CJWINTER

192 Series

Precision Involute Knurl / Spline Tools

Instruction Manual

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Introduction

Congratulations on your purchase of a CJWinter 192 Series Involute Knurl Rolling Tool. These tools have been designed specifically for use in the manufacture of Precision Involute Knurls and Splines on various machine tools.

This manual will help you use and maintain your tool.

What is an Involute Knurl or Spline?

Involute knurls and involute splines are two names for the same type of feature. They are a series of ridges formed on the periphery of a cylinder, where the shape of each ridge is defined by the involute formulas of a gear tooth. They are primarily used as shaft connection devices to transmit torque to components that are pressed onto or over molded the end of a shaft. The involute ridges transmit torque more effectively than a simple press into a round hole, and also can orient features between the shaft and the over-pressed component.

Why Roll Involute Knurl Connections?

Involute Knurl connections can be manufactured by a wide variety of means, including casting, forging, cutting, broaching, milling etc... However, none of these processes can match the speed at which rolling can form a knurl, the economy of the process, the convenience of performing the operation in a traditional metalworking lathe or mill without specialized equipment, nor the strength of the final product.

Knurl rolling typically occurs in 2 to 3 seconds. Time will naturally vary with the knurl length, and diameter, but in virtually all cases, rolling is an order of magnitude faster than conventional machining processes.

Tooling cost per part is extremely competitive to all other processes, usually 5 to 10 times less expensive than the next closest option, which makes it perfect for high volume, low margin jobs.

Knurling can be completed on virtually any lathe, mill, or multi-spindle machine. No specialized equipment is required, no secondary processes are required. For the most part, if you can machine the blank, you can knurl the part.

Knurl rolling is a cold-forming process, where material is displaced and formed into the final shape at room temperature. The material's grain structure is refined, and the grain boundaries are forced to flow smoothly past all root radii, rather than being cut. As a result, the final part is work-hardened into a tougher connection. The knurl tooth is more resistant to deformation, and cracking, and can carry a higher load than a cut counterpart.

Why Use a CJWinter Knurl Rolling Tool?

For nearly 50 years, CJWinter has been an industry leader in supplying thread rolls, knurls, burnishing rolls and thread rolling tools globally. CJWinter has used that experience to design knurling tools specifically for the Precision Involute Knurling applications. We believe this is the easiest to use, most precise tool to manufacture involute knurls on the market. Our in-house engineering staff is always available to assist with any technical manufacturing situation.

The CJWinter 192 Series tools and rolls have incorporated unique, Patent Pending features and advantages not always found on other knurl tools.

1-Twist Size Adjustment. The CJWinter tools requires the loosening of only 3 locking screws, and a simple twist of the head to adjust the distance between the 3 knurling rolls. This 1 twist will cause all three rolls move equally towards, or away, from the centerline of the tool, ensuring that each roll does an equal amount of work, that the work piece is always evenly supported, and ensuring the best concentricity of the knurl surfaces back to the part centerline. Other axial knurling tools on the market require as many as 27 separate screws to adjust size, and have no means of keeping the rolls concentric to the tool axis. This can lead to one knurl working harder than the others, bent parts, knurls that run out, and material slivering.

Graduated Scale. Adjustments to size are made while referencing a graduated scale on the side of the head. The scale is clearly labeled (+) and (-) so fine adjustments can be made with confidence.

Master Pinion Gear with Adjustable Backlash. Precision Involute Knurls can require very tight orientation between the 3 rollers to properly roll the part.

The CJWinter 192 series knurling head uses a master pinion that has the same form as the finished work piece, to mesh with the three knurling rolls with little to no backlash. Backlash is adjustable within tenths. Other knurl rolling systems either do not orient the rolls, which often leads to double tracking and a malformed work piece, or have coarse timing mechanisms which can lead to part size variation, or material slivering.

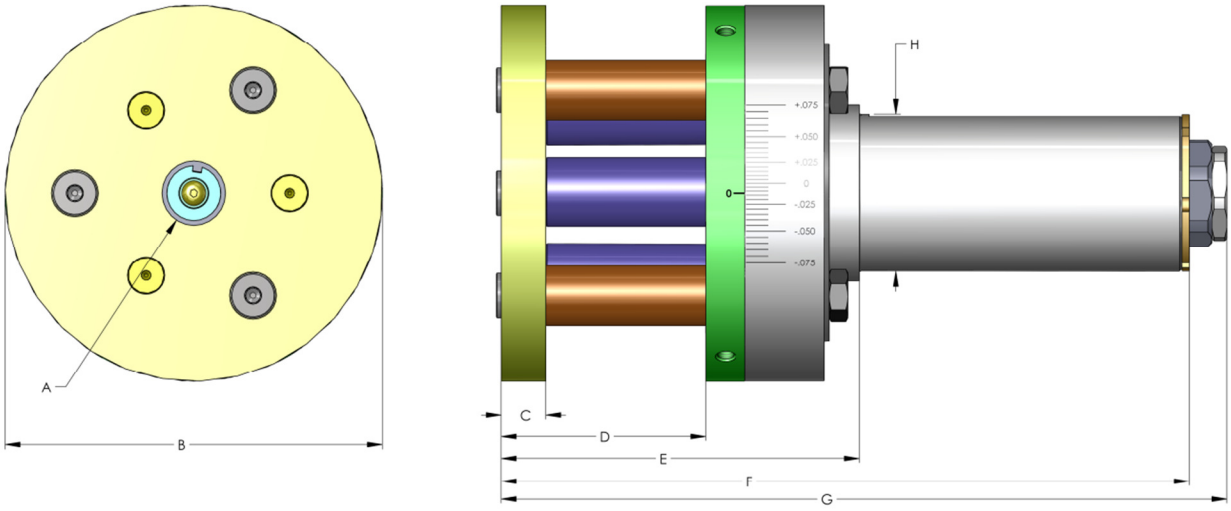
Reversible Rolls. The rolls, as well as the master pinion, are reversible, so as one edge wears out, you can get twice the life out of each set of tools.

Retractable Master Pinion. The master pinion is spring loaded, and can be pushed back into the head by the rotating end of the work piece, to allow for knurls on the work piece that are longer than the workface width of the rolls. As the master pinion is pushed back, it disengages from the knurl rolls, and as the work piece is withdrawn, it automatically re-engages the knurl rolls, to maintain timing for the next cycle. The master pinion can be stationary if required. CJWinter offers attachments that have a larger overall length on the roll which will allow the master pinion to stay engaged.

Coolant Thru Tooling. The shank of the tool is equipped with a coolant port so coolant can be directed right at the interface between the knurls and the part.

Wide Range of Knurl Sizes. The tool can be modified to accommodate knurled parts ranging in size from roughly Ø0.625" to Ø1.250" with a variety of different involute pitches. Please consult with a CJWinter Applications Engineer for more details.

192 Series Tool Size and Capacity



Overall dimensions for the standard tool are illustrated above.

Capacity of the tool includes most parts in the following ranges:

Knurl Major Diameter:	Ø0.630" min	to	Ø1.250" max
Knurl Lengths up to:	.813" all diameters 2.0" for Ø.80 or less		
Typical Involute Pitches:	16 D.P	to	128 D.P.

** Note: Not all pitches can be rolled on all size parts without interference. Contact CJWinter engineering for an evaluation of your application.*

	A	B	C	D	E	F	G	H
192 ES-01	.81	4.75	.56	1.57	3.51	7.66	8.63	2.0
192 ES-02	1.03	4.75	.52	1.83	3.75	7.90	8.37	2.0
192 ES-05	.81	4.75	.56	2.57	4.51	8.66	9.13	2.0

Package Contents

This tool is shipped complete with everything you need to knurl you parts except the knurls themselves, which are application specific.

In the event you need a spare, each part (size permitting) is permanently identified with laser-marked part # for easy identification, and replacement.

All part identification in this manual will refer to the BOM Balloon # on the Assembly Drawing contained in this manual, and be noted as in parentheses after the part name, *i.e.: Center Plate (#3).*

Machine Mounting

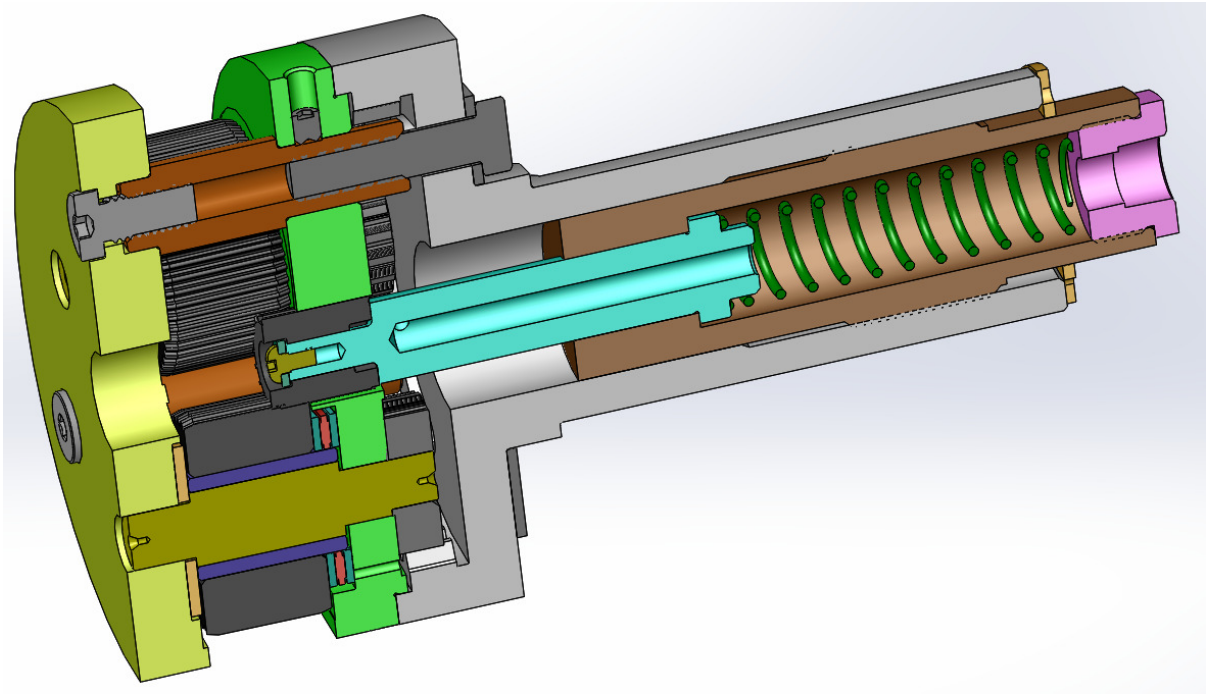
The 192 Series tool is available with a standard 2.00" shank. Alternate shank diameters are available on a custom order basis. Drill bushings can also be used to adapt to larger tool holders.

Shanks are roughly 4" long, and have an additional 1" protrusion for the coolant hook-up and backlash adjusting screw. Most CNC lathes have more than adequate clearance behind the tool holder to accommodate the entire length of this tool, and this tool can be extended out from shallow tool holders if required. Each shank is equipped with a single, flat for the holder retaining screws. Overall dimensional drawings are available from our sales department to help determine if this tool fits your machine application.

192 Series tool shanks are also equipped with a 1/4-NPT port for thru-coolant connections.

Assembling the Tool

Your tool will come pre-assembled from the factory. In the event you need to disassemble your tool, please refer to the supplied assembly drawing for an exploded view and proper part assembly order.



Please note, should you need to disassemble the gear train for the 3 eccentric roll pins, proper orientation at re-assembly is critical to ensure the rolls are concentric to the tool shank. See detailed instructions in the section titled "shifting the size adjustment range" for the recommended disassembly and re-assembly procedure.

Periodic Maintenance

CJWinter recommends an annual teardown and inspection of this tool.

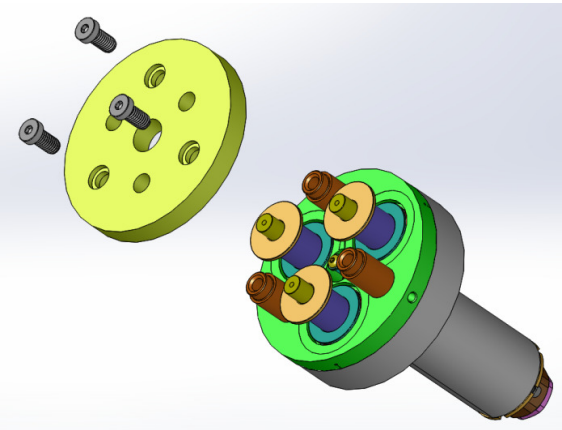
We recommend the periodic lubrication of all moving parts with oil, and replacement of the Thrust Bearings (#10) and Thrust Washers (#11 & #22) in the tool. The frequency of lubrication and replacement depends greatly on the severity of service the tool sees, the type of knurl being rolled, and the adherence to proper setting and operation procedures. The frequency should be determined by your own in-shop experience, and be scheduled in a preventative manner. At a minimum, we recommend replacement of these components during the annual inspection.

The remaining components are not generally considered "wear" parts, and should be replaced only in the event of damage or excessive wear.

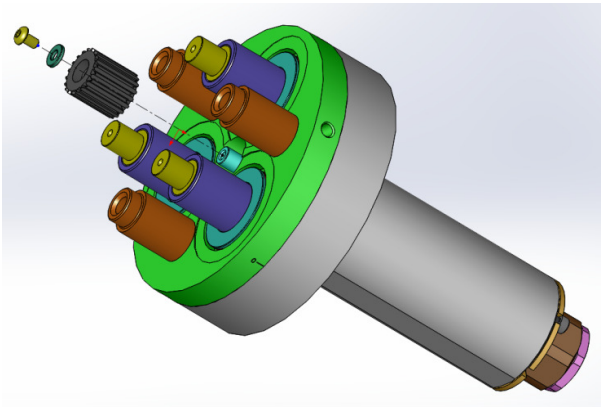
Preparing the Tool

To install the appropriate knurl rolls, follow these simple steps:

1. Remove the three Low Head Cap Screws (#8) from the Front Plate (#1).
2. Pull the Front Plate (#1) away from the rest of the tool body, being careful not to drop any of the Thrust Washers (#11 & #22), Bearings (#10) or Carbide Bushings (#5).

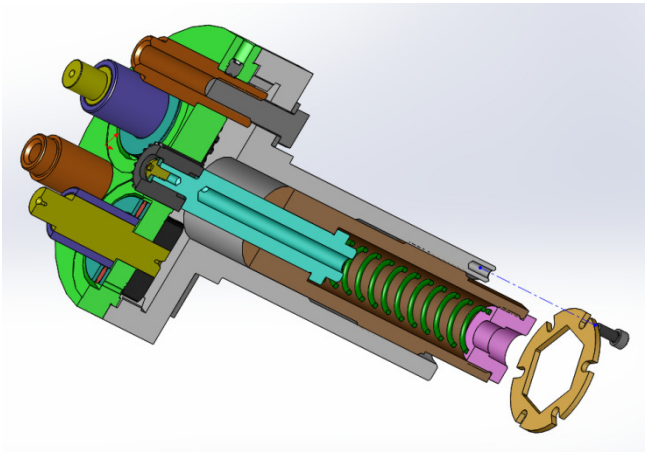


3. Install a new master pinion by loosening the Button Head Socket Screw (#17) at the center of the gear, replacing the gear, and reinstalling the screw with the Thrust Washer (#15) under the head.



4. Unlock the Adjusting Sleeve (#14) by removing the #8-32 SHCS (#21) and the Spline Brake (#19) at the rear of the Shank (#6).

5. Add backlash to the gear train by unthreading the Adjusting Sleeve (#14) until the top of master pinion is protrudes roughly 3/16" above flush with the top of the Center Plate (#3).



6. Make sure the Thrust Washers (#11 & #22), Thrust Bearings (#10), Eccentric Roll Pins (#20) and the Carbide Bushings (#5) all are freshly oiled, and free from any contaminants.

7. Oil the ID and faces of the knurl rollers, and slide them onto the Carbide Bushings/Eccentric Roll Pins.

8. Reassemble Front Plate (#1).

9. Turn the Adjusting Sleeve (#14) in, to tighten the backlash until the rolls just bind, and then back off slightly until they rotate freely. Lock the backlash adjustment by re-installing the Spline Brake (#19) and #8-32 SHCS (#21).

Note: Step #9 can be delayed if you need to adjust part size, as it will just need to be repeated again later.

Pre-Setting the Knurl Diameter

New knurl rolls may vary in diameter somewhat from batch to batch, and from new to used. When installing new rolls, the easiest way to pre-set the knurl size is to use a previously knurled part, inserted between the 3 knurl rollers, and pinch down on that part using the head size adjustment. To adjust the diameter, follow these steps:

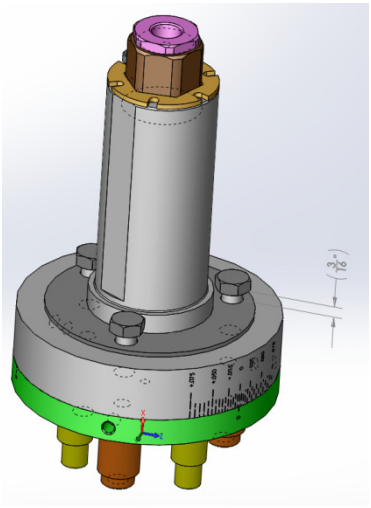
1. Loosen the three hex head bolts (#9) a 1/2 turn using a 9/16 open end wrench.
2. Twist the head of the tool relative to the shank. The graduated scale on the side will tell you if you are adjusting the part size up or down.
3. Lock the size by tightening the three hex head bolts.

   Note: When running the knurls with little to no backlash, it is advisable to add backlash by loosening the Adjusting Sleeve (#14) before adjusting part size downward. This will avoid binding the knurls on the master pinion gear. After size has been adjusted and locked, reset the Adjusting Sleeve (#14) position so the rollers just rotate freely, and lock this adjustment as well.

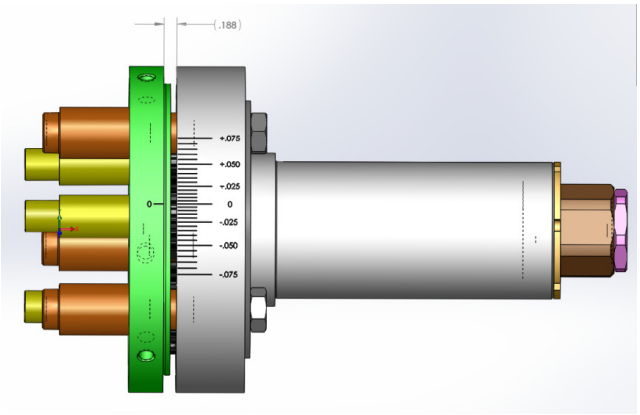
Shifting the Size Adjustment Range

The 192 series head is designed with an ample adjustment range, while maintaining the ability to make small, precise changes. If you run out of adjustment when setting your part size, the range can be shifted upwards or downwards to accommodate your particular part and roll diameter combination. The steps required to shift the range are as follows:

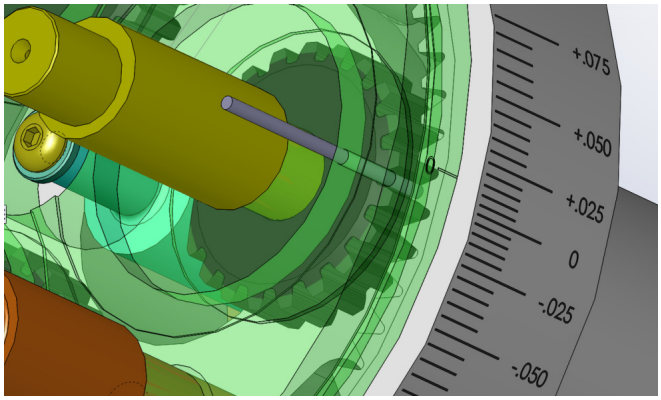
1. Remove the Front Plate (#1), Knurl Rollers , Thrust Washers (#11 & #22), Thrust Bearings (#10) and the Carbide Bushings (#5) from the body of the tool.



2. Place the tool face DOWN (Shank UP), on a workbench.
3. Loosen the three hex head bolts (#9) approximately a 3/16" (3 turns) using a 9/16 open end wrench.
4. Twist the head relative to the shank, until the graduated scale on the side reads approximately ZERO.



5. Lay the tool on its side, and slide the Shank (#6) back away from the Center Plate (#3) approximately 3/16".
6. Using a .070" pin or wire, insert the pin into one of the three gear timing holes in the Center Plate (#3), and twist the size adjustment slightly until the pin drops



between a gear tooth and locks the head.

7. Place additional pins in the two remaining gear timing holes.

   Tips and Tricks:
   Using a small dab of thick grease in the pin hole, or three small magnets, will help hold the pin in place while handling the head.

8. Completely remove the three Hex Head Bolts (#9), and pull the Shank (#6) away from the Center Plate (#3) until the gears are disengaged.
9. If you need to shift the adjusting range UPWARDS to make a bigger part, twist the Shank so that the Zero timing mark on the Shank slides towards the (-) side of the scale, skipping 1 or 2 gear teeth. Twist towards the (+) side of the scale if you need to shift the range to make a smaller part.
10. Carefully re-engage the ring gear on the Shank (#6), with the three Eccentric Gears (#4), and slide the Center Plate (#3) and Shank (#6) back together. This will push the three locking pins back out of the holes, and they can be removed.
11. Reinstall the Ring Washer (#7), and the three Hex Head Bolts (#9).
12. Reassemble the Thrust Washers (#11 & #22), Thrust Bearings (#10), Carbide Bushings (#5) and Knurl Rollers.
13. Reattach the Front Plate (#1).

Work Piece (Blank) Preparation

Prior to knurling, the work piece needs to be prepared. Typically, the blank needs to be turned to a diameter approximately halfway between the major OD and Minor OD of the finished knurled part. To start, you may want to bias this diameter about .003"/inch smaller, so that the dies do not overfill. This can later be adjusted upwards to get the proper amount of fill, and achieve the desired Major diameter. The lead-in chamfer should typically be a flat 30° (measured from the part axis), and should extend down below the minor diameter of the part. Failure to properly chamfer your blank will lead to premature roll breakage. Surface finish should be 125 RMS or better, and the tolerance held on the pre-knurl blank diameter should be roughly 1/3 of the tolerance on the finished knurl major diameter. Adjustments made to the blank diameter should be small, since there is a roughly 3 to 1 relationship between blank diameter and the finished major diameter. The knurl can extend into an undercut, or terminate right on the blank diameter prior to a shoulder. It should be noted that each knurl roll has a lead-on chamfer. Unless a sufficient undercut is present in the blank, the knurl roll will leave a partially incomplete section of knurl at the inboard end of the part knurl surface. The size of this incomplete section is variable by the Knurl Roller design, but shorter knurl chamfers tend to diminish the life of the roll. Consult with our application specialists for your particular application.

Work Piece Materials

Knurl Rolling can be performed on almost any ductile metal material under Rc40. Some materials roll better than others. For questions on the rollability of your particular part, please consult with our application specialists.

The Knurling Procedure

The tool motion should be programmed much like a drill cycle. The recommended SFM is between 50 and 200, with tougher and work-hardening materials trending towards the low end, and easily machinable materials trending towards the high.

Axial feed rates of .010"/rev and .020"/rev are usually adequate to produce a quality knurl.

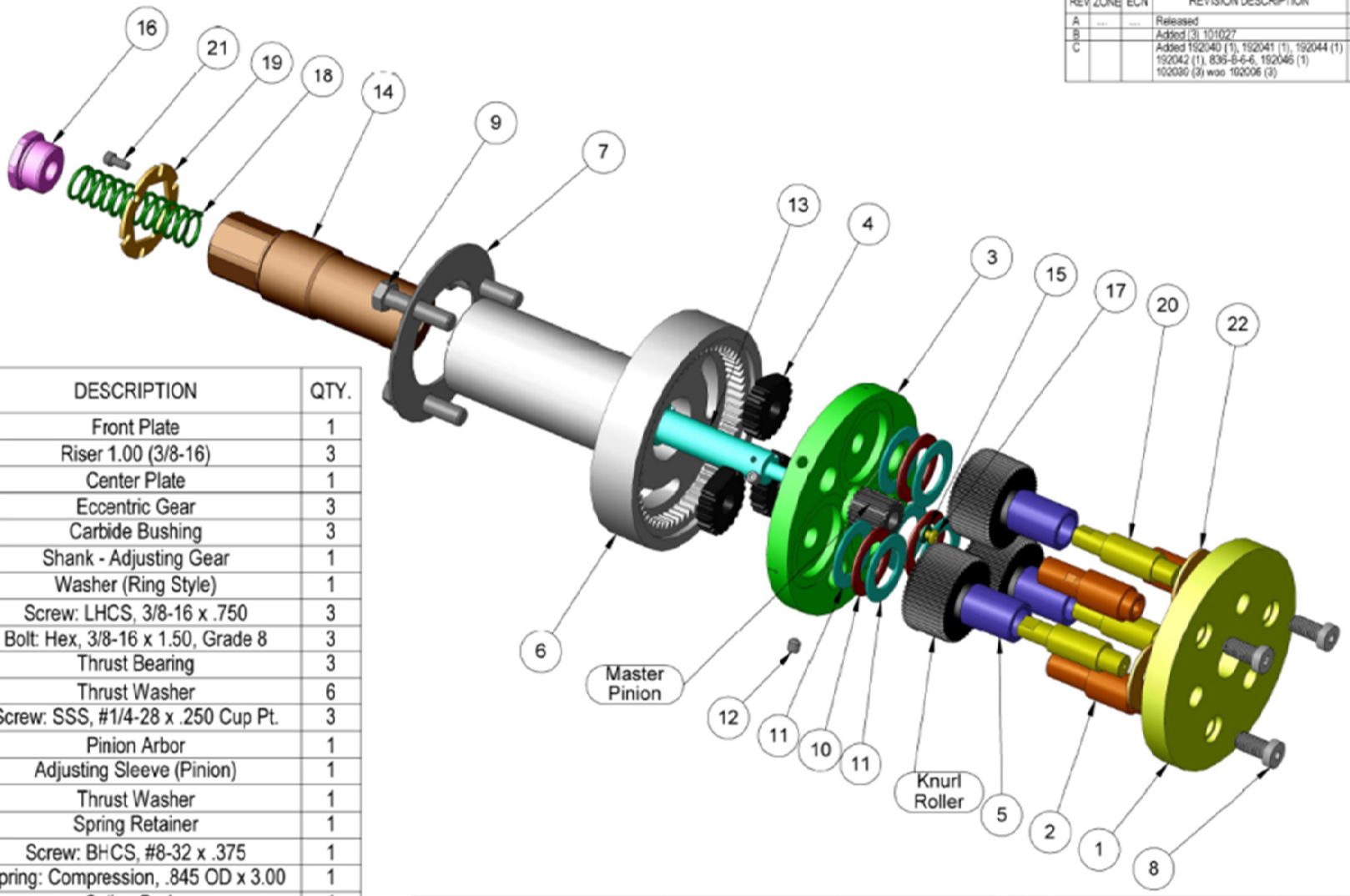
If no prior parts are available to help set size, start with the head open, and adjust the opening between the dies downward until the dies pinch on a pin roughly .010 larger than the minor diameter of the knurl you will be rolling. Run a trial part on an undersized blank prepared per the section entitled "Work Piece (Blank) Preparation" , and adjust the die opening downwards until proper pitch diameter size is obtained. Then, adjust the blank size upwards until proper major diameter and die fill is obtained. Make blank diameter size changes slowly, as adjustments to the blank are amplified by a factor of 3 on the finished rolled knurl major diameter.

Ordering Parts

Our sales staff will be happy to assist you in ordering rolls or replacement parts for your tools. We can be contacted in a variety of ways.

By phone at:	1-800-288-ROLL
	1-800-288-7655
By fax at:	585-235-6568
Or on the web at:	www.cjwinter.com

REV	ZONE	ECN	REVISION DESCRIPTION	DATE	ENG
A	....	....	Released	02/11	PA
B			Added (3) 101027	06/11	PA
C			Added 192040 (1), 192041 (1), 192044 (1) 192042 (1), 836-B-6-6, 192046 (1) 102030 (3) was 102006 (3)	04/12	PA



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	192004	Front Plate	1
2	192038	Riser 1.00 (3/8-16)	3
3	192003	Center Plate	1
4	192008	Eccentric Gear	3
5	192036	Carbide Bushing	3
6	192002	Shank - Adjusting Gear	1
7	192016	Washer (Ring Style)	1
8	140366	Screw: LHCS, 3/8-16 x .750	3
9	134205	Bolt: Hex, 3/8-16 x 1.50, Grade 8	3
10	192017	Thrust Bearing	3
11	192018	Thrust Washer	6
12	101027	Screw: SSS, #1/4-28 x .250 Cup Pt.	3
13	192040	Pinion Arbor	1
14	192041	Adjusting Sleeve (Pinion)	1
15	192044	Thrust Washer	1
16	192042	Spring Retainer	1
17	836-B-6-6	Screw: BHCS, #8-32 x .375	1
18	192046	Spring: Compression, .845 OD x 3.00	1
19	192047	Spline Brake	1
20	192039	Eccentric Roll Pin (.015)	3
21	125156	Screw: SHCS, #8-32 x .375	1
22	192050	Thrust Washer	3

UNLESS OTHERWISE SPECIFIED: DRAWING MUST COMPLY TO C.J. WINTER ENGINEERING STANDARD E1058 & ASME Y14.5M 1994. UNTOLERANCED DIMENSIONS ARE BASIC

.020 | A | B | C | SW

DRAWN BY: P. Allart
DWG DATE: 02/22/11
ENG. APPR:
APPR DATE:
MATERIAL:
HEAT TRT:

C. J. WINTER
MACHINE TECHNOLOGIES, INC.

Spline Attachment

DWG SIZE: B
SCALE: 1:8
SHEET 1 OF 3
DRAWING NO. 192 ES-01

Legal Disclosure

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