60 BROWN AVENUE
SPRINGFIELD, NJ 07081
USA
(973)-376-7770

MARK 25

OPERATION MANUAL

Yaskawa Controller
INTERACTX

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TRICO POLY SYSTEMS LLC
60 BROWN AVE SPRINGFIELD NEW JERSEY 07081 USA

MARK 25 Operation Manual

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GENERAL SAFETY

WARNING – HAZARD OF ELECTRIC SHOCK

All electrical wiring to electrical equipment must be installed in accordance with the National Electrical Code or local electrical codes by a qualified person. For maximum equipment protection, the **National Electrical Code** recommends ground fault protection is provided for the branch circuit supplying electrical equipment.

NOTE: It is required that the end user provide a fused disconnect in close proximity to each piece of electrical equipment supplied by Trico Poly Systems LLC.

WARNING – MECHANICAL AND OR CHEMICAL HAZARD

Equipment involving heaters, motors, gears, pumps, hoses, powered by air and, or fluids, in or on equipment, provided by Trico Poly Systems LLC must be operated or serviced by trained authorized personal only. Proper personal safety equipment, energy lock-outs, and proper tools must be used at all times.

Proper handling, ventilation, and or, breathing apparatus may be required to operate, the Trico Poly Systems LLC equipment if toxic chemicals are used in the manufacture of products from this equipment.

NOTE: Material Safety Data Sheets are to be understood and complied by at all times.

Machines are designed to make a person's work more effective and to make a better product. All satisfaction is lost when a person gets injured while operating machinery. Therefore, we urge you to observe the following safety precautions in addition to those outlined by your own company.

1. Follow all safety directions for each material being processed by the machine. If you don't know what these directions are, locate someone that does.

2. Avoid skin contact with cleaning solvents and materials.

3. **At all times wear required protective clothing**. Always have goggles and gloves on when dispensing materials, flushing the head or handling materials.

4. Avoid contact with vapors by wearing the proper breathing respirators as required. Fume removal systems must be in good working order.

5. Do not use flammable solvents for cleaning the mix head or any part of the machine. Keep flammable solvents away from the machine as sparks from DC motors, AC contactors, etc could ignite them.

6. **When working on the machine shut off power and remove all pressure on tanks, lines etc.** Voltages on this machine can cause death upon contact. Make sure only qualified electricians work on electrical circuits.

Warning:

Do not attempt to repair the machine alone. Have someone present to disconnect power in the event of an emergency.

Additional Safety Information

1. This equipment produces sound at approximately 91 dB. Ear protection is recommended.
2. The allowable operating environment temperatures are 50 to 90 degrees F.
3. DO NOT use any flammable materials in or around the Tanks. Do not use any materials inside the Tank that can contribute to rust formation, such as water.
4. Most polyurethane resins are sensitive to moisture. Take care to avoid contact with water or humidity as this may cause curing.

CHEMICAL RECOMMENDATIONS AND SAFETY

1. The MK25 system is designed to process chemical systems that produce many cast elastomers such as: polyurethanes, urethanes, epoxies, silicone and most other multi-component resin / curative based materials.

2. Prior to your purchase, MSDS sheets, as well as the Chemical Processing Parameter sheets were reviewed, and the system was deemed capable of working within these parameters.

3. If changes are made to the originally specified materials to be processed, or if you intend to try and process chemicals that fall outside the categories list above, contact TPS immediately.

4. Other areas of this manual address safety as well. Be sure they are fully understood as well as your company's Health and Safety requirements for working with chemicals.

5. As with any chemical system listed above, there may be the need to utilize solvents for cleaning and or flushing the material streams of the MKXX. It is the customers' responsibility to fully understand how to use them safely.

WARNING: DO NOT ATTEMP TO USE ANY FLAMMABLE SOLVENTS NEAR THE MKXX WHILE POWER IS ON OR COMPONENTS ARE HOT.

Typical materials to be **avoided** at all times inside the MK25 or its auxiliary equipment:

A. Any aggressive solvents that can cause damage to Silicone, Viton or Teflon.
B. Flammable solvents when the system is powered and or components are heated.
C. Materials that contain any abrasive particles (unless approved by TPS)
D. Materials that contain any solid or semi-solid particles (unless approved by TPS)
E. Water

IMPORTANT GUIDELINES

These are some of the basic practices followed by some of our most successful customers:

1. Make one or preferably two individuals in your company responsible for the day-to-day operational integrity of the machine. This individual should direct the maintenance and cleaning as required. He/She should understand how the various systems and parts work on the machine. If there is a problem, they should be the first person alerted to the situation. They should be the coordinator of all activity associated with the machine to assure that it will run properly and make good parts.

2. **Keep the machine clean!** Remove every spill as it occurs and make sure everyone is held accountable around the machine to clean up his or her own spills. Always have the necessary spare parts on hand for preventative maintenance. Lock them up in a cabinet near the machine and limit access to the parts.

3. **Make sure that the machine operator reads this manual! If unskilled personnel are to be utilized or if rapid employee turnover is a problem, consider developing a basic training program.**

4. Contact our Technical Service Department if you have an unusual problem.

Proper and Improper Handling of the Machine

Proper	Improper
• Perform routine maintenance • Start pumps slowly • Use adequate ventilation and a fume removal system • Keep the mix head clean • Keep/pour pressure balanced • Work Safely!! • Be aware of the characteristics of the materials your processing	• Trying to pump or meter cold materials • Overheating materials • Never use torches to melt out lines or suspected blockages • Letting untrained personnel operate equipment • Not following start-up or shut down procedures

OPERATING SUPPLIES

Chemicals:

1. Solvent (DBE) or equivalent for mix head purge
2. Plasticizer for lubricating seals and bearings (Benzoflex 9-88 SG)
3. Mold release
4. Process materials (prepolymer, curative, colors, etc.)
5. Vacuum pump oil
6. Dow Silicone grease for lubricating "O" Rings and seals

Tools and Equipment:

1. Face shield
2. Gloves: check with manufacturer for appropriate gloves for handling chemicals
3. Waste catcher for purging of lines and mix-head
4. Test molds (pie tins, cups, etc.) for ratio calibration
5. Spill protection for floor (plastic, cardboard, heavy paper)
6. Absorbent material for cleaning up spills (paper towels, rags)
7. Medium and large crescent wrench, pipe wrench, bung tool, Allen wrenches, nut drivers, screw drivers, knife, tweezers, pliers, end wrenches, wire brushes

NOTE: Many components of the machine are made of 6061 Aluminum to allow for better heat transfer. This is a SOFT metal when compared to the above listed tools. Never scrape or gouge too hard against surfaces. You will damage them!

8. Fume removal (exhaust hood, suction hose at mix-head discharge)
9. Pour hoses of a chemical resistant, reinforced, flexible material

10. Electronic scale sized for your operating range. (If you are pouring 10lbs/min the scale should handle 10lbs.)
    Note: Scale error should be small compared to allowable process error.
11. Flashlight for looking into material tanks and machine recesses
12. Metal container for cleaning parts in solvent
13. Drum dolly
14. Oven or chamber for reheating drums
15. Clean dry air source for lube and valve operation. (85 psi minimum)
16. Nitrogen source for blanketing tanks, drums and pressurization of MOCA tanks. Normal psi on machine tanks is (30-35 psi)

UNCRATING, SETUP & INSTALLATION

MARK XX UNCRATING AND SETUP

The MARK 25 Hydrospenser is shipped in a wooden crate and is bolted to the top, and base. The uncrating should start with the removal of the four bolts located on the top, and once these are removed, the balance of the Mark 25's crate can be disassembled. Remove the Hydrospenser from the base and place it in its position. Before leveling and bolting to the floor, all the auxiliary equipment must be in place with the material transfer lines. The color and purge tanks (if applicable) will be strapped to the crate base inside the Mark 25 Hydrospenser. Larger color tanks will be crated separately.

POWER HOOK-UP

The Mark 25 receives its main power from three-phase **208-240 volts 60 Hz** service. Refer to each machines' nameplate for amperage requirements. The balanced power is distributed by circuit breakers mounted on the upper rear of the Hydrospenser. The qualified electrician may be required to make a hole in the upper right-side panel. **CARE SHOULD BE TAKEN NOT TO GET CHIPS INSIDE THE MACHINE.** A conduit connector should be mounted in this area. The service with ground is to be provided from a fused disconnect located close to the Mark 25, and without an obstruction in its path.

AIR HOOK-UP

The air inlet to the hydrospenser is located on the rear left side when viewing from the rear, just under the pump shelf. This controls the inlet air for the Mark 25 pneumatic sensing, purge, color, and lubrication systems. The air source provided must be free of oil, and, or water. 85-100 PSI is required. Some systems may be configured to run nitrogen to all systems. Some systems may have a separate connection for nitrogen. Nitrogen feed to the machine should be set at 40 psi.

Warning:
The MK25 will not operate properly without a minimum 85 psi main air.

MARK 25 INSTALLATION

The start-up of a system must begin by a proper installation of the equipment. The machine has been fully tested prior to the arrival at your plant; however, it is possible that damage has occurred during shipping. Check all wiring, air tubing, and lubrication **prior to the start-up**. Tighten all screws, bolts, lines and heated material transfer hoses. They must be completely secure. This must be done prior to energizing the equipment, with any air, fluids, or power.

MACHINE TYPES

The Mark 25 dispensing machine comes in two configurations: non-recirculating and recirculating. A non-recirculating machine has no material return hoses to the supply tanks. When not pouring, the metering pumps are off and thus there is no material flow.

A recirculating machine has return hoses and when not pouring (but in the Operate mode), the metering pumps continue to run and pump material back to the supply tanks. Although a more complex machine, a recirculating machine has the advantage of immediately introducing mixed material into the mix-chamber on ratio. A non-recirculating machine requires a few seconds for the pumps to reach speed and thus the initial mixed material in the chamber is not on ratio. Another advantage of a recirculating machine is that since the material is constantly in motion, it will have a better and more uniform temperature profile.

Air regulators and solenoid valves are used to maintain the proper pressure on each valve at the mix-chamber. During pour, each "Delta-p" valve has a dedicated air regulator. This maintains the proper pressor on the delta-p's diaphragm. When not pouring, solenoid valves switch from the dedicated air regulators to the "main delta-p" air regulator. This causes the Delta-p valve to fully close. See page 17 for a description of the Delta-p valve.

DAILY STARTUP

NOTE: MK25 systems are modular in design and can vary greatly in configuration. Read each individual manual and startup / shut down procedure for the equipment supplying the MK25. Failure to do this could result in damage or injury.

A. Verify the E-STOP switch is in the outward position it is located on the top of the control box at the mixer.

B. Verify POUR switch is off (left position). Verify the OPERATE switch is in the off position (center).

C. Turn on the main (240 volt 3-Phase) red and yellow power disconnect switch located on the upper right panel.

D. Check to see that all appropriate temperature controllers are energized. If not, press the corresponding white on/off push buttons. Allow all heated components to rise to operating temperatures. Press the asterisk key on each controller to verify the setpoint. Hold this key and either the up or down arrow key to adjust.

E. Apply clean, dry main air or nitrogen to the system 85-100 psi. This allows proper function of the lubricator and delta-p valves, etc.

NOTE:
The (optional) flowmeters on the MK25 require a 30-minute warm-up. This time is independent of heat and cannot be rushed or disregarded.

OPTIONAL: MOCA flow meters will not heat until their respective heated lines have reached set point. In the event that a proper purge was not done at the prior shut down, this prevent damage to the meter.

D. After turning on power, the HMI (Human Machine Interface) will boot up (approximately 3minutes). The operator must **NOT** touch the screen during the process! Doing so could possibly corrupt the loading of the machine operational software and the process may have to be repeated. **In addition, NO operator without administrative access (i.e. Password) should be allowed to enter the Windows environment.** Once the TPS logo appears touch the screen once to gain access to the operation screens.

E. If the system alarm is energized, silence (acknowledge) the alarm by pressing the alarm reset button on the control box mounted at the mixer. Refer to the Alarm screen to identify the problem. The operator must find and remove the source of the problem (s) prior to running.

F. Check tank and lube levels and add sufficient material to satisfy the planned production. Make sure there is sufficient solvent in the supply tank to properly purge the mixer.

G. Turn operate-off-purge selector switch to the OPERATE position. Press the lubricator button several times to pump lubricant into the mixer shaft seals.

H. Inspect and insure that the heated fluid transfer line ends, both resin and hardener and additives (if applicable), are properly connected to their ports and secured with lock pins. **NOTE: MKXX systems are modular in design and can vary greatly in configuration. Read each individual manual and startup procedure for the equipment supplying the MKXX. Failure to do this could result in damage or injury.**

I. Adjust the tank and color regulators, so that 30-60 psi is applied to them. Since each machine configuration is different consult with TPS during machine installation for proper pressures and note them. **AS PRESSURE BUILDS CHECK FOR LEAKS.** The Delta-P and pump inlet pressures typically should be the same.

J. Inlet and Discharge pressures are displayed on the MAIN and JOG screens. Readings may not be accurate until the machine is at temperature and pressures have stabilized.

CAUTION:

The inlet shutoff valves at the mixer must be OPEN at all times when materials are being dispensed. Failure to open the valves and attempting to pump material

into the mixer can cause <u>extremely high backpressure</u>. During this condition, the possibility for damage, leaks, and even <u>personal injury</u> is high.

K. At this point, provided all other related systems are functioning properly, test pours can begin with ratio checks. See “Typical Operation”.

L. If material lines are empty, a sufficient amount of “fresh” material should be jogged through each line to fill the flowmeters and displace any air. An appropriate speed for this is 50-75 RPM. Begin very slow to be sure all materials have melted such as MOCA. MOCA lines will always be partially empty on startup and should be jogged until a constant steady spray is achieved from the delta-p into a waste container.

M. OPTIONAL: Once the lines are believed to be full and pressures stable, locate the flowmeter meter transmitter for that stream and ensure the flow rate displays 0.0000 lbs/per min. If values are zero, specific gravity can also be verified by touching the scroll position on each transmitter until a value for g/cm3 is displayed.

N. OPTIONAL: After completing this for each material, the flowmeter meters may need to be Re-zeroed. Refer to the “Zeroing the Flowmeter Meter Transmitters” section of this manual to do so.

O. At this point, provided all other related systems are functioning properly, test pours can begin with ratio checks. See “Typical Operation”.

TYPICAL OPERATION

1. In the **Recipe** screen, press the load button on the lower left side of the screen. A list screen will appear.

2. Select the appropriate recipe and press enter to accept. If needed, the list can be scrolled up and down using the arrow keys.

3. **Verify the recipe parameters!** To change a value, tap the screen twice over the name of the item to be modified. A keypad will appear. Enter the new value and press enter.

4. On the recipe screen a new value will be in the field and an asterisk will appear in the far-left column for that parameter. The save button will be illuminated green reminding the operator to save the recipe. Provided all information is correct, save

the recipe and press the large arrow key pointing to the right. By doing so, the new recipe values will be loaded into the machine controller. This can be verified when pressing the button. A green "sending" light will flash in the lower right corner of the screen.

5. Enter the **Purge & Flow** screen. The potlife timer can be adjusted by entering a value in seconds. If applicable the automatic purge can be enabled. **Once the potlife time is exhausted, the mix-head will purge!** Be sure to have a suitable container underneath. The purge cycle time is the amount of time the solvent or air solenoid will apply pressure to the purge tank, forcing material through the check valves and into the mixer for cleaning. Note: Upon startup a zero may be displayed for purge; however, the controller will contain the setting from the last time the purge number was entered.

6. Enter the **Process Material** screen. To reset the Total Pounds Poured totalizer, press the button above the display. Note that this can only be performed if both the Pour and Operate switches are off. At this time a preset amount of material can be entered to pour or the option can be disabled. OPTIONAL: Verify color tank levels are suitable for planned production on the display.

7. Enter the **Alarm** screen. Verify there are no active alarms that may have occurred during startup. Press ack (acknowledge) to time stamp the alarms and clear to remove them before pouring. Should an audible alarm occur, it can be reset on this screen as well as at the mixer control box.

8. Enter the **Main** screen. The current recipe number will be displayed in the upper center. The theoretical flow rates will be displayed along with the commanded flow rates. OPTIONAL: Actual flowmeter rates are displayed below these.

9. Move the Operate switch from the OFF position to the OPERATE position. If machine is a recirculating type, the pumps will begin pumping material and the machine will be in the recirc mode (pumping material back to the supply tanks), the mixer motor will remain off.

LOG FILE (Optional if button is present)

10. Just prior to beginning a pour, a Data Log file can be initialized. Press the "Data Log Off" button, and it will display "Data Log On" and begin to flash. The file name for retrieval later is named "MKXXDatalog.mdb". The log file contains all data regarding a pour. It can be viewed using Microsoft Excel. To access this file, all pouring should be finished and you must exit the TPS runtime software. This procedure can be reviewed in the **Alarm screen** description later in this manual.

11. The Log file will record data as long as the data logging button is active (green) on the main screen.

12. To start a pour, be sure all material inlet and discharge pressures are even (refer to auxiliary equipment manuals if necessary for startup) turn the pour switch to the ON position (to the right). **Be sure ALL delta-p valves are secure and inlet valves must be open at the mixer.** Start at a slow speed to establish proper flow. Once a steady flow has been established, and air has been displaced in the mixer, material is ready for application. Adjust pump speed accordingly.

SPECIAL NOTE:

For any machine processing urethane or epoxy resin systems there are two main points to consider, namely:

1. **The ambient air, or rather the moisture in it, will act as a curing agent to the resin. It becomes important, therefore, to do everything possible to prevent any moisture from contacting the resin. Keep all "o" rings, and gasket seals in good condition. Use a dehumidifier on the vent port of the supply drums to Degassers and keep the lubrication systems in good working condition.**
2. **When using hot melt hardeners, the basic problem is to maintain sufficient temperature in the material to insure its proper liquid condition. The current overload sensing in the servo drive controllers through which the resin and hardener pumps are driven are used to protect the gears and shafts of the pump from damage, in the event that a solid particle or piece of foreign material gets in the gears of the pump.**

SHUTDOWN

NOTE: Shutdown procedures may vary greatly due to specific applications, materials processed and machine configuration. The following should be used as a reference. Refer to your machines' specific shut down procedure provided with this manual.

1. Set the ball valves at the mix-head to the closed position.

2. If MOCA use, remove the curative delta-p valve and plug the port. Be sure the valve is facing the floor and above a waste container. Follow the mixer purge sequence located later in this manual.

3. Close ball valves feeding the material lines to the machine. (refer to auxiliary equipment manuals if necessary for shut down)

4. Turn the Operate switch to off.

5. Turn off main power.

6. Remove main air and all pressure to auxiliary tanks and equipment.

NOTE:

If MOCA (or hot melt) is used as the curative, a proper shut down is as follows:

1. **Remove the delta-p, plug its port and aim it in a waste container. Close the discharge ball valve at the supply tank and vent the tank.**
2. **Jog at a slow speed (50 rpm) to empty most of the remaining MOCA from both the lower and upper material lines.**
3. **FAILURE TO FOLLOW THE ABOVE STEPS MAY RESULT IN MACHINE DAMAGE UPON THE NEXT START-UP. MOCA EXPANDS WHEN IT RE-MELTS AND CAN GENERATE EXTREEME PRESSURE.**

OPERATOR FUNCTIONS

A. LUBRICATOR PUSH BUTTON SWITCH

The lubricator push-button (momentary switch) works only when not pouring.

When the lubricator button is depressed and released, power is supplied to the lubricator solenoid valve. This operates the small high-pressure pump, located on the right side outer panel, forcing lubricant into the mixer shaft seals, and all metering pumps. When pouring, a timer in the system logic automatically cycles every 20 seconds to force a small amount of lubricant to the metering pumps, and to the dispensing mixer.

B. OPERATE/OFF/PURGE SWITCH

1. OPERATE
   a. Inlet pressures are checked.
   b. If Mark 25 is a recirculation machine, the pumps will be commanded on as per the recipe. The respective valves will also be commanded on. See page 19 for a description of the recirculation system.
   c. All normal control functions possible.

2. OFF
a. No functions possible except if machine is setup for autopurge.
b. If an alarm conditions exists, audible alarm will be switched off, but visual alarm (located on front panel) will illuminate.

3. PURGE
   a. Solvent solenoid valve is energized.
   b. Pressure is applied to solvent tank.

c. Solvent and air flows to the mixer through a check valve
d. Solvent cleans the mixer's internal parts and passageways
Note: following purge, the o/o/p switch should be placed in the off position, or returned to operate if another pour is desired.

C. POTLIFE TIMER

The pot life timer is used to keep track of the length of time reactive material has been in the mixer. The timer should be set so the material in the mixer can be removed before it starts to gel. If Autopurge is disabled, when the time limit is reached an alarm will sound and the pour switch should be depressed to purge the mixer with new material. If the Hydrospenser is not to be used for some time, the mixer should be purged with solvent. Refer to the purging section for further instructions.

D. DIGITAL TEMPERATURE CONTROLLER ON/OFF SWITCH

This maintained push button is also used to reset an alarm condition.

E. POUR SWITCH

The pour switch initiates a pour. It enables all machine systems to operate and dispense mixed material. The ON position is to the right. The pour switch is the final step in the operational procedure which should be reviewed thoroughly prior to "pouring".

F. ALARM

The alarm is composed of the audible (located on right side panel) and visual (located on front panel) indicators. If in the OPERATE mode and the alarm is energized, you will hear the alarm and see the indicator display a solid red. To silence the audible alarm, switch to the alarm screen and press the "silence" button or press the blue alarm reset button on the mixer control box. This switches off the audible and changes the visual indicator from a solid red to flashing red (indicating that the alarm is still present). A green indication represents a no alarm condition.

The alarm will not sound in the OFF or PURGE mode unless there is an over pressure alarm. However, the indicator will flash red if any alarm occurs.

It is the machine operator's responsibility to acknowledge an alarm and investigate its cause.

DELTA-P VALVE - THEORY

The delta-p valve is a regulator through which any remaining volumetric compressibility of the metering system is reduced to an absolute minimum. By function, the delta-p is defined as a constant backpressure regulator and in its present location at the mixer; it doubles as a shut-off valve and line end heater.

The function of the delta-p is to maintain a state of constant pressure in the metering system, nullifying volumetric change. It accomplishes this requirement within two major limits:

1. System pressure will vary from some point below tank pressure at the suction of the pumps to a point above tank pressure at discharge due to line friction and head loss. Head loss, due to height, is fairly small being in the range of .25 psi and can be neglected in most cases. Head loss due to friction can also be minimized by controlling material viscosity carefully, considering flow rates, and proper utilization of the machine.

2. The delta-p by its own physical size can control through only a limited pressure range. To understand this limit, it will be necessary to become better acquainted with its operating concept. With the delta-p in the closed position, (at which point it functions as a shut-off valve at the mixer), the pressure at the back of the diaphragm is equivalent to the tank pressure. At this time the differential is zero.

3. To clarify the constant back pressure-controlling phase, let us assume that through some fluctuation in shot pressure or material viscosity, the material pressure decreases. As the material pressure in the Delta-p attempts to decrease, the air pressure forces the diaphragm closed, reducing the available orifice until the material pressure equals the backpressure. When force is equal on both sides of the diaphragm, it will maintain its position. Similarly, if the material pressure attempted to increase, it would force the diaphragm open; increasing the available orifice until the material pressure again equals the air pressure.

4. The Delta-p is a valuable tool in increasing metering accuracy. The Delta-p valve regulates pressure within certain limits through a flexible diaphragm effectively varying an orifice, keeping the pressure constant in the metering system. Each time the diaphragm flexes, there is a volumetric change in the fluid stream proportional to the diaphragm movement. As the diaphragm moves forward, it displaces material into the mixer, as the diaphragm moves back if effectively removes metered material. The effect of this is a slight phase shift, delaying the flow initially and smaller shifts throughout the shot as backpressure varies in the mixer. These shifts are negligible in most cases; however, the effect can be noticed on extremely small shots and/or low volumetric mixers.

5. There are also other methods to increase the accuracy of the equipment depending on the particular application. The material side of the machine should not be overlooked.

Entrapped air in the metering system can lead to disastrous results, just as air in the material itself can account for inaccuracy.

NOTE:
The Delta-p diaphragm should be checked periodically for signs of wear. The diaphragm should be soft and flex freely. There should not be any permanent set in the diaphragm.

When checking the diaphragm, be sure that the through hole of the Delta-p is free of obstruction. If material has started to set up the passage, it is a sign of too low tank pressure. The tank pressure of the material going through the Delta-p should be raised in order to prevent this buildup of material. Moisture in the air will also cause material buildup. Care should be taken to thoroughly clean the mixer and Delta-p valves periodically.

DELTA-P VALVE – CONTROL

The Delta-p valves at the mix-head are controlled by solenoids. They are located on the backside of the machine's lower front panel. When not pouring, the solenoids are off and allow air pressure from the "Main Air Delta-P" regulator to the diaphragms. This pressure is typically set to 70-80 PSI and effectively closes the diaphragm so no material can flow through the valve. When in Pour mode or Jog mode, the solenoids are energized and each respective delta-p air regulator routes air to the diaphragm. The air setting is set to maintain as low as possible the differential pressure across the metering pump. These settings are adjusted during the machine installation and the initial running of the machine.

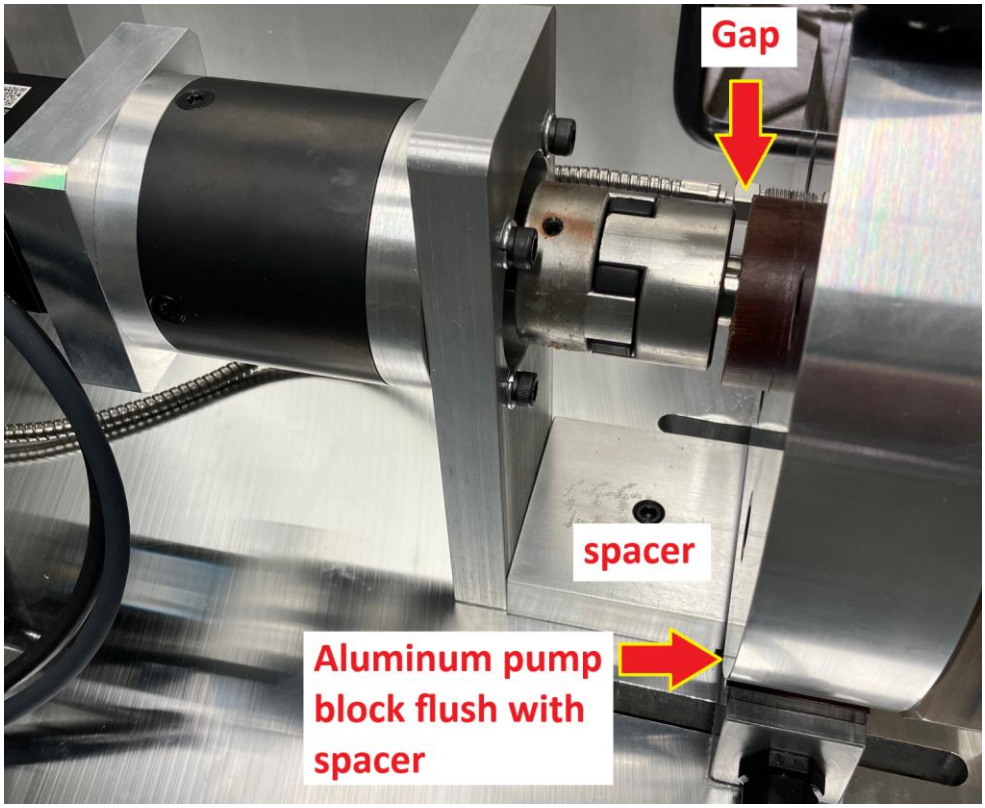
Machine – Lower Front Panel

MATERIAL METERING PUMPS

1. The MK25 uses precision positive displacement gear pumps to meter and help control ratio on all material streams.
2. Sizes of pumps can vary greatly as well as the care and maintenance.
4. The pumps are mounted to an aluminum pump block that contains a heater, temperature sensor, lubrication cap, shaft seals and a drive coupling.
5. For the most part, all pumps (except color) should remain engaged to their respective servo drive motors by using the lock nuts located under the pump shelf.
6. **CRITICAL: The gap between the pump drive coupling and seal retainer must be approximately 1/8". Drive shafts can slide through the pump. Care must be taken to be sure the shaft is not rubbing against the rear lubrication cap or fully extended through the seal retainer. The aluminum pump block must be with the spacer on the pump shelf, see picture below.**

NOTE: Remove all pressure when attempting to work on a pump or if it is to be dis-engaged from its drive coupling.

7. Refer to all individual pump drawings when problems arise. Contact TPS for proper maintenance procedures if operators were not trained by TPS.
8. Never attempt to disassemble the pump itself once removed from the pump block. Contact TPS.



OPTIONAL: COLOR PUMPS

1. Color pumps are located separately on a shelf below the main pump shelf.
2. To engage a pump, loosen the lock nut located under the shelf and slide the pump gear against the drive gear.
3. When a pump is engaged, it is also releasing an air pressure switch located behind the pump. This air switch routes air pressure from the color air regulator (machine's front panel) to the color's supply tank. If a color is not in use, be sure to lock it against the pressure switch. This action releases air pressure from the color tank.
5. A limit switch is mounted on the rear of the color shelf. The machine will not pour until the shelf is re-secured.
8. If OPTIONAL individual servo motors are equipped, refer to the HMI section for operation.

JOG MODE

The machine is capable of running individual pumps without the mixer turning on. This is called Jog Mode. This mode is useful to prime the pump and hoses or to possibly empty a material tank. In Jog mode, only one pump can run at a time. To enable Jog mode, set the Operate mode (Operate switch to the left position). Via the Jog screen, press the red "Jog Disabled" button at the upper right and the button will switch to green and "Jog Enabled". Once this is done, the individual control buttons will be displayed.

Set the pump speed and then press the button underneath to enable the pump's motor. Then press the button under the enable button to actually run the pump. See page 47.

LUBRICATION & MIXER

1. Shaft seal life has been increased through the utilization of mixer seal lubrication. The lubricating mechanism is a positive pressure type, metering approximately one to two drops per cycle.

2. The MK25 lubricator is activated only with the initiation of each pour or purge, at which time the metered drops are introduced between the two mixer shaft seals squeezing out equivalent drops beyond the lower seal face into the reactive mix. The actual volumetric quantity utilized on the mixer is approximately 0.08 cc per cycle. In pour mode, the rate is approximately 0.25cc/min.

3. The lubricants available at present can be material that will be compatible with the reactive mixed material, offer sufficient lubrication for the seals and at present be compatible with the elastomeric components within the lubricator. Some materials that have been successfully used as lubricant are polyethylene glycol, Benzoflex 9-88 SG and mineral oil. The actual lubricant used depends on the resin system and application. By lubricating the shaft seal interface, the coefficient of friction is reduced, permitting higher shaft speeds and lower heat generation. This is extremely important with the speed of the electric mixer. The lubricant also functions as a heat sink, absorbing some of the

generated heat energy and passing it on through the seal area into the mixer cavity, resulting in a further reduction of heat and an increase in reliability.

4. The Theory behind the origin of the lubricator was not merely to lubricate the shaft seal face, but to function as a wash past the lower seal face, flushing out reactive material which may tend to set-up from the generated heat, or removing filler particles if present, preventing them from becoming imbedded in the seal which would result in seal wear and grooving of the mixer shaft. To successfully accomplish this, the lubricant must flush the seal lip and eventually become part of the reactive mix. The material in the cavity below the seal is also continuously flushed, preventing stiffening of the seal lip chemically and possible set-up of the trapped material.

5. When a newly reassembled mixer is put into operation, care must be taken to manually bring lubricant up and into the area to be lubricated before operating. If this step is omitted and the shaft seal is run dry, the friction is sufficient to destroy the edge of the seal lip within the first few moments of operation, increasing friction and heat, resulting in a rapid degeneration of the seal. If filers are utilized, they can imbed themselves into the seal permanently, resulting in a burned-out seal and a scarred agitator shaft. However, if the lubricator is properly utilized, seal life is vastly improved, greatly reducing replacement and most important eliminating unnecessary “downtime".

6. To manually lube, the push button must be depressed and released slowly a sufficient number of times to bring air free lubricant through the points to be lubricated.

TYPICAL OPERATION OF THE LUBRICATOR

There are two modes of operation

1. When pouring, the lube solenoid is automatically cycled every 20 seconds. The flow rate is approximately 0.25cc/min.
2. When not pouring, the manual Lube push button switch is used to lubricate.

In either case, when the lubricant air pressure solenoid is operated; this causes the displacement of the lube piston to dispense lube under pressure. A pre-metered quantity of lube is then dispensed to its point of lubrication. When the solenoid signal is removed, the lubricating cylinder and metering injector recharge.

MIXER – GENERAL

There are many different combinations for assembling a mixer. The particular combination selected will be determined primarily by; (1) the type of resin and hardener to be mixed and their viscosity’s, (2) the rate at which these materials are to be mixed. Although is not practical to write a specific set of instructions for each mixer combination available, it is possible to discuss the conditions and requirements pertinent to all TPS’s mixers.

MIXER NORMAL OPERATION

The resin enters the mixer through a valve, into the color port block and passes straight ahead to the agitator shaft hole, through the center of the upper end of the block. From this point it passes completely around the agitator shaft, and rises to and completely fills that area just below the shaft seal. It is now pushed down along the agitator shaft into the mixer cavity area. For this reason, the resin is always fed into the mixer before the hardener to fill this entire cavity and prevent the hardener from penetrating this area and creating the possibility of catalyzed material forming around the shaft seal.

1. Hardener enters the mixer on the opposite side of the port block and slightly lower. It passes directly from the port into the mixer cavity area where it encounters the resin. It is at this point that the mix of both materials begins and continues as the two incoming streams drive through the mixer cavity.

2. As long as the metering pumps continue to turn, this process is taking place. At the end of the casting, the potlife timer now begins to time down. When it reaches zero the alarm sounds and the pour switch must be depressed long enough to dispense a volume of mixed material, just slightly greater than the volumetric holdup in the mixer chamber. The potlife period is a constantly reoccurring condition and begins at the end of each pour. It is dependent on the types of resin and hardener being processed, their ratios and temperature, the temperature of the mixer, and the volumetric holdup in the mixer. The potlife timer when exhausted will display on the HMI and an audible alarm will sound.

MIX-HEAD

The mix head and its associated parts are of critical importance to the quality of the finished product. Failure to keep the mix head clean and well maintained may result in off ratio, contaminated or poorly mixed urethane. At all times, operators should be aware of normal operating pour pressures and maintenance of the mix head.

Mix Chamber and Pin Mixer:
This area can become built up with urethane from not enough air/solvent cleaning or from long continuous pours where some reaction occurs in the head.

a. Urethane build up in the mix head or pour hose could be caused by increased pour pressure, reduced delivery or increased mixer motor load.

a. These problems could be influenced by machine throughput, material gel time, temperature, and external hose length.

b. Operating experience will determine acceptable intervals for disassembly and hand cleaning of the mixer.

c. The method to use for cleaning the chamber and pin mixer is to soak them

in solvent. To improve the reaction of the solvents they could be heated. If heated, precautions should be made with flammable or toxic material. After the pieces have been soaked, the urethane can then be blown or scraped off with soft tools...

d. Take care not to scar or damage any parts in the mixer or shaft.

Mix Head Seals:
Several factors can cause failure of the seals.

a. High back pressure in the chamber, can be caused by a dirty chamber, restricted pour nozzle, or restricted hose.

b. High pressure caused by trying to blow out semi jelled urethane with the purge system or jogging of the pumps.

b. Seal distortion could be caused by high temperatures of 300°F.

c. The seals may begin leak material over time, resulting in urethane filled seal areas. Clean or replace seals at the first sign of the leak.

MIXER TROUBLESHOOTING

Problem	Solutions
No resin or hardener flow	Ball valve on supply unit not open Delta-P clogged Pump not turning No discharge pressure from supply unit No material in supply unit Servo Fault Blockage in material transfer line Thick or frozen material
Poor Mix	Mixer motor not “ON” Mixer speed is too slow Mixer agitator not correctly fastened in collet Chemical dispersion problem
No Solvent	Purge switch not in “PURGE” position No air pressure on purge tank Inlet valve stuck closed No solvent in tank

PNEUMATIC CONTROLS

Located on the lower front panel are the pneumatic controls for the following:

1. Delta-P Valves – discussed in the Delta-P Valve section on page 18
2. Purge System
3. Color System
4. Batch Tank (optional)
5. Melter (optional)

Purge System and Color System consist of the following:

1. Regulator
2. Pressure gauge
   By turning the regulator's adjustable knob, clockwise to increase pressure and counterclockwise to decrease pressure, the operator can set the required air pressure to the supply tank. The purge solvent tank contains its own regulator and is normally always under pressure. The Color System pressure can be set by adjusting the color air regulator. The pressure will only be applied to the color supply tank when the color pump is engaged. Located near the color pump assembly, a brass air switch routes air pressure from the color regulator to the color tank. By engaging the color pump, the air switch is released and air pressure is supplied to the color tank. When the pump is disengaged from the drive shaft and pushed up against the air switch, the pressure on the color tank is relieved.

Batch Tank System consists of the following:

1. Regulator
2. Vacuum/pressure gauge
3. Four-way valve
   a. pressure
   b. vent
   c. vacuum
   d. common port to Tank

   The four-way valve allows the operator to apply preset air pressure, vacuum or vent off the Batch Tank. By turning the selector handle on the valve each function can be applied.

Melter System consists of the following:

1. Regulator
2. Pressure gauge
3. Shut-off Valve

The Melter System has air pressure from the air regulator supplying the Melter Tank. The Tank supply line goes from the regulator to the shut off valve, then to the Tank.

NOTE: It is recommended to use Nitrogen to pressurize the MOCA Melter, Nitrogen eliminates the discoloration caused by oxidation of the MOCA by atmospheric air. High quality Heat Stabilized MOCA is also recommended.

PRESSURE SENSORS

The pressure sensor used on the MARK 25 is composed of three sections (diaphragm, capillary, and electronics). The diaphragm section mounts to the pump block or discharge of the flow meter. The capillary is a liquid-filled pressure transmission system. The electronics converts the pressure to a 4-20 mA signal.

The pressure applied to the diaphragm is transmitted via the liquid in the capillary to a strain gauge in the electronics. The electronics then generates an electrical signal proportional to the pressure. **The sensor must be calibrated at the processing temperature AND with no inlet/outlet pressure (otherwise the pressure readings will be inaccurate).** To calibrate, bring the pump and if applicable, flowmeters to the processing temperature with no inlet/outlet pressure. Then follow the steps below.

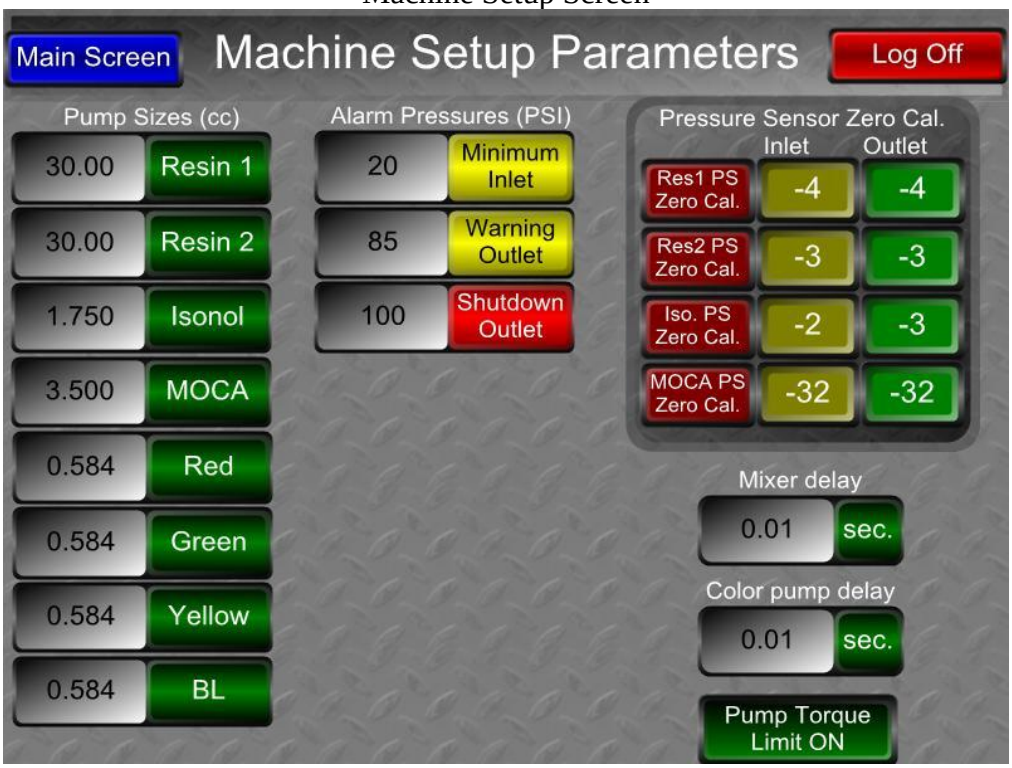
It is important to not over-tighten the diaphragm to the pump block. The o-ring may be severed and a leak will result.

NOTE: DO NOT use any sharp objects to clean the diaphragm. This will cause damage.

CALIBRATION FOR SENSORS (should be performed every 2-3 months)

1. Log into the machine using the Admin and password.
2. On the main screen press the Machine Setup button.
3. The machine MUST be in off mode, at process temperature and have no pressure.
4. At the upper right of the screen, find the respective “Zero Cal” button. Press the corresponding Zero Cal button. See next page.
5. The inlet and outlet pressure readings will jump around for several seconds and then stabilize at 0 +/- 3 PSI.

Machine Setup Screen



POT LIFE & PURGING

POTLIFE

1. The potlife timer functions through the HMI unit. The timer will only begin when the MARK 25 has finished a pour.

2. Input times can be entered on the HMI "PURGE" screen. Input times can range from seconds to minutes depending on the specific material potlife.

   When the potlife time has expired:
   a. An audible alarm will sound.
   b. A message will display on the HMI Alarm Screen. "POT LIFE EXHAUSTED"
   c. If AUTOPURGE is enabled a purge will take place, but no alarm is displayed.

   To Clear alarm:
   a. Silence the alarm by depressing the key on the HMI Unit.
   b. Be sure to purge the mixer as soon as possible.

NOTE: Normal potlife for most mixed prepolymers is ¼ of the gel time.

PURGING

A. GENERAL

Solvent or small chemical system pours for purging thru the mixer maybe required by the chemical system the customer has selected and the pour frequency relative to the pot life, brought about by the customer's process.

Typically, a pour should be made within 1/5 to ¼ of the flowable pot life of the chemical system in the mixer to prevent the building up of the reactive material. If a small chemical pour is made the "chemical clock" pot life timer is reset, and the ¼ of the flowable pot life is reestablished. However, if the reactive material in the mixer was displaced by the purge material; typical is DBE or safety solvent, this would not reestablish the pot life timer and no further purge of the mixer is required. However, startup of the mixer would require that the purge material is totally displaced as well as all air in the mixer.

WARNING

There is no universal purging material for all the chemicals in use today. The chemical make-up of the system you are using is known to you and your chemical supplier. We have general knowledge, but only your supplier and perhaps you have detail knowledge as to the best purging material for cleaning up spills, dissolving or flushing reactive material for the mixer.

It is important that the equipment is operated in compliance with all applicable local and federal laws and regulations pertaining to the safe handling of chemicals. Consult your chemical supplier for details.

1. PURGING

    a. Place an approved container below the mixer output.

    b. The purge solvent tank should be set to 35-40 PSI. Adjustment is made via the regulator on the tank's lid.

    c. Turn the function selector switch. (OFF/OPERATE/PURGE), to PURGE. This initiates the purge sequence of: air - solvent - air. The air pressure regulator is located on the machine's lower front panel. It should be set to 45-50 PSI. A solenoid routes air pressure to the mix-chamber. The time the air is on is controlled via the purge screen "air cycle time". After the air solenoid is switched off, solvent is introduced into the chamber. The solvent solenoid routes pressurized air to an air valve located on the solvent tank's lid. When the valve opens, solvent is routed to the chamber. This time is also set in the Purge screen, under "solvent cycle time". It is wise to watch the solvent material move through the tubing,

just before it enters the mixer, as a sure way to determine that the solvent is actually flowing. When the solvent solenoid switches off, the air valve closes and another shot of main air is forced into the mix chamber.

d. Enough purging material should be put through the mixer to insure the removal of the mixed prepolymer and curative. The mixer speed is a pre-determined speed set in the HMI.

e. Turn the selector back to operate.

CAUTION:

This equipment is not designed nor intended to be used in any area containing a spark ignitable solvent, gas or chemicals. Any person operating this equipment should be aware of the potential hazards that exist with the total chemical system your company has selected and the mechanical environment that your company has selected to operate the equipment in. Check with your Chemical Supplier and Safety Department prior to operating this equipment.

Under no conditions should this equipment be used at elevated temperatures approaching or exceeding the auto ignition temperature of the material stored or contained in or being processed in the area selected by your company.

HEATED HOSES (LINES)

1. The Mark 25 has, for each component, a set of heated material transfer lines. The lines are divided between an upper line and a lower line and optional middle line. Material transfer lines come in various lengths and diameters. Lengths are measured in inches and diameters are measured by the hose size. Resin line diameters are typically 8 QD, 12 QD, and 16 QD. Curative line diameters are 4 QD, 6 QD and 8 QD. At each end of the line is a special fitting called a "QD" or "quick disconnect". The line is held in place by a lock pin. This design allows quick change of lines and ease of pump maintenance.

2. All lines are manufactured by TPS and designed for specific reasons. The line itself is a Teflon hose with stainless steel over braid for reinforcement. The line is heated by supplying current to the stainless-steel braid. Current will vary due to line size and length. When the heated line temperature controller "calls" for heat, power is supplied to the line and the line will gradually heat up to operating temperature.

3. Power is supplied to the lines by a transformer mounted on the upper shelf of the Mark XX. The power supplied will be determined by the number of secondary wraps on the transformer. One end of the secondary wire is connected to Power Ground and the other end is connected to a fuse (or circuit breaker). From the

fuse, power goes to a solid-state relay and then to one end of the lower heated lines.

4. At each end of a heated line are "power leads". The power leads are soldered to the end socket on the hose. This socket is isolated from the QD fitting. If the socket should touch the fitting or any part of the machine with power on, the line will short out. When a line shorts out, the fuse or circuit breaker will usually blow and require replacement. Connected to the power leads are colored, insulated connectors. These connectors will be black, white, red or green. The transformer lead will have a female connector. The lower line at the supply vessel will have a male connector. The lower line at the metering pump will have a female connector. The lower line female will connect with the upper line male and the upper line connector at the mixer will have a female connector. This female connector will connect to a Power Ground connector mounted on the Mark XX front panel.

5. Usually, the lower line contains the temperature sensor. The sensor is routed via a two-pin connector to the pump block. From there, the wiring is included with the pump block wiring and routed up to the temperature controllers.

HEATED LINE TROUBLESHOOTING

Line will not heat	1. Check that temperature controller is "calling" for heat a. setpoint b. program c. output signal to relay
	2. Check Circuit Breaker 3. Check if solid state relay functioning a. receiving input from controller b. power is on (check for voltage or amperage draw) 4. Check that all power leads are connected properly a. tight connection between all connectors b. check ground connections 5. "Cold Spots" a. broken insulation or TFE lining

HEAT CONTROL SETTINGS

NOTE: OPTIONAL Flowmeter temperatures are controlled through the HMI.

CAL 3300 Program (Trico 100Ω RTD at inputs) – For mixer, pump and delta-p temperature sensors only

LEVEL 1		LEVEL 2		LEVEL 3	
Tune	OFF	**SP1.P**	--	**SP1.d**	SSd
bAnd	10 (18)	**bAnd**	OFF	**SP2.d**	rLY
int.t	5	**PL.1**	100	**Burn**	uP.SC
dEr.t	25	**PL.2**	100	**rEU.d**	1r.2r
dAC	1.5	**SP2.A**	bAnd	**rEU.L**	1n.2n
CYC.t	20	**SP2.b**	Lt.ho	**SPAn (see note 1)**	-56 (-101)
oFSt	0	**diSP**	1	**Zero (see note 1)**	15 (27)
SP.Lk	OFF	**hi.SC**	150 (302)	**ChEK**	Off
SPrr	0	**Lo.SC**	0 (32)	**rEAD**	--
SPrn	OFF	**inPt**	RTD	**tECh**	CTA
SoAk	--	**Unit**	°C (°F)	**Ver**	(factory set)
Set.2	8 (14)			**rESET**	(see below)
Bnd.2	0.1 (0.2)				
CYC.2	ON.OFF				

Note 1: For line (material hoses) temperature controllers ONLY, Span and Zero on LEVEL 3 must be set to zero.

LEVEL 4

DO NOT ALTER; USE DEFAULT SETTINGS ONLY

GENERAL INFO

1. These settings, when entered on all new units will configure both outputs properly and calibrate the unit for the special RTD temperature control. There should be no need to make any additional adjustments.
2. Set.2 represents the upper/lower band for alarm purposes. This can be adjusted by the operator for individual applications. The factory hysteresis is 2.0°C.

3. After setting all initial parameters and entering a setpoint, then turn at setpoint should run, this will tune the heating and pick the new P.I.D settings for SP1.

4. For the rESET setting, “all” should only be used to completely reset the controller in the event that a total reprogram is needed.

5. All temperature controllers have the same program and are interchangeable.

6. To silence Alarm and reset, depress white button below Controller. Depress once to turn Controller OFF and depress again to turn Controller ON.

7. Temperature Controllers are capable of various programs depending on customer’s application i.e. over-temperature only etc….

ADJUSTMENTS

1. To enter new setpoint, depress the * button. The unit of measure will appear first, then the present setpoint. While depressing the * button, depress the up or down scroll button to desired setpoint temperature.

2. To enter the program (Level 1, Level 2, Level 3), depress both scroll buttons simultaneously for three seconds. The word “tune” will appear on the display. This is the first entry on Level 1. To scroll to each input, depress either the up or down scroll button. To change an input, depress the *button and scroll up/down with the scroll buttons.

TEMPERATURE CONTROL TROUBLESHOOTING

Display	Cause	Solution
“Input Failure”	Sensor not connected Poor wire connection Controller defective Controller not programmed Poor connection of printed circuit board	Check connection Check connection on back Replace Enter program Pull out printed circuit Clean and replace
False Value Displayed	Loose wire connection Lead is shorted to ground Poor connection of printed circuit board Calibration not correct	Check connection on back Check connection to Sensor Check connection Recalibrate unit
No Display	No 24vdc	Push-button switch bad Replace Unit

OPTIONAL: ZEROING THE FLOWMETERS

Zeroing the flowmeter meter establishes the flowmeter's point of reference when there is no flow. If the flowmeter meter displays any number other than zero (0.000 lb/min) when it is full of material and there is no flow (pump off), then it should be zeroed.

Note: Read the entire procedure once before performing it.

Zeroing Procedure

1. Power up machine. Turn on flowmeter meter heaters. Allow flowmeter meters to warm up for 30 minutes. **NOTE:** The 30-minute time period is unrelated to heat. It is for the Flowmeter meter transmitter electronics.
2. Run material through flowmeter meter(s) until flow rate is constant. Be sure no bubbles are present. Then stop.
3. Close the inlet valve downstream from sensor.
4. Verify flow has completely stopped.
5. On the display of the flowmeter meter transmitter, locate the **scroll** and **select** "windows".
6. Simultaneously hold both thumbs up to the **scroll** and **select** windows for 4 seconds. When SEE ALARM or OFF-LINE MAINT appears on the display, then release.
7. Touch and release **scroll** until OFF-LINE MAINT appears.
8. Touch and release **select**. You have entered the maintenance menu.
9. Touch and release **scroll** until OFF-LINE ZERO appears.
10. Touch and release **select**. Display toggles from ZERO to YES? The next step in this procedure should be performed within 4 seconds, otherwise OFF-LINE ZERO will appear on the display and the **select** will need to be touched and released again to get back to the toggling display of ZERO to YES?
11. Touch and release **select**. The flashing light will switch from green to orange. Dots will traverse the top line of the display while zeroing is in progress. This will take approximately 30 seconds.
12. TEST OK should appear on the display.
13. Touch and release **scroll** until EXIT appears.
14. Touch and release **select** to exit the zero menu.
15. Touch and release **scroll** until EXIT appears.
16. Touch and release **select** to exit the maintenance menu and return to the flow rate reading. Display should read 0.0000 Kg/MIN.

CAUTION:

Zeroing the flowmeters is the <u>only</u> operation that will ever need to be performed at the transmitters. There are several different menus and settings in the transmitters that are factory preset. By altering any of these, could adversely affect the operation of the machine.

2L

OPTIONAL: RETRIEVING A LOG FILE

To retrieve a data log file, go to the MAIN screen and if data log is enabled (Data Log On), press the button to turn data log off. On the upper right of the screen, press the EXIT button. This will close the user screens and put the HMI screen on the Windows desktop.

The log files are located in the "Log Files" directory. There is a shortcut to this directory on the desktop. There will be one file named: MKXXDataLog.mdb

The file can now be utilized in any computer with a USB port and software capable of reading a Microsoft access file (Microsoft Access or Excel).

To return to the machine user screens, locate the "Interact X Runtime" icon. Double click on the icon and wait for the software to load.

SECTION 3

GENERAL TROUBLESHOOTING

The individual operating the machine is the one to primarily use this guide, though it should prove valuable to maintenance people as well. It does not cover, or could it possibly cover every problem, which may arise in the operation of the system, but most commonly noted troubles are listed along with problem causes and/or remedies.

It is believed that even if the specific reason for a problem is not listed, those that are listed will provide a logical path to the specific problem. Think before you tear into an assembly. Know the reasons why you're taking it apart. Lay the pieces out in a logical manner to facilitate reassembly and have the proper engineering drawings at hand.

NOTE: Remember there are potentially LETHAL VOLTAGES in the cabinet! Be careful! As in any machine maintenance or repair there is no substitute for common sense; use it.

A. Too Much Pour Back Pressure

1. The pour nozzle is restricted.
2. There is a blocked or defective 3-way valve.
3. There is an abnormal increase in material viscosity.
4. There is a buildup of material in the hose or another pour spout attachment.
5. There is insufficient mix-head or Delta-P heat.
6. The material is very viscous and not yet at operating temperature.
7. The material in the material lines is not melted
8. Fittings are exposed causing hot melt materials to harden.
9. Pressure sensor malfunctioning.

B. Mixer Motor Won't Run. See page 50 (section on mixer motor fault)

1. The mix motor CB has been tripped.
2. Too low an rpm has been set in the recipe
3. The mix chamber is potted
4. The mix motor drive is defective
5. The mix motor is defective.
6. The plug is loose at the motor

C. Dispensed Product Contains Bubbles or Defects

1. The material is insufficiently degassed.
2. The mix chamber is not fully purged of air when the pour began.
3. The mix chamber retaining screws are loose.
4. The mixer shaft seal is leaking.

5. By material splashing into the mold bubbles have been introduced.
6. The solvent purge valve is leaking at the seat.
7. Check the material lines for loose connections.
8. The flow is too low to purge air from the lines and mixer.
9. The temperature of the mold is improper.

F. Mix Head Not Flushing Properly

1. The solvent tank pressure is insufficient; adjust the regulator for the tank.
2. The solvent tank is empty; check the level.
3. The solvent purge valve seat is blocked by material buildup in the mix head.
4. The solvent used is not adequate.
5. A check valve is defective at the mixer or on the tank.

G. Pump Motor Will Not Run

1. The circuit breaker is tripped.
2. The motor is defective.
3. The motor controller is defective.
4. The speed is at “0”.
5. The metering pump has seized.
6. A cable is loose.
7. The machine was left in JOG mode prior to pouring.
8. Material has not melted.

CRITICAL OPERATIONAL GUIDELINES

1. OPTIONAL: Flowmeters must warm-up for 30 minutes prior to running any production materials.
2. The inlet valves at mixer must be open when running the pumps. **Failure to do this could result in personal injury and serious damage to the machine due to extremely high back pressure.**
3. Tank and pump inlet valves must be checked for proper position to provide inlet pressure and material to pumps.
4. Main air (85-100 psi) must be applied to the machine prior to start-up.
5. Mix head purge pressure should be set low enough to provide adequate cleaning. DBE is a good recommended solvent.
6. Flowmeter transmitter lights should be green. Amber is a problem. See Re-Zero flowmeter section.
7. Do not use the E–Stop Button to turn the machine on and off.
8. Lube, color and Solvent/Purge tanks must be full prior to start-up.
9. Flowmeters must be full to operate properly. This will require a jog of fresh material through each pump until no bubbles are visible from the Mixer and or Delta- P Valves. At this point see "Rezero flowmeter" if necessary.
10. All servo motor cables must be connected to their respective motors for the machine to operate.
11. All lines and color/solvent injector valves must be checked for obstruction before running.
12. Minimum pour flow rate is limited by the flowmeters. Should flow rate drop below accurate levels, the machine will operate in "open loop" and ignore flowmeter feedback.
13. On machine start-up do NOT touch the interface until the TPS logo appears.

Section 4

HMI Interface Screens

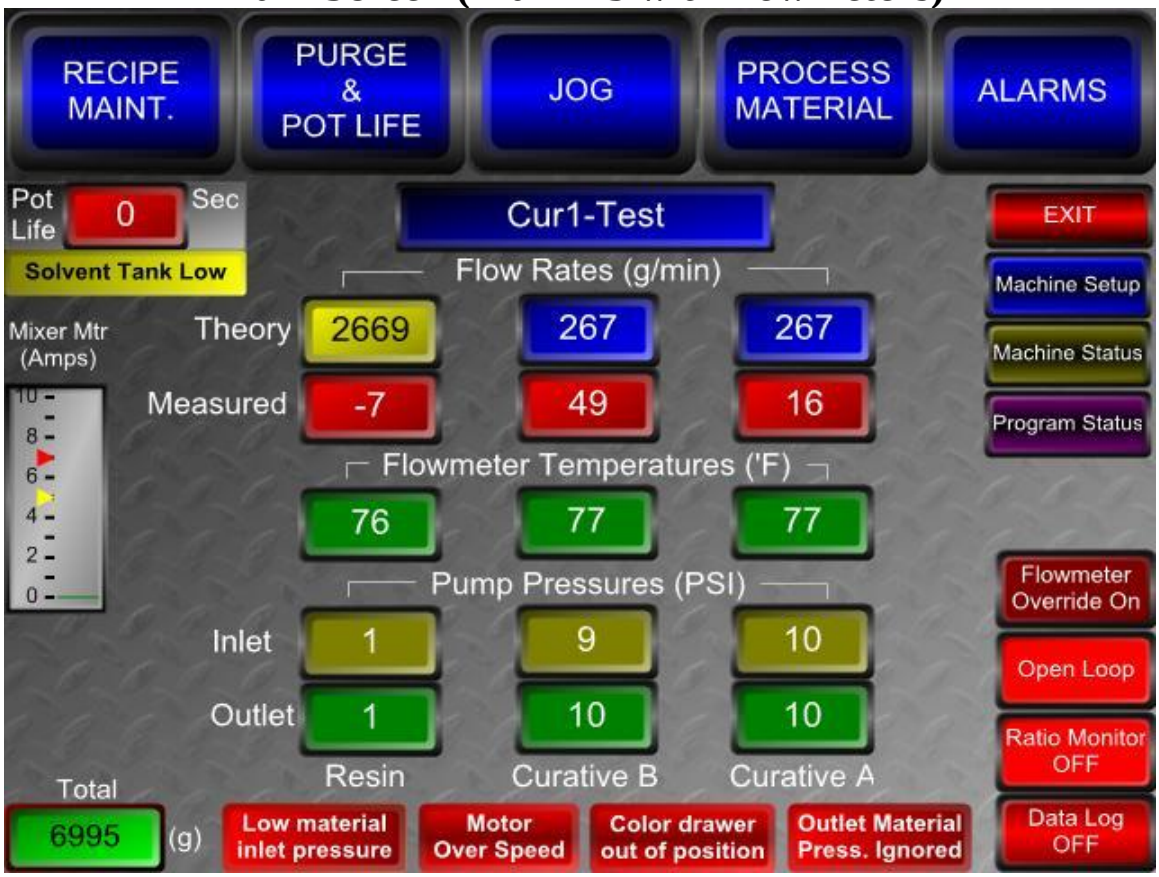
NOTE: References on screens may show optional features such as additive pumps and flow meters. These are to be disregarded if they are not present on the MK25.

Title Screen

1. This is the main screen. Shown above is a typical start-up screen. Press anywhere in the TPS logo to enter the MK25 operation screens.

NOTE: Some versions may require a user to log on before gaining permission to navigate to the other screens.

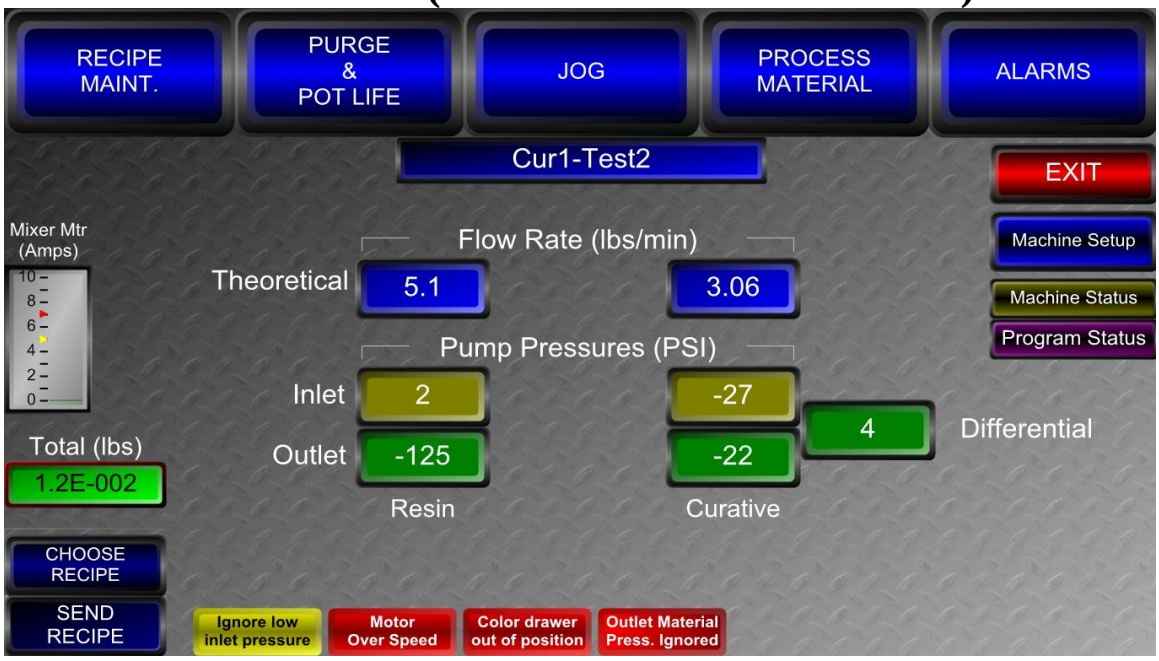
Main Screen (Mark 25 with flowmeters)



1. Buttons at top navigate to the appropriate screen. In some versions, the RECIPE button may not be accessible to the operator. The administrator with proper password can access the recipe screen.
2. **Machine Setup Button** – Once pressed, this takes the operator to the Machine Setup screen. This button is not visible under normal operation. The administrator must login to activate this button.
3. **EXIT Button** – This button stops the interface software and brings the operator to the Windows desktop environment.
4. **Pot Life**. This is a countdown timer. At the end of the count (zero), the machine will either alarm (autopurge disabled) or run the purge function (autopurge enabled). It appears below the "Recipe" button only after the pour is stopped.
5. **Theoretical Flow Rates (g/min) -** This is calculated by the current recipe. It is based on the pump size, speed and material density.
6. **Measured Flow Rates (g/min)** – Feedback flow rate from the flowmeter.
7. **Flowmeter temperatures -** indicate the current flowmeter temperature.
8. **Inlet input Pressure** (PSI) – Pump inlet pressure. Accuracy is +/- 5 psi
9. **Discharge (outlet) pressure** (PSI) – Pump outlet pressure. Accuracy is +/- 5 psi.

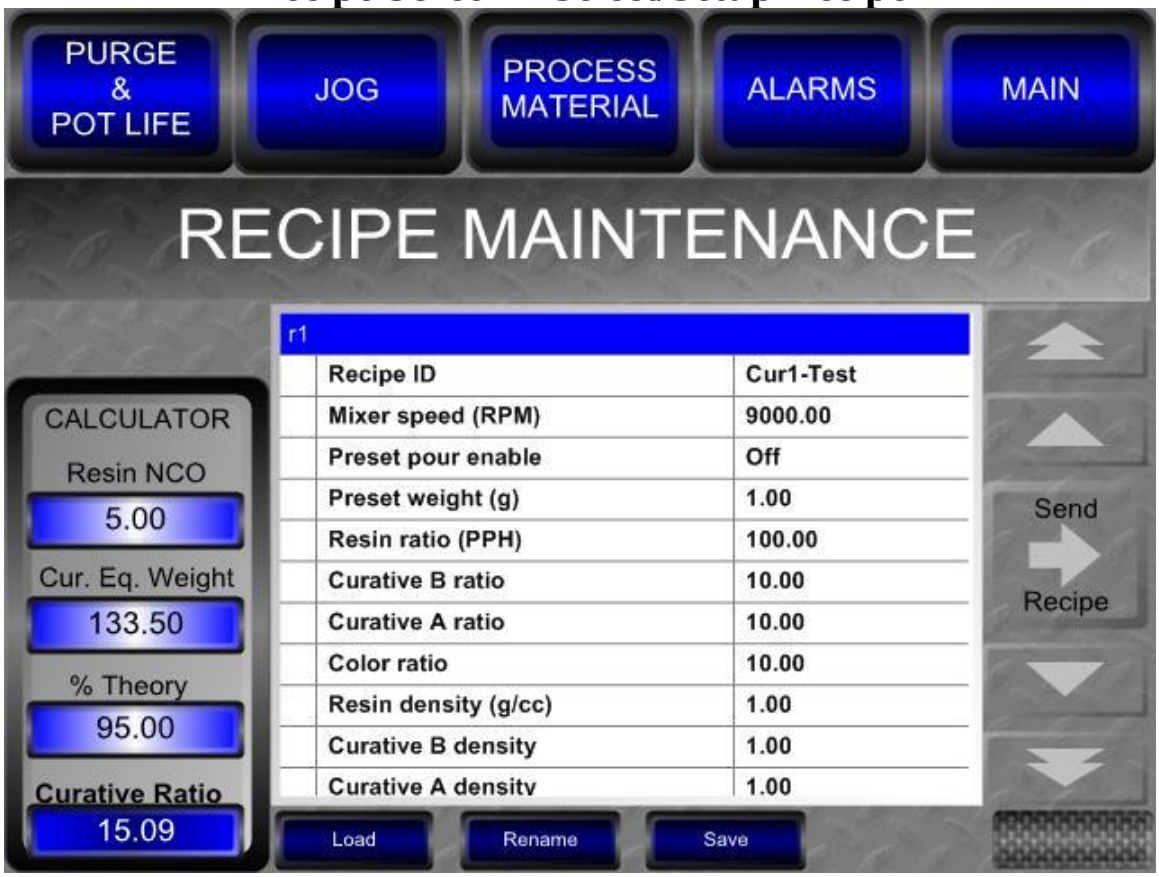
10. **Mixer Motor Arms** – The current load in amps that the motor is currently under.
11. **Total (lbs)** - Displays the total material weight in pounds for the pour.
12. **DATA LOG Button** – When enabled (DATA LOG ON), it starts data logging a pour and writes to the log file until disabled (by pressing the button again – DATA LOG OFF). The file is saved in the "Log Files" directory on the "C" hard-drive. The log file name is "MKXXDatalog.mdb". It is a database file and can be accessed with Microsoft Excel. As of this writing, the filename cannot be changed. The administrator can (at the end of the day) get to the Windows desktop and change the name or remove the file from the directory. If the name is not changed or the file is not removed, it will be appended to the next time the machine is run. All information about the machine and the pour is saved. All recipe values, flow rates, pump speeds, totalizers, and all associated alarms.
13. **Recipe** – Indicates the current recipe to pour.
14. **Flowmeter Override** – disables flowmeter feedback to adjust ratios. The pour ratios will be based on the recipe information entered ONLY.
15. **Open Loop / Ratio monitor off** – Indicates that due to a low flow rate on one stream or because flowmeter override is enabled, that the flowmeters are currently being bypassed and ratios are based on recipe information only.
16. **Machine Status and program Status –** For TPS technician use only!

Main Screen (Mark 25 without flowmeters)



Similar to previous screen, but no flowmeter information (measured flow rates, temperatures, closed/open loop operation).

Recipe Screen – Select/Setup Recipe



The recipe screen is used to enter and then transfer all data (for the specific pour) to the machine's motion controller. Note, on some machines the recipe screen is only accessible by the administrator. Press the red "Log Off" button to get back to normal operator control.

1. Use "LOAD" button to pop up a list of recipes.
2. Use "RENAME" button to create a new recipe from an existing recipe.
3. Use "SAVE" button to save the recipe as required.
4. The "ENTER" button is displayed as the large arrow pointing to the right. This must be pressed after a recipe is loaded. It sends all information to the controller. Failure to do so will run the previous recipe! When pressed, "sending" will quickly appear in the lower right corner of the screen to confirm data has been sent.
5. The curative ratio can be calculated by entering the resin NCO, curative equivalent weight, and percent theory. This number must then be entered into the recipe for storage.
6. The recipe consists of the following:

    i. Recipe ID – This can contain letters and is used for the customer's own internal recipe identification.
    ii. Mixer speed – in RPM.

iii. Preset Pour Enable – ON/OFF, on enabled, off disabled.
iv. Preset Pour weight – total weight of part. The machine will pour until the preset pour weight is attained.
v. Resin ratio – entered in PPH (parts per hundred). If Resin is to be used, this number should be set to 100 (as the other components are referenced from this). Enter 0 if not used.
vi. Curative B ratio – similar to Resin ratio. Enter 0 if not used.
vii. Curative A ratio – similar to Resin ratio. Enter 0 if not used.
viii. Color ratio – (PPH). Enter 0 if not used.
ix. Densities – in g/cm^3 Enter each material density at the process temperature.

Recipe Screen – Creating a Recipe

Once one recipe is created, others can be created by simply renaming the new recipe and going in and changing the parameters.

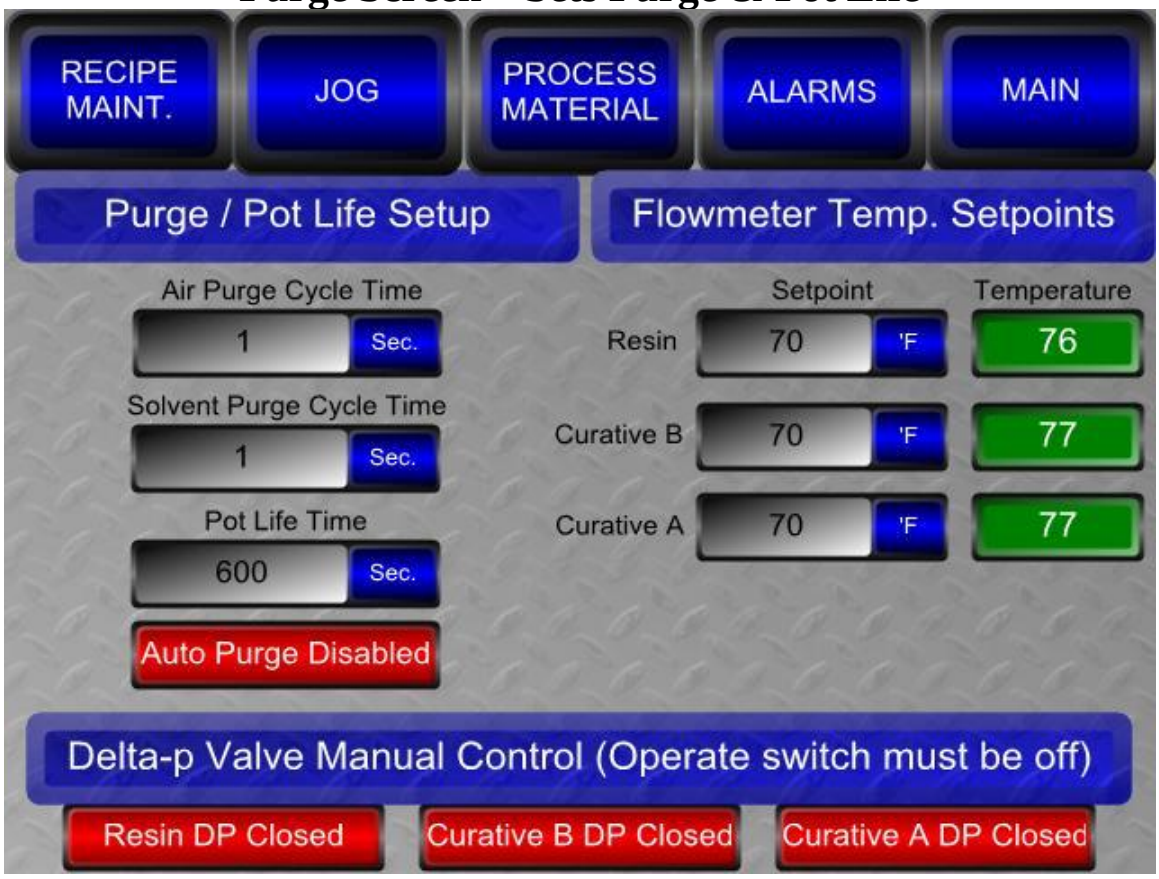
1. To rename (create) a recipe, simply load (use "Load" button) any recipe. Press the "Rename" button and the recipe list pops up. Press inside the yellow rectangle above the first recipe. This brings up the keyboard. Type in the new name for the recipe (must begin with a letter) and press "Enter". Once "Enter" is pressed, the keyboard disappears. Press "Accept" and the new

recipe is created. Now you must go into each parameter in the recipe and change the value.

2. To change a parameter value, press on the appropriate description (i.e. Recipe ID). This places a dashed rectangle around the parameter. Press again and a keyboard pops up. Enter the new value. An asterisk is displayed on the left and the "Save" button turns green. Once all parameters are changed, press the "Save" button and the recipe is now saved. Be aware that these actions do not send the recipe to the controller. You must press the arrow (on the right) to send the recipe to the controller.

NOTE: Once a recipe is created it cannot be deleted. A re-installation of the HMI software is required.

Purge Screen – Sets Purge & Pot Life



This screen contains entries for the purging of the mix-head. The flowmeter temperature setpoints are set on this screen. There are also enable buttons to manually control the delta-p diaphragms.

Purge Setup

1. Enable/Disable the auto purge function for the mix-head. If auto purge is disabled, the purge function will not occur, instead an alarm will sound and the alarm screen will display the "pot life timed out" alarm. If auto purge is enabled, the purge function will occur upon the pot life timer reaching zero.

2. Set the Pot life timer preset (1-1200sec). 1200 seconds gives a 20-minute maximum setting. This setting can only be changed when the machine is not pouring and the pot life is not counting down.

3. Set the air purge cycle time (1-90sec).

4. Set the solvent purge cycle time (1-90sec).

5. The purge sequence is as follows:
    i. Mixer on
    ii. Air purge
    iii. Solvent purge
    iv. Air purge
    v. Mixer off

Delta-p Manual Control

Manual control is given to the operator when the operate switch is in the off position. By pressing the appropriate button, the operator has control over the delta-p. Typically, this will be used when it is time to change the diaphragm. Pressing the button will turn the button from red (full air on diaphragm; valve closed) to green (no air on diaphragm; valve open). With no air pressure on the diaphragm, the cap on the delta-p valve may be removed and the diaphragm replaced.

Flowmeter Setpoints (optional)

Press the respective setpoint entry box to set the flowmeter temperature.

Process Material Screen

1. Displays the commanded and measured speeds for each pump. The measured accuracy is +/- 0.5% of the commanded speed.

2. Displays totalizers for each component. These numbers are displayed until the next time the pour switch is set to on; at which point they are reset to zero.

3. Displays the total production material weight (lbs). This counter does not reset and so should be reset to zero at the operator's discretion. It can only be reset when both POUR and OPERATE switches are off.

4. For preset pour, the operator can set the desired amount to be automatically poured. The operator must enable preset pour by pressing the "Preset Pour" button. This, changes from "Preset Pour Disabled" to "Preset Pour Enabled". To run preset pour, simply set the desired amount and set the POUR switch from OFF to ON and back to OFF. The machine will pour until the theoretical totalizer reaches the desired amount. To stop a pour before reaching the desired amount, set the OPERATE switch to off.

Jog Screen – Run individual pumps

Note: If recirculating machine, it is important to set the machine's pour speed (via the flow rate potentiometer located on the control box at the mixer) to zero. Otherwise the material pumps will run when the Operate/Off/Purge switch is to the Operate position (left).

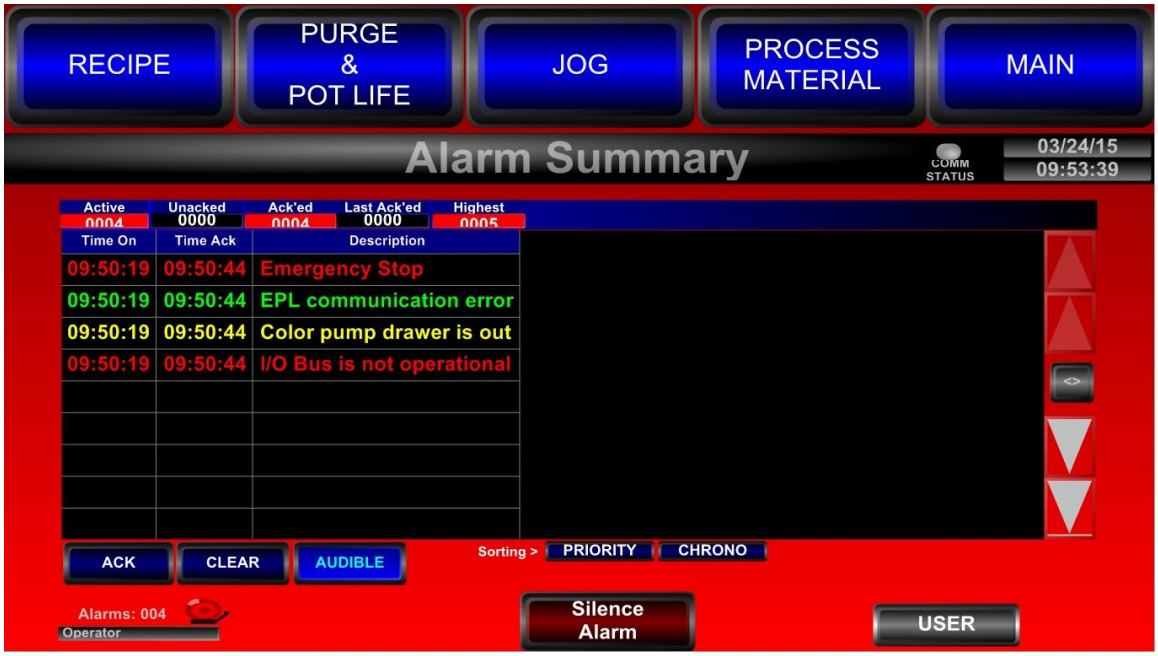
For Jog Mode:

1. Verify Operate switch is Off.
2. Set the machine's pour speed to zero
3. Set Operate/Off/Purge switch to Operate
4. Press the red "Jog Disabled" button to switch to enable

Use the "Jog Enabled" button at the upper right to enable / disable the Jog function. Jogging is used to run one pump at a time. When enabled, the individual speed entry and enable buttons will appear. Pressing the individual Jog RPM button opens a keypad that allows the pump speed to be changed. Each pump is enabled by its own "Enabled/Disabled" button. A preset amount can be entered at the lower right (press enable button first). Use the "Resin On" button to run the pump. The jog is active once the button is pressed. It must be pressed again to deactivate. **Note: Failure to be aware of the current jog status could result in personal injury, machine damage and or a large mess! Before leaving this screen, the**

jog must be disabled (the MKXX program will not respond until jog is disabled).

Alarm Screen



This screen shows all alarms. It puts a time stamp on the alarm for later review in a (OPTIONAL) Data Log File.

1. Current CPU Date and time.

2. <> Button - Expands the width of the current alarms listed so all fields are visible.

3. Scrolls up/down through the current alarm list.

4. Via the "USER" button at lower right, the proper user can login and get access to several additional functions.

5. Silence Alarm – Button silences the audible alarm but does NOT "cure" an alarm condition.

6. Acknowledges an alarm and time stamps it.

7. Clears non-active alarms.

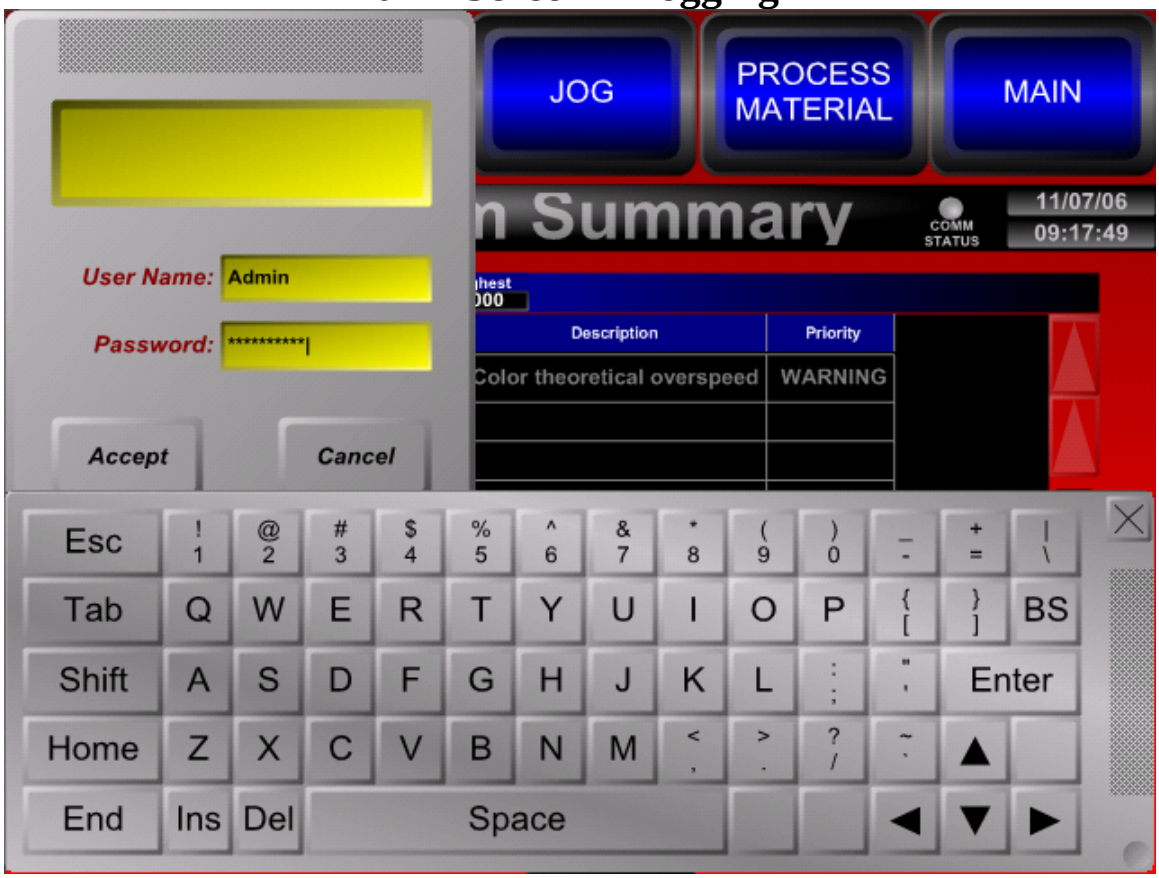
a. The possible alarms are as follows:
   i. Inlet under pressure – one for each component. An under-pressure alarm occurs when the inlet pressure is below the "minimum inlet" pressure. This is set in the Machine Setup screen.

ii. Warning outlet pressure – one for each component. A warning outlet alarm occurs when the outlet pressure is above the "warning outlet" pressure (set in the Machine Setup screen).
iii. Differential alarm – for curative pump. Alarm occurs if the differential pressure across the pump exceeds the setpoint alarm.
iv. Outlet over pressure – one for each component. An over pressure alarm occurs when the outlet pressure is above the "shut down outlet" pressure (set in the Machine Setup screen). This condition will stop a pour and shut down all pumps.
v. Pot life timer expired. Pot life timer has exceeded. Mixer should be purged or must start pouring again.
vi. Mixer Motor fault. An issue with the mixer motor or motor VF drive will enable this fault.
vii. Motor fault – one for each motor (not mixer motor). If there is a fault condition with the servo motor or servo drive, this alarm is displayed.
viii. Motor speed fault – one for each motor (not mixer motor). The software continuously monitors the feedback speeds. If any are out of specification, the machine stops and alarms.
ix. Motor overspeed – one for each motor (not mixer motor). Each motor (pump) speed is calculated from the ratio in the recipe and from the setting of the "main pump speed". If any of the motor speeds reach beyond 200RPM, the respective alarm will be displayed, but the machine will not allow the speed to be increased. This may cause a ratio error and a stoppage of a pour.
x. Main air low. The air switch located at the main air entrance to the machine has triggered on a low air condition.

- **Should the machine ever stop a pour due to an overpressure, speed fault, or servo motor fault condition; set both the Pour and Operate switches to OFF. The machine will run through an "error" program and then give control back to the operator.**
- If the machine stops a pour due to an overpressure condition, control will not be given back to the operator until the overpressure condition has been corrected (pressure relieved).
- If the machine stops a pour due to a mixer motor fault error, perform the following:
    1. Silence the alarm.
    2. Set both Pour and Operate switches to OFF.
    3. Locate the mixer motor's VF drive (back side of machine on left side panel). The VFD's display will show an error code. Note the error code.
    4. Switch off the mixer motor's circuit breaker.
    5. Wait a full minute. Note: there are large capacitors in the VFD that need to be discharged. If the circuit breaker is simply cycled off/on, the capacitors will not discharge and the fault will not be cleared.

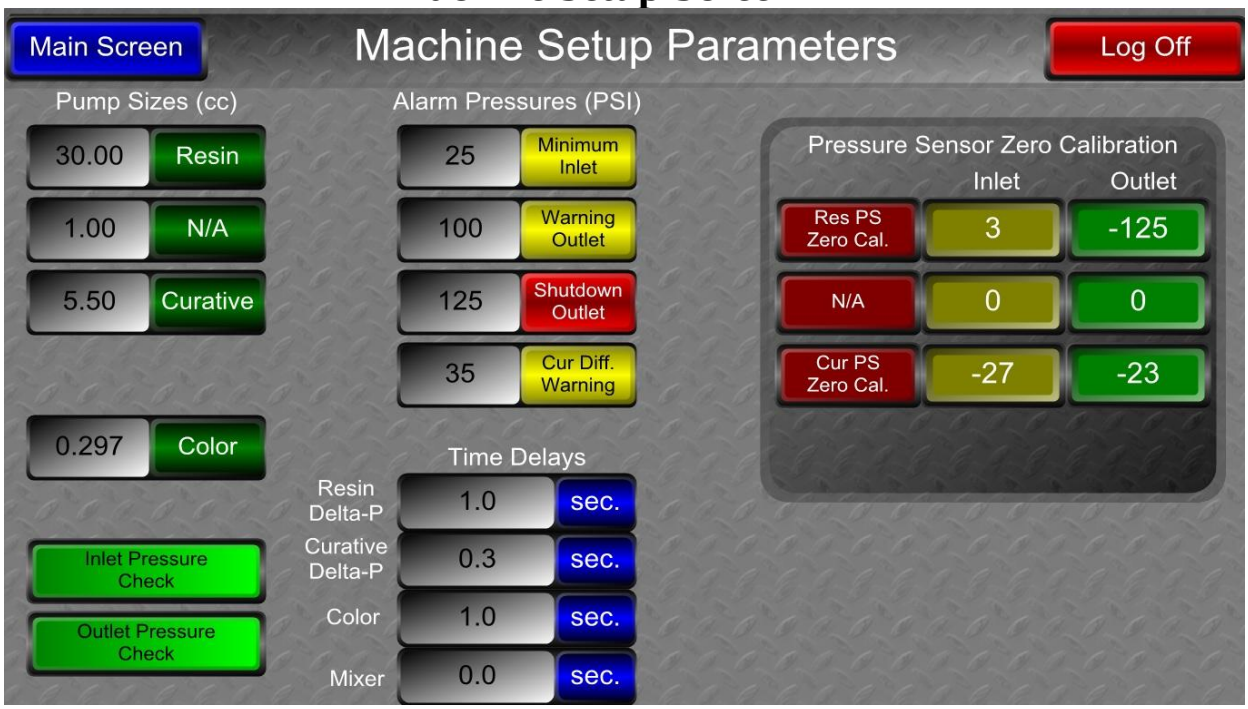
6. After switching the circuit breaker back on, go to the alarm screen and verify the “mixer motor fault” alarm is not active.
7. If the same fault re-occurs, there is an issue with the motor or VF drive. The most common fault is material build-up in the mixer chamber. This causes excessive load on the pin mixer and thus on the motor.

Alarm Screen – Logging in



By depressing the “USER” button, the operator will activate a keyboard and password entry screen. Upon entry of the correct User name and password, access to the Windows desktop environment and Machine Setup screen is granted.

Machine Setup Screen



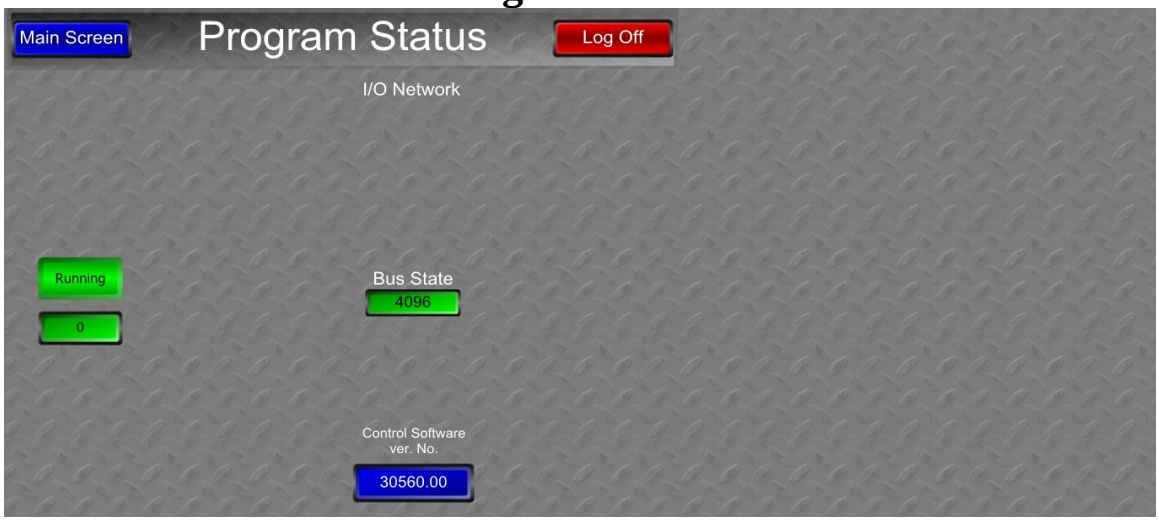
This screen is used to display machine setup parameters that normally do not change. It is not accessible under normal conditions. To enter this screen, the administrator must be logged on. From the Main screen, locate the "Machine Setup" button in the upper right side. Currently, the machine parameters include:

1. Component pump sizes
2. Minimum Inlet pressure – Alarm is activated when the inlet pressure falls below the setting.
3. Warning Outlet pressure – Alarm is activated when the discharge pressure reaches the setting.
4. Differential warning – Alarm is activated when the differential pressure (pump outlet – pump inlet) reaches the setting
5. Shutdown Outlet pressure – Alarm is activated, and the machine stops pouring when the discharge pressure reaches the setting.
6. Pressure sensor calibration. See page 25.
7. Main Screen – Sends HMI to the main screen without logging off the administrator.
8. Log Off – Sends HMI to the title screen. This logs off the administrator and removes the machine setup, status and program status buttons from the main screen.
9. Time Delay: Resin/Curative Delta-Ps – when switching from pour mode to off mode, a delay is used to prevent material pressure spikes.
10. Mixer Delay – Time delay from mixer on to pumps on.
11. Color pump delay – Time delay from mixer on to color pumps on.
12. Inlet Pressure Check – Prior to pouring, the inlet pressure of each material is checked against the minimum inlet pressure setting. If the pressure is below

this setting, pouring is not allowed. This can be overwritten by pressing this button. If pressed, the button will display “Inlet Pressure Ignored”.

13. Outlet Pressure Check – same above except for outlet pressure

Program Status



Program Status screen contains the software version number and an indicator displaying if the program is running.

Machine Status

Machine Status is for troubleshooting with support from TPS ONLY.

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MK25 Hydrospenser 3 Component

HMB PUMP (Curative 3.5cc / 5.5cc / 10cc)

Part #	Description	Quantity	Maintenance
41037	Shaft Seals 5/8	3	6 Months or first sign of leak
42008	O Ring 018	2	6 Months or first sign of leak
42032	O Ring 119	1	6 Months or first sign of leak
42159	O Ring 013	1	6 Months or first sign of leak
42161	O Ring 016	1	6 Months or first sign of leak
31453	Seal Adapter Female 5/8	1	6 Months or first sign of leak
31454	Seal Adapter Male 5/8	1	6 Months or first sign of leak
31455	Spring 5/8 Seal	1	6 Months or first sign of leak
41584	O Ring 224	1	6 Months or first sign of leak
31105	Shear Pin HMB Pump	1	At Breakage
41741	O Ring 010	2	6 Months or at sensor cleaning
41054	Heater 525W 240V	1	At Failure
31676	Sensor Temp.	1	At Failure

BLB PUMP (Prepolymers 10cc / 20cc / 30cc / 50cc / 100cc)

Part #	Description	Quantity	Maintenance
41004	Shaft Seals 3/4	3	6 Months or first sign of leak
42015	O Ring 019	1	6 Months or first sign of leak
42137	O Ring 122	1	6 Months or first sign of leak
41010	O Ring 118	2	6 Months or first sign of leak
42139	O Ring 216	1	6 Months or first sign of leak
42141	O Ring 226	1	6 Months or first sign of leak
31072	Seal Adapter Female 3/4	1	6 Months or first sign of leak
31073	Seal Adapter Male 3/4	1	6 Months or first sign of leak
31074	Spring 3/4 Seal	1	6 Months or first sign of leak
31106	Shear Pin BLB	1	At Breakage
41741	O Ring 010	2	6 Months or at sensor cleaning
41054	Heater 525W 240V	1	At Failure
31676	Sensor Temp.	1	At Failure

MIXER ASSEMBLY (Clean and Breakdown Mixer Every 2-4 Weeks)

*** **Replace at Breakdown**

Part #	Description	Quantity	Maintenance
42401	Seal Shaft Garlock	2	Inspect Daily ***
31414	Reverse Spin Agitator	1	3-6 Months
21208-3	Sensor Temperature	1	At Failure
31317-1	Diaphragm Delta P 1.75	1	Inspect Daily ***
31385	Port Insulators	1	3 Months
31368-	Mixer Chamber	1	At Failure
42008	O Ring 018	2	***
41010	O Ring 118	2	***
41741	O Ring 010	2	***
32293	Diaphragm Delta P 2.0	1	Inspect Daily ***
41196	Gasket (Mixer Nozzel)	1	At Failure
31441	Lock Pin	4	At Failure
23522-1	Mixer Heater	1	At Failure
46589	O Ring 121	1	***
41583	O Ring 223	1	***
41032	Seal Ball TFE	2	1 Month
41026	Seal TFE	2	1 Month
21346	Valve Check Kalrez	1	3-6 Months
31461	Insulator Mixer Chamber	1	3-6 Months

Section 6

OPTIONAL: Flex Arm

WARNING: Do not force the arm in any direction!! Be sure all lines have smooth bends and are not kinked. Failure to do so may result in personal injury.

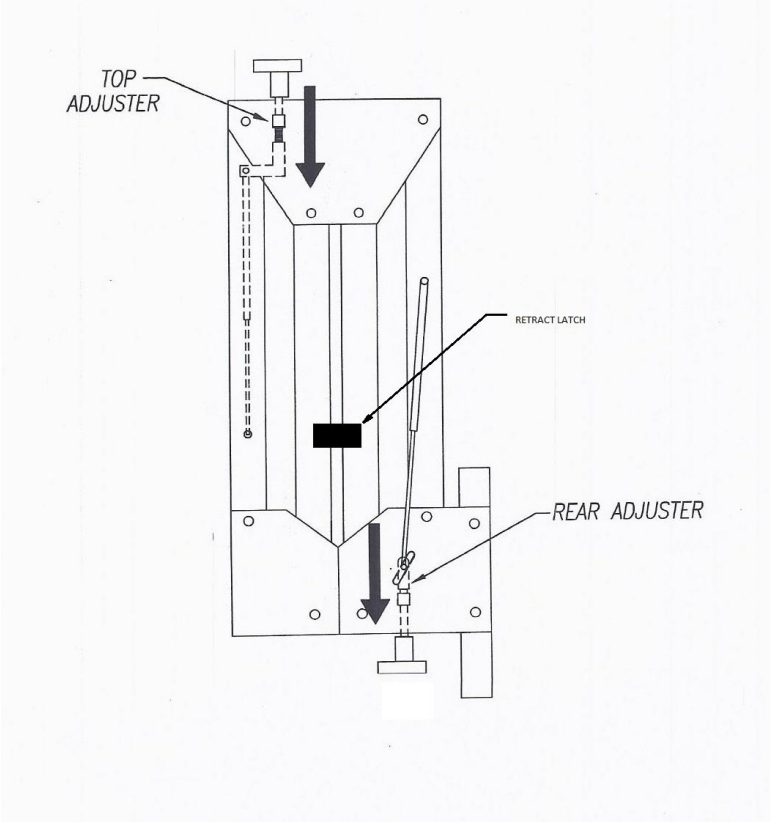
WARNING: Only move the arm using the black handle located on the left side as viewed from the front of the machine. Failure to do so may result in personal injury.

1. Both front and rear arms adjust to meet the operators' preference:

   a. The adjusters are located between the plates in either indicated location.

   b. Moving the adjuster downward will increase reaction in the rear arm and increase extension on the front arm.

   c. Moving the adjuster upward will decrease reaction on the rear arm and decrease extension on the front arm.


TOP
ADJUSTER
RETRACT LATCH
REAR ADJUSTER