

# Hydraulic Tube Bender

Model HB632

Bulletin 4391-B26



ENGINEERING YOUR SUCCESS.

## Table of Contents

Introduction..... 1

Bender Parts and Accessories ..... 2

Radius Blocks..... 3

Side Blocks..... 4

Clamp Blocks..... 4

Medium to Heavy Wall Tube Bending ..... 5 – 7

Thin Wall Tube Bending with Mandrel Equipment ..... 8 – 10

Parts Schematic ..... 11 – 13

Maintenance ..... 14

Warranty ..... 14

Troubleshooting ..... 14

Offer of Sale ..... 17

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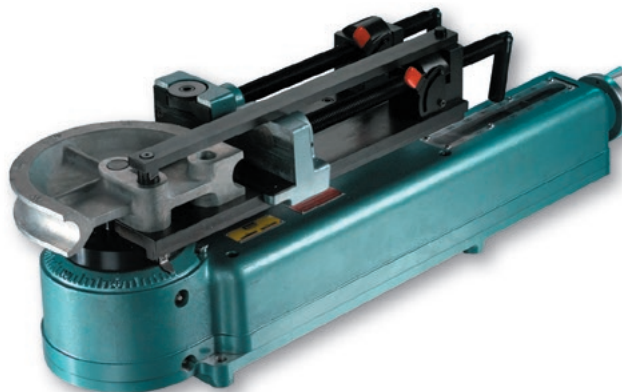


# Parker Hydraulic Tube Bender

## Model HB632

For 3/8" – 2" (10-50mm) tubing and 3/8 to 1-1/2 IPS Pipe

The Parker Model HB632 Tube Bender is a hydraulically operated bender for bending annealed steel and stainless steel tubing from 3/8" O.D. through 2" O.D. It is operated by means of a separate power source producing 10,000 psi hydraulic pressure. It can be operated without bolting to a table or bench if no mandrels are required, making it an excellent unit to move about and use at the point where the tubing installation is being made. It can also be attached to a table and used with mandrels.



Part No.: 631050

Bender Construction

The bender consists of a cast aluminum housing, with a hydraulically actuated drive mechanism which enables an operator to make bends up to 180° in one continuous smooth operation on tubing up to 2" in diameter.

### Capacity

Table 1 at right assigns a Model Code for each model of Parker tube benders. Table 2 gives the capacity for all Parker benders. The Model HB632 is represented by model code C so you can easily check for its capabilities in Table 2.

Tube Bender Model Codes				
Model Code	Model No.	Tubing O.D. Capacity	Bender Type	Rated Torque (in./lbs.)
A	412	1/4" – 3/4"	Worm & Gear	2,700
B	424	1/4" – 1-1/4"	Worm & Gear	11,000
C	HB632	1/4" – 2"	Hydraulic	52,000
D	CP432	3/8" – 2"	Hydraulic	N/A

Table 1 – Tube Bender Model Codes

Tube Benders Maximum Capacity Guide*													
Tube O.D. (in.)	Material	Tube Wall Thickness (inches)											
		0.035	0.049	0.058	0.065	0.072	0.083	0.095	0.109	0.120	0.134	0.156	0.188
Tube Bender Model Codes													
3/4	S	ABCD	ABCD	ABCD	ABCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
	SS	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
1	S	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
	SS	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	CD	CD
1-1/4	S	BCD	BCD	BCD	BCD	BCD	BCD	CD	CD	CD	CD	CD	CD
	SS	BCD	BCD	BCD	BCD	BCD	CD	CD	CD	CD	CD	C	C
1-1/2	S	BCD	BCD	BCD	BCD	BCD	CD	CD	CD	CD	CD	CD	CD
	SS	BCD	BCD	CD	CD	CD	CD	CD	CD	CD	CD	C	C
2	S	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD
	SS	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	—	—

Table 2 – Tube Benders Maximum Capacity Guide

\* See page 3 for pipe bending capabilities

### Specifications:

- 1) Min. tube size 3/8"
- 2) Max. tube size 2"
- 3) Min. bend radius 1-1/8"
- 4) Max. bend radius 12" (special order)
- 5) Max. tube bend 180°
- 6) Weight — 170 lbs. (77.1 kg) without accessories
- 7) Minimum tube wall thickness (% of O.D.) 4% with mandrel, 7% without mandrel
- 8) The HB632 is capable of bending 1/2" O.D. and under fully annealed steel and stainless steel tubing with no limit on tube wall thickness
- 9) The HB632 is capable of bending SOFT aluminum and copper tubing with no limit on wall thickness.
- 10) For HARD copper, ALLOY STEEL, and HIGH STRENGTH aluminum, use the tabulations shown for stainless steel.





900085 – Pump (std.)



974691 – High Flow Pump



Close Bend Radius Blocks



Standard Radius Blocks



Tie Bar



660221 – Radius Block Adapter Plate



Slide Blocks

Clamp Blocks



Bender Table – 520515

Heavy, all steel construction, strongly braced to keep bender, mandrel rod and rod stop assembly rigidly braced. Length 10 feet; weight 421 lbs.

## Mandrel Rods

### Part No. — See table

Mandrel rods are for use with the HB632 Model Bender and Exactol Models 412/424 benders. Mandrel rods (as well as mandrel rod stop assembly) are required when using mandrels. Overall mandrel rod lengths are approximately eight feet. Mandrel rod diameters are determined by tube I.D. (See Table 3.)

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

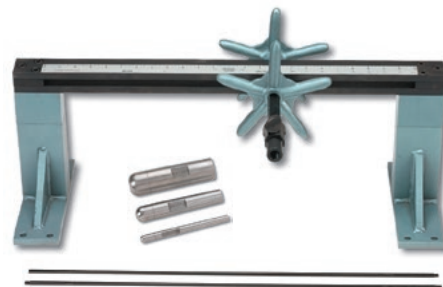
Table 3 – Mandrel Rod Sizes

## Mandrel Rod Stop Assembly

### For use with Model HB632 Bender

The mandrel rod stop assembly holds and supports the end of the mandrel rod in alignment with the tubing. The rod stop assembly is bolted to the other end of bender table. It keeps the mandrel and rod in alignment when mandrel bending. The stop screws can be adjusted for correct length and positioning of the mandrel in the tubing.

Description	Part No.
Mandrel Rod Stop Assembly (for Bender Model HB632)	631141



Part No. 631141 – HB632 Mandrels, Mandrel Rods and Rod Stop Assembly

## Universal Side Angle Indicator

### Part No. 520520

Accurately determines the angle between tube bends in different planes, and keeps out-of-plane angles accurate when making repeated bends. Incorporates a large, easy-to-read vernier dial. Maximum 3/4" O.D. tubing can be used if the tubing must be extended through the indicator. Maximum 1-1/2" O.D. tubing can be used if the end of tube is held in the clamp jaw.



Part No. 520520 – Universal Side Angle Indicator



When using radius blocks 631057-112, 631060-128, 974330 and 974350, first install the radius block adapter plate over the king pin, and then mount the radius block upon it, as shown above.

**Close bend radius blocks** — These blocks have a threaded pin which threads directly into both Triple-Lok and Ferulok (Seal-Lok requires an adapter) tube fitting nuts, permitting a first bend very close to the end of the tube.

**Inch Radius Block Chart**

Size	Tube O.D.		AND10111 Standard			MS33611 Standard			Radius Block – Close Bend**		
			Part No.	Radius*		Part No.	Radius*		Part No.	Radius*	
	in.	mm		in.	mm		in.	mm		in.	mm
6	3/8	9.5	540502	1-1/4	31.8	590512-18	1-1/8	28.6	—	—	—
8	1/2	12.7	530763	1-1/4	31.8	590515-24	1-1/2	37.5	530597	1-1/4	31.8
10	5/8	15.9	530764	1-1/2	37.5	590518-30	1-7/8	47.6	530601	1-1/2	38.1
12	3/4	19.0	530765	1-3/4	43.8	590521-36	2-1/4	57.2	530605	1-3/4	44.5
14	7/8	22.2	530766	2	50.2	590523-42	2-5/8	66.7	530609	2	50.8
16	1	25.4	—	—	—	590524-48	3	76.2	530613	3	76.2
18	1-1/8	28.6	530768	3-1/2	88.9	590526-54	3-3/8	85.7	530617	3-1/2	88.9
20	1-1/4	31.8	—	—	—	590527-60	3-3/4	95.3	530621	3-3/4	95.2
24	1-1/2	38.2	530770	5	127.0	590530-72	4-1/2	114.3	530625	5	127.0
28	1-3/4	44.5	—	—	—	631057-112	7	177.8	—	—	—
32	2	50.8	—	—	—	631060-128	8	203.2	—	—	—

\*Radius to tube centerline.

\*\*Note: Sizes 20 and 24 close bend radius blocks requires the removal of the clamp arm before installation.

**Metric Radius Block Chart**

Tube O.D. (mm)	Standard Radius Blocks		Close Bend Radius Blocks***	
	Part No.	Radius (mm)	Part No.	Radius (mm)
10	810023	32	—	—
12	780175	32	780185	32
14	780176	38	780186	38
15	780177	38	780187	38
16	780178	38	780188	38
18	780179	44	780189	44
20	780180	44	780190	44
22	780181	89	—	—
25	780182	100	—	—
30	780183	128	—	—
32	780184	128	—	—
35	974344	105	—	—
38	530770	127	530625	127
38	590530-72	114.3	—	—
42	974347	128	—	—
50	974350	150	—	—

\*\*\*Note: Size 38mm close bend radius blocks requires removal of the clamp arm before installation.

**Accessories for Close Bend Radius Blocks**

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

Threaded Pins and Seal-Lok Adapters for Close Bend Radius Blocks

**Inch Pipe Size Radius Block Chart**

Nominal Pipe Size (in.)	O.D. (in.)	Part No.	Bend Radius (in.)	Max. Pipe Schedule
3/8	0.675	974325	2-1/4	80
1/2	0.840	974326	2-5/8	160
3/4	1.050	974327	3-1/4	80
1	1.315	974328	4	80
1-1/4	1.660	974329	5	80
1-1/2	1.900	974330	6	40



**Slide Blocks**



**Clamp Blocks**



**Inch Tube Sizes**

Size	Tube O.D. (in.)	Part No.
6	3/8	864276
8-12-16-24	1/2, 3/4, 1, 1-1/2	520516
10-14-18-20	5/8, 7/8, 1-1/8, 1-1/4	520518
28	1-3/4	631063
32	2	631066

Slide Block

Size	Tube O.D. (in.)	Part No.
6	3/8	864266
8-12-16-24	1/2, 3/4, 1, 1-1/2	631092
10-14-18-20	5/8, 7/8, 1-1/8, 1-1/4	631093
28	1-3/4	027418-28
32	2	027418-32

Clamp Block

**Metric Tube Sizes**

Size	Tube O.D. (in.)	Part No.
10-12-14-16	10-12-14-16	790016
15-16-18-20	15-16-18-20	780192
22-25-30-32	22-25-30-32	780193
35	35	974345
38	38	520516
42	42	974348
50	50	974351

Slide Block

Size	Tube O.D. (mm)	Part No.
10-12-14-16	10-12-14-16	790017
15-16-18-20	15-16-18-20	780195
22-25-30-32	22-25-30-32	780196
35	35	974346
38	38	631092
42	42	974349
50	50	974352

Clamp Block

**IPS Tube Sizes**

Nominal Pipe Size (in.)	O.D. (in.)	Part No.
3/8, 1/2, 3/4	0.675, 0.840, 1.050	974331
1	1.315	974336
1-1/4	1.660	974340
1-1/2	1.900	974342

Slide Block

Nominal Pipe Size (in.)	O.D. (in.)	Part No.
3/8, 1/2, 3/4	0.675, 0.840, 1.050	974332
1	1.315	974338
1-1/4	1.660	974341
1-1/2	1.900	974343

Clamp Block

The bender is shipped completely assembled except for attaching a pump, hose, and installing selected bender dies.



### Step 1: Mounting Tube Bender

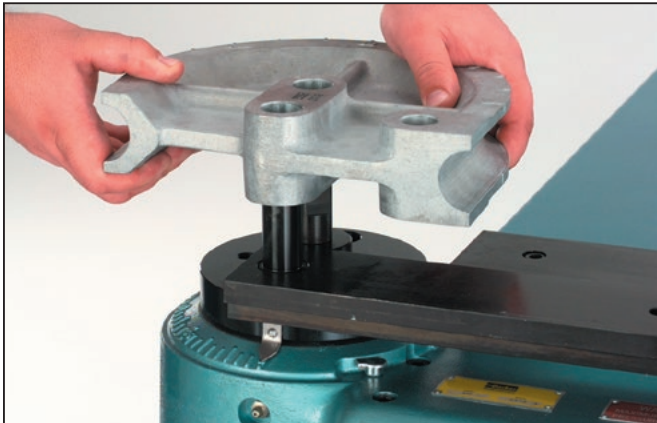
Position bender centered across the end of bender table and bolt securely in place. The Parker bender table has pre-drilled holes for bender attachment.

3 bolts, nuts and washers required for mounting bender



### Step 2: Connect Pump to Bender

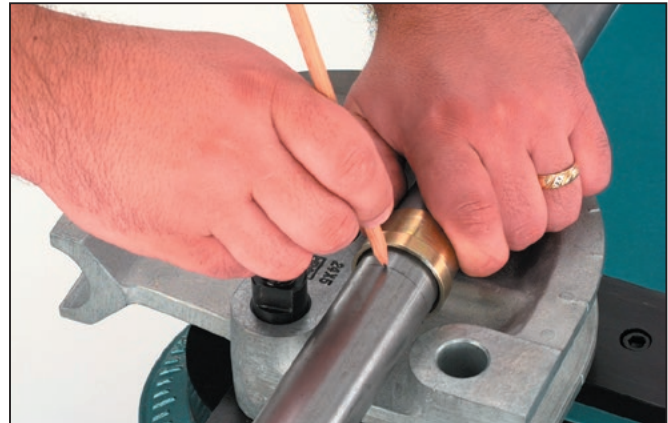
Connect the hose assembly (part no. 910004) to the pump (3/8" NPT end) and then connect hose to the bender. Be careful not to twist the hose when tightening. Use a pipe sealant on the pipe threads. The make-up for the NPT end is 2 to 3 turns from finger tight. The assembly torque for the Seal-Lok hose adapter (6G6L-S) that is connected to the bender is 360 in. lbs.



### Step 3: Select and Install Radius Block

Select the proper radius block according to the chart on page 3. Then install the selected radius block on the king and drive pins with the open end of the block toward the clamp arm.

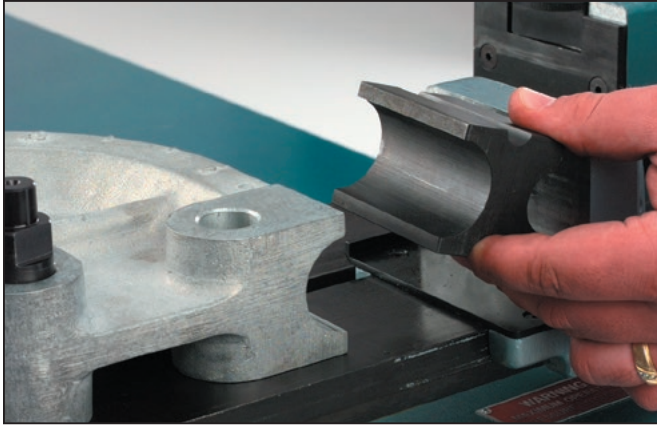
Radius blocks are accurately milled and bored to slip easily onto posts. Light lubrication of the posts will aid assembly. When handling radius blocks, as well as the slide and clamp blocks, care should be taken to avoid nicking the grooved surfaces.



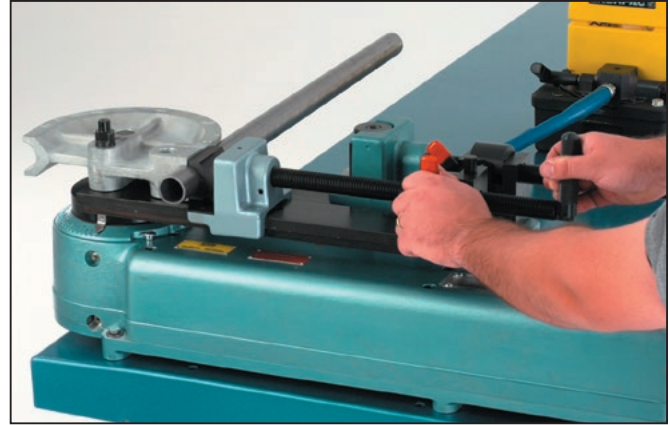
### Step 4: Mark the Tube

The first bend is easy. Simply measure from the end of the tube to the desired length of the centerline\* of the first bend.

\*For information on tube bending, centerline measurement, and back-bending compensation, see Parker Principles of Tube Line Fabrication, Manual 4306-B5.



**Step 5: Select Slide and Clamp Block Grooves**  
Select the proper groove of the slide block and clamp block for the outside diameter of tube (sizes are marked on end of each block). Lubricate the slide block to facilitate its sliding. Place the clamp block in its vise. Do not lubricate the clamp block. It's held in place magnetically.



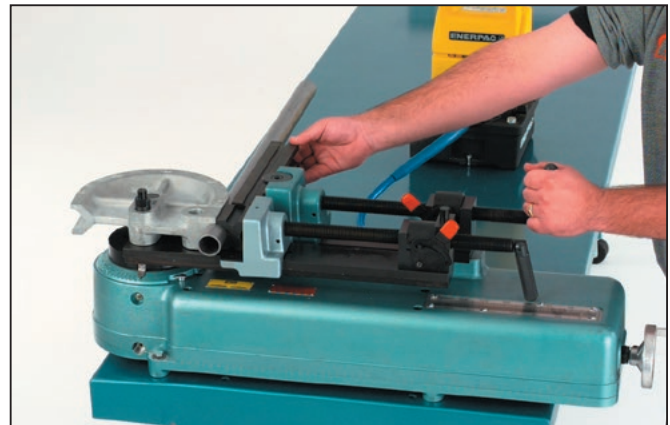
**Step 6: Rapid Positioning**  
Both the clamp and slide block vise screws feature rapid positioning, with a quick acting cam lock mechanism. To use, pull the respective cam lock mechanism to disengage, push the screw forward, then push the cam lock forward to engage.



**Step 7: Positioning the Tube**  
Advance the clamp block vise as described above. Then position the tube in the clamp block so that the mark is tangent to the radius block at the desired angle (90° for 90° bend; 45° for 45° bend, etc.). Use triangles to obtain accurate results (see diagram). 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.

For 180° bends, position the mark similar to 90° bends.

On long lengths of tubing, support is recommended to prevent sag.



**Step 8: Clamp the Tube**  
When in the proper position, clamp the tube with the clamp block vise. Next, advance the slide block vise using the rapid positioning sequence described.  
  
Rotate the slide block retainer to the proper height and insert the slide block. Then bring into snug position against the tube, but not with so much pressure as to prevent the block from sliding freely. The clamp block and slide block should not be touching.



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

If the tube is over 1" O.D. (25mm or 1/2 IPS), or heavy wall, or if mandrel bending, the tie bar must be used to prevent tube slippage and the clamp arm from flexing.

**Step 10: Setting Bend Angle** (Shown inset at top)

Set the angle to be bent on the angle indicator by turning the angle adjusting handle on the back of the bender housing. Generally add two to five degrees to the angle you wish to bend to compensate for the spring-back in the tube.

**Step 11: Bending the Tube**

To bend the tube, start the pump and close the valve.

**CAUTION** — Should it become apparent that the bend is too long for the slide block, stop the bender and loosen the slide block vise. Return the slide block to its original position. Retighten the vise screw and complete the bend.

When the preset angle has been reached, shut off the pump.

**Step 12: Completed Bent Tube**

Remove the tie bar, if in use, retract the slide and clamp vises, and pull the tube out from the radius block and lift up. Your tubing is bent, without flattening or cracking.

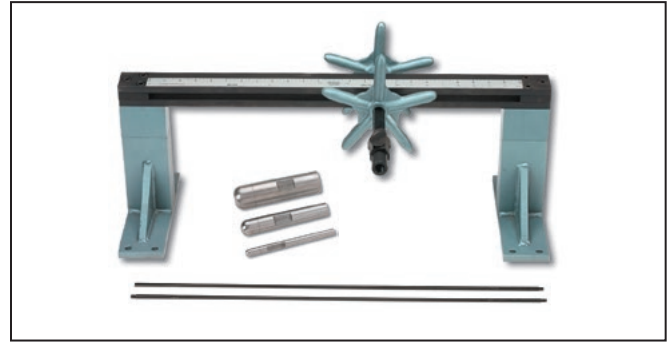
Releasing system pressure by opening the valve will relieve tension in the bender and the clamp arm will return to its original position.

### When to Mandrel Bend

For short radii bends and thin-wall tubing, mandrel equipment is necessary to prevent wrinkling, collapsing, or kinking of the tube. The mandrel supports the tube wall on the inside and maintains a full cross-section in a smooth bend. This is important and should be included as an indispensable part of bending equipment.

The rule that is generally followed to determine whether or not a mandrel is necessary is as follows: When the wall thickness of the tube to be bent is 7% or more of the tube O.D., a mandrel is usually not necessary. On wall thicknesses that ranges between 4-6% of the tube O.D., it is necessary to use a mandrel to avoid wrinkling and flattening in the bend area. These calculations are based on a bend radii of between three and four times the tube O.D.

Since mandrel equipment must be accurately aligned and rigidly held, we recommend the use of the bender table.



### Mandrel Rod Stop Assembly

This assembly holds the end of the mandrel rod in proper alignment with the tubing and bender. It bolts to the back end of the table. A scale permits accurate alignment of the stop screws. (Although not an extractor, this assembly is necessary to secure the mandrel and rod during the bending process.)

The Parker bender table has pre-drilled holes for the bender and rod stop assembly attachment. These pre-drilled holes insure proper bender and rod stop assembly alignment.

### Mandrel Specifications and Data

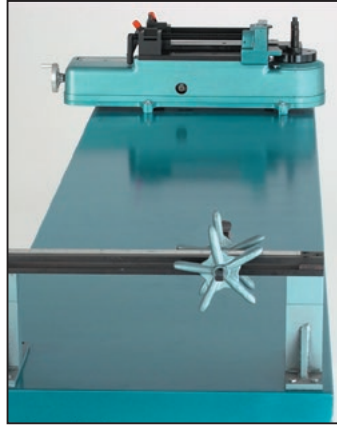
Size	Tube O.D.		Part No.	Type	Wall Thickness				
	in.	mm			in.	in.	in.	in.	in.
6	3/8	9.5	924417	Solid	—	.035	.042	—	—
8	1/2	12.7	924417	Solid	—	.035	.042	.049	—
10	5/8	15.9	924417	Solid	.035	.042	.049	.058	.065
12	3/4	19.0	924417	Solid	.035	.042	.049	.058	.065
14	7/8	22.2	924417	Solid	.035	.042	.049	.058	.065
16	1	25.4	924417	Solid	.035	.042	.049	.058	.065
18	1-1/8	28.6	924417	Solid	—	.049	.058	.065	—
20	1-1/4	31.8	924417	Solid	—	.049	.058	.065	—
24	1-1/2	38.1	924417	Solid	.049	.058	.065	.083	—

To order mandrels, specify part number, size and wall thickness.  
Example: 924417-12X058

### Mandrel Rod Specifications and Data

Mandrel Rod Size	Mandrel Rod Dia.		Tube I.D. inches (mm)	Part No.	Type
	in.	mm			
1/4	1/4	6.4	.283 (7.2) to .362 (9.2)	520506	Solid
5/16	5/16	7.9	.363 (9.2) to .484 (12.3)	520507	Solid
13/32	13/32	10.3	.485 (12.3) to 1.489 (37.8)	520508	Solid

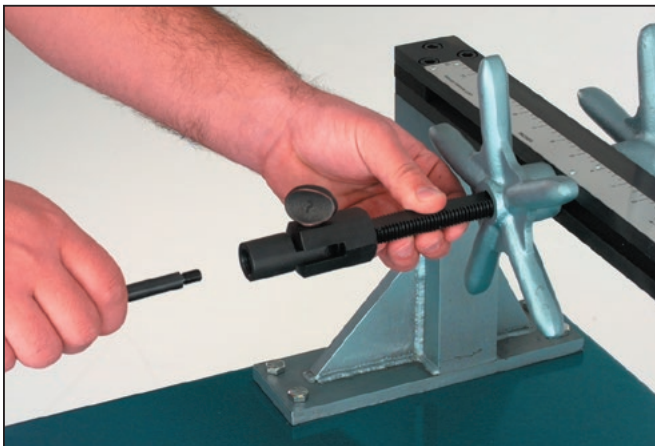
Description	Part No.
Mandrel Rod Stop Assembly	631141
Mandrel Rod Stop Adapter (1/4" Rod)	522398
Mandrel Rod Stop Adapter (5/16" Rod)	550501

**Step 1: Mandrel Rod Stop Assembly Installation**

The mandrel rod stop assembly must be rigidly mounted to the bender table in proper alignment with the bender. Zero ("0") at the end of the mandrel rod stop assembly scale must be in line with the center of the king pin.

**Step 2: Select Radius Block, Mandrel and Rod**

Select the proper radius block according to the chart on page 3. Select the mandrel and mandrel rod according to the outside diameter and wall thickness of the tubing.

**Step 3A: Install and Adjust Mandrel**

The selected mandrel is screwed onto one end of the mandrel rod. The other end of the mandrel rod is screwed into the adapter and then into the universal joint tongue on the rod stop assembly. The scale provided permits accurate alignment of the stop screw. The stop screw should be centered to the dimension on the scale corresponding to the bend radius.

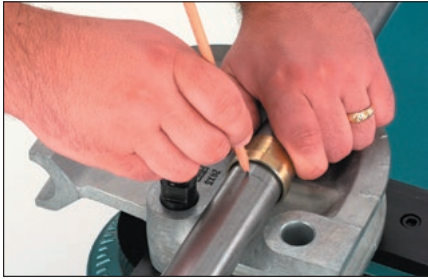
**Step 3B: Install and Adjust Mandrel (Continued)**

For average bending the mandrel should be adjusted so that the scribed line on its circumference is  $5/8$ " behind the line scribed on the face of the radius block. This adjustment is made by turning the mandrel rod stop handles at the rear of the bench. The mandrel may be moved inward slightly to produce a more perfectly round cross-section or it may be moved slightly outward to ease the bending effort. Extreme care must be used in establishing this position as even the slightest adjustment will affect the results.

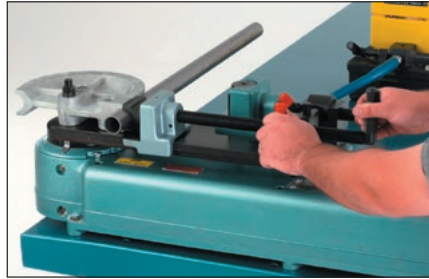
**Step 4: Insert the Tube**

First lubricate the mandrel with light lubricating oil. Then, slip the tube over the mandrel.

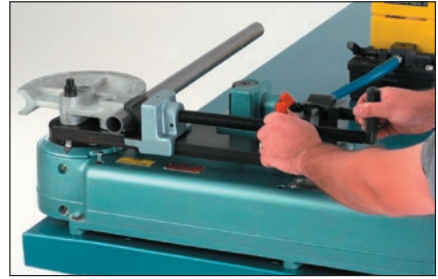
Steps 5 through 12 below are a repeat of steps 4 through 11 on pages 5-7.



**Step 5: Mark the Tube**



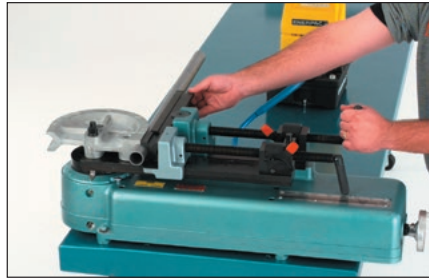
**Step 6: Select Slide and Clamp Block Grooves**



**Step 7: Rapid Positioning**



**Step 8: Positioning the Tube**



**Step 9: Clamp the Tube**

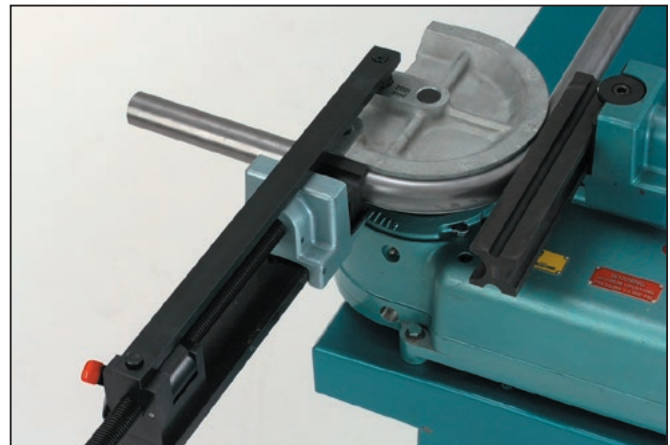


**Step 10: Using the Tie Bar**



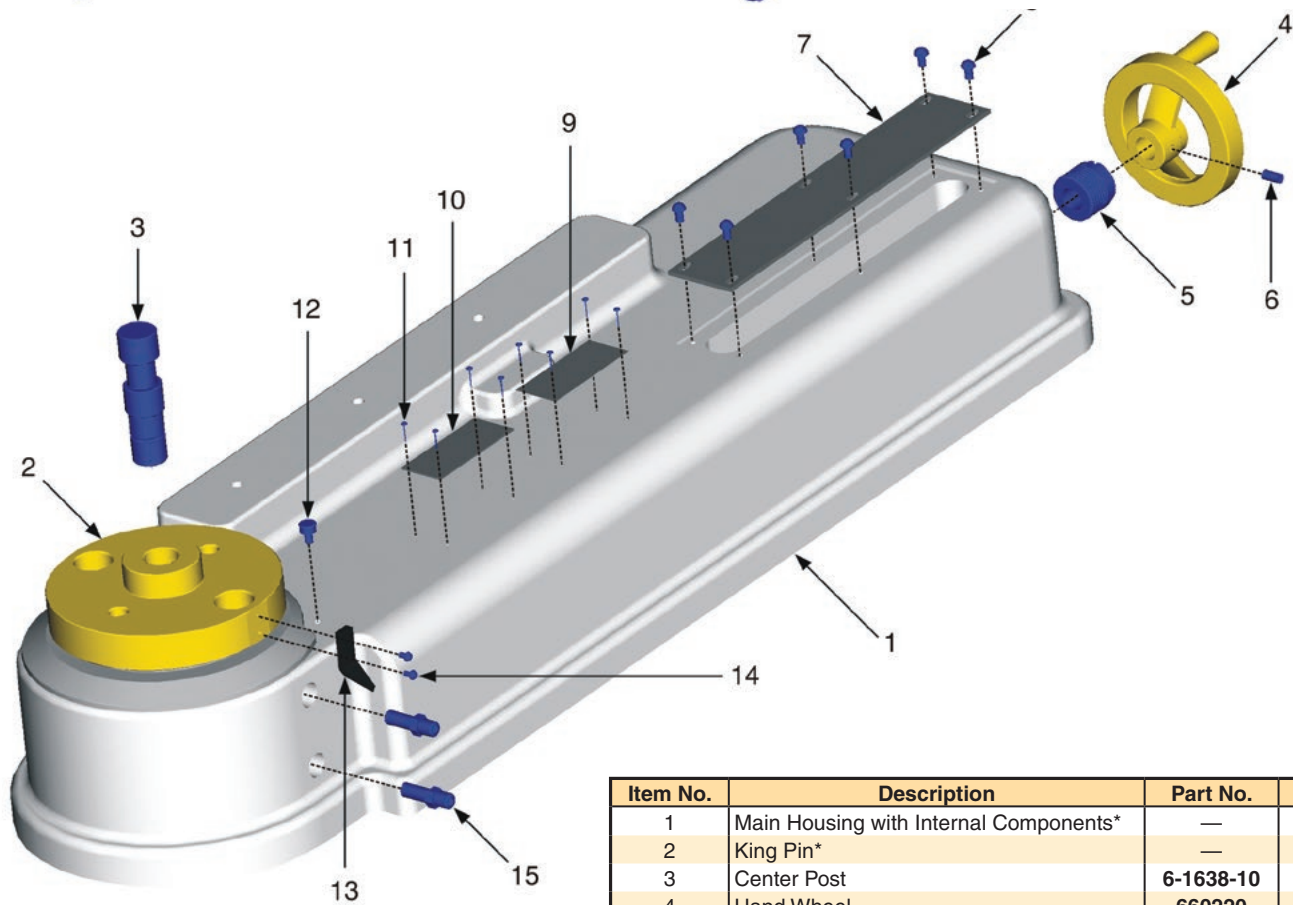
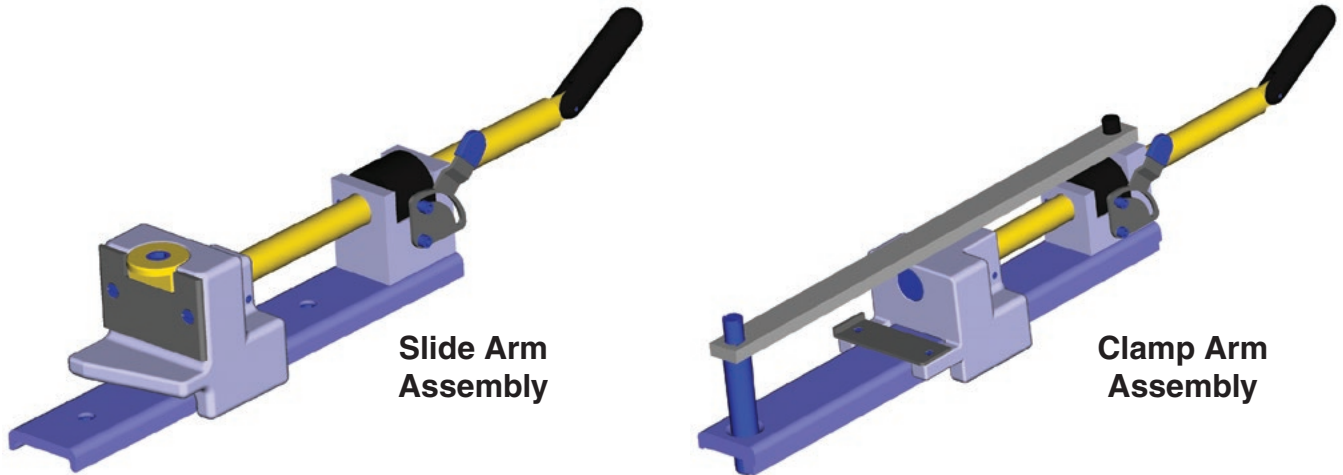
**Step 11: Setting the Bend Angle**

**Step 12: Bending the Tube**



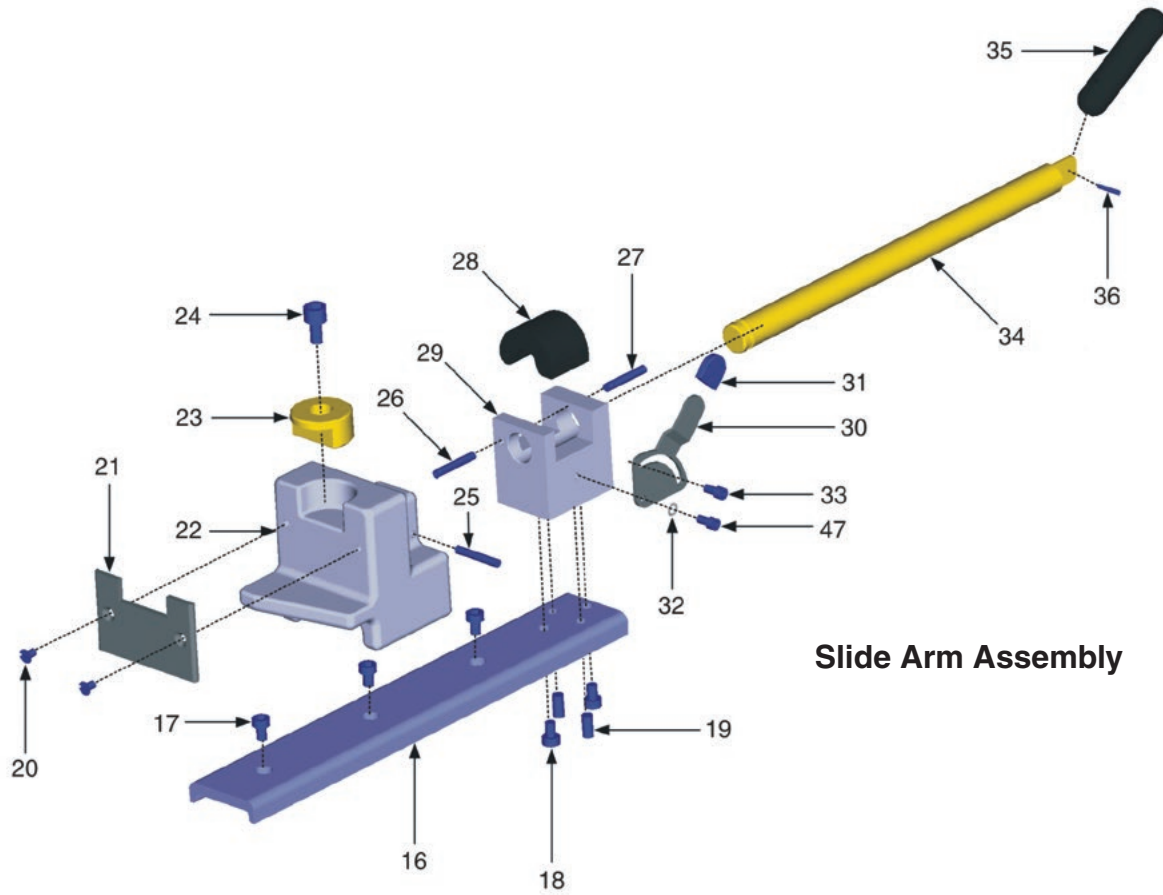
**Step 13: Completed Bent Tube**

After completion of the bend, remove the tie bar, retract the slide and clamp block vises, and by pulling the tubing to the left, slide it off of the mandrel rod assembly. Then release the system pressure by opening the valve. The clamp arm will return to the starting position.



Item No.	Description	Part No.	Qty.
1	Main Housing with Internal Components*	—	1
2	King Pin*	—	1
3	Center Post	6-1638-10	1
4	Hand Wheel	660220	1
5	Screw Bushing*	—	1
6	1/4-20 x 3/8" Socket Head Cap Screw	13302	1
7	Angle Indicator Plate	631138	1
8	#10-24 Round Head Screw	10-24X3/8	8
9	Warning Plate	631139	1
10	Nameplate	550609	1
11	#0-1/8 Drive Screw	13050	8
12	Oil Hole Cover, 5/16" diameter	502-G	2
13	Radial Pointer	631136	1
14	#6-32 x 1/4" Round Head Screw	13179	2
15	1/8" NPTF Grease Fitting	13359	2

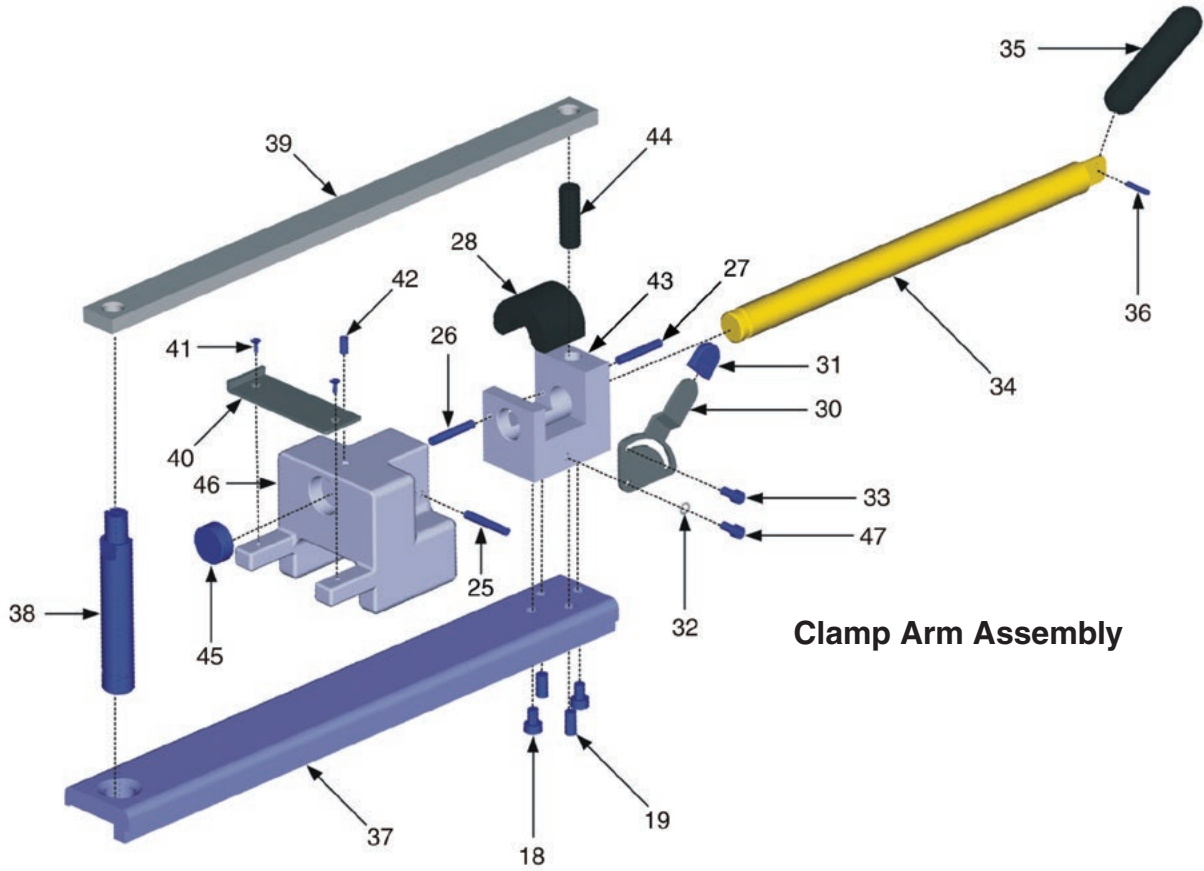
\*Contact the Tube Fittings Division for repair. Phone: (614) 279-7070.



Slide Arm Assembly

Item No.	Description	Part No.	Qty.
16	Slide Rail	660219	1
17	3/8-16 x 3/4" Socket Head Cap Screw	13321	4
18	3/8-16 X 1 Socket Head Screw	13305	4
19	Dowel Pin, 3/8" dia. x 1-1/2" long	13320	2
20	1/4-20 x 5/8" Flat Head Screw	13367	2
21	Wear Plate	900135	1
22	Vise Face, Slide Rail	631100	1
23	Slide Block Retainer	631101	1
24	1/2-13 x 1" Socket Head Cap Screw	13327	1
25	Roll Pin, 1/4" dia. x 1-7/8" long	13328	2
26	1/4" dia. x 1" long Drive Lok "C" pin	970096	2
27	1/4" dia. x 1-1/4" long Drive Lok "C" pin	13509	1
28	Pivot Half Nut	970088	2
29	Slide Arm Bracket	970086	1
30	Cam Latch	970089	2
31	Red Grip	970090	2
32	0.261" I.D. x 0.432" O.D. Wave Washer	970093	1
33	Dowel Pin, 1/4" dia. x 3/4" long	970091	1
34	Vise Adjusting Screw	631103	1
35	Vise Adjusting Screw Handle	522196	1
36	Roll Pin, 5/32" dia. x 7/8" long	5/32 X 7/8 ROLL PIN	1

(Table continued on the following page)



**Clamp Arm Assembly**

Item No.	Description	Part No.	Qty.
37	Clamp Rail Arm	660224	1
38	Drive Post	660238	1
39	Tie Bar	660438	1
40	Spacer Plate	660228	1
41	#8-32 x 5/8" Flat Head Screw	13346	2
42	1/4-20 x 3/8" Socket Head Set Screw, Nylon	13302	1
43	Clamp Arm Bracket	13387	1
44	Dowel Pin, 5/8" dia. x 1-1/2" long	13102	1
45	Cup Magnet, 1-1/4" dia. x 1", 15lb.	660227	1
46	Vise Face, Clamp Arm	660226	1
47	1/4" x 1-1/4" Socket Head Shoulder Screw	970092	2
34, 35, 36	Vise Adjusting Screw Sub-Assembly	13750	2
18, 19, 25-28, 30-47	Clamp Arm Bracket	13387	1
18, 19, 26-28, 30-33, 43, 44, 47	Clamp Arm Bracket Sub-Assembly	660223	1
18, 19, 26-33, 47	Slide Arm Bracket Sub-Assembly	13388	1

\*Contact the Tube Fittings Division for repair. Phone: (614) 279-7070.

## Bender Maintenance

The bender is equipped with two grease fittings on the side to lubricate the king pin bearings. This should be done at least once a year.

There are two oil hole covers on the top of the unit. These should be serviced once a year by running oil into them while the bender is rotating to lubricate the roller chain.

The threads of the vise screws should receive a few drops of oil occasionally to make certain they stay in working condition.

Visually check all hydraulic connections regularly for leakage.

## Warranty

The bender and accessories are warranted to be free of defects in workmanship for a period of one year from date of sale. The bender has a sticker placed over the king pin. Removal of the sticker voids the bender warranty. Alterations to the bender or accessories voids the warranty of the part.

## Repair

The bender can be repaired. External parts are available for sale (see Parts List). For repair of internal parts, the bender must be returned to Parker Hannifin Tube Fittings Division. Please contact the Division (614-279-7070) before sending the bender back for repair.

## Troubleshooting

Problem	Probably Cause	Solution
Bender will not rotate	No hydraulic power supply	Verify the hydraulic pump is connected, the connections are not leaking, and the valve is closed
	Angle indicator is set at 0°	Set the angle indicator to the desired bend angle
Tube slips in clamp block	Clamp block not tightened	Tighten clamp block
	Incorrect radius or clamp block	Check that the radius and clamp blocks match tube size
Tube is flattened or mis-shaped	Tube requires mandrel for bending	Check chart for mandrel bending
	Incorrect slot on slide block is used	Verify that the slot on the slide block used matches the tube size
Bender will not complete the bend	Tube wall thickness is too large	Check the capacity chart to verify the bender is rated for the wall thickness of the tube to be bent
	Slide block is overtightened	Lightly clamp the slide block – do not overtighten
	Pump is low on fluid	Check fluid level in the hydraulic pump







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**10. Buyer's Obligation; Rights of Seller.** To secure payment of all sums due or otherwise, Seller retains a security interest in all Products delivered to Buyer and this agreement is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

**11. Improper Use and Indemnity.** Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney

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**15. Waiver and Severability.** Failure to enforce any provision of this agreement will not invalidate that provision; nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

**16. Termination.** Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate this agreement, in writing, if Buyer: (a) breaches any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or one or more filed by a third party (d) makes an assignment for the benefit of creditors; or (e) dissolves its business or liquidates all or a majority of its assets.

**17. Governing Law.** This agreement and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

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**19. Entire Agreement.** This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged. The terms contained herein may not be modified unless in writing and signed by an authorized representative of Seller.

**20. Compliance with Laws.** Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards of care, including those of the United Kingdom, the United States of America, and the country or countries in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act") and the U.S. Food Drug and Cosmetic Act ("FDCA"), each as currently amended, and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that it is familiar with the provisions of the U. K. Bribery Act, the FCPA, the FDA, and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller.

05/14



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