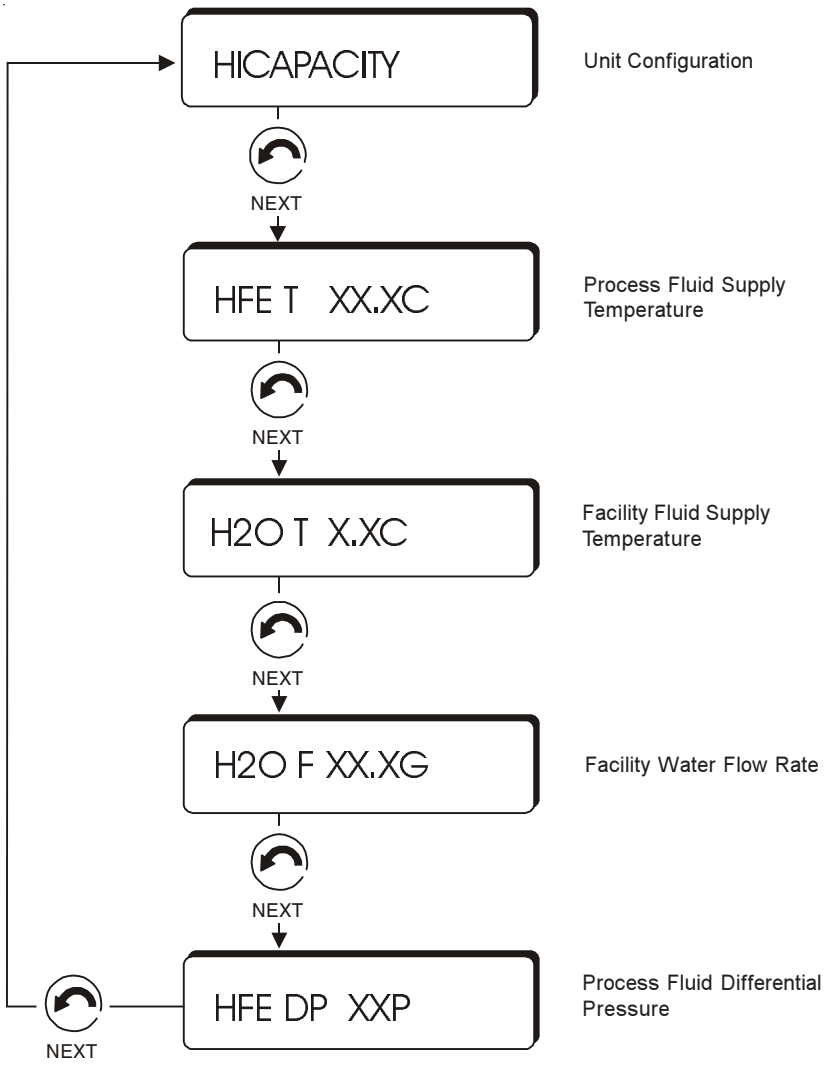
1. Swagelok Pocket Catalog of Tube Fittings MS-13-58

Main Loop

An alphanumeric display presents numeric readings of various operating conditions within the chiller. Display function is selected by pressing the appropriate keys to move through a menu of available information.

Main Loop

When the controller is first powered up it goes through a short self-test, and then enters the Main Loop and displays the unit configuration.

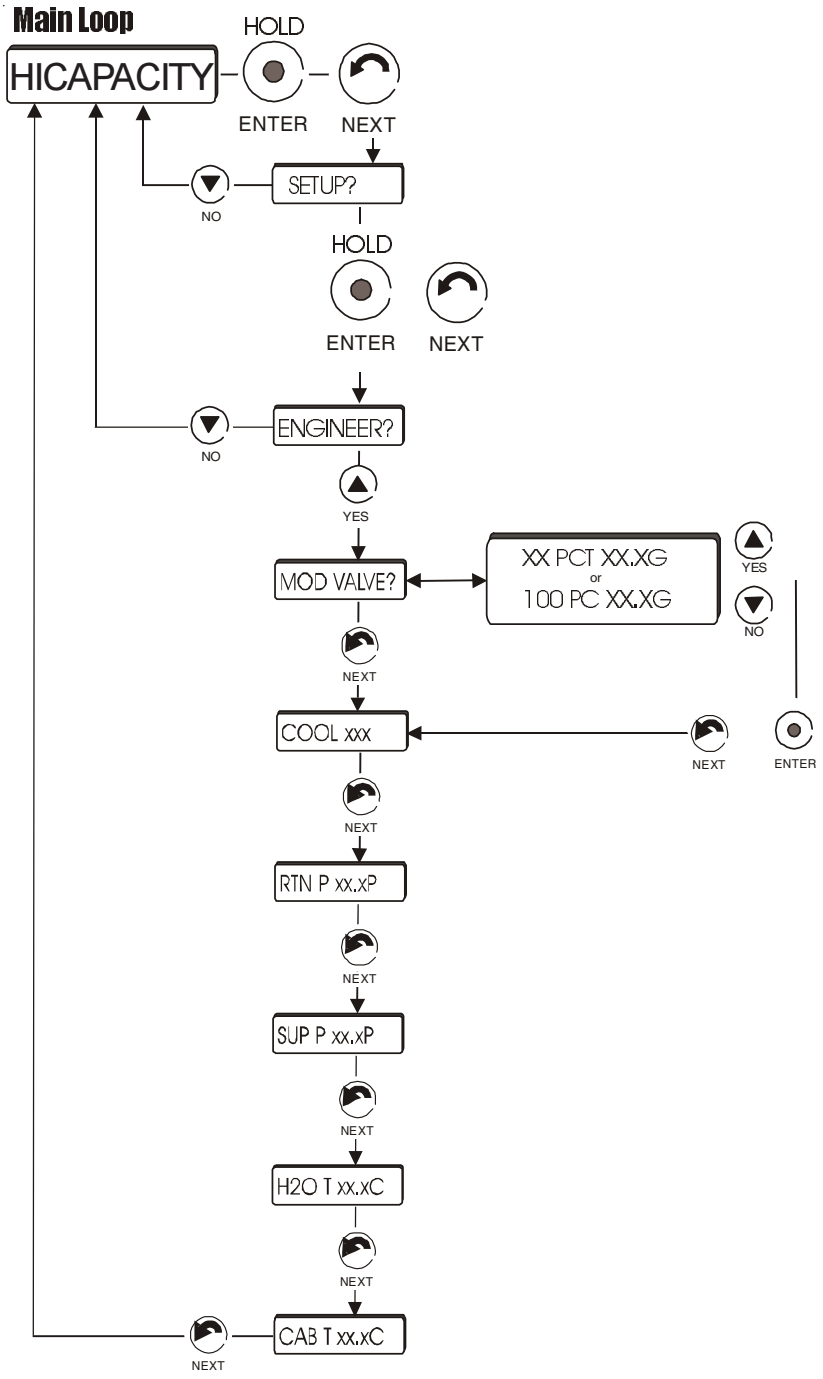


Main Loop

Engineering Loop

The Engineering Loop allows you to open or close the temperature control valve. Use the **YES** button to enter the valve condition. The display will then flash between the position of the valve and the facility flow value. Use the **YES** or the **NO** buttons to open or close it in 10% increments. When the desired value is displayed press **ENTER** and then **NEXT** to sequence through the displays.

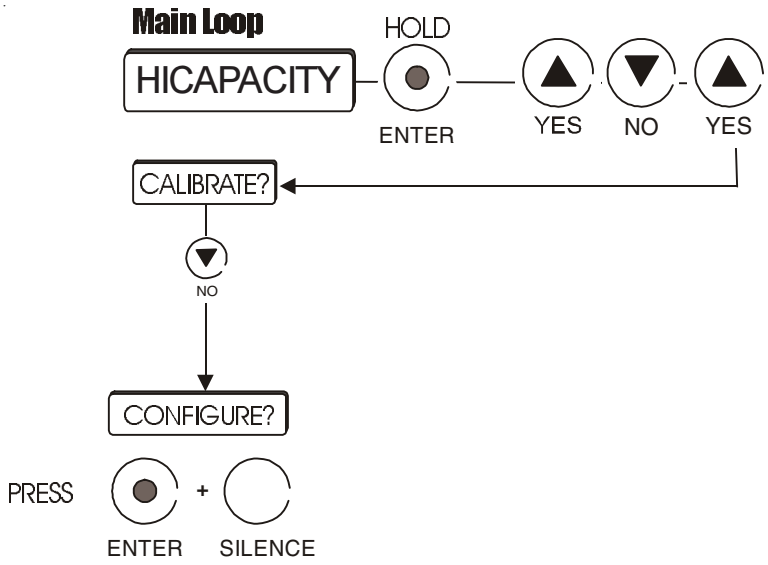
Press **NEXT** to sequence the display through the cool duty cycle, the coolant return pressure, the coolant supply pressure, the facility water temperature, and the ambient air temperature. Press **NEXT** again to return to the Main Loop.



Engineering Loop

Factory Reset

A Factory Reset returns all the controller settings to its factory preset values.

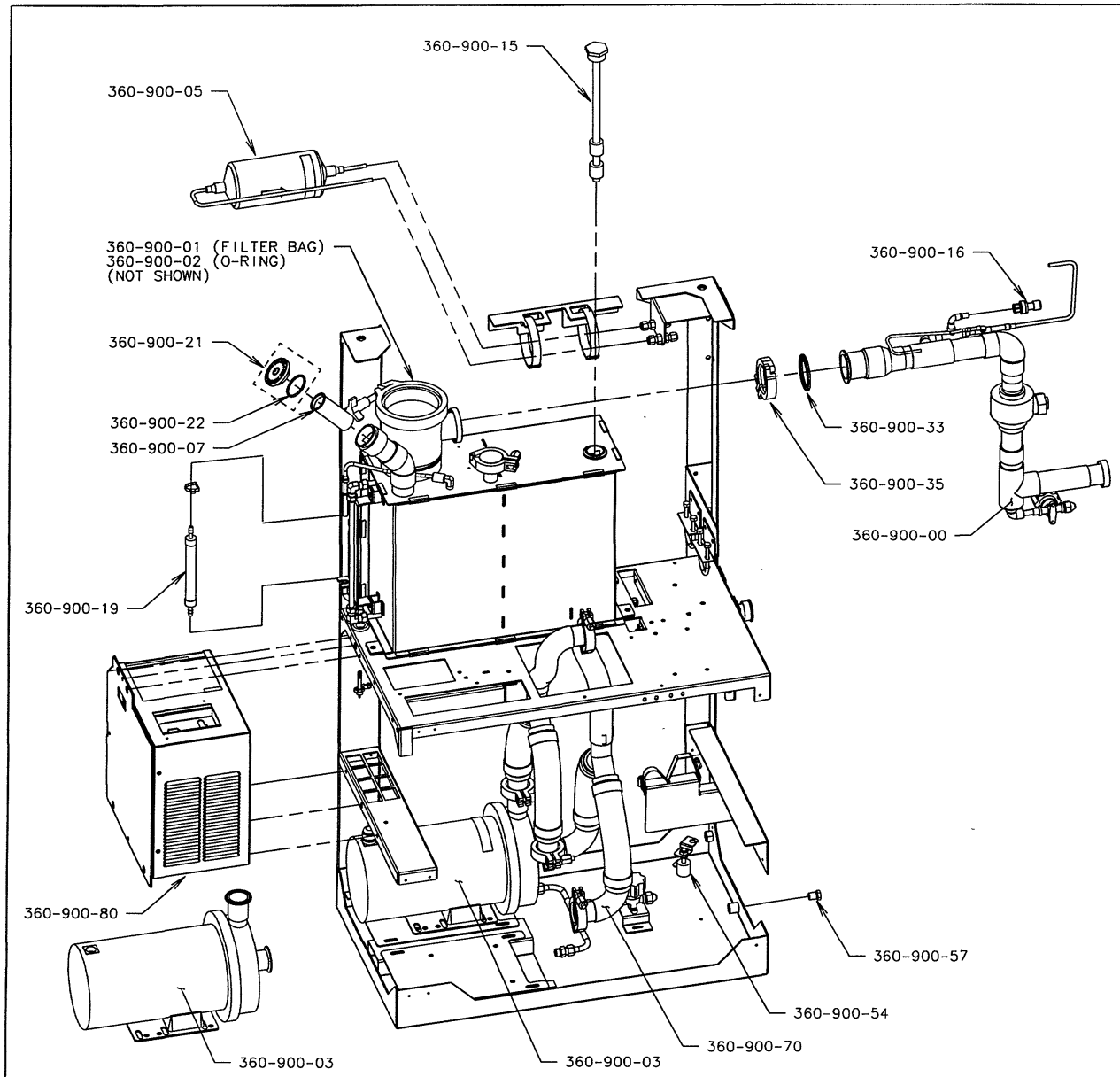


After the Reset a controlller calibration is required. Refer to Teradyne Service Documentation for proper procedure.

DWG NO 093599

REVISIONS

REV	DESCRIPTION	DATE	DFTR	CHKR	DSNR	APPD



FRU LIST

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360-900-81	087841	FRU CDU MOTOR OVERLOAD
360-900-80	087840	FRU CDU VFD BOX ASSEMBLY
360-900-79	087839	FRU CDU ELECTRICAL BOX ASSEMBLY
360-900-77	087838	FRU CDU VFD FILTER
360-900-76	087837	FRU CDU VARIABLE FREQUENCY DRIVE
360-900-75	087836	FRU CDU CONTACTOR
360-900-74	087835	FRU CDU CIRCUIT BREAKER
360-900-72	093544	FRU CDU FLOW TRANSDUCER
360-900-71	093543	FRU CDU SUPPLY LINE ASSEMBLY
360-900-70	093542	FRU CDU PUMP SUCTION LINE
360-900-59	093499	FRU CDU PIPING TO MODULATING VALVE
360-900-57	093498	FRU CDU DRIP PAN PLUG
360-900-55	087821	FRU CDU RTD HFE SIDE
360-900-54	087820	FRU CDU DRIP PAN SWITCH
360-900-52	093496	FRU CDU FACILITY INLET PIPE
360-900-42	015781	FRU CDU KEYPAD
360-900-41	015779	FRU CDU PRESSURE REGULATING VALVE CARTRIDGE
360-900-39	087791	FRU CDU EPROM SOFTWARE
360-900-38	087790	FRU CDU TC400 CONTROLLER BOARD
360-900-35	093383	FRU CDU 2" SANITARY CLAMP
360-900-34	093382	FRU CDU 1.5" SANITARY CLAMP
360-900-33	093381	FRU CDU 2" SANITARY GASKET
360-900-32	093380	FRU CDU 1.5" SANITARY GASKET
360-900-31	087788	FRU CDU EMO THERMOSTAT
360-900-29	087787	FRU CDU TEMP OPTION BOARD
360-900-28	087786	FRU CDU LON ADAPTER BOARD
360-900-26	087779	FRU CDU TRANSFORMER
360-900-23	093384	FRU CDU PETES PLUG
360-900-22	093363	FRU CDU FILL PORT O-RING
360-900-21	093397	FRU CDU FILL PORT CAP
360-900-19	093362	FRU CDU DRIER TUBE
360-900-18	087777	FRU CDU RTD H2O SIDE
360-900-16	087782	FRU CDU PRESSURE TRANSDUCER
360-900-15	087775	FRU CDU TANK LEVEL SWITCH
360-900-14	093388	FRU CDU INSULATING TAPE
360-900-13	087774	FRU CDU VALVE ACTUATOR ONLY
360-900-10	093387	FRU CDU TEFLON PASTE
360-900-08	093359	FRU CDU PRESSURE REGULATOR
360-900-07	093386	FRU CDU FILL PORT SCREEN
360-900-05	093449	FRU CDU INLINE DRIER
360-900-03	093356	FRU CDU PUMP W/GASKETS
360-900-02	093385	FRU CDU FILTER O-RING
360-900-01	093355	FRU CDU FILTER BAG
360-900-00	093354	FRU CDU RETURN PIPE ASSEMBLY
TERADYNE NUMBER	THERMO PART NUMBER	DESCRIPTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE: .XXX +/-.005, .XX +/-.015, FRACT. +/-1/64", ANGLES +/-45°
DO NOT SCALE FROM THIS DRAWING

DFTR: JOLIN DATE: MAR-04-2005
CHKR: DATE: 3-04-05
DSNR: ENOS DATE: FEB-16-2005
APPD: DEnos DATE: 3-19-05
MATL: AS LISTED
REF.DWG:

Thermo Control Technologies
Electron Corporation | 25 NIMBLE HILL RD. • NEWINGTON, NH 03801

TITLE: JAGUAR -30 FRU EXPLODED VIEWS CHINA UNIT

SIZE: B | PROJECT: Chiller_Cust-TeradyneJ | DWG NO: 093599 | REV: -
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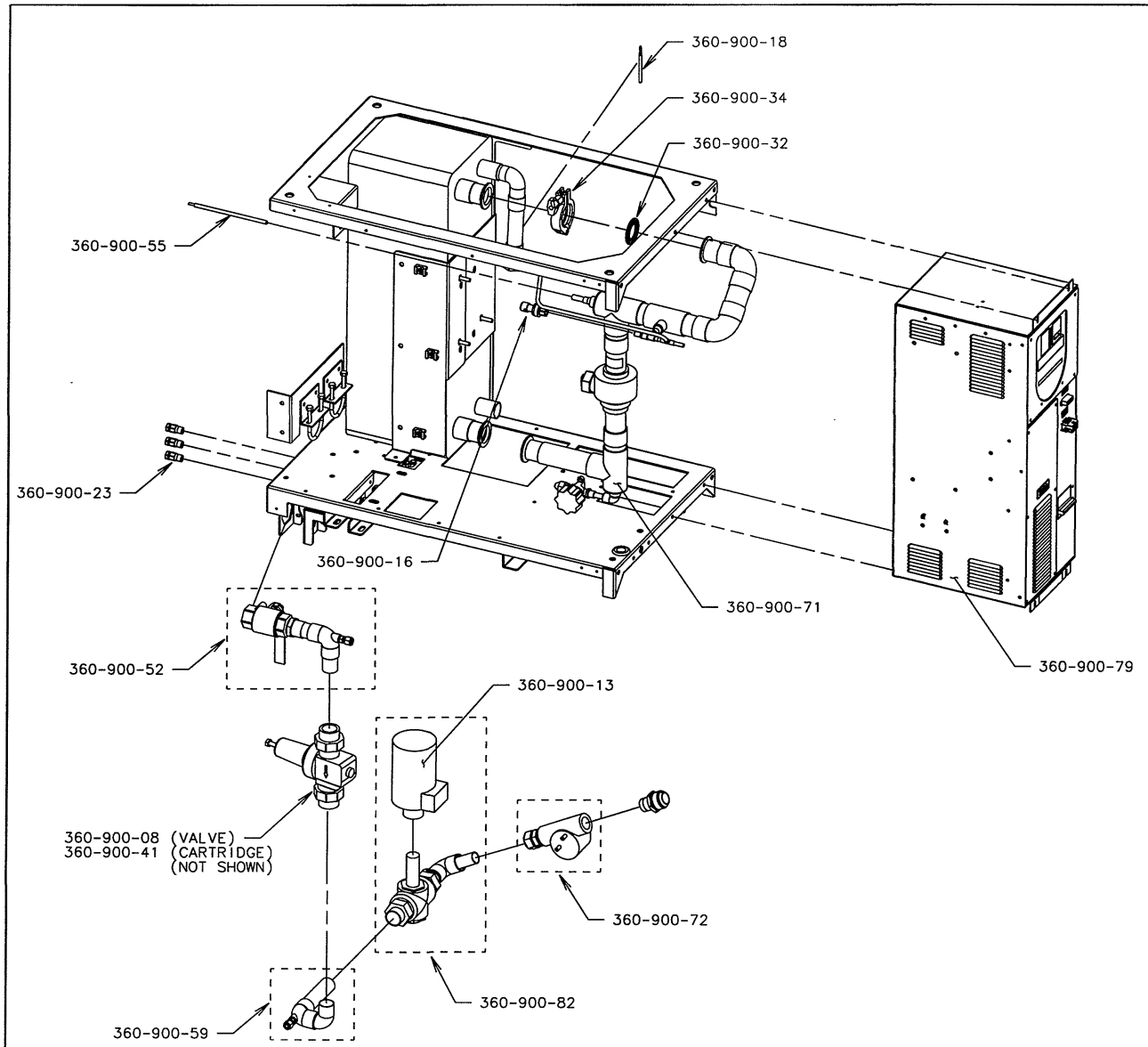
DWG NO 093599

REVISIONS

REV	DESCRIPTION	DATE	DFTR	CHKR	DSNR	APPD



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360-900-76	087837	FRU CDU VARIABLE FREQUENCY DRIVE
360-900-75	087836	FRU CDU CONTACTOR
360-900-74	087835	FRU CDU CIRCUIT BREAKER
360-900-72	093544	FRU CDU FLOW TRANSDUCER
360-900-71	093543	FRU CDU SUPPLY LINE ASSEMBLY
360-900-70	093542	FRU CDU PUMP SUCTION LINE
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360-900-57	093498	FRU CDU DRIP PAN PLUG
360-900-55	087821	FRU CDU RTD HFE SIDE
360-900-54	087820	FRU CDU DRIP PAN SWITCH
360-900-52	093496	FRU CDU FACILITY INLET PIPE
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360-900-23	093384	FRU CDU PETES PLUG
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360-900-21	093397	FRU CDU FILL PORT CAP
360-900-19	093362	FRU CDU DRIER TUBE
360-900-18	087777	FRU CDU RTD H2O SIDE
360-900-16	087782	FRU CDU PRESSURE TRANSDUCER
360-900-15	087775	FRU CDU TANK LEVEL SWITCH
360-900-14	093388	FRU CDU INSULATING TAPE
360-900-13	087774	FRU CDU VALVE ACTUATOR ONLY
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TERADYNE NUMBER	THERMO PART NUMBER	DESCRIPTION

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MATL: AS LISTED

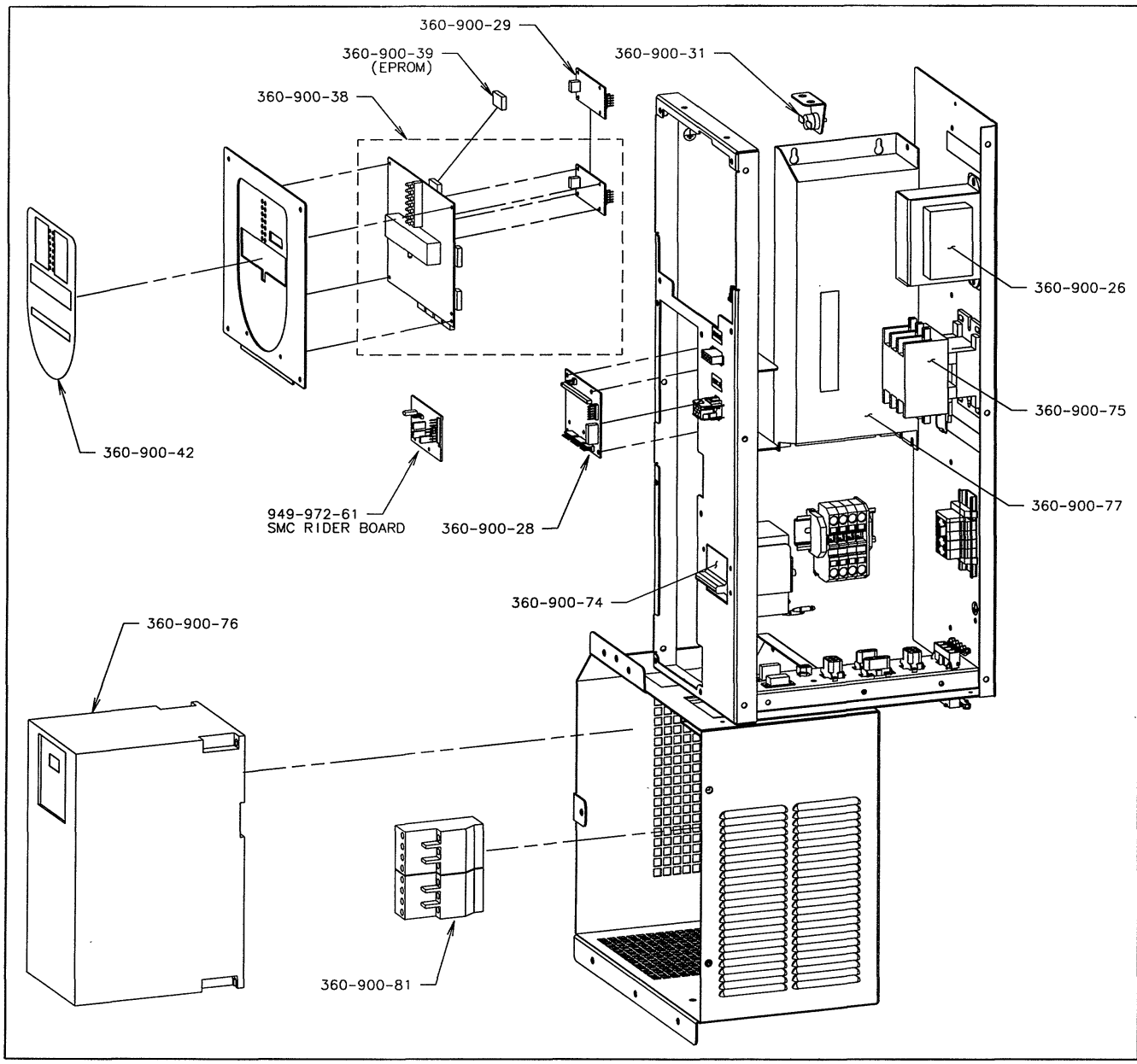
REF DWG:

Thermo Control Technologies
Electron Corporation | 25 NIMBLE HILL RD. • NEWINGTON, NH 03801

TITLE: JAGUAR -30 FRU EXPLODED VIEWS CHINA UNIT

SIZE	PROJECT	DWG NO	REV
B	Chiller_Cust-TeradyneJ	093599	-

SCALE: = 1 SHT: 2 OF 3



DWG NO 093599

REVISIONS

REV	DESCRIPTION	DATE	DFTR	CHKR	DSNR	APPD

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360-900-75	087836	FRU CDU CONTACTOR
360-900-74	087835	FRU CDU CIRCUIT BREAKER
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360-900-70	093542	FRU CDU PUMP SUCTION LINE
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360-900-55	087821	FRU CDU RTD HFE SIDE
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360-900-26	087779	FRU CDU TRANSFORMER
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360-900-22	093363	FRU CDU FILL PORT O-RING
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360-900-15	087775	FRU CDU TANK LEVEL SWITCH
360-900-14	093388	FRU CDU INSULATING TAPE
360-900-13	087774	FRU CDU VALVE ACTUATOR ONLY
360-900-10	093387	FRU CDU TEFLON PASTE
360-900-08	093359	FRU CDU PRESSURE REGULATOR
360-900-07	093386	FRU CDU FILL PORT SCREEN
360-900-05	093449	FRU CDU INLINE DRIER
360-900-03	093356	FRU CDU PUMP W/GASKETS
360-900-02	093385	FRU CDU FILTER O-RING
360-900-01	093355	FRU CDU FILTER BAG
360-900-00	093354	FRU CDU RETURN PIPE ASSEMBLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE: .XXX +/-.005, .XX +/-.015, FRACT. +/-1/64", ANGLES +/-45°
DO NOT SCALE FROM THIS DRAWING

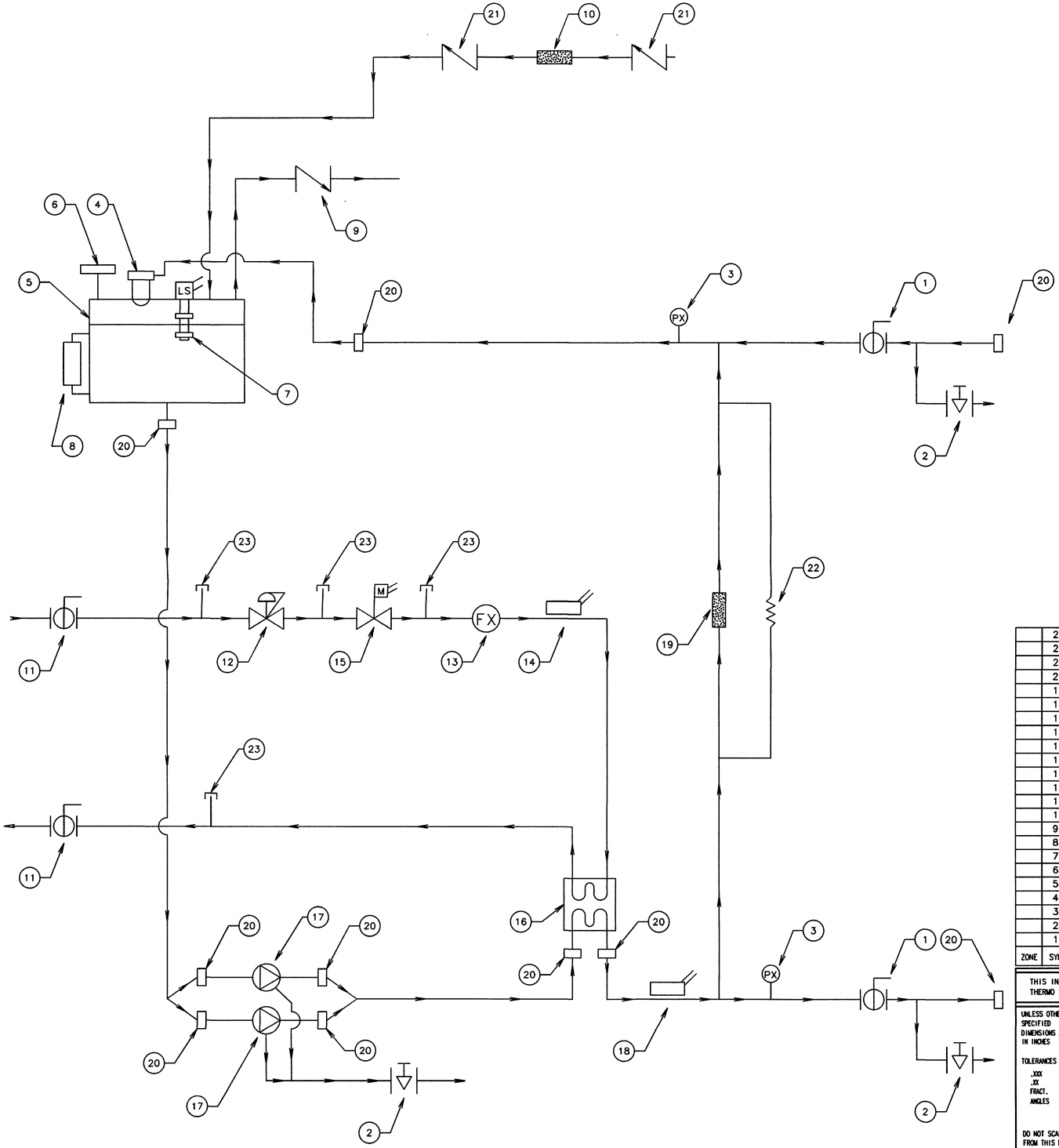
DFTR: JOLIN DATE: MAR-04-2005
CHKR: DATE: 3-07-05
DSNR: ENOS DATE: FEB-16-2005
APPD: DATE: 3-19-05

MATL: AS LISTED
REF.DWG:

Thermo Control Technologies
Electron Corporation | 25 NIMBLE HILL RD. • NEWINGTON, NH 03801

TITLE: JAGUAR -30 FRU EXPLODED VIEWS CHINA UNIT

SIZE: B | PROJECT: Chiller_Cust-TeradyneJ | DWG NO: 093599 | REV: -
SCALE: = 1 | SHT: 3 OF 3



REVISIONS							
ZONE	REV	DESCRIPTION	DATE	DFTR	CHKR	DSNR	APPD

ZONE	SYM	QTY	NOMENCLATURE	PART NO.	SPECIFICATION/VENDOR
	23	4	PRESSURE PORTS	------	
	22	1	BYPASS TUBE	------	3/16" OD, 12" LONG
	21	2	CHECK VALVE, 1/8"	------	DUCKBILL TYPE
	20	10	SANITARY FLANGE	------	
	19	1	DRYER	------	
	18	1	RTD, PROCESS	------	
	17	2	PUMP	------	
	16	1	HEAT EXCHANGER	------	
	15	1	MOTOR VALVE, TEMP CONTROL	------	
	14	1	RTD, FACILITY	------	
	13	1	FLOW TRANSDUCER	------	
	12	1	PRESSURE REGULATOR VALVE	------	
	11	2	BALL VALVE, FACILITY WATER	------	
	10	1	DRYER	------	
	9	1	CHECK VALVE, RELIEF	------	1/2 PSI
	8	1	INDICATOR TUBE, LEVEL	------	
	7	1	LEVEL SWITCH	------	2 POSITION
	6	1	AUXILIARY ACCESS PORT	------	
	5	1	TANK, RESERVOIR	------	
	4	1	FILTER	------	
	3	2	PRESSURE TRANSDUCER	------	
	2	3	DRAIN VALVE, W/ CAP	------	
	1	2	BALL VALVE, ISOLATION	------	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ARE:
.XXX +/-.005
.XX +/-.015
FRACT. +/-1/64"
ANGLES +/-45'

DO NOT SCALE FROM THIS DRAWING

DRAFTER: BRIAN MCKENZIE — DATE: MAR-18-2004
CHECKER: John — DATE: MAR-19-2004
DESIGNER: NATE WANG — DATE: MAR-16-2004
APPROVED: — DATE: MAR-19-2004
MATERIAL: AS LISTED

REF. DRAWING: F01026

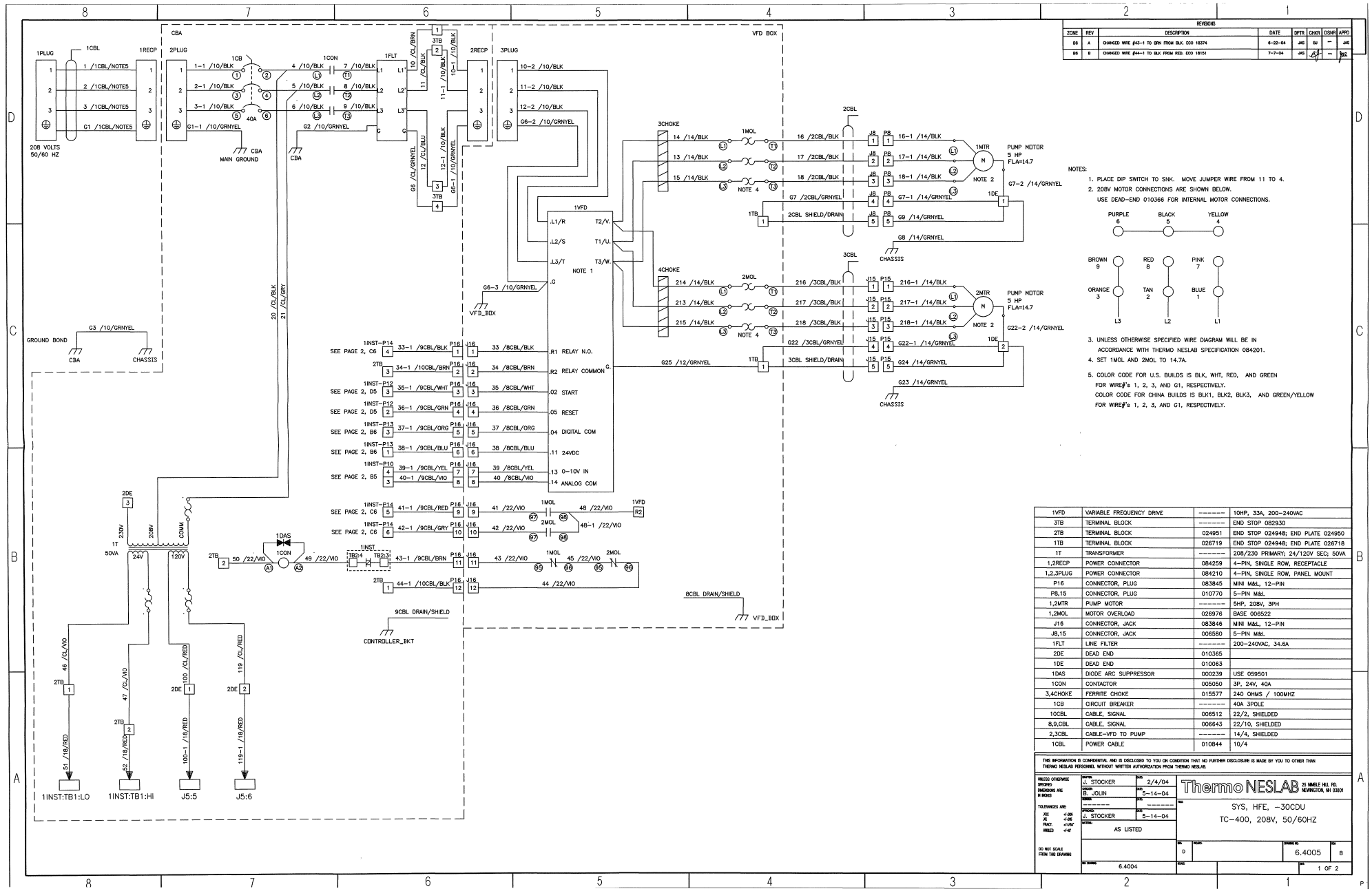
Thermo Electron Corporation | Control Technologies Division
25 NIMBLE HILL RD. • NEWINGTON, NH 03801

TITLE:
FLOW DIAGRAM
PUMP SYSTEM
-30CDU

SIZE: C | PROJECT: DRAWINGS | DRAWING NO: F01030 | REV: -

SCALE: NA | SHT: 1 OF 1

F01030



ZONE	REV	DESCRIPTION	DATE	DFTR	CHKR	DSNR	APPD
B6	A	CHANGED WIRE #43-1 TO BRN FROM BLK. ECO 18374	6-22-04	JAS	BJ	--	JAS
B6	B	CHANGED WIRE #44-1 TO BLK FROM RED. ECO 18151	7-7-04	JAS	JAS	--	JAS

NOTES:

1. PLACE DIP SWITCH TO SNK. MOVE JUMPER WIRE FROM 11 TO 4.
2. 208V MOTOR CONNECTIONS ARE SHOWN BELOW.
   USE DEAD-END 010366 FOR INTERNAL MOTOR CONNECTIONS.

3. UNLESS OTHERWISE SPECIFIED WIRE DIAGRAM WILL BE IN ACCORDANCE WITH THERMO NESLAB SPECIFICATION 084201.
4. SET 1MOL AND 2MOL TO 14.7A.
5. COLOR CODE FOR U.S. BUILDS IS BLK, WHT, RED, AND GREEN FOR WIRE#'s 1, 2, 3, AND G1, RESPECTIVELY.
   COLOR CODE FOR CHINA BUILDS IS BLK1, BLK2, BLK3, AND GREEN/YELLOW FOR WIRE#'s 1, 2, 3, AND G1, RESPECTIVELY.

1VFD	VARIABLE FREQUENCY DRIVE	-------	10HP, 33A, 200-240VAC
3TB	TERMINAL BLOCK	-------	END STOP 082930
2TB	TERMINAL BLOCK	024951	END STOP 024948; END PLATE 024950
1TB	TERMINAL BLOCK	026719	END STOP 024948; END PLATE 026718
1T	TRANSFORMER	-------	208/230 PRIMARY; 24/120V SEC; 50VA
1,2RECP	POWER CONNECTOR	084259	4-PIN, SINGLE ROW, RECEPTACLE
1,2,3PLUG	POWER CONNECTOR	084210	4-PIN, SINGLE ROW, PANEL MOUNT
P16	CONNECTOR, PLUG	083845	MINI M&L, 12-PIN
P8,15	CONNECTOR, PLUG	010770	5-PIN M&L
1,2MTR	PUMP MOTOR	-------	5HP, 208V, 3PH
1,2MOL	MOTOR OVERLOAD	026976	BASE 006522
J16	CONNECTOR, JACK	083846	MINI M&L, 12-PIN
J8,15	CONNECTOR, JACK	006580	5-PIN M&L
1FLT	LINE FILTER	-------	200-240VAC, 34.6A
2DE	DEAD END	010365	
1DE	DEAD END	010063	
1DAS	DIODE ARC SUPPRESSOR	000239	USE 059501
1CON	CONTACTOR	005050	3P, 24V, 40A
3,4CHOKE	FERRITE CHOKE	015577	240 OHMS / 100MHZ
1CB	CIRCUIT BREAKER	-------	40A 3POLE
10CBL	CABLE, SIGNAL	006512	22/2, SHIELDED
8,9,CBL	CABLE, SIGNAL	006643	22/10, SHIELDED
2,3CBL	CABLE-VFD TO PUMP	-------	14/4, SHIELDED
1CBL	POWER CABLE	010844	10/4

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ARE: XXX +/-.005, XX +/-.015, FRACT. +1/64", ANGLES +/-.5°

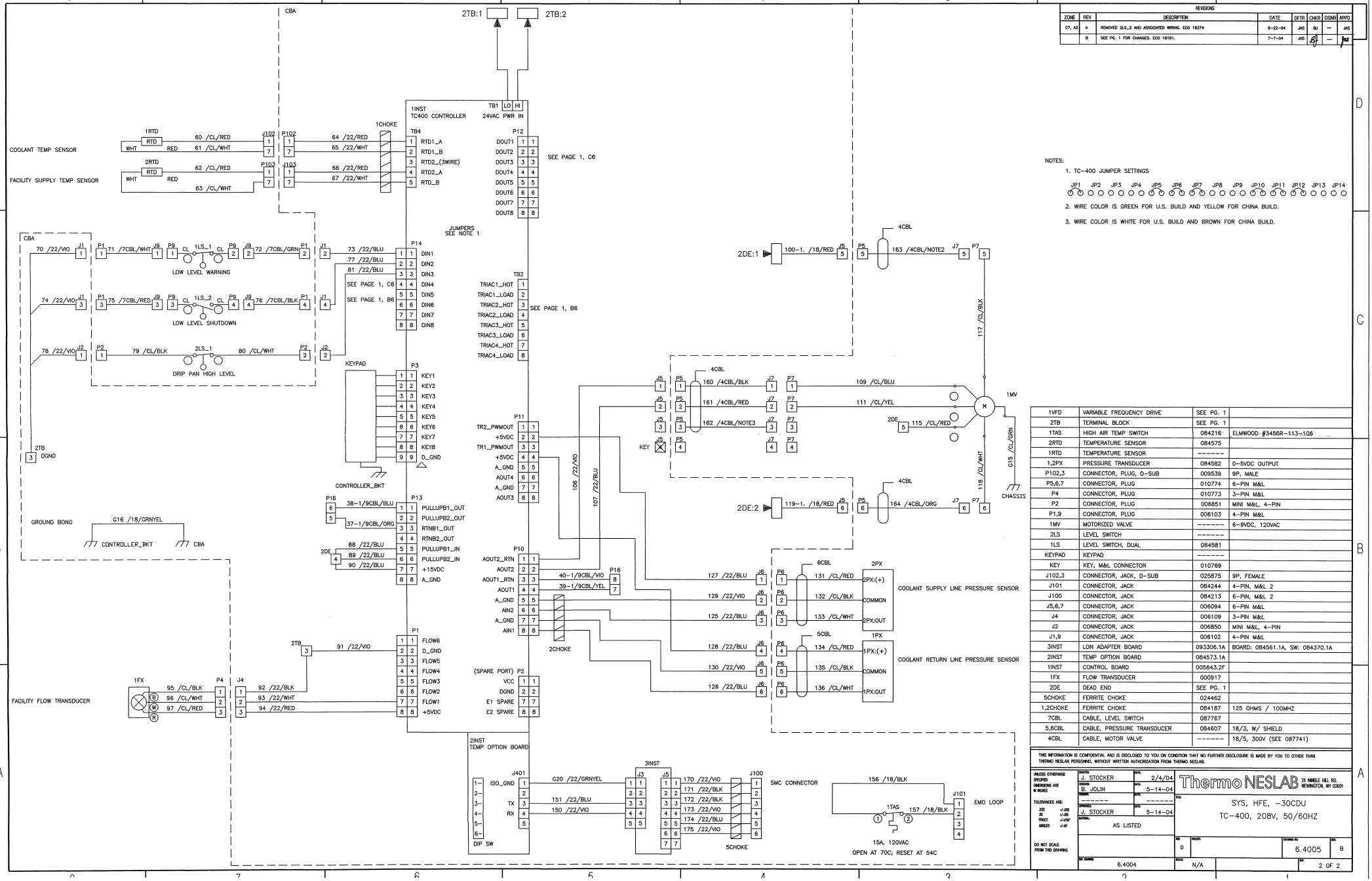
DO NOT SCALE FROM THIS DRAWING

DRAWN: J. STOCKER 2/4/04
ENGR: B. JOLIN 5-14-04
CHKR: ---------- ----------
APPROVED: J. STOCKER 5-14-04
MATERIAL: AS LISTED
DR. DRAWING: 6.4004

Thermo NESLAB 25 NIMBLE HILL RD. NEWINGTON, NH 03801

SYS, HFE, -30CDU
TC-400, 208V, 50/60HZ

SIZE: D
DRAWING NO.: 6.4005
REV: B
SCALE:
SHT: 1 OF 2



REVISIONS						
ZONE	REV	DESCRIPTION	DATE	DFTR	CHKR	DSNR	APPD
C7, A3	A	REMOVED 2LS_2 AND ASSOCIATED WIRING. ECO 18374	6-22-04	JAS	BJ	—	JAS
	B	SEE PG. 1 FOR CHANGES. ECO 18151.	7-7-04	JAS	BJ	—	JAS

NOTES:

1. TC-400 JUMPER SETTINGS

2. WIRE COLOR IS GREEN FOR U.S. BUILD AND YELLOW FOR CHINA BUILD.

3. WIRE COLOR IS WHITE FOR U.S. BUILD AND BROWN FOR CHINA BUILD.

1VFD	VARIABLE FREQUENCY DRIVE	SEE PG. 1	
2TB	TERMINAL BLOCK	SEE PG. 1	
1TAS	HIGH AIR TEMP SWITCH	084216	ELMWOOD #3455R-113-106
2RTD	TEMPERATURE SENSOR	084575	
1RTD	TEMPERATURE SENSOR	-------	
1,2PX	PRESSURE TRANSDUCER	084582	0-5VDC OUTPUT
P102,3	CONNECTOR, PLUG, D-SUB	009539	9P, MALE
P5,6,7	CONNECTOR, PLUG	010774	6-PIN M&L
P4	CONNECTOR, PLUG	010773	3-PIN M&L
P2	CONNECTOR, PLUG	006851	MINI M&L, 4-PIN
P1,9	CONNECTOR, PLUG	006103	4-PIN M&L
1MV	MOTORIZED VALVE	-------	6-9VDC, 120VAC
2LS	LEVEL SWITCH	-------	
1LS	LEVEL SWITCH, DUAL	084581	
KEYPAD	KEYPAD	-------	
KEY	KEY, M&L CONNECTOR	010769	
J102,3	CONNECTOR, JACK, D-SUB	025875	9P, FEMALE
J101	CONNECTOR, JACK	084244	4-PIN, M&L 2
J100	CONNECTOR, JACK	084213	6-PIN, M&L 2
J5,6,7	CONNECTOR, JACK	006094	6-PIN M&L
J4	CONNECTOR, JACK	006109	3-PIN M&L
J2	CONNECTOR, JACK	006850	MINI M&L, 4-PIN
J1,9	CONNECTOR, JACK	006102	4-PIN M&L
3INST	LON ADAPTER BOARD	093306.1A	BOARD: 084561.1A, SW: 084370.1A
2INST	TEMP OPTION BOARD	084573.1A	
1INST	CONTROL BOARD	005843.2F	
1FX	FLOW TRANSDUCER	000917	
2DE	DEAD END	SEE PG. 1	
5CHOKE	FERRITE CHOKE	024462	
1,2CHOKE	FERRITE CHOKE	084187	125 OHMS / 100MHZ
7CBL	CABLE, LEVEL SWITCH	087767	
5,6CBL	CABLE, PRESSURE TRANSDUCER	084607	18/3, W/ SHIELD
4CBL	CABLE, MOTOR VALVE	-------	18/5, 300V (SEE 087741)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ARE: XXX ±.005, XX ±.05, FRACT. ±1/64, ANGLES ±1°

DO NOT SCALE FROM THIS DRAWING

DRAWN: J. STOCKER 2/4/04
CHECKED: B. JOLIN 5-14-04
ENGR: ------- DATE: -------
APPROVED: J. STOCKER 5-14-04
MATERIAL: AS LISTED

ThermoNESLAB 25 NIMBLE HILL RD. NEWINGTON, NH 03801

TITLE: SYS, HFE, -30CDU
TC-400, 208V, 50/60HZ

SIZE: D | DRAWING NO.: 6.4005 | REV: B
NEXT ASSY: 6.4004 | SCALE: N/A | SHT: 2 OF 2

WARRANTY

Thermo Electron Corporation warrants for 24 months from date of shipment any Thermo Electron unit according to the following terms.

Any part of the CDU manufactured or supplied by Thermo Electron and found in the reasonable judgment of Thermo Electron to be defective in material or workmanship will be repaired at an authorized Thermo Electron Repair Depot without charge for parts or labor. The CDU, including any defective part must be returned to an authorized Thermo Electron Repair Depot within the warranty period. The expense of returning the CDU to the authorized Thermo Electron Repair Depot for warranty service will be paid for by the buyer. Thermo Electron's responsibility in respect to warranty claims is limited to performing the required repairs or replacements, and no claim of breach of warranty shall be cause for cancellation or recision of the contract of sales of any CDU. With respect to CDUs that qualify for field service repairs, Thermo Electron's responsibility is limited to the component parts necessary for the repair and the labor that is required on site to perform the repair. Any travel labor or mileage charges are the financial responsibility of the buyer.

The buyer shall be responsible for any evaluation or warranty service call (including labor charges) if no defects are found with the Thermo Electron product.

This warranty does not cover any CDU that has been subject to misuse, neglect, or accident. This warranty does not apply to any damage to the CDU that is the result of improper installation or maintenance, or to any CDU that has been operated or maintained in any way contrary to the operating or maintenance instructions specified in Thermo Electron's Instruction and Operation Manual. This warranty does not cover any CDU that has been altered or modified so as to change its intended use.

In addition, this warranty does not extend to repairs made by the use of parts, accessories, or fluids which are either incompatible with the CDU or adversely affect its operation, performance, or durability.

Thermo Electron reserves the right to change or improve the design of any CDU without assuming any obligation to modify any CDU previously manufactured.

THE FOREGOING EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Thermo Electron's OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE COMPONENT PARTS AND Thermo Electron DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR IT ANY OTHER OBLIGATION.

Thermo Electron ASSUMES NO RESPONSIBILITY FOR INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO LOSS OR DAMAGE TO PROPERTY, LOSS OF PROFITS OR REVENUE, LOSS OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE.

This warranty applies to CDUs sold in the United States. Any CDUs sold elsewhere are warranted by the affiliated marketing company of Thermo Electron. This warranty and all matters arising pursuant to it shall be governed by the law of the State of New Hampshire, United States. All legal actions brought in relation hereto shall be filed in the appropriate state or federal courts in New Hampshire, unless waived by Thermo Electron.