



Setup and Operation for the Hardinge 16C and 3J Indexing/Rotary Table System

16C and 3J Rotary Indexing Systems User Manual B-126B

Thank you for purchasing a Hardinge 16C or 3J Indexing/Rotary Table Product! This User's Manual is provided to assist you with setup procedures and to familiarize you with the features, specifications and maintenance recommendations for your unit.

The mechanical indexing head can be maintained by the customer with proper cleaning, lubrication, and maintenance. Any necessary repairs required during the warranty period will be made at Hardinge Inc. or by a factory authorized representative.

Hardinge supplies a complete array of 16C and 3J workholding products including collets, step chucks, expanding collets, chucks and fixture plates. Custom manufacturing is also available.

Hardinge Inc.
One Hardinge Drive
Elmira, New York 14902-1507 U.S.A
p. 800.843.8801
p. 800.468.5946 (Canada)
f. 607.734.3886



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Safety Recommendations

READ COMPLETE INSTRUCTIONS CAREFULLY BEFORE OPERATING THIS UNIT. Note: Equipment refers to the indexing/rotary table system and/or machine it is used with.

When this instruction book was printed, the information given was current. However, since we are constantly improving the design of our products, it is possible that the illustrations and descriptions may vary from the system you receive.

- WARNING -

Occupational Safety and Health Administration (OSHA) Hazard Communication Standard 1910.1200, effective May 25, 1986, and various state "employee right-to-know laws" require that information regarding chemicals used with this equipment be supplied to you. Refer to the applicable section of the Material Safety Data Sheets supplied with your unit when handling, storing, or disposing of chemicals.

HARDINGE SAFETY RECOMMENDATIONS

Your Hardinge machine is designed and built for maximum ease and safety of operation. However, some previously accepted shop practices may not reflect current safety regulations and procedures and should be re-examined to insure compliance with the current safety and health standards.

Hardinge Inc. recommends that all shop supervisors, maintenance personnel, and machine tool operators be advised of the importance of safe maintenance, setup, and operation of Hardinge-built equipment. Our recommendations are described below.

READ THESE SAFETY RECOMMENDATIONS BEFORE PROCEEDING ANY FURTHER.

READ THE APPROPRIATE MANUAL OR INSTRUCTIONS before attempting operation or maintenance of the equipment. Make certain that you understand all instructions.

DO NOT ALLOW the operation or repair of equipment by untrained personnel.

CONSULT YOUR SUPERVISOR when in doubt as to the correct way to do a job.

WEAR SAFETY GLASSES AND PROPER FOOT PROTECTION at all times. When necessary, wear respirator, helmet, gloves, and ear muffs or plugs.

DON'T OPERATE EQUIPMENT unless proper maintenance has been regularly performed and the equipment is known to be in good working order.

WARNING or INSTRUCTION TAGS are mounted on the unit for your safety and information. Do not remove them or damage them.

DO NOT ALTER THE EQUIPMENT to bypass any interlock, overload, disconnect, or other safety device.

DO NOT OPERATE EQUIPMENT if unusual or excessive heat, noise, smoke, or vibration occurs. Report any excessive or unusual vibration, sounds, smoke, or heat as well as any damaged parts.

LIFTING AND HANDLING OF THE UNIT should be done with full knowledge of the unit weight and using proper procedures.

MAKE CERTAIN that the equipment is properly grounded. Consult National Electric Code and all local codes.

REMOVE POWER FROM THE UNIT by unplugging the power cord before attempting repair or maintenance (Where Applicable).

DON'T OPEN THE CONTROL BOX without consulting with Hardinge. (Where Applicable)

DON'T TOUCH ELECTRICAL EQUIPMENT when hands are wet or when standing on a wet surface.

Safety Recommendations (continued)

REPLACE BLOWN FUSES with fuses of the same size and type as originally furnished. (Where Applicable)

ASCERTAIN AND CORRECT the cause of a shutdown caused by overload heaters before restarting the machine. (Where Applicable)

KEEP THE AREA AROUND THE MACHINE well lit and dry.

KEEP CHEMICAL AND FLAMMABLE MATERIAL away from electrical or operating equipment.

HAVE THE CORRECT TYPE OF FIRE EXTINGUISHER handy when machining combustible material and keep chips clear of the work area.

DON'T USE a toxic or flammable substance as a solvent cleaner or coolant.

MAKE CERTAIN THAT PROPER GUARDING is in place and that all doors to the primary machine are closed and secured.

DON'T OPEN GUARD DOORS of the primary machine while any machine component is in motion.

MAKE SURE chucks, closers, fixture plates, and all other spindle-mounted workholding devices are properly mounted and secured before starting the unit or the machine.

MAKE CERTAIN all tools are securely clamped in position before starting the unit or the machine.

REMOVE ANY LOOSE PARTS OR TOOLS left on the unit or the machine or in the work area before operating the equipment. Always check the machine and work area for loose tools and parts especially after work has been completed by maintenance personnel.

REMOVE CHUCK WRENCHES before starting the unit or the machine.

BEFORE PRESSING THE CYCLE START PUSH BUTTON, make certain that proper functions are programmed and that all controls are set in the desired modes.

KNOW WHERE ALL stop push buttons are located in case of an emergency.

CHECK THE LUBRICATION OIL LEVEL before operating the machine.

MAKE CERTAIN that all guards are in good condition and are functioning properly before operating the equipment.

INSPECT ALL SAFETY DEVICES AND GUARDS to make certain that they are in good condition and are functioning properly before the cycle is started.

CHECK THE POSITION of any load/unload automation before pressing the Cycle Start push button.

CHECK SETUP, TOOLING, AND SECURITY OF THE WORKPIECE if the machine has been OFF for any length of time.

DRY CYCLE a new setup to check for programming errors.

MAKE CERTAIN that you are clear of any "pinch point" created by moving slides before starting the machine.

DON'T OPERATE any equipment while any part of the body is in the proximity of a potentially hazardous area.

DON'T REMOVE CHIPS with hands. Use a hook or similar device and make certain that all machine movements have ceased.

BE CAREFUL of sharp edges when handling a newly machined workpiece.

DON'T REMOVE OR LOAD a workpiece while any part of the equipment is in motion.

Safety Recommendations (continued)

DON'T OPERATE ANY EQUIPMENT while wearing rings, watches, jewelry, loose clothing, neckties, or long hair not contained by a net or shop cap.

DON'T ADJUST tooling or coolant hoses while the equipment is running.

DON'T LEAVE tools, workpieces or other loose items where they can come in contact with a moving component of the equipment.

DON'T CHECK finishes or dimensions of workpiece near running spindle or moving slides.

DON'T JOG SPINDLE in either direction when checking threads with a thread gage.

DON'T ATTEMPT to brake or slow the equipment with hands or any makeshift device.

ANY ATTACHMENT, TOOL OR MACHINE MODIFICATION not obtained from Hardinge Inc. must be reviewed by a qualified safety engineer before installation.

USE CAUTION around exposed mechanisms and tooling especially when setting up. Be careful of sharp edges on tools.

DON'T USE worn or defective hand tools. Use the proper size and type for the job being performed.

USE ONLY a soft-faced hammer on tooling and fixtures.

DON'T USE worn or broken tooling on machine.

MAKE CERTAIN that all tool mounting surfaces are clean before mounting tools.

INSPECT ALL CHUCKING DEVICES daily to make certain that they are in good operating condition. Replace any defective chuck before operating the machine.

USE MAXIMUM ALLOWABLE gripping pressure on the chuck. Consider weight, shape, and balance of the workpiece.

DON'T EXCEED the rated capacity of the equipment.

DON'T LEAVE the equipment unattended while it is operating.

DON'T CLEAN the equipment with an air hose.

KEEP TOTE PANS a safe distance from the machine. Don't overfill the tote pans.

DON'T LET STOCK project past the back end of the collet closer or equipment spindle without being adequately covered and properly supported.

UNLESS OTHERWISE NOTED, all operating and maintenance procedures are to be performed by one person. To avoid injury to yourself and others, be sure that all personnel are clear of the equipment when opening or closing the coolant guard door and any access covers.

FOR YOUR PROTECTION - WORK SAFELY

DON'T OPERATE THE EQUIPMENT with damaged or worn electrical cables.

VERIFY that the electrical cables are not restrained or pinched during full travel movement of the machine.

1. Introduction to the Hardinge 16C and 3J Rotary Indexer System

1.1 Description

The 16C and 3J Rotary Indexer System is used for accurate and dependable positioning of medium and large parts in machining operations such as milling, drilling, tapping, contouring and spiral milling.

The Hardinge® 16C and 3J Rotary Indexer System is a fully integratable, programmable, rotary positioning device that saves on workspace without sacrificing performance. The mechanical indexing head holds the workpiece, which is positioned by programming angular movements into the all-digital servo control as a slave to a CNC machine or directly into a CNC control in a true 4th axis setup. The Hardinge All-Digital Servo Control is industry compatible and will drive most brands of brush or brushless motor indexing heads. The mechanical indexing head features an A2-5 spindle nose for spindle tooling compatibility with A2-5 spindle CNC lathes. It can be used in the horizontal position or mounted vertically for face and end work.

The Hardinge Spindle

The 16C and 3J Rotary Indexer spindle is based off the industry standard A2-5 spindle design that has been used in Hardinge lathe production for over a century. The Hardinge-engineered mechanical elements guarantee the spindle will be accurate, repeatable, reliable, and flexible to suit many different machining applications. The spindle carries a centerline from the machine bed of 6.00"/152.4mm, which is compatible with many other indexing products.

The spindle is hardened and ground for accuracy and has a rigid design with dual angular contact bearings to support heavy cutting forces. Positioning of the spindle is accomplished through a self-locking gear set.

1.2 High Stiffness Overall System

The Hardinge 16C and 3J Rotary Indexer System uses a high-quality hardened gear system with a 60:1 ratio. This type of gearing allows for an efficient forward driving capability (motor side through the worm) while at the same time preventing back driving from occurring by the applied cutting forces at the spindle side. This is an important operating characteristic of the high ratio gear system since it adds stiffness into the machining operation. This spindle is also equipped with a high torque pneumatic fail-safe clamp which prevents chatter and adds a considerable amount of stiffness. Stiffness or rigidity is one of the more important features of any system employed in the activity of machining operations and is the driving force for Hardinge-engineered rotary systems.

1.3 Machinable Part Size

The Hardinge 16C and 3J Rotary Indexer System has been designed for those parts that can be conveniently clamped to the slotted face plate. Typical parts are in the range of approximately 5"/127mm in diameter, and generally not longer than 7"/178mm without the use of a tailstock and are figured at a 50% duty cycle. A typical cut is figured at 7.5 HP with face or end milling.

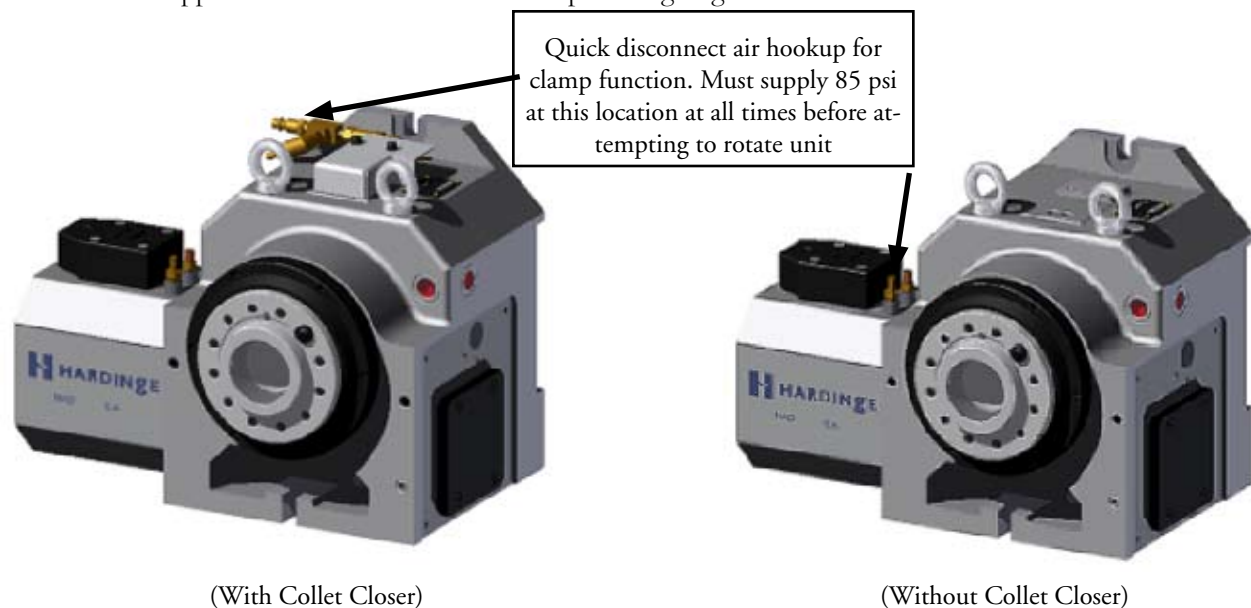
Larger part sizes than those described above can be handled with additional support (ie. tailstock, etc.) but should not exceed 220lb/100kg in weight.

1.4 Standard Spindle Clamp

The Hardinge 16C and 3J Rotary Indexer comes with a fail-safe spindle clamp that is standard right from the factory. This clamp allows the spindle to handle cutting forces equal to 232 ft-lb/315 Nm, allowing for

greater cutting forces in the non-contouring mode of operation. The unit contains a pressure sensor that will prevent indexing in the event that air pressure drops below 85 psi to the clamp so that damage is prevented. Air is supplied to the clamp via a quick disconnect fitting on top of the motor cover. When equipped with the Hardinge servo control, the clamp can be controlled automatically so that the clamp is engaged when the Rotary Indexer arrives at its programmed destination or it can be controlled with “G” codes. For ease of use, a “C” will appear on the display of the control whenever the clamp is engaged. There is a potential for a drop in air pressure if the air line supplying the Rotary Indexer is also supplying something else with air. If you receive a low pressure alarm, the first thing you should check is the air pressure supplied to the Rotary Indexer. Please note that even a momentary drop in air pressure will create an alarm situation.

CAUTION: Never attempt to defeat the clamp protection logic as this may result in an opportunity for the system to rotate when the clamp is engaged. This will cause an overload fault and repeated attempts to operate in this manner may damage the clamp. The clamp requires a minimum of 85psi of air to fully release the spindle and must be supplied to the unit even if the clamp is not going to be used.



1.5 Features

RIGID DESIGN

Increased distance between large bearings support heavy cutting forces on large or small parts

HARDENED AND GROUND SPINDLE

For higher accuracy

DUAL ANGULAR CONTACT BEARINGS

Support heavy cutting forces

AUTOMATIC CIRCLE DIVISION (With Hardinge Servo Control)

You can program a step that automatically divides a circle into any number of equal parts between 2 and 999

STOP/FEED-HOLD (With Hardinge Servo Control)

You can use the STOP to feed-hold spindle movement without losing position on restart

FAST SETUPS (With Hardinge Servo Control)

All connectors are “quick-disconnect”, ensuring fast and easy setups

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INTERFACING (With Hardinge Servo Control)

Most CNC mills can be interfaced quickly and easily by using a spare “M” function which provides a switch-closer as a signal between your mill and the control

LINEAR & SPIRAL MILLING (With Hardinge Servo Control)

For semi fourth-axis capability

MEMORY (With Hardinge Servo Control)

A nonvolatile memory retains your program even when power is turned off – and remembers the current spindle position and step number

PROGRAM STORAGE (With Hardinge Servo Control)

Store and recall up to fifty different programs

PROGRAMMABLE PARAMETERS (With Hardinge Servo Control)

You can alter many of the basic features by performing basic programming

PROGRAMMING (With Hardinge Servo Control)

Program to rotate the spindle clockwise or counterclockwise with step sizes from .001 to 9999.99 degrees
Using G83 & G84, continuous rotation is allowed. Contact Hardinge for maximum speeds based on duty cycle.

ABSOLUTE OR INCREMENTAL PROGRAMMING (With Hardinge Servo Control)

Up to 1000 different steps can be stored in memory and each step can be repeated (looped) 999 times

RS-232 INTERFACE (With Hardinge Servo Control)

For computer control of sending and receiving programs and controlling indexer via the CNC control of host machine capable of RS-232 communication

RESOLUTION

Standard resolution of .001 degrees

SIMPLE EDITING (With Hardinge Servo Control)

Edit a program by simply writing over existing steps, or inserting or deleting a line (or several lines) between steps, with automatic program line renumbering

SUBROUTINES (With Hardinge Servo Control)

Allows repeated sequences up to 999 times, saving programming time and memory space

VARIABLE FEED RATES

Variable from .001 deg./sec. to 300 deg./sec.

ZERO RETURN (With Hardinge Servo Control)

An “automatic home” position can be programmed to return the spindle to its original starting position from any point

12-MONTH/1-YEAR WARRANTY

The Hardinge 16C and 3J Indexing/Rotary Table Systems are provided with a 12-month warranty against any defects in material and workmanship.

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1.6 Specifications

Spindle:

Torque (ft-lb/Nm)	70/95
Runout Maximum (TIR)	0.0002"
Backlash (arc/sec)	40
Speed (degrees/sec)	0.001 to 300
RPM Maximum	50
Load Support	Dual Angular Contact Bearings
Spindle Nose	A2-5
Spindle center to base (inch/mm)	6.000"/152.4 ± 0.001/.025

Indexing:

Accuracy (arc/sec)	+/- 30
Repeatability (arc/sec)	10
Resolution (degree)	0.001"
Max Rotation/Step (degree)	9999.99
Gear Diameter (inch/mm)	6.2/157.0

Motor:

Type (hp/kW DC servo)	0.78/0.58 (With Hardinge Servo Control)
Gear Ratio (gear set)	60:1

Operating Specifications:

Duty Cycle	90% at full speed without tailstock
Operating Temperature / Humidity	41 to 104°F/5 to 40°C, 85% Relative Humidity
Power Rating	120Vac, 60Hz, 15A or 230Vac, 50Hz, 10A
Oil Requirements	Mobil Delvac Synthetic Gear Oil 75w-90
Air Pressure Range For Clamp (psi/bar)	85/5.9-94/6.5

Weight:

Rotary Indexer (lb/kg)	200/90.7
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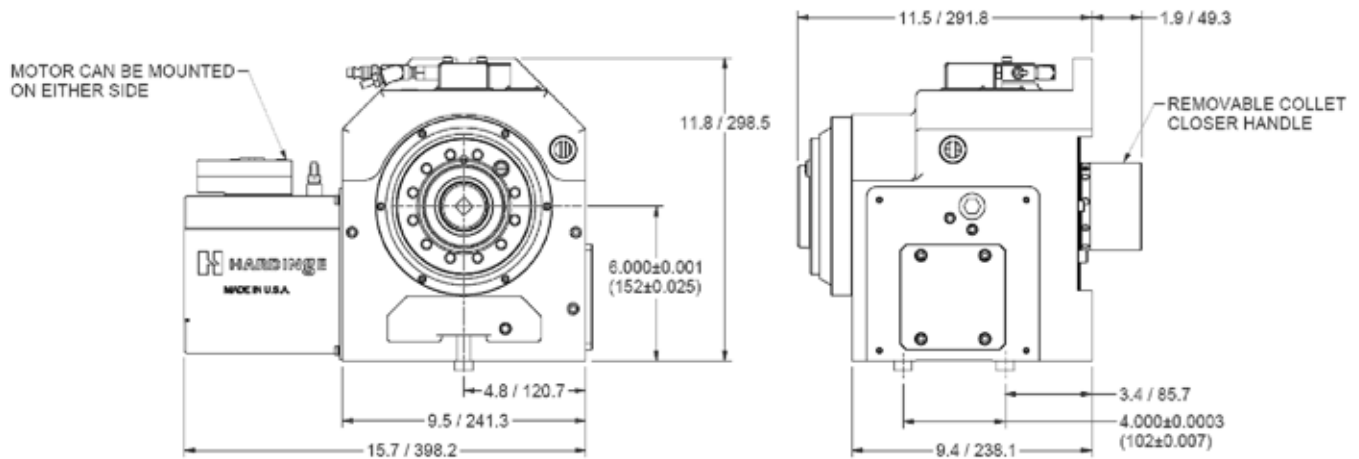
Workholding:

	<u>16C</u>	<u>3J</u>
Collets-Round (maximum capacity) inch/mm	1-5/8"/41.27	1-3/4"/44.45
Collets-Hex (maximum capacity) inch/mm	1-13/32"/35.71	1-17/32"/38.89
Collets-Square (maximum capacity) inch/mm	1-9/64"/28.97	1-1/4"/31.75
Step Chucks –Regular Depth (maximum capacity)	up to 6"/152.4	up to 6"/152.4
Step Chucks-Extra Depth (maximum capacity)	up to 6"/152.4	-
3-Jaw Chucks (diameter)	5", 6", 8" and 10"	6", 8", and 10"
Sure-Grip® Expanding Collets-Collet Style	1/2"-4"/12.70-101.60	1/2"-4"/12.70-101.60
Sure-Grip Expanding Collets-Spindle Style	1/8"-4"/3.17-101.60	-
Fixture Plate – Spindle Mount (diameter)	5 1/2"/139.70, 8-7/8"/225.42	5-1/2"/139.70, 8-7/8"/225.42
Fixture Plate – Collet Style (diameter)	6-3/8"/161.92	-
Face Plate ñ Slotted (diameter)	10"/254.00	10"/254.00
Collet Stops (part control length)	YES	YES

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1.7 Dimensions

Single-Spindle 16C or 3J Indexing/Rotary Table Unit



The 16C and 3J Indexing/Rotary Table systems can be ordered with the motor on either side of the unit. If the unit is ordered with the motor in the standard orientation, as shown in the picture above (motor is on the left looking at the spindle face), counter clockwise is the positive direction and the spindle key will be in the 12 o'clock position when the rotary is in the zero position. If the unit is ordered with the motor on the right hand side of the unit, then the spindle will move clockwise when programmed to move in the positive direction and the spindle key will be in the 6 o'clock position when the rotary is in the zero position.

NOTE: The Hardinge servo control and most machine control parameters can be changed to make either clockwise or counter clockwise the positive direction.

2. Setting up the Hardinge 16C and 3J Indexing/Rotary Table System

2.1 General Setup

1. Fill out the warranty information by visiting www.hardinge.com/rotarywarranty on the internet.
2. Place the indexer/rotary table on the machine. Route the cable from the head so that it avoids tool changers and table edges. Cable slack must be provided for your machine's movements. If the cable is cut, the motor will fail prematurely; replace a damaged cable immediately. Secure the indexer/rotary table to the machine's T-Slot table as shown below (upright or on it's back). T-nut packages are available for purchase for various T-slot tables. Kit includes (2) T-nuts, (2) bolts, and (2) flat washers. Check to verify that all clearances are satisfied in full machine axis' movements and that there is no possibility of a collision.



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3. Place the indexer/rotary table in an area free from chips and coolant where air can circulate freely. Do not let chips pile up over the motor enclosure, as this would prevent proper cooling.
4. Connect the 16C or 3J Indexing/Rotary table using one of the techniques as described in the Hardinge servo control or Hardinge 4th axis manual, which will be included with the mechanical unit.
5. Route the cable over the back of the mill sheet metal (if using Hardinge Servo Control).
6. If adding an indexer to a Hardinge mill using a remote CNC cable or as a true 4th axis, refer to the instructions in the Hardinge 4th axis manual or call the Hardinge service department.
7. If using the Hardinge servo control, secure it in required placement. Do not cover any surface of the control, as it will quickly overheat. Do not place the unit on top of other hot electronic controls.
 - 7a. Connect the two cables from the indexer to the controller in the appropriate locations.

CAUTION: Never connect or disconnect these cables with the power on. Instant failure will result.

- 7b. Connect the AC line cord to a 120V AC grounded receptacle. The cord is a three-wire ground type, and the ground must be connected. Power is 120VAC. The power service must supply a minimum of 15 amps continuously. Conduit wire must be 12 gauge or larger and fused for at least 20 amps. If an extension cord is to be used, use a three-wire ground type and the ground line must be connected. Avoid outlets that have large electric motors connected to them. Use only heavy duty 12 gauge extension cords capable of 20 amp load. Do not exceed a length of 30 feet. Permanent installations should be hard-wired or installed with locking plugs.
- 7c. Semi-Fourth Axis: Connect the remote interface cable. See separate Hardinge Servo Control manual.
8. Connect 85 psi of air to the quick disconnect fitting on top of the indexer if using a collet closer or on top of the motor cover if not using a collet closer for releasing the spindle clamp. Refer to section 1.4.

CAUTION: Never index the 16C/3J Indexer without 85 psi connected to the fitting or mechanical damage will occur.

9. Check the oil level. If it is low, add oil. Use MOBIL Delvac synthetic gear oil 75w-90 only.
10. Save the packing materials in case you need to ship the unit.
11. At the end of the workday or shift, it is important to clean the indexer/rotary table. The indexer/rotary table should be free of any chips or grime. Clean with a chip brush and apply a coat of rust preventative.

CAUTION! Do not use an air gun around the front or rear seals. Chips may damage the seal if blown in with an air gun.

NOTE: Prior to powering on the control, read and understand the entire control or 4th axis manual.

12. Turn on the mill (and servo control, if applicable) and home the indexer by pressing the zero return button. The indexer/rotary table homes in the counterclockwise direction as viewed from the spindle.

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M10 Eyehooks supplied for lifting.



Reposition eyehooks to the face for lifting and mounting the indexer/rotary table on its back. Remove eyehooks before operating the unit.

2.2 Use of Collets, Sure-Grip® Expanding Collets, Sure Grip® 3-Jaw Power Chucks, and Face Plates

The unit accepts standard Hardinge 16C or 3J collets, step chucks, ID gripping collets, chucks, and face plates. When inserting the collet, align the keyway on the collet with the key inside the spindle. Push the collet in and turn the collet closer drawbar clockwise until proper collet tightness is obtained.

Chucks and face plates utilize the A2-5 spindle nose on the indexer. Always make sure that the spindle and chuck or face plate are free of dirt and chips. Align the chuck draw tube keyway with the spindle collet key and slide the chuck onto the spindle. Turn the collet closer drawtube to engage the chuck. Push the chuck tight to the spindle and tighten the chuck mounting bolts to the proper torque indicated in your chuck installation manual. Use the collet closer drawtube to adjust the chuck for proper stroke required for ID and OD gripping. Since the A2-5 spindle nose is such a tight tapered fit, a face plate or 3-jaw chuck may be difficult to remove from the spindle even after the bolts are removed. If this happens, support the face plate or 3-jaw chuck with a hoist and lightly strike the outside diameter of the face plate or 3-jaw chuck with a piece of brass, a plastic hammer, or a rubber hammer so that nothing is damaged.

Note: A hoist may be required to mount a 3-jaw chuck depending on the size of the chuck.

2.3 Use of the 16C and 3J Collet Closer (Optional)

The 16C collet closer has a 1.625" (41.27mm) through-hole while the 3J collet closer has a 1.75" (44.45mm) through-hole design with pneumatic open and close. The through-hole can be used for through-spindle coolant or for holding long parts. The pneumatic closer has .625" (15.87mm) of stroke which allows the use of power chucks. The low profile closer fits within the closer housing so that the unit can lay flat on its back for face and end working. The adjusting nut must be removed prior to mounting the unit on its back. This is done by removing the 4 bolts on the back of the nut. The air pressure can be adjusted to achieve different drawbar forces out of the collet closer as shown in the chart below.

Air Pressure (psi)	Drawbar Force (lbs)
10	650
20	1301
30	1951
40	2601
50	3251
60	3902
70	4552
80	5202
85	5527
90	5852
100	6503

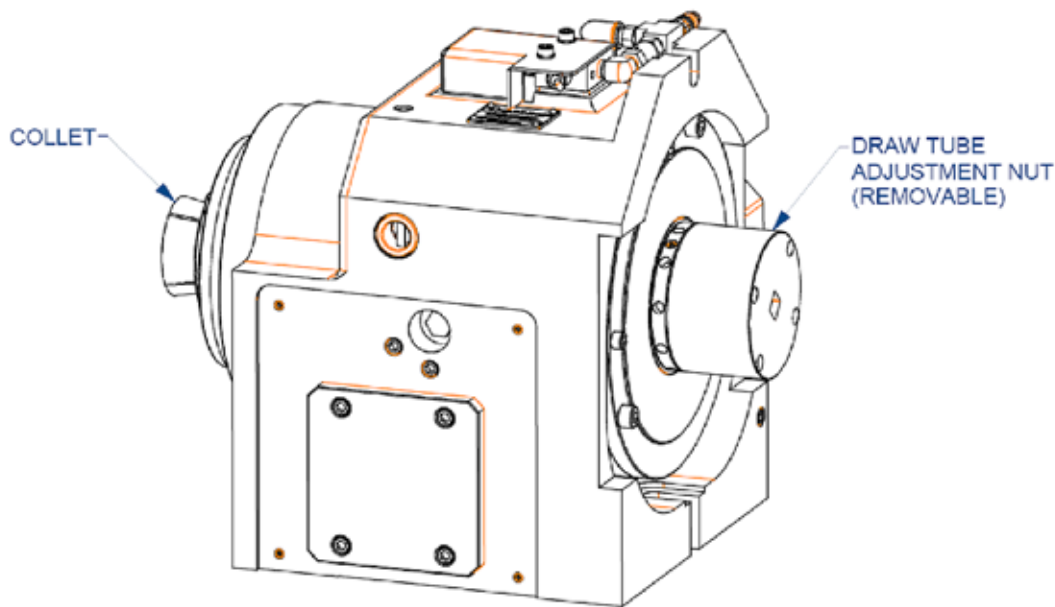
CAUTION: If it is desired to use less than 85 psi of air on the collet closer, the spindle clamp must be plumbed separately from the collet closer.

NOTE: Do not supply the collet closer with air pressure in excess of 100 psi at any time

2.4 Use of Collets with the Hardinge Collet Closer

NOTE: All collets must be free from burrs and in good condition.

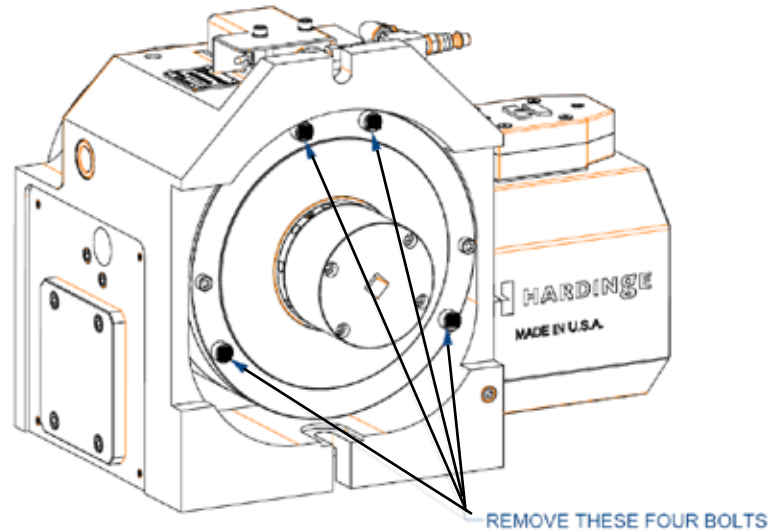
To install a collet, first make sure that the closer is in the open position. Align the collet keyway with the spindle key and insert the collet and turn the draw tube adjustment nut to engage the collet. Turn the draw tube adjustment nut until the collet grips the part, and then back off approximately ¼ turn. This will be a good starting point for fine-tuning the grip range. The wrench extension shown in the following graphic can be removed for mounting the system vertically. The collet should be adjusted with the rear adjusting nut as shown in the following graphic.



NOTE: To prevent excessive wear and collet sticking, make sure collets are in good condition and free from burrs. A light coat of Molybdenum grease on the collet wear surfaces will extend the life of the spindle and/or collet and help prevent sticking, especially when operating dry.

2.5 Removing the Hardinge Collet Closer

Air collet closers fitted at the factory are not intended to be removed. However, if servicing is required, first remove all workholding followed by the air supply to the closer. Before proceeding, clean the closer and surrounds so that chips and coolant will not get into the clamp located behind the closer. Then, remove the four biggest bolts (M8) on the back of the collet closer. These four bolts are the only bolts that secure the collet closer to the indexer housing. A brass or aluminum bar long enough to put through the spindle from the front and locate on the inside face of the drawbar nut will be required. With the bar in place, tap on the bar with a rubber hammer. This will free the closer from the locating pins. One person should hold the closer while the other taps on the bar. Once broken free, the closer can be pulled out of the back of the indexer for servicing. Note: be careful not to lose or misplace the o-rings which seal the face of the closer to the casting.



CAUTION! The Hardinge Collet Closer relies on air pressure to maintain clamping force and is released upon the removal of the air pressure. For situations where the air is accidentally removed during operation, a check valve will temporarily maintain clamping force so the system can be brought to a safe stop condition.

2.6 Tooling Locations

The indexing/rotary table system is equipped with tooling points in order to speed setups. One of the most time-consuming procedures in setup is aligning the head with the table. On the mounting surfaces there are two 0.500" (12.7mm) bored holes on 4.000" (101.6mm) centers. The holes on the bottom surface are parallel to the spindle within 0.001" (0.25mm) per 6 inches (152.4mm) and on the center within ± 0.001 " (0.25mm). By boring machine holes in your tooling plate, setups become routine. Using the tooling holes will also prevent the head from shifting on the mill table when the part is subjected to heavy cutting forces. On CNC mills, a machined stepped locating pin of 0.500" (12.7mm) diameter on one side and 0.625" (15.87mm) on the other comes with the Hardinge head. The 0.625" (15.87mm) diameter fits into the T-slot of the mill table. This will give quick parallel alignment that will be close enough for most jobs.



NOTE: 0.625" (15.87mm) and 18mm locating pins are supplied as standard. Locating pins can be turned down to another diameter to accommodate tables with different slot dimensions.

3. Backlash Adjustment

3.1 Measuring Backlash

Make sure the spindle clamp is released prior to attempting to measure backlash. To measure backlash, you need the use of a .0001" indicator and a magnetic v-block or magnetic block. Home the indexer as that is where backlash is checked at the Hardinge Factory. Place the magnetic block on the indexer spindle face so that the top of the block is parallel to the machine bed and in line with the spindle centerline as shown in the picture. Set up the indicator so that it is measuring the top of the magnetic block 2 inches from the center of the spindle. Use

a wrench or steel bar to move the spindle by placing it across (2) two M10 bolts that need to be screwed into the face of the spindle. Use your hand to put pressure on the wrench or bar to physically move the spindle in one direction. Move the spindle in that one direction until you measure approximately 0.001" on your indicator. Remove your hand from the wrench or bar so that the spindle can spring back to a nominal position. When the indicator shows that the spindle has sprung back some, zero out the indicator at this position. Put pressure on the wrench or bar to move the spindle in the opposite direction now. Again, you are going to want to move the spindle at least 0.001" and release the wrench or bar so the spindle can spring back. Record the reading on your indicator as this will be used to calculate gear backlash. Take the distance recorded by the indicator and divide that number by 2 because your measurement was taken 2 inches from spindle centerline. Now take the inverse tangent $(\tan)^{-1}$ of this calculated number and that will be how many degrees of backlash you have in your gears. To figure out how many arc seconds that is, simply multiply the degrees you calculated by 3600. If you calculate your backlash to be 40 arc seconds or less, then no backlash adjustments are necessary. To compensate for the mechanical backlash electronically, see the control manual. A chart of various angles in arc-seconds measured linearly at different radii along with a pictorial description of backlash follow.

	1" radius	2" radius	3" radius	4" radius	5" radius	6" radius
1 arc-sec	0.0000048"	0.0000097"	0.000014"	0.000019"	0.000024"	0.000029"
5 arc-sec	0.000024"	0.000048"	0.000073"	0.000097"	0.00012"	0.00014"
10 arc-sec	0.000048"	0.000097"	0.00014"	0.00019"	0.00024"	0.00029"
20 arc-sec	0.000096"	0.00019"	0.00029"	0.00039"	0.00048"	0.00058"
30 arc-sec	0.00014"	0.00029"	0.00044"	0.00058"	0.00073"	0.00087"
40 arc-sec	0.00019"	0.00038"	0.00058"	0.00077"	0.00097"	0.0012"



3.2 Adjusting Backlash

NOTE: A small amount of backlash is required for the gear set.

If it is determined that the backlash needs to be reduced, Hardinge highly recommends that the unit be sent back to the factory if still within the warranty period. If the customer decides to make the adjustments on their own, Hardinge has included the following detailed instructions.

1. A special tool is required to move the eccentric to adjust the backlash. This tool can be made from either steel or aluminum. Failure to make and use this tool may result in damage to the eccentric which will not be covered under warranty.

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2. The eccentric that you will be adjusting is on the side of the indexer opposite of the motor cover. Start by removing the (4) four M6 bolts that hold the square black plate to that side of the indexer housing. (Figure 2).
3. Remove the (4) four M6 bolts in the eccentric housing. (Figure 3).
4. Take note of the small dimple in the face of the eccentric. The eccentricity of the eccentric goes towards this dimple. Use the special tool you made to turn the eccentric to the next available hole in the direction that makes the dimple go towards the top of the indexer housing. This may be either a clockwise or counter clockwise rotation.
5. Replace the (4) four M6 bolts in the eccentric and measure the backlash again.
6. Continue adjusting the eccentric one hole at a time and checking backlash until an acceptable backlash is achieved.

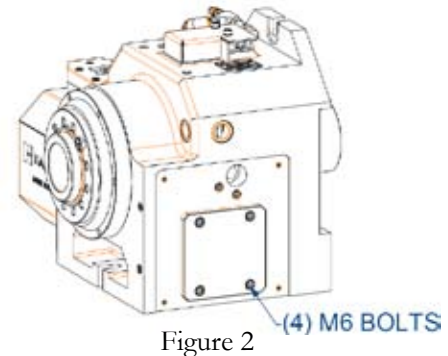
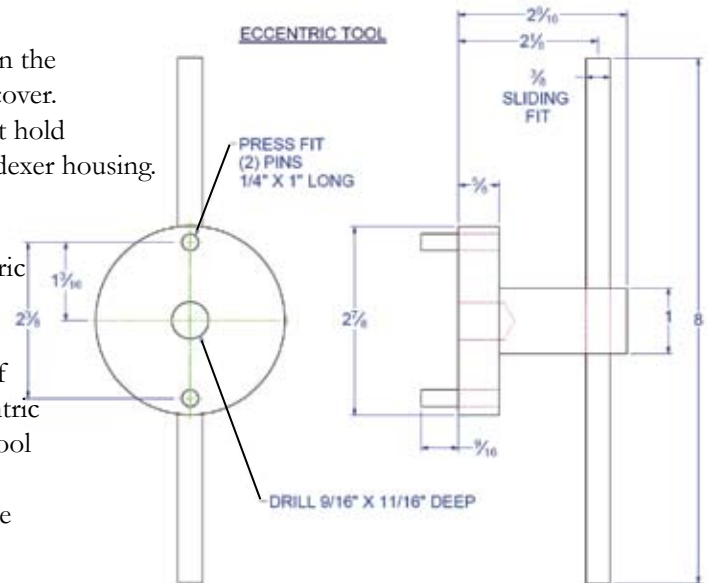


Figure 2

NOTE: Make sure when adjusting backlash that you have at least 10 arc seconds of backlash in the gear set or the gears may prematurely wear.

7. Put the black plate back on the indexer once finished adjusting backlash.

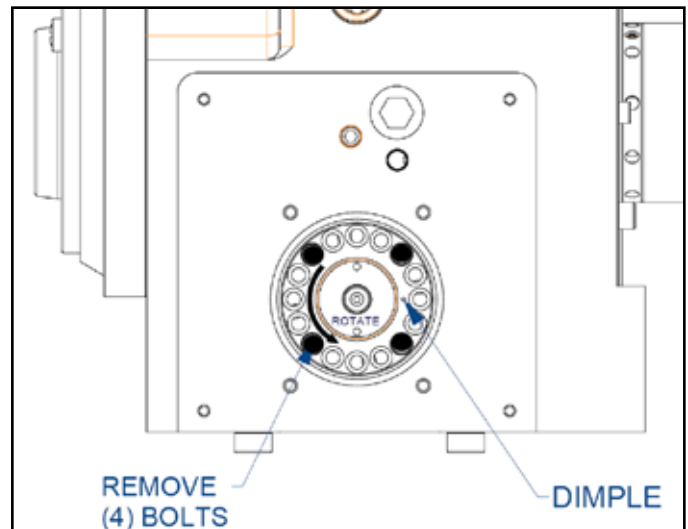


Figure 3

4. Routine Maintenance

4.1 Use of Oil- and Water-Soluble Coolants

For the use of oil- and water-soluble coolants, the following guidelines should be observed:

- **DO NOT SUBMERGE THE UNIT IN COOLANTS.** Keep the coolant lines on the workpiece spraying away from the head. Tool spraying and splatter usually will not be detrimental to the motor, but large amounts of pressurized coolant should be directed away from the head. Some machining centers provide flood coolant at enormous rates so that the head is practically submerged. Try to cut the flow down to match the job.
- Inspect the cables and gaskets for cuts or swelling. Damage must be repaired immediately.

4.2 Lubrication

To check the lube level of the Hardinge Indexer/Rotary Table, view the level of lube visible in the lubricant window when the unit is stopped. The window is located on the front and side of the unit opposite the motor. The lube level should reach the middle of the window. If necessary, add lubricant until the level reaches the midpoint of the window. The oil should be changed after the first 6 months of operation and then once per year.

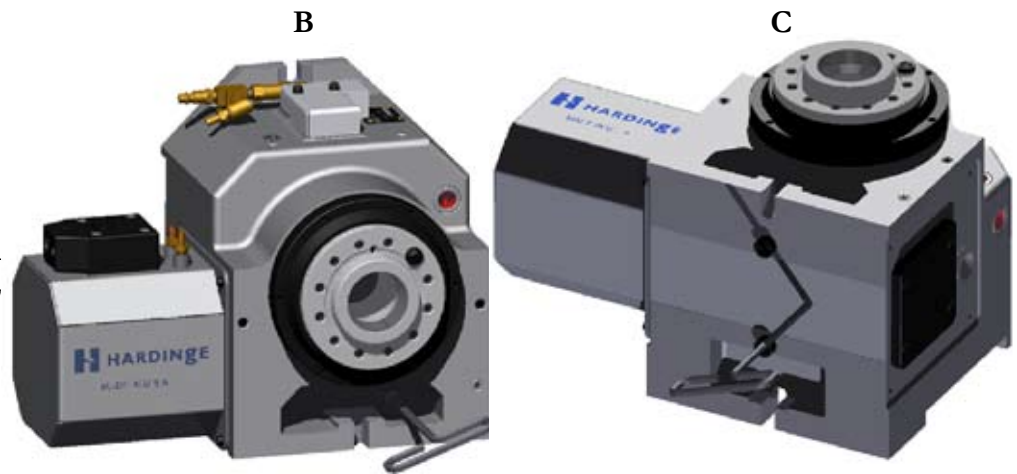
To add lubricant to the unit, locate and remove the pipe-plug from the lube fill port. This is located behind the eyehook on top of the unit. Add Mobil Delvac synthetic gear oil (75w-90) until the proper level is reached. Replace the fill port pipe-plug and tighten.

A

Oil Fill – (photo A)

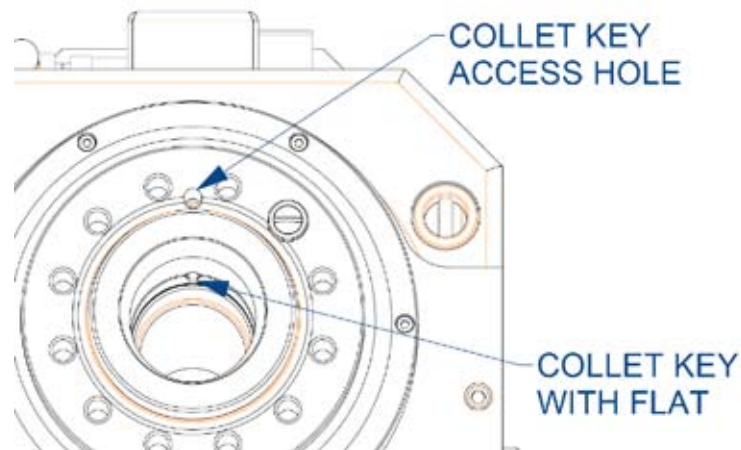


Drain oil (photo B & C) using the drain location found on the front or bottom of the indexer/rotary table unit.



4.3 Collet Key Replacement

Remove the set screw in the collet key access hole and then remove the collet key using a 3mm Allen wrench for both items. Screw the new 16C or 3J collet key into the spindle until it begins to protrude into the inside diameter of the spindle. Align the flat on the key to be parallel with the spindle centerline. Slide a collet into the spindle to check the key fit. Remove collet and adjust key until proper fit is achieved. Loctite #242 can be used to secure key. Replace the set screw back into the key access hole using pipe sealant.



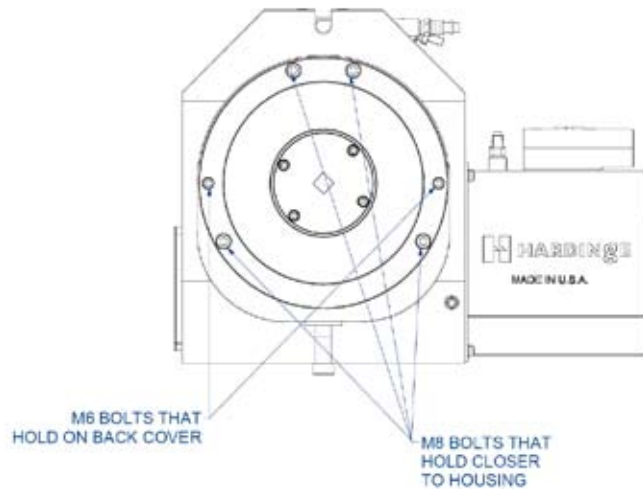
4.4 Clean Up

At the end of the workday or shift, it is important to clean the indexer/rotary table. The head should be free of any chips or grime. Clean with a chip brush and apply a coat of rust preventative. Do not use an air gun around front or rear seals. Chips may damage seal if blown in with an air gun.

4.5 Collet Closer Cleaning

The 16C/3J collet closer may, over time, collect machined material chips between the piston and back cover of the closer. These chips should be periodically cleaned out of the closer or eventually the collet closer may bind the unit, causing overload alarms.

First, remove the (4) four M8 bolts that holds the collet closer to the housing. Do not remove the closer from the housing as you are only going to remove the back cover. Now, remove the (2) two M6 bolts that hold the back cover of the closer to the closer body. Now that all of the bolts are removed, carefully pull on the drawtube handle removing it and the back cover. You should now be able to see the piston and any chips that have been collected. Carefully clean the chips out of the closer and drawtube nut and replace the rear cover. As you tighten the (2) two M6 bolts, rotate the drawtube nut to make sure there is no binding. If the drawtube does bind up so that it cannot be rotated by hand, loosen up the M6 bolts and try to re-center the rear cover until the drawtube rotates without binding. Finally, replace the (4) four M8 bolts that hold the closer to the indexer housing to finish the cleaning process.



5. 12-Month/1-Year Limited Warranty

The Hardinge 16C and 3J Indexing/Rotary Table Systems are provided with a 12-month warranty against any defects in material and workmanship.

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Hardinge Inc. | One Hardinge Drive | P.O. Box 1507 | Elmira, New York 14902-1507 USA
USA: 800-843-8801 | Canada: 800-468-5946 | Fax: 607-734-3886
To Order Online: www.shophardinge.com | Corporate Home Page: www.hardinge.com | E-mail: info@shophardinge.com