

# BEHLEN®

## MAINTAINING YOUR BEHLEN STRIP JOINER



 **BEHLEN®**  
Box 569 • Columbus, NE 68601 USA

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## 1 GENERAL OPERATION

Your Behlen strip joiner was designed to give years of trouble free service. The design of your machine contains the best combination of function and reliability.

In order to keep your Behlen strip joiner performing like it did when you first put into service the following instructions must be followed:

1. **Maintain your depth switch setting to the shallowest setting which will yield a good joint.** Lower penetration reduces die wear, the amount of burrs, and the amount of slugs and fines that builds up in the die.
2. **Stitches made with straight side punches must have a needle inserted to maintain the joint.** The needle must be strong enough to resist the shearing effect of the cuts in the material being joined.
3. **For standard and arrow stitches make sure the stitch shifts at least 1/16" (1.5 mm), 1/8" (3 mm) is better, before sending the joint down the line.** If enough tension can't be generated to shift the stitch into lock position, then a needle must be inserted to assure that the joint stays together. If you don't do one of these things you will have no assurance that the joint will stay together.
4. **Make only as many rows of stitches as necessary.** Multiple rows will increase the joint strength, but only if you can shift and lock the stitch. The force required to shift and lock aluminum stitches is very high. So when you add more rows you increase the shift force required to shift and lock the stitches thereby increasing the possibility that the stitches won't shift and lock. Behlen can help you with calculations for joint strength and shift force required.
5. **Keep the material centered in the die.** If the load isn't centered, one side may penetrate deeper than the other and increase wear on the die.
6. **Keep the die clean and free of foreign materials by using compressed air to blow any fine particles from the die at least once per day under normal service conditions.** The lower die usually collects more of the fines, so pay close attention to the lower die.
7. **Keep the limit switch on the ram down position set to coast to a stop at the bottom of the cylinder stroke.** If the motor and pumps continue to run some after the ram has completely bottomed, the pumps may cavitate and possibly draw air into the system.
8. **The hydraulic pressure relief valves are pre-set at the factory and should not be field adjusted.** A quick way to verify the valve has not been adjusted is to remove the cover and check the length of the adjustment screw; it should have 5/32" (4 mm) of thread exposed.
9. **Maintain the oil level near the top of the site gage on the reservoir.** A sight glass is provided on the side of the reservoir to simplify the checking of the oil level. Your machine was filled to the proper level at the factory with Mobil DTE-26 hydraulic fluid unless otherwise specified.
10. **Visually inspect the entire machine for loose fasteners and tighten if necessary once every week.**
11. **Follow the lubrication instructions contained in this document or the owner's manual.**
12. **Do not over grease the bushings.** Grease can get trapped on top of the guide pin and be contained by the die bushing. The excessive grease can affect how well the die penetrates the material being joined.
13. **At least once every year, (more frequently under severe conditions) remove the die and maintain the sharp cutting edges as required on all punches.** A detailed instruction for this procedure is in the owner's manual.

14. **Take care when removing and installing a die.** Detailed instruction for this is procedure in the owner's manual. Damage to press and or the die can result if the die change is not done properly.
15. **At least once every year, test the hydraulic fluid for particle contamination and replace if necessary.**
16. **Normally, lubrication on the punches and stripper plates should be avoided.** If a small amount of lubricant is necessary to ensure stripping, we recommend using light hydraulic oil.

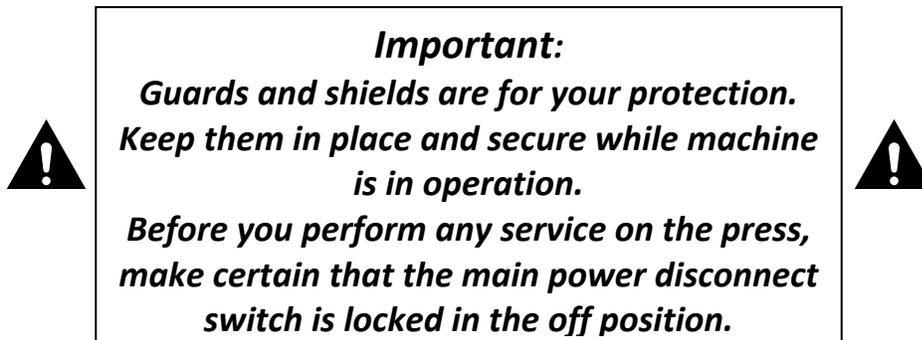
## 2 SAFETY



1. The safety-alert symbol above means Attention! Be Alert! Your personal safety is involved! This symbol draws your attention to important instructions concerning your personal safety. Read the message carefully to avoid personal injury or death
2. It is your responsibility as a supervisor or operator to know what hazards exist and to make these known to other personnel working in the area so that they too may take any necessary safety precautions that may be required.
3. If the decal(s) become damaged or detached, contact your Behlen representative or Behlen Mfg. Co. for replacements.



- ▲ Guards and shields are for your protection. Keep them in place and secure while machine is in operation.
- ▲ Replace safety shields that may have been damaged or removed for servicing purposes and fasten securely before operating machinery.
- ▲ Enforce the use of safety blocks whenever dies are being adjusted, repaired or replaced in the press.
- ▲ Before you before any service on the press, make certain that the main power disconnect switch is locked in the off position.



4. The design and installation of any and all safety and guarding equipment for the passage of the metal strip through the Strip Joiner Press that may be necessary to conform with United Sates Federal Safety Standards (O.S.H.A.) or any local applicable safety regulations to meet

your particular line configuration are your responsibility, not that of Behlen Mfg. Co. Make the electrical connections according to the enclosed schematic.

5. In the event the press fails to operate the die (even though the pump motor is running), it is possible the pump motor is running in reverse. Check the rotation. This situation can be corrected by interchanging any two (2) of the three (3) phase line leads.
6. Before each stitching operation, check the press to make sure the die is free of foreign material.

### 3 DIE SERVICE

Behlen Manufacturing has a staff of technicians who can maintain your stitching die in like new operating condition. If you have second die, it is possible to place the second die in service and send the first die to us for service. When your die arrives, Behlen will assess what is required and give a firm quotation of costs before proceeding.

Contact information for this service is:

#### Behlen Strip Joiner Service Department

Behlen Mfg Co  
4025 East 23<sup>rd</sup> St.  
Columbus, NE, USA 68601

Phone: 402-564-3111

Fax: 402-563-7405

### 4 INSTRUCTIONS FOR ORDERING REPLACEMENT PARTS

In order to insure the correct parts will be provided, all orders for replacement parts for the press must include the serial number and model of the strip joiner. These numbers may be found on the nameplate fastened to the press frame near the operator controls.

Likewise with the die, to insure the correct parts are ordered, the serial number or project number for the die should be included. The four digit project number for the die is found on the die shoe by the guide pins. There may or may not be "P" ahead of the project number. Four digit numbers elsewhere on the die, such as the strippers or punch plates are not serial numbers for the die. If there is a serial number on the die it is located near the guide pins on the opposite end of the die

Below are pictures of a typical nameplate on a Behlen Strip Joiner and a four digit project number on a die.



Basic part lists for both the joiner and a die can be found in the "Operating Instructions and Service Information" manual. However, to verify the correct parts, it is very important to find

these serial and model numbers. This is more so with the dies, because many times dies are moved to different joiners and many joiners have two or more dies that are used in it. So the die that requires parts must be clearly identified.

## **5 LUBRICATION INSTRUCTIONS**

### **5.1 Die Guide Bushings**

1. Every Behlen stitching die is provided with four (4) grease fittings. One will be found on each of four guide bushings. The die has been properly lubricated at the time of manufacture and it is not necessary to lubricate at time of installation unless the die has been in storage for a period of six months or more.
2. Lubrication of the guide bushings should be done as part of a planned maintenance schedule. The recommended lubrication interval after placing die in service (under normal conditions) is once every month.
3. Recommended lubricant is the same as shown for lubrication of motor bearings.
4. Recommended lubricant volume per each grease fitting is 0.5 Cu inch (8 Cu cm). Do not over grease, excessive grease can get trapped on top of the guide pin and be contained by the die bushing. The excessive grease can affect how well the die penetrates the material being joined.

### **5.2 Pillow Block Bearings (Material Support Rolls)**

1. As an option the Behlen stitching press can have two (2) material support rolls (one on the entry side and one on the exit side) unless ordered otherwise. There are four (4) grease fittings. One will be found on each of the four pillow block bearings at the end of the support rolls. These bearings have been properly lubricated at the time of manufacturing and it is not necessary to lubricate at the time of installation unless the press has been in storage for a period of six months or more.
2. Lubrication of the pillow block bearings should be done as part of a planned maintenance schedule. The recommended lubrication interval after placing the machine in service is once a month.
3. Recommended lubricant is the same as shown for lubrication of motor bearings.
4. Recommended lubricant volume per each grease fitting is 0.5 Cu inch (8 Cu cm). Do not over grease, excessive grease can damage the seals. Also excessive grease can push against the seals increasing the amount of drag in the bearing. With light gauge materials this increased drag can prevent the roller from spinning freely and possibly marking the material.

### **5.3 Motor Bearings**

Motors covered by this Instruction Manual are equipped with several types of bearings. This description covers re-greaseable anti-friction bearings only. Non-regreaseable ball bearings require no periodic maintenance. See I/M B-3654 for oil mist lubricated anti-friction bearing procedures.

#### **1. GREASE LUBRICATED BEARINGS:**

- This motor has been properly lubricated at the time of manufacture and it is not necessary to lubricate at the time of installation unless the motor has been in storage for a period of six months or more.
- Lubrication of anti-friction bearings should be done as a part of a planned maintenance schedule. The Recommended Lubrication Interval should be used as a guide to establish this schedule.

- Cleanliness is important in lubrication. Any grease used to lubricate anti-friction bearings should be fresh and free from contamination. Similarly, care should be taken to properly clean the grease inlet area of the motor to prevent grease contamination.

**2. RECOMMENDED LUBRICANT:**

- For motors operating in ambient temperatures shown below, use the following lubricant or its equal:

**3. BALL BEARING MOTORS:**

OPERATING TEMPERATURE  $-25^{\circ}\text{C}$  ( $-15^{\circ}\text{F}$ ) to  $50^{\circ}\text{C}$  ( $120^{\circ}\text{F}$ ) CHEVRON OIL SRI NO.2  
 MINIMUM STARTING TEMPERATURE  $-60^{\circ}\text{C}$  ( $-76^{\circ}\text{F}$ )

SHELL OIL CO.	AEROSHELL 7
EXXON	UNIREX N2
SHELL OIL CO.	DOLIUM R
TEXACO, INC.	PREMIUM RB

**4. ROLLER BEARING MOTORS:**

OPERATING TEMP.  $-25^{\circ}\text{C}$  ( $-15^{\circ}\text{F}$ ) to  $50^{\circ}\text{C}$  ( $120^{\circ}\text{F}$ )

CHEVRON OIL	BLACK PEARL EP NO.2
TEXACO, INC.	PREMIUM RB

**5. LUBRICATION PROCEDURE:**

Baldor regreaseable anti-friction bearings may be lubricated with the motor running or stationary. Stationary with the motor warm is preferred.

- Locate the grease inlet, clean the area and replace the pipe plug with a grease fitting, if the motor is not equipped with grease fittings.
- If motor is equipped with grease drain plug, remove plug and loosen any hardened grease that may block drain.
- Add the Recommended Volume of the Recommended Lubricant using a hand operated grease gun.
- Run the joiner normally for two hours.
- Replace the pipe plug in grease drain.
- Grease may not relieve from drain. Use only volume shown in Table 3.

**6. LUBRICATION INSTRUCTIONS:**

- Select Service Condition from Table 1.
- Select Lubrication Frequency from Table 2.
- Select Lubrication Volume from Table 3.
- Lubricate the motor at the required frequency with the lubricant volume required in accordance with LUBRICATION PROCEDURE.

NOTE: Mixing of lubricants is not recommended due to possible incompatibility. If it is desired to change lubricant, follow instructions for lubrication and repeat lubrication a second time after 100 hours of service. Care must be taken to look for signs of lubricant incompatibility, such as extreme soupiness visible from the grease relief drain area, or from the shaft opening.

## 6 LUBRICATION GUIDELINES FOR MOTOR BEARINGS

### 6.1 Service Conditions

**Table 1**

Standard Conditions	Eight hours per day, normal or light Loading, clean @ 40°C (100°F) Maximum ambient.
Severe Conditions	Twenty-four hour per day operation or shock loading, vibration, or in dirt or dust @ 40-50°C (100-120°F) ambient.
Extreme Conditions	Heavy shock or vibration or dust.

### 6.2 Lubrication Frequency

**Table 2**

<b>BALL BEARINGS</b>				
<b>Speed</b>	<b>NEMA (IEC) Frame</b>	<b>Standard Conditions</b>	<b>Severe Conditions</b>	<b>Extreme Conditions</b>
1800 RPM And Slower	182(112) Thru 215(132)	3 Years	1 Year	6 Months
	254(160) Thru 365(200)	2 Years	6 to 12 Months	3 Months
	404(225) Thru 449(280)	1 Year	6 Months	1 to 3 Months
3600 RPM	ALL	6 Months	3 Months	1 Month
<b>ROLLER BEARINGS</b>				
For Roller Bearings divide the time periods above by 2.				

### 6.3 Lubrication Volume

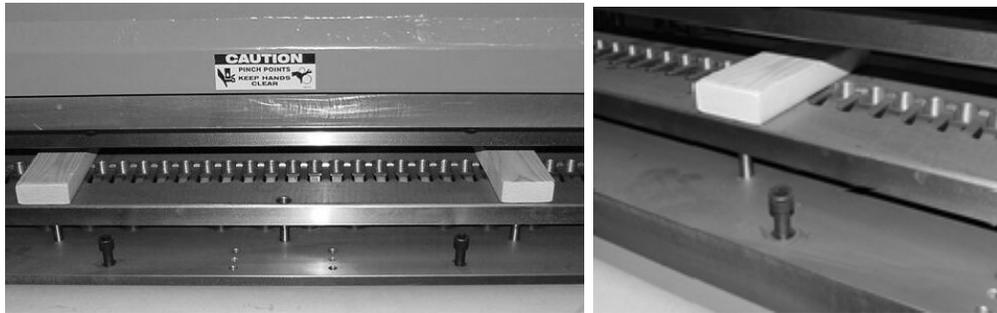
**Table 3**

<b>NEMA (IEC) Frame Size</b>	<b>Volume in Cubic Inches (cm<sup>3</sup>)</b>
182 Thru 215 (112-132)	0.5 (8)
254 Thru 286 (160-180)	1.0 (16)
324 Thru 365 (200-225)	1.5(24)
404 Thru 449 (250-280)	2.5(40)

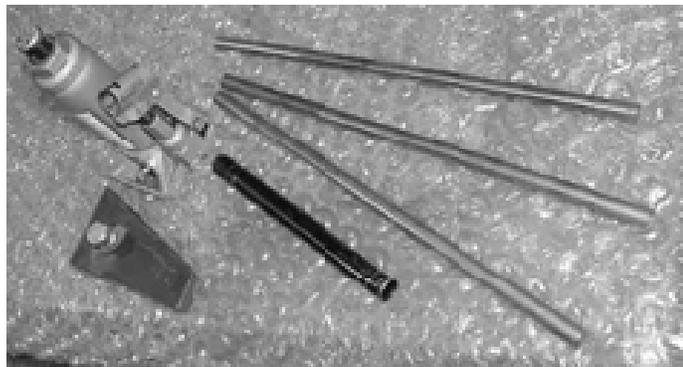
## 7 INSTRUCTIONS FOR SERVICING THE DIE

### 7.1 Die Removal Instructions

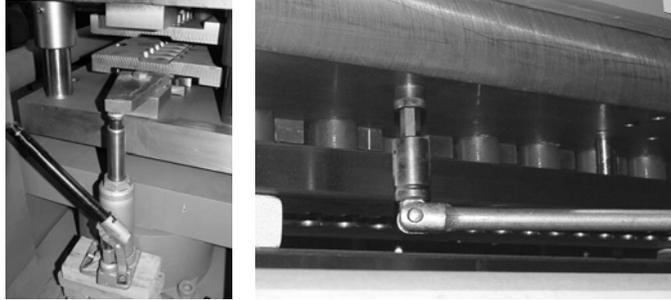
1. Lock out the machine electrically at the control panel and or the service panel for this machine.
2. Make markings on die and press to ensure proper orientation when re-installing.
3. When removing the die through the end window, as show in these instructions, it will be necessary to remove any attachments such as entry guides, exit tables, and hole punches that extend out past the edge of the die shoes.
4. Remove any guards, switches, or other items that would be in the way of removing the die or could be damaged when removing the die.
5. Place wooden blocks (2 places) into the die opening approximately as shown. Both blocks should be the same height. The blocks shown are 1 ½" x 3 ½" x 12" each.
6. Loosen the bottom bolts and remove them from die as shown.



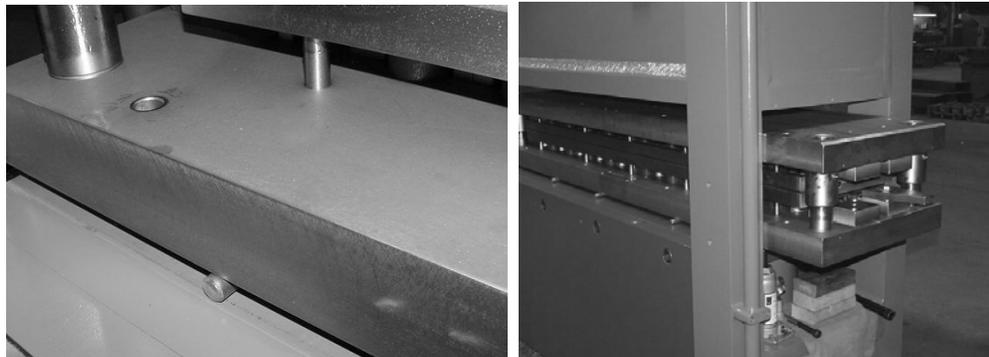
7. Next you will need to raise the lower die up until the wood blocks contact the upper stripper. This can be done using 2 bottle jacks and 2 brackets similar to those shown below. Also three steel rolling rods are in the picture. The rolling rods will be used to roll the die out of the press.



8. Bolt the lifting brackets to the lower die and jack both ends of the lower die up until the wooden blocks contact the upper die, see the photo below. Place at least three 5/8-3/4" (15-20 mm) diameter x 18" long steel rounds similar to those shown above, under lower die. All the rods used must be the same diameter.



9. Loosen and remove the top bolts from the upper die shoe, see the photo above.
10. Next lower the lower die shoe onto the steel rounds and remove the bottle jacks.
11. The die now is completely disconnected from the joiner and is resting on the rods that will act as rollers. Next push the die out through the window of the press onto a die cart or some other support.



12. Reverse the procedure to install the die.

## 8 INSTRUCTIONS FOR SHARPENING BEHLEN STITCHING DIES

### 8.1 Opening the Die

1. Remove the entire die assembly from the press by following the instructions that are given in section 7.
2. Separate the die into a top and bottom die assemblies. To make the work easier it is best place the die halves on heavy duty saw horses or a work bench. Below is a picture of a typical die opened up and resting on saw horses.



3. An overhead crane makes the work easier in separating the die halves, and in handling the big die components. The top half of the die must be rolled over to remove the strippers and work on the rest of the die. Below are some pictures showing the top half of the die being rolled over using an overhead crane. Note how the chains are attached to die.



## 8.2 Punch Arrangement

1. If the punches are grouped in clusters of 3 as shown below, skip to section 8.5 and continue.



2. If the punches are grouped in clusters of 2 as shown below, skip to section 8.4 and continue.



3. Otherwise, your punches are not grouped and should appear as shown here. Continue onto section 8.3.



### 8.3 Instructions for Restoring Cutting Edges on a Standard Die

1. The stripper plates and urethane stripper plugs must be removed to expose the working punches. The strippers are removed by removing the stripper bolts, then lifting the stripper off of the die. Loosen all of the stripper bolts  $\frac{1}{2}$  turn at a time until all of the pressure is removed from the urethane springs. Then completely remove all of the stripper bolts.
2. There are threaded holes in two corners of the strippers where a lifting device can be attached. See the picture below showing how chains are attached to the stripper. Once the strippers are removed, mark the stripper plates "upper" and "lower" and place them aside. See the picture below, note how the lift chains are attached to opposite corners on the stripper. Also once the stripper has been removed; take note of the number and location of the urethane springs that were used. See in the photo that in this case not every pocket has a urethane spring in it, so it is important note the number and position of the springs.

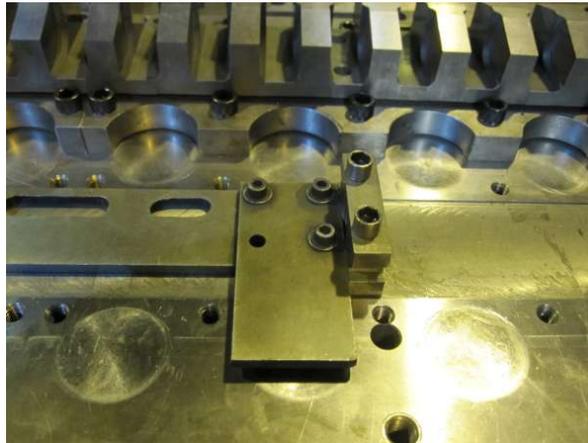


3. Remove the urethane springs and clean the die. Replace the urethane springs if they are cracked or damaged, or have been compressed to a height of  $1 \frac{7}{8}$ " (48 mm) or less.
4. Inspect all the punches for edge chipping and edge wear. Mark the punch edge or edges that will require the greatest material removal during sharpening. Each punch has 3 surfaces that must be ground to sharpen the punches. These surfaces must have the same amount removed from each in order to maintain the original punch point geometry. All punches that will possess an overall length after grinding of less than 2.440" (62mm) shall be discarded and replaced. If you determine the material removal for the marked edges will yield an overall punch length of less than this, it will be necessary to selectively replace the punches having the greatest amount of edge deterioration with new punches. When selectively replacing punches, do not shuffle the order of the remaining punches and spacers.
5. When you begin to replace punches:
  - Install two  $\frac{3}{8}$ " x  $1 \frac{3}{4}$ " bolts in the starter spacer. The heads of the bolts may need to be turned down so the bolts will clear.
  - Tighten the starter spacer so it maintains its location during the maintenance operation.
  - With arrow punches it is important to note the critical side of the locating groove. It is the side on which the wider side of the punch is located.
  - Then loosen and remove the end blocks.
  - Next loosen and remove the tie rods.
  - Finally loosen and remove the hold down clamps.

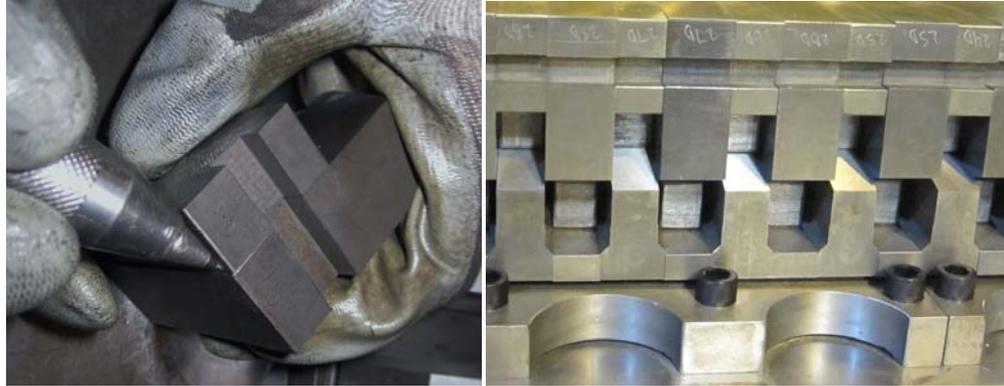
If the starter spacer is removed it must be aligned with a square and bolted in place to reassemble the die. A starter spacer is only required in the bottom die, it is located in the center of the row of punches. Note a two row die will have two starter spacers. See the pictures below showing the above mentioned items.



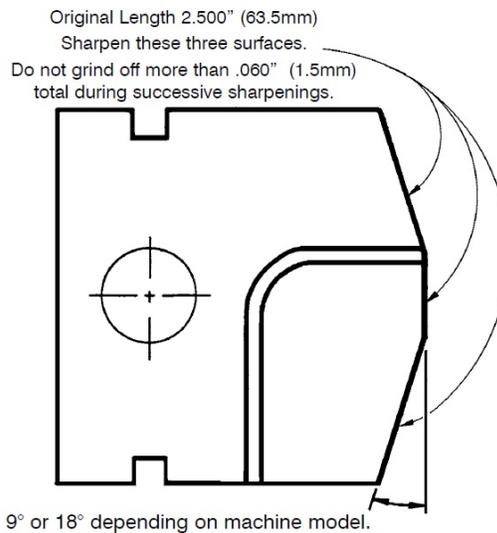
6. If the center spacer was removed it must be aligned with a square and bolted in place to reassemble the die. Please refer to the picture below showing the starter spacer being aligned with a square.



7. As you before you begin to remove punches make sure that each punch and spacer is numbered in order of placement on the die shoe. Rows can be assigned A,B,C, and D (four rows for a two row dies), punches and spacers can be marked consecutively. A good way to do this is with an engraving pen. When selectively replacing punches, ***do not*** shuffle the order of the remaining punches and spacers. See the pictures below showing how the punches and spacers are numbered.



8. You can now proceed with the grinding operation. Using a surface grinder and supporting fixture proper for your punch angle (either 9 degree or 18 degree), grind equal amounts from 3 surfaces on each punch. The 9 or 18 degree angle is not critical. The distance across and the position of the flat cutting point of each punch is very important after grinding. The design distance of this flat on a standard punch is 0.500" (12.7 mm) and must be centered on the punch body. The following illustration shows the surfaces of the punches that are to be ground.



9. If a grinding fixture is not available to sharpen a group of punches at once, they may be ground individually. Follow closely the instructions for the procedure to remove and replace punches as stated above.
10. After grinding the punches you can begin reassembling the punches and spacers onto the die shoes. When re-assembling it is important to keep everything clean and free of small particles including dust. Make sure the locating slot or key is kept clean.
11. Begin by assembling the punches and spacers on the lower die. Install the punches and spacers in the same order as they were before disassembly. Loosely fasten the hold down clamps on the lower die and install the tie rod and nuts. Snug up the tie rod and clamps but do not torque down. **When re-assembling the punches and spacers, lubricate the tie rod threads and tighten the tie rod nuts to 95 ft-lb (129 N-m) torque.** Check to make sure all of the punches are located in the groove or on the key, then torque the tie rod to specification.
12. If the die uses a .050" (1.3 mm) deep groove to locate the punches, it will be necessary to bump the punches against the critical side of the groove with a soft brass punch (arrow punches only). See the picture below showing how to bump the punches. Straight side and

standard WRSJ punches do not require bumping. After bumping the punches torque the hold down clamps to 32 ft-lb (44 N-m). Check the punches to make sure that they didn't move during the torquing process. If any of the punches moved bump them back against the locating groove. Once the punches are aligned and tightened remove the bolts from the starter spacer.



13. Next assemble upper die in much the same way the lower die was assembled, minus the starter spacer details. After the punches and spacers have been assembled in the proper order and tie rod and clamps installed and snugged, the two die halves are ready to be put back together to begin the final punch alignment process.
14. Assemble upper die to the lower die using adjustable die stops to prevent the punches from entering each other. Close the die against the stops set so that the punches are close to entering. Use a soft mallet to bump against the end of the row of upper punches as required attaining the proper alignment with the lower punches. Adjust the stops to allow the punches to engage each other, taking care not to allow the edges of the punches to contact each other. Once the punches are engaged continue to bump the end of the row of the upper punches to attain a uniform cutting clearance.



15. After bumping the punches, ***torque the hold down clamps to 32 ft-lb (44 N-m)***. Check the punches to make sure that they didn't move during the torquing process. This is best done by assembling the die again and closing the die until the punches engage each other. If any of the punches moved bump as required to attain the proper clearance.



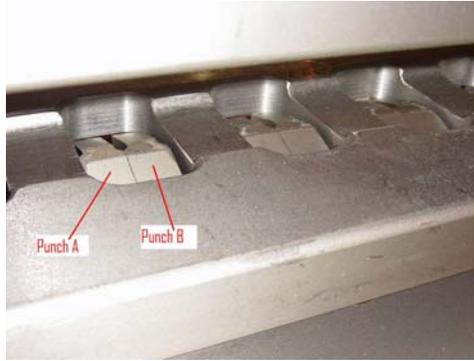
16. After sharp edges are restored, and the punches have been assembled to the die shoes, examine all urethane stripper springs for signs of rupture and excess deflection. If any show rupture cracks or have an overall relaxed length of less than 1 7/8" (48 mm), discard them and replace.
17. Examine the stripper plates for cracking and excess warping; straighten or replace as needed. It is recommended that the shoulder screws be replaced when the die is serviced. If full set of shoulder screws is not available for replacement check to see if any are bent or show thread damage and replace at least those that show wear or damage.
18. Restore the internal threads in die shoe as required with the proper size bottoming hand tap.
19. Replace and fasten the following in order before the final mating the upper and lower die.
  - The end blocks
  - The urethane plugs
  - The stripper plates
  - The stripper shoulder screws
    - 5/8" x 1 3/4" shoulder screws, tighten to 50 ft-lb (44 N-m)
    - 1/2" x 1 3/4" shoulder screws, tighten to 29 ft-lb (44 N-m)

When tightening the shoulder screws, once the stripper contacts the urethane springs evenly tighten all of the shoulder screws in 1/2 turn increments until all of the shoulder screws bottom against their shoulders. Then torque all of the screws three times to assure a full and uniform torque. The high pressure of the urethane springs can cause false torque readings.

Skip to section 8.6 and continue.

#### 8.4 Instructions for Restoring Cutting Edges on 15T Model Dies

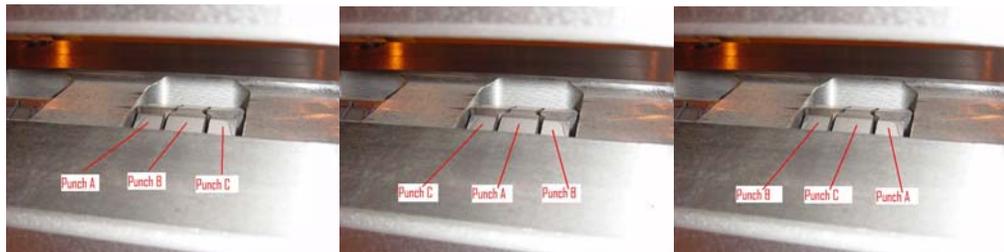
1. Begin disassembling the die in the same way as described in section 8.3 by removing the stripper plates and the urethane stripper plugs to expose the working punches.
2. Examine each cluster of punches to determine if there are unused cutting edges within each cluster. If the internal edges in each cluster are still sharp, you will be able to restore new cutting edges by switching the position of punch A and Punch B in each cluster. When switching the position of punches in the die, **do not** shuffle the order of the spacers and **do not** move any punches from one cluster to another. It is best to mark the punches as described section 8.3. See Illustration below.



3. Inspect the punches and replace if necessary as described in section 8.3.
4. If the internal cutting edges have all been used you may proceed with the grinding operation as described in items 8.3.
5. After grinding reassemble the die as described in section 8.3.  
Skip to section 8.6 and continue.

#### 8.5 Instructions for Restoring Cutting Edges on 225T Model Dies

1. Begin disassembling the die in the same way as described in section 8.3 by removing the stripper plates and the urethane stripper plugs to expose the working punches.
2. Examine each cluster of punches to determine if there are unused cutting edges within each cluster. If the internal edges in each cluster are still sharp, you will be able to restore new cutting edges by changing the position of punch A, Punch B, and Punch C in each cluster. When switching the position of punches in the die, ***do not*** shuffle the order of the spacers and ***do not*** move any punches from one cluster to another. It is best to mark the punches as described section 8.3. See Illustration below.



3. Inspect the punches and replace if necessary as described in section 8.3.
4. If the internal cutting edges have been used you may proceed with the grinding operation as described in section 8.3.
5. After grinding reassemble the die as described in section 8.3.

Skip to section 8.6 and continue.

#### 8.6 Instructions for Sharpening Splice Detection Hole Punch

1. If your die is fitted with the optional splice detection hole punch, you must now sharpen this unit.
2. If grinding an amount from the die plate equals to the amount removed from the stitching punches on the lower die will restore a sharp edge, proceed with removal of this amount.

3. If it is necessary to remove an amount greater than that removed from the stitching punches on the lower die, it will be necessary for you to construct a hard shim corresponding to the excess grinding required. If needed, make and place this shim directly under the hardened die plate.
4. If grinding an amount from the splice detection hole punch equals to the amount removed from the punches on the upper die will restore a sharp edge, proceed with removal of this amount.
5. If sharpen grinding beyond the amount taken from the stitching punches on the upper die is required, discard and replace the hole punch. Replace the urethane stripper surrounding the hole punch if necessary.

## **9 RETURNING THE DIE BACK TO SERVICE**

### **9.1 Replacing the Die**

1. The die may now be reassembled. Then it can be placed back into the machine in the reverse order as described in section 7. The die must be oriented back in the press as originally assembled. Observe markings that were made prior to removing die from press.
2. It will now be necessary to make an adjustment to the stitch depth switch to compensate for the shorter punches. The required adjustment should be equal to the sum total of the material removed from the length of the upper and lower punch.