OWNER'S MANUAL

SINGLE OR TWIN ELECTRIC STEAM MIXER KETTLE COMPLETE WITH HYDRAULIC POWER TILT BRIDGE

MODELS:

► SINGLE
- FTM-40LE
- FTM-60LE
- FTM-80LE

► TWIN
- FTM(2)-40LE
- FTM (2)-60LE
- FTM (2)-80LE

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DESCRIPTION:
Construction shall be welded stainless steel type 304 satin finish. A double-wall kettle interior shall form a steam jacket around the lower 2/3 of the kettle. The bottom of the kettle shall be of hemispheric design for maximum heat transfer. (*316 stainless steel liner is standard on 40 gallon for high-acid content products*). The tubular legs shall be constructed of stainless steel pipe fitted with four-hole adjustable flanged feet for securing to the floor. A sealed stainless steel tilt mechanism shall permit the kettle to tilt forward a full 90° for complete emptying. The tilt mechanism shall be self-locking for positive stop action.

The mixer is a variable-speed unit powered by a 5 hp electric motor driving a hydraulic pump. Two agitators shall be included: a primary stainless steel scraper/agitator, and a secondary high-speed mixer. Both agitators shall be removable for cleaning, and no tools will be required for removal.

The console front to have the main power switch, mixer lift switch, and variable speed control. The bridge is constructed of 10-gauge stainless steel and contains two heavy-duty hydraulic motors to drive the agitators. The bridge shall be power tilt, and swing 140° out of the way for kettle tilting or cleaning.

Kettle controls shall include a power switch, indicator light, vacuum/pressure gauge, pressure relief valve, and low-water shutoff. Thermostat range to be 140°F to 285°F (*60°C to 140°C*), at a maximum pressure of 50 psi (*3.7 kg/cm^2*). Removable heating elements rated at 24 KW.

CAPACITIES:
All models are suffixed with either -40, -60, or -80 to indicate the capacity of that kettle in gallons. Thus a FTM-40LE is two-thirds jacketed direct steam kettle mounted on legs with a capacity of 40 gallons and a FTM(2)-40LE is two-thirds jacketed direct steam kettle mounted on legs with a capacity of a twin 40 gallon mixer kettle.

OPERATION WILL BE BY:
Electrically self-generating closed steam system equipped for operation on, 208 Volt, 3 Ph, 60 Hz or 240 Volt, 3 Ph, 60 Hz.

FUNCTIONING MODE:
All electrically powered self steam generating kettles consist of a jacket containing a permanent solution of water and antifreeze sufficient to completely immerse and protect replaceable electric heating-elements. To minimize tampering, the Safety Valve is plumbed toward the rear of the kettle jacket. Should any component malfunction and cause the pressure in the jacket to reach the rated pressure of the kettle, this protective device will open automatically and release excessive pressurized steam.

When the Power Switch is turned ON and the Temperature Control (*Thermostat*) Knob dialed, the TEMPERATURE pilot light will ignite and contactors will close to allow power to the elements. Steam generation will commence and continue until the preselected temperature is reached, at which point the contactors open, cutting off power to heating the elements. The TEMPERATURE pilot light will then extinguish. When the temperature of the water in the jacket drops slightly, the cycle will repeat itself thus making it possible to maintain any selected precise cooking mode temperature.

The temperature required for the cooking process to function adequately must be greater than the boiling point of the liquid food product: Further, the higher the temperature, the greater the steam pressure attained in the jacket and consequently the quicker the cooking process. For example, steam pressurized at 30 p.s.i. at-

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tains a temperature of 274° Fahrenheit.

Since air is an unsuitable media through which heat may be transferred, it has been removed from the kettle jacket during testing at the factory. The Pressure Gauge should indicate vacuum in the jacket in green zone on the gauge (*approximately 20 - 25 inches Hg*) when the kettle is cold or has been inoperative for some time. The kettle jacket is intended to function at all times as a completely sealed self-contained chamber and it is especially advisable not to trip the safety relief valve during inoperative periods since this will break the vacuum seal and allow air to enter the kettle jacket.

The Temperature Controls (thermostats) used in these kettles have been calibrated to prevent the heating elements from generating steam pressure that would exceed the rated working pressure of the kettle. In the unlikely event that the Temperature Control fails and the heating elements remain energized, the Safety Valve will blow and release the excessive pressure and steam from the jacket, consequently lowering the water level in the jacket. The Safety Probe sensing depletion of the water level in the kettle jacket will not only activate the LOW WATER level indicator pilot light, but also signal the Liquid Level Control to switch off power and de-energize the circuit to the heating elements (*preventing element burn outs*) until the water level is adequately replenished.

The mixer is a variable speed unit powered by a 5 hp electric motor driving a hydraulic pump. Two heavy duty hydraulic motors drive the primary scraper/agitator and secondary high speed mixer. Both are removable without tools for cleaning. They are housed in a stainless steel bridge that is power tilt and swings 1400 out of the way for tilting the kettles(s). Once the bridge has been lifted the agitators cannot be operated as a safety switch is activated. Bridge may now be moved out of the way or if a twin mixer, moved to the other kettle. The speed control is located on the front panel and may be set to the desired speed by turning. The maximum speed will not exceed 54 RPM on the smallest kettle and 40 RPM on the largest.

UNPACKING:
Immediately after unpacking, check for possible shipping damage. If the kettle is found to be damaged, save the packaging material and contact the carrier within 15 days of delivery.

ELECTRICAL CONNECTIONS:
A control box with a power supply equivalent to the electrical rating of the unit should be located nearby. A waterproof electrical connection for the power supply to the unit must be provided. Remove the back panel of the hydraulic console and make electrical connection per wiring diagram located inside the console in plastic bag attached to tank. A waterproof electrical connection from power supply to rear of hydraulic console must be provided. Ground kettle to terminal provided in the hydraulic console. Once proper connections are made, replace the back panel on hydraulic console, turn power ON and check for proper operation. All internal wiring for the kettle and hydraulic power unit is complete. Connect water supply for cooling system as shown in Service Connections. If faucet is provided connect water supply and check for proper operation.

CODES AND STANDARDS:
Your electric mixing kettle must be installed in accordance with Provincial and local codes, or in the absence of local codes, with C.S.A. C22.1 Canadian Electrical Code, Part 1, or in the U.S.A., the National Electrical Code ANSI/NFPA-70 (latest edition). ANSI NFPA Standard #96 “Vapour Removal from Cooking Equipment”, (latest edition), available from the National Fire Protection Association, Batterymarch Park, Quincy, MA, 02269.

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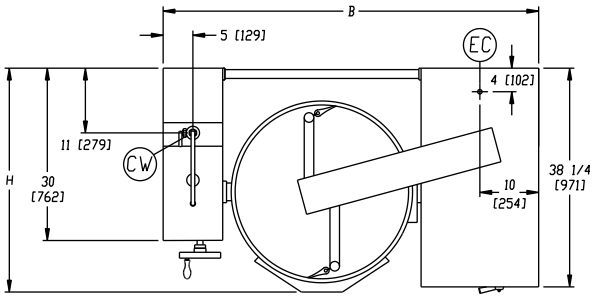
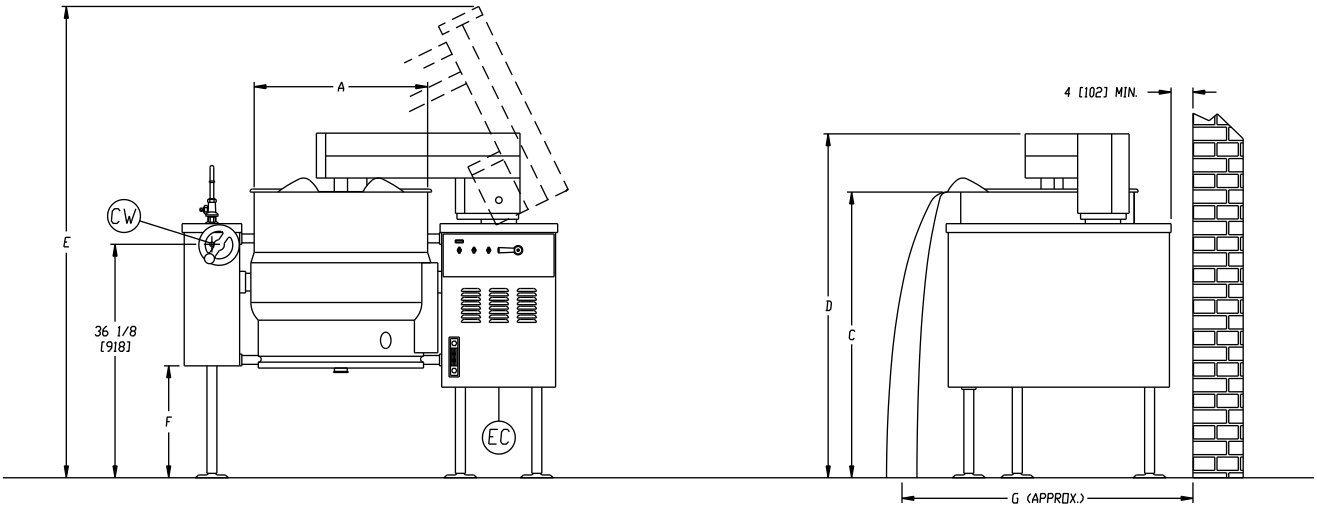
SINGLE ELECTRIC MIXER KETTLE

DIMENSIONS

MODEL	CAPACITY		A	B	C	D	E	F	G
FTM-40LE	40 Gallons	inches	26	62	45.5	55	75.625	15.125	56
	152 Liters	*mm*	*660*	*1575*	*1156*	*1397*	*1921*	*384*	*1422*
FTM-60LE	60 Gallons	inches	29.5	65	49	58.5	80	19.5	58
	227 Liters	*mm*	*749*	*1651*	*1245*	*1486*	*2032*	*495*	*1473*
FTM-80LE	80 Gallons	inches	33	67.75	49	58.5	80	19.5	60
	303 Liters	*mm*	*838*	*1721*	*1245*	*1486*	*2032*	*495*	*1524*

FLANGED FOOT DETAIL
4 EQUALLY SPACED
7/16" 11mm DIA. HOLES
ON 3" 76mm B.C.





SERVICE CONNECTIONS

Electrically Operated

EP□ □	Power Supply - Use wire suitable for at least 90ºC. Normal amp per line wire:

VOLTS	1pH	3pH	For 24kW MODELS
208 (*197-219*)	115□	67□	FTM-40LE
240 (*220-240*)	100□	58□	FTM-60LE
480 (*360-500*)	50	29	FTM-80LE

Details of other electrical systems available upon request.

CW	Cold Water - 3/8" (*10mm*) O.D. tubing to fill faucet (optional).
EC	Electrical Connection -To be specified n Data Plate.

NOTE: *PVC and CPVC pipe are not acceptable materials for drains.*

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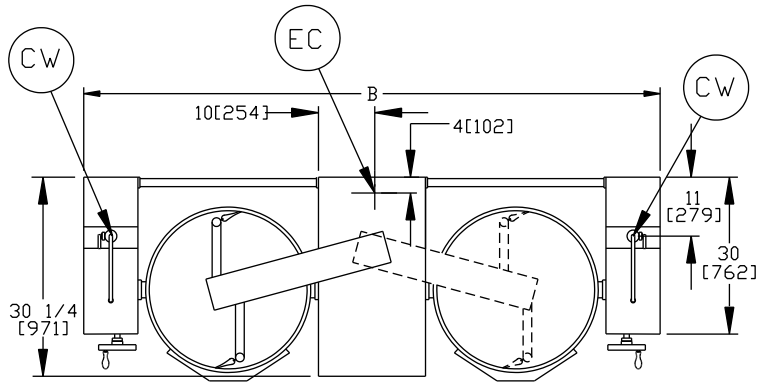
TWIN ELECTRIC MIXER KETTLE

DIMENSIONS

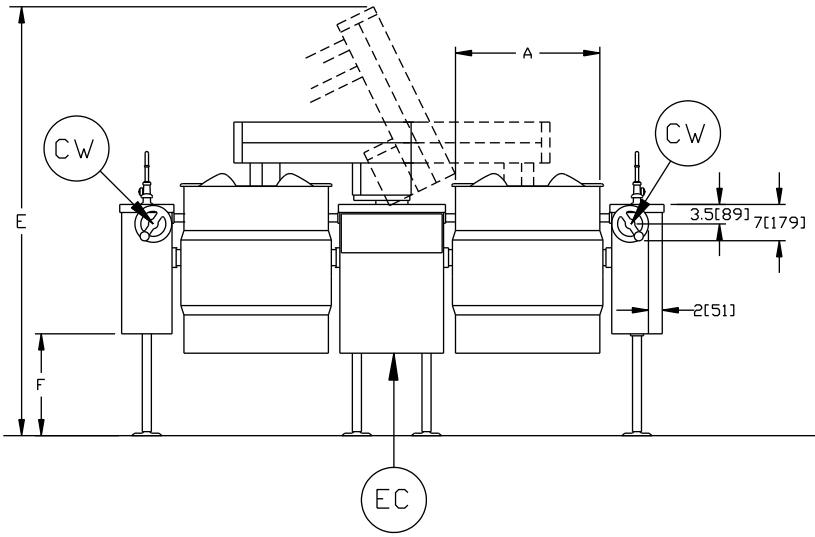
MODEL	CAPACITY		A	B	C	D	E	F	G
FTM(2)-40LE	40 Gallons	inches	26	102	45.5	55	75.625	15.125	56
	152 Liters	*mm*	*660*	*2591*	*1156*	*1397*	*1921*	*384*	*1422*
FTM(2)-60LE	60 Gallons	inches	29.5	108	49	58.5	80	19.5	58
	227 Liters	*mm*	*749*	*2743*	*1245*	*1486*	*2032*	*495*	*1473*
FTM(2)-80LE	80 Gallons	inches	33	116	49	58.5	80	19.5	60
	303 Liters	*mm*	*838*	*2946*	*1245*	*1486*	*2032*	*495*	*1524*

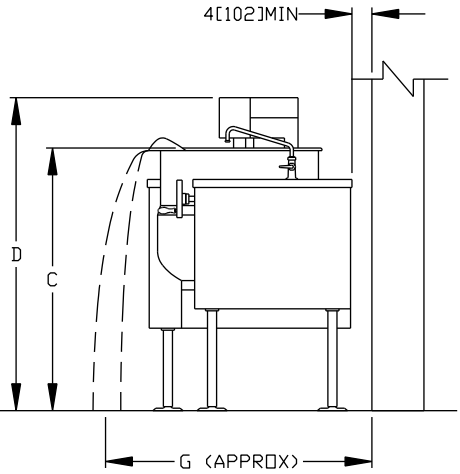


NOTE: *PVC and CPVC pipe are not acceptable materials for drains.*

SERVICE CONNECTIONS
Electrically Operated

EP□ □	Power Supply - Use wire suitable for at least 90ºC. Normal amp per line wire: **VOLTS** — **24kW 1pH** — **33kW 3pH** — **ALL MODELS** 208 (*197-219*) — 148□ — 198□ — FTM(2)-40LE 240 (*220-240*) — 130□ — 173□ — FTM(2)-60LE 480 (*360-500*) — 65 — 87 — FTM(2)-80LE Details of other electrical systems available upon request.
CW	Cold Water - 3/8" (*10mm*) O.D. tubing to fill faucet (optional).
EC	Electrical Connection - To be specified on Data Plate.





INSTALLATION

INSTALLATION INSTRUCTIONS:

Before installing, verify that the electrical service agrees with the specifications on the rating plate located on the right side of the tilt console. If the supply and equipment requirements do not agree, contact the factory or your dealer.

1. Select a location to provide drainage for kettle pour path when tilted and for butterfly valve if so equipped. Allow sufficient rear clearance from wall for access to rear service panel on hydraulic console.
2. Level unit. With kettle in the upright position, place a carpenter's level on top of the kettle and turn the adjustable feet to level kettle side-to-side and front to back. Mark hole locations on floor through anchoring holes provided in flanged adjustable feet.
3. Remove unit and drill holes where marked and insert expansion shields to accommodate 5/16" size lag bolts.
4. Reposition unit. Re-level kettle by making necessary adjustments on flanged feet.
5. Bolt down unit and seal with Silastic or equivalent sealing compound. Sealant must be applied not only to bolt heads but also around flanges making contact with the floor surface to fulfil NSF requirements. Wipe off excess sealant immediately.
6. Connect water drain line from cooling system to drain or return line.
7. Connect cold water supply line for cooling system as indicated in bottom of hydraulic console.
8. The relief valve on the kettles(s) must not be adjusted or closed off as they are set to relieve excess pressure in the kettle(s).
9. Do not make any adjustments to the hydraulic system as it has been set at the factory.

OPERATION

OPERATING INSTRUCTIONS:

<u>WARNING:</u> The kettle and its parts are hot. Use care when operating, cleaning and servicing the kettle.

Ensure that the external electrical service to kettle is on.

Check pressure gauge for correct cold kettle reading. Reading should be in the green area of the gauge indicating 25 - 30 In. Hg (630 - 730mm Hg) of vacuum. If reading is not low enough, follow VENTING procedure in Troubleshooting section prior to using kettle.

Place power switch to ON position.

Preheat kettle by placing thermostat knob at '10' and wait until TEMPERATURE light goes off.

NOTE: *Preheating should not be used when cooking milk and egg food products which adhere to hot cooking surfaces. These foods should be placed into kettle before heating has begun.*

Add food to be cooked into kettle.

Place thermostat knob at required temperature setting from 1 to 10 coinciding with the following table:

THERMOSTAT SETTING	APPROXIMATE (JACKET) TEMPERATURE	
1	140°F	60°C
2	155°F	68°C
3	172°F	78°C
4	187°F	86°C
5	205°F	96°C
6	223°F	106°C
7	240°F	116°C
8	255°F	124°C
9	271°F	133°C
10	285°F	140°C

When cooking is finised set thermostat knob

OPERATION

and power switch to OFF.

Pour finished product from kettle using tilt handle. Be careful to avoid splashing.

Add water to kettle for cleaning purposes.

Wash kettle thoroughly (*see Cleaning Instructions starting on this page*).

RAISING MIXER BRIDGE:

Tilt kettle for emptying or to clean agitators, the mixer bridge will tilt hydraulically upward and manually swing to clear the kettle. To do this, first turn “speed control” to “stop” and then turn mixer switch to “off”.

NOTE: *Mixer agitator arms must be stopped at 90^{O} to the mixer bridge before raising the bridge. If the agitator arms do not stop in this position when speed selector is set to stop, the “jog” the selector on and off to achieve this position.*

Push the “tilt” switch to the “raise” position a nd hold. Bridge will raise to maximum height. Bridge will stop at any position the tilt switch is released and will remain until the switch is pushed to wither raise or lower.

NOTE: *The bridge is equipped with a safety which prevents turning of the agitators, regardless of the mixer switch, or speed control settings. Agitators will not engage unless the bridge is lowered so that the guide pin rests fully in the guide pin bracket on the side of the kettle.*

REMOVAL OF AGITATORS:

The agitators are removable without tools, for ease of cleaning. To remove raise bridge as described in “Raising Mixer Bridge” and swing clear of kettle. Grasp shaft of large agitator, push up and turn to disengage lock pin. Pull straight down on agitator. Remove the small agitator in the same manner. If it is necessary to remove scrapers blades for cleaning purposes, remove the pin at the end of the mounting shaft and then slide the scraper blade off the shaft.

CLEANING PROCEDURE

WARNINGS:

- Disconnect the power supply to the appliance before cleaning or servicing.
- Never spray water into electric controls or components!
- The appliance and its parts are hot. Use care when operating, cleaning and servicing.
- Do not use cleaning agents that are corrosive.
- If you are cleaning a valve that is assembled to a kettle, be sure the kettle is completely empty of any product.

Your kettle should be cleaned immediately after each use or when cooking a different product. Before cleaning, check that the kettle has cooled enough to touch it.

1. Ensure that power supply is OFF.
2. Pre-rinse inside of kettle thoroughly and drain to remove any food particles.
3. Using a nylon brush, clean kettle with a mild detergent and warm water rinse. Never use steel wool or scouring powder as it will scratch stainless steel.
4. Tilt kettle fully or open the tangent draw-off valve if one is provided to allow soap and water solution to drain. Rinse with clean water.
5. Wipe the exterior of kettle with a clean, damp cloth.

Use of cleaning agents that contain chloride, acids or salts are corrosive and may cause pitting and corrosion when used over a period of

CLEANING PROCEDURE

time; this will reduce the life of the appliance. Should pitting or corrosion occur, this is not covered by warranty.

Follow the recommended cleaning instructions. Use a mild detergent, warm water and rinse thoroughly.

BUTTERFLY VALVE:
WARNING: If you are cleaning a valve that is assembled to a kettle, be sure the kettle is completely empty of any product.

DISASSEMBLY AND REPAIR:
In the event that repairs or replacement becomes necessary, the following procedures are suggested.

1. Drain and flush the piping surrounding the valve.
2. To remove handle, remove the socket head screw found on top of the valve handle with proper size Allen wrench.
3. Remove the nut and cap screws.
4. Separate the valve body halves.
5. Set the butterfly disc to the open position.
6. Squeeze the seal until oval shaped, then slide the short end of the stem from the seal.
7. Pinch the disc between the thumb and forefinger and pull the long end of the stem.
8. Check for and replace a cracked or worn seal, bushing, stem and disc, or screws.
9. Reassembly is opposite of disassembly.

WHAT TO DO IF SURFACE RUST APPEARS:
Metal utensils should never be used as they will scratch the surface of the equipment and rust may begin to form. To remove surface accumulation of rust from the inadvertent use of such utensils, the following procedure may be used.
CAUTION: Improper use of this procedure may damage your appliance!

1. Use undiluted white vinegar with a non-abrasive scouring pad (plastic) or cloth on the affected area to remove the rust stain. The appliance should not be heated and remain at room temperature during the entire cleaning process.
2. If the stain resists removal, additional exposure time with vinegar may be required, to a maximum of one hour.
3. Thoroughly wash all of the vinegar away with fresh clear water. Dry the surface completely and allow one hour before using the appliance to cook.

Following daily and period maintenance procedures will prolong the life of your equipment. Climatic conditions - salt air - may require more thorough and frequent cleaning or the life of the equipment could be adversely affected.

STAINLESS STEEL:
To remove normal dirt, grease or product residue from stainless steel, use ordinary soap and water (with or without detergent) applied with a sponge or cloth. Dry thoroughly with a clean cloth. Never use vinegar or any other corrosive cleaner.

To remove grease and food splatters or condensed vapors that have baked on the equipment, apply cleanser to a damp cloth or sponge and rub cleanser on the metal in the direction of the polishing lines. Rubbing cleanser as gently as possible in the direction of the polished lines will not mar the finish of the stainless steel. NEVER RUB WITH A CIRCULAR MOTION.

Soil arid burn deposits which do not respond to the above procedure can usually be removed by rubbing the surface with SCOTCH-BRITE scouring pads or STAINLESS scouring pads. DO NOT USE ORDINARY STEEL WOOL as any particles left on the surface will rust and further spoil the appearance of the finish. NEVER USE A WIRE BRUSH, STEEL SCOURING PADS (EXCEPT STAINLESS), SCRAPER, FilE

CLEANING PROCEDURE

OR OTHER STEEL TOOLS. Surfaces which are marred collect dirt more rapidly and become more difficult to clean. Marring also increases the possibility of corrosive attack. Refinishing may then be required.

TO REMOVE HEAT TINT:
Darkened areas sometimes appear on stainless steel surfaces where the area has been subjected to excessive heat. These darkened areas are caused by thickening of the protective surface of the stainless steel and is not harmful. Heat tint can normally be removed by the foregoing, but tint which does not respond to this procedure calls for a vigorous scouring in the direction of the polish lines using SCOTCH-BRITE scouring pads or a STAINLESS scouring pad in combination with a powdered cleanser. Heat tint action may be lessened by not applying or by reducing heat to equipment during slack periods.

All food contact surfaces must be thoroughly drained and flushed prior to cooking in the kettle.

CONTROL PANEL:
The textured control panel should be cleaned with warm water and mild soap. Never use an abrasive cloth or steel wool. Never use cleaning solvents with a hydrocarbon base.

MAINTENANCE & REPAIR

Trunnion block bearings, fitted with a grease nipple should be filled with grease every couple of months or more frequently if so required. They are located in each console box and support the kettle for ease of tilting. The segment gear and worm should be greased at the same time if required. These are located in the tilt console box. No other general maintenance is required other than adhering to the Cleaning Procedure instructions.

HYDRAULIC SYSTEM SERVICE:
Set up regular schedule for checking the oil temperature, hydraulic hoses and keeping the equipment clean. A thick layer of dirt acts as an insulation and prevents the hydraulic system from cooling.

The hydraulic system has been adjusted and tested at the factory and no adjustment should be needed. If the unit fails to operate properly, all service work must be performed by a qualified service agent.

A thermostat controlled cooling system has been installed in the hydraulic system to maintain oil temperatures while in operation. The oil is cooled by cold water flowing through a heat exchanger alongside of the oil. A thermostat activates at 1400 Fahrenheit oil temperature opening the valve and releasing cold water into the heat exchanger, cooling the oil.

NOTE: *At least twice a year have an authorized service person clean and service the unit for maximum performance.*

SETTING THE MIXER SYSTEM FLOW:
1. On the operator panel, switch “POWER” to on, “MIXER” to on, and set mixer speed to “FAST”, the maximum speed.
2. Increase or decrease flow to maximum rpm as listed, or less if requested by customer. Turn in “c” to decrease, turn out to increase.

40 Gallon Mixer Kettle	54 RPM
60 Gallon Mixer Kettle	48 RPM
80 Gallon Mixer Kettle	43 RPM

CAUTION: Do not exceed 54 RPM! Decreasing the flow to less than 10 rpm may over centre the swash plate and will damage the pump!

MAINTENANCE & REPAIR

3. Use jam nut to lock adjusting screw when complete.

SETTING THE BRIDGE ACTUATOR:

1. On the operator panel, switch “POWER” to on, “MIXER” to on, and set mixer speed to “STOP”.
2. The pressure reducing valve and associated gauge are located at the back of the hydraulic unit. Adjust it to 800 psi.
3. The speed of the actuator is controlled by an in-line flow control valve also located at the back of the unit. There is also a locking set screw provided on the adjusting knob.
4. Using the “RAISE/LOWER” tilt switch on the operator panel, adjust the flow control so that the stroke is completed at a safe speed.

SETTING MIXER SYSTEM PRESSURE:

Refer to Figure 1.

1. On the operator panel, switch “POWER” to on, “MIXER” to on, and set mixer speed to “STOP”.
2. Turn trim relief stem, item “B”, completely in.
3. Increase the pump pressure by turning “A” inwards, until gauge “0” reads 1700 psi. The pressure must be 300 psi higher than the pump setting.
4. Adjust trim relief “B” outwards until pressure indicated on gauge “0” begins to drop.
5. Lock the trim relief “B”.
6. Decrease the pump pressure by turning “A” outwards, until gauge “0” reads 1400 psi and lock in place.

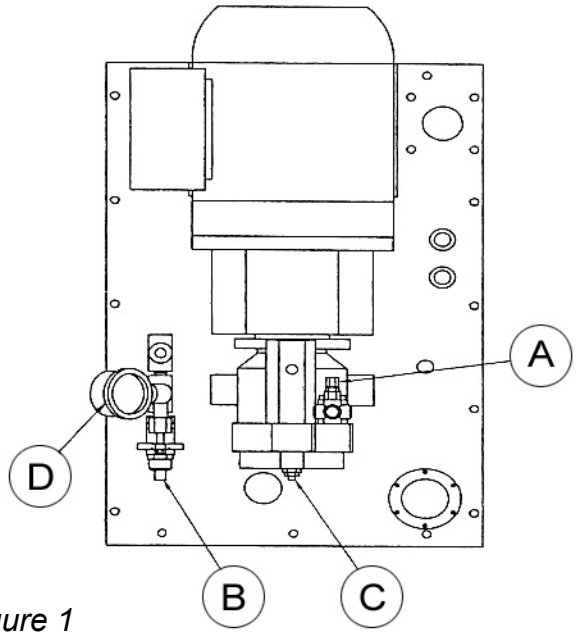


Figure 1

TROUBLE-SHOOTING

LOW WATER LEVEL:

Proper water level must be maintained within the jacket for the kettle to operate. Depletion of water may occur from excessive opening of or leakage through the safety relief valve. If water is below required operating level, either initially at start-up or during use, the kettle will automatically shut off and the LOW WATER signal light will come on.

In order for the kettle to operate, the following must be followed. The kettle must be cool before proceeding with the following steps. Trip the safety relief valve lever to relieve all pressure from the kettle jacket. At exterior rear of kettle jacket remove nut from Air Vent. Insert funnel into Air Vent opening and slowly add the indicated amount of clean water for:

MODEL	PER KETTLE			
	ADD:		IF COMPLETELY EMPTY, ADD:	
FTM-40LE	220 ounces	6.50 liters	548 ounces	16.2 liters
FTM-60LE	250 ounces	7.39 liters	586 ounces	17.33 liters
FTM-80LE	340 ounces	10.05 liters	850 ounces	25.12 liters

Replace air vent nut. Follow AIR VENTING INSTRUCTIONS. Continue normal operating procedure of kettle.

TROUBLE-SHOOTING

EXTREMELY SLOW COOKING TIME:
If the cooking time is abnormally slow then the difficulty may be due to insufficient steam pressure. First determine that pressure on incoming stream line at kettle is with in 15 PSI of rated kettle pressure. Note that pressure approaching the rated kettle pressure are liable to set off the safety relief valve. If required pressure is available to kettle, then possibly volume of steam is not sufficient. Minimum 3/4" pipe size is required to the kettle but if the steam generating source is at a great distance from the kettle, larger pipe will be required. Finally, the core of the steam flow will require disassembly and inspection.

PUMPS: *Pump makes excessive noise.*
1. Check for vacuum leaks in the suction line.
2. Check alignment with drive mechanism. Misalignment will cause wear and subsequent high noise level in operation.
3. Check compatibility of fluid being pumped against manufacturers recommendations.
4. Relief or unloading valve set to high.
5. Aeration of fluid in reservoir, return lines above fluid level.
6. Reversed rotation.
7. Plugged reservoir filter breather.
8. Oil viscosity too high or operating temperature too low.
9. Loose or worn pump parts.
10. Pump being driven in excess of rated speed.
11. Air leak at pump shaft seal.
12. Oil level too low and drawing air in through inlet pipe opening.
13. Air bubbles in intake oil.

Pump parts inside housing fail to operate.
1. Seizure due to lack of oil.
2. Excessive system pressure above maximum pup rating.
3. Excessive torquing of housing bolts.
4. Solid matter being drawn in from reservoir and wedged in pump.

Excessive pump wear:
1. Abrasive dirt in the hydraulic oil being circulated through the system.
2. Oil viscosity too low.
3. System pressure exceeds pump rating.
4. Pump misalignment.
5. Air being drawn in through inlet of pump.

OIL: *Dirty oil.*
1. Components not properly cleaned after servicing.
2. Inadequate screening in fill pipe.
3. Air breather left off.
4. Filter dirty or ruptured.

SOLENOID VALVE: *Fails to operate.*
1. Is there an electrical signal to the solenoid or operating device? Is the voltage too low. Check with the volmeter, test light in an emergency.
2. Has foreign matter jammed the main spool? Remove en caps and see that main spool is free in its movement. Remember that there will be a quantity of fluid escaping when the cap is removed and provide a container to catch it.
3. Are solenoids improperly interlocked so that a signal is provided to both units simultaneously? Put test light on each solenoid lead in parallel and watch for simultaneous lighting. Check electrical interlock. this condition probably burns out more solenoids then any other factor.
4. Is fluid media excessively hot? Check for localized heating which may indicate an internal leak, Check reservoir temperature and see if it is within machine specifications.
5. Voltage too low? If voltage will not complete the stroke of alternating current (AC) solenoid will burn out coil.

TROUBLE-SHOOTING

6. Signal to both solenoids of a double solenoid valve simultaneously. One or both of the solenoids will be unable to complete their stroke and will burn out. Make certain the electrical signal is interlocked so that this condition cannot exist.
7. Mechanical damage to leads. Short circuit, open connections, etc.
8. Tight spool or other mechanical parts of the valve being actuated can prevent the solenoid from completing its stroke and subsequently burning out.
9. Wrong voltage or frequency will either prevent operation, because of inadequate capacity to handle the load with the lower voltage or burn out the oil, because of improper winding and excessive voltage.

OVERHEATING:

1. Continuous operation at relief setting.
   a. Stalling under load etc.
   b. Fluid viscosity too high or too low.
2. Excessive slippage or internal leakage.
   a. Fluid viscosity too low.
3. System relief valve set too high.
4. Power unit ambient temperature too high.

MOISTURE IN OIL:

1. Cooling coils not below fluid level.
2. Moisture in cans used to replace fluid in tanks.
3. Extreme temperature differential in certain geographical locations.

FOAMING OIL:

1. Return of tank line not below fluid level.
2. Fluid contaminated with incompatible foreign matter.
3. Suction leak to pump aerating oil.

PETRO-CANADA

Material Safety Data Sheet

WHMIS (Pictograms)	WHMIS (Classification)	Protective Clothing	TDG (pictograms)
	**Not controlled**		

Section 1. Chemical Product and Company Identification

Product Name **PURITY* FG AW HYDRAULIC FLUID 32, 46, 68, 100**

Code 491-010, PFAW32
491-011, PFAW46
491-012, PFAW68
491-013, PFAW100

Validated on 11/28/2003.

Synonym Not available

Manufacturer PETRO-CANADA
P.O. Box 2844
Calgary, Alberta
T2P 3E3

In case of Emergency Petro-Canada:
403-296-3000
Canutec Transportation:
613-996-6666
Poison Control Centre:
Consult local telephone directory for emergency number(s).

Material Uses PURITY FG AW Hydraulic Fluid 32, 46, 68, 100 are food grade hydraulic fluids and light gear oils.

NSF H1 Registered.

All components comply with FDA 21 CFR 178.3570 " Lubricants with Incidental Food Contact". It is intended for application on industrial and food equipment. It should not be added directly to the food product.

Section 2. Composition and Information on Ingredients

			Exposure Limits (ACGIH)		
Name	**CAS #**	**% (W/W)**	**TLV-TWA(8 h)**	**STEL**	**CEILING**
Mixture of severely hydrotreated and hydrocracked base oil (petroleum) and other proprietary, non-hazardous additives.	Mixture	100	5 mg/m³ (oil mist)	10 mg/m³ (oil mist)	Not established

Manufacturer Recommendation Not applicable

Other Exposure Limits Consult local, state, provincial or territory authorities for acceptable exposure limits.

Section 3. Hazards Identification.

Potential Health Effects Prolonged or repeated contact may cause skin irritation, defatting, drying and dermatitis. Not expected to cause more than slight skin or eye irritation. With its relatively low vapour pressure, this product is not expected be inhaled in any appreciable quantity at ambient conditions. If heated to high temperatures or subjected to mechanical actions which produce vapours or mists, inhalation may cause respiratory tract irritation. Ingestion may produce a laxative effect. For more information refer to Section 11 of this MSDS.

Section 4. First Aid Measures

Eye Contact IMMEDIATELY flush eyes with running water for at least 15 minutes, keeping eyelids open. Seek medical attention.

Skin Contact Remove contaminated clothing - launder before reuse. Wash gently and thoroughly the contaminated skin with running water and non-abrasive soap. Seek medical attention

Inhalation Evacuate the victim to a safe area as soon as possible. If the victim is not breathing, perform artificial respiration. Allow the victim to rest in a well ventilated area. Seek medical attention.

Ingestion DO NOT induce vomiting because of danger of aspirating liquid into lungs. Seek medical attention.

Note to Physician Not available

Section 5. Fire-fighting Measures

Flammability	May be combustible at high temperature.	**Flammable Limits**	Not available
Flash Points	OPEN CUP: ≥200°C (392°F) (Cleveland)	**Auto-Ignition Temperature**	Not available
Fire Hazards in Presence of Various Substances	Low fire hazard. This material must be heated before ignition will occur.	**Explosion Hazards in Presence of Various Substances**	Do not cut, weld, heat, drill or pressurize empty container. Containers may explode in heat of fire.
Products of Combustion	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), phosphorus compounds (POx), silicon oxides (SiOx), smoke and irritating vapours as products of incomplete combustion.		
Fire Fighting Media and Instructions	NAERG96, GUIDE 171, Substances (low to moderate hazard). If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (0.5 mile) in all directions; also, consider initial evacuation for 800 meters (0.5 mile) in all directions. Shut off fuel to fire if it is possible to do so without hazard. If this is impossible, withdraw from area and let fire burn out under controlled conditions. Withdraw immediately in case of rising sound from venting safety device or any discolouration of tank due to fire. Cool containing vessels with water spray in order to prevent pressure build-up, autoignition or explosion. SMALL FIRE: use DRY chemicals, foam, water spray or CO2. LARGE FIRE: use water spray, fog or foam. For small outdoor fires, portable fire extinguishers may be used, and self contained breathing apparatus (SCBA) may not be required. For all indoor fires and any significant outdoor fires, SCBA is required. Respiratory and eye protection are required for fire fighting personnel.		

Section 6. Accidental Release Measures

Material Release or Spill	Consult current National Emergency Response Guide Book (NAERG) for appropriate spill measures if necessary. Extinguish all ignition sources. Stop leak if safe to do so. Dike spilled material. Use appropriate inert absorbent material to absorb spilled product. Collect used absorbent for later disposal. Avoid contact with spilled material. Avoid contaminating sewers, streams, rivers and other water courses with spilled material. Notify appropriate authorities immediately.

Section 7. Handling and Storage

Handling	Avoid contact with any sources of ignition, flames, heat, and sparks. Avoid skin contact. Avoid eye contact. Avoid inhalation of product vapours or mists. Empty containers may contain product residue. Do not pressurize, cut, heat, or weld empty containers. Do not reuse containers without commercial cleaning and/or reconditioning. Personnel who handle this material should practice good personal hygiene during and after handling to help prevent accidental ingestion of this product. Properly dispose of contaminated leather articles including shoes that cannot be decontaminated.
Storage	Store away from incompatible and reactive materials (See section 5 and 10). Keep container tightly closed. Store in dry, cool, well-ventilated area.

Section 8. Exposure Controls/Personal Protection

Engineering Controls	For normal application, special ventilation is not necessary. If user's operations generate vapours or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit. Make-up air should always be supplied to balance air removed by exhaust ventilation. Ensure that eyewash station and safety shower are close to work-station.
Personal Protection	***-The selection of personal protective equipment varies, depending upon conditions of use***
Eyes	Eye protection (i.e., safety glasses, safety goggles and/or face shield) should be determined based on conditions of use. If product is used in an application where splashing may occur, the use of safety goggles and/or a face shield should be considered.
Body	Wear appropriate clothing to prevent skin contact. As a minimum long sleeves and trousers should be worn.
Respiratory	Where concentrations in air may exceed the occupational exposure limits given in Section 2 (and those applicable to your area) and where engineering, work practices or other means of exposure reduction are not adequate, NIOSH approved respirators may be necessary to prevent overexposure by inhalation.
Hands	Wear appropriate chemically protective gloves. When handling hot product ensure gloves are heat resistant and insulated.
Feet	Wear appropriate footwear to prevent product from coming in contact with feet and skin.

Section 9. Physical and Chemical Properties

Physical State and Appearance	Viscous liquid.	**Viscosity**	32: 29.8 cSt @ 40ºC (104ºF), 5.2 cSt @ 100ºC (212ºF), VI=101 46: 45.4 cSt @ 40ºC (104º), 6.8 cSt @ 100ºC (212ºF), VI=102 68: 63.3 cSt @ 40º (104ºF), 8.4 cSt @ 100ºC (212ºF), VI=102 100: 101.5 cSt @ 40º (104ºF), 11.5 cSt @ 100ºC (212ºF), VI=99
Colour	Colourless.	**Pour Point**	32: -18ºC 46: -18ºC 68: -18ºC 100: -15ºC
Odour	Mild petroleum oil like.	**Softening Point**	Not applicable.
Odour Threshold	Not available	**Dropping Point**	Not applicable.
Boiling Point	Not available	**Penetration**	Not applicable.
Density	0.8629 - 0.8731 kg/L @ 15ºC	**Oil / Water Dist. Coefficient**	Not available
Vapour Density	Not available	**Ionicity (in water)**	Not available
Vapour Pressure	Negligible at ambient temperature and pressure.	**Dispersion Properties**	Not available
Volatility	Non-volatile.	**Solubility**	Insoluble in water.

Section 10. Stability and Reactivity

Corrosivity	Not available		
Stability	The product is stable under normal handling and storage conditions.	**Hazardous Polymerization**	Will not occur under normal working conditions.
Incompatible Substances / Conditions to Avoid	Reactive with oxidizing agents, acids and alkalis.	**Decomposition Products**	May release COx, NOx, SOx, POx, SiOx, formaldehyde, smoke and irritating vapours when heated to decomposition.

Section 11. Toxicological Information

Routes of Entry Skin contact, eye contact, inhalation and ingestion.

Acute Lethality

Acute toxicity information is not available for the product as a whole, therefore, data for some of the ingredients is provided below:
Acute Oral toxicity (LD50): >5000 mg/kg (rat)
Acute Dermal toxicity (LD50): >2000 mg/kg (rabbit)
Acute Inhalation toxicity (LC50): >2500 mg/m³/4h (rat)

Chronic or Other Toxic Effects

Dermal Route:	Prolonged or repeated contact may defat and dry skin, and cause dermatitis. Short-term exposure is expected to cause only slight irritation, if any.
Inhalation Route:	With its relatively low vapour pressure, this product is not expected be inhaled in any appreciable quantity at ambient conditions. If heated to high temperatures or subjected to mechanical actions which produce vapours or mists, inhalation may cause respiratory tract irritation
Oral Route:	Ingestion of this product may lead to aspiration of the liquid, especially if vomiting occurs. This may result in chemical pneumonitis (inflammation of the lungs) and/or pulmonary edema (an accumulation of fluid in the lungs). May produce a laxative effect.
Eye Irritation/Inflammation:	Short-term exposure is expected to cause only slight irritation, if any.
Immunotoxicity:	Not available
Skin Sensitization:	Contact with this product is not expected to cause skin sensitization, based upon the available data and the known hazards of the components.
Respiratory Tract Sensitization:	Contact with this product is not expected to cause respiratory tract sensitization, based upon the available data and the known hazards of the components.
Mutagenic:	This product is not known to contain any components at >= 0.1% that have been shown to cause mutagenicity. Therefore, based upon the available data and the known hazards of the components, this product is not expected to be a mutagen.

Reproductive Toxicity:	This product is not known to contain any components at >= 0.1% that have been shown to cause reproductive toxicity. Therefore, based upon the available data and the known hazards of the components, this product is not expected to be a reproductive toxin.
Teratogenicity/Embryotoxicity:	This product is not known to contain any components at >= 0.1% that have been shown to cause teratogenicity and/or embryotoxicity. Therefore, based upon the available data and the known hazards of the components, this product is not expected to be a teratogen/embryotoxin.
Carcinogenicity (ACGIH):	This product is not known to contain any chemicals at reportable quantities that are listed as Group A1 or A2 carcinogens by ACGIH.
Carcinogenicity (IARC):	This product is not known to contain any chemicals at reportable quantities that are listed as Group 1, 2A, or 2B carcinogens by IARC.
Carcinogenicity (NTP):	This product is not known to contain any chemicals at reportable quantities that are listed as carcinogens by NTP.
Carcinogenicity (IRIS):	This product is not known to contain any chemicals at reportable quantities that are listed as carcinogens by IRIS.
Carcinogenicity (OSHA):	This product is not known to contain any chemicals at reportable quantities that are listed as carcinogens by OSHA.
Other Considerations	No additional remark.

Section 12. Ecological Information

Environmental Fate	Not available	**Persistance/ Bioaccumulation Potential**	Not available
BOD5 and COD	Not available	**Products of Biodegradation**	Not available
Additional Remarks	No additional remark.		

Section 13. Disposal Considerations

Waste Disposal	Spent/ used/ waste product may meet the requirements of a hazardous waste. Consult your local or regional authorities. Ensure that waste management processes are in compliance with government requirements and local disposal regulations.

Section 14. Transport Information

TDG Classification	Not a hazardous material for transport according to the TDG Regulations. (Canada)	**Special Provisions for Transport**	Not applicable.

Section 15. Regulatory Information

Other Regulations

This product is acceptable for use under the provisions of WHMIS-CPR. All components of this formulation are listed on the CEPA-DSL (Domestic Substances List).

All components of this formulation are listed on the US EPA-TSCA Inventory.

All components of this product are on the European Inventory of Existing Commercial Chemical Substances (EINECS).

German Water Hazard Classification (Verwaltungsvorschrift wassergefährdende Stoffe - VwVwS) WGK=1

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

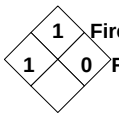
Please contact Product Safety for more information.

DSD/DPD (Europe)	Not classified under the Dangerous Substances or Dangerous Preparations Directives.	**HCS (U.S.A.)**	Does not meet the definitions of a health or physical hazard according to the OSHA - Hazard Communication Standard. (United States)
ADR (Europe) (Pictograms)		**DOT (U.S.A) (Pictograms)**	

HMIS (U.S.A.)

Health Hazard	1
Fire Hazard	1
Reactivity	0

NFPA (U.S.A.)



Rating
0 Insignificant
1 Slight
2 Moderate

Personal Protection	B	**Specific hazard**	3 High 4 Extreme

Section 16. Other Information

References Available upon request.
* Marque de commerce de Petro-Canada - Trademark

Glossary

ACGIH - American Conference of Governmental Industrial Hygienists
ADR - Agreement on Dangerous goods by Road (Europe)
ASTM - American Society for Testing and Materials
BOD5 - Biological Oxygen Demand in 5 days
CAN/CGA B149.2 Propane Installation Code
CAS - Chemical Abstract Services
CEPA - Canadian Environmental Protection Act
CERCLA - Comprehensive Environmental Response, Compensation and Liability Act
CFR - Code of Federal Regulations
CHIP - Chemicals Hazard Information and Packaging Approved Supply List
COD5 - Chemical Oxygen Demand in 5 days
CPR - Controlled Products Regulations
DOT - Department of Transport
DSCL - Dangerous Substances Classification and Labeling (Europe)
DSD/DPD - Dangerous Substances or Dangerous Preparations Directives (Europe)
DSL - Domestic Substance List
EEC/EU - European Economic Community/European Union
EINECS - European Inventory of Existing Commercial Chemical Substances
EPCRA - Emergency Planning and Community Right to Know Act
FDA - Food and Drug Administration
FIFRA - Federal Insecticide, Fungicide and Rodenticide Act
HCS - Hazardous Communication System
HMIS - Hazardous Material Information System
IARC - International Agency for Research on Cancer
IRIS - Integrated Risk Information System
LD50/LC50 - Lethal Dose/Concentration kill 50%
LDLo/LCLo - Lowest Published Lethal Dose/Concentration
NAERG'96 - North American Emergency Response Guide Book (1996)
NFPA - National Fire Prevention Association
NIOSH - National Institute for Occupational Safety & Health
NPRI - National Pollutant Release Inventory
NSNR - New Substances Notification Regulations (Canada)
NTP - National Toxicology Program
OSHA - Occupational Safety & Health Administration
PEL - Permissible Exposure Limit
RCRA - Resource Conservation and Recovery Act
SARA - Superfund Amendments and Reorganization Act
SD - Single Dose
STEL - Short Term Exposure Limit (15 minutes)
TDG - Transportation Dangerous Goods (Canada)
TDLo/TCLo - Lowest Published Toxic Dose/Concentration
TLm - Median Tolerance Limit
TLV-TWA - Threshold Limit Value-Time Weighted Average
TSCA - Toxic Substances Control Act
USEPA - United States Environmental Protection Agency
USP - United States Pharmacopoeia
WHMIS - Workplace Hazardous Material Information System

For Copy of MSDS

The Canadian Controlled Products Regulations (CPR) (Under the Hazardous Products Act, part of the WHMIS legislation) only apply to WHMIS Controlled (i.e., hazardous) products. Therefore, the CPR and the 3-year update rule specified therein do not apply to WHMIS Non-Controlled products. Although this is true, customarily Petro-Canada reviews and updates Non-Controlled product MSDS if a customer requests such an update. These Non-Controlled product updates are given a lower priority than Controlled products but are handled as soon as practicable. If you would like to verify if the MSDS you have is the most current, or you require any further information, please contact:

Internet: www.petro-canada.ca/msds

Lubricants:
Western Canada, telephone: 1-800-661-1199; fax: (780) 464-9564
Ontario & Central Canada, telephone: 1-800-268-5850 and (905) 822-4222; fax: 1-800-201-6285
Quebec & Eastern Canada, telephone: 1-800-576-1686; fax: 800-201-6285

For Product Safety Information: (905) 804-4752

Prepared by Product Safety - JDW on 11/28/2003.

Data entry by Product Safety - RS.

Material Safety Data Sheet

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

24-Hour Emergency Phone Number: 989-636-4400

Product: DOWFROST* HD HEAT TRANSFER FLUID, DYED

Product Code: 04632

Effective Date: 08/03/04 Date Printed: 08/04/04 MSD: 002239

The Dow Chemical Company, Midland, MI 48674

Customer Information Center: 800-258-2436

2. COMPOSITION/INFORMATION ON INGREDIENTS

Propylene glycol	CAS# 000057-55-6	94%
Dipotassium phosphate	CAS# 007758-11-4	<5%
Deionized water	CAS# 007732-18-5	<5%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

****

* Clear yellow liquid. Odorless. Avoid temperatures above 450F, 232C. *

****

POTENTIAL HEALTH EFFECTS (See Section 11 for toxicological data.)

EYE: May cause slight transient (temporary) eye irritation. Corneal injury is unlikely. Mists may cause eye irritation.

SKIN CONTACT: Prolonged contact is essentially nonirritating to skin. A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. Repeated exposures may cause flaking and softening of skin.

INGESTION: Single dose oral toxicity is considered to be extremely low. No hazards anticipated from swallowing small amounts incidental to normal handling operations.

INHALATION: At room temperature, vapors are minimal due to physical properties. Mists may cause irritation of upper respiratory tract (nose and throat).

(Continued on page 2 , over)

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Repeated excessive exposure to propylene glycol may cause central nervous system effects.

CANCER INFORMATION: Did not cause cancer in laboratory animals.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Exposures having no adverse effects on the mother should have no effect on the fetus.

REPRODUCTIVE EFFECTS: In animal studies, has been shown not to interfere with reproduction.

4. FIRST AID

EYES: Flush eyes with plenty of water.

SKIN: Wash off in flowing water or shower.

INGESTION: No adverse effects anticipated by this route of exposure incidental to proper industrial handling.

INHALATION: Remove to fresh air if effects occur. Consult a physician.

NOTE TO PHYSICIAN: No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES
FLASH POINT: 214 F, 107 C (based on a similar material)
METHOD USED: PMCC
AUTOIGNITION TEMPERATURE: Not determined

FLAMMABILITY LIMITS
LFL: Not determined
UFL: Not determined

HAZARDOUS COMBUSTION PRODUCTS: During a fire, smoke may contain the original material in addition to unidentified toxic and/or irritating compounds. Hazardous combustion products may include and are not limited to carbon monoxide and carbon dioxide.

(Continued on page 3)

OTHER FLAMMABILITY INFORMATION: Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Flammable concentrations of vapor can accumulate at temperatures above 214F. Liquid mist of this product can burn. Spills of these organic liquids on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion. Container may rupture from gas generation in a fire situation.

EXTINGUISHING MEDIA: Water fog or fine spray, carbon dioxide, dry chemical, foam. Alcohol resistant foams (ATC type) are preferred if available. General purpose synthetic foams (including AFFF) or protein foams may function, but much less effectively. Do not use direct water stream. May spread fire.

MEDIA TO BE AVOIDED: Do not use direct water stream.

FIRE FIGHTING INSTRUCTIONS: Keep people away. Isolate fire area and deny unnecessary entry. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Fight fire from protected location or safe distance. Consider use of unmanned hose holder or monitor nozzles. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of re-ignition has passed. Immediately withdraw all personnel from area in case of rising sound from venting safety device or discoloration of the container. Move container from fire area if this is possible without hazard.

PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, pants, boots and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES (See Section 15 for Regulatory Information)

PROTECT PEOPLE: Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls/Personal Protection.

PROTECT THE ENVIRONMENT: Avoid contamination of all waterways.

(Continued on page 4 , over)

CLEAN-UP: See Section 13, Disposal Considerations.

7. HANDLING AND STORAGE

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: No special handling requirements data available.

HANDLING: See Section 8, Exposure Controls/Personal Protection.

STORAGE: See Section 10, Stability and Reactivity.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION: Use safety glasses. Safety glasses should be sufficient for most operations; however, for misty operations wear chemical goggles.

SKIN PROTECTION: Use gloves impervious to this material.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required for certain operations, use an approved air-purifying respirator. In misty atmospheres, use an approved mist respirator.

EXPOSURE GUIDELINES: Propylene glycol: AIHA WEEL is 10 mg/m3 for total vapor and aerosol.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE: Clear yellow liquid
ODOR: Odorless
VAPOR PRESSURE: 0.22 mmHg @ 20 C
VAPOR DENSITY: 2.6
BOILING POINT: 320 F, 160 C
SOLUBILITY IN WATER/MISCIBILITY: Complete
SPECIFIC GRAVITY OR DENSITY: 1.058 @ 25/25 C

10. STABILITY AND REACTIVITY

(Continued on page 5)

CHEMICAL STABILITY: Thermally stable at typical use temperatures.

CONDITIONS TO AVOID: Avoid use temperatures above 450F, 232C. Product can degrade at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems.

INCOMPATIBILITY WITH OTHER MATERIALS: Avoid contact with oxidizing materials. Avoid contact with strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS: Hazardous decomposition products depend upon temperature, air supply and the presence of other materials.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION (See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in Section 1)

SKIN: The LD50 for skin absorption in rabbits is >10,000 mg/kg.

INGESTION: The oral LD50 for rats is 20,000 - 34,000 mg/kg.

MUTAGENICITY: In vitro mutagenicity studies were negative. Animal mutagenicity studies were negative.

12. ECOLOGICAL INFORMATION (For detailed Ecological data, write or call the address or non-emergency number shown in Section 1)

ENVIRONMENTAL FATE

MOVEMENT & PARTITIONING: Based largely or completely on data for major component(s). Bioconcentration potential is low (BCF less than 100 or Log Pow less than 3). Potential for mobility in soil is very high (Koc between 0 and 50).

DEGRADATION & PERSISTENCE: Based largely or completely on data for major component(s). Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Degradation is expected in the atmospheric environment within minutes to hours.

ECOTOXICITY: Based largely or completely on data for major component(s). Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50 >100 mg/L in most

(Continued on page 6 , over)

sensitive species).

13. DISPOSAL CONSIDERATIONS (See Section 15 for Regulatory Information)

DISPOSAL: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND OR INTO ANY BODY OF WATER. All disposal methods must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. THE DOW CHEMICAL COMPANY HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION 2 (Composition/Information On Ingredients).

FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: recycler, reclaimer, incinerator or other thermal destruction device.

As a service to its customers, Dow can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Telephone Dow's Customer Information Center at 800-258-2436 or 989-832-1556 for further details.

14. TRANSPORT INFORMATION

DEPARTMENT OF TRANSPORTATION (D.O.T.): For D.O.T. regulatory information, if required, consult transportation regulations, product shipping papers, or contact your Dow representative.

CANADIAN TDG INFORMATION: For TDG regulatory information, if required, consult transportation regulations, product shipping papers, or your Dow representative.

15. REGULATORY INFORMATION (Not meant to be all-inclusive--selected regulations represented)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following

(Continued on page 7)

specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See other sections for health and safety information.

U.S. REGULATIONS

SARA 313 INFORMATION: To the best of our knowledge, this product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Not to have met any hazard category

TOXIC SUBSTANCES CONTROL ACT (TSCA):

All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

CHEMICAL NAME	CAS NUMBER	LIST
1,2-PROPANEDIOL	000057-55-6	PA1

PA1=Pennsylvania Hazardous Substance (present at greater than or equal to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:

(Continued on page 8 , over)

REGULATORY INFORMATION (CONTINUED)

This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

CANADIAN REGULATIONS
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WHMIS INFORMATION: The Canadian Workplace Hazardous Materials Information System (WHMIS) Classification for this product is:

This product is not a "Controlled Product" under WHMIS.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA):

This product contains one or more substances which are not listed on the Canadian Domestic Substances List (DSL). Contact your Dow representative for more information.

16. OTHER INFORMATION

MSDS STATUS: Revised Section 8 (Exposure Guidelines).