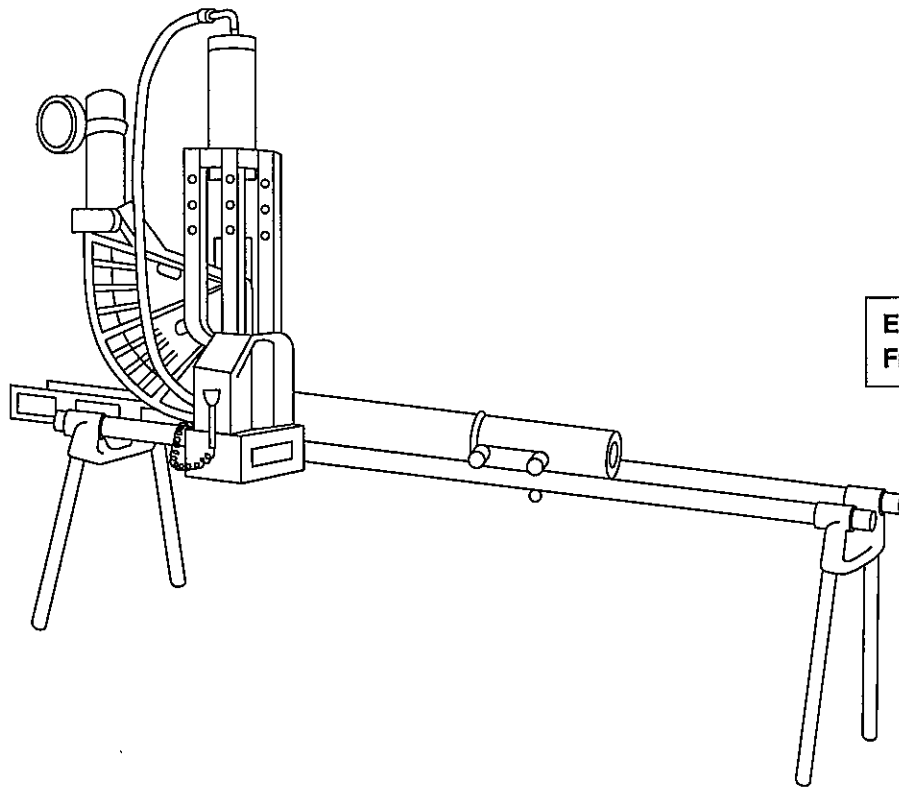


INSTRUCTION MANUAL



GREENLEE®

A Textron Company



Español.....	33
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881 and 881CT Cam Track® Hydraulic Benders and 1813 Bending Table



Read and understand all of the instructions and safety information in this manual before operating or servicing this tool.

Register this product at www.greenlee.com

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Description

The 881 and 881CT Cam Track® Hydraulic Benders are intended to bend rigid conduit, IMC (intermediate metallic conduit), EMT (electrical metallic conduit), and Schedule 40 pipe. Bending shoes, follow bars, and saddles are available for bending 2-1/2" through 4" conduit or pipe.

The bender is to be coupled to any Greenlee hydraulic pump capable of developing 10,000 psi with a usable oil volume of 6 quarts or more. Suggested pumps include the following models:

- Electric Pump (120 volt): 960 SAPS, 980
- Electric Pump (220 volt): 980-22FS, 980-22PS

Safety

Safety is essential in the use and maintenance of Greenlee tools and equipment. This instruction manual and any markings on the tool provide information for avoiding hazards and unsafe practices related to the use of this tool. Observe all of the safety information provided.

Purpose of this Manual

This instruction manual is intended to familiarize operators and maintenance personnel with the safe operation and maintenance procedures for the Greenlee 881 and 881CT Cam Track® Hydraulic Benders.

Keep this manual available to all personnel.

Replacement manuals are available upon request at no charge at www.greenlee.com.

All specifications are nominal and may change as design improvements occur. Greenlee Textron Inc. shall not be liable for damages resulting from misapplication or misuse of its products. Cam Track is a registered trademark of Greenlee Textron Inc.

KEEP THIS MANUAL

IMPORTANT SAFETY INFORMATION



SAFETY ALERT SYMBOL

This symbol is used to call your attention to hazards or unsafe practices which could result in an injury or property damage. The signal word, defined below, indicates the severity of the hazard. The message after the signal word provides information for preventing or avoiding the hazard.

⚠ **DANGER**

Immediate hazards which, if not avoided, **WILL** result in severe injury or death.

⚠ **WARNING**

Hazards which, if not avoided, **COULD** result in severe injury or death.

⚠ **CAUTION**

Hazards or unsafe practices which, if not avoided, **MAY** result in injury or property damage.



⚠ **WARNING**

Read and understand all of the instructions and safety information in this manual before operating or servicing this tool.

Failure to observe this warning could result in severe injury or death.

⚠ **WARNING**

Use only Greenlee shoes and components when operating this bender. Other manufacturers' shoes and components may fail during operation, propelling broken parts with great force.

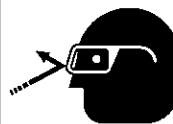
Failure to observe this warning could result in severe injury or death.



⚠ **WARNING**

Pinch points:

Keep hands away from bending shoe, follow bar, saddle, conduit, and other moving parts when bender is in use. Failure to keep hands away from these areas could result in serious injury.



⚠ **WARNING**

Wear eye protection when operating the bender.

Failure to wear eye protection could result in serious eye injury from flying debris or hydraulic oil.

IMPORTANT SAFETY INFORMATION**⚠ WARNING**

Do not operate while wearing loose clothing. Loose clothing could get caught in moving parts. Failure to observe this warning could result in severe injury.

⚠ CAUTION

Inspect the bender, pump, and hose before each use. Replace damaged, worn, or missing parts with Greenlee replacement parts; a damaged or worn component may fail and strike nearby personnel.

⚠ WARNING

Do not stand in direct line with the hydraulic ram. A component failure could propel parts with great force, striking nearby personnel. Failure to observe this warning could result in severe injury or death.

⚠ CAUTION

Some bender parts and accessories are heavy and require more than one person to lift and assemble. Failure to observe this precaution may result in injury or property damage.

⚠ WARNING

Do not stand in direct line with the follow bar. A component failure could propel the follow bar with great force, striking nearby personnel. Failure to observe this warning could result in severe injury or death.

IMPORTANT

Make sure all hose fittings are properly seated before starting the bend. Incomplete connections may not allow the ram to retract after the bend is complete.

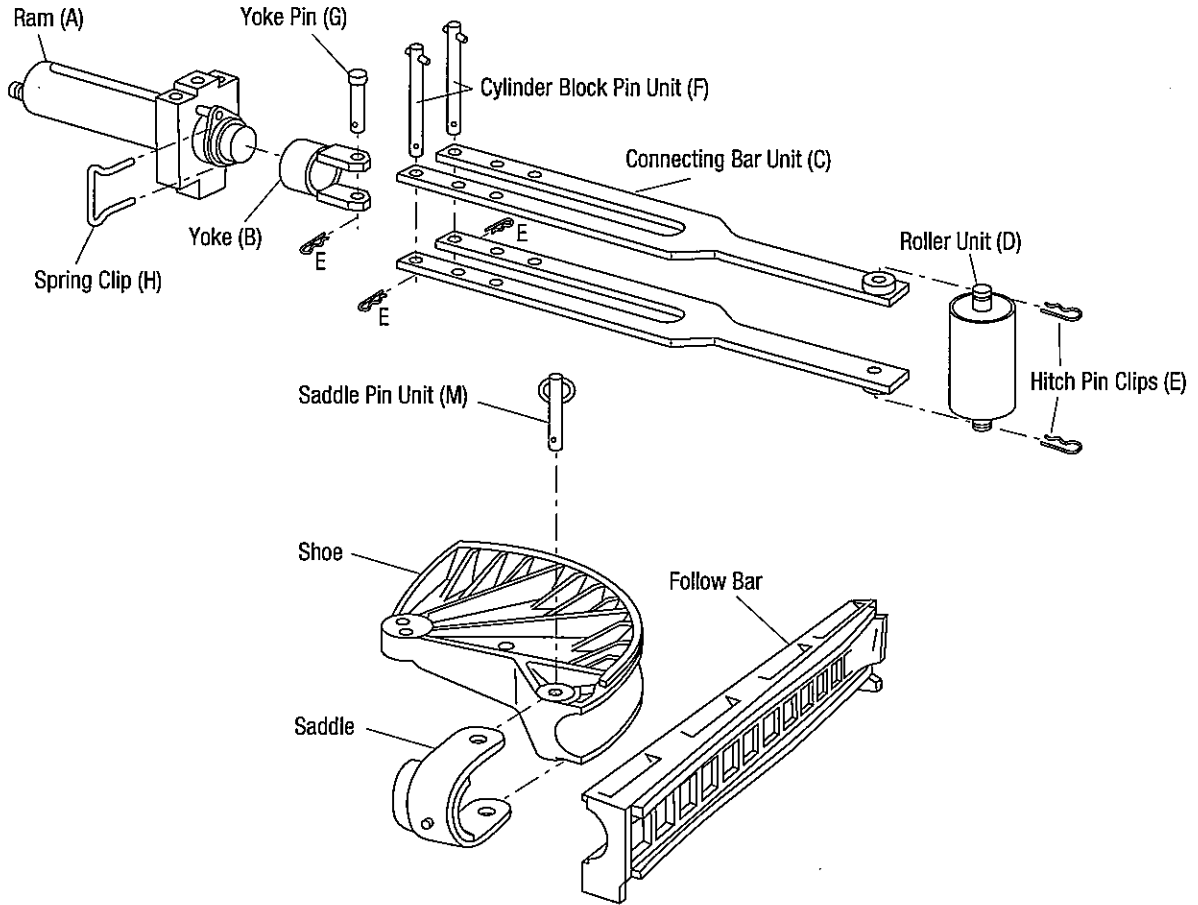
IMPORTANT

Follow the instructions and safety information supplied with your hydraulic pump.

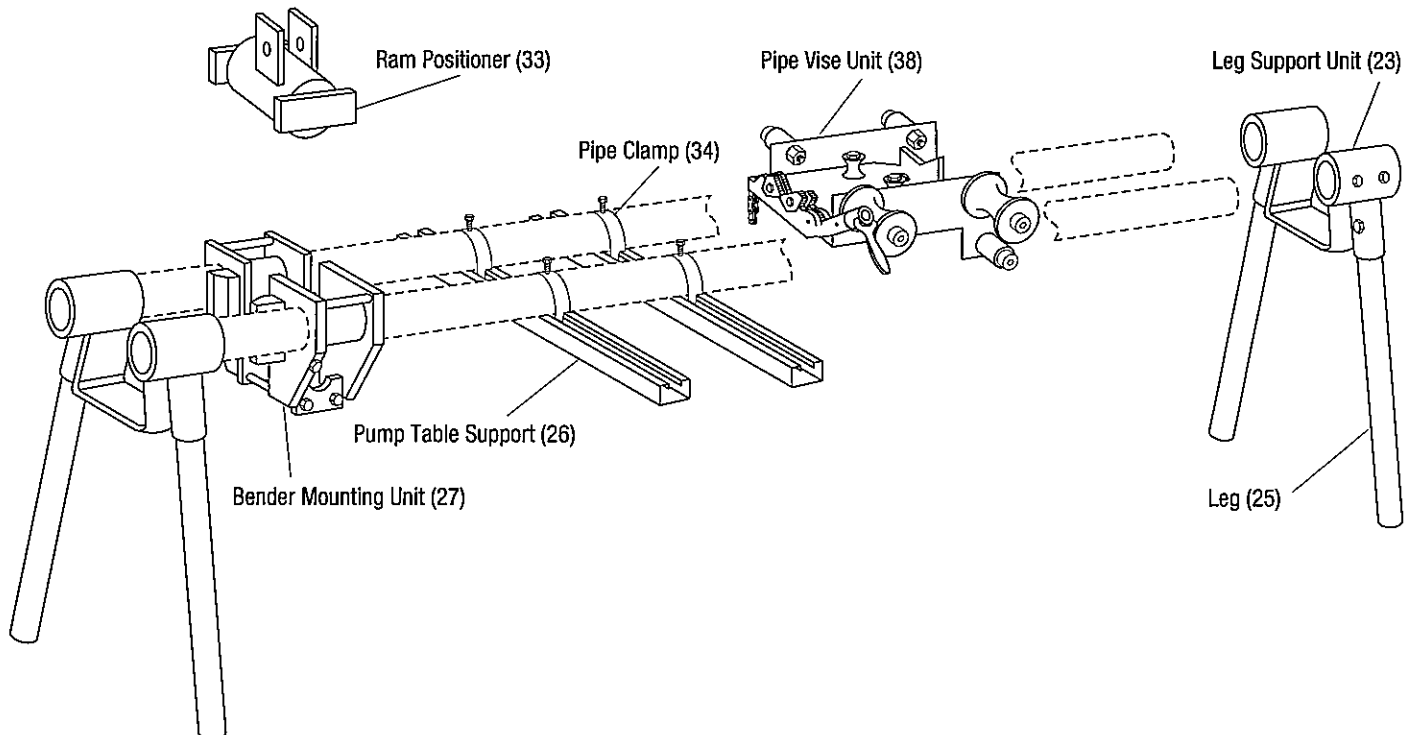
Note: Keep all decals clean and legible, and replace when necessary.

Identification—Major Components

881 and 881CT Hydraulic Benders

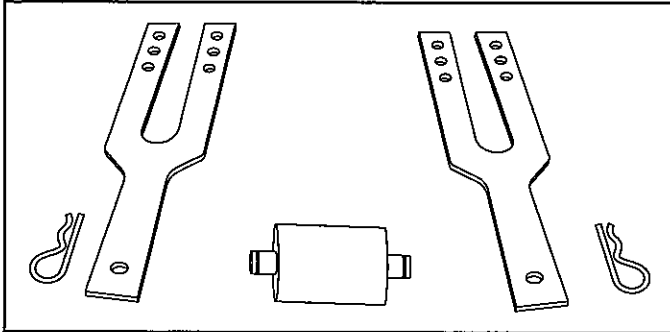


1813 Bending Table

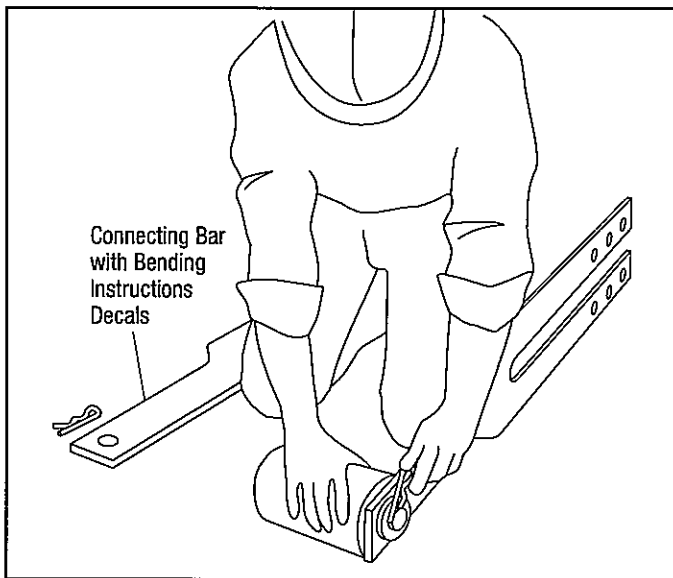


Assembly and Operation Instructions

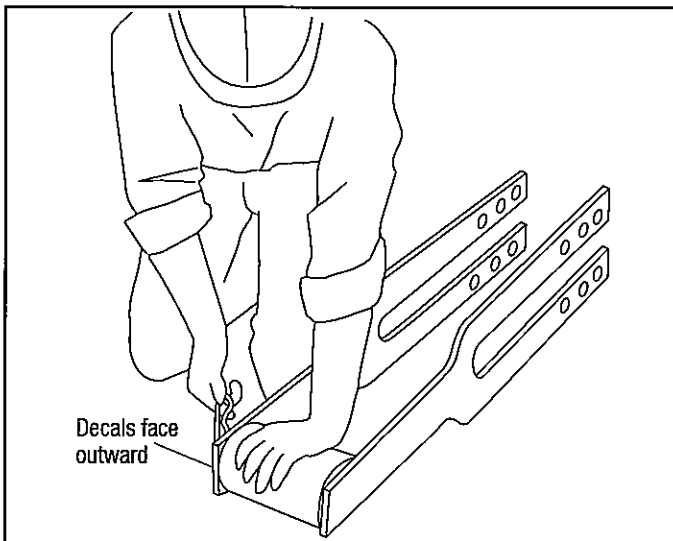
881 and 881CT—Floor Operation (refer to “Identification—Major Components”)



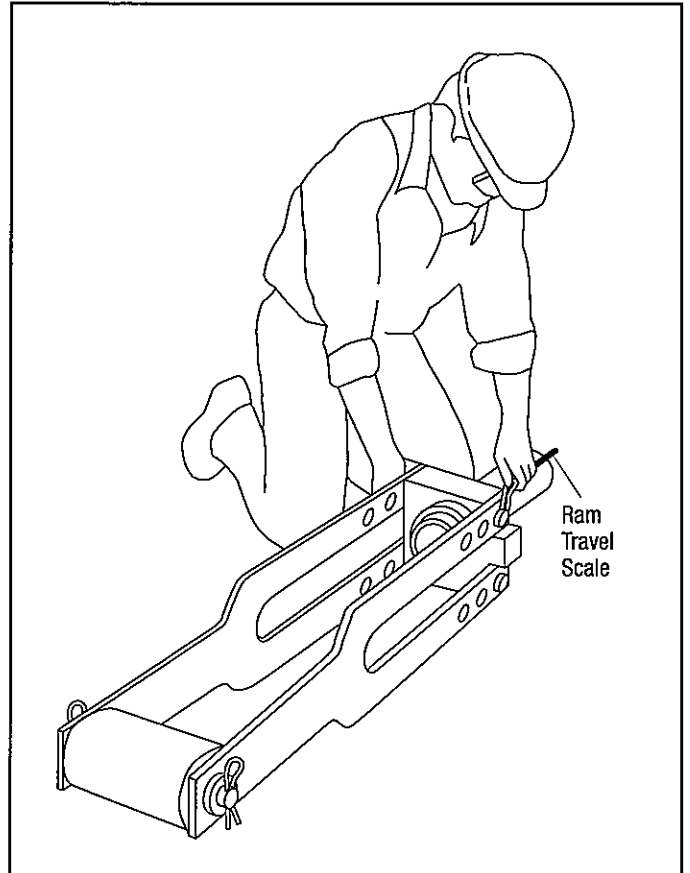
1. Lay out the connecting bars (C), roller unit (D), and two hitch pin clips (E).



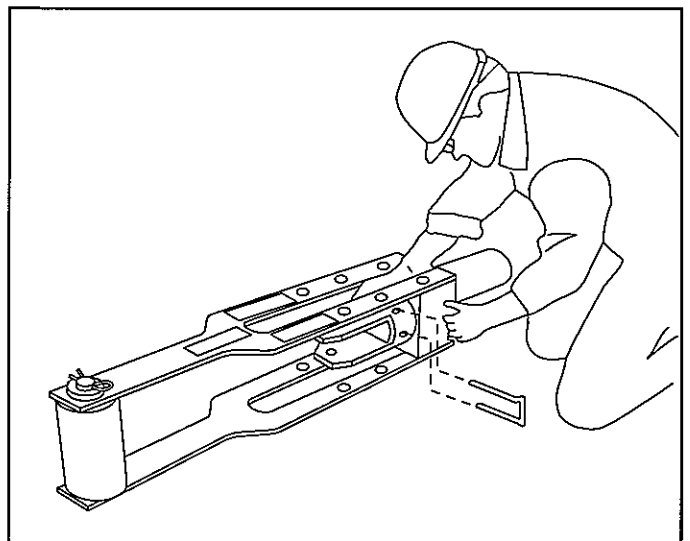
2. Attach the roller unit to one of the connecting bars with a hitch pin clip, as shown.



3. Repeat Step 2 for the other connecting bar.



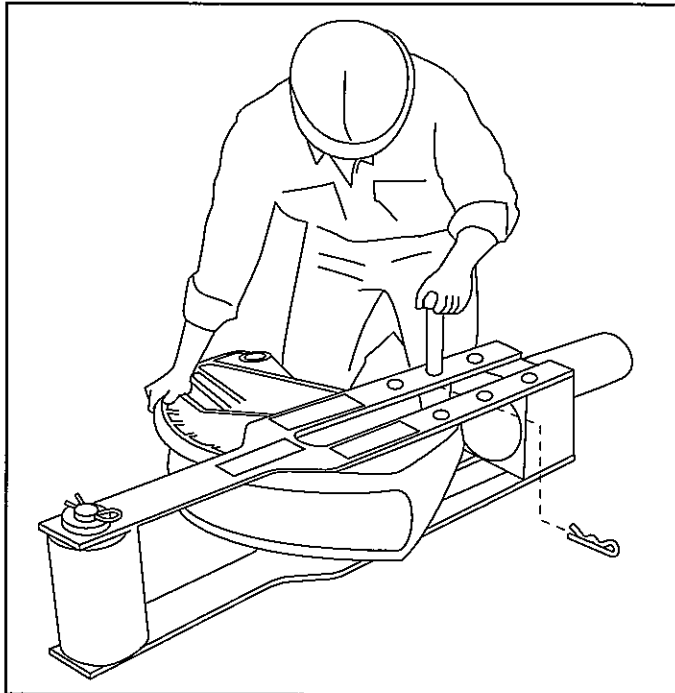
4. Position the ram and cylinder block so that, from the operator's point of view, the ram scale is up and to the left of the ram.



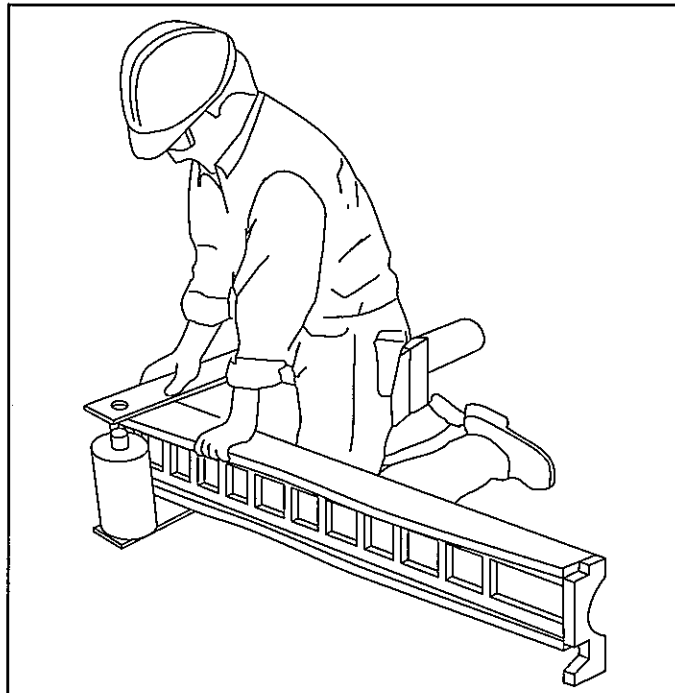
5. Attach the yoke (B) to the ram with the spring clip (H).

Assembly and Operation Instructions

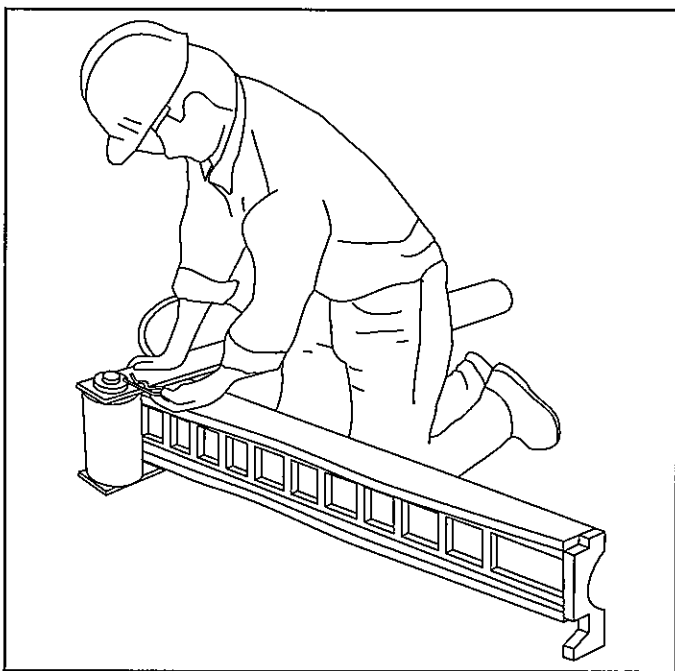
881 and 881CT—Floor Operation (cont'd)



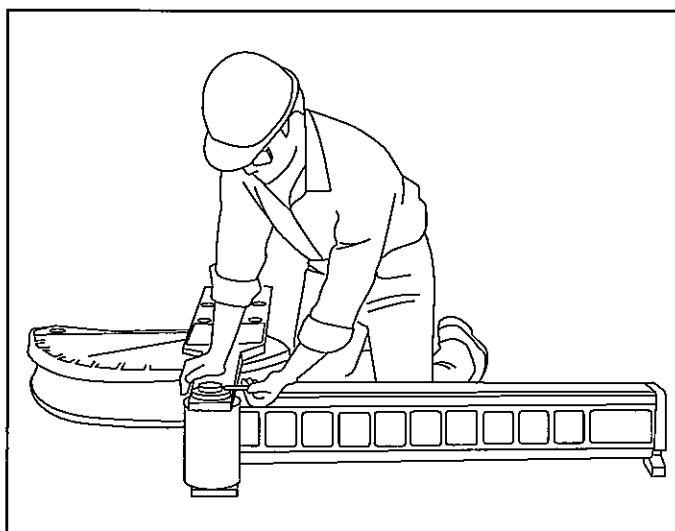
6. Select the shoe for the size of conduit to be bent. Insert the shoe with the shoe size marking facing up. Align either the EMT or Rigid/IMC hole with the yoke and insert the yoke pin (G). Secure the yoke pin with a hitch pin clip (E).



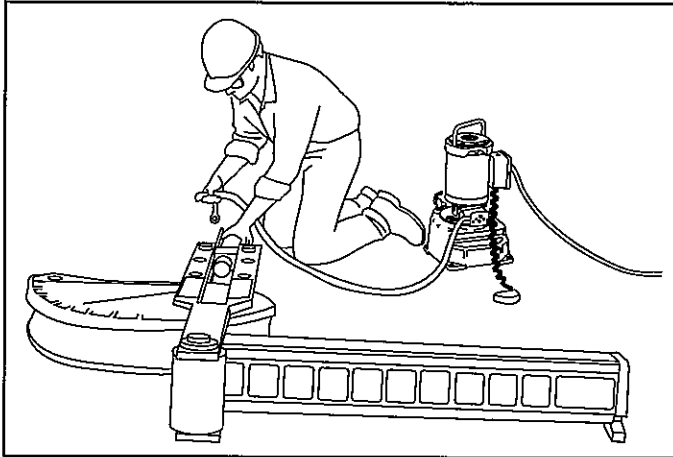
8. Lift the connecting bar and insert the follow bar.
Note: Insert the end marked START.



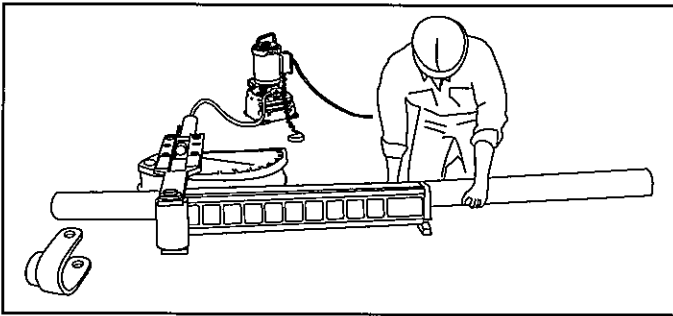
7. Remove one hitch pin clip from the roller shaft.



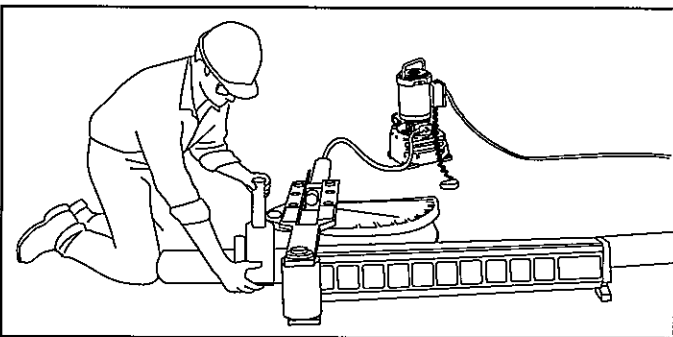
9. Reinsert the hitch pin clip into the roller shaft.

Assembly and Operation Instructions
881 and 881CT—Floor Operation (cont'd)


10. Attach the hose (L) to the pump and ram.



11. Make sure the shoe and follow bar grooves are clean. Insert the conduit into the bender.



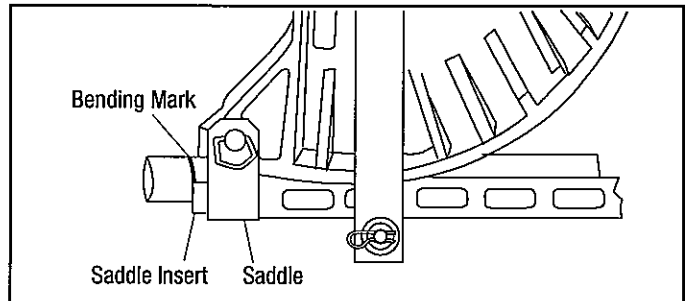
12. Set the conduit into the groove of the shoe. Rotate the shoe as necessary to align the saddle with the shoe. Position the saddle so the saddle insert is toward the operator, as shown. Attach the saddle to the shoe with the saddle pin unit (M); secure the pin unit with the hitch pin clip (E).

Note: Align the bending mark on the conduit with the outside edge of the saddle insert.

IMPORTANT

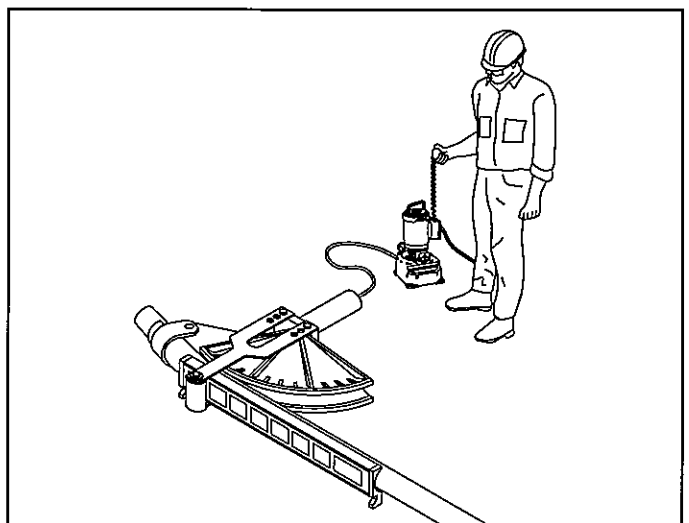
Follow the instructions and safety information supplied with your hydraulic pump.

The instructions provided here apply to Greenlee 960 (shown in the illustrations) and 980 (not shown) hydraulic pumps only.



13. Rotate the pump control lever counterclockwise. Activate the hydraulic pump until the shoe just contacts the conduit. Check that the saddle and follow bar are snug. Be sure that the follow bar contacts the saddle. Be sure that the bending mark on the conduit is aligned with the front edge of the saddle insert. Calibrate the bender (refer to "Calibrate Bender Before Bending" under "Table 3—Ram Travel").

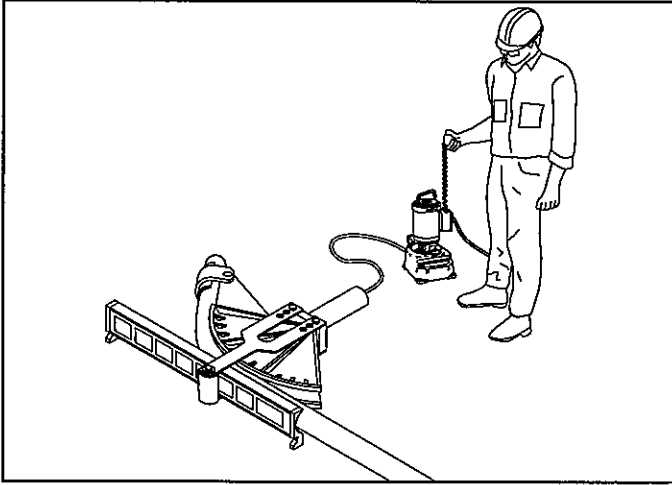
Activate the hydraulic pump to begin the bend.



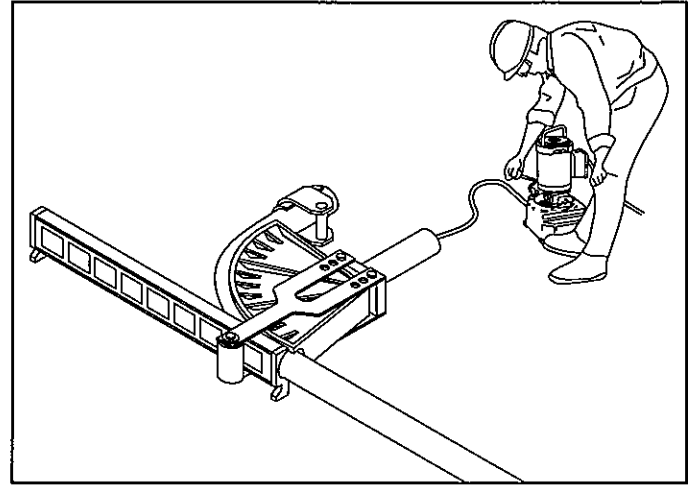
14. 10° of bend.

Assembly and Operation Instructions

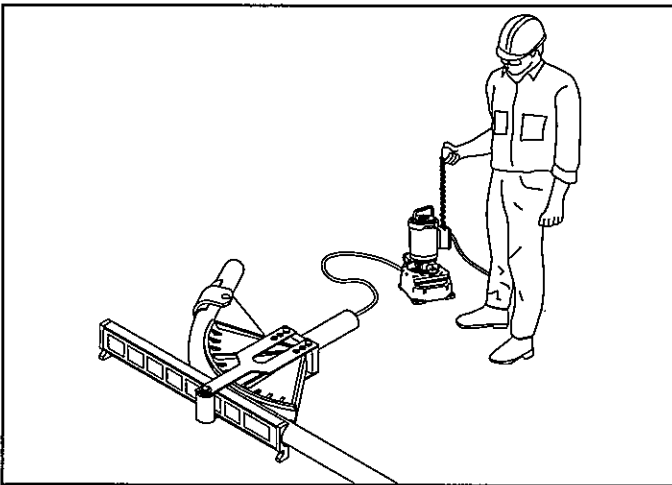
881 and 881CT—Floor Operation (cont'd)



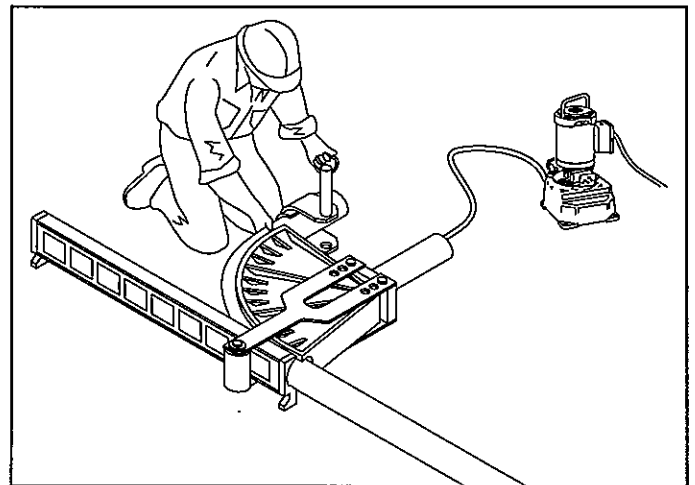
15. 45° of bend.



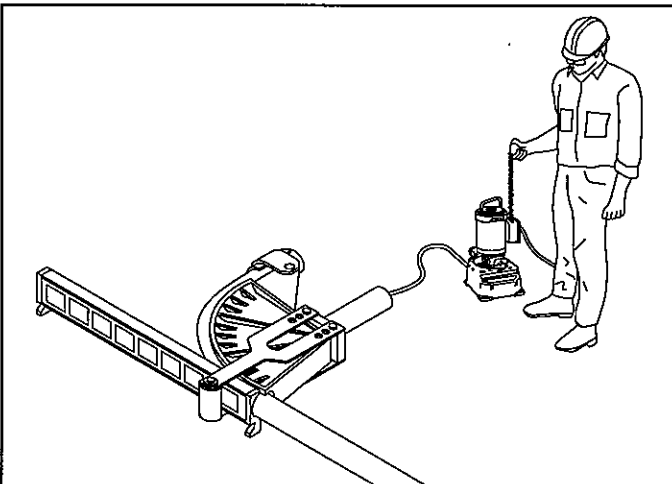
18. Release the hydraulic pressure. The ram will retract.



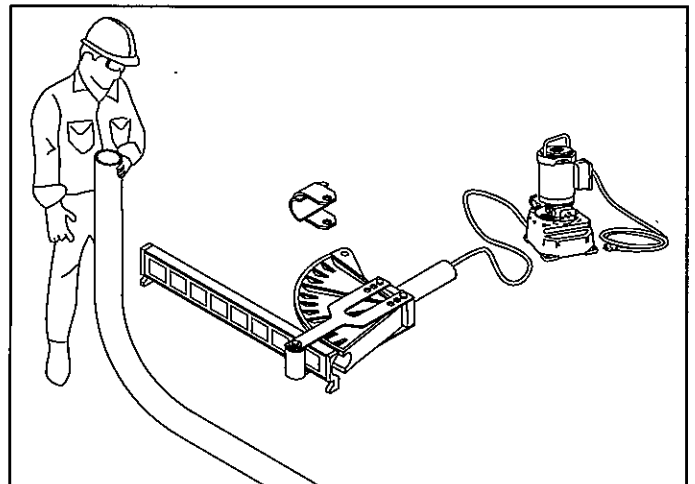
16. 60° of bend.



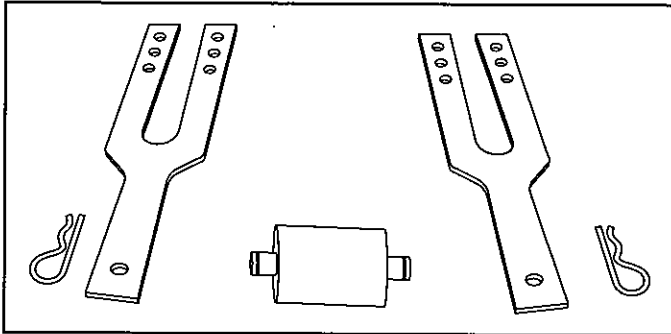
19. Remove the saddle pin.



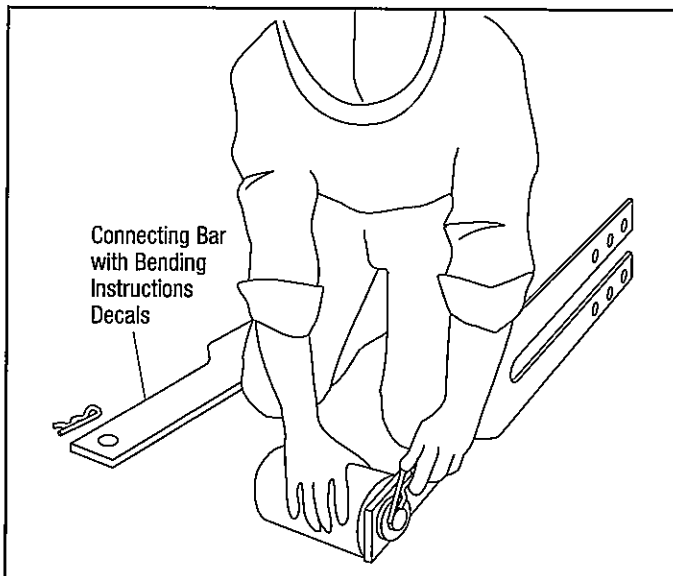
17. 90° of bend.



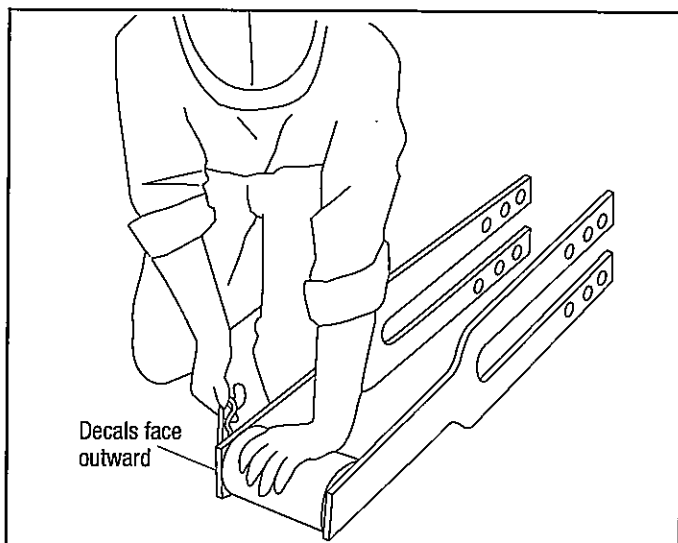
20. The 90° bend is complete.

Assembly and Operation Instructions
881 and 881CT with 1813 Bending Table (refer to "Identification—Major Components")


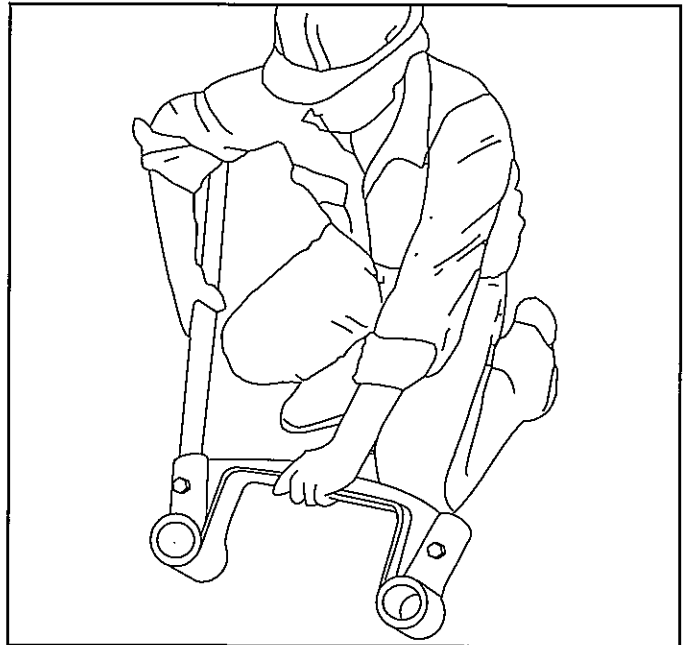
1. Lay out the connecting bars (C), roller unit (D), and two hitch pin clips (E).



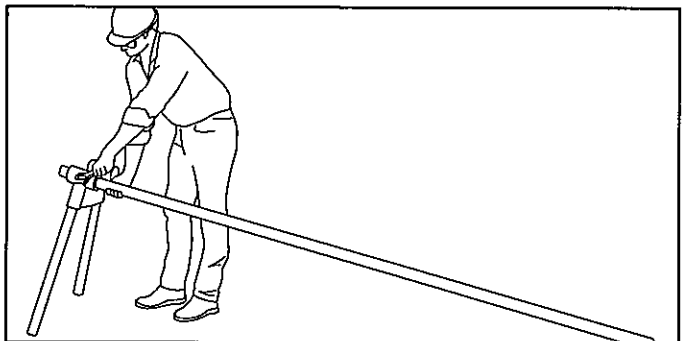
2. Attach the roller unit to one of the connecting bars with a hitch pin clip, as shown.



3. Repeat Step 2 for the other connecting bar.

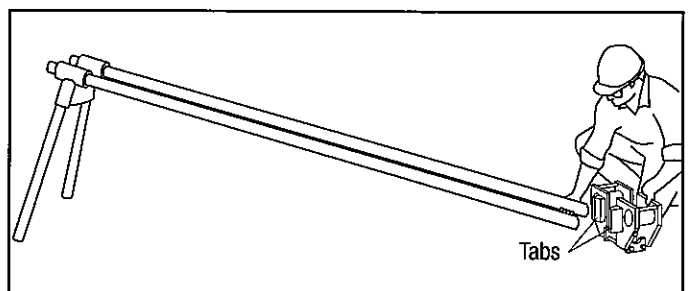


4. Insert 29" leg (25) into leg support unit (23). Tighten the cap screw (24). Repeat for the other three legs.



5. Insert two 10-foot lengths of IMC or rigid conduit into the leg support unit (23). Tighten four cap screws (24).

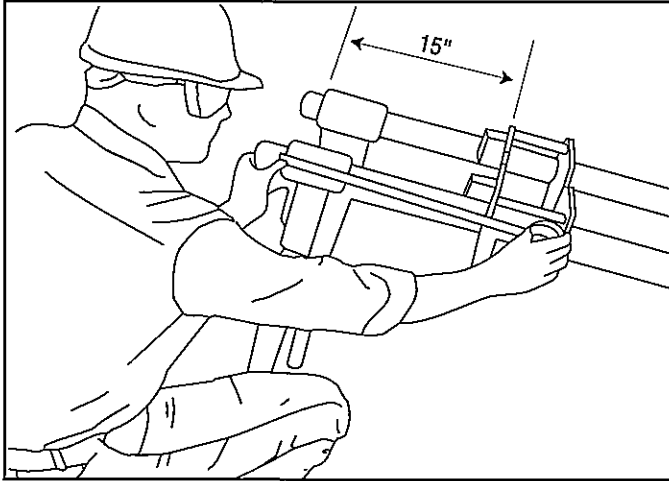
Note: These lengths of conduit are not furnished with the 1813 Bending Table.



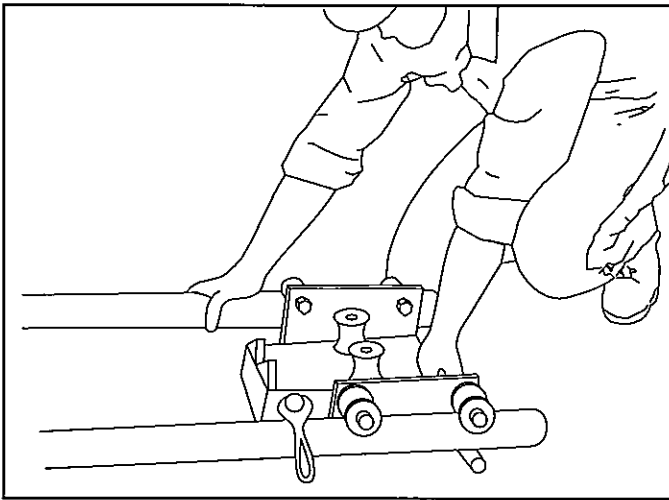
6. Position the bender mounting unit (27) as shown, and slide it, tabs first, onto the two 10-foot conduits.

Assembly and Operation Instructions

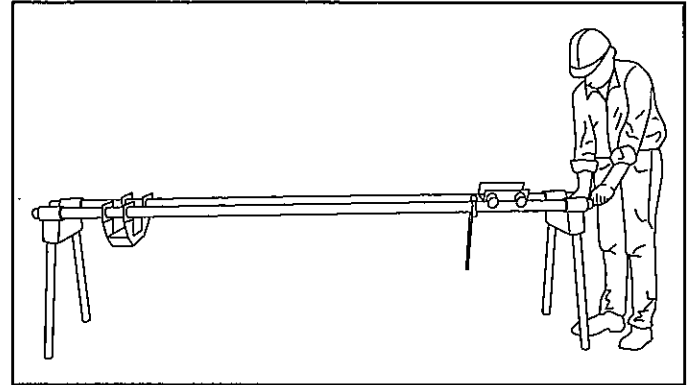
881 and 881CT with 1813 Bending Table (cont'd)



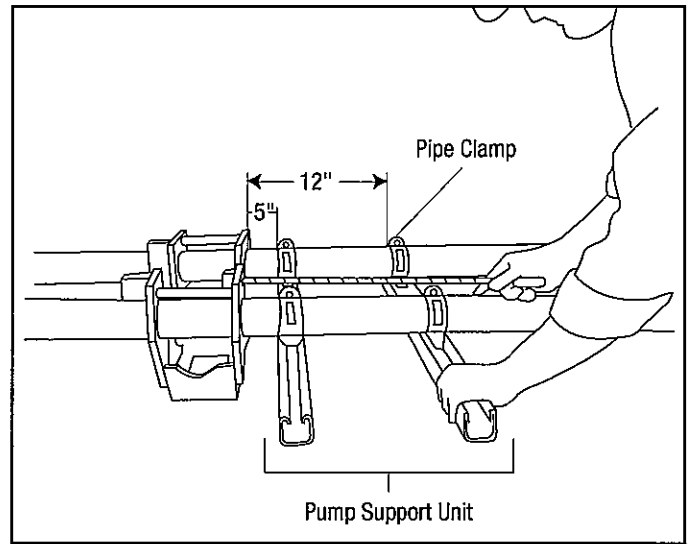
7. Position the bender mounting unit 15" from the leg support unit. Tighten the two bender mounting unit screws (28).



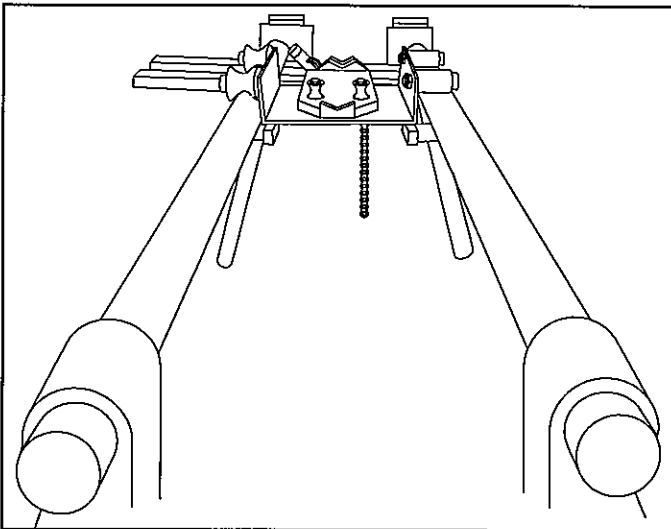
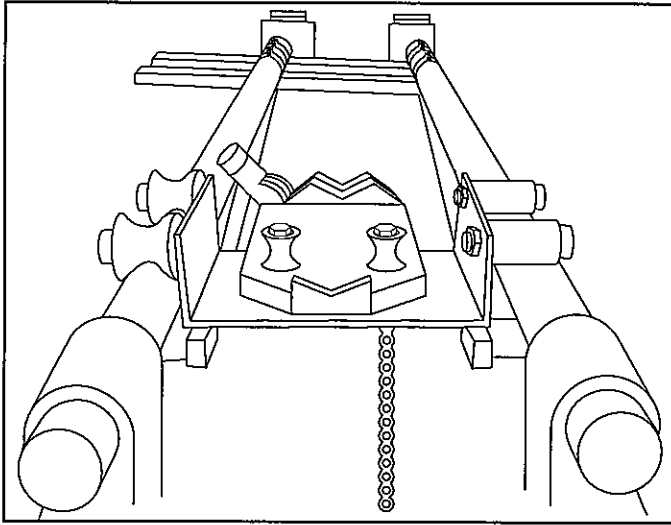
8. Slide the pipe vise unit (38) onto the two 10-foot conduits, as shown.



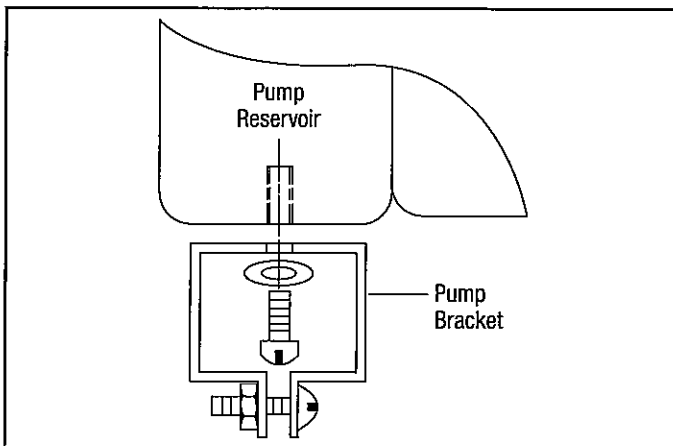
9. Attach the second leg support unit (23) to the 10-foot conduits. Tighten the four screws (24).



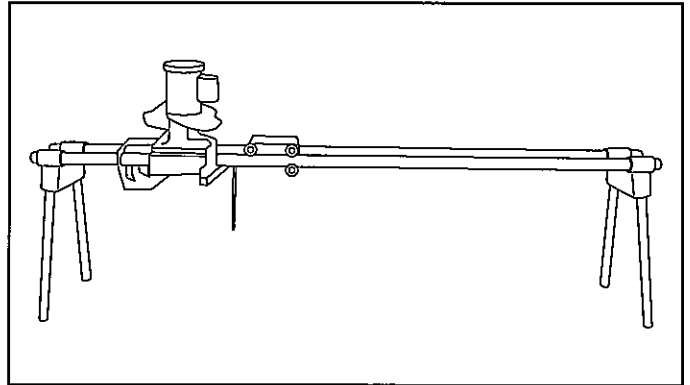
10. Hang the two pipe clamps (34) over each of the 10-foot conduits. Set the pipe clamps 5" and 12" from the bender mounting unit. Mount the pump supports (26) onto the clamps. Do not tighten the clamps.

Assembly and Operation Instructions
881 and 881CT with 1813 Bending Table (cont'd)


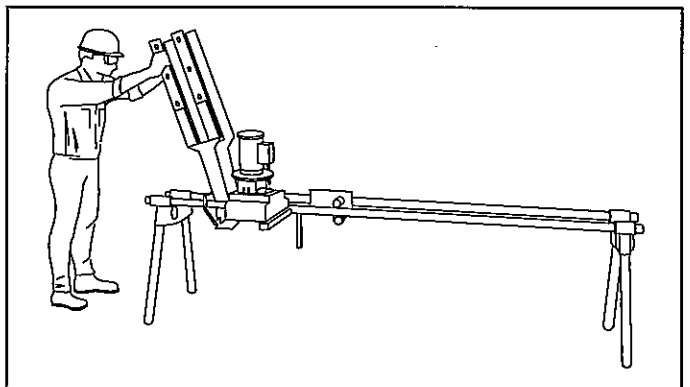
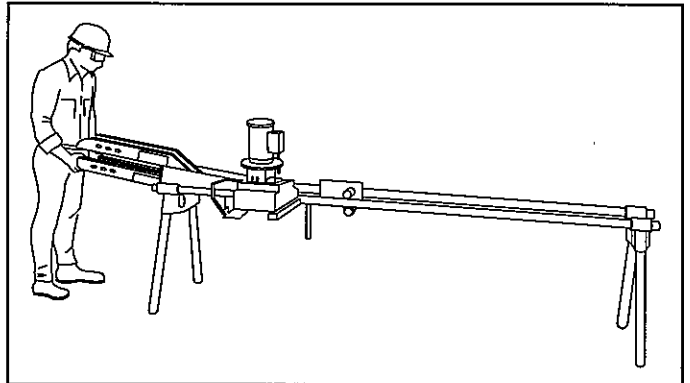
11 and 12. Level the table at both ends.



13. Remove the rubber feet/casters from the pump. Attach the pump bracket (64) to the pump with the pump bracket mounting hardware (40-43). See illustration.



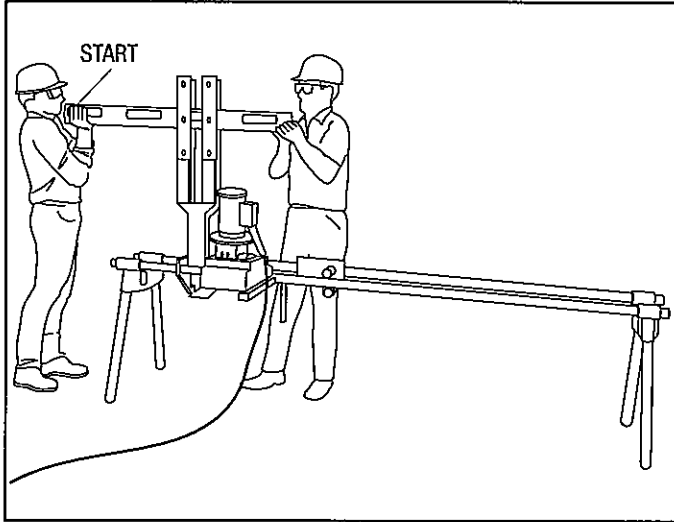
14. Slide the pump onto the pump supports. Tighten the screws on the lower sides of the pump brackets to secure the pump. Verify that the pump supports are 5" and 12" from the bender mounting unit. Tighten the pipe clamp screws.



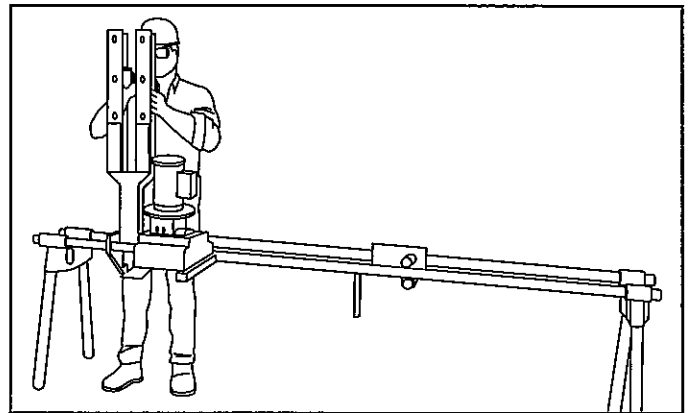
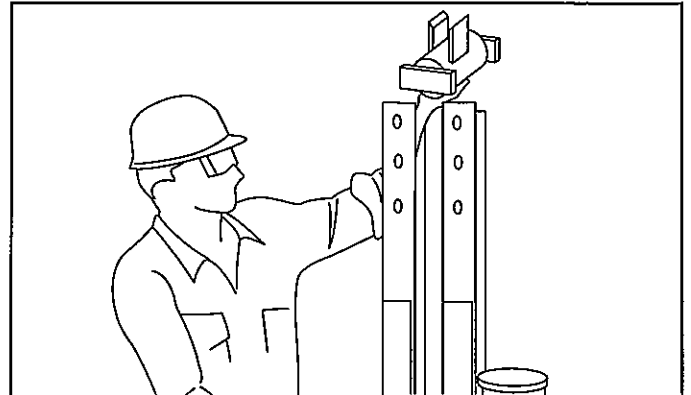
15 and 16. Load the connecting bar and roller unit into the bender mounting unit.

Assembly and Operation Instructions

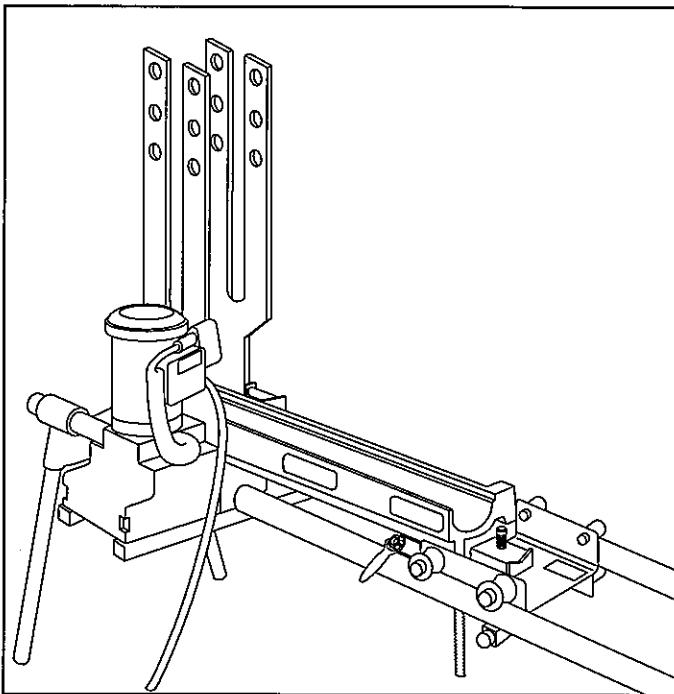
881 and 881CT with 1813 Bending Table (cont'd)



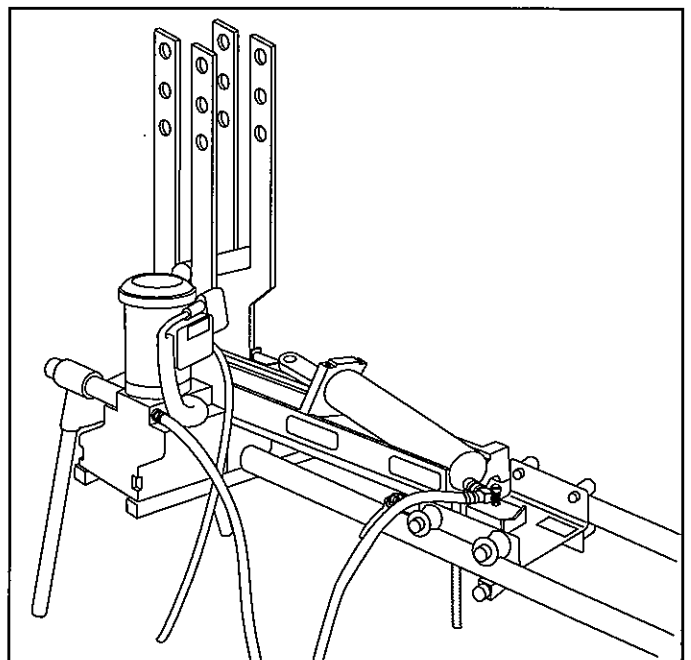
17. Insert the follow bar into the bender with the end marked **START**, as shown.



19 and 20. Insert the ram positioner (33).



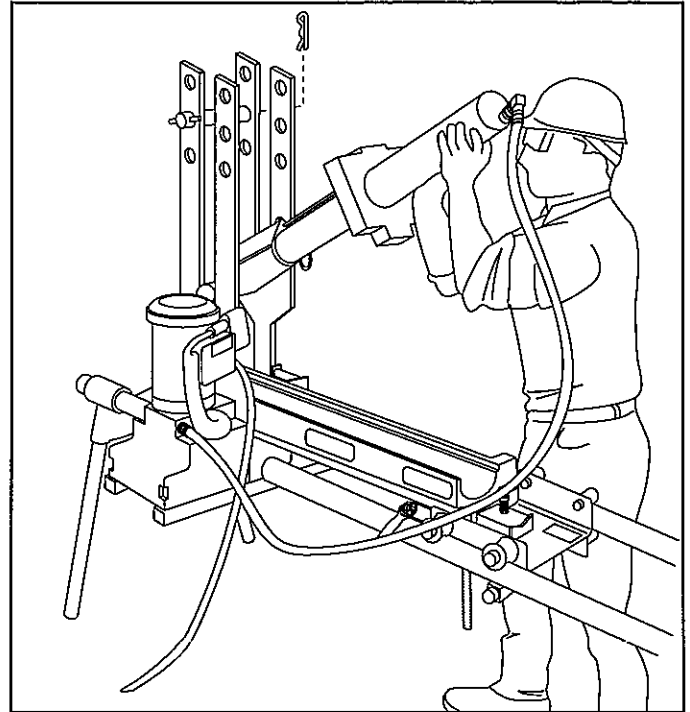
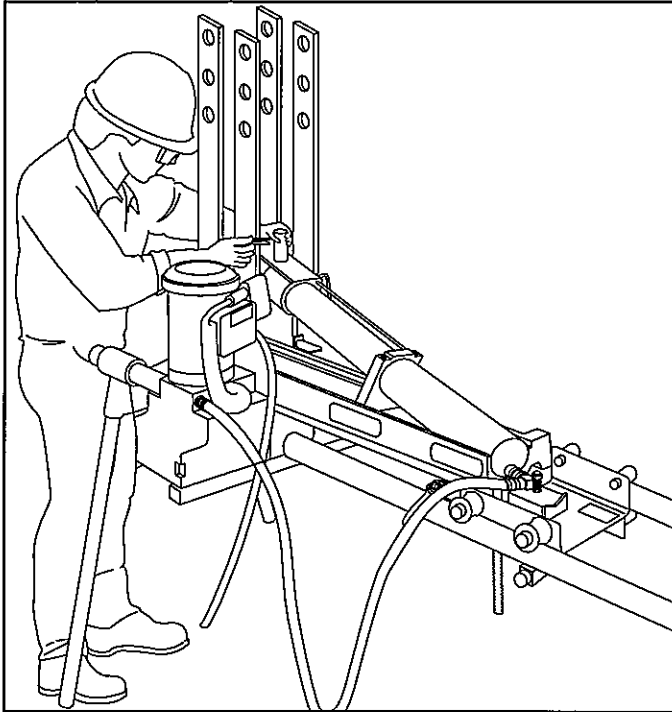
18. Support the rear of the follow bar on the pipe vise unit.



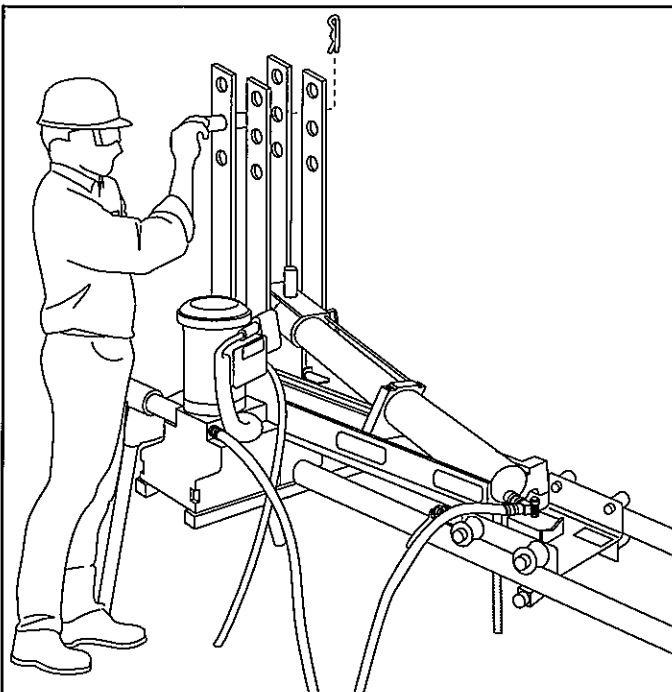
21. Attach the hydraulic fitting unit (29) to the ram, and connect the hose to the fitting unit. Set the cylinder and yoke unit on the follow bar. Rotate the pump control lever counterclockwise.

Assembly and Operation Instructions

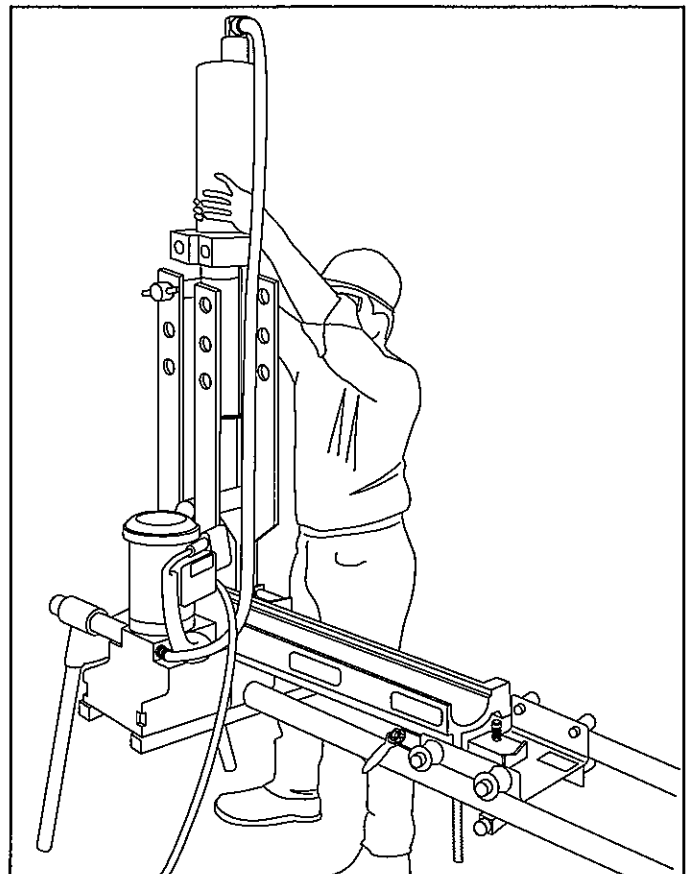
881 and 881CT with 1813 Bending Table (cont'd)



22. Activate the hydraulic pump to extend the ram approximately 14". DO NOT OVER EXTEND. Attach the yoke to the ram positioner with the yoke pin (G). Secure the yoke pin with a hitch pin clip (E).



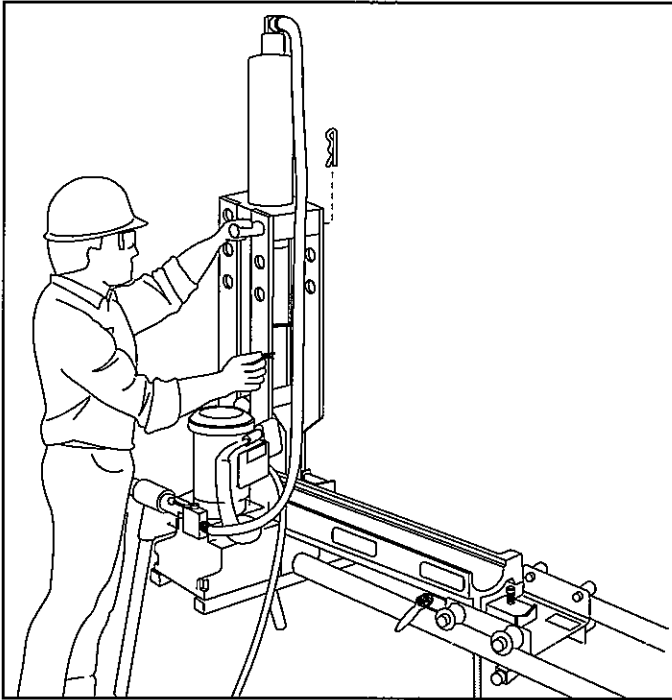
23. Insert one cylinder block pin (F) into the hole marked 3" CONDUIT as shown.



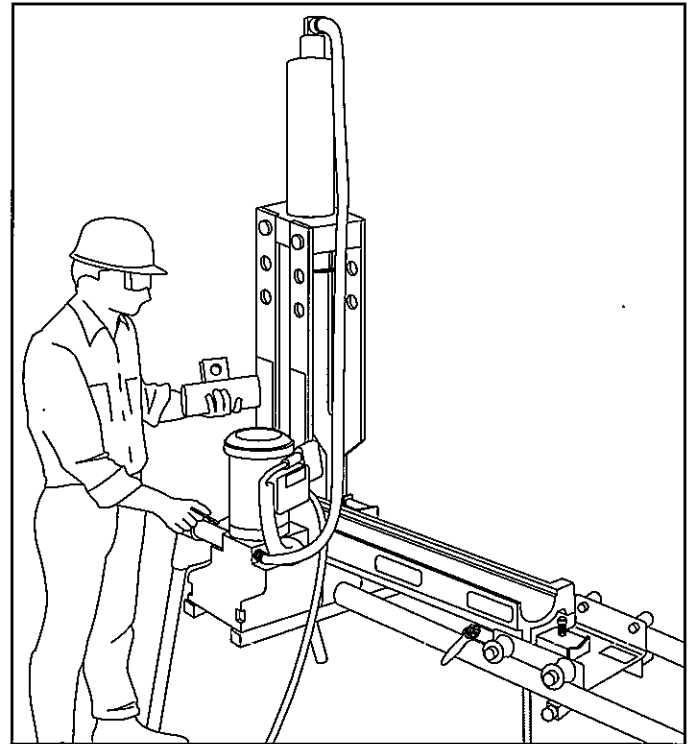
24 and 25. Swing the ram unit into position.

Assembly and Operation Instructions

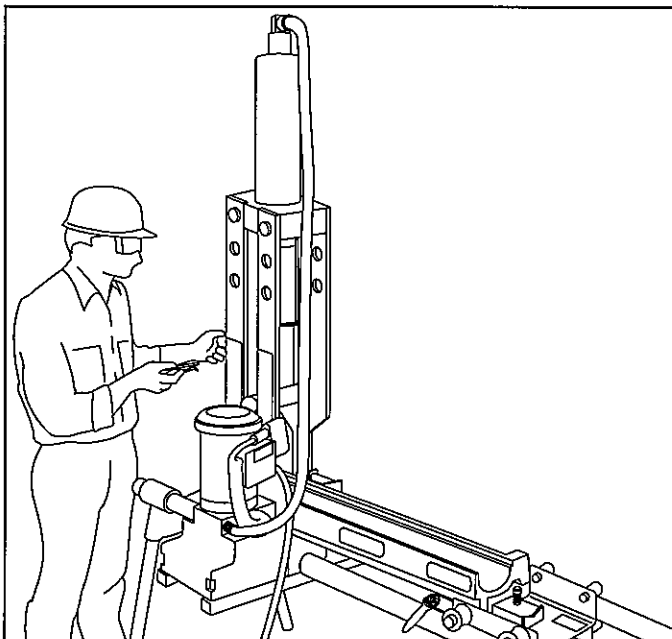
881 and 881CT with 1813 Bending Table (cont'd)



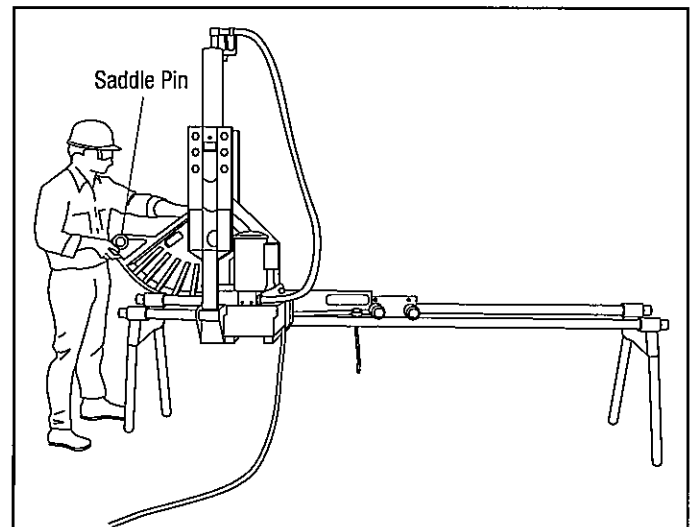
26. Remove the cylinder block pin from the 3" conduit hole in the connecting bar. Rotate the pump control lever clockwise to retract the ram. Position the cylinder block at the proper location for the size of conduit to be bent. Insert the two cylinder block pins (F) through the connecting bars and through the cylinder block. Secure the pins with two hitch pin clips (E).



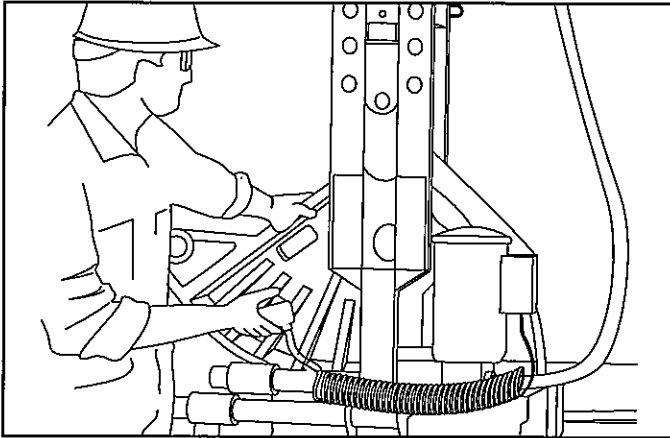
28. Remove the ram positioner from the connecting bar unit.



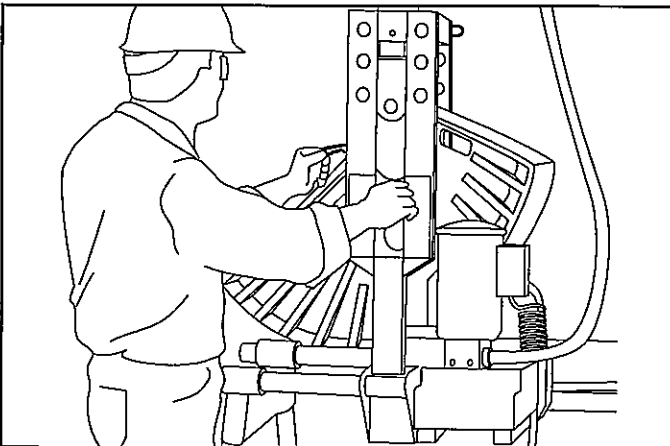
27. Remove the yoke pin from the ram positioner.



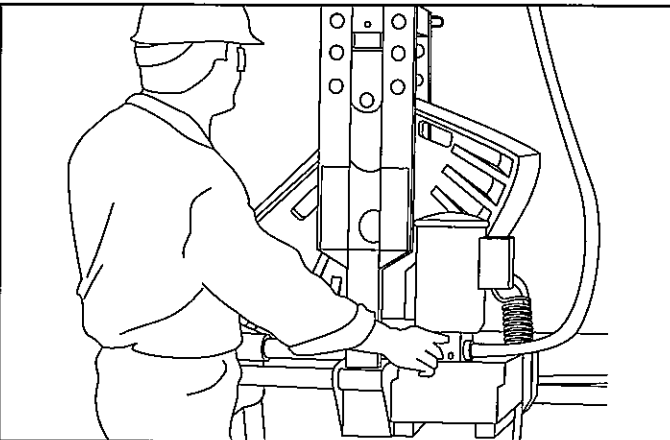
29. Load the shoe into the bender with the saddle pin hole to the left, as shown.

Assembly and Operation Instructions**881 and 881CT with 1813 Bending Table (cont'd)**

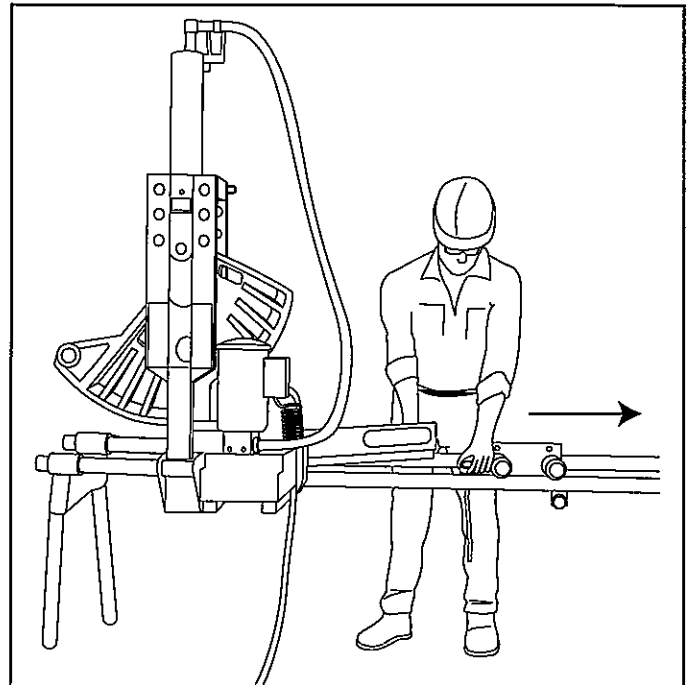
30. Rotate the pump control lever counterclockwise. Activate the hydraulic pump to advance the shoe until the yoke is aligned with the proper shoe yoke pin hole (EMT or IMC/Rigid).



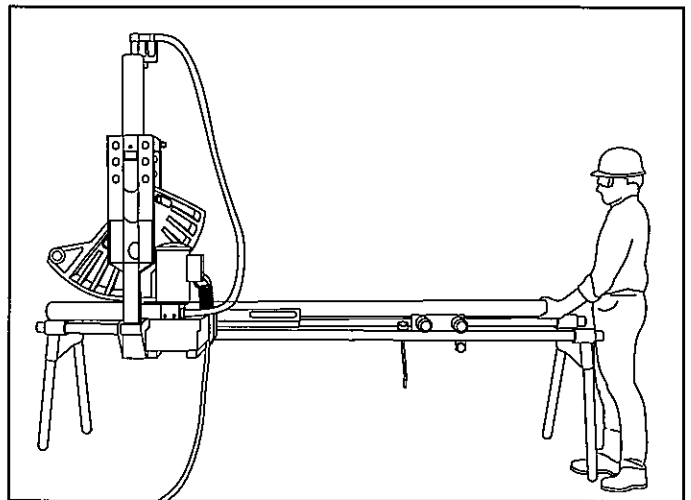
31. Attach the yoke to the shoe with the yoke pin (G). Secure the yoke pin with a hitch pin clip (E).



32. Rotate the pump control lever clockwise to retract the ram.



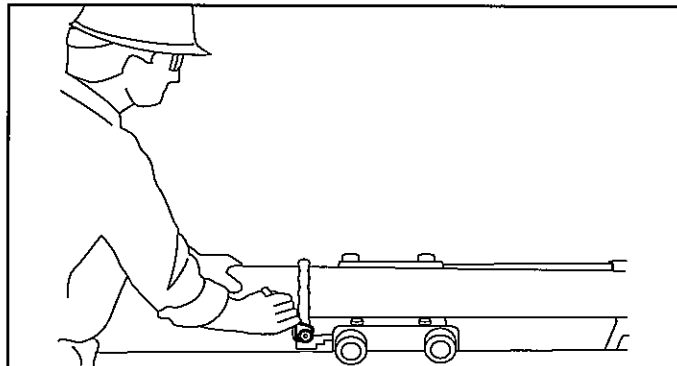
33. Remove the vise unit from its position below the follow bar. Slide the vise unit to the far end of the bending table.



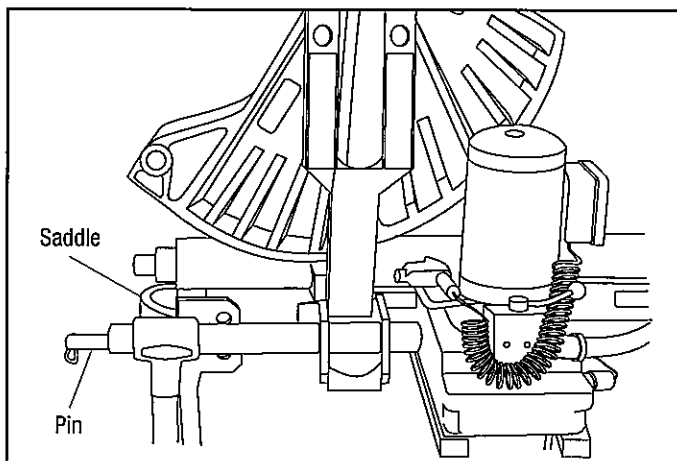
34. Insert the conduit to be bent. Rotate the pump control lever counterclockwise and advance the shoe until it nearly contacts the conduit.

Assembly and Operation Instructions

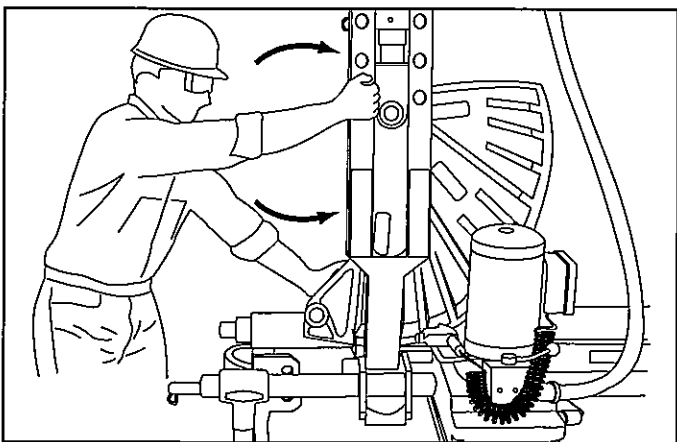
881 and 881CT with 1813 Bending Table (cont'd)



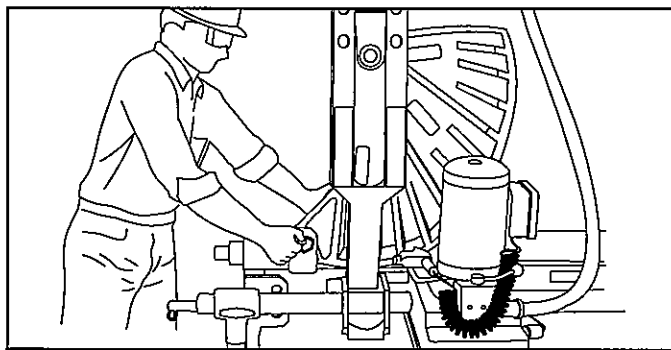
35. Position the vise unit at a distance from the pump support so that the vise unit will not contact the pump support before the bend is complete. Clamp the conduit down in the vise unit.



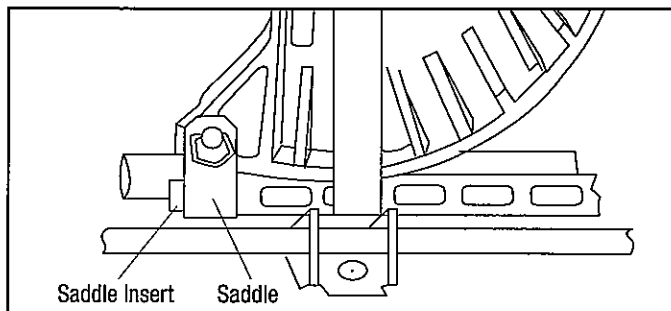
36. Push the follow bar back (to the right in the illustration) until the follow bar foot contacts the bender mounting unit. Position the saddle and saddle pin (M) where they can be reached for assembly.



37. Rock the bender frame as shown and rotate the shoe back for the assembly of the saddle and pin.



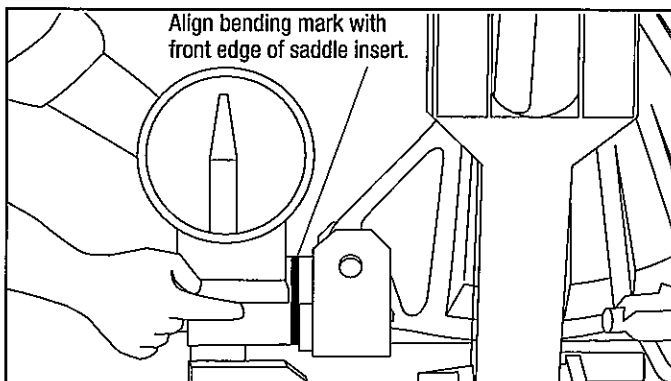
38. Hold the shoe against the conduit and position the saddle so the saddle insert is toward the operator. Align the hole in the saddle with the hole in the shoe and insert the saddle pin (M). Secure the saddle pin with the hitch pin clip (E).



39. Allow the bender to rock forward and ensure that the follow bar comes forward with it, so that the follow bar contacts the saddle.

IMPORTANT

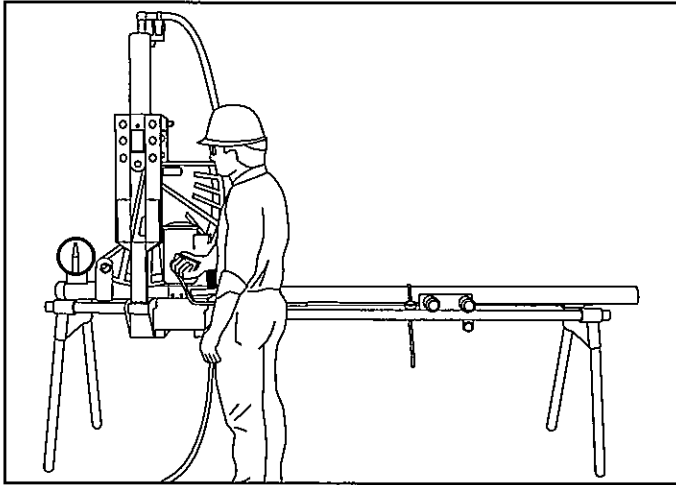
Follow the instructions and safety information supplied with your hydraulic pump.



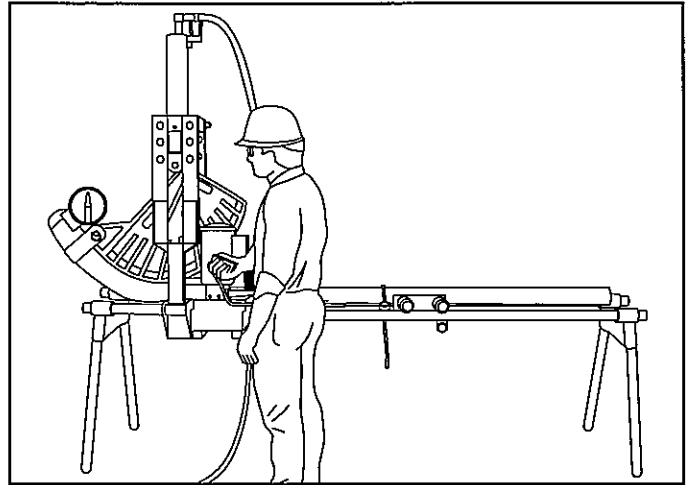
40. Rotate the pump control lever counterclockwise. Activate the hydraulic pump until the shoe just contacts the conduit. Check that the saddle and follow bar are snug, and that the follow bar is against the saddle, as shown. Be sure that the bending mark on the conduit is aligned with the front edge of the saddle insert. Attach the model 1805 Bending Degree Indicator (35) to the conduit. Zero the indicator by rotating the degree wheel.

Assembly and Operation Instructions

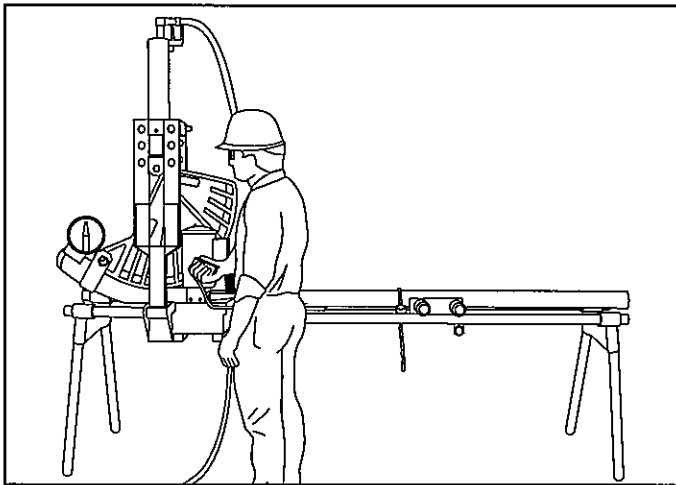
881 and 881CT with 1813 Bending Table (cont'd)



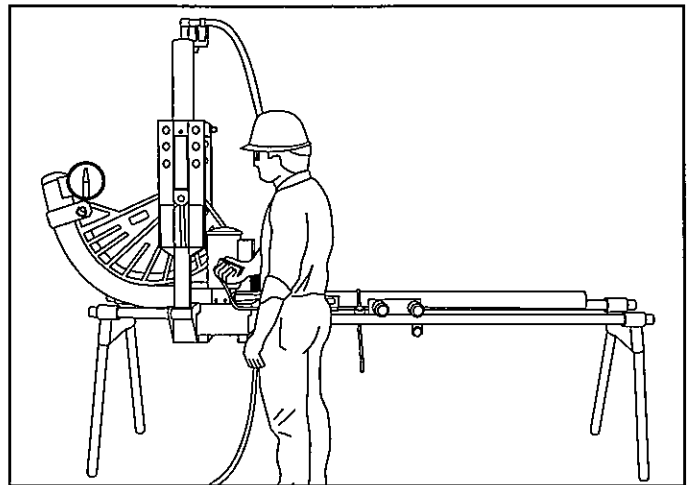
41. Activate the hydraulic pump to begin the bend.



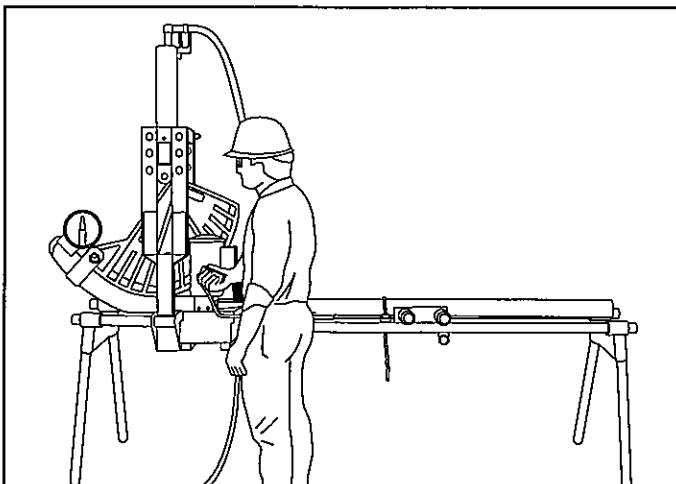
44. 45° of bend.



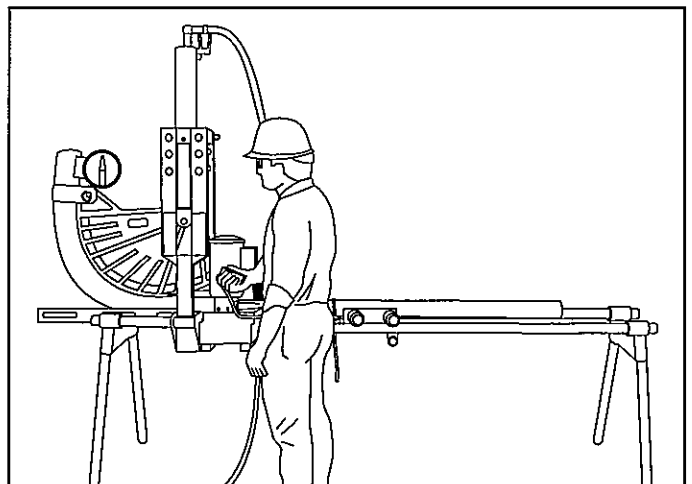
42. 15° of bend.



45. 60° of bend.



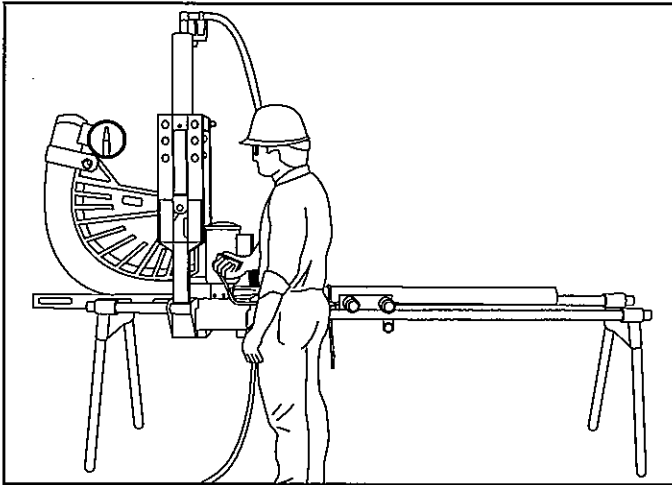
43. 30° of bend.



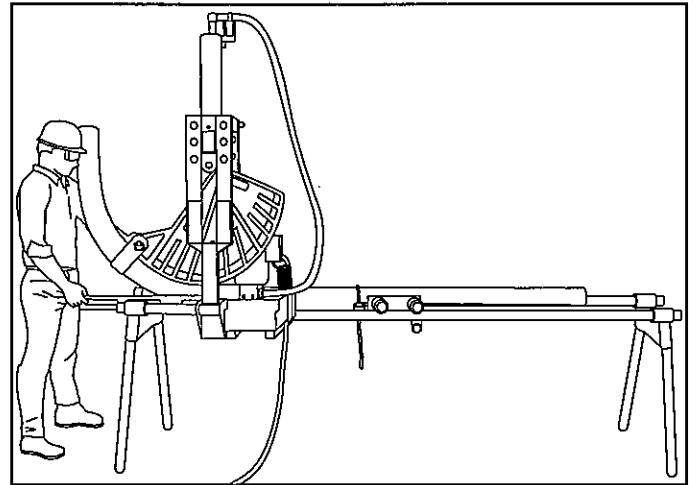
46. 75° of bend.

Assembly and Operation Instructions

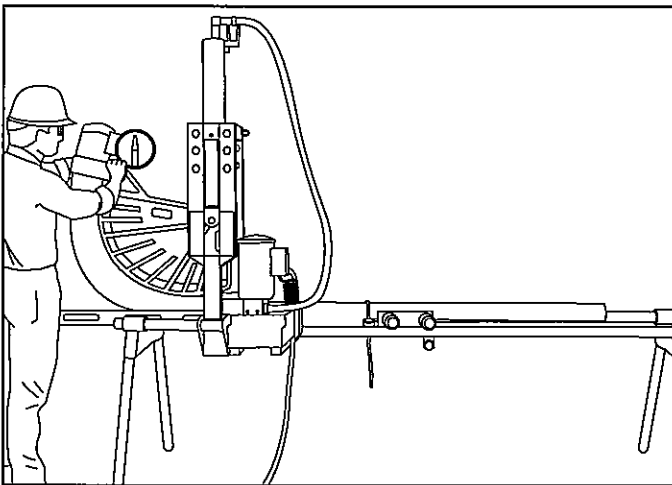
881 and 881CT with 1813 Bending Table (cont'd)



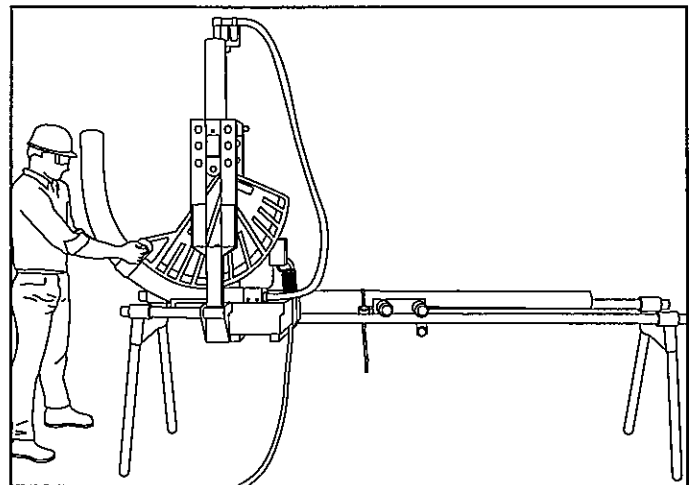
47. 90° of bend.



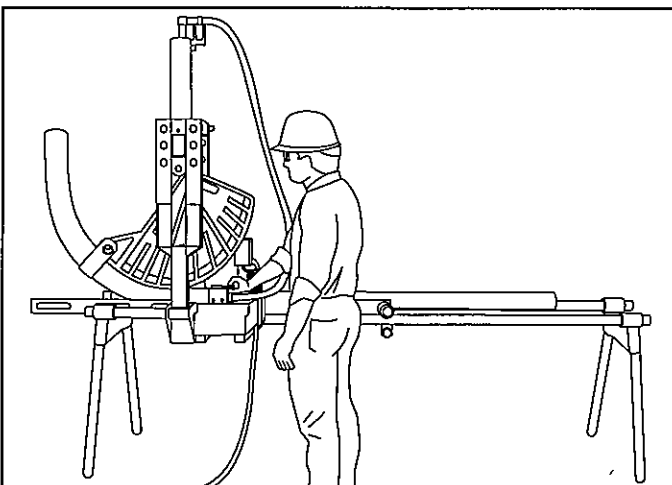
50. Push the follow bar back to the start position.



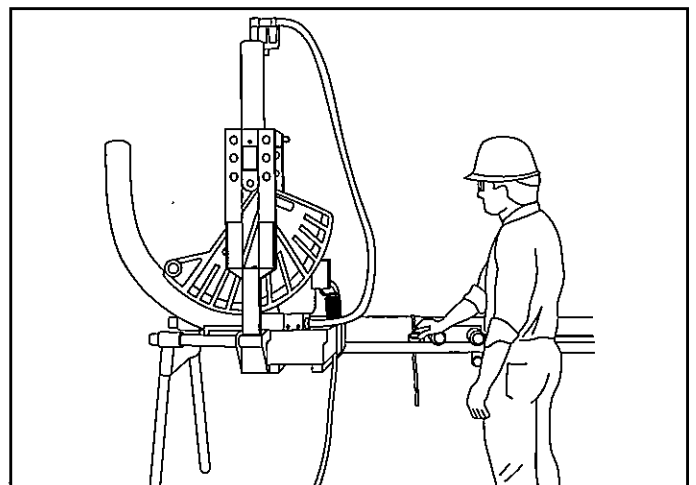
48. Remove the 1805 Bending Degree Indicator.



51. Remove the saddle pin and saddle.



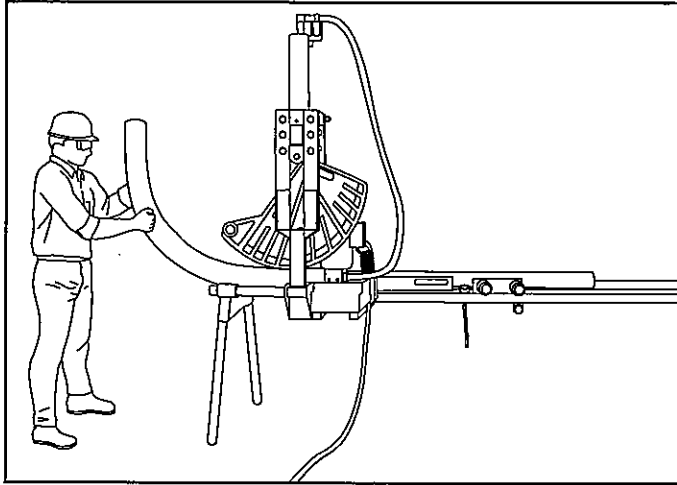
49. Rotate the pump control lever clockwise to retract the shoe.



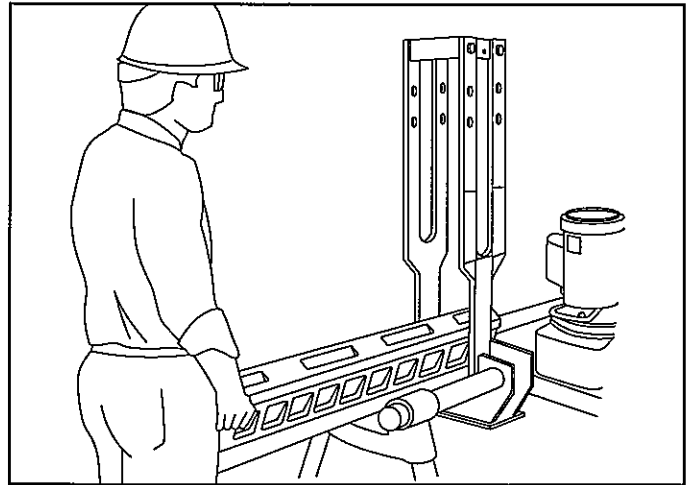
52. Release the vise chain.

Assembly and Operation Instructions

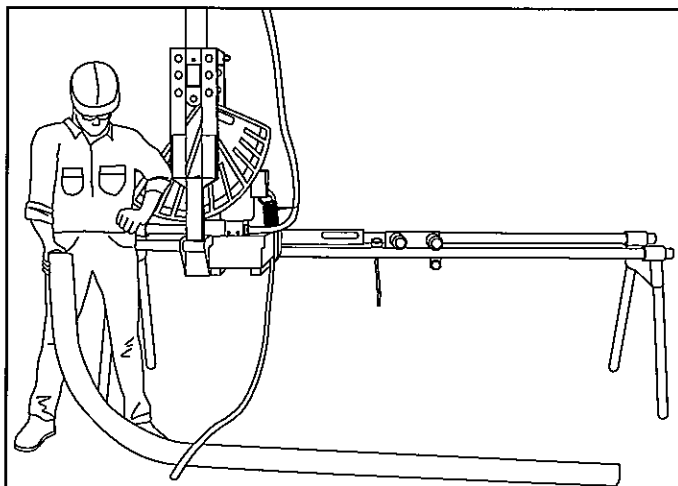
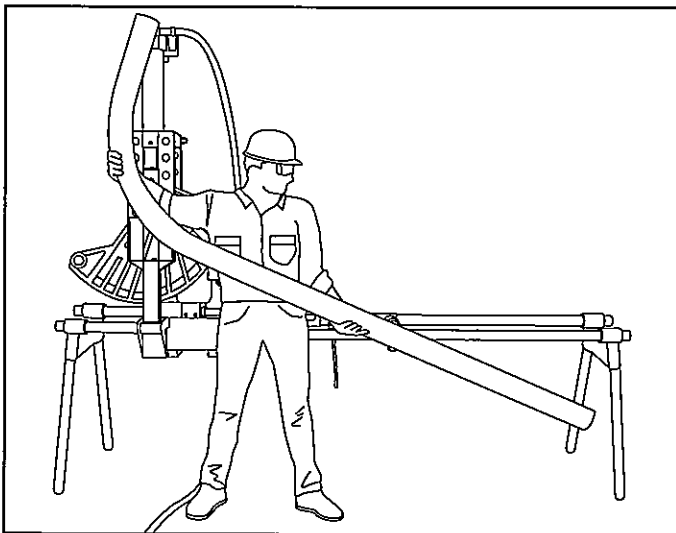
881 and 881CT with 1813 Bending Table (cont'd)



53. Remove the conduit from the bender.



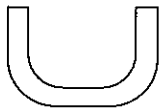
56. To change the follow bar, twist and remove.



54 and 55. The 90° bend is complete.

Glossary of Bending Terms with Illustrations

- amount of offset**—the distance that the conduit or pipe must be re-routed to avoid an obstruction; see offset in this glossary and “Offsets” in “Laying Out Bends” in this manual



- back-to-back bend**—any U-shaped bend formed by two parallel 90-degree bends with a straight section of conduit or pipe between the bends

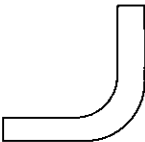
- center-to-center distance**—the distance between the successive bends that make up an offset or a three-bend saddle

- depth of offset**—same as amount of offset

- height of offset**—same as amount of offset



- leg length**—the distance from the end of a horizontal section of conduit or pipe to the bend; measured from the end to the center line, inside edge, or outside edge of the conduit or pipe.

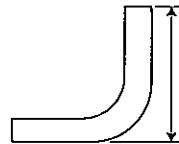


- 90° bend**—any bend that changes the direction of the conduit or pipe by 90 degrees

- O.D.**—the size of any piece of conduit or pipe as measured by its outside diameter

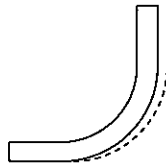
- offset bend**—two bends with the same degree of bend; used to avoid an obstruction blocking the run of the conduit or pipe

- ram travel**—the distance that the ram of a hydraulic bender moves to accomplish a particular bend; inches of ram travel are proportionate to degrees of bend



- rise**—the distance from the end of a vertical section of conduit or pipe to the bend; measured from the end to the center line, inside edge, or outside edge of the conduit or pipe

- shot**—a single bend



- springback**—the amount, measured in degrees, that a conduit or pipe tends to straighten after being bent

- stub**—same as rise

- stub-up**—same as rise

Laying Out One-Shot 90° Bends

1. Measure the length of the required stub.
2. Find the Minimum Stub Length on Table 2: Deduct, Stub Dimensions, and Minimum Distance from End of Conduit. The stub you require must be equal to or longer than the minimum stub length.
3. Measure and mark the stub length on the conduit. This is Mark 1.
4. Find the Deduct on Table 2. Subtract the Deduct from Mark 1 and make a new mark. This is Mark 2, or the bending mark. Find the Minimum Distance from End of Conduit in Table 2; be sure that Mark 2 is at least this distance from the end of the conduit.
5. Align Mark 2 with the outside edge of the saddle. Bend the conduit—see the instructions under “Assembly and Operation Instructions.”

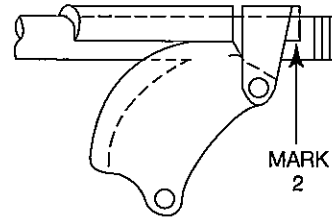
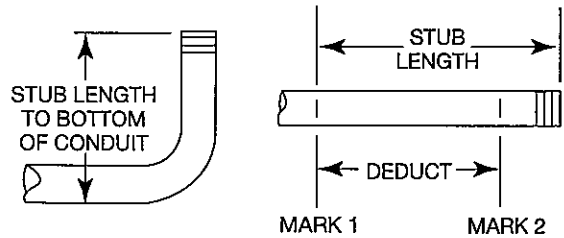


Table 2—Deduct, Stub Dimensions, and Minimum Distance from End of Conduit

CONDUIT SIZE →	2-1/2	3	3-1/2	4
EMT				
Deduct	21-1/2	24	27-3/4	32-1/4
Minimum Stub Length	24	27	31-1/4	36-1/4
Minimum Distance from End of Conduit	2-1/2	3	3-1/2	4
IMC-RIGID				
Deduct	21-1/2	24-1/4	28-1/4	32-1/2
Minimum Stub Length	24	26-3/4	30-3/4	35
Minimum Distance from End of Conduit	2-1/2	2-1/2	2-1/2	2-1/2

Table 3—Ram Travel

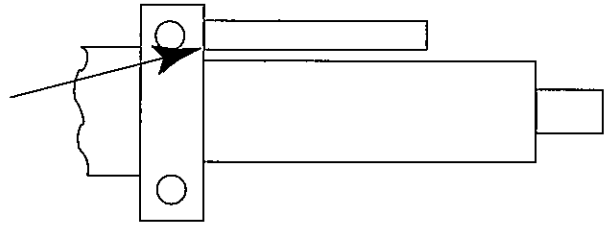
(Figures are approximate)

Ram Travel: Read scale at edge of block.

Note: Ram scale must be set on zero.

Note: Calibrate Bender Before Bending:

Snug up bender by advancing ram until shoe, conduit and follow bar are snug. (Do not squeeze or begin to bend.) Stop pump. Compare reading on scale with appropriate Snug-Up 0° column on ram travel charts. Note variance if any. Incorporate this variance in ram travel measurements used for bending the same size and type of conduit.



Degree of Bend	EMT					
	2-1/2 (90°)	3 (90°)	3-1/2 (90°)	4 (90°)	3-1/2 (45°)	4 (45°)
Snug-Up 0°	4-3/16	3-7/8	3-1/8	2-3/8	5	3-9/16
10°	5	4-15/16	4-1/8	3-1/4	6-5/8	5-1/8
15°	5-1/4	5-5/16	4-1/2	3-3/4	7-1/8	5-1/2
30°	6-3/16	6-5/16	5-1/2	4-13/16	8-13/16	6-3/8
45°	7-1/8	7-5/16	6-1/2	6	10-1/4	7-3/4
60°	8	8-3/8	7-1/2	7-1/4	See Table 4	See Table 4
90°	9-1/2	10-3/8	9-13/16	9-5/8	See Table 4	See Table 4

Degree of Bend	IMC					
	2-1/2 (90°)	3 (90°)	3-1/2 (90°)	4 (90°)	3-1/2 (45°)	4 (45°)
Snug-Up 0°	2-7/8	2-1/4	2-1/16	1-7/16	5	2-3/8
10°	4	3-5/8	3-1/8	2-5/8	6-5/8	4-5/16
15°	4-7/16	4-1/16	3-9/16	3-1/4	7-1/8	4-15/16
30°	5-3/4	5-3/8	5-1/16	4-5/8	8-13/16	6-5/8
45°	7-3/16	6-15/16	6-7/16	6-1/4	10-1/4	8-1/2
60°	8-11/16	8-7/16	7-7/8	7-7/8	See Table 4	See Table 4
90°	11	11-5/8	10-7/8	11-1/8	See Table 4	See Table 4

Degree of Bend	RIGID					
	2-1/2 (90°)	3 (90°)	3-1/2 (90°)	4 (90°)	3-1/2 (45°)	4 (45°)
Snug-Up 0°	2-7/8	2-1/4	2	1-5/16	4-5/8	2-1/8
10°	3-15/16	3-5/8	3	2-3/8	6-3/8	4-1/16
15°	4-3/8	4-1/16	3-1/2	3	6-13/16	4-3/4
30°	5-3/4	5-3/8	4-7/8	4-1/2	8-1/2	6-1/2
45°	7-1/8	6-15/16	6-1/4	6-1/8	10-1/8	8-1/4
60°	8-1/2	8-7/16	7-3/4	7-3/4	See Table 4	See Table 4
90°	11	11-5/8	10-3/4	11	See Table 4	See Table 4

Table 4—Laying Out Two-Shot 90° Bends for 3-1/2" and 4" Conduit (881 Only)

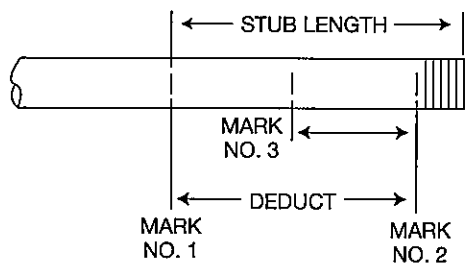
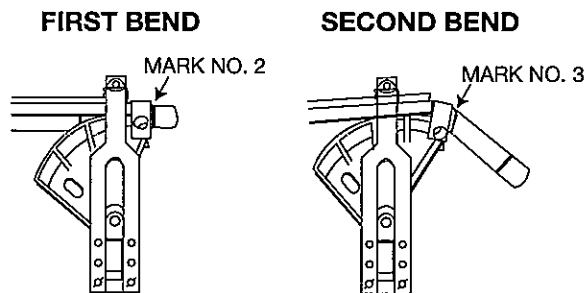
1. Measure the length of the required stub.
2. Find the Minimum Stub Length on Table 2: Deduct, Stub Dimensions, and Minimum Distance from End of Conduit. The stub you require must be equal to or longer than the minimum stub length.
3. Measure and mark the stub length on the conduit. This is Mark 1.
4. Find the Deduct on Table 2. Subtract the Deduct from Mark 1 and make a new mark. This is Mark 2, or the first bending mark. Find the Minimum Distance from End of Conduit in Table 2; be sure that Mark 2 is at least this distance from the end of the conduit.
5. Measure and make Mark 3, or the second bending mark:
 - For 3-1/2" conduit, Mark 3 must be 14-1/2" from Mark 2.
 - For 4" conduit, Mark 3 must be 15-1/2" from Mark 2.
6. Refer to the tables and "First Bend" figure on this page. Using the suggested amount of ram travel, align Mark 2 with the outside edge of the saddle and bend the conduit.
7. Align Mark 3 with the outside of the saddle.

Note: A portion of the previous bend will fall inside the shoe.
8. Bend the conduit until the 90° bend is complete.

EMT	CONDUIT SIZE	FIRST BEND	90°
RAM TRAVEL	3-1/2	10-3/16	9-3/4
	4	8-3/16	8-3/16

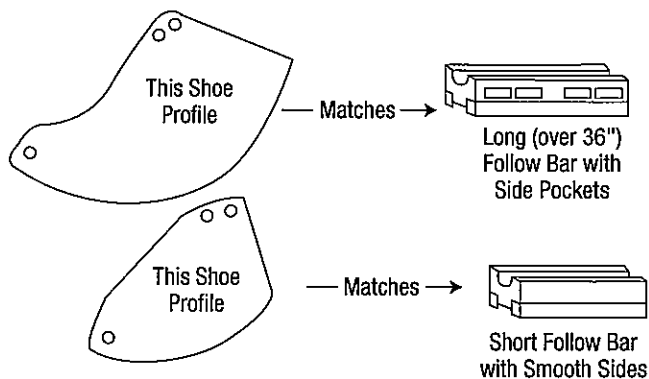
IMC	CONDUIT SIZE	FIRST BEND	90°
RAM TRAVEL	3-1/2	11-1/4	10-11/16
	4	9	9-1/16

RIGID	CONDUIT SIZE	FIRST BEND	90°
RAM TRAVEL	3-1/2	11-1/8	10-1/2
	4	8-5/16	8-7/8



IMPORTANT

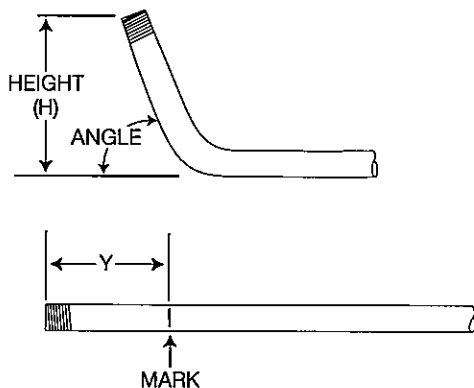
The 45° two-shot shoes and follow bars are not interchangeable with the 90° one-shot shoes and follow bars. See Illustration below.



Laying Out Bends

The following drawings and bending charts are intended to provide the information necessary to accomplish the most common types of bends. The "Special Bending Information Chart" contains precise measurements for the most commonly needed bends.

Stubs



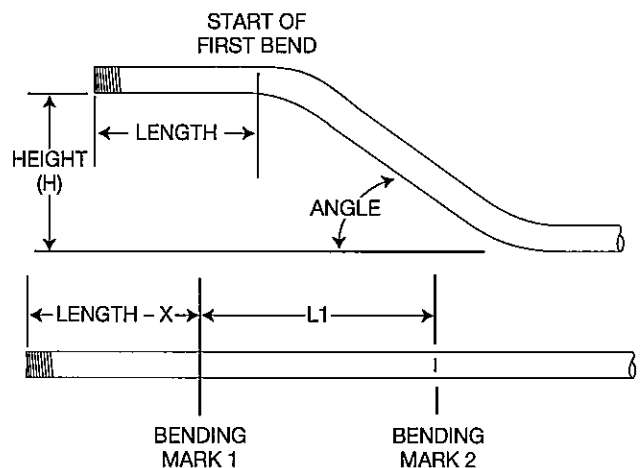
1. Select the size and type of conduit. Determine the height of stub and the angle of bend.
2. Find the chart that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find the angle of bend.
4. Find the row labeled Y. In the row at the top of the page, find the height (H) of the stub.
5. The number shown at the intersection of row Y and the appropriate H column is the distance Y. Place the bending mark Y inches from the end of the conduit.
6. Bend the conduit.

Offsets

An offset is used to route the conduit around an obstruction. To make an offset, two equal bends are required. The distance between the two bends is the center-to-center distance. This is represented by L1 in the bending tables.

When working past an obstruction, it is necessary to determine the location of the first bend. The center-to-center distance is then used to find the location of the second bend. See "Offsets: Working Past an Obstruction." When working toward an obstruction, it is necessary to determine the location of the second bend. The center-to-center distance is then used to find the location of the first bend. See "Offsets: Working Toward an Obstruction."

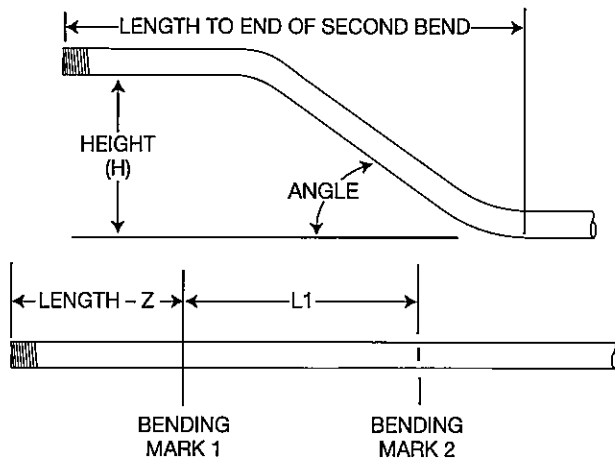
Offsets: Working Past an Obstruction



1. Select the size and type of conduit. Measure the height of the obstruction and the distance labeled LENGTH. Select the angle to be used.
2. Find the chart that corresponds to the size and type of conduit selected in Step 1.
3. To the right of the size and type of conduit, find the dimension labeled X. Subtract X from LENGTH. Place the first bending mark this distance from the end of the conduit.
4. Under the column labeled ANGLE, find the angle of bend. Find the row labeled L1. In the row at the top of the page, find the height (H) of the offset.
5. The number shown at the intersection of row L1 and the appropriate H column is L1. Place the second bending mark L1 inches from the first bending mark.
6. Bend the conduit.

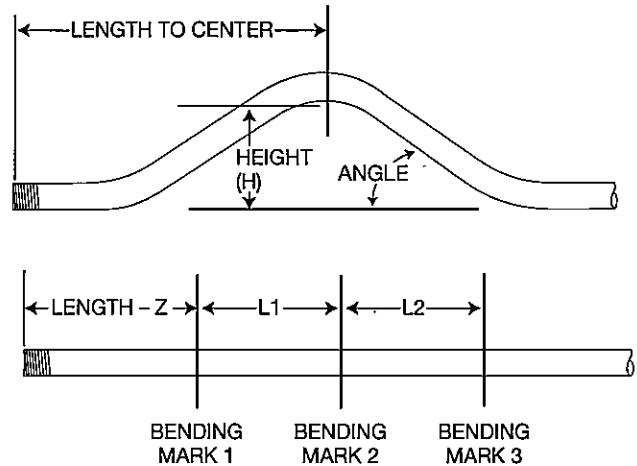
Laying Out Bends (cont'd)

Offsets: Working Toward an Obstruction



1. Select the size and type of conduit. Measure the height of the obstruction and the distance labeled LENGTH TO END OF SECOND BEND. Select the angle to be used.
2. Find the chart that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find the angle of bend. Find the row labeled Z. In the row at the top of the page, find the height (H) of the offset.
4. The number shown at the intersection of the Z row and the appropriate H column is Z. Subtract Z from LENGTH TO THE END OF SECOND BEND. Place the first bending mark this distance from the end of the conduit.
5. In the same column, find the row labeled L1. Place the second bending mark L1 inches from the first bending mark.
6. Bend the conduit.

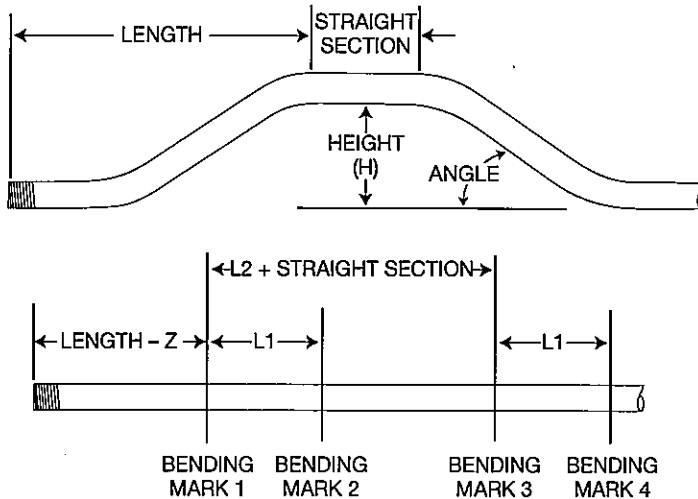
Three-Bend Saddle



1. Select the size and type of conduit. Measure the height of the obstruction and the distance from the end of the conduit to the center (LENGTH TO CENTER) of the bend. Select the angle to be used.
Note: The second bend angle will be twice the number of degrees as the first and third bends.
2. Find the chart that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find the angle of bend needed. Find the row labeled Z. In the row at the top of the page, find the height (H) of the offset.
4. The number shown at the intersection of the Z row and the appropriate H column is Z. Subtract Z from the LENGTH TO CENTER. Place the first bending mark this distance from the end of the conduit.
5. In the same column, find the row labeled L1. Place the second bending mark L1 inches from the first bending mark.
6. In the same column, find the row labeled L2. Place the third bending mark L2 inches from the second bending mark.
7. Bend the conduit.

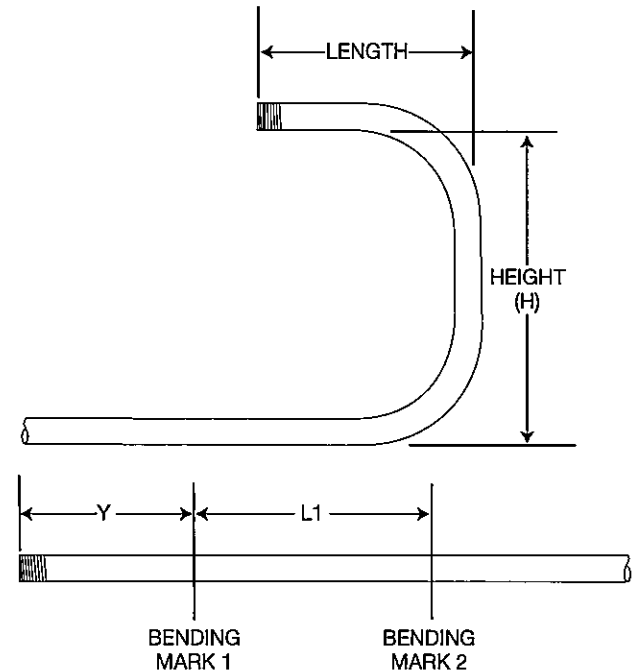
Laying Out Bends (cont'd)

Four-Bend Saddle



1. Select the size and type of conduit. Measure the height of the obstruction, the distance labeled LENGTH, and the distance labeled STRAIGHT SECTION. Select the angle to be used.
2. Find the chart that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find the angle of bend needed. Find the row labeled Z. In the row at the top of the page, find the height (H) of the offset.
4. The number shown is Z. Subtract Z from the LENGTH. Place the first bending mark this distance from the end of the conduit.
5. In the same column, find the row labeled L1. Place the second bending mark L1 inches from the first bending mark.
6. In the same column, find the row labeled L2. Add L2 to the STRAIGHT SECTION. Place the third bending mark this distance from the first bending mark.
7. Make the final bending mark L1 inches from the third bending mark.
8. Bend the conduit.

U-Bends



1. Select the size and type of conduit. Determine the LENGTH and the HEIGHT.
2. Find the chart that corresponds to the size and type of conduit selected in Step 1.
3. Under the column labeled ANGLE, find 90°.
4. Find the row labeled Y. In the row at the top of the page, find the height (H) that corresponds to the LENGTH.
5. The number shown at the intersection of the Y row and the appropriate H column is the distance Y. Place the bending mark Y inches from the end of the conduit.
6. Find the row labeled L1, and go to the right to find the height (H) that corresponds to the HEIGHT.
7. The number shown at the intersection of the L1 row and the appropriate H column is L1. Place the second bending mark L1 inches from the first mark.
8. Bend the conduit.

Special Bending Information Chart

		HEIGHT - H										
DIM.	ANGLE	10"	12"	15"	18"	24"	30"	36"	42"	48"	60"	
2-1/2 EMT		Dia. = 2.875		Radius = 13.9		x = 6.15						
	Y	15.00	25.10	32.83	44.42	56.01	79.19	102.38	125.56	148.74	171.92	218.29
	L1	15.00	38.62	46.34	57.93	69.53	92.71	115.89	139.07	162.25	185.44	231.80
	L2	15.00	42.26	49.98	61.57	73.16	96.35	119.53	142.71	165.89	189.08	235.44
	Z	15.00	47.13	54.59	65.79	76.99	99.38	121.77	144.16	166.56	188.95	233.73
MINIMUM H = 2.54												
	Y	22.50	13.46	18.69	26.53	34.37	50.04	65.72	81.40	97.08	112.76	144.12
	L1	22.50	26.06	31.29	39.13	46.97	62.64	78.32	94.00	109.68	125.36	156.72
	L2	22.50	31.52	36.74	44.58	52.42	68.10	83.78	99.46	115.14	130.82	162.17
	Z	22.50	35.82	40.65	47.89	55.14	69.62	84.11	98.59	113.08	127.56	156.53
MINIMUM H = 4.47												
	Y	30.00	7.25	11.25	17.25	23.25	35.25	47.25	59.25	71.25	83.25	107.25
	L1	30.00	19.83	23.83	29.83	35.83	47.83	59.83	71.83	83.83	95.83	119.83
	L2	30.00	27.11	31.11	37.11	43.11	55.11	67.11	79.11	91.11	103.11	127.11
	Z	30.00	30.92	34.38	39.58	44.78	55.17	65.56	75.95	86.35	96.74	117.52
MINIMUM H = 6.80												
	Y	45.00		3.03	7.27	11.52	20.00	28.49	36.97	45.46	53.94	70.91
	L1	45.00		16.37	20.62	24.86	33.34	41.83	50.31	58.80	67.28	84.25
	L2	45.00		27.29	31.53	35.77	44.26	52.75	61.23	69.72	78.20	95.17
	Z	45.00		29.67	32.67	35.67	41.67	47.67	53.67	56.67	65.67	77.67
MINIMUM H = 12.49												
	Y	60.00			1.49	4.95	11.88	18.81	25.73	32.66	39.59	53.45
	L1	60.00					26.22	33.15	40.07	47.00	53.93	67.79
	L2	60.00					40.77	47.70	54.63	61.56	68.49	82.34
	Z	60.00					36.06	39.52	42.98	46.45	49.91	56.84
MINIMUM H = 19.23												
	Y	90.00					2.51	8.51	14.51	20.51	26.51	38.51
	L1	90.00							30.03	36.03	42.03	54.03
	L2	90.00							51.87	57.87	63.87	75.87
	Z	90.00							33.95	33.95	33.95	33.95
MINIMUM H = 33.95												
3 EMT		Dia. = 3.5		Radius = 16.48		x = 5.77						
	Y	15.00	23.94	31.66	43.25	54.85	78.03	101.21	124.39	147.57	170.76	217.12
	L1	15.00	38.61	46.34	57.93	69.52	92.70	115.89	139.07	162.25	185.43	231.80
	L2	15.00	42.93	50.65	62.25	73.84	97.02	120.20	143.38	166.57	189.75	236.11
	Z	15.00	47.43	54.89	66.09	77.29	99.68	122.07	144.46	166.86	189.25	234.03
MINIMUM H = 2.62												
	Y	22.50	12.51	17.74	25.58	33.42	49.09	64.77	80.45	96.13	111.81	143.17
	L1	22.50	26.05	31.27	39.11	46.95	62.63	78.31	93.99	109.67	125.35	156.70
	L2	22.50	32.52	37.74	45.58	53.42	69.10	84.78	100.46	116.14	131.82	163.17
	Z	22.50	36.47	41.30	48.54	55.78	70.27	84.75	99.24	113.72	128.21	157.18
MINIMUM H = 4.72												
	Y	30.00	6.31	10.31	16.31	22.31	34.31	46.31	58.31	70.31	82.31	106.31
	L1	30.00	19.80	23.80	29.80	35.80	47.80	59.80	71.80	83.80	95.80	119.80
	L2	30.00	28.43	32.43	38.43	44.43	56.43	68.43	80.43	92.43	104.43	128.43
	Z	30.00	31.92	35.39	40.58	45.78	56.17	66.56	76.96	87.35	97.74	118.52
MINIMUM H = 7.30												
	Y	45.00		1.90	6.14	10.38	18.87	27.36	35.84	44.33	52.81	69.78
	L1	45.00			20.50	24.75	33.23	41.72	50.20	58.69	67.17	84.14
	L2	45.00			33.45	37.69	46.18	54.66	63.15	71.63	80.12	97.09
	Z	45.00			34.42	37.42	43.42	49.42	55.42	61.42	67.42	79.42
MINIMUM H = 13.73												
	Y	60.00			0.02	3.48	10.41	17.34	24.26	31.19	38.12	51.98
	L1	60.00					25.94	32.87	39.80	46.73	53.65	67.51
	L2	60.00					43.20	50.13	57.06	63.98	70.91	84.77
	Z	60.00					38.66	42.12	45.58	49.05	52.51	59.44
MINIMUM H = 21.48												
	Y	90.00					0.00	6.00	12.00	18.00	24.00	36.00
	L1	90.00								34.93	40.93	52.93
	L2	90.00								60.81	66.81	78.81
	Z	90.00								38.73	38.73	38.73
MINIMUM H = 38.73												

Special Bending Information Chart (cont'd)

		HEIGHT - H										
DIM.	ANGLE	10"	12"	15"	18"	24"	30"	36"	42"	48"	60"	
3-1/2 EMT		Dia. = 4		Radius = 19.18		x = 6.56						
Y	15.00	21.82	29.55	41.14	52.73	75.92	99.10	122.28	145.46	168.65	215.01	
L1	15.00	38.61	46.34	57.93	69.52	92.70	115.88	139.06	165.25	185.43	231.79	
L2	15.00	43.63	51.36	62.95	74.54	97.72	120.90	144.09	167.27	190.45	236.81	
Z	15.00	48.93	56.39	67.59	78.79	101.18	123.57	145.96	168.36	190.75	235.53	
MINIMUM H = 3.00												
Y	22.50	10.53	15.76	23.60	31.43	47.11	62.79	78.47	94.15	109.83	141.19	
L1	22.50	26.03	31.26	39.10	46.94	62.62	78.30	93.97	109.65	125.33	156.69	
L2	22.50	33.56	38.79	46.63	54.47	70.15	85.83	101.51	117.18	132.86	164.22	
Z	22.50	38.33	43.16	50.40	57.65	72.13	86.62	101.10	115.59	130.37	159.04	
MINIMUM H = 5.43												
Y	30.00	4.30	8.30	14.30	20.30	32.30	44.30	56.30	68.30	80.30	104.30	
L1	30.00	19.76	23.76	29.76	35.76	47.76	59.76	71.76	83.76	95.76	119.76	
L2	30.00	29.81	33.81	39.81	45.81	57.81	69.81	81.81	93.81	105.81	129.81	
Z	30.00	34.16	37.62	42.82	48.02	58.41	68.80	79.19	89.58	99.98	120.76	
MINIMUM H = 8.42												
Y	45.00			3.88	8.12	16.61	25.09	33.58	42.06	50.55	67.52	
L1	45.00				24.63	33.12	41.60	50.09	58.57	67.06	84.03	
L2	45.00				39.69	48.18	56.67	65.15	73.64	82.12	99.09	
Z	45.00				40.45	46.45	52.45	58.45	64.45	70.45	82.45	
MINIMUM H = 15.87												
Y	60.00				0.84	7.77	14.7	21.63	28.55	35.48	49.34	
L1	60.00						32.58	39.51	46.44	53.36	67.22	
L2	60.00						52.66	59.59	66.52	73.45	87.31	
Z	60.00						46.03	49.49	52.96	56.42	63.35	
MINIMUM H = 24.86												
Y	90.00						2.26	8.26	14.26	20.26	32.26	
L1	90.00								39.77	51.77		
L2	90.00								69.90	81.90		
Z	90.00								44.92	44.92		
MINIMUM H = 44.92												
4 EMT		Dia. = 4.5		Radius = 21.5		x = 8.5						
Y	15.00	18.61	26.34	37.93	49.52	72.71	95.89	119.07	142.25	165.43	211.80	
L1	15.00	38.60	46.33	57.92	69.51	92.70	115.88	139.06	162.24	185.43	231.79	
L2	15.00	44.23	51.96	63.55	75.14	98.33	121.51	144.69	167.87	191.05	237.42	
Z	15.00	51.48	58.95	70.14	81.34	103.73	126.12	148.51	170.91	193.30	238.08	
MINIMUM H = 3.67												
Y	22.50	7.48	12.70	20.54	28.38	44.06	59.74	75.42	91.10	106.77	138.13	
L1	22.50	26.02	31.25	39.09	46.93	62.60	78.28	93.96	109.64	125.32	156.68	
L2	22.50	34.46	39.69	47.53	55.37	71.05	86.73	102.41	118.08	133.76	165.12	
Z	22.50	41.20	46.02	53.27	60.51	74.99	89.48	103.96	118.45	132.94	161.91	
MINIMUM H = 6.53												
Y	30.00	1.24	5.24	11.24	17.24	29.24	41.24	53.24	65.24	77.24	101.24	
L1	30.00	19.74	23.74	29.74	35.74	47.74	59.74	71.74	83.74	95.74	119.74	
L2	30.00	30.99	34.99	40.99	46.99	58.99	70.99	82.99	94.99	106.99	130.99	
Z	30.00	37.34	40.81	46.00	51.20	61.59	71.98	82.38	92.77	103.16	123.94	
MINIMUM H = 10.01												
Y	45.00			0.63	4.87	13.35	21.84	30.32	38.81	47.29	64.27	
L1	45.00					33.02	41.50	49.99	58.47	66.96	83.93	
L2	45.00					49.90	58.39	66.87	75.36	83.84	100.81	
Z	45.00					50.31	56.31	62.31	68.31	74.31	86.31	
MINIMUM H = 18.60												
Y	60.00					4.20	11.13	18.06	24.99	31.91	45.77	
L1	60.00						32.33	39.26	46.19	53.11	66.97	
L2	60.00						54.84	61.77	68.70	75.63	89.49	
Z	60.00						50.65	54.11	57.57	61.04	67.97	
MINIMUM H = 28.86												
Y	90.00							3.75	9.75	15.75	27.75	
L1	90.00										50.77	
L2	90.00										84.54	
Z	90.00										51.50	
MINIMUM H = 51.5												

Special Bending Information Chart (cont'd)

		HEIGHT - H										
DIM.	ANGLE	10"	12"	15"	18"	24"	30"	36"	42"	48"	60"	
2-1/2 IMC/RIGID		Dia. = 2.875		Radius = 13.9		x = 6.15						
	Y	15.00	25.10	32.83	44.42	56.01	79.19	102.38	125.56	148.74	171.92	218.29
	L1	15.00	38.62	46.34	57.93	69.53	92.71	115.89	139.07	162.25	185.44	231.80
	L2	15.00	42.26	49.98	61.57	73.16	96.35	119.53	142.71	165.89	189.08	235.44
	Z	15.00	47.13	54.59	65.79	76.99	99.38	121.77	144.16	166.56	188.95	233.73
MINIMUM H = 2.54												
	Y	22.50	13.46	18.69	26.53	34.37	50.04	65.72	81.40	97.08	112.76	144.12
	L1	22.50	26.06	31.29	39.13	46.97	62.64	78.32	94.00	109.68	125.36	156.72
	L2	22.50	31.52	36.74	44.58	52.42	68.10	83.78	99.46	115.14	130.82	162.17
	Z	22.50	35.82	40.65	47.89	55.14	69.62	84.11	98.59	113.08	127.56	156.53
MINIMUM H = 4.47												
	Y	30.00	7.25	11.25	17.25	23.25	35.25	47.25	59.25	71.25	83.25	107.25
	L1	30.00	19.83	23.83	29.83	35.83	47.83	59.83	71.83	83.83	95.83	119.83
	L2	30.00	27.11	31.11	37.11	43.11	55.11	67.11	79.11	91.11	103.11	127.11
	Z	30.00	30.92	34.38	39.58	44.78	55.17	65.56	75.95	86.35	96.74	117.52
MINIMUM H = 6.80												
	Y	45.00	0.20	3.03	7.27	11.52	20.00	28.49	36.97	45.46	53.94	70.91
	L1	45.00			20.62	24.86	33.34	41.83	50.31	58.80	67.28	84.25
	L2	45.00			31.53	35.77	44.26	52.75	61.23	69.72	78.20	95.17
	Z	45.00			32.67	35.67	41.67	47.67	53.67	59.67	65.67	77.67
MINIMUM H = 12.49												
	Y	60.00			1.49	4.95	11.88	18.81	25.73	32.66	39.59	53.45
	L1	60.00					26.22	33.15	40.07	47.00	53.93	67.79
	L2	60.00					40.77	47.70	54.63	61.56	68.49	82.34
	Z	60.00					36.06	39.52	42.98	46.45	49.91	56.84
MINIMUM H = 19.23												
	Y	90.00					2.51	8.51	14.51	20.51	26.51	38.51
	L1	90.00							30.03	36.03	42.03	54.03
	L2	90.00							51.87	57.87	63.87	75.87
	Z	90.00							33.95	33.95	33.95	33.95
MINIMUM H = 33.95												
3 IMC/RIGID		Dia. = 3.5		Radius = 16.48		x = 6						
	Y	15.00	23.71	31.43	43.02	54.62	77.80	100.98	124.16	147.34	170.53	216.89
	L1	15.00	38.61	46.34	57.93	69.53	92.70	115.89	139.07	162.25	185.43	231.80
	L2	15.00	42.93	50.65	62.25	73.84	97.02	120.20	143.38	166.57	189.75	236.11
	Z	15.00	47.66	55.12	66.32	77.52	99.91	122.30	144.69	167.09	189.48	234.26
MINIMUM H = 2.68												
	Y	22.50	12.28	17.51	25.35	33.19	48.86	64.54	80.22	95.90	111.58	142.94
	L1	22.50	26.05	31.27	39.11	46.95	62.63	78.31	93.99	109.67	125.35	156.70
	L2	22.50	32.52	37.74	45.58	53.42	69.10	84.78	100.46	116.14	131.82	163.17
	Z	22.50	36.70	41.53	48.77	56.01	70.50	84.98	99.47	113.95	128.44	157.41
MINIMUM H = 4.81												
	Y	30.00	6.08	10.08	16.08	22.08	34.08	46.08	58.08	70.08	82.08	106.08
	L1	30.00	19.80	23.80	29.80	35.80	47.80	59.80	71.80	83.80	95.80	119.80
	L2	30.00	28.43	32.43	38.43	44.43	56.43	68.43	80.43	92.43	104.43	128.43
	Z	30.00	32.15	35.62	40.81	46.01	56.40	66.79	77.19	87.58	97.97	118.75
MINIMUM H = 7.42												
	Y	45.00		1.67	5.91	10.15	18.64	27.13	35.61	44.10	52.58	69.55
	L1	45.00			20.50	24.75	33.23	41.72	50.20	58.69	67.17	84.14
	L2	45.00			33.45	37.69	46.18	54.66	63.15	71.63	80.12	97.09
	Z	45.00			34.65	37.65	43.65	49.65	55.65	61.65	67.65	79.65
MINIMUM H = 13.90												
	Y	60.00				3.25	10.18	17.11	24.03	30.96	37.89	51.75
	L1	60.00					25.94	32.87	39.80	46.73	53.65	67.51
	L2	60.00					43.20	50.13	57.06	63.98	70.91	84.77
	Z	60.00					38.89	42.35	45.81	49.28	52.74	59.67
MINIMUM H = 21.68												
	Y	90.00						5.77	11.77	17.77	23.77	35.77
	L1	90.00								34.93	40.93	52.93
	L2	90.00								60.81	66.81	78.81
	Z	90.00								38.96	38.96	38.96
MINIMUM H = 38.96												

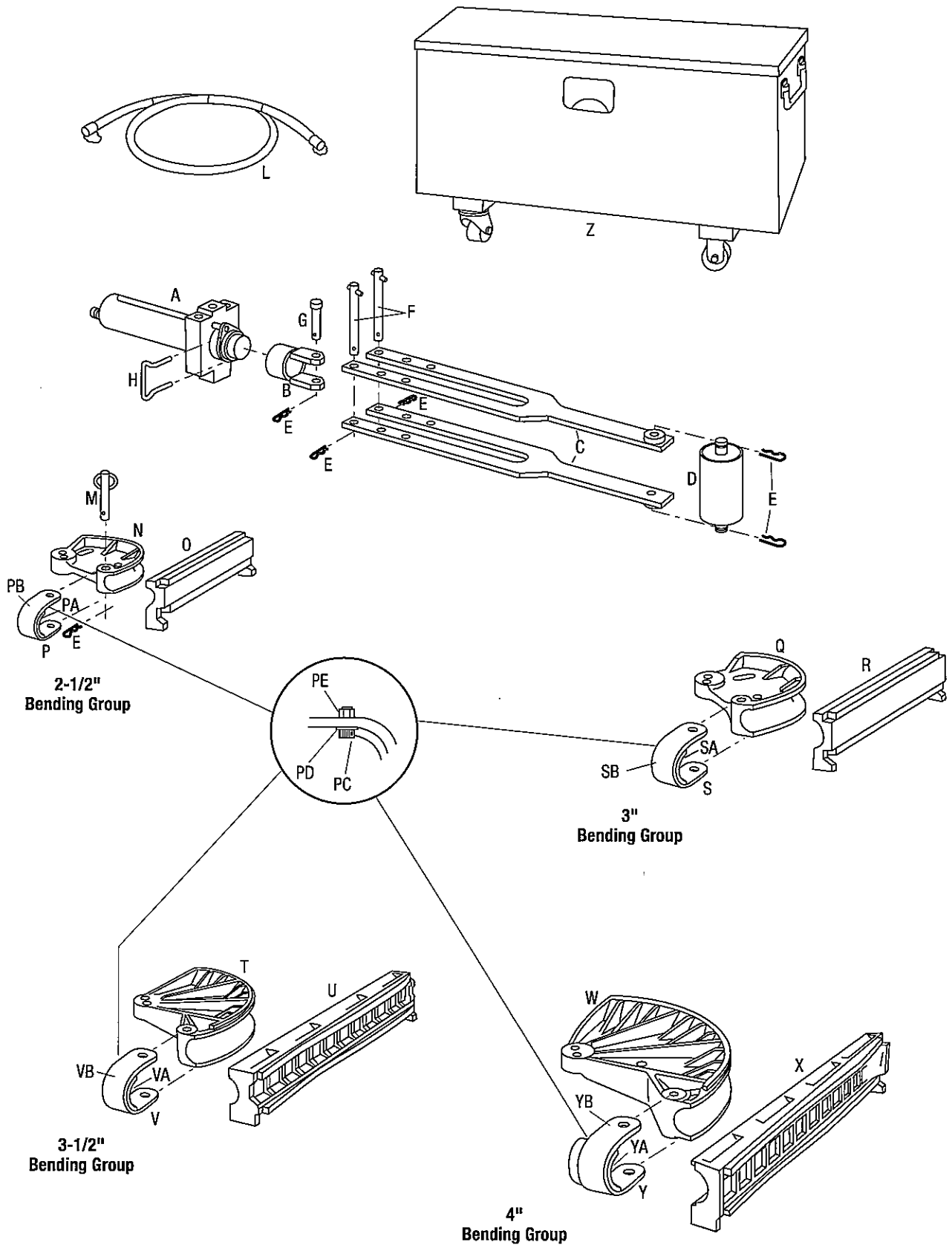
Special Bending Information Chart (cont'd)

		HEIGHT - H										
DIM.	ANGLE	10"	12"	15"	18"	24"	30"	36"	42"	48"	60"	
3-1/2 IMC/RIGID		Dia. = 4		Radius = 19.18		x = 7						
Y	15.00	21.38	29.11	40.70	52.29	75.48	98.66	121.84	145.02	168.21	214.57	
L1	15.00	38.61	46.34	57.93	69.52	92.70	115.88	139.06	162.25	185.43	231.79	
L2	15.00	43.63	51.36	62.95	74.54	97.72	120.90	144.09	167.27	190.45	236.81	
Z	15.00	49.37	56.83	68.03	79.23	101.62	124.01	146.40	168.80	191.19	235.97	
MINIMUM H = 3.12												
Y	22.50	10.09	15.32	23.16	30.99	46.67	62.35	78.03	93.71	109.39	140.75	
L1	22.50	26.03	31.26	39.10	46.94	62.62	78.30	93.97	109.65	125.33	156.69	
L2	22.50	33.56	38.79	46.63	54.47	70.15	85.83	101.51	117.18	132.86	164.22	
Z	22.50	38.77	43.60	50.84	58.09	72.57	87.06	101.54	116.03	130.51	159.48	
MINIMUM H = 5.60												
Y	30.00	3.86	7.86	13.86	19.86	31.86	43.86	55.86	67.86	79.86	103.86	
L1	30.00	19.76	23.76	29.76	35.76	47.76	59.76	71.76	83.76	95.76	119.76	
L2	30.00	29.91	33.81	39.81	45.81	57.81	69.81	81.81	93.81	105.81	129.81	
Z	30.00	34.60	38.06	43.26	48.46	58.85	69.24	79.63	90.02	100.42	121.20	
MINIMUM H = 8.64												
Y	45.00			3.44	7.68	16.17	24.65	33.14	41.62	50.11	67.08	
L1	45.00				24.63	33.12	41.60	50.09	58.57	67.06	84.03	
L2	45.00				39.69	48.18	56.67	65.15	73.64	82.12	99.09	
Z	45.00				40.89	46.89	52.89	58.89	64.89	70.89	82.89	
MINIMUM H = 16.19												
Y	60.00				0.40	7.33	14.26	21.19	28.11	35.04	48.90	
L1	60.00						32.58	39.51	46.44	53.36	67.22	
L2	60.00						52.66	59.59	66.52	73.45	87.31	
Z	60.00						46.47	49.93	53.40	56.86	63.79	
MINIMUM H = 25.24												
Y	90.00						1.82	7.82	13.82	19.82	31.82	
L1	90.00									39.77	51.77	
L2	90.00									69.90	81.90	
Z	90.00									45.36	45.36	
MINIMUM H = 45.36												
4 IMC/RIGID		Dia. = 4.5		Radius = 21.5		x = 8.75						
Y	15.00	18.36	26.09	37.68	49.27	72.46	95.64	118.82	142.00	165.18	211.55	
L1	15.00	38.60	46.33	57.92	69.51	92.70	115.88	139.06	162.24	185.43	231.79	
L2	15.00	44.23	51.96	63.55	75.14	98.33	121.51	144.69	167.87	191.05	237.42	
Z	15.00	51.73	59.20	70.39	81.59	103.98	126.37	148.76	171.16	193.55	238.33	
MINIMUM H = 3.73												
Y	22.50	7.23	12.45	20.29	28.13	43.81	59.49	75.17	90.85	106.52	137.88	
L1	22.50	26.02	31.25	39.09	46.93	62.60	78.28	93.96	109.64	125.32	156.68	
L2	22.50	34.46	39.69	47.53	55.37	71.05	86.73	102.41	118.08	133.76	165.12	
Z	22.50	41.45	46.27	53.52	60.76	75.24	89.73	104.21	118.70	133.19	162.16	
MINIMUM H = 6.62												
Y	30.00	0.99	4.99	10.99	16.99	28.99	40.99	52.99	64.99	76.99	100.99	
L1	30.00		23.74	29.74	35.74	47.74	59.74	71.74	83.74	95.74	119.74	
L2	30.00		34.99	40.99	46.99	58.99	70.99	82.99	94.99	106.99	130.99	
Z	30.00		41.06	46.25	51.45	61.84	72.23	82.63	93.02	103.41	124.19	
MINIMUM H = 10.13591												
Y	45.00			0.38	4.62	13.10	21.59	30.07	38.56	47.04	64.02	
L1	45.00					33.02	41.50	49.99	58.47	66.96	83.93	
L2	45.00					49.90	58.39	66.87	75.36	83.84	100.81	
Z	45.00					50.56	56.56	62.56	68.56	74.56	86.56	
MINIMUM H = 18.78												
Y	60.00					3.95	10.88	17.81	24.74	31.66	45.52	
L1	60.00						32.33	39.26	46.19	53.11	66.97	
L2	60.00						54.84	61.77	68.70	75.63	89.49	
Z	60.00						50.90	54.36	57.82	61.29	68.22	
MINIMUM H = 29.08												
Y	90.00							3.50	9.50	15.50	27.50	
L1	90.00										50.77	
L2	90.00										84.54	
Z	90.00										51.75	
MINIMUM H = 51.75												

Troubleshooting

Problem	Probable Cause	Probable Remedy
Wrinkling of EMT.	Shoe pin is in wrong position.	Move shoe pin to hole marked EMT.
	Follow bar is in backwards.	Remove follow bar and insert end marked START toward saddle.
	Contact surfaces between shoe and follow bar have debris or damage.	Clean shoe and follow bar. Replace shoe or follow bar as necessary.
	Follow bar is not positioned within 1" of saddle at start of bend.	Position follow bar according to the bending instructions.
	Follow bar is not centered on roller at start of bend.	Center the follow bar on the roller.
	Shoe or follow bar grooves are worn or spread.	Replace shoe or follow bar.
	Roller is not rolling on shaft.	Lubricate roller.
	High yield strength conduit.	Use standard EMT.
Side creasing of EMT.	Follow bar is not centered on roller at start of bend.	Center the follow bar on the roller.
	Conduit is not level (when bending on the floor).	Level the conduit.
	Contact surfaces between shoe and follow bar have debris or damage.	Clean shoe and follow bar. Replace shoe or follow bar as necessary.
	Pipe vise unit of 1813 is clamped too close to bender.	Move the pipe vise unit further from the bender.
	Follow bar groove is worn or spread.	Replace follow bar.
Will not bend EMT.	Follow bar is in backwards.	Remove follow bar and insert end marked START toward saddle.
Wrinkling of IMC or rigid.	Follow bar is in backwards.	Remove follow bar and insert end marked START toward saddle.
Side creasing of IMC or rigid.	Conduit is not level (when bending on the floor).	Level the conduit.
	Follow bar is not centered on roller at start of bend.	Center the follow bar on the roller.
Will not bend IMC or rigid.	Shoe pin is in wrong position.	Move shoe pin to hole marked IMC/RIGID.
	Follow bar is in backwards.	Remove follow bar and insert end marked START toward saddle.
Ram will not advance.	Pump does not have enough oil.	Add oil. Refer to instructions supplied with the pump.
	Pump vent is closed.	Open the pump vent.
	Hose couplings are not fully tightened.	Tighten the hose couplings.
	Excessive voltage drop from long extension cord.	Use a shorter or heavier extension cord.

Illustration—Major Components of 881 and 881CT



Parts List—881 and 881CT

Key	Part No.	Description	Qty
A	50274163	Ram, 40-ton (see separate parts list).....	1
B	50303090	Yoke	1
C	50263099	Connecting bar unit (includes the next three items)	2
	50266284	Bushing	2
	90529324	Screw, cap, 5/16–18 x .750 socket head.....	4
	50027549	Decal, warning	2
D	50273647	Roller unit (includes two Key E)	1
E	90503023	Clip, hitch pin, #8	6
F	50273817	Cylinder block pin unit (includes one Key E).....	2
G	50263064	Pin, yoke, 1.24 x 5.80.....	1
H	50263498	Clip, spring	1
L	50112899	Hose unit, 3/8 x 6' with couplers (includes the following two items).....	1
	90507606	Hose, hydraulic, 3/8 x 6', 3/8 M NPTF.....	1
	90508238	Coupler, quick, 3/8 male	2
M	50266241	Saddle pin unit (includes the following item)	1
	90503023	Clip, hitch pin, #8	1

Parts List—Shoe Groups for the 881 and 881CT

Key	Part No.	Description	Qty
	50275542	2-1/2" one-shot 90° shoe group (13-1/2" centerline bending radius)	
N	50262971	2-1/2" shoe	1
O	50263668	2-1/2" follow bar unit (includes the following two items).....	1
	50263641	Bar, reinforcement, 2-1/2"	2
	90502264	Screw, cap, 5/16–18 x 1.25 socket head	6
P	50265806	2-1/2" saddle (includes PA, PB, PC).....	1
PA	50265830	2-1/2" saddle insert	1
PB	50265814	2-1/2" saddle strap	1
PC	90510887	Screw, cap	2
	50275550	3" one-shot 90° shoe group (16" centerline bending radius)	
PD	90500288	Lock washer.....	2
PE	90526465	Lock nut	2
Q	50263005	3" Shoe	1
R	50354000	3" follow bar +.....	1
		+ to order both reinforcement bars for this follow bar, order the following item:	
	50354671	Conversion kit, 3" reinforcement bar	
S	50265849	3" saddle (includes SA, SB, PC)	1
SA	50265873	3" saddle insert.....	1
SB	50265857	3" saddle strap.....	1
PC	90510887	Screw, cap	2
PD	90500288	Lock washer.....	2
PE	90526465	Lock nut	2

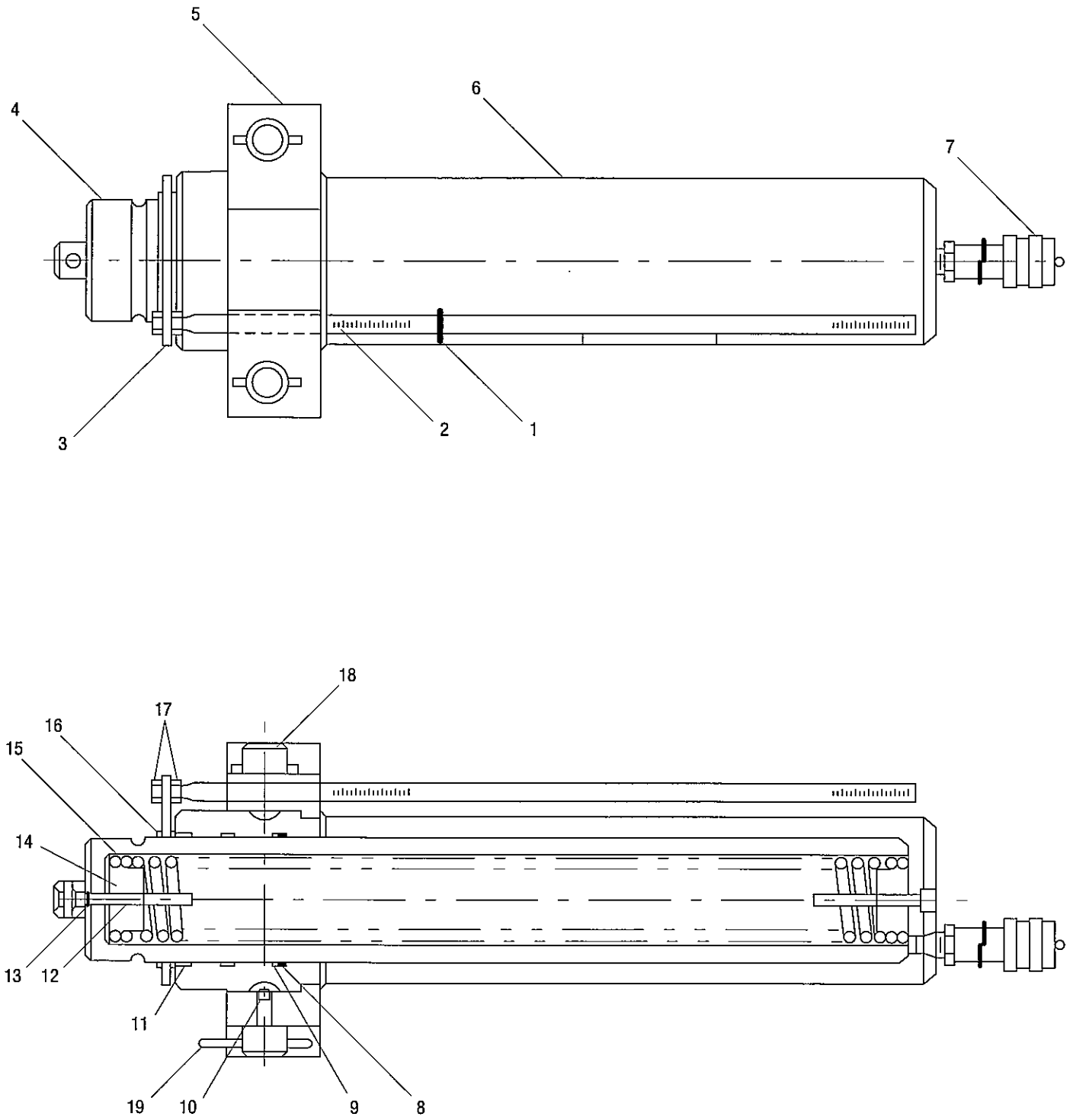
Parts List—Shoe Groups for the 881CT Only

Key	Part No.	Description	Qty
	50312812	3-1/2" one-shot 90° shoe group (18-5/8" centerline bending radius) (includes T, U, V)	
T	50318829	3-1/2" shoe	1
U	50312782	3-1/2" follow bar (to replace, order 50318810).....	1
	50312774	Bar, reinforcement 3-1/2"	2
	90502248	Screw, cap, 5/16-18 x 1.00 socket head	4
	90502264	Screw, cap, 5/16-18 x 1.25 socket head	2
V	50265881	3-1/2" saddle (includes the next two items and PC)	1
VA	50265938	3-1/2" saddle insert	1
VB	50265903	3-1/2" saddle strap	1
PC	90510887	Screw, cap	2
PD	90500288	Lock washer.....	2
PE	90526465	Lock nut	2
	50312740	4" one-shot 90° shoe group (20-7/8" centerline bending radius) (includes W, X, Y)	
W	50318845	4" shoe.....	1
X	50312715	4" follow bar (to replace, order 50318837).....	1
	50312707	Bar, reinforcement, 4"	2
	90502248	Screw, cap, 5/16-18 x 1.00 socket head	4
	90502264	Screw, cap, 5/16-18 x 1.25 socket head	2
Y	50265946	4" saddle (includes the next two items and PC).....	1
YA	50265970	4" saddle insert.....	1
YB	50265954	4" saddle strap.....	1
PC	90510887	Screw, cap	2
PD	90500288	Lock washer.....	2
PE	90526465	Lock nut	2

Parts List—Shoe Groups for the 881CT Only

Key	Part No.	Description	Qty
	50275569	3-1/2" shoe group (18-5/8" centerline bending radius) (includes T, U, V)	
T	50263021	3-1/2" shoe	1
U	50263897	3-1/2" follow bar unit (includes the following two items).....	1
	50263927	Bar, reinforcement, 3-1/2".....	2
	90502264	Screw, cap, 5/16-18 x 1.25 socket head.....	6
	50275577	4" shoe group (21" centerline bending radius) (includes W, X, Y)	
W	50263056	4" Shoe	1
X	50312928	4" follow bar unit (includes the following two items).....	1
	50312936	Bar, reinforcement, 4"	2
	90502264	Screw, cap, 5/16-18 x 1.25 socket head.....	6
Z	50233637	Box, job.....	1
	50302396	Set, casters (two rigid, two swivel).....	1

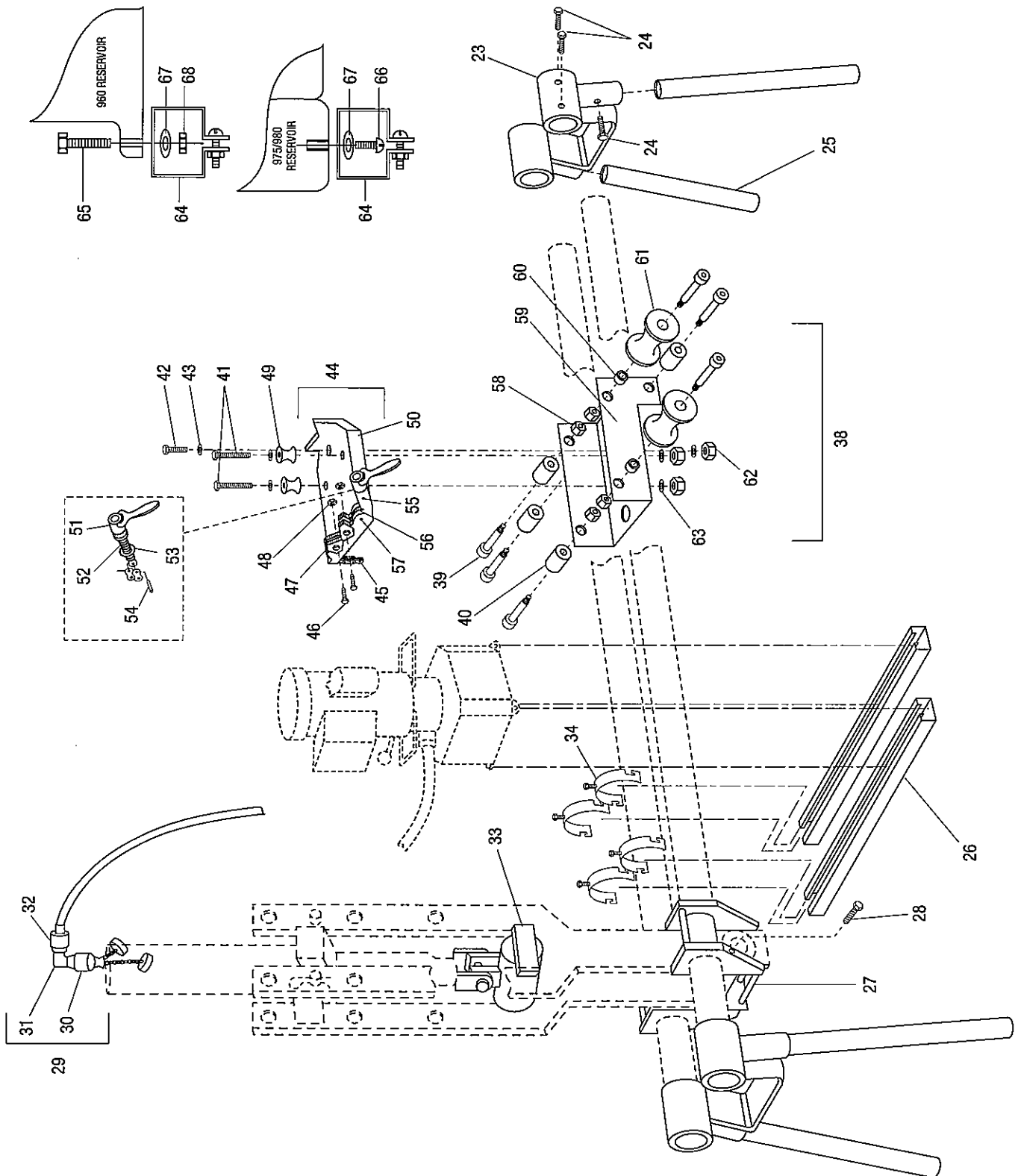
Illustration—Ram (50274163)



Parts List—Ram (50274163)

Key	Part No.	Description	Qty
1	90528670	O-ring, .437 x .625 x .093	1
2	50219480	Scale, piston	1
3	50219499	Bracket, scale	1
4	50162667	Piston, hydraulic	1
5	50274171	Block, cylinder	1
6	50162675	Cylinder, hydraulic.....	1
7	90508076	Coupler, quick, 3/8" female.....	1
8	90508300	O-ring, 3.25 x 3.62 x .187	1
9	90508297	Back-up ring, spiral, 3.25 x 3.62 x .185.....	1
10	90522176	Screw, set, 3/8–16 x .500 socket.....	1
11	50172050	Liner, cylinder.....	1
12*	50106708	Screw, tension spring.....	2
12A*	50031406	Screw, tension spring.....	2
13*	50034200	Washer, flat, .321 x .428 x .040 nylon	2
13A*	50134965	Washer, flat, .321 x .460 x .040 nylon	2
14	50106627	Retainer, spring	2
15	50106619	Spring, extension, 1.70 x 2.33 x 16.6	1
16	52060457	Ring, retaining, 3.25 Truarc	2
17	90508483	Nut, hex, 3/8–24 light jam	2
18	50273817	Pin unit, cylinder block, 1.13 x 10.2 (includes Key 19).....	2
19	90503023	Clip, hitch pin #8	2
	50235605	Decal (not shown)	1
	50343165	Decal, read IM (not shown)	1
	50354990	Decal, warning (not shown).....	1
	50137972	Packing kit, repair (includes 8, 9, 13, and 13A) Items 12 and 13 were used prior to April 1997; items 12A and 13A have been used since April 1997. Use 12A and 13A if possible.	

Illustration—1813 Bending Table (50289012)



Parts List—1813 Bending Table (50289012)

Key	Part No.	Description	Qty
23	50215418	Leg support unit (includes Key 24)	2
24	90517873	Screw, cap, 1/2–13 x 1.00 hex head.....	12
25	50213466	Leg	4
26	50290045	Support, pump table.....	2
27	50288857	Mounting unit, bender (includes Key 28)	1
28	90505328	Screw, cap, 3/8–16 x 1.25 hex head.....	2
29	50290142	Fitting unit, hydraulic coupling (includes Keys 30–32).....	1
30	90508076	Coupler, quick, 3/8" female.....	1
31	90511379	Elbow, 3/8 NPTF 90° street.....	1
32	90508238	Coupler, quick, 3/8" male.....	1
33	50290223	Positioner, ram	1
34	90547667	Clamp, pipe.....	4
35	50213180	Gage, bending (not shown).....	1
36	50232746	Box (not shown)	1
37	50351320	Decal, identification (not shown).....	1
38	50289004	Vise unit, pipe (includes Keys 39–63)	1
39	90517881	Screw, shoulder, .750 x 2.75 x 5/8–11	6
40	50247204	Roller, .767 x 2.50 x 2.12.....	2
41	90524713	Screw, cap, 1/2–13 x 3.25 hex head.....	2
42	90505441	Screw, cap, 1/2–13 x 1.50 hex head.....	1
43	90515102	Washer, flat, .531 x 1.06 x .093.....	3
44	50279947	Vise unit, bench (includes Keys 45–57).....	1
45	50249711	Chain, leaf, 23"	1
46	90511662	Screw, cap, 5/16–18 x 2.00 hex head.....	2
47	50290037	Jaw, vise.....	4
48	90506383	Nut, hex, 5/16–18, full.....	2
49	50273728	Spool, .656 x 1.50 x 1.87	2
50	50273167	Table, vise chain.....	1
51	50255509	Handle unit, vise chain.....	1
52	50255533	Screw, vise chain	1
53	50249878	Spacer, .775 x 1.23 x .062	1
54	50264303	Pin, chain, .242 x .750.....	1
55	90504208	Pin, roll, .125 x 1.00	1
56	50249851	Roller, .390 x .998 x .625.....	1
57	90531604	Pin, drive, .375 x 1.75	1
58	90526104	Nut, hex, 5/8–11 lock head thin	4
59	50288938	Carriage unit.....	1
60	50213512	Spacer, .824 x 1.05 x .38	2
61	50247654	Roller, .767 x 1.50 x 2.68.....	4
62	90527941	Nut, hex, 1/2–13 zinc-plated.....	3
63	90505077	Washer, lock, .516 x .871 x .099 spring	3
	50121219	Decal, Safety (not shown)	1
64	90538242	Bracket, pump	4
65	90509757	Screw, cap, 1/4–20 x 1.00 hex head (for the 960 SAPS pump).....	4
66	90511859	Screw, machine, 1/4–20 x .500 round head (for the 980 pump).....	4
67	90516745	Washer, lock, .259 x .489 x .062	4
68	90515935	Nut, hex, 1/4–20 steel (for the 960 SAPS pump)	4

Parts List—Decals

Part No.	Description	Qty
For the 881 (50277782)		
50265989	Decal, bender ram travel.....	1
50265997	Decal, parts list	1
50266012	Decal, bender offset.....	1
50266020	Decal, bender 90° stub	1
50326880	Decal, caution	1
50351397	Decal, identification.....	1
For the 881CT (50312871)		
50313045	Decal, bender ram travel.....	1
50313061	Decal, parts list	1
50319094	Decal, offset	1
50326880	Decal, caution	1
50351419	Decal, identification.....	1
On the Ram (50274163)		
50235605	Decal, Greenlee.....	1
50343165	Decal, read IM.....	1
50354990	Decal, warning	1
On the Job Box (50233637)		
50009940	Decal, danger.....	1
50010573	Decal, warning	1
50264109	Decal, identification.....	1
50351028	Decal, Greenlee.....	1