
Section 13: Chip Removal Devices

HydroSweep™

**WARNING**

When operating the HydroSweep™ make sure hands, feet and clothing are clear of all moving parts.

**Maintenance
Schedule****Each Part Cycle**

- 1) Make certain that the HydroSweep unit is cycled before every part change, or run at least 20 minutes per hour run time. Use an M20 in the program to make it automatic. Frequent washing out of chips prevents them from building up into difficult-to-remove piles, and clears drum from chip buildup.
- 2) Clean away any chips that may lodge in rear trough at bottom of Y-axis sliding tray.

Daily Maintenance

- 1) Wash down interior with coolant hose nozzle, using care to keep splash away from Automatic Tool Changer, Head assembly, or any wiring connections.
- 2) Wash out HydroSweep drum, clearing any chips from inside. Inspect behind HydroSweep Ram for any stray chips blocking return slot.
- 3) Clean chips from behind Table and Saddle, the Sliding Guard, and behind the Sliding Guard near the Y-axis ballscrew. Inspect between the front Y-axis way cover and the front of the machine for chip buildup.
- 4) Remove the screen/tank cover over the fluid tank, and clean the screen that is protecting the pumps.
- 5) Using a shovel, check for any chip buildup in the tank ahead of the screen.
- 6) Check the tank reservoir fluid level, and refill as necessary, using only coolant with anti-foam inhibitors.
- 7) Check the Waylube level, refill with Castrol Magna BD68, Shell Tonna V68, or Mobil Vactra #2.

- 8) Check the air pressure. Single regulators should be set for 80PSI. Dual regulators should be set at 80PSI on the left gauge, and 90-100PSI maximum on the right gauge.
- 9) Move the X-axis to either side, and flip over the outer X-axis way cover. Inspect for chip buildup, and clean. Check for waylube presence on both X-axis ways. Inspect Z-axis and Y-axis as well.
- 10) Check the pressures/vacuum on the Coolant-Thru pump filter and replace the filter, if necessary.

Weekly Maintenance

- 1) Remove the Head Cover, and inspect the fluid lines for the Hi/Lo Idler assembly, refilling, if necessary.
- 2) Remove all tools from the tool changer, and clean out any chip buildup in the ATC. When returning tools to the ATC, inspect the retention ring tension on the tool holders for excessive looseness. Replace rings, if necessary.
- 3) Disconnect the front Y-axis way cover from the saddle, and check for chip buildup.
- 4) Inspect under the Y-axis motor for chips, and clear out drain ports under the Y-axis ways nearest the column.

Monthly Maintenance

- 1) Remove the spindle motor top filter cover, and inspect the filter. Replace, if necessary.
- 2) Inspect all HydroSweep nozzles for chip clogging.
- 3) Inspect the Chiller cabinet for low fluid in the container. The level should be 1/2 to 3/4 full.
- 4) Inspect the Chiller recirculation pump filter, and clean as needed.
- 5) Blow air into the Chiller louvers to clear out dirt collecting on the condenser.
- 6) At the bottom of the rear cabinet, remove the fan filter screen and clean.
- 7) Inspect the front door rollers, tightening as necessary.
- 8) Check the door interlock system for proper operation.
- 9) Remove the head cover and inspect the spindle belts. Also, check for any Coolant-thru system leaks.
- 10) Inspect all cables, hoses, and tubing for looseness, or damage.

The above maintenance procedures may be performed by the customer's maintenance crew.

6-Month Planned Maintenance

This should be performed by the Fadal Planned Maintenance Crew semi-annually.

Auger, Chip Removal System



WARNING

When operating the Auger make sure hands, feet and clothing are clear of all moving parts.

PCB-0197 Auger Control & Door Interlock Monitor Board 1310-0C

Terminals

The terminal connections for the 1310-0C are identical to the 1310-0A.

The 1310-0C does have two additional connectors (J103 and J104) which are for future use. These connections do not change the functioning of the board.

Software

1310-0C requires Auger software version 2.21 or later.

Inputs

There are three door interlock switches monitoring the left access panel, the right access panel and the front door respectively. Each switch has a normally open and a normally closed contact. Each switch and each contact are monitored separately. These inputs are J4 pins 1-12.

The 120 VAC Emergency Stop circuit from the 1100-1 TB1-10 goes to pin 7, the control switch for the Auger or Wash Only is at J3 pin 2. The start/stop switch input is at J3 pin 1.

Outputs

The logic level outputs are external slide hold (J3 pin 13), and an additional external slide hold at J103 and J104.

A 120 VAC output to control the spindle contactor is at J1 pins 9 and 10.

The 230 VAC 3-phase for the motor is at J2 pins 1-3.

Power

The board requires +5V and COM (J3 pins 11 and 12). If these inputs are reversed, the diode will short out the board, preventing damage to the circuitry.

120 VAC is also required for operation (J1 pins 1 and 6).

230 VAC 3-phase is required for the auger motor (J2 pins 5-7).

Operation

The 1310-0C monitors the interlocks for the three doors. If any door is open, an External Slide Hold is sent to the CNC control. If one circuit of the switch indicates door closed but the other indicates door open, a door open condition will be assumed by the board. The External Slide Hold is sent immediately when a door is opened. In addition, after a 5-10 second delay that allows time for a controlled stop, the spindle contactor will be de-energized and removes power to the spindle drive; the delay is adjustable within the range of 5 seconds minimum to 10 seconds maximum by the Delay Adjust potentiometer (R148). An Emergency stop will also de-energize the spindle contactor after the delay.

J103 and J104 are for future use. J103 pin 1 is identical to J3 pin 13 (active low output to generate External Slidehold). J103 pin 2 is an active high External Slidehold. J104 are Doors Closed signals which will change with the Doors Closed LED (D110). J104 pin 1 is active high (sourcing) and J104 pin 2 is active low (sinking).

When the Auger button on the front of the machine is pressed, the Auger will start and then after a few seconds the washdown cycle will begin. The length of the washdown cycle is determined by the setting of the potentiometer next to the auger button. When the washdown cycle is complete the pump will be turned off for 20 seconds and then the washdown cycle will repeat. Pressing the auger button a second time will turn off the auger and washdown.

If the Auger/Wash switch is in the Wash position, the auger will not come on and only one washdown cycle will be performed.

If the auger becomes blocked it will reverse for five seconds and then start forward again. If this occurs four times in a row the auger will stop and the Fault LED will be set. A manual reset of the 1310-0C will then be required.

If the auger is running backwards, the problem is most likely at the power input to the machine. Never reverse any 3-phase wiring to correct direction until you have verified whether one motor is running backwards or all the 3-phase motors are running backwards. (Axis and spindle motors are not dependent on the phasing of the input power because they are variable speed).

Indicators (LEDs)

The LEDs on the 1310-0C are slightly different than the 1310-0A:

There is only one green LED (D110) for the doors. It will be on only if all doors are closed and all circuitry is indicating doors closed.

There is a separate red LED for each door circuit (one for the normally open of each door and one for the normally closed of each door). The red LED will be on if that circuit is indicating a door open condition.

There is a yellow LED for each door. This indicates a fault condition in a door circuit (i.e. one circuit indicating door open but the other indicating door closed). This LED will flash whenever the door is opened or closed because the two circuits do not change state at the exact same instant. The flash is normal.

There are two red LEDs for the External Slidehold outputs. D116 indicates the status of J3 pin 13 and J103 pin 1. D117 indicates the status of J103 pin 2. The LEDs light when the output is active. J3 pin 13 and J103 pin 1 are active low. J103 pin 2 is active high. J103 is for future use.

A green LED has been added for the status of the spindle solid state relay. It will light when the output for the spindle contactor is on. In other words, it will light when all the doors are open and will go out 5-10 seconds after a door is opened.

The HEART LED indicates normal operation of the 1310-0C. It will be blinking whenever the microcontroller is running. It will be off when a door is open or when the VMC is in Emergency Stop.

The FAULT LED is lit whenever a major fault occurs: repeated overloads, overcurrent, etc. When this LED is on the 1310-0C board must be manually reset (S1).

The FWD LED will be on when the auger is moving in the forward direction.

The REV LED will be on when the auger is moving in the reverse direction. The OVERLOAD LED will flash when there is an overload. There are always "overloads" when the motor first starts due to the initial starting current. These "overloads" in the first 200 milliseconds will be ignored by the microcontroller. After the initial starting time, any overload will cause the motor to reverse.

The OVERCURRENT LED lights when there is a very large overcurrent such as a short or major fault. This LED will be lit when the board initially powers up. The microcontroller will reset it shortly after the Heart LED begins blinking. An

extended motor overload condition will also set this LED; however such a condition should never occur because the microcontroller will respond first.

**Daily and Weekly
Safety Tests for Door
Monitor**

To ensure proper functioning of safety circuits, the following tests should be performed on a regular basis.

Daily

- 1) Close all doors. Make sure VMC is not in emergency stop.
- 2) Start Auger.
- 3) Start spindle at slow speed.
- 4) Open front door.
 - a. The Auger will should stop automatically.
 - b. The spindle should stop immediately (fully stopped from any speed in less than 5 seconds). Five to ten seconds after the door is opened, the spindle contactor will open (the five to ten second delay allows the spindle to come to a controlled stop).
- 5) Close front door. The spindle contactor will immediately reenergize.

Weekly

- 1) Close all doors. Verify that the VMC is not in emergency stop.
- 2) Open the cabinet containing Door Interlock Board (1310-0C) and examine LEDs and relays on the 1310-0C board.
 - Heart LED should be blinking.
 - Red door LEDs should be off.
 - Yellow door LEDs should be off.
 - Green “Doors Closed” LED should be on.
 - Red Slidehold LEDs should be off.
 - Estop relay (K7) should be on (LED lit).
 - Green “Spindle Enable” LED should be on.
 - “Spindle” relay for spindle contactor (K5) should be on (LED lit).
- 3) Press the Emergency Stop switch.
 - Heart LED should stop blinking.
 - E-stop relay should go off immediately.
 - The Auger should stop immediately and auger contactor release.
 - Spindle Enable LED and Spindle relay should go off after 5 to 10 seconds. Spindle contactor should then release.

- 4) Release the Emergency Stop switch and clear the emergency stop condition by pressing Jog.
- 5) Open the front door.
 - Heart LED should stop blinking.
 - Front door red LEDs should be on.
 - Green “Doors Closed” LED should be off.
 - The yellow LED for the front door should flash at the instant the door is opened.
 - Spindle Enable LED and Spindle relay should go off and Spindle contactor should release after 5 to 10 seconds.
- 6) Close the front door and open left side door.
 - Heart LED should stop blinking.
 - Left door red LED's should be on.
 - Green “Doors Closed” LED should be off.
 - Yellow door LED should flash at the instant the one door is closed and when the other door is opened.
 - Spindle Enable LED and Spindle relay should go off and Spindle contactor should release after 5 to 10 seconds.
- 7) Close the left side door and open right side door.
 - Heart LED should stop blinking.
 - Right door red LED's should be on.
 - Green “Doors Closed” LED should be off.
 - Yellow door LED should flash at the instant the one door is closed and when the other door is opened.
 - Spindle Enable LED and Spindle relay should go off and Spindle contactor should release after 5 to 10 seconds

Chip Conveyor**Installation
Procedure**

- 1) Place the chip conveyor in the coolant tank.
- 2) Measure the height to the top of the conveyor sheet metal (should be approximately the height of the coolant tank).
- 3) Set the machine height (the machine should be on the small leveling pads) to slightly above the height established in step 2 above.
- 4) Slide the coolant tank/conveyor underneath the machine.

- 5) Slide the coolant tank/conveyor so that conveyor is against the left side of the sheet metal (Figure 13-1).



Figure 13-1

- 6) Slide the coolant tank/conveyor so that the face of the sheet metal coolant tank is slightly in front of the machine sheet metal (it should overlap the machine sheet metal), Figure 13-2.



Figure 13-2

- 7) Adjust the machine height (during leveling and installation) to minimize the gap (or overlap) between the coolant tank face and the machine sheet metal, Figure 13-3.

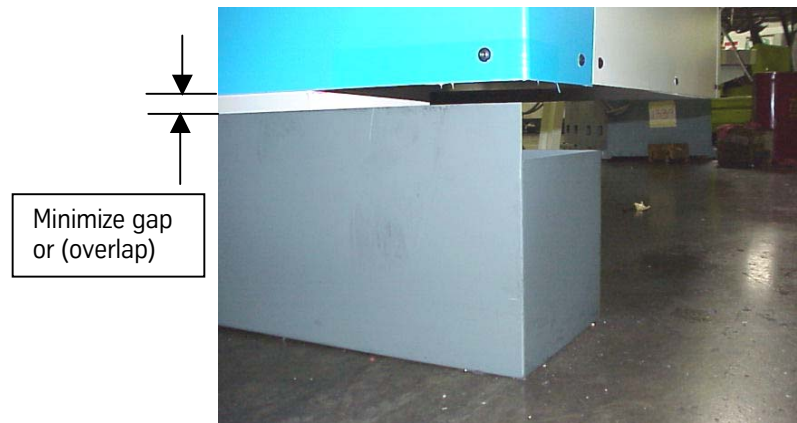


Figure 13-3

- 8) Coolant, wash down and flood pumps are connected per normal installation/setup.
- 9) A standard 55 gallon drum can be positioned underneath the conveyor discharge to collect the chips.

Chip Conveyor Power and Controls

- 1) The chip conveyor requires 220 volt single phase power.

Note: The conveyor must be plugged into the provided outlet on the VMC which is dedicated for the chip conveyor.

- 2) The control (Figure13-4) has 3 operating positions:

Forward	-Controls the forward motion of the conveyor belt
Stop/Reset	-Shuts off the conveyor
Reverse	-Reverses direction of the conveyor belt (for clearing jams)

- 3) The control also has a variable speed control for the belt speed. The belt speed can be controlled from 2.60 ft./min. to 10.80ft/min. (See Figure 13-5).



Figure 13-4



Figure 13-5

Pre-Startup Safety Inspection



- 1) At the initial running, confirm the following before turning power on.
 - a. Inspect for and remove any article other than material (chip, etc.) to be transported on conveyor link belt portion.

WARNING

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- 2) Confirm the direction of rotation by turning switch on for about two seconds.
 - a. If motor rotates in reverse, correct electrical connection.
- 3) Run conveyor continuously while machine tool is exhausting chips.

Stopping the Chip Conveyor on US and CE Machines

On US machines, hitting the VMC Emergency Stop will stop all machine operations including the chip conveyor.

On CE machines, hitting the VMC Emergency Stop, opening the front door, or switching off an Estop switch at the conveyor chute will stop the chip conveyor.

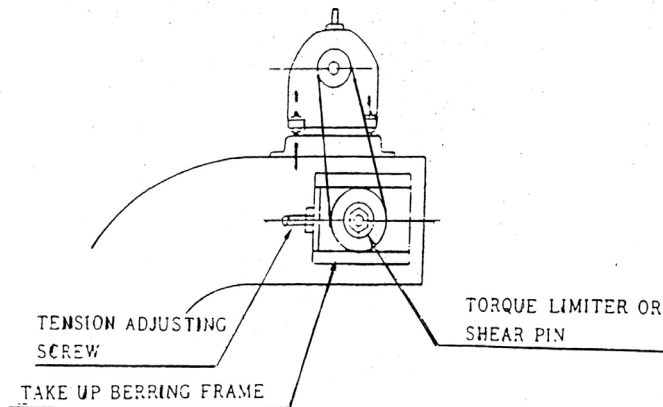
Note: The Estop switch at the chute stops only the conveyor; it has no effect on the VMC.

Restarting the Chip Conveyor

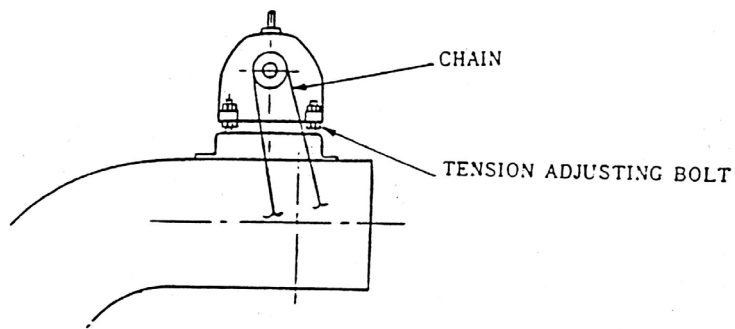
When the chip conveyor is stopped, it must be restarted at the chip conveyor control by switching it off, and then on again. Closing the front doors on a CE machine or resetting the Estop switch will not restart the chip conveyor.

Observance and Inspection

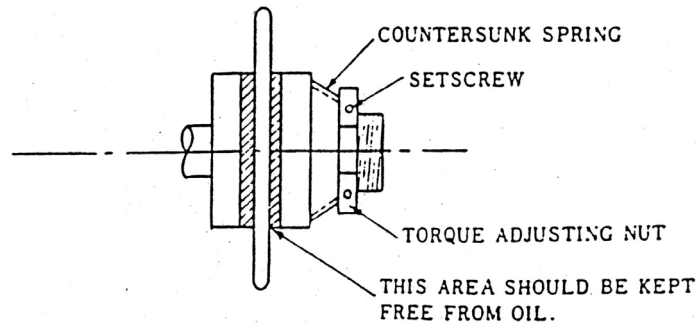
- 1) Maintain oil level in the speed reducer at specified level; check at least once a year.
- 2) Keep correct tension of conveyor chain by adjusting take-up bearing. (Obtain equal tension on both right and left hand conveyor chains by adjusting screw.)



- 3) Check roller chain between motor and conveyor for proper alignment and correct tension.



- 4) The greatest care should be exercised to keep friction surface of torque limiter free from oil when lubricating roller chain.



5) Lubricate conveyor chain and roller chain every 150 Hours.

Cause of Trouble and Corrective Action

- 1) Problem: Inoperative when unloaded
 - a. Slip of torque limiter
 - Cause: Incorrect adjustment of torque limiter
Solution: Tighten nut for torque adjustment
 - Cause: Large part lodged in conveyor
Solution: Reverse and remove part
- 2) (Special design)
 - a. L.S. for slip detection is activated
 - Set detector correctly
- 3) Problem: Shear pin is broken or not installed
 - a. Solution: Replace or install shear pin
- 4) Problem: Thermal relay is tripped
 - a. Solution: Restart thermal
- 5) Problem: Breaker is gone
 - a. Solution: Set breaker
- 6) Problem: Inoperative when loaded
 - a. Solution: Motor is overheated
- 7) Problem: Thermal is working overloaded
 - a. Solution: Reduce to normal load

- 8) Problem: Slip of torque limiter
 - a. Cause: Incorrect adjustment, of torque limiter
 - Solution: Adjust torque. To specified value
- 9) Problem: Shear pin is broken
 - a. Cause: Overloaded
 - Solution: Reduce to normal load
 - b. Cause: Weak pin
 - Solution: Replace with correct shear pin
- 10) Problem: Irregular operation (knocking condition)
 - a. Cause: Incomplete tension
 - Solution: Stretch belt again to normal condition
- 11) Problem: Abnormal noise
 - a. Cause: Out of oil
 - Solution: Check and fill oil
 - b. Cause: Broken bearing
 - Solution: Replace with new bearing

**Maintenance
Schedule Chip
Conveyor**

Please carry out daily, monthly, and yearly inspection according to the following directions.

Daily Inspection

- 1) Always keep oil in the speed reducer at the specified oil level.
- 2) Check motor for abnormal operation, i.e. noise, heat excessive current, etc.
- 3) Lubricate conveyor chain and roller chain every 150 hours.
- 4) Discard chips on the surface of the belt and inside of frame (place a rag on the belt and reverse until the rag is discarded).

Monthly Inspection

- 1) Change oil at 100 hours initially, every 1,500 to 2,000 hours thereafter.
- 2) Check motor for abnormal operation, i.e. noise, heat excessive current, etc.
- 3) Keep correct tension of conveyor chain by adjusting take-up bearing.
- 4) Check roller chain between motor and conveyor for proper alignment and correct tension.
- 5) The greatest care should be exercised to keep friction surface of torque limiter free from oil when lubricating roller chain.
- 6) Lubricate conveyor chain and roller chain every 150 hours.

Yearly Inspection

- 1) Carry out all monthly inspection items.
- 2) Pull out belt and clean inside of frame.
- 3) Check for worn out parts inside of frame and belt assembly and replace with new if necessary.
- 4) Check bolts for looseness.
- 5) Check friction disk for abrasion, and replace if necessary.