MODEL 8D RADII-CUTTER

INSTRUCTION MANUAL

INTRODUCTION

Congratulations! You have purchased the finest radius cutting lathe attachment available. The combination of the Holdridge Radii-Cutter and your lathe allows you to turn a wide variety of parts with great accuracy and excellent finishes. The Radii-Cutter is capable of cutting almost any spherical contour you would ever require. Typical applications include complete balls, sockets, ball bearing races, pipe bending dies, tube rolling diesets, concave and convex sections on parts and more. The only limit is your creativity. The Model 8D Holdridge Radii-Cutter has a capacity of 8 inches maximum and .5 inches minimum diameter convex, and can be used for up to 20 inches diameter concave with some restrictions. For more information regarding your particular application contact your dealer or the factory at (213) 321-4937.

MODEL 8D PARTS

The main parts in the Model 8D Radii-Cutter are as follows. For a complete listing consult the Parts Price List included in your Radii-Cutter set. The use of these parts is described in detail in the following pages.

PART NO.	DESCRIPTION
8-1S	**Frame.** Attaches to compound, holds various yokes.
8-2S	**Handle.** Used to rotate yokes in frame.
8-3S-1	**"C" Yoke.** Turns convex up to 3" diameter, concave to 8" diameter.
8-3S-2	**"C" Yoke.** Turns convex 3" to 6" diameter.
8-3S-3	**"C" Yoke.** Turns convex 6" to 8" diameter.
8-6S	**Tie Down Plate.** Locks Frame to compound of lathe.
8-7S	**Parallel Bar.** Used for measuring radius of cut.
8-TBS	**Tool Bit Support.** Stiffens extended Tool Bits.
8-GF	**Grinding Fixture.** Used for resharpening Tool Bits.
8-13D-1	**5/8" Diameter Straight Spindle Yoke.** Used for concave circumferential cuts up to 1 inch diameter.
8-13D-2	**7/8" Diameter Straight Spindle Yoke.** Used for concave circumferential cuts up to 1¾ inches diameter.
8-13D-3	**1 9/16 Diameter Straight Spindle Yoke.** Used for concave circumferential cuts up to 5 inches diameter.

PART NO.	DESCRIPTION
8-15D	**Dial.** Used for accurately controlling the sweep of the tool bit.
8-5S-L	**6" Long Straight Tool Bit.** Used for concave cuts.
8-5S-M	**4½" Long Straight Tool Bit.** Various uses.
8-5S-S	**2½" Long Straight Tool Bit.** Various uses.
8-14D	**¼" Carbide Tool Bit.** Used in 8-13D-1 and offset tool bits.
8-14D-1	**1" Long ⅜" Diameter Tool Bit.** Used in 8-13D-2.
8-14D-2	**1½" Long ⅜" Diameter Tool Bit.** Used in 8-13D-2.
8-17D-1	**45 Degree Offset Tool Bit.** Used to solve clearance problems.
8-17D-2	**30 Degree Offset Tool Bit.** Used to solve clearance problems. (Note: only one offset tool bit is included in the Radii-Cutter Set. Normally this is #8-17D-1)

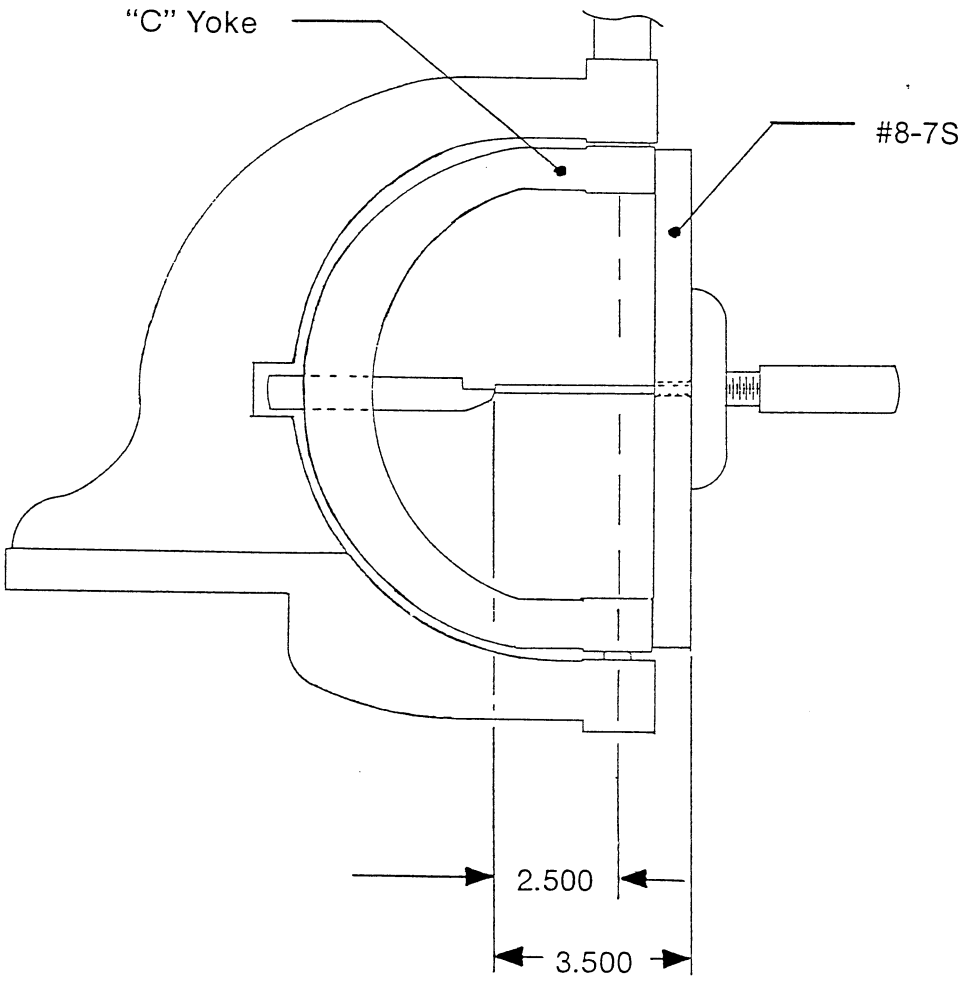
RADIUS SETTINGS

The radius that the Radii-Cutter will cut is determined by the distance from the tip of the tool bit to the axis of rotation of the yoke. The tool will cut convex when the tip of the tool bit is "inside" of the axis and concave when it is "outside." The radius settings are made using the #8-7S Parallel Bar, the appropriate "C" or Straight Spindle Yoke, a depth micrometer (not included in the set), and at times .500 or 1.000 inch blocks (not included in the set). Magnetic blocks work best. Keep in mind that when the Parallel Bar is held against the flats on the ends of the yokes, the outside surface of the Parallel Bar is 1.000 inch from the axis of rotation of the yoke. Radius Settings are made as follows:

1. Determine the required radius.
2. Select appropriate yoke for application.
3. Insert Tool Bit through hole in center of Yoke.
4. Locate #8-7S Parallel Bar against flats on end of Yoke.
5. Set depth micrometer for desired radius.
6. Hold depth micrometer against Parallel Bar, with spindle extended through hole in center of Parallel Bar.
7. Slide Tool Bit until tip touches end of depth micrometer, then lock in place using set screw in yoke.

CONVEX (Ball Shaped) CUTS: The radius setting will be exactly 1.000 inch less than the micrometer reading, because of the distance from the parallel bar surface to the axis of rotation.

Example: Convex radius setting. You desire to cut a 5.000 inch diameter ball. The required radius setting is then 2.500 inches. Because the Parallel Bar surface is 1.000 inch from the axis of rotation the depth micrometer reading would be 3.500 inches.



Example: Convex Radius Setting

CONCAVE (Socket-Shaped) CUTS: The depth micrometer setting is determined by subtracting the desired radius from the total distance from the #8-7S Parallel Bar to the axis of rotation of the Yoke. In cases where the desired radius exceeds .575 inches the Parallel Bar will have to be blocked away from the flats on the Yoke. Assuming 1.000 inch thick blocks, the blocking requirements are:

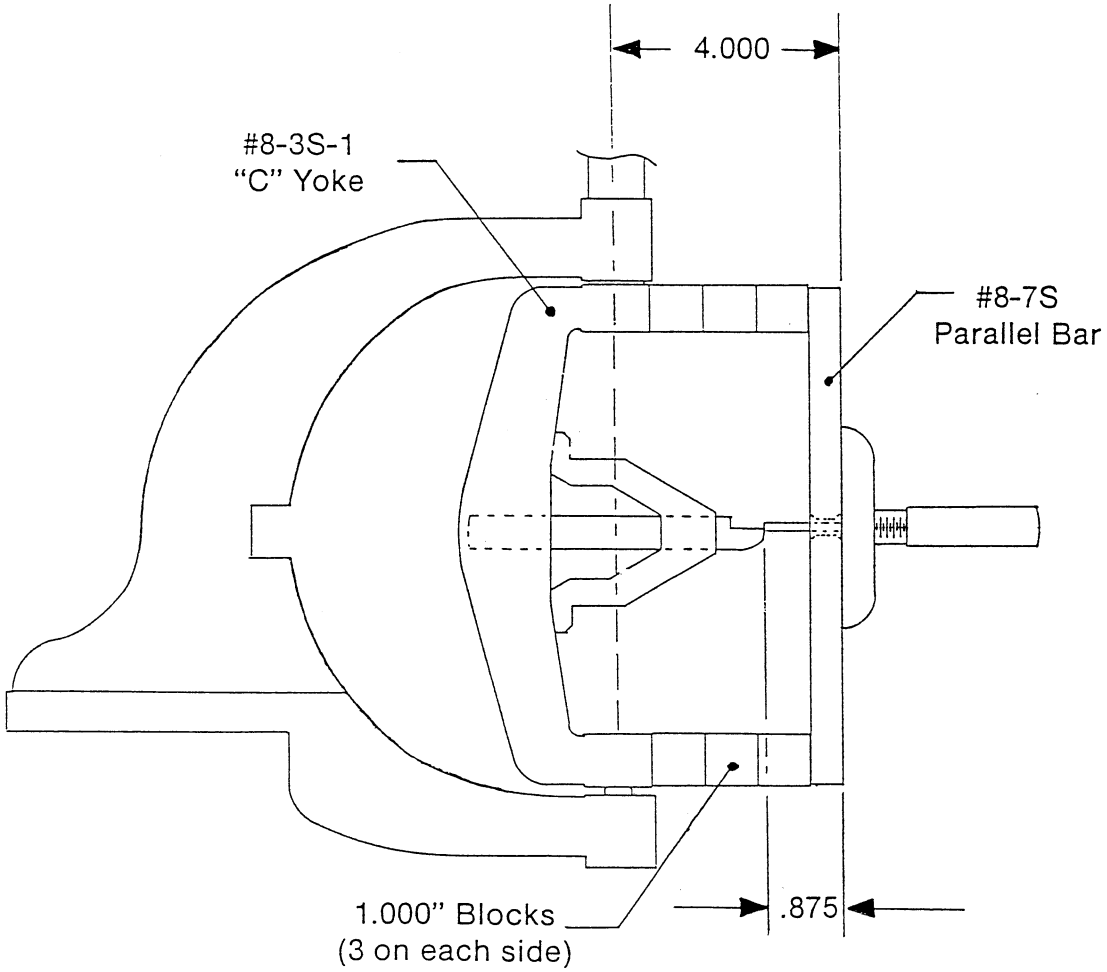
RADIUS RANGE	BLOCKING REQUIRED
0.00 to .575 inch	None
0.576 to 1.575	1.000 inch
1.576 to 2.575	2.000
2.576 to 3.575	3.000
3.576 to 4.000	4.000

Example: Concave radius setting. You desire to cut a 6.250 inch diameter socket. The required radius setting is then 3.125 inches. From the table above, the #8-7S Parallel Bar must be blocked away from the flats on the Yoke 3.000 inches, making the total distance from the outside surface of the Parallel Bar to the axis of rotation 4.000 inches. The Depth Micrometer setting is determined by the relation:

Parallel Bar-to-Axis distance
(-) Desired Radius
(=) Depth Micrometer Setting

Or, in this example:

Parallel bar-to-Axis distance:	4.000
Desired Radius:	(-) 3.125
Depth Micrometer Setting:	0.875



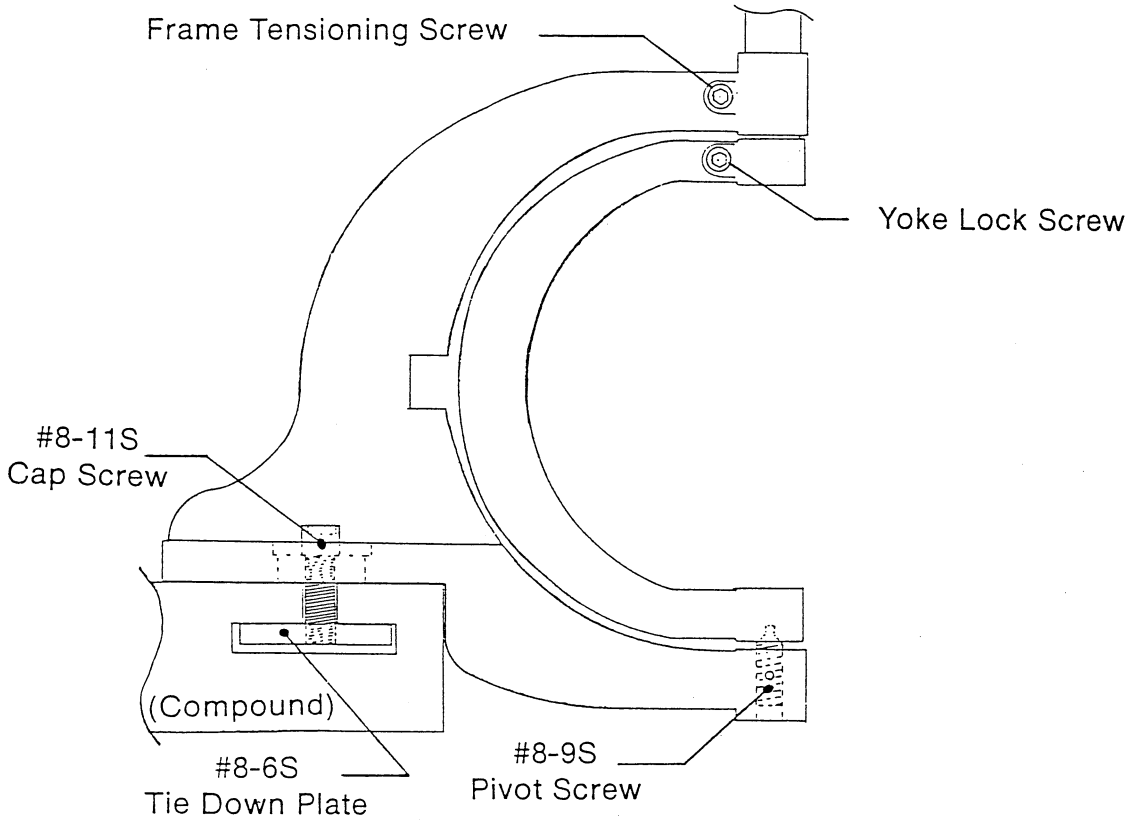
Example: Concave Radius Setting

SETTING THE RADIUS FOR THE OFFSET TOOL BITS

The radius settings for the offset tool bits cannot be done as described above. Instead use the following procedure:

1. Set desired radius using straight tool bit as described above.
2. Make a cut on the stock turning in the lathe.
3. Stop lathe, swing yoke so tool bit can be removed without moving carriage, compound or cross-slide. (If you cannot swing yoke to clear for tool bit removal, use travel indicator to note carriage position and then move Radii-Cutter away from stock using carriage.)
4. Remove straight tool bit and insert offset tool bit.
5. Swing yoke back (or relocate against travel indicator) and touch off the tip of the offset tool bit against the surface that was machined in step (2).
6. Lock the offset tool bit in place. It is now set for the same radius as the straight tool bit that was removed.

RADII-CUTTER SETUP



1. **Mounting Radii-Cutter on Lathe.** The Model 8D Radii-Cutter fits best on a 15 inch swing lathe or larger. The Model 8D is designed for machines with the distance from the top of the compound to the spindle centerline being 1⅝ to 1¾ inches, but machines not in this range can still be fitted with the Model 8D. The 8-1S frame sits on the compound of the lathe, the 8-6S Tie-Down Plate sliding into the T-Slot of the compound. Secure the frame using the Tie-Down Plate Cap Screws (#8-11S) through the base of the frame and into the Tie-Down Plate. The compound can be adjusted to any angle; we suggest you start at a 45 degree angle.

   Once the frame is mounted on the compound, the yoke and handle are assembled to the frame in the same manner which they were received from the factory in the carrying case. Locate the pivot point of the yoke on the Pivot Screw in the frame, then slide the handle through the bore in the top boss of the frame, inserting the stepped down section of the handle into the bore in the top of the yoke. Then tighten the lockscrew in the top of the yoke to secure the yoke to the handle. Adjust, if necessary, the tensioning screw in the top of the frame. The handle-yoke assembly should rotate freely in the frame with a slight amount of drag. There should be no lateral play in the assembly. CAUTION: DO NOT OVERTIGHTEN FRAME TENSIONING SCREW OR DAMAGE TO THE FRAME OR HANDLE MAY RESULT.

2. **Centering the Radii-Cutter on the lathe.** For proper operation the Radii-Cutter must be centered in the vertical and cross-slide axis. It is helpful to have a travel indicator or Digital Readout on the cross-slide axis. The following procedure is recommended.

Centering along the cross-slide axis

a. Place a piece of scrap round stock in the lathe chuck; preferable of a known, easy-to-work-with diameter such as one inch.

b. Set the Radii-Cutter to cut a convex radius the same as the radius of the stock.

c. For a rough centering of the Radii-Cutter, rotate the yoke so that the tool bit is at 90 degrees from the axis of the stock and touch-off the tool bit on the perimeter of the stock. This should get you within .002 inches from true center. For more accurate centering continue with the following steps.

d. Running the lathe forward (counterclockwise), make a few cuts on the stock, feeding in with the carriage after each cut, until a small portion of the radius has been formed. Cut from the outside (towards operator) towards the center. CAUTION: DO NOT FEED TOOL BIT BEYOND CENTER OF STOCK OR TOOL BREAKAGE CAN OCCUR.

e. Stop lathe, swing Radii-Cutter to back side of stock, and start the lathe in reverse.

f. Adjust cross-slide until tool bit touches the surface machined in (d), noting the amount of the adjustment.

g. Move the cross-slide in the opposite direction one-half of the amount noted in (e).

h. Repeat steps (d) through (f) as necessary until machining on the back side of the stock produces only a very fine skin cut.

Once the cross-slide center has been established, we recommend locking the cross-slide and compound in place so accidental movement cannot occur.

Vertical Centering. The vertical center is easily established using the #8-9S Pivot Screw located in the bottom boss of the frame. Adjust the Pivot Screw up or down, making cuts on the stock, until the tip of the stock is smooth, with no nub.

USE OF THE MODEL 8D RADII-CUTTER

The Radii-Cutter can be used to produce a variety of different radiused parts. Generally, they fall into two categories: face cuts and circumferential cuts. Face cuts are made on the end of the stock turning in the lathe; circumferential cuts are made on the perimeter of the stock.

FACE CUTS

Face cuts are normally balls, sockets and radius sections on the end of the stock.
Balls and convex sections are cut in the following manner:

1. Set tool bit for proper radius as described in RADIUS SETTINGS. Select "C" Yoke to minimize tool bit extension.
2. Set up Radii-Cutter as described above. Once Radii-Cutter is centered, lock cross-slide and compound to avoid accidentally knocking it off center.
3. Mount stock in lathe chuck: if complete ball is to be machined, a hub must be machined on the end of the stock and the stock mounted so there is clearance between the back side of the stock and the chuck. The stock should be left about .100 inch longer than the diameter of the ball, and the diameter should be about .020 inches greater than the ball diameter to allow for clean up cuts. It is recommended that the machine be run as fast as possible.
4. Begin machining from the end of the stock towards the outside, make successive cuts by feeding in with the carriage. As the full ball end is formed, finish by feeding from the outside toward the center, slowing the feed as you approach the center to account for the slower linear speed.
5. If cutting a complete ball, finish the ball by machining the portion of the ball toward the chuck. An offset tool bit should be used to clear the chuck. Once this portion of the ball is machined, finish the ball by machining from the hub completely around to the tip. Then remove the ball, cut off the hub and radius the hub machining the ball between radiused cups, one in the chuck and one turning with a live center.

Sockets and concave sections are cut in the following manner:

1. Set tool bit for proper radius as described in RADIUS SETTINGS. Normally the 8-3S-1 "C" Yoke will be used. The #8-TBS Tool Bit Support can be used to stiffen extended tool bits.
2. Set up Radii-Cutter as described above. Once Radii-Cutter is centered, lock cross-slide and compound to avoid accidentally knocking it off center.

3. Mount stock in lathe chuck.
4. Begin machining by feeding tool bit from outside of face toward center. Make successive cuts by feeding in with the carriage; depending on material cuts of .04 deep can be made. If a radius-depth socket is to be cut, in other words a socket whose depth is to be the same as its radius, an offset tool bit must be used to avoid interference problems.
5. Large diameter sockets can be achieved by extending the tool bit out of the back of the "C" Yoke.

CIRCUMFERENTIAL CUTS

Examples of circumferential cuts are bending dies and tube rolling diesets. In these cases the Radii-Cutter is first centered and then moved along the cross-slide axis to the perimeter of the stock.

1. Select the proper yoke, normally one of the Straight Spindle Yokes, and set the radius as in RADIUS SETTINGS.
2. Locate the Radii-Cutter in the proper location along the outside of the stock, and make successive cuts feeding in, using the cross-slide to the desired depth.
3. If doing a convex circumferential cut, select the proper "C" Yoke. An offset tool bit may be needed if the cut ends at a shoulder.

USE OF OTHER PARTS

#8-TBS Tool Bit Support. Used with the 8-3S-1 and 8-3S-2 Yokes to support extended tool bits when doing concave cuts. The two feet of the Tool Bit Support mount to the cavity in the yoke, and the lockscrew in the bore of the Tool Bit Support locks on the tool bit.

#8-GF Grinding Fixture. Used to resharpen the 8-5S-S,-M and -L tool bits. The tool bit locks into the Grinding Fixture with the flat on the tool bit aligning with the lockscrew. The relief angles on the tool bit are then established by holding the grinding fixture with the two milled surfaces against the table of your pedestal grinder. Use a diamond grinding wheel to resharpen the carbide tip of the tool bits.

#8-15D Dial. Used to accurately control the sweep of the tool bit. The base of the Dial locates atop the bore through the top boss of the frame and the dial locks to the portion of the handle that goes through the frame bore.

We hope you find these instructions complete and helpful. If you have any questions regarding your particular application or the use of the Radii-Cutter, call the factory at (213) 321-4937 or fax your question to us at (310) 329-3854.