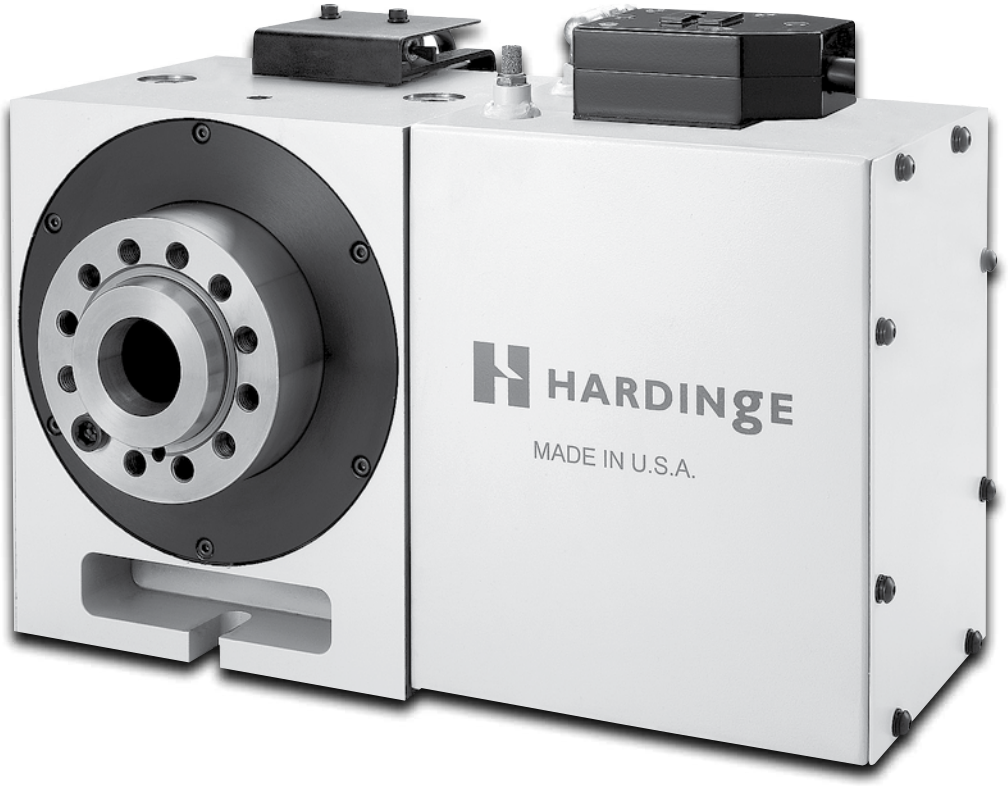


Setup and Operation
for the Hardinge®

GD160LP Rotary Table

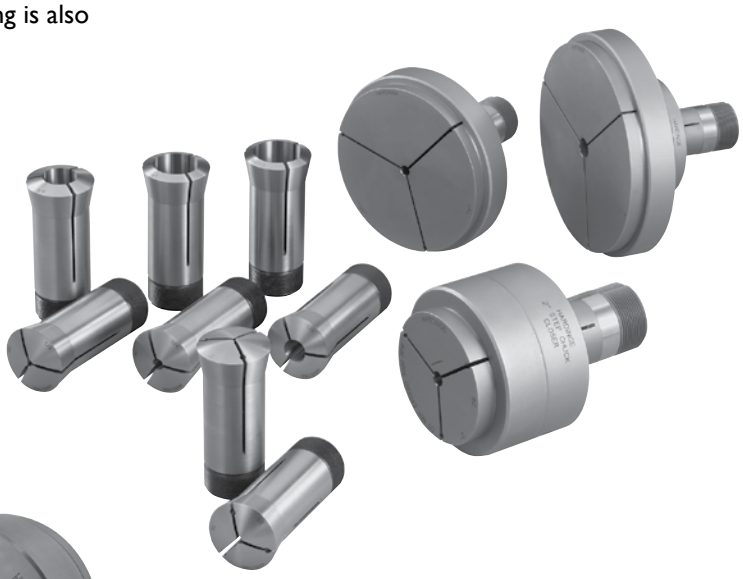
Original U.S.A. Instructions

Part No. BC -0009500-0157

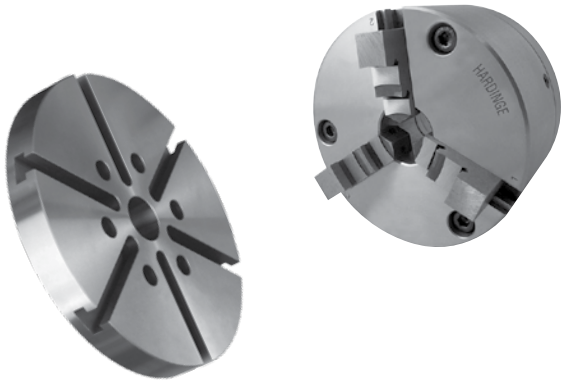
Thank you for purchasing a Hardinge GD160LP Low-Profile Rotary Table! This User's Manual is provided to assist you with setup procedures and to familiarize you with the features, specifications and maintenance recommendations of your unit.

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 workholding products including manual chucks, fixture plates, face plates and Sjogren chucks. Custom-manufacturing is also available.



Hardinge Inc.
One Hardinge Drive
Elmira, New York 14902-1507 U.S.A.
p. 800.843.8801, or 607.378.4022
p. 800.468.5946 (Canada)
f. 607.734.3886



Part No. BC -0009500-0157

Table of Contents

Safety Recommendations 4

1. Introduction

1.1 Description 7
1.2 High Stiffness Overall System 7
1.3 Machinable Part Size 7
1.4 Standard Spindle Clamp 8
1.5 Features 9
1.6 Specifications and General Requirements 10
1.7 Dimensions 11

2. Set Up

2.1 General Setup 12
2.2 Use of the GD160LP Collet Closer 14
2.3 Use of Collets, Manual Chucks, Face and Fixture Plates 14
2.4 Use of Collets with the Hardinge Collet Closer 15
2.5 Tooling Locations 16

3. Backlash Adjustment

3.1 Measuring Backlash 16
3.2 Adjusting Backlash 17

4. Routine Maintenance

4.1 Use of Oil- and Water-Soluble Coolants 19
4.2 Lubrication 19
4.3 Clean Up 20

5. One-Year Limited Warranty 20

Part No. BC -0009500-0157

Safety Recommendations

READ COMPLETE INSTRUCTIONS CAREFULLY BEFORE OPERATING THIS UNIT. NOTE: Equipment refers to the rotary table 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.

- 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 rotary table 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.

DO NOT 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. (Where Applicable)

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

Part No. BC -0009500-0157

Safety Recommendations (continued)

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 STOOP 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.

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.

Part No. BC -0009500-0157

Safety Recommendations (continued)

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.

Part No. BC -0009500-0157

1. Introduction

1.1 Description

The Hardinge® GD160LP Rotary Table provides accurate and dependable positioning of small and medium parts in machining operations such as milling, drilling, tapping, contouring and spiral milling.

The GD160LP is a fully integrable, programmable rotary positioning device that saves on workspace without sacrificing performance. The mechanical 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 mechanical head features an A2-4 spindle nose for spindle tooling compatibility with A2-4 spindle CNC lathes coupled with a precision ground 160mm slotted face plate. The spindle also houses a 5C collet seat, which accepts a variety of the 5C tooling that Hardinge is noted for.

The Hardinge Spindle

The GD160LP Rotary Table spindle is based on the industry standard A2-4 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 center-line from the machine bed of 5.00"/127mm, which keeps the unit small enough to fit on many machines.

The spindle is hardened and ground for accuracy and has a rigid design with two large deep groove ball bearings to support heavy cutting forces. Positioning of the spindle is accomplished through a self-locking gear set and timing belt.

1.2 High Stiffness Overall System

The Hardinge GD160LP Rotary Table uses a high-quality hardened gear system with a 90:1 ratio achieved through gear and timing belt reduction. This type of gearing allows for an efficient transmission of high torque driving capability through the worm. The bearing set for this system consists of two large deep-groove ball bearings located on either side of the gear set. The bearings have been separated by the gear to increase the distance between the pivot points of the spindle, which greatly decreases the amount of system deflection caused by machining forces. This spindle is also equipped with a high-torque pneumatic fail-safe clamp, which prevents back driving 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 GD160LP Rotary Table has been designed for those parts that can be conveniently clamped to the slotted face plate or conveniently gripped in any of the 5C gripping systems. Typical parts are in the range of approximately 2"/50.8mm in diameter and generally not longer than 6"/152.4mm without the use of a tailstock. It is typical to speak in terms of the L/D ratio, which is the length divided by the part diameter. A 2"/50.8mm diameter part 6"/152.4mm long has an L/D ratio of 3:1. Part pieces with larger L/D ratios should be used with a tailstock up to a typical L/D ratio of 6:1.

Larger part sizes than those described above can be handled with certain restrictions but should not exceed 50lb/22.7kg in weight.

Part No. BC -0009500-0157

1.4 Standard Spindle Clamp

The GD160LP comes with a fail-safe spindle clamp that is standard from the factory. This clamp allows the spindle to handle cutting forces equal to 150 ft-lb/203 Nm, allowing for greater cutting forces in the non-contouring mode of operation. The unit contains an air sensor that will prevent rotation 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 operated with the Hardinge servo control, the clamp can be controlled automatically so that the clamp is engaged when the rotary table 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 table with air 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 table. Please note that even a momentary drop in air pressure can 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. Clamp requires a minimum of 85psi and a maximum of 100psi of dry filtered air to fully release the spindle.

Part No. BC -0009500-0157

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 DEEP GROOVE BALL 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

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 when the servo is stopped

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 the rotary table 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 step, (or several steps) with automatic program step 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 240 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

ONE-YEAR WARRANTY
The Hardinge GD160LP Low-Profile Rotary Table is provided with a one-year warranty against any defects in material and workmanship.

Part No. BC -0009500-0157

1.6 Specifications

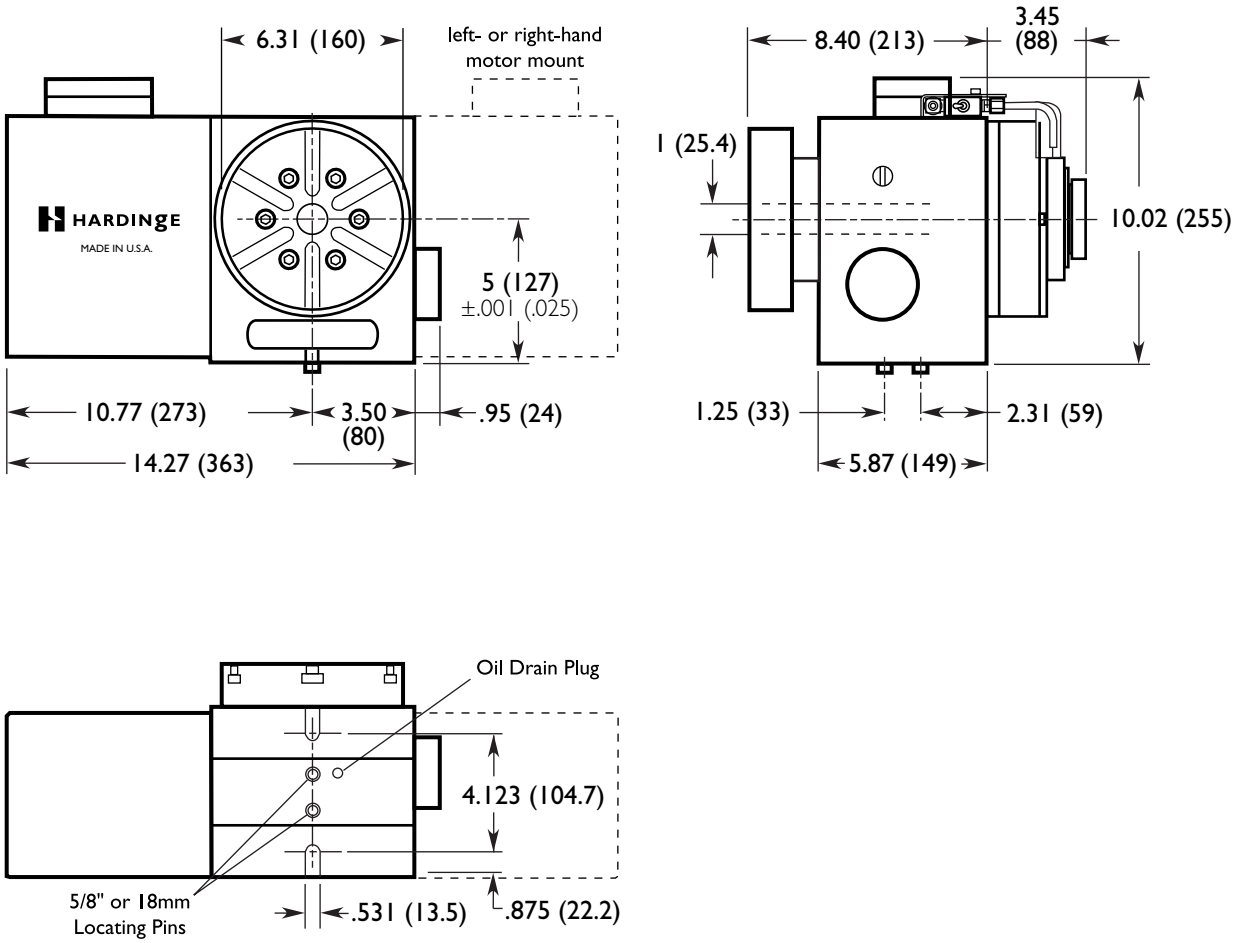
Spindle	
Torque (ft-lb/Nm)	73/99
Spindle Runout Max (TIR)	0.0002"
Faceplate Runout Max	0.0002"
Faceplate Perpendicularity	0.0002"
Backlash (arc/sec)	40
Speed (degrees/sec)	0.001 to 240
RPM Maximum	40
Load Support	Dual Deep-Groove Ball Bearings
Spindle Nose	A2-4
Spindle center to base (inch/mm)	5.000"/127 ± 0.001/.025
Positioning:	
Accuracy (arc/sec)	± 20*
Repeatability (arc/sec)	±5
Resolution (degree)	0.001
Max Rotation/Step (degree)	Continuous
Gear Diameter (inch/mm)	3.65/92.7
Motor	
Type (hp/kW DC servo)	0.78/0.58 (with Hardinge Servo Control)
Clamping Torque	150 ft-lb / 203 Nm
Gear Ratio (gear set)	90:1
L-pitch Timing Belt Frequency (Hz)	251-263
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	MOBILGEAR 600 XP 220
Air Pressure Range for Clamp (psi/bar)	85min-100max/5.9min-6.9max (dry filtered air)
Weight	
Rotary Table (lb/kg)	120/5.4
Workholding	5C
Collets-Round (maximum capacity) inch/mm	$1\,{}^{1}/_{16}$"/26.98
Collets-Hex (maximum capacity) inch/mm	${}^{29}/_{32}$"/23.01
Collets-Square (maximum capacity) inch/mm	${}^{3}/_{4}$"/19.05
Step Chucks-Regular Depth (max. capacity) inch/mm	Up to 4"/102.8
Step Chucks-Extra Depth (max. capacity) inch/mm	Up to 4"/102.8
3-Jaw Manual Chucks (diameter) inch/mm	5"/127, 6"/152.4
Sure-Grip® Expanding Collets-Collet Style inch/mm	${}^{1}/_{8}$"-3"/3.17-76.2
Slotted Face Plate (diameter) inch/mm	6.299/160
Collet Stops for Part Positioning	YES

*Accuracies can be improved with electronic compensation

Part No. BC -0009500-0157

1.7 Dimensions

GD160LP Rotary Table



The GD160LP can be ordered with the motor on either side of the unit. If the unit is ordered with the motor in the standard orientation, the motor is on the left looking at the faceplate as shown above and counterclockwise is the positive direction. The drive dog will be in the 2 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 drive dog will be in the 8 o'clock position when the rotary is in the zero position.

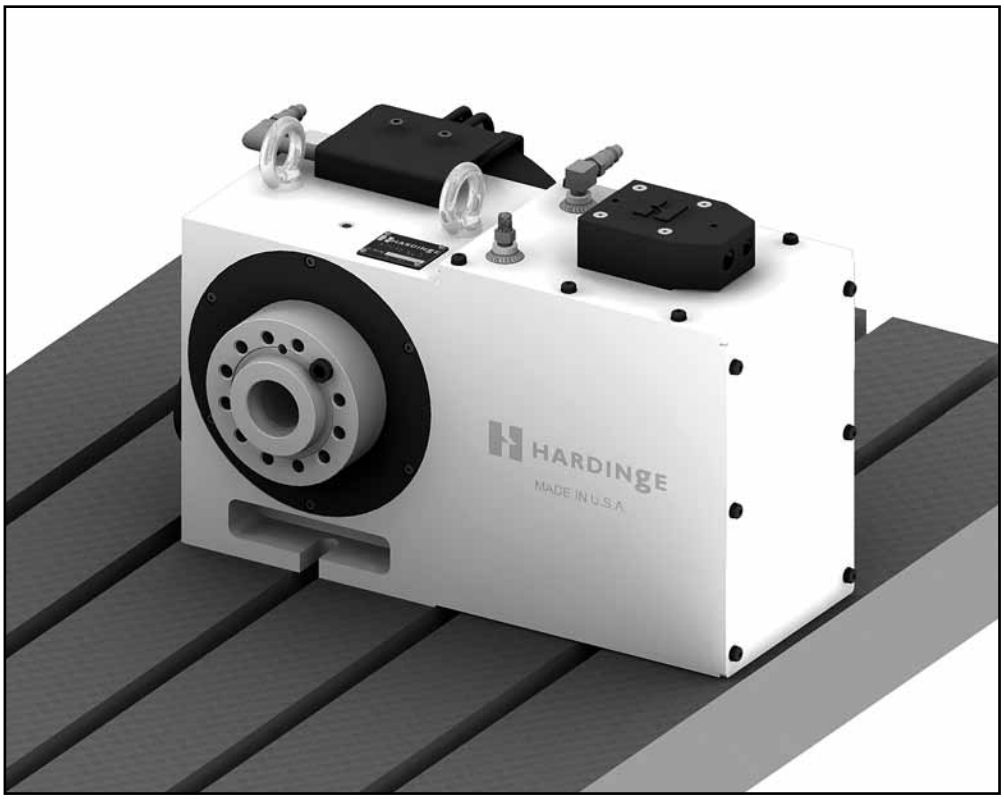
NOTE: The Hardinge servo control and most machine control parameters can be changed to make either clockwise or counter-clockwise the positive direction.

Part No. BC -0009500-0157

2. Set Up

2.1 General Setup

1. Fill out the warranty information by visiting "www.hardinge.com/rotarywarranty" on the internet.
2. Place the GD160LP 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. Use a cable retractor for excessive cable slack. Secure the rotary table to the machine's T-slot table as shown below (upright or on its back). T-nut packages are available for purchase for various T-slot tables. Kit includes (2) T-nuts, (2) bolts and (2) flat washers. Mounting the rotary table on its back will require a special vertical mounting plate. Check to verify that all clearances are satisfied in full machine axes movements and that there is no possibility of a collision.



3. Place the GD160LP 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 GD160LP 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 a rotary table to a Hardinge mill using a remote CNC cable, or as a true 4th axis, the settings must be set for the specific unit. 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 its 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.

Part No. BC -0009500-0157

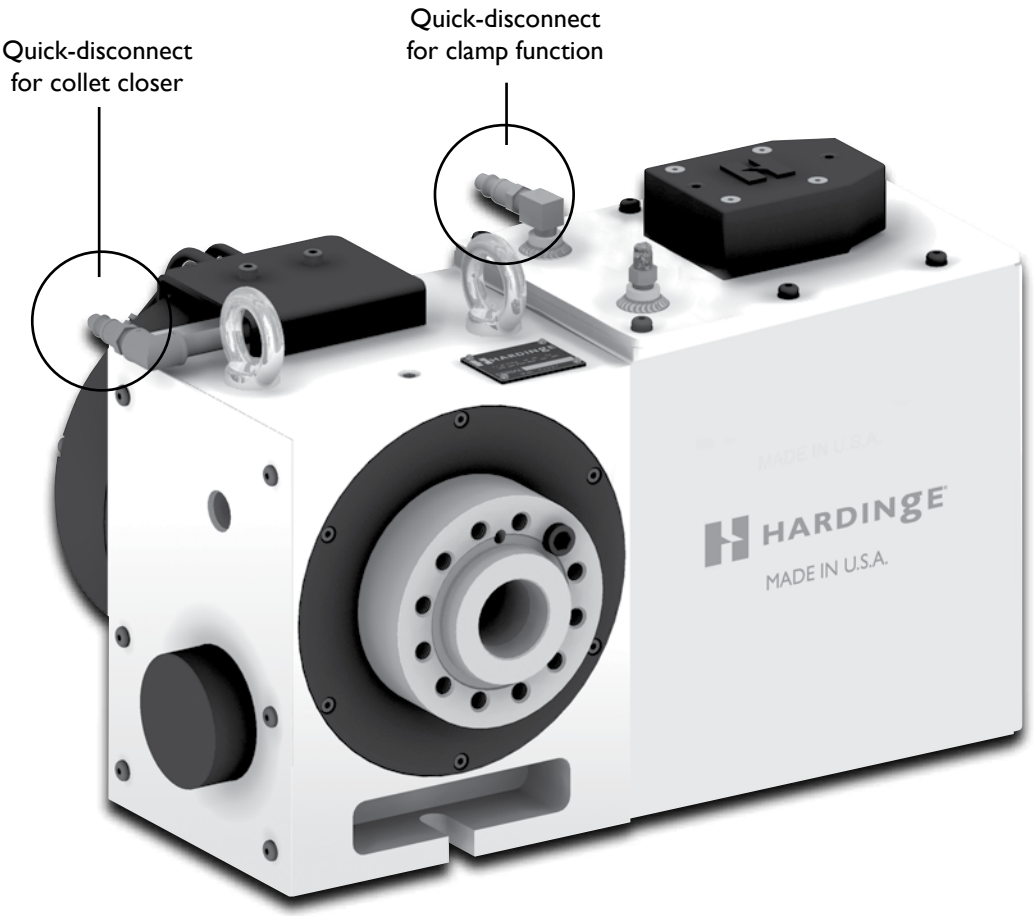
7a. Connect the two cables from the rotary table to the controller in the appropriate locations.

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 using an extension cord, use a three-wire ground type and the ground line must be connected. Use only heavy-duty 12-gauge extension cords capable of 20 amp load. Avoid outlets that have large electric motors connected to them. 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 the separate Hardinge servo control manual for more information (included with the unit).

8. Connect a minimum of 85 psi or maximum of 100psi of dry filtered air to the quick-disconnect fitting on top of the motor cover for releasing the spindle clamp.



CAUTION: Never operate the GD160LP without a minimum of 85 psi or maximum of 100psi dry filtered air connected to the fitting or mechanical damage may occur.

Part No. BC -0009500-0157

9. Check the oil level. If it is low, add oil. Use MOBILGEAR 600 XP 220 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 rotary table. The 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.

NOTE: If using a tailstock, always use Live Centers. The use of Dead Centers could cause damage to the gear systems.

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

2.2 Use of the GD160LP Collet Closer (Optional)

The GD160LP collet closer has a 1.08"/27.4mm through-hole design with pneumatic open and close. The through-hole can be used for through-spindle coolant or for holding long parts or material. The pneumatic closer has a .375"/9.5mm stroke. Since the closer is actuated both forward and backwards pneumatically, the air pressure can be regulated to get different desired drawbar forces for specific gripping applications. An example of the adjusted drawbar forces is below.

GD160LP Collet Closer Drawbar Force Chart

Air Pressure (psi)	**Drawbar Pull Force (lbs)**	**Drawbar Push Force (lbs)**
70	1618	1500
80	1850	1713
90	2080	1927
100	2312	2141

2.3 Use of Collets, Sure-Grip® Expanding Collets, Manual Chucks, Face and Fixture Plates

The unit accepts standard Hardinge® 5C collets, step chucks, ID gripping collets, manual and power chucks, face and fixture 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.

Manual chucks and face plates utilize the A2-4 nose on the spindle. We recommend using manual or power chucks that are 6"/152.4mm in diameter, or smaller, and weigh less than 20 pounds. Pay special attention when installing chucks. Always make sure that the spindle nose and face of the spindle are free of dirt and chips. Apply a thin coating of oil to the spindle. Bolt the chuck to the spindle using the supplied bolts, making sure to tighten the bolts to the specified torque.

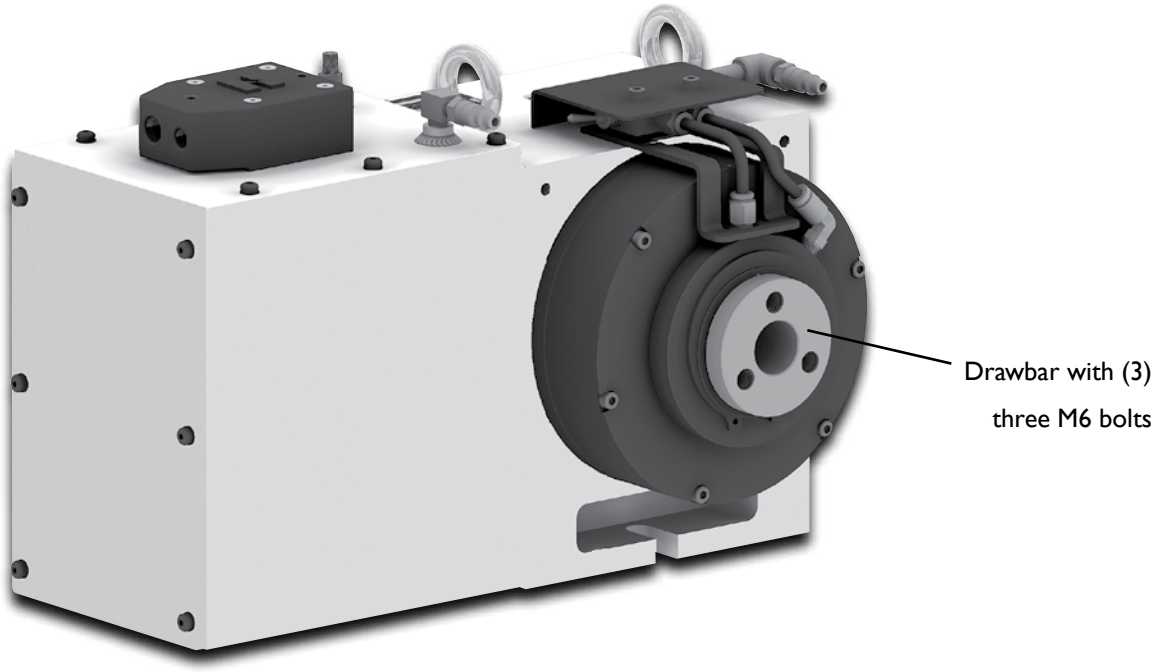
Part No. BC -0009500-0157

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 the (3) three M6 bolts in the back of the drawbar are completely backed out of the piston. Align the collet keyway with the spindle key and insert the collet until the collet threads contact the end of the drawbar. If the collet goes all the way in the spindle without touching the drawbar threads, the closer may have to be actuated in the opposite direction that it is currently in. Turn the drawbar until the collet grips the part and then back the collet out ¼ turn of the drawbar until the M6 bolts on the back of the drawbar line up with the tapped holes in the piston. Tighten all (3) three of the M6 bolts back down before actuating the collet closer.

Back of Rotary Table showing Optional Collet Closer

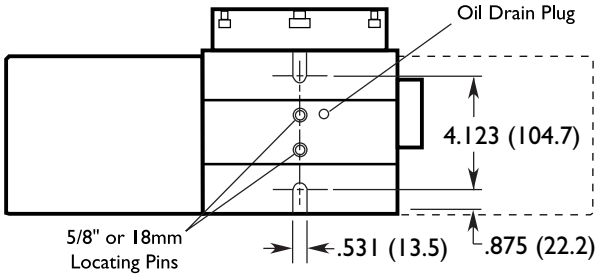


NOTE: To prevent excessive wear and collet sticking, make sure collets are in good condition and free from burrs. A light coat of Molybdenum grease on the collet wear surfaces will extend the life of the spindle and/or collet and help prevent sticking, especially when operating dry.

Part No. BC -0009500-0157

2.5 Tooling Locations

The GD160LP Rotary Table is equipped with tooling points in order to speed up 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 1.250"/31.75mm 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 plug of 0.500"/12.7mm diameter on one side, and 0.625"/15.87mm on the other, comes with the Hardinge rotary table. The 0.625"/15.87mm diameter fits into the T-slot of the mill table. This will give quick parallel alignment that will be adequate for most jobs.

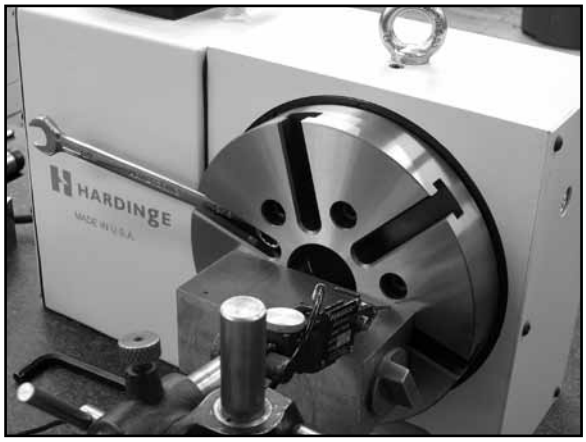


NOTE: 0.625"15.87mm and 18mm plugs are supplied as standard. Plugs can be turned down to another diameter to accommodate tables with different slot dimensions.

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 inch indicator and a magnetic v-block or magnetic block. Home the rotary table, as that is where backlash is checked at the Hardinge factory. Place the magnetic block on the rotary table face plate 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. Setup 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 in the t-slot of the face plate.



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 inches 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 inches 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 arcseconds that is, simply multiply the degrees you calculated by 3600. If you calculate your backlash to be 40 arcseconds 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 arcseconds measured linearly at different radii along with a pictorial description of backlash follow.

Part No. BC -0009500-0157

	1" radius	1.625" radius	2 " radius	3 " radius	4" radius	5" radius	6" radius
1 arc-sec	0.0000048"	0.000008"	0.0000097"	0.000014"	0.000019"	0.000024"	0.000029"
5 arc-sec	0.000024"	0.000039"	0.000048"	0.000073"	0.000097"	0.00012"	0.00014"
10 arc-sec	0.000048"	0.000079"	0.000097"	0.00014"	0.00019"	0.00024"	0.00029"
20 arc-sec	0.000096"	0.000158"	0.00019"	0.00029"	0.00039"	0.00048"	0.00058"
30 arc-sec	0.00014"	0.000236"	0.00029"	0.00044"	0.00058"	0.00073"	0.00087"
40 arc-sec	0.00019"	0.000315"	0.00038"	0.00058"	0.00077"	0.00097"	0.0012"

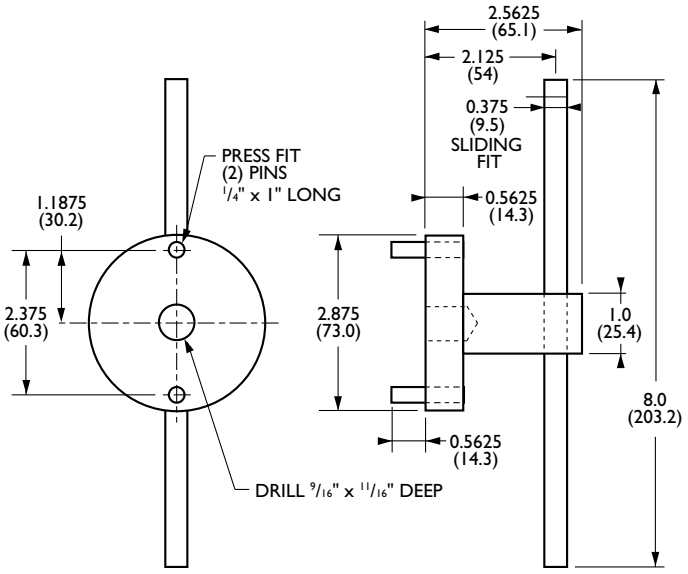
3.2 Adjusting Backlash

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.

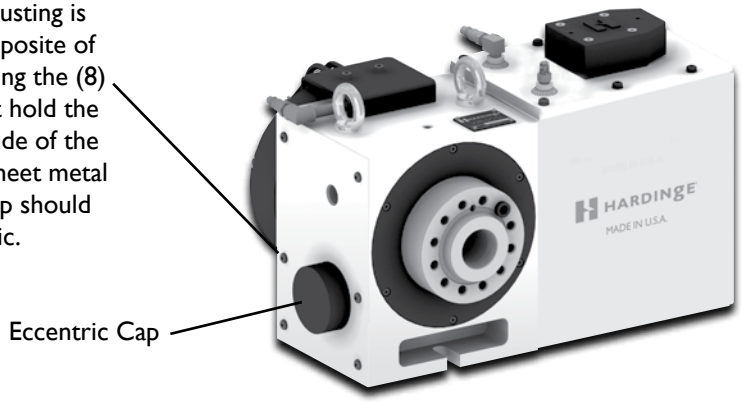
1. The first thing needed for the adjustment of an eccentric is a special eccentric tool. This tool can be made from either steel or aluminum. Failure to make and use this tool may result in damage to the eccentric which will not be covered under warranty.

   SEE SPECIFICATIONS ON RIGHT.

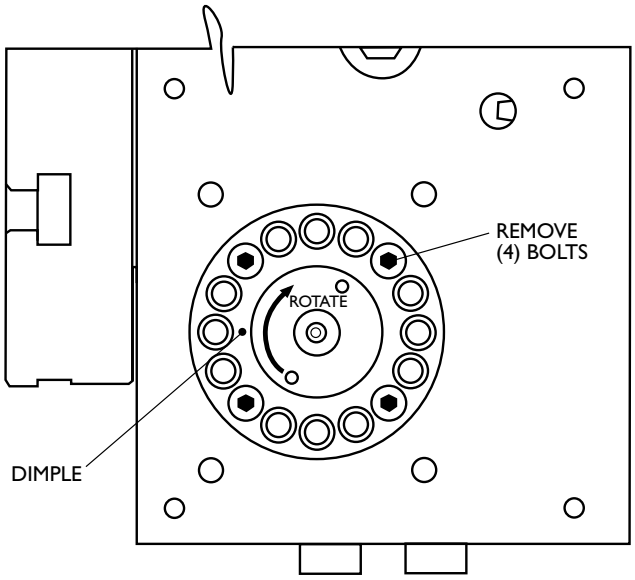


Part No. BC -0009500-0157

2. The eccentric that you will be adjusting is on the side of the rotary table opposite of the motor cover. Start by removing the (8) eight M5 button head screws that hold the flat piece of sheet metal to that side of the rotary table housing. Once the sheet metal plate is removed, the eccentric cap should just come right off of the eccentric.



3. Remove the (4) four M6 bolts in the eccentric housing.
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 rotary table housing.
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.



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

7. Put the rotary table back together once finished adjusting backlash.

NOTE: Put Teflon tape on the M4 set screw and screw it in to the eccentric end cap, so that it is flush with the outside of the end cap, after you have installed the end cap back into the housing.

Part No. BC -0009500-0157

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:

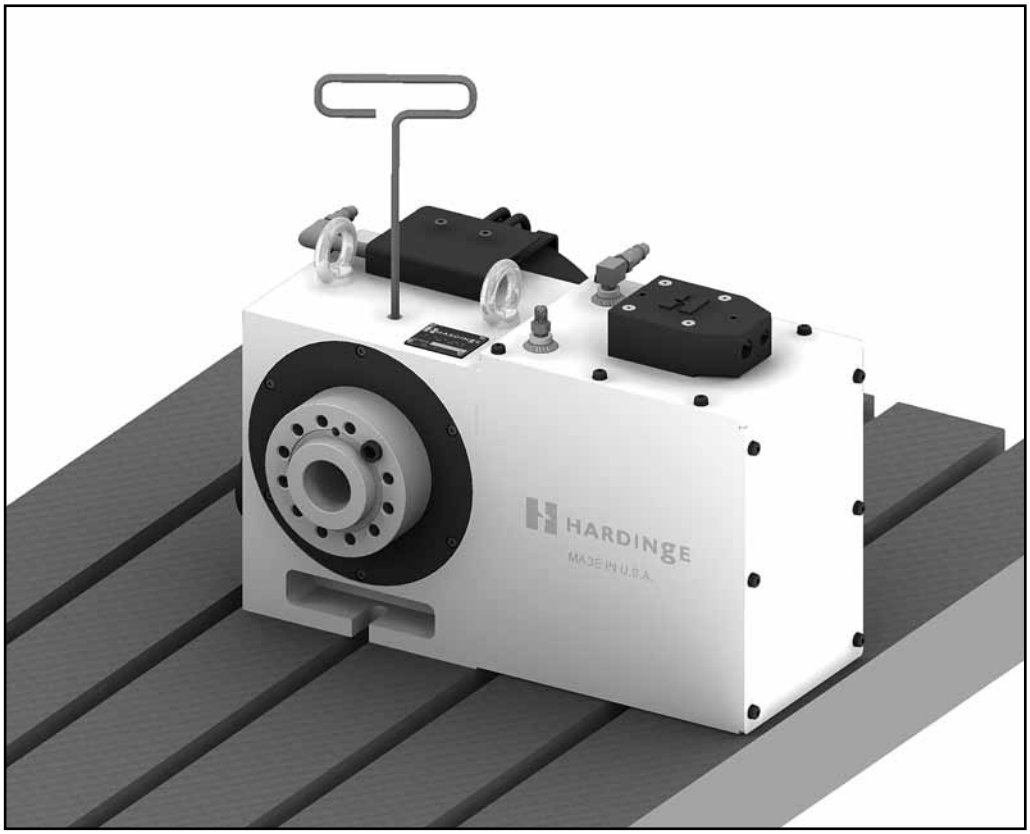
- DO NOT SUBMERGE THE UNIT IN COOLANTS. Keep the coolant lines on the work piece spraying away from the head. Tool spraying and spatter usually will not be detrimental to the motor, but large amounts of pressurized coolant should be directed away from the head. Some machining centers provide flood coolant 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 rotary table, view the level of lube visible in the lubricant window when the unit is stopped. The window is located on the side of the unit opposite the motor. The lube level should reach the middle of the window. If the unit is mounted on its back, the oil should cover the entire lubricant window. If necessary, add lubricant until the level reaches the appropriate level on the window.

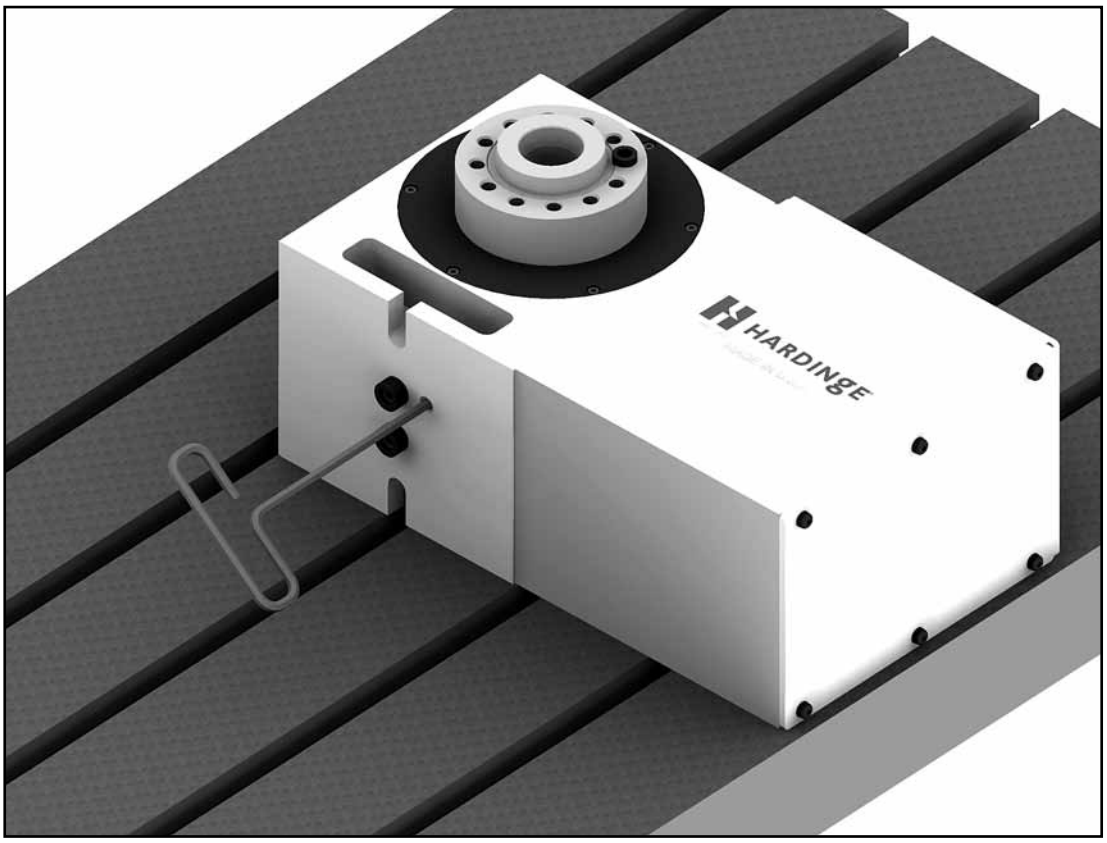
To add lubricant to the unit, locate and remove the pipe-plug from the lube fill port. This is located above the spindle on top of the unit. Add MOBILGEAR 600 XP 220 until the proper level is reached. Replace the fill port pipe-plug and tighten.

Oil Fill – replace the oil every year



Part No. BC -0009500-0157

Drain oil using the drain location found on the bottom of the rotary table.
Place the unit in the vertical position to completely drain the oil.



4.3 Clean Up

At the end of the workday or shift, it is important to clean the 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.

5. One-Year Limited Warranty

The Hardinge GD160LP Rotary Table is provided with a one-year warranty against any defects in material and workmanship. Specific details of the warranty can be found in the Hardinge Terms and Conditions document associated with the purchase agreement.

Part No. BC -0009500-0157

Notes:

Part No. BC -0009500-0157

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 Homepage: www.hardinge.com | E-mail: info@shophardinge.com | Live Online Support: www.shophardinge.com

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