MODEL # KM550-12-483
SERIAL # 99-1218-1A to 1J

DESIGN DATA

Temperature Limits: 50° F Min., 550° F Max.
Pressure Limits: 1 Atm Min., 75 PSI Max.
Flow Limits: 8 GPM Min., 72 GPM Max.
Tank Level Limits: 3" Min., 11" Max.
Expansion Tank Rating: 15 PSIG AT 450° F
Initial Fill Capacity: 10 Gallons
Empty Weight of System: 600 Pounds
Electrical Classification: NEMA 12

OPERATIONAL DATA

Heat Transfer Fluid: Paratherm NF
Fluid Temperature Range: -13° F to 600° F
Heater Rating: 12 KW on 480 VAC, 3ø, 14.4 FLA
Motor Rating: 3 HP, 460 VAC, 3ø, 60 Hz, 4 FLA
Expansion Tank Normal Pressure: Atmos.
Remarks:

Special Design: Automatic Bypass with Hand Valves, Auto Air Bleed, Cascade TIC, Mold Temperature Indicator, Pump Monitor with Alarm Horn

UTILITIES

Power: 480 VAC, 3ø, 60 Hz, 19 FLA

SEQUENCE OF OPERATION
99-1218-1A to 1J

NORMAL OPERATION:

1. TURN THE DISCONNECT (DISC) TO THE "ON" POSITION. THE WHITE "POWER ON" LIGHT (W), TEMPERATURE INDICATING CONTROLLER (TIC), TEMPERATURE INDICATOR (TI) AND PUMP POWER MONITOR (PM) ENERGIZE.

NORMAL/RUN MODE:

2A. TURN THE MODE SELECTOR SWITCH (SS-2) TO THE "NORMAL/RUN" POSITION. THIS ENSURES THAT THE B-SIDE MOLD TEMPERATURE IS THE PRIMARY INPUT TO THE TEMPERATURE CONTROLLER, THAT THE AUTOMATIC BYPASS VALVE IS CLOSED AND THAT THE TEMPERATURE CONTROLLER SETPOINT IS FOR NORMAL RUN CONDITIONS.

MOLD CHANGE MODE:

2B. TURN THE MODE SELECTOR SWITCH (SS-2) TO THE "MOLD CHANGE" POSITION. THIS ENSURES THAT THE OIL TEMPERATURE IS THE PRIMARY INPUT TO THE TEMPERATURE CONTROLLER, THAT THE AUTOMATIC BYPASS VALVE IS OPENED AND THAT THE TEMPERATURE CONTROLLER SETPOINT IS FOR IDLE CONDITION.

3. TO ENERGIZE THE PUMP, PRESS THE "PUMP START" BUTTON (PB-2) UNTIL THE PUMP CIRCUIT ENERGIZES. THE GREEN "PUMP ON" LIGHT (G) AND MOTOR STARTER (1M) ENERGIZE.

4. TO ENERGIZE THE HEATER CIRCUIT, PRESS THE "RESET" BUTTON (PB-3) TO RESET THE HIGH TEMPERATURE SWITCH (TSH). TURN THE HEATER SELECTOR SWITCH (SS-1) TO THE "ON" POSITION. THE HEATER CONTACTOR (C) AND AMBER "HEAT ON" LIGHT (A) ENERGIZE. THE SCR (JC) WILL PROPORTION THE OUTPUT POWER ACCORDING TO THE INPUT FROM THE TEMPERATURE CONTROLLER.

5. THE TEMPERATURE INDICATING CONTROLLER (TIC) WAS FACTORY SET BY H.E.A.T., INC. WITH THE FOLLOWING CONFIGURATION:
   A. THE PRIMARY INPUT IS SET FOR RTD, DEGREES F READING.
   B. THE SECONDARY INPUT IS SET FOR RTD, DEGREES F READING.
   C. THE OUTPUT IS SET FOR ONE SSR OUTPUT.
   D. THE CONTROL ALGORITHM IS SET FOR PID.
   E. THE SETPOINT LIMITS ARE SET FOR 50-450° F.
   F. THE EVENT INPUT IS SET FOR IDLE SETPOINT SELECTION.

NOTE: THE AUTO-TUNING PROCEDURE SHOULD BE USED ON THE TEMPERATURE CONTROLLER TO OPTIMIZE THE CONTROL PROCESS. PLEASE REFER TO WATLOW MODEL 988/989 USER'S MANUAL FOR AN EXPLANATION OF THE AUTO-TUNING PROCEDURE.

ALARM CONDITIONS:

1. THE FOLLOWING CONDITIONS CAUSE THE PUMP TO SHUT OFF:
   A. THE "PUMP STOP" BUTTON (PB-1) IS PRESSED.
   B. THE THERMAL OVERLOADS (OL) OF THE MOTOR STARTER (M) TRIP. THE OVERLOADS MAY BE RESET BY PRESSING THE RESET LEVER ON THE MOTOR STARTER INSIDE THE CONTROL BOX ONLY AFTER THE CONDITION HAS RETURNED TO NORMAL.

ALARM CONDITIONS: (CONTINUED)

2. THE FOLLOWING CONDITIONS CAUSE THE RED “PUMP PROBLEM” LIGHT (R) AND ALARM HORN TO ENERGIZE:
   A. THE PUMP POWER MONITOR LOW TRIP ALARM (PM-1) IS ENERGIZED.
   B. THE PUMP POWER MONITOR HIGH TRIP ALARM (PM-2) IS ENERGIZED.

3. THE FOLLOWING CONDITIONS CAUSE THE HEATER CIRCUIT TO SHUT OFF:
   A. THE PUMP IS DE-ENERGIZED FOR ANY REASON.
   B. THE HIGH TEMPERATURE SWITCH (TSH) IS TRIPPED. RESET THE SWITCH BY PRESSING THE "RESET" PUSHBUTTON (PB-3) ONLY AFTER THE TEMPERATURE HAS RETURNED TO NORMAL.
   C. THE TEMPERATURE INDICATING CONTROLLER (TIC) SENSES A TEMPERATURE EQUAL TO THE SETPOINT. [NOTE: THE "HEAT ON" LIGHT (A) REMAINS ENERGIZED, HOWEVER, THE SCR OUTPUT IS ZERO.]
   D. THE HEATER SELECTOR SWITCH (SS-1) IS TURNED TO THE "OFF" POSITION.

Bill of Materials for Job # 001218-1 KM550-12-483

Item #	HEAT Part #	Qty	Description
PUMP	MP1210404803SHTO	1	Pump, 1.5" x 1.25" x 6", 5.90" impeller, 3 HP, 460/3/60, premium efficiency, TEFC driver. MP Pumps # HTO-80
LI	SG04X096BW	1	Sight Glass, 1/2" NPT tank connection, 5/8" x 12" long glass tube, brass shutoff valves with safety check. Conbraco # 20-150-00
	WIK1201100BB	1	Pressure Gage, 1.5" dia, 0-100 psi, 1/8" NPT center back connection, copper alloy wetted, air service. Wika model # 111.10, Wika part # 9690234
	WMSC024030050	1	Cabinetry, special, 24" x 30" x 50" per HEAT dwg. 1218-1DA. Base and base supports to be #11 ga. c.s., 3/4" square tubing frame, removable front, sides, top and back with slotted recessed style 1/4 turn latches.
	1218CASTER	4	Caster, 1/2"-13 x 1-1/2" lg. straight thread stem, polyurethane Hi-tech wheel, ball bearings, 250 lb. capacity, Colson # 2.03254.95(53)
	HOF8X8CL	2	Louver Kit, 8"x8", 14 Ga. carbon steel. Hoffman # A-VK88
TE2	PYR03006RTD120	1	RTD, dual element, 3-wire, 6" long, 3/16" dia. SS sheath, 120" SS armored leadwire with high temperature transition fitting and strain relief. Pyromation # R1T285H38063-00-15H-8A120-1
TE1, TE4	ATSRTD	2	RTD, single element, 3-wire, 3" long, 3/16" dia. SS sheath, with SS armored leadwire and special spring-loaded connector. ATS # RBF185AA3-3A288-006-2P3B
PI	WIK2002100BBLF	1	Pressure Gage.2.5" dia, 0-100 psi/kgcm2, 1/4" center back connection, copper alloy wetted, glycerine filled, with stainless steel front flange. Wika model # 213.53, Wika part # 9693895/1327063
	DEI1SWCTRLVLV	1	Control Valve, 1" S.W., 2-way, 3 piece, C.S. ball type, with multifill seats and spring-return type AF120, 120 Volt electric actuator, DEI # 2-100-035-3PC-CSB-HT
	DEI1SWBV	2	Ball Valve, 1" S.W., 3 piece, C.S. body, S.S. ball and stem, multifill seats, Apollo # 83-445-64A

Bill of Materials for Job # 001218-1 CC12-124-483

Item #	HEAT Part #	Qty	Description
BOX	HOF24240804WM	1	Box, 24"x24"x8", NEMA 12/4, 16 Ga. carbon steel, wall mount. Hoffman # C-SD242408
PANEL	HOF2424WM	1	Panel, 24"x24", (22.20"x22.20" actual), carbon steel. Hoffman# C-P2424
DISC, FB-1	AB194R30ADISC	1	Disconnect Kit, 30 Amp, 600 V, 3 pole, with red and yellow NEMA 12 rotary handle, shaft and operating mechanism, with class CC fuse clips, Allen Bradley # 194R-NC030P34ER1
FB-2, FB-3	BUS030600M	2	Fuseblock, 30A, 600V, class CC, Bussman # BC6033PQ
1FU-3FU	BUS00300LPCC	3	Fuse, 30A 600V class CC, DE, time delay, low peak. Bussman # LP-CC-30
4FU-6FU	BUS00200LPCC	3	Fuse, 20A 600V class CC, DE, time delay, low peak. Bussman # LP-CC-20
7FU-9FU	BUS00100LPCC	3	Fuse, 10A 600V class CC, DE, time delay, low peak. Bussman # LP-CC-10
10FU, 11FU	BUS00005CC	2	Fuse, 1/2A 600V Class CC, time delay. Bussman # FNQ-R-1/2
12FU	BUS00020CC	1	Fuse, 2A 600V class CC, fast acting. Bussman # KTK-R-2
TF, FB-4	SQD0150480F	1	Transformer, 240/480V primary, 120V secondary, with top mounted fuseblock. Square D # 9070TF150D1
JC	WTL0206032C	1	SCR, 20A 600V 3P-2leg, burst fire output, 120VAC input, no fan. Watlow # DB2C-2060-K200
C	AB030600IE16	1	Contactor, 30A 600V 3P, 120V 60 Hz coil, IEC style. Allen-Bradley # 100-NX66D
M	AB053126I	1	Starter, 5 HP max, AB, 600V 3P, 120 VAC 60 Hz coil, IEC style. Allen-Bradley # 100-C09D10
OL	ABEA1EB	1	Overload, 1.6-5.0 A, solid state, 3 pole, 1 N.O. alarm contact, manual reset. Allen-Bradley # 193-EA1EB
AUX. CONT.	AB2NO100	1	Auxilliary Contact, 2 N.O., front mount, for use with all 100-C devices. Allen-Bradley # 100-FA20

Bill of Materials for Job # 001218-1 CC12-124-483

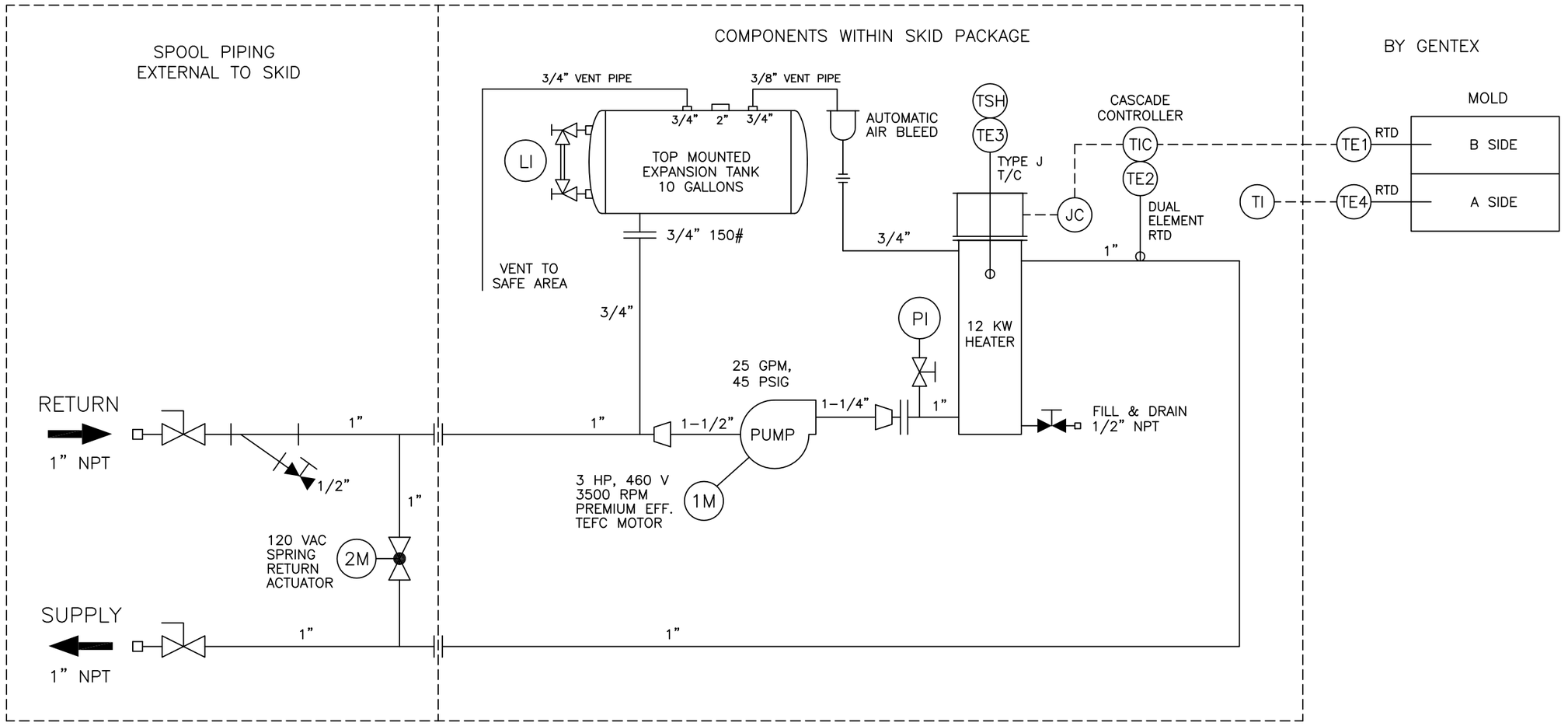
Item #	HEAT Part #	Qty	Description
PM, CT	LCIPMP25	1	Pump Motor Power Monitor, for 3 HP, 460 V, 3ø motor, S.P.D.T. high and low trip alarms, 4-20 mA output, with current transformer and optional panel mount kit for door mounting, Load Controls, Inc. # PMP-25
HORN	EDW870PN5	1	Adaptahorn Vibrating Horn, flush type, 103 dB @ 10 ft., 120 VAC, 15.6 VA, NEMA 4X rated. Edwards # 870P-N5
TIC	WTL988B22KA	1	TIC, 1/8 DIN, (2) universal inputs, (1) SSR output, 100-240V, cascade configuration, green / red display. Watlow # 988B-22KA-AAGR
TI	WTL96A0CAAA	1	TI, 1/16 DIN, unused open collector output, RTD input, 100-240V, green/red display. Watlow # 96AO-CAAA-00GR
TSH	WTL475FJ120R	1	TSH, 475F setpoint, type J input, 120 VAC, SPDT, manual reset. Watlow # 142A-3612-1200
CR1-CR3	ID4PDTB120V	3	Relay, 4PDT, 10A 120V, blade type, CE mark. Idec # RH4B-ULAC120v
CR SOCKET	ID14BMS	3	Socket, 14 blade, pressure plate terminals, finger safe. Idec # SH4B-05C
W	ABWPLIEC	1	Pilot light, AB, white lens, 22.5mm, plastic bezel, NEMA 12,4,4X rated. Allen-Bradley # 800E-PL1
LT MODULE	AB120VMODIEC	1	Pilot light module, AB, 120V with full voltage incadescent bulb. Allen-Bradley # 800E-3DL5
W TAG	TLPO	1	Legend plate, "POWER ON", 27x8mm plate, black letters with white background. Telemecanique # ZA2BZ32102 custom
PB-1	ABRPBIECO	1	Pushbutton, AB, red flush, 22.5mm, plastic bezel, NEMA 12,4,4X rated. Allen-Bradley # 800EP-F4
NC CONTACT	AB1NC800E	1	Contact block, AB, 1 N.C., 120V with mounting collar. Allen-Bradley # 800E-3LX01
PB-1 TAG	TLSTOP	1	Legend plate, "STOP", 27x8mm plate, white letters with red background. Telemecanique # ZA2BZ32304
PB-2, G	ABGIPBIECO	1	Pushbutton, AB, green illuminated flush, 22.5mm, plastic bezel, NEMA 12,4,4X rated. Allen-Bradley # 800EP-LF3

Bill of Materials for Job # 001218-1 CC12-124-483

Item #	HEAT Part #	Qty	Description
PB MODULE	AB120V1NO	1	Light module assembly, AB, 120V, 1 N.O. contact, full voltage incadescent bulb. Allen-Bradley # 800E-3DL5X10
PB-2 TAG	TLPUO	1	Legend plate, "PUMP ON", 27x8mm legend, black letters with white background. Telemecanique # ZA2BZ32012 custom
PB-3	ABBPBIECO	1	Pushbutton, AB, black flush, 22.5mm, plastic bezel, NEMA 12,4,4X rated. Allen-Bradley # 800EP-F2
NO CONTACT	AB1NO800E	1	Contact block, AB, 1 N.O., 120V with mounting collar. Allen-Bradley # 800E-3LX10
PB-3 TAG	TLRESET	1	Legend plate, "RESET", 27x8mm plate, black letters with white background. Telemecanique # ZA2BZ32102 custom
SS-1, A	AB2AISSIECO	1	Selector switch, AB, amber illuminated, 2 position, 22.5mm, plastic bezel, NEMA 12,4,4X. Allen-Bradley # 800EP-LSM25
SS MODULE	AB120V1NO	1	Light module assembly, AB, 120V, 1 N.O. contact, full voltage incadescent bulb. Allen-Bradley # 800E-3DL5X10
SS-1 TAG	TLHOO	1	Legend plate, "HEAT OFF/ON", 27x8mm plate, black letters with white background. Telemecanique # ZA2BZ32102 custom
SS-2	AB2SSIECO	1	Selector switch, AB, 2 position, non-illuminated, 22.5mm, plastic bezel, NEMA 12,4,4X rated. Allen-Bradley # 800EP-SM22
NO CONTACT	AB1NO800E	1	Contact block, AB, 1 N.O., 120V with mounting collar. Allen-Bradley # 800E-3LX10
R	ABRPLIEC	1	Pilot light, AB, red lens, 22.5mm, plastic bezel, NEMA 12,4,4X rated. Allen-Bradley # 800E-PL4
LT MODULE	AB120VMODIEC	1	Pilot light module, AB, 120V with full voltage incadescent bulb. Allen-Bradley # 800E-3DL5
R TAG	TLPUMPPROBLEM	1	Legend plate, "PUMP PROBLEM", 27x8mm plate, black letters with white background. Telemecanique # ZA2BZ32102 custom
	1218TAGS	1	Lot of Tags for control box door and valves, all to be yellow textured plastic with black lettering, 14 per machine required.

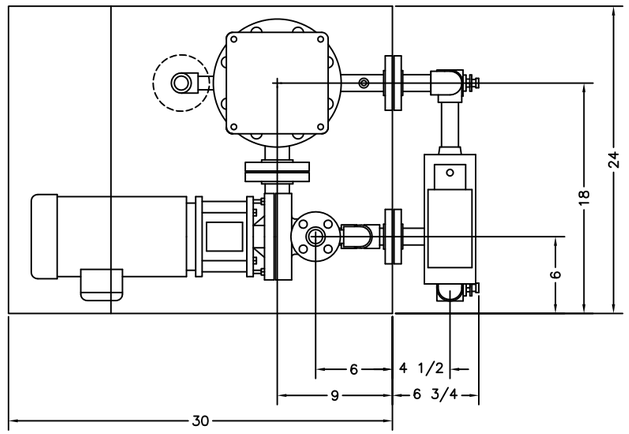
Bill of Materials for Job # 001218-1 CC12-124-483

Item #	HEAT Part #	Qty	Description
NC CONTACT	AB1NC800E	1	Contact block, AB, 1 N.C., 120V with mounting collar. Allen-Bradley # 800E-3LX01

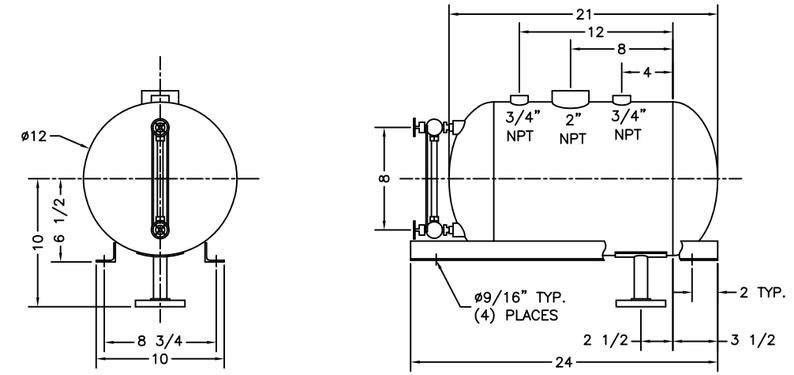


HEAT EXCHANGE AND TRANSFER, Inc.
500 Superior Street · Carnegie, PA 15106
Phone: 412-276-3388 · Fax: 412-276-3397
Electric · Process · Heating · Equipment

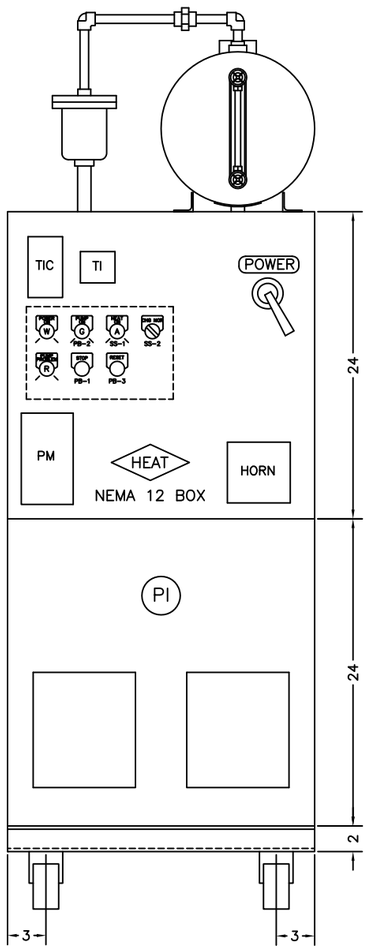
SERIAL NUMBER: 99-12181A		DRAWN BY:	S. LANZA
JOB NUMBER: 1218-1		ENGINEER:	S. LANZA
		APPROVED BY:	S. LANZA
CUSTOMER:			
P.O. NUMBER:			
MODEL#: KM550-12-483 PIPING & INSTRUMENT DIAGRAM			
SCALE: NTS	DATE: 11/11/99	SHEET SIZE: B	DRAWING NUMBER: 1218-1MB / REVISION #: 1



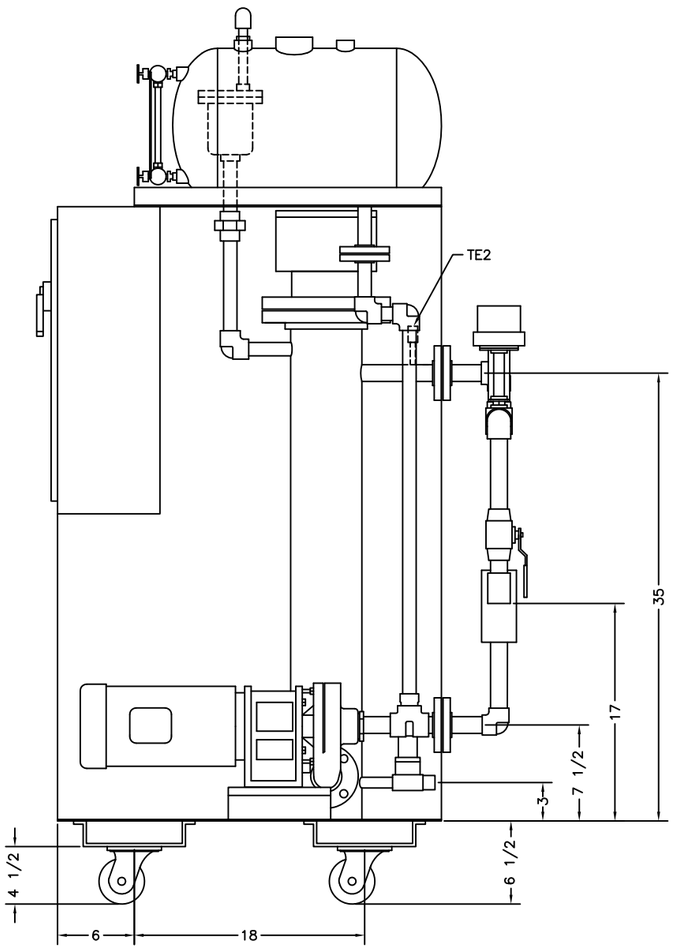
PLAN VIEW



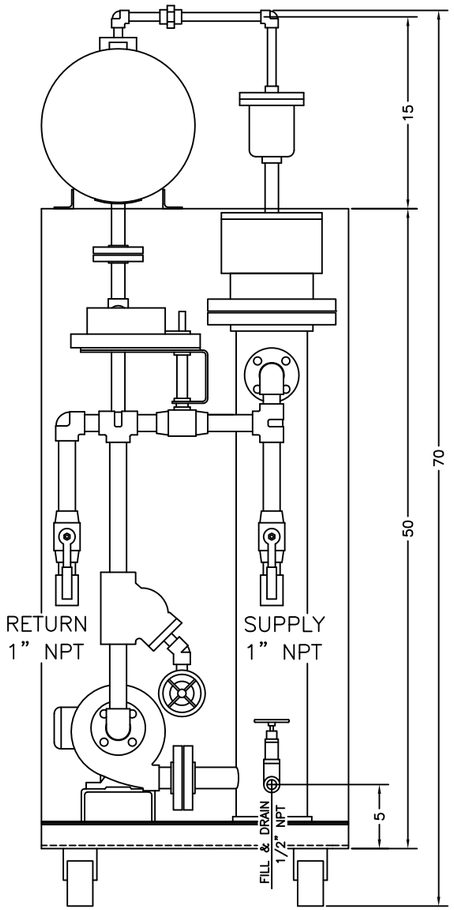
10 GALLON EXPANSION TANK



FRONT VIEW



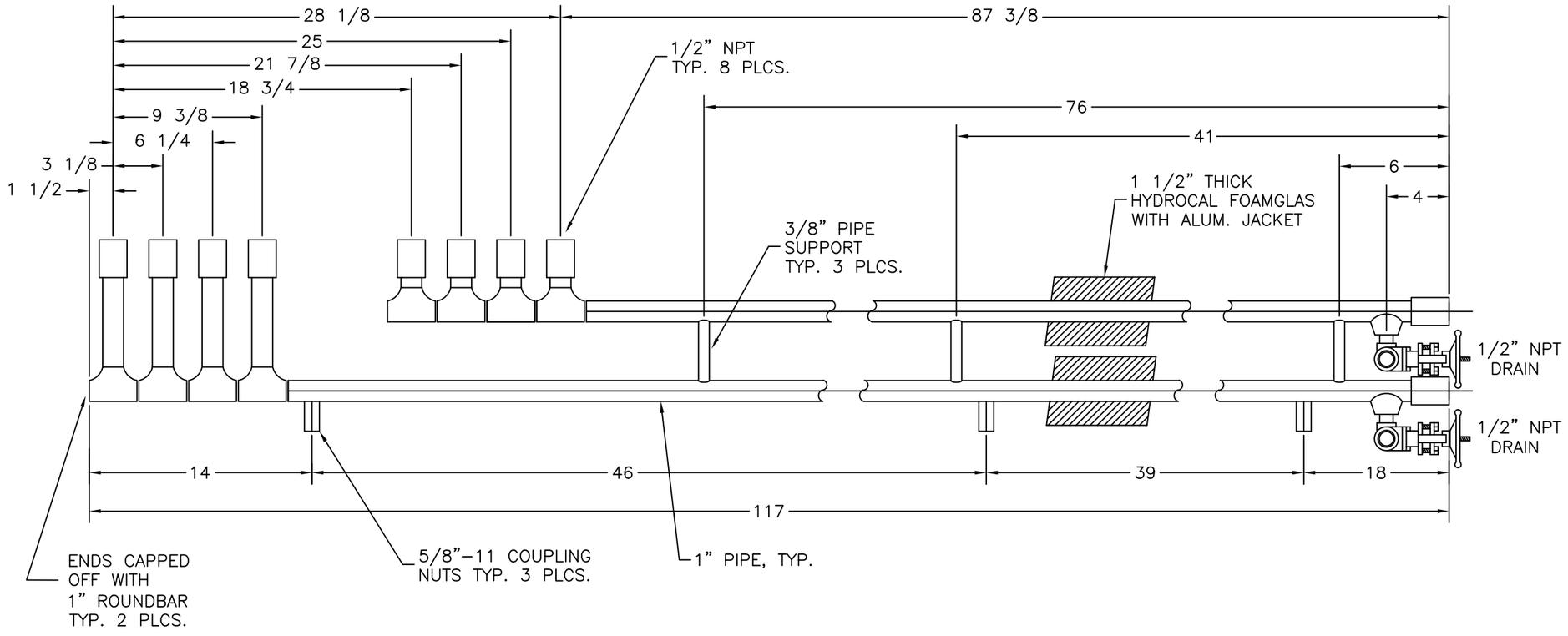
SIDE VIEW



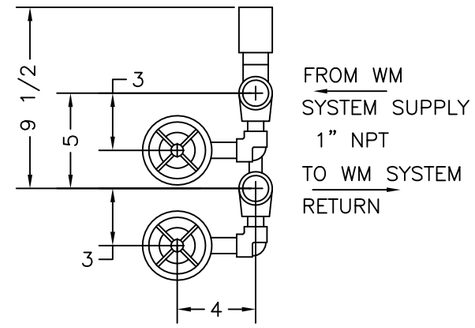
BACK VIEW

HEAT EXCHANGE AND TRANSFER, Inc.
500 Superior Street · Carnegie, PA 15106
Phone: 412-276-3388 · Fax: 412-276-3397
Electric · Process · Heating · Equipment

SERIAL NUMBER: 99–1218–1A		DRAWN BY:	S. LANZA
JOB NUMBER: 1218–1		ENGINEER:	S. LANZA
		APPROVED BY:	S. LANZA
CUSTOMER:			
P.O. NUMBER:			
MODEL#: KM550–12–483 GENERAL ARRANGEMENT			
SCALE: 1=12	DATE: 12/15/99	SHEET SIZE: B	DRAWING NUMBER: 1218–1MA / REVISION #: 3



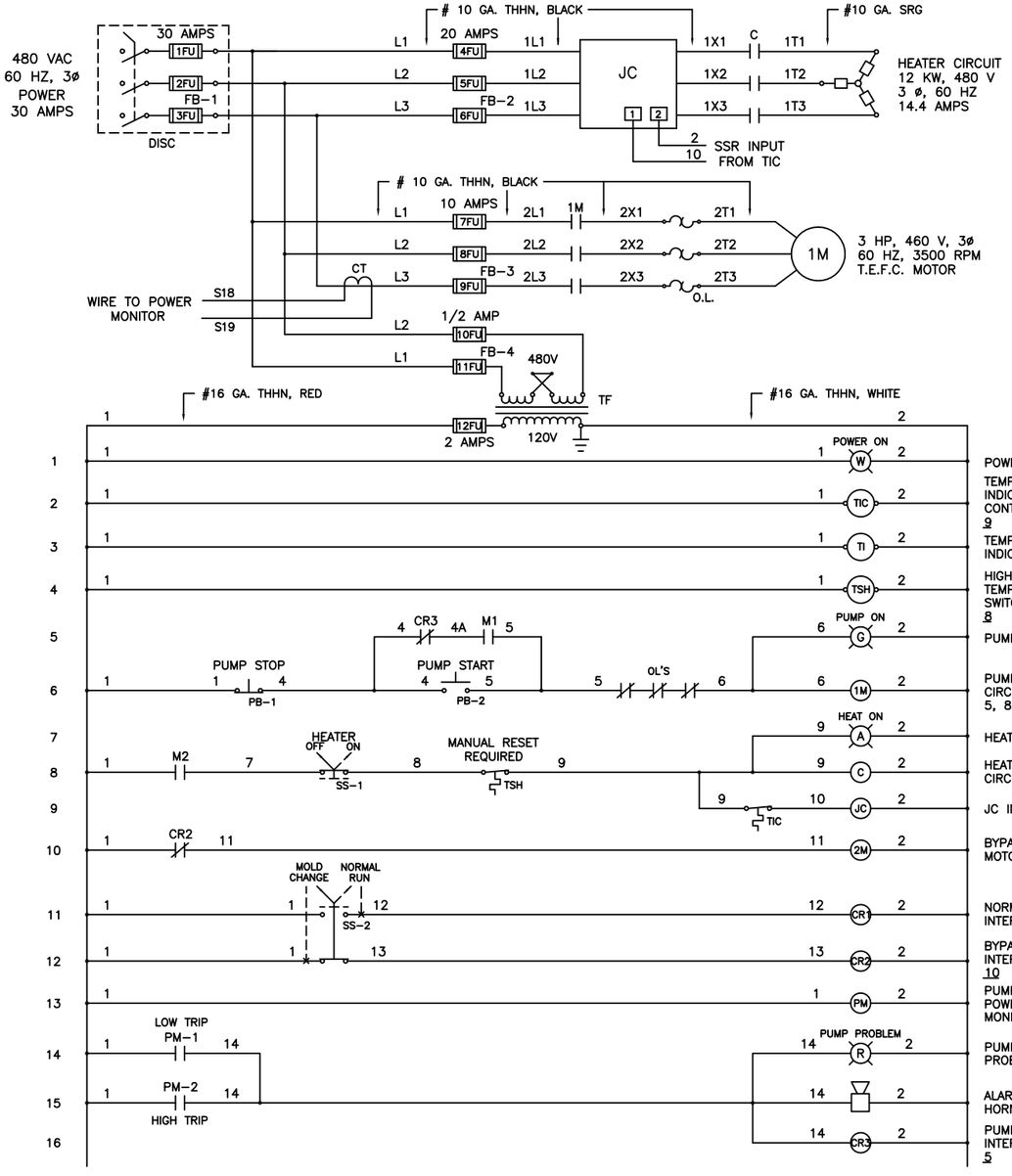
SIDE VIEW

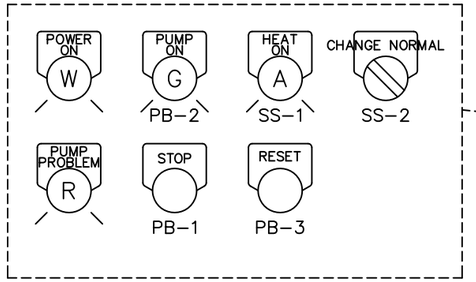


END VIEW

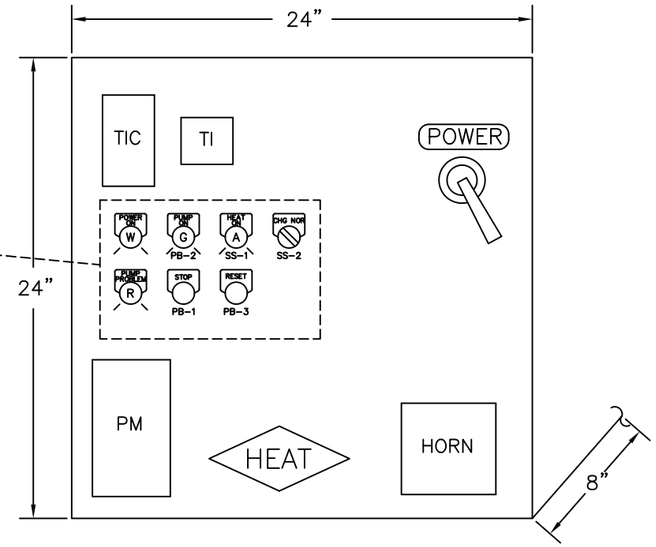
10 PCS. REQUIRED

TOLERANCES (EXCEPT AS NOTED)	**HEAT** INC. CARNEGIE, PA.		
DECIMAL ± ——	REF: 1218-2	SCALE NTS	DRAWN BY M.J.S APPROVAL BY S.M.L
FRACTIONAL ± ——	TITLE SUPPLY / RETURN HEADER GENERAL ARRANGEMENT		
ANGULAR ± ——	DATE 11/04/99	DRAWING NUMBER 1218-2MA	REVISION # 1

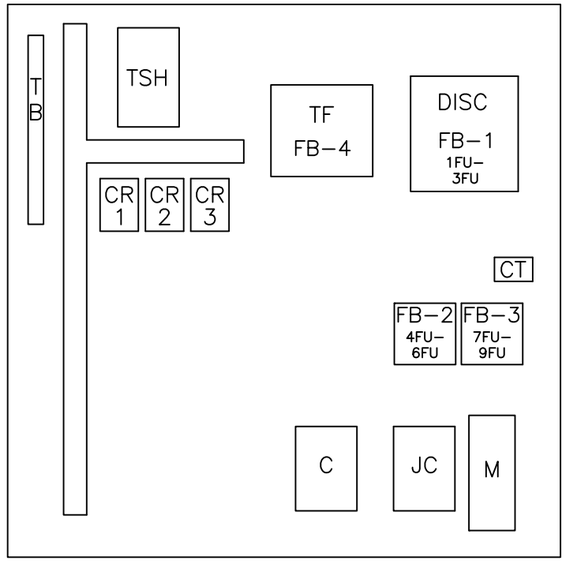




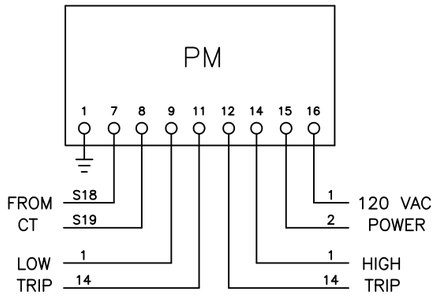
OPERATOR INTERFACE

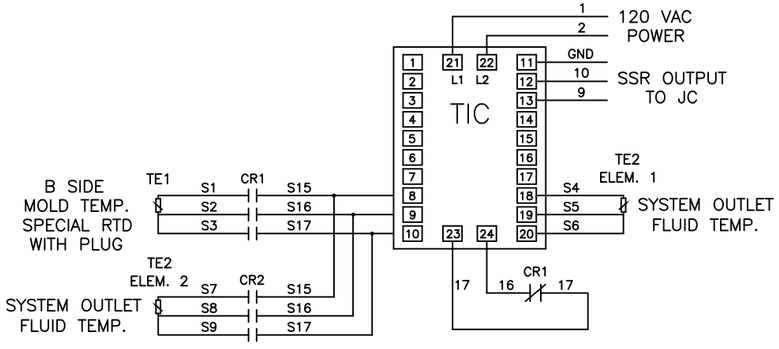


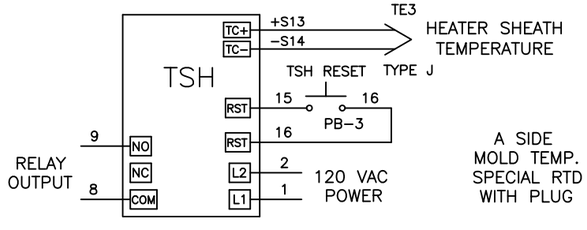
DOOR LAYOUT

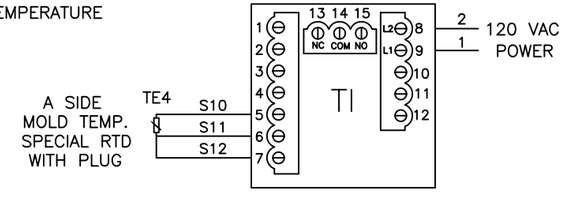


PANEL LAYOUT









HEAT EXCHANGE AND TRANSFER, Inc.	500 Superior Street · Carnegie, PA 15106 · Phone: 412-276-3388 · Fax: 412-276-3397 · *Electric · Process · Heating · Equipment*
SERIAL NUMBER: 99-1218-1A	DRAWN BY: S. LANZA
JOB NUMBER: 1218-1	ENGINEER: S. LANZA
	APPROVED BY: S. LANZA
CUSTOMER:	
P.O. NUMBER:	
MODEL#: KM550-12-483 CONTROL CENTER WIRING AND LAYOUT	

SCALE:	DATE:	SHEET SIZE:	DRAWING NUMBER:	REVISION #
NTS	12/15/99	B	1218-1EA	1

HEAT EXCHANGE AND TRANSFER, INC.
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E-Mail: sales@heat-inc.com
Web: www.heat-inc.com

SERVICE MANUAL
SM-100
February, 2005

ELECTRIC FLUID HEAT TRANSFER SYSTEMS

TABLE OF CONTENTS

GENERAL

This Service Manual is furnished to aid the customer in checking, installing and operating Heat Exchange and Transfer, Inc.'s fluid heat transfer systems. It does not, however, replace or modify commonly recognized practices or instructions published by suppliers of heat transfer fluids. Refer to the equipment data sheet for the system's model number, ratings (electrical, temperature and pressure) and other important information.

NOTHING IN THIS MANUAL IS INTENDED TO REPLACE OR MODIFY THE STANDARD LIMITED EXPRESS WARRANTY OF HEAT EXCHANGE AND TRANSFER (HEAT) INC. (DESCRIBED ON PAGE 12 OF THIS MANUAL) WHICH IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE WARRANTY OF MERCHANTABILITY, THE WARRANTY OF SUITABILITY OR FITNESS FOR USE AND THE WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE OR USE. NO WARRANTIES OR REPRESENTATIONS AT ANY TIME MADE BY ANY PERSON (DISTRIBUTOR, SALES REPRESENTATIVE OR EMPLOYEE) SHALL BE EFFECTIVE AGAINST HEAT TO MODIFY OR EXPAND THE LIMITED EXPRESS WARRANTY OF HEAT OR TO OTHERWISE OBLIGATE HEAT TO THE CUSTOMER OR TO ANY OTHER PARTY.

HEAT's fluid heat transfer system includes: heaters, circulating pump, expansion tank, control center, indicating controller, high limit switch and interconnecting piping and pipe fittings. These industrial rated components are assembled to form a packaged machine on a metal skid base. The system has been factory tested at operating temperature and is ready to operate once it has been piped to the process, wired to the appropriate electrical supply and filled with heat transfer fluid. A brief description of the system's major components and optional items follows:

CAUTION: Hazard of electric shock. All equipment involving electricity must be grounded to earth as per National Electric Code (NEC) and local codes.

MAJOR COMPONENT DESCRIPTIONS

HEATER

The fluid heater is designed especially for heat transfer fluid service and offers many distinct features. Each immersion heater assembly is constructed from metal sheathed elements. The elements consist of a resistance coil wound from a high quality nickel alloy, centered inside the metal sheath. The metal sheath is filled with magnesium oxide for electrical insulation and heat conduction. The elements are rolled to compact the magnesium oxide and are then formed into a hairpin design or "U" shape. Bundles of these hairpin elements are welded to a flange. Baffles are included in the bundle to direct the flow across the elements and maintain element spacing.

The immersion heater is designed specifically for each application. The following criteria are considered:

1. Maximum and normal operating temperatures
2. The heat transfer fluid being used
3. The watt density of the heating element
4. The sheath material of the heating element
5. The length of cold section of the heating element
6. The proper baffling to control the velocity and flow path of the heat transfer fluid

MAJOR COMPONENT DESCRIPTIONS

HEATER (continues)

The terminal housing, bussing and wire connections for the heater circuits are designed in accordance with the National Electric Code (NEC). The immersion heater is installed in the heater chamber and pressure tested for leaks.

NOTE: To ensure the system's proper performance, all replacement heaters should be from HEAT.

PUMPS

The three styles of pumps used in heat transfer systems are centrifugal, positive displacement (gear) and turbine.

Centrifugal Pumps are considered by HEAT to be the best for heat transfer service because they can produce high flows at low pressures and field adjustments are possible when process conditions warrant them. Other advantages are:

1. Pressure is limited without the use of a relief valve.
2. The horsepower used is based upon the actual flow.
3. Small particles can be passed without jamming.
4. The pumps are quiet running.
5. The pumped fluid is not used for the pump's lubrication.
6. Close clearances that can cause future problems are not required.

Positive Displacement Pumps are normally used when the process has small diameter fluid passages thus creating a high back pressure. These pumps try to produce a flow regardless of this back pressure; therefore, high pressures are possible and a bypass relief valve is a must. Also for pump protection, a strainer should be installed. This type of pump relies on the heat transfer fluid as a lubricant, but at elevated temperatures, the heat transfer fluids lose their lubricity. Since the pump's rated flow is based on knowing the exact clearance between the gear teeth, and since this changes with variations in temperature, it is hard to know what the actual flow is. Positive displacement pumps are noisier than centrifugal or turbine pumps.

Turbine Pumps are also used where high back pressures are present and have some of the same draw backs as positive displacement. Turbine pumps have close or tight clearances and are subject to jamming by small particles.

SHAFT SEALS

Whichever pump is used, its shaft must be sealed against leaks. The most common methods of doing this sealing are packing and mechanical seal. Another method would be to use a sealess pump.

Packing, sometimes called wet seal, has low costs but a small amount of leakage or seepage for cooling and lubrication is needed. HEAT does not recommend packed pumps for hot heat transfer fluid service.

Mechanical Seals - There are many different mechanical seals, but generally two types are used in heat transfer systems. They are spring loaded, single inside, unbalanced (Figure A) and metal bellows, single inside, unbalanced (Figure B). Mechanical seals can give years of successful leak free service, if cooling and proper maintenance are performed as required by the pump or mechanical seal manufacturer.

Sealess Pumps have been used successfully on fluid heat transfer systems. There are two types; magnetic drive and canned. Both types eliminate the seal completely because the pump's shaft is contained within the pumping chamber or casing.

Magnetic Drive Pumps use standard induction motors. The pump shaft is turned by the pairing of magnets, one on the inside of the casing, the other on the outside.

Canned Pumps go one step further. They have both the pump and motor inside the same casing or can. While sealess pumps have the advantage of being leak free, they are very expensive. Maintenance or repair can be a problem because usually they can only be done at the factory. Sealess pumps cannot always be substituted for a pump with a sealed shaft.

NOTE: A centrifugal pump should never be run backwards or run without liquid in the casing. Extensive damage to the casing, impeller and mechanical seal may result.

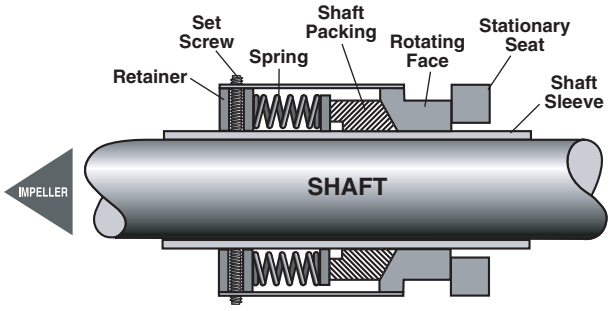

FIGURE A

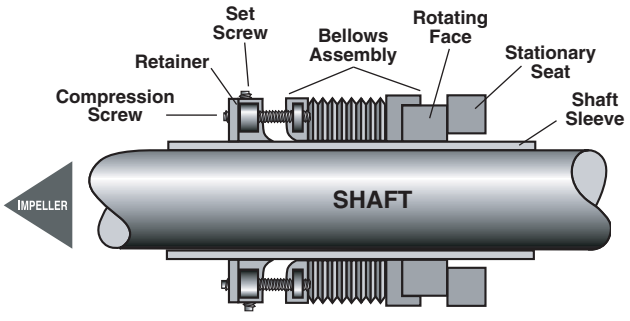

FIGURE B

MAJOR COMPONENT DESCRIPTIONS

EXPANSION TANK

The expansion tank vents air and moisture, allows thermal expansion of the fluid and provides net positive suction head (NPSH) for the pump.

During the initial fill and air purging cycle, air escapes through the expansion tank. If there is water in the oil piping system during the heating cycle, vent the water vapor from the expansion tank to a safe location.

Because heat transfer fluids expand when heated and this expanded volume accumulates in the expansion tank, the tank size should be twice the volume of this expansion.

Install the expansion tank at the highest point in the piping circuit, so it can be open to the atmosphere. If not at the highest point, pressurize the tank to create a high enough pressure at the pump's suction for maintaining the pump's required NPSH and to prevent gravity from forcing fluid out through the expansion tank.

Regardless of the expansion tank's location, some heat transfer fluids require pressurization to maintain a system pressure higher than the heat transfer fluid's vapor pressure. Whenever the expansion tank is pressurized, special provisions must be made for filling the system, purging the air and venting the water vapors to a safe area. See the "Installation" (Expansion Tank, page 6) section for additional information.

CONTROLS AND ELECTRICAL

The heat transfer system's controls and electrical wiring are in accordance with the National Electric Code (NEC). Standard controls include the following:

- Main disconnect switch or circuit breaker
- Fused power and motor branch circuits
- Power control
- Indicating temperature control
- High temperature switch
- Fused 120 volt control circuit transformer
- Pilot devices

Heater power controls range from on-off type magnetic contactors to SCR power controllers. Temperature controllers range from electromechanical bulb and capillary types to microprocessor based controllers with digital readout and computer interface capabilities.

Controls are designed for each application. For additional instructions, refer to the electrical drawings and read the control manufacturer's instructions.

PIPING AND PIPING COMPONENTS

HEAT's standard system's fluid heater shell and internal piping are carbon steel seamless type SA-106 pipe. All piping connections and joints are either flanged or welded.

The process piping between the heat transfer system and the user should be specifically designed for the application.

BOLT OR STUD TIGHTENING SEQUENCE

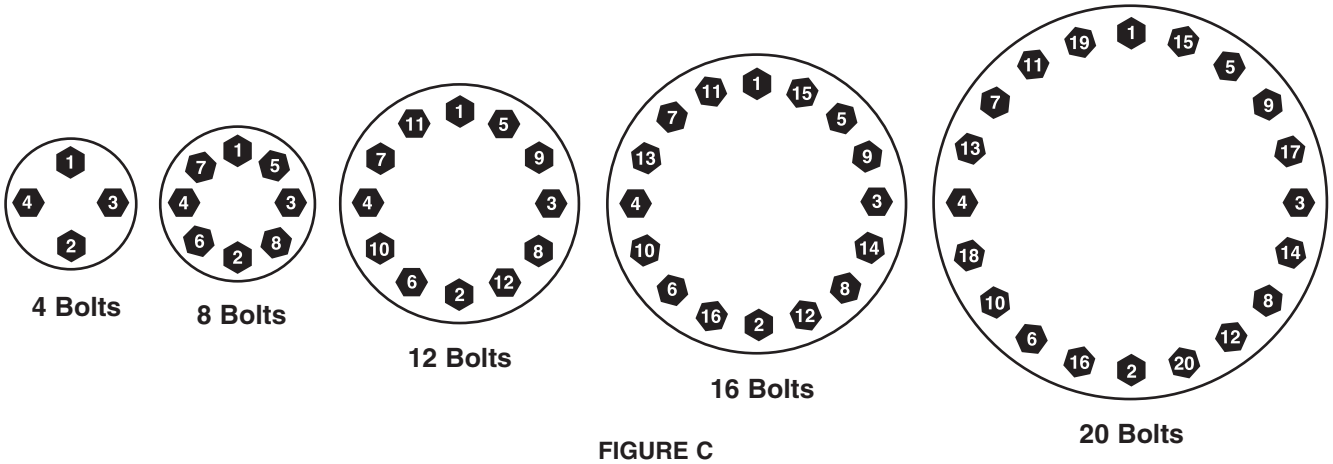

FIGURE C

Notes:

1. Extend the stud through the nut by at least one complete thread.
2. Properly align flange faces and bolt holes prior to torquing the studs.
3. Alignment of bolted joints with spiral wound gaskets is particularly critical as uneven tightening can cause buckling or disassembly of the spiral windings.

PIPING AND PIPING COMPONENTS (continued)

Install atmospheric vent valves at the high points in the process piping and drain valves at the low points. Piping should be of all-welded construction with flanged connections where necessary. Drains, vents and instrument connections 1/2 inch and smaller may be threaded where flanges are not practical. Use Schedule 80 seamless pipe for threaded connections. However, threaded connections have a tendency to leak and should be avoided.

High-temperature heat transfer fluids are contained at the higher operating temperatures only when the mechanical connections are kept very tight. Leakage control is important because even small leaks can be hazardous to personnel. Leaking oil can be absorbed into the insulation and can ignite spontaneously. Expose all threaded connections outside the pipe insulation to allow for detection of leaks.

Note: All threading must be to gauge, smooth, clean cut, and thoroughly solvent cleaned according to Industry Standards.

Use a high-temperature pipe thread sealant (Deacon #770 or equivalent) on all threaded connections. ***Never*** use Teflon tape on oil joints. Use 150 lb. raised face forged steel flanges for operating temperatures up to 550° F. Above 550° F, 300 lb. flanges are recommended. HEAT uses graphite-filled, spiral wound, stainless steel gaskets (Flexitallic or equivalent) to seal flange joints. A193B7 alloy studs with A1942H hex nuts should be lubricated with a high-temperature thread lube, tightened in the correct sequence (*see Figure C*) and torqued to the specified torque values (*see Table D*) to evenly compress the gasket.

Note: Arrange the entire system's piping to minimize pockets where air may be trapped. Every time the flow path of the fluid drops, air pockets may form, so provide manual air vents or bleeder valves in these places.

VALVES

Use cast or forged steel valves for fluid heat transfer systems. HEAT uses both globe and gate valves designed for high temperature heat transfer fluid service. While globe valves offer a more positive shut off, they also have a higher pressure drop and are normally used when balancing parallel flows.

Anticipated operating pressure and temperatures should be considered when selecting the valves. For example, at high operating temperatures, galling of the valve seats and gates can occur, reducing the expected degree of tight shut off. However, valves with wear-resistant alloys for valve trim can reduce the galling and alleviate this problem.

Pack valve stems with high-temperature, all graphite packing. Graphite packing is not always the standard. Repacking may be required prior to installation. A more expensive alternative to packing is a metal bellows stem seal.

Where possible, install valves with their stem in a horizontal, inverted or downward-angle position. If a leak develops at the stem, the fluid will drip away from the insulation around the valve. Leave valves and flanges uninsulated until the system has been tested and brought up to its maximum operating temperature. This allows for visual inspection of potential leak sites and final torquing of all studs.

TABLE D

Flange Size (inches)	150#				300#			
	O.D. (Inches)	No. of Holes	Stud Dia.	Torque Ft. Lbs.	O.D. (Inches)	No. of Holes	Stud Dia.	Torque Ft. Lbs.
3/8	3 7/8	4	1/2	60	4 5/8	4	5/8	120
1	4 1/8	4	1/2	60	4 7/8	4	5/8	120
1 1/4	4 5/8	4	1/2	60	4 7/8	4	5/8	120
1 1/2	5	4	1/2	60	6 1/8	4	5/8	120
2	6	4	5/8	120	6 1/2	8	5/8	120
2 1/2	7	4	5/8	120	7 1/2	8	3/4	200
3	7 1/2	4	5/8	120	8 1/4	8	3/4	200
4	9	8	5/8	120	10	8	3/4	200
5	10	8	3/4	200	11	8	3/4	200
6	11	8	3/4	200	12 1/2	12	3/4	200
8	13 1/2	8	3/4	200	15	12	7/8	320
10	16	12	7/8	320	17 1/2	16	1	490
12	19	12	7/8	320	20 1/2	16	1 1/8	710
14	21	12	1	490	23	20	1 1/8	710

Notes:
1. Unlubricated studs can reduce the applied stress value by as much as 50%.
2. Tighten studs by using a crossing pattern in the proper sequence (Refer to Figure C). Torque should be applied to each stud uniformly using a minimum of 3 passes. Recheck torque values after system temperature has cycled through normal operation.

MAJOR COMPONENT DESCRIPTIONS

STRAINERS

A strainer is standard on HEAT's SL series systems and can be installed in the pump's suction line on the WM and KM series. During start up, a strainer removes coarse particles of rust, millscale and organic debris. The strainer is not a filter and will not remove small or fine (less than 1/16 inch diameter) particles.

INSULATION

High operating temperatures and safety considerations make the selection of suitable insulation material important. Heat transfer liquids pose a potential fire hazard when they contact absorbent insulation materials at elevated temperatures. HEAT uses foamglass insulation with glass fabric and waterproof mastic coating. Embossed aluminum jacketing is also available.

WARNING: Oil saturated insulation on piping may spontaneously ignite at elevated temperatures. Repair leaks and replace oil soaked insulation immediately!!

DO'S and DO NOTS

DO provide for expansion and contraction of process piping and connections to the system. Piping strains can lead to pump and motor misalignment and excessive wear on the pump body, bearing and mechanical seal. In addition, piping strain will eventually cause failure of the pump and system. Properly support piping so the pump can be removed without changing the position of the connections.

DO check all vent tubes, purge valves and relief valves on a regular basis. Blockage may result in excessive system pressures and/or an explosion. Hot heat transfer oils oxidize when air or oxygen is present. The sludge that results can block critical piping.

DO tighten all connections and joints after thermal cycling. Check all threaded connections on controls, gauges, etc, for leaks.

DO properly vent all systems operating at atmospheric pressure. Vents must be rigid metal piping terminating into a safe area. Never restrict or use vent lines made of plastic, rubber, or other low temperature materials. Use 1/2 inch or larger pipe on all vent lines.

DO provide sufficient cross sectional area in the process piping connections equivalent to the system's pipes. Maximum velocity in all piping should be less than 10 feet per second to prevent undue pressure drop.

DO provide for bypass of oil when using automatic process valves. Severe system damage may occur if the process piping is restricted or blocked by closed valves.

DO NOT use threaded pipe connections on any piping over 1/2 inch. Use flanges with spiral wound gaskets for these connections.

DO NOT use teflon tape or pipe seal on threaded connections on hot oil systems. Use high temperature sealants compatible with the heat transfer fluid.

DO NOT use porous insulation which absorbs oil. Oil soaked insulation may spontaneously ignite and burn.

DO NOT leave leaks unrepaired. Periodic inspection of piping, valves, and insulation is essential.

DO NOT insulate an open expansion tank. Its temperature should be kept below 140° F for most heat transfer oils.

DO NOT restrict or add a valve to the expansion tank line or vent line.

DO NOT use process piping connections smaller than HEAT's system piping. Keep the fluid velocity less than ten (10) ft/sec.

OPTIONAL EQUIPMENT

There are many options available on hot oil heat transfer systems. Refer to the equipment data sheet, drawings and manufacturer's installation, operation and maintenance instructions for additional information. The following are some commonly requested options.

LEVEL SWITCH on the expansion tank is especially useful on systems where the expansion tank is remote mounted. Level switches activate an alarm circuit and/or de-energize the system.

SOLID STATE CONTROLS are standard on all systems. The most basic is an indicating solid state control with a relay output. A more elaborate system might include a microprocessor based controller, with computer interface feeding a control signal to a SCR.

SYSTEMS OPERATING ABOVE 550° F require design changes. For example, a different class of heat transfer fluids might have to be used. Check fluid manufacturer's data sheet for maximum operating temperature. Also, 300 lb. flanges rather than 150 lb. will be needed. In addition, a lower watt density and extended terminal housing should be included in the heater design. The pump's design will also have to be for the higher temperature including cooling for the bearing housing. A higher temperature mechanical seal such as a metal bellows is another option. Another consideration is a system for cooling and filtering a small slip-stream of the heat transfer fluid through the pump's mechanical seal chamber as a means of prolonging seal service life. [NOTE: These systems are commercially available under trade names such as Seal Guard (Dean Brothers Pumps, Inc.)].

OPTIONAL PUMPS include positive displacement, turbine or a sealess (magnetic-drive or canned) pump. A second pump as an installed spare is another option.

A COOLING CYCLE drops the temperature at the end of a run or removes excess heat due to the addition of frictional heat or an exothermic reaction. The cooling cycle is accomplished by adding an oil to a water heat exchanger or a water cooling coil to the heat transfer system.

Review the process requirements to determine the best method of adding the cooling cycle. A three way diverting valve (or (2) two way valves) directing the flow of heat trans-

MAJOR COMPONENT DESCRIPTIONS

OPTIONAL EQUIPMENT (continued)

fer fluid around or through the heat exchanger is usually the best design. This design gives accurate control of the heating and cooling cycle, but it is expensive. On some installations this added expense cannot be justified. Another method includes a cooling coil around the heater chamber and energizes the cooling by opening a solenoid in the incoming water supply. There are many ways to switch from heating to cooling or vice versa. The drawings included as part of the total service package provide information about the switching method and type of cooling used.

FLUIDS

There are two (2) classes of heat transfer fluids; the true oils or mineral oils and the manufactured chemical or synthetic oils. Mineral oils are derived from crude oil that has been refined and fortified with oxidation inhibitors. Mineral oils have a maximum temperature between 500° F and 600° F depending on the manufacturer.

Synthetic oils have a wide range of chemical compositions. They derive from glycol derivatives, phenyls and silicon polymers and are normally produced by a chemical company. Operating temperatures of the synthetic oils are between -100° F and 750° F. A list of the frequently specified fluids is available upon request.

INSTALLATION

Remove crating materials and inspect for any possible damage during transit. If any, contact the carrier at once. Notify Heat Exchange and Transfer, Inc. before repairing any damages. Mount the system on a solid level foundation. The standard system is designed for operating in an indoor, non hazardous area. If the system's operating area is not this classification, confirm that the system has been designed for this specific area.

Note: Allow sufficient room to remove the heating element when installing the system.

PUMP-MOTOR ALIGNMENT

The pump-motor coupling can either be close or standard coupled. All WM series systems and all standard KM series systems have a close coupled assembly and are not normally subject to misalignment. On SL series systems and other systems designed above 550° F operation, the pump motor coupling is standard coupled and has been factory aligned prior to shipment. The coupling is then removed and shipped separately. The pump and motor may become misaligned in transit. Realign them after the unit has been permanently set in place. Misalignment can cause wear on the pump shaft mechanical seal and bearings. It will eventually cause failure of the pump, and in turn, the system.

Note: Refer to pump manufacturer's installation, operation and maintenance instructions for pump-motor alignment procedure and for additional information about the pump.

EXPANSION TANK MOUNTING & PIPING CONNECTIONS

Mount the expansion tank at the highest point in the system. (*Note:* If the tank is mounted on the system, it is designed for easy removal for remote mounting.) If the fluid sight glass was shipped separately, install it on the expansion tank. Run the atmospheric vent line to a safe area. The vent line should be a minimum of 1/2 inch internal pipe size and should not include valves or other restrictions. If the expansion tank is pressurized, run the relief valve line into a safe area. This line should be the same size as the relief valve discharge.

Note: If Dowtherm A or Therminol VP1 is the heat transfer fluid being used, install the relief line so that any pockets where liquid may collect are in an area where the temperature is never below 54° F. This is the freezing point of these fluids.

Note: If the expansion tank cannot be mounted at the highest point in the system, or if the system is operating above the boiling temperature of the heat transfer fluid, the expansion tank must be pressurized. This reduces the possibility of the heat transfer fluid flashing into vapor in the heater or at the suction of the pump. Flashing causes the pump to vapor lock. Pressurizing hot oil heat transfer systems is usually done with nitrogen to reduce fluid oxidation. The tank pressure should be 5-10 PSI above the vapor pressure of the heat transfer fluid at its operating temperature. Review the special provisions for filling, air bleeding, start up and shut down on a pressurized system.

WARNING: If the expansion tank is to be pressurized, then it must be equipped with a safety relief valve. The expansion tank must be ASME coded if this pressure exceeds 15 PSIG. Run the piping between the expansion tank/system and the process/system. Run the pump's water cooling lines and any air (pneumatic) lines to the corresponding connections on the system. Reread "PIPING AND PIPING COMPONENTS" section (page 3) for pipe specifications. These pipe runs should be the same size as the system connections. Run bleed lines from all bleed valves, including any on the process to the expansion tank or another safe area.

ELECTRICAL (Wiring must comply with NEC and/or local codes)

Install the appropriate electrical connections at the top of the main disconnect switch(es) or circuit breaker. Turn the system's operating temperature controller to the lowest setting and the heater's on-off switch to the "OFF" position. Check the rotation of the pump by jogging the "START" and "STOP" buttons and carefully observing the pump's or motor shaft's rotation. If rotation is incorrect, reverse any two of the three phase power supply lines (POWER OFF) at the motor starter location in the control enclosure. The pump's casing has an arrow indicating the correct rotation. Never run the pump dry. **NOTE**: Check and tighten, if necessary, all electrical connections. Connections will loosen during transit.

SAFETY

NOTICE: Do not operate the heat transfer system without proper protection.

Safety around industrial machinery is a participatory activity and assumes user responsibility for being aware of and correcting safety hazards.

During normal operation, personnel hazards around fluid heat transfer systems includes burns from hot piping, flanges, pumps, valves and fittings. Insulate piping whenever possible without hiding potential leak points. Approach an operating system with proper protection.

Electric shock is always a potential hazard with electrical equipment. Wire and ground all equipment according to the National Electric Code (NEC) and local codes. Follow proper lockout procedures before any maintenance, wiring or troubleshooting is done.

Leaks in the process piping are not normal and should be corrected immediately. Leaks of heat transfer fluid pose hazards of burns, slips and falls to personnel. At elevated temperatures, leaking fluids pollute the work area with fumes. Leaking oil, when soaked into surrounding insulation is a fire hazard. Most leaks occur in the piping system at threaded fittings, valve packing and at worn mechanical seals or joints.

All systems have a high limit temperature switch interlocked with the heater primary controls. Its sensor is in the heater chamber. Its set point should never exceed the maximum design temperature of the heat transfer system as detailed on the "Equipment Data Sheet" included in the manual.

When the expansion tank remains open to the atmosphere, it is an integral part of the overpressure safety interlock. No valves are permitted in the piping from the expansion tank to the heater chamber or in the atmospheric vent line from the expansion tank to a safe area. If the expansion tank is pressurized or valves do exist in the expansion tank lines, a safety relief valve is required to relieve the pressure around these obstructions to a safe area.

Other safety interlocks are available and should be considered for secondary lines of defense.These include: low flow, low differential pressure switches, high/low level switches and high/low pressure switches. These alarms can be interlocked with the system mounted components or with part of the user's process controls.

Proper maintenance is a must for safety. Observe and log process conditions regularly so trends become obvious. For example, changes in operating pressure or flow may indicate a gradual blockage of process lines. Other process conditions to be checked include:

1. Power supply voltage
2. Heater amperage
3. Pump/motor amperage
4. Temperature stability
5. Alarm trips

In addition, check the expansion tank vent for blockage. Also, check heat transfer fluid samples to ensure compliance with the fluid manufacturers recommended procedures. Repair any leaks immediately. Operators should note any dangerous conditions and correct them immediately.

Standard industrial codes and OSHA require that safety devices be incorporated into this system. These safety devices should never be tampered with or disconnected.

HEAT's heat transfer systems are designed to include a high temperature switch with manual reset.

NOTE: This high temperature switch must remain wired into the system's electrical circuit. Any tampering with or revising the wiring could cause injury to personnel and voids the "Warranty." The following safety items are listed in other sections of the manual; however, they are important enough to be mentioned here.

CAUTION: Hazard of electric shock. All electrical equipment must be grounded to earth per NEC and/or local standards. The pump's motor is electrically interlocked with the heater(s) so the heater(s) cannot be turned "ON" without the pump being energized.

WARNING: Failure to perform the correct method of air and moisture removal from the system may cause an eruption of the hot fluid from the expansion tank which is hazardous to personnel in the area.

CAUTION: To avoid possible rupture of the expansion tank due to pressure, inspect the vent and/or relief lines on a regular basis to be sure they are open to the atmosphere. Failure to do so may result in rupture of the expansion tank or other parts of the system causing injury or hazard of fire.

WARNING: If the expansion tank is to be pressurized, then it must be equipped with a safety relief valve. The expansion tank must be ASME coded if this pressure exceeds 15 PSIG.

CAUTION: Do not restrict the expansion tank's process and vent lines during normal operations. If restricted, the system will build up pressure as the bulk fluid temperatures rises. Never exceed 140° F as the normal operating temperature of the expansion tank. The expansion tank should not be hot during normal operations since most heat transfer liquids exhibit oxidation and deterioration at elevated temperatures when exposed to air or oxygen.

Do Not use teflon tape or pipe seal on threaded connections of hot oil systems. Use high temperature sealants compatible with the heat transfer fluid.

WARNING: HAZARD OF FIRE! Oil saturated insulation on piping may ignite and burn spontaneously at elevated temperatures. Repair leaks and replace oil soaked insulation immediately!!

CAUTION: HAZARD OF ELECTRIC SHOCK. Disconnect all electrical power before servicing or replacing any component of the heat transfer system.

FILLING, STARTUP AND OPERATION

INITIAL STARTUP

Reread the "SAFETY" section.

NOTE: The initial heat-up may require 4 to 8 hours. This gradual heat-up procedure may not be necessary once the unit has been put into normal service.

NOTICE: To avoid possible damage to the heater(s), do not energize the heater(s) unless the system is filled with fluid and the pump is operating.

Read the fluid manufacturer's technical bulletins and instructions carefully. Some heat transfer fluids may ignite or burn spontaneously if not properly used.

HEAT's Fluid Heat Transfer Systems are designed for a particular heat transfer fluid or a class of heat transfer fluids. Check the equipment data sheet or call the factory to verify that an accepted heat transfer fluid is being used.

Do Not mix heat transfer fluids unless authorized and approved by the fluid manufacturer. All heat transfer fluids are not compatible with each other. Even those fluids made by the same manufacturer are not necessarily compatible. To switch fluids, check with the fluid manufacturer to determine:

1. Is the new fluid compatible with the old?
2. What is the recommended cleaning method to remove the old fluid, its sludge, or any deposits remaining in the system?
3. Does the fluid manufacturer have a recommended procedure for disposal of used or old fluid? Do they have a reclaiming service for used fluid?
4. How does the fluid manufacturer's cleaning procedure affect the integrity of the other components in the system?

Foreign liquids in the heat transfer fluid may not cause trouble immediately. However, the foreign liquid could cause a chemical change in the heat transfer fluid after the system has been in operation. This could lead to the formation of sludge and carbon on the heating elements, and eventually, failure of the heating element and pump.

WARNING: Never operate the heat transfer system above its design temperature or above the heat transfer fluid's maximum bulk temperature as recommended by the fluid manufacturer. HEAT's heat transfer systems are designed for a specific maximum temperature. Check with the factory or consult the equipment data sheet to determine the correct design temperature.

Exceeding the temperature limits of the heat transfer fluid causes its thermal breakdown or degradation. This results in the formation of carbon on the heating elements and eventually causes pump and heater failure.

NOTE: Exceeding the heat transfer system's design temperature or the maximum recommended heat transfer fluid's bulk temperature can cause injury to personnel in the area and voids the heat transfer system's warranty.

INITIAL FILL

Fill the system through the fill/drain port. Filling from the "bottom up" ensures that most of the air in the system is forced out through the expansion tank. Proper filling eliminates many start up problems. Fill direct from a 55 gallon drum by connecting a hose from a drum pump or a PFS-1 "Pump/Filter System" (available from HEAT) to the fill/drain port. Open the fill/drain valve and all valves, including all air bleed valves. Pump the fluid from the 55 gallon drum into the system. Close the customer's process bleed valve(s) as the fluid reaches them. When the expansion tank is about 1/3 full, stop the pump and close the fill/drain valve.

Let the fluid settle a few minutes and open the bleed valves to let any entrapped air bleed off.

PUMP STARTUP

WHEN USING WATER COOLED PUMPS, THE COOLING WATER MUST BE "ON" AT ALL TIMES.

Turn the power on by moving the circuit breaker handle to the "ON" position. The "POWER ON" lamp lights. Make sure the heater(s) selector switch(es) are in the "OFF"position.

The pump is started by pushing the "START" button and stopped by pushing the "STOP" button. Let the pump circulate oil for one to two hours, while venting all entrapped air.

NOTE: Rapid fluctuation of the pressure, indicated by the discharge pressure gauge, suggests air in the system. Provide air bleed valves at all high points in the system and where the heat transfer fluid flow drops in the vertical plane. Air will collect in these places.

Add more oil through the fill/drain port if the liquid level in the expansion tank drops significantly. Keep the heater(s) selector switch(es) in the "OFF" position.

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FILLING, START UP AND OPERATION

INITIAL HEAT UP

AFTER ALL THE AIR IS PURGED FROM SYSTEM.

1. If the high temperature switch is adjustable, set it to 35°F higher than the desired operating temperature.

NOTE: Many system's high temperature switch is preset at the factory and does not require any adjustments.

2. Set the temperature controller to 150° F and turn the heat on. Turn the heater on by turning the selector switch to the "ON" position. The heater will operate only if the pump is on, the temperature controller calls for heat and the over temperature controller is not tripped. The "HEAT" light indicates the heater circuit is energized.

3. Carefully observe the system for any air in the heat transfer fluid and for pump cavitation (liquid vaporizing in the suction line). If air is present, keep the controller at 150° F and run until the air is vented.

4. After the air is vented, reset the controller to 200° F. Let the temperature climb and stabilize.

5. Once stabilized and no air or vapors are evident, reset the controller to 250° F. At this temperature, water or moisture in the heat transfer fluid turns to steam.

NOTE: Water in the system would not normally be noticed until the fluid temperature is above 212° F. Water in the system is indicated in the same way as air in the system.

CAUTION: During the initial start up, continually check the liquid level in the expansion tank. The liquid level should neither exceed the three quarter mark on the glass nor drop below the one quarter mark.

NOTE: If abnormal expansion of fluid is detected, air or steam may still be present in the system. Check all bleed valves. If the problem continues, de-energize the pump and recheck the bleed valves.

6. Observe the system for boiling or vapors in the heat transfer fluid and for pump cavitation. Check the expansion tank sight glass for heat transfer fluid appearance. Cloudy or milky fluid and/or any boiling indicates moisture in the heat transfer fluid. There are three (3) ways to remove moisture. The best method depends on the amount. Removal could take hours or even days.

A. Remove very small amounts of water the same way air is removed, except the operating temperature is above 212° F. Larger amounts of water can also be removed this way, but depending on the amount, removal could take hours or even days.

B. Completely drain the fluid from the system and process, flush all piping with new water free heat transfer fluid and refill with a second batch of new water free fluid. This is both time consuming and expensive.

C. Remove the fluid from the system through HEAT's "Pump/Filter System" which removes moisture from the heat transfer fluid.

7. When the system has reached 250° F and has been operated for 30 minutes to 1 hour, close all venting and purge valves ensuring the piping to and from the expansion tank remains open.

8. If no vapors are evident, increase the set point by 50° F increments until the desired temperature is reached.

CAUTION: Do not restrict the expansion tank vent and process lines during normal operations. If restricted, the system will build up pressure as the bulk fluid temperature rises.

Never exceed 140° F as the normal operating temperature of the expansion tank. The expansion tank should not be hot during normal operations since most heat transfer liquids exhibit oxidation and deterioration at elevated temperatures when exposed to air or oxygen.

OPTIONAL COOLING

The cooler circuit will operate with the selector switch in the "AUTO" position or in the "MANUAL COOL" position. The cooling light indicates the cooling circuit is energized. Refer to the equipment data sheet and/or mechanical and electrical drawings for additional information about its operation.

RUNNING ADJUSTMENTS

Centrifugal pumps are equipped with impellers and non overloading motors sized to give satisfactory performance for the majority of liquid heat transfer fluid applications. No two applications are identical; therefore, minor pump adjustments may be necessary to account for differences in viscosity, specific gravity or piping flow restrictions. Some installations may not have sufficient natural flow restrictions (flow too high) and additional artificial pressure drop must be added. Other applications may have excessive flow restrictions (flow too low) and pressure drop will have to be removed from the process and related piping. Refer to the "Trouble Shooting" section for additional information.

In general, the circulating pump on an oil type heat transfer system should operate at approximately 1 GPM for each kilowatt of heater size, i.e. the pump on a 30 kW system should deliver approximately 30 gpm.

TROUBLE SHOOTING

PROBLEM	CAUSE	DO
Power light off	Main power feed off	Turn on main power
	Disconnect switch or circuit breaker off	Turn on disconnect switch or circuit breaker
	Primary fuse blown on control transformer	Replace fuse
	Control circuit fuse blown	Replace fuse
	Bad transformer	Replace
	Pilot light blown	Replace
Power light on, pump will not start	Motor overloads tripped	Reset overloads, check operating current
	Motor starter bad	Check motor starter coil, replace coil or motor starter
Power light on, pump light on, motor not running	Motor fuse blown	Replace fuse, check motor overloads
	Motor burned out	Replace motor, check motor for overloads
	Wrong voltage	Check Equipment Data Sheet, rewire if necessary
Power light on, pump light on, motor running, pump not running	Broken coupling	Check and replace coupling
	Impeller off	Check motor amperage, if low, call factory
Power light on, pump light on, motor running, heater light will not come on	Heat on-off switch “OFF” position	Turn switch to “ON”
	Process control set too low	Set process control to desired temperature
	Over temperature cutout tripped	Check and determine why tripped, correct problem and reset
Insufficient heat at process	Incorrect pump rotation	Reverse any two of the three phase power lines at disconnect or circuit breaker
	Heater fuses blown	Check and replace fuses
	Incorrect signal from controlling thermostat	Check control and replace if necessary
	Bad thermocouple or sensing element	Check and replace if necessary
	Heater elements burned out	Check continuity and resistance of heater elements, replace heater
	No or low fluid flow to process, piping too small or restricted	Check process piping, piping should be same size as system, check to verify all valves are open and strainer is clean
	No or low fluid to process, fluid bad	Drain fluid and clean all sludge from system, piping and process using fluid manufacturer’s procedures
	Heater transfer area too small	Increase heat transfer fluid temperature, but do not exceed the maximum allowed temperature of the fluid system.
	Piping or process not insulated	Insulate piping and process
Pump’s mechanical seal leaking	Seal failed	Determine why seal failed: is cooling water off, the fluid dirty, or just worn out? Correct if a problem, check pump’s shaft, if good, replace seal, if not good, replace pump.

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TROUBLE SHOOTING

PROBLEM	CAUSE	DO
Process Piping leaks at temperature and after cool down	Expansion and contraction due to temperature has loosened connections	Check all flange studs and connections, tighten and torque to specifications
	Wrong gasket material or joint compound	Replace gaskets as necessary using spiral wound or Grafoil gaskets, eliminate all threaded connections where possible, where not possible, use a high temperature sealant
Pump noisy, discharge pressure gauge vibrating and has low reading (below 15 psi)	Fluid level in expansion tank too low	Add additional fluid
	Strainer clogged	Clean
	Vapor lock due to air or steam in fluid	Bleed air and steam from system. If problem continues, change fluid or run fluid through HEAT's PFS-1 Pump/ Filter System
	Net positive suction pressure too low	Raise expansion tank to increase suction head or pressurize the tank
	Too high flow, not enough flow restrictions	Partially close discharge valve until only 1/4 to 3/4 open
		Install a suitable sized orifice plate into fluid piping flanges at discharge connection
		Check with factory to replace pump impeller with one of a smaller diameter
High discharge pressure (higher than "norm"), gauge fluctuating rapidly, pump noisy	System or process piping blocked or restricted	Check for closed valves or improperly installed automatic valves. Check bleed valves for air or steam. Check that process piping size is the same size as system connections
	Restriction in heater	Remove heater and check for deposits on elements, clean if necessary
Expansion tank overflows	Air or moisture in fluid	Bleed air and steam from system, if problem continues, change fluid or run fluid through HEAT's PFS-1 Pump/Filter System
	Expansion tank mounted too low	Mount expansion tank at the highest point in the fluid piping
	Expansion tank too small for amount of fluid in system and process	Check volume in system process including all piping

TECHNICAL SUPPORT AND START UP SUPERVISION

Heat Exchange and Transfer, Inc. maintains an engineering staff to assist customers with technical and/or start up questions concerning its equipment.

Inspection and repair services for used or older fluid electric heat transfer systems are also available. Contact "Factory Service" to obtain such assistance.

MAINTENANCE

CAUTION: Hazard of electric shock. Disconnect all electrical power before servicing or replacing any component of the heat transfer system.

ELECTRICAL

Check and tighten (if necessary) all electrical connections and terminal screws after initial heat up and then annually. (POWER OFF) Give special attention to the high voltage, load carrying wires. These are connected at the master switch, fuse blocks, contactors, SCR (if applicable) and heater terminals. This helps avoid hot connections which can destroy wiring insulation or the connection.

Routine maintenance should include:

1. Checking the heater terminals for fluid leakage
2. Checking the operation of the controllers, over temperature control, pilot lights, magnetic contactors, motor starter and motor overloads
3. Checking continuity of all fuses

MECHANICAL

Check and clean (if necessary) the strainer, after initial heat up and then annually. Check all flanged connections, motor mounts and valve packing glands and tighten (if necessary).

Examine and replace all insulation that has been discolored by heat transfer fluid that has spilled or leaked.

WARNING: *HAZARD OF FIRE*. Oil saturated insulation on piping may ignite spontaneously at elevated temperatures. Repair leaks and replace oil soaked insulation immediately!!

Check relief valves annually per ASME or local codes.

Check pump's mechanical seal for leaks and replace if leaking. Check pump's water cooling circuit for corrosion and blocked lines (clean if necessary).

Clean the expansion tank's sight glass.

Inspect all vent and/or relief lines on a regular basis to ensure they are open.

CAUTION: To avoid possible rupture of a component of the heat transfer system due to over-pressure, check the expansion tank's vent and/or relief line on a regular basis to be sure they are always open to atmosphere. Failure to do so may result in rupture of the expansion tank or other parts of the system causing injury or hazard of fire.

Replace all sheet metal panels removed during servicing or maintenance.

WARRANTY

SELLER warrants to PURCHASER that the goods hereupon are free from defects in material and workmanship for a period of 12 months from the date of shipment from SELLER's factory. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING BUT NOT LIMITED TO THE WARRANTY OF MERCHANTABILITY, THE WARRANTY OF SUITABILITY OR FITNESS FOR USE AND THE WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE. THIS WARRANTY CANNOT BE MODIFIED BY ANY PERSON (DISTRIBUTOR, SALES REPRESENTATIVE, EMPLOYEE, ETC.), AND IS EXCLUSIVE FOR THE ORIGINAL PURCHASER OF HEAT EXCHANGE AND TRANSFER, INC'S PRODUCTS.

LIMITATIONS:

1. This warranty does not apply unless all payments are current and in accordance with the terms of the contract.
2. There is no warranty against damage resulting from misapplication, improper specifications given by the customer or their representative, or other operating conditions beyond the control of the SELLER.
3. The equipment must be installed and maintained in accordance with SELLER's "Installation, Operation, and Instruction Manual", and standard industrial practices and codes.
4. This warranty is void if the equipment is disassembled or reworked by others without prior written approval from SELLER.
5. Material furnished by suppliers to SELLER are guaranteed by SELLER only to the extent of the original manufacturer's express warranty to SELLER
6. Warranty shall extend only to the original direct purchaser from HEAT, Inc. Original equipment manufacturers (OEM's) can pass HEAT EXCHANGE AND TRANSFER, INC's warranty to their customers, but all warranty issues must go through the OEM who then contacts HEAT, Inc.

REMEDY:

1. SELLER agrees to replace or repair at SELLER's sole discretion, any defective parts manufactured as covered under this warranty, subject to inspection by SELLER. The PURCHASER is to ship the part,FOB: SELLER's plant Freight Allowed.
2. If a product is believed to be defective, a Purchase Order must be issued to Heat Exchange and Transfer, Inc. Attn: SERVICE DEPARTMENT for a replacement. At this time, the SERVICE DEPARTMENT will issue a "Return Materials Authorization Number" (RMA). All returned items must be accompanied by the RMA number. A credit will be issued, if the return item is found to be defective.
3. SELLER will ship a replaced or repaired item FOB: Shipping Point, Freight Allowed to the location of the original sale.
4. This is the exclusive remedy available.

GENERAL:

1. All warranty issues are through HEAT Inc.'s SERVICE DEPARTMENT.
2. SELLER will not assume liability for cost of disassembly, reassembly, or rework performed on the defective product.
3. In no event shall SELLER's liability exceed the invoice price of the articles with reference to which claim occurs and under no circumstances shall SELLER be liable for special consequential damages, or the expenses or losses incurred due to geographical location of the product, difficulty of access to the product as installed, or urgency as to time on the part of the user and/or buyer of the equipment.
4. Upon the expiration of twelve (12) months from the date of shipment, all such liability shall terminate. The foregoing shall constitute the sole remedy to the PURCHASER and sole liability of the SELLER.

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SERVICE MANUAL
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INSTALLATION CHECKLIST

- ☑ 1. Complete provisions for unloading and storage (if applicable) of heat transfer fluid. Cover drums and store them inside to prevent possible fluid contamination from standing water on the top.
- ☑ 2. Develop clean out procedures that will ensure the process equipment and process piping are clean and dry.
- ☑ 3. Develop procedure for final pressure testing of process equipment and process piping.
- ☑ 4. Complete pressure test.
- ☑ 5. Complete safety audit on start up and operating procedures.
- ☑ 6. Check equipment data sheet to ensure fluid being used is appropriate to system's design.
- ☑ 7. Check equipment data sheet to compare process and operating temperatures with system design.
- ☑ 8. Check equipment data sheet to verify electrical power available compared with system design.
- ☑ 9. Check all electrical connections for tightness (POWER OFF). Tighten if necessary.
- ☑ 10. Perform continuity and ground resistance checks on electrical components. (POWER OFF)
- ☑ 11. Verify that piping materials and connections meet specifications.
- ☑ 12. Check piping connections and mounting bolts for tightness. Tighten if necessary.
- ☑ 13. Mount expansion tank at the highest point or pressurize it. If pressurized, equip the tank with pressure relief valve. Review special filling, start up and drain provisions.
- ☑ 14. Run expansion tank vent or relief valve line to a safe area.
- ☑ 15. For pumps with cooling jacket, make provisions to cool pump seal, if operating above 275° F.
- ☑ 16. Install bleed valves at all high points in piping circuit.
- ☑ 17. Install drain valves at all low points in piping circuit.
- ☑ 18. Provide personnel with burn protection from hot surfaces, above 140° F.
- ☑ 19. Check all safety devices for proper operation. Replace if defective.

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INITIAL STARTUP CHECKLIST

NOTE: Check all safety systems at the proper time with the following being done in the listed sequence.

- ☑ 1. Open all air vents
- ☑ 2. Fill system through the fill/drain port using a drum pump or HEAT Inc.'s PFS-1, Pump/Filter System.
- ☑ 3. Cycle control valves while system is filling.
- ☑ 4. Stop filling when level in expansion tank sight glass is 1/3 full. Close fill/drain valve and all air vent valves.
- ☑ 5. Let fluid settle a few minutes, open all air vent valves to bleed entrapped air through the expansion tank.
- ☑ 6. With power on and heater(s) off, check pump rotation by jogging the "START" and "STOP" push buttons. Correct rotation if necessary.
- ☑ 7. With heater(s) off, circulate the fluid until all entrapped air bleeds off.
- ☑ 8. Check expansion tank level, if below 1/4 full, add fluid through the fill/drain port.
- ☑ 9. If the system has an adjustable high temperature switch, set it 35° F above normal operating temperature.

  NOTE: Most system's high temperature switch is pre-set at the factory and cannot be changed.

- ☑ 10. Set temperature controller at 150° F
- ☑ 11. Turn heater "ON", bleed air from fluid.
- ☑ 12. When fluid temperature reaches 150° F and no additional air is in the fluid, reset controller to 200° F.
- ☑ 13. When fluid temperature reaches 200° F and no additional air is in the fluid, reset controller to 250° F.
- ☑ 14. While temperature increases, check the fluid level and appearance in expansion tank sight glass. If level is low, add fluid through the fill/drain port. If fluid is cloudy or milky, moisture is present. Run the system at this temperature until fluid is clear. If fluid does not become clear in a short time, replace it or run it through HEAT's PFS-1 "Pump/Filter System."
- ☑ 15. Observe system for any boiling or vapors in the fluid.
- ☑ 16. Close all venting and purge valves at 250° F.
- ☑ 17. If no vapors are present, increase the set point in 50° F increments until the desired temperature is reached.
- ☑ 18. Operate system at desired temperature for at least 30 minutes without any evidence of vapors or boiling.
- ☑ 19. Record all operating data at the normal operating temperature (incoming voltage, heater amperage, motor amperage, discharge pressure and process delta temperature).
- ☑ 20. If there is a cooling cycle, turn it "ON" and record all cooling data.

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FIELD SERVICES RATES

For Continental US and Canada

Normal Rate:	Domestic Field Service Rate of $1000.00 per day, and $1,200.00 for each night Stay over thereafter. This is an all inclusive rate, and includes reasonable hours to complete the requested work. (This includes hotel, rental car, meals fuel, and Parking).
Emergency Rates	Less than two (2) business days notice $1200.00 plus applicable rate
Expenses:	Airfare is separate if required. Note: A Handling Fee of 10% applies to all expenses.

*** SPECIAL NOTES ***

** Credit Card or Cash in Advance is required on Field Services.

** If additional stay over beyond original contract are requested, a new authorization or Prepayment is required.

** International travel rates are shown on our published International Service Rate Sheet. Personnel will be determined on an individual basis as required.

** Prices are in U. S. Currency.[1]

[1] Prices effective July 1, 2001

GSP-1A
July 2001

GENERAL SERVICE POLICY

1. The purchase of spare parts is highly recommended for all equipment with a final destination outside the continental United States, to avoid extended down time as a result of the inaccessibility of these parts.

2. International Service trips require two (2) specialists be assigned so that all decisions made for H.E.A.T., Inc. can be accomplished at the job site. Please contact factory for International Service rates.

3. A purchase order for Start-up Assistance, Inspection or Repair Service must be received and approved before our personnel leave for the job site. For start-up, we also require all preparation items be completed from a checklist.

4. The customer's field start-up personnel are encouraged to visit our facility for operational and maintenance training during the factory testing of the equipment.

5. North America Field Service Rates, which include Start-up, Inspection, Training and Repair Services are listed on the reverse side.

6. Start-up service rates can be quoted as a separate item during the proposal stage. If purchased, a separate factory order will be issued by the Service Department.

7. A formal written "Field Service Report" will be provided following all Start-ups, Inspections and Repair Services performed at the customer's site.

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TERMS AND CONDITIONS

1. All orders are subject to factory approval.

2. The contract may be canceled by the Buyer or Seller. Unless prior arrangements were agreed upon, cancellation charges will be based on the value of the contract minus the percentage of material, labor and engineering not completed at the time of the cancellation. Minimum charge will be 15% of the total contract.

3. BUYER is to procure and pay for any necessary permits and will be responsible for compliance with all local ordinances and state laws with respect to the use and/or installation of the SELLER's equipment unless otherwise stated.

4. DELIVERY: Every reasonable effort will be made to ship orders within the time scheduled, but under no circumstances will the SELLER assume responsibility for damage or losses due to late delivery.

5. Claims for shortages must be made within 10 days from receipt of the equipment.

6. Prices are based on quoted equipment design. After the Purchase Order is let, customer requested design changes are subject to price adjustments and written confirmation by a Customer Change Order.

7. Minimum invoice charges are:
   A. $100.00 for spare or replacement parts.
   B. $150.00 for manufactured items or heaters.

8. Credit Terms:
   A. For orders under $15,000 received from inactive customers or customers having no credit history with H.E.A.T., Inc. - 50% Down Payment to be paid before equipment ships. The 50% balance invoiced Net 30 Days on the day of shipment upon credit approval.
   B. Rush Orders- Customers who are inactive or with no credit history with H.E.A.T., Inc. are COD, CIA or Credit Card.
   C. Upon Credit approval, Payment Schedule is:
      1. Orders under $15,000 will be invoiced on the date of shipment or when ready to transport if BUYER requests a delay in shipment - Net 30 Days.
      2. Orders between $15,000 - $40,000 will be invoiced:
         a. 25% upon receiving order - Net 30 Days or before shipment which ever occurs first.
         b. 75% upon shipment or when ready for transport if the BUYER requests a delay in shipping - Net 30 Days.
      3. Orders over $40,000 will be invoiced:
         a. 25% upon receiving order - Net 30 Days or before shipment which ever occurs first.
         b. 40% upon major purchase of material - Net 30 Days or before shipment which ever occurs first.
         c. 35% upon shipment or when ready for transport if the BUYER requests a delay in shipping - Net 30 Days.

9. International orders - All orders must be prepaid by check drawn on U.S. bank in U.S. funds before shipment or by Master Card or Visa credit card.

NOTES: A. All equipment held beyond date of completion will be subject to storage charges.
B. When orders are shipped prepaid with freight to be billed, freight to be billed, freight is net and subject to payment on presentation of invoice.
C. Invoices paid thirty (30) days beyond due date are subject to a service charge of 1.5% per month (18% annual) against the unpaid balance.
D. Heat Exchange and Transfer, Inc. reserves the right to require 90% or 100% of funds be paid prior to shipment if customer or delivery address is outside of the continental United States of America.

10. All Pennsylvania taxes presently or hereafter imposed on manufacture, sale, or delivery of any equipment shall be charged to the BUYER in addition to prices herein set forth.

11. All other taxes are the sole responsibility of the BUYER.

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INDUSTRIAL PRODUCTS WARRANTY

SELLER warrants to PURCHASER that the goods hereupon are free from defects in material and workmanship for a period of 12 months from the date of shipment from SELLER's factory. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING BUT NOT LIMITED TO THE WARRANTY OF MERCHANTABILITY, THE WARRANTY OF SUITABILITY OR FITNESS FOR USE AND THE WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE. THIS WARRANTY CAN NOT BE MODIFIED BY ANY PERSON (DISTRIBUTOR, SALES REPRESENTATIVE, EMPLOYEE, ETC.), AND IS EXCLUSIVE FOR THE ORIGINAL PURCHASER OF HEAT EXCHANGE AND TRANSFER, INC'S PRODUCTS.

LIMITATIONS:

1. This warranty does not apply unless all payments are current and in accordance with the terms of the contract.
2. There is no warranty against damage resulting from misapplication, improper specifications given by the customer or their representative, or other operating conditions beyond the control of the SELLER.
3. The equipment must be installed and maintained in accordance with SELLER's "Installation, Operation, and Instruction Manual", and standard industrial practices and codes.
4. This warranty is void if the equipment is disassembled or reworked by others without prior written approval from SELLER.
5. Material furnished by suppliers to SELLER are guaranteed by SELLER only to the extent of the original manufacturer's express warranty to SELLER.
6. Warranty shall extend only to the original direct purchaser from HEAT, Inc. Original equipment manufaturers (OEM's) can pass HEAT EXCHANGE AND TRANSFER, INC's warranty to their customers, but all warranty issues must go through the OEM who then contacts HEAT, Inc.

REMEDY:

1. SELLER agrees to replace or repair at SELLER's sole discretion, any defective parts manufactured as covered under this warranty, subject to inspection by SELLER. The PURCHASER is to ship the part, FOB: SELLER's plant Freight Allowed.
2. If a product is believed to be defective, a Purchase Order must be issued to Heat Exchange and Transfer, Inc. Attn: SERVICE DEPARTMENT for a replacement. At this time, the SERVICE DEPARTMENT will issue a "Return Materials Authorization Number" (RMA). All returned items must be accompanied by the RMA number. A credit will be issued, if the return item is found to be defective.
3. SELLER will ship a replaced or repaired item FOB: Shipping Point, Freight Allowed to the location of the original sale.
4. This is the exclusive remedy available.

GENERAL:

1. All warranty issues are through HEAT Inc.'s SERVICE DEPARTMENT.
2. SELLER will not assume liability for cost of disassembly, reassembly, or rework performed on the defetive product.
3. In no event shall SELLER's liability exceed the invoice price of the articles with reference to which claim occurs and under no circumstances shall SELLER be liable for special consequential damages, or the expenses or losses incurred due to geographical location of the product, difficulty of access to the prouct as installed, or urgency as to time on the part of the user and/or buyer of the equipment.
4. Upon the expiration of twelve (12) months from the date of shipment, all such liability shall terminate. The foregoing shall constitute the sole remedy to the PURCHASER and sole liability of the SELLER.

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SERVICE MANUAL
SM-104
November, 2007

CH & FH – CIRCULATION AND FLANGED HEATERS

General Description

Type CH circulation heaters are compact, self-contained units designed to heat flowing liquids and gases, including super heating steam. They use a type FH flanged heater.

Flanged immersion heaters consist of “U” bend tubular heating elements welded into a standard ANSI pipe flange. A thermowell is installed in the center of the flange which can house a high limit-sensing element. A terminal enclosure is installed to protect the heating element terminations.

The use of temperature regulating and limiting controls is recommended, since excessive temperature can permanently damage the heater and cause premature failure.

CAUTION: Install adequate temperature regulating controls, fusing and back-up safety devices are heating equipment. Back-up protective devices are essential, when the consequences of control failure may be severe. Although the safety of installation is the responsibility of the user, H.E.A.T. will make equipment recommendations upon request.

TABLE “A” Model Number Code:

Circulation And Flanged Heaters

Model #:

SERIES ABBREVIATION LETTERS

FH - STD FLANGED HEATER; FHE - EXTENDED; FHX EXPLOSION RESISTANT; FHXE - EXTENDED EXPLOSION RESISTANT
CH - STD CIRCULATION HEATER; CHE - EXTENDED; CHX - EXPLOSION RESISTANT; CHXE - EXTENDED EXPLOSION RESISTANT

HEATER FLANGE SIZE
03 06 12 18
04 08 14 20
05 10 16 24

NUMBER OF HEATING ELEMENTS

SPECIAL CONSTRUCTION
S = STAINLESS

KW RATING OF THE HEATER

OVERALL HEATING ELEMENT LENGTH (IN.)

SHEATH MATERIAL OF HEATER
S = 300 SERIES STAINLESS
C = CARBON STEEL
Y = INCOLOY
N = NICKEL
M = MONEL
K = COPPER

VOLTAGE CODE
FIRST TWO DIGITS OF OPERATING VOLTAGE
20 = 200V
24 = 240V
38 = 380V
41 = 415V
48 = 480V
57 = 575V
60 = 600V

PHASE

1 = SINGLE
3 = THREE

Installation

1. MECHANICAL

A. Check for shipping damage. If damage is found, report the claim to the carrier. DO NOT OPERATE THE EQUIPMENT.

B. Care should be taken when handling the heaters to avoid bending and possible breaking of the heater elements.

C. When installing a flanged heater bundle into a cir culation heater, care should be taken to orient the top baffle toward its respective chamber nozzle. Regardless of the type of chamber or vessel, ensure that the proper type of gasket is utilized to match the type of flanges and the fluid service used. Gaskets can be obtained through H.E.A.T.'s Customer Service Department. H.E.A.T. recommends the use of SA193B7 studs and SA194-2H nuts for flange nuts on the slightly lubricated studs(sprayed with anti-seize) to the appropriate values on Table B. Match-mark the heater and chamber flanges to ensure proper reinstal lation following future removal for maintenance requirements.

2. ELECTRICAL

The following must be checked prior to electrical installation.

A. Insure that the line voltage to be applied corresponds to the stamping on the heater nameplate. Acceptable line voltage variations are (+) 5% or (-) 10%. Applied voltages greater than the rated voltage will shorten heater life, while applied voltages less than the rated voltage will decrease the heater capacity.

B. Verify that the capacity of the power supply is in accordance with the National Electric Code and local codes (typically a 25% safety factor above the amp draw listed on the heater nameplate).

C. Insure that the rating of the incoming power wires is corrected to suit the operating temperature with in the heater terminal housing. Usually a 200ºC rated wire is appropriate.

D. Verify that the heater control circuitry includes a high temperature limit switch and has sensors to insure adequate level for an immersion heater or proper flow for a circulation heater.

E. Verify that the power wires are connected to the lugs in accordance with the appropriate heater-bussing diagram.

Operation

The following electrical tests should be performed prior to energizing the heater:

A. Since moisture can accumulate in the heater ele ments, each heater circuit should be subjected to a resistance to ground test. Readings from each lug should be 1 MΩ plus 1 MΩ per 1000 Volts of applied voltage. For example, on a 480 Volt heater, a good resistance reading would be 1.48 MΩ.

B. Moisture collection can be a recurring problem if a heater is not operated for a period of a month or, in very humid locations, as soon as a week. It is advisable to perform another resistance to ground test before operating in these situations.

C. The best way to eliminate moisture is to remove the terminal housing cover and place the heater in an oven at 250ºF for several hours. An alternative solution is to apply a low voltage, typically 120 Volts AC to the heater circuits for a period of time to dry out the elements. The length of time required is dependent upon the heater size, element watt density, material, etc. No two applications are the same. Consult the Customer Service Department for assistance.

Maintenance

A. Mechanical
Depending upon fluid and operating conditions, periodic inspection of the heater element bundle is advised to check for buildup or blockage. Contact the Customer Service Department for information on our heater inspection and repair services.

B. Electrical

1) After 4-6 hours of initial operation, de-ener gize the power and remove the terminal housing cover. Visually inspect the bussing and terminals for signs of arcing or corrosion. Each power wire connection should be retightened and each #10-32 element termi nal re-torqued to 3 -5 ft-lbs. In addition, re-torque all flange bolts as required. This pro cedure should be followed at monthly inter vals thereafter.

2) Record measurements of leg to leg and leg to ground resistance regularly.

3) With the heater energized, record measure ments of the operating current in each leg of each heater circuit and the leg-to-leg voltage. This should be done in the heater control center.

TABLE B FLANGE BOLTING TORQUE VALUES

Flange Size (inches)	150#				300#			
	O.D. (in.)	No. of Holes	Stud Dia.	Torque Ft.-lbs.	O.D. (in.)	No. of Holes	Stud Dia.	Torque Ft.-lbs.
1/2	1 1/4	4	1/2	7	1 1/4	4	1/2	12
3/4	1 9/16	4	1/2	11	1 9/16	4	5/8	22
1	1 7/8	4	1/2	14	1 7/8	4	5/8	30
1 1/4	2 3/8	4	1/2	16	2 3/8	4	3/4	33
1 1/2	2 3/4	4	1/2	22	2 3/4	4	5/8	56
2	3 3/8	4	5/8	35	3 3/8	8	5/8	29
2 1/2	3 7/8	4	5/8	41	3 7/8	8	3/4	34
3	4 3/4	8	5/8	61	4 3/4	8	3/4	50
4	5 7/8	8	5/8	44	5 7/8	8	3/4	73
5	7	8	3/4	64	7	8	3/4	88
6	8 1/4	8	3/4	91	8 1/4	12	3/4	100
8	10 3/4	12	3/4	172	10 3/4	12	7/8	223
10	12 1/2	12	7/8	122	12 1/2	16	1	173
12	14 3/4	12	7/8	166	14 3/4	16	1 1/8	266
14	16	12	1	207	16	20	1 1/8	232
16	18 1/4	16	1	209	18 1/4	20	1 1/4	347
18	20 3/4	16	1 1/8	337	20 3/4	24	1 1/4	415
24	27	20	1 1/4	429	27	24	1 1/2	703

WARRANTY

SELLER warrants to PURCHASER that the goods hereupon are free from defects in material and workmanship for a period of 12 months from the date of shipment from SELLER's factory. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING BUT NOT LIMITED TO THE WARRANTY OF MERCHANTABILITY, THE WARRANTY OF SUITABILITY OR FITNESS FOR USE AND THE WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE. THIS WARRANTY CANNOT BE MODIFIED BY ANY PERSON (DISTRIBUTOR, SALES REPRESENTATIVE, EMPLOYEE, ETC.), AND IS EXCLUSIVE FOR THE ORIGINAL PURCHASER OF HEAT EXCHANGE AND TRANSFER, INC'S PRODUCTS.

LIMITATIONS:

1. This warranty does not apply unless all payments are current and in accordance with the terms of the contract.
2. There is no warranty against damage resulting from misapplication, improper specifications given by the customer or their representative, or other operating conditions beyond the control of the SELLER.
3. The equipment must be installed and maintained in accordance with SELLER's "Installation, Operation, and Instruction Manual", and standard industrial practices and codes.
4. This warranty is void if the equipment is disassembled or reworked by others without prior written approval from SELLER.
5. Material furnished by suppliers to SELLER are guaranteed by SELLER only to the extent of the original manufacturer's express warranty to SELLER.
6. Warranty shall extend only to the original direct purchaser from HEAT, Inc. Original equipment manufacturers (OEM's) can pass HEAT EXCHANGE AND TRANSFER, INC's warranty to their customers, but all warranty issues must go through the OEM who then contacts HEAT, Inc.

REMEDY:

1. SELLER agrees to replace or repair at SELLER's sole discretion, any defective parts manufactured as covered under this warranty, subject to inspection by SELLER. The PURCHASER is to ship the part,FOB: SELLER's plant Freight Allowed.
2. If a product is believed to be defective, a Purchase Order must be issued to Heat Exchange and Transfer, Inc. Attn: SERVICE DEPARTMENT for a replacement. At this time, the SERVICE DEPARTMENT will issue a "Return Materials Authorization Number" (RMA). All returned items must be accompanied by the RMA number. A credit will be issued, if the return item is found to be defective.
3. SELLER will ship a replaced or repaired item FOB: Shipping Point, Freight Allowed to the location of the original sale.
4. This is the exclusive remedy available.

GENERAL:

1. All warranty issues are through HEAT Inc.'s SERVICE DEPARTMENT.
2. SELLER will not assume liability for cost of disassembly, reassembly, or rework performed on the defective product.
3. In no event shall SELLER's liability exceed the invoice price of the articles with reference to which claim occurs and under no circumstances shall SELLER be liable for special consequential damages, or the expenses or losses incurred due to geographical location of the product, difficulty of access to the product as installed, or urgency as to time on the part of the user and/or buyer of the equipment.
4. Upon the expiration of twelve (12) months from the date of shipment, all such liability shall terminate. The foregoing shall constitute the sole remedy to the PURCHASER and sole liability of the SELLER.

HEAT EXCHANGE AND TRANSFER, INC.
500 Superior Street · Carnegie, PA 15106 · (412) 276-3388 · FAX: (412) 276-3397

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1A Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

12 KW 480 VAC 3 Ø 60 HZ Ambient Temperature: 40 °F

Inspected By : Ray DeJohn Date : 12/13/99
Tested By : Ray DeJohn Date : 12/13/99

Initial Upon Compliance

RD All prints, ECDS, & BOM are together in possession of the inspector.

RD Verify the System is a direct representation of the P&ID.

RD Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

RD Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

RD Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

RD Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : RD Date: 12/13/99 Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 12/13/99

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
HTO80	29411	1 1/4	99K1190	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __65GPM___ Temperature : __100__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :

P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__ L-L Value : 35 KW : 12 Amp Draw (calculated) : 14.4
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ___
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ___
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ____
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 16
Flange Stamped Properly __YES__ (Y/N) % output..... : 100 %

Component and Interlock Operational Checks :

__495__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__RD__ All Pilot Devicess Operational Check - OK
__RD__ Manual Reset Operational Check - OK
__RD__ Pump/Heater Interlock Operational Check - OK
__RD__ TIC and SCR Operational Check - OK (for all outputs)
__N/A__ FSL (Delta P) Operational Check - OK __N/A__ FSL Interlock Operational Check - OK
__N/A__ FSL (H2O) Operational Check - OK __N/A__ FSL Interlock Operational Check - OK
__N/A__ LSL Operational Check - OK __N/A__ LSL Interlock Operational Check - OK
__N/A__ LSH Operational Check - OK __N/A__ LSH Interlock Operational Check - OK
__N/A__ PSL Operational Check - OK __N/A__ PSL Interlock Operational Check - OK
__N/A__ PSH Operational Check - OK __N/A__ PSH Interlock Operational Check - OK
__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__N/A__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__RD__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Compliance (N/A - not applicable) (con't)

__N/A__ Pressure Transmitter(s) Operational Check - OK

N/A Temperature Transmitter(s) Operational Check - OK
RD PI(s) Operational Check - OK
N/A TI(s) Operational Check - OK
N/A Regulators (Air, Nitrogen, etc.) Operational Check - OK
N/A BPCV Operational Check - OK
RD Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	M/OL	5 Amps

HEATING DATA :

	ZONE 1			ZONE 2					
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	T.I. #2 Reading	Head PSIG
100		40	3.4						0
150		40	3.3						0
200		40	3.3						0
250		39	3.3						0
300		38	3.2						0
350		38	3.2						0
400		36	3.1						0
450									
500									
550									
600									
650									
700									
750									

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1B Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

12 KW 480 VAC 3 Ø 60 HZ Ambient Temperature: 40 °F

Inspected By : John Stepovich Date : 12/27/99
Tested By : John Stepovich Date : 12/27/99

Initial Upon Compliance

JS All prints, ECDS, & BOM are together in possession of the inspector.

JS Verify the System is a direct representation of the P&ID.

JS Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

JS Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

JS Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

JS Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : JS Date: 12/27/99 Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 12/27/99

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
MP Pumps	HTO 80	1 1/4	99K1191	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __50GPM___ Temperature : __200__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :

P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__ L-L Value : 34.5 KW : 12 Amp Draw (calculated) : 14.4
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ___
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ___
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ____
Circuit # : ____ L-L Value : ___ KW : _____ Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 16
Flange Stamped Properly __YES__ (Y/N) % output..... : 100 %

Component and Interlock Operational Checks :

__495__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__JS__ All Pilot Devicess Operational Check - OK
__JS__ Manual Reset Operational Check - OK
__JS__ Pump/Heater Interlock Operational Check - OK
__JS__ TIC and SCR Operational Check - OK (for all outputs)
__N/A__ FSL (Delta P) Operational Check - OK __N/A__ FSL Interlock Operational Check - OK
__N/A__ FSL (H2O) Operational Check - OK __N/A__ FSL Interlock Operational Check - OK
__N/A__ LSL Operational Check - OK __N/A__ LSL Interlock Operational Check - OK
__N/A__ LSH Operational Check - OK __N/A__ LSH Interlock Operational Check - OK
__N/A__ PSL Operational Check - OK __N/A__ PSL Interlock Operational Check - OK
__N/A__ PSH Operational Check - OK __N/A__ PSH Interlock Operational Check - OK
__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__N/A__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__JS__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Compliance (N/A - not applicable) (con't)

N/A Pressure Transmitter(s) Operational Check - OK
N/A Temperature Transmitter(s) Operational Check - OK
JS PI(s) Operational Check - OK
JS TI(s) Operational Check - OK
N/A Regulators (Air, Nitrogen, etc.) Operational Check - OK
N/A BPCV Operational Check - OK
JS Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	M/OL	5 Amps

HEATING DATA :

	ZONE 1			ZONE 2					
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	T.I. #2 Reading	Head PSIG
100									
150		39	3.8						0
200		39	3.7						0
250		39	3.6						0
300		38	3.6						0
350		36	3.5						0
400		34	3.5						0
450									
500									
550									
600									
650									
700									
750									

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1C Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

12 KW 480 VAC 3 Ø 60 HZ Ambient Temperature: 40 °F

Inspected By : Rich Kotar Date : 01/11/00
Tested By : Rich Kotar Date : 01/11/00

Initial Upon Compliance

RK All prints, ECDS, & BOM are together in possession of the inspector.

RK Verify the System is a direct representation of the P&ID.

RK Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

RK Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

RK Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

RK Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : RK Date: 01/11/00 Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 01/11/00

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
MP Pumps	HTO 80	1.25x1.5x6	99K465	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __45GPM___ Temperature : __200__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :

P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__ L-L Value : 35.4 KW : 12 Amp Draw (calculated) : 14.4
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ___
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ___
Circuit # : ____ L-L Value : ___ KW : ____ Amp Draw (calculated) : ____
Circuit # : ____ L-L Value : ___ KW : _____ Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 15.2
Flange Stamped Properly __YES__ (Y/N) % output..... : 100 %

Component and Interlock Operational Checks :

__495__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__RK__ All Pilot Devicess Operational Check - OK
__RK__ Manual Reset Operational Check - OK
__RK__ Pump/Heater Interlock Operational Check - OK
__RK__ TIC and SCR Operational Check - OK (for all outputs)
__N/A__ FSL (Delta P) Operational Check - OK __N/A__ FSL Interlock Operational Check - OK
__N/A__ FSL (H2O) Operational Check - OK __N/A__ FSL Interlock Operational Check - OK
__N/A__ LSL Operational Check - OK __N/A__ LSL Interlock Operational Check - OK
__N/A__ LSH Operational Check - OK __N/A__ LSH Interlock Operational Check - OK
__N/A__ PSL Operational Check - OK __N/A__ PSL Interlock Operational Check - OK
__N/A__ PSH Operational Check - OK __N/A__ PSH Interlock Operational Check - OK
__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__RK__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__RK__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Compliance (N/A - not applicable) (con't)

N/A Pressure Transmitter(s) Operational Check - OK
N/A Temperature Transmitter(s) Operational Check - OK
RK PI(s) Operational Check - OK
N/A TI(s) Operational Check - OK
N/A Regulators (Air, Nitrogen, etc.) Operational Check - OK
N/A BPCV Operational Check - OK
RK Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	OL	5 Amps

HEATING DATA :

	ZONE 1			ZONE 2					
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	Pump Monitor	Head PSIG
100		40	3.8					2.5	0
150		38	3.5					2.3	0
200		37	3.4					2.2	0
250		36	3.3					2.1	0
300		35	3.2					2	0
350		34	3.2					1.9	0
400		33	3.1					1.9	0
450									
500									
550									
600									
650									
700									
750									

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1D Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

__12__ KW __480__ VAC __3__ Ø __60__ HZ Ambient Temperature: __55__ °F

Inspected By : Rich Kotar Date : 01/10/00
Tested By : Rich Kotar Date : 01/10/00

Initial Upon Compliance

RK All prints, ECDS, & BOM are together in possession of the inspector.

RK Verify the System is a direct representation of the P&ID.

RK Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

RK Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

RK Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

RK Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : __RK__ Date: __01/10/00__ Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 01/10/00

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
MP Pumps	HTO 80	1.25x1.5x6	99K467	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __45 GPM___ Temperature : __100__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :
P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__	L-L Value : 34.5	KW : 12	Amp Draw (calculated) : 14.4
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ____
Circuit # : ____	L-L Value : ____	KW : _____	Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 15.5
Flange Stamped Properly __YES__ (Y/N) % output..... : 100 %

Component and Interlock Operational Checks :

__495__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__RK__ All Pilot Devicess Operational Check - OK
__RK__ Manual Reset Operational Check - OK
__RK__ Pump/Heater Interlock Operational Check - OK
__RK__ TIC and SCR Operational Check - OK (for all outputs)

__N/A__	FSL (Delta P) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	FSL (H2O) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	LSL Operational Check - OK	__N/A__	LSL Interlock Operational Check - OK
__N/A__	LSH Operational Check - OK	__N/A__	LSH Interlock Operational Check - OK
__N/A__	PSL Operational Check - OK	__N/A__	PSL Interlock Operational Check - OK
__N/A__	PSH Operational Check - OK	__N/A__	PSH Interlock Operational Check - OK

__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__RK__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__RK__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Complianc e (N/A - not applicable) (con't)

N/A Pressure Transmitter(s) Operational Check - OK
N/A Temperature Transmitter(s) Operational Check - OK
RK PI(s) Operational Check - OK
N/A TI(s) Operational Check - OK
N/A Regulators (Air, Nitrogen, etc.) Operational Check - OK
N/A BPCV Operational Check - OK
RK Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	OL	5 Amps

HEATING DATA :

		ZONE 1			ZONE 2				
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	Pump Monitor	Head PSIG
100		40	3.8					3	0
150		39	3.5					2.6	0
200		37	3.3					2.1	0
250		35	3.2					2	0
300		33	3.2					2	0
350		32	3.2					1.9	0
400		32	3.2					1.9	0
450									
500									
550									
600									
650									
700									
750									

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1E Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

12 KW 480 VAC 3 Ø 60 HZ Ambient Temperature: 46 °F

Inspected By : Rich Kotar Date : 01/18/00
Tested By : Rich Kotar Date : 01/18/00

Initial Upon Compliance

RK All prints, ECDS, & BOM are together in possession of the inspector.

RK Verify the System is a direct representation of the P&ID.

RK Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

RK Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

RK Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

RK Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : RK Date: 01/18/00 Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 01/18/00

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
MP Pumps	HTO 80	1.25x1.5x6	99K468	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __45 GPM___ Temperature : __100__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :
P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__	L-L Value : 34.5	KW : 12	Amp Draw (calculated) : 14.4
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ____
Circuit # : ____	L-L Value : ____	KW : _____	Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 15.2
Flange Stamped Properly __YES__ (Y/N) % output..... : 100 %

Component and Interlock Operational Checks :

__499__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__RK__ All Pilot Devicess Operational Check - OK
__RK__ Manual Reset Operational Check - OK
__RK__ Pump/Heater Interlock Operational Check - OK
__RK__ TIC and SCR Operational Check - OK (for all outputs)

__N/A__	FSL (Delta P) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	FSL (H2O) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	LSL Operational Check - OK	__N/A__	LSL Interlock Operational Check - OK
__N/A__	LSH Operational Check - OK	__N/A__	LSH Interlock Operational Check - OK
__N/A__	PSL Operational Check - OK	__N/A__	PSL Interlock Operational Check - OK
__N/A__	PSH Operational Check - OK	__N/A__	PSH Interlock Operational Check - OK

__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__RK__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__RK__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Complianc e (N/A - not applicable) (con't)

N/A Pressure Transmitter(s) Operational Check - OK
N/A Temperature Transmitter(s) Operational Check - OK
RK PI(s) Operational Check - OK
N/A TI(s) Operational Check - OK
N/A Regulators (Air, Nitrogen, etc.) Operational Check - OK
N/A BPCV Operational Check - OK
RK Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	OL	5 Amps

HEATING DATA :

		ZONE 1			ZONE 2				
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	Pump Monitor	Head PSIG
100		44	4.2					2.5	0
150		43	4					2.2	0
200		42	3.9					2	0
250		41	3.3					2	0
300		40	3.2					1.9	0
350		40	3.2					1.9	0
400		39	3.2					1.8	0
450									
500									
550									
600									
650									
700									
750									

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1F Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

12 KW 480 VAC 3 Ø 60 HZ Ambient Temperature: 46 °F

Inspected By : Rich Kotar Date : 01/18/00
Tested By : Rich Kotar Date : 01/18/00

Initial Upon Compliance

RK All prints, ECDS, & BOM are together in possession of the inspector.

RK Verify the System is a direct representation of the P&ID.

RK Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

RK Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

RK Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

RK Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : RK Date: 01/18/00 Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 01/18/00

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
MP Pumps	HTO 80	1.25x1.5x6	99K463	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __50 GPM___ Temperature : __100__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :
P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__	L-L Value : 34.5	KW : 12	Amp Draw (calculated) : 14.4
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ____
Circuit # : ____	L-L Value : ____	KW : _____	Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 15.7
Flange Stamped Properly __YES__ (Y/N) % output..... :100 %

Component and Interlock Operational Checks :

__499__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__RK__ All Pilot Devicess Operational Check - OK
__RK__ Manual Reset Operational Check - OK
__RK__ Pump/Heater Interlock Operational Check - OK
__RK__ TIC and SCR Operational Check - OK (for all outputs)

__N/A__	FSL (Delta P) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	FSL (H2O) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	LSL Operational Check - OK	__N/A__	LSL Interlock Operational Check - OK
__N/A__	LSH Operational Check - OK	__N/A__	LSH Interlock Operational Check - OK
__N/A__	PSL Operational Check - OK	__N/A__	PSL Interlock Operational Check - OK
__N/A__	PSH Operational Check - OK	__N/A__	PSH Interlock Operational Check - OK

__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__RK__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__RK__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Complianc e (N/A - not applicable) (con't)

N/A Pressure Transmitter(s) Operational Check - OK
N/A Temperature Transmitter(s) Operational Check - OK
RK PI(s) Operational Check - OK
N/A TI(s) Operational Check - OK
N/A Regulators (Air, Nitrogen, etc.) Operational Check - OK
N/A BPCV Operational Check - OK
RK Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	OL	5 Amps

HEATING DATA :

		ZONE 1			ZONE 2				
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	Pump Monitor	Head PSIG
100		44	3.6					2.2	0
150		42	3.3					2	0
200		40	3.2					1.9	0
250		39	3.2					1.8	0
300		36	3.1					1.8	0
350		36	3.1					1.7	0
400		35	3.1					1.7	0
450									
500									
550									
600									
650									
700									
750									

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1G Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

12 KW 480 VAC 3 Ø 60 HZ Ambient Temperature: 45 °F

Inspected By : Rich Kotar Date : 01/26/00
Tested By : Rich Kotar Date : 01/26/00

Initial Upon Compliance

RK All prints, ECDS, & BOM are together in possession of the inspector.

RK Verify the System is a direct representation of the P&ID.

RK Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

RK Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

RK Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

RK Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : RK Date: 01/26/00 Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 01/26/00

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
MP Pumps	HTO 80	1.25x1.5x6	99K462	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __50 GPM___ Temperature : __100__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :
P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__	L-L Value : 34.5	KW : 12	Amp Draw (calculated) : 14.4
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ____
Circuit # : ____	L-L Value : ____	KW : _____	Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 15.8
Flange Stamped Properly __YES__ (Y/N) % output..... : 100 %

Component and Interlock Operational Checks :

__499__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__RK__ All Pilot Devicess Operational Check - OK
__RK__ Manual Reset Operational Check - OK
__RK__ Pump/Heater Interlock Operational Check - OK
__RK__ TIC and SCR Operational Check - OK (for all outputs)

__N/A__	FSL (Delta P) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	FSL (H2O) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	LSL Operational Check - OK	__N/A__	LSL Interlock Operational Check - OK
__N/A__	LSH Operational Check - OK	__N/A__	LSH Interlock Operational Check - OK
__N/A__	PSL Operational Check - OK	__N/A__	PSL Interlock Operational Check - OK
__N/A__	PSH Operational Check - OK	__N/A__	PSH Interlock Operational Check - OK

__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__RK__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__RK__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Complianc e (N/A - not applicable) (con't)

N/A Pressure Transmitter(s) Operational Check - OK
N/A Temperature Transmitter(s) Operational Check - OK
RK PI(s) Operational Check - OK
N/A TI(s) Operational Check - OK
N/A Regulators (Air, Nitrogen, etc.) Operational Check - OK
N/A BPCV Operational Check - OK
RK Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	OL	5 Amps

HEATING DATA :

		ZONE 1			ZONE 2				
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	Pump Monitor	Head PSIG
100		40	3.8					2.3	0
150		40	3.7					2.1	0
200		38	3.6					2	0
250		37	3.6					1.9	0
300		36	3.5					1.8	0
350		35	3.4					1.7	0
400		33	3.4					1.7	0
450		31	3.4					1.6	0
500									
550									
600									
650									
700									
750									

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1H Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

12 KW 480 VAC 3 Ø 60 HZ Ambient Temperature: 45 °F

Inspected By : Rich Kotar Date : 01/25/00
Tested By : Rich Kotar Date : 01/25/00

Initial Upon Compliance

RK All prints, ECDS, & BOM are together in possession of the inspector.

RK Verify the System is a direct representation of the P&ID.

RK Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

RK Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

RK Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

RK Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : RK Date: 01/25/00 Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 01/25/00

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
MP Pumps	HTO 80	1.25x1.5x6	99K469	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __45 GPM___ Temperature : __100__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :
P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__	L-L Value : 35.5	KW : 12	Amp Draw (calculated) : 14.4
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ____
Circuit # : ____	L-L Value : ____	KW : _____	Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 15.1
Flange Stamped Properly __YES__ (Y/N) % output..... : 100 %

Component and Interlock Operational Checks :

__499__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__RK__ All Pilot Devicess Operational Check - OK
__RK__ Manual Reset Operational Check - OK
__RK__ Pump/Heater Interlock Operational Check - OK
__RK__ TIC and SCR Operational Check - OK (for all outputs)

__N/A__	FSL (Delta P) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	FSL (H2O) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	LSL Operational Check - OK	__N/A__	LSL Interlock Operational Check - OK
__N/A__	LSH Operational Check - OK	__N/A__	LSH Interlock Operational Check - OK
__N/A__	PSL Operational Check - OK	__N/A__	PSL Interlock Operational Check - OK
__N/A__	PSH Operational Check - OK	__N/A__	PSH Interlock Operational Check - OK

__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__RK__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__RK__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Complianc e (N/A - not applicable) (con't)

N/A Pressure Transmitter(s) Operational Check - OK
N/A Temperature Transmitter(s) Operational Check - OK
RK PI(s) Operational Check - OK
N/A TI(s) Operational Check - OK
N/A Regulators (Air, Nitrogen, etc.) Operational Check - OK
N/A BPCV Operational Check - OK
RK Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	OL	5 Amps

HEATING DATA :

		ZONE 1			ZONE 2				
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	Pump Monitor	Head PSIG
100		40	3.6					2.4	0
150		39	3.5					2.3	0
200		38	3.3					2.3	0
250		37	3.3					2.2	0
300		36	3.2					2.1	0
350		34	3.2					2	0
400		32	3					1.9	0
450									
500									
550									
600									
650									
700									
750									

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1I Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

__12__ KW __480__ VAC __3__ Ø __60__ HZ Ambient Temperature: __45__ °F

Inspected By : Rich Kotar Date : 01/26/00
Tested By : Rich Kotar Date : 01/26/00

Initial Upon Compliance

RK All prints, ECDS, & BOM are together in possession of the inspector.

RK Verify the System is a direct representation of the P&ID.

RK Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

RK Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

RK Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

RK Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : __RK__ Date: __01/26/00__ Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 01/26/00

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
MP Pumps	HTO 80	1.25x1.5x6	99K464	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __50 GPM___ Temperature : __150__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :
P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__	L-L Value : 34.8	KW : 12	Amp Draw (calculated) : 14.4
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ____
Circuit # : ____	L-L Value : ____	KW : _____	Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 15.5
Flange Stamped Properly __YES__ (Y/N) % output..... : 100 %

Component and Interlock Operational Checks :

__499__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__RK__ All Pilot Devicess Operational Check - OK
__RK__ Manual Reset Operational Check - OK
__RK__ Pump/Heater Interlock Operational Check - OK
__RK__ TIC and SCR Operational Check - OK (for all outputs)

__N/A__	FSL (Delta P) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	FSL (H2O) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	LSL Operational Check - OK	__N/A__	LSL Interlock Operational Check - OK
__N/A__	LSH Operational Check - OK	__N/A__	LSH Interlock Operational Check - OK
__N/A__	PSL Operational Check - OK	__N/A__	PSL Interlock Operational Check - OK
__N/A__	PSH Operational Check - OK	__N/A__	PSH Interlock Operational Check - OK

__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__RK__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__RK__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Complianc e (N/A - not applicable) (con't)

N/A Pressure Transmitter(s) Operational Check - OK
N/A Temperature Transmitter(s) Operational Check - OK
RK PI(s) Operational Check - OK
N/A TI(s) Operational Check - OK
N/A Regulators (Air, Nitrogen, etc.) Operational Check - OK
N/A BPCV Operational Check - OK
RK Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	OL	5 Amps

HEATING DATA :

		ZONE 1			ZONE 2				
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	Pump Monitor	Head PSIG
100		40	3.6					2.6	0
150		39	3.5					2.5	0
200		38	3.3					2.3	0
250		36	3.2					2.1	0
300		34	3.2					2	0
350		32	3.1					2	0
400		30	3.1					1.9	0
450									
500									
550									
600									
650									
700									
750									

SYSTEM INSPECTION AND TEST REPORT

April 1997
rev. 10/97

Serial Number : 1218-1J Customer :
Model Number :KM550-12-483 Fluid Used: Sunvis 21

12 KW 480 VAC 3 Ø 60 HZ Ambient Temperature: 45 °F

Inspected By : Rich Kotar Date : 01/25/00
Tested By : Rich Kotar Date : 01/25/00

Initial Upon Compliance

RK All prints, ECDS, & BOM are together in possession of the inspector.

RK Verify the System is a direct representation of the P&ID.

RK Verify mechanical components (manufacturer, size, and ratings) are in accordance with the description as specified on the MCDS.

RK Verify electrical components (manufacturer and size) are in accordance with the description as specified on the ECDS.

RK Verify any marks on the W.O. print copies requiring print and/or bill changes are complete prior to preparing the system for test.

RK Verify the System is completely detailed (correct nomenclature, complete vent lines, proper pipe bracing, clean enclosure and base, etc.).

Action Items :

_____ Check only if equipment is on "**HOLD**" status until revisions are completed.
*** If checked, please note test date is completely dependent on completion of aforementioned Action Items.

Inspector's Initials : RK Date: 01/25/00 Pg. 1 Forwarded to : _____

Model Number : KM550-12-483 Date : 01/25/00

PUMP DATA :

				Motor Nameplate		
MFG.	MODEL #	SIZE	S/N	HP	VOLTS	FLA
MP Pumps	HTO 80	1.25x1.5x6	99K166	3	460	4.1

GPM as plotted on the Pump Curve : Pump #1 __50 GPM___ Temperature : __150__ °F
Pump #2 _____ Temperature : _____ °F

HEATER DATA :
P/N : FH0509-12-38S-483 Circuit Type (circle one) : **WYE** / DELTA

Circuit # : __1__	L-L Value : 34.8	KW : 12	Amp Draw (calculated) : 14.4
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ___
Circuit # : ____	L-L Value : ___	KW : ____	Amp Draw (calculated) : ____
Circuit # : ____	L-L Value : ____	KW : _____	Amp Draw (calculated) : ____

Circuit(s) used for testing : __1___ Amp Draw (measured) : 15.1
Flange Stamped Properly __YES__ (Y/N) % output..... : 100 %

Component and Interlock Operational Checks :

__499__ Test Voltage (VAC)

Initial Upon Compliance (N/A - not applicable)

__RK__ All Pilot Devicess Operational Check - OK
__RK__ Manual Reset Operational Check - OK
__RK__ Pump/Heater Interlock Operational Check - OK
__RK__ TIC and SCR Operational Check - OK (for all outputs)

__N/A__	FSL (Delta P) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	FSL (H2O) Operational Check - OK	__N/A__	FSL Interlock Operational Check - OK
__N/A__	LSL Operational Check - OK	__N/A__	LSL Interlock Operational Check - OK
__N/A__	LSH Operational Check - OK	__N/A__	LSH Interlock Operational Check - OK
__N/A__	PSL Operational Check - OK	__N/A__	PSL Interlock Operational Check - OK
__N/A__	PSH Operational Check - OK	__N/A__	PSH Interlock Operational Check - OK

__N/A__ Solenoid(s) Operational Check - OK
__N/A__ I/P(s) Operational Check - OK
__RK__ 2 and 3-Way CV's Operational Check - OK
__N/A__ Purge Kit Operational Check - OK (Includes Proper Operation of Shunt Trip)
__RK__ TSH Open Sensor Fail Safe Circuit Test-0K

Initial Upon Complianc e (N/A - not applicable) (con't)

_N/A_ Pressure Transmitter(s) Operational Check - OK
_N/A_ Temperature Transmitter(s) Operational Check - OK
_RK_ PI(s) Operational Check - OK
_N/A_ TI(s) Operational Check - OK
_N/A_ Regulators (Air, Nitrogen, etc.) Operational Check - OK
_N/A_ BPCV Operational Check - OK
_RK_ Fuse Continuity Check - OK

Bench Set Components

List all adjustable components which were either bench set or set after installation and record their values. Ex. Pressure Switch, Air Regulator, Flow Switch, BPCV,etc.

Component	P&ID Label	Setting
Motor Over Loads	OL	5 Amps

HEATING DATA :

		ZONE 1			ZONE 2				
Bulk Oil Temp. °F	Suction PSI	Discharge PSI	Motor Amps	Suction PSI	Discharge PSI	Motor Amps	T.I. #1 Reading	Pump Monitor	Head PSIG
100		42	4.1					2.7	0
150		41	3.9					2.5	0
200		40	3.8					2.4	0
250		39	3.8					2.2	0
300		37	3.6					2.1	0
350		35	3.5					2	0
400		33	3.4					1.9	0
450									
500									
550									
600									
650									
700									
750									