HURCO®

MAINTENANCE AND SAFETY MANUAL

for VM Series Machining Centers

November 2012 704-0212-211 Revision A

The information in this document is subject to change without notice and does not represent a commitment on the part of Hurco Companies, Inc. (Hurco). The software described in this document is furnished under the License Agreement to customers. It is against the law to copy the software on any medium except as specifically allowed in the license agreement. The purchaser may make copies of the software for backup purposes. No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, for any purpose without the express written permission of the Hurco machine tool owner.

Hurco Manufacturing Company reserves the right to incorporate any modification or improvements in machines and machine specifications which it considers necessary, and does not assume any obligation to make any said changes in machines or equipment previously sold.

Hurco products and services are subject to Hurco's then current prices, terms, and conditions, which are subject to change without notice.

Patents: U.S. Patents B14,477,754; 5,453,933; Canadian Patent 1,102,434; Japanese Patents 1,649,006 and 1,375,124; other Patents pending.

Hurco Companies, Inc.
One Technology Way
P.O. Box 68180
Indianapolis, IN 46268-0180
Tel (317) 293-5309 (products)
(317) 298-2635 (service)
Fax (317) 328-2812 (service)

For Hurco subsidiary contact information, go to Hurco's Web site:
www.hurco.com

VM 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)

Weekly (Every 40 - 50 Hours)

Monthly (Every 150-200 Hours)

Every 3 Months (Every 500 Hours or as stated)

Every 6 Months (Every 1000 Hours or as stated)

Annually (Every 2000 Hours or as stated)

TABLE OF CONTENTS

LIST OF FIGURES

DOCUMENTATION CONVENTIONS

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

Additional information is available on the machine's Documentation CD.

Console Buttons and Keys

References to console buttons and keys appear in bold text throughout the documentation. For example, the Start Cycle button appears as the **Start Cycle** button and the Manual key appears as the **Manual** console key in text.

Refer to the *Getting Started with WinMax* manual for information about console buttons and keys, in addition to other information about using softkeys and the pop-up text entry window.

Icons

This manual may contain the following icons:

Caution/Warning

The operator may be injured and 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.

Table of Contents

To assist with onscreen PDF viewing, this icon is located on the cover page. Click the icon to access the Table of Contents (TOC).

You can also access many of the same TOC entries from the Adobe Reader bookmarks located on the left side of the PDF page.

MACHINE STANDARDS

This chapter describes machine standards for machines sold in Europe (CE). Machine standards for machines sold in the US comply with ANSI standards, also described in this chapter.

CE Requirements

The information in this section ascertains Hurco's compliance with the European Community's machine safety standards.

As defined in the Foreword of the "prEN 12417 Machine Tools—Safety—Machining Centers" document,"... This European standard has been prepared under a mandate given to CEN by the Commission of the European Communities and the Secretariat of the European Free Trade Association, and supports the essential safety requirements of the Machinery Directive to determine safety for new machining centres.

"This standard has been prepared to provide one means of conforming with the essential requirements of the Machinery Directive and associated EFTA regulations.

"It was prepared by CEN/TC 143/WG4 – 'Safety of Machining Centres' under the direction of CEN Technical Committee 143 'Safety of Machine Tools.'..."

European Directives and Standards

Hurco machining centers installed in Europe must conform to the directives and standards accepted by the European community. Consult local authorities for additional safety directives and standards that may apply in your country.

Directives

The Directives are listed on the Declaration of Conformity provided with each machine sold in Europe. Please refer to the sample that follows.

Harmonized Standards

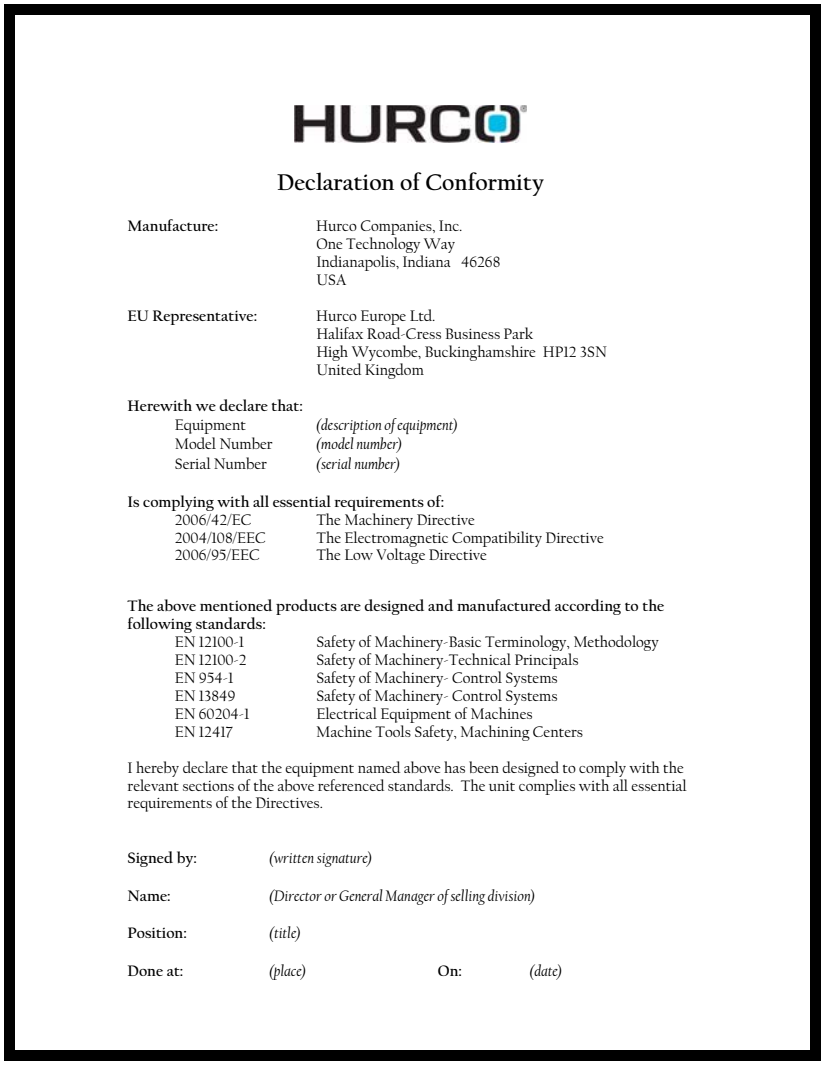
The Standards are listed on the Declaration of Conformity provided with each machine sold in Europe. Please refer to the sample that follows.

Other Standards

- BS5499 Part 5
- BS 5378 Part 1

Declaration of Conformity

Here is a sample Declaration of Conformity form:



HURCO

Declaration of Conformity

Manufacture: Hurco Companies, Inc.
One Technology Way
Indianapolis, Indiana 46268
USA

EU Representative: Hurco Europe Ltd.
Halifax Road-Cress Business Park
High Wycombe, Buckinghamshire HP12 3SN
United Kingdom

Herewith we declare that:

Equipment	*(description of equipment)*
Model Number	*(model number)*
Serial Number	*(serial number)*

Is complying with all essential requirements of:

2006/42/EC	The Machinery Directive
2004/108/EEC	The Electromagnetic Compatibility Directive
2006/95/EEC	The Low Voltage Directive

The above mentioned products are designed and manufactured according to the following standards:

EN 12100-1	Safety of Machinery-Basic Terminology, Methodology
EN 12100-2	Safety of Machinery-Technical Principals
EN 954-1	Safety of Machinery- Control Systems
EN 13849	Safety of Machinery- Control Systems
EN 60204-1	Electrical Equipment of Machines
EN 12417	Machine Tools Safety, Machining Centers

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced standards. The unit complies with all essential requirements of the Directives.

Signed by: *(written signature)*

Name: *(Director or General Manager of selling division)*

Position: *(title)*

Done at: *(place)* **On:** *(date)*

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 ANSI B11.23-2002 (R07), titled “Safety Requirements for Machining Centers and Automatic, Numerically Controlled Milling, Drilling and Boring Machines.”

MACHINE COMPONENTS

The following topics are covered in this chapter:

Overview

Before using the machine, you should become familiar with its components. Because of European Committee (CE) requirements, Hurco machines sold in Europe may differ from those sold elsewhere. The location of some components may differ on different models.

Hurco machines are available with several hardware and software options.

⇨ Information about options is available from Hurco or your Hurco full-service distributor.

Hurco machines use microprocessor-based, computer numerical control (CNC) digital control systems. Part programs are entered in either Conversational or Conventional NC (G-Code) format.

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

⇨ Specification measurements are supplied in metric and English.

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.

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

Refer to the *Parts Listing and Wiring Diagrams Manual* for mechanical and electrical component drawings for your machine.

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

Machine Model Names

The information in this manual applies to VM5, VM10 series (VM10, VM10G, VM10P, and VM10U), VM20, and VM30 machining centers.

Frame

The major structural assemblies of each machine are constructed of thick-walled, fine-grain cast iron. This construction provides strength and excellent dampening characteristics, keeping deflection and resistance at a minimum during machining.

Table

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

T-slot Specifications

T-slot specifications appear in these tables in metric and English measurements.

Machine	T-slots Width	T-slots Spacing on centers	Number of T-slots
VM5	18 mm	100 mm	3
VM10	18 mm	100 mm	3
VM10G	18 mm	100 mm	3
VM10P	18 mm	100 mm	3
VM10U	10 mm x 60° radial locations	NA	6
VM20	18 mm	100 mm	5
VM30	18 mm	100 mm	5

Table 2–1. VM Machine Table T-slot Specifications, Metric

Machine	T-slots Width	T-slots Spacing on centers	Number of T-slots
VM5	0.71 in	3.94 in	3
VM10	0.71 in	3.94 in	3
VM10G	0.71 in	3.94 in	3
VM10P	0.71 in	3.94 in	3
VM10U	0.39 in x 60° radial locations	NA	6
VM20	0.71 in	3.94 in	5
VM30	0.71 in	3.94 in	5

Table 2–2. VM Machine Table T-slot Specifications, English

Machine Table Specifications

The following tables list additional table specifications, in metric and English.

Machine	Floor to Table Surface	Working Surface	Load Capacity
VM5	825 mm	457 mm x 356 mm	227 kg
VM10	851 mm	762 mm x 406 mm	340 kg
VM10G	851 mm	762 mm x 356 mm	340 kg
VM10P	851 mm	762 mm x 406 mm	340 kg
VM10U largest part size	1076 mm	198 mm Diameter 320 mm Diameter x 254 mm	150 kg
VM20	910 mm	1168 mm x 508 mm	544 kg
VM30	910 mm	1321 mm x 508 mm	544 kg

Table 2–3. VM Machine Table Specifications, Metric

Machine	Floor to Table Surface	Working Surface	Load Capacity
VM5	32.5 in	18 in x 14 in	500 lb
VM10	33.5 in	30 in x 16 in	750 lbs
VM10G	33.5 in	30 in x 14 in	750 lbs
VM10P	33.5 in	30 in x 16 in	750 lbs
VM10U largest part size	42.4 in	7.8 in Diameter 12.6 in Diameter x 10 in	330 lbs
VM20	35.8 in	46 in x 20 in	1200 lbs
VM30	35.8 in	52 in x 20 in	1200 lbs

Table 2–4. VM Machine Table Specifications, English

Head

The cast iron head assembly is designed to produce superior cutting accuracy. Each machine has a vertical spindle and uses a motor brake for the Z axis.

Guideways

The axes guideways are precision linear rails.

Machine	Axis	Way Type
VM5	X, Y and Z (oil lubrication)	Linear, size 25 standard block
VM10 VM10G VM10P VM10U	X and Y Z (oil lubrication)	Linear, size 30 standard block Linear, size 35 standard block
VM20 VM30	X and Y Z (oil lubrication)	Linear, size 35 standard block Linear, size 45 standard block

Table 2–5. VMX Machine Guideways

Switches and Sensors

Limit switches, proximity switches, and electrical sensors monitor machine functions. These devices report their status to the control. If a malfunction is detected, a stop condition will shut off power to the servo systems and spindle.

Enclosure

A full chip enclosure is standard in every Hurco center.

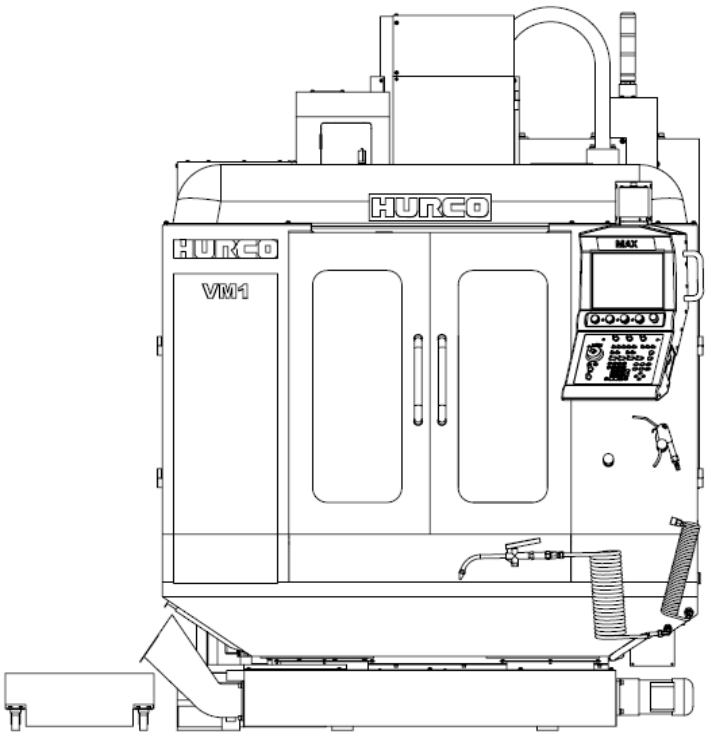


Figure 2–1. Full Chip and Coolant Enclosure

Standard features may include a flood coolant system with chip pan. An optional chip conveyor may be installed. An optional chip auger may be available for installation on some models. The VM10G is fully enclosed, and requires the use of a dust vacuum system.

Consult Hurco or your Hurco distributor for details about purchasing options.

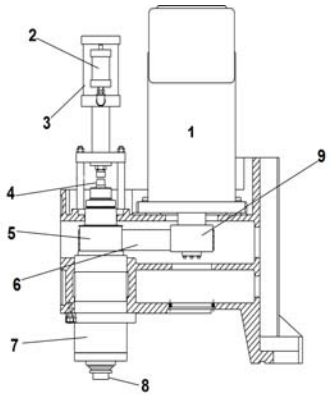
Spindle and Drive System

Hurco machines have a cartridge-type spindle. This spindle is precision-balanced, and made of high-grade alloy steel. The spindle shaft (inside the cartridge) is supported by ABEC-7 class angular contact bearings. The bearings are grease packed.

Belt-Driven Spindle

The 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 following figure illustrates 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	Spindle Tool Holder
9	Motor Pulley

Figure 2–2. Example of Belt-Driven Spindle and Drive

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.

Spindle Specifications

The following tables list additional machine spindle specifications, in metric and English measurements. Peak measurements are One Minute Rating.

Machine	Max RPM	Motor Power		Spindle Torque	
		Cont.	Peak	Cont. @ Base RPM	Peak @ Base RPM
VM5	8000	3.7 kW	7.5 kW	24.4 Nm @1450	48.8 Nm @ 1450
VM10	10000	7.5 kW	11.0 kW	49.1 Nm @ 1450	73.6 Nm @ 1450
VM10G	20000	6.0 kW	8.0 kW	2.4 Nm @ 20000	3.0 Nm @ 20000
	30000	6.0 kW	7.5 kW	2.7 Nm @20000	3.4 Nm @ 20000
VM10P	12000	3.7 kW	7.5 kW	23.7 Nm @ 1500	47.5 Nm @ 1500
VM10U	10000	5.5 kW	8.9 kW	35.3 Nm @ 1500	56.9 Nm @ 1500
VM20	10000	11.0 kW	15.0 kW	74.0 Nm @ 1450	102.0 Nm @ 1450
VM30	10000	11.0 kW	15.0 kW	74.0 Nm @ 1450	102.0 Nm @ 1450

Table 2–6. Spindle Drive System Specifications, Metric

Machine	Max RPM	Motor Power		Spindle Torque	
		Cont.	Peak	Cont. @ Base RPM	Peak @ Base RPM
VM5	8000	5.0 hp	10.0 hp	18.0 ft-lb @ 1450	36.0 ft-lb @ 1450
VM10	10000	10.0 hp	15.0 hp	36.0 ft-lb @ 1450	54.0 ft-lb @ 1450
VM10G	20000	8.0 hp	10.0 hp	1.75 ft-lb @ 20000	2.2 ft-lb @ 20000
	30000	8.0 hp	10.0 hp	1.75 ft-lb @ 20000	2.2 ft-lb @ 20000
VM10P	12000	5.0 hp	10.0 hp	17.5 ft-lb @ 1500	35.0 ft-lb @1500
VM10U	10000	7.4 hp	12.0 hp	26.0 ft-lb @ 1500	42.0 ft-lb @ 1500
VM20	10000	15.0 hp	20.0 hp	54.0 ft-lb @ 1450	75.0 ft-lb @ 1450
VM30	10000	15.0 hp	20.0 hp	54.0 ft-lb @ 1450	75.0 ft-lb @ 1450

Table 2–7. Spindle Drive System Specifications, English

VM10G Spindle

The VM10G is equipped with a motorized spindle that uses a spindle oil chiller to maintain the temperature of the spindle during machining operations. The motorized spindle on the VM10G machine rotates in a clockwise direction (while looking down on the spindle from above).

⇨ Because the spindle only rotates in a clockwise direction, do not use tap operations or counter-clockwise spindle direction for programs that will be run on a VM10G machining center.

VM10G Tool Holder

To ensure that the spindle operates correctly, the tool holder used in the VM1G ATC must be properly balanced.

Specification	20,000 RPM Spindle	30,000 RPM Spindle
Balance for Tool Holder	2.5G @ 30,000 RPM	2.5G @ 30,000 RPM

Table 2–8. Required Tool Holder Balance for VM10G Machine

⚠ 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.

The status of the tool holder is displayed in the Machine Diagnostics screen and is either Tool Clamp, Tool Unclamp, or Clamp No Tool.

- **Tool Clamp**—the tool is securely inserted in the tool holder and the spindle will operate.
- **Tool Unclamp**—there is no tool in the spindle. The spindle will only operate under Tool Unclamp status during a tool change. A tool does not have to be in the spindle during machine warm-up; however, the maximum speed at which the spindle can run without a tool is 5000 RPM.
- **Clamp No Tool**—the tool is not properly inserted in the spindle. The spindle will not operate under Clamp No Tool status during Manual Spindle On, Auto, or Manual machine modes.

⚠ A Clamp No Tool status error message indicates that the tool is not fully inserted in the tool holder and may fly out of the holder during machine operation.

These are the recommended settings for tool holder specifications that will provide optimal operation of a VM10G machine. Only a Hurco-certified Service Engineer can adjust tool holder specification settings.

Specification	Recommended Setting	
Draw Bar Stroke	4.5 mm	0.18 in
Maximum Clamping Force	3.5 kN	787 lb
Air Seal Pressure	33 psi (at 2.5 bar)	

Table 2–9. Recommended Tool Holder Specifications for VM10G

AC Spindle Drive Unit

The spindle drive unit contains closed-loop control and controls the spindle motor using an encoder. A microprocessor governs the closed-loop control, including monitoring.

The VM10G employs an open-loop control system that contains an Agree Signal for spindle speed monitoring.

The following messages are output at terminals via relay contacts:

- Ready/Fault
- Main Spindle Messages
- Heat Sink Temperature Monitoring
- Motor Over-temperature
- Orient Complete

Electronic Spindle Orientation

The standard spindle on a machining center uses electronic spindle orientation. The spindle is stopped at a fixed position through signals sent from an electronic encoder assembly attached to the top of the spindle motor shaft.

The VM10G machine does not use electronic spindle orientation.

Proximity Sensor Spindle Orientation

Hurco machining centers with the Coolant-thru Spindle (CTS) option use proximity sensor spindle orientation. This method of orientation uses a magnetic or proximity switch mounted on the spindle, and either a screw on the collar of the spindle shaft, or a slot on the spindle shaft as its target.

Spindle Motor

The belt-driven spindle motor and spindle are coupled using a no-slippage gear belt. The motor is fully enclosed, uses forced-air cooling, and has no brushes to inspect or replace.

To allow the machining of a variety of parts, the spindle RPM is specified in the part program. A manual spindle speed override on the control console permits fine-tuning of the spindle RPM for a specific machining cycle, without changing the part program.

Machine	Main Spindle Max RPM	Main Spindle Drive/Belt Ratio
VM5	8000	1:1
VM10	10000	1:1
VM10G	20000	NA
	30000	NA
VM10P	12000	1:1
VM10U	10000	1:1
VM20	10000	1:1
VM30	10000	1:1

Table 2–10. Spindle Drive/Belt Ratio

Axes Motion System

AC servo drive systems power the X, Y, and Z axes, as well as the A, B, and C axes, if equipped, in Hurco machining centers.

Axis Travel Dimensions

Machine axis travel dimensions appear in the tables below, in metric and English measurements. If NA is indicated, the axis is not available for the machine model.

Machine	Maximum Travel		
	X-axis	Y-axis	Z-axis
VM5	457 mm	356 mm	356 mm
VM10	660 mm	406 mm	508 mm
VM10G	660 mm	406 mm	508 mm
VM10P	660 mm	406 mm	508 mm
VM10U	533 mm	406 mm	483 mm
VM20	1016 mm	508 mm	508 mm
VM30	1270 mm	508 mm	508 mm

Table 2–11. Axis Maximum Travel, Metric

Machine	Maximum Travel		
	X-axis	Y-axis	Z-axis
VM5	18 in	14 in	14 in
VM10	26 in	16 in	20 in
VM10G	26 in	16 in	20 in
VM10P	26 in	16 in	20 in
VM10U	21 in	16 in	19 in
VM20	40 in	20 in	20 in
VM30	50 in	20 in	20 in

Table 2–12. Axis Maximum Travel, English

Rapid Traverse Rates

The following tables show rapid traverse rates, in metric and English, for the axes. The Spindle Max RPM values are listed in some tables to differentiate between machine types. Where NA is indicated, the axis is not available for the machine model.

Machine	Spindle Max RPM	Rapid Traverse X and Y Axes	Rapid Traverse Z Axis	Rotary Axis Rotation Speed
VM5	8000	19 m/min	19 m/min	NA
VM10	10000	24 m/min	24 m/min	NA
VM10G	20000 **30000	24 m/min	24 m/min	NA
VM10P	12000	30 m/min	24 m/min	NA
VM10U	10000	24 m/min	24 m/min	25 rpm
VM20	10000	24 m/min	24 m/min	NA
VM30	10000	24 m/min	24 m/min	NA

Table 2–13. Rapid Traverse Rates, Metric

Machines	Spindle Max RPM	Rapid Traverse X and Y Axes	Rapid Traverse Z Axis	Rotary Axis Rotation Speed
VM5	8000	750 ipm	750 ipm	NA
VM10	10000	945 ipm	945 ipm	NA
VM10G	20000 **30000	945 ipm	945 ipm	NA
VM10P	12000	1181 ipm	945 ipm	NA
VM10U	10000	945 ipm	945 ipm	25 RPM
VM20	10000	945 ipm	945 ipm	NA
VM30	10000	945 ipm	945 ipm	NA

Table 2–14. Rapid Traverse Rates, English

Servomotors

Axis velocity, position, and travel direction are controlled using AC servomotors along with the CNC control. These motors are enclosed, transistor-driven, and self-cooled. Because they are designed without brushes, the motors are free from flashover and commutation loss.

The servomotors power the ballscrews by belt drive on the X and Y axes, and by direct drive transmissions on the Z axis.

Ballscrews and Bearings

The precision ballscrews are the double ballnut type (the VM series machines have a single nut anchored on both ends of each ballscrew). The ballscrews are hardened and ground to minimize “drag torque” and reduce backlash.

The axes positioning drives are supported at the drive-ends by ABEC-7 class bearings.

Feedback Systems

Each drive has circuitry to detect conditions in the servo closed-loop system. Each axis motor is equipped with a rotary encoder that provides velocity and position feedback signals for each closed-loop system. These signals are required for motor control and accurate positioning.

Limit switches mounted on each axis are used to establish reference points for initial machine zeros and for determining end-of-travel.

Machine Electrical Cabinet

The electrical cabinet contains power circuitry and CNC electronics. The cabinet is attached to the machine column and connects to the machine systems via cable and harness assemblies. Power-related circuitry distributes power, while CNC-related electronics control machine operation (e.g., spindle speed and axis positioning).

The electrical control cabinet located at the back of the machine contains CNC-related electronics and power-related circuitry.

⇨ 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.

Safety Procedures for Electrical Service

Before removing or working on any printed circuit board (PCB), cables, fuses, breakers, or other machine 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.

Handling Printed Circuit Boards

The following procedures should be taken to prevent damage when removing PCBs, or when checking the boards for proper and secure connections.

Avoid flexing the PCBs. Rough handling can result in hairline cracks in the printed circuit etching. Problems caused by cracks in PC boards can be hard to isolate. Avoid touching the components on a PCB because they can be damaged by static electricity.

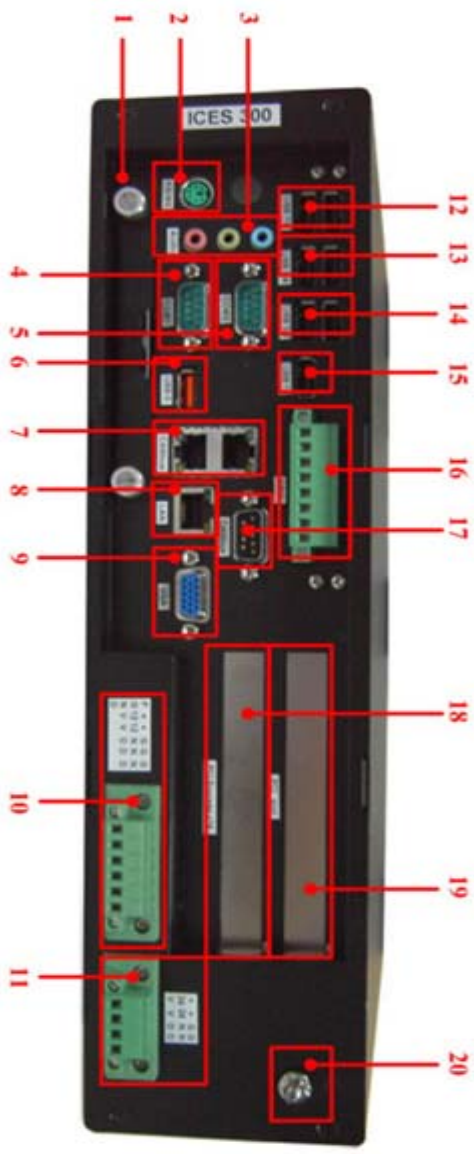
- Always put on a static-safe handling wrist strap before touching PCB assemblies inside the cabinets, and before removing replacement boards from their static protective packaging.
    - Visually inspect the wrist strap every time you put it on, making sure that the snap fasteners are properly connected.
    - Be sure the strap fits snug to the wrist. Taking off the wrist strap should be the last thing done when finished inside the cabinet.
- After the replacement PCB is properly mounted, place the defective PCB assembly into the static shielding and return it to Hurco.

Electrical Cabinet Layout

Electrical cabinet layout may vary depending upon the machine. See the *Parts Listing and Wiring Diagrams Manual* for your machine model.

Electrical Cabinet Components—Mini-ITX Hardware Platform

The following section describes the electrical components contained in the Mini-ITX hardware platform. Shown below is the Mini-ITX Card Rack:



1	SATA Hard Driver Drawer
2	PS/2 Mouse/Keyboard, 6-pin MiniDIN Connector
3	High Definition Audio Connector
4	COM 1 with DB-9 Connector
5	COM 2 with DB-9 Connector
6	High Retention USB 2.0 Port (USB-0)
7	CANbus Interface RJ-45 x 2
8	Gigabit Ethernet RJ-45
9	Analogue VGA with DB-15 Connector
10	12V Power Output with 6-pin Terminal Block (Pin Definition from Left to Right: FG/12V/12V/GND/GND/GND)
11	24V Power Input with 4-pin Terminal Block (Pin Definition from Left to Right: 24V/24V/GND/GND)
12	USB 2.0 Port x 2 (USB-6/7)
13	USB 2.0 Port x 2 (USB-4/5)
14	USB 2.0 Port x 2 (USB-2/3)
15	USB 2.0 Port x 2 (USB-1)
16	External GPIO Interface with 8-pin Terminal Block
17	CANbus Interface DSub-9 Pin Connector x 1
18	PCI Express x 16 Slot (Support PEG Interface Board)
19	PCI Slot for PCI ZMP or PCI STP Board
20	Frame Ground (FGND)

Figure 2–3. Mini-ITX Card Rack

Operating Temperature

The electronics inside the electrical cabinet are designed to tolerate ambient temperatures from 0º C (32º F) up to 50º C (122º F). Fans on some of the electronic assemblies and a heat exchanger on the cabinet door circulate warm air away from components. The cabinet contains a temperature sensor mounted on the Slice I/O unit for machines so equipped.

This sensor is preset to a temperature limit of 55º C (131º F). If the temperature exceeds the limit, the machine will post an error message for the operator.

Hurco machines that are not equipped with the air conditioning option may be operated in ambient temperatures to 35º C (95º F), and in relative humidity (non-condensing) up to 95%.

Control Transformer

The 500VA control transformer converts 230VAC to 200W fpr 115 VAC for the CNC power supply and 300W for 115 VAC for the field power supply. The AC outlet on the transformer powers all electrical components.

Power Supply

The Mini-ITX hardware platform uses 2 power supplies: CNC Power and Field Power.

CNC Power

Control power is converted from the 115VAC through a 24VDC, 240W power supply that goes to the terminal block via a cable. Multiple cables exit the terminal block:

- A cable connects from the terminal block into the bottom of the Slice 0 I/O.
- A cable connects from the terminal block to the Mini-ITX Card Rack.
- A cable connects from the terminal block to the RMB (Remote Motion Block).
- A cable connects from the terminal block to the console.

Field Power

Field power is isolated from the control and is converted from the 115VAC through a 24VDC, 120W power supply. The 24VDC runs though the MGND to the Bank Commons located in the Slice I/O and powers sensors and relays.

Card Rack Electronics

The Mini-ITX control is an embedded CNC and Slice I/O device used with the RMB to distribute power to the machine and console and to control machine operation. There is also a quick change SATA drive caddy.

In the upright position, installed in the electrical cabinet, the access panel is on the right-hand side of the case. Remove the 10 screws to open the case. Holes are available for screwdriver access to the PCI and PCIe cards inside the case.

Processor

The Mini-ITX CNC contains a COM Express CPU with a 2 GHz Core 2 duo processor and 2 GB DDR2 667 Mhz maximum system memory.

Digital Watchdog

The Mini-ITX digital watchdog is located on the card rack carrier board. The watchdog monitors the refresh or “heartbeat” of the host processor. The watchdog disables control power in the event the heartbeat should stop. If this occurs, the Main Slice I/O ES System Status LED illuminates to indicate an Embedded E-Stop: Host Watchdog Timeout condition.

PCIe Video Board

The PCIe video board is located on the front of the Mini-ITX card rack, next to the Motion board. The video card is a PCI Express x16 High Performance, Dual VGA. The PCIe board rests on a retainer inside the card rack. Access to the board is allowed through a screwdriver hole in the bottom of the card rack.

PCI Motion Board

The PCI motion board is located on the front of the Mini-ITX card rack, next to the Video board. Milling machines use the ZMP PCI motion board. The PCI board rests on a retainer inside the card rack.Access to the board is allowed through a screwdriver hole in the bottom of the card rack.

The motion control subsystem consists of two major component types: the ZMP motion processor and one or more Remote Motion Blocks (RMB). Each component is connected in a token ring network topology using shielded CAT5e cables terminated with RJ45 connectors (a.k.a. the SynqNet bus). The network complies with the 100Base-T physical standard, but uses a deterministic full-duplex protocol called SynqNet to communicate between the controller and its nodes. SynqNet is an open standard developed by Motion Engineering, Inc.

The ZMP motion processor is a PCI card with an intelligent DSP controller that accepts position/velocity/time commands from the CNC host computer, and sends velocity commands digitally via the SynqNet bus. The RMB then converts the digital velocity command to an analog voltage compatible with the servo drive velocity input. Conversely, the incremental position data from the axis encoders is decoded by the RMB, and transmitted as an absolute position to the SynqNet bus. The ZMP receives the position feedback and passes it to the host computer via PCI bus. The ZMP uses the same position feedback in its fine interpolation algorithm to determine its velocity command.

Each RMB supports four motors (command and feedback) and one encoder (feedback only). Hurco machines use a single RMB for a 3-axis (XYZ and S) configuration. An additional RMB is required for 4th-axis, 5th-axis, and dual loop linear scale configurations.

Slice I/O

The Slice I/O monitors machine sensors and controls electrical and electomechanical devices such as the Tool Changer. The device is mounted on the DIN rail, accommodating installation and servicing. The I/O devices and wiring terminals are merged into one unit for fewer connections, higher reliability, and a smaller footprint.

The standard configuration consists of a Main (Slice 0), a Slave (Slice 1) and another Slave (Slice 2). Each Slice component contains Diagnostic LEDs that indicate the status of all I/O points.

Main Slice

The Main Slice contains System Status LEDs, several Input and Output connections (see *Figure 2–4. Slice I/O, on page 2 - 19* for a list of each).

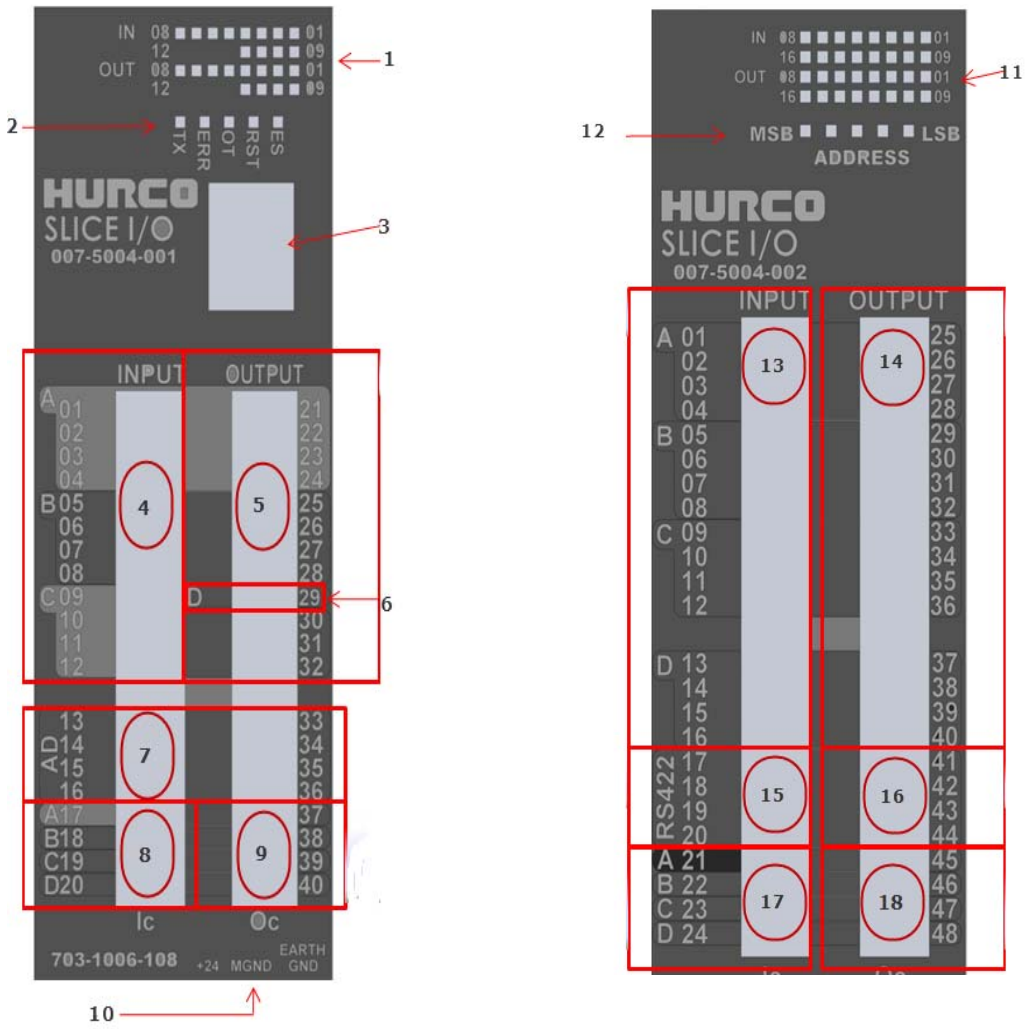
System Status LEDs on Slice 0 indicate the following when lit:

- **ES**—Embedded E Stop
- **RST**—System Reset
- **OT**—Over Temp
- **ERR**—CAN Communication Error
- **TX**—CAN Message

Slave Slice

The secondary Slice I/O devices have binary Slice Address LEDs. Each Slice I/O has a unique address. Most machines are equipped with Slice 0 I/O and 2 secondary Slice I/O (Slice 1 and Slice 2), expandable up to 17 slices (268 inputs and 268 outputs) (see *Figure 2–4. Slice I/O, on page 2 - 19* for a list of each).

The following figure identifies the components of the Slice 0 and Slice 1 I/O devices:



(Main) Slice 0	(Slave) Slice 1
1 I/0 Status LEDs	**11** I/0 Status LEDs
2 System Status LEDs	**12** Slice Address (binary)
3 RJ45 CAN	**13** 16 Inputs
4 12 Inputs	**14** 16 Outputs
5 12 Outputs	**15** (2) RS422 Inputs
6 OUT9 (COR)	**16** (2) RS422 Outputs
7 4 A/D Inputs	**17** Input Bank Commons
8 Input Bank Commons	**18** Output Bank Commons
9 Output Bank Commons	
10 Clean 24V Power In	

Figure 2–4. Slice I/O

COMM Panel

The Communication Panel is typically arranged with these ports:

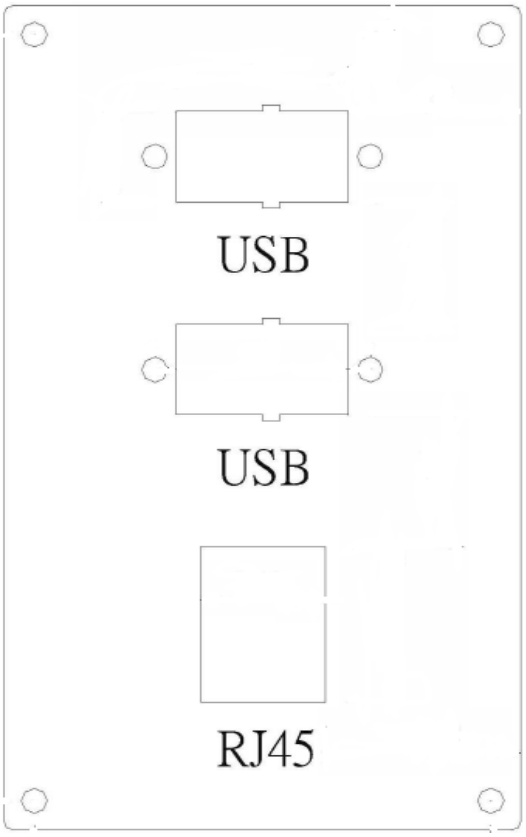


Figure 2–5. Communication Panel

USB Ports

The Comm panel has two USB (Universal Serial Bus) ports. The USB port is a high-speed port that allows you to connect devices, such as printers and jump drives to the panel. You can use a jump drive to transfer files.

Network Port

The 10/100Base-T (RJ45) connector is used with the UltiMonitor option. This option requires a Local Area Network (LAN or “network”) that supports the IEEE 802.3 Ethernet hardware standards. Contact your IT provider for guidance about proper LAN design and setup.

With UltiMonitor, you can communicate with other CNCs, and with PCs or file servers connected to your LAN using standard TCP/IP and FTP protocols. UltiMonitor also includes Extended Shop Floor (ESF) for remote machine monitoring and communication.

Control Systems

Circuit diagrams for electrical, hydraulic, and pneumatic systems are available in the *Parts Listings and Wiring Diagram Manual* for the machine.

Operator Control Console

VM10 and VM10U machines come with dual-screen or single-screen (Max) consoles; VM10G, VM10P, VM20, and VM30 machines come with Max consoles. Contact your full service distributor or Hurco for more information about console features.

The dual-screen console sits on a base-mounted pendant. Text is displayed on the left screen, and graphics are displayed on the right. A USB (Universal Serial Bus) drive is located on the right side of the console.

The Max console uses only one screen to alternately display text and graphics. It is mounted to an overhead pendant arm, which the operator can position. A USB (Universal Serial Bus) drive is located on the right side of the console.

For operating and programming information, refer to the on-screen Help or the manuals that are available in PDF format on the machine's hard drive.

A dual-screen console is pictured below:

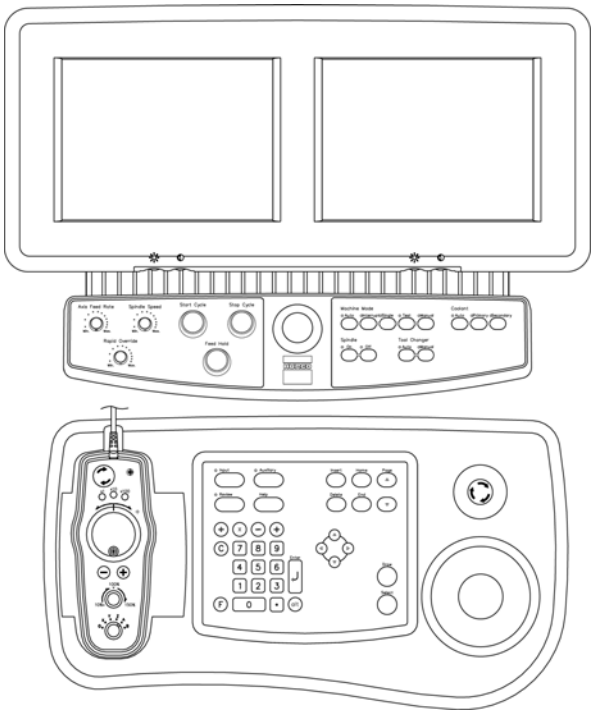


Figure 2–6. Dual-Screen Control Console

A Max console is pictured below:

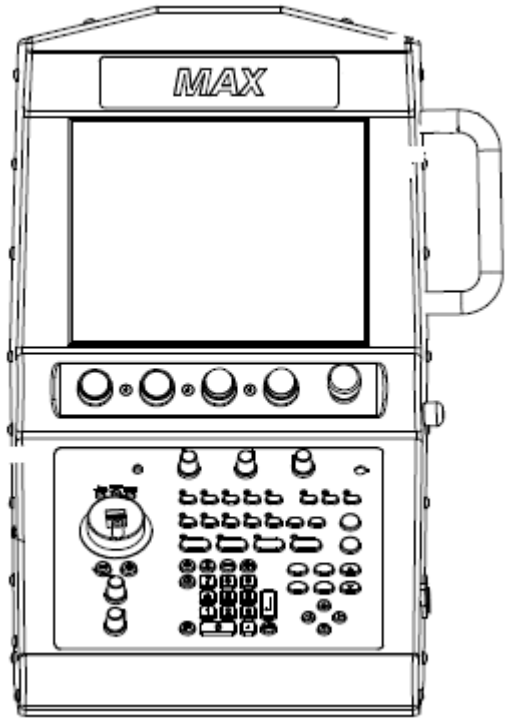


Figure 2–7. Max Control Console

Touchscreen and Touchscreen Controller

The touchscreen is a passive device consisting of a glass substrate and two layers of silver-ink screened polyester film separated by microscopic plastic spacers. The silver is thinly and precisely applied so that the silver ink has a consistent sheet resistance.

When the operator applies pressure to the outer polyester film, the silver ink planes contact each other, momentarily completing a pair of voltage dividers. During that brief period the touchscreen controller applies a DC voltage between the top and bottom bus bars on the front silver ink plane. The touchscreen controller then reads the voltage level from the rear plane to determine vertical position.

During the second half of the scan cycle, the controller applies a differential voltage horizontally across the rear plane, then reads its voltage or horizontal positions from the front layer. This scan cycle occurs several hundred times per second and screen coordinates are digitally filtered before they are transmitted via RS232 to the host CPU and driver software.

The 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.

Flat Panel Node

The Flat Panel Node (FPN) board communicates console I/O status to the host computer serially via CANbus. The following devices rely on the FPN to function:

- Program Entry Keyboard.
- Machine Function Keyboard.
- Console Keyboard LEDs.
- Control Panel—Pushbuttons, Lamps, Override dials, E-Stop Status.
- Console Jog Functions (Max console only)—Handwheel, Rapid Jog Feed Dial, Axis Selector, +/- Jog console keys, Store Position console key, LEDs.
- Floppy Drive—(if equipped) has a dedicated non-CANbus interface that resides on the FPN. Its SVDC power is sourced from the FPN.
- Remote Jog Unit (FPN provides a CANbus pass-through connection).

Display

The monitor assembly contains a 307.3 mm (12.1 in) LCD TFT module with 800x600 pixel resolution. In addition, a switching power supply and internal A/D board converts the incoming VGA signal to a digital signal compatible with the LCD module. The monitor is powered by DC voltage supplied from the Flat Panel Node. Dual-screen consoles have a brightness control knob under the plastic bezel. Brightness level is fixed on Max console systems.

USB Drive

A USB (Universal Serial Bus) port is located on the right-hand side of the console. It is connected to the main CPU via USB active extension cable in the Control Interface Harness.

Console Jog Unit

Standard Max consoles have a Console Jog Unit. Features include

- Store Position console key
- Manual Pulse Generator (MPG) x1, x10, and x100 rate selections.
- 100 position MPG Handwheel
- Rapid +/- console keys
- Rapid Feed control knob
- Axis selector switch

Remote Jog Unit

Standard dual-screen controls have a Remote Jog Unit that interfaces to the host computer via CANbus. It is powered by 12VDC via the Flat Panel Node. Features include

- Emergency Stop button
- Store Position console key
- Manual Pulse Generator (MPG) x1, x10, and x100 rate selections.
- 100 position MPG Handwheel
- Rapid +/- console keys
- Rapid Feed control knob
- Axis selector switch

The Remote Jog Unit may be equipped with an Enable button.

LCD Remote Jog Unit

The optional LCD Remote Jog Unit features include interfaces to the host computer via CANbus. It is powered by 12VDC via the Flat Panel Node. Features include:

- Motion Hold button
- Stop Cycle button
- Emergency Stop button
- Enable button
- Store Position key
- LCD screen with Mode Selector buttons
- Jog Hand Wheel
- Jog Feed Keys
- Manual Pulse Generator (MPG) x1, x10, and x100 rate selections
- Jog Feed Override
- Axis Select Switch

⇨ Please refer to the WinMax Mill Help for details about operating the Remote Jog Unit and the LCD Remote Jog Unit.

QWERTY Keyboard Port

A 6-pin mini-DIN female PS2 style keyboard connector is mounted to the rear of the dual-screen console. On the Max control the connector is located under the console. Each connects to the host computer via the Control Interface Harness in the pendant arm (or overarm). An optional external QWERTY keyboard with protective cover and mounting provision is available for each dual-screen and Max control. Information about options is available from Hurco or your Hurco full-service distributor.

If using a QWERTY keyboard, it must be connected prior to powering on the machine.

Coolant System

The flood coolant system pumps coolant to the tool in the spindle, cleans swarf from the cut, and protects the part and tool. A washdown spray gun is externally mounted on the machine to spray chips found inside the enclosure. The washdown spray gun may be an option on some machine models.

The system is self-contained. The operator can control the coolant system using console keys. See the *Machine Maintenance* chapter of this manual for more information on these systems, and on selecting coolant.

The VM10G requires the use of a spindle oil chilling system rather than the flood coolant system described here. Refer to the manufacturer's handbook for more information on the use and operation of the spindle oil chiller.

The following tables list coolant tank, pump, and wash down specifications, in metric and English measurements.

Machine	Tank Capacity	Flood Pump Rating
VM5	62 liter	60 liter/min
VM10	62 liter	60 liter/min
VM10P	62 liter	60 liter/min
VM10U	62 liter	60 liter/min
VM20	122 liter	60 liter/min
VM30	122 liter	60 liter/min

Table 2–15. Coolant Capacity and Pump Rating, Metric

Machine	Tank Capacity	Flood Pump Rating
VM5	16.3 gal	15.8 gal/min
VM10	16.3 gal	15.8 gal/min
VM10P	16.3 gal	15.8 gal/min
VM10U	16.3 gal	15.8 gal/min
VM20	32.0 gal	15.8 gal/min
VM30	32.0 gal	15.8 gal/min

Table 2–16. Coolant Capacity and Pump Rating, English

Pneumatic System

The pneumatic system regulates the air valves that supply compressed air to various machine systems, such as spindle blow out. Compressed air is also used in tool release and the ATC motion system.

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

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.

Incoming air pressure can be adjusted using the knob on top of the filter assembly. For information about maintaining the FRL Unit, refer to *Filter, Regulator, and Lubricator Unit, on page 4 - 21*.

VM10G Dust Collector

The dust collector vacuums graphite dust particles from the cutting area on the VM10G machine.

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.

These softkeys can be used to turn the dust collector on and off while servo power is on:

- **DUST COLLECTOR OFF** *F6*—turns off the motor, overriding the servo power condition that turns it on. This override is reset when servo power is turned off.
- **DUST COLLECTOR ON** *F5*—turns the motor on manually when servo power is on if it had been turned off. An error message appears if servo power is not on and this softkey is selected.

⇨ When the DUST COLLECTOR OFF softkey is selected in Auto Mode, the motor remains off while the remaining part of the program runs. When a new program starts, the dust collector turns on again.

Trunnion Table

A Trunnion table that allows four- and five-axis programming is standard equipment on VM10U machining centers. The maximum allowable diameter for a workpiece on the rotary axis (C-axis) is 610 mm (24 inches). The clamping system uses hydraulic pressure to regulate flow of oil to the system. The system's hydraulic pressure is set at 35 Bar during factory installation.

⚠ 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.

During the execution of a part program, the Trunnion table is capable of rotating 360° in the C-axis and tilting in the A-axis -30° to +110°. The table below lists the maximum allowable weight of a workpiece to be machined on the Trunnion table, distributed evenly on the table surface.

Trunnion Table Machine Model	Maximum Allowable Workpiece Weight
VM10U	150 kg

Table 2–17. Trunnion Table Maximum Allowable Workpiece Weight, Metric

Trunnion Table Machine Model	Maximum Allowable Workpiece Weight
VM10U	331 lbs

Table 2–18. Trunnion Table Maximum Allowable Workpiece Weight, English

⇨ Large or irregularly-shaped workpieces may become unbalanced during table rotation. You may need to reset the machining center's parameters, reduce the speed, acceleration, or deceleration of the machining center, or insert anti-tearing joints on the Trunnion table to ensure large or irregularly-shaped workpieces do not damage the machining center or rotary table.

Pneumatic Clamping System

The VM10U machining centers have a pneumatic system for operating the clamping system for the A and C axes. The clamping system uses pneumatic pressure to regulate the flow of air to the system. Refer to *Pneumatic System, on page 4 - 21* for details.

Automatic Tool Changer

Each VM machining center is equipped with a swing-arm random pocket Automatic Tool Changer (ATC). The tables below list tooling specifications in metric and English.

For information about the ATC and Machine Diagnostics, refer to the on-screen Help or the *Getting Started with Your WinMax Mill* PDF file that is available on the control's hard drive.

Machine	Taper	Number of Tool Pockets	Maximum Tool Diameter	Maximum Tool Diameter Adjacent Tool Pockets Empty	Maximum Tool Length	Maximum Tool Weight
VM5	40	16	89 mm	127 mm	200 mm	6.8 kg
VM10	40	20	89 mm	127 mm	250 mm	6.8 kg
VM10G	30	20	60 mm	100 mm	250 mm	5.0 kg
VM10P	30	20	66 mm	75 mm	250 mm	3.0 kg
VM10U	40	20	89 mm	127 mm	250 mm	6.8 kg
VM20	40	20	89 mm	127 mm	250 mm	6.8 kg
VM30	40	20	89 mm	127 mm	250 mm	6.8 kg

Table 2–19. ATC Tool Specifications, Metric

Machine	Taper	Number of Tool Pockets	Maximum Tool Diameter	Maximum Tool Diameter Adjacent Tool Pockets Empty	Maximum Tool Length	Maximum Tool Weight
VM5	40	16	3.5 in	5.0 in	7.9 in	15.5 lbs
VM10	40	20	3.5 in	5.0 in	9.8 in	15.5 lbs
VM10G	30	20	2.4 in	3.9 in	9.8 in	11.0 lbs
VM10P	30	20	2.6 in	3.0 in	9.8 in	6.6 lbs
VM10U	40	20	3.5 in	5.0 in	9.8 in	15.5 lbs
VM20	40	20	3.5 in	5.0 in	9.8 in	15.0 lbs
VM30	40	20	3.5 in	5.0 in	9.8 in	15.0 lbs

Table 2–20. ATC Tool Specifications, English

OPERATION REQUIREMENTS

This chapter contains the following requirements for operating the center.

Machine Installation

Inspect the machine to ensure that all parts are included and intact. The owner is responsible for proper site preparation before the machine is installed. A 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 electronic component failure.

If the owner decides later to move the machine from its installed location, it is recommended that the owner call Hurco for assistance.

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

Guarding System

Each machine has a self-contained guarding system. Enclosure doors are located on the front of each machine. Inspect the machine to ensure the guarding system is intact.

- The enclosure doors lock during Automatic Run Mode to prevent access to the moving parts of the machine.
- The side doors on each machine are either latched or secure.
- The enclosure doors are secured with an interlocking door switch.

Foundation Conditions

The foundation must be able to support the weight of the machine, and should be constructed of continuous concrete (reinforced concrete is best). The thickness and consistency of the concrete must be compatible with industry standards for supporting machine weight. Actual requirements will depend upon the physical properties of underlying soil. Friction pads or machine anchors may be required to assure optimal machine performance.

Electrical Service Requirements

Follow all requirements below to help ensure personnel safety and to prevent equipment damage.

Run electrical power to the machine location, with adequate length to reach the connections in the power cabinet. Final connections MUST be supervised by a Hurco-certified Service Engineer.

Connecting Electrical Service

Observe the following guidelines when connecting electrical service:

- On-site wiring must comply with all established directives and standards.
- Dedicated, grounded 3-phase AC power is required to prevent high and/or low voltages, spikes, surges, and high frequency noise caused by inductive loads.
- The AC power source must match the voltage specifications listed on the machine data plate.
- Failure to provide the required power parameters may affect machine safety, performance and warranty.
- Wiring to the machine must be capable of supplying continuous, full-load specified amperage.

Recommended Isolation Transformer Configuration

If a transformer other than the one provided with the machine is used, it must meet Hurco's machine operating voltage requirements. Use a Delta to balanced Wye configuration. Refer to the *Getting Started* manual for more information.

Grounding Equipment

The machine electrical and electronic control systems are interconnected, terminating at the Protective Earth (PE) or ground point.

- The ground point must be properly connected to the ground circuit of the AC power source. The ground point is located inside of the machine's power cabinet.
- The ground point provides only one conducting path between the machine and external ground, preventing an unwanted ground loop (ground differential voltage).

Compressed Air Requirements

For machines requiring compressed air, a continuous supply of clean and dry air is essential for proper machine operation, and must be connected to the machine as described here.

Compressed Air Specification

Compressed air must conform to the specification:

- 5 CFM at 80 - 100 psi; or
- 0.14 M^3/min at 6.0 - 8.0 bar.
- Air humidity: 2º C (35º F)

Connecting Compressed Air

The air supply line must meet these requirements:

- An NPT pipefitting must connect the air supply line to the machine.
- A regulator valve must be installed to control the air pressure into the machine.
- A factory-set pressure switch must be installed to shut off control voltages if the air pressure falls below the pre-set level.
- A minimum 1.27 cm diameter (1/2 inch, trade size) pipe, or an equivalent 1.99 cm (7/8 inch) diameter air hose supply line is required to provide adequate air volume.
- A drip leg should be installed in the line ahead of the filter/regulator assembly. The drip leg will help remove moisture accumulation in the supply, making the filter last longer.
- Quick coupler type fittings should not be used at the connection to the air filter/regulator, or within the supply line to the machine.

Anti-Vibration Mountings

Anti-vibration mountings, consisting of a spring-mounted ball bearing, are attached to each machine. Loose springs and balls are signs of excessive vibration.

Check the mountings before uncrating the machine to ensure that the machine has been handled properly prior to its arrival. Continue to inspect the mountings on a regular basis.

Initial Test and Examination

Follow the instructions below for performing the initial test and examination of the machine and its guarding system.

Arrange for a Hurco-certified Service Engineer to perform the final machine setup. Complete these procedures prior to the arrival of the Service Engineer:

1. Provide utilities to the machine.
2. Check all machine lubrication levels.
3. Place the flood coolant tank, tubing, and coolant pump motor near the machine base.

The Hurco-certified Service Engineer performs these tasks:

1. Inspects the machine level and makes required adjustments.
2. Checks and connects electrical service to the machine.
3. Installs the control console.
4. Measures voltages in the electrical cabinet and control enclosure and makes adjustments, if needed.
5. Installs the flood coolant tank, tubing, and coolant pump motor.

   Hurco is not responsible for failures of the motor encoder and cable assemblies resulting from abuse and direct spray of coolant.

6. Installs covers and enclosures.
7. Checks fans and pumps for proper operation.
8. Checks all axes for calibration and correct limit switch operation.
9. Tests the disk drive.

Proper Operation and Maintenance

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

Hurco machines are built to comply with the standards outlined in the Machine Standards chapter. Enclosure doors are located on the front of each machine.

Enclosure doors should always be closed when the machine is operating in Auto Mode.

Enclosure doors are provided to minimize the risks of ejection of the workpiece, machine components, tools or parts of them, swarf, chips, or coolant.

Enclosure doors are designed and constructed to withstand foreseeable impact energy, depending upon the diameter of the largest possible clamping device for the machine and its maximum speed.

If machining unbalanced workpieces, an ejection hazard is possible. Reduce this risk by counter balancing or machining at reduced speeds. Enclosure doors are intended to minimize the risks of ejection and not to eliminate them completely.

Setup

Follow these precautions during machine and production setup:

- Perform all setup work with the Emergency Stop engaged. Never put your hands near a part being machined.
- Clamp the fixtures and workpiece securely before starting the machine. Loose objects such as wrenches and chuck keys can become flying projectiles if not removed before starting the machine.
- 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.

Operation and Maintenance

- Know where 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. 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.

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.

Housekeeping

- 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 and dust, make certain the cutter is 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.

Machinery 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 may be 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. Please refer to *Operation Requirements, on page 3 - 11* for details about operation limitations with doors open.

- The spindle cannot operate unless all enclosure doors are closed, excluding doors that are fastened shut with bolts or screws.
- When the Limited Manual Operations are Enabled in the CE Diagnostics screen, the spindle can be run and the axes can be jogged with the enclosure door open at a limited RPM when the **Start Cycle** button is pressed and held down.
- Enclosure doors must be closed and locked during automatic operation, such as run program, warm-up cycle, calibration cycle, automatic tool changes, or probing.
- 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).
- After turning off control power, and after a deceleration delay of approximately 7 to 10 seconds, the spindle drive will be disabled.
- 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.

Pressing the **Emergency Stop** button will lock the enclosure doors.

Operation Requirements

Hurco machine tools are equipped with door interlocks to ensure the enclosure doors do not open during machining operations. Periodically check the safety circuits, especially after changing components. Basic mode operations are listed below.

Pressing the **Emergency Stop** button will lock the enclosure doors.

Manual Mode Operations, Enclosure Doors Open

- 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.
- Cannot begin an automatic tool change cycle.
- Cannot run a part program in Auto mode.

You may access the Auto (Conversational) screen and select the Run Part Program *F8* softkey. The **Start Cycle** button flashes. When you press **Start Cycle** at this point, a message appears: “Cannot Start Cycle with Guard Door open.” Press the OK screen button to continue. At this point, you can shut the door and press **Start Cycle** to run the program.

You may select the **Auto** console key and access Auto (Conversational) screen to perform Estimated Run Time or Check for Errors regardless of door status.

Limited Manual Operations Enabled, Enclosure Doors Open

The user may enable limited manual operations with the doors open to allow the spindle to run at a limited speed or to jog the axes at a limited feedrate. Refer to *Enabling Limited Manual Operations, on page 3 - 12* for directions. When Limited Manual Operations are Enabled in the CE Diagnostics screen,

- Cannot run spindle unless the **Start Cycle** button is pressed and held down to run the spindle at a limited speed of 500 RPM, or as otherwise specified by regulations.
  - If the **Enable** button is equipped, you must press and hold both the **Start Cycle** and **Enable** buttons to run the spindle at a limited speed of 500 RPM.
  - Spindle speed is limited so it will stop within 2 revolutions, including setting on Spindle Speed override dial.
- Can jog the axes using the “**+**” or “**-**” jog keys. The axes feedrate is limited to 2M/min (78.7 in/min), or as otherwise specified by regulations, including the setting of Axis Feed Rate override dial.

- If the **Enable** button is equipped, you must press and hold both the "**+**" or "**-**" jog key and the **Enable** button to jog the axes at the limited feedrate.

Enabling Limited Manual Operations

To enable Limited Manual Operations,

1. Press the **Manual** console key to access the Manual screen.
2. Select the Diagnostics softkey.
3. Select the CE Diagnostics softkey.
4. Select the Enter Access Code softkey. A prompt appears for entering the 4-digit Access code. For more information about the CE Diagnostics screen and the Access code, please refer to the WinMax Help.
5. Enter the numeric code using the console keypad. Asterisks (*) appear representing each entered digit.
6. The Limited Manual Operations field changes from Disabled to Enabled. The spindle can now be run at a limited RPM, or the axes can be jogged at a limited feedrate in Manual Mode with the enclosure doors open. The Limited Manual Operations must be enabled prior to each manual operation to be performed.

   ⇨ For more information about the CE Diagnostics screen, please refer to the WinMax Help.

Auto Mode Operations

- Doors must be closed to start a program and must remain closed while the program is running.
- Doors may be opened when the program is complete.
- Doors may be open for Check for Errors or Estimated Run Time.
- Doors can be opened at a Position Stop Block or M00/M01 command, but must be closed prior to pressing **Start Cycle** to resume the program.
- Select the **Interrupt** console key and the doors unlock after axis motion is completed.
  - In Interrupt mode, doors are allowed to be opened after all axes, spindle, and ATC operations are stopped. The doors must be closed prior to pressing the **Auto** console key then press the **Start Cycle** console key to resume 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.

Do not close enclosure doors while performing maintenance inside the machine enclosure.

Never perform maintenance inside the machine enclosure without someone else present.

If all safety circuits are intact, it is not possible to run an automatic operation while a person is in direct contact with any axis, spindle, the tool changer, chip conveyor or chip auger.

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.

   Pressing the **Emergency Stop** button will lock the enclosure doors.

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 from the floor, 1 meter from the machine's enclosure. The maximum ambient noise level reading taken for machines is 60 dB. The maximum reading for any Hurco machine will not exceed 85 dB.

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.

The following topics are covered in this section:

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 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).
- Jog each axis through its full travel, watching for smooth operation.
- 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 - 28* for more information.
- 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, or on the right side of the swing arm unit, depending on your model.
- Check and clean the tool lock pins.
- 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, 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 and check the rotary table oil level.
- Lubricate the spindle, and clean it with a lint-free cloth dipped in clean, light oil.

- 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 - 35*.

- 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 *Machine Warm-up, on page 4 - 32* for details about the warm-up procedure.

- For VM10G machines, 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 may be cleaned with a soft cloth dampened with water and a mild detergent.
- The control console exterior may be cleaned with a soft cloth moistened (not wet) with water and a mild detergent.
- The console screens may be wiped with a damp, soft, lint-free cloth.
- The machine enclosure should be thoroughly cleaned annually, or as needed.

USB Port

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

Heat Exchanger

❒ Weekly: Clean the filter inside the heat exchanger.

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 it.
3. Rinse the filter with clean water and dry it.
4. Reinstall the filter inside the heat exchanger.

Exterior Wiring

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

Lubrication

❒ Daily: Check and maintain all lubricant levels.

Keep the machine in good operating condition. Lubrication points and recommended lubricants appear in the table below. This list is not exhaustive. Lubricants that meet the same specifications as those listed below may be substituted. Local suppliers should be able to cross-reference recommended lubricants. Viscosity ranges are based on ambient temperatures.

Lube Point	Fill Level or Condition	Lubricant Type
ATC Oil Unit 30/40-Taper, 20-station VM Swing Arm ATC	Maintain reservoir at 1/3 full.	I.S.O. VG32
ATC Tool Changer Arm	Zerk fitting	NGLI1
ATC Tool Pot Slides	Manually grease with brush	NGLI 1
Autolube—Linear Ways and Ballscrews	Between High and Low marks on reservoir.	I.S.O. VG68 Include Rust Preventative
FRL Unit	Between high and low marks on the lubricator unit	I.S.O. VG 32
Hydraulic Oil System VM10U	Sight glass on remote hydraulic tank half full	Hydraulic oil I.S.O. VG46
Spindle Chiller, Water Based	250 BTU / 13 liters	12.35 liters drinking water 0.65 liters Motorex Coolant-F
	400 BTU / 35 liters	33.25 liters drinking water 1.75 liters Motorex Coolant-F
	750 BTU / 44 liters	41.80 liters drinking water 2.20 liters Motorex Coolant-F
Tool Release Cylinder	Maintain at 1/3 full, not to exceed half full.	I.S.O. VG68
Trunnion Table Rotary Axis (C-axis)	2.0 liters	I.S.O. VG150
Trunnion Table Tilt Axis (A-axis) (VM10U)	2.0 liters	I.S.O. VG150

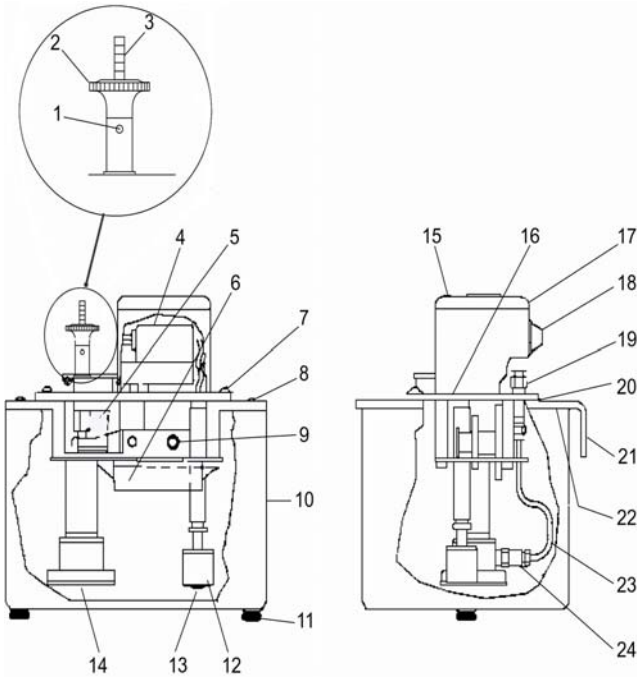
Table 4–1. Lubrication

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. Refer to *Adjust Autolube Discharge Rate, on page 4 - 7* for details. The way lube pressure should be set at 2.9 bar or 42 psi.

Machining centers use a digital timer Autolube system. 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 Autolube system is located on the back of the machine. Open the machine's rear access door to access the Autolube system.

Here is a diagram of a machining center Autolube system:



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. Autolube Pump and Tank Assembly

⇨ 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 can be 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.

Refer to *Table 4–1.Lubrication, on page 4 - 5* for more information.

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

Maintain Autolube Filler Filter Screen and 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. Refer to *Table 4–1.Lubrication, on page 4 - 5* for oil type.
3. Replace the oil filler cap.

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. Follow these steps 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.

Clean Autolube Tank and Suction Pump Filter

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

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. Refer to *Table 4–1.Lubrication, on page 4 - 5*.
14. Manually activate the system.

Activate Autolube System Manually

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

Follow these steps:

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

Automatic Tool Changer

The lubrication required depends upon the type of ATC. Refer to *Lubrication, on page 4 - 5* for a list of recommended lubricants. Please refer to *Automatic Tool Changer, on page 2 - 29* for information about each 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.

Maintain the Tool Changer Indexer Oil Level

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

Observe the oil level in the reservoir cup, located on the front of the tool changer (viewed from the front of the machine). The oil level should always be in the middle of the round sight glass.

If the oil level is low, add the recommended type. Refer to *Table 4–1.Lubrication, on page 4 - 5* for recommended lubricants.

Replace the Tool Changer Oil

❒ Annually or after 2000 hours: Replace the ATC oil.

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.

Grease the ATC Magazine Chain

❒ Every 6 Months or every 1000 hours: Grease the ATC magazine chain assembly

These machine models use ATC Magazine Chains: VM machines with 20-station ATCs, VMX machines with 24-station ATCs, and machines with 40-station ATCs and larger.

Use a brush to apply grease. Spread a light coating of grease over the chain assembly. Avoid grease build-up.

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.

❒ Every 6 months: Add grease to the Zerk fittings on the tool changer arm.

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.

⇨ The machine must be in a calibrated state.

ATC Magazine Type

1. Select the **MANUAL** console key.
2. Select the DIAGNOSTICS *F3* softkey.
3. Select the ATC DIAGNOSTCS *F7* softkey.

   ⇨ Softkey labels for this menu are machine specific. Please refer to the Getting Started with WinMax Mill Help, Programming Basics, Automatic Tool Changer, ATC and Machine Diagnostics section for more details.

4. Position the arm in the down position for cleaning and press the **Emergency Stop** button. To move the arm down,
   a. Select the More F7 softkey until the MOVE Z TO T/C HEIGHT *F6* softkey appears on the menu.
   b. Select the MOVE Z TO T/C HEIGHT *F6* softkey. The Start Cycle button flashes. Press the Start Cycle button to move Z to the tool change height.
   c. Select the ORIENT SPINDLE *F1* softkey. The Start Cycle button flashes. Press the Start Cycle button to orient the spindle.
   d. Select the TOOL HOLDER UP/DOWN *F2* softkey. The Start Cycle button flashes. Press the Start Cycle button to move the tool holder down.
   e. Select the EXCHANGE ARM 0°/ 60° *F3* softkey. The Start Cycle button flashes. Press the Start Cycle button to move the arm to 60°.
   f. Select the SPINDLE CLAMP/UNCLAMP *F4* softkey. The Start Cycle button flashes. Press the Start Cycle button to unclamp the spindle.
   g. Select the EXCHANGE ARM ROTATE *F5* softkey. The Start Cycle button flashes.

      ⇨ The following step will require the operator to act quickly. Read the entire step before executing any portion of it.

   h. Before pressing the Start Cycle button, prepare to press the Emergency Stop button with the other hand.
   i. Press the Start Cycle button. As soon as the arm is in the DOWN position, press the Emergency Stop button to prevent the arm from moving back up.

5. Use the air gun to remove chips or debris from the Tool Lock Pins and Tool Gripper Fingers. Use a lint-free cloth dipped in clean, light machine oil to clean the Tool Lock Pins and Tool Gripper Fingers.
6. Return the ATC to the Home position. Home is defined as ATC Door Closed (if equipped), Exchange Arm at 0°, Tool Holder at UP (or 0°), and Magazine in Pos #1.
    a. Release the Emergency Stop button.
    b. Press the Power On button.
    c. Press the Start Cycle button to energize the servos. The current screen will be the Manual screen. To return to the ATC Diagnostics screen, follow steps 1-3 at the beginning of this section.
    d. When the ATC Diagnostics screen is the current screen, select the EXHCHANGE ARM ROTATE *F5* softkey. The Start Cycle button flashes. Press the Start Cycle button to rotate and bring the arm to the UP position.
    e. Select the SPINDLE CLAMP/UNCLAMP *F4* softkey. The Start Cycle button flashes. Press the Start Cycle button to clamp the spindle.
    f. Select the EXCHANGE ARM 0°/ 60° *F3* softkey. The Start Cycle button flashes. Press the Start Cycle button to rotate the arm to 0°.
    g. Select the TOOL HOLDER UP/DOWN *F2* softkey. The Start Cycle button flashes. Press the Start Cycle button to raise the tool holder to the UP position.
    h. Select the EXIT F8 softkey to exit Diagnostics.
    i. Verify the TOOL IN SPINDLE & ATC MAP and correct if necessary.

Check and Clean the Tools

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

1. Open the enclosure maintenance door on the side of the machine to access the magazine.
2. Check the condition of the tools and clean them with a lint-free cloth dipped in clean light machine oil.

Check and Clean Tool Holders

❒ Weekly: Check each tool holder for damage.

Follow these steps to use the Hurco-recommended way to access tools:

1. Cycle the tool from the magazine into the spindle.
2. Remove the tool from the spindle.
3. Inspect tools and tool flanges for damage.
4. Clean tools and tool flanges with a lint-free cloth dipped in light machine oil.
5. Place the cleaned tool back into the spindle and return it to the magazine.

The following steps provide an alternative method to access the tool holders in the magazine when checking and cleaning tools:

1. Open the enclosure maintenance door on the side of the machine to access the magazine.
2. Remove all tools from the magazine.
3. Move the magazine and tool holder.
    - Use the magazine direction switch (located on the outside of the machine near the enclosure maintenance door) to move a tool holder along the magazine.
    - For large machining centers, use the rotate push button (located on the outside of the machine near the enclosure maintenance door) to move a tool holder along the magazine.
4. Check each tool holder for damage. Clean tool holders with a lightly oiled, lint-free cloth.
5. Inspect tools and tool flanges for damage.
6. Clean tools and tool flanges with a lint-free cloth dipped in light machine oil before replacing them in the magazine tool holders.

Spindle

Most Hurco machines come equipped with a non-motorized spindle.Air blows from the spindle taper hole 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.

❒ Daily: Lubricate the non-motorized spindle taper, and wipe it 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.

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.

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 Spindle Chiller Solution

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

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. Refer to *Table 4–1.Lubrication, on page 4 - 5* for appropriate lubrication. Do not overfill the tank.

Use a fully synthetic water miscible corrosion-protection concentrate for spindle cooling systems to protect against corrosion. The additive should not contain any glycols, which can be harmful to galvanized parts.

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 (if equipped) for dirt and damage.

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.

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. Refer to *Maintain Spindle Chiller Solution, on page 4 - 13*.
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. Refer to *Flush, Clean Tank, and Refill the Chiller Solution in the Spindle Chiller Tank, on page 4 - 14* for instructions.

Flush, Clean Tank, and Refill the Chiller Solution in the Spindle Chiller Tank

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

Follow these steps:

1. Gradually add the flushing agent solution per the flushing agent supplier's recommendations.
2. Leave machine power on to allow the solution to circulate through the chiller system for 24 hours.
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. Refer to *Table 4–1.Lubrication, on page 4 - 5* for appropriate lubricant amounts and types. Do not overfill tank.

Remove Air from Spindle Chiller Circulating System

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.

Repair Leaks in the Spindle Chiller

Leaky pipes can be 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 refrigerant our of the cooler unit according to the relevant regulations of environmental protection.

Operation Checklist

Before operating the spindle chiller,

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

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

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.

Refer to *Table 4–1.Lubrication, on page 4 - 5* for the amount and type of fluid recommendation.

Follow these safety precautions:

- Keep the spindle chiller in a safe area, free of dampness or moisture.
- Do no 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 Temperature Requirement

For all machining centers, the spindle chiller should be set for Differential 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. Refer to *Differential Temperature Mode, on page 4 - 16* for details.

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.

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.

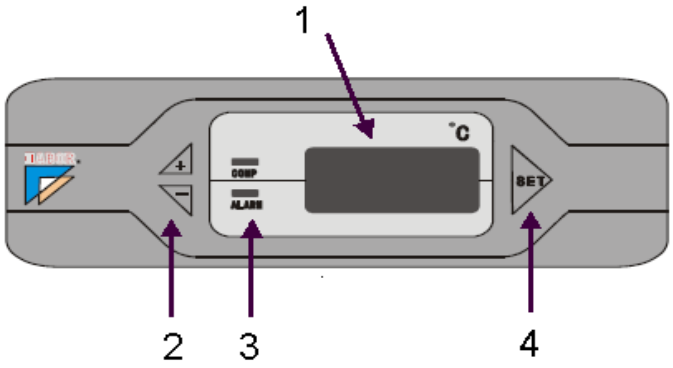
The following table shows the Differential Temperature cooling process as the liquid temperature changes:

	Differential at -2° C			
	No Cool	**Cool**	**No Cool**	**Cool**
Liquid Temperature	22° C	23° C	23° C	24° C
Ambient Air Temperature	25° C	25° C	26° C	26° C

Table 4–2. Differential Temperature Cooling process

Spindle Chiller Control Panel for Model HWK

Here is the control panel located on the HWK spindle chiller:



1	Display
2	+/- Function keys
3	LED Indicators
4	Set Function key

Figure 4–2. HWK Spindle Chiller Control Panel

The spindle chiller turns on when machine and control power is on. The spindle chiller displays 888 initially, then the current liquid temperature appears, and the system begins operation. A temperature sensor monitoring the ambient temperature is located on the left side of the control panel.

If an error occurs with the spindle chiller unit, a code may appear on the spindle chiller display. Please refer to the label on the front of the spindle chiller for troubleshooting information.

The control panel has 2 LED indicators.

- The **COMP** field displays a green light to indicate the Compressor is operating properly. The green light flashes to indicate the Compressor is in the delay phase.
- The **ALARM** field displays a red light to indicate there is an alarm. When the red light is off, there is no alarm and the unit is operating properly.

The control panel has 3 function keys.

- The **Plus** (**+**) and **Minus** (**-**) keys on the left side of the panel adjust the display value.
- The **Set** key on the right side of the panel accesses the chiller parameters.

Press the Plus (+) function key to display the room temperature.

Press the Minus (-) function key to display the liquid temperature.

Change the Liquid Temperature Setting

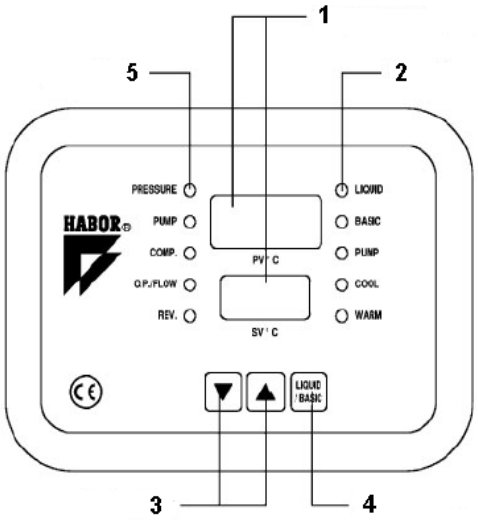
Press and hold the Set function key. The display shows 888 initially, then the Liquid Temperature Setting appears. To change this value, press Set again. Then press the Plus (+) or Minus (-) function key.

Hurco recommends setting the value for the Differential Liquid Temperature Setting parameter to **-2° C**. The default value is +10° C.

To save changes, press and hold the Set function key after making a change. The spindle chiller reverts to the temperature display mode if no further instructions are given within 30 seconds.

Spindle Chiller Control Panel for Model HWT

Here is the control panel located on the spindle chiller:



1	Temperature Display
2	Operation Lamps
3	Temperature Setting Buttons
4	Liquid/Basic Temperature Display Switch
5	Alarm Message Indicators

Figure 4–3. HWT Spindle Chiller Control Panel

The spindle chiller turns on when machine power is On. The spindle chiller displays show dashes followed by the temperatures, and the system operation begins. The objects on the control panel are defined as follows:

- **Temperature Display**—displays temperature information in LED screens:
  - **PV°C**—displays the current temperature of the liquid or ambient air temperature.
    - Select the **Liquid / Basic** button on the spindle chiller control panel until the **Basic** Operation Lamp lights to display the ambient air temperature.
    - Select the **Liquid / Basic** button on the spindle chiller control panel until the **Liquid** Operation Lamp lights to display the liquid temperature.
  - **SV°C**—displays the differential temperature between ambient air and liquid, the temperature at which the liquid cooling occurs.

- **Operation Lamps**—lights indicate operation:
  - **Liquid**—indicates liquid temperature is being displayed in PV°C Temperature Display.
  - **Basic**—indicates ambient air temperature is being displayed in PV°C Temperature Display.
  - **Pump**—indicates the pump is operating.
  - **Cool**—indicates the cooling process is operating.
  - **Warm**—indicates the heater is operating.
- **Temperature Setting Buttons**—sets the SV°C temperature setting up or down.

  ⇨ Press the up or down button for at least 0.5 seconds to change the value.

- **Liquid/Basic Temperature Display Switch**—changes the PV°C display from the liquid temperature to the ambient air temperature when pressed. The default display is the liquid temperature.
- **Alarm Message Indicator**—indicates errors if they occur by illuminating the appropriate light and showing a message in the Temperature Display screens. If an error occurs, the spindle chiller operation stops. Refer to the label on the front of the spindle chiller for more information about alarm messages.

  When no lights are illuminated, the spindle chiller is operating properly.

  - **Pressure**—lights when a pressure fault within the refrigeration system occurs.
  - **Pump**—lights when a fault within the pump trips the overload protector.
  - **Comp.**—lights when a fault within the compressor trips the overload protector.
  - **O.P./Flow**—lights when a liquid pressure fault occurs or when there is an insufficient amount of liquid within the liquid circulating system.
  - **Rev.**—lights when the power phase input is reversed.

Setting the SV°C Temperature

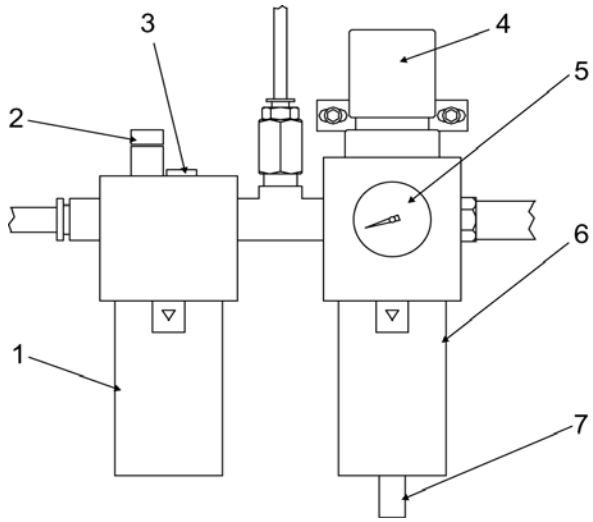
To set the SV°C temperature, press the **Up** or **Down** arrows on the spindle chiller control panel for at least 0.5 seconds for each press. Hurco recommends keeping the SV°C set at -2° C for Differential Temperature control.

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.

Filter, Regulator, and Lubricator Unit

⇨ The air supply requirement for the machine is a continuous 5 CFM of clean, dry compressed air at 80-100 psi (0.14 M^3/min at 6.0 to 8.0 bar), and dewpoint at 1.67° C (35° F).



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

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

Set Air Pressure

❒ Daily: Check the FRL 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.

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. Refer to *Table 4–1.Lubrication, on page 4 - 5* for oil type.

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

Adjust Drip Rate Screw

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.

❒ Every 3 Months or every 500 hours: 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.

❒ Every 3 Months: Drain moisture from the lines of 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.

Flood Coolant and Washdown System

The flood coolant system pumps coolant to the tool in the spindle.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.

Selecting Coolant

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

- Suitable for the workpiece material and machining operation.
- Soluble in water.
- 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.
- Adequate rust protection.
- Anti-foam, anti-bacterial, and anti-fungal agents.
- No skin irritation when prepared to manufacturer specifications.
- Penetrating lubrication oil should float on the surface of the coolant (instead of dissolving in the coolant).
- No 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.

Preparing Coolant

Follow these guidelines when preparing coolant:

- Mix the coolant according to manufacturer 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, find the level indicator on the coolant tank and proceed as follows:

1. 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.

❒ Every 3 Months or every 500 hours: Replace coolant and coolant filters.

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.

Coolant Filter for CTS

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

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

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.

To access the CTS coolant filter:

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

Chip Conveyor

The chip conveyor is optional with some models. The chip conveyor runs along the machine base.

Chip Conveyor Tank and Screens

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

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

Chips that are not flushed out of the machine collect in the chip conveyor tank.

To clean the tank:

1. Attach a hose to the plug located in the front of the chip conveyor tank to drain the contaminated coolant.
2. Pull the tank forward and remove any remaining chips from the tank with a soft brush.
3. Remove the two chip screens from the coolant tank.
4. Rinse the screens and dry, before replacing them.

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.

Dust Collector—VM10G

The dust collector vacuums graphite dust particles from the cutting area on the VM10G machine.

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

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.

⇨ Please refer to the dust collector manufacturer's *Installation and Operation Manual* for procedures for replacing filters.

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 zeroes.

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. Position the X and Y axes at their furthest negative location.
2. Open the enclosure maintenance door on the side of the machining center.
   - The X limit switches and both dogs are located on the machine base.
   - The Y limit switches and dogs are located on the column base.
3. The negative dog for the Z axis is visible when the head is fully retracted. Remove the left overarm cover to access the Z limit switch and positive dog.
4. Check the tightness of limit switch and dog fasteners.

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.

Place a precision level (resolution 0.0005 in/ft.) parallel and perpendicular to the work table surface.

Enclosure Windows

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

Polycarbonate Panels which are used as viewing window of machines are subject to significant deterioration in its impact resistance due to the action of metal working fluids and other lubricants. The degradation process depends on the amount and type of fluids and can lead to a loss of approximately 10% of panel's impact resistance per year. It is the operator's responsibility to ensure that the control measures for ejections of work pieces and/or chuck jaw are sufficient for the hazard and that the control measures are in proportion to the risk.

Hurco recommends that the user contact your Hurco representative for application of safety film or replacement glass periodically to ensure the proper corrective action is taken.

Trunnion Table

A Trunnion table is standard equipment on VM10U machining centers. During the execution of a part program, the Trunnion table is capable of rotating 360° in the C-axis and tilting in the A-axis -30° to +110°.

⚠ 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.

Inspect the Clamping System Pneumatic Lines

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

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.

Maintain the Clamping System's Oil Level

❒ Weekly or every 40 hours of operation: Check the oil level for the clamping system (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. See *Lubrication, on page 4 - 5* for recommended oil types.
4. Close the ATC access door.

Oil Drip Rate for 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.

Clean the Trunnion Table

❒ Daily, after every shift, or every 8 hours of Trunnion operation: Clean the Trunnion table (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 may become lodged underneath and cause damage to the Trunnion table.

Rotary-Axis Maintenance

The rotary-axis (i.e., C-axis) on the Trunnion table can be 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.

Maintain the Rotary-Axis Oil Level

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

Follow these steps:

1. Move the rotary-axis to 0° (i.e., the table is in the horizontal 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.
3. 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). See *Lubrication, on page 4 - 5* for recommended oil types.

Replace the Rotary-Axis Oil

❒ Annually or after 2000 hours of operation: Replace the rotary-axis oil (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. See *Lubrication, on page 4 - 5* for recommended oil types.
7. Close the oil fill plug.

Tilt-Axis Maintenance

The tilt-axis (i.e., A-axis) on the Trunnion table can be 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.

Maintain the Tilt-Axis Oil Level

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

Follow these steps:

1. Remove the machine's inspection plate on the right side of the machining center.
1. 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).
2. 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. See *Lubrication, on page 4 - 5* for recommended oil types.
3. Replace the machine's inspection plate.

Replace the Tilt-Axis Oil

❒ Annually or after 2000 hours of operation: Replace the tilt-axis oil (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. See *Lubrication, on page 4 - 5* for recommended oil types.
7. Close the oil fill plug.
8. Replace the machine's inspection plate.

Machine Warm-up

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

The warm-up cycle takes less than 16 minutes to complete, depending on the maximum spindle speed of your machine. A 30,000 RPM spindle takes around 30 minutes to complete the warm-up cycle.

Control power must be on and the axes must be calibrated before the machine can be warmed up. During warm up the spindle speed is incrementally increased and maintained for a specified time until the maximum RPM is reached.

Warm-up Procedures

The table below shows the order of spindle speed and run time intervals necessary for spindle warm-up.

6000 Max RPM Spindle	
Warm-up Speed (RPM)	Machine Warm-up Run Time
1. 1500	2 min
2. 3000	2 min
3. 4500	2 min
4. 6000	2 min

Table 4–3. 6000 Max RPM Spindle Warm-up

8000 Max RPM Spindle	
Warm-up Speed (RPM)	Machine Warm-up Run Time
1. 1000	2 min
2. 3000	2 min
3. 5000	2 min
4. 7000	2 min
5. 8000	2 min

Table 4–4. 8000 Max RPM Spindle Warm-up

10000 Max RPM Spindle	
Warm-up Speed (RPM)	Machine Warm-up Run Time
1. 1000	2 min
2. 3000	2 min
3. 5000	2 min
4. 6000	2 min
5. 7000	2 min
6. 9000	2 min
7. 10000	2 min

Table 4–5. 10000 Max RPM Spindle Warm-up

12000 Max RPM Spindle	
Warm-up Speed (RPM)	Machine Warm-up Run Time
1. 1000	2 min
2. 3000	2 min
3. 5000	2 min
4. 6000	2 min
5. 7000	2 min
6. 9000	2 min
7. 11000	2 min
8. 12000	2 min

Table 4–6. 12000 Max RPM Spindle Warm-up

15000 Max RPM Spindle	
Warm-up Speed (RPM)	Machine Warm-up Run Time
1. 1000	2 min
2. 3000	2 min
3. 5000	2 min
4. 7000	2 min
5. 9000	2 min
6. 11000	2 min
7. 13000	2 min
8. 15000	2 min

Table 4–7. 15000 Max RPM Spindle Warm-up

18000 Max RPM Spindle	
Warm-up Speed (RPM)	Machine Warm-up Run Time
1. 1000	2 min
2. 3000	2 min
3. 5000	2 min
4. 7000	2 min
5. 9000	2 min
6. 11000	2 min
7. 13000	2 min
8. 15000	2 min
9. 18000	2 min

Table 4–8. 18000 Max RPM Spindle Warm-up

20000 Max RPM Spindle	
Warm-up Speed (RPM)	Machine Warm-up Run Time
1. 5000	5 min
2. 10000	5 min
3. 15000	5 min
4. 20000	5 min

Table 4–9. 20000 Max RPM Spindle Warm-up

30000 Max RPM Spindle	
Warm-up Speed (RPM)	Machine Warm-up Run Time
1. 5000	5 min
2. 10000	5 min
3. 15000	5 min
4. 20000	5 min
5. 25000	5 min
6. 30000	5 min

Table 4–10. 30000 Max RPM Spindle Warm-up

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 55º C (130º F) once the maximum RPM is achieved.
3. If spindle flange temperature does not exceed 55º C (130º F) at any time during the spindle run-in procedure, then the warm-up procedure is complete.
4. If spindle flange temperature exceeds 55º C (130º F) 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 55º C (130º F).

6000 Max RPM Spindle	
Run-in or Cycle Speed (RPM)	Spindle Run-in Run Time
1. 1500	15 min
2. 3000	15 min
3. 4500	30 min
4. 6000	60 min

Table 4–11. 600 Max RPM Spindle Run-in or Cycle

8000 Max RPM Spindle	
Run-in or Cycle Speed (RPM)	Spindle Run-in Run Time
1. 1500	15 min
2. 3000	15 min
3. 4500	15 min
4. 6000	15 min
5. 7500	30 min
6. 8000	60 min

Table 4–12. 8000 Max RPM Spindle Run-in or Cycle

10000 Max RPM Spindle	
Run-in or Cycle Speed (RPM)	Spindle Run-in Run Time
1. 1500	15 min
2. 3000	15 min
3. 4500	15 min
4. 6000	15 min
5. 7500	15 min
6. 9000	30 min
7. 10000	60 min

Table 4–13. 10000 Max RPM Spindle Run-in or Cycle

12000 Max RPM Spindle	
Run-in or Cycle Speed (RPM)	Spindle Run-in Run Time
1. 1500	15 min
2. 3000	15 min
3. 4500	15 min
4. 6000	15 min
5. 7500	15 min
6. 9000	15 min
7. 10000	15 min
8. 11000	30 min
9. 12000	60 min

Table 4–14. 12000 Max RPM Spindle Run-in or Cycle

15000 Max RPM Spindle	
Run-in or Cycle Speed (RPM)	Spindle Run-in Run Time
1. 1500	15 min
2. 3000	15 min
3. 4500	15 min
4. 6000	15 min
5. 7500	15 min
6. 9000	15 min
7. 10500	15 min
8. 12000	15 min
9. 13500	30 min
10. 15000	60 min

Table 4–15. 15000 Max RPM Spindle Run-in or Cycle

18000 Max RPM Spindle	
Run-in or Cycle Speed (RPM)	Spindle Run-in Run Time
1. 4500	5 min
2. 0	5 min
3. 9000	5 min
4. 0	5 min
5. 18000	15 min

Table 4–16. 18000 Max RPM Spindle Run-in or Cycle

20000 Max RPM Spindle	
Run-in or Cycle Speed (RPM)	Spindle Run-in Run Time
1. 5000	12 min
2. 10000	12 min
3. 15000	12 min
4. 20000	12 min

Table 4–17. 20000 Max RPM Spindle Run-in or Cycle

30000 Max RPM Spindle	
Run-in or Cycle Speed (RPM)	Spindle Run-in Run Time
1. 5000	12 min
2. 10000	12 min
3. 15000	12 min
4. 20000	12 min
5. 25000	12 min
6. 30000	12 min

Table 4–18. 30000 Max RPM Spindle Run-in or Cycle

While performing the spindle run-in, monitor the temperature at the spindle flange, upper bearing, and lower bearing to ensure it is below 55º C (130º F).

If the temperature at the spindle flange, upper bearing, or lower bearing exceeds 55º C (130º F) at any time during the spindle run-in, stop the spindle immediately.

Allow the spindle to cool to room temperature before restarting the spindle run-in process at the speed last achieved prior to the temperature spike.

Troubleshooting

Failure conditions can be 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 may be 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.
- Power switch on the computer and rack inside the electrical cabinet is in the On position.

Initialization Error Messages

After power has been switched on, initialization messages appear on the text screen. Errors indicated by the following error messages below can be easily remedied.

“Non-system disk detected. Press any key.”	There is a diskette in the floppy drive (if equipped). Remove the diskette and turn the power off and then back on.
“Security device is invalid or has failed.”	The software security device has been removed, is broken, or is not properly connected. Switch off the control and remove the security device. If the device is damaged, replace it. Reconnect the device and switch on the power.

Other possible messages during initialization usually 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.
- Unplug and reseat circuit boards; sometimes connectors become tarnished and do not conduct well. If the contact points on a printed circuit board (PCB) are dull looking, polish them with a rubber eraser.

Perform a Reset

Technical assistance personnel may ask you to reset a circuit board or the machine.

- To reset a PCB, press the board reset button, if present.
- To reset the machine, switch the main power off and then back on.

Swap Out a Printed Circuit Board

If the PCB is bad or has an intermittent problem, or the connector on the board is not making sufficient contact, then take the PCB out, clean the contacts with a rubber eraser, and reinstall it, taking care to reseat it firmly. If the error is not corrected, remove the board and replace it with a fresh PCB.

⚠ Turn off machine power before checking the circuit boards.
DO NOT perform any circuit board work with the power on.

⚠ Be sure to wear a static-sensitive strap (grounded to the electrical cabinet) before handling any PCB.

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.

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

Machine Diagnostics

The control detects the status of various machine components and presents this information on the ATC & Machine Diagnostics screen.

To reach the ATC & Machine Diagnostics screen, follow these steps:

1. Press the Machine Mode **Manual** console key.
2. Select the **DIAGNOSTICS** *F3* softkey.
3. Select the **MACHINE DIAGNOSTICS** *F6* softkey.

If an error condition is displayed, follow these steps:

1. Follow the instructions on the MACHINE DIAGNOSTICS screen.
2. Once the error status is corrected, exit the MACHINE DIAGNOSTICS screen.
3. Restart and calibrate the machine.

Please refer to the Machine Diagnostics information in the WinMax Mill On-screen Help for more details about machine and ATC diagnostics for your machining center.

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 can be 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
Missing	• Open grounds • Open neutrals • Open phase connections • Missing neutral-to-ground strap at main source
Improper	• Phase and neutral reversed • Phase and ground reversed • Ground and neutral reversed • Ground and neutral shorted at panel
Loose	• At main panels • At equipment • At other equipment in system • At service entrance

Table 4–19. 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	Solutions
Power sag	Fuse blows Power is lost Motor(s) overheat	• Repair faulty in-plant wiring. • Move any other machines on the circuit to separate circuits.
Power spike	Microprocessor and/or control PC boards fail Machine stops and/or data is lost.	• Move any nearby high current switching devices (arc welders, inductive motors) away from the machine. • Properly ground equipment. • Install surge protection to insulate against lightning strikes.

Table 4–20. 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 table below if a problem occurs with the coolant system.

Problem	Cause	Solution
Coolant flows slowly or stops.	• Clogging due to dirty coolant. • Pump is not working properly.	• Flush lines, clean filters, drain and refill the system with fresh coolant. • Check and service the pump. For mist system, check shop air pressure.
Coolant fails to start.	• Coolant is not programmed to be On. • Coolant pump not working.	• Check the operating mode (auto or manual) or programming. • Check connector.

Table 4–21. Troubleshooting: Coolant System

Motion and Spindle Rotation

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

Cause	Solution
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.

Table 4–22. Troubleshooting: Spindle Unit

Machining

Refer to the table below if the machine control power is Off and the screen shows a Motion Error message.

Cause	Solution
Chip buildup causes a Motion Error.	Look under chip covers for excessive chip buildup. Clean and maintain to avoid reoccurrence.
The X 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 4–23. 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. 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. Make sure the tool shaft is clean and not bent. 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 for foreign material. Clean if necessary. Inspect the tool holder to see that the tool is inserted straight. Reinsert the tool if needed. Check tool retention force on the draw bar.

Table 4–24. 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 4–25. 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 4–26. 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 can be 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.

RECORD OF CHANGES

704-0212-211, November 2012, ECN 17365

Revised by: K.Gross

Approved by: D.Skrzypczak, November 2012

Changes
Updated the Lubrication Table Trunnion Table Rotary Axis and Tilt Axis Lubricant type from ISO VG220 to ISO VG150. Updated the Oil Drip Rate for C-Axis Clamp/Unclamp.

704-0212-210, September 2012, ECN 17365

Revised by: K.Gross

Approved by: D.Skrzypczak, September 2012

Changes
Added Machine Standards chapter. Removed references to CE Safety Manual, Machine Standards chapter from Operation Requirements chapter. Updated Machine Installation, Guarding System section of Operation Requirements chapter. Updated Proper Operation and Maintenance, Enclosure Doors and Guarding section of Operation Requirements chapter. Removed ISA Hardware Platform information. Added information about greasing ATC Zerk fitting to Lubrication and Tool Gripper Fingers sections. Revised with updated logo and Hurco Brand Standards.

704-0212-209, February 2012, ECN 17280

Revised by: K.Gross

Approved by: P.Baechle, J.Bryan, J.Higgason, W.Kline, D.Skrzypczak, January 2012

Changes

704-0212-209 Rev B:
Added information for VM5 per technical specifications:

- VM5: 757-4002-605, Rev B

704-0212-209 Rev A:
Added information for VM5 per technical specifications:

- VM0: 757-4002-605, Rev A

Updated VM10 series, VM20, and VM30 machines per revised technical specifications:

- VM10: 757-4002-425, Rev H
- VM10: 757-4002-356, Rev H
- VM10P: 757-4002-497, Rev G
- VM10U: 757-4002-507, Rev D
- VM20: 757-4002-426, Rev G
- VM30: 757-4002-427, Rev F

Added “Inspect the Clamping System Pneumatic Lines” section to the Trunnion Table section in the Maintenance chapter. This information applies to the VM10U. Removed the “Maintain the Hydraulic Pressure of the Clamping System” section of the VM Maintenance chapter.

Removed information for VM1, VM1G, VM1P, VM2, and VM3.

Removed information for Floppy Disk Drive on console. Replaced with USB port.

704-0212-208, November 2010, ECN 17135

Revised by: K.Gross

Approved by: D. Skrzypczak, November 2010

Changes

- Updated Machine Electrical Cabinet and Operator Control Console sections of Machine Components chapter with USB drive on console.
- Updated Safety Circuits section of Operation Requirements chapter for CE2009.
- Expanded Spindle Chiller section in Maintenance chapter.
- Expanded Tool Lock Pin and Tool Gripper Fingers section in Maintenance chapter.
- Added Chip Conveyor Paddle Screws and Chains section in Maintenance chapter.
- Added Enclosure Window section in Maintenance chapter.

704-0212-207, March 2009, ECN 16535

Revised by: K.Gross

Approved by: P. Baechle, D. Skrzypczak, March 2009

Changes

- Revised table information for VM10 series, VM20, and VM30 per revised technical specifications:

  VM10 757-4002-425, Rev E
  VM10G 757-4002-356, Rev G
  VM10P 757-4002-497, Rev E
  VM20 757-4002-426, Rev E
  VM30 757-4002-427, Rev E

704-0212-206, October 2008, ECN 16541

Revised by: K.Gross

Approved by: P. Baechle, F.Gross, D. Ornelas, D. Skrzypczak, October 2008

Changes

- Added information for VM10 series, VM20, and VM30 per technical specifications:

  VM10 757-4002-425, Rev D
  VM10G 757-4002-356, Rev F
  VM10P 757-4002-497, Rev D
  VM10U 757-4002-507, Rev A
  VM20 757-4002-426, Rev D
  VM30 757-4002-427, Rev D

704-0212-205, February 2008, ECN 16402

Revised by: K.Gross

Approved by: P. Baechle, F.Gross, D. Ornelas, D. Skrzypczak, February 2008

Changes

- Added information for VM1P per technical specifications:

  VM1P—757-4002-497, Rev B

- Added operation instructions for VM1G Dust Collector.
- Added ATC and Machine Diagnostics, I/O Maps, and Machine Parameters sections.
- Added Spindle Warm-up and Spindle Run-in sections. Revised for Rev B.

704-0212-204, August 2007, ECN 16292

Revised by: M. Baechle

Approved by: P. Baechle, D. Ornelas, and S. Kays, July 2007
D. Skrzypczak, August 2007

Changes

- Updated information for VM1, VM2, and VM3, per technical specifications:

  VM1—757-4002-425, Rev B

  VM2—757-4002-426, Rev B

  VM3—757-4002-427, Rev B

704-0212-203, 06/29/05, ECN 15925

Revised by: L. Hart

Approved by: P. Baechle, D. Ornelas, D. Skrzypczak, July 2005

Changes

- Updated VM1 and VM2 information per technical specifications:

  VM1—757-4002-313, Rev C

  VM2—757-4002-338, Rev C

- Added VM3 and VM1G information per technical specifications:

  VM3—757-4002-357, Rev B

  VM1G—757-4002-356, Rev C

INDEX

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W