

# TOOLS AND INSTALLATION

Safe, leak-free operation of any high-pressure system is dependent on correctly prepared and installed connections. This section outlines proper instructions for the machining and assembly of BuTech L/P, M/P, and H/P connections. In addition, this section also offers hand and power tools to make the preparation of the tubing easier.

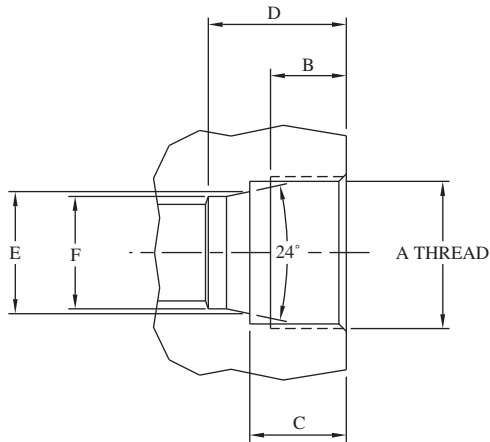


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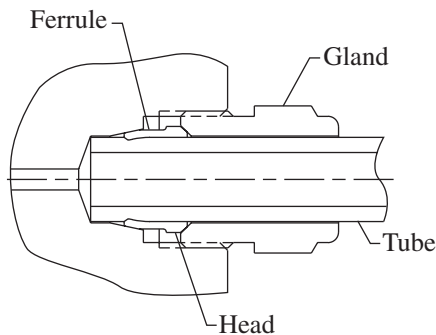
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# LOW PRESSURE CONNECTIONS



Connection	A Thread	B	C	D	E	F
1/8" L/P	3/8"-24	0.22" (5.6)	0.31" (7.9)	0.47" (11.9)	0.19" (4.8)	0.128" (3.3)
1/4" L/P	3/4"-16	0.34" (8.6)	0.44" (11.2)	0.69" (17.5)	0.35" (8.9)	0.257" (6.5)
1/4" SL/P	1/2"-20	0.38" (9.7)	0.44" (11.2)	0.69" (17.5)	0.35" (8.9)	0.257" (6.5)
3/8" L/P	3/4"-16	0.38" (9.7)	0.44" (11.2)	0.69" (17.5)	0.47" (11.9)	0.386" (9.8)
3/8" SL/P	5/8"-18	0.38" (9.7)	0.47" (11.9)	0.75" (19.1)	0.47" (11.9)	0.386" (9.8)
1/2" L/P	13/16"-16	0.41" (10.4)	0.50" (12.7)	0.81" (20.6)	0.60" (15.2)	0.515" (13.1)



Tube Size	Engagement Allowance
1/8"	0.50" (12.7)
1/4"	0.75" (19.1)
3/8"	0.75" (19.1)
1/2"	0.88" (22.4)

## Assembly Procedure

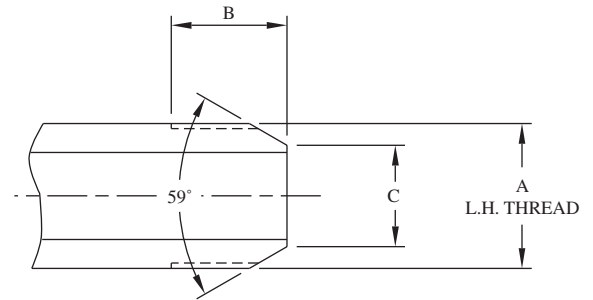
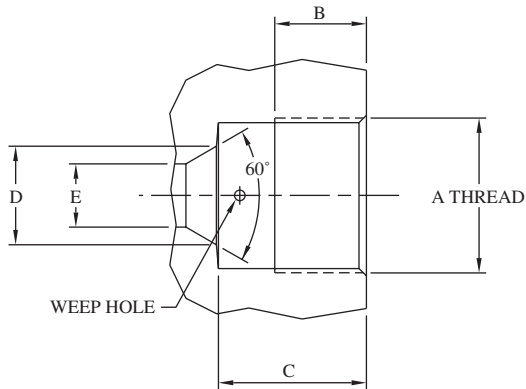
1. Cut tubing to desired length and de-burr, allowing extra length for proper engagement (see chart above)
2. Place gland nut and ferrule on tubing, making sure head of ferrule is toward gland nut. Push tubing into fitting until it bottoms.
3. Screw gland nut into connection until finger-tight.
4. Tighten gland nut approximately 1-1/4 turn with an open-end wrench.

## Re-Assembly Procedure

1. Insert tubing with gland nut and ferrule into fitting
2. Screw gland nut into connection until finger-tight.
3. Tighten gland nut approximately 3/8 of a turn with an open-end wrench.

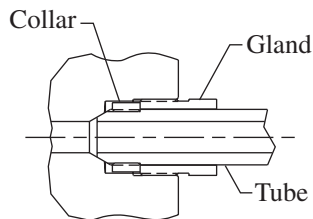
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# MEDIUM PRESSURE CONNECTIONS



Connection	A Thread	B	C	D	E
1/4" M/P	7/16"-20	0.28" (7.1)	0.50" (12.7)	0.19" (4.8)	0.109" (2.8)
3/8" M/P	9/16"-18	0.38" (9.7)	0.62" (15.7)	0.31" (7.9)	0.203" (5.2)
9/16" M/P	13/16"-16	0.44" (11.2)	0.75" (19.1)	0.50" (12.7)	0.312" (7.9)
3/4" M/P	3/4"-14 NPSM	0.50" (12.7)	0.94" (23.9)	0.62" (15.7)	0.437" (11.1)
1" M/P	1-3/8"-12	0.81" (20.6)	1.31" (33.3)	0.88" (22.4)	0.562" (14.3)

Connection	A Thread*	B	C
1/4" M/P	1/4"-28	0.34" (8.6)	0.140" (3.6)
3/8" M/P	3/8"-24	0.44" (11.2)	0.250" (6.4)
9/16" M/P	9/16"-18	0.50" (12.7)	0.406" (10.3)
3/4" M/P	3/4"-16	0.62" (15.7)	0.562" (14.3)
1" M/P	1"-14	0.78" (19.8)	0.718" (18.2)



## Assembly Procedure

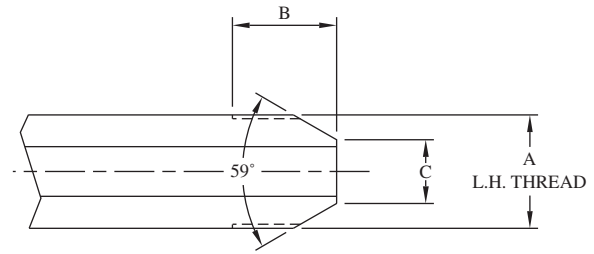
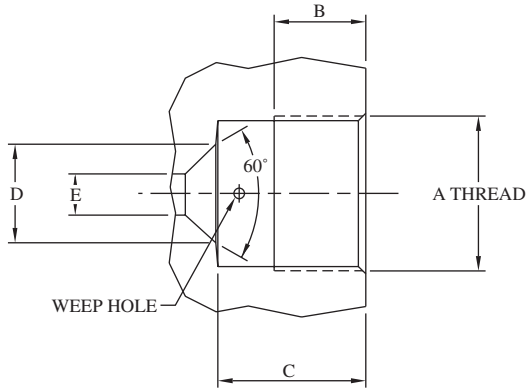
1. Slip gland nut onto tubing or nipple.
2. Screw collar onto threaded end of tubing or nipple. Allow one or two threads to be exposed on tubing or nipple between collar and coned tubing.
3. Lubricate male threads of gland nut with a non-hardening lubricant suitable for use on stainless steel. Lubricant chosen should also be compatible with working temperature requirements.
4. Insert tubing into female connection of valve or fitting. Screw gland into connection until finger-tight.
5. Tighten gland nut to torque value shown at right which corresponds to connection size being assembled.

Tube Size	Engagement Allowance	Required Torque
1/4"	0.55" (14.0)	20 lb-ft 27 Nm
3/8"	0.69" (17.5)	30 lb-ft 41 Nm
9/16"	0.84" (21.3)	55 lb-ft 75 Nm
3/4"	1.01" (25.7)	90 lb-ft 122 Nm
1"	1.47" (37.3)	125 lb-ft 170 Nm

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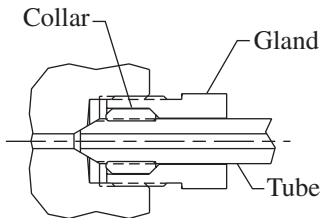


# HIGH PRESSURE CONNECTIONS



Connection	A Thread	B	C	D	E
1/4" H/P	9/16"-18	0.38" (9.7)	0.44" (11.2)	0.17" (4.3)	0.093" (2.4)
3/8" H/P	3/4"-16	0.53" (13.5)	0.62" (15.7)	0.26" (6.6)	0.125" (3.2)
9/16" H/P 60,000 PSI	1-1/8"-12	0.62" (15.7)	0.75" (19.1)	0.38" (9.7)	0.188" (4.8)
9/16" H/P 40,000 PSI	1-1/8"-12	0.62" (15.7)	0.75" (19.1)	0.38" (9.7)	0.188" (4.8)
1" H/P	1-3/8"-12	0.81" (20.6)	1.31" (33.3)	0.88" (22.2)	0.438" (11.1)

Connection	A Thread	B	C
1/4" H/P	1/4"-28	0.56" (14.2)	0.125" (3.2)
3/8" H/P	3/8"-24	0.75" (19.1)	0.219" (5.6)
9/16" H/P 60,000 PSI	9/16"-18	0.94" (23.9)	0.281" (7.1)
9/16" H/P 40,000 PSI	9/16"-18	0.94" (23.9)	0.281" (7.1)
1" H/P	1"-14	0.92" (23.2)	0.562" (14.3)



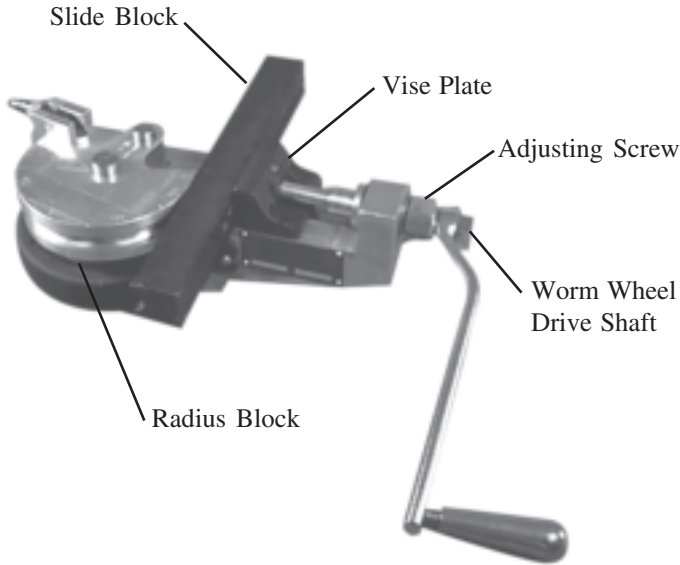
## Assembly Procedure

1. Slip gland nut onto tubing or nipple.
2. Screw collar onto threaded end of tubing or nipple. Allow one or two threads to be exposed on tubing or nipple between collar and coned tubing.
3. Lubricate male threads of gland nut with a non-hardening lubricant suitable for use on stainless steel. Lubricant chosen should also be compatible with working temperature requirements.
4. Insert tubing into female connection of valve or fitting. Screw gland into connection until finger-tight.
5. Tighten gland nut to torque value shown at right which corresponds to connection size being assembled.

Tube Size	Engagement Allowance	Required Torque
1/4"	0.49" (12.4)	25 lb-ft 34 Nm
3/8"	0.68" (17.3)	50 lb-ft 68 Nm
9/16"	0.86" (21.8)	100 lb-ft 136 Nm
1"	1.60" (40.6)	150 lb-ft 203 Nm

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# TUBE BENDER



The BuTech tube bender is designed to bend heavy wall tubing and provide fast, accurate and reliable bending with only one setup. The tube bender is complete with slide block, radius block and bending shoes in a portable, lockable case.

This unit is compact and weight is held to a minimum. It may be easily transported to any area for service use where a vise is available for holding the bender.

The bender operating mechanism consists of a cast aluminum frame and base, with a manual crank-operated steel worm gear mechanism. A 60:1 gear ratio enables the operator to make bends up to 180° in one continuous smooth operation without strain or fatigue. Center drive shaft and worm gear shaft are supported with pre-lubricated ball bearings. The worm gear has a ball-type thrust bearing.

Worm wheel and gear are enclosed for safety, and protection from external damage. Worm wheel drive can be readily disengaged to allow quick return of the radius block after bending without being returned through the gear train.

An adjustable screw vise, guided on the bender frame, is used to position the slide block against the radius die block to hold the tube for proper bending. Hardened steel face of the vise guides the slide block parallel to the bender centerline during the bending operation. The bender is designed to permit use of mandrel equipment when desired. Standard slide block is furnished with grooves for tube sizes 1/4", 3/8" and 9/16".

The crank handle which operates the bender may also be used to adjust the screw connected to the vise plate. This screw telescopes so it will not project outward to interfere with rotation of the operating handle during the bending operation.

The main base of the bender has a square boss for clamping in a bench vise, permitting 90° positioning; or the bender base can be mounted to an adapter unit and fastened to a work bench and used with mandrel equipment when extremely smooth bends in thin-wall tubing are required.

Each radius die block has graduated markings from 0° to 180° at intervals of 15° to indicate degree of bend. Each block has an integral clamp device for easy, quick, positive clamping of the tube. Radius die blocks can be furnished for all tube sizes with standard bends up to 5" radius. Each radius block is marked with tube size and radius for identification.

To order a complete tube bender, specify catalog number from chart below:

Included Radius Block sizes	Catalog Number
1/4", 3/8", 9/16"	MTB469
1/4"	MTB4
3/8"	MTB6
9/16"	MTB9

To order extra radius blocks, specify catalog number from chart below:

Tube O.D.	Catalog Number	Bend Radius	Min Tube Length*
1/4"	PH-2043	1.25" (31.75)	8.00" (203.2)
3/8"	PH-2044	1.75" (44.5)	8.00" (203.2)
9/16"	PH-2045	2.62" (66.5)	14.00" (355.6)

\*For 90° bend

Case size: 22" x 9.50" x 9.75"  
(559mm x 241mm x 248mm)

Weight: 25 lbs (11 kg)

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# HAND CONING TOOLS

The BuTech Hand Coning Tool uses a precision collet to maintain concentricity between the tube and the cutter blades. This unique feature makes the BuTech hand coning tool the perfect tool for machining a cone at the end of a tube, or for re-dressing an existing, damaged cone connection.



Connection	Catalog Number	Replacement Parts	
		Blade	Collet
1/4" M/P	20HCT4	20BL4	PH-1905
3/8" M/P	20HCT6	20BL6	PH-1903
9/16" M/P	20HCT9	20BL9	PH-1893
3/4" M/P	20HCT12	20BL12	PH-1859
1" M/P	20HCT16	20BL16	PH-1858
1/4" H/P	60HCT4	60BL4	PH-1905
3/8" H/P	60HCT6	60BL6	PH-1903
9/16" H/P	60HCT9	60BL9	PH-1893
1" H/P	30HCT16	30BL16	PH-1858



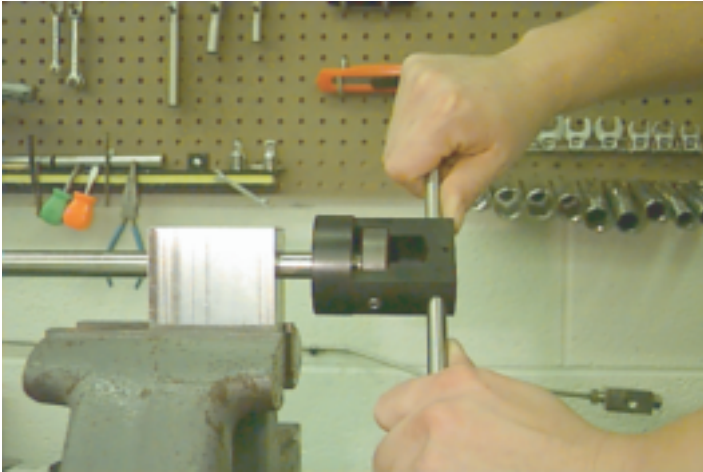
## Instructions for Operation

1. Place the body of the hand coning tool in a suitable vise. The crank handle end of the tool should be elevated slightly so that the lubricant can flow down the lubricant channel to the cutter head. Be sure to provide adequate clearance for the rotation of the crank handle.
2. Fully retract the cutter blades past the access window by turning the knurled nut counter-clockwise.
3. Loosen the gland at the front of the tool and insert the tube. The end of the tube should be even with the front of the access window (nearest the cutter blade), but should not contact the cutter blade.
4. Tighten the gland holding the tube.
5. Apply a liberal amount of lubricant to the exposed end of the tube, the cutter blades and through the lubrication channel at the crank handle. Important: Apply lubricant frequently and liberally throughout the cutting operation.
6. Turn the knurled nut clockwise to gently touch the cutter blade to the tube, then back the knurled nut off 1/4 turn.
7. Crank the handle clockwise to spin the cutter blades. Turn the knurled nut clockwise to engage and to begin cutting the tube. For best results, establish a gentle but constant feed of the knurled nut and a smooth and continuous cutter rotation. Do not try to remove too much material at once. Let the cutter blades do the work. Thin, curled machining chips should fall freely from the lower access window. Note: Back the cutter blades off the work-piece before interrupting the cut. Use compressed air or a small brush to clean the accumulation of chips from the blades and work-piece throughout the coning operation. The operation is complete when the blades begin to cut the land area at the base of the cone.
8. Back the cutter blades off the work-piece and loosen the gland to remove the tubing. Inspect the cone for completeness and surface finish.

Important: Clean the machining chips from the blade and from the collet before coning the next tube.

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# HAND THREADING TOOLS



The BuTech Hand Threading Tool is designed to permit on-site end preparation for medium and high pressure tubing installations from 1/4" to 1" O.D.

The manual threading tool uses an adjustable split die and a precision guide bushing to cut a perfect thread.

Connection	Catalog Number	Replacement Parts	
		Die	Bushing
1/4" M/P	THT4-H	TD4	TB4
3/8" M/P	THT6-H	TD6	TB6
9/16" M/P	THT9-H	TD9	TB9
3/4" M/P	THT12-H	TD12	TB12
1" M/P	THT16-H	TD16	TB16
1/4" H/P	THT4-H	TD4	TB4
3/8" H/P	THT6-H	TD6	TB6
9/16" H/P	THT9-H	TD9	TB9
1" H/P	THT16-H	TD16	TB16

## Instructions for Operation

1. Start with tubing that has been coned, either in a lathe, or with a BuTech Hand or Power Coning Tool.
2. Secure tube in a tube vise, with no more than the recommended length of tubing extending beyond the face of the vise.
3. Lubricate the end of the tube and slide on the threading tool.
4. Take a firm grip on the handles of the tool and, with a steady pressure, turn the tool counter-clockwise. Approximately every half turn of the tool, reverse direction to break off and remove chips. Important: Apply lubricant frequently and liberally throughout the cutting operation.
5. Continue threading until the proper length of thread is reached. Remove tool from the tubing end.

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

Tube O.D.	Recommended Length
1/4"	1.25" - 1.50" (31.8) - (38.1)
3/8"	1.25" - 1.50" (31.8) - (38.1)
9/16"	1.75" - 2.00" (44.5) - (50.8)
3/4"	3.00" - 3.50" (76.2) - (88.9)
1"	3.00" - 3.50" (76.2) - (88.9)

Connection	Thread Length
1/4" M/P	0.34" (8.6)
3/8" M/P	0.44" (11.2)
9/16" M/P	0.50" (12.7)
3/4" M/P	0.62" (15.7)
1" M/P	0.78" (19.8)
1/4" H/P	0.56" (14.2)
3/8" H/P	0.75" (19.1)
9/16" H/P	0.94" (23.9)
1" H/P	0.92" (23.2)

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# POWER CONING TOOLS

The BuTech Power Coning Tool is designed to adapt easily to any power hand drill. This unique feature makes the BuTech Power Coning Tool the perfect tool for fast machining of several tube ends.



Connection	Catalog Number	Replacement Parts	
		Blade	Bushing
1/4" M/P	20CT4	20BL4	CB4
3/8" M/P	20CT6	20BL6	CB6
9/16" M/P	20CT9	20BL9	CB9
3/4" M/P	20CT12	20BL12	CB12
1" M/P	20CT16	20BL16	CB16
1/4" H/P	60CT4	60BL4	CB4
3/8" H/P	60CT6	60BL6	CB6
9/16" H/P	60CT9	60BL9	CB9
1" H/P	30CT16	30BL16	CB16

## Instructions for Operation

1. Secure tube in a tube vise, with no more than the recommended length of tubing extending beyond the face of the vise.
2. Mount threading tool in a 3/8" or 1/2" variable speed power drill. Lubricate the end of the tube and slide on tool.
3. Apply a steady pressure against the end of the tube while the drill motor/tool cuts the cone. The tool can be removed any time during the coning operation for inspection. Important: Apply lubricant frequently and liberally throughout the cutting operation.
4. Continue cutting until the cone is complete. The tool will stop cutting when the tube angle and facing is complete.

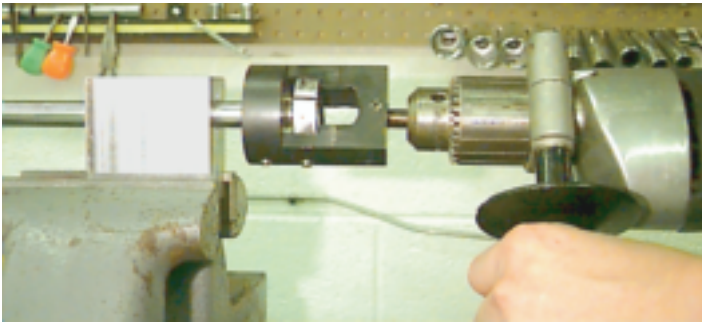
Important: Clean the chips from the blade and body of the tool before coning the next tube.

Tube O.D.	Recommended Length	
	1/4"	1.25" - 1.50"
3/8"	1.25" - 1.50"	(31.8) - (38.1)
9/16"	1.75" - 2.00"	(44.5) - (50.8)
3/4"	3.00" - 3.50"	(76.2) - (88.9)
1"	3.00" - 3.50"	(76.2) - (88.9)

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# POWER THREADING TOOLS



The BuTech Power Threading Tool is designed to adapt easily to any power hand drill. This unique feature makes the BuTech Power Threading Tool the perfect tool for fast machining of several tube ends.

Connection	Catalog Number	Replacement Parts	
		Die	Bushing
1/4" M/P	THT4-P	TD4	TB4
3/8" M/P	THT6-P	TD6	TB6
9/16" M/P	THT9-P	TD9	TB9
3/4" M/P	THT12-P	TD12	TB12
1" M/P	THT16-P	TD16	TB16
1/4" H/P	THT4-P	TD4	TB4
3/8" H/P	THT6-P	TD6	TB6
9/16" H/P	THT9-P	TD9	TB9
1" H/P	THT16-P	TD16	TB16

## Instructions for Operation

1. Start with tubing that has been coned, either in a lathe, or with a BuTech Hand or Power Coning Tool.
2. Secure tube in a tube vise, with no more than the recommended length of tubing extending beyond the face of the vise.
3. Mount threading tool in a 3/8" or 1/2" variable speed power drill. Lubricate the end of the tube and slide on tool.
4. Make sure the drill motor is set to turn counter-clockwise. Apply a steady pressure against the end of the tube with the drill motor/tool as the threads are cut. Important: Apply lubricant frequently and liberally throughout the cutting operation.
5. Continue threading until the proper length of thread is reached. Reverse direction on the drill motor and remove tool from the tubing end.

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

Tube O.D.	Recommended Length
1/4"	1.25" - 1.50" (31.8) - (38.1)
3/8"	1.25" - 1.50" (31.8) - (38.1)
9/16"	1.75" - 2.00" (44.5) - (50.8)
3/4"	3.00" - 3.50" (76.2) - (88.9)
1"	3.00" - 3.50" (76.2) - (88.9)

Connection	Thread Length
1/4" M/P	0.34" (8.6)
3/8" M/P	0.44" (11.2)
9/16" M/P	0.50" (12.7)
3/4" M/P	0.62" (15.7)
1" M/P	0.78" (19.8)
1/4" H/P	0.56" (14.2)
3/8" H/P	0.75" (19.1)
9/16" H/P	0.94" (23.9)
1" H/P	0.92" (23.2)

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# TUBE VISES



Tube O.D.	Catalog Number
1/4"	TV4
3/8"	TV6
9/16"	TV9
3/4"	TV12
1"	TV16

- Lightweight and inexpensive.
- No collapsing of tubing.
- Better holding power on tubes.
- No soft jaws required on vises
- No marking on OD of tubing
- Use as a stop gauge when coning and threading

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