



## CONING, THREADING, BENDING TOOL OPERATION

### *HP TUBING CONNECTION PROCEDURES*

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**H2O JET, INC.**



H2O Jet  
1145 85<sup>th</sup> Ave SE  
Tumwater, WA 98501

Phone: (866) WATERJET  
Fax: (360) 866-7610  
Email: [info@waterjetparts.com](mailto:info@waterjetparts.com)

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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 the HP tubing outside diameter sizes of 1/4", 3/8" and 9/16". 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. Having one coning, one bending, and one threading tool with optional accessories allows the user to prepare all sizes of HP tubing, eliminating 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

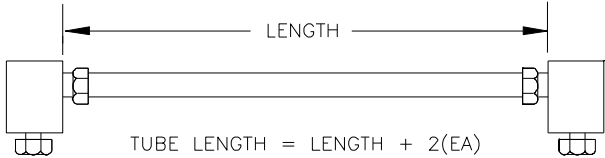
Tubing must be cut to the proper length and bent to the desired angle. Both ends of the tubing must then be coned, threaded, and deburred.

To determine the length of straight pieces of tubing:

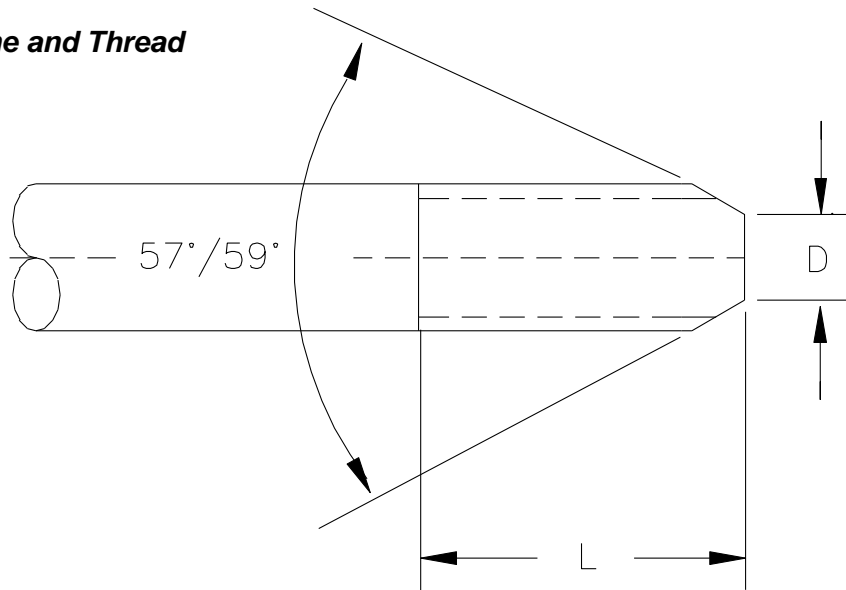
- 1) measure the distance between the fittings;
- 2) add two times the engagement allowance shown in Table 1.

The required cone and thread dimensions illustrated in Figure 1 are provided in Table 2.

**Table 1 - Engagement Allowance**

	Engagement Allowance (EA)	Tube Length
1/4" HP	0.49" (12.4 mm)	
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**  
**60,000 psi 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

**Table 3**  
**Cone and Thread Dimensions**  
**94,000 psi High-Pressure Connections**

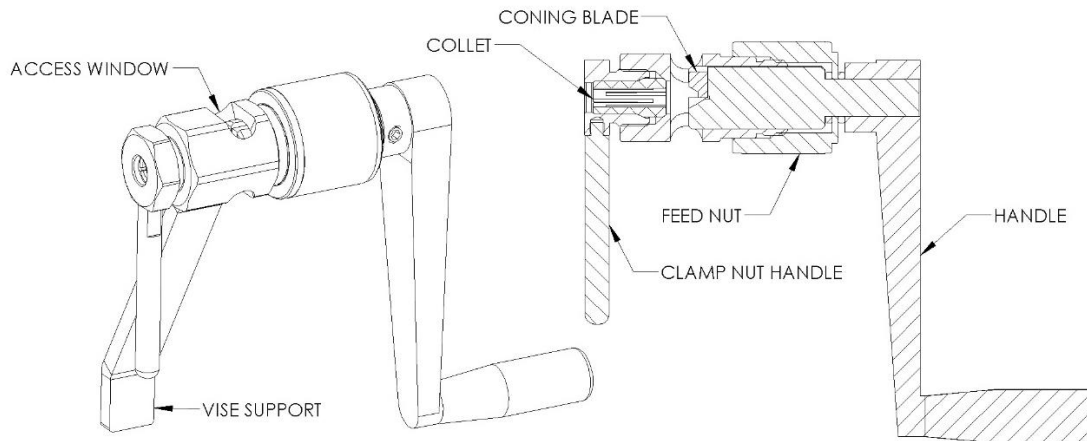
Tube OD	Tube ID	D (Maximum)	L (Minimum)	Thread UNF-LH
1/4" (6.35 mm)	0.083" (2.11 mm)	0.125" (3.2 mm)	0.56" (14.2 mm)	1/4" - 24
3/8" (9.52 mm)	0.125" (3.18 mm)	0.219" (5.6 mm)	0.75" (19.1 mm)	3/8" - 24
9/16" (14.29 mm)	0.188" (4.78 mm)	0.281" (7.1 mm)	0.94" (23.9 mm)	9/16" - 18

### 3. TUBE CONING - MANUAL

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 support 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. An access window allows for easy application of lubricants and the cleaning out of metal chips.

1. Completely deburr the outside of the tubing.
2. Place the vise support in a vise that allows enough clearance for the rotation of the handle. Ensure that the installed coning bit and collet match the size of tubing you plan to cone. (See Table 7, 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. (*Note: the end of the tubing should be even with the blade side of the access window, but should not contact the cutting blade.*) At this stage, tighten the clamp nut only enough so that it slightly grips the tubing.
5. To keep the blade away from the tubing, give the feed nut a 1/4 counter-clockwise turn. Fully 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.

*Throughout the cutting operation, apply lubricant liberally and frequently. Medium-weight cutting oil with high sulfur content is recommended.*

7. In a smooth, continuous motion, turn the handle in a clockwise direction and 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. Throughout the coning operation, use compressed air or a small brush to remove the accumulation of chips from the blade and the tubing.

8. Continue the operation until the blade begins to cut the land area at the base of the cone. To face-off the end of the cone, turn the handle several more rotations.
9. Retract the coning blade, loosen the gland nut, and remove the tubing. Inspect the cone for surface finish and completeness. Ensure that the coned area is free of longitudinal lines and has minimal chatter.

**NOTE:**

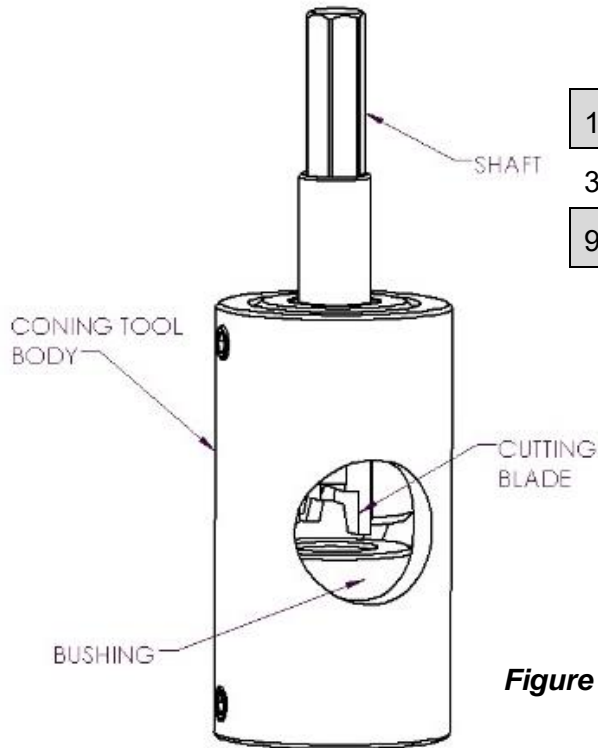
Before coning the next piece of tube, clean the machining chips from the blade and from the collet.

## **Coning Blade and Collet Removal and Replacement**

10. To remove the blade, start by completely unthreading the feed nut and removing it 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 debris from the pocket where the coning blade will sit.
13. Insert the coning bit into the pocket. Ensure that the bit is placed all the way in toward the center.
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 CONING - POWER**

1. Secure the tubing in a tube vise. Be sure that no more than the recommended length of tubing extends beyond the face of the vise. (See Table 4, Recommended Extension Length.)



**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)

**Figure 3: Power Coning Tool**

2. Mount the coning tool in a 3/8" or 1/2" variable speed power drill. Lubricate the end of the tube and slide the coning tool on the tubing.
3. Apply steady pressure against the end of the tubing while the cone is being cut. The tool can be removed for inspection at any time during the coning operation.

*Throughout the cutting operation, apply lubricant liberally and frequently. Medium-weight cutting oil with high sulfur content is recommended.*

4. Stop the tool when you attain the correct tube angle and face.

**NOTE:**

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

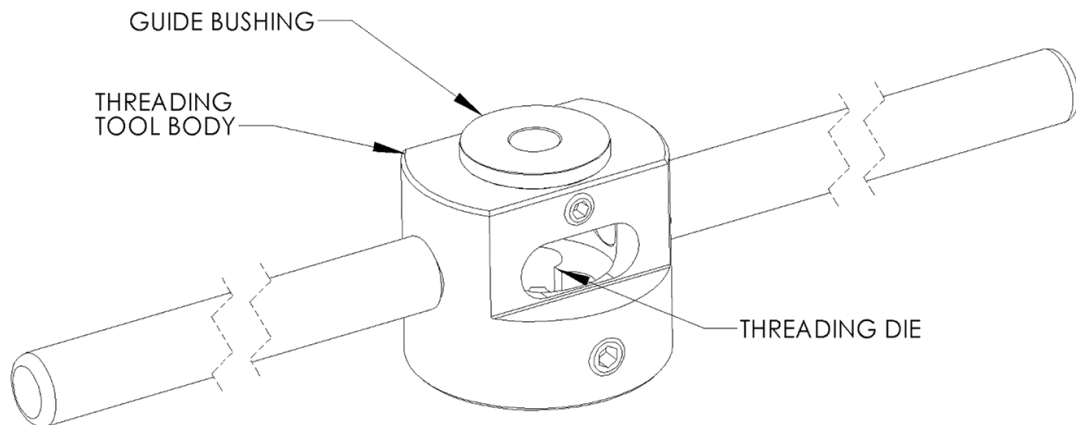


## 5. TUBE THREADING - MANUAL

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 to avoid damaging the tubing. No more than the recommended length of tubing should extend beyond the face of the vice. (See Table 4, Recommended Extension Length.)

**Figure 5: Threading Tool - Manual**



2. Ensure the proper threading die and guide bushing are installed for the size of tubing you plan on threading. (See Table 8, 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.

*Throughout the cutting operation, apply lubricant liberally and frequently. Medium-weight cutting oil with high sulfur content is recommended.*

5. Continue threading until the proper thread length is reached. (See Column L in Table 2 or Table 3, Cone and Thread Dimensions.) 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**

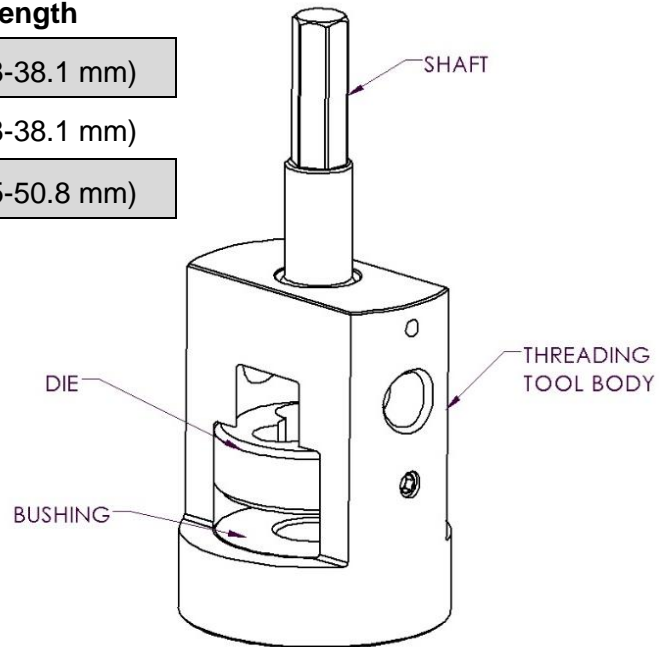
- To remove the threading die, first loosen both 5/16" set screws holding the die in place. Remove threading die.
- Thoroughly clean the pocket where the threading die sits.
- Install a new threading die so that the lettering on the die faces down towards the guide bushing. This ensures the proper orientation of the leading thread.
- 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 that they engage the recessed pockets.
- Remove the guide bushing by loosening the 1/4" set screw.
- Thoroughly clean the pocket where the guide bushing sits.
- Reinstall the correct-sized guide bushing for the size of tubing you plan to use. Tighten the set screw.

## 6. TUBE THREADING - POWER

1. Secure the coned tubing in a tube vise. No more than the recommended length of tubing should extend beyond the face of the vice. (See Table 4, Recommended Extension Length.)

**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)



**Figure 6: Threading Tool - Power**

2. Mount the threading tool in a 3/8" or 1/2", variable speed power drill. Apply lubricant to the end of the tube and slide the threading tool on the tubing.
3. Make sure the drill is set to turn counter-clockwise. Apply steady pressure against the end of the tubing while the threads are being cut.

*Throughout the cutting operation, apply lubricant liberally and frequently. Medium-weight cutting oil with high sulfur content is recommended.*

4. Continue threading until the proper thread length is reached. (See Column L in either Table 2 or Table 3.) Reverse the direction of the drill and remove the threading tool.

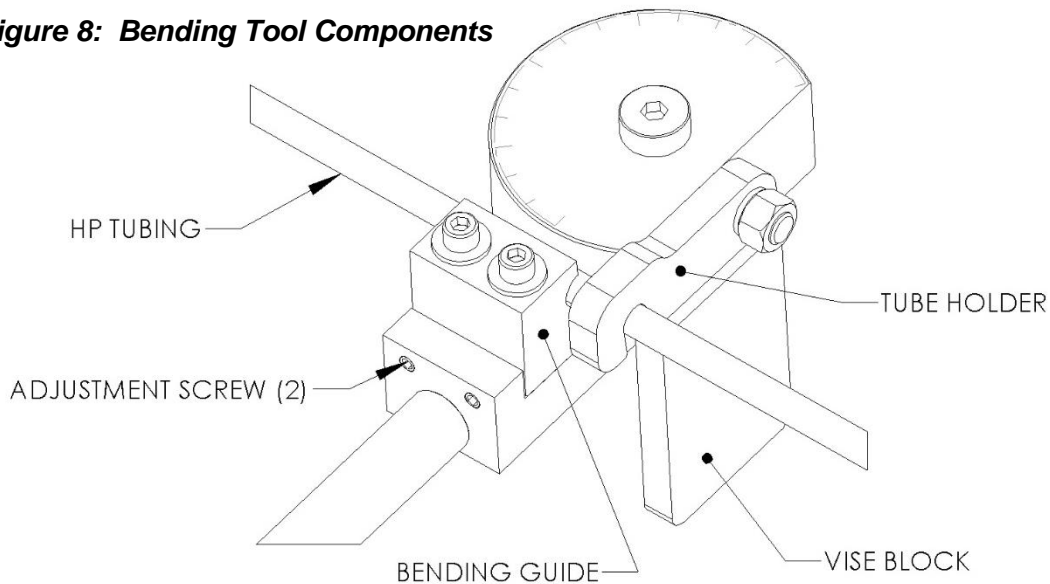
**NOTE:**

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

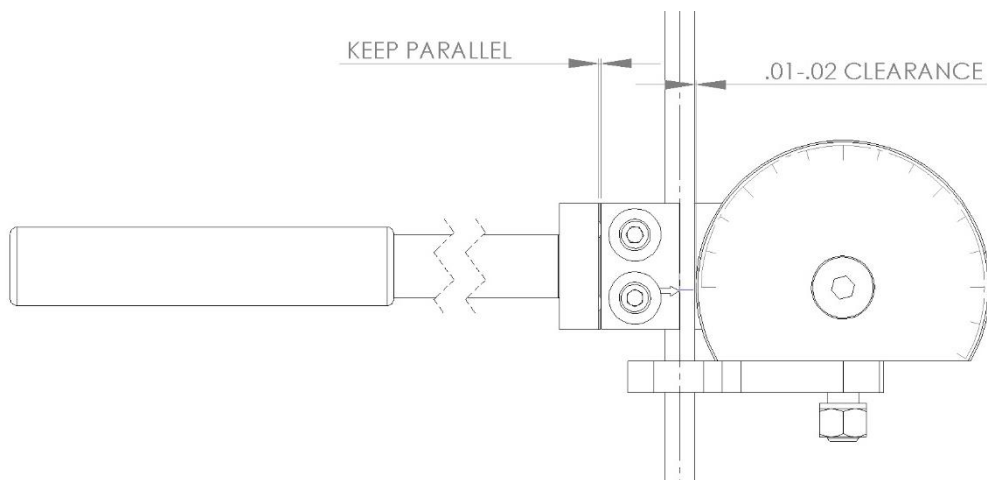
## 7. TUBE BENDING

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 8: Bending Tool Components**



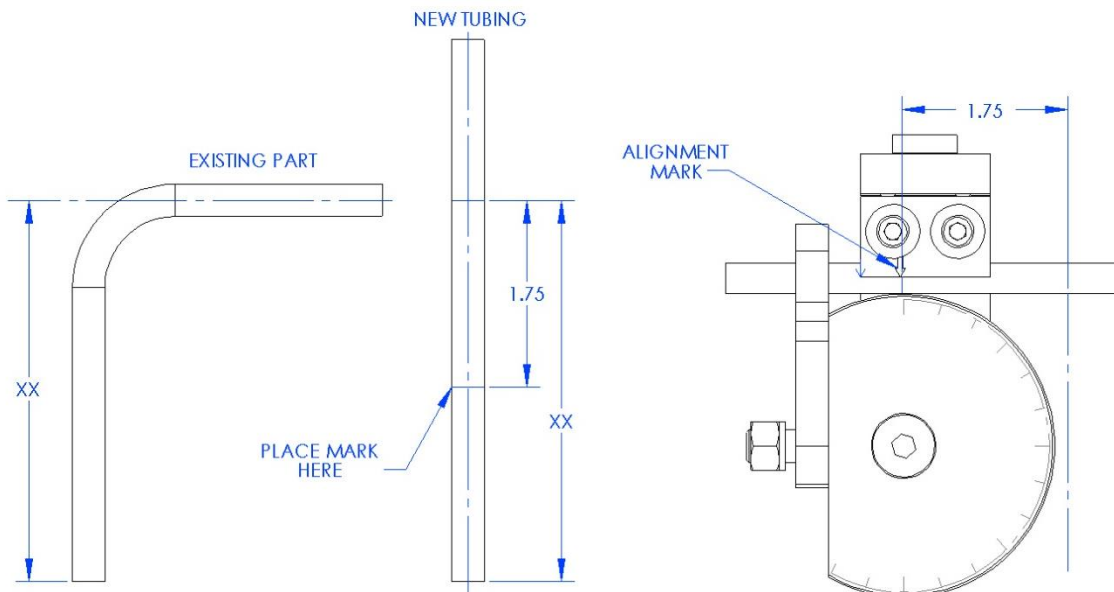
**Figure 9: Bending Tool Set-Up**



1. Tightly clamp the vise block in a secure vise to prevent movement during bending.
2. Before bending your first piece of tubing, or after changing tubing sizes, the bending guide will need to be adjusted for proper clearance. If you have not changed tubing sizes since the last bend, go ahead to step 7. Otherwise, continue with step 3. (See Table 9, Tube-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. To align the tubing correctly, measure the original part from the end of the tubing to the centerline of the tubing after the radius. (See Figure 10: Measurement Diagram.) Now subtract 1.75" from this measurement and mark the distance from one end of the new tubing.
9. Place the tubing into the bending tool—the mark you just made will need to line up with the alignment arrow and the 0 degree mark on other side.
10. Bend tubing to desired angle. *Note that you may need to exceed the desired bend angle slightly as the tubing will spring back a little after it is released.*
11. Return the bending handle to the starting point and release the tube holder. The tubing can now be removed from the bending tool.

**Figure 10: Measurement Diagram**



## 8. HIGH-PRESSURE CONNECTION PROCEDURE

When installing discharge piping, it is essential that you:

- 1) carefully remove all burrs by lightly spraying the inside of the tube with a carrier fluid (such as WD-40);
- 2) purge the tubing sections with clean compressed air.

Piping must be installed without torsional or bending stresses (to avoid premature component failure). Proper supports and guides must be provided.

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

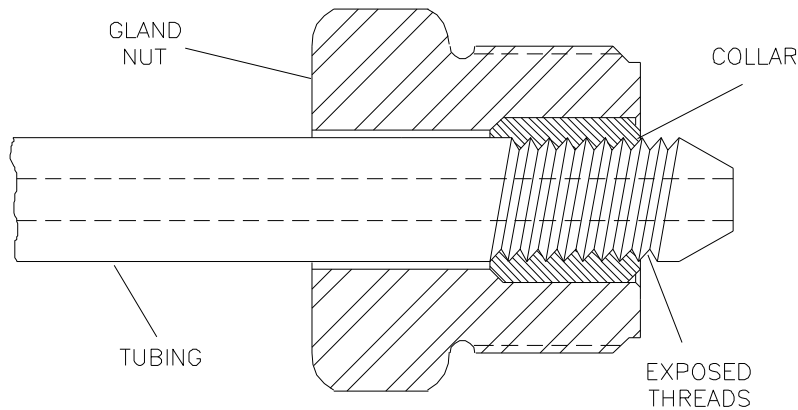


**Do not use** any anti-seize compound other than Blue Goop.  
Apply Blue Goop **only to stainless steel** components.

## Standard Connections

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

**Figure 11: 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 it finger-tight.
5. Tighten the gland nut to the torque specifications in Table 6.



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

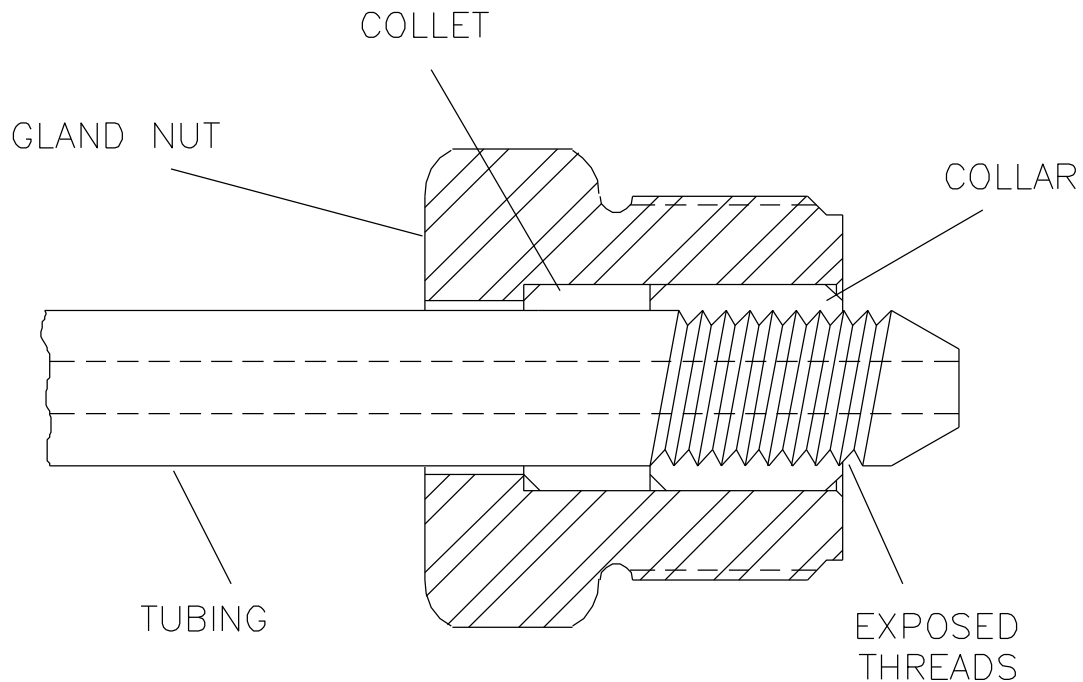
**Table 6**  
**Torque Specifications**

	High-Pressure
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 12: 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 6.

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 when it is not subjected to torsional stress.



## 9. 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 7**  
**Coning Tool Parts**

Item	Part Number	Description
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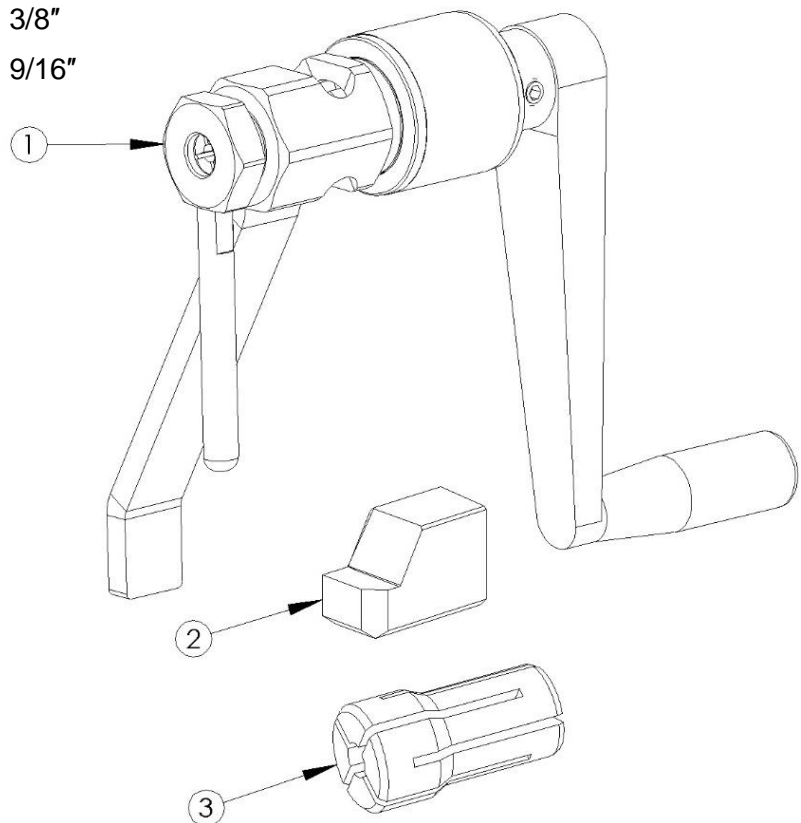
**High-Pressure (60,000 psi & 94,000 psi)**

- |   |          |                             |
|---|----------|-----------------------------|
| 1 | 301044-1 | Coning Tool Assembly, 1/4"  |
|   | 301044-2 | Coning Tool Assembly, 3/8"  |
|   | 301044-3 | Coning Tool Assembly, 9/16" |

- |   |          |                     |
|---|----------|---------------------|
| 2 | 400029-2 | Coning Blade, 1/4"  |
|   | 400029-3 | Coning Blade, 3/8"  |
|   | 400029-4 | Coning Blade, 9/16" |

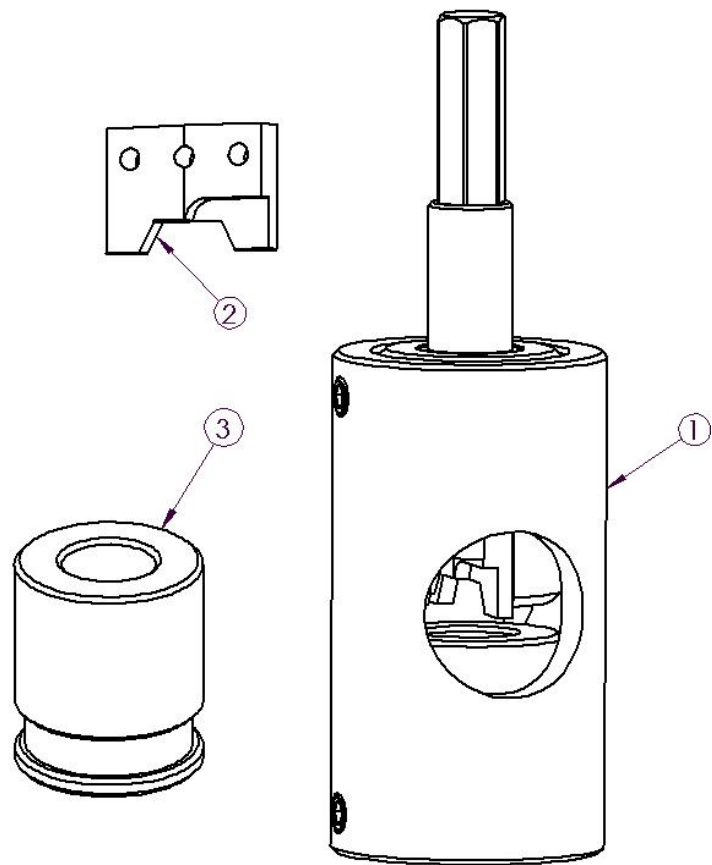
- |   |          |               |
|---|----------|---------------|
| 3 | 400029-5 | Collet, 1/4"  |
|   | 400029-6 | Collet, 3/8"  |
|   | 400029-7 | Collet, 9/16" |

**Figure 13: Coning Tool Parts**



<b>Table 5 – Power Coning Tool Part Numbers</b>		
<b>Assembly</b>		
<b>1</b>	301064-1	Power Coning Tool Assembly 1/4"
	301064-2	Power Coning Tool Assembly 3/8"
	301064-3	Power Coning Tool Assembly 9/16"
<b>Blade Only</b>		
<b>2</b>	400136-1	Coning Blade 1/4"
	400136-2	Coning Blade 3/8"
	400136-3	Coning Blade 9/16"
<b>Bushing Only</b>		
<b>3</b>	100285-1	Bushing 1/4"
	100285-2	Bushing 3/8"
	100285-3	Bushing 9/16"

**Figure 4: Power Coning Tool Components**



**Table 8**  
**Threading Tool Parts**

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**Item Part Number Description**

---

**High-Pressure (60,000 psi & 94,000 psi)**

1	301043-1	Threading Tool Assembly, 1/4" (60,000 psi only)
	391043-1	Threading Tool Assembly, 1/4" (94,000 psi only)
	301043-2	Threading Tool Assembly, 3/8"
	301043-3	Threading Tool Assembly, 9/16"
2	400118-1	Thread Die, 1/4" (60,000 psi only)
	490118-1	Thread Die, 1/4" (94,000 psi only)
	400118-2	Thread Die, 3/8"
	400118-3	Thread Die, 9/16"
3	100280-1	Bushing, 1/4"
	100280-2	Bushing, 3/8"
	100280-3	Bushing, 9/16"

**Figure 14: Threading Tool Parts**

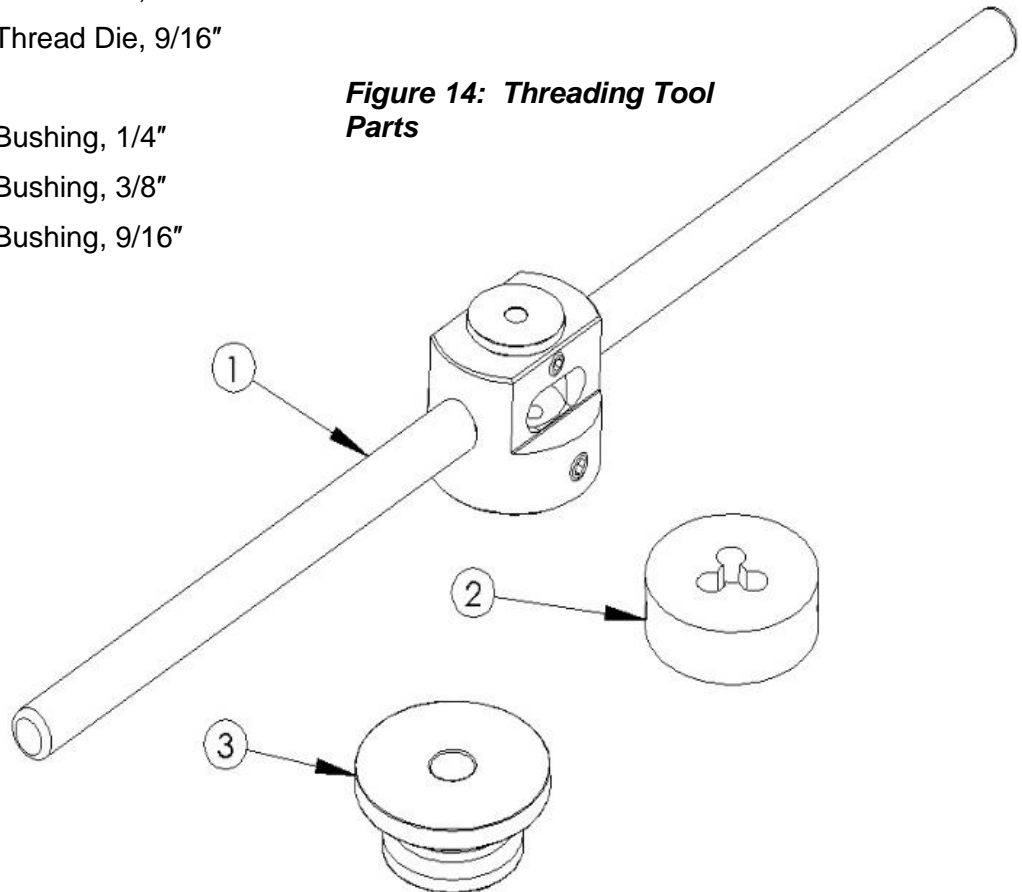
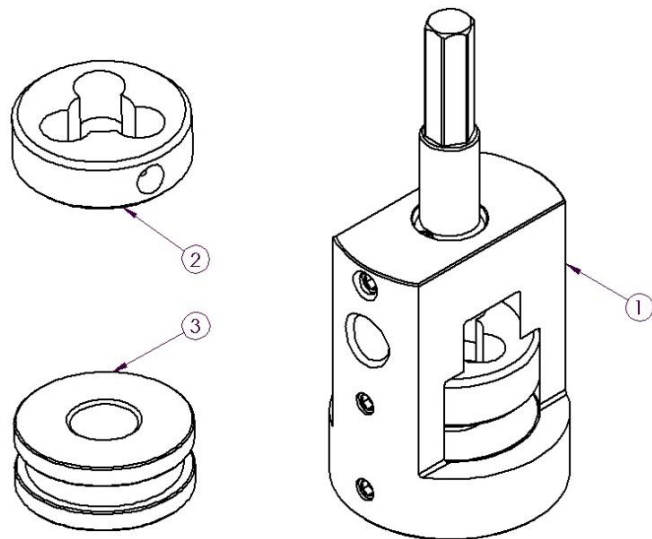


Table 5 – Power Threading Tool Part Numbers		
<b>Assembly</b>		
<b>1</b>	301063-1	Power Threading Tool Assembly 1/4"
	301063-2	Power Threading Tool Assembly 3/8"
	301063-3	Power Threading Tool Assembly 9/16"
<b>Die Only</b>		
<b>2</b>	400118-1	Coning Blade 1/4"
	400118-2	Coning Blade 3/8"
	400118-3	Coning Blade 9/16"
<b>Bushing Only</b>		
<b>3</b>	100283-1	Bushing 1/4"
	100283-2	Bushing 3/8"
	100283-3	Bushing 9/16"

**Figure 7: Power Threading Tool Components**



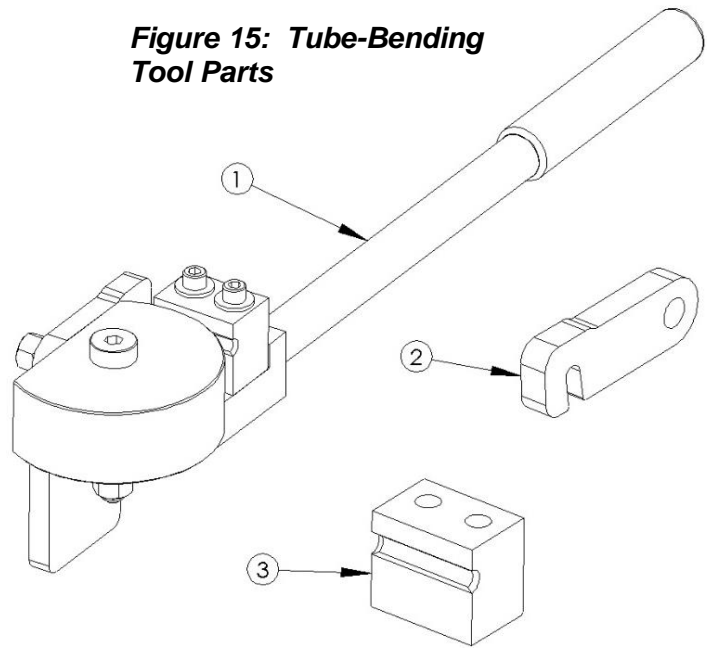
**Table 9**  
**Tube-Bending Tool Parts**

Item	Part Number	Description
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**High-Pressure (60,000 psi & 94,000 psi)**

1	301045-1	Tube Bender, 1/4"
	301045-2	Tube Bender, 3/8"
2	100281-1	Tube Holder, 1/4"
	100281-2	Tube Holder, 3/8"
3	100282-1	Bending Guide, 1/4"
	100282-2	Bending Guide, 3/8"

**Figure 15: Tube-Bending Tool Parts**



**Table 10**  
**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, 1/4"
05108790	Tube Vise, 3/8"
05108774	Tube Vise, 9/16"



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

Date	Rev. Id.	Description of Change	Written by	Checked by	Approved by
May 25, 2011	0	Created.			
Feb 16, 2017	A	Incorporated new material: Power Coning and Power Threading.	Robert Garabedian	LJ	HA



H2O Jet  
1145 85<sup>th</sup> Ave SE  
Tumwater, WA 98501

Phone: (866) WATERJET  
Fax: (360) 866-7610  
Email: sales@waterjetparts.com