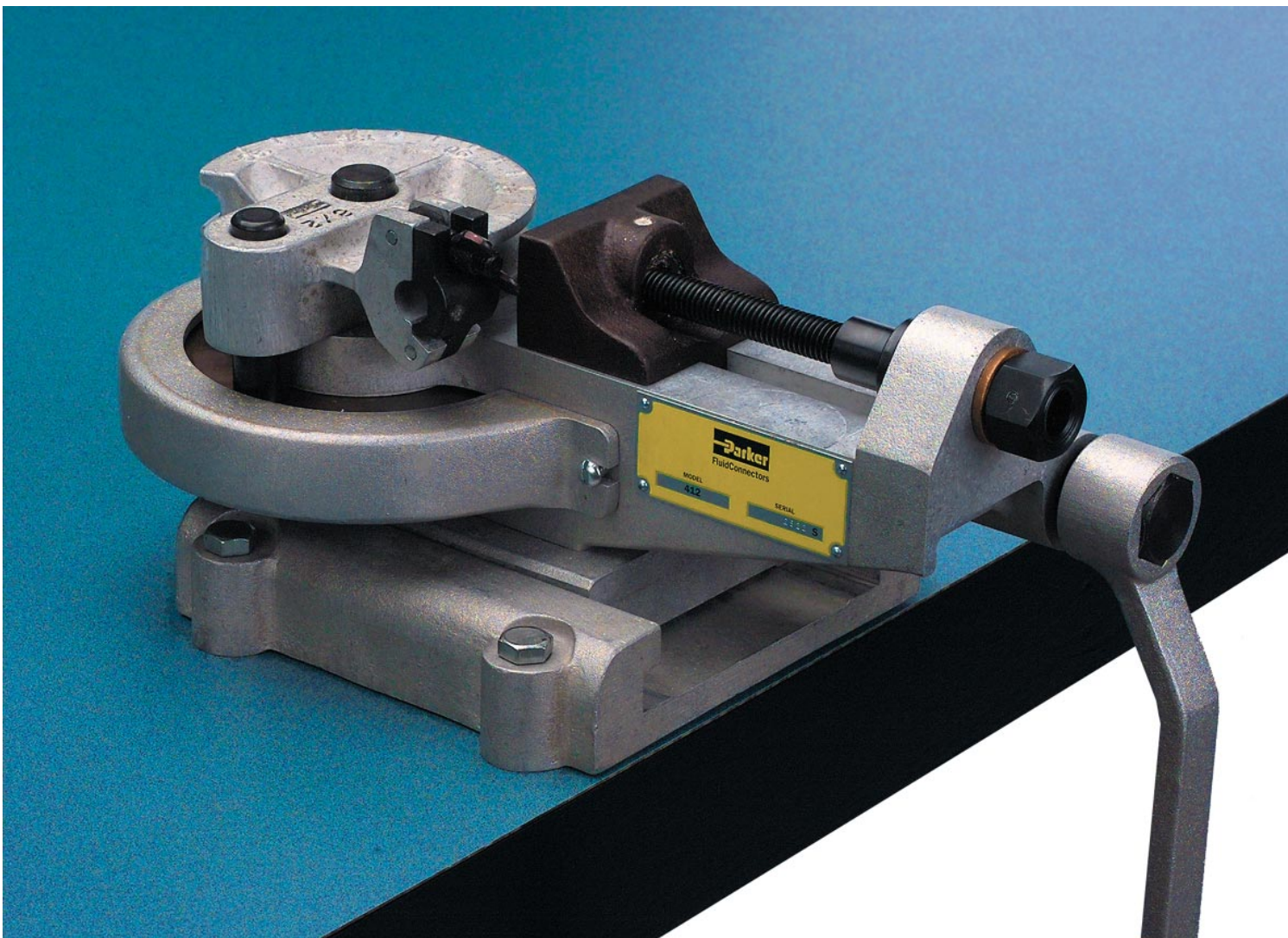




Bulletin 4391-B400S  
January 2000

# Parker EXACTOL® 400 Series Tube Benders

*Supersedes: 4391-B12, 4391-B16, 4391-B24*



***The Fitting Authority***



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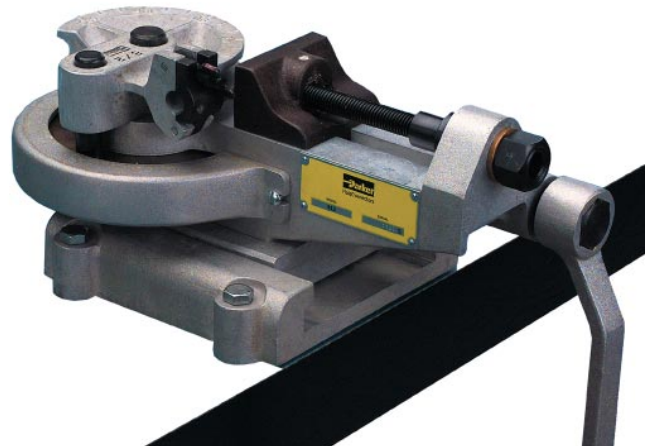
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# EXACTOL® Tube Benders

(For 1/4" – 1 1/2" diameter tubing)

**Sturdy...Simple...Manual...  
Bends to exact tolerances.**

The Parker Exactol Tube Benders are probably the most versatile bench benders available today. Built for easy manual bending of copper, brass, aluminum, steel and stainless steel tubes to exact tolerances, the 400 Series benders are also compact and portable to any area for service use where a vise is available.



Along with the bender itself, Parker has developed a complete package of accessories to enable this tool to be used for all types of bending: close bend radius blocks, mandrels for thin wall tubes, bench mounting adapters and more.

## Capacity

The following chart gives the capacity for all Parker Benders.

**\*Bender Codes:**

(A) Model 412: Tubing (1/4" thru 3/4") — Worm & Gear — Rated Torque 2700 in/lbs.

(C) Model 424: Tubing (1/4" thru 1-1/2") — Worm & Gear — Rated Torque 11000 in/lbs.

### Tube Benders Maximum Capacity Guides

Tube O.D.	Material	Tube Wall Thickness (Inches)											
		0.035	0.049	0.058	0.065	0.072	0.083	0.095	0.109	0.12	0.134	0.156	0.188
3/4"	S	AC	AC	AC	AC	C	C	C	C	C	C	C	C
	SS	AC	AC	C	C	C	C	C	C	C	C	C	C
1"	S	C	C	C	C	C	C	C	C	C	C	C	C
	SS	C	C	C	C	C	C	C	C	C	C	C	C
1 1/4"	S	C	C	C	C	C	C						
	SS	C	C	C	C	C							
1 1/2"	S	C	C	C	C	C							
	SS	C	C										

Tube O.D. (mm)	Material	Tube Wall Thickness (mm)					
		1.5	2	2.5	3	3.5	4
18	S	AC	AC	AC	AC	C	C
	SS	C	C	C	C	C	C
20	S	AC	AC	AC	C	C	C
	SS	C	C	C	C	C	C
22	S	C	C	C	C	C	C
	SS	C	C	C	C	C	
25	S	C	C	C	C	C	
	SS	C	C	C	C		
28	S	C	C	C	C		
	SS	C	C				
30	S	C	C	C	C		
	SS	C	C				
32	S	C	C				
	SS	C					
38	S	C					
	SS						

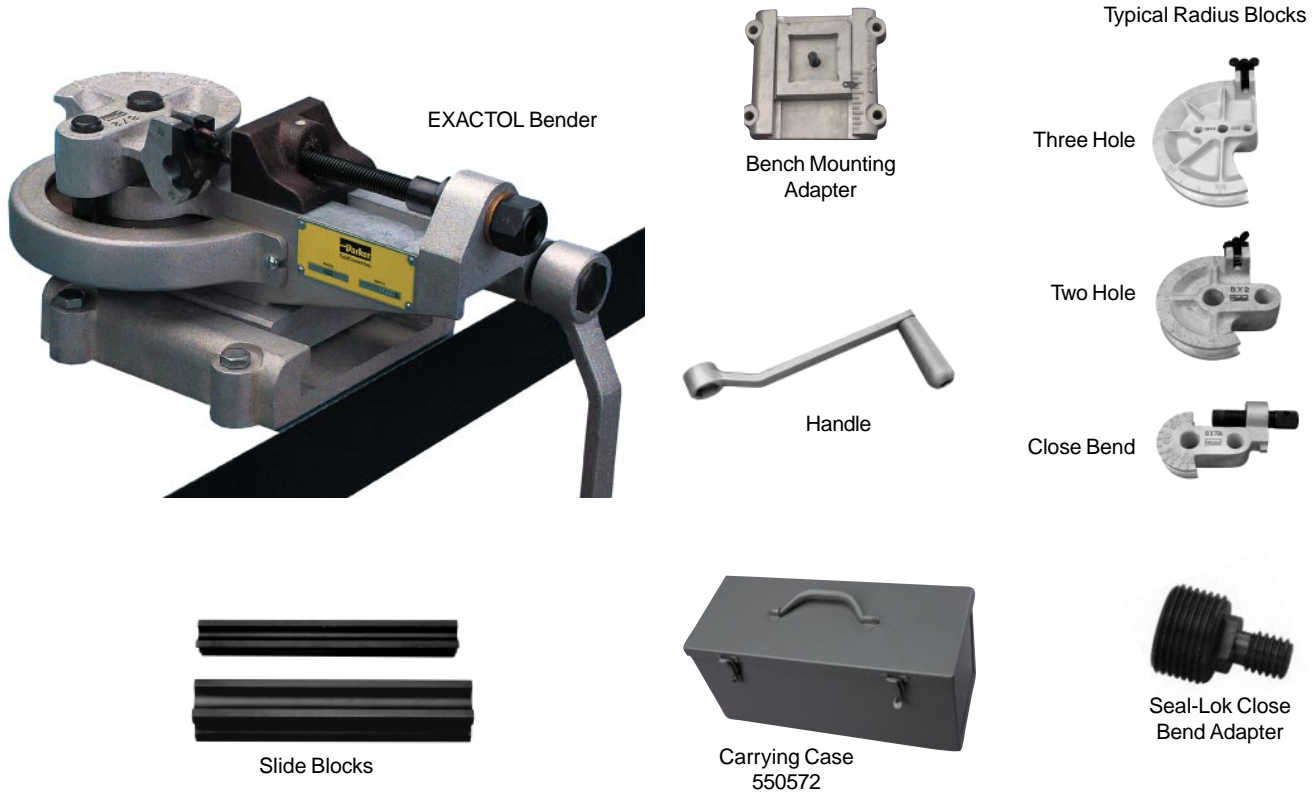
## Specifications

Description	Model 412	Model 424
Min. tube size	1/4"	1/4"
Max. tube size	3/4"	1-1/2"
Max. bend	180°	180°
Max. radius	3"	5"
Gear ratio	60:1	60:1
Weight (base unit)	14 lbs.	40 lbs.
Finish	Natural Aluminum	Natural Aluminum

## Notes

1. All benders are capable of bending 1/2" O.D. and under fully annealed steel and stainless steel tubing with no limit on wall thickness.
2. All benders are capable of bending soft aluminum and copper tubing to the full range of each bender type capacity with no limit on wall thickness.
3. For hard copper and high strength aluminum use the tabulations shown for stainless steel. Observe that very hard materials may not be ductile enough to bend without fracture.

## Bender Parts and Accessories



Slide Block	
Inch Sizes	Part #
4, 5, 6, 8, 10, 12	<b>550585</b>
14, 16, 18, 20	<b>621045</b>
24	<b>870150</b>
Metric Sizes	Part #
6, 8, 10, 12, 14mm	<b>820091</b>
15, 16, 18, 20mm	<b>820092</b>
22, 25, 28, 30mm	<b>820093</b>
38mm	<b>870150</b>

EXACTOL Bender (with Handle and Tie Bar)		
Model #	Tie Bar	Part #
412	N/A	<b>560569</b>
424	Included	<b>621044*</b>

Bench Mounting Adapter	
Model #	Part #
412	<b>550570</b>
424	<b>631156</b>

\*Previously Model #420. Part number 621044 has been upgraded in capacity to support bending of 1 1/2" tubing.

Seal-Lok Close Bend Adapter		
Tube O.D. (in.)	Threaded Pin Part No.	Seal-Lok Adapter Part No.
1/2	<b>930420-8</b>	<b>930421-8</b>
5/8	<b>930420-10</b>	<b>930421-10</b>
3/4	<b>930420-12</b>	<b>930421-12</b>
1	<b>930420-16</b>	<b>930421-16</b>
1 1/4	<b>930420-20</b>	<b>930421-20</b>
1 1/2	<b>930420-24</b>	<b>930421-24</b>

## Bender Construction

Each bender consists of a cast aluminum frame and base, with a manual crank-operated steel worm gear mechanism. A 60:1 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

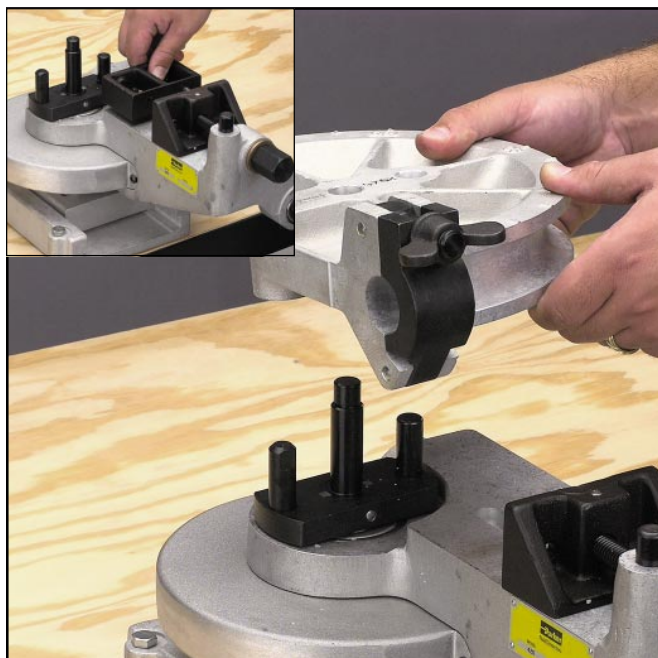
ball bearings. The worm gear has a ball-type thrust bearing, and is completely enclosed for safety and protection from external damage. The main base of the benders has a square base for clamping in a vise or each bender can also be mounted in an adapter unit and fastened to a workbench.



## Radius Die Blocks

Radius die blocks can be furnished from stock in 34 sizes for standard bends ranging from 9/16" to 5" radii, as given in the chart below. There are six small radius die blocks, eleven large radius die blocks, three sizes of close bend radius blocks, and fourteen metric sizes of radius blocks (shown in chart below).

Each radius die block has a graduated marking at intervals of 15° to indicate degree of bend. Each radius die block also has an integral clamp arrangement for easy, quick, positive clamping of the tube, except for the close bend radius blocks. Radius blocks are marked with tube size and radius for identification.



**Three Hole Blocks** — To use the larger three hole radius blocks, just install third pin in drive plate, if necessary, then remove the slide block vise adapter by removing the two Allen-headed screws in back of plate to provide space for the larger radius blocks.

**Close Bend Radius Blocks** — The close bend radius blocks have a threaded pin which threads directly into both Triple-Lok and Ferulok tube fitting nuts. With the use of Parker's Seal-Lok close bend adapter, one can also use Seal-Lok fittings with a close bend radius block. They permit an operator to make his first bend very close to the end of the tube.

## Radius Block Charts

Size	Tube O.D.		Radius Block		Radius Block		Radius Block Close Bend		
	(in.)	(mm)	Part No.	Radius* (in.) (mm)	Part No.	Radius* (in.) (mm)	Part No.	Radius* (in.) (mm)	
4	1/4	6.4	550573	9/16 14.3	550579	3/4 18.5	—	—	—
5	5/16	7.9	550574	11/16 17.5	550580	1 25.4	—	—	—
6	3/8	9.5	550575	15/16 23.8	550581	1 1/4 31.8	—	—	—
8	1/2	12.7	550576	1 1/4 31.8	550582	2 50.8	590535	1 1/4 31.8	—
10	5/8	15.9	550577	1 1/2 37.5	550583	2 1/2 63.5	590535	1 1/2 38.1	—
12	3/4	19.0	550578	1 3/4 43.8	550584	3 76.2	590537	1 3/4 44.5	—
14	7/8	22.2	—	—	621046	3 1/2 88.9	—	—	—
16	1	25.4	—	—	621047	4 101.6	—	—	—
18	1 1/8	28.6	—	—	621048	4 1/2 114.3	—	—	—
20	1 1/4	31.8	—	—	621049	5 127.0	—	—	—
24	1 1/2	38.0	—	—	870149	5 127.0	—	—	—

\*Radius to tube centerline.

Tube O.D. (mm)	Bend Radius (mm)	Part No.
6	14	820090-6mm
8	18	820090-8mm
10	24	820090-10mm
12	32	820090-12mm
14	38	820090-14mm
15	38	820090-15mm
16	38	820090-16mm
18	44	820090-18mm
20	44	820090-20mm
22	89	820090-22mm
25	102	820090-25mm
28	102	820090-28mm
30	127	820090-30mm
38	127	870149

# Instructions for Medium to Heavy Wall Tube Bending

## Step 1: Mounting Tube Bender

The tube bender should be mounted in a bench vise (or in adapter assembly fastened to a bench). Be sure the bender is tightly clamped or securely bolted down.



## Step 2: Select Radius Block

Select proper radius block according to chart on page 3. Radius blocks, size 1/4" through 3/4" are made to drive with two pins; radius blocks, 7/8" through 1-1/2", are made to drive with three pins. After selecting the proper size radius block remove or add one drive pin in the drive plate to correspond with the radius block.

Mount selected radius block on center post and drive post, position the radius block so 0° mark is toward vise face and handle end of bender. Radius blocks are accurately milled and bored to slip easily onto posts. Light lubrication of the posts will aid assembly. When handling radius blocks, as well as the slide block, care should be taken to avoid nicking the grooved surfaces.



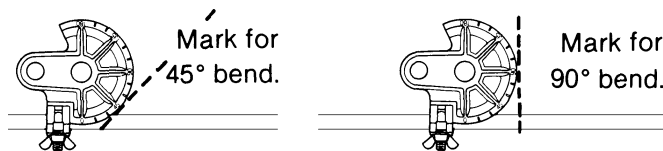
## Step 3: Mark Tube

The first bend is easy. Simply measure from the end of the tube to the desired length of the centerline of the first bend. The tubing should be positioned in the bender so that the end measured from (or "measurement end") is to the **left** as you face the bender.

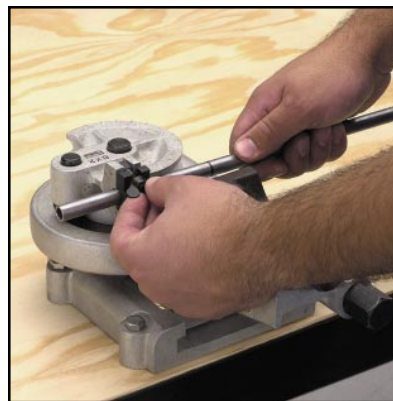


## Step 4: Clamp Tube

Position the tube in the "opened" tube clamping device of the radius block so that the mark is tangent to the desired degree mark on the radius block (see diagram).



On long lengths of tubing support is recommended to prevent sag and help keep tubing aligned with radius block centerline.



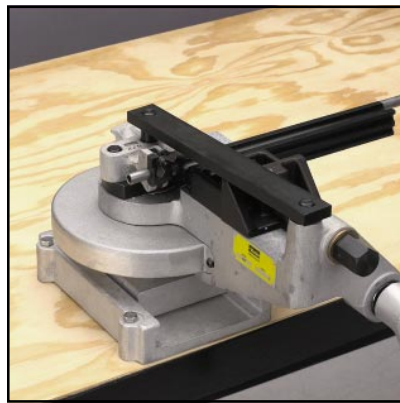
### Step 5: Select Slide Block Groove

Select proper groove of slide block for outside diameter of tube (sizes are marked on end of the slide block) and position slide block accordingly, against slide block vise face with end of block adjacent to tube clamp of radius block. Lubricate slide block to facilitate sliding. Then, advance slide block, by means of telescopic adjustment screw, to rest snugly against the tube but not with so much pressure as to prevent block from sliding easily along slide block vise face.



### Step 6: Using the Tie Bar (if required)

When it becomes difficult to hold distortion of the tube within 5% because of deflection of the bender, place the tie bar over the center post and the dowel pin. Always use the tie bar with heavy wall tubing — sizes 7/8" or above.

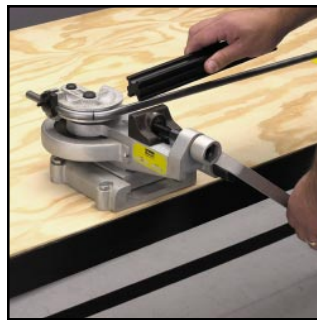


### Step 7: Bend the Tube

Tube bending is accomplished with ease by means of the crank handle operating the mechanism through 60:1 ratio worm gear. As the bend is being made, the slide block travels with the tube and bears lightly against the radius block to form a true round die enclosing the tube, providing a smooth, full cross-section bend. The angle of the bend is indicated by the marks on the radius block. At completion of bend the desired degree mark will be in line with the left side of the bender.

### Step 8: After Bending the Tube

First, remove the tie bar, if in use. Next, retract slide block vise and remove slide block.



### Step 9: Completed Bent Tube

Then loosen wing nut on clamp, open, pull tube out from radius block and lift up. Your tubing is smoothly bent, without flattening or cracking.

To reset the tube bender, turn worm wheel shaft counterclockwise to disengage. Turn radius block back until 0° mark is at original starting point. Bender is then ready for inserting next tube. Then turn worm wheel shaft in clockwise direction to re-engage gear for start of next bend.



**Bends from 90° to 180°** — The 400 Series Tube Benders bend tubing up to 180° with ease. The procedure for bends over 90° is the same as for bends to 90°. See Step 4.

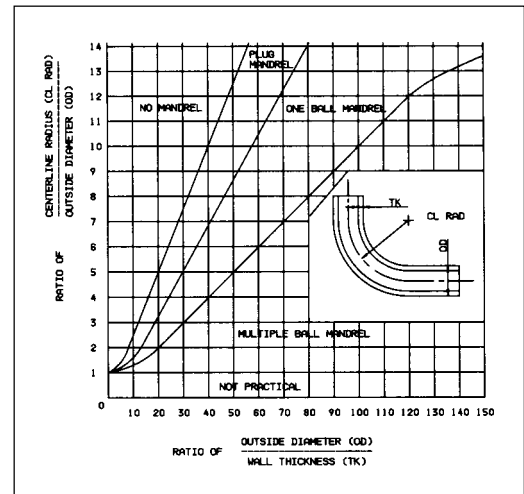


# Instructions for Thin Wall Tube Bending with Mandrel Equipment

## Mandrels (Plug Type)

Size	Tube O.D. (in.)	Part No.	Wall Thickness				
			(in.)	(in.)	(in.)	(in.)	(in.)
6	3/8	924417	—	0.035	0.042	—	—
8	1/2	924417	—	0.035	0.042	0.049	—
10	5/8	924417	0.035	0.042	0.049	0.058	0.065
12	3/4	924417	0.035	0.042	0.049	0.058	0.065
14	7/8	924417	0.035	0.042	0.049	0.058	0.065
16	1	924417	0.035	0.042	0.049	0.058	0.065
18	1 1/8	924417	—	0.049	0.058	0.065	—
20	1 1/4	924417	—	0.049	0.058	0.065	—
24	1 1/2	924417	0.049	0.058	0.065	0.083	—

To order mandrels, specify tube O.D. and wall thickness. Example: 924417-12X058



## Mandrel Rod Specifications & Data

Mandrel Rod Dia. (in.)	Tube I.D. (in.)	Part No.	Mandrel Type
1/4	0.283 to 0.362	520506	solid
5/16	0.363 to 0.484	520507	solid
13/32	0.485 to 1.489	520508	solid



Mandrel

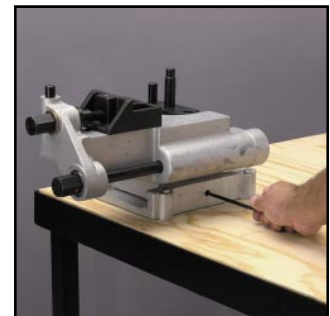
Mandrel Graph Chart

To order mandrel rods, specify mandrel rod size and mandrel type.

## Instructions

### Step 1: Mount Bender in Adapter Assembly

For mandrel bending, it is necessary to install the bender in a bench mounting adapter assembly. Locate the adapter assembly front mounting holes about 3" from the front edge of the bench, with T slot front to back and scale on right. Secure the bender in the adapter assembly by tightening the flat head screws in the bottom of the adapter slide. Then place the bender in the mounting assembly with the axis of its drive handle shaft parallel with the T slot. This places the handle end of the bender towards the operator with the adapter scale to the right. (The adapter slide and scale will be used later to align the bender with the mandrel).



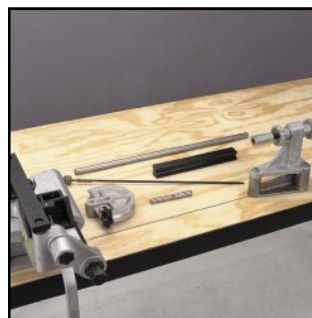
### Step 2: Install Mandrel Rod Stop Assembly

Draw a centerline for the mandrel rod stop assembly and height adapter to the right of the reference mark (A) on the adapter assembly. Position the rod-stop assembly and height adapter on this line with the single mounting hole nearest the bender.



### Step 3: Select Radius Block Mandrel and Rod

Select proper radius block according to chart as described in Step 2 on page 4. Select Mandrel according to outside diameter and wall thickness of tubing. The selected Mandrel is screwed onto one end of the mandrel rod. The other end of the mandrel rod is screwed onto the adapter and then into the rod stop assembly.





**Instructions for Thin Wall Tube Bending with Mandrel Equipment (Continued)**

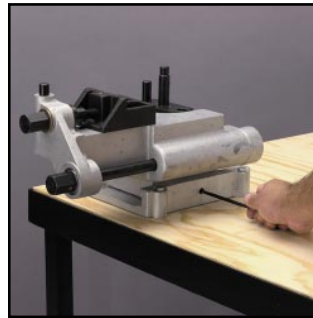
**Step 4: Adjust Mandrel**

For average bending, the mandrel should be adjusted so that the scribed line on its circumference is 5/8" behind 0 mark on the radius block. Make this adjustment by turning locknuts on mandrel rod stop assembly. Mandrel may be moved forward slightly to produce a more nearly perfect round cross-section of the bent tube, or it may be moved slightly backward to ease the bending effort. However, extremes in either direction may cause wrinkling, breaking, or flattening of the tube.



**Step 5: Adjust Adapter Slide**

Loosen the Allen head screw in slide adapter base and move bender to adjust for the radius block in use. Position the slide indicator pointer to the radius of the radius block being used, in order to properly center the radius block with respect to the tube and mandrel rod. Then tighten the adapter slide screw with the Allen wrench.



**Step 6: Mark Tube**

**Step 7: Clamp Tube**

**Step 8: Select Slide Block Groove**

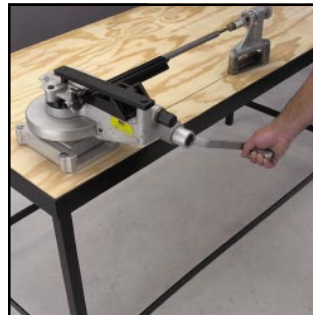
**Step 9: Using the Tie Bar (if required)**



These four steps are the same as Steps 3, 4, 5 and 6 shown on pages 4-5.

**Step 10: Bend the Tube**

Mandrel tube bending is easily accomplished by means of the crank handle operating the mechanism through the 60:1 ratio worm gear. As the bend is being made, the slide block travels with the tube and bears lightly against the radius block to form a true round die enclosing the tube, providing a smooth, full cross-section bend.



**Step 11: After Bending Tube**

At completion of bend, remove tie bar, retract slide block vise and unscrew the wing nut on the radius block clamp. Then, to remove the tube, slide it out to the left, back along the axis of the mandrel assemble. Loosen mandrel assembly if necessary to facilitate tube removal.

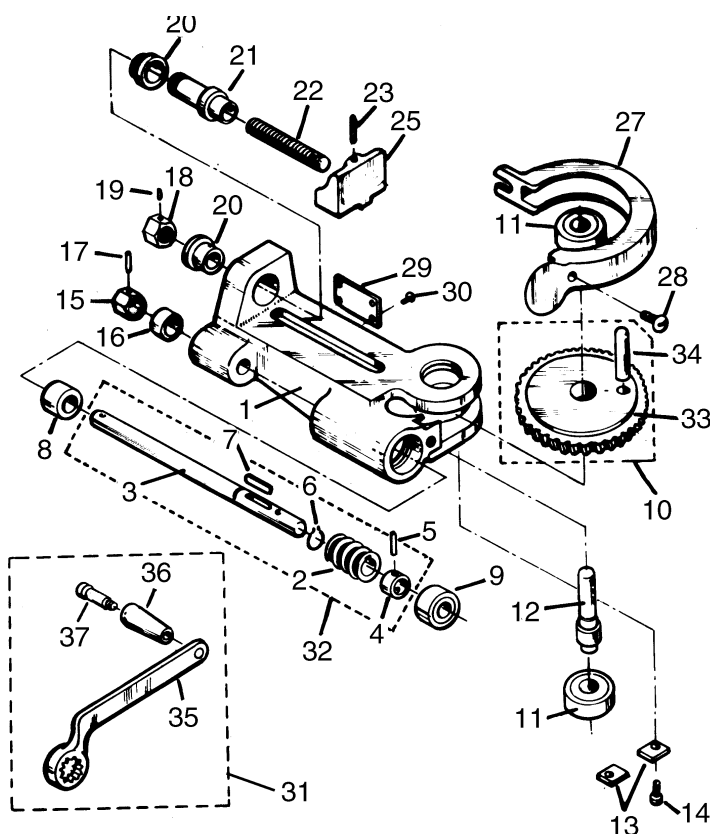


## Model 412 Tube Bender/Maintenance and Parts List

### Bender Maintenance

All parts should be kept clean and free from dirt and grit. Slide block and radius blocks should be handled carefully to avoid damaging the smooth grooved surfaces. Presence of nicks, burrs, pieces of dirt or chips may mar the surface of the tube and thereby weaken it.

All threaded parts should be cleaned and slightly greased occasionally to keep them in good working condition. This equipment will operate efficiently for a long period of time and will bend to exact tolerances repeatedly if these precautions are heeded.



### Model 412 Parts List (Part # 560569)

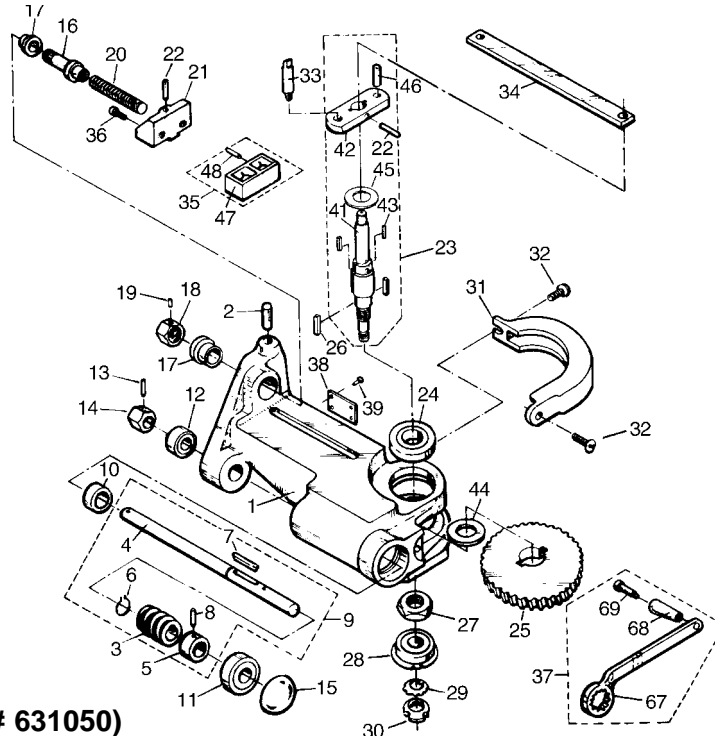
Part	Part No.	Required	Part	Part No.	Required
1. Body	13001	1	19. Pin, 3/16 x 1 Driv-lok, C	48x240 Rd Hd Screw	1
2. Worm	550602	1	20. Bearing, "Oilite" F-1025-6	550597	2
3. Shaft	550603	1	21. Screw Pilot	550596	1
4. Collar	550604	1	22. Screw, Clamp	550599	1
5. Pin, 3/16 x 3/4 Driv-lok, C	48x238 Drive Pin	1	23. Retaining Screw	550594	1
6. Snap Ring, Truarc #5100-75	56x207 Snap Ring	1	25. Slide Shoe	550593	1
7. Key, 1/8 sq. x 1" long	13008	2	27. Gear Guard	550590	1
8. Bearing, "Nice" 1207-22	550606	1	28. Screw, 8/32 x 3/8 Rd. Hd.	13048	2
9. Bearing, "Nice" 400-26	550608	1	29. Nameplate	13049	1
10. Worm Gear and Drive Post Assembly	550587	1	30. Drive Screw, P.K. type "U" #0 x 1/8	13050	4
11. Bearing, N.D. 99504	550592	2	31. Crank Handle Subassembly	550612	1
12. Center Post	13016	1	32. Worm & Shaft Subassembly (2-7)	550601	1
13. Bearing Stop	550615	2	33. Worm Gear	550587	1
14. Screw, 10-32 x 1/2 rd. Head	13023	2	34. Dowel Pin	13021	1
15. Worm Nut	550610	1	35. Crank Handle	13502	1
16. Bearing, "Nice" 603-1/4	550607	1	36. Knob	13054	1
17. Pin	550611	1	37. Shoulder Screw	13055	1
18. Clamp Nut	550598	1			

## Model 424 Tube Bender/Maintenance and Parts List

### Bender Maintenance

All parts should be kept clean and free from dirt and grit. Slide block and radius blocks should be handled carefully to avoid damaging the smooth grooved surfaces. Presence of nicks, burrs, pieces of dirt or chips may mar the surface of the tube and thereby weaken it.

All threaded parts should be cleaned and slightly greased occasionally to keep them in good working condition. This equipment will operate efficiently for a long period of time and will bend to exact tolerances repeatedly if these precautions are heeded.



### Model 424 Parts List (Part # 631050)

Part	Part No.	Required	Part	Part No.	Required
1. Body	621062	1	27. Nut, Worm Gear Retaining	621081	1
2. Dowel Pin, 5/8 x 1-1/2	13102	1	28. Bearing, #499604 N.D. Single Row Ball	13141	1
3. Worm	621067	1	29. Lockwasher, #W-04	13142	1
4. Shaft	621068	1	30. Locknut, #N-04	13143	1
5. Collar	621069	1	31. Guard, gear	621082	1
6. Snap Ring Truarc #5100-75	56x212	1	32. Screw, 1/4-28 x 5/8 long Round Hd. Mach. 4x126	13367	1
7. Key, 3/16 sq. x 1-5/8 long	13110	1	33. Pin, Drive	621083	2
8. Pin, Driv-lok Type A 1/4 dia. x 1	13111	1	34. Tie, Bar	621084	1
9. Subassembly Work & Shaft	621066	1	35. Adapter & Pin Subassembly, Slide Block	621085	1
10. Bearing, #D2620	13113	1	36. Screw, 5/10-18 x 3/4 Soc. Hd. Cap	13152	1
11. Bearing, #3038DS	13114	1	37. Crank-handle Subassembly	621063	1
12. Bearing, #607	13115	1	38. Nameplate	550609	1
13. Pin, Driv-lok Type E 1/4 dia. x 1-1/4	13117	1	39. Screw, #0 x1/8 Type "U" P.K.	13050	4
14. Nut, Drive	621071	1	41. Center Post	13157	1
15. Plug, Bearing Retainer	621072	1	42. Drive Plate	13159	1
16. Screw, Pilot Adjusting	621073	1	43. Key, 1/4 sq. x 19/32	13160	1
17. Bearing, Flange, #FF-1102-6 "Oilite"	13123	2	44. Washer	621070	1
18. Nut, Vise Jaw	621074	1	45. Washer	621070	1
19. Pin, Vise Jaw Nut	621075	1	46. Dowel Pin 5/8	13163	1
20. Screw, Vise Jaw Adjusting	621076	1	47. Vise Jaw Adapter	13165	1
21. Vise Jaw	621077	1	48. Dowel Pin 1/4	13166	1
22. Pin, Vise Jaw Adjusting Screw	621078	1	49. Crank Handle	13168	1
23. Center Post Subassembly	621079	1	68. Knob	13054	1
24. Bearing, #55507 N.D. Double Row Ball	13136	1	69. Screw	13055	1
25. Gear, Worm	621080	1			
26. Key, Worm Gear 1/4 sq. x 19/32 long 22x20	13160	2			



### Model 412 Bender Kit

Part No.	Description
560569	412 Bender Body
550585	Slide Block for Sizes 4-6-8-10-12
550579	Size 4 Radius Block
550581	Size 6 Radius Block
550582	Size 8 Radius Block
550583	Size 10 Radius Block
550584	Size 12 Radius Block
—	Carrying case designed specifically for the 412 Kit.



### Model 424 Bender Kit

Part No.	Description
631050	424 Bender Body
550585	Slide Block for Sizes 4-6-8-10-12
621045	Slide Block for Sizes 14-16-18-20
550579	Size 4 Radius Block
550581	Size 6 Radius Block
550582	Size 8 Radius Block
550583	Size 10 Radius Block
550584	Size 12 Radius Block
621047	Size 16 Radius Block
621049	Size 20 Radius Block
—	No carrying case available.

**Note:** Size 24 Slide Block (870150) and Radius Block (870149) will be included in the kit effective 7/1/00.



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**Parker Hannifin Corporation**  
Tube Fittings Division  
3885 Gateway Blvd.  
Columbus, Ohio 43228  
Telephone: (614) 279-7070  
Fax: (614) 279-7685  
[www.parker.com/tfd](http://www.parker.com/tfd)

