



## CONING, THREADING, BENDING TOOL OPERATION HP TUBING CONNECTION PROCEDURES

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# CONING, THREADING, AND BENDING TOOL OPERATION HP TUBING CONNECTION PROCEDURES

## 1. Overview

H2O Jet manufactures a manual coning and threading tool for optimal performance with HP tubing sizes of 1/4", 3/8" and 9/16" outside diameters. H2O Jet also offers a manual bending tool that will bend 1/4" and 3/8" HP tubing. These high quality precision tools allow the customer to prepare HP tubing installations on site. One coning, one bending, and one threading tool with optional accessories allows the user to prepare all sizes of HP tubing. This eliminates the need for multiple tools of differing sizes.

Safe and proper operation is dependent on correctly prepared and installed connections. High pressure tubing and fittings must be appropriately rated and sized. Tubing lengths must be coned, threaded and bent prior to installation.



Failure to use properly rated components may result in component failure causing equipment damage, personal injury or death.

## 2. Measurements and Dimensions

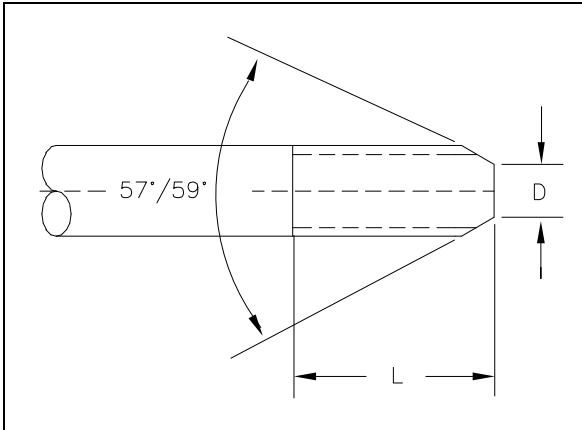
Tubing must be cut to the proper length and bent to the desired angle. Both ends of the tubing must then be coned, threaded and deburred.

To determine the length of straight pieces of tubing, measure the distance between the fittings, and add two times the engagement allowance shown in Table 1. The required cone and thread dimensions illustrated in Figure 1 are provided in Table 2.

**Table 1**  
**Engagement Allowance**

Tube Size	Engagement Allowance (EA)	Tube Length
1/4" HP	0.49" (12.4 mm)	<p style="text-align: center;">TUBE LENGTH = LENGTH + 2(EA)</p>
3/8" HP	0.68" (17.3 mm)	
9/16" HP	0.86" (21.8 mm)	

Figure 1: Cone and Thread Dimensions



**Table 2**  
**Cone and Thread Dimensions**  
**High Pressure Connections**

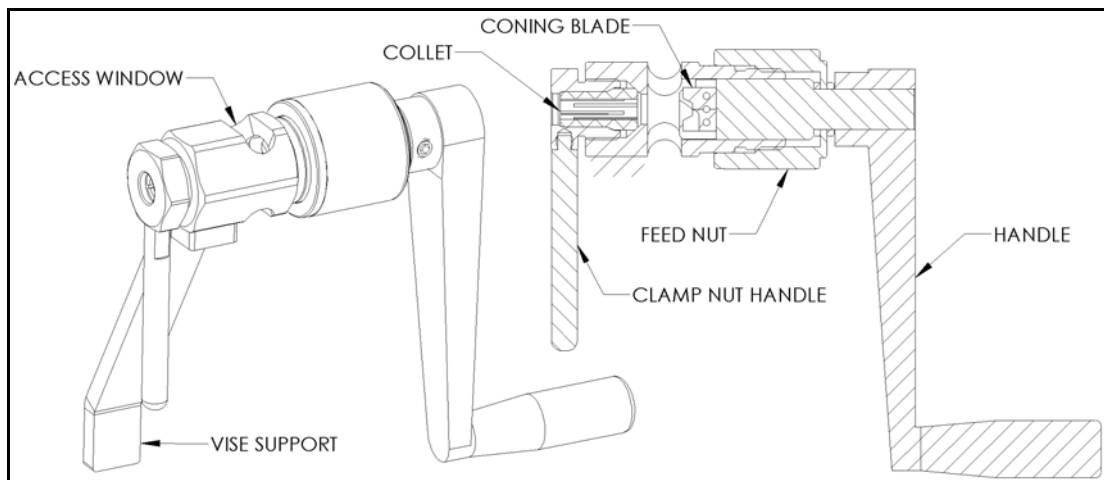
Tube OD	Tube ID	D (Maximum)	L (Minimum)	Thread UNF-LH
1/4" (6.35 mm)	0.083" (2.11 mm)	0.125" (3.2 mm)	0.56" (14.2 mm)	1/4" - 28
3/8" (9.52 mm)	0.125" (3.18 mm)	0.219" (5.6 mm)	0.75" (19.1 mm)	3/8" - 24
9/16" (14.29 mm)	0.188" (4.78 mm)	0.281" (7.1 mm)	0.94" (23.9 mm)	9/16" - 18

### 3. Tube Coning

The coning tool offers interchangeable collets and blades for each size of tubing, and works to keep the tubing concentric for a perfect cone. The integrated vise arm allows easy installation of the tubing, free access to the clamp nut, and unobstructed use of the handle. The coning blade is designed to square-off and finish the end of the tubing when the cone is completed. A sight window allows for easy application of lubricants and cleaning out of metal chips.

1. Completely deburr the outside of the tubing.
2. Place the vice support in a vise allowing adequate clearance for the rotation of the handle. Ensure the proper coning bit and collet are installed for the size of tubing you plan on coning. See Table 5 for coning tool parts.

**Figure 2: Coning Tool**



3. Turn the feed nut counter-clockwise to retract the cutting blade past the access window.
4. Loosen the gland nut and insert the tubing through the collet. The end of the tubing should be even with the access window, but should not contact the cutting blade. Loosely tighten the clamp nut to slightly grip the tubing.
5. Turn the feed nut counter-clockwise 1/4 turn to retract the cutting blade away from the tubing, and tighten the clamp nut by hand or with a wrench.
6. Apply a liberal amount of cutting lubricant to the exposed end of the tubing and the cutting blade.

Apply lubricant frequently and liberally throughout the cutting operation. Medium weight cutting oil with high sulfur content is recommended.

7. In a smooth, continuous motion, turn the handle in a clockwise direction. Simultaneously turn the feed nut in a clockwise direction to establish a constant feed. Do not remove too much material at once; the cutting blade should make light, uninterrupted cuts.

**NOTE**

Before interrupting the cut, back the coning blade away from the tubing. Use compressed air or a small brush to remove the accumulation of chips from the blade and the tubing throughout the coning operation.

8. Continue the operation until the blade begins to cut the land area at the base of the cone. Turn the handle several more rotations to face-off the end of the cone.
9. Retract the coning blade, loosen the gland nut and remove the tubing. Inspect the cone for surface finish and completeness. Ensure there is minimal chatter and no longitudinal lines on the coned area.

**NOTE**

Clean the machining chips from the blade and from the collet before coning the next piece of tube.

**Coning Blade and Collet Removal and Replacement**

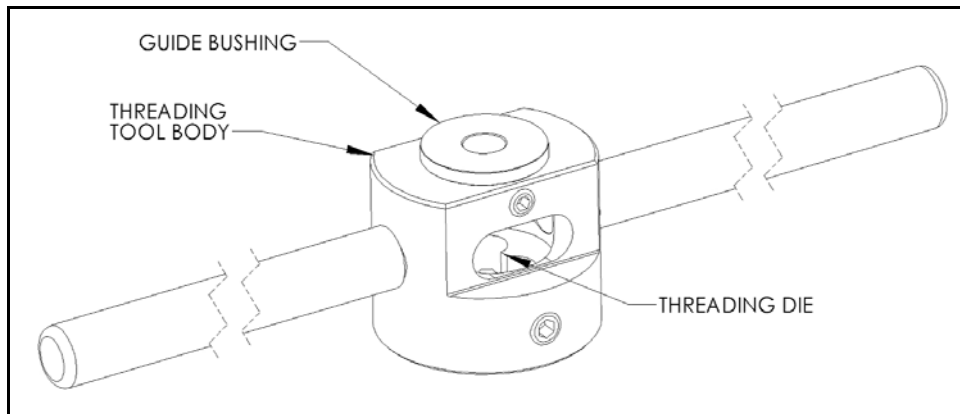
10. To remove the blade, first begin by completely unthreading the feed nut and remove from the assembly. This will expose the coning bit.
11. Loosen the #10 set screw holding the coning blade in place. Remove the coning blade.
12. Thoroughly clean the pocket where the coning blade will sit of debris.
13. Center the new coning bit in the pocket, being careful to line up the set screw with the center hole of the coning bit.
14. Tighten the set screw and re-thread the feed nut onto the assembly.
15. Remove the clamp nut and collet.
16. Thoroughly clean the pocket of the clamp nut and housing where the collet is installed.
17. Re-install collet.

#### 4. Tube Threading

The threading tool allows the user to select the corresponding guide bushing and threading die to easily thread 1/4", 3/8" and 9/16" HP tubing. The guide bushing provides proper centering of the tubing, and its bronze material eliminates any marring of the tubing during threading.

1. Secure the coned tubing in a tube vise. Use only a vise with soft jaws as to not damage the tubing. No more than the recommended length of tubing should extend beyond the face of the vice. See Table 3, Recommended Extension Length.

**Figure 3: Threading Tool**



2. Ensure the proper threading die and guide bushing are installed for the size of tubing you plan on threading. See Table 6 for threading tool parts.
3. Apply lubricant to the end of the tube and slide the threading tool on the tubing.
4. Grip the handles of the tool firmly, apply steady pressure and turn the tool **counter-clockwise**. Approximately every half turn, reverse direction to break off and remove the chips.

Apply lubricant frequently and liberally throughout the cutting operation. Medium weight cutting oil with high sulfur content is recommended.

5. Continue threading until the proper thread length is reached. See Table 2, Column L. Remove the tool from the end of the tubing.

**NOTE**

Clean the machining chips from the die and body of the tool before threading the next tube.

**Table 4**  
**Recommended Extension Length**

1/4" Tubing	1.25-1.50" (31.8-38.1 mm)
3/8" Tubing	1.25-1.50" (31.8-38.1 mm)
9/16" Tubing	1.75-2.00" (44.5-50.8 mm)

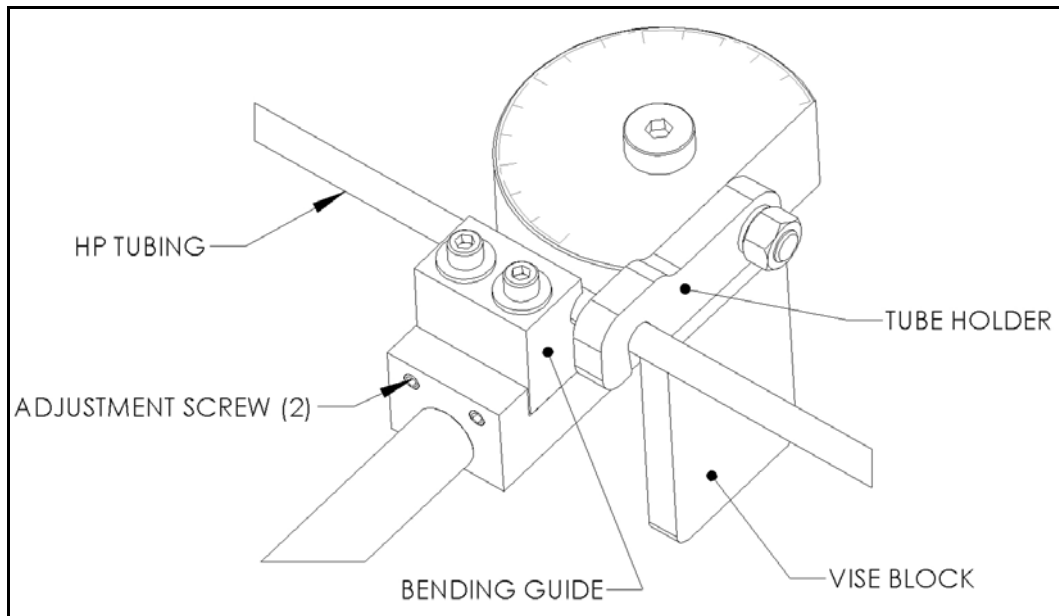
### **Threading Die and Guide Bushing Removal and Replacement**

6. To remove the threading die, first loosen both 5/16" set screws holding the die in place. Remove threading die.
7. Thoroughly clean the pocket where the threading die sits.
8. Install a new threading die so that the lettering on the die face down towards the guide bushing. This ensures the proper orientation of the leading thread.
9. Line up the two recessed pockets on the sides of the die with the set screws. Slightly tighten one set screw, then fully tighten the opposite set screw, ensuring they engage the recessed pockets.
10. Remove the guide bushing by loosening 1/4" set screw.
11. Thoroughly clean the pocket where the guide bushing sits.
12. Reinstall the correct sized guide bushing for the size of tubing you plan to use. Tighten set screw.

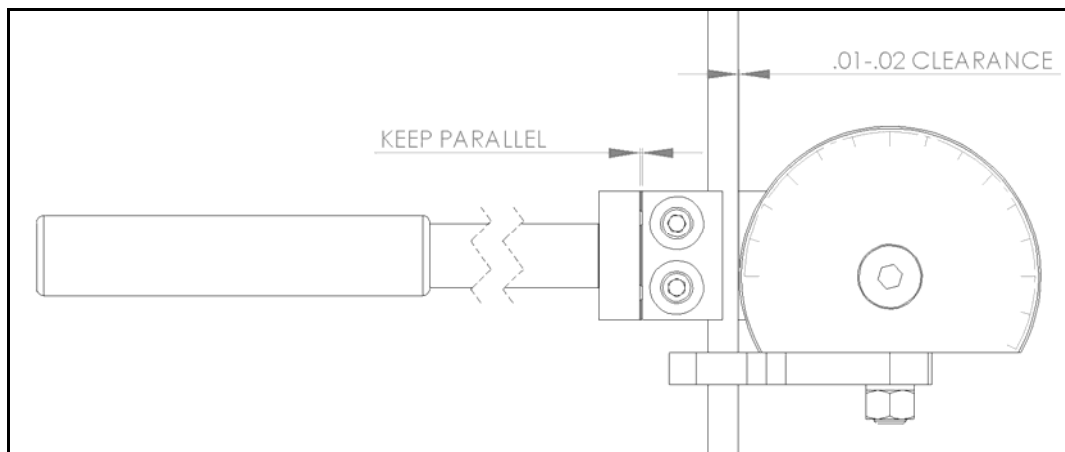
## 5. Tube Bending

The tube bending tool allows proper bending of both 1/4" and 3/8" HP tubing. This is achieved by use of a removable bending guide and tube holder. The tool allows up to 180° bends to be achieved with a radius of 1.75".

*Figure 4: Bending Tool Components*



*Figure 5: Bending Tool Setup*



1. Tightly clamp the vise block in a secure vice that prevents movement during bending.
2. Before bending your first piece of tubing or after changing tubing sizes, the bending guide needs to be adjusted for proper clearance. If you have not changed tubing sizes since the last bend, continue to step 7. Otherwise continue to step 3. See Table 7 for bending tool parts.
3. Loosen the two screws on the top of the bending guide.

4. Slide a piece of HP tubing into the tool and lock it in place with the tube holder.
5. Turn the two adjustment screws equally so that a .010" to .020" clearance is maintained between the tubing and the bending radius block.
6. Tighten the two screws on top of the bending guide and re-check clearance.
7. Lightly coat the hp tubing with oil to prevent tearing of the tubing during bending.
8. Align the tubing as desired and perform bend. Note that you may need to exceed the desired bend angle slightly as the tubing will spring back slightly after released.
9. Return the bending handle to the starting point and release the tube holder. The tubing can now be removed from the bending tool.

## 6. High Pressure Connection Procedure

When installing discharge piping it is essential that all burrs be carefully removed and the tubing sections purged with clean compressed air prior to assembly. Lightly spraying the inside of the tube with a carrier fluid, such as WD-40, before purging with air will help carry the burrs.

Piping must be installed without torsional or bending stresses and proper supports and guides must be provided. Torsional stress will cause premature component failure.

Blue Goop anti-seize lubricant must be applied to the threads and contact surfaces of all stainless steel components prior to assembly. Failure to lubricate components with Blue Goop will result in galling, rendering the components useless.

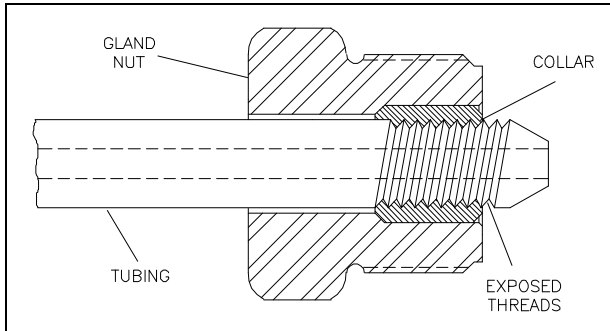


**Do not** use any other anti-seize compound. Apply Blue Goop **only to stainless steel** components.

## Standard Connections

Standard connections are used for general applications where internal pressure is the only load on the tubing.

**Figure 6: Standard High Pressure Connections**



1. Deburr the tubing ID and thoroughly clean the tubing threads.
2. Slip the gland nut onto the tubing.
3. Screw the collar onto the threaded end of the tubing leaving 1-1/2 to 2-1/2 threads exposed on the tubing between the collar and the coned tubing.
4. Apply Blue Goop to the male threads on the gland nut and insert the tubing into the connection. Engage the gland nut and tighten finger tight.
5. Tighten the gland nut to the torque specifications in Table 4.



Proper piping supports and guides must be provided. End connections will not support the tubing load alone.

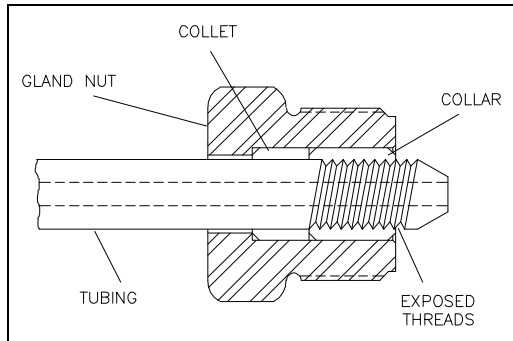
**Table 4**  
**Torque Specifications**

	<b>High Pressure</b>
1/4" Tubing	25 ft-lb (34 Nm)
3/8" Tubing	50 ft-lb (68 Nm)
9/16" Tubing	110 ft-lb (149 Nm)

### Anti-Vibration Connections

The bending stresses resulting from excessive vibration or shock on the threaded area of the tubing can cause premature failure at the back of the thread. When tubing will be subjected to vibration, rotation and movement, anti-vibration connections must be used. The anti-vibration collet gland transfers the stress to the unthreaded section of the tubing, and the gripping action of the collet strengthens the entire assembly.

**Figure 7: Anti-Vibration Connections**



1. Deburr the tubing ID and thoroughly clean the tubing threads.
2. Slip the gland nut and the collet onto the tubing.
3. Screw the collar onto the threaded end of the tubing leaving 1-1/2 to 2-1/2 threads exposed on the tubing between the collar and the coned tubing.
4. Apply Blue Goop to the male threads on the gland nut and insert the tubing into the connection. Engage the gland nut and tighten finger tight.
5. Tighten the gland nut to the torque specifications in Table 4.

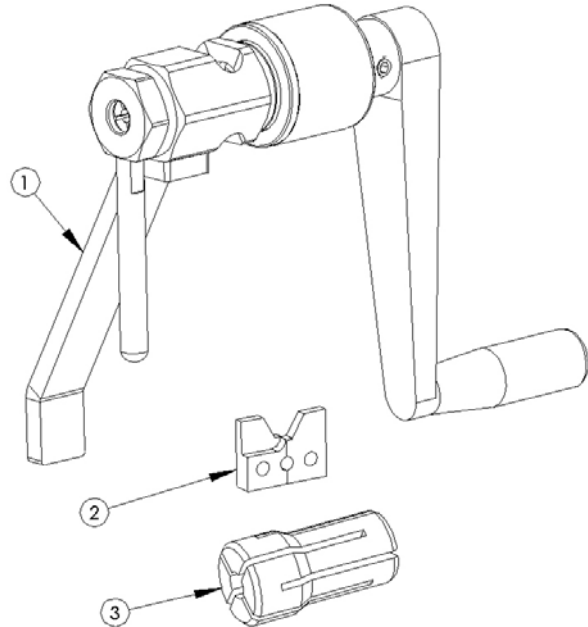
When a flexible whip is used to allow cutting nozzle movement, anti-vibration fittings and proper supports and guides must be provided to prevent failures from non-water related stresses. The whip will only flex in a single plane without being subjected to torsional stress.

## 7. Parts List

To facilitate the ordering of replacement parts, item numbers in the following tables correspond to the identifying numbers in the accompanying figures.

**Table 5**  
**Coning Tool Parts**

Item	Part Number	Description
<b>High Pressure (60,000 psi)</b>		
1	301044-1	Coning Tool Assembly, .25"
	301044-2	Coning Tool Assembly, .38"
	301044-3	Coning Tool Assembly, .56"
2	05108808	Coning Blade, .25"
	05108824	Coning Blade, .38"
	05108816	Coning Blade, .56"
3	400029-5	Collet, 1/4"
	400029-6	Collet, 3/8"
	400029-7	Collet, 9/16"



**Table 6**  
**Threading Tool Parts**

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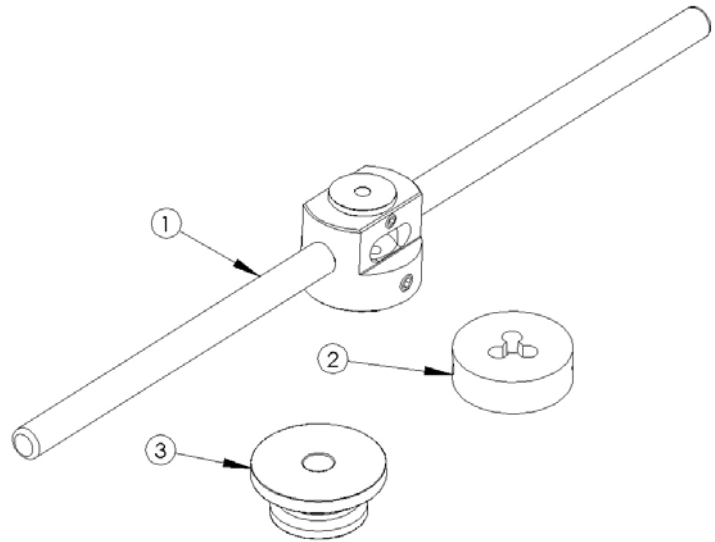
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Item	Part Number	Description
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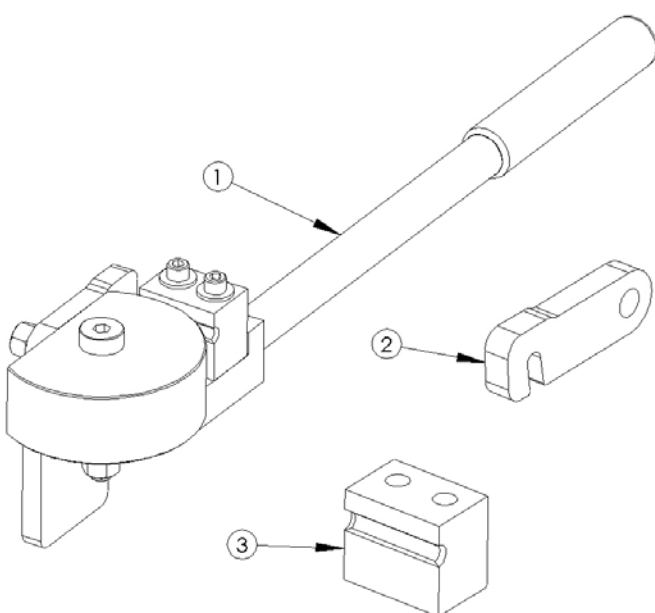
**High Pressure (60,000 psi)**

1	301043-1	Threading Tool Assembly, .25"
	301043-2	Threading Tool Assembly, .38"
	301043-3	Threading Tool Assembly, .56"
2	400118-1	Thread Die, .25"
	400118-2	Thread Die, .38"
	400118-3	Thread Die, .56"
3	100280-1	Bushing, .25"
	100280-2	Bushing, .38"
	100280-3	Bushing, .56"



**Table 7**  
**Tube Bending Tool Parts**

Item	Part Number	Description
<b>High Pressure (60,000 psi)</b>		
1	301045-1	Tube Bender, .25"
	301045-2	Tube Bender, .38"
2	100281-1	Tube Holder, .25"
	100281-2	Tube Holder, .38"
3	100282-1	Bending Guide, .25"
	100282-2	Bending Guide, .38"



**Table 8**  
**Tool Accessories**

Part Number	Description
400120-1	Coning and Threading Oil, Sulfur Based
400029-8	Deburr Tool for HP Tubing
400001-1	Blue Goop Anti-Galling Lubricant (2oz Tube)
400350-1	Tool Box
05108782	Tube Vise, .25"
05108790	Tube Vise, .38"
05108774	Tube Vise, .56"



**Coning, Threading , and Bending Tool Operation**  
*HP Tubing Connection Procedures*



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