

TYPHOON[®]HSM

HIGH SPEED MACHINING SPINDLE TJS-HPC

OPERATION MANUAL



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This device has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio and television reception.

However, there is no guarantee that interference will not occur in a particular installation. If this device does cause such interference, which can be verified by turning the device off and on, the user is encouraged to eliminate the interference by one or more of the following measures:

- Re-orient or re-locate the receiving antenna.
- Increase the distance between the device and the receiver.
- Connect the device to an outlet on a circuit different from the one that supplies power to the receiver.
- Consult the dealer or an experienced radio/TV technician.



WARNING!

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with FCC Rules Part 15

Operation is subject to two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference that may be received or that may cause undesired operation.

To comply with FCC Section 1.310 for human exposure to radio frequency electromagnetic fields, implement the following instructions: A distance of at least 20 cm between the equipment and all persons should be maintained during the operation of the equipment.



⚠ Read the Manual

Safety of the operator is a main concern. This equipment is as safe as we are able to make it. Avoid accidents by reading the safety alerts, investing a few seconds of thought and a careful approach to handling equipment. You, the operator, can avoid many accidents by observing the following precautions.

Review the safety instructions of the manufacturer, supplier, owner, and all organizations responsible for the prevention of accidents.

⚠ Ensure the Following

- The work area and the area around the CNC machine are free of obstacles.
- The work area is properly lit.
- This equipment is operated only by a responsible adult trained in this operation.
- This equipment is not operated by a person under the influence of drugs or alcohol.
- This equipment is not operated by a person with any illness or physical condition that might reduce reflexes or awareness and increase exposure to risk.
- Before starting any kind of work, install all of the safety devices prescribed by the builder of the machine or power tool.

⚠ Warning

- Rotating Tools: Entanglement Hazard

To avoid risks associated with the use of rotating tools it is strongly recommended to use the utmost caution and concentration when working.

⚠ Warning

- Risk of cuts or other serious injuries during tool change.
 - Do not change the tool in a rotating or moving state.
 - Always wear appropriate protective equipment (such as protective gloves, safety glasses, etc.) during the change of cutting tools to avoid cuts caused by cutting edges.

⚠ Warning

- Always use safety glasses or protective screens to protect your eyes.
- Only install tools in perfect condition that are recommended for the material to be worked and that are suitable for the type of machine used.
- Do not use cracked or deformed tools.
- Check that the balancing, keying and centering of rotary tools are carried out correctly
- Secure the tool correctly using the proper tightening and adjustment devices. Remove all tightening and adjustment devices before use.
- Check that the tool rotates in the correct direction.
- Never exceed the limits of a piece of machinery.
- **If its ability to do a job or to do so safely is in question - DON'T TRY IT.**

Statement of Conformity

The HSM HPC Spindle meets the following standards:

European Standards (CE)

- EMC: EN 301489-1/17
- Radio: EN 300328 V 1.8.1
- Safety: EN 61010-1:2010

American Standards (UL)

- EMC: FCC Part 15 B
- Radio: FCC Part 15 C
- Safety: UL 61010-1

International Standards

- Safety: IEC 61010-1:2010

Introduction

The HSM HPC Spindle is a unique High Pressure Coolant (HPC), High Speed Machining (HSM) spindle. It is driven by the CNC machine spindle's coolant-through-flow, and can handle operating pressure up to 70 bar (7Mpa).

The HSM HPC Spindle does not require any special installation, aside from mounting onto the machine spindle. It operates as any other standard tool holder in the tool magazine or ATC.

The HSM HPC Spindle case includes:



Fig. 1. Spindle case contents

- Nut ER11 GHS
- Wrench ER11 SMS
- Shaft Lock Flat Key
- Allen key - Hexagonal 2.0 mm
- Battery - Lithium metal non-rechargeable, CR2 type

The wireless RPM display case includes:



Fig. 2. Display case contents

- TSD - wireless RPM display
- AC/DC 5V power supply

Actual size and types of accessories may vary due to configuration and manufacturing process

For USA/Japan:
Included EU to US/Japan AC adapter plug



Fig. 3. Shaft lock flat key and wrench

1.5 Main Features

The HSM HPC Spindle system uses the machine's existing coolant or cutting fluid supply as a pressurized energy source (40 to 70 bars), rotating the spindle turbine in the range up to 45000 RPMs.

The spindle features a compact, robust, patented design, engineered for operation with high pressure coolant pumps. Max power output 1.5 Kw up to 45000 RPMs*. It is ideal for finishing / semi-finishing applications using small diameter cutting tools.

** RPMs are based on pressure coolant stability and flow rate. The obtained RPMs depend on the output efficiency which is influenced by the inducted coolant pressure, fluid density and flow rate.*

1.5.1 Wireless Rotation Speed Display - Overview

The HSM HPC Spindle is equipped with an integrated wireless display system, allowing real-time monitoring of the rotation speed during machining. The spindle housing is fitted with a wireless transmitter that sends RPM data to the display unit (receiver) mounted outside of the machine.

The receiver is powered by a 5V DC universal AC/DC power adapter connected to either a 220V AC or 110V AC power source. The transmitter is powered by a non-rechargeable CR2 lithium battery.



Fig. 5. HSM HPC Spindle wireless transmitter and display

Display Information

Wireless RPM display main view

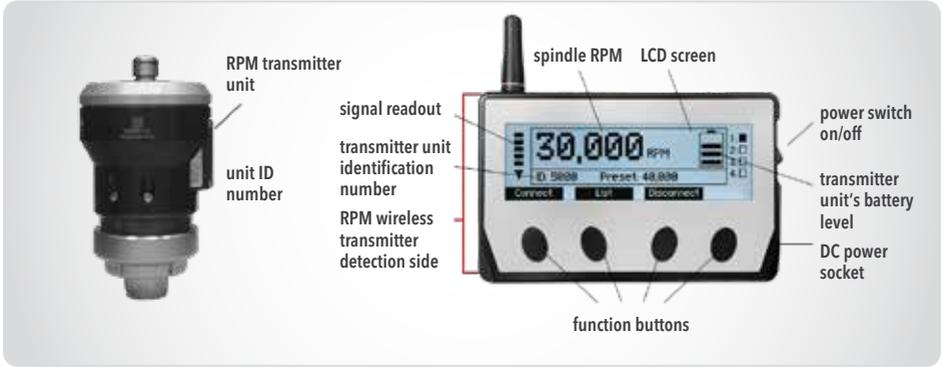


Fig. 6. Wireless RPM display main view

- 2.4 GHz radio frequency transmission
- Direct wireless rotational speed monitoring, range up to 10m
- Externally powered receiver display
- Connection up to 127 tools. Displays information from only one operating unit
- Internal battery-powered transmitter unit
- Individual ID number for each transmitter unit



Fig. 7. Wireless RPM display mounting options

1.5.2 Built-in and Direct Mounting System to CNC Spindle

The HSM HPC Spindle mounting adaptation options:

- ER32 collet chuck with a special tightening nut, suitable for all standard toolholders with an ER32 adaptation.
- Integral options for other adaptations are available upon request.

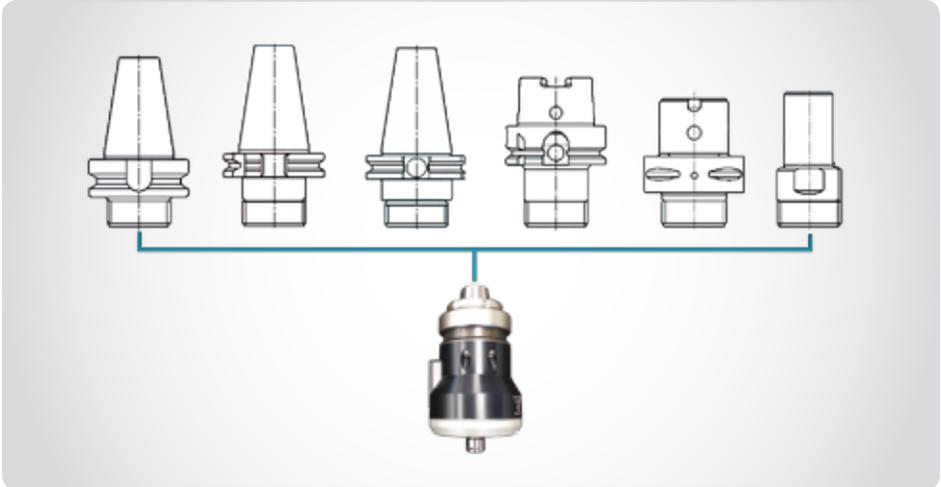


Fig. 8. HSM HPC Spindle with mounting adaptation options (for illustration purposes only)

1.5.3 Shaft Locking for Tool Clamping

The shaft lock mechanism provides a simple, easy way to change the cutting tool on the HSM HPC Spindle. For tool mounting instructions see page 19.



Fig. 9. HSM HPC Spindle with shaft lock mechanism

1.5.4 Integrated Coolant Nozzle System

Integrated coolant nozzle system provides direct jet coolant application for fast efficient chip evacuation.



Fig. 10. Integrated coolant nozzle system

1.5.5 Tool Clamping

The HSM HPC Spindle is compatible with ER11 collet chuck. It is recommended to use ER 11 high-precision spring collets.

When longer overhang is required, 10 and 25mm length ER11 thermal shrink collets are available.

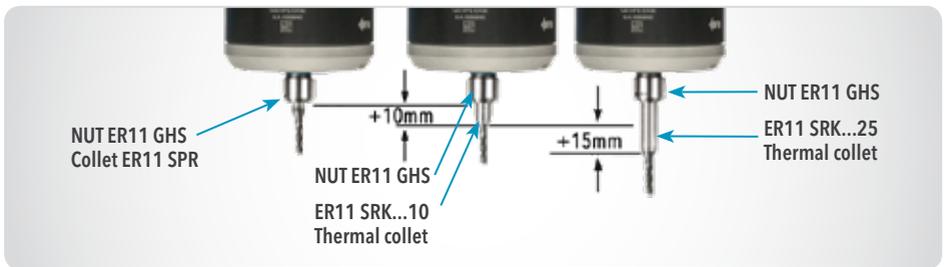


Fig. 11. Overhang solution types

2.1 Battery Installation for RPM Wireless Transmitter

Install battery into the RPM transmitter:

1. Unscrew the 4 battery case cover screws with 2 mm hexagonal Allen key
2. Remove the case cover
3. Ensure O-ring inside the cover is seated properly, and is intact
4. Insert the CR2 lithium battery (+/-)
5. Replace the battery case cover
6. Replace the 4 battery case cover screws securely
7. The transmitter is ready for operation



Fig. 12. Battery case opening

2.2 Display

HSM HPC Spindle is equipped with an integrated wireless display unit, allowing real-time monitoring of the rotating speed during machining.

2.2.1 Prerequisite for Display Installation

Make sure that the following prerequisites are met:

1. Electrical power: 220/110V AC, standard socket.
2. Distance from HSM HPC Spindle to display unit no more than 10 m.
3. Place display unit in accessible area for unobstructed viewing.

2.2.2 Display Installation Workspace

1. Mount the display onto a metallic surface using the magnet on the back of the display, or place on a flat and level surface.
2. Connect the display to an AC socket.
3. Switch the display ON



Fig. 13. Switch display ON

2.2.3 Connect HSM HPC Spindle to Display

The display and the HSM HPC Spindle must be connected (paired) so they can "identify" each other. Each transmitter unit has an individual ID number

How to connect the Spindle to the display:

1. Make sure the display is ON.
2. Press 'CONNECT' on the display panel, and then slide the transmitter (assembled on the spindle) across the left side (detection side) of the display unit, as shown in the image right.



Fig. 14. Several spindles (not working simultaneously) connected to one display

2.2.4 Display Screen

When turned on, **NO SIGNAL / 0 RPM** screen will appear.



Fig. 15. NO SIGNAL displayed

While connecting the spindle you will see **CONNECTING** displayed, then **<device ID> CONNECTED**.

Notice that the battery level of the spindle is shown.

Make sure **<device ID>** on connected screen corresponds to ID # signed on to the RPM transmitter unit.



Fig. 16. Connection screens

The main display screen shows the spindle currently operating. The spindle ID number, rotation speed, and battery level appear.



Fig. 17. Main display screen

To view a list of all spindles connected to the display, press the "List" button.



Fig. 18. List of connected Spindles on display

Note: Disconnected feature will turn OFF internal battery consumption in the transmitter unit.



Fig. 19. Disconnected display

If the display detects more than one spindle working at the same time, the message "MULTIPLE SIGNALS" is shown (see Fig.20).



Fig. 20. More than one device working simultaneously screen

Select "List" to select the device to disconnect from the next screen.



Fig. 21. Disconnection list for multiple signals screen

The display can be cleared from all connected spindles, or a list of previously connected devices can be viewed.



Fig. 22. Disconnect all sensors screen

If the connect or disconnect procedure is not successful for any reason, an appropriate message is shown - see page 24 for troubleshooting.



Fig. 23. Connection failed screen



Fig. 24. Disconnect failed screen

If the battery of the spindle currently in operation is running low, the following warning is shown - see page 24 for troubleshooting.



Fig. 25. Low battery screen

If the spindle is not spinning fast enough, the "LOW RPM" alert is shown.



Fig. 26. Low RPM screen

If the spindle is spinning too fast, the "HIGH RPM" alert is shown.



Fig. 27. High RPM screen

2.2.5 Disconnect HSM HPC Spindle from Display

1. Make sure the display is **ON**.
2. Press '**DISCONNECT**' on the display panel, then slide the transmitter (assembled on the spindle) across the left side (detection side) of the display unit, as shown in the picture. When disconnecting the spindle you will see the "**Disconnecting**" screen. "**<device ID> disconnected screen**" - notice that the battery level of the spindle is shown. Make sure the <device ID> on disconnected screen corresponds to the ID # signed on to the RPM transmitter unit.



2.3 The HSM HPC Spindle

2.3.1 Prerequisite for CNC Machine

1. Coolant flow through the main CNC machine spindle.
2. Minimum coolant pressure at main machine spindle outlet: 40 bar.
3. Maximum coolant pressure at main machine spindle outlet: 70 bar.
4. Moderate flow rate of 16 - 22 L/min.
5. Use with water-based emulsion or cutting oil; viscosity up to 20 (Cp)
6. Minimum coolant filtration level: 100 µm.
7. Active mist collector.
8. With emulsion coolant, use an anti-foaming agent additive suitable for emulsion to prevent foaming.
9. With oil coolant, high pressure increases the amount of oil fumes:
 - Use appropriate means of fire protection and extinguishing.
 - Use anti-dissolution additive suitable for the oil.

2.3.2 HSM HPC Spindle Installation to CNC

When the HSM HPC Spindle is mounted on the machine, the CNC machine spindle should be stationary, except for tool check procedure or Z-offset measurement. In these cases, machine spindle must be rotated at max. 3000 RPMs to avoid risk of breakage/injury.

To avoid CNC machine spindle rotation during the HSM HPC Spindle operation, use the correct software M-code to lock the spindle orientation. Eg: "M19" code locks the spindle in a defined angle position.



Fig. 28. (1 + 2) HSM HPC Spindle on CNC machine



2.3.3 Placement of HSM HPC Spindle in Toolholder

Caution: Deviation from these steps may lead to locking of the tightening nut to the HSM HPC Spindle. The HSM HPC Spindle only operates with a toolholder that has a coolant through channel. To secure the HSM HPC Spindle in a toolholder: See steps in Figure 29 (left to right).



Fig. 29. (1 - 5)
Placement of HSM HPC Spindle in toolholder

1. Use a standard toolholder with ER32 collet chuck
2. Loosen the HSM HPC Spindle tightening nut 1.5 full turns
3. Insert built-in ER32 taper shank into ER32 collet chuck until the HSM HPC Spindle tightening nut will be placed on the toolholder
4. Fasten the HSM HPC Spindle tightening nut onto the toolholder, without turning the spindle relative to the nut
5. Fasten the HSM HPC Spindle tightening nut to clamp it together with the toolholder using an ER 32 spanner. Use hand force only



Fig. 30. Example of toolholder with a coolant-through hole



Fig. 31. HSM HPC Spindle holding ER32 collet chuck

2.3.4 Tool Prerequisites

HSM HPC Spindles are used in applications with tool shank diameters up to 6 mm.

2.3.5 Tool Installation for HSM HPC Spindle

First assemble the ER 11 collet and tool.

1. Insert nut for tightening. Align flat sides of the shaft with the positioning slot on the spindle cover.
2. Position shaft lock flat key over the nut. Black dot fits into the positioning slot underneath.
3. Slide shaft lock flat key to the left to secure it in place



Fig. 32 Inserting nut



Fig. 33 a + b Inserting shaft lock flat key

4. Insert ER11 wrench into the grooves on the Nut.
5. Turn ER11 wrench clockwise to tighten.



Fig. 34 a + b Inserting wrench

To remove the tool:

Insert the wrench and turn counter-clockwise to loosen the nut (this may take a few turns). Slide the shaft lock flat key to the right to unlock. Keep the shaft lock in the secure position if you wish to insert a new tool.

2.3.6 Tool Clamping and Runout Check (Recommendations)

The HSM HPC Spindle is designed to perform high speed operations with small diameter cutting tools for very accurate machining.

It is very important to properly perform the instructions related to cutting tool setup, correct clamping procedure and tool runout.

Standard clamping tools, such as ER11 spring collets and standard clamping accessories are used on the HSM HPC Spindle.

To get a minimum runout value use ER11 SPR...AA or AAA spring collets with an exact hole size.

According to ISO 15488, the collet runout tolerances should be checked as shown in the images below.

Spindle housing should remain static!

Runout is measured by rotating the shaft manually or running an air supply through the machine spindle.

Dynamic Balancing System:
• Shaft G0.4

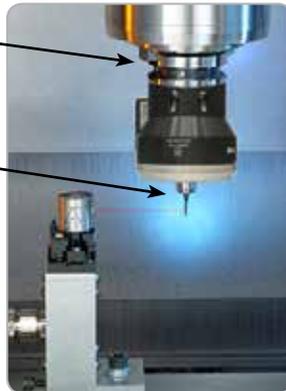


Fig. 37.
Testing runout tolerance

3.1. Periodic Maintenance

The HSM HPC Spindle is free from periodic maintenance.

3.2. Battery Change on RPM Transmitter

The battery in the RPM transmitter mounted on the HSM HPC Spindle will lose power over time. To change the battery, please proceed as in chapter 2 (Installation p.11)

3.3. Recommended Operating Environment

- Temperature range: 15° - 30° C

3.4. Storage

3.4.1 Pre-Storage

Before storing the HSM HPC Spindle:

- Clean the HSM HPC Spindle by air blowing for 10-15 seconds. Do not use air in the shaft lock hole.
- Disconnect the HSM HPC Spindle from the display device.
- Place the HSM HPC Spindle back in its case.

3.4.2 Storage Conditions

The HSM HPC Spindle must be stored in conditions meeting the following requirements:

- Sheltered from possible adverse weather conditions.
- Ideal storage temperature range: 15 °C to 27 °C.
- Humidity range: 30% to 60% relative humidity (RH)

⚠ Warning: It is strictly prohibited immerse the HSM HPC Spindle in a fluid bath!

- Clean external adaptor and ER11 nut using alcohol and treating with oil.
- Clean internal shaft using air pressure only.
- Any damage caused by one of the above „Warnings“ will not be covered by limited warranty.



WARNING!

Use the utmost caution when working with rotating tools.

The HSM HPC Spindle system was developed to enable optimal cutting speed conditions for machines equipped with high pressure coolant pumps and using small diameter, solid carbide tools requiring high RPMs.

The HSM HPC Spindle rotates at its rated speed when idle. When the cutting tool enters the workpiece, it is expected that the rotation speed might slow down by several thousand RPM.

If the HSM HPC Spindle rotation speed drops by more than several thousand RPM, when the cutting tool enters the workpiece, review the cutting process parameters and adjust them accordingly.

In order to take advantage of high speed machining, minimize cutting forces and reduce wear, tool diameter should be selected according to the spindle speed (whenever possible).

- Always select the smallest tool diameter, according to the application requirements.
- Always select cutting tools in grades that are suitable for high speed machining

4.1 Recalculation of Table Feed for the HSM HPC Spindle

There are two calculation methods for table feed F [mm/min], with the HSM HPC Spindle:

- Existing machining process (transition from machining with a machine spindle to an HSM HPC Spindle)
- New machining process

4.1.1. Existing Machining Process

The feed per tooth f_z remains constant while the table feed F increases in proportion to the HSM HPC Spindle rotation speed.

The feed per tooth f_z should remain constant while the table feed F changes. Calculate the table feed F [mm/min] according to the following formula:

$$F \approx \text{Ratio} \times F \text{ current}$$

F:	New table feed
Ratio:	The ratio between the machine spindle speed and HSM HPC Spindle speed, (new speed divided by the current speed).
F current:	Current table feed with original machine spindle.

For example:

If using a machine spindle at 8,000 rpm, with a table feed of 160 [mm/min], and the HSM HPC Spindle set to 30,000 rpm, then the new recommended table feed is as follows:

$$\text{New table feed} = 30,000/8,000 = 3.75 \times 160 = 600 \text{ [mm/min]}$$

The new table feed is 600 mm/min

4.1.2 New Machining Process

Calculate the table speed, F [mm/min], according to the formula:

$$F = n \times z \times f_z$$

n [rpm]:	rotation speed for table speed calculation, can be determined only after reading the actual rotation speed obtained when the tool has engaged the material
z:	Number of teeth
f_z [mm/tooth]:	Feed per tooth, select according to tool vendor's recommendations, taking into consideration the machining material, application and the tool geometry.

5.1 Display Messages

Display Message	Indication	Action Required
No Signal	No HSM HPC Spindle connected is operating within range	If no HSM HPC Spindle is currently operational: no action is required. If the spindle is operating: wait 10 sec. If message persists, disconnect and then reconnect.
Multiple Signals	More than one device is working simultaneously	Press LIST button, then disconnect one of the HSM HPC Spindles
Low RPM	HSM HPC Spindle is rotating too slowly	Check: Coolant pressure, and cutting parameters
High RPM	HSM HPC Spindle is rotating too quickly	Check: HSM HPC Spindle and coolant pressure
Failure to connect	Connection did not succeed	Retry connection process. If still not working, replace the HSM HPC Spindle battery.
Failure to disconnect	Disconnection did not succeed	Retry disconnection process. If still not working, replace the HSM HPC Spindle battery.
Battery low	Battery is low on power	Replace the battery

5.2 HSM HPC Spindle Shaft Does Not Rotate or RPMS Not Corresponding To Coolant Pressure

May result in "Low RPM" message.

1. Check coolant and pressure in cooling system.
2. Run coolant through the HSM HPC Spindle for 5 minutes while idle.
3. If status persists - call for technical assistance.

5.3 HSM HPC Spindle Unused Within the Past Month

Before working with an HSM HPC Spindle that has not been recently operated, first assemble it on the CNC machine. Then run coolant through the jet spindle for 3 to 5 minutes. Ensure that the jet spindle reaches a speed corresponding to the coolant pressure being pumped through it.

HSM HPC Spindle and Display Unit Warranty Frame

The manufacturer warrants that its spindles are to be free from defects in material, design and workmanship under normal use. Maintenance and service, for a period commencing from the date of invoice referenced by the spindle serial no. imprinted on the spindle housing, is valid until: 12 months or 300 hours - whichever comes first - from the date of invoice.

Within the frame of warranty, the following conditions are in effect:

- Warranty does not apply to spindles that have been subject to operator / programmer error (i.e. crashed or improper preventative maintenance, installation errors, and/or contamination)
- Warranty does not apply to spindles that have been repaired, or have attempted to be repaired by anyone other than a manufacturer authorized representative.
- Warranty does not apply to worn-out bearings.
- Claim of defect must be issued by returning the spindle in its original packaging accompanied by a written claim form; with an explanation of the malfunction, inclusion of the spindle serial no. and a copy of the product invoice.

The manufacturer's liability under this warranty shall be limited to the repair of, or replacement of, at the manufacturer's discretion, any part determined to the manufacturer's satisfaction to be defective, and which has not been found to have been misused, abused, abnormally used, or damaged by accident or improper maintenance, altered, or carelessly handled.

Upon determination by the manufacturer that a warranty claim is valid, a refurbished or new spindle will be shipped as a replacement, on a no charge bases. All spindles repaired under warranty will remain under the initial warranty timeframe for the balance of the valid warranty period.

Customer shall pay shipping and handling costs for the spindle's return to the manufacturer's premises. Return of the repaired or replacement spindles under warranty shall be sent to the customer's premises only, at the expense of the manufacturer.

The manufacturer reserves the right to choose the method of shipment on all replacement parts supplied under warranty.

The customer shall bear all shipping costs related to spindles which are not under warranty.

Repair and Refurbishment: HSM HPC Spindle and Display Unit Warranty Frame

A Spindle that has undergone repair by the manufacturer not within the warranty cover terms and/or valid time frame shall be entitled to a limited warranty period of 6 months or 200 hours - whichever comes first - from the invoice date; all warranted repairs must be performed by the manufacturer as the sole certified entity. Using any repair service other than a manufacturer authorized rep, will immediately terminate the warranty; validity, scope and terms.

The repaired spindle warranty is subject to the above mentioned restriction terms as equally applied and specified for the "HSM HPC Spindle and Display Unit Warranty Frame".

This warranty document supersedes all and any previous warrant policy information published by the manufacturer, including warranty assurances and conditions stated in the product User Manuals.

The manufacturer reserves the right to make changes in products or specifications at any time, without prior notice.

This warranty shall not apply to:

Modifications to the product, or other circumstances beyond the manufacturer's control.

- Claims or damage resulting from customer or third party repairs or
- Claims or damage due to non-compliance with recommended installation, operation and maintenance procedures, as specified by the manufacturer, including, without limitation; abuse, neglect, misuse of the product by the customer, its agents, employees or contractor.
- Damage resulting from operation of product not within the working parameters and working environment it was designed for.
- Claims or damage resulting from the use of third party replacement parts.
- Any direct or indirect loss, consequential loss, personal injury or damage to property, loss arising from interruptions or delays in production.
- Claims or damage resulting from buyer's non-compliance with applicable laws, regulations, codes or by-laws, and standard industry practices.

Transfer of Warranty

Spindles are only covered under warranty to the original buyer of the spindle and this warranty is non-transferable to, and may not be enforced by, any third parties, including, but not limited to; subsequent buyers, users or assignees of the spindle.

After the HSM HPC Spindle was purchased from an authorized Colibri sales representative

Whenever a malfunction cannot be resolved by the solutions mentioned in the troubleshooting section, you are requested to consult your authorized sales representative for further assistance or instructions.

The unit should not be returned before receiving written approval from your authorized sales representative. The serial number for the unit must be indicated on your claim form (you can find this information on the unit housing).

We hope this information will be helpful. Our goal is to provide the best possible service to our customers.

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