# Maintenance and Safety Manual for i-Series Machines

## December 2017

**Original Instructions**

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# MAINTENANCE CHECKLIST

⚠ Do not attempt to access the machine enclosure while machine power is on. Observe proper lock-out/tag-out procedures before performing any maintenance inside the machine enclosure.

## Daily (Every 8 - 10 Hours)

- ❒ Clean the C-Axis rotary table to remove debris that may cause damage (mills only, if equipped). . . . . 4 -55
- ❒ Check the trunnion rotary-axis oil level (mills only, if equipped). . . . . 4 -51
- ❒ Check the trunnion tilt-axis oil (mills only, if equipped). . . . . 4 -53
- ❒ Check the condition of tools to ensure they are clean and free of damage. . . . . 4 -5
- ❒ Maintain the spindle chiller system (if equipped). . . . . 4 -43
- ❒ Check the trunnion table clamping system's incoming pneumatic lines for leaking, cracking, or kinks (mills only, if equipped). . . . . 4 -50
- ❒ Check the coolant level every day at the start of operation. . . . . 4 -36
- ❒ Check the hydraulic pressure of the trunnion table clamping system to ensure it is between 30 and 40 Bar (mills only, if equipped). . . . . 4 -30
- ❒ Clean the trunnion table (mills only, if equipped). . . . . 4 -50
- ❒ Check and maintain all lubricant levels. . . . . 4 -4
- ❒ Check and maintain autolube lubricant levels. . . . . 4 -10
- ❒ Check and maintain electro-spindle air-oil lubricant levels (mills only, if equipped). . . 4 -15
- ❒ Check and maintain motorized spindle air-oil lubricant levels (mills only, if equipped). 4 -16
- ❒ Check Steady Rest lubrication points on the 2 rollers and the center arm (lathes only, if equipped). . . . . 4 -64
- ❒ Check the auto moisture drain on FRL. . . . . 4 -29
- ❒ Check the FRL or FR unit air pressure. . . . . 4 -28
- ❒ Check the spindle chiller to be sure the working environment has appropriate ventilation and the ambient temperature is between 10° and 40°C (50° and 104°F) (if equipped). . . . . 4 -47
- ❒ Check the spindle for leakage. . . . . 4 -17
- ❒ Check the USB port. Keep dirt, dust, coolant, and oils away from opening. . . . . 4 -6
- ❒ Clean the chip conveyor chip screens (if equipped). . . . . 4 -38
- ❒ Clean the coolant collector filter (lathes only). . . . . 4 -59
- ❒ Clean the tool lock pins and tool gripper fingers located on the tool changer arm (mills only). . . . . 4 -41
- ❒ Grease the chuck (lathes only) . . . . . 4 -5
- ❒ Inspect for leaks in spindle chiller (if equipped). . . . . 4 -43
- ❒ Inspect the enclosure windows for scratches, damage, cracks, or other deformities that could adversely affect the impact resistance. . . . . 4 -5
- ❒ Lubricate the non-motorized spindle taper (mills only). . . . . 4 -17
- ❒ Perform operational checks. . . . . 4 -2
- ❒ Perform Pre-lube and Warm-up Spindle cycles for the High Speed (18000 RPM) Motorized Spindle or the High Speed (18000 RPM) Electro-spindle (mills only, if equipped). . . . . 4 -18
- ❒ Warm up a machine that has been idle for eight hours before cutting parts. . . . . 4 -5

## Weekly (Every 40 - 50 Hours)


- ❒ Check the oil level for the B-Axis tilt mechanism (mills only, if equipped). . . . . 4 -54
- ❒ Inspect the spindle chiller tank air filter and water filter for dirt and damage (if equipped). . . . . 4 -45
- ❒ Clean the coolant filters (if equipped). . . . . 4 -37
- ❒ Check the oil level for the trunnion clamping system (mills only, if equipped). . . . . 4 -50
- ❒ Check and fill oil level of unclamp cylinder cup (mills only). . . . . 4 -17
- ❒ Check each tool holder for damage (mills only). . . . . 4 -6
- ❒ Check the auto moisture drain on the Filter and Regulator Unit for TM i-Series models (lathes only). . . . . 4 -29
- ❒ Check the CTS coolant filter and clean when necessary (mills only, if equipped). . . . . 4 -49
- ❒ Check the oil level for the C-Axis rotary table, and if necessary add oil (mills only, if equipped). . . . . 4 -55
- ❒ Check the spindle chiller to be sure there is a sufficient amount of liquid in the tank or in the system (if equipped). . . . . 4 -47
- ❒ Check the Tool Clamping System collet chuck for damage, dirt, and adequate lubrication. Replace O-rings if damaged (lathes only). . . . . 4 -17
- ❒ Check the Tool Clamping System pull force with a pull measurement system (mills only). . . . . 4 -17
- ❒ Clean the filter inside the heat exchanger (if equipped). . . . . 4 -7
- ❒ Inspect the chiller solution level, and if necessary, add solution to the unit (if equipped). . . . . 4 -45
- ❒ Remove air from spindle chiller circulating system (if equipped). . . . . 4 -46


## Monthly (Every 150-200 Hours)


- ❒ Inspect limit switches and dog fasteners for damage. . . . . 4 -7
- ❒ Add a rust preventative to the autolube system if the machine will be idle for 30 days or more. . . . . 4 -10
- ❒ Apply grease to tool holders (mills only). . . . . 4 -7
- ❒ Check the Tool Clamping System alignment dimension in release position with the clamping unit under pressure in the unclamp position (mills only). . . . . 4 -17
- ❒ Check the Tool Clamping System operating sequence by performing a clamping and releasing operation with a tool (mills only). . . . . 4 -17
- ❒ Check the turret oil level (lathes only). . . . . 4 -57
- ❒ If compressed air is used, remove the drain plug and open the Steady Rest drain (lathes only, if equipped). . . . . 4 -64
- ❒ Inspect conduit, connectors, cabling, and wiring external to the machine or evidence of fraying, cracking, and looseness. . . . . 4 -8
- ❒ Maintain the autolube fluid level and check the filler filter screen. . . . . 4 -12
- ❒ Manually activate the autolube system if the machine has been idle for a long time before powering up, or if the oil has just been replaced. . . . . 4 -13
- ❒ Perform a spindle run-in before operating the machine if the spindle has been idle for more than 30 days or if the spindle has never been used. . . . . 4 -22

## Every 3 Months (Every 500 Hours)


- ❒ Check the hydraulic system oil level (if equipped). . . . . 4 -33
- ❒ Inspect and clean the TMM i-Series coolant valve located inside the turret (lathes only, if equipped). . . . . 4 -60
- ❒ Inspect and clean the TMX i-Series coolant valve located on the turret (lathes only, if equipped). . . . . 4 -62
- ❒ Replace the CTS coolant filter (mills only, if equipped). . . . . 4 -49
- ❒ Check the ATC oil level (mills only). . . . . 4 -41
- ❒ Clean the chip conveyor (if equipped) whenever the coolant is replaced. . . . . 4 -38
- ❒ Check the FRL air filter element regularly and replace it. . . . . 4 -28
- ❒ Replace coolant and coolant filters (if equipped). . . . . 4 -37
- ❒ Drain moisture from the lines of the Filter and Regulator Unit or the FRL. . . . . 4 -29
- ❒ Measure the ground impedance (resistance to true earth). . . . . 4 -8
- ❒ Replace the Tool Clamping System O-ring (mills only). . . . . 4 -17


## Every 6 Months (Every 1000 Hours or as stated)


- ❒ Check the grease in the live-tooling turret gear box (lathes only, if equipped). . . . . 4 -57
- ❒ Check the live-tooling turret power intake rotary seal (lathes only, if equipped). . . . . 4 -58
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- ❒ Grease the outriggers (mills only). . . . . 4 -9
- ❒ Grease the ATC magazine chain assembly (mills only, if equipped). . . . . 4 -41
- ❒ Grease the ATC magazine drum (mills only, if equipped). . . . . 4 -42
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- ❒ Add NGLI 1 grease to the Zerk fittings on the tool changer arm (mills only). . . . . 4 -41
- ❒ Inspect the chip conveyor chains and paddle screws (if equipped) for tightness. . . . . 4 -40


## Annually (Every 2000 Hours or as stated)


- ❒ Replace the trunnion rotary-axis oil (mills only, if equipped). . . . . 4 -52
- ❒ Replace the trunnion tilt-axis oil (mills only, if equipped). . . . . 4 -53
- ❒ Replace the ATC oil (mills only). . . . . 4 -42
- ❒ Clean the autolube reservoir tank and suction filter. . . . . 4 -14
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- ❒ Replace the oil for the B-Axis tilt mechanism (mills only, if equipped). . . . . 4 -54


## Every Three Years


- ❒ Replace polycarbonate windows in enclosure doors. . . . . 4 -5

# Documentation Conventions

This documentation uses several conventions to explain the safety features and emphasize key concepts. These conventions are described in this section.

## Icons

This manual may contain the following icons:

### Caution/Warning



The operator may be injured and/or the machine severely damaged if the described procedure is not followed.

### Important



Ensures proper operation of the machine and control.

### Troubleshooting

?

Steps that can be taken to solve potential problems.

### Hints and Tricks



Useful suggestions that show creative uses of the WinMax features.

### Where can we go from here?



Lists several possible options the operator can take.

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# MACHINE STANDARDS

Hurco machinery conforms to applicable North American and European standards.

## ANSI Standards

In order to comply with the American National Standards Institute (ANSI®) for machines sold in the US, machine operations meet the accredited procedures listed in the following:

- ANSB11.23-2002 (R07), titled “Safety Requirements for Machining Centers and Automatic, Numerically Controlled Milling, Drilling and Boring Machines.”
- ANSB11.22-2002 (R07), titled “Safety Requirements for Turning Centers and Automatic, Numerically Controlled Turning Machines.”

## CE Requirements

In order to comply with CE requirements for machines sold in Europe, machine operations meet the following standards:

- EN 12417: 2001 + A2: 2009: Machine tools – Safety – Machining centres
- ISO/DIS 16090-1: Machine tools safety – Machining centres, Milling machines, Transfer machines – Part 1: Safety requirements
- EN 60204-1: 2006 + A1:2009 Electrical equipment
- EN 13849-1: 2015 Safety of machinery—Safety-related parts of control systems—Part 1: General principles for design
- EN 13849-2: 2012 Safety of machinery—Safety-related parts of control systems—Part 2: Validation
- EN 4413: 2010: Hydraulic fluid power—General rules and safety requirements for systems and their components
- EN 4414: 2010: Pneumatic fluid power—General rules and safety requirements for systems and their components

The Declaration of Conformity is provided with all machines sold in Europe; a sample is shown below:

HURCO

EC/EU Declaration of Conformity

MACHINERY DIRECTIVE 2006/42/EC

ELECTROMAGNETIC COMPATIBILITY DIRECTIVE 2014/30/EU

# DECLARATION OF CONFORMITY

This declaration is issued under the sole responsibility of the manufacturer

| | |
|---|---|
| **Manufacturer's name and full address** | Hurco Companies, Inc.<br>One Technology Way<br>Indianapolis, Indiana 46268<br>USA |
| **Authorised Representative and full address** | Hurco Europe Ltd.<br>Halifax Road-Cressex Business Park<br>High Wycombe, Buckinghamshire HP12 3SN<br>UK |
| **Description and identification of the machinery** | |
| Product/Type | CNC Machining Center |
| Models | |
| **This machinery conforms to all the requirements of the Machinery Directive 2006/42/EC** | |
| **This machinery also conforms to the following Directives** | EMC Directive 2014/30/EU |
| **The following standards have been used** | EN ISO 12100:2010, EN 12417:2001+A2:2009, EN 60204-1:2006, EN 61000-6-2:2005, EN 61000-6-4:2007+A1:2011 |
| The technical file is compiled in accordance with part A of Annex VII of the Machinery Directive 2006/42/EC | |
| **Name and address of the person authorised to compile the technical file (based in the European Community)** | Hurco Europe Ltd.<br>Halifax Road-Cressex Business Park<br>High Wycombe, Buckinghamshire HP12 3SN<br>UK |
| **Person authorised to make this declaration** | Hurco Europe Ltd. |
| **Name** | |
| **Function** | |
| **Signature** | |
| **Place of Declaration** | High Wycombe, UK |
| **Date of Declaration** | |

# MACHINE COMPONENTS

Hurco machining and turning centers use microprocessor-based, computer numerical control (CNC) digital control systems to send precise commands via part programs to control spindles and axis drive systems mounted on cast-iron frames to remove material from workpieces. Part programs are entered into the CNC control by the machine operator or toolpath programmer in either Conversational or Conventional NC (G-Code) format.

Optimum machine performance is reliant upon installation conditions being within Hurco's recommended specifications (power supply, air supply, ambient air conditions, etc.).

The machining centers described in this manual have either a vertical or horizontal spindle with programmable spindle speeds, multiple axes, and a multi-tool Automatic Tool Changer (ATC). Options are available to accommodate various machining applications.

The turning centers described in this manual have a multi-tool turret with two axes. Turning centers are available with other configurations, such as live-tooling and C-axis, a programmable tailstock, Y-axis motion, a long bed, and a sub-spindle. Options are available to accommodate various turning applications.

Closed loop servo drive systems and motors with rotary encoders power the mechanical drives that position the axes. The rotary encoders provide positioning feedback information to the control. Limit switches mounted on each axis determine end-of-travel and establish reference points for initial machine zeros.

The control positions an axis by sending a command to the appropriate servo drive, which in turn supplies voltage to the axis servomotor.

Refer to the *Mechanical and Electrical Manual* for component drawings for your machine.

## Frame

The major structural assemblies of each machine are constructed of thick-walled, fine-grain cast iron. The cast iron is designed to produce superior cutting accuracy. This construction provides strength and excellent dampening characteristics, keeping deflection and resistance at a minimum during turning or machining.

The axes guideways for most models are precision linear rails to minimize drag torque which results in greater accuracy and contouring capabilities.

The machine tool provides easy setup for a variety of part sizes.

- Axis travel lengths
- Spindle Nose to Table Surface measurement
- Work holding limits
- Maximum Table Load weight

# Enclosure

Most Hurco machines have a full chip enclosure. Enclosure doors are provided to minimize the risks of ejection of the workpiece, machine components, tools or parts of them, swarf, chips, or coolant and have been designed and constructed to withstand foreseeable impact energy based on EN 12417 standard for Machine Tools—Safety—Machining Centers and EN 12415 standard for Machine Tools—Safety—Small Numerically Controlled Turning Machines and Turning Centers" document.

Enclosed machines have these features:

- Operator sliding doors equipped with polycarbonate windows that lock when in Run mode or with Automatic operations. The doors also lock with Power Off.
- Side door for cleaning inside the enclosure.
- Side door for access to ATC (machining centers) or spindle (turning centers) and for cleaning inside the enclosure.
- Full enclosure keeps chips and coolant contained inside the enclosure.
- Auxiliary doors with latches also lock with Power Off or in Auto Mode.



Enclosure doors are not designed to withstand dangers from noxious materials that can result in fire, explosion, or noxious dust.

Chip management is handled by conveyor and/or auger to dispense chips out to the side of the machine. Coolant management system provides these functions:

- Flood coolant around cutting area
- Washdown coolant for interior of enclosure
- Exterior washdown gun for clean-up
- Exterior air gun for clean-up

# Spindle and Drive System

Hurco machines are equipped with either a cartridge-type spindle or a motorized spindle. Spindles are precision-balanced, and made of high-grade alloy steel.

## Tool Release Cylinder (Machining Centers only)

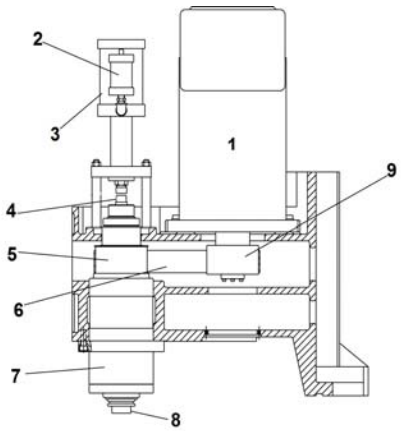
Machining centers are equipped with a Tool Release Cylinder which activates a plunger on the drawbar to release a tool from the spindle. Tools are held in the spindle by grippers that grab the tool retention knob when the Tool Release Cylinder is in retract position. The Tool Release Cylinder has sensors that indicate Clamp, Unclamp to the CNC control. Other models may also have a sensor for clamp with no tool in spindle.

Air blows from the spindle taper when the spindle is unclamped. Any moisture in the air system will be detrimental to the taper, especially when the machine is stopped for an extended time.

## Cartridge-type Spindle

The cartridge-type spindle and drive system consists of a spindle, motor with encoder, pulley arrangement, and drive unit. Different size spindles, motors, and pulleys give each machine its unique cutting power specification. The belt-driven spindle shaft (inside the cartridge) is supported by ABEC-7 class angular grease packed contact bearings. The belt-driven spindle motor and spindle are coupled using a no-slippage gear belt.

⇨ Some i-Series machining centers offer an optional Coolant-thru Spindle (CTS) feature.




**Vertical Spindle and Drive Components**

**1** Spindle Motor
**2** Air/Oil Unit
**3** Tool Release Cylinder
**4** Drawbar
**5** Spindle Pulley
**6** Spindle Belt
**7** Spindle Assembly
**8** Tool Holder
**9** Motor Pulley

***Figure 2–1. Typical Components of Belt-Driven Vertical Machining Centers Spindle***

Machines with belt-driven spindles are equipped with a 3-phase, 220/400 VAC spindle motor that is electronically controlled by the CNC control to provide maximum torque and power to the spindle. The torque and power characteristics vary with specific models. The spindle motor is fully enclosed, has no brushes to inspect or replace, and is air or liquid cooled.

For machining centers, heavy disc springs retain the tool holder in the spindle by clamping the tool holder pull stud via a drawbar. Pneumatics release the tool holder during a tool change. A dual-piston air cylinder supplies the necessary thrust force to the drawbar for tool release.

## Motorized Spindle

The integral motor spindle uses a spindle chiller to maintain the temperature of the spindle during machining operations.

## Spindle Drive Unit

The AC spindle drive unit controls the spindle motor or motorized spindle via a microprocessor using an encoder feedback for closed-loop control, ensuring more accurate speed control. The position of the spindle is monitored and encoded information is fed back to the CNC controller for position closed-loop control, such as tapping. The spindle drive unit controls the rotating speed, direction, and start/stop of the spindle motor or motorized spindle according to input signals from the CNC control.

The following messages are output at terminals via relay contacts:

- Ready/Fault
- Heat Sink Temperature
- Motor Over-temperature
- Orient Complete
- Speed Agree
- Spindle Fault

### Spindle Orientation (all except live tool turning centers)

Spindle orientation stops the spindle at a fixed position via feedback signals either from an electronic or non-contact sensor assembly. For electronic orientation, the spindle is stopped at a fixed position via signals sent from an electronic encoder assembly.

### Sensor Spindle Orientation

For non-contact, sensor orientation, a proximity switch is mounted near the spindle, and the orient target is set by a screw on the collar or a slot on the spindle shaft.

## Coolant-thru-Spindle (CTS)

Coolant-thru-spindle (CTS) sends coolant through the spindle at 300 psi (20 bar) to blast chips out of deep holes. CTS also promotes longer tool life by avoiding re-cutting chips, and aids in heat dissipation. Includes separate pump and easily accessible replaceable filter tank.

## Air-thru-Spindle (ATS)

Some CTS machines may be configured for air-through-spindle (ATS) with a maximum of 94 psi (6.5 bar).

## Chuck Types (Turning Centers only)

The turning center spindle holds and turns the stock for cutting in either a three-jaw chuck or collet chuck clamped by a hydraulically actuated draw tube. Pressure is adjusted through a valve located behind an access panel at the front lower left side of the machine. Clamping by external, internal, or collet type workholding can be set through Manual mode. The chuck is opened or closed by pressing the foot pedal.

# Axes Motion System

All axes are controlled by AC servo drives and motors.

## Axis Drive Units

AC axis drives control the rotating speed, direction, and start/stop of the axis motors via microprocessor using an encoder feedback for closed-loop control, ensuring more accurate speed and positioning control. To position an axis, the CNC control sends a command to the servo drive, which then supplies voltage to the axis motor. Some axis drive units may have braking resistors or brake units on the vertical axes that dissipate electrical energy when axis motion stops and hold the axis in place when the axis is stopped.

## Axis Motors

Axis velocity, position, and travel direction are controlled by the CNC control using AC axis motors. These motors are enclosed, transistor-driven, and self-cooled. Because they are designed without brushes, the motors are free from flashover and commutation loss. Axis motors are either belt-driven or direct drive to provide power to the precision ball screws.

## Ballscrews and Bearings

Precision ballscrews are hardened and ground, with a double ballnut, to minimize friction and reduce backlash. Positioning drives are supported by ABEC-7 or greased class bearings on both ends.

## Feedback Systems

Each axis motor is equipped with a rotary encoder that provides velocity and position feedback signals for each closed-loop system. Limit switches mounted on each axis are used to establish reference points for initial machine zeros and to determine travel limits. Alternatively, axes may be equipped with linear scales or direct encoders to provide position feedback to the CNC control.

# Machine Electrical Cabinet

The electrical cabinet contains power circuitry and CNC electronics. The cabinet connects to the machine systems via cable and harness assemblies. Power-related circuitry distributes power, while CNC-related electronics control machine operation.

230VAC is the standard operating voltage. Some models are equipped with an externally mounted transformer to convert 3 phase AC line voltage to 230VAC secondary output voltage to the main power disconnect.

⇨ An industrial UPS (Uninterruptible Power Supply) kit is available as an option. The UPS contains a battery that can power the machine for an extended amount of time in the case of a power outage. Please contact Hurco or your Hurco Distributor for details.

## Operating Temperature

Electrical cabinets may be equipped with a standard heat exchanger.

⚠ For shop temperatures higher than 35ºC (95ºF), an optional air conditioner must be used to ensure the electronics operate within their rated limits.

The electronics inside the electrical cabinet are designed to operate at internal cabinet temperatures from 0ºC to 50ºC (32ºF to 122ºF). An internally mounted temperature sensor is monitored by the software to post an alarm message if the internal temperature exceeds 55ºC (131ºF). If the electrical cabinet temperature exceeds 60ºC (140ºF), the CNC control will disable power to the axis and spindle drives, and prevent further operation of the machine until the internal temperature is below 50ºC (122ºF).

## Control Transformer and Power Supply

A control transformer converts 230VAC to 115VAC for the CNC power supply and 115VAC for the field power supply.

### CNC Power

The 115VAC output from the control transformer feeds the CNC power supply which provides 24VDC for the CNC card rack. Its 24VDC output is connected to a terminal block that distributes DC power to the following devices:

### Field Power

The 115VAC output from the control transformer feeds the field power supply. Its 24VDC output provides power to sensors and relays via the Slice I/O and its associated terminal blocks. The field power rating varies by model and the number of auxiliary components.

## CNC Card Rack

The CNC card rack is Mini-ITX and contains the CPU module, carrier board, boot device, memory, video board, motion interface, and I/O controller.

The rack is installed in the electrical cabinet. The components inside the Mini-ITX card rack are not designed to be serviced. At no time should the access panel be removed or internal components replaced without direct authorization and supervision by Hurco.

# Flood Coolant and Washdown System

The flood coolant system pumps coolant to the cutting tool, cleans swarf from the cut, and provides a cleaner work environment.

The washdown system uses a large flow of coolant to move chips to the front of the machine and onto the chip removal system. A washdown spray gun, if equipped, is externally mounted on the machine to spray chips found inside the enclosure.

The Coolant Washdown Flood system is self-contained. The operator can control the coolant system using console keys.

# Pneumatic System

The pneumatic system regulates the compressed air supplied to various machine systems and solenoid control valves.

The Filter, Regulator, and Lubricator (FRL) Unit is connected to the air manifold, and meters lubricant into the pneumatic system. The FRL prevents moisture from contaminating the compressed air supply, promotes trouble-free operation of air cylinders and valves, and extends the service life of metal components that come in contact with the compressed air stream.

## Air Gun

Some models may have an externally-mounted air gun for cleaning parts.

# Hydraulic System

Some models have a hydraulic system to control various machine systems, including rotary or pallet components and spindle. Hydraulic systems consist of a hydraulic tank, 3 phase motor, pump, solenoid valves, and pressure gauges. The system's hydraulic pressure is set at the factory and should not be adjusted unless directed by Hurco.

# Operator Console

Hurco machines are available with the single-screen, 19-inch (48.2 cm) LCD touchscreen Max5 console. A second graphics screen is available as an option.




***Figure 2–2. Max5 Control Console***

The console is equipped with:

- A number keypad for program entry.
- Console keys for mode and system control: Auto, Manual, Tool Change operations, and manual spindle or axis control.
- Pushbuttons to activate these functions: Start Cycle, Power, Stop Cycle, Feed Hold or Motion Hold.
- Override controls for spindle speed, axis feedrate, and rapid traverse.
- Remote Jog Unit for manual axis control that includes operator buttons for Start, Feed Hold, and Stop. Remote Jog Unit is available in Basic, LCD display, and wireless LCD display.
- A QWERTY keyboard with retractable drawer.
- Two Universal Serial Bus (USB) ports located on the right side of the console.
- Volume and brightness control buttons.
- Optional equipment include a shelf, auxiliary screen, and tool holder.

The operator console is attached to the machine enclosure either by an L-tube or T-tube that allows the console to pivot towards the front enclosure door opening. Some Hurco machine models have the console mounted on a pendant arm that also pivots toward the front enclosure door opening.

For dual-screen configurations, the right-hand screen displays graphic operations. Single-screen configurations require a key press to toggle the screen between text and graphic operations.

⇨ Refer to the on-screen Help for operating and programming information.

The touchscreen driver software has a built-in utility that the Service engineer uses to calibrate the touchscreen at machine installation. This procedure can be repeated by the operator as necessary.

## Jog Unit

Features include

- Emergency Stop button
- Store Position button
- Incremental Jog Handwheel
- x1, x10, and x100 Rapid Jog buttons
- Rapid +/- buttons
- Rapid Feedrate control knob
- Axis selector knob
- Enable pushbutton
- On/Off button for rear-mounted LED lamp and work light
- Start, Feed Hold, and Stop buttons
- Rear-mounted magnetic supports
- Optional LCD digital read-out display for Machine and Part position and mode selection
- LED charging indicator light on optional Wireless model

# Automatic Tool Changer (Machining Centers only)

Machining centers are equipped with a multi-station swing-arm random pocket Automatic Tool Changer (ATC) for multiple cutting operations to be completed in succession with different tools, without requiring machine operator intervention to change tools. Basic ATC components are electric motor driven ATC arm and transmission, magazine with tool pots, and an electric motor driven magazine. Some models may have a sliding mechanism for the ATC assembly or an ATC door to separate ATC components from the machining area.

All ATC operations require that the servo power is on, the machine is calibrated, and the ATC is at Home position. Diagnostics on the control allow for easy recovery of tool change issues.

⇨ Some models may also be equipped with an Automatic Rear Tool Loader.

# Spindle Chiller

The spindle chiller maintains spindle temperature by circulating liquid around the spindle cartridge. Chilling the spindle reduces thermal growth, which improves machining accuracy. If the chiller liquid level in the tank is not maintained at or above the low mark, the system pump could be damaged and spindle cooling impaired.

# Turret (Turning Centers only)

Turning centers are equipped with an indexable, multi-station turret for multiple cutting operations to be completed in succession without machine operator intervention to change tools. Turret rotation is controlled by hydraulics and valves. A turret assembly consists of a hydraulic turret, a tool station disk, hydraulic motor, and coolant nozzles.

# Rotary Axes (Machining Centers only)

Machining centers can come equipped with rotary or rotary/tilt as added options, while certain machining center models come equipped with rotary, tilt, swivel, or combinations of these axes. In all cases,

- the A-axis rotates about the X-axis
- the B-axis rotates about the Y-axis
- the C-axis rotates about the Z-axis

Rotary axes typically rotate 360 degrees. Tilt axes are typically mounted with a rotary axis and rotate less than 360 degrees. Swivel axes typically have the spindle head mounted to the swivel axis and also rotate less than 360 degrees.

# Dust Collector (Machining Centers only)

The optional dust collector vacuums graphite dust particles from the cutting area.

The dust collector motor turns on when servo power is established in either Manual or Auto Mode. When servo power is disabled, the dust collector motor remains on for 60 seconds before shutting off. In Auto Mode, dust collector can be switched off, but will return to On when program starts again. Dust collector can also be operated in Manual Mode.

# Tailstock (Turning Centers only)

Machines may be equipped with a tailstock assembly. The tailstock supports long pieces of stock while the spindle is turning and the part is being cut. The tailstock quill touches the loose end of the stock, on the right-hand side. The quill can be activated by footswitch or M function from control.

# Steady Rest (Turning Centers only)

Machines may be equipped with a Steady Rest device. This device is used with turning centers to hold long pieces of stock in the center while cutting. The Steady Rest device can be manually hitched to the Z-Axis to assist with movement of the Steady Rest to the proper location.

The position of the Steady Rest device is tracked in order to avoid colliding with the tailstock. A safety switch located on a bracket under the way cover also protects against the Steady Rest and Tailstock colliding. If the safety switch is tripped, the machine will enter the Emergency Stop mode.



Please refer to the Steady Rest manufacturer's Instruction Manual for complete details regarding installation and maintenance.

# OPERATION REQUIREMENTS

## Machine Installation

The customer is responsible for proper site preparation before the machine is installed. A certified Hurco Field Service Engineer must install the machine in the prepared location. This location must not subject the machine to uncontrolled cabinet temperatures or unfavorable work environment conditions that could cause component failure.

If the customer decides later to move the machine from its installed location, call Hurco for assistance.



Improper moving of the machine may result in personal injury or damage to the machine.

See the *Pre-Installation Manual for i-Series Machines* for detailed information about:

- Foundation Guidelines
- Electrical Service Requirements
- Compressed Air Requirements
- Lifting and Moving the Machine Guidelines
- Other materials and fluids to have available at installation Requirements

# Initial Test and Examination

Arrange for a Hurco-certified Service Engineer to perform the final machine setup.

A Certified Electrician needs to provide power to the machine prior to the service engineer's arrival.

The Hurco-certified Service Engineer performs these tasks:

1. Checks electrical service to the Main Disconnect switch on the machine.
2. Installs the control console.
3. Measures voltages in the electrical cabinet and the control enclosure.
4. Installs the flood coolant tank and coolant pump motor.
5. Installs covers and enclosures.
6. Completes the machine level and makes required adjustments.
7. Checks fans and pumps for proper operation
8. Certifies machine is operational.

If it becomes necessary to move your machine, follow the instructions below for performing the initial test and examination of the machine and its guarding system.

# Proper Operation

This section addresses the proper operation of the machine. The information presented here is not a substitute for operator training, skill, and good judgment. Hurco does not accept any liability for operator error.

## Training for Operators

Hurco or a Hurco-authorized distributor must train all machine operators. Hurco offers classes to demonstrate the programming capabilities of its CNC system. The training classes provide hands-on development of part programs.

Study this manual before attempting to operate the machine and become familiar with machine functions and safety features. Review all caution and warning messages, as well as all warning and instruction plates or decals on the machine.

## Enclosure Doors and Guarding

Sliding enclosure doors are located on the front of each machine and provide access to the work area for work setup and part removal. Sliding doors or doors with clasps have a locking mechanism that locks when the machine is in automatic operation mode.

Side enclosure doors may also be present to provide access for maintenance and cleanup. These doors must remain closed during machine operation.



Enclosure doors must be closed when machine is performing any movement or action that requires a button push to initiate, for example, the Start button or +/- jogging.

For machines sold in Europe, CE fencing surrounds the moving mechanism on boring mills only.

## Machining Preparation

During the arrangement of the tools and apparatus required for the performance of an operation, follow these precautions:

- Engage the Emergency Stop button when fixturing the workpiece. Never put your hands near a part being machined.
- Clamp the fixtures and workpiece securely before pressing the Start Cycle button to begin an automatic machine operation. Loose objects such as wrenches and chuck keys become flying projectiles if not removed before pressing the Start Cycle button to begin an automatic machine operation.
- Wear gloves or use a shop cloth when handling tooling.
- Inspect tools and tool holders frequently. Use tools that are properly sharpened and in good condition.
- Never start the machine when the cutter is in contact with the workpiece. Make sure the direction of spindle rotation is correct to prevent cutter breakage. Rotate the spindle clockwise for right-hand tools, and counterclockwise for left-hand tools.
- Keep the work area well-lighted. Adjust lamps so that light does not shine directly into the operator's eyes.
- Make certain all guards are in place before beginning operation.
- Know where all of the Emergency Stop pushbuttons are located.
- The operator should stay within reach of an Emergency Stop button when the machine is in motion.
- Be aware of all pinch points caused by the motion of the axes, table, head, and automatic tool changer or turret. Be aware of protruding machine parts.
- Keep the electrical cabinet doors closed while power is on. Before opening the electrical cabinet doors, verify that the main disconnect switch has been turned Off.

  ⚠ High voltages present in the machine electrical system can cause serious injury or death.

- Do not remove or bypass safety limit switches, interlocks, and other safeguards.
- Do not start the machine unless all systems contain the proper amount and type of lubricant.
- Make certain that all necessary guards and protective devices are in place before operating the machine.
- If unusual sounds, smoke, heat, or damaged parts occur, turn off the machine.
- Be sure that all Daily, Weekly, Monthly, Annually, etc. operation and maintenance checks have been completed prior to operating the machine.

# Working Practices

Follow the correct service and repair procedures to ensure proper operation of the machine, and to reduce the likelihood of serious operator injury.

Observe these basic precautions when working near a machine:

## Responsible Conduct

- Follow the instructions provided when performing a maintenance task.
- Keep all parts of your body away from moving parts.
- Be alert and keep safety in mind.
- Never attempt to operate or repair a machine if you have taken strong medication, used a prescription drug, or consumed an alcoholic beverage.
- Do not attempt to operate or repair a machine until you have read and understood all information that pertains to the machine, including all warning and instruction plates or decals mounted on the machine.
- Know how the machine functions, and understand its safety features.

## Personal Care

- Avoid frequent or prolonged skin contact with fresh or used cutting fluids and oils.
- If machining chemicals come in contact with your skin, wash the area immediately.
- Wash your hands thoroughly before eating.
- Change clothing that has become contaminated with machining fluids and oils.
- For complete information about handling industrial chemicals used in machining, refer to the international Control of Substances Hazardous to Health (COSHH) materials from the chemical suppliers.

## Wearing Apparel

- Wear eye protection and safety shoes while in the machining work area. Safety glasses with side shields are recommended. Safety shoes should be in good condition, with steel reinforced toes and oil-resistant soles.
- Remove clothing and jewelry that could get caught in machine moving parts. Do not wear loose-fitting clothing. Long shirt sleeves are not recommended.
- Keep long hair tied back so that vision is not obstructed and hair cannot become caught in moving parts.

## Heavy Lifting

- Do not attempt to lift more than you can safely handle. When lifting, keep your back straight and use your legs.
- Use a hoist for heavy lifting, making sure that the load is evenly balanced and is raised slowly.
- Do not raise a large load over aisles and make certain that the landing area is clear and level.

## Work Area

- Maintain a clean and orderly workspace around the machine. The floor must be free of spills and obstructions.
- Use only sturdy work platforms with anti-slip surfaces around the machine.
- Do not store tools, shop cloths, and miscellaneous parts on the machine.
- When removing chips or dust, make certain the spindle and cutter are completely stopped. Use a brush or chip scraper to remove chips—do not use compressed air to blow chips from the spindle, table, controls, cabinet or floor. Do not remove chips by hand, or while the spindle is turning. Dispose of chips and dust frequently.

# Machine Safety

The Hurco machine's safety circuit is designed to provide safe and reliable operation. Tamper-resistant fasteners are used to hold combination door lock/switches in place and to prevent access to internal wiring.

If the owner or operator modifies the hardware or software by removing, altering, disabling, or tampering with any safety circuit, safety switch, or other safety operation and operates the machine with those modifications, such operation is extremely hazardous and is a *foreseeable misuse* of the machine, and voids the Hurco warranty. In addition, it is in violation of federal or local regulations, directives, codes, or ordinances. If such modifications are discovered, the machine must be immediately shut off and not used. Contact a Hurco-certified Service Engineer for assistance in restoring the machine to safe operation.

Following are basic rules governing operation.

- The spindle cannot operate unless all enclosure doors are closed, excluding doors that are fastened shut with bolts or screws.
- For machines with CE enabled, limited manual operations are available in the CE Diagnostics screen.
- Enclosure doors must be closed and locked during automatic operations such as run program, warm-up cycle, calibration cycle, automatic tool changes, probing, or turret diagnostics functions or tool setter operation.
- In the event that an enclosure door is opened during automatic operation, an immediate command to stop all motion will be executed, changing modes from Auto to Interrupt.
- Redundancy is included in electrical design to detect single point failures (e.g., switch contact, relay coil).
- When the Emergency Stop button is pressed, power is removed from the spindle and axis drives, and the door locking mechanism is enabled.
- ATC electrical circuits will be isolated from source power when any door is open.

# Operation Requirements for Enclosure Doors

Hurco machine tools are equipped with door interlocks to ensure the enclosure doors do not open during machining operations. Door interlocks are functional only on CE or ANSI enabled machines. Periodically check the safety circuits, especially after changing components. Operating restrictions for manual and Auto mode are listed below.



Pressing the **Emergency Stop** button will lock the enclosure doors when doors are in closed position.

On CE or ANSI enabled machines, in Manual mode with doors open, some operations will require the Enable button to be pressed. The Enable button is located on the back of the Remote Jog Unit. In order to perform specific operations with the enclosure doors open, both the **Enable** button and the **Start Cycle** button must be pressed. The Enable button has three positions: fully up (off), middle (on), and fully down (off). The button must be held in the middle position to be enabled.

## Manual Mode Operations, Enclosure Doors Open

The following list of operations cannot be completed in Manual Mode if the enclosure doors are open. This list may not be comprehensive of all restrictions or options installed on the machine.



Turning centers may also require that the spindle door also be closed.

- Cannot park the machine or home the axes.
- Cannot warm up the machine.
- Cannot begin machine calibration cycle.
- Cannot start chip auger or conveyor.
- Cannot perform coolant functions except for washdown gun.
- Cannot perform ATC Diagnostics or Turret Diagnostics.
- Cannot begin an automatic tool change cycle or index turret.
- Cannot run a part program in Auto mode.
- Cannot run spindle in Manual mode.
- Cannot perform Tool Probing (if equipped).
- Cannot jog any axis.
- Can run spindle at reduced speed if Limited Manual Operations is set.
- Can jog an axis at reduced feedrate if Limited Manual Operations is set.
- Can index Turret if Limited Manual Operations is set (turning centers only).
- Cannot turn Control Power On (turning centers only).
- Cannot retract the Part Catcher, if equipped (turning centers only).
- Cannot run the Steady Rest Clamp/Unclamp, if equipped (turning centers only).
- Can activate Chuck (turning centers only).

- Can activate Tailstock (turning centers only).
- Can activate Auto Door option (turning centers only).

### Auto Mode Operations

- Doors must be closed to start a program and must remain closed while the program is running.
- Doors are unlocked when the program is complete.
- Doors may be open for Check for Errors or Estimated Run Time.
- Doors are unlocked at a Position Stop Block or M00/M01 command, but must be closed prior to pressing **Start Cycle** to resume the program.
- Doors are unlocked after the **Interrupt** console key is selected and after axis, spindle, and tool change operations are completed.
    - The doors must be closed prior to resuming the program.

## Persons Trapped in Machine

Closing the enclosure door with control power Off locks the door; therefore, it is possible for a person to be locked inside the enclosure.



Never perform maintenance inside the machine enclosure without someone else present. Do not close enclosure doors while performing maintenance inside the machine enclosure.

### Releasing a Person Trapped Inside the Machine Enclosure

To release a person trapped inside the machine enclosure, where the machine is functionally sound (i.e., the machine functions as intended), follow these steps:

1. Release the **Emergency Stop** button.
2. Press the **Manual** console key.
3. Press the **Power On** button.
4. Press the **Start** button. The enclosure doors will automatically unlock.

# Noise Levels

Noise level readings are taken in the vicinity of the console, 1.6 meters (60 in) from the floor, 1 meter (39 in) from the machine's enclosure.

⇨ The maximum noise levels are for reference only, and are not necessarily safe working levels. While there is a correlation between the emission and exposure levels, this cannot be used to determine whether further precautions are required. Factors that influence the actual level of exposure of the workforce include characteristics of the workroom, other sources of noise, the number of machines and other adjacent processes. Also the permissible exposure level can vary from country to country. This information, however, will enable the user of the machine to make a better evaluation of the hazard and risk.

# MACHINE MAINTENANCE

The maintenance schedule in this chapter is based on normal use (8 hours of operation per day). Your machine maintenance schedule may vary. Machines operated for longer periods each day or in warm or humid environments should be serviced more often..

⚠ Do not attempt to access the machine enclosure while machine power is on. Observe proper lock-out/tag-out procedures before performing any maintenance inside the machine enclosure.

⇨ Machine linear positioning accuracy was set at the factory, in an ambient temperature of 68° F (20° C). Continual operation at higher or lower temperatures may require that you re-compensate the linear positioning accuracy.

## Safety Procedures for Electrical Service

Before removing or working on any cables, fuses, breakers, or other electrical components, make sure that the main disconnect switch on the electrical cabinet door is in the off position. Whenever work will be performed in an area away from the main disconnect switch, post a warning at the switch informing others that the machine is being serviced and the power must remain off.

⚠ High voltages inside the electrical cabinet can cause serious injury or death. Only qualified personnel may service the machine, and must follow all safety rules and precautions. The line-side of the main disconnect switch is hot, unless the AC source is disconnected.

⚠ Service procedures requiring electrical work while equipment is energized shall only be performed by qualified service personnel. Service personnel performing troubleshooting or adjustment procedures to electrical equipment in the control cabinet or other electrical enclosures with doors open or protective covers removed while machine power is energized, shall observe applicable safety practices, such as those outlined in NFPA 70E and Occupational Safety and Health Administration (OSHA) 29 CFR part 1910.331-335.

# Daily Operational Checks

❒ Daily: Perform operational checks.

The operator should check the following items each day:

- Clean the machine.
- Check that all shields, covers, and doors operate properly.
- Check the motorized spindle (if equipped) for leakage.
- Check the spindle chiller to be sure there is enough liquid in the tank or system.
- Check the working environment around the spindle chiller for appropriate ventilation and ambient temperature between 40° and 10° C (104° and 50° F).
- Check the chip removal system to ensure proper movement and equipment is free of extraneous items, such as tools or swarf.
- Jog each axis through its full travel, watching for smooth operation.J
- Ensure that all axis limit switches are functioning correctly and are calibrated to their proper travel limits..
- Inspect the way covers for scratches or excessive wear.
- Inspect the enclosure windows for scratches, damage, cracks, or other deformities that could adversely affect the impact resistance. Please refer to *Enclosure Windows, on page 4 - 5*.
- Check that the way wipers are not damaged.
- Touch the guideways to check for proper lubrication. All axis guideways should have a thin film of lubricant.
- Check the oil level on the inside cover of the tool changer (if equipped), or on the right side of the swing arm unit, depending on your model.
- Check and clean the tool lock pins (if equipped).
- Check the hydraulic fluid level (if equipped) and verify pressure is set at 40 - 50 bar.
- Check the coolant level every day at the start of operation. If the machine is used more than 8 hours daily, check the coolant level every 8 hours.
- Turn power off and rotate the spindle by hand. It should rotate easily.
- Check that all console control buttons and keys light when pressed, and that all buttons and keys activate the intended functions.
- Clean the chip screens.
- Clean chips from way covers, enclosure, ATC, turret, and chip conveyor(s).
- Check the FRL unit or FR unit (depending on the type of machine) air pressure.
- Check the way lube level in pump.
- Clean the rotary table (if equipped) and check the rotary table oil level.

- Lubricate the spindle taper (if equipped), and clean it with a lint-free cloth dipped in clean, light oil.
- If the motorized spindle (if equipped) is disabled for more than 30 minutes, perform Spindle Pre-Lube and Warm-up cycles. Please refer to *Motorized Spindle Pre-lube and Warm-up, on page 4 - 18*.
- Run the spindle at various speeds, including the minimum and maximum RPM, while observing for proper start, stop, and spindle operation.

  ⚠ If the spindle is idle for more than thirty (30) days, please refer to the *Spindle Run-in or Cycle Procedure, on page 4 - 22*.

- Program a loop and tap at 800 RPM. The spindle rotation should not exhibit abnormal noise or vibration, and speed changes should be smooth.

  ⚠ If a machine has been idle for eight hours, it should be warmed up before cutting parts. Please refer to *Spindle Warm-up Cycles, on page 4 - 18* for details about the warm-up procedure.

- For VM10HSi machines configured with the dust catcher option, monitor the dust catcher panel to view differential pressure setting. Replace filters if pressure is close to the Alarm setting. Alternatively, listen for the air blast from the nozzles. If they are firing continuously, the filters may need replacing.

# Cleaning the Machine

Follow these recommendations when cleaning the machine:

- Machined and unpainted surfaces should be wiped clean with a lint-free cloth dipped in a clean, light machine oil.
- Exterior painted surfaces should be cleaned with a soft cloth dampened with water and a mild detergent.
- The control console exterior should be cleaned with a soft cloth moistened (not wet) with water and a mild detergent.
- The console screens should be wiped with a damp, soft, lint-free cloth.
- The machine enclosure should be thoroughly cleaned annually, or as needed.

# Lubrication

❒ Daily: Check and maintain all lubricant levels.

Keep the machine in good operating condition. Lubrication points and recommended lubricants for machines appear in the respective sections. Lubricants that meet the same specifications as those listed may be substituted. Local suppliers should be able to cross-reference recommended lubricants. Viscosity ranges are based on ambient temperatures.

# General Maintenance

## T-Slots

Exceeding the T-slot torque on table specification listed below could result in deformation of the table or damage the T-slot.

| T-Slot Size | T-Slot Torque on Table |
|---|---|
| 10 mm | 25 Nm |
| 18 mm | 89 Nm |
| 22 mm | 418 Nm |

| T-Slot Size | T-Slot Torque on Table |
|---|---|
| 0.39 in | 19 ft-lb |
| 0.71 in | 66 ft-lb |
| 0.87 in | 307 ft lb |

## Machine Warm-up

❒ Daily: Warm up a machine that has been idle for eight hours before cutting parts.

The warm-up cycle moves the axes at a set feedrate while running the spindle through increasing speed ranges to cause lubricants to work with all moving parts and to establish a stable temperature environment for critical moving components.

Control power must be on and the axes must be calibrated before a machine is warmed up. Hurco machines have an automatic cycle that runs the axes and spindle through warm up. See WinMax Help for instructions on how to start the automatic warm-up cycle. During warm up the spindle speed is incrementally increased and maintained for a specified time until the maximum RPM is reached. Software parameters control the duration at each speed increment as well as the spindle speed increments and the axial feedrate.

## Check and Clean the Tools

❒ Daily or before operation: Check the condition of tools to ensure they are clean and free of damage.

Check the condition of the tools and clean them with a lint-free cloth dipped in clean light machine oil.

## Enclosure Windows

❒ Daily: Inspect the enclosure windows for scratches, damage, cracks, or other deformities that could adversely affect the impact resistance.

❒ Every three years or less: Replace polycarbonate windows in enclosure doors.

Enclosure windows are made from polycarbonate that is impact resistant to ejected parts or materials during machining. The impact resistance of polycarbonate is reduced by as much as 10% each year due to exposure to metal working fluids, lubricants, and UV light. Replacement of the polycarbonate windows is recommended every three years or less, dependent upon machine usage and amount of fluids in contact with the window, in order to maintain the impact resistance.

Some polycarbonate panels may be labeled with manufacture date or installation date to provide basis for determining frequency of window replacement.

## Chuck

❒ Daily: Grease the chuck (lathes only)

The chuck is located inside the enclosure on the left side of the turning center. There are three lubrication points on the chuck for applying grease. Fill each of the 3 plug points with Moly Kote EP grease using a grease gun.

## USB Port

❒ Daily: Check the USB port. Keep dirt, dust, coolant, and oils away from opening.

USB ports are located on the right-hand side of Max and dual-screen consoles. In addition, there are two USB ports on the electrical cabinet communications panel located on the on the rear of the machine. Each port should be checked for debris daily.

## Check and Clean Tool Holders

❒ Weekly: Check each tool holder for damage (mills only).

1. Clean tools and tool flanges with a lint-free cloth dipped in light machine oil.
2. Check each tool holder for damage. Clean tool holders with a lightly oiled, lint-free cloth.
3. Inspect tools and tool flanges for damage.
4. Clean tools and tool flanges with a lint-free cloth dipped in light machine oil before replacing them in the magazine tool holders.

### Tool Holder Balance

To ensure that the spindle operates correctly, the tool holder must be properly balanced. These specifications indicate the proper balance for two ranges of spindle RPM. Refer to the Spindle section of the Model-specific Specifications document for the type of tool holder for your machine.

| Required Tool Holder Balance |
| --- |
| <G6.3 @ <= 12000 RPM $min^{1}$ |
| <G2.5 @ >12000 RPM $min^{1}$ |

## Heat Exchanger

❒ Weekly: Clean the filter inside the heat exchanger (if equipped).

The heat exchanger removes heat from the control cabinet. Follow these steps to remove dust:

1. Locate the heat exchanger either on top of the power cabinet or on the power cabinet door.
2. Lift the filter from the heat exchanger in order to remove the filter.
3. Rinse the filter with clean water and dry it.
4. Reinstall the filter inside the heat exchanger.

OR

1. Remove the filter from its mount on the outside of the electrical cabinet door (at the rear of the machine).
2. Rinse the filters with clean water and dry.
3. Reinstall the filter into its mount on the outside of the electrical cabinet door.

## Grease Tool Holders

❒ Monthly: Apply grease to tool holders (mills only).

Using a brush, apply NGLI 1 grease to tool holders once a month.

## Limit Switches and Dogs

❒ Monthly or 150-200 hours of operation: Inspect limit switches and dog fasteners for damage.

Limit switches and dogs are mounted on each axis and are used to determine end-of-travel and to establish reference points for initial machine zero settings.

Follow these steps to inspect the limit switches and dogs for cleanliness, loose connections, or damage. If necessary, use an Allen wrench to tighten the limit switches and dogs.

1. Refer to the *Mechanical and Electrical Manual* for your machine for limit switch and dog locations.

   ⇨ Before removing any covers, clean excess coolant, chips, and debris from surfaces.

2. If necessary, remove covers to access limit switch and dog. Some limit switches may be in base casting and not accessible.
3. Check tightness of limit switch fasteners. Refer to the Machine-specific Specifications document for the Torque specification.
4. Check tightness of limit switch dog fasteners. Refer to the Machine-specific

Specifications document for the Torque specification.

## Exterior Wiring

❒ Monthly: Inspect conduit, connectors, cabling, and wiring external to the machine for evidence of fraying, cracking, and looseness.

## Machine Electrical Ground

❒ Every 3 Months: Measure the ground impedance (resistance to true earth).



Only a licensed electrician should perform this procedure.

The ground for the machine is located inside the control cabinet, near the disconnect switch.

## Machine Level

❒ Every 6 Months or every 1000 hours: Verify the machine is sitting level.

After the service engineer has leveled the machine, it is the customer's responsibility to check and maintain this level (using the initial leveling specifications obtained at installation). Check machine level each month for the first six months after installation, and then once every six months.

Place a calibrated precision level (resolution 0.020 mm/m or 0.0005 in/ft.) parallel to X then Y on the work table surface. For turning centers, place the level on the leveling plate that bolts onto the turret.

1. Place the level at the center of the table, oriented in the X-Axis direction.
2. Move the table to nine positions equally spaced within the travel limits of the X and Y axes. There will be 3 X-axis positions and 3 Y-axis positions to be measured at each of the X-axis positions.
3. Record values at each position.
4. Place the level at the center of the table, oriented in the Y-axis direction.
5. Move the table to nine positions equally spaced within the travel limits of the X and Y axes. There will be 3 X-axis positions and 3 Y-axis positions to be measured at each of the X-axis positions.
6. Record values at each position.

For 3-axis machines, no value should exceed 0.020 mm (0.0005 in/ft). If this value is exceeded, contact Hurco Service.

## Outriggers

❒ Every 6 Months or after 1000 hours of operation: Grease the outriggers (mills only).

Outriggers support the table at either end of its travel. Apply NLGI 2 grease into Zerk fittings located beneath the X-axis way covers.

To grease the outriggers:

1. Remove the right and left outrigger telescoping way covers on the front of the saddle (one on each side) to expose the way surface.
2. Apply the recommended grease into each of the Zerk fittings.
3. Run the Y-axis through its full travel, twice.

Run the table to the rear and inspect the outrigger way surface for signs of scratches or wear. The surface must be coated with a film of grease.

# Autolube System

❒ Daily: Check and maintain autolube lubricant levels.

Hurco machines use one autolube system for lubricating the slideways, guideways, and ballscrews, another autolube system for lubricating the electro-spindle, motorized spindle, or steady rest (if equipped).

## Slideways, Guideways, and Ballscrews Autolube System

The autolube system automatically lubricates the slideways, guideways, and ballscrews. The preset discharge rate is 3.0 cubic centimeters (cc) per pump cycle for most machines. The way lube pressure should be set at 2.9 bar or 42 psi.

Fill the Autolube reservoir between the high and low marks with ISO VG68 Way Oil.

The autolube system operates with a digital timer autolube system in one of two ways.

- When servos are On and adequate pressure is attained, the system cycles on for 30 seconds to send lube oil through the machine, then cycles off for 15 minutes.
- The factory-set Machine Parameters run the lube cycle every 9 minutes.

The autolube system is located on the back of the machine. If necessary, open the machine's rear access door to access the autolube system.

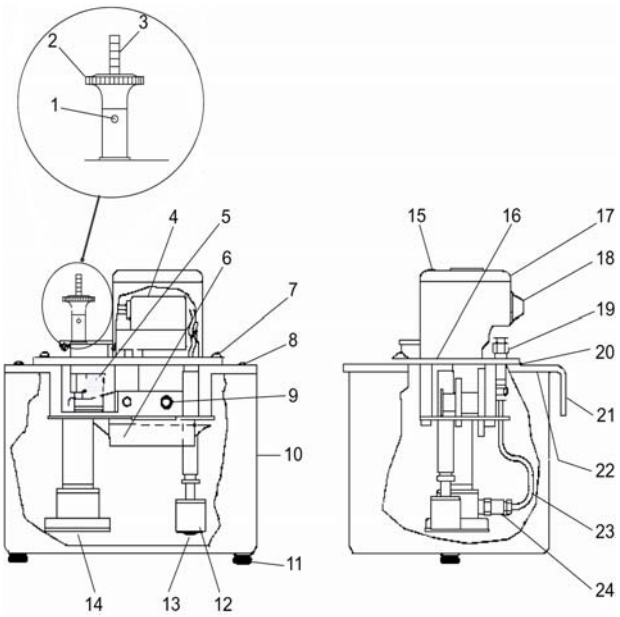
⇨ Excess Servo On time without table or head movement may cause oil to accumulate on the table and guideways. To eliminate excess lubrication, the Power Off Timer is set to automatically shut off power to a machine that has been idle for a specified time.

⚠ ❒ Monthly: Add a rust preventative to the autolube system if the machine will be idle for 30 days or more.

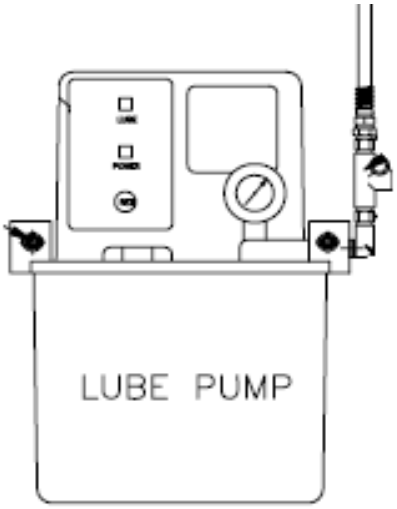
Initiate a manual lube cycle and move all axes through full travel several times to allow delivery of the rust preventative throughout the system.

⇨ If the level of way lube becomes low, a message will appear on the screen.

Here are these two types of autolube systems:




**Cycles on 15 seconds / off 30 minutes**




**Cycles every 9 minutes**

| | | | | | |
|---|---|---|---|---|---|
| **1** | Set screw | **9** | Retaining ring | **17** | Motor cover |
| **2** | Discharge plunger | **10** | Reservoir | **18** | Grommet |
| **3** | Indicator rod | **11** | Screw | **19** | “Thru” coupling |
| **4** | Electric motor | **12** | Float switch assembly | **20** | Reservoir gasket |
| **5** | Filter screen | **13** | O-ring | **21** | Mounting bracket, reservoir |
| **6** | Reservoir worm and gear lube | **14** | Suction filter group | **22** | Reservoir gasket |
| **7** | Screw, cover mounting | **15** | Screw, cover mounting | **23** | Outlet tube assembly |
| **8** | Screw, reservoir mounting | **16** | Gasket, motor cover | **24** | Outlet check valve assembly |

***Figure 4–1. Two types of Slideways, Guideways, and Ballscrews Autolube systems***

## Maintain Autolube Filler Filter Screen / Autolube Fluid Level

❒ Monthly: Maintain the autolube fluid level and check the filler filter screen.

The filter screen inside the oil filler section of the tank prevents contamination from entering the system. The filter screen must be checked and replaced if it becomes plugged. The autolube oil must be replaced monthly.

1. Lift the oil filler cap and check the filter screen. If the screen is dirty or clogged, clean and dry the screen before reinstalling it.
2. The oil level should be between the high and low marks (about 1/2 inch or 1.25 cm from top cover of tank). If needed, add oil to the tank.
3. Replace the oil filler cap.

Depending on the type of Autolube System equipped on your machine, follow the appropriate steps below:

1. Push the feed button on the Autolube System, then release it.
2. Repeat this action several times.

Or:

1. Press the F (Feed) key on the Autolube system. The RUN light will illuminate.
2. Press the F (Feed) key on the Autolube system until the ACT light is illuminated and blinking.
3. Press the F (Feed) key on the Autolube system a third time. The INT light will illuminate.
4. Press the F (Feed) key on the Autolube system a fourth time to initiate the lubrication cycle.

## Activate Autolube System Manually

❒ Monthly: Manually activate the autolube system if the machine has been idle for a long time before powering up, or if the oil has just been replaced.

Follow these steps for machining centers:

1. Pull upward on the discharge plunger then release it.
2. Stroke the plunger in this manner three to six times.

Follow these steps for turning centers:

1. Press the **Manual** console key to access the Manual screen.
2. Select the DIAGNOSTICS softkey.
3. Select the LUBE softkey. The Lube Diagnostics screen appears.
4. Select the MANUAL LUBE softkey to start the pump. At this point, you may step to the side of the machine and observe the site gauge on the Autolube Pump.

## Adjust Autolube Discharge Rate

An indicator rod is located in the autolube system discharge chamber. The scale graduations on the flat surface of the rod indicate the discharge rate in cubic centimeters (cc) per pump cycle.

Depending on the type of Autolube System equipped on your machine, follow the appropriate steps below to adjust the Autolube system discharge rate:

1. Loosen (but do not remove) the set screw in the center of the discharge plunger body.
2. Turn the plunger body clockwise to increase, or counterclockwise to decrease, the pump discharge rate.
3. Once the required discharge rate is obtained, align the set screw with the flat surface on the rod.
4. Tighten the set screw to secure the rod position.

Or:

1. Press the F (Feed) key on the Autolube system two times until the ACT light illuminates and blinks.
2. Press the + or - on the Autolube system to increase or decrease the length of time that oil will flow to the machine.
3. Press the F (Feed) key on the Autolube system a third time. The INT light will illuminate.
4. Press the + or - key on the Autolube system to increase or decrease the dwell time between lubrication cycles.

## Clean Autolube Tank and Suction Pump Filter

❒ Annually or at about every 2000 hours of use: Clean the autolube reservoir tank and suction filter.

The suction pump filter is 250 microns (60 mesh).

1. Shut off power to the machine.
2. Loosen and remove the two thumbscrews that secure the reservoir to its mounting bracket.
3. Lower the reservoir downward from the threaded spacers.
4. Remove the suction filter group by first carefully prying out the retaining ring.
5. Noting the order of assembly, remove the suction filter discs and screws.
6. Insert the new coarse screen (filter disc support), fine screen (filter disc, screen disc), filter clamp ring, and retaining ring.
7. Clean any contaminates from the inside of the tank. Dry the inside of the tank with a clean, lint-free cloth.
8. Check the filter screen in the oil filler. It should be clean and undamaged.
9. Make certain the gasket is installed and in good condition.
10. Place the tank on its mounting bracket, guiding it over the threaded spacers.
11. Carefully tighten the two thumb screws that secure the tank to its mounting bracket.

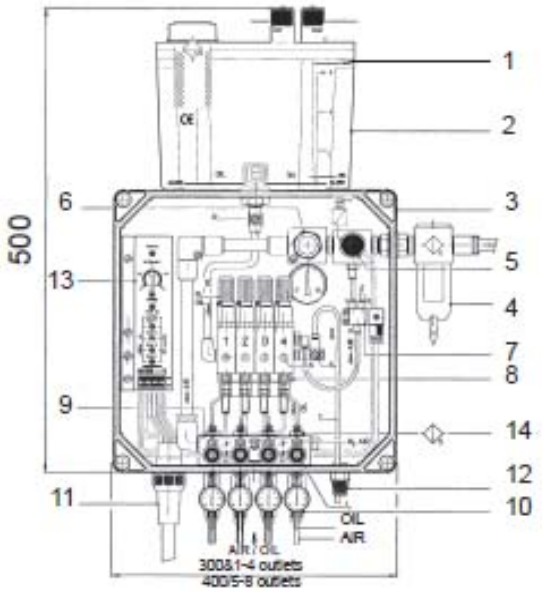
    ⚠ Over-tightening these thumbscrews can damage the tank.

12. Make certain the filter screen is installed in the oil filler.
13. Fill the reservoir with the recommended oil.
14. Manually activate the system.

# Electro-spindle Autolube System

❒ Daily: Check and maintain electro-spindle air-oil lubricant levels (mills only, if equipped).

The air-oil lubrication system lubricates the 18000 RPM electro-spindle. The micro-lubrication system lubricates bearings that rotate at a high speed. A distributor injects a small quantity of lubricant in the air flow that is broken into micro parts upon contact with the bearings. Fill the Air/Oil Unit with ISO VG68 oil (CLP) with EP-additives.




1. Switch lever
2. Tank
3. Box IP65
4. Air Filter
5. Pressure Switch
6. Flow Adjustment
7. Solenoid
8. Micropump
9. Mixing unit
10. Distribution pipe
11. Electrical wiring
12. Verification System
13. PLC
14. Oil Filter Supply

***Figure 4–2. Electro-spindle Air-Oil Lubrication Tank Assembly***

The electro-spindle air-oil lubricator has these specifications:

- Pump flow rate: variable from 3 to 24 $mm^3$
- Air filter: automatic discharge and 5 micron filtration
- Maximum flow: 0.77 liters/min
- Pressure gauge: electrical signal calibrated at 5 bar on inlet
- Minimum pressure gauge: adjustable from 0.3 to 5 bar
- Oil filter: 5 micron filtration
- Oil type: ISO VG68 (CLP) with EP-additives.

⚠ **Never**, under any circumstances, use the following:

- MoS2 additives
- oil mixtures
- way lubricating oil

# Motorized Spindle Autolube System

❒ Daily: Check and maintain motorized spindle air-oil lubricant levels (mills only, if equipped).

The air-oil lubrication system lubricates the motorized spindle.

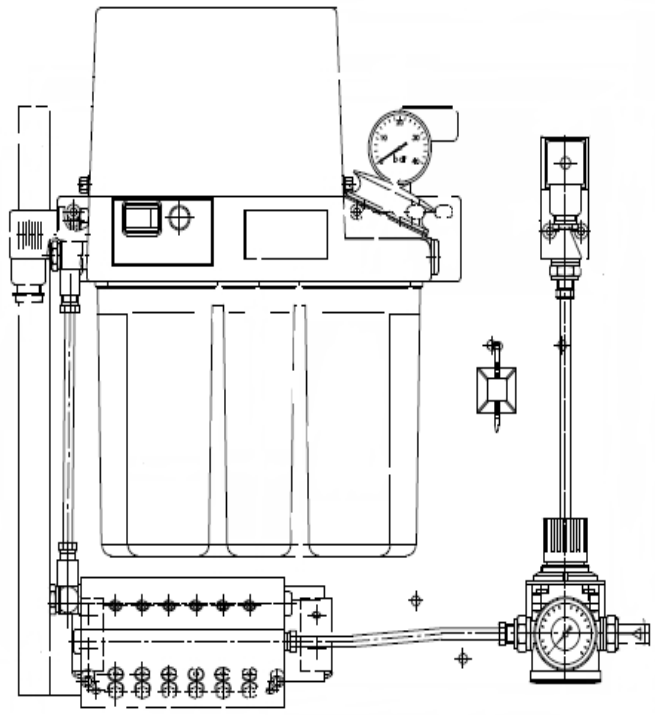


***Figure 4–3. Motorized Spindle Air-Oil Lubrication Tank Assembly***

The motorized spindle air-oil lubricator air pressure is adjusted to 3 bar, and the output flow rate is 0.24 liter/min.

Oil purity on bearings is according to ISO 4406, Code 13/10. Code designations are

- 13: between 40-80 particles $\geq$ 4 microns/ml of fluid.
- 10: between 5-10 particles $\geq$ 6 microns/ml of fluid.

Recommended oil lubricant type is Hydraulic Oil - ISO VG68 (CLP) with EP-additives.

⚠ **Never**, under any circumstances, use the following:

- MoS2 additives
- oil mixtures
- way lubricating oil

# Spindle

⇨ Do not use compressed air to clean the spindle. Dirt blown into the spindle will irreparably damage the motorized spindle bearings.

❒ Daily: Lubricate the non-motorized spindle taper (mills only).
Wipe clean with a lint-free cloth dipped in clean, light oil. If the machine will be idle, wrap the spindle taper in a cloth soaked with clean Autolube oil.

❒ Daily: Check the spindle for leakage.

❒ Weekly: Check and fill oil level of unclamp cylinder cup (mills only).
Use ISO VG32 oil and maintain at 1/3 full, not to exceed 1/2 full.

❒ Weekly: Check the Tool Clamping System pull force with a pull measurement system (mills only).

❒ Weekly: Check the Tool Clamping System collet chuck for damage, dirt, and adequate lubrication. Replace O-rings if damaged (lathes only).

❒ Monthly: Check the Tool Clamping System alignment dimension in release position with the clamping unit under pressure in the unclamp position (mills only).

❒ Monthly: Check the Tool Clamping System operating sequence by performing a clamping and releasing operation with a tool (mills only).

❒ Every 3 Months: Replace the Tool Clamping System O-ring (mills only).

⚠ Failure to meet spindle warm-up, spindle run-in, or tool holder balance requirements may affect machine warranty, and may cause premature spindle failure, excessive spindle vibration, surface finish irregularities, and other performance problems.

## Spindle Warm-up Cycles

The tables below show the recommended spindle speed and machine run time intervals necessary for spindle warm-up.

| 6000 Max RPM | | 6500 and 8000 Max RPM | | 10000 Max RPM | | 15000 Max RPM | |
|---|---|---|---|---|---|---|---|
| Speed (RPM) | Run Time | Speed (RPM) | Run Time | Speed (RPM) | Run Time | Speed (RPM) | Run Time |
| 1. 1500 | 2 min | 1. 1000 | 2 min | 1. 1000 | 2 min | 1. 1000 | 2 min |
| 2. 3000 | 2 min | 2. 3000 | 2 min | 2. 3000 | 2 min | 2. 3000 | 2 min |
| 3. 4500 | 2 min | 3. 5000 | 2 min | 3. 5000 | 2 min | 3. 5000 | 2 min |
| 4. 6000 | 2 min | 4. 7000 | 2 min | 4. 6000 | 2 min | 4. 7000 | 2 min |
| | | 5. 8000 | 2 min | 5. 7000 | 2 min | 5. 9000 | 2 min |
| | | | | 6. 9000 | 2 min | 6. 11000 | 2 min |
| | | | | 7. 10000 | 2 min | 7. 13000 | 2 min |
| | | | | | | 8. 15000 | 2 min |

| 12000 Max RPM | | 18000 Max RPM | | 20000 Max RPM | | 30000 Max RPM | |
|---|---|---|---|---|---|---|---|
| Speed (RPM) | Run Time | Speed (RPM) | Run Time | Speed (RPM) | Run Time | Speed (RPM) | Run Time |
| 1. 1000 | 2 min | 1. 1000 | 2 min | 1. 5000 | 5 min | 1. 5000 | 5 min |
| 2. 3000 | 2 min | 2. 3000 | 2 min | 2. 10000 | 5 min | 2. 10000 | 5 min |
| 3. 5000 | 2 min | 3. 5000 | 2 min | 3. 15000 | 5 min | 3. 15000 | 5 min |
| 4. 6000 | 2 min | 4. 7000 | 2 min | 4. 20000 | 5 min | 4. 20000 | 5 min |
| 5. 7000 | 2 min | 5. 9000 | 2 min | | | 5. 25000 | 5 min |
| 6. 9000 | 2 min | 6. 11000 | 2 min | | | 6. 30000 | 5 min |
| 7. 11000 | 2 min | 7. 13000 | 2 min | | | | |
| 8. 12000 | 2 min | 8. 15000 | 2 min | | | | |
| | | 9. 18000 | 2 min | | | | |

## Motorized Spindle Pre-lube and Warm-up

❒ Daily: Perform Pre-lube and Warm-up Spindle cycles for the High Speed (18000 RPM) Motorized Spindle or the High Speed (18000 RPM) Electro-spindle (mills only, if equipped).

Please refer to the Model-specific Specifications document for information about the spindle.

When the spindle is stopped (0 RPM), the spindle pump and air continue to cycle for an additional 30 minutes. If the spindle is turned on and off during this 30 minutes, the timer does not reset unless the spindle is off for 20 seconds. The pre-lube cycle requirement begins following this 30 minutes..

Adding the 30 minute cycle that occurs after the spindle is off, a pre-lube cycle is needed for a motorized spindle if the spindle is off for 30 additional minutes or more; an electro-spindle requires a pre-lube cycle if the spindle is off for an additional hour or more. Both spindle types require a warm-up cycle if the spindle is off for an additional 30 minutes or more.

From the operator's perspective, the spindle pre-lube and warm-up cycle is required after the motorized spindle is off for 60 minutes and after 90 minutes for the electro-spindle.

The type of spindle pre-lube and spindle warm-up cycle required changes as the amount of time the spindle is off (spindle-off time) increases.

These tables describe the different cycles based on spindle-off time:

- *High Speed 6000, 10000, or 18000 RPM Motorized Spindle , on page 4 - 20*.
- *High Speed 18000 RPM Electro-spindle, on page 4 - 21*.

The spindle needs to be run for more than 20 seconds to reset the timer for the pre-lube and warm-up cycles. If spindle pre-lube and spindle warm-up cycles are required, the following limitations are in place:

- Spindle cannot be enabled in manual mode.
- The Machine Warm-up cycle cannot be started.
- Cannot run a program in Auto mode.
- Cannot select Auto mode from an Interrupt mode condition if the Spindle has been off for more than 30 minutes.

A message appears on the screen when a pre-lube or warm-up cycle is required.

## Motorized Spindle Pre-Lube and Spindle Warm-up Cycles

To initiate a Spindle Pre-Lube and Spindle Warm-up cycle:

1. Turn On Control Power.
2. Select the **Manual** mode console key.
3. Insert a tool in the spindle (the Tool in Spindle must not be 0).
4. Select the **Diagnostics** softkey.
5. Select the **Machine Diagnostics** softkey.
6. Select the **Pre-Lube & Warm-Up Cycle** softkey. The **Start Cycle** button flashes.
7. Press the **Start Cycle** button.
   - An in-process message appears on the screen until both cycles are done.
   - When both cycles have been completed, the message is cleared and the limitations listed above are removed.

   ⇨ All CE requirements for enclosure doors must be satisfied to begin the cycles and until the cycles are completed.

   ⇨ If either cycle is interrupted, then both cycles will need to be restarted.

## High Speed 6000, 10000, or 18000 RPM Motorized Spindle

The following table lists the total time required to complete the Motorized Spindle Pre-Lube and Spindle Warm-up cycles in which the spindle limitations are in effect..

| Spindle Off Time | Spindle Pre-lube | Spindle Warm-up | Total Time (min:sec) |
|---|---|---|---|
| 0 to 60 min | Not required | Not required | 0:00 |
| 60 min to 48 hours | Duration of cycle = 1 min:<br>• Pump on for 10 sec<br>• Pump off for 10 sec | Spindle on at 500 RPM for 30 sec<br>Spindle on at 1500 RPM for 30 sec<br>Spindle on at 3000 RPM for 30 sec<br>Spindle on at 50% for 1 min<br>Spindle off for 1 min<br>Spindle on at 75% for 1 min | 5:30 |
| 2 days to 7 days | Duration of cycle = 1 min:<br>• Pump on for 10 sec<br>• Pump off for 10 sec | Spindle on at 500 RPM for 30 sec<br>Spindle on at 1500 RPM for 30 sec<br>Spindle on at 3000 RPM for 30 sec<br>Repeat 5 times:<br>• Spindle on at 25% for 1 min<br>• Spindle off for 1 min<br>Repeat 5 times:<br>• Spindle on at 50% for 1 min<br>• Spindle off for 1 min<br>Repeat 5 times:<br>• Spindle on at 75% for 1 min<br>• Spindle off for 1 min | 32:30 |
| More than 7 days | Duration of cycle = 5 min:<br>• Pump on for 10 sec<br>• Pump off for 50 sec | Spindle on at 500 RPM for 30 sec<br>Spindle on at 1500 RPM for 30 sec<br>Spindle on at 3000 RPM for 30 sec<br>Repeat 5 times:<br>• Spindle on at 25% for 30 sec<br>• Spindle off for 2 min<br>Repeat 5 times:<br>• Spindle on at 50% for 30 sec<br>• Spindle off for 2 min<br>Repeat 5 times:<br>• Spindle on at 75% for 30 sec<br>• Spindle off for 2 min<br>Repeat 5 times:<br>• Spindle on at 100% for 30 sec<br>• Spindle off for 2 min | 56:30 |

## High Speed 18000 RPM Electro-spindle

The following table lists the total time required to complete the VMX42HSRTi 18000 RPM Electro-spindle Pre-Lube and Spindle Warm-up cycles in which the spindle limitations are in effect.

| Spindle Off Time | Spindle Pre-lube | Spindle Warm-up | Total Time (min:sec) |
|---|---|---|---|
| 0 to 30 min | Not required | Not required | 0:00 |
| 30 min to 90 min | Not required | Spindle on at 7200 RPM<br>(40% Max Spindle Speed) for 1 min<br><br>Spindle on at 12600 RPM<br>(70% Max Spindle Speed) for 1 min<br><br>Spindle on at 18000 RPM<br>(100% Max Spindle Speed) for 1 min | 3:00 |
| 1 hour to 16 hours | Pump on for 5 min | Spindle on at 3600 RPM<br>(20% Max Spindle Speed) for 1 min<br><br>Spindle on at 5400 RPM<br>(30% Max Spindle Speed) for 1 min<br><br>Spindle on at 7200 RPM<br>(40% Max Spindle Speed) for 1 min<br><br>Spindle on at 12600 RPM<br>(70% Max Spindle Speed) for 1 min<br><br>Spindle on at 18000 RPM<br>(100% Max Spindle Speed) for 1 min | 10:00 |
| More than 16 hours | Pump on for 5 min | Spindle on at 900 RPM<br>(5% Max Spindle Speed) for 1 min<br><br>Spindle on at 2700 RPM<br>(15% Max Spindle Speed) for 1 min<br><br>Spindle on at 5400 RPM<br>(30% Max Spindle Speed) for 1 min<br><br>Spindle on at 7200 RPM<br>(40% Max Spindle Speed) for 1 min<br><br>Spindle on at 9000 RPM<br>(50% Max Spindle Speed) for 1 min<br><br>Spindle on at 12600 RPM<br>(70% Max Spindle Speed) for 1 min<br><br>Spindle on at 18000 RPM<br>(100% Max Spindle Speed) for 1 min | 12:00 |

# Spindle Run-in or Cycle Procedure

❒ Monthly: Perform a spindle run-in before operating the machine if the spindle has been idle for more than 30 days or if the spindle has never been used.

1. Referring to the appropriate Max RPM Spindle table that follows, run the spindle for the indicated time, at the recommended speeds, depending on your maximum spindle speed. Proceed in the order listed in the table.
2. Monitor the temperature at either the front or upper bearing and either the rear or lower bearing (depending on the type of machine), both of which should not exceed 55ºC (130ºF) once the maximum RPM is achieved.

   ⚠ SRi, SWi, and SRTi electro-spindles that have been idle for 3 months or more should not exceed 50ºC (122ºF).

   Please refer to *SR, SW, or SRT i-Series Electro-spindle Run-in Cycle, on page 4 - 26* for details.
3. If spindle flange temperature does not exceed 55ºC (130ºF) at any time during the spindle run-in procedure, then the warm-up procedure is complete.
4. If spindle flange temperature exceeds 55ºC (130ºF) at any time during the spindle warm-up, then stop the spindle immediately. Allow the spindle to cool to room temperature.
5. Restart the warm-up procedure at the last speed used prior to the temperature spike.
6. Repeat steps 1-3 above until the spindle runs at each specified RPM for the time specified, below 55ºC (130ºF).

| Spindle Speed<br>1600 RPM | Spindle Run Time |
|---|---|
| 1. 200 RPM | 2 min |
| 2. 400 RPM | 2 min |
| 3. 600 RPM | 2 min |
| 4. 800 RPM | 2 min |
| 5. 900 RPM | 5 min |
| 6. 1000 RPM | 10 min |
| 7. 1100 RPM | 16 min |
| 8. 1200 RPM | 20 min |
| 9. 1400 RPM | 30 min |
| 10. 1600 RPM | 60 min |

| Spindle Speed 2800 RPM | Spindle Run Time |
|---|---|
| 1. 300 RPM | 4 min |
| 2. 500 RPM | 5 min |
| 3. 1000 RPM | 10 min |
| 4. 1500 RPM | 16 min |
| 5. 2000 RPM | 20 min |
| 6. 2500 RPM | 30 min |
| 7. 2800 RPM | 60 min |

| Spindle Speed 3000 RPM | Spindle Run Time |
|---|---|
| 1. 300 RPM | 8 min |
| 2. 500 RPM | 5 min |
| 3. 1000 RPM | 10 min |
| 4. 1500 RPM | 16 min |
| 5. 2000 RPM | 20 min |
| 6. 2500 RPM | 30 min |
| 7. 3000 RPM | 60 min |

| Spindle Speed 3500 RPM | Spindle Run Time |
|---|---|
| 1. 300 RPM | 8 min |
| 2. 500 RPM | 5 min |
| 3. 1000 RPM | 10 min |
| 4. 1500 RPM | 16 min |
| 5. 2000 RPM | 20 min |
| 6. 2500 RPM | 20 min |
| 7. 3000 RPM | 30 min |
| 8. 3500 RPM | 60 min |

| Spindle Speed 4500 RPM | Spindle Run Time |
|---|---|
| 1. 600 RPM | 4 min |
| 2. 1200 RPM | 2 min |
| 3. 1800 RPM | 2 min |
| 4. 2000 RPM | 5 min |
| 5. 2400 RPM | 10 min |
| 6. 3000 RPM | 16 min |
| 7. 3600 RPM | 20 min |
| 8. 4200 RPM | 30 min |
| 9. 4500 RPM | 60 min |

| Spindle Speed 4800 RPM | Spindle Run Time |
|---|---|
| 1. 600 RPM | 4 min |
| 2. 1200 RPM | 2 min |
| 3. 1800 RPM | 2 min |
| 4. 2000 RPM | 5 min |
| 5. 2400 RPM | 10 min |
| 6. 3000 RPM | 16 min |
| 7. 3600 RPM | 20 min |
| 8. 4200 RPM | 30 min |
| 9. 4800 RPM | 60 min |

| Spindle Speed 6000 RPM | Spindle Run Time |
|---|---|
| 1. 600 RPM | 2 min |
| 2. 1200 RPM | 2 min |
| 3. 1800 RPM | 2 min |
| 4. 2400 RPM | 2 min |
| 5. 3000 RPM | 5 min |
| 6. 3600 RPM | 10 min |
| 7. 4200 RPM | 16 min |
| 8. 4800 RPM | 20 min |
| 9. 5400 RPM | 30 min |
| 10. 6000 RPM | 60 min |

| 6000 Max RPM Motorized Spindle Run-in or Cycle | | 6500 Max RPM Belt Driven, High Torque, 50 Taper Spin-dleRun-in or Cycle | | 8000 Max RPM Belt Driven, 50 Taper Spindle Run-in or Cycle | | 10000 Max RPM Motorized Spindle Run-in or Cycle | |
|---|---|---|---|---|---|---|---|
| Speed (RPM) | Run Time | Speed (RPM) | Run Time | Speed (RPM) | Run Time | Speed (RPM) | Run Time |
| 1. 1500 | 5 min | 1. 1500 | 15 min | 1. 1500 | 15 min | 1. 1500 | 15 min |
| 2. 0 | 5 min | 2. 3000 | 15 min | 2. 3000 | 15 min | 2. 3000 | 15 min |
| 3. 3000 | 5 min | 3. 4500 | 30 min | 3. 4500 | 15 min | 3. 4500 | 15 min |
| 4. 6000 | 15 min | 4. 6500 | 60 min | 4. 6000 | 15 min | 4. 6000 | 15 min |
| | | | | 5. 7500 | 30 min | 5. 7500 | 15 min |
| | | | | 6. 8000 | 60 min | 6. 9000 | 30 min |
| | | | | | | 7. 10000 | 60 min |

| 12000 Max RPM Motorized Spindle Run-in or Cycle | | SRi, SWi, or SRTi Machines 12000 Max RPM Electro Spindle Idle for 3 Months or More | | 15000 Max RPM Motorized Spindle Run-in or Cycle | |
|---|---|---|---|---|---|
| Speed (RPM) | Run Time | Speed (RPM) | Run Time | Speed (RPM) | Run Time |
| 1. 1500 | 15 min | 1. 500 | 10 min | 1. 1500 | 15 min |
| 2. 3000 | 15 min | 2. 1000 | 10 min | 2. 3000 | 15 min |
| 3. 4500 | 15 min | 3. 2000 | 10 min | 3. 4500 | 15 min |
| 4. 6000 | 15 min | 4. 4000 | 10 min | 4. 6000 | 15 min |
| 5. 7500 | 15 min | 5. 6000 | 5 min | 5. 7500 | 15 min |
| 6. 9000 | 15 min | 6. 8000 | 5 min | 6. 9000 | 15 min |
| 7. 10000 | 15 min | 7. 10000 | 5 min | 7. 10500 | 15 min |
| 8. 11000 | 30 min | 8. 12000 | 5 min | 8. 12000 | 15 min |
| 9. 12000 | 60 min | | | 9. 13500 | 30 min |
| | | | | 10. 15000 | 60 min |

| 18000 Max RPM Motorized Spindle Run-in or Cycle | | 20000 Max RPM Motorized Spindle Run-in or Cycle | | 30000 Max RPM Motorized Spindle Run-in or Cycle | |
|---|---|---|---|---|---|
| Speed (RPM) | Run Time | Speed (RPM) | Run Time | Speed (RPM) | Run Time |
| 1. 4500 | 5 min | 1. 5000 | 12 min | 1. 5000 | 12 min |
| 2. 0 | 5 min | 2. 10000 | 12 min | 2. 10000 | 12 min |
| 3. 9000 | 5 min | 3. 15000 | 12 min | 3. 15000 | 12 min |
| 4. 0 | 5 min | 4. 20000 | 12 min | 4. 20000 | 12 min |
| 5. 18000 | 15 min | | | 5. 25000 | 12 min |
| | | | | 6. 30000 | 12 min |

# SR, SW, or SRT i-Series Electro-spindle Run-in Cycle

Run the electro-spindle at the specified RPM for the specified amount of time (refer to *SRi, SWi, or SRTi Machines 12000 Max RPM Electro Spindle Idle for 3 Months or More, on page 4 - 25*), while measuring the temperature inside the electro- spindle cone with a temperature measuring device in the location shown below.

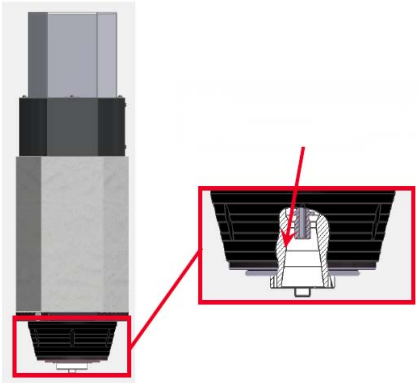


***Figure 4–4. Electro-spindle Temperature Measurement Location***

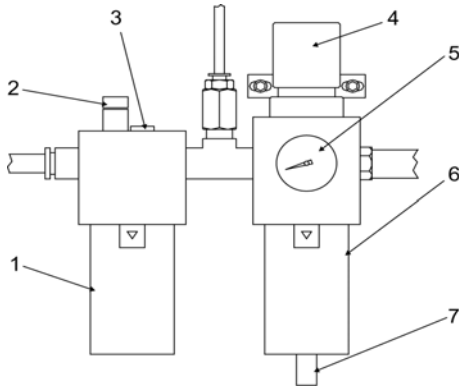
Monitor the electro-spindle temperature until the temperature becomes stable for five minutes at the specified RPM and does not exceed 50°C (122°F).

⇨ If the electro-spindle temperature exceeds 50°C (122° F),
stop running the electro-spindle,
allow it to cool to 20-25°C (68°-77°F),
then restart the procedure from the beginning
(500 RPM for 10 minutes).

Repeat at each RPM increment for the specified amount of time until the electro-spindle run-in procedure is completed.

# Pneumatic System

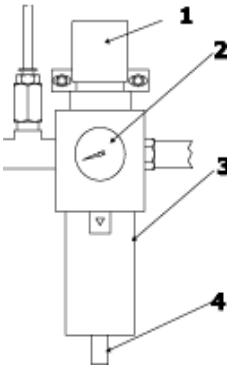
The pneumatic system includes a Filter, Regulator, and Lubricator (FRL) Unit. The filter cleans incoming compressed air, and expels accumulated moisture through a drain. The lubricator meters oil into the air stream to lubricate cylinders and valves. The rate at which lubricant is released into the pneumatic system (i.e., the drip rate) is adjustable.




1. Lubricator unit
2. Drip rate adjust
3. Fill/Oil drip viewer
4. Air pressure adjust
5. Air pressure gauge
6. Filter unit
7. Auto moisture drain

***Figure 4–5. Filter, Regulator, and Lubricator Unit***

For TM i-Series models the pneumatic system includes a Filter and Regulator Unit with no lubrication unit. Other turning centers pneumatic systems include the FRL system. The parts catcher and auto door options operate using the pneumatic system.




1. Air pressure unit
2. Air pressure gauge
3. Filter unit
4. Auto moisture drain

***Figure 4–6. Filter and Regulator Unit (for TM i-Series)***

## Set Air Pressure

❒ Daily: Check the FRL or FR unit air pressure.

If the air pressure reading on the gauge does not meet the required specification, adjust the knob on top of the filter unit to set the correct system pressure. To adjust the knob, pull it up and turn. To lock the knob, push it back down.

⇨ Do not tamper with the factory-set air pressure-detecting switch that monitors the air supply to the solenoid control valves.

## Maintain Lubricator Oil Level

Maintain the lubricator oil level between the low and high marks on the lubricator unit. If oil must be added, do not overfill. Use oil type ISO VG32.

⇨ Shut off the compressed air supply before adding lubricant or removing one of the housings. Use only recommended oils or equivalents.

## Adjust Drip Rate Screwe

The oil drip rate was factory-set and should not need adjustment. However, if the oil drip is not visible at the top of the lubricator unit, turn the drip rate adjustment screw to obtain one drop of lubricant for every 8 tool changes.

## Check and Replace Air Filter Element

❒ Every 3 Months or every 500 hours: Check the FRL air filter element regularly and replace it.

If the filter becomes clogged, the air pressure may still measure as acceptable, but air flow to the pneumatic system will be restricted.

⚠ First remove the metal bowl guard, then remove the bowl to access the filter element, clean the bowl using a soft, lint-free cloth dabbed with the recommended lubricant. Do not use any type of cleaning fluid.

Before reconnecting the air supply, reinstall the metal bowl guard.

# Check Auto Moisture Drain

❒ Daily: Check the auto moisture drain on FRL.

❒ Weekly: Check the auto moisture drain on the Filter and Regulator Unit for TM i-Series models (lathes only).

❒ Every 3 Months: Drain moisture from the lines of the Filter and Regulator Unit or the FRL.

Make sure the auto moisture drain is not stuck open and leaking air. If the drain is stuck open, follow these steps:

1. Disconnect the compressed air supply to the machine.
2. Turn the auto drain nut at the filter unit bottom counter-clockwise one turn.
3. Using a crescent wrench, turn the auto drain nut at the bottom of the filter unit counterclockwise one turn.
4. Tighten the nut clockwise.

# Hydraulic System

Some Hurco machines use hydraulics to run certain components. The hydraulic pressure is set at the factory and should not be adjusted.

## HMX Hydraulic Pressure Settings

The HMX i-Series machines have a hydraulic system for operating the table clamp, B-axis clamp, spindle clamp, APC Up/Down (Automatic Pallet Changer), and APC Right/Left.

| Machine Model | Table Clamp/ Unclamp | B-Axis Clamp | Spindle Clamp/ Unclamp | APC Hydraulics | |
|---|---|---|---|---|---|
| | | | | Left/Right | Up/Down |
| HMX400 | 35KG | 35KG | 50KG | 30KG | 35KG |
| HMX630 | 50KG | 35KG | 85KG | 30KG | 50KG |

## SRT, SW, HSRT, HSW models Hydraulic Pressure Settings

| Hydraulic System | Pressure Setting |
|---|---|
| B-Axis (Tilting Head) | 30-40 Bar |
| C-Axis (Rotary Table, SRT, HSRT only) | 30-40 Bar |
| Unclamp Cylinder | 40-50 Bar |

## Trunnion Hydraulic Pressure Setting

❒ Daily or every 8 hours: Check the hydraulic pressure of the trunnion table clamping system to ensure it is between 30 and 40 Bar (mills only, if equipped).

The trunnion table clamping system uses hydraulic pressure to regulate flow of oil to the system. The rotary axis (C-axis) and tilt-axis (A-axis) each have separate oil systems to ensure adequate lubrication.

⇨ Some models have a pneumatic clamping system.

⚠ Operating the clamping system above 40 Bar may cause buckling of the clamping system and damage to the tilt and rotary axes of the trunnion table. The system's hydraulic pressure is set at 35 Bar during factory installation. Hurco recommends maintaining the hydraulic pressure for the clamping system at 35 Bar.

⚠ Disassembling the trunnion table or any component of the table may cause irreparable damage and void your Hurco warranty. Contact a Hurco-certified Service Engineer to service the trunnion table.

⚠ VMX30Ui and VMX42Ui machining centers use a pneumatic clamping system. Refer to *Pneumatic System, on page 4 - 27* for details.

Follow these steps to check the pressure:

1. Locate the T-valve on the back of the tilt-axis (i.e., A-axis) table below the pressure switch.
2. Attach a pressure gauge to the T-valve to read the hydraulic pressure.
3. Make sure the air pressure at the booster cylinders (accessible through the side enclosure panel) is between 3 and 3.2 Bar. If necessary, adjust the air pressure at the booster cylinders.

Follow these steps to adjust the hydraulic pressure of the clamping system:

1. Open the access door for the ATC on the left side of the machine.
2. Use the pressure regulator knob to adjust the hydraulic pressure.
   - Turn the pressure regulator knob clockwise to increase pressure.
   - Turn the pressure regulatory knob counter clockwise to decrease pressure.
3. Close the ATC access door.

## Turning Centers Hydraulic Pressure Settings

Turning centers hydraulic systems operate the chuck, turret, and optional tailstock assembly. The hydraulic pump provides power for the chuck, turret, and tailstock assembly. The following table contains hydraulic pump pressure settings for the turning centers.

| Machine | Hydraulic Pressure Setting | |
|---|---|---|
| TM6i | 32.0 bar | 455 psi |
| TM8i | 32.0 bar | 455 psi |
| TM10i | 40.0 bar | 580 psi |
| TM12i | 53.9 bar | 782 psi |
| TM18i | 39.2 bar | 569 psi |
| TM18Li | 39.2 bar | 569 psi |
| TMM8i | 54.0 bar | 782 psi |
| TMM10i | 71.6 bar | 1038 psi |
| TMX8i | 54.0 bar | 782 psi |
| TMX8MYi | 68.6 bar | 995 psi |
| TMX8MYSi | 68.6 bar | 995 psi |
| TMX10i | 54.0 bar | 782 psi |
| TMX10MYi | 68.6 bar | 995 psi |
| TMX10MYSi | 68.6 bar | 995 psi |

- **Hydraulic Pump Low Pressure Cut-off**—$\Delta$ 15.0 kg/cm$^2$ ($\Delta$ 213 psi).

  ⇨ The hydraulic pressure falling below the low pressure cut-off results in an error on the control.

- **TMM Series C-Axis Assist Brake Hydraulic Pressure Setting**—2.8 - 3.2 kg/cm$^2$ (40-45 psi).
- **TMM Series Turret Pressure**—is adjustable and should be set to 50 +/- 2

kg/cm$^2$ (711 +/- 29 psi).

- **TMX Series Turret Pressure**—is adjustable and should be set to 50 bar +2.5/-10 bar (725 + 35/-145 psi).

## Chuck Hydraulic Pressure Setting

The chuck hydraulic pressure gauge is located on the front, left side of the enclosure. If there are two gauges, the chuck gauge is on the left; the tailstock gauge is on the right.

The amount of hydraulic pressure affects the pressure the jaws apply to the stock. The maximum hydraulic pressure setting for the chuck is 40.8 kg/cm$^2$ (580 psi) for all turning center models.

To adjust the hydraulic pressure for the chuck,

1. Open the door beneath the gauge.
2. If there are two knobs, use the one on the left to adjust the hydraulic pressure for the chuck. Turn the knob locking ring under the pressure adjustment to unlock the knob.
3. Turn the knob clockwise to turn up the pressure for harder stock; turn the knob counterclockwise to turn down the pressure for softer stock.
4. Turn the locking ring clockwise to lock the knob in place.

## Tailstock Hydraulic Pressure Gauge Setting

The tailstock hydraulic pressure gauge is located on the front, left side of the enclosure. If there are two gauges, the chuck gauge is on the left; the tailstock gauge is on the right.

The amount of hydraulic pressure affects the speed at which the tailstock quill advances or retracts and the force applied by the tailstock.

To adjust the hydraulic pressure for the tailstock,

1. Open the door beneath the gauge.
2. If there are two knobs, use the one on the right to adjust the hydraulic pressure for the tailstock. Turn the knob locking ring on the pressure adjustment to unlock the knob.
3. Turn the knob clockwise to turn up the pressure for harder stock; turn the knob counterclockwise to turn down the pressure for softer stock.



When the quill is advanced, the pressure can only be adjusted higher because of the check valve. To lower the pressure when the quill is advanced,

1. Retract the quill.
2. Turn the knob counterclockwise to lower the pressure setting.
3. Advance the tailstock.
4. Turn the knob clockwise to the desired pressure.

⚠ Adjust the tailstock movement with the flow control valve located behind the left door housing. Open the door to access the valve. With this setting, the pressure remains unchanged, but the speed of the tailstock movement is increased or decreased.

4. Turn the locking ring clockwise to lock the knob in place.

## Maintain the Oil Level

❒ Every 3 Months or 500 hours of operation: Check the hydraulic system oil level (if equipped).

- Hydraulic Tank—Maintain the oil level at180.0 liters with either Teresso Oil 32 (Esso), DTE Oil Light (Mobil), or Tellus Oil 32 (Shell).
- HMX i-Series Rotary Table (B-axis) Gearbox—Maintain the oil level so the sight glass is half full with 0.5 liter of ISO VG100~150 oil.T
- SR/SRT/SW i-Series models (C-axis)—Maintain the oil level so the sight glass on the remote hydraulic tank is half full with ISO VG46 hydraulic oil.
- TM i-Series Hydraulic Tank—Maintain the oil level so the sight glass at rear of machine is half full with ISO VG32 oil.
  - TM6i tank capacity is 40.0 liters/10.6 gal..
  - TM18Li tank capacity is 90 liters/23.8 gal.
  - TM8i, TM10i, TM12i, TM18i, TMM8i, TMM10i, TMX8i, TMX8MYi, TMX8MYSi, TMX10i, TMX10MYi, TMX10MYSi tank capacity is 70.0 liters/18.5 gal.

Follow these steps to maintain the oil level:

1. Check the tank sight gauge.
2. If the level is low, add the recommended oil type.

# Replace Hydraulic Oil

❒ Annually or every 2000 hours of operation: Replace the hydraulic oil and filter (if equipped).

The intake filter or strainer used on the Hydraulic tank is 150 microns (100 mesh).

Follow these steps to replace the hydraulic oil:

1. Drain the oil using the plug at the bottom of the tank.
2. Flush the system. Use a non-volatile flushing agent that is suitable for use in a mineral-type hydraulic system.
3. Check the filter and replace it, if necessary.
4. Replace the drain plug.
5. Add the recommended oil type to the tank, checking the sight gauge on the tank to determine when the tank is full.

# Flood Coolant and Washdown System

The flood coolant system pumps coolant to the tool in the turret or spindle. The washdown system uses a large flow of coolant to move chips to the front of the machine and onto the chip conveyor. A washdown spray gun is externally mounted on the machine to spray chips found inside the enclosure.

Chips that are flushed out of the machining center collect in the chip conveyor tank. Used coolant is cleaned of chips and oil and recirculated into the coolant tank. Filters remove contaminants from the coolant. When the chip conveyor tank becomes full with coolant, the coolant over flows into the coolant tank.

## Selecting Coolant

Use a non-synthetic or semi-synthetic water soluble coolant to prevent damage to the machine oil, guideways, precision ballscrews, and painted surfaces. Coolant should have these qualities:

- Must be suitable for the workpiece material and machining operation.
- Must be soluble in water.
- Must contain mineral content of at least 35%. When synthetic coolants and coolants that contain too little mineral oil come in contact with guideway lube oil, they can clog the guideways.
- Must provide adequate rust protection.
- Must be innocuous (not harmful) to paint.
- Must contain anti-foam, anti-bacterial, and anti-fungal agents.
- Must be non-irritating to skin.
- Must allow penetrating lubrication oil (way oil) to float on the surface of the coolant (instead of dissolving in the coolant).
- Must not contain aggressive additives. However, suitable additives can increase cutting capacity.

⚠ Failure of devices or performance problems related to coolant are not a defect in Hurco's material or workmanship, and will not be covered by Hurco's warranty. Some Coolants in certain circumstances may affect machine's paint or labeling of control keyboard. Damages of this kind are not a defect in Hurco's material or workmanship, and will not be covered by Hurco's warranty.

## Preparing Coolant

Follow these guidelines when preparing coolant:

- Mix the coolant according to coolant manufacturer's instructions. Use deionized (preferred) or softened water for the coolant mixture. To prevent zinc contamination, do not store coolant in a galvanized container.
- Check coolant concentration regularly with a refractometer or by titration.
- Screen off any residue floating in the coolant.
- Use coolant additives such as bactericides, fungicides, and anti-foam corrosion agents only if recommended by the coolant manufacturer.
- Do not allow foreign matter to mix with the coolant. Contaminated coolant can damage machine parts.

## Check and Maintain the Coolant

❒ Daily or every 8 hours: Check the coolant level every day at the start of operation.

To maintain the coolant level, proceed as follows:

1. Find the level indicator on the coolant tank. If the flood coolant pump is off, then fill the coolant to the H (High) mark. Note that the machine should be off for at least 5 minutes before filling the tank with coolant.
2. If the flood coolant pump is delivering coolant to the machine, then fill to the MAX mark.



If the coolant level drops below the L (Low) level mark on the coolant tank, the coolant system may not operate properly.

## Replacing Coolant

❒ Weekly or after 40-50 hours of operation: Clean the coolant filters (if equipped).

❒ Every 3 Months or every 500 hours: Replace coolant and coolant filters (if equipped).

1. Using a suitable brush, remove chips and other debris from the enclosure (and chip conveyor, if installed).
2. Drain used coolant from the system and tanks.
3. Clean or change pump filters and pick-up tubes.
4. Fill the coolant tank with a neutral aqueous (water-based) cleaning agent and flush thoroughly.
5. Drain the cleaning agent.
6. Rinse the system thoroughly with a 1% coolant solution. If bacteria or fungi contaminate the system, use a cleaning agent recommended by the coolant manufacturer.
7. Drain the rinsing solution.
8. Add new coolant.
9. Dispose of used coolant and cleaning solution in compliance with applicable pollution control regulations.

## Cleaning the Coolant Tank

To clean the tank:

1. Drain coolant from chip conveyor and coolant tank using vacuum or pump.
2. Disconnect hoses from the tank and pull the tank out toward the side.
3. Remove any remaining chips from the tank with a soft brush.
4. Remove the two chip screens from the coolant tank.
5. Rinse and dry the screens before replacing them.
6. Reposition the coolant tank in same location as original. Weir from chip conveyor should align with screen on top of coolant tank.
7. Re-attach all hoses previously disconnected.

# Chip Conveyor

The chip conveyor is intended to collect chips or swarf that are washed into the conveyor from the machine enclosure and then remove chips or swarf from the conveyor using conveyor paddles or belt to the exit chute into a collection receptacle. However, some chips or swarf may remain in the conveyor and the chip conveyor may require periodic cleaning to remove the chips that cannot be removed via the paddles or belt system.

⚠ Activate E-Stop prior to attempting to access any part of the chip removal system and prior to removal of the chip conveyor from the normal operating position beneath the machine tool enclosure.

⚠ Do not reach into the chip removal system. Disconnect the chip removal power connector prior to service or accessing the chip conveyor.

## Check and Maintain Chip Conveyor

❒ Daily: Clean the chip conveyor chip screens (if equipped).

Chip conveyor may require multiple cleanings per day when chips or swarf are small and have tendency to float on top of chip conveyor (i.e. small chips or swarf of copper, aluminum, plastics).

❒ Every 3 Months or after 500 hours of operation: Clean the chip conveyor (if equipped) whenever the coolant is replaced.

## Removing Chip Conveyor from Machine

Be sure the chip conveyor is not in motion before moving it from beneath the machine.

⇨ The Manual and Auto screens show the status of the conveyor as Off, Forward, or Reverse. The alarm lamp also illuminates a yellow signal when the conveyor is in forward or reverse condition. For machines equipped with CE or ANSI door safety switches, the front enclosure doors will also be locked when the chip conveyor is in forward or reverse.

It is also recommended that the console E-stop be engaged.

If the chip removal system must be moved, follow these steps:

1. Disconnect the chip conveyor power plug, typically located at the side of the enclosure.
2. Unscrew the four (4) bolts located under each corner of the conveyor.

⇨ The Hurco Service Engineer screws the bolts into place during installation, and the conveyor cannot be moved. These bolts are in place to keep the conveyor from moving, and to keep the conveyor at a slight angle, allowing coolant to drain out of the conveyor to the coolant tank.

3. Remove chip chutes that may be protruding from the interior of the enclosure into the chip conveyor. The chip chutes will prevent moving the chip conveyor from beneath the machine.
4. Remove front splash guard, if equipped.
5. Empty coolant out of the chip conveyor into a proper receptacle using a vacuum or pump.
6. Pull the conveyor out from the machine, toward the side.

To replace conveyor beneath machine, reverse these steps. When re-seating the leveling bolts, be sure that all leveling bolts raise the chip conveyor rollers off of the floor and that there is a slight angle towards the weir for proper coolant drainage from the chip conveyor into the coolant tank.

# Chip Conveyor Paddle Screws and Chains

❒ Every 6 Months: Inspect the chip conveyor chains and paddle screws (if equipped) for tightness.

There are two types of chip conveyors: drag flight and belt.

## Drag Flight

The drag flight operates with paddles that pull the chips toward the conveyor for disposal. There are 3 button-head screws on each end of the drag flight paddles. These screws need to be checked for tightness. If any screws are loose, tighten the screws.

The drag flight paddles move with sprockets and chains located on the inside of each side of the chip conveyor. Check the chains for looseness and tighten if necessary.

## Belt

The belt type operates by collecting the chips on top of a belt moving to the conveyor for disposal. The belt runs on guides with sprockets and chains located on the inside of each side of the chip conveyor. Check the chains for looseness and tighten if necessary.

# Automatic Tool Changer

The lubrication required depends upon the type of ATC. Please refer to the Automatic Tool Changer section of the Model-specific Specification document for information about your machine's ATC taper size and number of tool pockets.

Tool changers have an enclosed oil lubrication system. The tool changer housing holds the oil, some of which is displaced into a small oil reservoir during the tool change cycle.

⇨ Some cam parts are grease-packed, and do not require routine maintenance.

## Clean the Tool Lock Pins and Tool Gripper Fingers

❒ Daily: Clean the tool lock pins and tool gripper fingers located on the tool changer arm (mills only).

❒ Every 6 months: Add NGLI 1 grease to the Zerk fittings on the tool changer arm (mills only).

There are 2 tool lock pins on top of the tool changer arm, located near the center. When the tool changer arm is in the Up position, the tool lock pins plunge down into the tool changer arm, flush with the top of the arm. They must be free of chips and debris for proper operation.

Tool gripper fingers are located on each end of the tool changer arm. These fingers mechanically grip the tool and move the tool to the spindle or tool magazine. They must be free of chips and debris for proper operation.

## Maintain the ATC Arm and Transmission Oil Level

❒ Every 3 Months or after 500 hours of operation: Check the ATC oil level (mills only).

Observe the oil level in the reservoir cup, located on the front of the tool changer or on right-hand side of swing arm. The oil level should always be in the middle of the round sight glass. If the oil level is low, add a maximum of 5.8 quarts of ISO VG150 ~220 oil.

## Grease the ATC Magazine Chain

❒ Every 6 Months or every 1000 hours: Grease the ATC magazine chain assembly (mills only, if equipped).

Use a brush to apply a light coating of NGLI 1 grease over the chain assembly. Avoid grease build-up. Also use a grease gun to apply 5 cc of NGLI 2 grease into the Zerk fitting.

## Grease the ATC Magazine Drum

❒ Every 6 Months or every 1000 hours: Grease the ATC magazine drum (mills only, if equipped).

The ATC magazine of HMX i-Series machines is housed in a drum. Follow these steps:

1. Use a grease gun or soft-bristled brush to apply NGLI 1 oil between each tool pocket on the drum.
2. Avoid grease build-up.

## Replace the Tool Changer Oil

❒ Annually or after 2000 hours: Replace the ATC oil (mills only).



The oil should be changed more often than annually if it appears to be darkening.

1. Open the drain plug located near the bottom of the swing arm transmission casting, or the cup inside the cover of the tool changer. Drain the oil.
2. Flush the system. Use a non-volatile flushing agent that is suitable for a mineral-type lubricating system.
3. Replace the drain plug.
4. Add the new oil.

# Spindle Chiller

The Spindle Chiller must be located in a clean, well-ventilated area. The room temperature must be between 0° and 40°C (32° and 104°F). Ensure there are no obstructions to the air intake or exhaust components on the spindle chiller, leaving a clearance of 1 meter (3 feet) around the unit.

If there is a need to move the spindle chiller,

- Disconnect the power cord and drain the liquid from inside the cooler unit before moving.
- Keep the cooler unit in the upright position and avoid collision or shock during transport. Do not incline, lay on the side, or turn the unit upside down.
- Use a forklift or crane to move the unit.
- If using a crane, use lifting straps connected to the eye bolts.
- Keep the cooler unit balanced.

The spindle chiller has two operating modes: Differential and Fixed.

- In **Differential** mode, the chiller operates when the difference between the ambient air and liquid temperatures exceeds the setting on the temperature display.
- In **Fixed** mode, the chiller operates when the temperature of the liquid exceeds a fixed temperature as shown on the temperature display.

## Maintain the Spindle Chiller System

❒ Daily or before operation: Maintain the spindle chiller system (if equipped).

Follow these steps:

1. Check the chiller solution level and add solution, if necessary.
2. Inspect chiller tubing for bends, tears, or constrictions that may impair flow to the spindle. Replace any damaged tubing.
3. Check the chiller tubing for leaks. Repair or replace if necessary..
4. Check the spindle chiller solution for presence of contaminates; sediment in the solution could block tubing.
5. Replace contaminated solution by flushing and cleaning the tank before refilling.

## Repair Leaks in the Spindle Chiller

❒ Daily: Inspect for leaks in spindle chiller (if equipped).

Leaky pipes are repaired using tube clips or by replacing the pipes. If welding is required to repair a leaky pipe,

1. Choose a well-ventilated area.
2. Extract all water from the cooler unit.
3. Disconnect all pipes between the machine tool and the cooler unit..
4. Extract liquid from the cooler unit according to the relevant regulations of environmental protection.

## Maintain Spindle Chiller Solution

❒ Weekly: Inspect the chiller solution level, and if necessary, add solution to the unit (if equipped).

Follow these steps:

1. Check the solution level through the sight gauge on the chiller tank.
2. If the level is low, add the recommended chiller solution to the tank. Do not overfill the tank. See the table below for the appropriate quantity and lubrication type.



Use a fully synthetic water miscible corrosion-protection concentrate for spindle cooling systems to protect against corrosion.

| Quantity | Lubrication Type |
|---|---|
| 250 BTU / 13 liters<br>250 BTU / 3.5 gal. | 12.35 liters (3.3 gal.) drinking water<br>0.65 liters (1.4 pt.) Motorex Coolant-F |
| 400 BTU / 35 liters<br>400 BTU / 9.3 gal. | 33.25 liters (8.8 gal.) drinking water<br>1.75 liters (3.7 pt.) Motorex Coolant-F |
| 750 BTU / 45 liters<br>750 BTU / 11.9 gal. | 41.80 liters (11.1 gal.) drinking water<br>2.20 liters (4.7 pt) Motorex Coolant-F |
| 1000 BTU / 45 liters<br>1000 BTU / 11.9 gal. | 41.80 liters (11.1 gal.) drinking water<br>2.20 liters (4.7 pt) Motorex Coolant-F |

For motorized spindles, fill the chiller unit with clean water and anti-corrosive additive XTREMECOOL (mixing ratio 10%).

## Maintain the Spindle Chiller Tank Air Filter and Water Filter

❒ Weekly or after 40 hours of operation: Inspect the spindle chiller tank air filter and water filter for dirt and damage (if equipped).

To maintain the spindle chiller air filter screen, follow these steps:

1. Shut off the machine power.
2. Pull the air filter out of the spindle chiller using the black tab located above the control panel. The air filter is positioned horizontally.
3. Inspect the spindle chiller tank air filter.
4. Clean the air filter using a vacuum cleaner, compressed air, or brush and water if the air filter is dirty.
5. Replace the air filter if it is damaged.
6. Inspect the water filter located in the rear of the spindle chiller tank, near the water lines exiting the tank.
7. Replace the water filter cartridge if it is dirty or damaged.

## Remove Air from Spindle Chiller Circulating System

❒ Weekly: Remove air from spindle chiller circulating system (if equipped).

If air penetrates the circulating system, the flow rate will decrease and there will be noise in the system. To remove air from the circulating system,

1. Turn on the main machine power. This starts the chiller unit, and the pump will start operating.
2. Loosen the pipe slightly at the outlet of the cooler unit to push the air out of the system.
3. Tighten the pipe.
4. Switch off the main machine power.

## Flush, Clean Tank, and Refill Chiller Solution

❒ Annually or every 2000 hours, or every 1000 hours if in a hard water area: Flush, clean, and refill the spindle chiller tank once each year and any time the spindle chiller solution shows signs of contamination or overheating (if equipped).

Follow these steps:

1. Gradually add the flushing agent solution per the flushing agent supplier's recommendations. Recommended flushing agent for motorized spindles is TST Cleaner LUBRIZOL CONTRAM CB-1 (mixing ratio 3%).
2. Continue to use the spindle/chiller system normally for the next 48 hours. It is important that the chiller system is left running to flush the complete system through.
3. Empty the solution.
   a. Shut off machine power.
   b. Locate the drain on the bottom front of the chiller tank.
   c. Remove the drain plug.
   d. Use a funnel to drain fluid into a container. Discard the chiller solution per applicable laws.
   e. Replace the drain plug.
4. Fill the chiller system with clean chiller solution per the Maintain Spindle Chiller Solution section. Do not overfill tank.

## Operation Checklist

Before operating the spindle chiller,

❒ Daily: Check the spindle chiller to be sure the working environment has appropriate ventilation and the ambient temperature is between 10° and 40°C (50° and 104°F) (if equipped).

❒ Weekly: Check the spindle chiller to be sure there is a sufficient amount of liquid in the tank or in the system (if equipped).



Insufficient liquid within the system will cause damage to the pump.



Restarting the spindle chiller frequently will cause damage to the unit. Do not restart the cooler unit within 3 minutes after turning it off.

Follow these safety precautions:

- Keep the spindle chiller in a safe area, free of dampness or moisture.
- Do not stack anything on top of the spindle chiller.

Follow these steps to keep the exterior of the spindle chiller clean:

1. Turn off machine power.
2. Clean the surface of the spindle chiller with cool water, mild detergent, and a lint-free cloth.
3. Wipe electrical components with a dry cloth.

If repairs or replacement parts are required, please follow these safety precautions:

- Turn the machine's main power switch Off before proceeding.
- Avoid flame near any oil (in the form of liquid or gas).
- Choose a well-ventilated location if releasing refrigerant.

## Spindle Chiller Control Panel for Model HWK

Refer to the supplier's manual for details about the Spindle Chiller Control Panel.

# Spindle Chiller Temperature Requirement

The spindle chiller should be set for Differential Temperature Control, except for SR, SW, and SRT i-Series models which should be set for Fixed Temperature Control.

Hurco recommends the Differential Temperature on the spindle chiller be set to 2°C cooler than the ambient temperature to maintain the appropriate liquid temperature.

Hurco recommends setting the Fixed Temperature on the spindle chiller to 24°C.

## Differential Temperature Mode

When the Spindle Chiller is in Differential Temperature Mode, setting the Liquid Temperature to -2°C programs the spindle chiller to constantly maintain the liquid temperature 2° cooler than the ambient temperature. If the ambient temperature changes, the liquid temperature is adjusted to keep it 2° cooler than the ambient temperature.Refer to the supplier's manual for instructions.

With machine power on, the cooler unit starts the cooling process when the temperature difference between the liquid and the ambient air is greater than the Differential Temperature setting.

The cooling process stops when the temperature differential between the liquid and the ambient air is equal to or less than the Differential Temperature setting.

## Fixed Temperature Mode

For SR, SW, and SRT i-Series machines, Hurco recommends the spindle chiller be set to Fixed Temperature mode. With machine power on, the cooler unit starts the cooling process when the liquid temperature rises above the Fixed Temperature setting. If the temperature of the liquid reaches the Fixed Temperature setting or lower, the cooling process stops.

If the ambient temperature reaches 31°C or greater, increase the Fixed Temperature setting to be 5°C cooler than the ambient air temperature to reduce condensation in the spindle head.

During the course of a day, the ambient temperature can change. When that occurs, the Fixed Temperature needs to be adjusted.

# Coolant thru Spindle (CTS)

The optional Coolant Thru Spindle (CTS) pump assembly has an internal filter to clean coolant used by the CTS system. The CTS pump assembly is located at the rear of the coolant tank.

## Coolant Filter for CTS

❒ Weekly: Check the CTS coolant filter and clean when necessary (mills only, if equipped).

❒ Every 3 Months or 500 hours: Replace the CTS coolant filter (mills only, if equipped).

To access the CTS coolant filter:

1. Remove the filter housing unit from the CTS pump assembly.
2. Remove the CTS coolant filter from the housing unit.
3. Rinse the filter with clean, soapy water and dry. If the filter is damaged, replace it.

# Trunnion Table

The trunnion table clamping system uses hydraulic pressure to regulate flow of oil to the system. The rotary axis (C-Axis) and tilt-axis (A-Axis) each have separate oil systems to ensure adequate lubrication.

## Inspect the Trunnion Clamping System Pneumatic Lines

❒ Daily or every 8 hours of operation: Check the trunnion table clamping system's incoming pneumatic lines for leaking, cracking, or kinks (mills only, if equipped).

If the incoming pneumatic lines are exposed to the working environment, ensure the lines are free of damage from chips and are not twisted or bent.

## Clean the Trunnion Table

❒ Daily, after every shift, or every 8 hours of trunnion operation: Clean the trunnion table (mills only, if equipped).

Use flood coolant and a clean brush to remove chips from the trunnion table. Use gentle pressure while cleaning the table to retain table alignment.

⚠ Do not use compressed air to remove chips or dirt from the trunnion table. Air-blown water and chips come lodged underneath and cause damage to the trunnion table.

## Maintain the Trunnion Clamping System's Oil Level

❒ Weekly or every 40 hours of operation: Check the oil level for the trunnion clamping system (mills only, if equipped).

1. Open the access door on the right side of the machine.
2. Check the level of the oil in the sight gauge located on the side of the booster cylinder. The oil sight gauge level should be half-filled with oil.
3. If the oil level is low, add oil to the reservoir bowl until the oil sight gauge level is half-filled with oil.
4. Close the ATC access door.

# Check Oil Drip Rate for Trunnion C-Axis Clamp/Unclamp

The trunnion table C-axis clamping system is factory set at 1 drop per 8-10 clamp/ unclamp cycles. The drip rate adjustment knob is located on the right hand side of the C-axis.

⚠ Some machine models have a cover for the clamping system. For those machines, remove the cover to access the drip rate adjustment knob.

If the drip rate needs to be adjusted, turn the drip rate adjustment knob so the indicator lines up with one of the numbers 8, 9, or10 at the base of the knob.

# Trunnion Rotary C-Axis

The rotary-axis (i.e., C-axis) on the trunnion table is positioned 360° and becomes the machining center's fourth axis for part programming. The rotary axis has a separate oil system to ensure adequate lubrication.

Use a maximum of 2.0 liters of ISO VG150 oil.

## Maintain the Trunnion Rotary C-Axis Oil Level

❒ Daily or after 8 hours of operation: Check the trunnion rotary-axis oil level (mills only, if equipped).

Follow these steps:

1. Move the rotary-axis to 0° (the horizontal table position).
2. Check the oil level through the oil level sight gauge located on the front side of the trunnion table. The oil sight gauge should be half-filled with oil.

If the oil level is low, open the oil fill plug located on the top of the trunnion table and add clean oil until the level of oil in the sight gauge is half-filled (the level of oil will cover the red dot in the sight gauge).

## Replace the Trunnion Rotary C-Axis Oil

❒ Annually or after 2000 hours of operation: Replace the trunnion rotary-axis oil (mills only, if equipped).



The rotary-axis oil should be changed more often than annually if the oil appears to be darkening.

Follow these steps::

1. Move the rotary-axis to approximately 60°, until the oil fill plug on the top of the trunnion table faces the bottom of the machining center.
2. Place a suitable container underneath the trunnion table to collect the used oil.
3. Open the drain plug on the top of the trunnion table and drain the used oil into the container.
4. Close the oil drain plug.
5. Tilt the rotary axis to approximately 30°, until the oil fill plug on the top of the trunnion table faces towards the back of the machining center.
6. Open the oil fill plug located on the back side of the trunnion table and add approximately 2. 0 liters of clean oil.
7. Close the oil fill plug.

# Trunnion Tilt A-Axis Maintenance

The tilt-axis (i.e., A-axis) on the trunnion table is tilted between -30° and +110° to become the fifth axis during part programming. A separate oil system is used to keep the tilt-axis lubricated.

Use a maximum of 2.0 liters of ISO VG150 oil.

## Maintain the Trunnion Tilt A-Axis Oil LevelMantenere la Trunnion Tilt A-Axis del livello dell'olio

❒ Daily or after 8 hours of operation: Check the trunnion tilt-axis oil (mills only, if equipped).

Follow these steps:

1. Remove the machine's inspection plate on the right side of the machining center.
2. Check the oil level through the oil level sight gauge. The oil sight gauge should be half-filled with oil (i.e., the level of oil should cover the red dot in the sight gauge).
3. If the oil level is low, open the oil fill plug located above the oil level sight gauge and add clean oil until the level of oil in the sight gauge is half-filled.
4. Replace the machine's inspection plate.

## Replace the Trunnion Tilt A-Axis Oil

❒ Annually or after 2000 hours of operation: Replace the trunnion tilt-axis oil (mills only, if equipped).



The tilt-axis oil should be changed more often than annually if the oil appears to be darkening.

Follow these steps:

1. Place a suitable container underneath the tilt-axis to collect the used oil.
2. Open the oil drain plug located on the bottom of the tilt-axis.
3. Drain the used oil into the container.
4. Close the oil drain plug.
5. Remove the machine's inspection plate on the right side of the machining center.
6. Open the oil fill plug located above the oil level sight gauge and add approximately 2.0 liters (one gallon) of clean oil.
7. Close the oil fill plug.
8. Replace the machine's inspection plate.

# B-Axis

## Maintain the Oil for the B-Axis Tilt

❒ Weekly or after 40 hours of operation: Check the oil level for the B-Axis tilt mechanism (mills only, if equipped).

Use a maximum 0.75 liter (25.4 ounces) of ISO VG150 synthetic oil.

Follow these steps to maintain the oil for the tilt spindle:

1. View the oil level through the sight gauge located on the tilt mechanism gear box. If the oil level looks adequate when viewed through the sight gauge, but a low oil error message appears when attempting to run a part program.
2. If the oil level is low, open the oil fill plug on the top of the tilt mechanism gear box.
3. Add oil until the level of oil is half-full in the sight gauge.
4. Close the oil fill plug on the gear box.

## Replace the Oil for the B-Axis Tilt Mechanism

❒ Annually: Replace the oil for the B-Axis tilt mechanism (mills only, if equipped).

Follow these steps to replace the oil for the tilt spindle:

1. Run the B-axis for at least 15 minutes.
2. Open the oil drain plug located at the bottom of the tilt mechanism gear box.
3. Drain the used oil into a suitable container.
4. Replace the oil drain plug.
5. Open the oil fill plug located at the top of the tilt mechanism gear box and add approximately 0.75 liters (25.4 ounces) of new oil.

# C-Axis Rotary TableC-

Check the oil through the oil level indicator. The oil level of the rotating axis must be checked with the table in horizontal position at 0° with both axes clamped. Fill with a maximum of 1.65 liters (55.8 ounces) of ISO VG150 synthetic oil so the sight glass is half full.

## Clean the C-Axis Rotary Table

❒ Daily after every shift or 8 hours of operation: Clean the C-Axis rotary table to remove debris that may cause damage (mills only, if equipped).

Follow these steps to clean the rotary table:

1. Use a lint-free cloth to wipe any chips away from the rotary table.
2. Use a clean, lint-free cloth dipped in clean mineral oil to gently wipe the rotary table clean. Use gentle pressure when cleaning the rotary table to retain table alignment.

## Maintain the Oil Level for the C-Axis Rotary Table

❒ Weekly: Check the oil level for the C-Axis rotary table, and if necessary add oil (mills only, if equipped).

Use a maximum1.65 liters (55.8 ounces) of ISO VG150 Synthetic Oil.

Follow these steps to maintain the oil level for the rotary table.

1. Check the oil level through the oil sight gauge on the rotary table. The oil sight gauge should be half-filled.
2. If the oil level is low, open the oil fill plug located directly above the oil sight gauge and add clean oil until the level of oil in the sight gauge is half-filled.
3. Push the adjuster knob down to lock it in this position.
4. Jog the C-axis 360° and listen for the whistling sound. Adjust the flow control valve for the C-axis rotary table until the noise is minimal.



Do not completely close the flow control valve.

## Adjust Air Pressure and Flow Control for Rotary Table

The integrated C-axis rotary table uses pneumatic pressure to keep coolant and debris out of the rotary table unit. The air pressure also relieves excess pressure on the table seals, preventing premature wear of the seals, but may result in a slight whistling or squealing sound. This noise has no effect on the table operation.

To set the pneumatic pressure,

1. Locate the regulator for the TRBTH610 C-axis rotary table. This unit is positioned on the rear left-hand side of the machine, when facing the front of the machine. There are 2 air lines on the output side of the regulator. One air line, usually located on the top, connects to the spindle; the other air line, usually located on the bottom, connects to the C-axis rotary table.
2. Fully open the flow control valve that connects the C-axis rotary table.
3. Unlock the regulator by pulling up the adjuster knob.
4. Turn the adjuster knob until the reading is between 0.4 and 0.6 Bar. Counter-clockwise lowers the pressure; clockwise increases the pressure.

   ⚠ Regulators need to bleed off when lowering the pressure. Always bleed below the desired pressure then bring the pressure back up to the desired amount of pressure.
5. Push the adjuster knob down to lock it in this position.
6. Jog the C-axis 360 degrees and listen for the whistling sound. Adjust the flow control valve for the C-axis rotary table until the noise is minimal.

   ⚠ Do not completely close the flow control valve.

# Dust Collector

The dust collector uses cartridge-style filters and downward airflow to remove dust particles.

The dust collector monitors the differential pressure between the clean and dirty air chambers. If the air flow is low, in Manual Mode the spindle motor and dust collector motors turn off; when in Auto Mode, the machine is put in Interrupt Mode stopping the spindle and the dust collector motor.

Filter conditions may appear on the display of the dust collector unit. An alarm and a message appears on the control when the filters need to be replaced.

Remove, inspect, or change the filter cartridges from outside the unit by removing the filter access cover and sliding the filter out.

# Turret

❒ Monthly: Check the turret oil level (lathes only).

Fill with ISO VG100-150 oil so sight glass on the front of the turret is half full.

The turret is located inside the enclosure on the right side of the turning center. Check the oil level in the sight glass on the front of the turret oil tank. The tank should be at least 1/2 full. Use the inlet plug located in the front to fill the tank. Refer to *Lubrication, on page 4 - 4* for information about turret lubrication.

The live-tooling turret is available on TMM8, TMM10, TMX MY, and TMX MYS i-Series turning centers for inserting live-tooling tool holders.

## TMM10i MDT20 Gear Box

❒ Every 6 Months or 1000 hours of operation: Check the grease in the live-tooling turret gear box (lathes only, if equipped).

Use 200 grams of Klubersynth UH1 14-1600 (Cod. 0897155) grease.

Remove the plug at the top of the MDT housing and check the amount of grease in the gear box.

1. Remove the plug at the top of the MDT housing shown in the figure below.

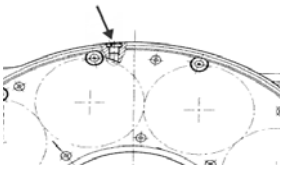


***Figure 4–7. Live-tooling Turret Gear Box***

2. Insert a small-diameter screw driver and touch the gear below the plug hole.
3. Remove and inspect the screw driver tip:
   - If no grease is present on the screw driver tip, add grease (maximum 40 $cm^3$ or 2.5 $in^3$). Use 200 grams of Klubersynth UH1 14-1600 (Cod. 0897155).
   - If dark grease is present on the screw driver tip, do not add grease.
   - If there is a grease and metallic dust mixture, grease and coolant mixture, or grease and oil mixture on the screw driver tip, contact a Hurco service representative for assistance.
4. Replace the plug at the top of the MDT housing.

### Turret Disk

❒ Every 6 Months or 1000 hours of operation: Clean the back of the live-tooling turret disk and the gasket (lathes only, if equipped).

The turret disk is sealed with a gasket. The gasket is a green ring that is visible behind the turret disk.

1. Remove the turret disk assembly by removing the 8 M8 SHCS and Dia. 10 alignment pins, if present.
2. Inspect the turret disk and clean if necessary.
3. Remove and clean the green seal and seal cavity.
   a. Remove the 13 M4x8 SHCS (**1**) and 13 springs (**2**).
   b. Inspect and replace the seal if damaged.
   c. Install the 13 M4x8 SHCS (**1**) and 13 springs (**2**).

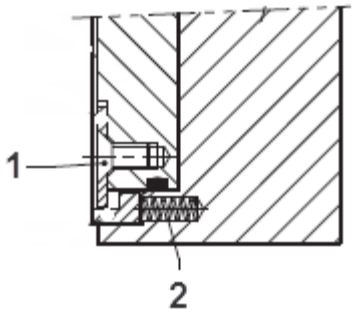


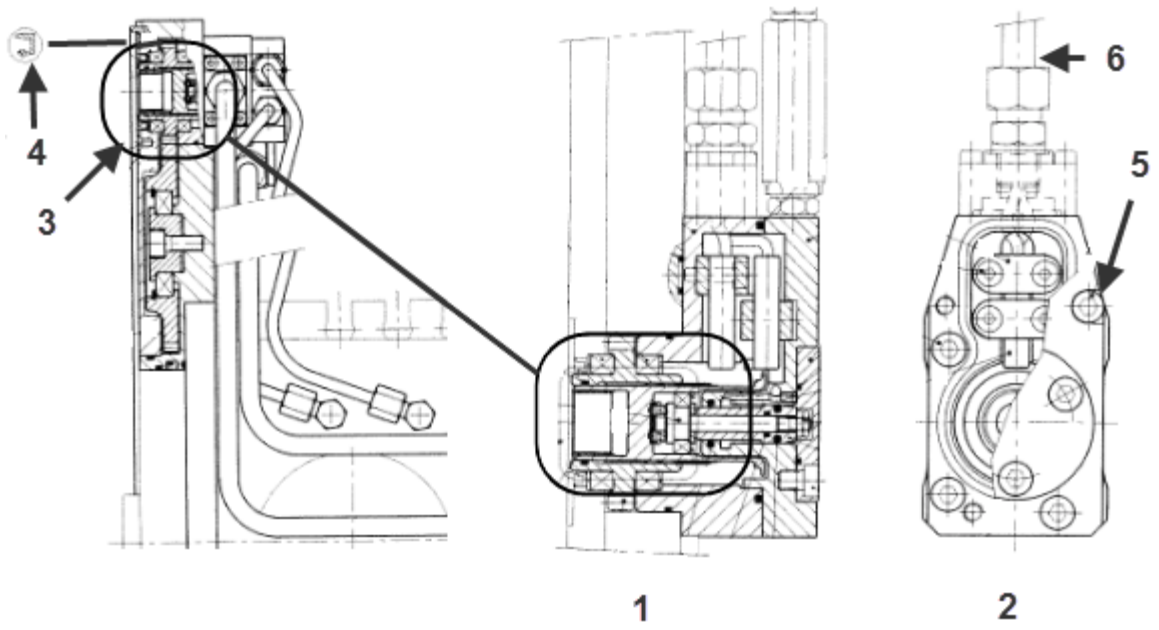

***Figure 4–8. Turret Disk side view M4x8 SHCS and spring***

4. Install the turret disk assembly and tighten the 8 M8 SHCS and Dia. 10 alignment pins, if present, and torque to 34 Nm on the front of the turret disk.
5. Realign the turret disk upon installation.
   a. Attach a coaxial indicator to the chuck.
   b. Sweep the outside of the tool holder with the end of the coaxial indicator until the dial indicates the center (0,0).

## Turret Power Intake Rotary Seal

❒ Every 6 Months or 1000 hours of operation: Check the live-tooling turret power intake rotary seal (lathes only, if equipped).

1. Remove the power intake engagement group on the rear of the turret by removing the 4 M6x18SHCS.
2. Loosen the 2 hydraulic lines.
3. Remove the tool disk, screw, and washer..
4. Inspect the rotary seal gasket and replace if necessary.
5. Replace the screw and washer.
6. Install the power intake engagement group.




| | |
|---|---|
| **1** | Power Intake—Side View |
| **2** | Power Intake—Rear View |
| **3** | Screw and Washer |
| **4** | Gasket (Rotary Seal) |
| **5** | Socket Head Cap Screw |
| **6** | Hydraulic Lines |

***Figure 4–9. Power Intake assembly and Rotary seal***

## Turning Center Coolant Collector Filter

❒ Daily: Clean the coolant collector filter (lathes only).

A coolant collector is located at the rear of the spindle, inside the enclosure. This device collects coolant that runs through the spindle as the spindle turns and returns the coolant through a hose into the coolant tank.

In addition to returning the coolant, the collector uses a filter to keep the tank free of chips. This filter needs to be cleaned frequently to avoid having the coolant overflow from the collector.

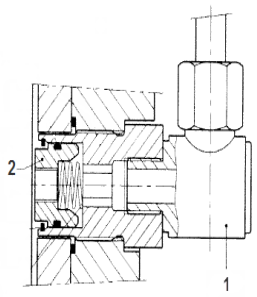
To access the coolant collector and filter, open the enclosure door on the left side of the machine, where the Communications Panel is located.

# TMM i-Series Coolant Valve

❒ Every 3 Months or 500 hours of operation: Inspect and clean the TMM i-Series coolant valve located inside the turret (lathes only, if equipped).

## TMM8i MDT16 Turret

The coolant valve assembly is located inside the turret. Access the coolant valve assembly from the back of the turret.



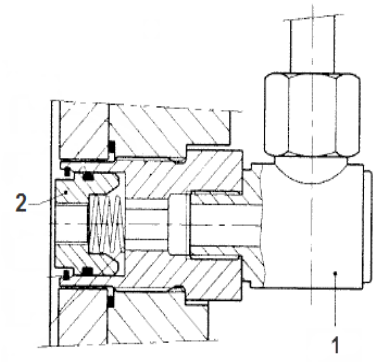

| | |
|---|---|
| **1** | Screw |
| **2** | Coolant PlugPlug refrigerante |
| **3** | Spring |
| **4** | Coolant Valve |

***Figure 4–10. Live-tooling TMM8i MDT16 Turret Coolant Valve assembly***

1. Remove the turret covers.
2. Remove the screw (**1**) at the top of the Coolant Valve assembly.
3. Remove the coolant plug (**2**) by inserting an M5 bolt and pulling the plug out.
4. Remove the coolant valve spring (**3**).
5. Remove the coolant valve (**4**) by inserting an M6 bolt and pulling the valve out.
6. Check the condition of the coolant valve O-ring seal.
   a. Thoroughly clean the coolant valve.
   b. Thoroughly clean the valve cavity inside the turret.
7. Replace the coolant valve if necessary.
8. Install the coolant valve.
9. Install the coolant plug.
10. Tighten the screw.
11. Install the turret covers.

## TMM10i MDT20 Turret

The coolant valve is located at the end of the coolant valve assembly. The coolant valve assembly is located inside the turret. Access the coolant valve assembly from the back of the turret by removing the coolant fitting.




| | |
|---|---|
| **1** | Banjo Fitting |
| **2** | Coolant Valve |

***Figure 4–11. Live-tooling TMM10i MDT20 Turret Coolant Valve assembly***

1. Remove the turret covers.
2. Remove the banjo fitting (**1**).
3. Remove the coolant valve assembly (**2**).
4. Check the condition of the coolant valve O-ring seal.
   a. Thoroughly clean the coolant valve.
   b. Thoroughly clean the valve cavity inside the turret.
5. Replace the coolant valve if necessary.
6. Install the banjo fitting.
7. Install the turret covers.

# TMX i-Series Turret Coolant Valve

❒ Every 3 Months or 500 hours of operation: Inspect and clean the TMX i-Series coolant valve located on the turret (lathes only, if equipped).

TMX i-Series machines are equipped with a turret that has a coolant valve. The coolant valve needs to be cleaned periodically.

Follow these steps to remove the coolant valve plug and clean the valve and spring:

1. Remove the set screw with a 3.0 mm hex key.
2. Thread a 5.0 mm SHCS into the plug.
3. Remove and clean the plug, removing any chips.
4. Thread a 4.0 mm SHCS into the cap and spring assembly.
5. Remove and clean the spring and cap, removing any chips.
6. Replace the P9 O-ring if damaged.
7. Remove the nozzle plug with an M8 bolt. Check the condition of the P9 O-ring and the nylon plug surface.
8. Reinstall the coolant plug, using the 8.0 mm bolt.
9. Replace the spring and cap, using the 4.0 mm SHCS threaded into the assembly.
10. Replace the set screw using a 3.0 mm hex key.

# Parts Catcher

## Adjust Parts Catcher Speed

You can adjust the speed that the turning center optional parts catcher moves up and down.

1. Remove the access door on the front of the turning center. The screws are on the inside of the machine.
2. Locate the two brass knobs. Each knob is connected to its own air line feeding pressure to it.
   - The knob on the top controls the speed for the upward movement.
   - The knob on the bottom controls the speed for the downward movement.
3. Turn the knob (top or bottom) clockwise to lower the speed and counterclockwise to increase the speed.
4. Observe the parts catcher in operation and make adjustments to the knob settings before reattaching the access door.

# Steady Rest

Some i-Series machines may be equipped with an optional Steady Rest device. The device supports long thin stock at its mid-point.

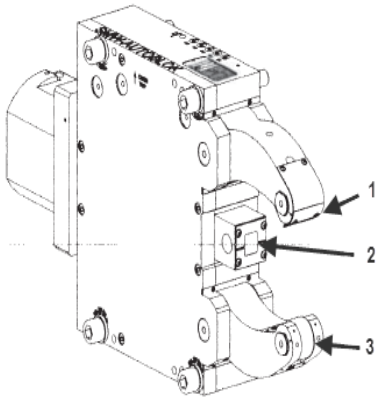
❒ Daily: Check Steady Rest lubrication points on the 2 rollers and the center arm (lathes only, if equipped).

❒ Monthly: If compressed air is used, remove the drain plug and open the Steady Rest drain (lathes only, if equipped).

Ensure that air can pass through. Replace the plug to close the drain.

❒ Annually: Disassemble and clean the Steady Rest (lathes only, if equipped).

❒ Annually: Check the Steady Rest safety valve (lathes only, if equipped).




| | |
|---|---|
| **1** | Roller (lubrication point 1) |
| **2** | Roller (lubrication point 2) |
| **3** | Roller (lubrication point 3) |

***Figure 4–12. Steady Rest Clamping mechanism***

# Steady Rest Autolube System

The Steady Rest lubrication system lubricates the optional Steady Rest mechanism for turning centers.

Fill the reservoir with a maximum 2 liters of HLP 46 - 68 DIN 51502 oil, filling between the high and low marks on the reservoir. The reservoir has a float switch.

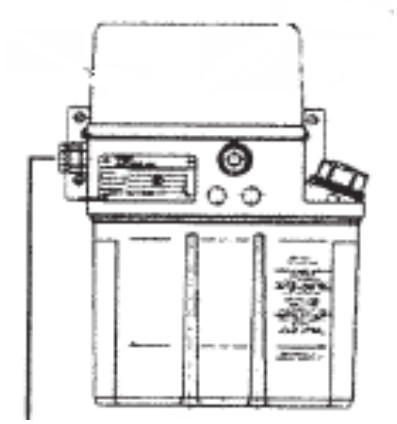


***Figure 4–13. Steady Rest Autolube system***

The Steady Rest Oil Lubricator air pressure is adjusted from 0.5 to 3 bar.

The Steady Rest Oil Lubricator cycles as follows:

- Once an hour when the Steady Rest is installed.
- Every 4 minutes when the Steady Rest is clamped and the spindle is running.
- Every 10 minutes when the Steady Rest is clamped and the spindle is not running.

# TROUBLESHOOTING

Failure conditions are evident during power up and operation. Failure detection and prevention descriptions follow.

⚠ Before testing live circuits or attempting any repairs to electrical connections, make sure that the power switch on the electrical cabinet is in the Off position. Follow all established safety practices. Remember that the power line from the source to the machine is live even though the machine tool is not receiving power.

## Power-Up Troubleshooting

If a problem occurs during power up, look for one of the following symptoms:

? 
- No messages appear on the console screen. The system may beep, but does not start up.
- Error messages appear during the initialization process before the Input screen appears.
- Error messages appear on the Input screen.

### No Response on the Console

If no messages appear on the text screen after switching the power on, make sure of the following:

? 
- Power supply cord inside the electrical cabinet is properly connected to the power source.
- Main fuses supplying power to the machine have not failed.

## Initialization Error Messages

After power has been switched on, initialization messages appear on the text screen.

Other possible messages during initialization may indicate missing or corrupted files. The usual solution for such problems is to restore or delete files. For help solving these problems, contact your local Hurco service representative.

⇨ Before calling a Hurco service representative for assistance, always switch off the control at the power button, wait a few minutes, and then power on again..

If an error message appears, write down the entire message before calling a Hurco service representative for assistance.

# Error Messages

If errors occur after power up, take careful note of any error messages on the screen. Note if the red beacon is on or flashing when the error occurs. Also, note if the control responds to any key, button, or touchscreen selection after the error occurs.

## Corrective Measures

One or more of the following corrective measures may be necessary:

### Check Wiring

Perform these checks:

- Trace the wiring as far as possible.
- Wiggle connectors and ensure they are properly seated.
- Test the connections with an ohmmeter.

### Perform a Reset

Technical assistance personnel may ask you to reset the machine. Switch the main power off and then back on. If possible, complete proper shutdown procedures.

## Emergency Stop Condition

Pressing the Emergency Stop button removes all servo power and power to the way lubrication pumps. A message on the screen indicates the Emergency Stop condition, and the red beacon lights up.

To restore machine power after an Emergency Stop condition:

1. Twist and lift the **Emergency Stop Button**.

   ⇨ There may be more than one Emergency Stop Button on your machine. Know the location of each one and release each.

2. Press these console keys in this order:
   a. Press the **Manual** console key.
   b. Press the **Power On** button. The Start Cycle button flashes.

      ⇨ The system begins processing information about the servos as soon as the button begins flashing. When this processing is complete, a prompt message appears on the screen for you to press the Start Cycle button.

   c. Press the **Start Cycle** button to enable the servos.

## Machine Diagnostics

The control detects the status of various machine components, such as the automatic tool changer or turret, and presents this information on Diagnostics screens. Refer to the WinMax Help for information about machine diagnostics.

# Common Problems

Common operator problems are listed below, with potential causes and solutions. These problems are usually noticeable without the help of error messages, although error messages may occur. More than one problem can result from a single cause.

Machine operation failures are a programming or a hardware problem. Hardware includes electronic components, wiring, and electro-mechanical devices.

## Power-on Self Test

When you turn on the machine, the control performs a self test. If an error in the control circuitry is detected, a pattern of beeps may sound instead of the normal start-up beep. A screen error message may appear—follow any on-screen instructions.

## Machine Voltages

Missing or faulty connections can cause a combination of problems, as listed below.

| Connections | Description |
|---|---|
| Missings | • Open grounds<br>• Open neutrals<br>• Open phase connections<br>• Missing neutral-to-ground strap at main source |
| Improper | • Phase and neutral reversed<br>• Phase and ground reversed<br>• Ground and neutral reversed<br>• Ground and neutral shorted at panel |
| Loose | • At main panels<br>• At equipment<br>• At other equipment in system<br>• At service entrance |

***Table 5–1. Troubleshooting: Missing or Faulty Connections***

Fluctuating voltages to the machine may occur when power usage in your region is high (typically on a very hot or cold day). See the following table.

| Causes | Problems | SolutionsSoluzioni |
|---|---|---|
| Power sag | Fuse blows | • Repair faulty in-plant wiring.<br>• Move any other machines on the circuit to separate circuits. |
| | Power is lost | |
| | Motor(s) overheat | |
| Power spike | Microprocessor and/or control PC boards fail | • Move any nearby high current switching devices (arc welders, inductive motors) away from the machine..<br>• Properly ground equipment.<br>• Install surge protection to insulate against lightning strikes. |
| | Machine stops and/or data is lost. | |

***Table 5–2. Troubleshooting: Power Fluctuation***

If a machine malfunction occurs, then consider the following issues:

- Is another machine that uses high current connected to the AC distribution power supply line?
- Is the ground impedance of the AC distribution power supply line sufficient?
- Are there fluctuations in the input voltage to the machine?
- Is there a source of “noise” nearby (crane, welder, etc.)?
- If other CNC or NC machines are connected to the same group of circuits, do any of those machines demonstrate similar problems?
- Was another machine operating at the same time the problem occurred?
- Does the problem occur mainly at a certain time of day?

⇨ Power surges can occur when large loads are suddenly placed on, or removed from, an electrical system.

# Coolant System

Refer to the tables below if a problem occurs with the coolant system.

| Problem | Cause | Solutionsoluzione |
|---|---|---|
| Coolant flows slowly or stops. | • Clogging due to dirty coolant.<br>• Pump is not working properly. | • Flush lines, clean filters, drain and refill the system with fresh coolant.<br>• Check and service the pump. For mist system, check shop air pressure. |
| No liquid (only air) comes from nozzle. | • Coolant tank is empty.Serbatoio liquido di raffreddamento è vuoto.<br>• Manual valve is off. | • Fill coolant tank with fresh coolant.<br>• Close off valve, then slowly open again to get desired flow. |
| Coolant fails to start. | • Coolant valve is not turned On.<br>• Coolant is not programmed to be On.<br>• Coolant pump not working. | • Turn on the valve (via the control).<br>• Check the operating mode (auto or manual) or programming.<br>• Check connector. |
| Coolant fails to stop when head is up to Z retract level. | • Incorrect program parameters. | • Check parameters and correct the setting. |

***Table 5–3. Troubleshooting: Coolant System***

# Washdown Coolant System, Machining Centers

Refer to the table below if a problem occurs with the washdown coolant system.

| Problem | Cause | Solution |
|---|---|---|
| Washdown coolant flows intermittently in machine enclosure. | Pulsating or Delay Washdown Enable is set to 1 and Alt Washdown Dwell is greater than 0. | Do not set Pulsating or Delay Washdown Enable to 1.<br>Set Pulsating or Washdown Enable to 0 for continuous washdown flow on right and left sides of machine enclosure.<br>• Set Pulsating or Washdown Enable to 2 and use Washdown Delay On/Off Timers to cycle washdown pump and pause coolant flow. |
| Washdown coolant flow does not pause for time in Alt Washdown Off Time. | Pulsating or Delay Enable is set to 1 and Alt Washdown Off Time is greater than 0. | Do not set Pulsating or Delay Washdown Enable to 1.<br>Set Pulsating or Washdown Enable to 2 and use Washdown Delay On/Off Timers to cycle washdown pump and pause coolant flow. |
| Washdown coolant flow does not alternate as programmed. | Pulsating or Delay Washdown Enable is set to 0. | Do not set Pulsating or Delay Washdown Enable to 0.<br>Set Pulsating or Washdown Enable to 1 and define alternate washdown coolant flow using Alt Washdown Dwell, Alt Dwell Lt Side, and Alt Washdown Off Time. |
| Washdown coolant does not flow. | Washdown On Delay Timer is set to 0. | Set Washdown On Delay Timer to define the time, in seconds, for washdown coolant to pump to the machining center. |
| Washdown coolant pump won't turn off. | Washdown Off Delay Timer is set to 0. | Set Washdown Off Delay Timer to define the time, in seconds, for washdown coolant to stop pumping to the machining center. |

***Table 5–4. Troubleshooting: Washdown Coolant System***

# Motion and Spindle Rotation

Refer to the appropriate table below if a problem occurs with the spindle unit.

| Belt-Driven Spindle | |
|---|---|
| **Causecausa** | **Solution** |
| Override pot is at 0. | Move spindle override pot above 0%. |
| Program might not have proper RPM setting. | Check the RPM setting in the program. If this setting is wrong, check and correct the entire program. |
| Spindle drive breaker is tripped. | Power down the machine, reset the breaker on the spindle amp, and turn on power. |
| Spindle will not rotate and error message displays. | Contact Hurco service representative for information. |

| Machining Centers Only | |
|---|---|
| **Cause** | **Solution** |
| For SK tool holders, tool is not released. | • The tool cone/cone is not greased/clean. |
| For HSK tool holders, coolant in the tool holder. | • The O-ring seal in the clamping taper of the collet chuck is damaged or broken.<br>• Replace the O-ring seal; check tool for burring and ensure correct fitting. |

| Motorized Spindle | |
|---|---|
| **Cause** | **Solution** |
| Motorized spindle does not start. | Motor phases may not be fully connected; verify that electrical connections are complete. |
| Motorized spindle overheats. | Chiller solution flow may not be sufficient; change the direction of the pump by swapping two of the three phase wires. |
| | Chiller solution temperature too high.<br>• Verify the safety system in the spindle chiller cabinet.<br>• Make sure spindle chiller thermostat is set at 30°C.<br>• Check coolant level of spindle chiller and add freon, if necessary. |
| | Bearings may overheat because lubricant level is too low.<br>• Make sure air and oil levels of spindle chiller are correct.<br>• Inspect chiller tubing and repair/replace damaged tubes. |
| | The machining center overloaded with work. Verify that the material removal efficiency (milling width x depth of cut x feed rate) for every kW of spindle power is lower than the following:<br>• aluminum: 60 $cm^3$/min<br>• steel: 20 $cm^3$/min |
| | Inspect bearings and replace any worn bearings. |
| Motorized spindle barely moves or stops. | • Check to make sure the tool post is properly inserted into the taper.<br>• Check the condition of the flexible tubing and repair or replace damaged tubing. |
| Coolant leaks from the rotary transmission unit inside the motorized spindle. | • Check the seal on the unit.<br>• If worn, replace the rotary transmission unit. |
| Oil level is half-filled on tilt mechanism gear box, but low oil error message appears when attempting to run a part program. | Reactivate the oil level switch check the oil level again.<br>1. Rotate the B-axis +90 degrees five times, then -90 degrees five times.<br>2. Remove the B-axis oil plug and add a small amount of oil. Refer to *Lubrication, on page 4 - 4* for oil type and amount.<br>3. If error message continues, repeat steps 1 and 2. |
| Tool post on motorized spindle does not release tool from ATC. | Check the system pressure to make sure incoming tool change plunger pressure is lower than system pressure. |

***Table 5–5. Troubleshooting: Spindle Unit***

| Cause | Solution |
|---|---|
| Chip buildup causes a Motion Error. | Look under chip covers for excessive chip buildup. Clean and maintain to avoid reoccurrence. |
| The X, Y and Z axes ballscrews are not well lubricated. | Check the lube oil level, lubrication to the way ballscrews, and lube pump operation. Correct as needed. |
| Servo cable connections are not making good contact. | Check each connector (by hand, visual check is not enough). Clean, press together and wiggle. Replace the connection if it is intermittent during wiggling. |
| Check servo for amplifier error LED On error message. | Note the location of lighted LED(s) and message text. Contact your Hurco distributor for technical assistance. |
| Parts not made to correct size. Servo encoder not working properly. | Verify axis machine motion matches the motion displayed on screen. Jog the axes while watching position numbers on the screen. |
| Actual collision or binding occurs between machine parts and product fixtures. | Examine the path, parts, and fixtures for evidence of collision or rubbing. |

***Table 5–6. Troubleshooting: Power Off Motion Error***

Refer to the table below if the machine chatters while machining or cutting.

| Cause | Solution |
|---|---|
| Machine feeds too fast. | Preview the program settings for Feed and Speed – reprogram if they are wrong.<br>Make sure that the actual speed matches the programmed speed. |
| Incorrect tool, tool is damaged, or tool is dull. | Make sure the right tool is being used for the application.<br>Make sure the tool shaft is clean and not bent.<br>Sharpen the tool or replace it. |
| Fixture is not rigid enough. | Inspect the fixture. Tighten or reinforce it if needed. |
| Work material is not held perfectly straight. | Inspect the spindle taper, chuck, or collet for foreign material. Clean if necessary.<br>Inspect the tool holder to see that the tool is inserted straight. Reinsert the tool if needed.<br>Check tool retention force on the draw bar. |

***Table 5–7. Troubleshooting: Machine Chatter***

Refer to the table below if small errors in dimensions show up occasionally.

| Cause | Solution |
|---|---|
| Temperature fluctuates as the part is machined. | Stabilize the temperature of the blank by providing enough coolant while machining. |

***Table 5–8. Troubleshooting: Errors in Dimensions***

## Environmental Conditions

Temperature and other environmental variables can cause problems that might otherwise be attributed to the machine.

When the electrical cabinet overheats, control power is disabled and a message appears on the screen until the cabinet temperature sensor registers a temperature drop to an acceptable level. If this error condition occurs, make certain the cabinet is not subject to an additional heat source, such as a space heater or bright sunlight from a nearby window.

| Problems | Causes | Solutions |
|---|---|---|
| Relatively small dimensional problems occur in the product. | Metal blanks stored in temperatures much higher or lower than the temperature of the machining area can expand or contract during and after machining. | Before machining, move the blanks to the machine area and allow the blanks time to reach ambient temperature. |
| Dust, debris, rust or discoloration accumulates on work surfaces. | Extreme temperatures are typically the problem, and/or the environment is too humid or too dusty. | Improve the machine environment. For example, close the machining area to outside dust and install air conditioning to lower room temperature and humidity levels. |

***Table 5–9. Troubleshooting: Environmental Factors***

# ORDERING REPLACEMENT PARTS

Hurco maintains a large inventory of service parts. You may order parts from Hurco by telephone, fax, mail, or from your local Hurco Distributor. Contact information is provided during the installation. In addition, Hurco subsidiary contact information are found on the Hurco Web site: **www.hurco.com.**

## Information Required for Parts Orders

For Hurco to process your order and supply you with the correct part(s), you must provide the detailed information described below:

- **Serial Number** index of the Hurco machine. The machine serial number is located on the identification/data plate, which is attached to the electrical cabinet door.
- Your company purchase order number.
- The part number, part name (description) and quantity desired. State where you found the part number. If you found it in a manual, include the manual part number, revision or date, and page the part was found on.
- Your company name and complete address.
- Name and telephone number of person ordering the parts.
- Indicate the condition of the machine (e.g., inoperable or functional).
- Provide the billing address to which invoices are to be mailed.
- Provide the shipping address, as well as any special shipping instructions, including mode of shipment, the department and person to ship to, and the delivery date requested.

# Returning Parts

You must contact Hurco to receive a Return Materials Authorization (RMA) number before returning a part. The RMA number must be written on the outside of the container used to ship the returned part.

⇨ Hurco will not accept parts shipped without an RMA number clearly displayed on the outside of the shipping container.

All parts are subject to inspection before credit is issued.

All defective parts replaced under warranty agreement must be returned within 30 days.

# RELEASE NOTES

**Maintenance and Safety Manual for i-Series Machines**

v573N December 2017

Revised by: H. Arle

Approved by: D. Skrzypczak

Updated Machine Standards chapter, including CE standards and Declaration of Conformity; updated Machine Components and Operation Requirements chapters.

v453EN August 2016

Revised by: K. Gross, H. Arle

Approved by: D. Skrzypczak

Updates to Machine Maintenance chapter (enclosure windows per SI 3956, chip conveyor per SI 3871, spindle chiller per SI 4186), Machine Components chapter (operator control console per CQ 35769), and Operation Requirements chapter (machine and production setup per CQ 33501).

v388EN March, 2015

Revised by: K. Gross

Approved by: D. Skrzypczak

Maintenance and safety information for all i-Series machines.
(Added turning centers to v382.)

v382EN January, 2015

Revised by: K. Gross

Approved by: D. Skrzypczak

Maintenance and safety information for all i-Series machining centers

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