BOTTOM FORMER

INSTALLATION & OPERATION MANUAL

English Version 2.0 | Original Instructions | Date of Issue: January 2018

Pride Engineering, LLC | 10301 Xylon Avenue North, Suite 100 | Minneapolis, MN 55445 USA
Phone: +1 763.427.6250 | E-mail: customer@pridecan.com
www.pridecan.com

PRIDE BOTTOM FORMER

The Pride Bottom Former uses a two-stage system to form can bottoms. The initial clamping force of our clamp ring is supplied by our air cylinder design. This initial clamping pressure controls the flow of the material into the base profile and prevents wrinkles and material tears. The secondary stage, when the material is sandwiched between the clamp ring and the punch sleeve, sets the form of the can's base profile. This set helps maintain the consistent dome height the Pride Bottom Former is recognized for. To gain the peak performance from your Pride Bottom Former, it is imperative that the installation and maintenance procedures are followed exactly. Make sure both of these procedures are read and understood by line personal before attempting to install or operate the Pride Bottom Former.

The Pride Bottom Former is a simple mechanism that produces the above two forces required to form quality bottoms. These two forces are created by our air cylinder and urethane spring. Since the performance of these two devices is critical, it is important they be properly maintained. Please consult the maintenance section of this manual regarding these components. Even more important however, is proper alignment and tool geometry. This manual covers alignment in the installation instructions. The can maker generally controls tooling geometry. Pride will consult with the users as appropriate to help resolve tool geometry issues. Please see our section on tool geometry in this manual regarding the tool clearances required for proper performance.

One of the reasons the Pride Bottom Former performs significantly better than others is due to the close dimensional and geometric tolerances held in the manufacture of the components. These close tolerances ensure complete component and Bottom Former interchangeability without negative impact on the product that they produce. When the Bottom Former's locking nut assembly and the spacer have been correctly fit to the Bodymaker, squareness and alignment of the Bodymaker are within the manufacturers specification, the Pride Bottom Former is completely interchangeable. If the profile changes, then the Spacer must be resized and the Bottom Former and parts will again be interchangeable for this new profile.

To keep your Pride Bottom Former operating at its peak level of performance, it is imperative that only Pride manufactured components are used in your units. Our component designs have been developed over a twenty-year span and have been manufactured to resolve the unique demands encountered during can manufacturing.

English Version 2.0

TABLE OF CONTENTS

REFER TO PAGES 38 THROUGH 43 FOR COMPLETE BOTTOM FORMER SCHEMATICS, LABELED ITEM NUMBERS AND PART NUMBERS.

BOTTOM FORMER

PREPARATION FOR INSTALLATION

PRIDE ENGINEERING

I. Preparation for New Bottom Former Installation
(200 and 300 Series Hybrid Bottom Formers)

Adequate preparation will reduce the Bodymaker down time required to set up the Bottom Former.

To reduce Bodymaker downtime:

1. Assemble all of the materials listed in Section I. A.
2. Assemble all of the tools required to set up the Bottom Former listed in Section I. B.
3. Design and build the base profile tooling, see "Tool Geometry" Section V. for design suggestions.
4. Check the dimensions and surfaces of the Bodymaker Doming Door (Standun or CMB) or Shoe (Ragsdale) to be certain that the Door/Shoe is prepared for the installation of the Pride Bottom Former. See Section II. A. Mounting Flange Installation & Alignment Procedure for the specifications for the Door/Shoe. Place close attention to the squareness requirement.
5. Perform the necessary plumbing on the Bodymaker to be sure that Air, Oil and Coolant Plumbing are ready before shutting down the Bodymaker to install the new Bottom Former. Much of the plumbing can be performed while the Bodymaker is running. See Section II. D. Bottom Former Plumbing Instructions.
6. The Bottom Former installer will need access to a lathe and surface grinder to size the Spacer (over travel) and Locking Nut for each individual Bodymaker. Like all Bottom Former components, the Spacers and Lock Nuts are made from tough material that is difficult to machine. The lathe work will require a cutting tool with a carbide insert such as CNMG 432 with a TIN coating similar to grade KC 9040. The lathe operator will need a turning tool holder such as a Kennametal DCLNR-164D NAQ to hold the carbide insert. Use of lower quality tool bits such as cemented carbide will add many hours to the Bottom Former installation and Bodymaker downtime.

I. A. Required Materials

The following materials are necessary for the installation and setup of your Pride Bottom Former. Bodymaker down-time may be minimized if these materials are assembled at the Bodymaker to receive the new Bottom Former prior to installation of the new Bottom Former.

1. Anti-seize thread compound for Clamp Ring Retainer threads (an example would be Loctite™ 767). (Can maker must provide.)
2. 1/4" OD (approximately 6 mm) stainless steel or copper tubing to supply high pressure oil (Bodymaker crankcase oil) to the Bottom Former Oiler, Item 34. (Can maker must provide.)
3. 1/4" OD (approximately 6 mm) polyethylene tubing for low pressure oil. Low pressure oil includes the oil supply line from the Bottom Former Oiler, Item 34, to the Bottom Former oil inlet (top of Bottom Former) and from the Bottom Former oil drain to the Bodymaker crankcase oil sump. (Pride will supply with Bottom Former.)

4. 3/8″ OD (10 mm) polyethylene tubing for coolant. (Pride will supply with Bottom Former.)
5. 3/8″ ID (10 mm) Push-Lok™ 801-6 tubing for air supply (furnished).

   NOTE: A 3/8″ ID air line is a minimum for the air supply from the shop air supply to the Bottom Former. (Pride will supply with Bottom Former.)

6. Air Regulator for the 3/8″ ID (approximately 10 mm) air supply line. (Can maker must provide.)
7. 1″ Travel Dial Indicator with magnetic base. (Can maker must provide.)
8. 1/4″ ID (approximately 6.5 mm) air line for air supply to Air Blow Off. (See tooling section.)

I. B. Bottom Former Assembly and Maintenance Tools

In addition to dial indicators, torque wrenches and English standard size wrenches, Bottom Former installation and maintenance requires special tools. The following tools should be available when setting up a Pride Bottom Former.

1. Pride Tool Kit:

   Turn to the **Bottom Former Tools Identification** drawing on page 8.

   a. Temporary Thin Wall Nut (20-006-S1)

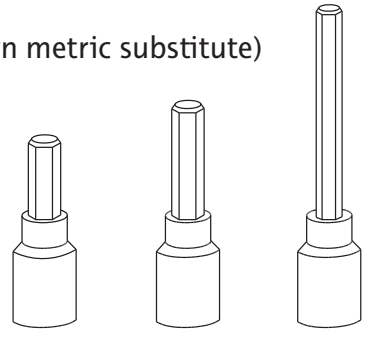
   b. Retainer Wrench (20-020-02)

   c. Nut Wrench (20-021-03)

   d. Nut Fixture (20-027-01)

   e. Spacer Turning/Grinding Fixture (20-022-01)

2. 1/4″ Allen wrench for adjusting Bottom Former and Mounting Flange alignment
3. 5/32″ Allen wrench for adjusting Dome Door squareness
4. 2″ wrench to open and tighten Standun Dome Door or 2-1/4″ wrench for Alcoa (Ragsdale) Shoe
5. Large torque wrench with 1/2″ drive (standard model) (No known metric substitute)
6. 1/2″ Drive Sockets for setting Torque
   5/16″ Socket (Part. No. 20-078-03) for Mounting Flange bolts
   3/16″ Socket (Part. No. 20-078-02) for Dome Die screws
   3/8″ Socket (Part. No. 20-078-04) for Locking Nut Lock screw
   9/16″ Socket (Standard Model) for Locking Device bolts
   15/16″ Socket (Standard Model) for Retainer Wrench and Tension Bolts

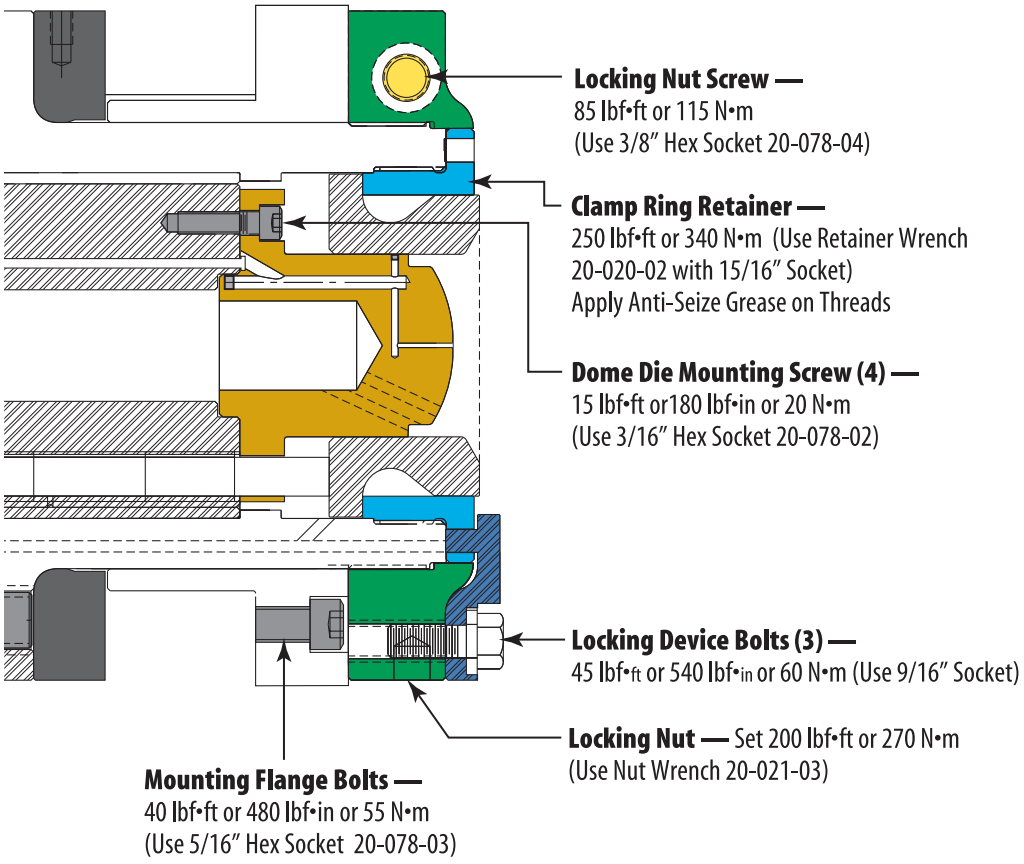


Locknut Socket 20-078-04 | Mounting Flange Bolt Socket 20-078-03 | Dome Die Bolts Socket 20-078-02

(See Pride Hex Socket Kit 20-078-01 for special Hex Sockets listed above.)
Items with a Pride Part No. are in Tool Kit 60-076-02 or 30-076-02 (fro 300 Series) purchased from Pride.

Phone: +001 763.427.6250 • www.pridecan.com

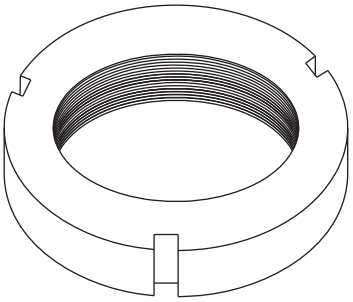
BOTTOM FORMER TORQUE REQUIREMENTS



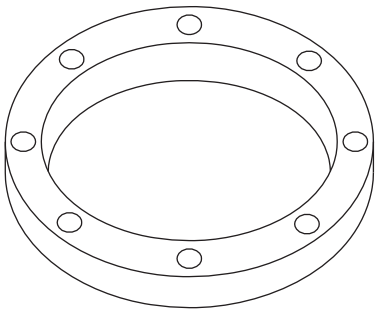
*THE DAY AFTER INSTALLATION, PLEASE RE-TORQUE TO ABOVE SPECIFICATIONS.

7. Split Spacer (for setup only) Part No. 20-008-03. Save the Spacer (Part No. 60-008-17) that came with the Bottom Former for installation after over travel is determined and Spacer thickness has been developed.
8. Wrench or socket wrench that will allow the installer to manually bar over the Bodymaker Crank (usually a long handled 2" socket wrench with socket extension).
9. Carbide inserts such as CNMG 432 with a TIN coating similar to grade KC 9040. The lathe operator will need a turning tool holder such as a Kennametal DCLNR-164D NAQ to hold the carbide insert.
10. Utilize a Pride Engineering Portable Guardian or Guardian II over travel gauge to accurately measure over travel.
11. 1" Travel Dial Indicator with magnetic base.

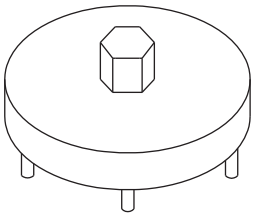
BOTTOM FORMER TOOLS IDENTIFICATION



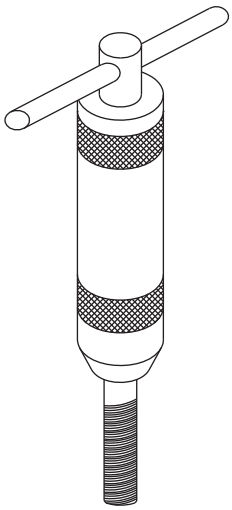
Temporary Thin Wall Nut
20-006-S1



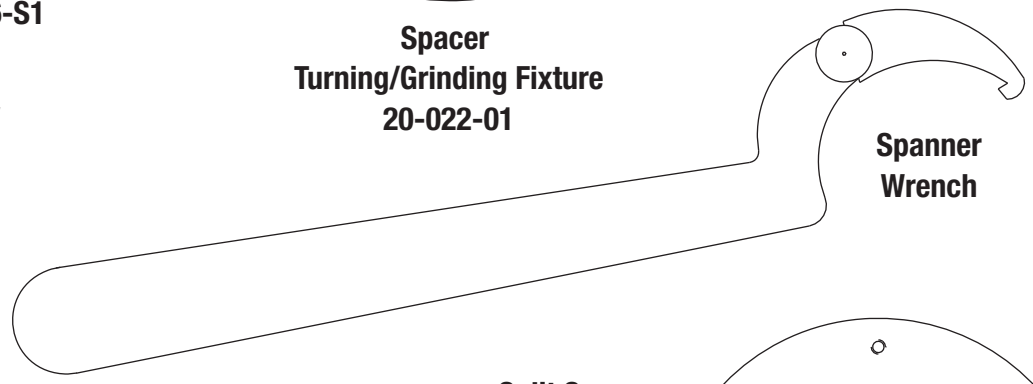
Spacer
Turning/Grinding Fixture
20-022-01



Retainer Wrench
20-020-02

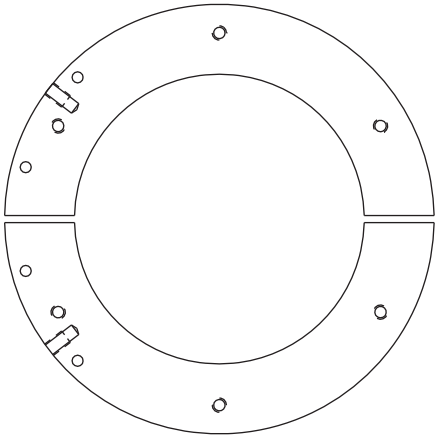


Helicoil Insertion Tool
20-023-02

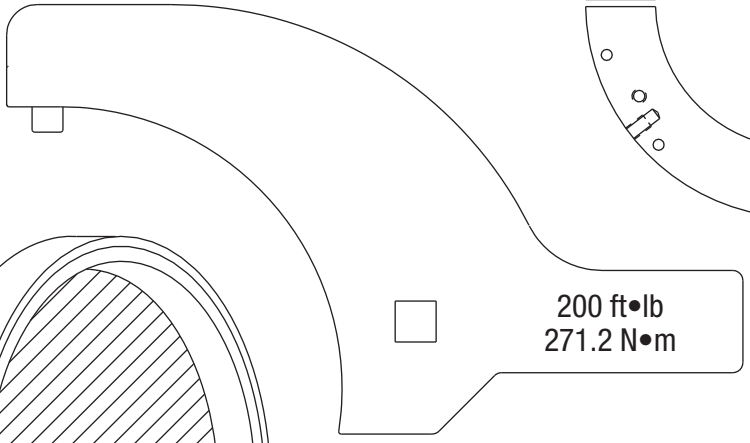


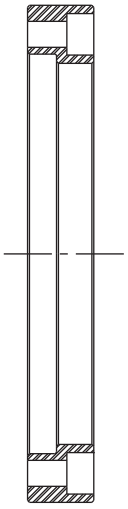
Spanner
Wrench

Split Spacer
20-008-17
(Optional)

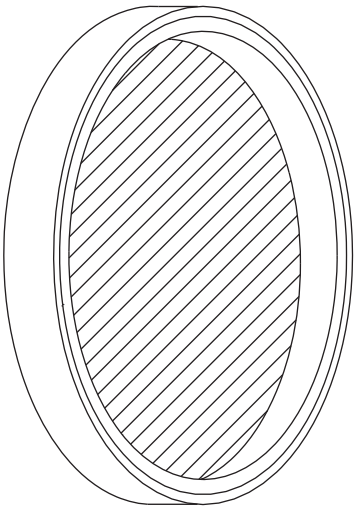


Nut Wrench
20-021-03



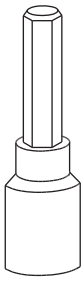


Nut Fixture
20-027-01

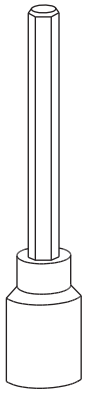


Piston Seal Assembly Tool
60-028-00

Locknut Socket
20-078-04



Mounting Flange
Bolt Socket
20-078-03



Dome Die
Bolts Socket
20-078-02

BOTTOM FORMER

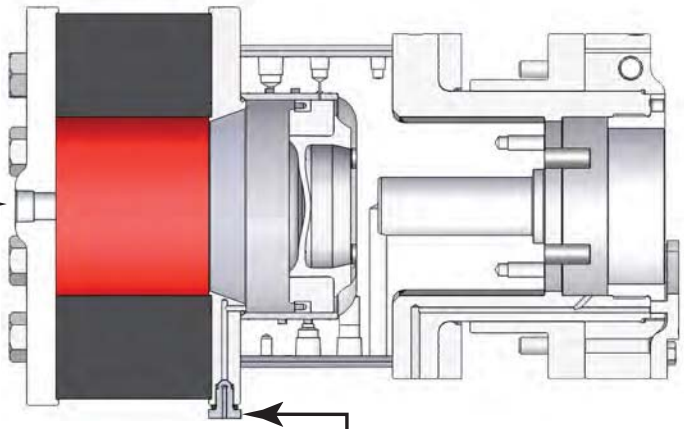
INSTALLATION PROCEDURES

PRIDE ENGINEERING

II. Installation Procedures

Disconnect compressed air to bottom former before any disassembly or maintenance.

0 psi



Open valve to relieve any potential air pressure and then close again.

II. A. Mounting Flange Installation & Alignment Procedure

1. Select the appropriate Mounting Flange that will position the Bottom Former so that the Bottom Former Locking Nut thickness is a minimum of 1.250" (32 mm) and the Bottom Former spacer is a minimum of .500" (13 mm).

2. Prior to assembly, check the dome door. The typical configuration of the central bore of the Doming Door (Standun or CMB) or Ragsdale Shoe is shown below in Figure II. A. 1. The counterbore shown as the "Door Counterbore Face" is not always required on some Bodymakers such the Standun B6 but the surface must be held flat and parallel to surface C within .001" (25 µm) and the bolt circle hole pattern shown in Figure II. A. 3. below must be present.

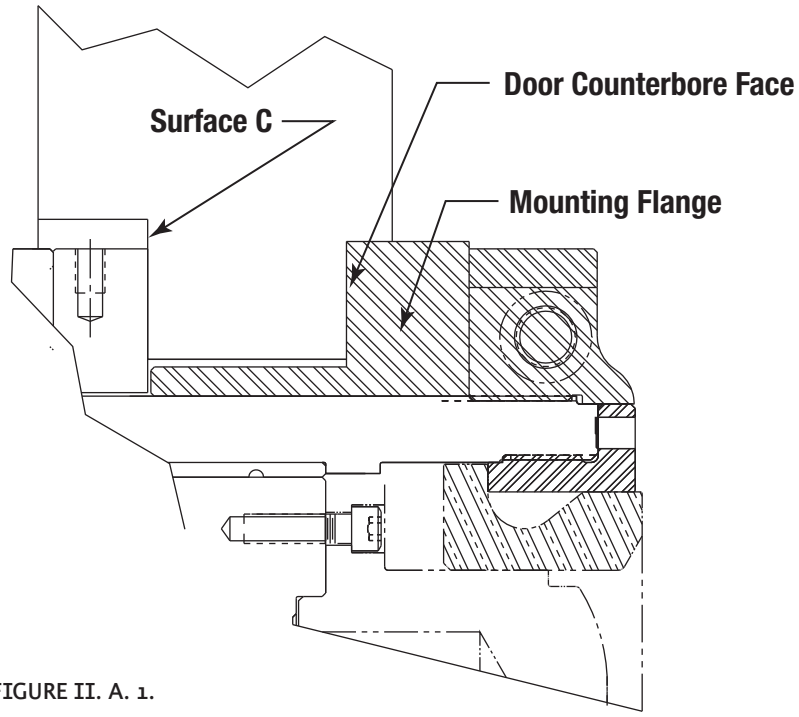


FIGURE II. A. 1.

NOTE: Figure II. A. 1 above depicts a Ragsdale Shoe and some Standun B6 Doors. The counterbore in the Door/Shoe at surface C is required on Doors/Shoes thicker then 2.500" (65 mm) only. The Counterbore shown the front surface of the Door/Shoe is not required on some Bodymakers such as some Standun B6 Bodymakers.

Figures II. A. 2. and 3. below show a typical Dome Door/Shoe configuration for the Pride Hybrid 200 Series Bottom Former which is designed for a can such as a 211 can or smaller. A Hybrid 300 Series Bottom Former is appropriate for wider diameter cans such as the 300 or 307 food can or the 1 Liter or 24 oz. beverage can.

- Surface C does not have to be at the bottom of a counterbore as long as the door is not thicker than 2.500" (65 mm) but must conform to the same flatness and parallelism requirements. The

Phone: +001 763.427.6250 • www.pridecan.com

Doming Door cross section shown in Figure II. A. 2. is typical of many older Bodymakers and does not have any counterbore at surface C.

Be sure that the Dome Door/Shoe counterbore face is parallel to the back face (surface C) of the Dome Door/Shoe within .001" (25 µm) or problems such as misalignment or Outer Housing failure will arise.

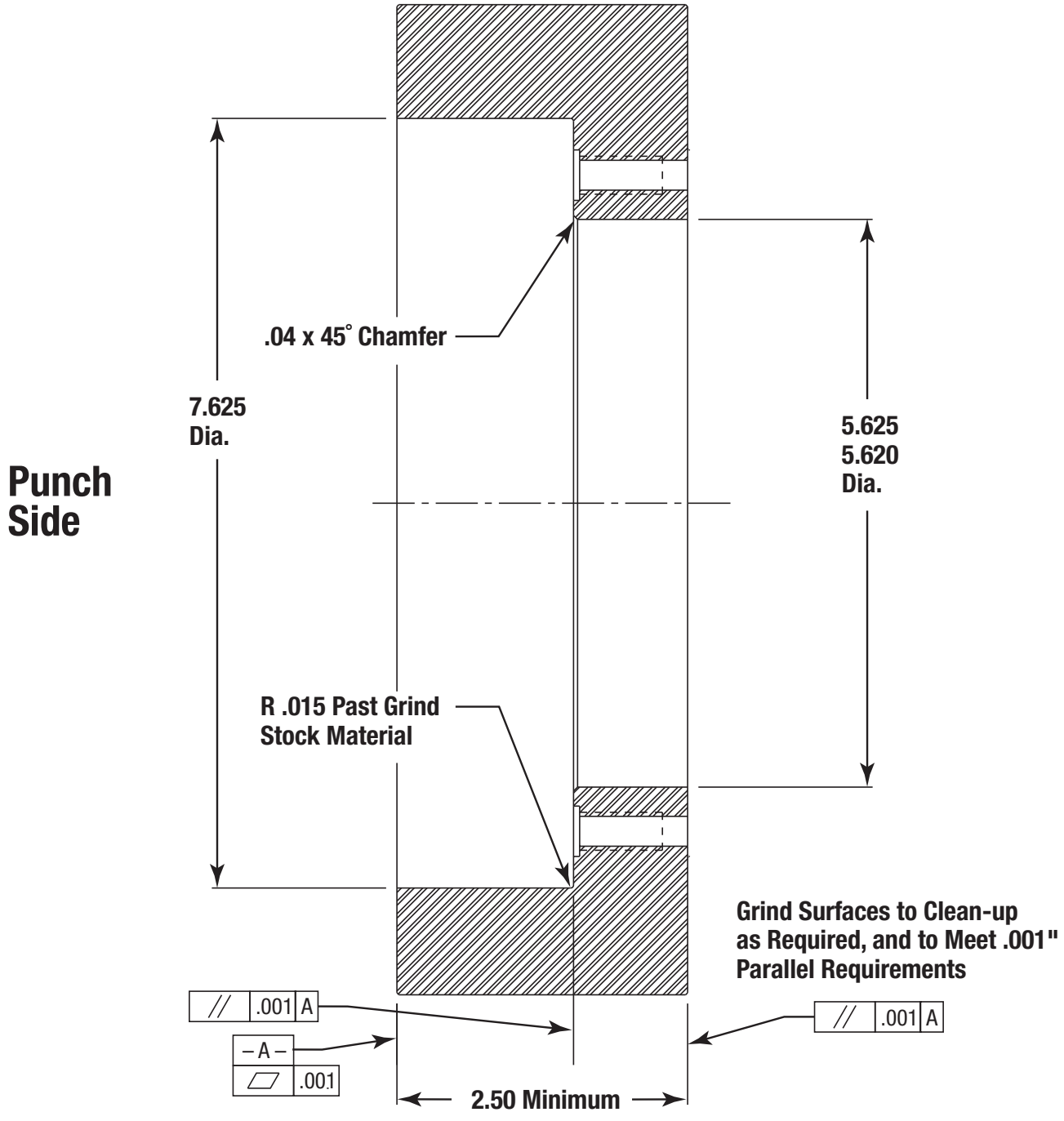


FIGURE II. A. 2.
200 SERIES BOTTOM FORMER

When the Bottom Former Door/Shoe requires alignment, machine the front face (may be bottom of front counterbore) flat within .001" (25 µm) and parallel to the door alignment pads. Next turn the Door/Shoe over and set it up on parallels on the front face (may be bottom of front counterbore). Machine or grind the back face (surface C) flat and parallel to the counterbore within .001" (25 µm).

Figure II A. 3. shows the bolt hole pattern of a Dome Door/Shoe machined for a Hybrid 200 Series Bottom Former.

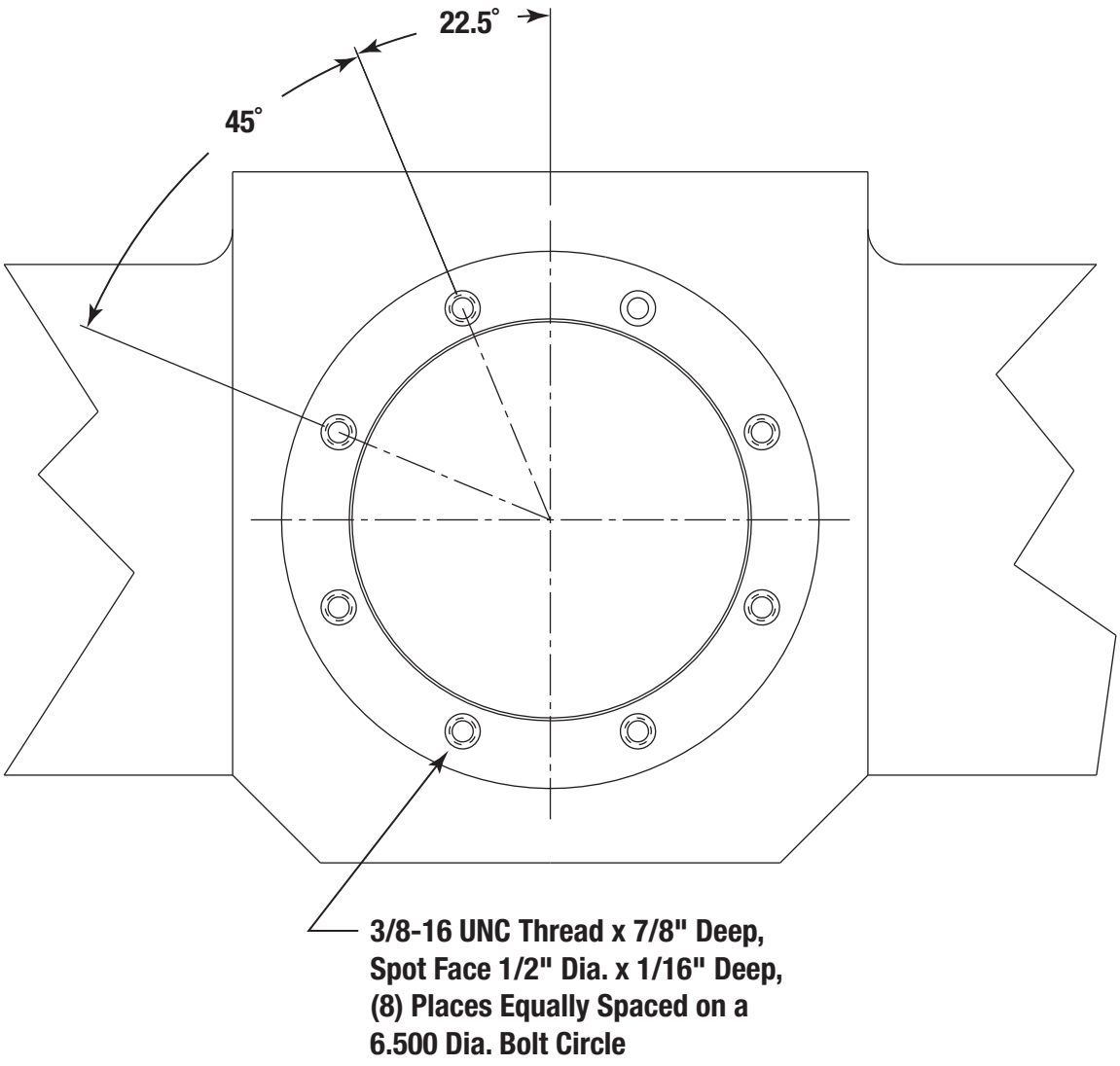


FIGURE II. A. 3.
200 SERIES BOTTOM FORMER

Door specifications for Hybrid 300 Series Bottom Former

The same information about the counterbore requirements that apply to the Hybrid 200 Series also apply to the Hybrid 300 Series. Only the size dimensions are different.

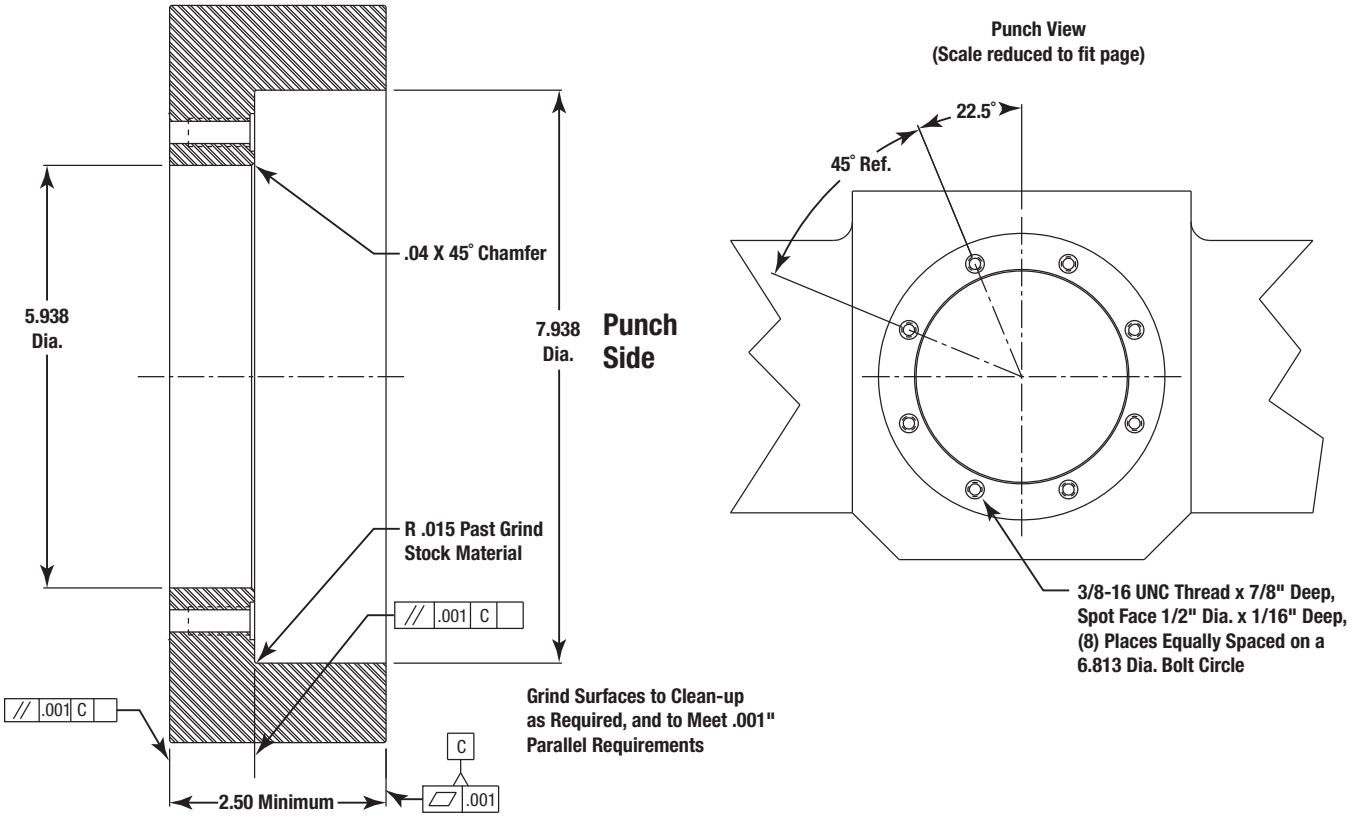
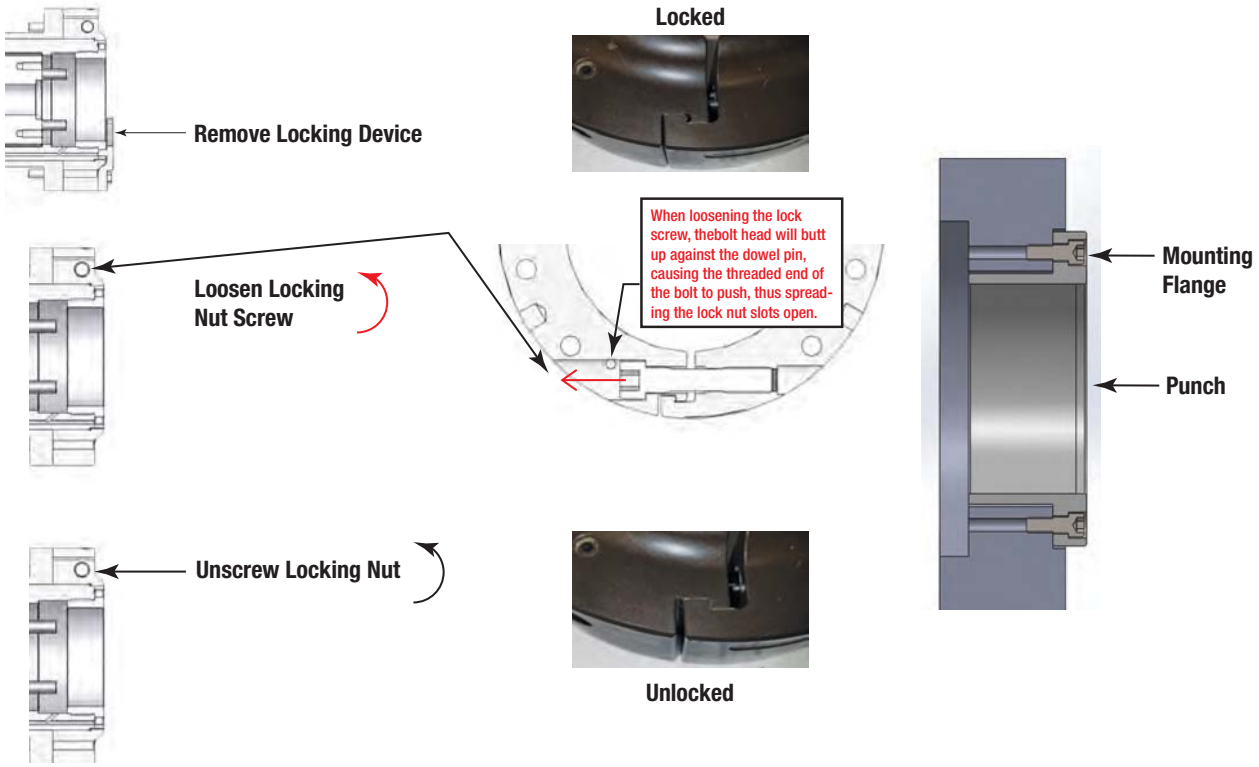


FIGURE II. A. 4.
300 SERIES BOTTOM FORMER

3 Square up the dome door. Remember that the mounting surfaces and pads must be clear of debris and burrs while squareness is being checked. Square up the dome door to the cradle by grinding or shimming the door's four alignment pads. The door should be square to the Bodymaker cradle within .001" (25 µm).

4 Remove the Mounting Flange from the Bottom Former by removing the Bottom Former Locking Device and Locking Nut Assembly. Assemble the Mounting Flange (Item 4) (Part No. 200-005-01) onto the door with the flange facing the punch.

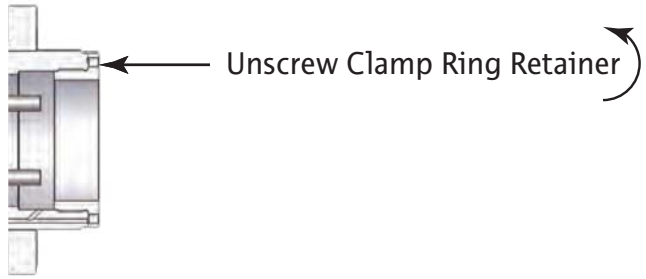


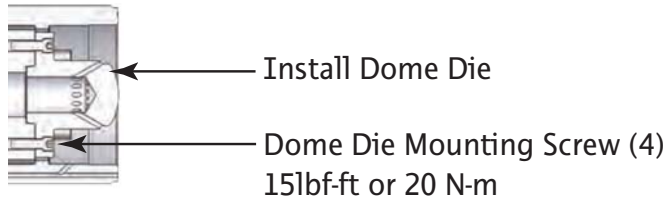
5 Indicate the Mounting Flange bore using a cylindrical square from the cradle. Door register pins, mounting surfaces, and pads must be clear of debris and burrs while center alignment is being checked.

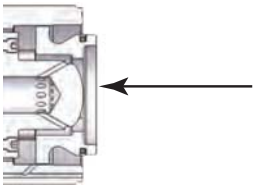
Note: Centering of the Mounting Flange (Item 4) can be done by using the centering devices that are typically supplied by the manufacturers of the Doming Doors or Shoes. If the Doming Door or Shoe utilizes centering screws, these should move the Mounting Flange (Item 4) quite easily, requiring only a small amount of torque. If the Mounting Flange doesn't move easily, check to see if the Mounting Flange Bolts (Item 24) are too tight, or if something else may be preventing movement. Be careful not to force the Mounting Flange (Item 4) out of round during alignment. The Mounting Flange should be centered to the Bodymaker cradle within .001" (25 µm). Optimum alignment will be within .0002" (5 µm) side to side and less then .001" (25 µm) top to bottom.

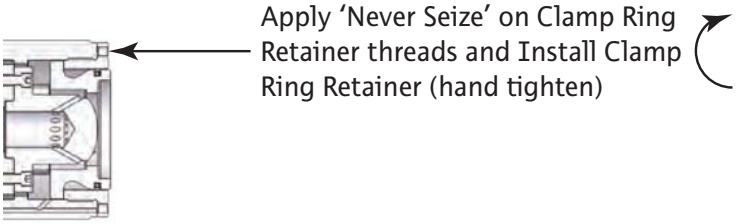
6 After the Mounting Flange is aligned tighten the eight Mounting Flange Bolts to 40 ft·lb (55 N·m) using hex socket 20-078-03.

7 Use the 20-020-02 Retainer Wrench to remove the Clamp Ring Retainer (Item 6) from the Bottom Former. Install the Doming Die (Item Y) and the four retaining screws (Item 19). Torque each of the four screws to 15 ft·lb (20 N•m) using hex socket 20-078-02.

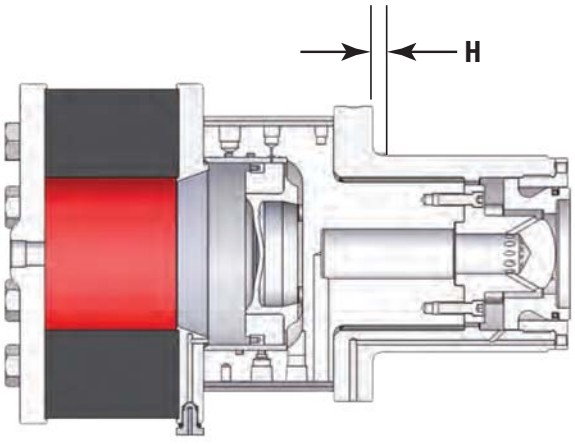


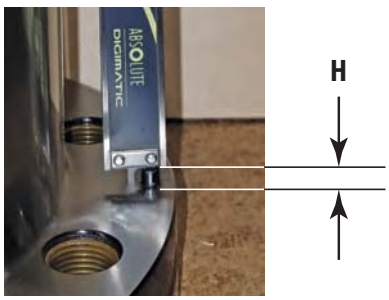






Measure and record height of spacer locating pin (H) for use later in determining spacer thickness.

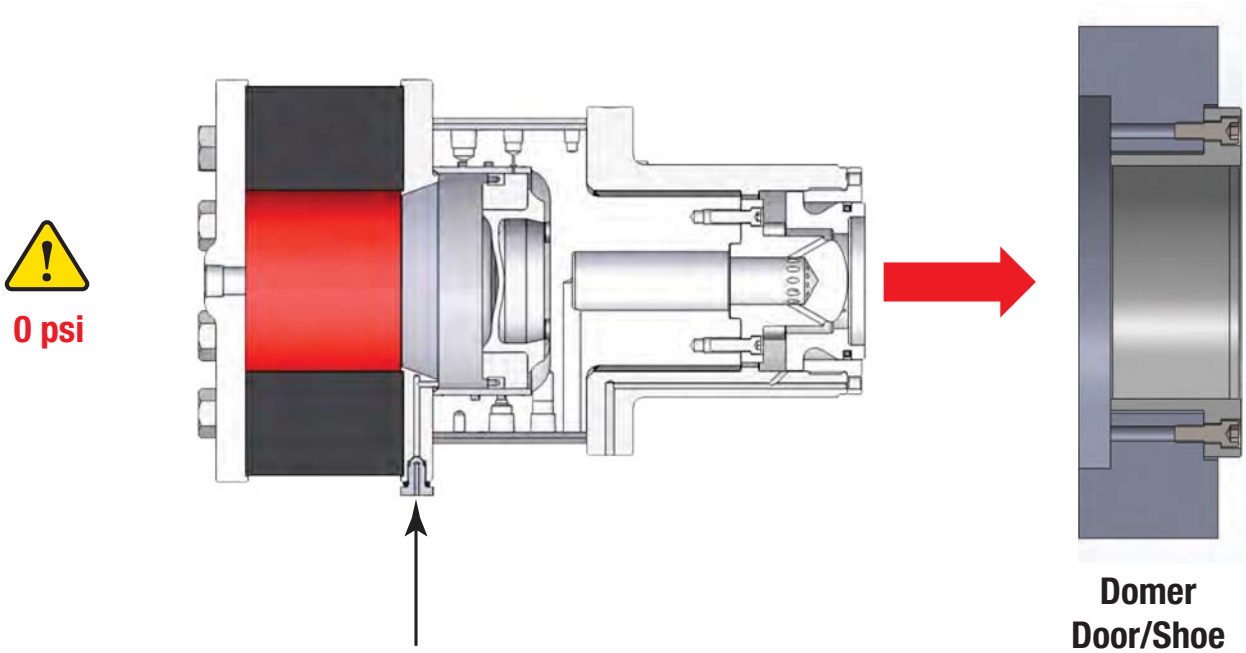




8 Install the Bottom Former into the Mounting Flange/Doming Door or Shoe assembly, making certain that the mating surfaces are clean and oiled, and the side marked "TOP" is to the top.

NOTE: The Bottom Former should slide into the Mounting Flange/ Doming Door or Shoe assembly quite easily, if it does not, the Mounting Flange (Item 4) has been forced out of round and the alignment should be done again, making certain that the Mounting Flange moves easily when centering.

Slide Bottom Former into Mounting Flange



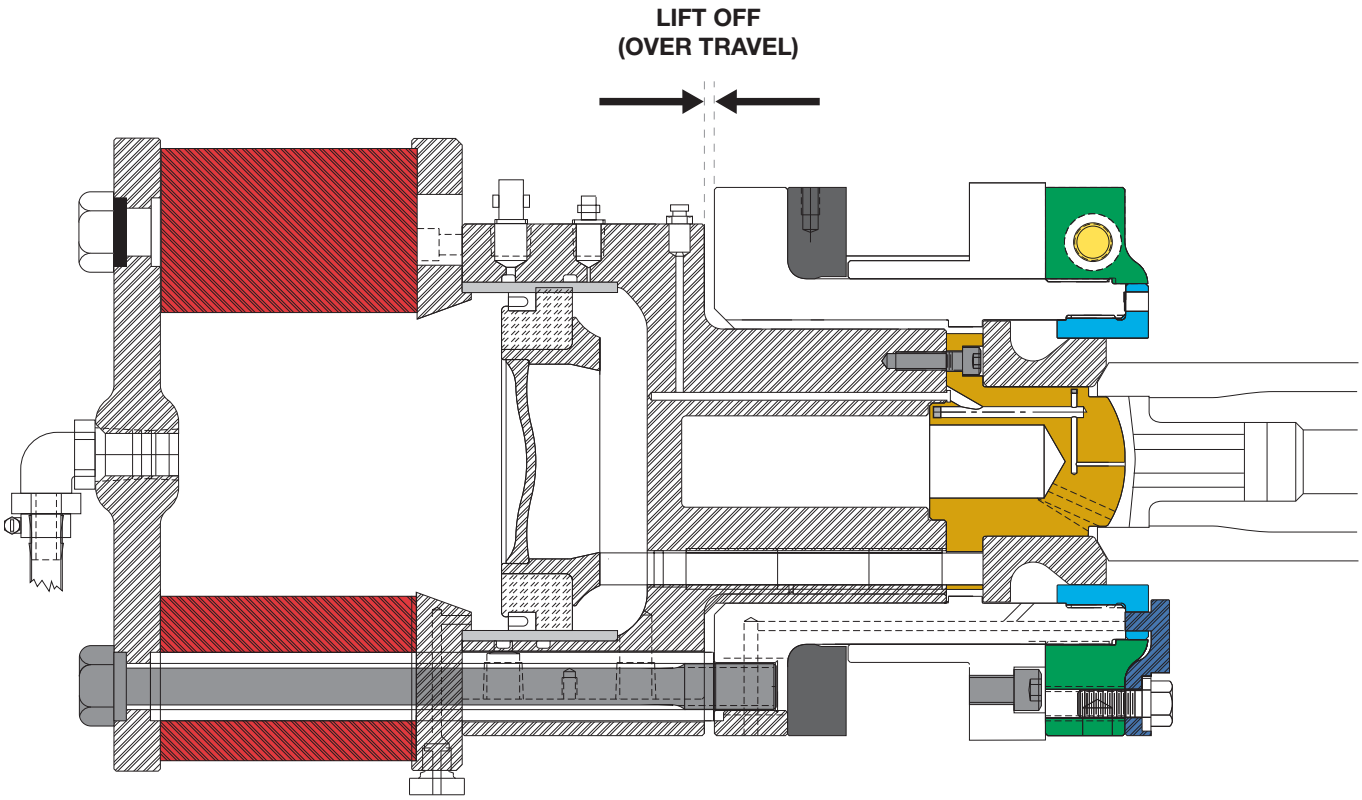
Open valve to relieve any potential air pressure and then close again.

II. B. Bodymaker/Bottom Former Over Travel

The purpose of over travel is to allow the Bottom Former spring to provide a "final form" force. This force "sets" the base profile established by the Bodymaker Punch Nose, Clamp Ring and the Dome Plug tooling. Without this final form set, the can profile will "spring back" causing variation in the dome depth and base profile. The Bottom Former spring must provide enough force to "set the form."

The recommended over travel for Bottom Formers using the yellow donut spring is .018" (.46 mm) to .023" (.58 mm).

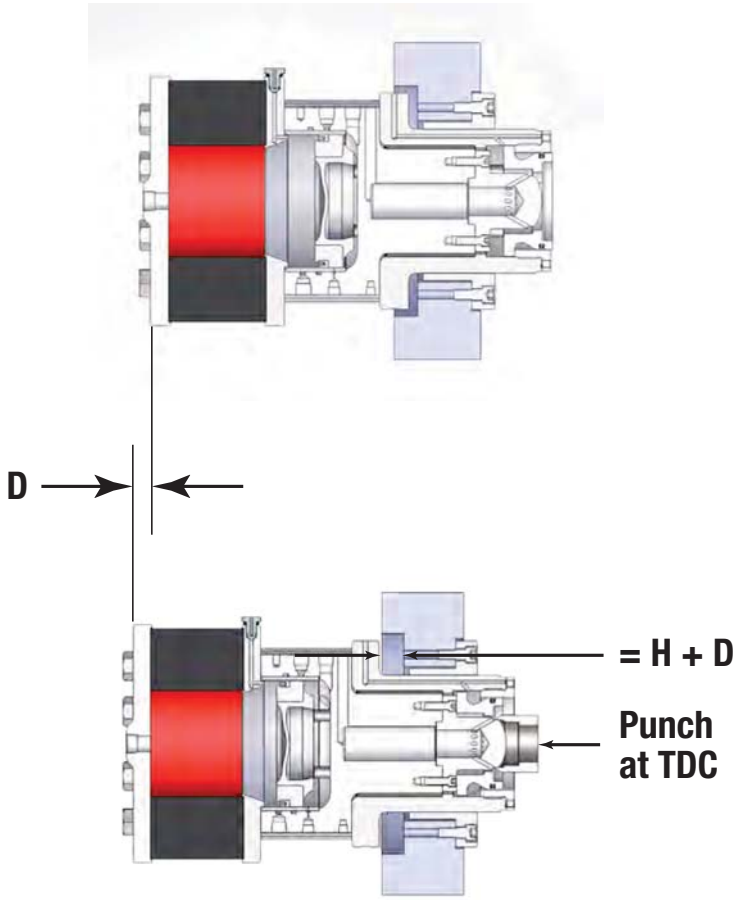
The recommended over travel for Bottom Formers using the blue donut spring or red donut spring is .003" (75 µm) to .006" (150 µm).



Over travel is measured as a gap (Lift Off) between the Cylinder Housing (Item 3) and the Outer Housing (Item 1) when the Bodymaker stroke is at its full length at position "O", using a Pride Portable Guardian or Guardian II over travel measurement system. If the tooling is already proven and made to size, proceed to step 1. If the tooling is unproven and/or has machining stock, refer to the Tooling Geometry, Section V. of this manual on page 59.

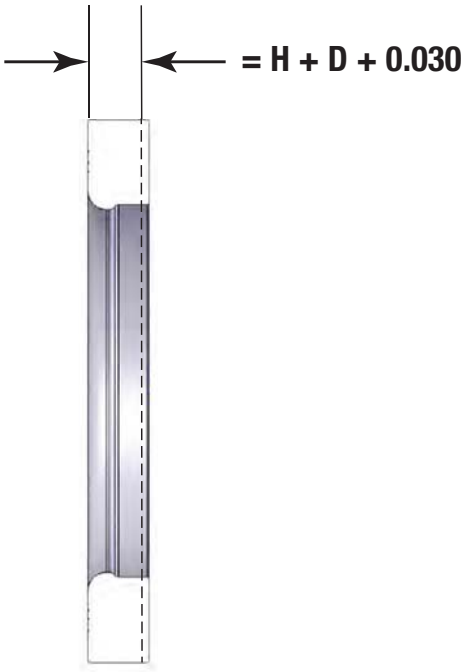
1. Advance punch by barring the machine over manually until punch is at TDC (Top Dead Center) compressing the clamp ring until seated against the dome die flange.

2. Measure the distance bottom former was pushed back (D).



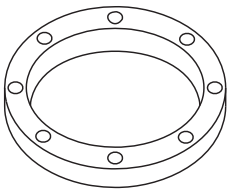
3 Machine the Spacer (Item 7) until it is .003" to .006" (80 µm to 150 µm) larger that the size shown below to allow for grinding stock.

NOTE: See lettering on the spacer "MACHINE FAR SIDE." The Spacer must not be machined or ground on this side to protect the radius on the ID of the spacer.



Turn and grind spacer to measured thickness (H + D) + 0.030 inches (0.76 mm).

A Split Spacer (P/N 20-008-17) is provided as an option to make it easier during initial installation to determine the spacer thickness. The solid spacer can then be ground to the right thickness for use during production.

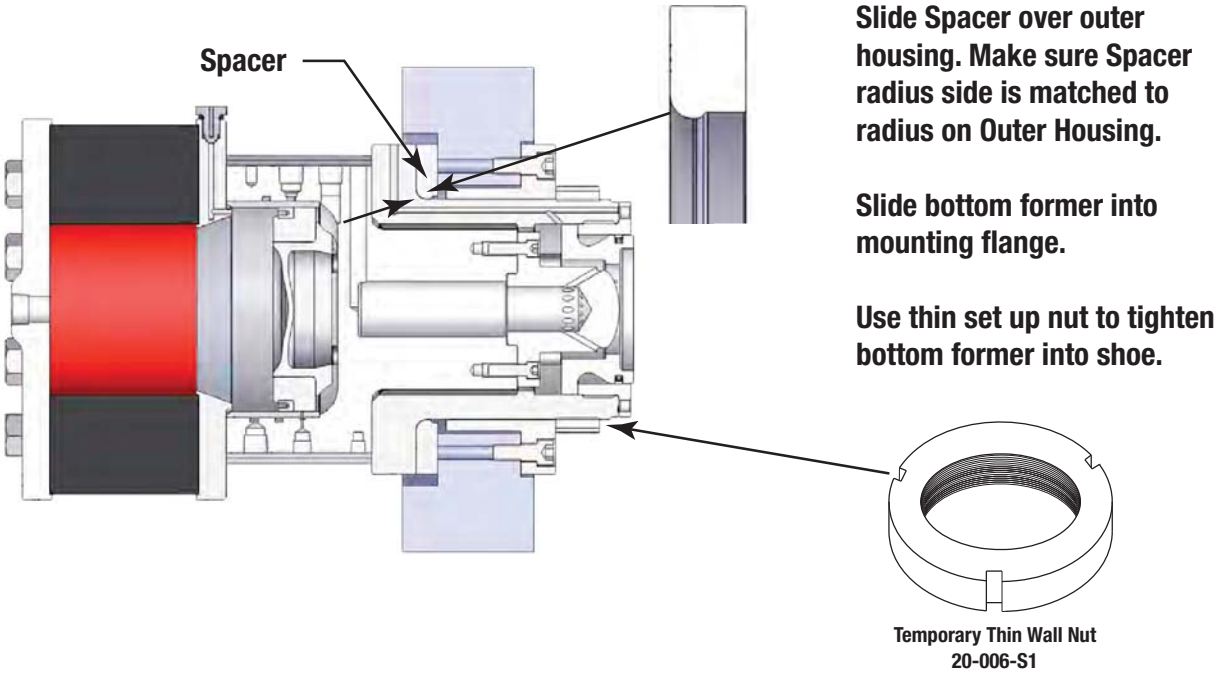


Spacer
Turning/Grinding Fixture
20-022-01

NOTE: "Machine Far Side" as noted on spacer.

The radius on the Spacer fits against radius on the Outer Housing flange. Turning/Grinding Fixture (Part No. 20-022-01) is required if the spacer is split. No Turning/Grinding fixture is required to face the Solid Spacer. Grind the Spacer (Item 7) until you reach the dimension shown above (H + D + .030 inches) (0.76 mm). The Split or Solid Spacer must remain square and parallel within .0005" (13 µm).

4 Install the Spacer (Item 7) into the Bottom Former and slide the Bottom Former back into the Mounting Flange in the Bodymaker.



5 Tighten the Temporary Thin Wall Nut, while keeping the Bottom Former oil and coolant ports to the top.

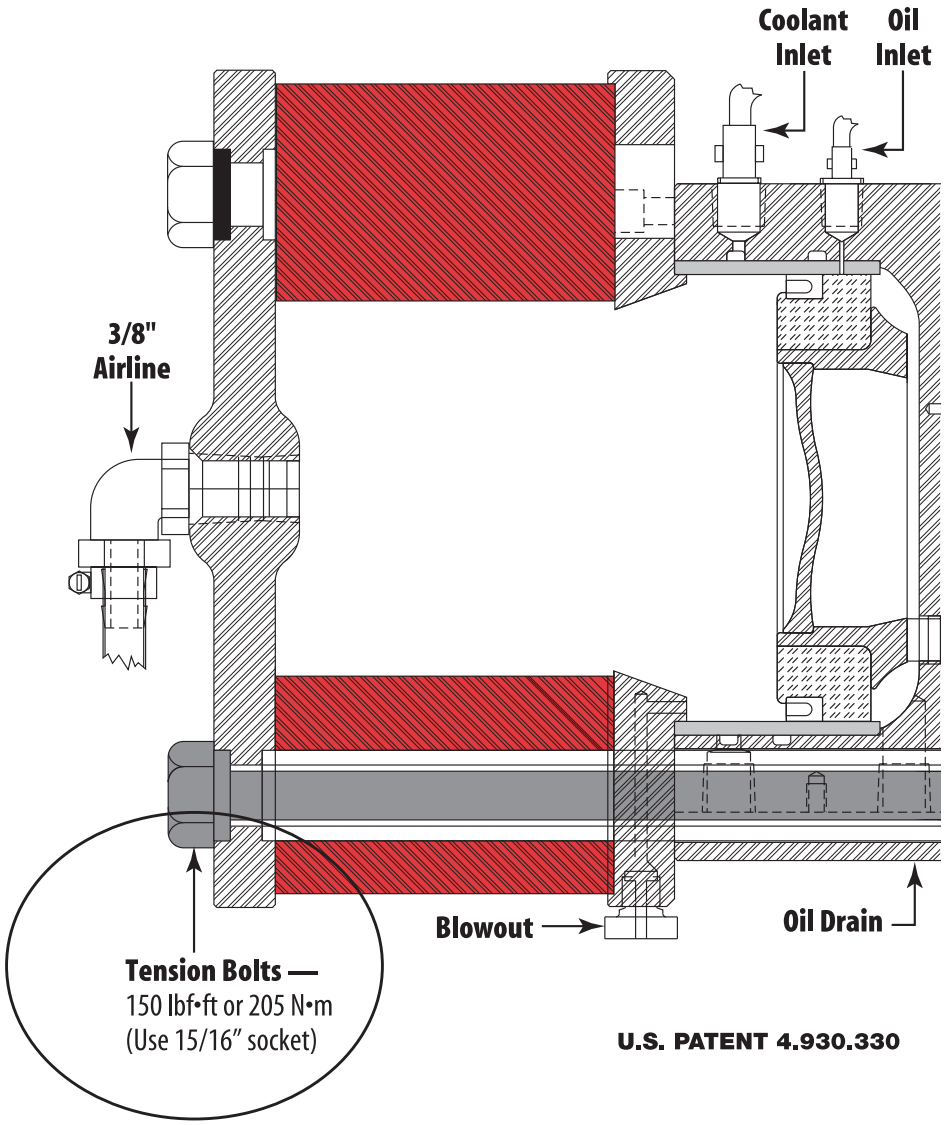
6 Tighten the 8 tension bolts in a star pattern using a **torque wrench**

DO NOT USE AN IMPACT WRENCH!

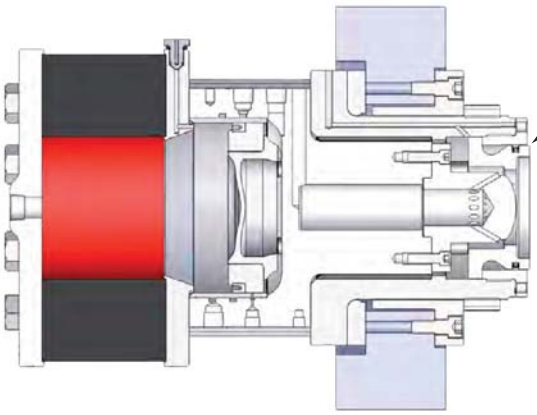
Fully torque the eight (8) tension bolts to 150 ft·lb (205 N·m) torque at some time prior to setting over travel (see Torque Specifications Section III). New Bottom Formers are shipped with loose tension bolts to delay the onset of spring wear. Holes are provided in the flange of the Outer Housing (Item 1), so that a bar that is 3/8" or 1/2" (9.5 mm or 12.5 mm) in diameter may be used to hold the Bottom Former while tightening the tension bolts. These bolts must always be tightened and loosened in a "star pattern," slowly pulling the assembly tight in an even fashion. Completely loosening or tightening only one bolt at a time will cause damage to the bolts, Heli-Coil® locking inserts and other Bottom Former parts.

Be sure to apply 150 ft·lb (205 N·m) torque to all tension bolts. Replace the Tension Bolt Heli-Coils® in the Outer Housing if there is any spring back to the torque pressure.

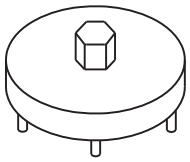
NOTE: Never loosen or tighten the (Item 13) tension bolts with a pneumatic wrench (impact wrench). The tension bolts are anchored to the outer housing with a modified locking Heli-Coil®, which cannot withstand the pounding of a pneumatic wrench.



7 Tighten Clamp Ring Retainer using Retainer wrench.

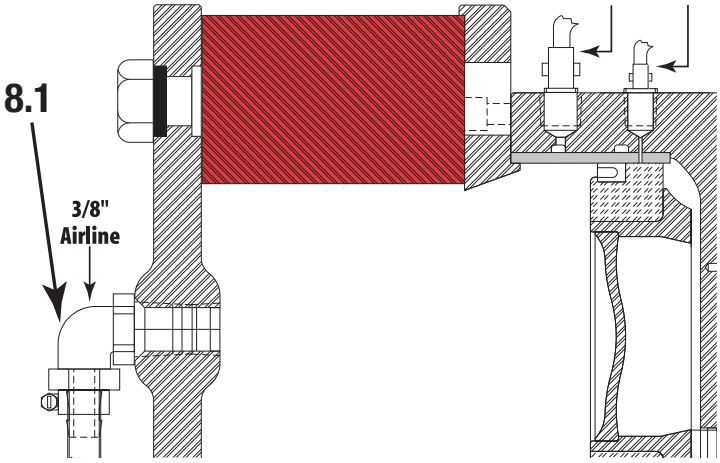


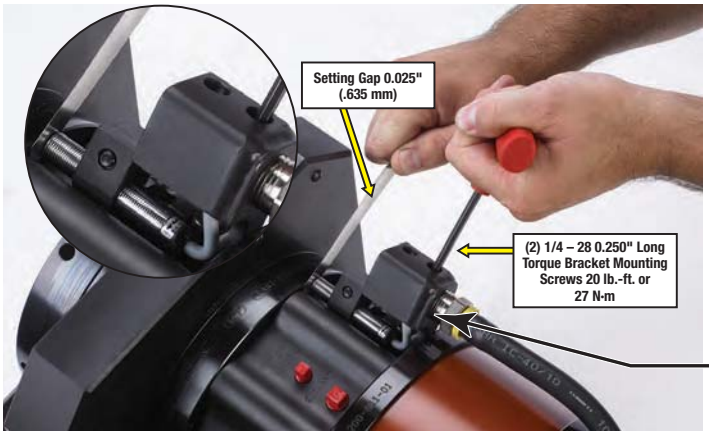
Clamp Ring Retainer – 250 ft•lb or 340 N•m (Use Retainer Wrench 20-020-02 with 15/16" Socket, apply anti-seize grease on threads



Retainer Wrench 20-020-02

8 Attach air, coolant and oil lines to bottom former and install Guardian Over Travel Sensor.





NOTE: Reference Section on Bottom Former Plumbing Instructions for details on connecting air, coolant and oil supply from the bodymaker.

8.1 Attach air line

8.2 Attach coolant line

8.3 Attach oil line

8.4 Install Guardian Over Travel Sensor (if equipped)

Phone: +001 763.427.6250 • www.pridecan.com

9. Operate the Bodymaker at the lowest operating speed to check over travel. To check for over travel, run 30 cans and monitor over travel with Portable Guardian or Guardian II Over Travel gauge. Over travel is measured as a gap (lift off) between the Cylinder Housing and the Outer Housing when the Bodymaker stroke is at its full length.

10. If, when using the Yellow Donut Spring and the over travel is between .018" (.46 mm) and .023" (.58 mm), proceed to step 11. Or, when using the Blue or Red Donut Spring and the over travel is between .003" (75 µm) and .006" (150 µm), proceed to step 11. If no (or inadequate) over travel is measured, loosen the Temporary Thin Wall Nut and remove the Spacer (Item 7). Grind up to .005" (130 µm) off of the Split or Solid Spacer, grinding it square and parallel within .0005" (13 µm). Re-install the Spacer (Item 7) and tighten the Temporary Thin Wall Nut. Remember to avoid grinding the Spacer surface marked "MACHINE FAR SIDE." Repeat this process until adequate travel is achieved at the lowest normal operating speed.

11. Operate the Bodymaker at the lowest operating speed and produce 15-20 cans. Check a sample of cans for dome depth consistency. Dome depths should not vary by more then .002 inch (50 µm) total as long as there is as little as .003" (75 µm) over travel. If the bottom is not correct or consistent at both low and high speeds contact your dealer or Pride Customer Service.

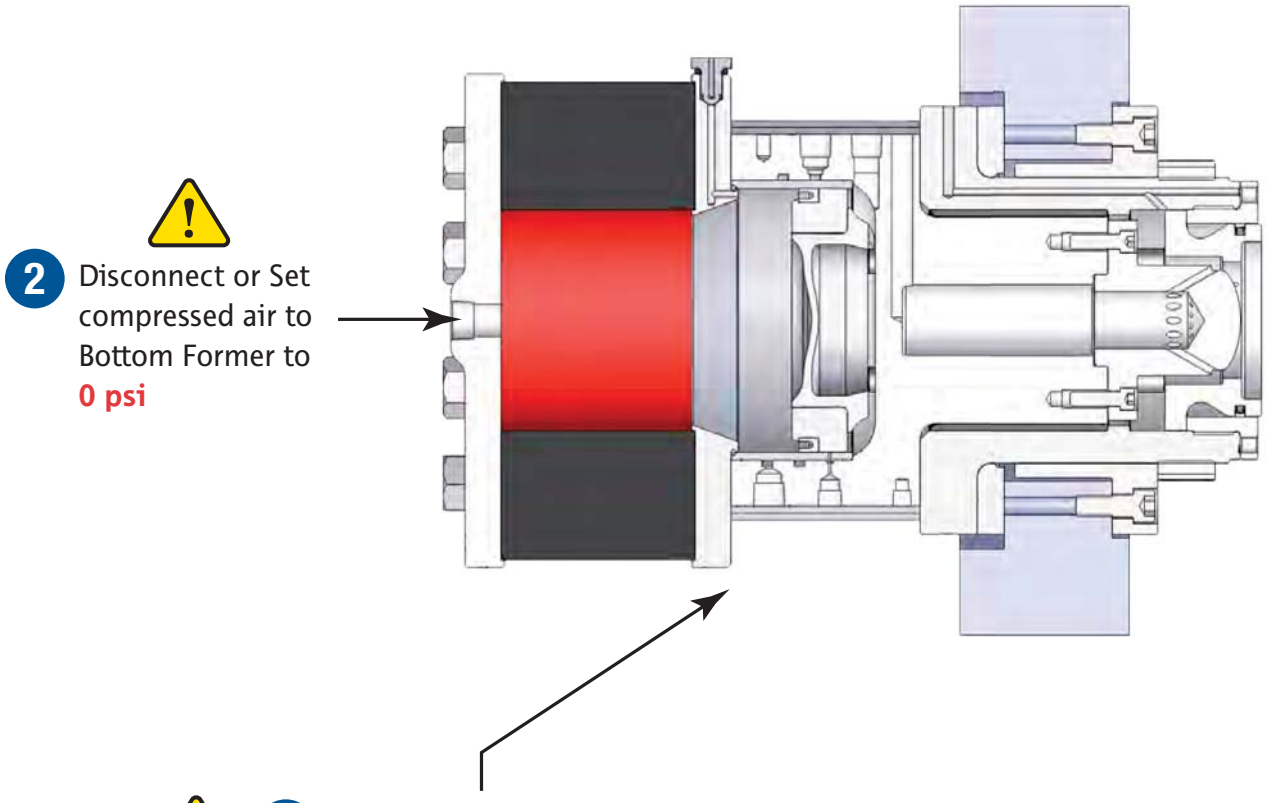
    If dome/panel depth is consistent, but not within specification, refer to section V. A. which discusses tooling development.

II. C. Bottom Former Locking Nut Assembly Installation Instructions

1 The Bottom Former Locking Nut Assembly consists of:

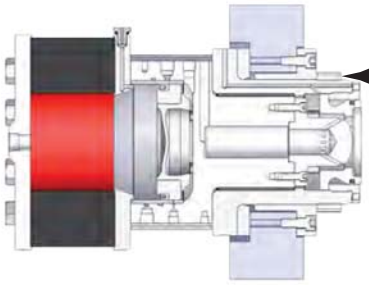
- Locking Nut 20-006-09 or 30-006-09 (Item 5)
- 3 Locking Device Bolts 60-057-09 (Item 46)
- 3 Locking Device Washers 60-056-08 (Item 45)
- Lock Screw Kit 20-025-10 (Item 23)
- Locking Device 30-055-09 or 60-055-09 (Item 44)

After completing the procedure for setting Bodymaker/Bottom Former over travel (Section II. C. of this manual) and establishing correct spacer thickness, the Locking Nut Assembly can be assembled to the Bodymaker. The thickness will be different for every Bodymaker...the thicker the Spacer then the thinner the Locking Nut. Every .005" (.13 mm) removed from the Spacer to achieve over travel is .005" that must be added to the thickness of the Locking Nut. Locking Nut thickness should not be determined until the Bottom Former Spacer is ground to a thickness that achieves the desired Bodymaker over travel. Because these dimensions are different for every Bodymaker it will help if the same Spacer and Locking Nut always remain with the same Bodymaker.



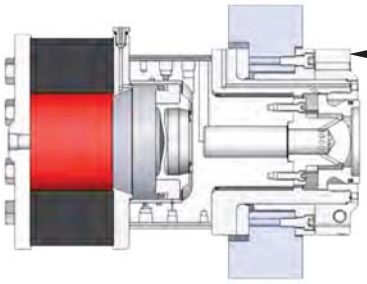
2 Disconnect or Set compressed air to Bottom Former to **0 psi**

3 Open valve to relieve any potential air pressure and then close again.



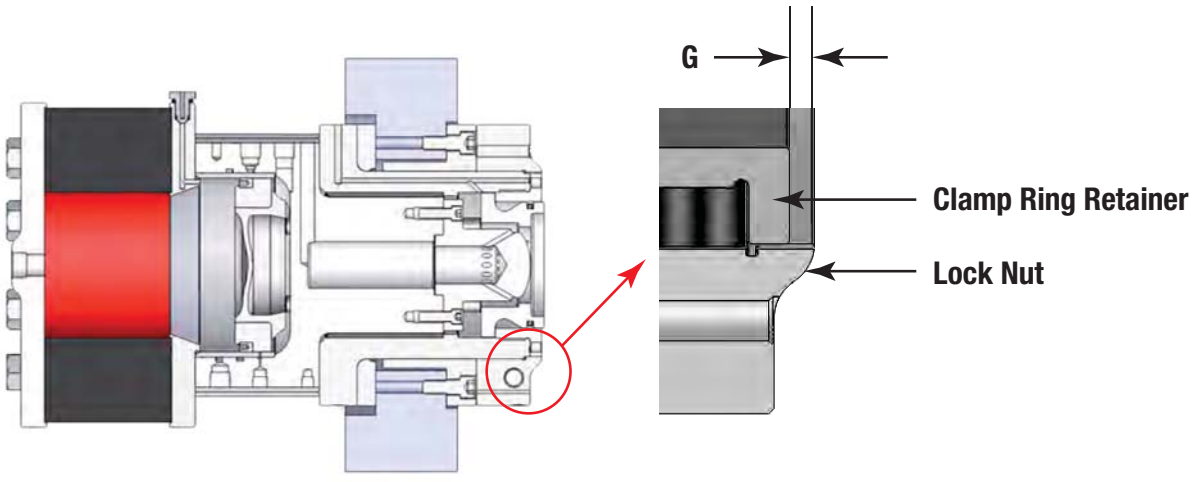
4 Remove temporary locking nut.

5 Loosen Locking Nut Screw on Locking Nut (see page 14).

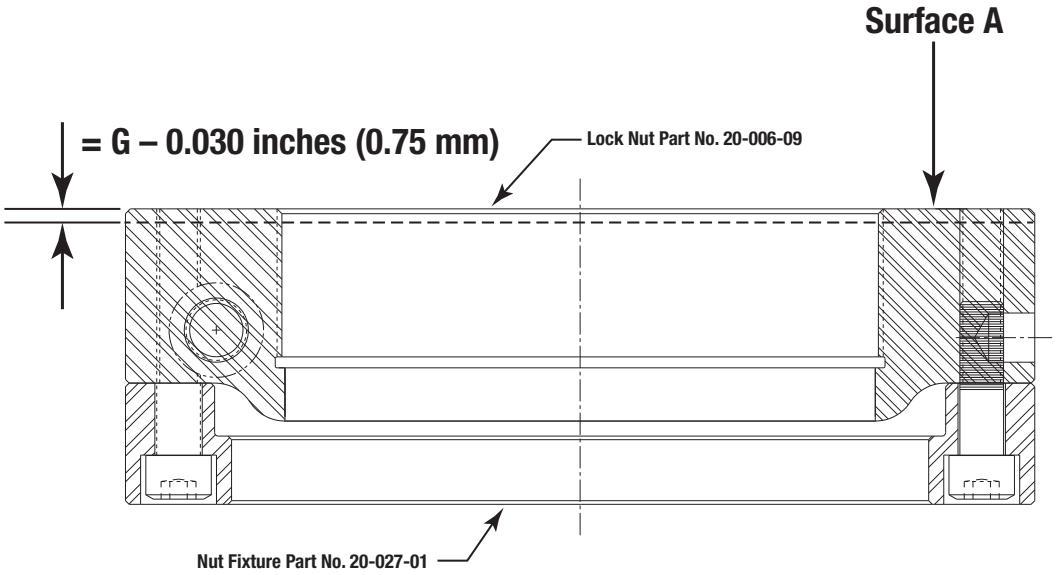


6 Install Locking Nut.

7 Measure the difference, “G”, in height of top of Locking Nut to top of Clamp Ring Retainer. Determine how much needs to be removed from Surface A to have the Locking Nut be ~ 0.030 inches (0.75 mm) above Clamp Ring Retainer surface.



8 Use fixture 20-027-01 to hold Locking Nut while grinding surface A to remove G-0.030 inches (0.75 mm).



If the installer needs to remove more then .010" (.25 mm) from the back (surface A) of the Locking Nut, the Locking Nut may be machined down to .010" (.25 mm) oversize in a lathe using the Nut Fixture and the same carbide inserts used to machine the spacer such as CNMG 432 with a TIN coating similar to grade KC 9040. The lathe operator will need a turning tool holder such as a Kennametal DCLNR-164D NAQ to hold the carbide insert. **Grind the last .010" (.25 mm) to leave a high quality surface that is flat and parallel to reduce breakage of the Locking Nut.**

9 Remove from the Nut Fixture and thoroughly deburr all of the edges of the new ground surface.

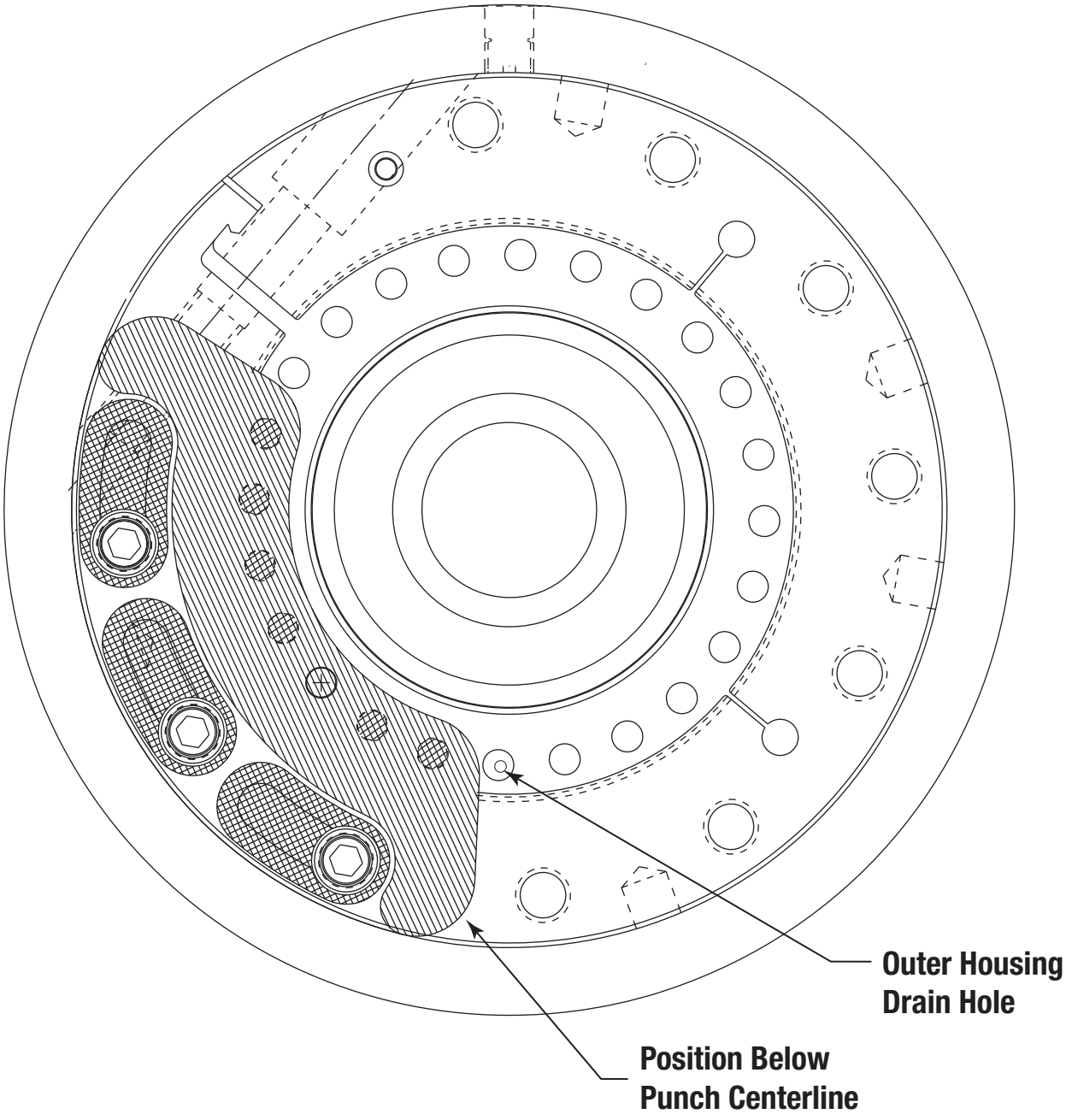
10 Re-install the Locking Nut onto the Bottom Former. Torque to 200 ft·lb (270 N·m) of torque. O**ver tightening the Locking Nut will prevent the threads of the Locking Nut and the threads of the Outer Housing from seating together when the Lock Screw (Part No. 20-025-10) is torqued.** This condition will minimize thread contact and could allow the Locking Nut to unscrew and become loose after the Bodymaker goes into operation. If the Locking Nut comes loose, premature Outer Housing thread wear will occur causing the failure of the Locking Nut and Outer Housing. Over tightening the Locking Nut could also cause damage to the Outer Housing (Item 1) and inhibit the proper functioning of the clamp ring retainer (Item 6). **Using a punch and hammer in place of the proper Nut Wrench (Part No. 20-021-03) will damage the Locking Nut assembly and void its warranty.**

11 Tighten the Lock Screw, 20-025-03. Torque to 85 ft*lb".

12 Whenever the Locking Nut needs to be removed, the cross-bolt must first be loosened enough to fully spread the Locking Nut (see page 14).

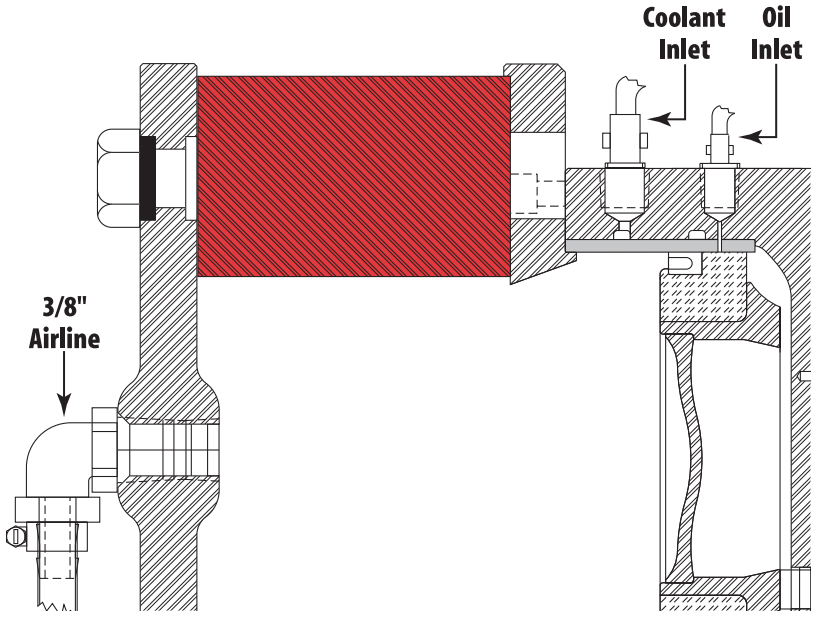
13 The Locking Device (Item 44) can now be installed to the Locking Nut. When possible, **avoid positioning the Locking Device where the Locking Device Bolts are directly above the path of the Bodymaker punch/ram**. However, it may be necessary to locate the locking device differently to avoid interference with the Bodymaker take-away conveyor. The Locking Device system is designed to allow for many mounting positions. Use the Locking Device Bolts (Item 46) and Washers (Item 45) to retain the Locking Device. Torque the Locking Device Bolts to 45 ft·lb (60 N·m).

CORRECT POSITION OF LOCKING DEVICE



II. D. Bottom Former Plumbing Instructions

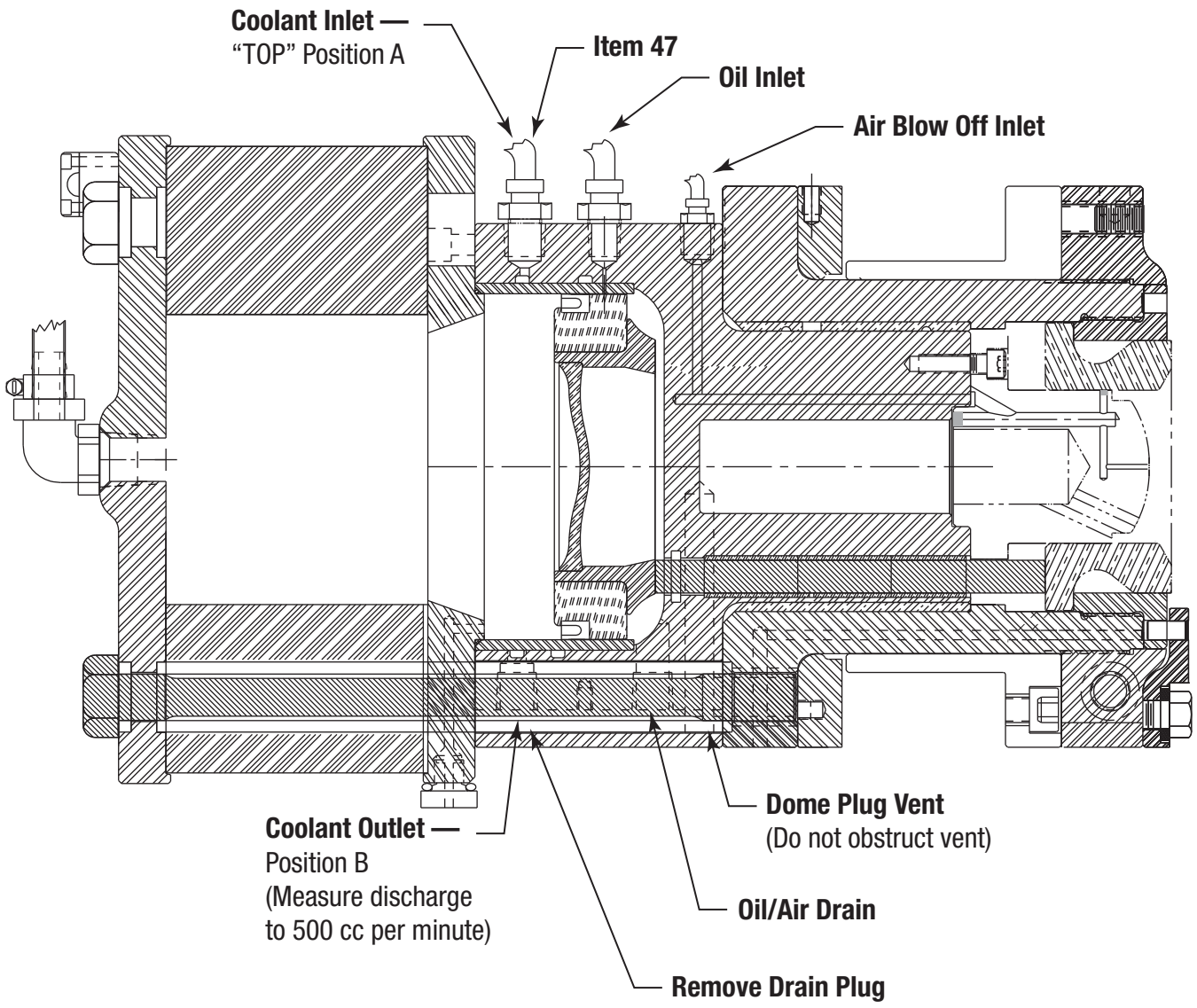
Pride Bottom Formers require different plumbing arrangements depending on which model you have. All Pride Bottom Formers require shop air that is plumbed to the cylinder to control clamping pressure. In addition to shop air, the original Model 20 Bottom Formers require Bodymaker oil to lubricate the movement of the piston while the Model 60 Bottom Former utilizes Bodymaker coolant to lubricate the movement of the Piston (Item 14), as well as to cool the Cylinder Housing (Item 3). In addition to shop air, the Hybrid 200 & 300 Series Bottom Formers utilize Bodymaker coolant to cool the Cylinder Housing and Bodymaker oil to lubricate the movement of the Piston. Both types of plumbing instructions are detailed below.



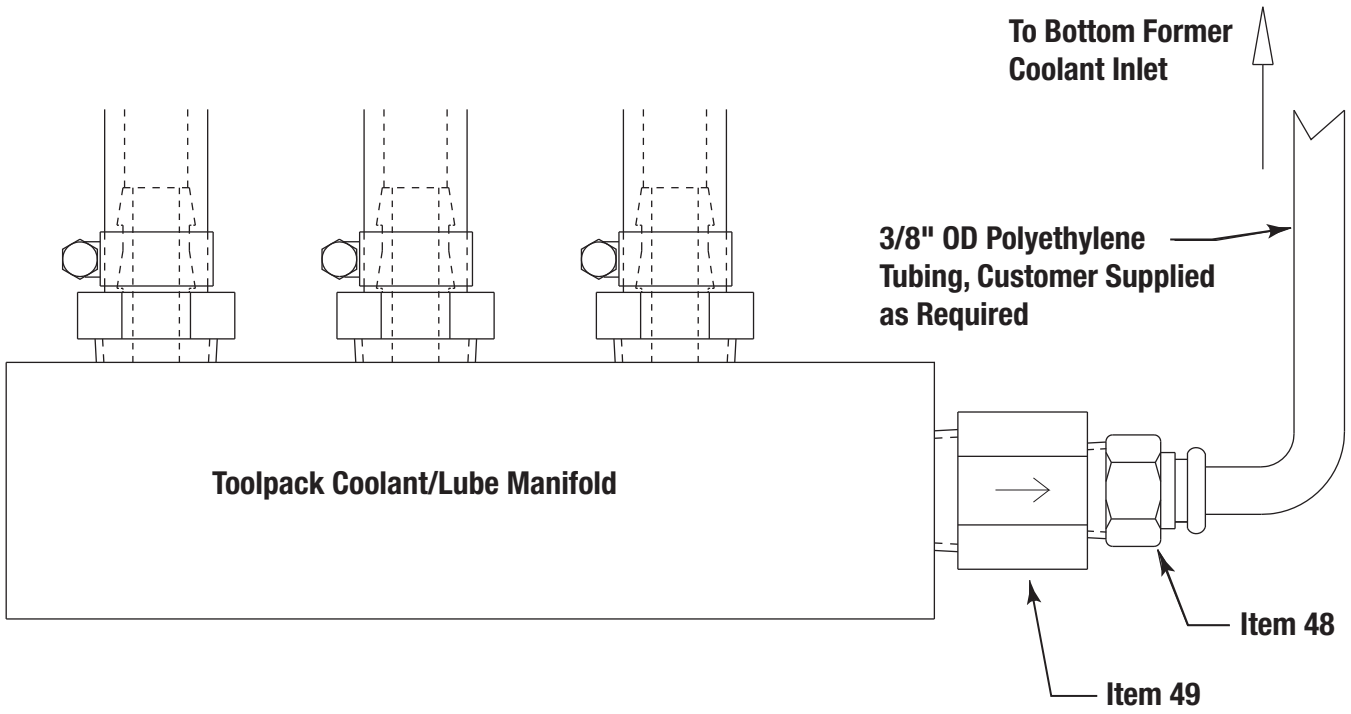
PLUMBING - COOLANT

The Hybrid Bottom Former uses Bodymaker coolant to cool the cylinder housing which will cool the piston as well. The 30 and 60 Series Bottom Formers use Bodymaker coolant to both cool the cylinder housing and to lubricate the movement of the piston.

1. Locate the red plastic plugs at positions A and B below. Remove both of these hex plugs.
2. Install the Item 47, 90° Push-Lok™ Fitting (Part No. 200-040-01) into the coolant inlet, position A. Use Teflon tape or sealant on the pipe threads. DO NOT completely tighten the fittings at this time.



3. Locate an unused port on the Bodymaker manifold (see below) that provides coolant to the Bodymaker Tool Pack. Install Item 49 (60-029-02, Coolant Orifice) into this port.



4. Install Item 48, Push-Lok™ Fitting (Part No. 200-041-01), into Item 49 Coolant Orifice (Part No. 60-029-02) using Teflon tape or sealant. Fittings must be tightened so that the polyethylene tubing can be easily directed toward the fitting installed in the Bottom Former.

5. Install the 3/8" OD X .062" wall natural polyflow tubing (provided by Pride). Tighten all fittings.

6. Pride recommends approximately 2 cups (500 cc per minute) coolant flow. Flow may be measured at the coolant outlet hole (see note on drawing).

PLUMBING – OIL

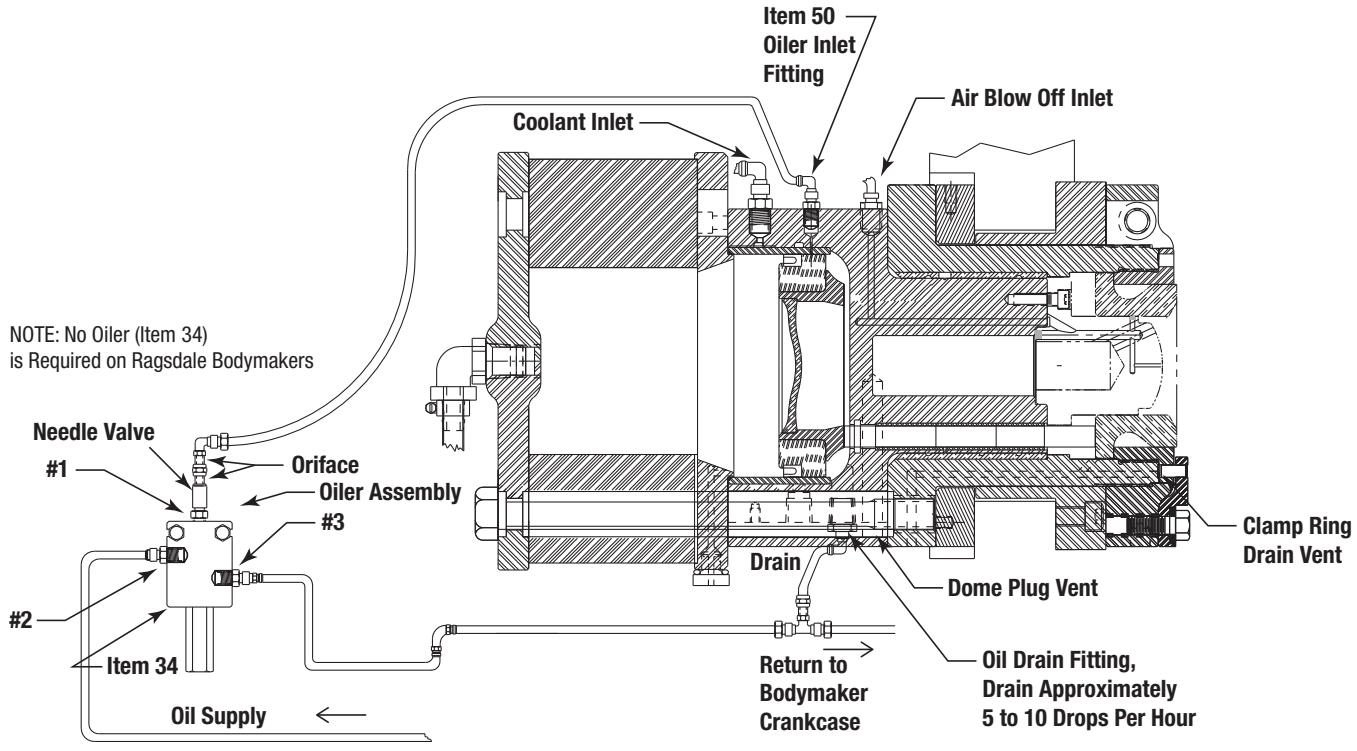
The Bottom Former piston requires approximately 15 drops of oil per hour. All Pride Bottom Formers require lubricating from oil supplied from the Bodymaker lubrication system. Both Standun and CMB Bodymakers use an oiler supplied by Pride. The oiler can be operated manually or electronically from the Bodymaker control. Ragsdale Bodymakers have lubrication ports that can be plumbed directly to the Bodymaker so no additional oiler is required.

A. Standun and CMB Bodymakers - Manually or Electronic Controlled Oilers

For Standun or CMB Bodymakers locate an unused, plugged NPT outlet on the Bodymaker's high-pressure lubrication system. This should be the same oil used in the Bodymaker crankcase and will be the source of clean, cooled oil to lubricate the Bottom Former piston. Some Bodymakers (like the Standun B6) have high-pressure oil at a cooling manifold behind the Bodymaker.

1. Manually Controlled Oilers

a. Find a suitable location on the Bodymaker frame that is close to the Bottom Former to mount the Pride Oiler (Item 34). Plumb a 1/4" OD (approximately 6 mm) stainless steel or copper tube from the high pressure oil source to port #2 of the Bottom Former Oiler. Plumb the Oiler port #1 to the Needle Valve and then from the Needle Valve to the reduction Orifices, Item 49. Plumb a 1/4" OD X .040" thick wall natural polyflow tubing, (provided by Pride) from the Orifice to the Bottom Former oil inlet, Item 50, on top of the Cylinder Housing. It is optional to plumb the Bottom Former drain at the bottom of the Cylinder Housing back to the Bodymaker oil sump for the return oil. The oil inlet on the top for the Cylinder Housing is labeled.



THE DRAIN LINE RETURNING TO THE BODYMAKER OIL SUMP MUST BE PLUMBED LOWER THAN THE BOTTOM FORMER OIL DRAIN.

NOTE: When using the manually controlled oiler port #1 is the oiler outlet to supply the Bottom Former. Oiler port #2 is the oil supply inlet from the Bodymaker high pressure supply. Oiler port #3 is the drain for the pressure relief valve.

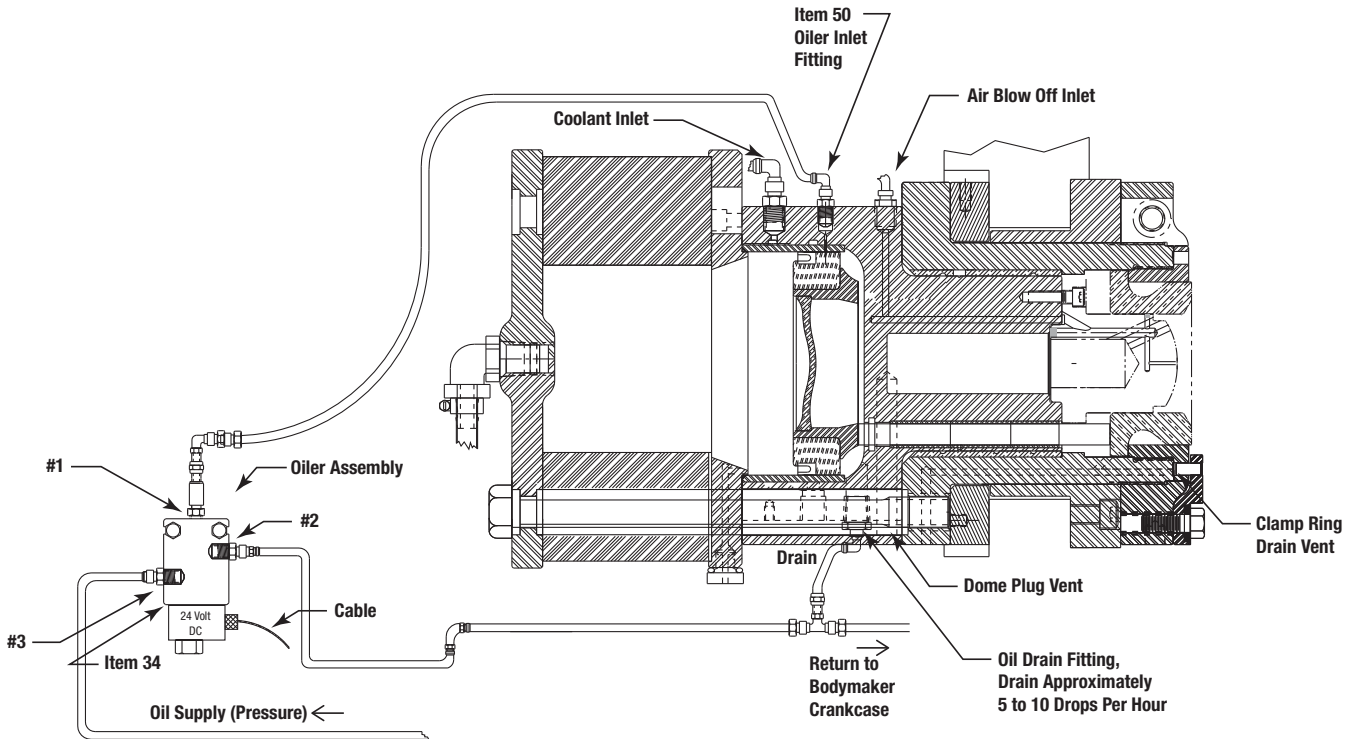
b. Adjust oil flow to a minimum, approximately 15 drops per hour. Excess oil will not be of benefit. Too much oil will actually inhibit the performance of the Bottom Former.

c. Plumb a 1/4" OD (approximately 6 mm) polyflow tubing provided by Pride from the cylinder drain under the Bottom Former (see "Oil Drain" above) to drain the oil from Cylinder Housing back to the Bodymaker oil sump. You will find NPT threads for a 1/4" OD tube fitting underneath the Bottom Former in the cylinder drain.

d. The oiler pressure relief outlet (port #3) may be plumbed back to the Bodymaker oil sump with the Cylinder Housing drain but care should be taken to be sure that the entire drain line is lower then the Bottom Former drain outlet or oil will back up into the Bottom Former.

2. **Electronic Oilers**

a. Find a suitable location on the Bodymaker frame or on the frame that is close to the Bottom Former to mount the Pride Oiler (Item 34). Plumb a 1/4" OD (approximately 6 mm) stainless steel or copper tube from a high pressure oil source to port #3 of the Bottom Former Oiler. Plumb the Oiler port #1 to the Needle Valve and then from the Needle Valve to the reduction Orifices, Item 49. Plumb a 1/4" OD X .040" wall natural polyflow (polyethylene) tube from the Orifice to the Bottom Former oil



THE DRAIN LINE RETURNING TO THE BODYMAKER OIL SUMP MUST BE PLUMBED LOWER THAN THE BOTTOM FORMER OIL DRAIN.

inlet, Item 50, on top of the Cylinder Housing. It is optional to plumb the Bottom Former drain at the bottom of the Cylinder Housing back to the Bodymaker oil sump for the return oil. The oil inlet on the top for the Cylinder Housing is labeled.

NOTE: When using the electronically controlled oiler port #1 is the outlet to supply the Bottom Former. Oiler port #2 is the drain for the pressure relief valve. Oiler port #3 is the oil supply inlet from the Bodymaker high pressure supply

b. Adjust oil flow to a minimum, approximately 15 drops per hour. Excess oil will not be of benefit. Too much oil will inhibit the performance of the Bottom Former.

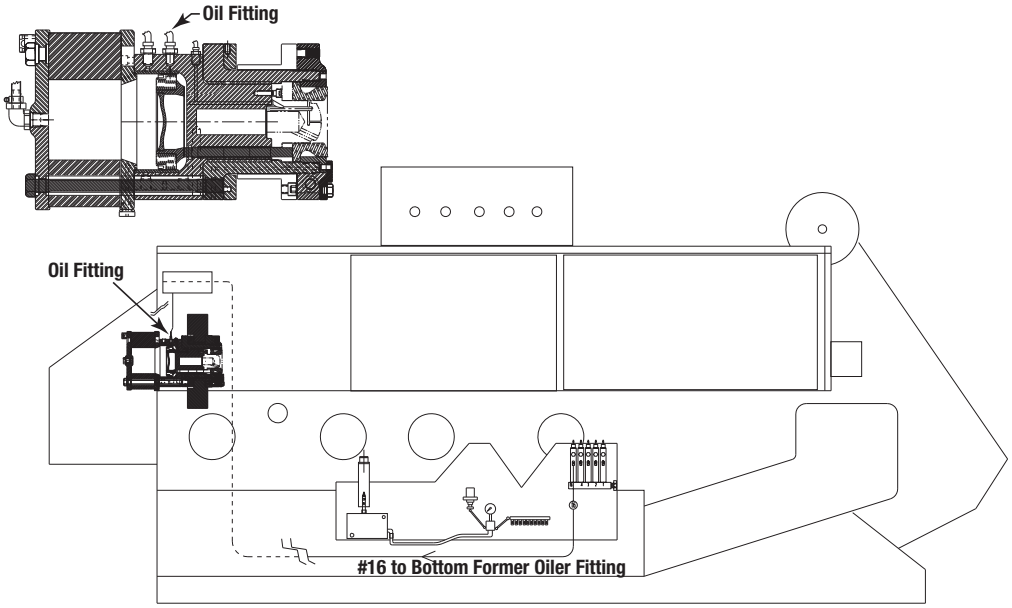
c. Plumb a 1/4" OD (approximately 6 mm) polyflow tubing provided by Pride from the cylinder drain under the Bottom Former (see "Oil Drain" above) to drain the oil from Cylinder Housing back to the Bodymaker oil sump. You will find NPT threads for a 1/4" OD tube fitting underneath the Bottom Former in the cylinder drain.

d. The oiler pressure relief outlet (port #2) may be plumbed back to the Bodymaker oil sump with the Cylinder Housing drain but care should be taken to be sure that the entire drain line is lower then the Bottom Former drain outlet or oil will back up into the Bottom Former.

B. **Ragsdale Bodymakers**

The Ragsdale Bodymaker has a lubricating system that makes it possible to lubricate the Bottom Former's piston without the addition of an Oiler (Item 34). Ragsdale Bodymakers have controlled oil connections at the oil manifold located on the lower right side of the Bodymaker.

1. Plumb a 1/4" (approximately 6.35 mm) OD stainless steel or copper tube from one of the Bodymaker's SL 42 Lincoln Injectors the Bottom Former oil inlet, Item 50, on top of the Cylinder Housing.



PRIDE RECOMMENDS THAT THE CAN MAKER USE ONE OF THE SL 42 LINCOLN INJECTORS WHICH ARE STANDARD ON RAGSDALE BODYMAKERS. ADJUST THE INJECTOR TO FEED .001 TO .002 CL EVERY THREE MINUTES UP TO .04 CL PER HOUR.

2. Adjust oil flow to a minimum, approximately 15 drops per hour. Excess oil will not be of benefit. Too much oil will actually inhibit the performance of the Bottom Former.

3. **Optional** - Plumb a 1/4" OD (approximately 6 mm) polyflow tubing provided by Pride from the cylinder drain under the Bottom Former (see "Oil Drain" above) to drain the oil from Cylinder Housing back to the Bodymaker oil sump. You will find NPT threads for a 1/4" OD tube fitting underneath the Bottom Former in the cylinder drain.

PLUMBING – AIR

1. Identify a source for the 3/8" ID (10 mm) air supply. There is usually a shop air source close to the Bottom Former end of the Bodymaker or Trimmer. When the Bottom Former air supply is plumbed through the Bodymaker control it will monitor the air pressure to the Bottom Former and shut down the Bodymaker of if there is a loss of adequate air pressure in the cylinder of the Bottom Former. Do not use the air supply in the Bodymaker control panel unless its supply is a minimum of 3/8" ID (10 mm).

2. Install the air supply regulator and tubing. The Bottom Former is supplied with a black 3/8" (approximately 10 mm) ID tubing. 3/8" ID airline must be used to connect the air regulator to the main air supply. Many older Bodymakers are plumbed with smaller fittings. If there is not a minimum 3/8" (10 mm) ID on the Bodymaker then another source of air must be found. Do not use smaller hose or reduction bushings with smaller size fittings. Use 3/8" (10 mm) ID from the shop air supply to the Bottom Former. Restricting airflow will reduce the performance of the Bottom Former. Clamp all hose connections.

   If the Bodymaker is supplied with a low air pressure sensor, connect it in the Bottom Former airline between the air regulator and the Bottom Former as close to the Bottom Former as possible.

3. Set air pressure to 50 PSI (3-1/2 bars). Operate the Bodymaker for several cycles at low speed. Inspect the resulting cans for wrinkles. If the cans have wrinkles, increase the air pressure by 5 PSI (.3 bars) and repeat the test. Continue this procedure until the cans are wrinkle free. (NOTE: The wrinkles should be eliminated by the time 70 PSI (5 bars) is reached). If more than 80 PSI (5-1/2 bars) is required, check your redraw pressure, alignments, and then the clamping surface of your tooling.

PLUMBING – AIR BLOW OFF

The Pride Bottom Former is equipped to utilize blow off tooling. With certain dome profiles, the can maker may encounter difficulty in releasing the can from the Bottom Former. Damaged cans can also occur because the can isn't releasing properly, resulting in marks or dents by the can take away system. In addition, as speeds are increased to 350 strokes per minute and above, coolant may become trapped in the dome die, which may also cause difficulties in releasing the can from the Bottom Former.

There is an Air Blow Off Port designed in the Cylinder Housing that vents air to the dome die, allowing for an air assist in releasing the can from the Bottom Former. This is accomplished by venting the air via the design recommendation in the Tooling Geometry section found in Section V.

1. Identify a source for the air supply. There is usually a shop air source close to the Bottom Former end of the Bodymaker or Trimmer. Plumbing a 1/4" poly tube to the Air Blow Off Port, utilizing an air regulator set to low pressure should be sufficient air pressure. It is recommended that the line be fitted with a solenoid to shut off the air pressure when the Bodymaker is not stroking to save on shop air.

II. E. 200-112-01 Donut Spring Conversion Installation Instructions

1. Uncrate parts kit and inspect parts to insure all parts are in the kit. The kit includes the following parts:

PARTS KIT FOR DONUT SPRING CONVERSION			
Item No.	**Quantity**	**Model 60 Part No.**	**Description**
	1		Schematic Drawing
9	8	200-010-01	Stand-off
10	1	200-011-01	Cover Plate
11	1	200-012-01	Donut Spring
12	1	200-013-01	Spring End Plate
13	8	200-014-03	Tension Bolts
22	1	20-026-01	O-ring, Cover Plate
39	1	200-045-01	Hose Retainer (Air)
41	1	60-030-01	Street Elbow
51	1	60-030-02	Female Fitting 37˚ (Air)

2. Installation of the Donut Spring Conversion Kit may be completed with or without removing the Bottom Former from the door or shoe. Pride does recommend the Bottom Former be removed, cleaned, and serviced during the kit installation.

3. Remove Bottom Former tooling.

4. Referring to the Figure for the 217 Bottom Former, remove the Tension Bolts (Item 13), Spring End Plate (Item 12), Donut Spring (Item 11), Stand-offs (Item 9), and Cover Plate (Item 10).

5. Cylinder Housing (Item 3) from Outer Housing (Item 1). Discard the O-ring (Item 22).

6. Remove the Push Rods (Item 8) and the Piston (Item 14) from the Cylinder Housing. Clean and wash the Cylinder Housing, removing all grit and contaminants. Piston Seal should be checked for wear at this time.

7. Clean up Stand-off counter bores in the Outer Housing. Check Tension Bolt Locking Heli-Coils® (Item 15) in the Outer Housing. Replace Heli-Coils® if damage is suspected or if they appear to be loose in the housing. Pride also suggests that a bolt be hand threaded into place if minimal resistance is encountered, replace the Heli-Coil®.

8. Apply a small amount of Lubriplate to the nose of the Cylinder Housing and reinstall into Outer Housing making sure surface D on the Outer Housing is clean and free of debris.

9. Grease and install the Push Rods into the Cylinder Housing. Push Rods should be installed from the Piston Cylinder end of the Bottom Former. Install the Piston Assembly into the Cylinder Housing.

10. Install new Cover Plate (Part No. 200-011-01, Item 10), and new O-ring (Part No. 20-026-01, Item 22), using the four (Item 30) 1/4 - 20 SHCS after insuring surface G on the Cylinder Housing is clean and free of debris.

11. Install eight (Part No. 200-010-01, Item 9) Stand-offs making sure they are seated in the Outer Housing. Set the Spring End Plate, (Part No. 200-013-01, Item 12) on the top of Stand-Offs. Lift the Cylinder Housing and Cover Plate Assembly to make sure there is no binding. If there is no binding, move to next step. If there is binding, call your Pride dealer or Pride Customer Service for instructions.

12. Grease and install the eight (Part No. 200-010-01) Stand-offs (Item 9) making sure they are completely seated in their counter bores in the Outer Housing.

13. Install the (Part No. 200-012-01) Donut Spring (Item 11) making sure it is properly seated in the counter bore on the Cover Plate.

14. Before installing the (Part No. 200-013-01) Spring End Plate (Item 12), note that the side with lettering must be on the outside and the word “TOP” should be up.

15. Grease the eight (Part No. 200-014-03) Tension Bolts (Item 13) and install. The Tension Bolts should be greased on the thread area and under the cap to prevent scoring. Tighten lightly in a star pattern.

16. Install air supply fittings (Part No. 60-030-01), 37˚ Street Elbow (Item 41) along with (Part No. 60-030-02), 37˚ Swivel Fitting (Item 51) and (Part No. 200-045-01) Hose Retainer (Item 39) to Spring End Plate.

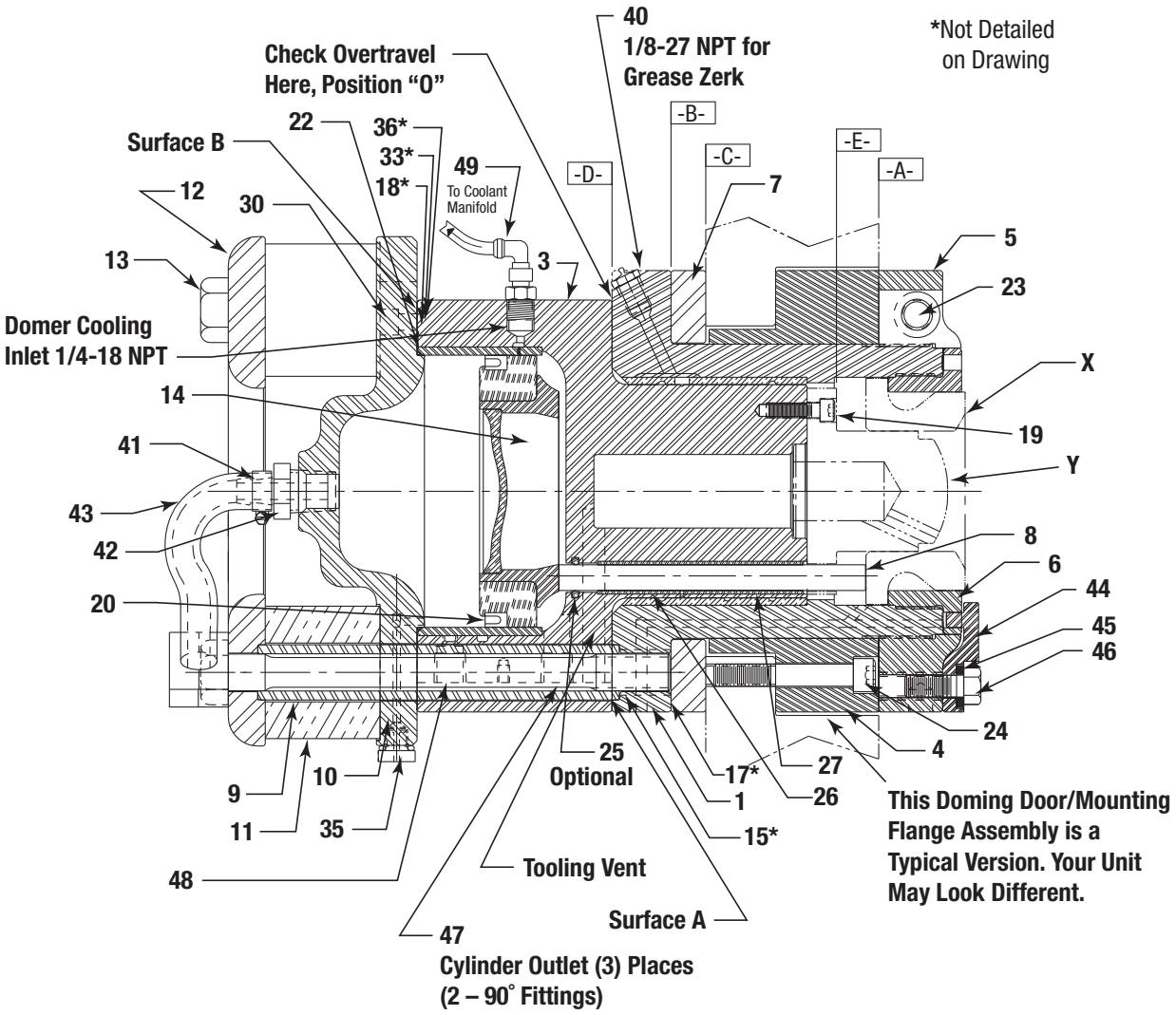
17. The Bottom Former can now be re-installed to the Bodymaker. After installation is complete, torque the eight Tension Bolts in a star pattern to 150 ft·lb (205 N·m). Grease the Bottom Former through the top grease zerk (on older models), reconnect air, coolant and oiler if so required.

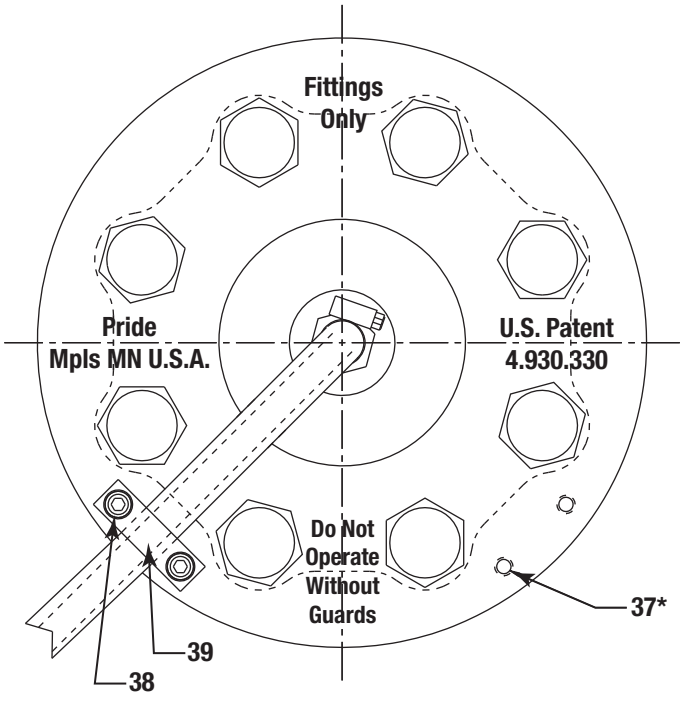
II. F. 30 & 60 Series Bottom Former – Recommended Spare Parts List

Pride maintains a well-stocked inventory of spare parts. Contact your dealer for delivery and pricing. It is absolutely essential that only Pride original parts are used on your Bottom Former. Non-Pride components are generally manufactured of inferior material or design parameters and the **use of non-Pride parts will automatically void any factory warranty.**

RECOMMENDED SPARE PARTS FOR CAN PLANTS RUNNING ONE LINE				
Item No.	**Quantity**	**Model 30 Part No.**	**Model 60 Part No.**	**Description**
	1	30-076-02	60-076-02	Bottom Former Tool Kit
1	1	300-002-16	200-002-17	Outer Housing
3	1	300-004-16	200-004-16	Cylinder Housing
5	1–2	30-006-09	20-006-09	Locking Nut
6	2–3	30-007-09	20-007-09 ATS	Clamp Ring Retainer
7	1–2	30-008-10	60-008-17	Solid Spacer
8	4–12	60-009-03	60-009-03	Push Rods
9	8–24	60-010-01	60-010-01	Stand-off
10	1–2	60-011-10	60-011-10	Cover Plate
11	8–24	60-012-01	60-012-01	Springs
13	8–24	20-014-01	20-014-01	Tension Bolts
14	1–3	30-015-02	60-015-02	Piston
15	8–24	20-023-01	20-023-01	Outer Housing Heli-Coils®
19	4–8	60-023-01	60-023-01	Cylinder Housing Nose Heli-Coils®
20	2–5	60-028-05	60-028-05	Piston Seal
22	2–5	20-026-01	20-026-01	O-ring, Cover Plate
23	2–5	20-025-10	20-025-10	Lock Screw Kit
35	2–5	20-095-01	20-095-01	Petcock Assembly
44	1–2	30-055-09	60-055-09	Locking Device
45	8–24	60-056-08	60-056-08	Locking Device Washers
46	8–24	60-057-09	60-057-09	Locking Device Bolts
	1	316	217	Pride Bottom Former

MODEL 60 BOTTOM FORMER





NOTES:

1. Before operating domer, see installation, assembly, and maintenance instructions.
2. Dome tooling is the responsibility of the customer.
3. Replacement of bushings must be done by Pride.
4. Grease bolts and screws before assembly. Use anti-seize compound on threads. Greasing should be done with good commercial grade grease that resists being washed away by coolant/lube.
5. Requires wrenches and fixtures
   (Set Part No. 60-076-02)
   20-020-02 Retainer Wrench
   20-021-03 Nut Wrench
   20-022-01 Turning/Grinding Fixture
   20-006-S1 Temporary Nut
   20-027-01 Turning/Grinding Nut Fixture
   20-078-02 Dome Die Bolts Socket
   20-078-04 Lock Nut Socket
   20-078-03 Mounting Flange Bolt Socket
   60-028-00 Piston Seal Assembly Tool

II. G. 30 & 60 Series Bottom Former – Full Parts List

COMPLETE LIST OF PARTS FOR MODEL 30 & MODEL 60 BOTTOM FORMERS

Item No.	Model 30 Part No.	Model 60 Part No.	Per	Description
	30-076-02	60-076-02		Bottom Former Tool Kit
1	300-002-16	200-002-17	1	Outer Housing
3	300-004-16	200-004-16	1	Cylinder Housing
4	30-005-01	20-005-06	1	Mounting Flange
5	30-006-09	20-006-09	1	Locking Nut
6	30-007-09	20-007-09 ATS	1	Clamp Ring Retainer
7	30-008-10	60-008-17	1	Solid Spacer
8	60-009-03	60-009-03	4	Push Rods
9	60-010-01	60-010-01	8	Stand-off
10	60-011-10	60-011-10	1	Cover Plate
11	60-012-01	60-012-01	8	Springs
12	60-013-01	60-013-01	1	Spring End Plate
13	20-014-01	20-014-01	8	Tension Bolts
14	30-015-02	60-015-02	1	Piston
15	20-023-01	20-023-01	8	Outer Housing Heli-Coils®
16	20-024-01	20-024-01	1	Vent Plumbing Kit
17	60-060-00	60-060-00	2	Outer Housing Dowels
18	60-023-02	60-023-02	8	Spring End Plate Locking Heli-Coils®
19	60-023-01	60-023-01	4	Cylinder Housing Nose Heli-Coils®
20	60-028-05	60-028-05	1	Piston Seal
22	20-026-01	20-026-01	1	O-ring, Cover Plate
23	20-025-10	20-025-10	2	Lock Screw Kit
24	60-061-02	60-061-02	8	Mounting Flange Bolts
25	20-033-01	20-033-01	4	O-ring, Push Rods (Optional)
26	60-046-02	60-046-02	8	Push Rod Bushings, Greaseless
27	60-046-00	60-046-00	4	Push Rod Spacer Sleeves
30	60-061-01	60-061-01	4	Cover Plate Screws
31	60-032-01	60-032-01	1	Air / Lube Plumbing Kit
33	60-023-01	60-023-01	25	Cylinder Housing Locking Heli-Coils®
35	20-095-01	20-095-01	1	Petcock Assembly
36	60-060-01	60-060-01	1	Cylinder Housing Dowel
37	60-023-01	60-023-01	4	Cylinder Housing Heli-Coils®
38	60-061-01	60-061-01	2	Hose Clamp Screws
39	20-045-01	20-045-01	1	Hose Retainer (Air)
40	20-058-01	20-058-01	1	Grease Zerk
41	20-046-01-00	20-046-01-00	1	Hose Clamp
42	20-046-01	20-046-01	1	Barb Fitting / Hose Clamp
43	200-030-01-00	200-030-01-00	1	Air Supply Hose
44	30-055-09	60-055-09	1	Locking Device
45	60-056-08	60-056-08	3	Locking Device Washers
46	60-057-09	60-057-09	3	Locking Device Bolts
47	200-040-01	200-040-01	1	Coolant Fitting, Push-Lok™
48	200-041-01	200-041-01	2	Coolant Fitting, Push-Lok™, Strait
49	60-029-01	60-029-01	1	Coolant Orifice

II. H. 200 & 300 Series Bottom Former – Recommended Spare Parts List

Pride maintains a well-stocked inventory of spare parts. Contact your dealer for delivery and pricing. It is absolutely essential that only Pride original parts are used on your Bottom Former. Non-Pride components are generally manufactured of inferior material or design parameters and the **use of non-Pride parts will automatically void any factory warranty.**

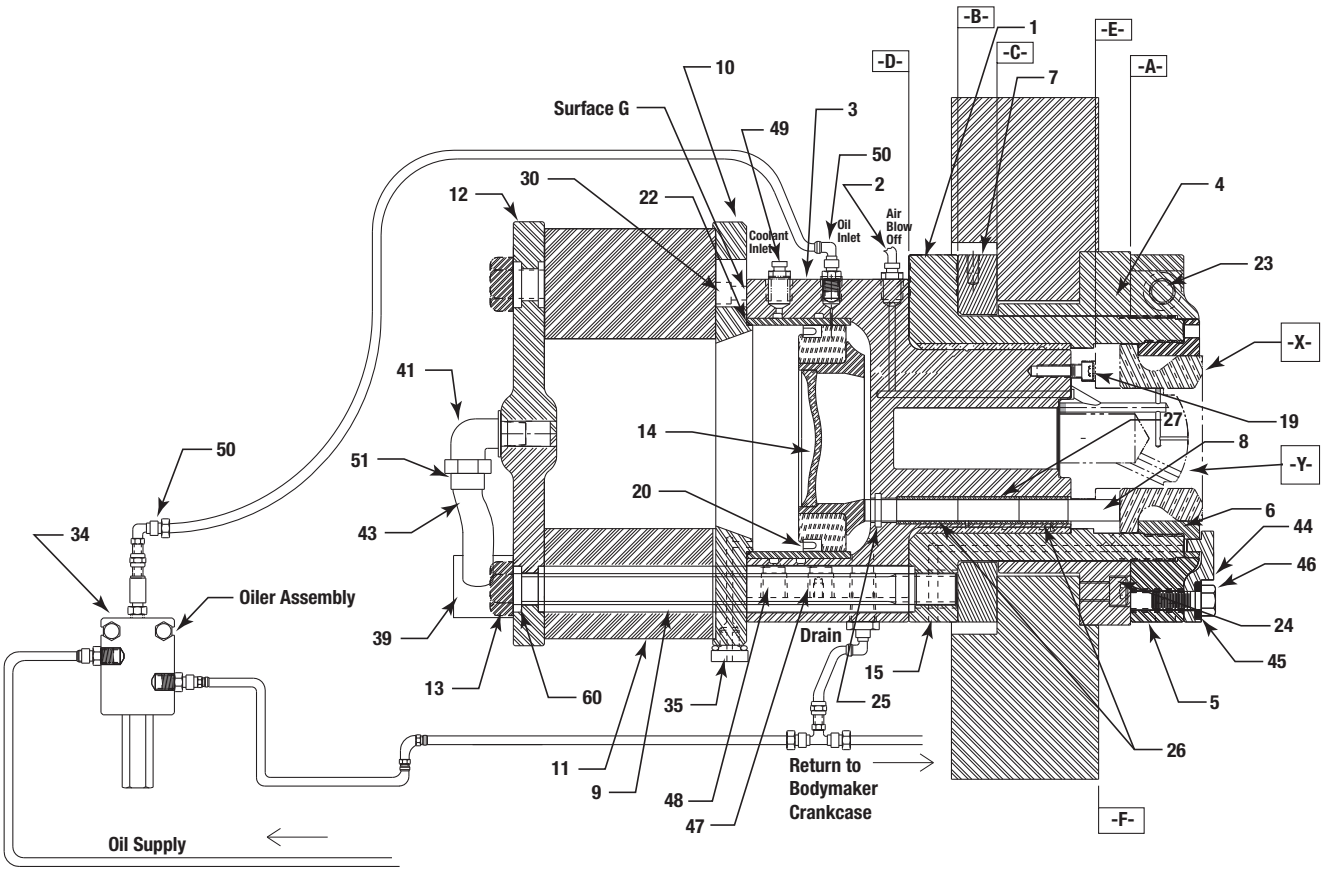
RECOMMENDED SPARE PARTS FOR CAN PLANTS RUNNING ONE LINE					
Item No.	**Quantity**	**Model 217 Part No.**	**Model 316 Part No.**	**Model 31607 Part No.**	**Description**
	1	60-076-02	30-076-02	30-076-02	Bottom Former Tool Kit
1	1	200-002-17	300-002-16	300-002-16	Outer Housing
3	1	200-004-16	300-004-16	300-004-16	Cylinder Housing
5	1–2	20-006-09	30-006-09	30-006-09	Locking Nut
6	2–3	20-007-09 ATS	30-007-09	307-007-09	Clamp Ring Retainer
7	2–3	60-008-17	30-008-10	30-008-10	Solid Spacer
8	4–12	60-009-03	60-009-03	60-009-03	Push Rods
9	8–24	200-010-01	200-010-01	200-010-01	Stand-off
10	1–2	200-011-01	200-011-01	200-011-01	Cover Plate
11	2–3	200-012-01	300-012-05	300-012-05	Donut Spring
13	8–24	200-014-03	200-014-03	200-014-03	Tension Bolts
14	2–3	60-015-02	30-015-02	30-015-02	Piston
15	8–24	20-023-01	20-023-01	20-023-01	Outer Housing Heli-Coils®
20	2–5	60-028-05	60-028-05	60-028-05	Piston Seal
22	2–5	20-026-01	20-026-01	20-026-01	O-ring, Cover Plate
23	2–5	20-025-10	20-025-10	20-025-10	Lock Screw Kit
25	4–12	20-033-03	20-033-03	20-033-03	Push Rod Seals
35	2–5	20-095-01	20-095-01	20-095-01	Petcock Assembly
44	1–2	60-055-09	30-055-09	30-055-09	Locking Device
45	6–12	60-056-08	60-056-08	60-056-08	Locking Device Washers
46	6–12	60-057-09	60-057-09	60-057-09	Locking Device Bolts
60	8–24	200-056-01	200-056-01	200-056-01	Stand-off Washers
	1	217	316	31607	Pride Bottom Former

II. I. 200 & 300 Series Bottom Former – Full Parts List

COMPLETE LIST OF PARTS FOR 200 & 300 SERIES BOTTOM FORMERS

Item No.	Model 217 Part No.	Model 316 Part No.	Model 31607 Part No.	Per	Description
	60-076-02	30-076-02	30-076-02		Bottom Former Tool Kit
1	200-002-17	300-002-16	300-002-16	1	Outer Housing
2					Blow OFf
3	200-004-16	300-004-16	300-004-16	1	Cylinder Housing
4	20-005-06-XX	30-005-02	30-005-02	1	Mounting Flange
5	20-006-09	30-006-09	30-006-09	1	Locking Nut
6	20-007-09 ATS	30-007-09	307-007-09	1	Clamp Ring Retainer
7	60-008-17	30-008-10	30-008-10	1	Solid Spacer
8	60-009-03	60-009-03	60-009-03	4	Push Rods
9	200-010-01	200-010-01	200-010-01	8	Stand-off
10	200-011-01	200-011-01	200-011-01	1	Cover Plate
11	200-012-01	300-012-05	300-012-05	1	Donut Spring
12	200-013-01	200-013-01	200-013-01	1	Spring End Plate
13	200-014-03	200-014-03	200-014-03	8	Tension Bolts
14	60-015-02	30-015-02	30-015-02	1	Piston
15	20-023-01	20-023-01	20-023-01	8	Outer Housing Heli-Coils®
17	60-060-00	60-060-00	60-060-00	2	Outer Housing Dowels
18	60-023-02	60-023-02	60-023-02	8	Spring End Plate Heli-Coils®
19	PP-1/4-20 x 7/8"	PP-1/4-20 x 7/8"	PP-1/4-20 x 7/8"	4	1/4-20 x 7/8"
20	60-028-05	60-028-05	60-028-05	1	Piston Seal
21	20-024-01	20-024-01	20-024-01	1	Vent Plumbing Kit
22	20-026-01	20-026-01	20-026-01	1	O-ring, Cover Plate
23	20-025-10	20-025-10	20-025-10	1	Lock Screw Kit
24	60-061-02	60-061-02	60-061-02	8	Mounting Flange Bolts
25	20-033-03	20-033-03	20-033-03	4	Push Rod Seals
26	60-046-02	60-046-02	60-046-02	8	Greaseless Bushings
27	60-046-00	60-046-00	60-046-00	4	Bushing Sleeve Spacers
30	PP-1/4-20 x 1"	PP-1/4-20 x 1"	PP-1/4-20 x 1"	4	1/4-20 x 1"
34	200-99-01	200-99-01	200-99-01	1	Electronic Oiler
35	20-095-01	20-095-01	20-095-01	1	Petcock Assembly
36	60-060-01	60-060-01	60-060-01	1	Cylinder Housing Dowel
37	60-023-01	60-023-01	60-023-01	4	Cylinder Housing Locking Heli-Coils®
38	60-061-01	60-061-01	60-061-01	2	Hose Clamp Screws
39	200-045-01	200-045-01	200-045-01	1	Hose Retainer (Air)
41	60-030-01	60-030-01	60-030-01	1	Street Elbow
42	20-046-01	20-046-01	20-046-01	1	Barb Fitting Hose Clamp (Air @ Regulator)
43	200-030-01-00	200-030-01-00	200-030-01-00	1	Air Supply Hose
44	60-055-09	30-055-09	30-055-09	1	Locking Device
45	60-056-08	60-056-08	60-056-08	3	Locking Device Washers
46	60-057-09	60-057-09	60-057-09	3	Locking Device Bolts
47	200-040-01	200-040-01	200-040-01	1	Coolant Fitting, Push-Lok™, 90˚
48	200-041-01	200-041-01	200-041-01	1	Coolant Fitting, Push-Lok™, Straight
49	60-029-02	60-029-02	60-029-02	1	Coolant Orifice
50	200-040-02	200-040-02	200-040-02	2	Oil Fittings, Push-Lok™, 90˚
51	60-030-02	60-030-02	60-030-02	1	Female Fitting 37˚ (Air)
60	200-056-01	200-056-01	200-056-01	8	Stand-off Washers

MODEL 217 BOTTOM FORMER

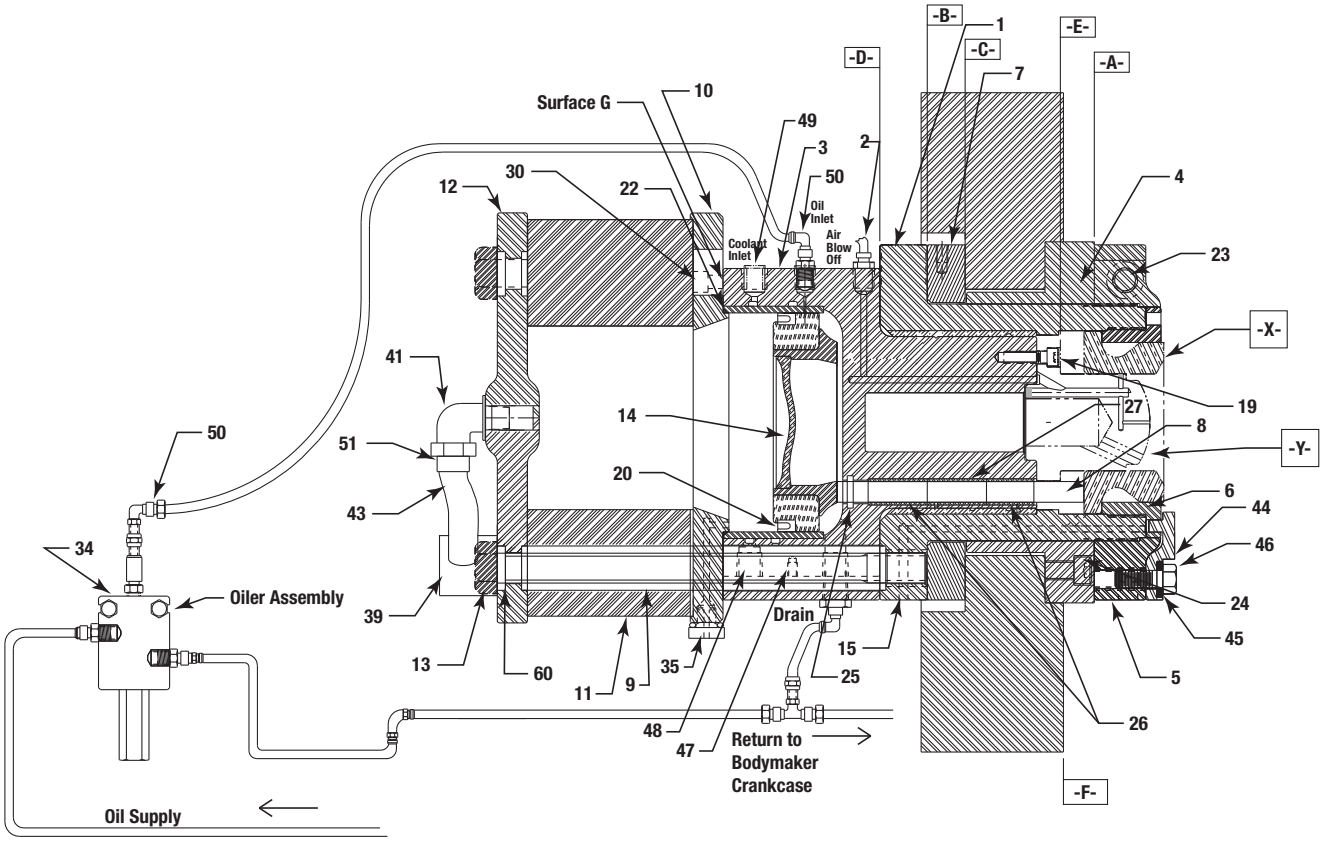


Item No.	Part No.	Part Description
1	200-002-17	Outer Housing
2		Blow Off
3	200-004-16	Cylinder Housing
4	20-005-06-XX	Mounting Flange
5	20-006-09	Locking Nut
6	20-007-09-ATS	Clamp Ring Retainer
7	60-008-17	Solid Spacer
8	60-009-03	Push Rod
9	200-010-01	Stand Off
10	200-011-01	Cover Plate
11	200-012-01	Donut Spring
12	200-013-01	Spring End Plate
13	200-014-03	Tension Bolts
14	60-015-02	Piston
15	20-023-01	Outer Housing Heli-Coils®
19	PP-1/4-20 x 7/8"	1/4-20 x 7/8"
20	60-028-05	Piston Seal
22	20-026-01	O-ring, Cover Plate

Item No.	Part No.	Part Description
23	20-025-10	Lock Screw Kit
24	60-061-02	Mounting Flange Bolts
25	20-033-03	Push Rod Seals
30	PP-1/4-20 x 1"	1/4-20 x 1"
34	200-99-01	Electronic Oiler
35	20-095-01	Petcock Assembly
39	200-045-01	Hose Retainer (Air)
41	60-030-01	Street Elbow
42	20-046-01	Barb Fitting
43	200-030-01-00	Air Supply Hose
44	60-055-09	Locking Device
47	200-040-01	Coolant Fitting, Push-Lok™, 90˚
48	200-041-01	Coolant Fitting, Push-Lok™, Straight
49	60-029-02	Coolant Orifice
60	200-056-01	Stand-off Washers

Phone: +001 763.427.6250 • www.pridecan.com

MODEL 316 BOTTOM FORMER



Item No.	Part No.	Part Description
1	300-002-16	Outer Housing
2		Blow Off
3	300-004-16	Cylinder Housing
4	30-005-02	Mounting Flange
5	30-006-09	Locking Nut
6	30-007-09	Clamp Ring Retainer
7	30-008-10	Solid Spacer
8	60-009-03	Push Rod
9	200-010-01	Stand Off
10	200-011-01	Cover Plate
11	300-012-05	Donut Spring
12	200-013-01	Spring End Plate
13	200-014-03	Tension Bolts
14	30-015-02	Piston
15	20-023-01	Outer Housing Heli-Coils®
19	PP-1/4-20 x 7/8"	1/4-20 x 7/8"
20	60-028-05	Piston Seal
22	20-026-01	O-ring, Cover Plate
23	20-025-10	Lock Screw Kit
24	60-061-02	Mounting Flange Bolts

Item No.	Part No.	Part Description
25	20-033-03	Push Rod Seals
26	60-046-02	Greaseless Bushings
27	60-046-00	Bushing Sleeve Spacers
30	PP-1/4-20 x 1"	1/4-20 x 1"
34	200-99-01	Electronic Oiler
35	20-095-01	Petcock Assembly
39	200-045-01	Hose Retainer (Air)
41	60-030-01	Street Elbow
43	200-030-01-00	Air Supply Hose
44	30-055-09	Locking Device
45	60-056-08	Locking Device Washers
46	60-057-09	Locking Device Bolts
47	200-040-01	Coolant Fitting, Push-Lok™, 90˚
48	200-041-01	Coolant Fitting, Push-Lok™, Straight
49	60-029-02	Coolant Orifice
50	200-040-02	Oil Fittings, Push-Lok™ 90˚
51	60-030-02	Female Fitting 37˚ (Air)
60	200-056-01	Stand-off Washers

BOTTOM FORMER

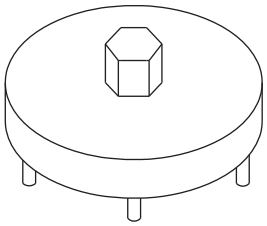
TORQUE SPECIFICATIONS

PRIDE ENGINEERING

III. Torque Specifications

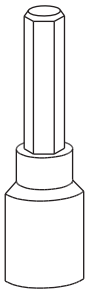
The torque specification chart in this section covers all current Pride Bottom Formers. Some of our models have different spring arrangements, but the torque chart is valid for all models. It is very important to set the correct torque for each component to assure long component life. Some Pride Bottom Former component dimensions are developed for the shape they will achieve after the proper torque setting. Some components that are designed to be round or cylindrical will not achieve their shape until the proper torque is applied. Over-torquing is just as dangerous to component life as under-torquing.

All torque settings may be achieved with 1/2" drive socket type torque wrench together with the special tools that are offered by Pride.

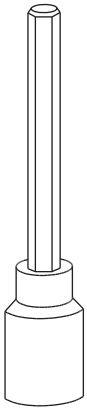


Retainer Wrench
20-020-02

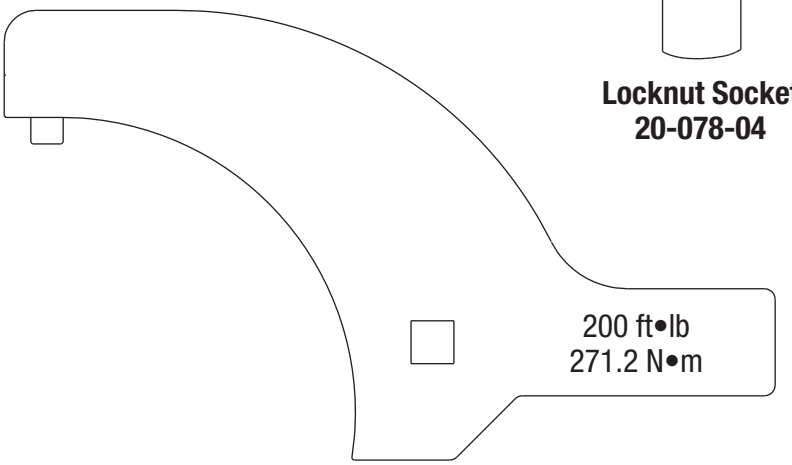
Locknut Socket
20-078-04



Mounting Flange Bolt Socket
20-078-03



Dome Die Bolts Socket
20-078-02



Nut Wrench
20-021-03

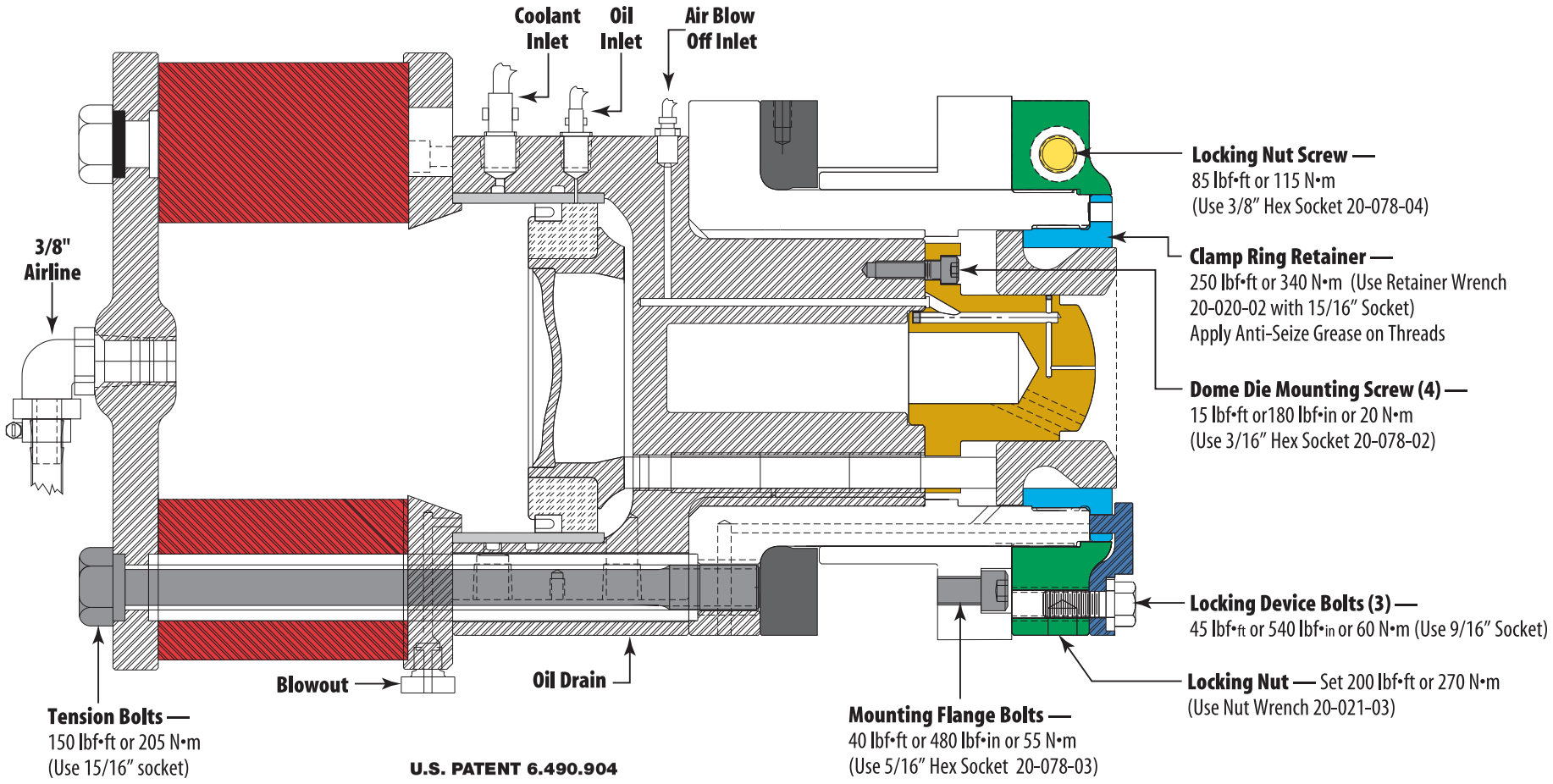
Pride Engineering, LLC
10301 Xylon Avenue North #100
Minneapolis, MN 55445

PRIDE ENGINEERING

Phone: 763-427-6250
Fax: 763-427-6226
www.pridecan.com

GREASELESS HYBRID BOTTOM FORMER TORQUE SPECIFICATIONS

1/2" Drive Torque Wrench Required



BOTTOM FORMER

OPERATION AND MAINTENANCE GUIDELINES

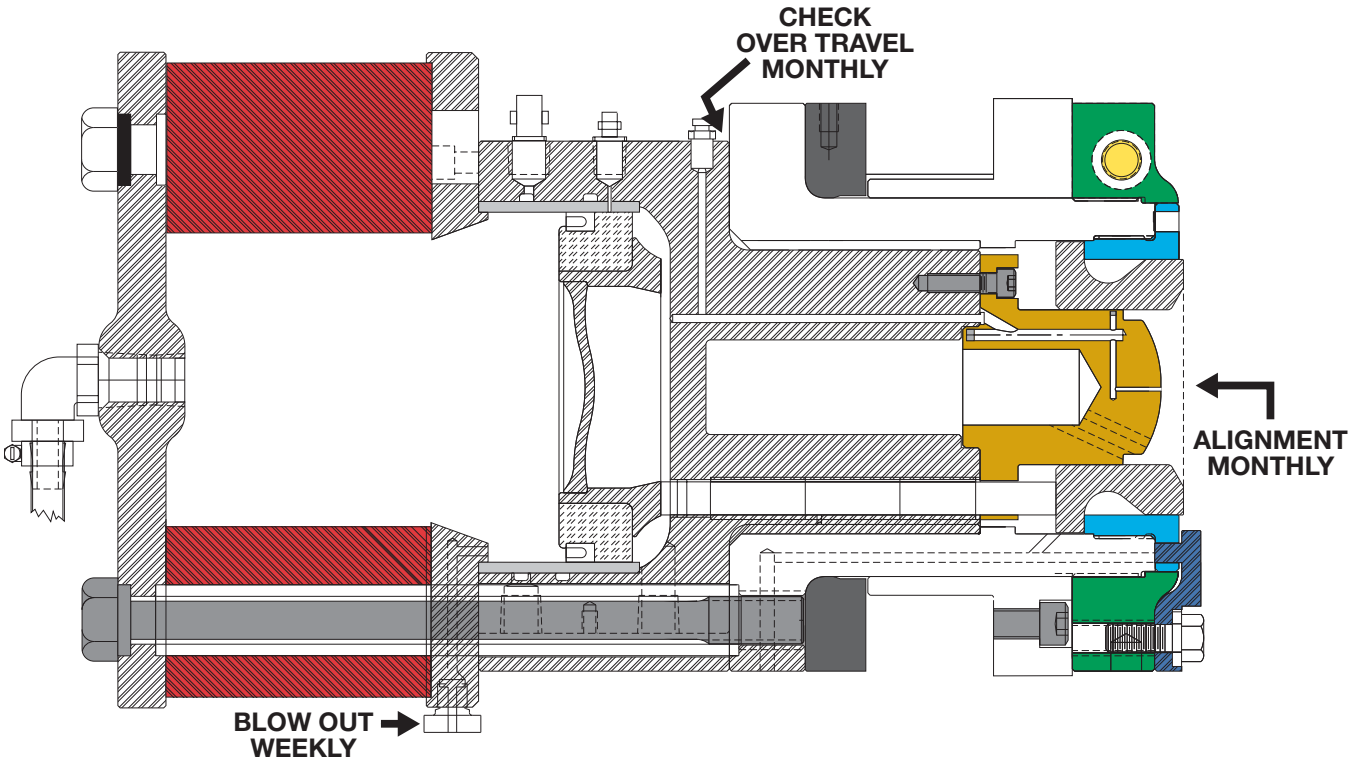
PRIDE ENGINEERING

IV. Operation and Maintenance Guidelines

The Pride Bottom Former is designed and manufactured to require the least possible maintenance. All components are built utilizing the best materials and machined to exact tolerances. As a result, the Pride Bottom Former will require minimum maintenance if properly installed and operated. Following the guidelines we have specified below will keep your Pride Bottom Former performing at its optimal level.

WEEKLY SERVICE REQUIREMENTS

Blow Out Weekly - The Cylinder Housing (Item 3) should be drained or blown out by opening the Petcock (Item 35) each week. The Petcock Assembly is opened by turning the Petcock 1/4 of a turn. Coolant and debris from the shop air will accumulate in the cylinder. Drain or blow out daily if large amounts of coolant or debris are found until the source of the coolant or debris is found.

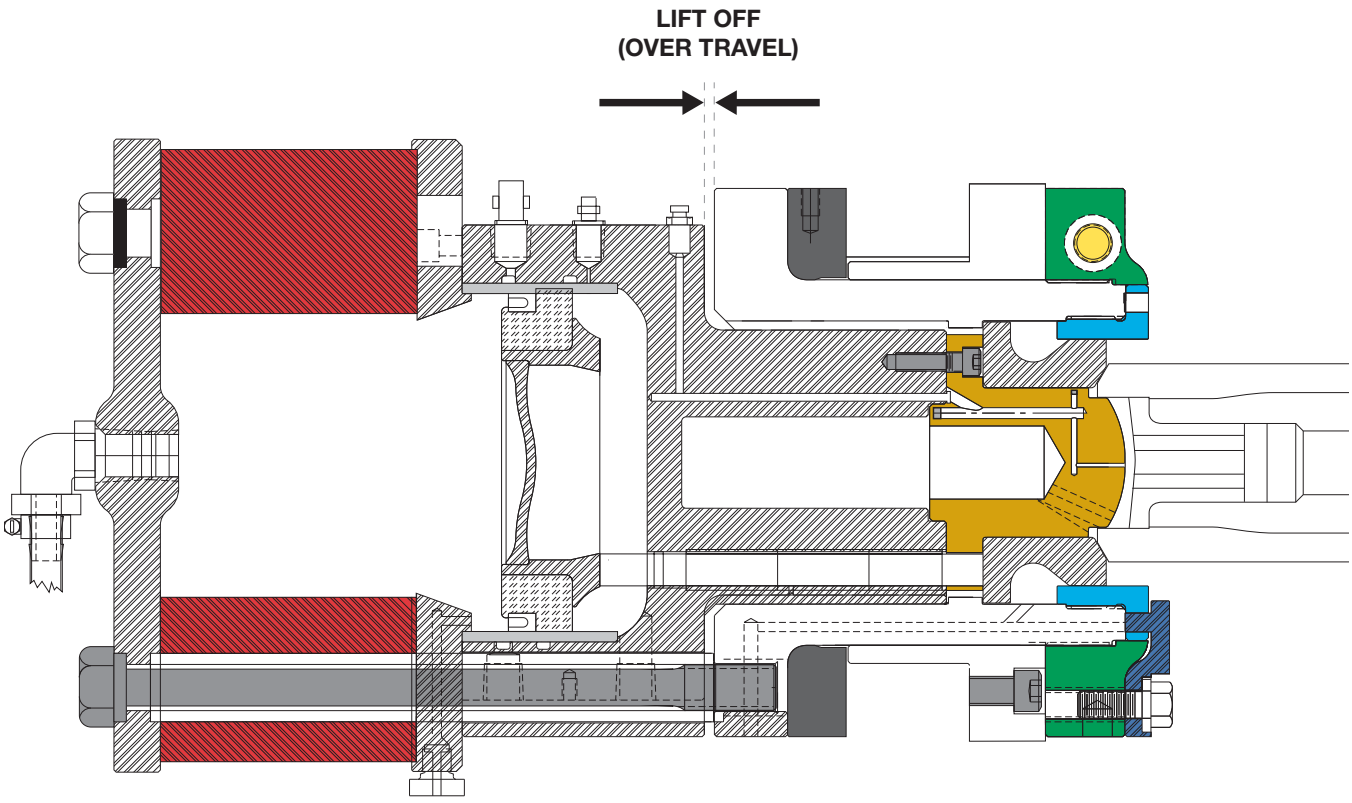


MONTHLY SERVICE REQUIREMENT

Check Over Travel - Over travel should be checked monthly. Changes in the tooling or bearing wear in the Bodymaker can increase over travel over time. Over travel should be kept to minimum to reduce stress on Bodymaker and Bottom Former components. Over travel is checked between Items 1 & 3, using the Portable Guardian or Guardian II gage. To check for over travel, run 30 cans at low speed and note the over travel reading on the gage. **The over travel specification for the Bottom Former with the individual springs or the Red Donut Spring is .003”-.006” (.075–.150 mm) at the lowest production operating speed. The over travel specification for the Bottom Former with the Yellow Donut Spring is .025”-.030” (.6 –.8 mm) at the lowest production operating speed.**

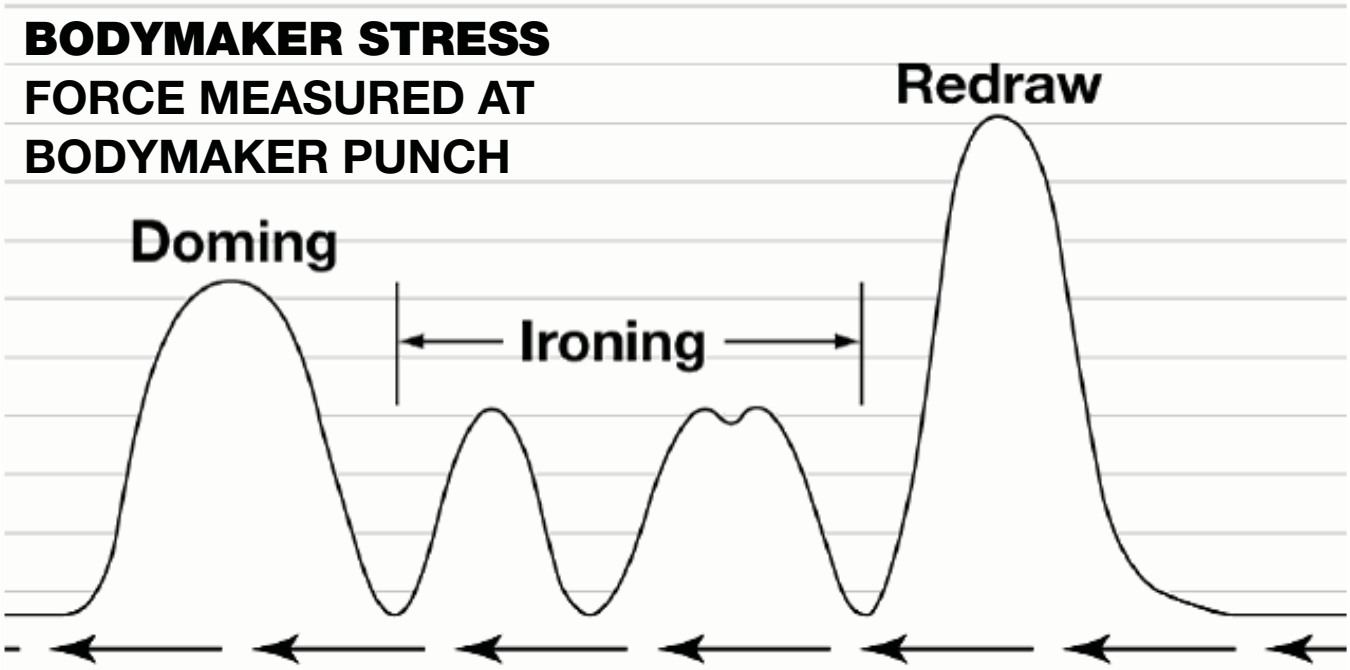
Never allow over travel to exceed .030” or .8 mm. Excess over travel will also cause stress and breakage of some Bottom Former and Bodymaker components.

If over travel is greater then .030” or .8 mm at operating speed, the low speed over travel may have to be set at less then .001” (25 µm). In some applications, we have observed negative low speed over travel is required to avoid exceeding .030” or .8 mm at high speed. High speed over travel should be checked monthly and at each occurrence of Bottom Former or tooling change.



Moderate over travel allows can makers to standardize base profile tooling. The purpose of over travel is to allow the spring to provide a "final form" force. This force "sets" the base profile established by the Bodymaker Punch Nose, Clamp Ring and the Dome Plug tooling. Without this final form set, the can profile will "spring back" causing variation in the dome depth and base profile. The Spring must provide enough force to "set the form." When can makers use under travel instead of over travel they are often forced to adjust their tooling differently for each Bodymaker to control dome depth leaving the can maker with the cost and confusion resulting from not using standardized tools.

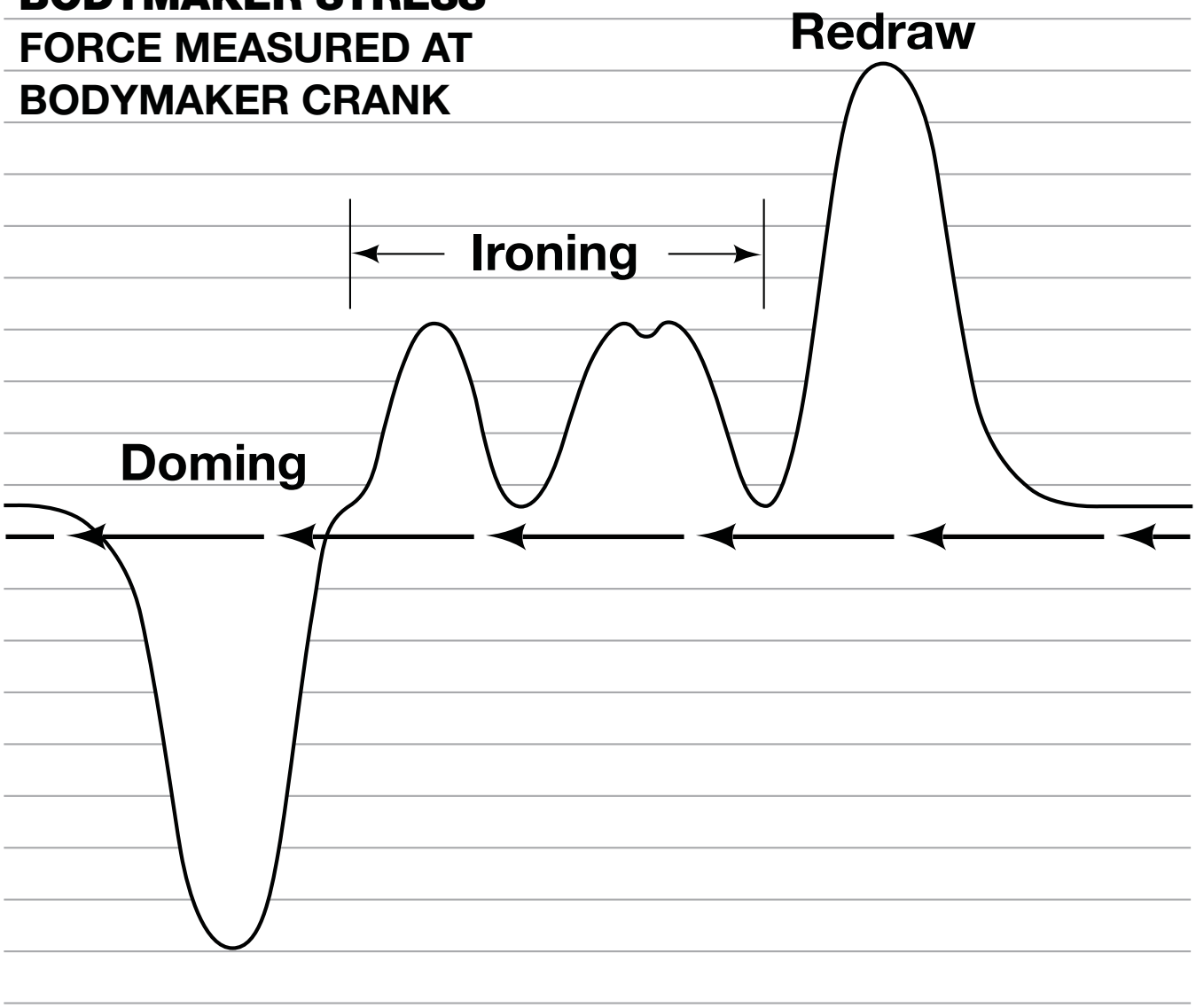
A can maker will not prevent damage to the Bodymaker linkage system by under traveling. Can makers that have set their Bodymakers in an under travel condition have experienced failures at high speeds. It is important to remember that the greatest stress on a Bodymaker linkage system occurs during the redraw segment of the Bodymaker cycle not the doming segment.



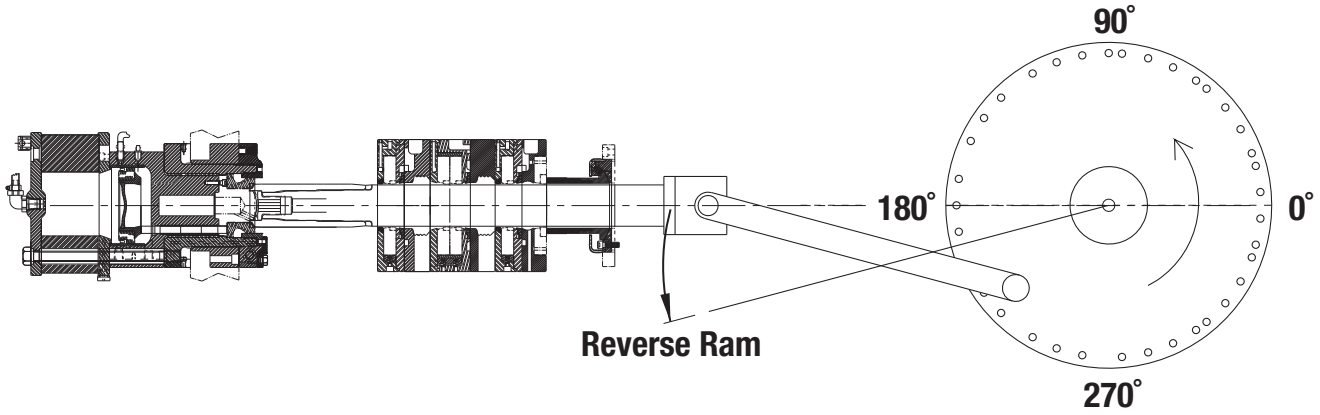
(The above Bodymaker Force Profile was graphed by mounting a strain gauge behind the punch on a Bodymaker making beverage cans.)

If the strain gage were mounted at the start of the Bodymaker linkage the strain gage would look very different at higher operation speeds.

BODYMAKER STRESS
FORCE MEASURED AT BODYMAKER CRANK



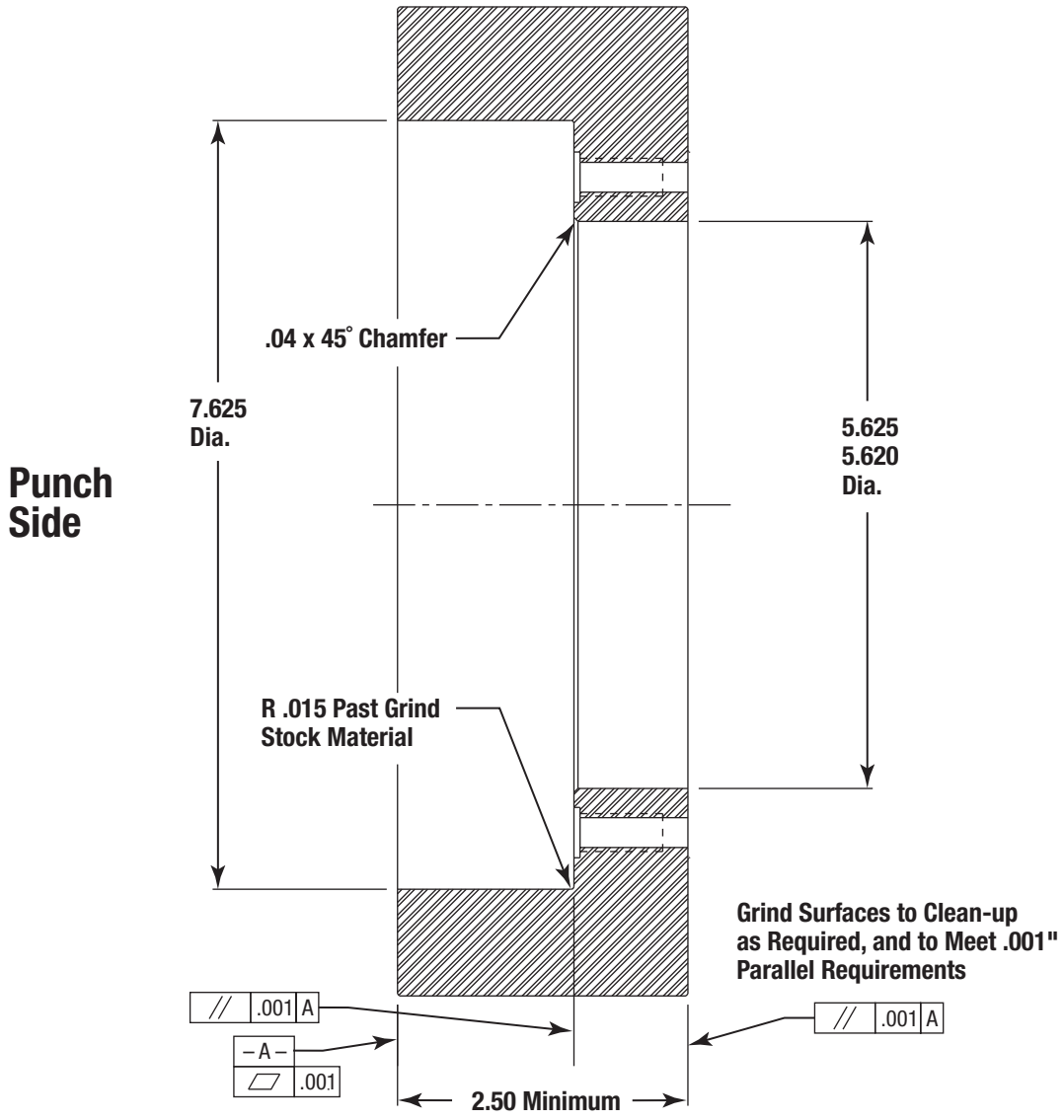
The force profile shows a different pattern at the dome station because doming force is provided by the inertia of the Bodymaker linkage after the Bodymaker is attempting to reverse the ram. The shock to the Bodymaker linkage occurs when the linkage is stretched out by the rams momentum while the linkage is already starting to accelerate its reversal.



Alignment - Recheck the alignment of the Bottom Former monthly to be sure that it hasn't moved. It is the alignment of the Bodymaker punch to the dome plug that will determine the quality of the base profile. Unfortunately, the ram is not stable enough to allow the use of the punch for the initial set up. A cylindrical square may be used to align the Bottom Former when the Bodymaker is cold and the ram is drooping more then it will in full operation. After the Bottom Former is set up and has been running for a few hours the initial alignment may be improved by aligning the Bottom Former plug to the punch. The Bottom Former will produce better base profiles, have a longer service life and require less maintenance if the Bottom Former is aligned (centered) within .0005" (13 µm) of the dynamic (operating) center-line of the punch.

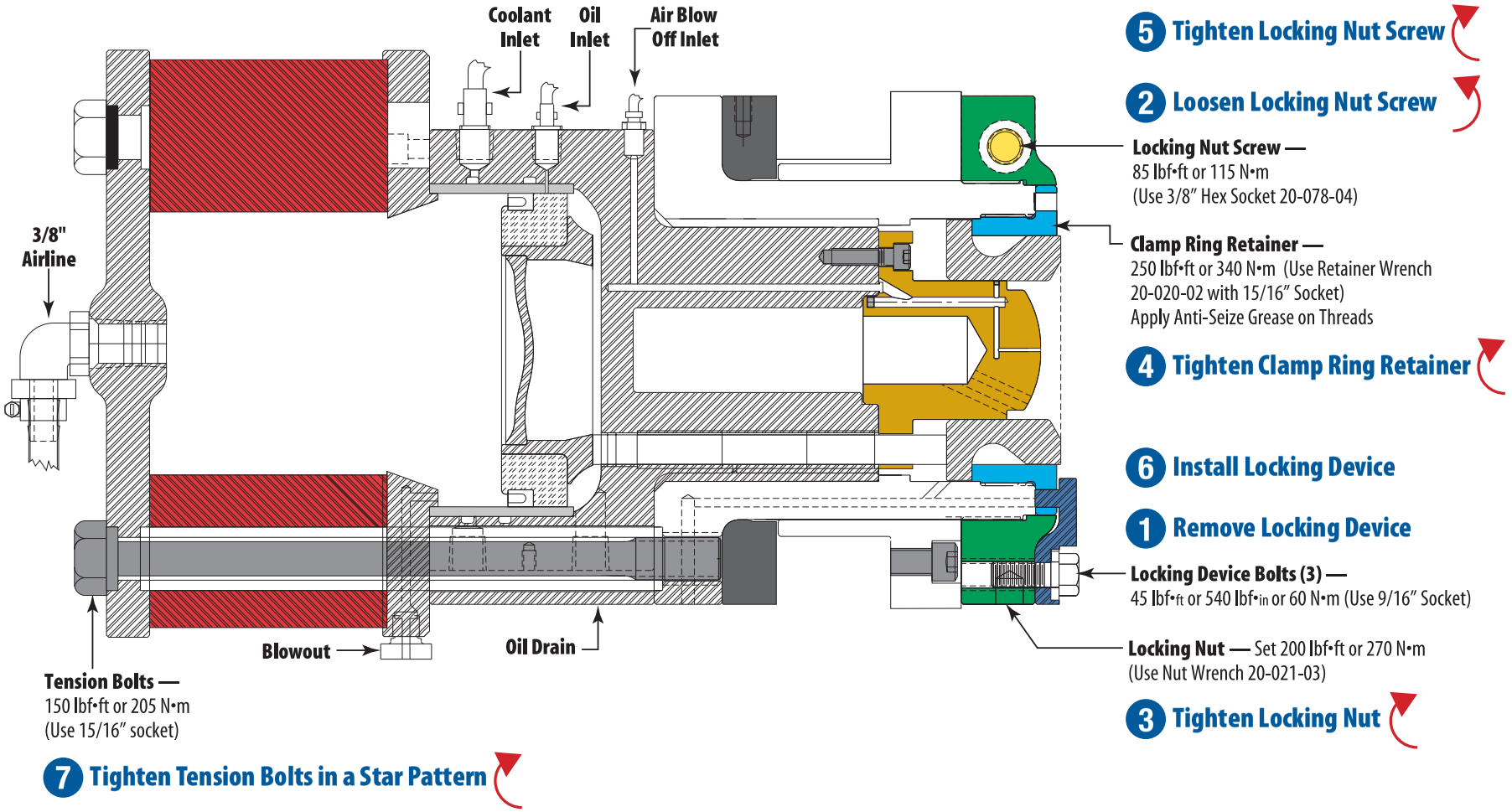
When the Bottom Former Door/Shoe requires alignment, machine the front face (may be bottom of front counterbore) flat within .001" (25 µm) and parallel to the door alignment pads. Next turn the Door/Shoe over and set it up on parallels on the front face (may be bottom of front counterbore): machine or grind the back face (surface C) flat and parallel to the counterbore within .001" (25 µm).

TYPICAL DOMING DOOR FOR MODEL 200 BOTTOM FORMER



GREASELESS HYBRID BOTTOM FORMER TORQUE MAINTENANCE

1/2" Drive Torque Wrench Required

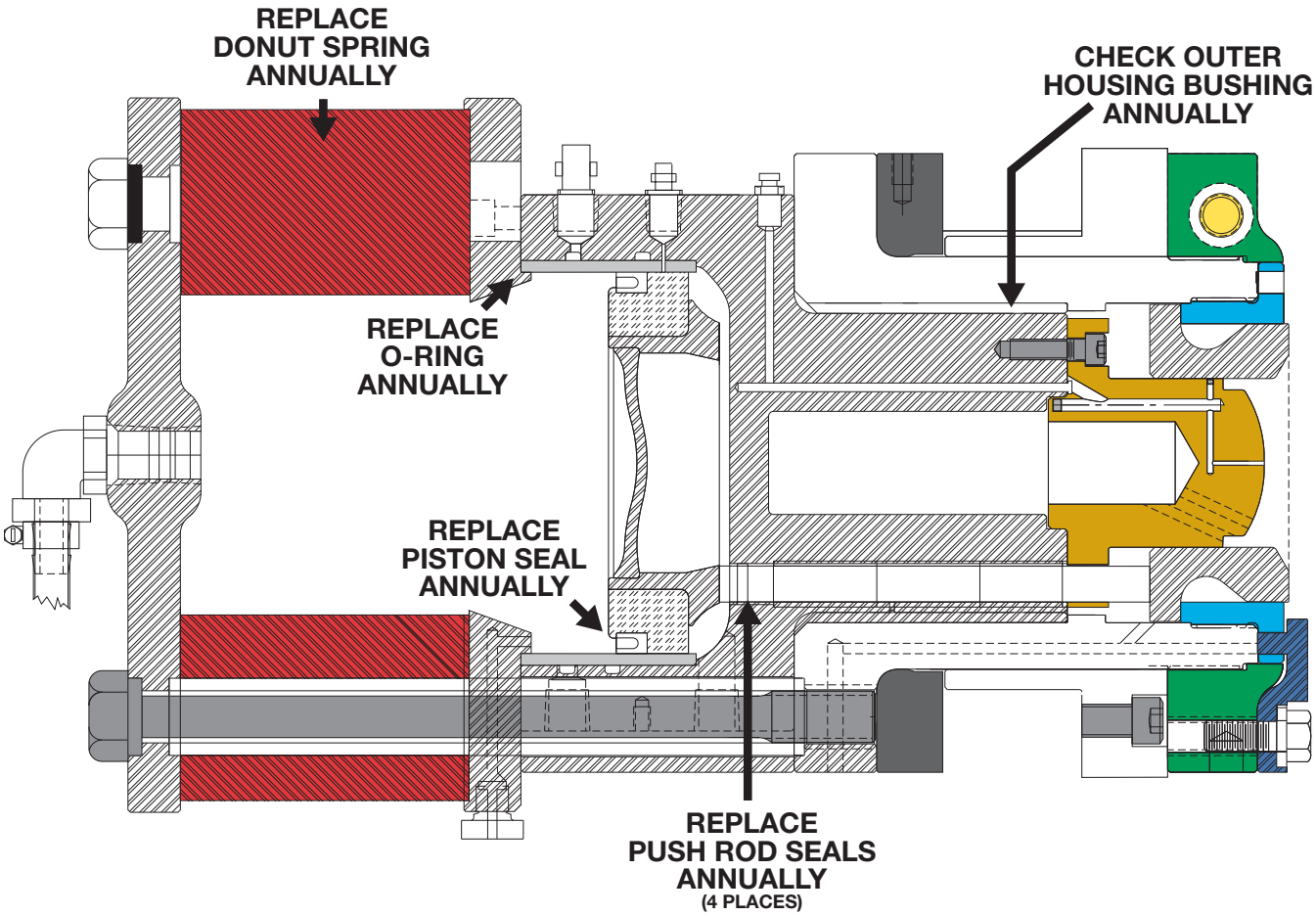


Pride Engineering recommends re-torquing each of these items in the order shown above the day after they are installed and then check at least once per month.

ANNUAL SERVICE REQUIREMENT

Pride recommends that the following components be replaced annually:

1. Donut Spring (Item 11) 200-012-01 or 300-012-05
2. Piston Seal (Item 20) 60-028-05
3. Push Rod Seals (4 Places) (Item 25) 20-033-03
4. Push Rods (4 Places) (Item 8) 60-009-03
5. O-ring (Item 22) 20-026-01



Pride recommends that the following components be inspected for wear annually.

1. **Cylinder Housing** - The Cylinder Housing should be returned to Pride for re-work if there are any wear rings, gouges, or ridges in the ID of the cylinder (on older-style domers, if chrome is worn off of in any part of the ID of the cylinder). Push Rod Sleeves should be changed whenever the Cylinder Housing is reworked.

2. **Outer Housing** - The Outer Housing should be inspected for thread damage. The Outer Housing Bushing should be inspected for erosion/pitting, gouges, and out-of-roundness (.003" or 80 µm max). The Outer Housing should be returned to Pride for rework if any of these conditions are significant.

OPENING THE HYBRID BOTTOM FORMER

There are three reasons to open a Pride Hybrid Bottom Former outside of the normal maintenance cycles discussed above:

- Dome Depth Variation
- Wrinkles or Flowers
- Broken or Damaged Components

1. **Dome Depth Variation** common causes in order of importance are:

    a. Worn Spring - Assuming that the Bottom Former is set up with proper over travel, dome depth variation is usually caused by worn out a spring. See the following discussion "Item 11 Bottom Former Spring."

    b. Venting Problems - As Bodymaker speeds increase the need for coolant venting increases. Tooling that had no problem venting surplus coolant from the tools at one operating speed would trap Bodymaker coolant at faster Bodymaker speeds. See the drawing on page 61 in Tool Geometry, Section V. that demonstrate trapped coolant causing a deeper dome depth. Trapped coolant under the clamp ring will cause shallow dome depths.

    c. Obstructions – Any foreign article in the area of the Dome Door, Bottom Former or in front of the punch may cause dome depth variation. Rags, loose punch bolts, loose Locking Device Bolts can all interfere with stable Bottom Former depths.

2. **Wrinkles or Flowers**, common causes in order of importance are:

    a. Most wrinkles result from problems at the Bodymaker redraw station. Make one can after opening the dome door and removing the ironing dies to learn if the wrinkles are caused at the redraw station.

    b. If there are no wrinkles at the redraw then the most likely cause of wrinkles or flowers is insufficient clamping pressure. See discussion and drawing about clamping surface in Section V. If the tool has been running successfully for a long period without any change in material then the most likely cause of insufficient clamping pressure is a worn Bottom Former Piston Seal. See the following discussion "Item 15 Piston Seals" for detailed instructions.

    c. Alignment problems may cause wrinkles or split (cracked) domes. A misalignment at the redraw or at the dome station will cause wrinkles. Unfortunately, one element of the process can move causing problems on what had been a high quality base profile.

    d. The tooling should be checked if a wrinkle problem persists. See Section V. guidelines.

Pride recommends that the Spring, Piston Seal (Item 20) and Push Rod Seal (Item 25) be replaced when the spring is changed to reduce the frequency of the maintenance cycles. If the a Push Rod does fall out it should not be pushed back in from the nose side. Push Rods must be assembled from the cylinder side only. Push Rods pushed in from the nose side will tear the Push Rod Seals.

Routine maintenance or service cycles will vary from application to application. The single most

significant factor is the operating speed of the Bottom Former. As speeds increase, service intervals will shorten due to the increased cycles per minute. We suggest each plant serialize each Bottom Former and record the install date of the Bottom Former each time it is placed in service. Each plant should be able to establish their own service window by comparing the quantity of cans manufactured with the maintenance performed and the frequency of maintenance.

Below are the unique requirements for each Bottom Former component:

Item 1 **Outer Housing** - Minimal thread damage can be cleaned up on site to prevent further damage to the housing or mating parts. The housing should be returned to Pride if galled, corroded, damaged, or if the flange is out of flat by .002" (50 µm) or more. The housing should also be returned if the flange and Stand-off surfaces have less then 90% good contact surface. Caution: Split spacers contribute to wear and corrosion on the dome door. When Split Spacers are used, check dome door for wear that could prevent 90% surface contact. The Dome Door surface should be re-machined flat and parallel if the dome door surfaces are no longer flat (see Section II. A. Mounting Flange Installation & Alignment Procedure).

Outer Housing Bushing - The Outer Housing should be returned to Pride for re-bushing if the bushing is unevenly worn, galled, scarred or more then .003" (80 µm) out of round. Return the bushing and Outer Housing intact.

Item 3 **Cylinder Housing** - Must have 90% contact where the Doming Die is attached, and be flat within .0005" (13 µm). Any wear marks greater than .0005" (13 µm) on either the inside (Piston) or outside (Outer Housing Bushing) diameters, or any galling, scarring, or corrosion require return to Pride for refurbishing. Push rod bushings, (Items 26 and 27) will be replaced when refurbished.

Item 4 **Mounting Flange** - Should be replaced for damage to inside diameter. The face that contacts the Locking Nut Assembly must have 90% good contact surface. The Mounting Flange should be coated with an anti-seize compound before re-assembly.

Item 5 **Locking Nut Assembly** - Replace if any galling exists on face where Mounting Flange is contacted or if less than 90% good contact area exists. Replace if sprung (twisted out of square) or if there is any damage to the detail which controls maximum opening. (see Locking Nut Assembly Installation Instructions, Section II. D.).

Item 6 **Clamp Ring Retainer** - Replace if inside diameter has damage or wear bands of .001" (25 µm) or more. If the contacting Clamp Ring (Outer Dome Die) has less than 90% good contact surface, or are out of flat by .0005" (13 µm) or more, the retainer should be replaced. Replace if retainer shows any sign of thread damage. **Always be sure to shut off the Bottom Former air supply before removing or assembling the Clamp Ring Retainer.** The threads should be coated with an anti-seize compound before re-assembly.

Item 7 **Split or Solid Spacer** - Replace with exact size (thickness) if corrosion or handling damage reduce good working surface to less than 90%. It is the Spacer that must compensate for the build up of all of the tolerances in Bodymaker ram linkage system. Each spacer must be ground to fit to the individual Bodymaker to maintain proper mounting of the Bottom Former. Pride strongly recommends the use of solid spacers instead of split spacer. **The use of split spacers is associated with the failure of Outer Housings at a later date. Split Spacers tend to wear away the surfaces of the dome door in an uneven fashion causing a gap to form between the spacers and the dome door where coolant will collect. Corrosion will result once coolant collects in the gap between the door and the spacers. Rust and wear will combine to reduce contact area between the dome door and Outer Housing leading to alignment problems and Outer Housing failure.**

Item 8 **Push Rods** - If any of the Push Rods are bent, if any part of the chrome surface is cracking or peeling, if any end faces are damaged, or if all of the Push Rod's length is not within .0003" (8 µm) of the other Push Rods in that individual Bottom Former then replace the entire set. The two ends of New Push Rods are ground in sets of four (sets of three for Model 20 Bottom Formers) giving them the same length within .0002" (5 µm).

The Push Rods must be assembled from the cylinder side only. T**he Push Rod Seals may tear if the Push Rods are pushed in from the nose side.**

Item 9 **Stand-off** - Replace if bent or faces are damaged or corroded. **Replace as a set.** Like the Push Rods discussed above, the length of the Stand-offs are ground together in sets of eight to a length within .0002" (5 µm) on each Bottom Former. The stand-offs are hard chromed for wear. Replace the set if the chrome is peeling.

Item 10 **Cover Plate** - Replace if contact area for the Spring is less than 90%, or if the plate is bent or twisted so that air in Piston area of Cylinder Housing does not seal. Replace if locating/sealing diameter is damaged in any way. The O-ring (Part No. 20-026-01) should be replaced at each service. For Hybrid Bottom Formers, Donut Spring contact surface must be 100%.

Item 11 **Bottom Former Spring** – Change the spring anytime dome depth variation occurs. The purpose of the spring in the Pride Bottom Former is to provide a "final form" force. This force "sets" the base profile established by the clamp ring and the Bottom Former plug tooling. Without this final form set, the can profile will "spring back" in a uncontrolled manor causing variation in the dome depth. The Spring must provide enough force to "set the dome". The Pride Bottom Former is designed to produce a set force with "over travel" or "lift off" dimension between .0015" to .006" (38 to 150 µm) unless the yellow donut spring is used. Increase this over travel, and the set force increases. Increasing this set force too much will cause the tooling to "over set" the form and could cause split domes and damage to the Bottom Former and Bodymaker linkage.

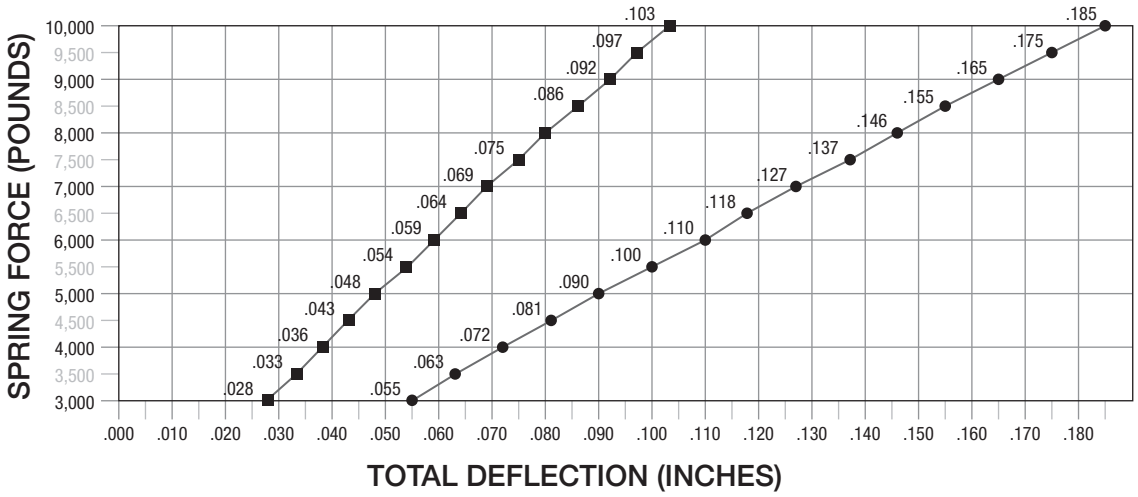
Dome depth will become inconsistent and shallower as the Spring wears. Assuming that the Bottom Former is set up with proper over travel, dome depth variation is usually caused by a worn out Spring. Replace the spring when dome depth does not

conform to your specification. Spring life is determined by the percentage of deflection multiplied by the number of deflections. The Hybrid Bottom Former utilizes a 3-1/2" long donut spring instead of the older 2" spring because the same over travel results in a lower percentage of spring deflection. The hybrid donut spring usually lasts one year which is 3 to 4 times longer then the traditional 2" spring. **It is very important that all springs are replaced as a set if the six or eight Spring configuration is used.** Mixing and matching will only cause premature failure of the new springs, inconsistent dome depth, and excessive wear to the Bottom Former outer housing. It is important to maintain balanced spring pressure or risk breaking Bottom Former components.

SPRING SELECTION

Can makers benefit from the use of the donut style Spring. It produces less force per increment of over travel. It therefore will better accommodate the additional over travel caused by "machine stretch" that comes as a result of increased speeds. It is very durable and runs very smoothly.

SPRING PERFORMANCE

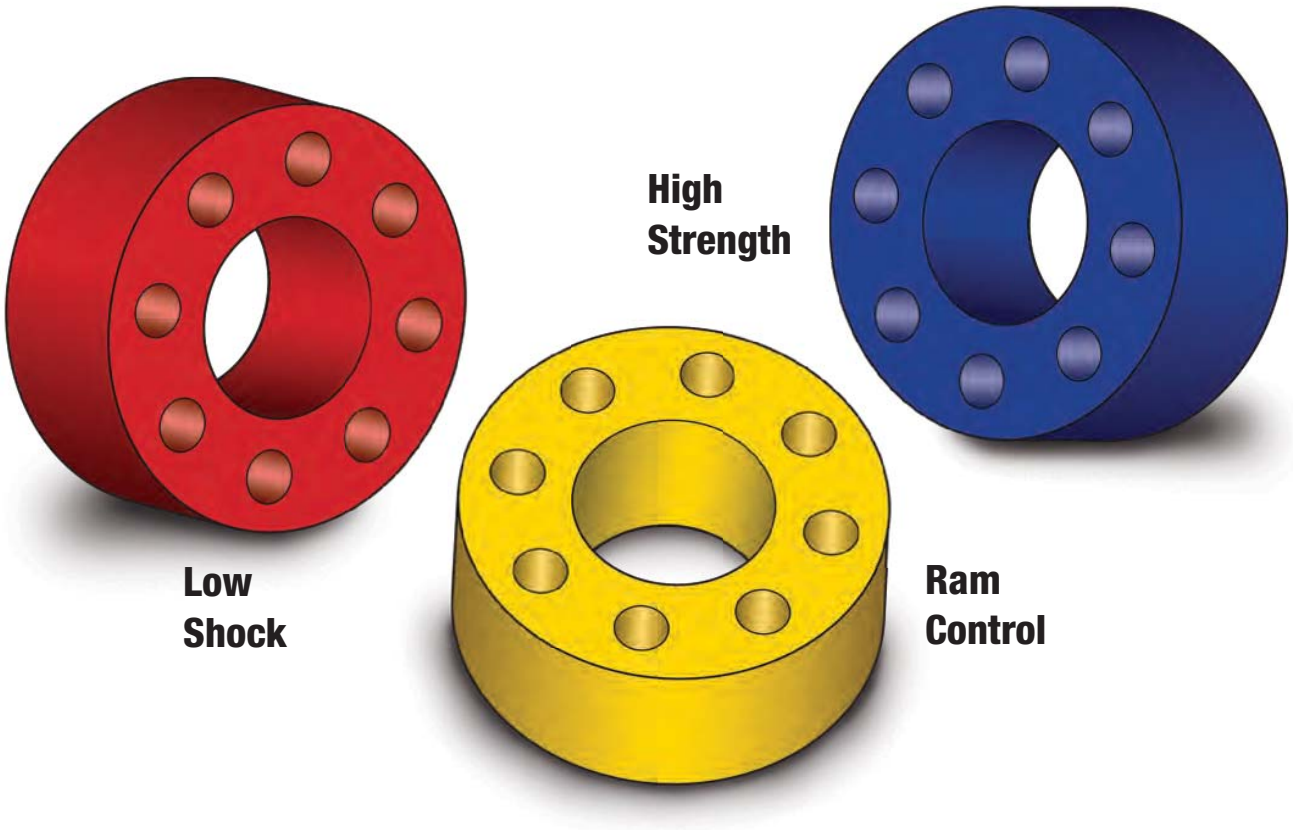


- **STANDARD SPRING –** .005" deflection per 500 pound pressure intervals
- **DONUT SPRING –** .009" deflection per 500 pound pressure intervals

Compare the steeper force curve above using traditional Bottom Former springs compared to the flatter force curve of the red donut spring. It is typical for a newer Bodymaker ram linkage to stretch .015" (.38 mm) at 400 cpm or even more on a older Bodymaker. .015" (.38 mm) can result in 1,500 pounds of additional force using the traditional spring. The added force would be half of that with the Donut Spring delaying the failure of Bodymaker linkage components.

Because of its geometry, the donut spring's life is exceptionally long and it's performance will degrade very slowly allowing the user to detect exactly when the spring needs to be replaced to prevent dome depth variation.

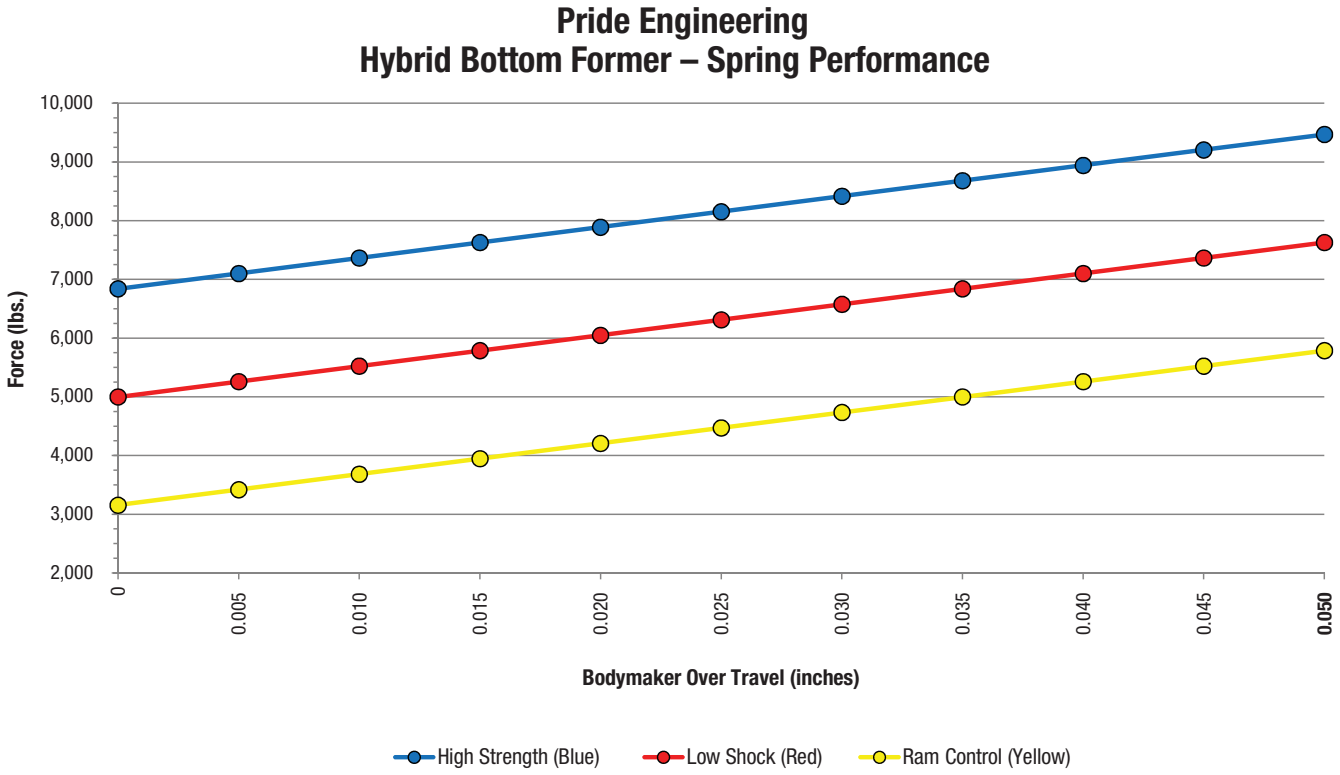
The large cavity in the donut spring also acts as a surge tank behind the piston and offers the best force characteristics for the clamp ring which will reduce split domes and be very helpful in any attempt to down-gage material. No surge tank would ever be needed with the donut configuration.



Red Donut Spring, 200-012-01
Designed for most beverage cans (202 and 211): All of the advantages of the donut spring design with moderate force. Best set up at .003" to .006" (75 µm to 150 µm) dynamic over travel. Dynamic over travel is the over travel achieved when the Bodymaker is in full operation and includes the "stretch" of the ram linkage.

Yellow Donut Spring, 200-012-10
Designed to help the ram reverse direction at the end of the Bodymaker stroke. The intent is to reduce shock on the Bodymaker ram linkage system and reduce ram whip. Unlike the Red or Blue Donut Springs, the Yellow Donut Spring is set up with .025" to .030" (.6 mm to .8 mm) dynamic over travel.

Blue Donut Spring, 300-012-05
Food can makers that are forming difficult flat panel profiles or beverage can makers that are making large beverage cans like the 24 oz. or 1 liter cans will require additional initial force and could use the blue donut spring. The blue spring still offers the benefits of the Donut Spring including the gradual increase in force, the enlarged air chamber and the extended spring life. Best set up at .003" to .006" (75 µm to 150 µm) dynamic over travel. Dynamic over travel is the over travel achieved when the Bodymaker is in full operation and includes the "stretch" of the ram linkage.



Item 12 **Spring End Plate** - Replace if locating diameter for Stand-offs is damaged or has less than 90% good surface. Replace if contact surface for the Springs is less than 90% good, or unit is bent or twisted more than .005" (.13 mm) out of flat. Replace if galled in area contacting tension bolts. For Hybrid Bottom Formers, Donut Spring contact surface must be 100%.

Item 13 **Tension Bolts** – Replace the tension bolts if bent or if threads are damaged. It is very important to loosen and tighten the Tension Bolts evenly in a star pattern, one revolution at a time, to prevent side loading caused by the spring tension. **Grease the threads of the Tension bolts** before assembly. The Locking Heli-Coil® Inserts (Item 15) may be damaged if this procedure is not followed. Generally, Heli-Coils® need to be replaced after the third maintenance cycle (third removal of the bolts). Tension Bolts will fail (break) if there is uneven tension on the tension bolts. This condition has one of three causes; improperly torqued tension bolts, Heli-Coil® (Item 15) failure or unbalanced spring tension on Bottom Formers with separate springs.

Unbalanced spring tension on Bottom Formers with six (6) or eight (8) separate Springs is caused by not replacing all of the Donut Springs (Item 11) together, at the same time, with Pride-manufactured Springs when one of the Springs needs to be replaced. **Anytime one spring is replaced, they must all be replaced and should all be replaced only by Pride-made springs**. The Bottom Former spring tension must be balanced for proper function of the Bottom Former.
Heli-Coil® failure is the most common cause of tension bolt failure. If one Heli-Coil® allows a bolt to turn (loosen), that tension bolt will break. If one tension bolt breaks it

increases stress on the two tension bolts on both sides of it and a second tension bolt is likely to break. If one or two tension bolts break the Outer Housing may fail causing a lengthy and expensive maintenance problem.

Make sure the mechanic has the proper torque wrench (with 15/16" socket) and is trained to use it.

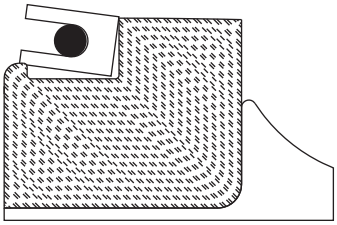
Item 14 **Piston** - Replace if galled, scarred, cracked or otherwise damaged. Replace if piston seal groove is eroded and no longer holds the Seal tightly in place. The Piston Body will consume Seals very rapidly once the Piston wears enough to allow the Seal to move or flex around the groove in the Piston Body where the Seal is mounted. If the Steel Insert that contacts the Push Rods shows the distinct marks where the Push Rods are contacting, there is a problem with squareness and alignment, or with air pressure. The Piston should constantly rotate while operating. If impact marks deeper than .0005" (13 µm) exist, the piston must be replaced.

Item 15 **Outer Housing Heli-Coil®** - These locking Heli-Coils® prevent the tension bolts from turning (loosen) and will assure the long life of the Tension Bolts (Item 13). Locking Heli-Coils® wear out after three maintenance cycles using proper maintenance procedures. Never use a pneumatic wrench (impact wrench) to tighten or loosen the tension bolts. The Heli-Coils® will fail after one maintenance cycle if a pneumatic wrench is used. If a Heli-Coil® causes the tension bolt to spring back when setting torque it must be replaced. If the locking Heli-Coils® allow the tension bolts to turn (loosen) while the Bodymaker is in operation the tension bolts will break. All of the Heli-Coils® should be replaced as part of the third maintenance cycle or after any instance of turning the tension bolts by pneumatic wrench. Broken or loose Tension Bolts is a major cause of Outer Housings failure. We offer a special wrench to change this special Heli-Coil®. Heli-Coil® Insertion Tool (Part No. 20-023-02).

Item 20 **Piston Seals** - Seal must be replaced when leakage of air causes "wrinkles or flowers". **Pride recommends that the Piston Seal be changed together with the Push Rod Seals and Donut Spring to reduce the number of service cycles to service the Bottom Former.** When removing seal, use a razor blade to carefully cut the seal. Do Not pry off which can damage the Piston. The piston body is made from a special polymer chosen for rigidity, light weight, and heat resistance but it is a polymer and can be easily damaged by a razor.

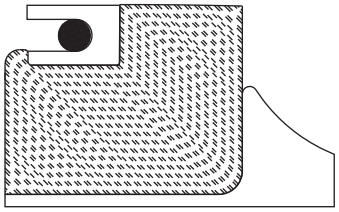
Inspect the new seal to make sure all surfaces are free from nicks or dirt. Press the piston seal onto the piston body using Pride Piston Seal Assembly Tool (Part No. 60-028-00). This tool insures the Seal is completely in place The piston seal may slip on by hand and look correct, but the ID of the seal may not be fully seated past the lip. It is very important that the edge of the seal is completely seated in the bottom of the grove in the piston body.

Seal Not Seated Correctly



Item 14 Piston Body

Seal Seated Correctly



Item 14 Piston Body

If the seal is not fully seated, erosion of the piston body will occur causing piston failure and abnormal wear of the cylinder. If the seal is properly seated, you will be able turn the seal around the piston body with little resistance.

Before installation of seal, inspect the piston body for wear. As the seal groove in the piston body wears, the fit between the seal and piston body will become loose and shorten seal life. Eventually, reduced seal life will force the replacement of the piston body.

We recommend that the Piston Seal be changed together with the Push Rod Seals and Donut Spring to reduce the number of times required to service the Bottom Former.

Item 25 **Push Rod Seals** - The Hybrid Bottom Former seals Bodymaker coolant out of the cylinder because Bodymaker coolant is abrasive and accelerates wear of Bottom Former components. While Bodymaker coolant is used to cool the cylinder with a water jacket around the cylinder, none of it enters the cylinder. The Push Rod Seals prevent coolant from entering the cylinder with the reciprocation of the Push Rods. Push Rod Seals should be changed yearly.

Pride recommends that the Push Rod Seals be changed together with the Piston Seal and Donut Spring to reduce the number of times required to service the Bottom Former.

Item 44 **Locking Device** - The vibrations of a functioning Bodymaker becomes a persistent force to loosen everything in a can plant. This force becomes evident quickly on the Bottom Former Clamp Ring Retainer (Item 6). Users of the Model 20 Bottom Formers or early Model 60 Bottom Formers have an on-going maintenance task of keeping the Clamp Ring Retainer tight. Whenever the Clamp Ring Retainer (Item 6) becomes loose, these vibrations will accelerate thread wear on the threads of both the Clamp Ring Retainer and the Outer Housing (Item 1). Eventually the Clamp Ring Retainer will not remain tight and both components must be replaced because of thread wear. The problem was alleviated in the design of the Model 60-001-09 Bottom Former with the addition of a Locking Device (Item 44). The Clamp Ring Retainer had to be redesigned to accommodate the Locking Device but the results have been excellent.

BOTTOM FORMER

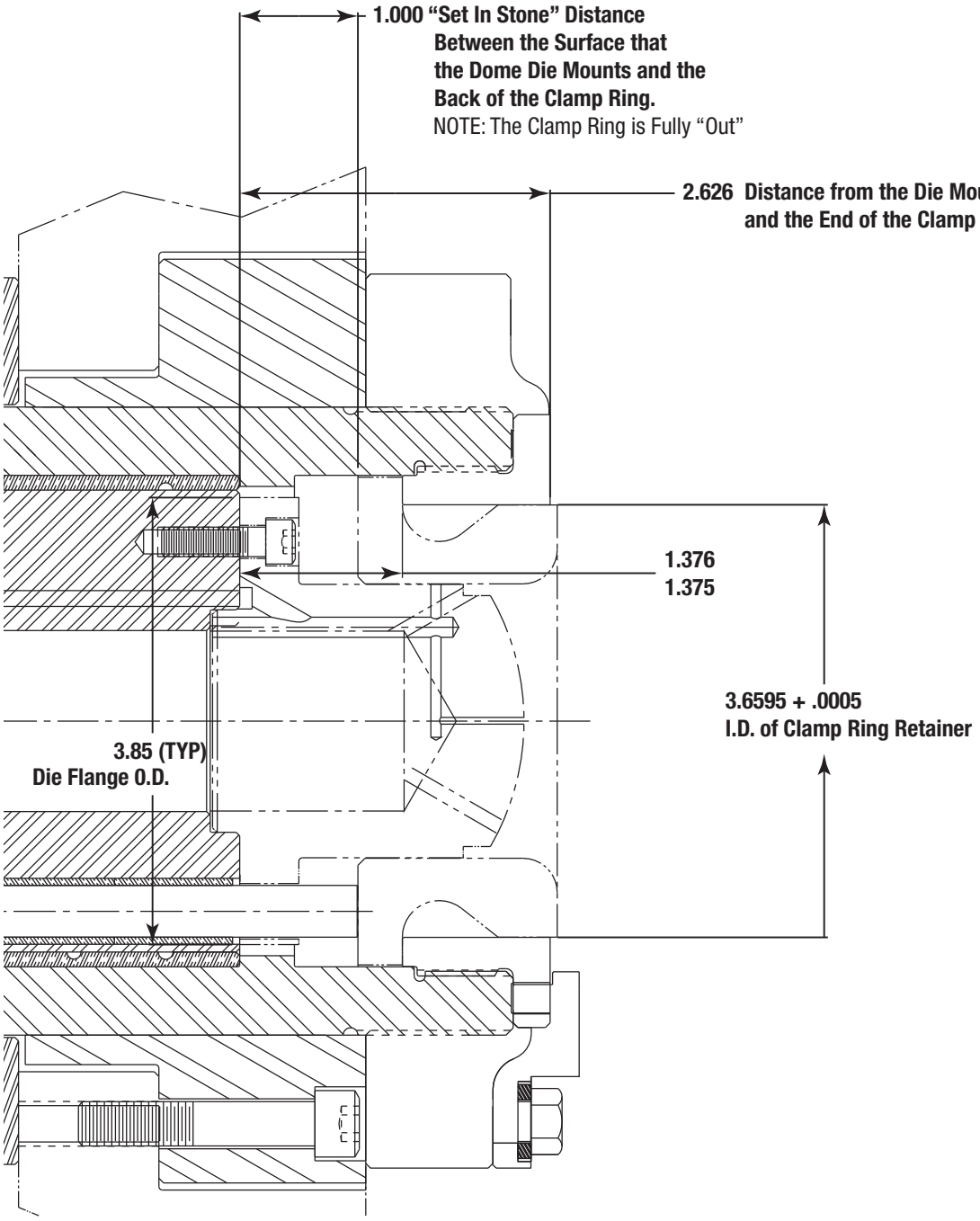
TOOL GEOMETRY GUIDELINES

PRIDE ENGINEERING

V. Tool Geometry

This set of guidelines is intended to be an engineering aid only.

This section is designed to aid the can maker in the development of tooling that will function optimally in the Pride Bottom Former. Each can maker owns a proprietary base profile design of their own and Pride Engineering does not offer design parameters for tooling profile geometry. The following are some design suggestions and the design parameters of tooling intended for the Pride Engineering Bottom Former.



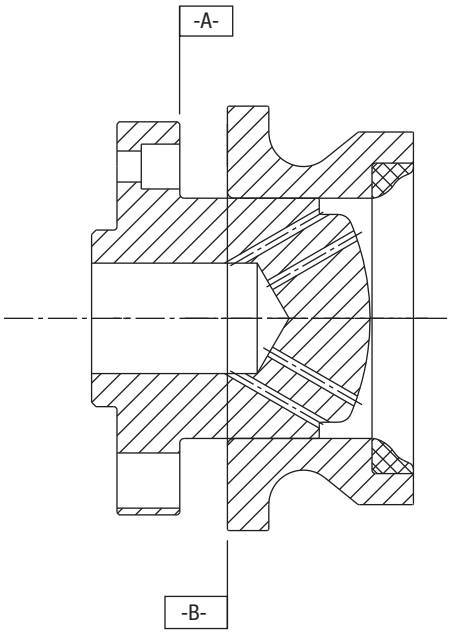
A. **Dome Spring Back – Proofing the Tools – Tooling Development**

The typical Spring Back allowance of .015" or .38 mm is a good starting point but spring back for each tool design will differ and must be developed with a trial. This trial should be conducted prior to ordering tools for each Bodymaker so the production tools will arrive ready to run. After making **one set** of dome tools as described in this section, load them in a Bottom Former on a Bodymaker.

Load the tooling into the Bottom Former on the Bodymaker.

1. Make sure the spring on the Bottom Former is in like new condition.
2. Set up the Bodymaker with .003" to .006" over travel at the lowest operating speed.

   The trial will have no meaning unless the Bottom Former and Bodymaker are set up in this fashion.
3. Run the Bodymaker at the lowest operating speed.
4. After the Bodymaker has run for a minute or two, select 3-4 samples cans, and measure, dome or panel depth.
5. If the dome or panel depths in the sample cans are not within .002" or .05 mm of each other, go back to steps 1 and 2.
6. After verifying set ups in steps 1 and 2 are correct, and dome or panel depth measurements are consistent, the relationship between the Dome Plug and Clamp Ring may be adjusted to achieve the desired depth to meet the specification.
7. One way to adjust the relationship between the Dome Plug and Clamp Ring is to grind material off the back side of the Clamp Ring (surface B) if the depth is low, or if the depth is high, make a new Dome Plug with more material on the front side of the Dome Plug Flange (surface A). Some canmakers prefer to only modify the front side of the Dome Plug Flange (surface A) to make any adjustments required (grind surface A if dome depth is low or make a new Dome Plug with more material on the front side of the Dome Plug Flange (surface A) if depth is high).



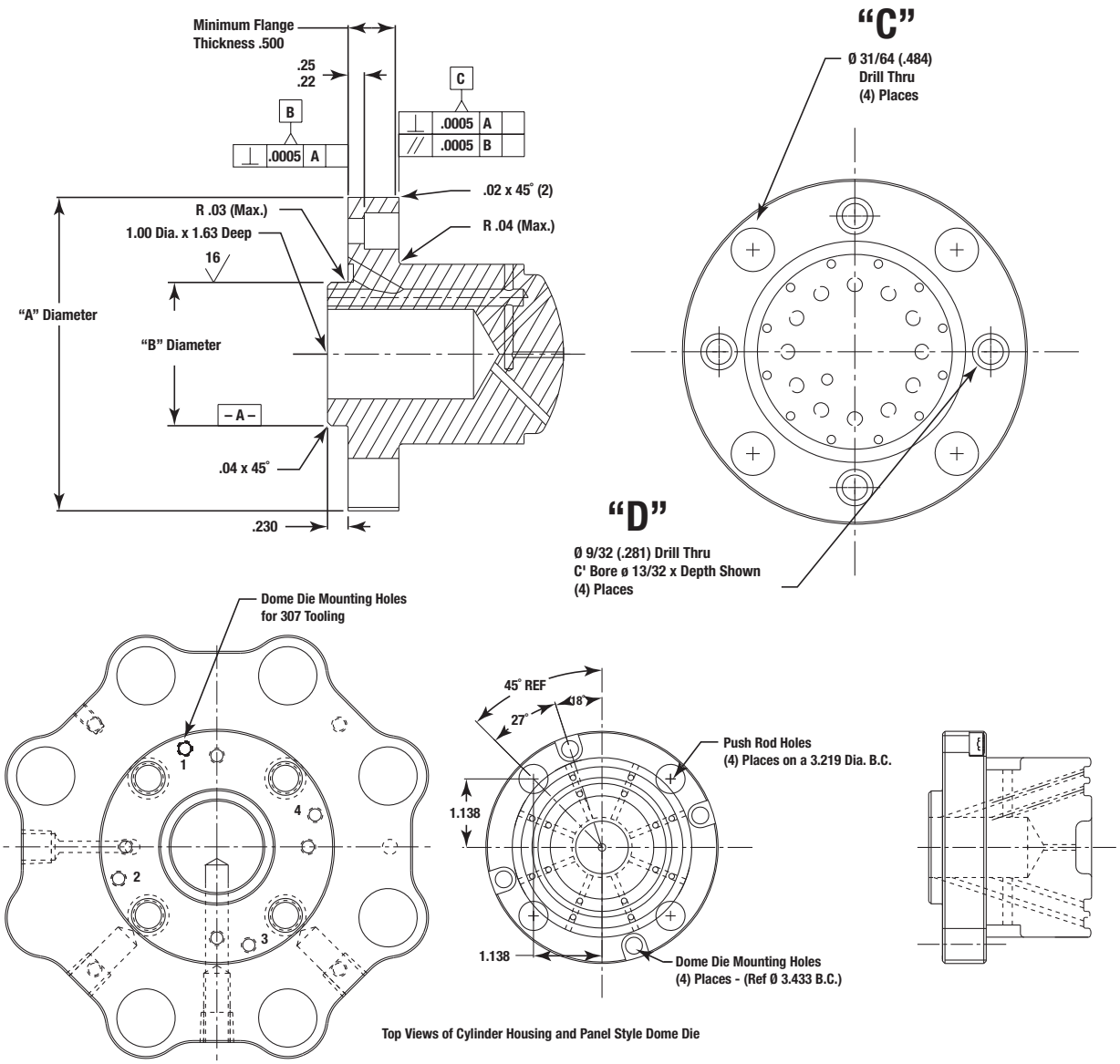
NOTE: All dimension changes to either surface A or B, should be transferred to the Dome Plug Flange dimension when updating the tooling print for the final production tooling design.

8. **Revise your tooling print to reflect this new dimension.** Tooling made from this revised drawing will work on all your Bodymakers that are running this base profile. The tooling should be interchangeable.

B. **Dome Plug** (Sometimes called Inner Die or Post)

All dimensions and geometry of the base (mounting flange) **should not be changed**.

STANDARD MOUNTING FLANGE DETAIL			
Dimension	**200 Series**	**300 Series**	**307 Tooling**
"A" Diameter	3.560	3.860	3.880
"B" Diameter	1.5990/1.5994	1.8750/1.8754	1.8745
"C" Push Rod Circle Diameter	2.938	3.219	3.219
"D" Mounting Bolt Circle Diameter	2.750	3.031	3.433



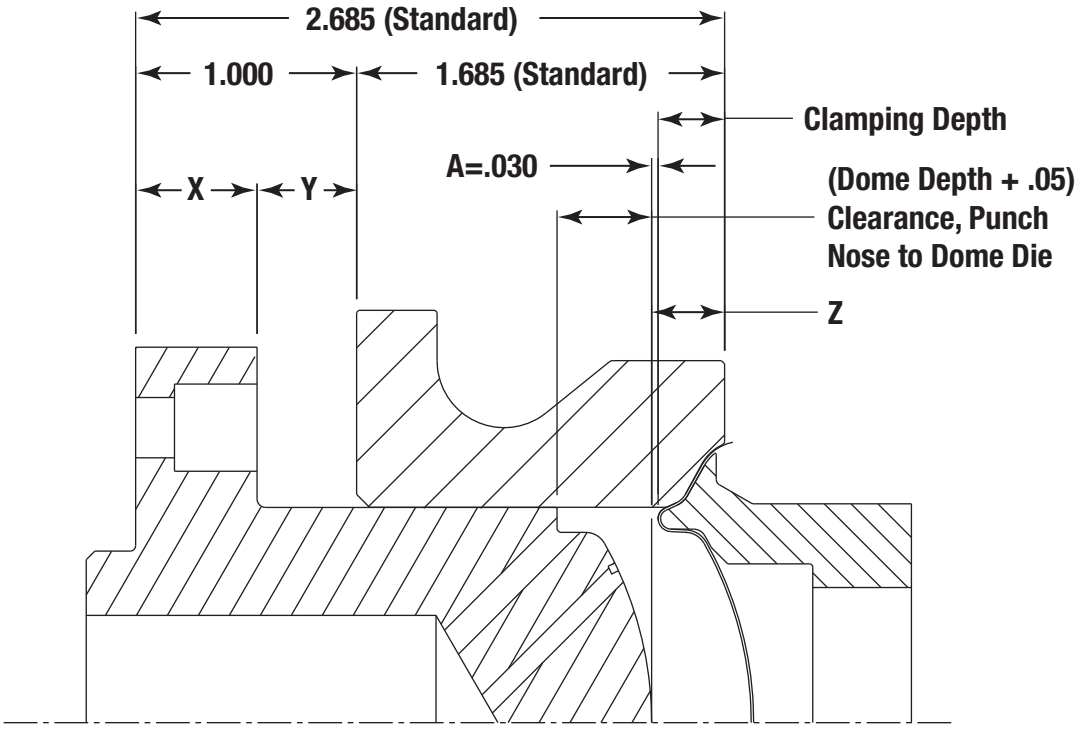
Top Views of Cylinder Housing and Panel Style Dome Die

Dome Plug Calculation

1. Define Punch Nose profile on CAD. 2.121/2.119" spherical radius typical for 211 size cans.
2. Create Clamp Ring on CAD. The overall length is 1.685" - standard length.
3. Lay out Dome Plug/Clamp Ring on CAD. Calculate clamping depth of the Punch Nose into the Clamp Ring. Draw with the correct material gauge in place. Some base profiles require pre-forming the dome or pre-doming to prevent excessive thinning which may lead to fractured or split domes. Pre-doming is limited by wrinkling and normally does not exceed .060"
4. Now define distance between the back of the flange and the tip of the Dome Plug as 2.685" – Z dimension.

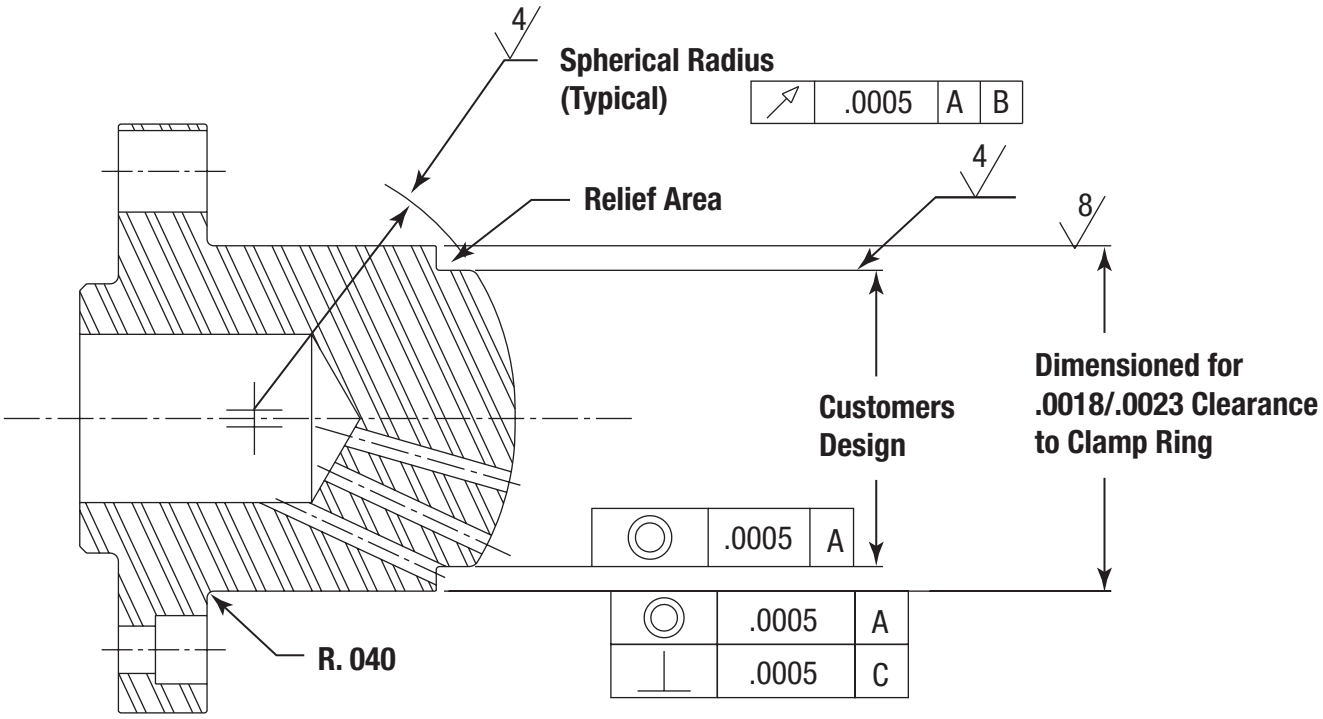
	Variable
A Clearance (Negative if Pre-dome)	.030"
Clamping Depth (measured from drawing)	
Z (Clamping Depth + A)	
Y (Dome Depth + .015 (Spring Back) + A	
X (1-Y)	.500"
Flange to Dome Plug Tip (2.685 – Z)	

5. There should be .0018" to .0023" (45 µm to 58 µm) total clearance between the Dome Plug and the ID of the Clamp Ring (aka Outer Die).

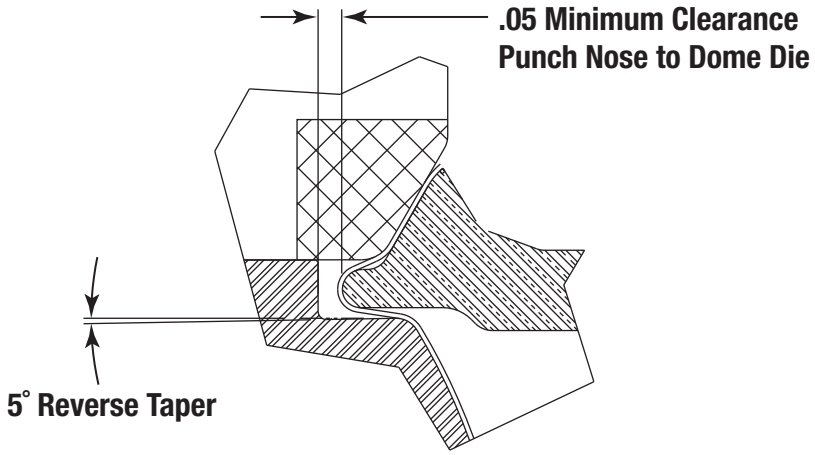


C. **Punch Nose Relief Area**

1. The gap between the base of the can (stacking radius) and the bottom surface of (depth) of the punch nose relief area should be minimized to retain as much guide area (bearing surface) as possible because the Die Plug is the primary guiding surface for the Clamp Ring. A minimum gap of .050" (1.3 mm) is required to prevent contact between the material and the bottom surface of the relief area.



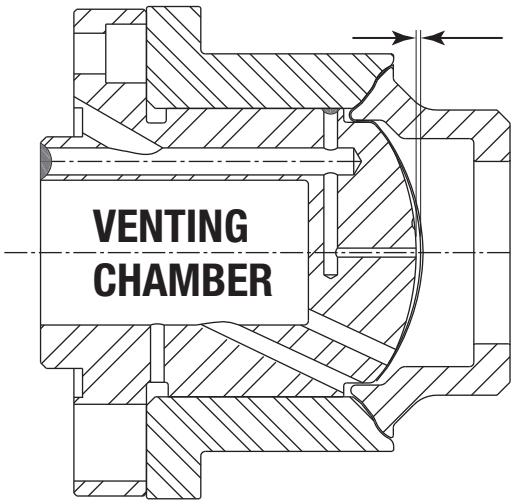
2. The side of the relief area may include a reverse taper. A typical relief would be 5˚ taper starting tangent from the blend radius (.07" in most cases) extending to the bottom surface of the relief area. This reverse taper relief reduces pinching during off-center strikes and reduces split or cracked domes.

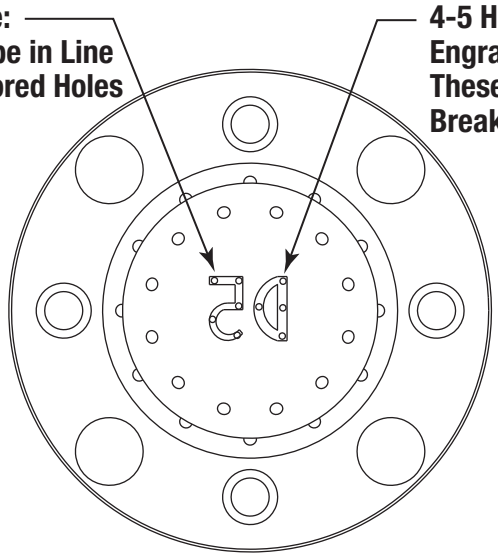


D. **Venting**

Generous venting is needed to reduce dome depth variation at higher Bodymaker operating speeds.

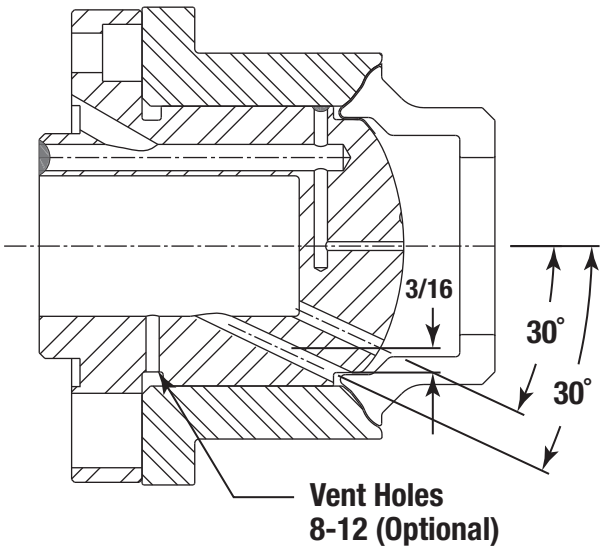
1. Inadequate venting on the spherical radius may cause dome depth variation and increase dome depths.
2. Inadequate venting in the Bodymaker numbers engraved into the spherical radius may inhibit the number impression.





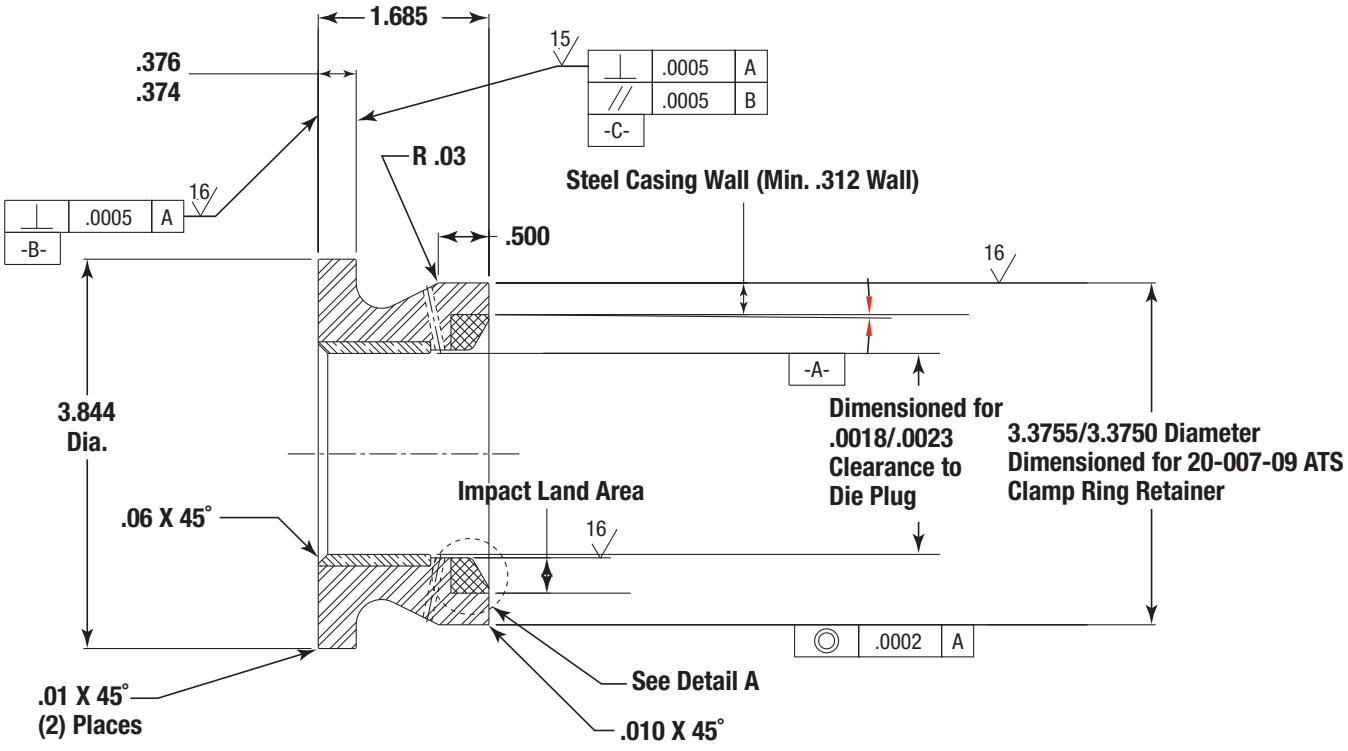
Engraving Example

3. Vent holes at the base of the dome plug can help prevent shallow domes by reducing hydraulic pressure under the clamp ring at higher Bodymaker speeds.
4. The vent holes in the relief area should be positioned on the bottom surface of the relief to insure that the can will not obstruct them.

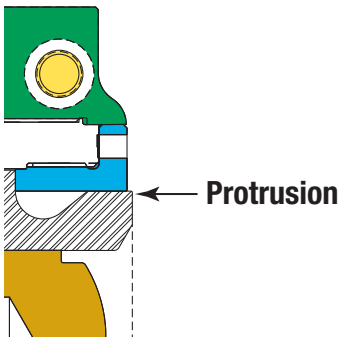


E. **Clamp Ring** - (Sometimes known as Outer Die, Draw Ring or Pressure Ring)

Dimension	200 Series Bottom Former	300 Series Bottom Former
"E" Diameter	3.844 Diameter	4.125 Diameter
"F" Diameter	3.3755 Diameter Size for Clamp Ring Retainer 20-007-09 ATS	3.6560 Diameter Size for Clamp Ring Retainer 30-007-09

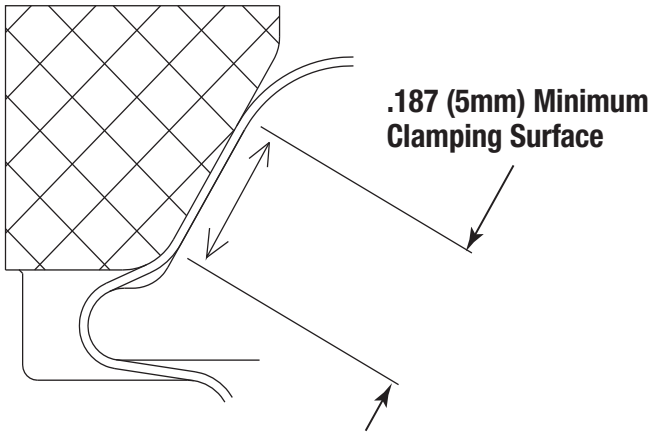


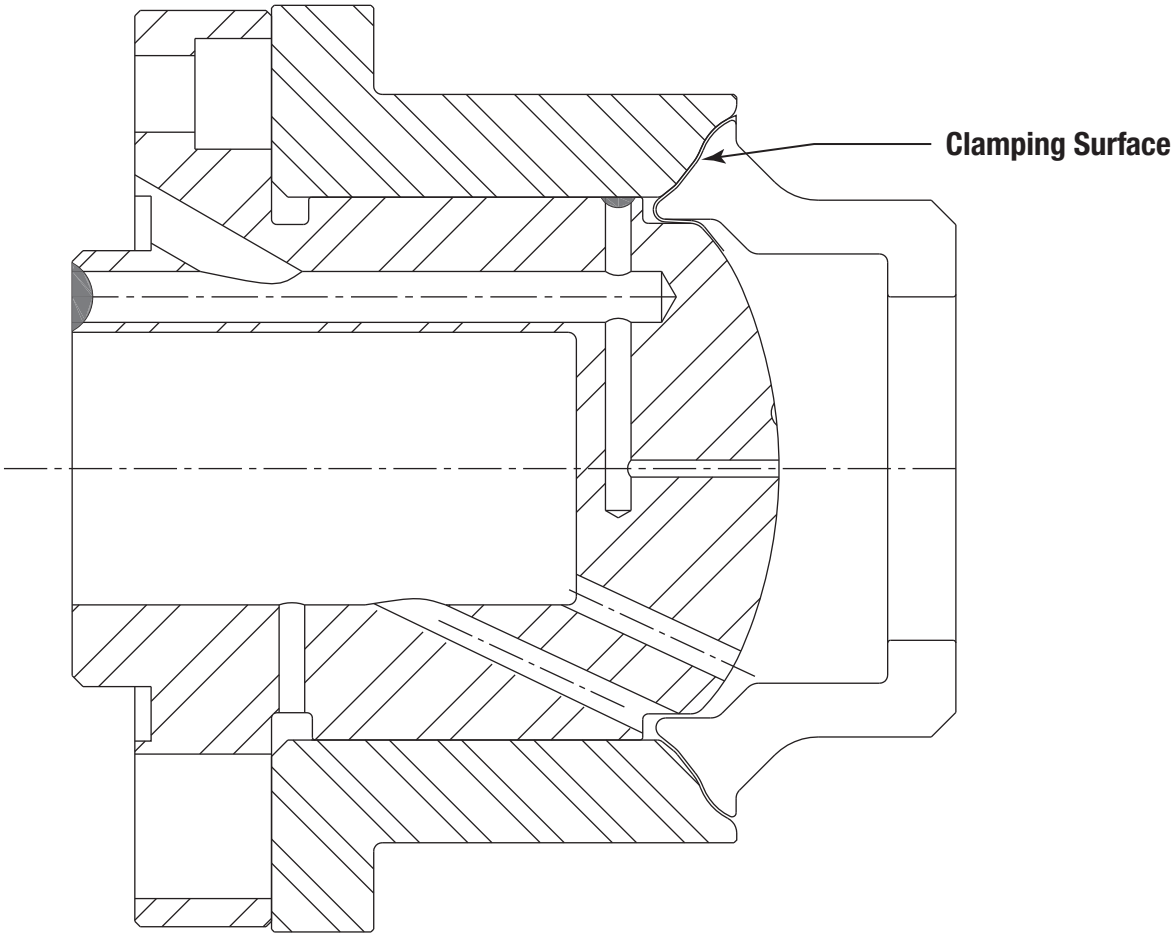
1. It is recommended that the Clamp Ring protrude beyond the front face of the Clamp Ring Retainer by at least .030" – .060" (.8 mm – 1.5 mm).



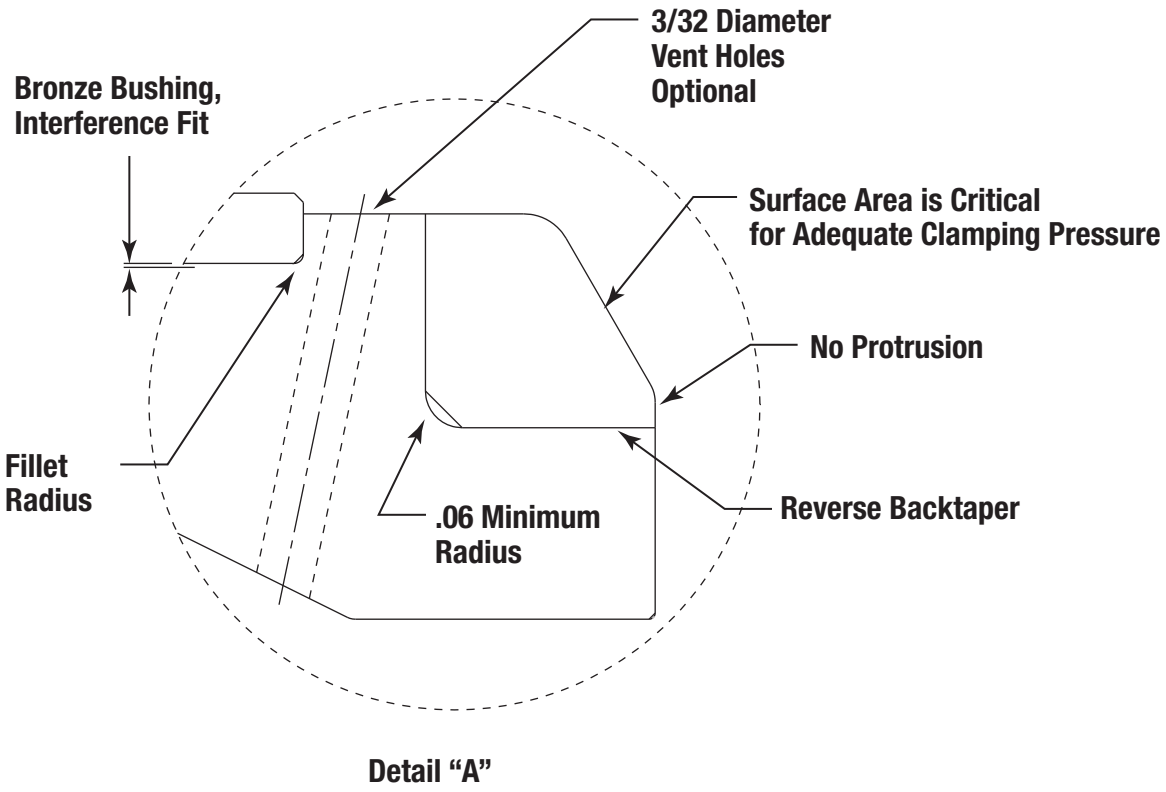
2. The clamping surface should have a minimum cross-section of .187" (4.75 mm) wide around the circumference of the Clamp Ring. The clamping surface area should be increased if Bottom Former cylinder air pressure above 80 PSI (5.5 bars) is required to prevent wrinkles.

3. The Clamp Ring is less likely to fracture in use if it is stress relieved before finish machining.





F. **Carbide/Ceramic Inserts**



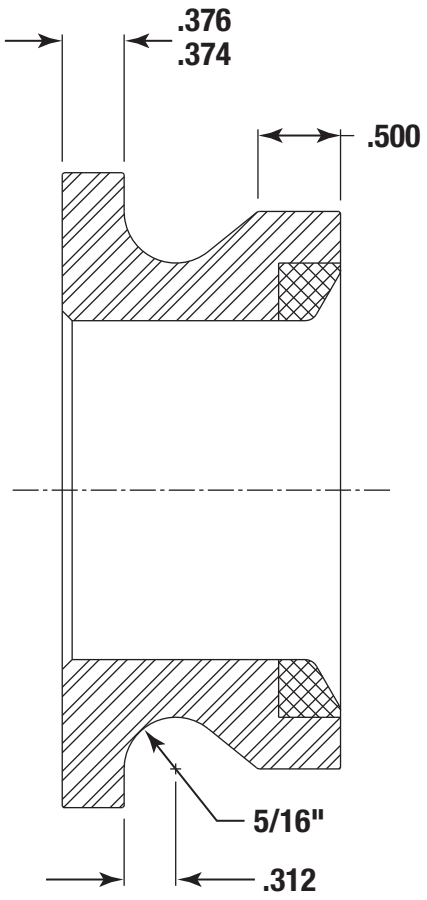
Detail "A"

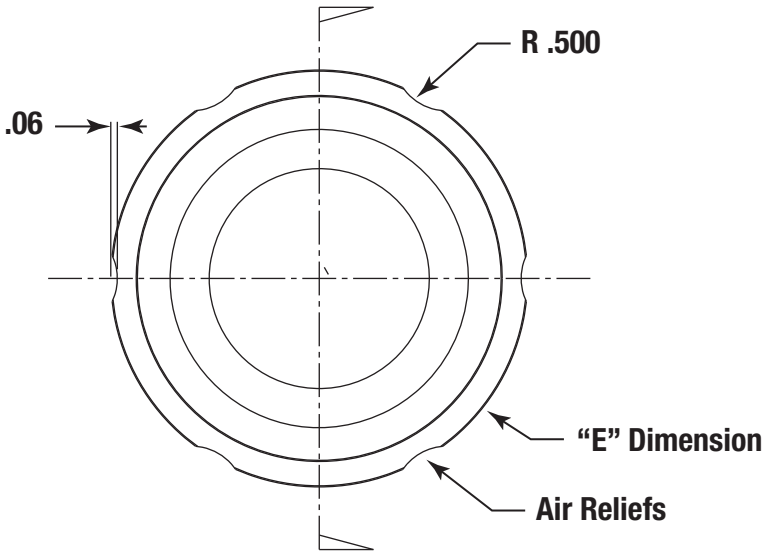
1. The carbide/ceramic insert should not protrude beyond the steel casing.
2. The carbide/ceramic insert requires a reverse taper on both the steel casing and insert to insure the insert's retention in the steel casing.
3. The minimum thickness of the carbide/ceramic insert should be .3125" (8 mm) cross-section.
4. The wall of the steel casing should be a minimum of .3125" (8 mm) thick. If straight tool steel is used, a .375" (9.5 mm) wall is sufficient.
5. The counter bore in the steel casing for the insert should have a generous fillet radius to assure the strength of the casing.
6. When using inserts, the Clamp Ring may perform better if using D2 tool steel tempered to Rc 50-52. Although tougher to machine, D2 will be stronger and more stable then A2 tool steel.

G. The movement of the Clamp Ring will effect the response time of the Bottom Former. It is recommended that its mass be kept to a minimum while retaining structural stability. If breakage should occur, the 5/16" (.312" or .8 mm) radius may be reduced to strengthen the Clamp Ring.

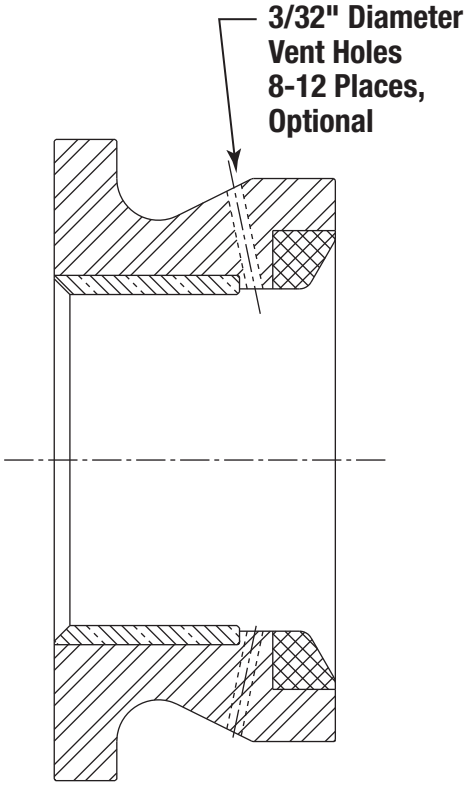
H. There is .002" (50 µm) per side clearance between the Clamp Ring and the Clamp Ring Retainer. This is an insurance guide only and is not intended to be the main guiding component for the Clamp Ring. This relatively close fit also helps keep the Bottom Former free of contaminants.

I. When the flange of the Clamp Ring comes to within .040" (1 mm) of the wall of the Bottom Former Outer Housing, we recommend air reliefs on the Clamp Ring outside diameters of the large flange, to prevent possible hydraulic action.





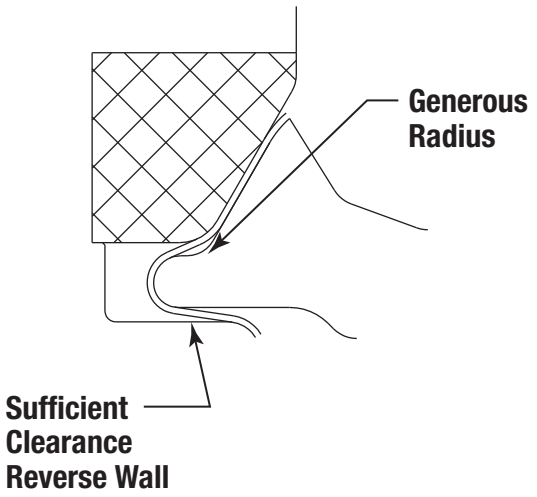
J. The Clamp Ring may be vented to improve the can's base profile at higher speeds.

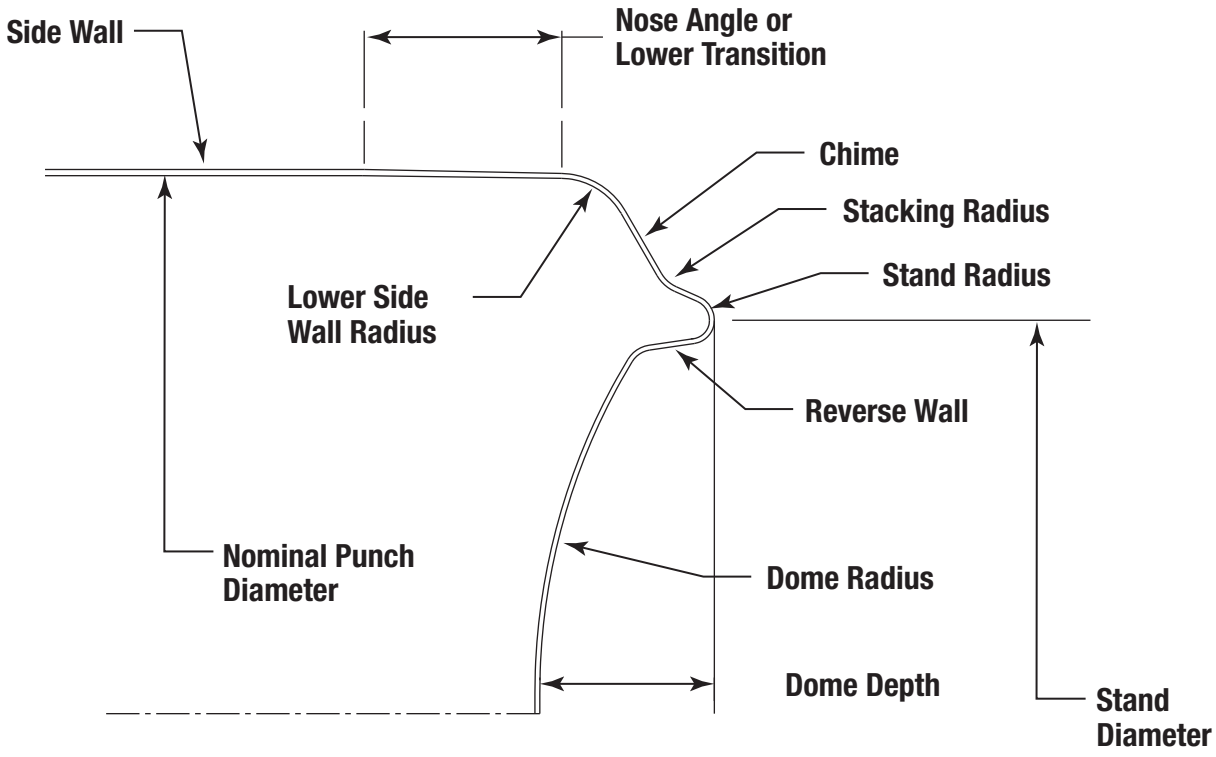


K. The Clamp Ring and Bodymaker Punch design should include generous radii to allow the smooth flow of material into the dome. Any pinching will lead to split or cracked domes.

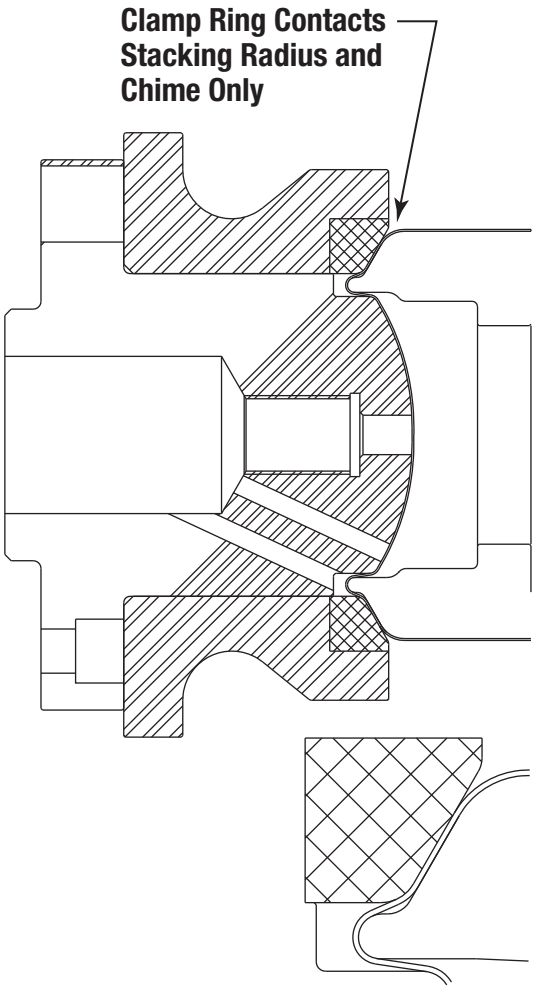
L. **Lower Side Wall Radius Wrinkles**

A radius may be added to the contour of the clamp ring to help guide the material around the Lower Side Wall Radius just above the Chime. Wrinkles in this area may be caused by a variety of reasons going back to the cupping process and can be the most difficult to cure.

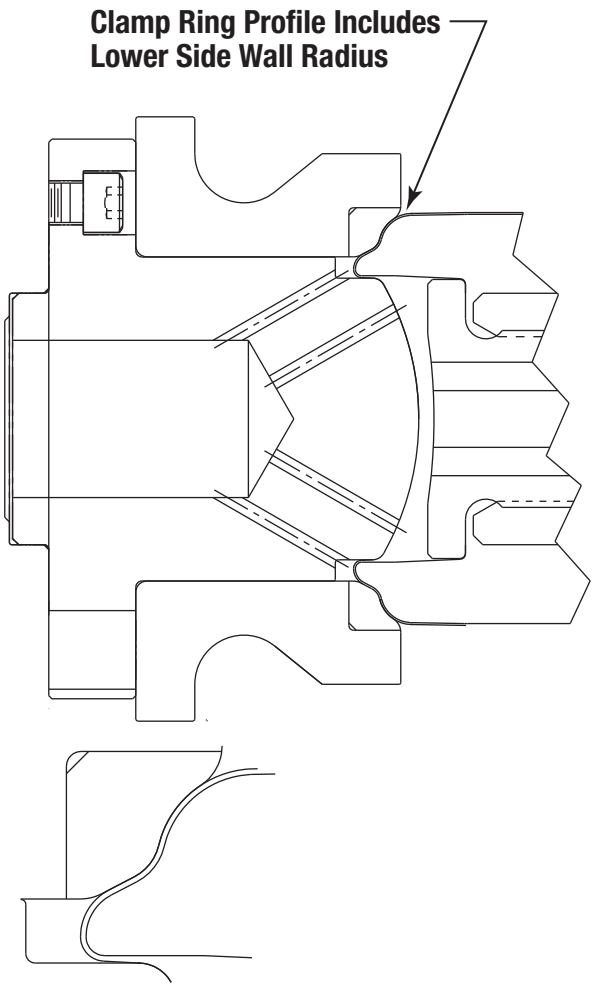




Lower Side Wall Radius
Without Support



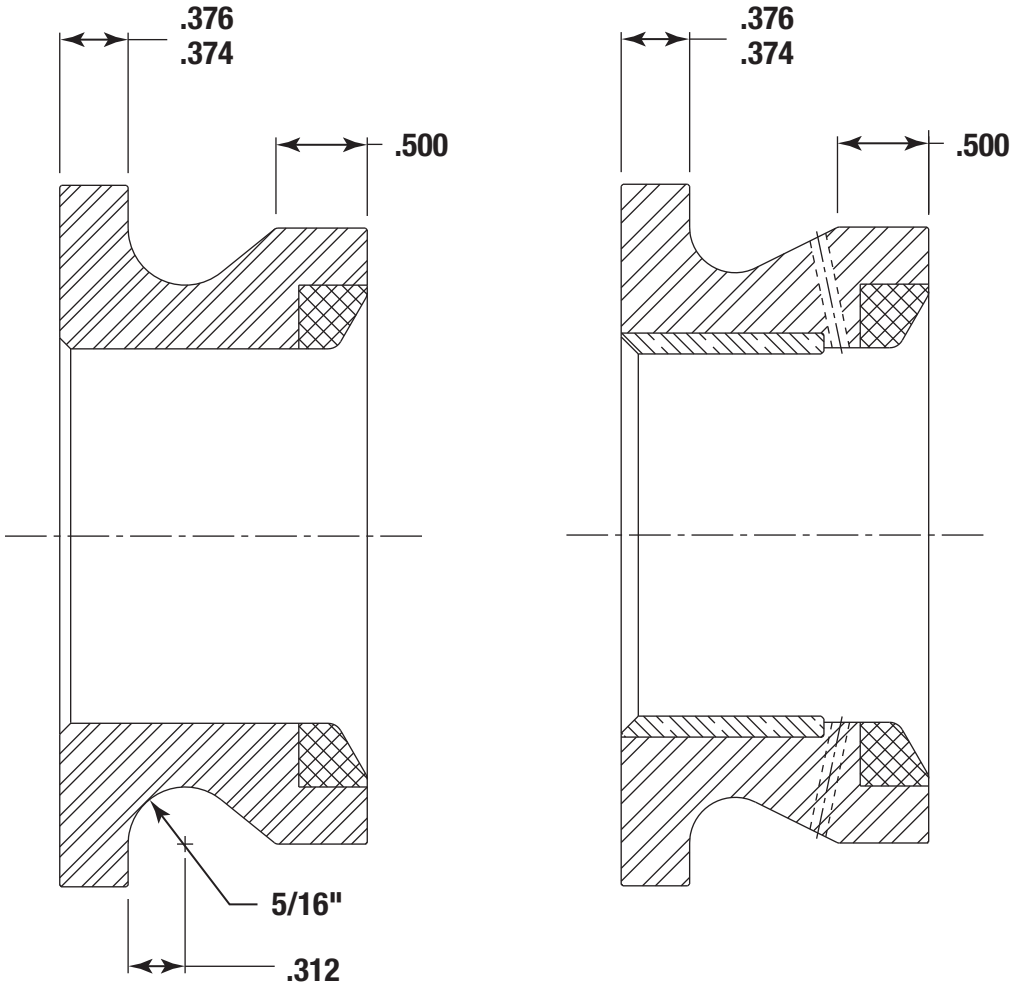
Lower Side Wall Radius
May Require Support



M. Bronze Bearing (Wear Ring) can extend the life of the tools.

1. The bronze bearing can be replaced and the tool set returned to service with an extended life.
2. Bronze bearings are usually made from oil impregnated bronze and are at least 1" min length.
3. Bronze bearings are assembled into the steel casing with an interference fit.

4. The addition of a bronze bearing will diminish the wall thickness and strength of the steel casing. Adequate strength may be maintained by reducing the size of the .312" radius, to either a .25" or a .1875" radius. Assuming no Bronze Bearing is used then the .312" radius is optimum for reducing weight and maintaining Clamp Ring strength.



5. A fillet radius at the bottom of the counter bore of the steel casing is required to maintain strength when a bronze bearing is to be used.