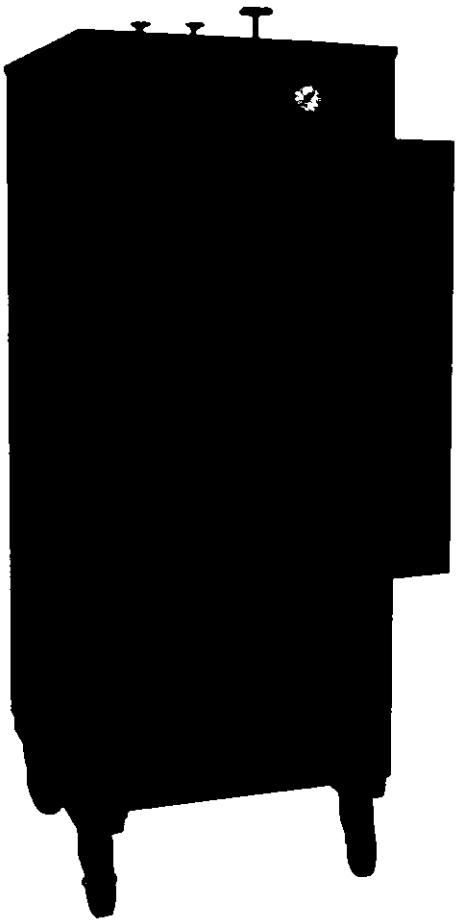
Application Engineering

OPERATION AND INSTALLATION MANUAL

$30.00

TrueTemp Series
TDH Hot Oil
Temperature Control Unit



IMPORTANT: PLEASE READ CAREFULLY BEFORE ATTEMPTING TO INSTALL OR OPERATE EQUIPMENT

AEC, Inc. is committed to a continuous program of product improvement.
Specifications are subject to change without notice.

Effective 1/12/95 Part Number A0549009 Revision 1

Safety Considerations

AEC, Inc. TrueTemp™ TDH Series hot oil temperature control units are designed to provide safe and reliable operation when installed and operated within design specifications and national and local safety codes.

To avoid possible personnel injury or equipment damage when installing, operating, or maintaining this equipment, always use good judgment and follow these safe practices:

- Only **PROPERLY TRAINED** personnel familiar with the information within this manual should work on this equipment.
- Follow all local **SAFETY CODES**.
- TDH cabinets and piping are hot and are a **BURN HAZARD**.
- Do not operate a TDH unit without all outer panels installed. Pressurized hot fluid leaks can cause serious injury.
- Wear **SAFETY GLASSES** and **WORK GLOVES**.
- Use care when **LOADING, UNLOADING, RIGGING,** or **MOVING** this equipment.
- Operate this equipment within design specifications.
- **OPEN, TAG, AND LOCK ALL DISCONNECTS** before working on equipment. AEC, Inc. recommends removing the fuses and carrying them with you.
- Make sure the unit is properly **GROUNDED** before switching on power.
- Do not jump or bypass any electrical safety control.
- Do not restore power until all tools, test equipment, etc. have been removed and panels have been replaced.

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1 General Information

1-1 Introduction

AEC/Application Engineering TDH Series hot oil temperature control units are reliable, accurate, and easy-to-use process temperature control units. They are self-contained, portable, and shipped ready to use.

A properly installed, operated, and maintained TDH will provide years of reliable operation. Please read and follow the instructions in this manual to get the most satisfaction from your unit. The TDH unit is designed to circulate heat transfer fluid through a process and precisely, automatically, and reliably maintain it at a specified temperature. Standard operating ranges run from 100°F (38°F) up to 400°F (204°C) on TDH4 models, up to 550°F (288°C) on TDH5 models, and optionally, up to 650°F (343°C). The unit is suited for use with a selection of commercially available heat transfer fluids. AEC, Inc. recommends TrueTherm™ heat transfer fluid for best results.

Rapid recirculation of the relatively small amount of fluid provides close and uniform temperature relation between **DELIVERY** and **RETURN** lines. This operation does, of course, depend on the configuration of your process and any restrictions within your process. This recirculation, combined with the immersion heater and optional cooling capability, can give fast and accurate response to bring the heat transfer fluid up to temperature or changes in the settings when needed.

1-2 Models Covered

This manual lists operation, installation, and maintenance instructions for the TDH Series hot oil temperature control unit.

Model numbers are listed on the serial tag. A model number followed by **-Q** indicates a specially constructed unit, and not all information in this manual may apply. Please know the model number, serial number, and operating voltage of your temperature control unit if you contact AEC, Inc.

1-3 TDH Specifications

The following tables list unit specifications for TDH4 and TDH5 models.

TDH4 Specifications

Heater	Flow/ Pressure	Pump	Amp Draw	Process Connection	Dimensions inches			Shipping Weight
kW	gpm/psi	hp	460/3/60	inches	W	D	H	pounds
6	18/30	1	9	1	24"	34"	62"	671
	18/50	1½	10					
	24/30	2	10					
	24/50	2	10					
12	18/30	1	17	1	24"	34"	62"	671
	18/50	1½	18					
	24/30	2	18					
	24/50	2	18					

TDH5 Specifications

Heater	Flow/ Pressure	Pump	Amp Draw	Process Connection	Dimensions inches			Shipping Weight
kW	gpm/psi	hp	460/3/60	inches	W	D	H	pounds
12	18/30	1	17	1	24"	34"	62"	671
	18/50	1½	18	1				671
	24/30	2	18	1				671
	24/50	2	18	1				671
	50/30	3	20	1½				746
	50/50	3	20	1½				746
18	18/30	1	24	1	24"	34"	62"	671
	18/50	1½	25	1				671
	24/30	2	25	1				671
	24/50	2	25	1				671
	50/30	3	27	1½				746
	50/50	3	27	1½				746
24	18/30	1	31	1	24"	34"	62"	679
	18/50	1½	32	1				679
	24/30	2	32	1				679
	24/50	2	32	1				679
	50/30	3	34	1½				754
	50/50	3	34	1½				754

TDH5 Specifications Cont'd.

Heater	Flow/Pressure	Pump	Amp Draw	Process Connection	Dimensions Inches			Shipping Weight
kW	gpm/psi	hp	460/3/60	inches	W	D	H	pounds
30	18/30	1	38	1	24"	44"	62"	910
	18/50	1½	39	1				910
	24/30	2	39	1				910
	24/50	2	39	1				910
	50/30	3	41	1½				985
	50/50	3	41	1½				985
36	18/30	1	45	1	24"	44"	62"	910
	18/50	1½	46	1				910
	24/30	2	46	1				910
	24/50	2	46	1				910
	50/30	3	48	1½				985
	50/50	3	48	1½				985
42	18/30	1	53	1	24"	44"	62"	918
	18/50	1½	54	1				918
	24/30	2	54	1				918
	24/50	2	54	1				918
	50/30	3	56	1½				993
	50/50	3	56	1½				993
48	18/30	1	60	1	24"	44"	62"	918
	18/50	1½	61	1				918
	24/30	2	61	1				918
	24/50	2	61	1				918
	50/30	3	63	1½				993
	50/50	3	63	1½				993

1-4 Necessary Documents

The following documents are necessary for the operation, installation, and maintenance of AEC/Application Engineering TDH Series hot oil temperature control units. Additional copies can be purchased from AEC, Inc. Familiarize the appropriate personnel with these documents:

☑ This manual.

☑ The electrical schematic and connection diagram mounted inside the control enclosure.

☑ The operation and installation manuals for accessories and options selected by the customer.

☑ The Customer Parts List included in this manual.

1-5 Standard Features

- One-person startup operation
- Sides and back lift off for easy access without tools
- Shrouded fluid level sight gauge up front
- Fork lift rails on base
- Y-type filter/strainer in **RETURN** piping
- Fluid **FILL** and **VENT** outlets on top of the unit
- Most piping connections can be made at the rear of the unit

Heaters

- Three-phase immersion heater design
- Low watt-density steel sheath
- Patented two-pass heater tube design (TDH5 only); maintains an optimum balance of fluid velocity versus watt density with maximum turbulence for excellent heat transfer and minimal pressure drop
- 6 kW, 12 kW, 18 kW, 24 kW, 30 kW, 36 kW, 42 kW, and 48 kW units available
- Single heater design for units up to 24 kW, dual heaters in series for units up to 48 kW

Pump

- Suited for use with a selection of AEC-recommended commercially-available heat transfer fluids; AEC, Inc. recommends AEC TrueTherm™ heat transfer fluid for best results
- Only two internal moving parts
- Specially designed seal gives years of trouble-free service, even at high temperatures
- Only routine maintenance required is periodic greasing
- Positive displacement mechanical seal gear pump
- 18, 24, and 50 gpm flow
- 30 or 50 psi pressure to process available
- 1, 1½, 2 hp (HL), and 3 hp (KK) pumps available
- Pump reverse feature lets you return fluid to the reservoir from the mold and process lines
- A bypass valve regulates discharge pressure

Ful-Flo Valve Bypass

- Prevents excessive pressure if the **DELIVERY** line is obstructed; if an obstruction occurs, the Ful-Flo valve bypass opens to divert fluid to the **RETURN** line

- Maintains a constant flow of fluid through the heater tank to prevent damage to the heating elements and fluid
- Factory pre-set to maintain the system pressure specified by the customer — **must not be tampered with in any way**

Pressure Switch

- Built into each unit
- Guards against heater damage
- Prevents the heater elements from being energized unless the pump is running and fluid is in the system
- Factory set; no field adjustments needed — **must not be tampered with**

Safety Thermostat

- Protects against thermal runaway
- Shuts down the heater outputs, sounds the audible alarm, and lights the alarm indicator if an over temperature condition exists
- Pump continues to run, pumping fluid through the system to prevent heater damage
- Automatic reset design resets the thermostat as the unit cools
- All heater controller functions lock out until you reset main power

Note: Always have a qualified maintenance technician determine and correct the cause of an over temperature fault before you resume operation

Electrical Components

- NEMA 1 standard electrical enclosure
- IEC motor starters
- Full unit fusing — pump motor, heater, primary side transformer
- High temperature heater cutout
- High temperature audible and visual alarm, activated by the safety thermostat
- Pressure switch shuts down heater for low pressure
- Mercury heater contactors
- Pump motor and immersion heater operate on three-phase, 50/60 cycle nominal voltage with control circuit at 115V single phase
- Single phase machine tool transformer with primary fuse protection and grounded secondary supplies control circuit voltage
- Electrical panel complies with NEC provisions

- Branch fused heater elements
- Full voltage magnetic reversing starter with fused branch circuit over current and thermal overload protection controls the pump motor

Benefits

- High fluid velocity for longer fluid/heater life and high heat transfer efficiency
- Selection of heat transfer fluids; AEC, Inc. recommends AEC TrueTherm™ heat transfer fluid for best results
- One-person startup operation
- Minimal fittings and leak points
- No tools required to gain access to TDH unit components — access panels lift off easily
- Pre-piped heat transfer fluid circuit using standard NPT pipe
- Open-vented 17 gallon reservoir tank
- Easily serviced, vertically suspended, low watt density flanged heaters
- Shrouded fluid level sight glass on front of unit
- Pressure relief valve
- Two swivel and two fixed casters
- **DELIVERY** pressure gauge
- Two-pass heater tank for increased fluid velocity and longer fluid and heater life (TDH5)
- Closed circuit cooling with U-tube heat exchanger with removable tube bundle (TDH5)
- Drop-in type interchangeable heat exchangers — 3.9/6.7 and 13.0/21.0 sq. ft. (TDH5)
- Tube bundle easily removed from top (TDH5)
- Check valve on **DRAIN** prevents backflow
- Factory tested prior to shipment
- Cooling options available

Microprocessor Controller

- Digital display of set point and process temperatures
- Microprocessor PID controller with auto tune and three year warranty on the plug-in control module
- Fahrenheit or Celsius operation

Indicator Lights

- Pump Forward and Reverse

- Heater On
- Cooling Valve On — for units with heat exchangers
- Auto Heat/Cool
- Manual Cool

Alarm lights

- Low Oil Level (optional)
- Low Oil Pressure
- Over Temperature

Audible Alarm

- Alerts operator to over temperature condition
- Alerts operator to low fluid pressure

Reservoir Tank

- 17 gallon usable capacity
- Sight glass
- Drain extends beyond TDH base for ease of draining

Function Switches

- Control Power On/Off
- Pump Start Forward/Reverse
- Control Mode Auto/Manual
- Alarm Silence

1-6 Available Options

Cooling

- Durable shell and tube heat exchanger, featuring U-tube construction
- Copper-nickel tubes provide optimal heat transfer
- Modular construction on TDH5 unit allows the tube bundle to be easily removed for periodic cleaning
- Check valves on the Cooling **WATER SUPPLY** and Cooling **WATER DRAIN** lines prevent backflow into the heat exchanger from a closed drain or into the water supply piping

- Controller automatically regulates cooling by opening and closing the cooling solenoid
- Water supply line rating between 25 psi and 75 psi required for connection to the heat exchanger

Other Options

- Hour meter
- Remote-mount controls
- NEMA 12 enclosure
- Reservoir tank low level light
- Non-fused disconnect switch
- Heat exchanger for TDH5 (3.9/6.7) (13.0/21.0)
- Heat exchanger for TDH4 (1.5 and 3.7)
- External communications (SPI, RS-232C, RS-422, and RS-485)

1-7 Uncrating

Carefully uncrate the unit and remove it from the shipping pallet. Keep in mind that **the unit is heavy**; take care to avoid tipping and losing control of the unit. You can uncrate the unit without removing the shipping plates.

Caution!

If you remove shipping plates, you must reinstall the bolts to secure the casters.

Inspect the unit for damage before accepting delivery. Retain the crate, pallet, and packing material if you discover any damage. If you **do** discover damage:

1. Notify the local agent of the transportation company if you discover any damage to the TDH unit.
2. Hold the damaged goods **with the crate and packing** for the inspection of the examining agent. Do not return any goods to AEC, Inc. prior to the inspection and authorization of the transportation company.
3. File a claim against the transportation company. Substantiate the claim by referring to the agent's report. A certified copy of our invoice is available upon request. The original Bill of Lading is attached to our original invoice. If the shipment was prepaid, write us for a receipted transportation bill.
4. Advise AEC, Inc. of the situation and any assistance needed.

2 Installation

2-1 Location Considerations

- Place the TDH unit as close as possible to the process for proper circulation and fluid temperature control.
- The area surrounding the unit must be free of obstructions to ensure proper ventilation of internal components and ease of servicing. **Allow a minimum clearance of at least 30 inches.**
- Never operate the unit in confined spaces. Air circulation is generally satisfactory for units operated at lower (up to 500°F) temperatures. AEC, Inc. recommends special local ventilation at higher temperatures for points where vapors can be expected to escape from the unit (reservoir tank vent, etc.).

Temperature Ranges	Minimum Temperature	Maximum Temperature
Ambient operation	-4°F (-20°C)	120°F (48°C)
Ambient storage	-40°F(-40°C)	185°F (85°C)
Fluid operating range	100°F (38°C)	*TDH4:* 400°F (204°C) *TDH5:* 550°F (287°C)

! WARNING !

PROLONGED OR REPEATED EXPOSURE TO VAPORS GENERATED AT HIGH TEMPERATURE MAY RESULT IN EYE AND RESPIRATORY TRACT IRRITATION AND INHALATION OF HARMFUL AMOUNTS OF MATERIAL.

CONSULT THE MATERIAL SAFETY DATA SHEET (MSDS) FOR THE FLUID YOU ARE USING.

Note: Before storing your TDH unit, remove all residual water from the unit with compressed air to avoid a potential freezing hazard. See Section 6-3 on Page 46 for more information.

2-2 Piping Connections

You should properly size all external piping to insure minimal external pressure drop for best operation.

Note: **Always use a backup wrench** to support TDH unit piping when making piping connections. All external piping **must be supported independently** of the TDH unit.

AEC, Inc. recommends that you have strainers installed on the cooling water inlets.

For service and maintenance reasons, AEC, Inc. recommends that you have customer-supplied shut-off valves on all piping connections. Use common black welded pipe for permanent installations.

If you must use a pipe joint compound, use a compound that can withstand the high temperatures and pressures of your TDH unit. Always insulate all piping to prevent burn hazards and to retain heat. Make sure insulation is properly rated for maximum operating temperatures of your TDH unit.

Piping Considerations for Mobile Installations

Because your TDH unit is mobile, it is well suited for multiple applications. You can purchase high-quality hose from AEC/Application Engineering to enhance the mobility of your TDH unit. We stock many lengths of flexible metal hose to be used in connecting the unit to your process. State length when ordering.

Although they cause a drop in pressure, you can also install quick disconnects to your TDH unit.

☝ Do **not** install check valves with quick disconnects unless absolutely necessary!

Process Piping Connections

Caution!

- **Hoses, valves and other components in your process must be able to withstand TDH unit maximum temperatures and pressures.**
- **Maximum temperatures and pressures are listed on the unit nameplate.**
- **Carefully inspect all components before installation.**
- **If in doubt about component suitability, obtain factory components.**
- **Fix all leaks! Fluid can be a potential fire and slip hazard.**

Process Piping Connections	18 - 30 GPM	31 - 70 GPM	71 - 90 GPM
Process DELIVERY	1" NPT	1½" NPT	2" NPT
Process RETURN	1" NPT	1½" NPT	2" NPT
FILL and VENT	1" NPT	1" NPT	1" NPT

Cooling Water Connections

You must provide cooling water at 25 to 75 psi pressure for proper operation. Untreated water can foul or corrode the heat transfer surfaces, slowing water flow and causing fluid temperature control problems. AEC, Inc. sells a complete line of water treatment equipment that can reduce downtime and maintenance costs.

Run properly-sized cooling water lines—never smaller than the outlets on the TDH unit. If external piping is larger than TDH unit connections, reduce the size of the piping at the unit.

Cooling Piping Connections	3.9 - 6.7 Sq. Ft.	13 - 21 Sq. Ft.
Cooling WATER SUPPLY	¾" NPT	1" NPT
Cooling WATER DRAIN	¾" NPT	1" NPT

Vent Connections

You must leave the vent connection open to the atmosphere at all times. The vent connection is located on top of the reservoir. On systems with piping above the reservoir level, you **must** run vent piping to a minimum height of one foot (1') above the highest point in the system. Run the piping down into an auxiliary vented overflow chamber, such as a vented, *covered* 55-gallon drum. This practice ensures that overflow will not create a hazard to personnel.

Remember: All external piping must be supported independently of the TDH unit.

Caution!

The reservoir tank must be vented to prevent pressurization.
A pressurized reservoir could rupture, allowing hot fluid to escape.

Note: Heat transfer fluids expand when heated. Expansion rates vary, depending on fluid types and temperatures. For more information on expansion rates, refer to specification information for the heat transfer fluid you select.

Generally, most heat transfer fluids expand at the rate of 2.5% for every increase of 50°F/°C from temperatures above 60°F (16°C).

2-3 Electrical Connections

These units are designed for three-phase voltage operation. Refer to the unit nameplate for proper voltage and amperage requirements, and make sure your electrical service conforms.

Caution!

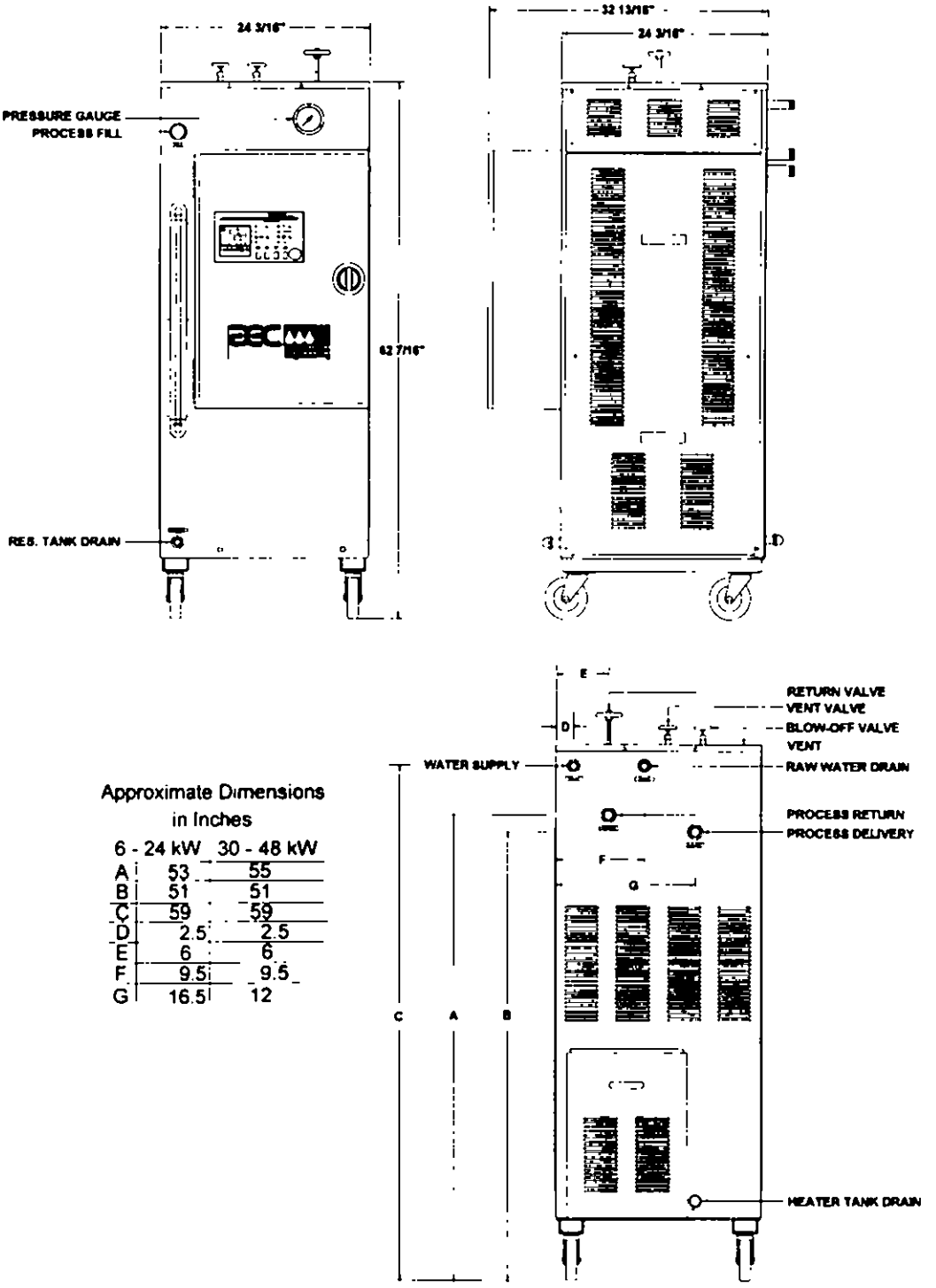
1. **Provide a correctly sized and protected power supply to the unit.**
2. **If an electrical supply disconnect is not installed as a factory option, the customer is responsible to properly size and install a suitable disconnect.**

   Refer to National Electric Code (NEC) 430-24-26 for proper feed conductor and supply disconnect sizing.
3. **Voltages must be within plus or minus ten percent (±10%) of the nameplate rating.**
4. **Maintain a safe ground and disconnect the power supply before servicing the unit.**

A qualified electrician should make electrical connections and disconnect the electricity when service calls are needed.

- Locate disconnnects in an **easily accessible location**. Operators should not have to squeeze around the TDH unit to reach disconnects, especially in case of emergency.
- When running conduit whips to the TDH unit, make sure that whips are routed away from hot piping.

Figure 1
TDH Dimensions



Approximate Dimensions
in Inches

	6 - 24 kW	30 - 48 kW
A	53	55
B	51	51
C	59	59
D	2.5	2.5
E	6	6
F	9.5	9.5
G	16.5	12

AEC, Inc. is dedicated to a continuing program of product improvement. Dimensions, appearances, and specifications are subject to change without notice.

Figure 2
Typical TDH Features

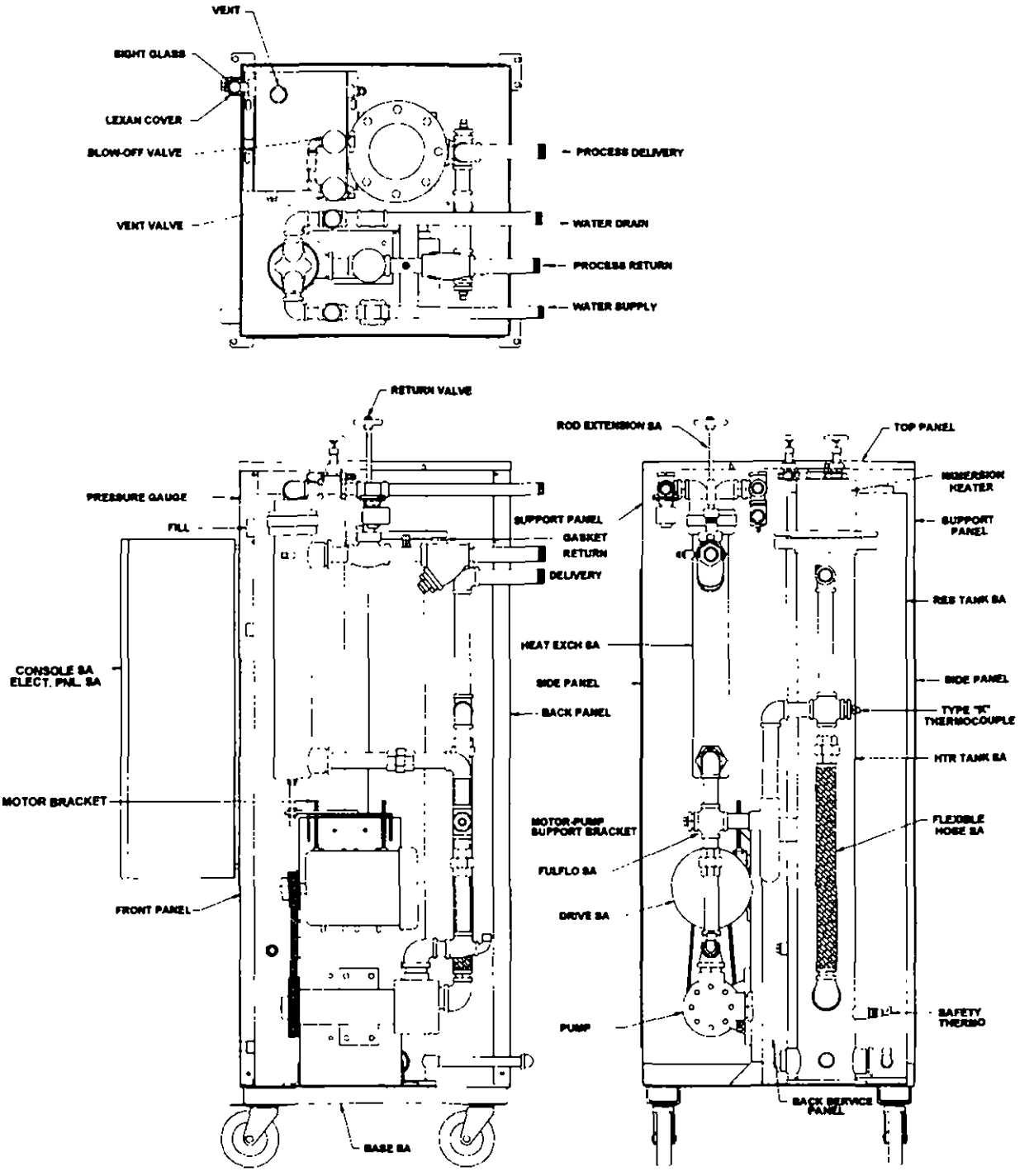
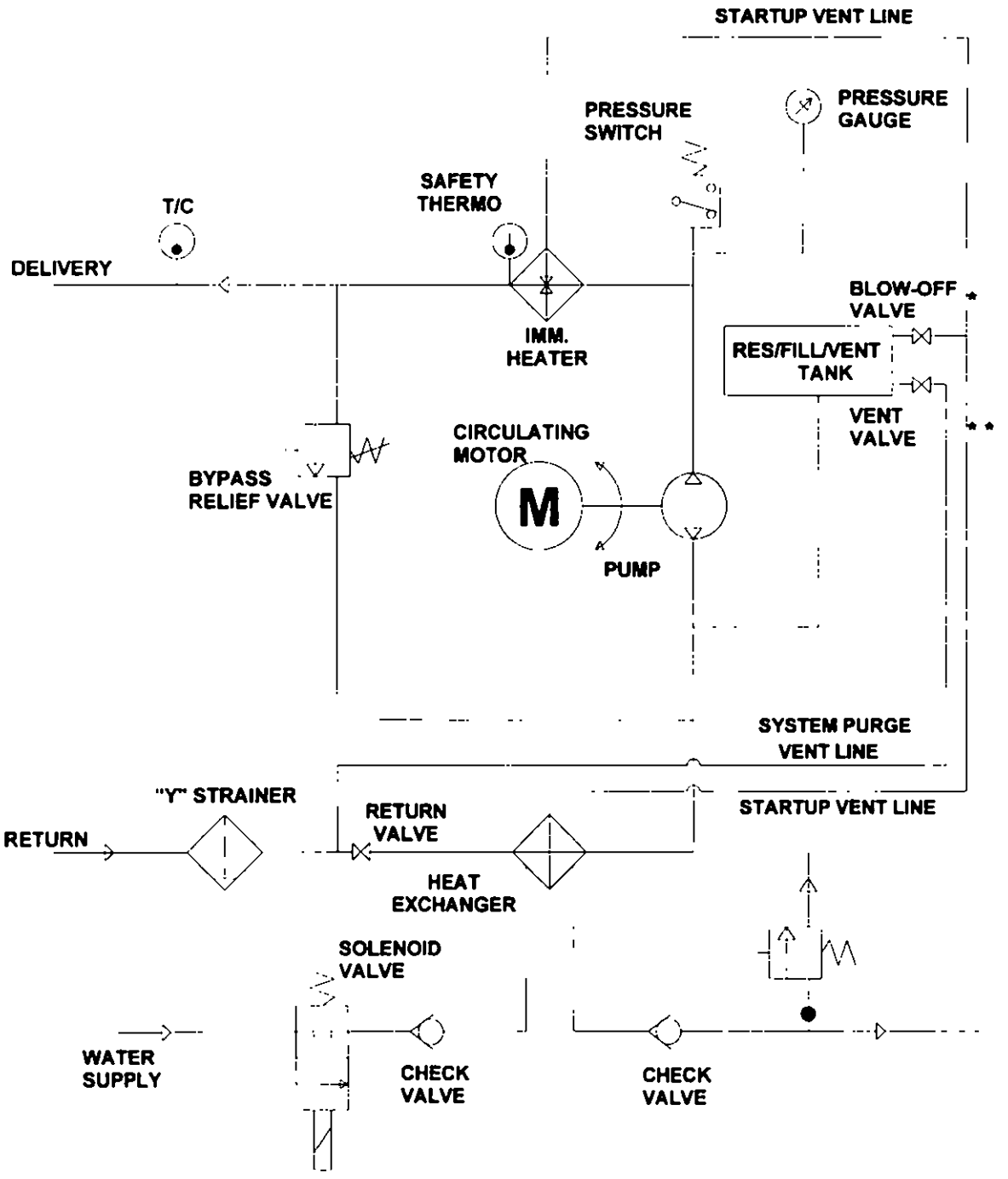


Figure 3
TDH Piping Diagram, Single Heater

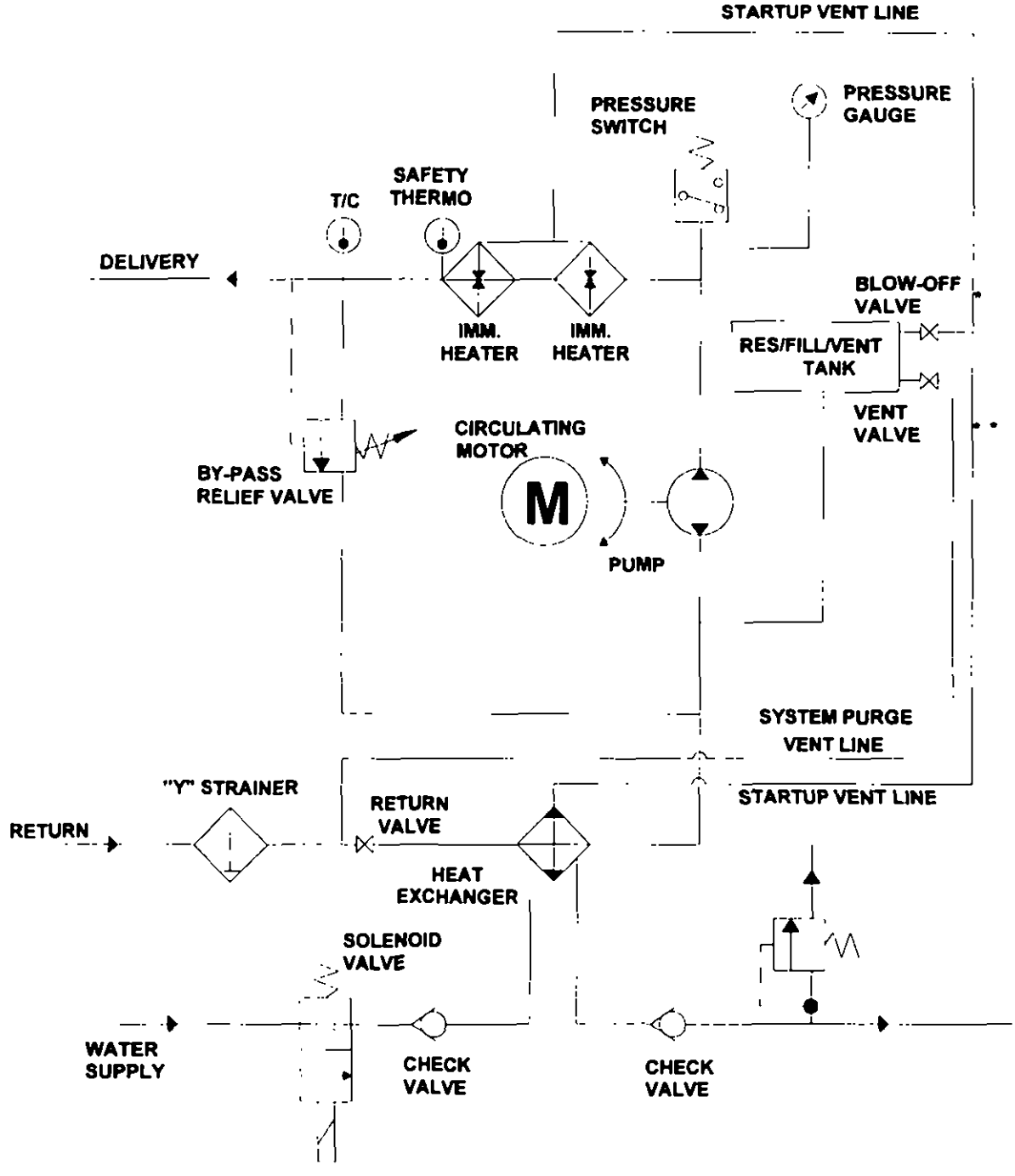


NOTE: HEAT EXCHANGER IS OPTIONAL

* OPEN FOR FILL/CLOSED FOR RUN/CLOSED FOR PUMP REVERSE

** CLOSED FOR FILL/CLOSED FOR RUN/OPEN FOR PUMP REVERSE

Figure 4
Typical TDH Piping Diagram, Dual Heaters



NOTE: HEAT EXCHANGER IS OPTIONAL

* OPEN FOR FILL/CLOSED FOR RUN/CLOSED FOR PUMP REVERSE

** CLOSED FOR FILL/CLOSED FOR RUN/OPEN FOR PUMP REVERSE

Figure 5
TDH Electrical Subpanel

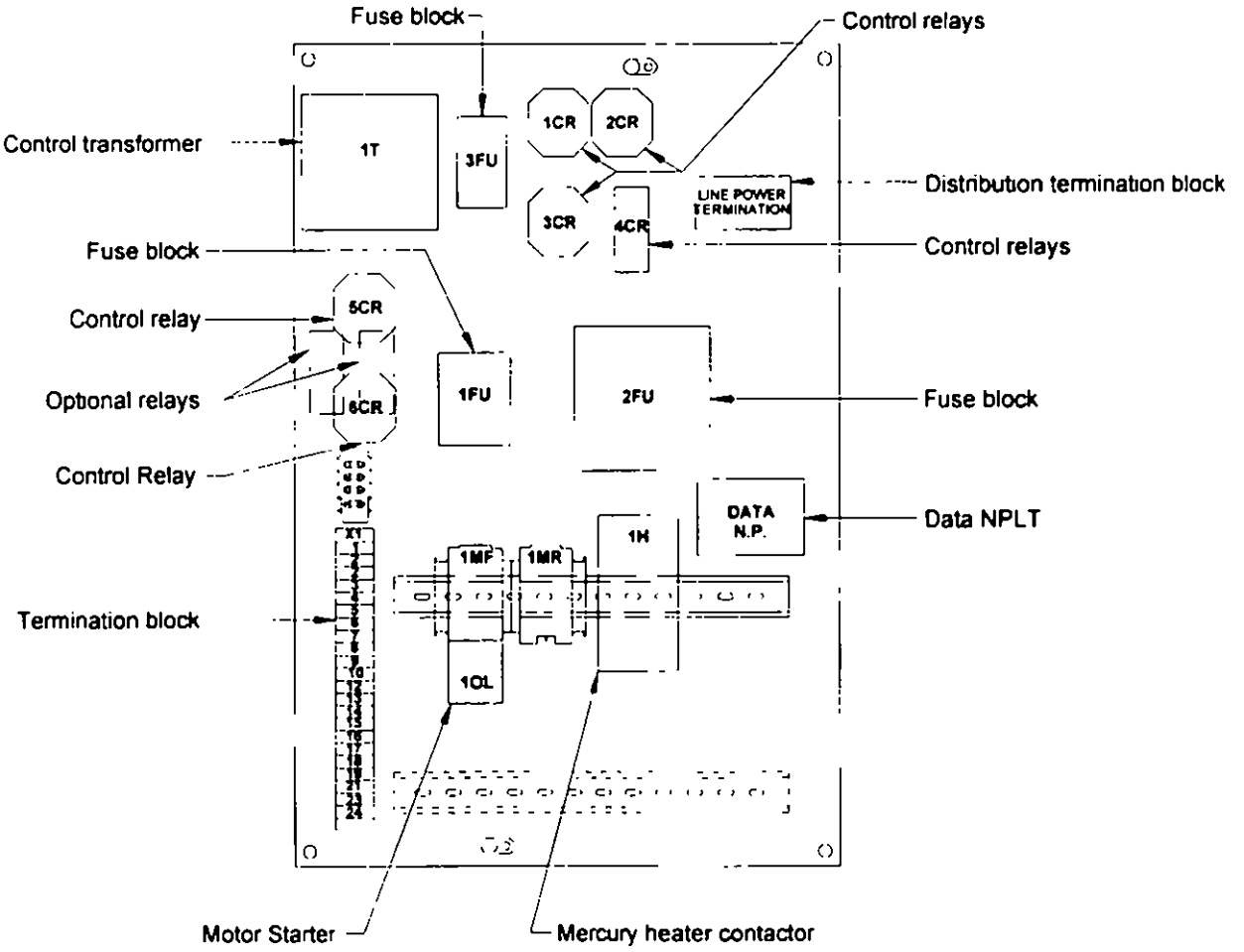


Figure 6
TDH Electrical Diagram, Drawing 1

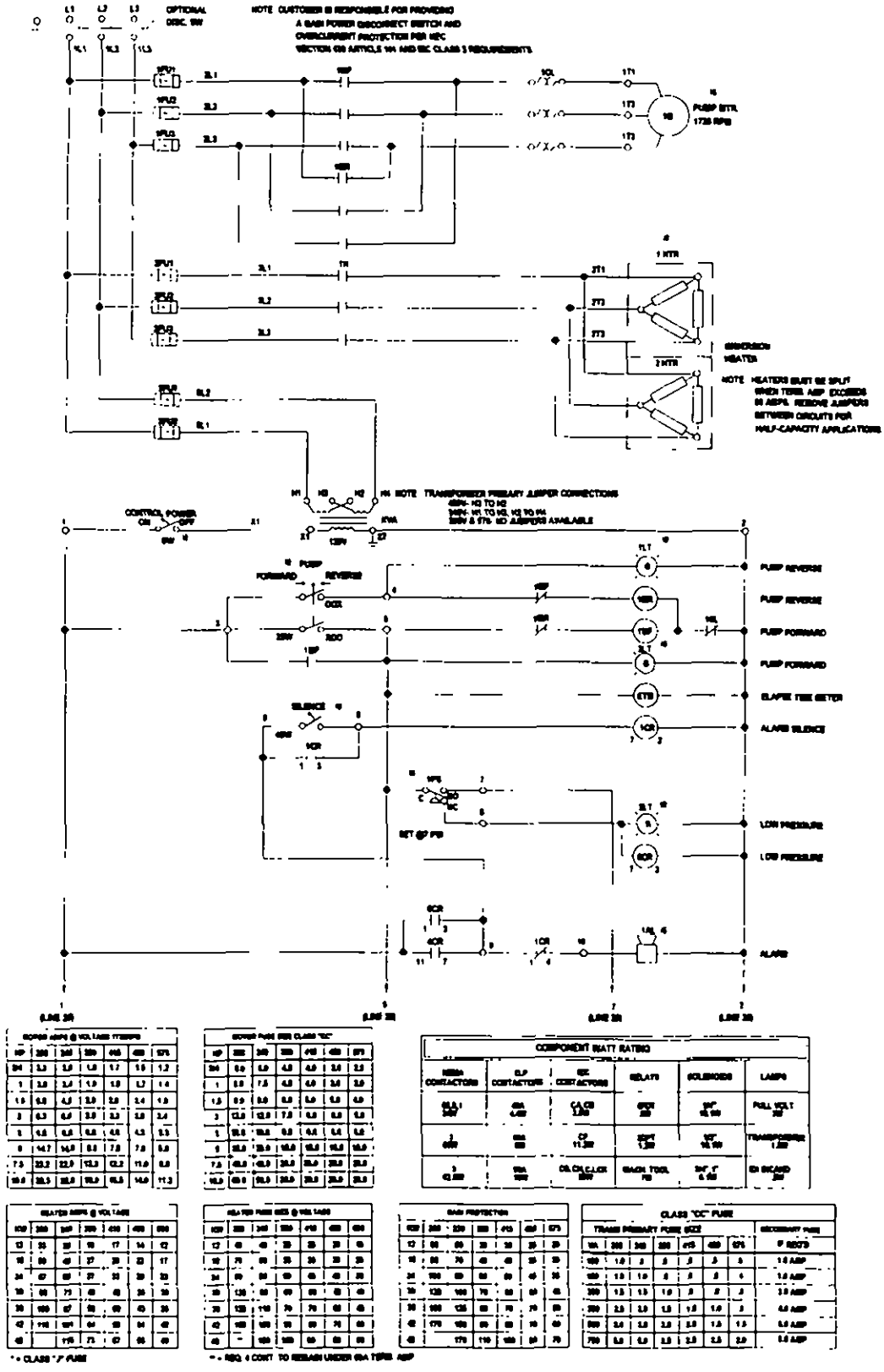
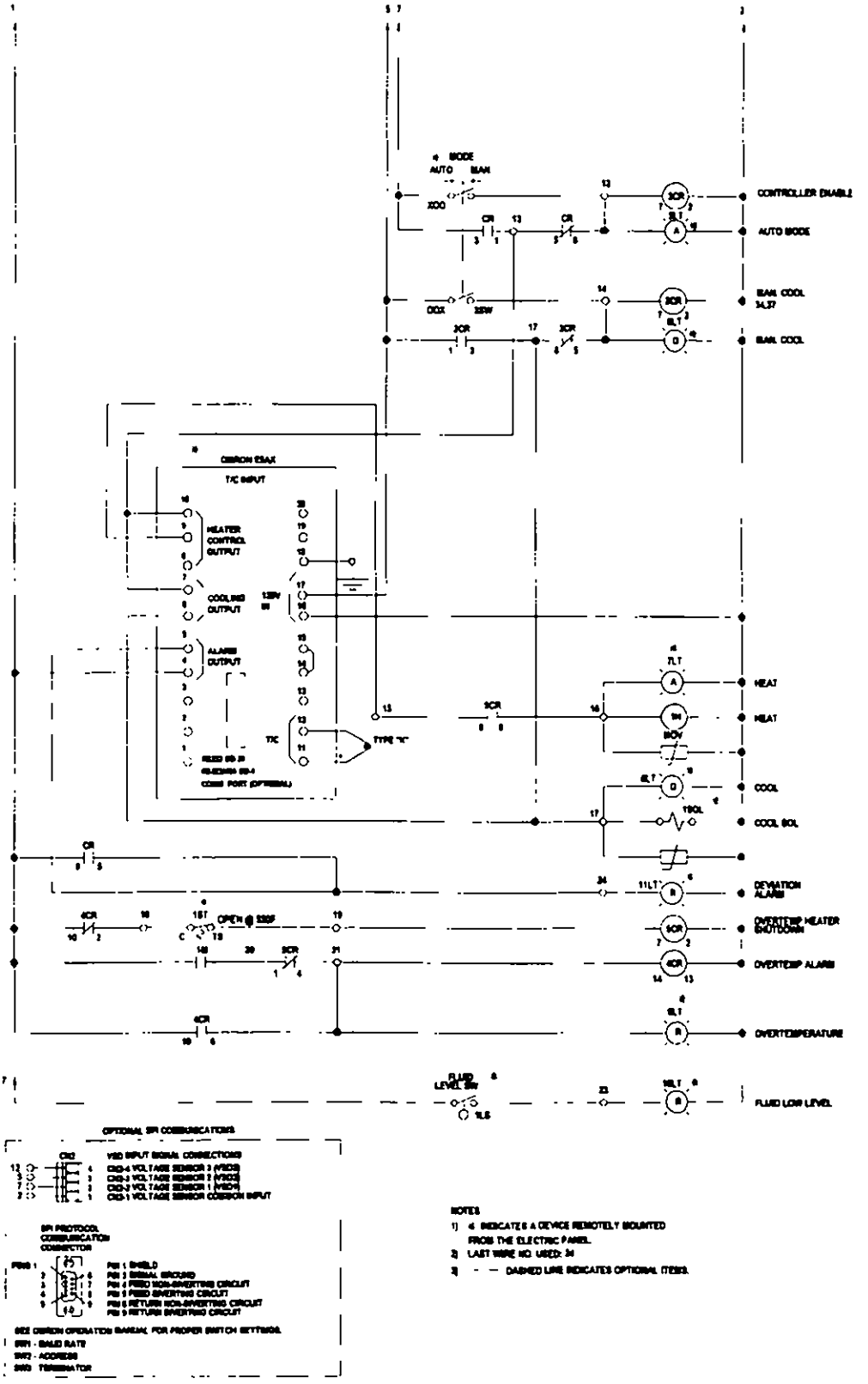


Figure 6
TDH Electrical Diagram, Drawing 2



- Notes -

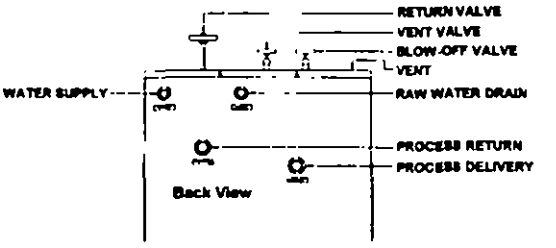
3 TDH Unit Setup

Connections are labeled appropriately on the back of each unit:

- Connect the **DELIVERY** hookup to the entrance of the process and the **RETURN** hookup to the exit of the process.
- Connect the **WATER SUPPLY** to your chiller tower water or central water supply.
- Connect the **WATER DRAIN** line to an open drain or to the **RETURN** line of your chiller tower water or central water system.

Caution!

If the drain line is flowing to an open drain, direct it away from personnel to prevent scalding.



Caution!

The connecting lines and connectors between the temperature control unit and the process should be carefully selected by the user to suit the needs and requirements of the application.

The lines and connectors should have a service rating of at least 100 psig, and a temperature rating at least equal to the maximum temperature attainable by your unit (consult unit nameplate).

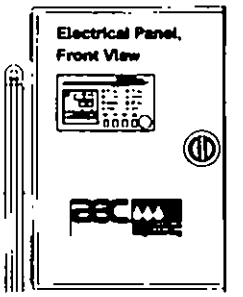
3-1 Electrical

Check the nameplate on the unit for required voltage and amperage before making any electrical connections.

!! DANGER !!

IMPROPER ELECTRICAL POWER CONNECTIONS CAN DAMAGE THE UNIT AND CAUSE SERIOUS OPERATOR INJURY OR DEATH!

Make all electrical power connections in the front of the unit. You can run power to the supply terminals from either side of the unit. Make sure that all three phases are wired correctly. If not wired properly, the pump may run backwards, possibly damaging the unit.



Caution!

Again, check the nameplate on the unit for correct voltage and amperage.

3-2 Unit Startup

A highly engineered controller and controls make this unit almost self-operating. Before you begin heating, you must perform the following startup procedures. By doing so, you ensure that all air is vented from the system to prevent fluid degradation and damage to the heater.

Note: AEC, Inc. recommends that you flush your TDH unit before you perform these procedures. See flushing instructions included with AEC TrueFlush™ flushing fluid for more information.

Caution!

Ensure that the reservoir tank vent port is not plugged. The reservoir tank must never be pressurized.

1. Add fluid to the reservoir tank until the level is near the top of the sight glass.

IMPORTANT!

AEC, Inc. strongly recommends AEC TrueTherm™ heat transfer fluid or equivalent for best results.

Use of fluids not recommended by AEC, Inc. may void your warranty.

2. Close the **RETURN** valve half way.
3. Open the **BLOW-OFF** valve.
4. Close the **VENT** valve.
5. Press **CONTROL POWER ON**.
6. Press **PUMP START FORWARD** to start the pump. Check motor rotation by observing the pressure gauge. If the gauge indicates positive pressure, rotation is correct. If not, disconnect and lock out power, then reverse any two incoming power leads.
7. As fluid is drawn out of the reservoir tank to fill the process, fluid level falls in the tank. Continue adding fluid to maintain the level about six inches above the bottom of the sight glass.
8. The **BLOW-OFF** valve vents air into the reservoir tank.
9. After 2 minutes of running, select a set point of 100°F (38°C) and switch the unit to Auto mode. As the fluid warms up, viscosity decreases and pressure falls. Close the **RETURN** line valve further to maintain a pressure of 30-50 psi.
10. Repeat Step 9 as necessary, increasing the set point to 150°F (66°C) and 200°F (93°C).
11. When fluid level has stabilized and all air has been purged from the system, close the **BLOW-OFF** valve and open the **RETURN** valve.
12. With the system properly purged, you should be able to view only 6 to 8 inches of fluid in the sight glass. This allows the fluid to expand as it heats; it also allows for process fluid capacity when you reverse the pump and withdraw fluid from the mold.
13. Perform the Auto Tune procedure. See Section 5-9 on Page 38 for more information.

The TDH is ready to use. Select a process set point on the controller as described in Section 5-7 on Page 38.

3-3 Unit Shutdown

1. Cool down the unit by switching the **CONTROL MODE** switch to **MANUAL**. This step disables the heaters (prevents the controller from turning them on) and, if so equipped, opens the Cool solenoid.

   You can monitor fluid temperature on the controller display during cool-down.

2. When fluid temperature equals room temperature, press **CONTROL POWER OFF** to turn off the unit.

3-4 Returning Fluid to the Tank

If you must move the unit from one process to another (i.e. mold changes, etc.), perform the following steps to drain the mold and process lines.

Note: This procedure is just the opposite of the unit startup/air purge procedure.

1. **Cool fluid to 100°F maximum.**
2. Press **CONTROL POWER OFF.**
3. Close the **RETURN LINE** valve.
4. Open the **VENT** valve to allow air to enter the system.
5. Press **CONTROL POWER ON.**
6. Press and hold **PUMP START REVERSE**. The pump runs in reverse, drawing fluid from the mold and lines, then drains the fluid into the reservoir tank.
7. Watch the sight glass to prevent overflow of the reservoir tank.
8. When you have finished returning fluid to the tank, press **CONTROL POWER OFF**.

Caution!

The reservoir tank may not have adequate volume to contain the total system capacity of fluid.

The total capacity of the tank is 17 gallons. If it appears that the tank may overfill, simply connect a line from the FILL port of the reservoir tank to an auxiliary container.

4 Graphic Panel

4-1 Switches

CONTROL POWER

- **ON** energizes the control circuit
- **OFF** de-energizes the control circuit and stops the pump.

PUMP START

- **FORWARD** starts pump in forward direction for normal operation.
- **REVERSE** reverses the pump direction for purge operation.

Caution !

Press CONTROL POWER OFF and let the pump stop before reversing pump rotation.

CONTROL MODE

- **AUTO** energizes the controller and allows it to monitor and control the process. The switch automatically returns to the center **OFF** position when in **AUTO** mode.

- **MANUAL** puts the TDH unit in Manual Cool mode; used during filling and venting during startup. The switch stays in the **MANUAL** position until moved to **AUTO**.

! WARNING !

- **RUN THE PUMP AT LEAST 10 SECONDS BEFORE SWITCHING TO AUTO MODE.**
- **NEVER SWITCH TO AUTO MODE WHEN FILLING OR VENTING THE UNIT, EXCEPT AS DESCRIBED IN SECTION 3-2 ON PAGE 28. THE IMMERSION HEATER WILL BE DAMAGED IF IT IS ENERGIZED WITH AIR IN THE HEATER TANK.**

ALARM SILENCE

Silences the audible alarm.

! WARNING !

LOCATE AND CORRECT THE CAUSE OF THE ALARM BEFORE ATTEMPTING FURTHER OPERATION OF THE TDH UNIT.

4-2 Indicator Lights

During typical operation, the **Pump Forward** indicator is lit constantly, while the **Heater On** and **Cooling Valve On** indicators light on and off intermittently as the controller activates each component.

Pump Forward

When lit, the pump operates in the normal forward operating direction.

Pump Reverse

When lit, the pump operates in the normal reverse operating direction.

Over Temperature

When lit, the controller outputs are disabled and the heaters are de-energized, but the pump continues circulating fluid to prevent damage to the heaters. The audible alarm sounds when this indicator lights.

Heater On

When lit, the heaters are energized.

Cooling Valve On

When lit, the cooling solenoid valve is open to allow cooling water into the heat exchanger. This light is installed only on units with the optional heat exchanger.

Note: Rapidly-cycling, alternating **Heater On** and **Cooling Valve On** lights indicate an inefficient process. Perform the Auto-Tune procedure in Section 5-9 on Page 38. For more information, see Chapter 7 — Troubleshooting on Page 57.

Low Pressure

When lit, the controller outputs are disabled and the heaters are de-energized, but the pump continues to run to prevent damage to the heater elements. The audible alarm sounds when this indicator lights.

Note: A lit Low Pressure fault indicator condition disables the controller outputs and heaters but still allows the pump to continue circulating fluid to prevent damage to the heater elements.

Auto Heat/Cool

When lit, the controller monitors the system and controls the process temperature.

Manual Cool

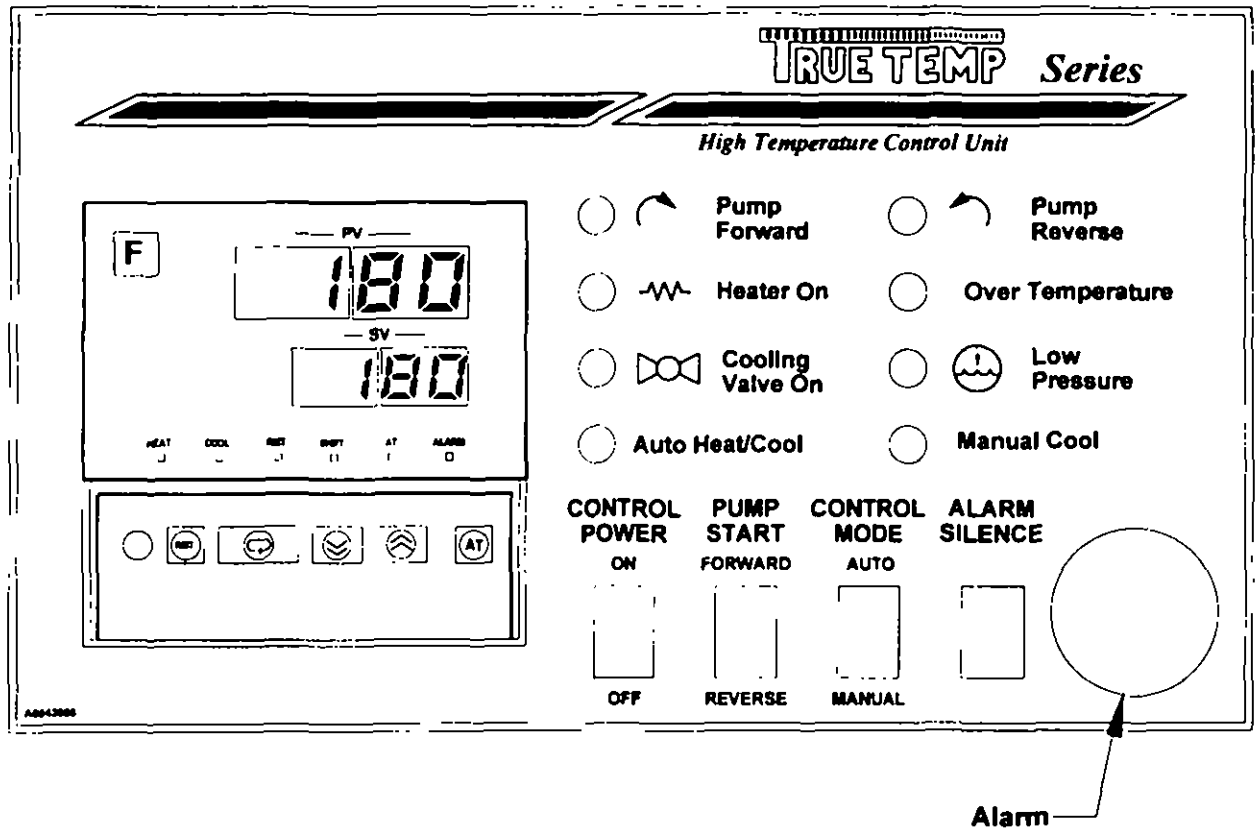
When lit, the controller is disabled and the cooling solenoid is open to allow maximum cooling.

Note: If neither **Manual Cool** or **Auto Heat/Cool** is on, the unit is in Standby mode. While in Standby mode, the pump continues to run, the immersion heater will not energize, and the cooling solenoid, if so equipped, will not open.

Low Level (optional)

When lit, this advisory indicator warns of low fluid level in the reservoir tank.

Figure 7
TDH Graphic Panel



Indicator Lights

Green

- Pump Forward
- Pump Reverse
- Manual Cool
- Cooling Valve On (if so equipped)

Amber

- Heater On
- Auto Heat/Cool

Red

- Over Temperature
- Low Pressure

5 Controller Operation

5-1 Microprocessor Control

The TDH unit has an easy to operate microprocessor-based PID control. When your process reaches the set point, the PID control cycles the cooling valve and immersion heater to maintain a proper leaving fluid temperature.

The control has been fully factory tested. Once you set the desired process temperature set point, the control does the rest. The built-in range of operation for the control is 100°F (38°F) to 400°F (204°C) on TDH4 models and 100°F (38°F) to 550°F (288°C) on TDH5 models. If you want a leaving fluid temperature to be outside these ranges on your TrueTemp™ TDH unit, consult the AEC, Inc. Service Department to see if the range on your control may be altered.

5-2 Control Display

Figure 8

PV LED

During normal operation, the red **PV** (process value) LED indicator displays the actual process temperature at the **DELIVERY** thermocouple. It lists parameters during setup and error messages if an error occurs.

SV LED

During normal operation, the green **SV** (set value) LED displays the process set point. It also displays parameter and pre-set function values during setup.

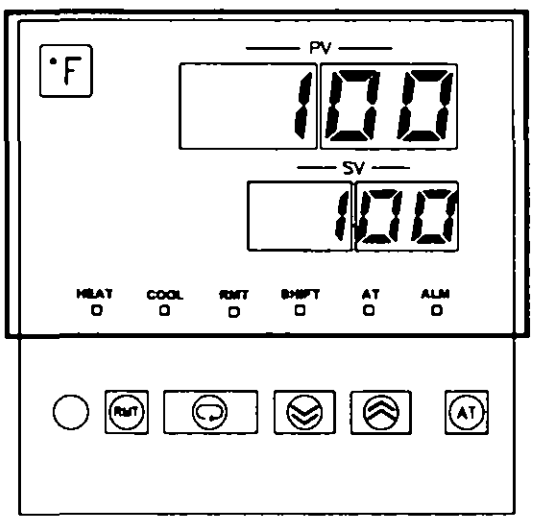
HEAT LED

The orange **HEAT** LED lights when the control energizes the immersion heater.

COOL LED

The orange **COOL** LED lights when the control energizes the cooling valve.

Figure 8
TDH Microprocessor Control



RMT LED

The orange **RMT** (remote) LED lights when remote operation occurs. This LED is only on units equipped with optional communications.

SHIFT LED

The orange **SHIFT** LED is not used on TrueTemp™ TDH units.

AT LED

The orange **AT** (Auto-Tune) LED flashes during the Auto-Tune sequence.

ALM LED

The red **ALM** (alarm) LED lights when the temperature at the process thermocouple is outside the set alarm value.

Note: The alarm mode and value is factory-set to track plus or minus 10°F/C° of the process set point.

5-3 Control Keys

Figure 8

LEVEL Key

When you press this key for two seconds or more, you can then select the next of three indication levels (0, 1, and 2) to set specific control parameters. The control defaults to Level 0 on power up.

(RMT) REMOTE Key

Units with optional communications feature this key. For information on RS-232C, RS-422, RS-485, or SPI communications, refer to the Communications booklet in your packet.

MODE Key

This key lets you scroll through parameters that can be set in Indication Levels 0 and 1. For example, in Level 0, you can call up the high/low temperature alarm (AL-2) so it can be set.

The factory alarm setting is plus or minus 10°F/C° of the set point and is satisfactory for most applications.

DOWN Key

The key with the arrows pointing down lets you lower the process set point temperature. During setup, it lets you decrease the value of the parameter displayed by the **PV** (process value) LED.

UP Key

The key with the arrows pointing up lets you raise the process set point temperature. During setup, it lets you increase the value of the parameter displayed by the **PV** (process value) LED.

AT Key

When you press this key for one second or more, you start the Auto-Tune sequence.
See Section 5-9 on Page 38 for more information.

5-4 Control Internal Switches

The control is set up and tested at the factory for optimum operation, and you don't need to adjust internal switches. If the control does not work properly, or you suspect someone has accidentally changed some settings, you can do two things. First, perform the Auto-Tune Procedure listed in Section 5-9 on Page 38. If that doesn't work, restore the control to the original factory settings listed in Section 6-5 on Page 44 for more information.

5-5 Control Anti-Tamper Lockout Switch (SW101)

This slide switch prevents unauthorized changes to the controller, allowing only the process set point to be changed and alarm settings to be viewed. When you move this switch to **ON**, you disable the **LEVEL** and **AT** keys. TrueTemp™ Series TDH temperature control units are factory set with protection turned **OFF**.

To set tamper protection:

☑ Disconnect main electrical power to the TrueTemp™ TDH unit.

☑ Press up the latch at the bottom of the front panel, then slide out the control chassis.

☑ Locate the slide-type switch labeled **Protect (SW101)** on the left circuit board. Slide it to **ON**.

☑ Slide the chassis back into the control housing.

Tamper protection is now set.

5-6 Changing Fahrenheit to Celcius

You can easily convert the control from the factory-set degrees Fahrenheit (°F) setting to degrees Celcius (°C).

☑ Disconnect main electrical power to the TrueTemp™ unit.

☑ Press up the latch at the bottom of the front panel and slide out the control chassis.

☑ Locate the DIP switch labeled **SW201 (FUNCTION)** on the right circuit board. Slide Switch **5** to **OFF**.

☑ Slide the chassis back into the control housing.

☑ Cover the °F label with the °C sticker included in your information packet.

5-7 Changing the Set Point

To change the process temperature set point:

- Press  to raise the set point.
- Press  to lower the set point.

5-8 Communications

For RS-232, RS-422, RS-485, and SPI communications, a connection port on the electrical cabinet permits easy connection to the host computer. The connection port is a direct pin-to-pin extension from the plug on the back of the controller. For pin outs, consult the Communication booklet.

5-9 Auto-Tune Procedure

The Auto-Tune feature lets you fine-tune the control PID to process requirements. Auto-tune the control PID whenever the process under control changes.

Don't be alarmed by control response. The process temperature may go above and below set points as many as three times. It then levels off and controls fluid temperature to the process set point. Allow at least 15 minutes to run the Auto-Tune sequence; you should do so before you run any process.

Auto-Tuning the Control

☑ Once the process has reached the set point, apply the smallest load the TrueTemp™ unit is required to heat or cool. For example, put the process in Idle or Standby mode.

☑ Press the **AT** key. The **AT** LED flashes, indicating that the control is tuning itself.

☑ When the **AT** LED light stops flashing, the controller is tuned and ready for operation.

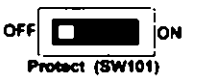
5-10 Restoring the Control to Factory Setup

! WARNING !

THE PUMP CONTINUES TO RUN IF YOU REMOVE THE SLIDE-OUT CHASSIS WHILE THE PUMP IS RUNNING.

If pre-set parameters on the microprocessor control have been tampered with and it will no longer control fluid temperature, try restoring the factory setup:

1. Turn off the power switch on the graphic display and remove all electrical power to the TrueTemp™ TDH unit.
2. Press up the latch at the bottom of the front panel and slide out the control chassis.
3. The slide-type lockout switch labeled **SW101 (PROTECT)** on the left circuit board should be **OFF**.



4. Make sure that the control outputs are installed on the right-hand circuit board. True-Temp™ TDH units use two E53-S solid state relays (SSRs) mounted in the sockets marked **S201 (HEAT)** and **S202 (COOL)**. These relays switch the heater and cooling valve on and off.
5. Set output selector switches **SW202** and **SW204** to **PUL** (pulse) on units with a standard solenoid cooling valve. These slide type switches are near the control output sockets.

6. Set the rotary-type alarm mode selector switch to position **5**. The selector switch is marked **SW203 [ALM]** and is on the right-hand circuit board. Seven other alarm functions are available and listed on the following page.

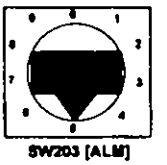
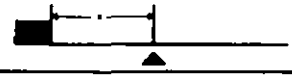
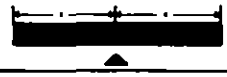
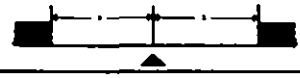
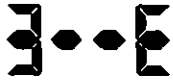
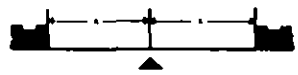
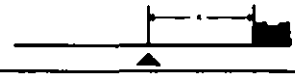
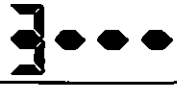
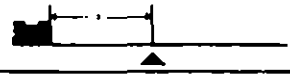
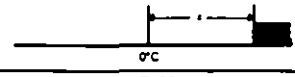
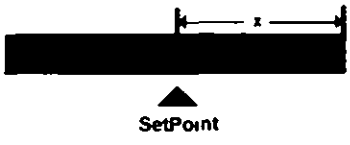


Figure 9
Alarm Function Choices

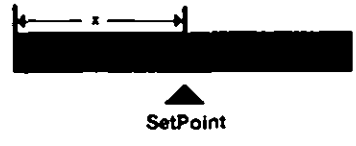
Switch 203 Position	ALM (SW203) Function	LED Display	Alarm Output OFF
0	No alarm function.	No indication.	
1	Upper and lower limit alarms.		
2	Upper limit alarm.		
3	Lower limit alarm.		
4	Upper and lower limit range alarm.		
5	Upper and lower limit alarm with standby sequence.		
6	Upper limit alarm with standby sequence.		
7	Lower limit alarm with standby sequence.		
8	Event alarm.		
9	No alarm function.	No indication.	Off

Note: If a negative value is set as **X**, alarm operation is as shown below:

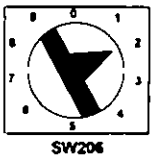
Lower Limit Alarm



Upper Limit Alarm



7. Set the rotary temperature sensor selector switch to Position **2**. It is marked **SW206 (INPUT TYPE)** and is on the right circuit board. TrueTemp™ units are factory-equipped with type K thermocouples; six other temperature sensor types listed below can be used if the switch is properly set.



Display Characters	Sensor Type	Switch Position	Temperature Range °C	Temperature Range °F
r Pr	Thermocouple Type R	0	0 - 1,700	0 - 3,000
S Pr	Thermocouple Type S	1	0 - 1,700	0 - 3,000
K CA	Thermocouple Type K	2	-200 to 1,300	-300 to 2,300
J	Thermocouple Type J	3	-100 to 900	-100 to 1,600
t CC	Thermocouple Type T	4	-200 to 400	-300 to 700
E Cr	Thermocouple Type E	5	0 to 600	0 to 1,100
Pt 1	Platinum RTD (JIS 1981)	6	-99.9 to 450.0	-99.9 to 800.0
Pt 2	Platinum RTD (DIN)	7	-99.9 to 450.0	-99.9 to 800.0
	Not Used	8		
	Not Used	9		

8. The DIP switch on the right circuit board labeled **SW201 (FUNCTION)** lets you select six control modes. Put this switch in the setup configuration (right) when entering initial control parameters. See the table below.

SW201 Setup Configuration	
1 OFF	Control Mode
2 OFF	Normal/Reverse Output
3 OFF	Input Shift
4 ON	Temperature Sensor Standard
5 ON	Scale Indication
6 ON	PID Constant Indication

9. Slide the control chassis back into the control housing. Set the remaining parameters with the keypad. Refer to Figure 10 on Page 43.
10. Ready the TrueTemp™ TDH unit for startup with a real or simulated load. Restore electrical power.
11. Turn **ON** control power. The **PV** LED displays four zeros (0000), then displays the current process temperature.
12. Press [⊜] to page through Level 0 control parameters. The **PV** LED displays codes indicating the currently selected mode; the **SV** LED displays the current setting of the selected parameter. Use [⊜] and [⊜] to select a setting.
13. Set Level 0 parameters. See Figure 10 on Page 43.
14. Press ○ for at least two seconds to access Level 1 parameters. Set them using the procedure in Step 12.

Note: You can proceed to Level 2, but these parameters are read-only. Controls with optional communications have user-set variables (unit address and ID) on Level 2.

15. Turn off the power switch on the graphic display and remove all electrical power to the TrueTemp™ TDH unit.
16. Press up the latch at the bottom of the front panel and slide out the control chassis.
17. Set selector switch **6** to **OFF**. It is marked **SW201 [FUNCTION]** and is on the right circuit board.

18. Prepare the TrueTemp™ unit to operate under a normal or simulated load before re-connecting the electricity.
19. Turn **ON** control power. The **PV** LED displays four zeros (0000), then displays the current process temperature.
20. Auto-tune the TrueTemp™ unit using the procedure in Section 5-9 on Page 38. If the control still fails to work properly, call the AEC, Inc. Service Department.

Figure 10
TDH Factory Parameter Settings

Parameter Setting Levels	Parameter Description	PV LED Display	TDH SV LED Setting
0	Display at power-up	Process temperature	Process set point
	Alarm range	AL-2	10°F
	Proportional bandwidth	P	11°F
	Reset time	I	122 seconds
	Rate time	d	31 seconds
1	Lower limit value of control range	SL-L	100°F
	Upper limit value of control range	SL-H	400°F, TDH4 550°F, TDH5
	Dead band	C-db	1°F
	Cooling coefficient	C-SC	1.0°F
	Heating control period	CP	20 seconds
	Cooling control period	C-CP	5 seconds
	Shift set value	SP-S	0°F
2	Control output variable	o	Read only
	Temperature sensor type	In-t	P CA
	Alarm mode	AL-2	3--E
	Unit number setting with optional communications	Un-S	Varies with network
	Baud rate setting w/optional communications	bP-S	Varies with network

- Notes -

6 Preventive Maintenance

!! DANGER !!

BEFORE SERVICING:

1. DISCONNECT POWER.

2. LET THE UNIT COOL DOWN.

3. TURN OFF COOLING WATER.

FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY OR DEATH!

6-1 Routine Servicing

TDH units require little preventive maintenance and servicing. You should follow scheduled maintenance to prevent costly repairs later.

Monthly or Every 500 Hours of Operation

- Adjust the tension on the pump drive belt. To do so, loosen the motor mounting bolts. Turn the tensioning nuts on top of the motor mount so the belt has no more than 1 inch of play. Make sure that the motor pulley is aligned with the pump pulley by using a straightedge, then re-tighten the motor mounting bolts.
- Keep all surfaces free of dirt, oil, or debris.
- Lubricate the pump by gently injecting a high quality lithium grease into the grease fittings.
- Keep the pump clean. The pump seal relies on air circulation for cooling.
- Check the motor air intake screen for dirt accumulation; clean if required.

Every 3 Months

- Remove and clean the screen in the Y-strainer. You may want to check the screen more frequently, as the actual interval check can vary with usage, fluid condition, etc.

6-2 Periodic Checks

Daily

- Check all connecting lines, hoses, and connectors for wear or damage.

Monthly

- Check for leaks developing at the pump seal, gaskets, etc.
- Check the pump drive V-belt for wear.
- Check the reservoir tank vent for any obstructions.

Every Three Months

- Check heat transfer fluid for deterioration. If fluid is noticeably darker in color, or viscosity has increased from 20% to 25%, drain the system and replace the fluid. Severe damage may occur from using degraded fluid. See Section 6-3 below for more information.

Note: Under normal conditions, heat transfer fluid should last 18 to 36 months.

Every Six Months

- Inspect electrical connections for secure attachments and secure ground connections. Inspect the power cable, especially at the entrance point to the electrical enclosure. **A qualified electrician should perform this inspection.**
- Check pump, motor, and heater flange bolts for proper tightness.
- Remove the heat exchanger tube bundle and check for lime/mineral deposits. Clean if required.

6-3 Draining

You should thoroughly flush and drain the TDH unit if you need to take it out of service for a long time, or if you expect it to become exposed to freezing temperatures. AEC, Inc. recommends TrueFlush™ flushing fluid or equivalent for flushing your TDH unit; follow unit flushing instructions that comes with TrueFlush™ flushing fluid. Drain plugs are provided at the base of the heater tank, reservoir tank, and on the pump. You should also remove, drain, and reinstall the heat exchanger tube bundle before storage.

6-4 Corrective Maintenance

Pumps and Seals

Each TDH unit is completely tested and calibrated before leaving the factory. The unit is then cooled, drained, and packed for shipment. If the unit stands idle for a long time before being installed in your factory, gaskets can dry out and possibly leak when you start the unit. In most cases, these gaskets soon swell and form a tight seal. If not, you may need to tighten the bolts to stop the leak.

Similarly, rough handling in shipping may sometimes cause minor leaks upon startup; you may need to re-tighten bolts or fittings to stop the leak.

You should expect to periodically replace the pump seal. If the pump is properly lubricated and used at moderate temperatures, the seal should last several years. The pump insert in this manual describes the proper procedures for replacing the seal (Mechanical seal, Pt. No. 162-00030-160). Periodic replacement of the pump drive V-belt is also to be expected. Review the following tables for V-belt part numbers:

TDH4 Models	
Flow in gpm at pressure in psi	V-Belt Part Number
18 @ 30	100-00033-00
18 @ 50	100-00025-00
24 @ 30	100-00025-00
24 @ 50	100-00025-00

TDH5 Models	
Flow in gpm at pressure in psi	V-Belt Part Number
18 @ 30	100-00033-00
18 @ 50	100-00025-00
24 @ 30	100-00025-00
24 @ 50	100-00025-00
50 @ 30	100-00188-00
50 @ 50	100-00188-00

Note: If the pump motor wiring is disconnected for removal from the unit, you **must** check the actual direction of rotation when the motor is rewired to the unit. See Figure 5, Drawings 1 and 2 on Pages 23 and 24 for more information.

6-5 Pump Maintenance

Disassembly

!! DANGER !!

BEFORE OPENING THE PUMP CHAMBER, MAKE SURE:

- **ANY PRESSURE IN THE CHAMBER HAS BEEN COMPLETELY VENTED**
- **MOTOR CANNOT BE STARTED WHILE YOU DO WORK ON THE PUMP**

FAILURE TO FOLLOW THESE PRECAUTIONS MAY RESULT IN SERIOUS INJURY OR DEATH!

1. Mark the head and casing before disassembly to insure proper reassembly. The idler pin, which is offset in the pump head, must be positioned toward and equal distance between port connections to allow proper flow of fluid through the pump.

   Remove the head from the pump. Do not allow the idler to fall from the idler pin. To prevent this from happening, tilt the top of the head back when removing. Avoid damaging the head gasket.

   If pump has a jacketed head plate, it will separate from the head when you remove it. You must completely remove the gasket between the head and jacketed head plate. Install a new gasket when assembling the pump.

2. Remove the idler and the bushing assembly.
3. Insert a length of hardwood or brass through the port opening between the rotor teeth to keep the shaft from turning. Bend up the lockwasher tang with a spanner wrench. Remove the locknut and lockwasher from the shaft.
4. Tap the shaft forward approximately 1½ inches and remove the pair of half round rings under the inner spacer collar.

Note: HL pump models do not contain half round rings.

5. Carefully remove the rotor and shaft to avoid damaging the bracket bushing.
6. Remove the rotary member of the seal from the shaft and the stationary seal seat from the bracket.
7. Loosen the setscrews. Using a spanner wrench, remove both end caps and lip seals. Remove the ball bearing and spacer collars.
8. Examine the seal chamber lip seal and remove if you note wear or damage. You must remove the lip seal if you must replace the bracket bushing.
9. Clean all parts thoroughly and examine for wear or damage. Check lip seals, the ball bearing, the bushing, and the idler pin; replace if necessary. Check all other parts for nicks, burrs, and excessive wear; replace if necessary.

   Wash bearings in clean solvent. Blow out bearings with compressed air. Do not allow bearings to spin; turn them slowly by hand. If you spin the bearings, you will damage the race and balls. Make sure bearings are clean, then lubricate with a non-detergent SAE 30-weight oil and check for roughness. You can determine roughness by turning the outer race by hand.

   Make sure that the shaft is free from nicks, burrs, and foreign particles that might damage the bracket bushing. Scratches on the shaft in the seal area provide leakage paths under the mechanical seal.
10. Check the casing for wear or damage while it is still mounted on the bracket.

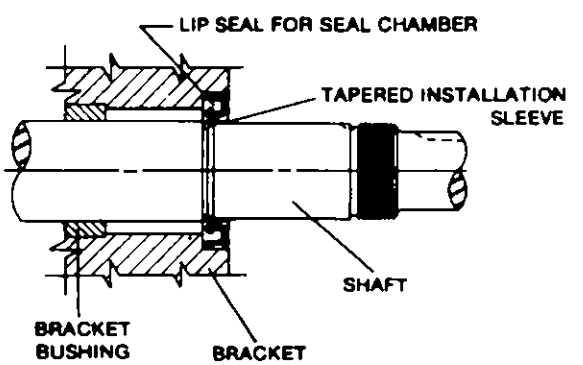
Assembly

Standard Mechanical Seal, Synthetic Rubber Bellows Type

The seal used in this pump is simple to install. If you take care during installation, good performance will result.

The principle of the mechanical seal is to make contact between the rotary and stationary members. These parts are lapped to a high finish, and their sealing effectiveness depends on complete contact. When requesting special seal information, make sure that you give the pump model number and serial number.

1. Install the bracket bushing. If the bracket bushing has a lubrication groove, install the bushing with the groove at the six o'clock position in the bracket.
2. Install the lip seal in the bracket. Refer to the following figure.

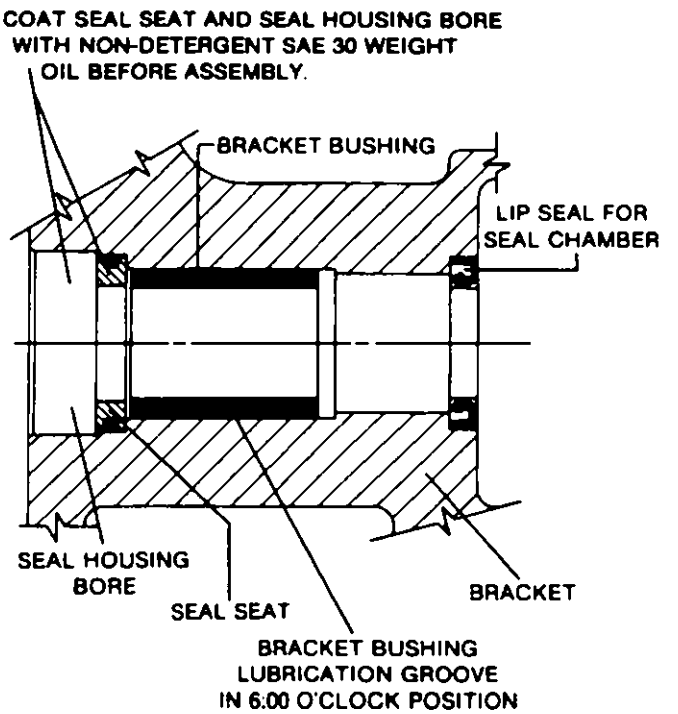


Prior to installing the rotating portion of the mechanical seal, prepare and organize the rotor shaft, head and idler assemblies, and appropriate gaskets for quick assembly.

Once the rotating portion of the mechanical seal is installed on the rotor shaft, you must assemble the parts **as quickly as possible** to insure that the seal does not stick to the shaft in the wrong axial position. You can expect the seal to stick to the shaft after several minutes setting time.

Never touch sealing faces with anything except clean hands or a clean cloth. Minute particles can scratch the seal faces and cause leakage.

3. Coat the idler pin with non-detergent SAE 30-weight oil. Place the idler and bushing on the idler pin in the head.
4. Clean the rotor hub and bracket seal housing bore. Make sure both are free from dirt and grit. Coat the outer diameter of the seal seat and the inner diameter of the seal housing bore with non-detergent SAE 30-weight oil.
5. Start the seal seat in the seal housing bore. Refer to the following figure. If force is necessary, protect the seal face with a clean cardboard disc and gently tap it in place with a piece of wood.
6. Place the tapered installation sleeve on shaft. Refer to the figure on the following page. Coat the rotor shaft, tapered installation sleeve, and the inner diameter of the mechanical seal rotary member with a generous amount of non-detergent SAE 30-weight oil. Petrolatum may be used, but **grease is not recommended**.
7. Place the seal spring on the shaft against the rotor hub. Refer to the figure on the following page.



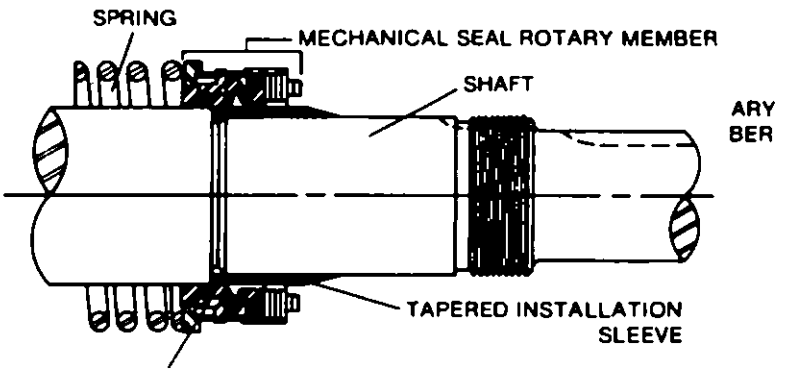
8. Slide the rotary member, lapped contact surface facing away from the spring, over the installation sleeve on the shaft until it is against the spring.

   Do **not** compress the spring.

9. Coat the rotor shaft with non-detergent SAE 30-weight oil. Start the end of the shaft in the bracket bushing and turn it from right to left, slowly pushing until the ends of the rotor teeth are just below the face of the casing.

   Leave the rotor in this position. Withdrawal of the rotor and shaft may displace the carbon seal rotating face, resulting in damage to the seal.

10. Using a .010 to .015 inch head gasket, install the head and idler assembly on the pump. The pump head and casing were marked before disassembly to insure proper reassembly. If not, make sure that the idler pin, which is offset in pump head, is positioned toward and equal distance between port connections to allow for proper flow of heat transfer fluid through the pump.



COAT ROTOR SHAFT, TAPERED INSTALLATION SLEEVE AND INNER DIAMETER OF MECHANICAL SEAL WITH NON-DETERGENT SAE 30 WEIGHT OIL BEFORE ASSEMBLY.

If the pump is equipped with a jacketed head plate, install it at this time; install a new gasket when installing the head plate.

Tighten head capscrews evenly.

Remove the tapered installation sleeve from the shaft.

11. Slide the inner spacer collar over the shaft with the recessed end facing the rotor.

Place the pair of half round rings on the shaft, and slide the inner bearing spacer collar over the half round rings to lock them in place.

Note: HL pump models have bearing spacer collars that are not recessed, and do not contain half round rings.

12. With the lip facing the end of shaft, press the lip seal into the inner end cap. Insert the end cap through the shaft end of the bracket. As you look at the shaft end, turn the end cap clockwise until it engages the threads. The end cap spanner wrench holes must be facing the rotor.

Turn the end cap with a spanner wrench until it projects slightly from the opening on the side of the bracket. The end cap must not be turned so far that the lip seal drops off the end of the spacer collar on the shaft or that the end cap becomes disengaged from the threads.

If this happens, remove the inner spacer collar, half round rings, and the end cap. Begin again at Step 11.

13. Pack the ball bearing with NLGI #2 multi-purpose grease. Place the ball bearing on the shaft and push or gently drive it into place in the bracket.

14. With the lip facing the end of the shaft, press the lip seal into the outer end cap. Insert the end cap into the bracket. Turn the end cap in the bracket until it is tight against the bearing.

15. Put the lockwasher and locknut on the shaft. Insert a length of hardwood or brass through the port opening between the rotor teeth to keep the shaft from turning. Tighten the locknut and bend one tang of the lockwasher into the locknut slot.
16. Adjust pump end clearance.
17. Lubricate the grease fitting over the seal chamber with petrolatum (Vaseline™) or other similar low melting point lubricant. Lubricate all other grease fittings with NLGI #2 multi-purpose grease.

!! DANGER !!

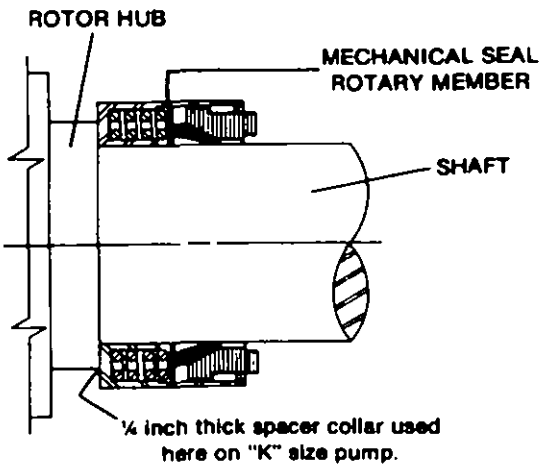
BEFORE STARTING THE PUMP, BE SURE ALL DRIVE EQUIPMENT GUARDS ARE IN PLACE.

FAILURE TO PROPERLY INSTALL THE GUARDS MAY RESULT IN SERIOUS INJURY OR DEATH!

Optional Mechanical Seal, Teflon™ Fitted Type

The seal type shown in figures on the following pages can be installed as an alternative to the standard mechanical seal, a synthetic rubber bellows type. Teflon™ seals are setscrew-driven, and the stationary seats have anti-rotation pins that mate with slots in the end of the bracket bushing.

1. Install the bracket bushing. If it has a lubrication groove, install the bushing with the groove at the six o'clock position in the bracket.
2. Install the lip seal in the bracket.
3. Clean the rotor hub and bracket seal housing bore. Refer to the first figure on the following page. Make sure both are free from dirt and grit. Coat the outer diameter of the seal seat gasket and inner diameter of the seal housing bore with non-detergent SAE 30-weight oil.
4. Start the seal seat in the seal housing bore. Make sure seat anti-rotation pins are aligned to engage slots in the end of the bracket bushing. Refer to the following figure.

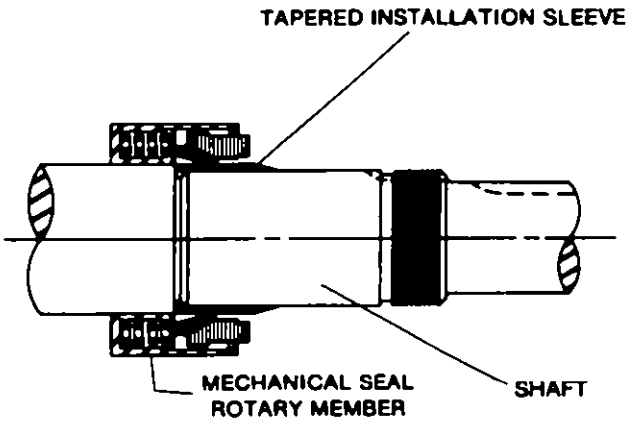


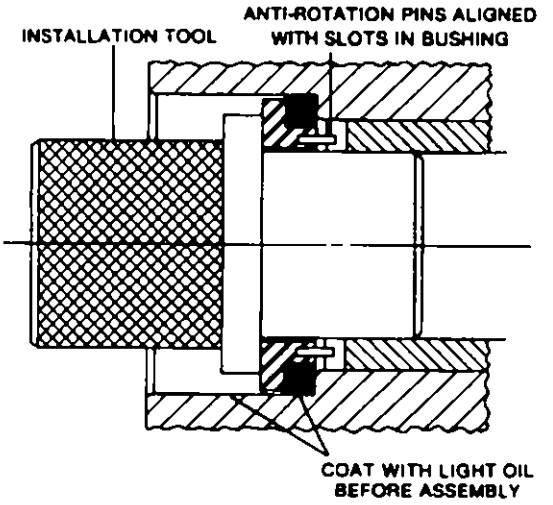
5. Using a cardboard disc to protect the lapped face of the seal seat, press the seal seat assembly to the bottom of the seal housing bore using a piece of wood. You can also use an arbor press to install the seal seat. The seal seat must be started square and carefully pressed to the bottom of the seal housing bore.

6. Place the tapered installation sleeve on the shaft. Refer to the first figure on this page.

   Coat the inner diameter of the seal rotary member, tapered installation sleeve, and the shaft with a generous quantity of non-detergent SAE 30-weight oil. Place the rotary member on the shaft over the sleeve and against the hub of the rotor. Refer to the second figure on this page.

   Some Teflon™ seals are equipped with holding clips that compress the seal springs. Remove the holding clips to release the springs after you install the seal on the shaft. Tighten all drive setscrews securely to the shaft.





BRACKET SEAL HOUSING BORE WITH SEAL SEAT INSTALLED. NOTE SPECIAL INSTALLATION TOOL USED FOR FACTORY ASSEMBLY.

At this point, complete the assembly procedures starting at Step 9 on Page 50 in the previous section, **Standard Mechanical Seal, Synthetic Rubber Bellows Type**.

Preventive Pump Maintenance

You can extend the life of your pump and reduce the cost per gallon pumped if you perform a few preventive maintenance procedures.

Lubricating the Pump

Using #2 ball bearing grease and a hand-operated grease gun, gently lubricate all grease fittings **after every 500 hours** of operation **or after 60 days**, whichever comes first. If pump service occurs in severe conditions, lubricate more frequently. Use an appropriate type of grease for hot or cold applications.

Adjusting the Pump Packing

You may need to occasionally adjust the pump packing to reduce leakage to a slight weep. If you cannot reduce leakage by slowly tightening the flanges, replace the packing or use a different type of packing.

Adjusting End Clearance

After long periods of service, the running clearance between the end of the rotor teeth and head may be increased from wear. The pump may lose some capacity or pressure as a result. If you reset the end clearance, pump performance should improve.

Examining Internal Parts

Remove the head occasionally and examine the idler, bushing, head, and pin for wear. Replace the idler bushing and idler pin after moderate wear to avoid replacing more expensive parts later.

Note: Make sure the idler doesn't slide off the idler pin during head removal to avoid damage and personal injury.

Cleaning the Pump

A clean pump is easier to inspect, lubricate, and adjust; it runs better and *looks better!*

Storing Your TDH Unit

If you anticipate that your TDH will be out of service or stored for a long time, flush and drain the pump and circulating system to protect it from freeze-ups or rusting. See Section 6-3 on Page 46 for more information.

Figure 11
Process Temperature Control Error Messages

Message	Cause	Control Output		Alarm Output
		With output unit other than current output unit	With current output unit	
FFFF	Input temperature has risen beyond the upper limit of the temperature range by more than 20°C (68°F) ①	OFF during reverse (heating) action, ON during normal cooling action.	4 mA during reverse (heating) action, 20 mA during normal (cooling) action.	Issues alarm outputs in accordance with the set alarm mode.
----	Input temperature has fallen below the lower limit of the temperature range by more than 20°C (68°F) ②	ON during reverse (heating) action, OFF during normal (cooling) action.	20 mA during reverse (heating) action, 4 mA during normal (cooling) action.	Issues alarm outputs in accordance with the set alarm mode.
SErr	The thermocouple has burned out or the short circuit bar has been removed. The platinum RTD has burned out or A and B have been short circuited.	OFF	Approximately 1 mA	Issues alarm outputs in accordance with the set alarm mode. Proportional alarm output is OFF
E111 E333 (flashes)	Memory failure (E111) or analog to digital converter failure (E333) has occurred Temperature controller must be repaired if recovery is not made by turning power off once and on again.	OFF	Approximately 1 mA	OFF

① When a type J thermocouple is used, this error message is not displayed until the temperature has risen above the normal operating temperature operating range by more than 70°C (158°F).

② When a platinum RTD sensor is used, this message is displayed when the temperature has fallen to -99.9°C (-147.82°F).

- Notes -

7 Troubleshooting

Symptom	Possible Cause	Solution
Temperature fluctuations/ rapid cycling from hot to cold.	Undersized connectors/lines.	Increase size of connectors/ lines.
	Long connecting lines between unit and mold.	Move the unit closer to the mold and shorten connecting lines.
	Serpentine flow through mold.	Connect lines for parallel flow instead of series flow.
	Blocked line in mold.	Check mold for metal chips or deposits. Clean mold.
	Quick disconnect fitting with check valve.	Do not use quick disconnect with check valve.
	Carbon build-up in unit piping or fittings.	Clean or replace affected piping. Replace fluid.
	RETURN valve closed.	Open **RETURN** valve.
	Faulty temperature control.	Check unit by connecting line directly from **DELIVERY** to **RETURN** to determine if TCU controls the set point fluid temperature.
Unit does not heat properly/cannot achieve set point.	Loss of fluid in process.	Check all lines/ connections/fittings.
	BLOW-OFF valve open.	Close **BLOW-OFF** valve.
	Faulty/dirty solenoid valve. Usually detected when there is a steady stream or trickle out of the drain line	On units with cooling heat exchangers, switch to **Manual Cool** several times to flush valve. If the leak continues, disconnect the power to the unit, turn off the water supply, and clean or replace the solenoid.
	Degraded fluid.	Drain and replace fluid.

Symptom	Possible Cause	Solution
Unit will not heat.	Defective heater contactor.	Repair/replace defective contactors.
	Defective immersion heater.	Check resistance on all three legs of heater with an ohm meter. If not all equal, contact factory for replacement heater.
	Heater burnout.	Check resistance on all three legs of heater with an ohm meter. Replace heater as required.
	Controller heater output open.	Check the heater output with an ohmmeter. It should read in the mega-ohm range. Infinite readings indicate a defective output.
Unit overheats/unable to cool.	Water supply to unit is turned **OFF**.	Open water supply.
	Drain is plugged or excessive back pressure in drain line.	Clear drain line or eliminate back pressure condition.
	Heat exchanger tubes plugged by lime deposits.	Remove tube bundles. Clean/replace as required.
	Faulty solenoid valve.	Test solenoid valve by switching to **Manual Cool** and listen for valve operation. Replace if faulty.
	Cooling water temperature is too hot; cooling water flow is insufficient.	Lower the cooling water temperature; increase cooling water flow.
	Heat exchanger is undersized.	Contact your AEC sales representative.

Symptom	Possible Cause	Solution
Rapid drop in pressure/no pressure.	Leaks in connecting lines.	Inspect/replace faulty line or connection.
	Air in circulating lines.	Perform venting sequence. See Chapter 3 – Unit Startup.
	Low fluid.	Check fluid level in sight glass. Add fluid if required.
	Defective Ful-Flo valve.	Disassemble valve. Check for broken spring or sticking valve.
	BLOW-OFF valve open.	Close **BLOW-OFF** valve.
	Pump runs in reverse.	Check motor. Rewire if necessary. Consult wiring diagram.
	Pump repair/adjustment needed.	Adjust head spacing or replace worn pump components.
	V-belt broken/worn.	Replace as required.

Figure 12
TDH Pump and Pump Components

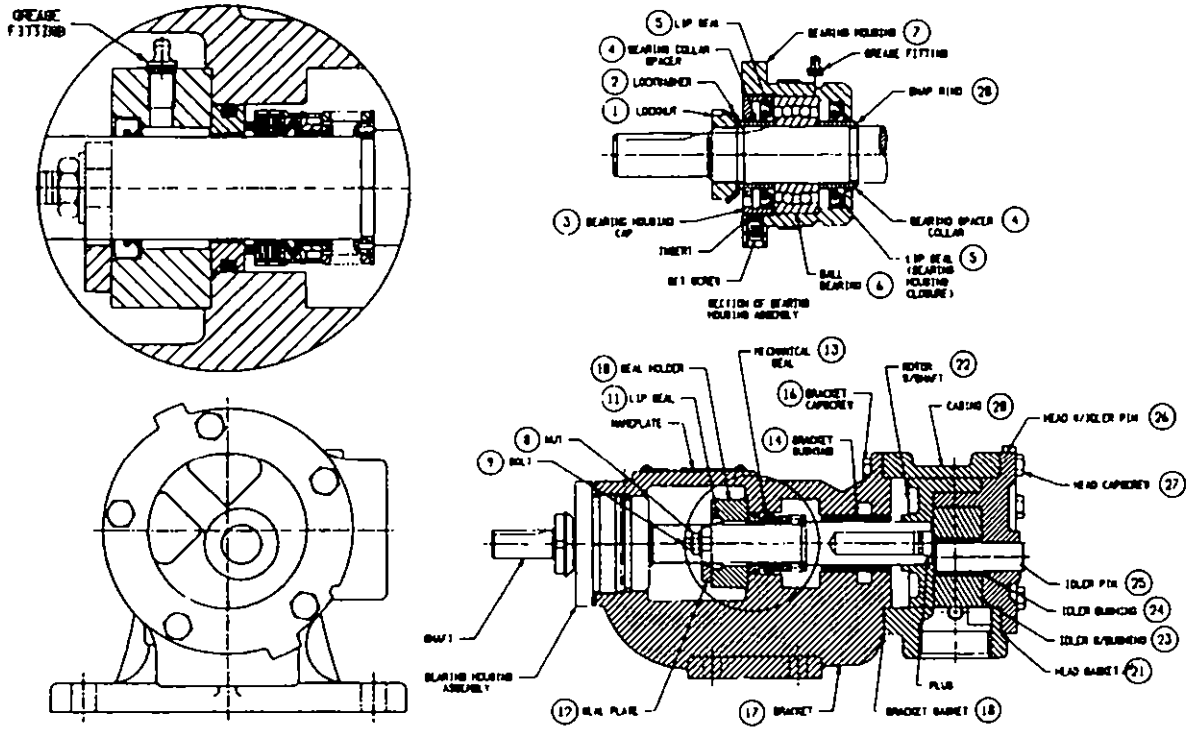


Figure 12
Pump Parts List

Item	Viking Part Number	Name of Part	AEC Part Number
1	2-507-003-675	Locknut	162-00008-35
2	2-807-003-375	Lockwasher	162-00008-40
3	2-140-001-781	Bearing housing cap	162-00008-17
4	2-288-003-210	Bearing collar spacer (2)	162-00008-19
5 (A)	2-283-105-381	Lip seal	162-00030-153
5 (B)	2-283-007-378	Lip seal (bearing housing closure) (2)	162-00008-20
6	2-055-012-375	Ball bearing	162-00008-14
7	3-060-034-922	Bearing housing w/setscrews	162-00008-24
8	2-505-004-375	Nut	162-00008-43
9	2-066-005-375	Bolt	162-00030-160
10	2-487-245-260	Seal holder	162-00030-159
11	2-283-105-381	Lip seal	162-00030-153
12	2-527-002-271	Seal plate	162-00030-154
13	2-475-012-999	Mechanical seal	162-00030-144
14	2-109-003-880-02	Bracket bushing	162-00008-98
16	2-150-004-255	Bracket cap screw (8)	162-00008-18
17	3-075-303-080	Bracket and bushing	162-00030-155
18	2-313-001-806-15C	Bracket gasket	162-00008-09
19	2-542-001-376	Pipe plug (3)	012-00001-00
20	2-194-801-100	Casing	162-00008-47
21	2-309-001-806-15C	Head gasket	162-00008-08
22	3-566-55H-012	Rotor ^{W}/shaft	162-00030-156
23	3-418-403-105-42	Idler ^{W}/bushing	162-00030-56
24	2-095-011-880-02	Idler bushing	162-00030-02
25	2-433-004-291	Idler pin	162-00030-157
26	3-370-401-088	Head ^{W}/idler pin	162-00030-158
27	2-150-004-255	Head cap screw	162-00008-18
28	2-556-006-375	Snap ring	162-00030-108

Troubleshooting the Pump

1. The pressure gauge installed on your TDH unit is the quickest and most accurate way of determining what is occurring in the pump. By installing a vacuum gauge on the suction side of the pump, you can have more pump operation information, too.
2. Check pump alignment.
3. Check piping to make sure that no strain is on the pump casing.
4. With the TDH unit off and power fully disconnected, rotate the pump shaft by hand to make sure it turns freely.

5. Jog the motor to make sure it is rotating in the proper direction.
6. If so equipped, make sure that the pressure relief valve is installed correctly.
7. Check suction piping to make sure:
   - it is connected tightly
   - valves are open
   - fluid has a place to go safely
8. Check discharge piping to make sure:
   - it is connected tightly
   - valves are open
   - the fluid has a place to go safely
9. Lubricate grease fitting(s) on the pump using good general purpose #2 ball bearing grease.
10. Do **not** use the pump with water to flush, pressure test, or prove the system. Remove the pump or run piping around it while flushing or testing. Pumping water, dirty or otherwise, can do more damage in a few minutes than months of normal service.
11. **Make sure all guards are in place.**

If the pump delivers fluid within one minute, it is working properly. If not, stop the TDH unit **immediately**. Do not run the pump without fluid in it or you will ruin it. Review the previous steps and prime the pump.

Energize the TDH unit again. If the fluid does not flow within two minutes, stop the unit. The pump is not a compressor, as it will not build up much air pressure. You may need to vent the drain line until the fluid begins to flow.

If the pump still doesn't deliver fluid, the cause may be one of the following:

- Suction line air leaks; vacuum gauge readings help you determine if this is the problem.
- End of the suction pipe is not submerged deep enough in the fluid.
- Suction lift is too great or suction piping is too small.
- Fluid vaporizes in the suction line before it gets to the pump.

If the pump still doesn't deliver fluid, review the steps in this section again. Review the following section, **Troubleshooting Pump Problems**, and try again. Contact the AEC, Inc. Service Department if you still have pump problems.

Troubleshooting Pump Problems

A properly installed and maintained pump gives long and satisfactory performance.

Note: Before making any pump adjustments or opening the pump chamber in any manner, make sure that:

- any pressure in the pumping chamber has been vented through the suction or discharge lines or other openings for this purpose
- the motor is locked out so it cannot be started while you work on the pump
- the pump is sufficiently cooled to no one will be burned when touching it

If trouble occurs, install a vacuum gauge in the suction port and a pressure gauge in the discharge port. These gauges can indicate where to locate the problem.

Vacuum Gauge — Suction Port

1. High vacuum reading indicates:
   - blocked suction line — stuck foot valve, closed gate valve, plugged strainer
   - fluid is too viscous to flow through piping properly
   - lift is too high
   - line is too small
2. Low reading indicates:
   - air leak in the suction line
   - end of the pipe is not in the fluid
   - pump is worn
   - pump is dry — must be primed
3. Fluttering, jumping, or erratic readings:
   - fluid is vaporizing
   - fluid is coming to the pump in slugs, a possible air leak, or an insufficient amount of fluid is available above the end of the suction pipe
   - vibrating from cavitation, misalignment, or damaged parts

Pressure Gauge — Discharge Port

1. High reading indicates:
    - fluid has high viscosity and small and/or long discharge line
    - partially closed gate valve
    - plugged filter
    - line partially plugged from buildup
    - fluid in pipe not up to temperature
    - fluid in pipe underwent a chemical reaction and solidified
    - relief valve set too high
2. Low reading indicates:
    - relief valve is set too high
    - relief valve poppet is not seating properly
    - bypass around the pump is partially open
    - too much extra clearance
    - worn pump
3. Fluttering, jumping, or erratic readings:
    - cavitation
    - fluid coming to the pump in slugs
    - air leak in the suction line
    - vibrating from misalignment or mechanical problems

Determining Pump Problems

A. Pump does not pump.

1. Pump lost priming — possible air leak, low tank levels, stuck foot valve.
2. Suction lift is too high.
3. Pump is rotating in the wrong direction.
4. The motor is not running at the proper speed.
5. Suction and discharge valves are not open.
6. Clogged strainer.
7. Open bypass valve, relief valve is set too low, relief valve poppet stuck open.

8. Pump is worn out.
9. Any changes in the fluid system or operation of the TDH unit, such as a new source of supply, more lines added, inexperienced operators, etc.
10. Tightened end clearance.
11. Incorrect head position.

B. Pump starts, then loses prime.

1. Empty supply tank.
2. Vaporized fluid in the suction line.
3. Air leaks or pockets in the suction line; air is leaking through packing or the mechanical seal.
4. Pump is worn out.

C. Pump is noisy.

1. Starved pump — heavy fluid cannot get to pump fast enough. Increase the suction pipe size or reduce the length.
2. Cavitating pump — fluid has vaporized in the suction line. Increase the suction pipe size or reduce the length; if pump is above the fluid, raise the fluid level closer to the pump. If the fluid is above the pump, increase the head of fluid.
3. Check motor and pump alignment.
4. Bent shaft or rotor tooth. Fix or replace.
5. Chattering relief valve — increase pressure setting.
6. Anchor base or piping more securely to eliminate or reduce vibration.
7. Foreign object getting into the pump through the suction port.

D. Pump not up to capacity.

1. Starving or cavitating — increase suction pipe size or reduce pipe length.
2. Partially clogged strainer.
3. Air leak in suction piping or along the pump shaft.
4. Pump is running too slowly. Check for proper motor wiring and speed.
5. Partially open bypass line around pump.
6. Stuck open relief valve or set too low.
7. Worn out pump.
8. Tighten end clearance.

9. Incorrect head position.

E. Pump takes too much power.

1. Runs too fast — check for correct motor speed, reducer ratio, sheave size, etc.
2. Liquid more viscous than the pump can handle. Heat the liquid, increase the pipe size, slow the pump down, or get a bigger motor.
3. Higher than calculated discharge pressure — check the pressure gauge. Increase the size, decrease the length of pipe, reduce speed/capacity, or get a bigger motor.
4. Packing gland is drawn down too tight.
5. Misaligned pump.
6. Clearance on pumping elements may not be sufficient for operating conditions. Check parts for evidence of drag or contact in the pump, and increase clearance where needed.

F. Rapid wear.

On most applications, the pump can operate for a long time before it gradually loses the ability to deliver capacity or pressure. You would see a smooth, even wear pattern on pump parts when examining such a pump. Rapid wear is indicated by deep, heavy grooving, galling, twisting, breaking, or similar signs of trouble.

Note the following table for rapid wear indications:

Symptom	Possible Cause	Solution
Gouges or marks made by large, hard particles; a rapid wearing of bushings from very small abrasives similar to pumice; or anything in between.	Abrasives	Flush the system after you remove the pump, using AEC TrueFlush™ flushing fluid or equivalent. Install a strainer in the suction line. Dirt and other contaminants are usually flushed out of the system in a few days. If the pump is rebuilt into good condition, it should last for a long time.

Symptoms	Possible Cause	Solutions
Rust, general overall aggressive attack or sloughing off metal.	Corrosion	Contact your AEC rep for pump construction material recommendations. Note if all materials used in pump were attacked. Note if the fluid was contaminated, making it more corrosive than expected.
Noisy operation, broken bushings, twisted shaft, evidence of high heat.	Exceeding operating limits	Note and follow operating limits for the TDH unit.
Pump stalls. Evidence of heavy contact between rotor teeth and head or other parts.	Insufficient clearance	Increase end clearance; contact your AEC rep to get information on proper extra clearance.
Noisy bearings, localized heating at bearings or lip seal, smoke rapid bushing wear.	Lack of lubrication	Grease all fittings before starting the pump; follow instructions for lubrication. Use auxiliary lubricating equipment.
Obvious uneven wear, such as on just one side of the casing or a portion of the head face.	Misalignment	Repeat alignment check of motor and pump as close to operating conditions as possible.
Pump stalls because of uneven parts expansion from frictional heat. Galling evident between surfaces having relative motion. Seat seals and idler pins change color from heat.	Dry running	Make sure that heat transfer fluid is in the system before you start the TDH unit.

Do's & Don'ts

Installation

- **Do** leave working space around the pump unit.
- **Do** use large, short, straight suction piping
- **Do** double-check alignment after the unit is mounted and piping is installed.
- **Do** record the pump model number and serial number; file for future reference.

Operation

- **Don't** run the pump at speeds faster than set specifications.
- **Don't** require the pump to develop pressures higher than set specifications.
- **Don't** operate the pump at temperatures above or below the limits in the set specifications.
- **Don't** operate the pump without **all guards fully in place.**
- **Don't** operate the pump without a pressure relief valve installed on the pump or the discharge piping; make sure the valve is installed and set correctly.
- **Don't** exceed set specifications for temperature and pressure of fluids in the jacketed areas of the pump.
- **Don't** use the pump in a system that includes a steam blow or an air or vapor blow or purge without provision for over speed shutdown if the pump begins acting like a turbine and over speeds the drive motor.
- **Do** have spare parts, pumps, or standby units available, especially if the pump is an essential part of a key operation or process.

Maintenance

- **Do** make sure that the drive motor is locked out when performing maintenance on the pump to prevent accidental starts.
- **Do** make sure that the pump has been drained, flushed, vented, and cooled before disassembly if it has handled corrosive, flammable, hot, or toxic liquids. See Section 6-3 on Page 46 for more information.
- **Don't** drop parts during disassembly. For example, the idler can slip from the pin during pump head removal, damaging the idler and possibly causing personal injury.
- **Don't** stick your fingers in the pump ports! Rotating parts can cause injury.
- **Don't** spin the idler on the idler pin. Fingers may jam between teeth and crescent.
- **Do** remember to follow a few simple preventive maintenance procedures, such as periodic lubrication, end clearance adjustment, and internal parts examination. You can extend the service life of your pump by practicing preventive maintenance.
- **Do** obtain, read, and keep maintenance instructions furnished with your TDH unit.

Figure 13
TDH Recommended Spare Parts

Part Number	Part Description
736-00009-00	Alarm Horn
042-00018-00	Swivel Single Zone Caster
042-00058-00	Swivel Dual Zone Caster
042-00019-00	Stationary Single Zone Caster
A0535011	¼ DIN NX Control
728-00119-00	25 Amp Disconnect Switch
728-00121-00	40 Amp Disconnect Switch
728-00122-00	63 Amp Disconnect Switch
728-00123-00	100 Amp Disconnect Switch
728-00130-00	200 Amp Disconnect Switch
156.00081.00	Electrical Enclosure
A0543668	TrueTemp™ graphic
A0543710	Graphic backer panel
542-00007-06	TDH4 6kW Heater Gasket
542-00007-08	TDH4 12kW Heater Gasket
542-00007-10	TDH5 All kW Heater Gasket
106-00167-00	TDH5 3.9 Sq. Ft. Heat Exchanger — HTX Assembly
106-00168-00	TDH5 6.7 Sq. Ft. Heat Exchanger — HTX Assembly
106-00169-00	TDH5 13.0 Sq. Ft. Heat Exchanger — HTX Assembly
106-00170-00	TDH5 21.0 Sq. Ft. Heat Exchanger — HTX Assembly
106-00024-00	TDH4 1.5 Sq. Ft. Heat Exchanger — HTX Assembly
106-00027-00	TDH4 3.7 Sq. Ft. Heat Exchanger — HTX Assembly
162-00047-10	TDH5 3.9 Sq. Ft. Heat Exchanger — Tube Bundle Only
162-00047-11	TDH5 6.7 Sq. Ft. Heat Exchanger — Tube Bundle Only
162-00047-12	TDH5 13.0 Sq. Ft. Heat Exchanger — Tube Bundle Only
162-00047-13	TDH5 21.0 Sq. Ft. Heat Exchanger — Tube Bundle Only
572-82482-00	TDH4 6kW Heater Tank
572-82767-00	TDH4 12kW Heater Tank
572-82139-00	TDH5 All kW Heater Tank

Figure 13 Cont'd.

Part Number	Part Description
722-00043-01	TDH4 400°F 6kW 230V Immersion Heater
722-00043-02	TDH4 400°F 6kW 460V Immersion Heater
722-00043-05	TDH4 400°F 6kW 575V Immersion Heater
722-00043-07	TDH4 400°F 6kW 208V Immersion Heater
722-00043-10	TDH4 400°F 6kW 415V Immersion Heater
722-00043-17	TDH4 400°F 6kW 380V Immersion Heater
722-00126-49	TDH4 400°F 12kW 230V Immersion Heater
722-00126-50	TDH4 400°F 12kW 460V Immersion Heater
722-00126-51	TDH4 400°F 12kW 575V Immersion Heater
722-00126-52	TDH4 400°F 12kW 208V Immersion Heater
722-82124-01	TDH5 550°F 12kW 208V Immersion Heater
722-82124-02	TDH5 550°F 18kW 208V Immersion Heater
722-82124-03	TDH5 550°F 24kW 208V Immersion Heater
722-82124-04	TDH5 550°F 12kW 230V Immersion Heater
722-82124-05	TDH5 550°F 18kW 230V Immersion Heater
722-82124-06	TDH5 550°F 24kW 230V Immersion Heater
722-82124-07	TDH5 550°F 12kW 380V Immersion Heater
722-82124-08	TDH5 550°F 18kW 380V Immersion Heater
722-82124-09	TDH5 550°F 24kW 380V Immersion Heater
722-82124-10	TDH5 550°F 12kW 415V Immersion Heater
722-82124-11	TDH5 550°F 18kW 415V Immersion Heater
722-82124-12	TDH5 550°F 24kW 415V Immersion Heater
722-82124-13	TDH5 550°F 12kW 480V Immersion Heater
722-82124-14	TDH5 550°F 18kW 480V Immersion Heater
722-82124-15	TDH5 550°F 24kW 480V Immersion Heater
722-82124-16	TDH5 550°F 12kW 575V Immersion Heater
722-82124-17	TDH5 550°F 18kW 575V Immersion Heater
722-82124-18	TDH5 550°F 24kW 575V Immersion Heater
A0541658	Green Indicator Light
A0541659	Red Indicator Light
A0543734	Amber Indicator Light
720-09217-00	¾ hp Motor
720-09240-00	1 hp Motor
720-09242-00	1½ hp Motor
720-09218-00	2 hp Motor
720-09231-00	3 hp Motor
037-00119-00	0-100 psi Pressure Gauge

Figure 13 Cont'd.

Part Number	Part Description
733-00029-00	Pressure Switch
075-00370-00	18-30 gpm Pump
075-00421-00	31-70 gpm Pump
724-00034-00	TDH4 200°F to 400°F Safety Thermostat
724-00041-00	TDH5 200°F to 550°F Safety Thermostat
A0542776	**Control Power ON-OFF** Selector Switch
A0546237	**Pump Start FORWARD-REVERSE** Selector Switch
A0546237	**Control Mode AUTO-MANUAL** Selector Switch
A0546238	**Alarm Silence** Selector Switch
732-00012-00	½" valve, 115V coil (0-125 psi, 300°F)
732-00013-00	¾" valve, 115V coil (0-125 psi, 300°F)
732-00036-00	1" valve, 115V coil (0-125 psi, 300°F)
701-00036-00	Type K Thermocouple Temperature Sensing Probe
A0549000	TrueTherm™ Heat Transfer Fluid, 5-Gallon Container
A0549001	TrueTherm™ Heat Transfer Fluid, 55-Gallon Drum
A0549002	TrueFlush™ Flushing Fluid, 5-Gallon Container

Electrical Components Parts List

	Transformer Primary Fuses					
kW	208 Volts	240 Volts	380 Volts	415 Volts	480 Volts	575 Volts
6	725-00753-00	725-00753-00	725-00751-00	725-00751-00	725-00751-00	725-00751-00
12	725-00753-00	725-00753-00	725-00751-00	725-00751-00	725-00751-00	725-00751-00
18	725-00753-00	725-00753-00	725-00751-00	725-00751-00	725-00751-00	725-00751-00
24	725-00753-00	725-00753-00	725-00751-00	725-00751-00	725-00751-00	725-00751-00
30	725-00753-00	725-00753-00	725-00751-00	725-00751-00	725-00751-00	725-00751-00
36	725-00755-00	725-00753-00	725-00751-00	725-00751-00	725-00751-00	725-00751-00
42	725-00755-00	725-00755-00	725-00751-00	725-00751-00	725-00751-00	725-00751-00
48	725-00755-00	725-00755-00	725-00751-00	725-00751-00	725-00751-00	725-00751-00

	Motor Fuses					
hp	208 Volts	240 Volts	380 Volts	415 Volts	480 Volts	575 Volts
¾	725-00761-00	725-00761-00	725-00759-00	725-00759-00	725-00758-00	725-00757-00
1	725-00810-00	725-00762-00	725-00759-00	725-00759-00	725-00758-00	725-00758-00
1½	725-00811-00	725-00811-00	725-00761-00	725-00760-00	725-00760-00	725-00759-00
2	725-00813-00	725-00813-00	725-00762-00	725-00761-00	725-00761-00	725-00760-00
3	725-00815-00	725-00815-00	725-00811-00	725-00811-00	725-00810-00	725-00761-00
5	725-00817-00	725-00816-00	725-00814-00	725-00814-00	725-00814-00	725-00812-00
7½	725-00783-00	725-00782-00	725-00816-00	725-00816-00	725-00815-00	725-00815-00
10	725-00785-00	725-00784-00	725-00817-00	725-00817-00	725-00816-00	725-00815-00

Electrical Components Parts List Cont'd.

Heater Fuses						
kW	208 Volts	240 Volts	380 Volts	415 Volts	480 Volts	575 Volts
6	725-00676-00	725-00675-00	725-00698-00	725-00698-00	725-00698-00	725-00698-00
12	725-00680-00	725-00679-00	725-00676-00	725-00676-00	725-00675-00	725-00674-00
18	725-00683-00	725-00682-00	725-00678-00	725-00678-00	725-00677-00	725-00676-00
24	725-00685-00	725-00684-00	725-00681-00	725-00680-00	725-00679-00	725-00677-00
30	725-00688-00	725-00685-00	725-00682-00	725-00682-00	725-00680-00	725-00679-00
36	725-00688-00	725-00687-00	725-00683-00	725-00683-00	725-00682-00	725-00680-00
42	725-00689-00	725-00689-00	725-00684-00	725-00684-00	725-00683-00	725-00682-00
48	725-00695-00	725-00689-00	725-00686-00	725-00685-00	725-00684-00	725-00682-00

RVS Motor Starters						
hp	208 Volts	240 Volts	380 Volts	415 Volts	480 Volts	575 Volts
¾	726-00186-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00
1	726-00186-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00
1½	726-00186-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00
2	726-00186-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00
3	726-00187-00	726-00187-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00
5	726-00188-00	726-00188-00	726-00186-00	726-00186-00	726-00186-00	726-00186-00
7½	726-00189-00	726-00189-00	726-00188-00	726-00188-00	726-00187-00	726-00186-00
10	726-00191-00	726-00190-00	726-00189-00	726-00189-00	726-00188-00	726-00187-00

Transformers						
kW	208 Volts	240 Volts	380 Volts	415 Volts	480 Volts	575 Volts
6	704-00060-00	704-00052-00	704-00004-00	704-00068-00	704-00052-00	704-00054-00
12	704-00060-00	704-00052-00	704-00004-00	704-00068-00	704-00052-00	704-00054-00
18	704-00060-00	704-00052-00	704-00004-00	704-00068-00	704-00052-00	704-00054-00
24	704-00060-00	704-00052-00	704-00004-00	704-00068-00	704-00052-00	704-00054-00
30	704-00060-00	704-00052-00	704-00004-00	704-00068-00	704-00052-00	704-00054-00
36	704-00006-00	704-00052-00	704-00004-00	704-00068-00	704-00052-00	704-00054-00
42	704-00006-00	704-00089-00	704-00004-00	704-00068-00	704-00052-00	704-00054-00
48	704-00006-00	704-00089-00	704-00004-00	704-00068-00	704-00052-00	704-00054-00

Mercury Heater Contactors						
kW	208 Volts	240 Volts	380 Volts	415 Volts	480 Volts	575 Volts
6	A0530042	A0530042	A0530042	A0530042	A0530042	A0530042
12	A0500515	A0500515	A0530042	A0530042	A0530042	A0530042
18	A0502728	A0500515	A0530809	A0530809	A0530042	A0530042
24	A0544085	A0502728	A0500515	A0500515	A0500515	A0530809
30	A0544086	A0544085	A0500515	A0500515	A0500515	A0500515
36	A0544086	A0544086	A0502728	A0502728	A0500515	A0500515
42	A0544086	A0544086	A0502728	A0502728	A0502728	A0500515
48	NA	A0544086	A0544085	A0544085	A0502728	A0502728

Auxiliary Contactors			
Contactor 1	725-00175-179	Contactor 2	725-00180-197
Auxiliary Device for Contactor 1	162-00009-61	Auxiliary Device for Contactor 2	162-00009-62

Electrical Components Parts List Cont'd.

Motor Overloads						
hp	208 Volts	240 Volts	380 Volts	415 Volts	480 Volts	575 Volts
¾	731-00258-00	731-00258-00	731-00256-00	731-00256-00	731-00256-00	731-00255-00
1	731-00258-00	731-00258-00	731-00256-00	731-00256-00	731-00256-00	731-00256-00
1½	731-00259-00	731-00259-00	731-00259-00	731-00259-00	731-00257-00	731-00256-00
2	731-00260-00	731-00260-00	731-00258-00	731-00258-00	731-00258-00	731-00257-00
3	731-00261-00	731-00261-00	731-00259-00	731-00259-00	731-00259-00	731-00258-00
5	731-00263-00	731-00263-00	731-00261-00	731-00261-00	731-00261-00	731-00260-00
7½	731-00270-00	731-00270-00	731-00263-00	731-00263-00	731-00262-00	731-00261-00
10	731-00272-00	731-00272-00	731-00268-00	731-00268-00	731-00263-00	731-00262-00

Motor Starter Fuse Blocks			
30 amps, 208 through 575 volts	725-00818-00	60 amps, 208 through 575 volts	725-00793-00

Heater Contactor Fuse Blocks			
30 amps, 208 through 575 volts	725-00692-00	60 amps, 208 through 575 volts	725-00693-00
100 amps, 208 through 575 volts	725-00673-00	200 amps, 208 through 575 volts	725-00691-00

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