ROTARY DRAW BENDER

MODEL:TB-500

OPERATING MANUAL

CONTENTS

1. INTRODUCTION

1.1

You have made a practical choice in TTMC an Model TB-500 Pipe and Tube Bender.

It has been carefully built of high quality materials and designed to give many years of efficient service. The simplicity of design and minimum effort required to operate the machine contributes towards meeting schedules and producing greater profits

1.2

The Model TB-500 is a manually powered "Rotary Draw" bending machine. To bend material, a bending die. counter die and hook sleeve are required. The material is hooked by the hook sleeve and is powerfully rotated in the clockwise direction. As the bending die rotates, the counter die remains stationary. Forcing the material to conform to the radius and shape of the bending die. The Model TB-500 is capable of producing 180 degree bends in one shot by continuing to pull the ratchet lever. ***(200*** deg. max.) Each pull of the lever gives approximately4 degrees of movement.

1.3

The Model TB-500 Bending Machine you have purchased is built of solid steel and high quality components ensuring maximum rigidity.

1.4

In the next chapter of this manual, there are safety-related

descriptions for attention. These matters for attention contain the essential information to the Operators while Operating and maintaining. Failure to follow these instructions may result in great damage on the machine or the Operator.

2. SAFETY PRECAUTIONS

Safety Guide

2.1 Read this manual before Operating the machine

2.2 Keep this manual handy for answers to any questions you may have. Store it near the machine to be usable in the future

2.3 Workers shall not depend on only the safety equipment. They shall familiarize and understand the machine before Operating and maintaining the machine

Safety Precautions

2.4 Before being engaged in Operating this machine. Please read and understand the entire instruction manual, and follow all the warning signs labeled on the machine. Do not disfigure or remove

2.5 During operation please do not expose any of your body parts near to the moving parts of the machine.

2.6 Never touch work piece or tooling unless completely stopped and in the unloaded condition.

2.7 Before using the machine, make sure that the tooling is properly installed to avoid accidents and machine damage.

2.8 Operators should wear safety glasses, and remove rings.

watches, jewelry and loose fitting clothing for their own protection while operating the machine.

2.9 There must be no obstacles to obstruct the operator while in the working area.

2.10 If machine is going to be left unattended, the handle should be removed.

2.11 Please do not put any tools or measuring devices on the moving parts of the machine

3. UNPACKING

3.1 After receiving machine, visually inspect for damage. Any damage should be reported immediately to TTMC. Inc

3.2 The machine weight is approximately 103 kg. Extreme care should be taken when un-packaging. There are many small pieces so check all packing material for small parts.

3.3 Check and identify all parts as shown in the bill of materials, and layout in a clean area, for easy identification.

4. ASSEMBLY INSTRUCTIONS

4.1 Locate a position to mount the stand base in your shop. Give enough clearance around machine to allow for operation. Approx a 6 foot radius from the center of the machine is adequate.

4.2 Fasten the stand welding to a concrete floor and use "Red Head" style concrete anchors.

Caution: This machine must be anchored to a concrete

floor.

4.3 After the stand welding is fastened to the floor the main machine can be assembled

4.4 Begin by a gathering all of the parts and lay them out as shown below

4.5 Before the major components can be assembled, you must pre-assemble some components. Looking at dwg #M050-EV2. Locate parts #2.3.7.8.9.10.11 & 20. Install bumper pins and snap rings into the plates orienting them as shown below. Note: # 7 & 8 are different lengths

4.6 Locate the mid-plate #2 and install the threaded lower bushing #17 as shown below and in M050-EV2.

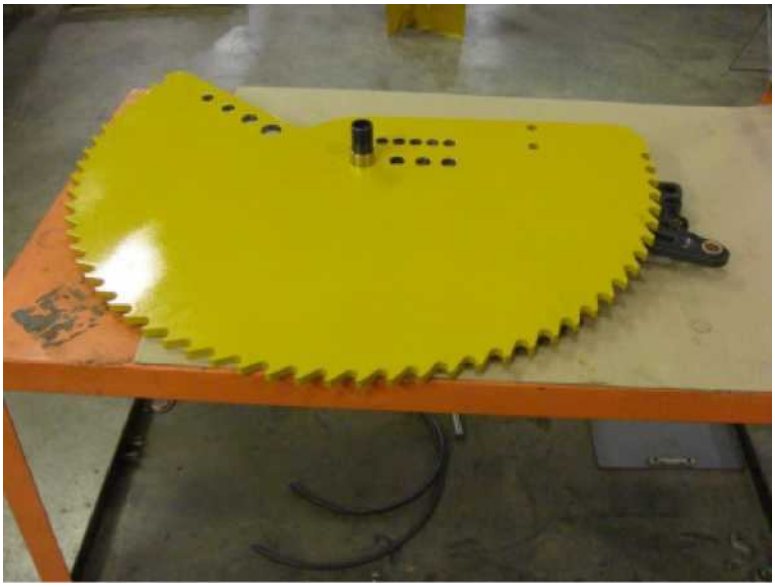
4.7 Install the bronze pivot bushing #13 and one of the blue thrust washers #12 onto the threaded lower bushing as shown below. Coat the inside and outside of the pivot bushing and the blue thrust washers with general purpose grease. This will aid in holding the thrust washers in place and provide lubrication during bending..

4.8 Locate the latch drive bars (upper #9 and lower #11*)* making sure the bumper pins are installed along with the snap rings.

4.9 Install upper drive bar #9

4.10 Install another blue thrust washer as shown below

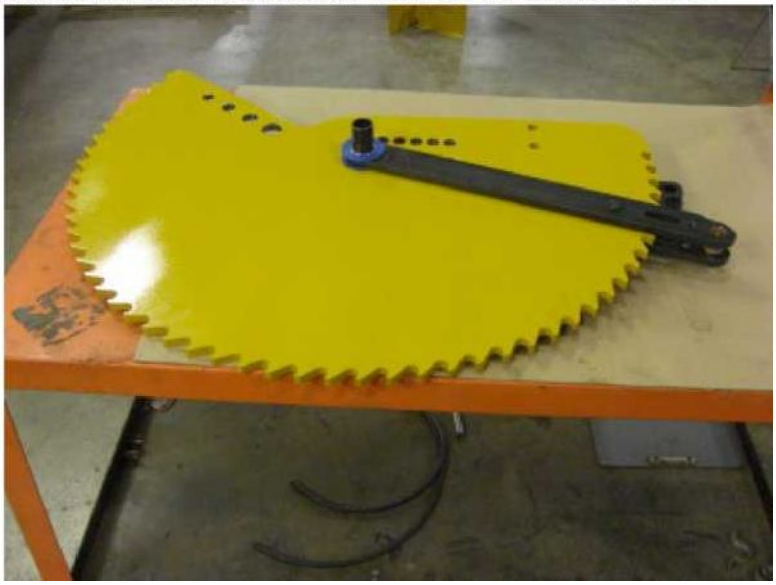
4.11 Next install the ratchet wheel # 1 onto the lower pivot sleeve. Note the orientation of the ratchet wheel because it can be put on backwards. Orient as shown below.



4.12 Install another blue thrust washer as shown below

4.13 Install the latch drive bar (lower) #11 orienting as shown

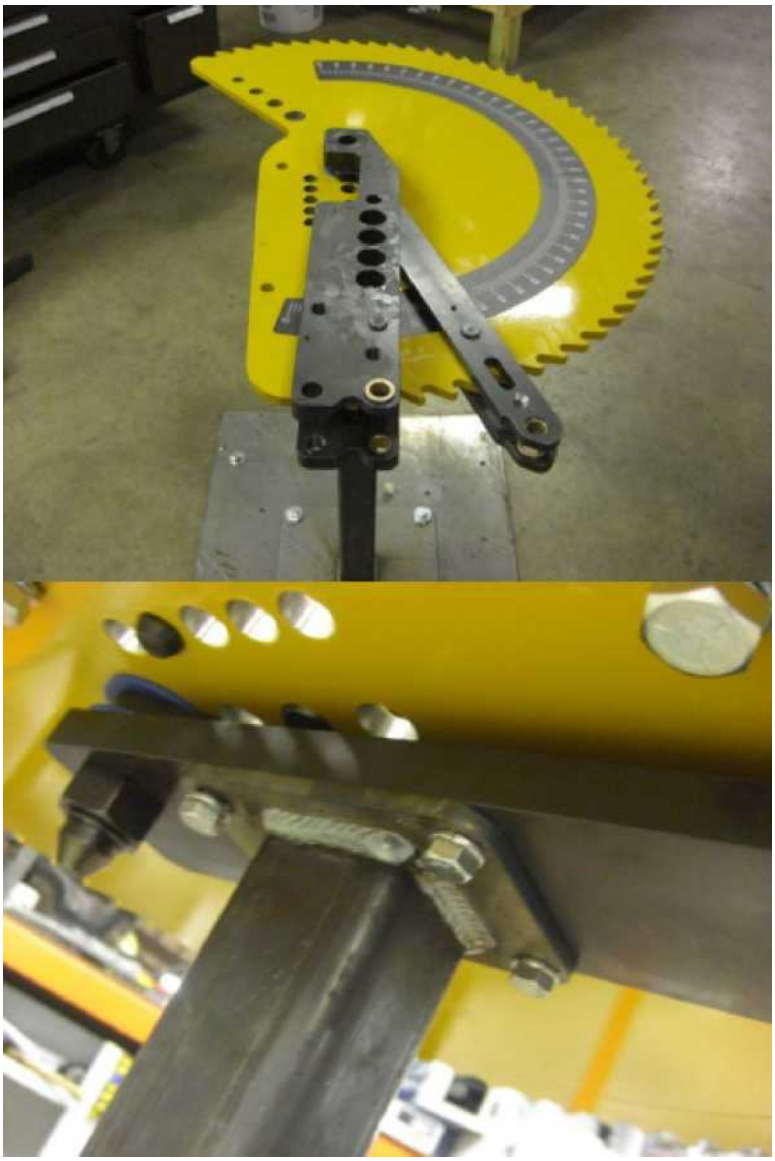
4.14 Install another blue thrust washer as shown below



4.15 Locate the bottom plate #3 and slide onto the threaded sleeve as shown below. Make sure the short bumper pin is installed in the bottom plate as shown

4.16 Locate the large locknut #14 and thread it onto the threaded sleeve as shown below

4.17 Using two people grab the partially assembled ratchet wheel assembly and flip it over lowering it onto the stand. Install the (4) 3/8-16 x 1” bolts and lock washers. Your assembly should look like the picture below.



4.18 Next the top frame section can be assembled; use dwa # M050-EV4 Locate the (2) remaining thrust washers (#9)**.** the top plate (#1) upper pivot bushing (bronze) (#10). hook drive plate (#2) and the 1 -1/2” snap ring (#15). Insert the pivot bushing into the top plate. Grease as you did in the previous step. Insert thrust washer onto the pivot bushing

4.19 Install the bronze bushing as shown below.

4.20 Install one of the blue thrust washers as shown below.

4.21 Install the hook drive Plate. This must be oriented correctly as it can be put on backwards, see picture below

4.22 Install the remaining thrust washer and finally the 1-1/2” snap ring.

4.23 Locate the plate spacer (#4) and the rectangular spacer (#11) and fasten them to the ratchet wheel using 5/8-11 x 1-1/2 with lock washers, as shown below. Do not tighten yet

4.24 Locate the 3 long spacers (#3). short spacer (2) 3/4-10 x 6.5 HHCS. and (1） 3/4-10 x9.0 HHCS with lock washers. Install the top plate assembly spacers and bolts as shown below. Do not tighten any of the main bolts yet.

4.25 Now that the majority of the machine is built, the drive lever section can now be assembled, use dwa #M050-EV3. Locate the 2 drive links (#2) the shaft block (#4). Bolt together using (8)5/16-18 X 1” as shown below.

4.26 Set this assembly aside and continue with the latch drive bars from the last step. Locate spacer (#6) and bolt the drive bars together with the 3/8-16 x 1 -3/4” flat head screw

4.27 Install snap ring onto shaft (#11) and slip through drive link end hole through middle and bottom plates. and install lower snag ring to shaft (#11) as shown below

4.28 Locate lock tabs (#7). Spacer (#8). 5/8” drive pin (#5). install a 5/8” snap ring onto shaft (#5). slip shaft through holes in lock tab. upper drive lever slots and then lower drive lever slots and finally the latch plate. Install the 5/8” lower snap ring onto shaft

4.29 Install pivot pin (#12) through drive link, lock tab slots. upper drive bar. the drive link again. lower drive bar. and finally the lower lock tab.

Install snap rings on both sides, as shown below.

4.30 Next the anti spring back lever can be pre assembled, using dwa #M050-EV-4 locate the anti spring back lever (#7). pivot block (#8). 1/2-13x1 -3/4 hex bolt. 1/2” lock. (2) 1/2” washers and (2) 5/16x1 hex bolts

4.31 Install on the machine as shown below

4.32 Install the lower latch plate as shown using (2) 1/4-20x3/4” screws

4.33 Install 3 springs and 6 screws as show below

4.34 The remaining pins can be installed in their respective locations. Each pin will get a snap ring installed onto its groove

4.34.1 Main die pin 1” dia.

4.34.2 Counter die pivot pin 1 -1/4” dia.

4.34.3 Die drive pin 7/8” dia.

4.34.4 Hook strap pin 3/4” dia.

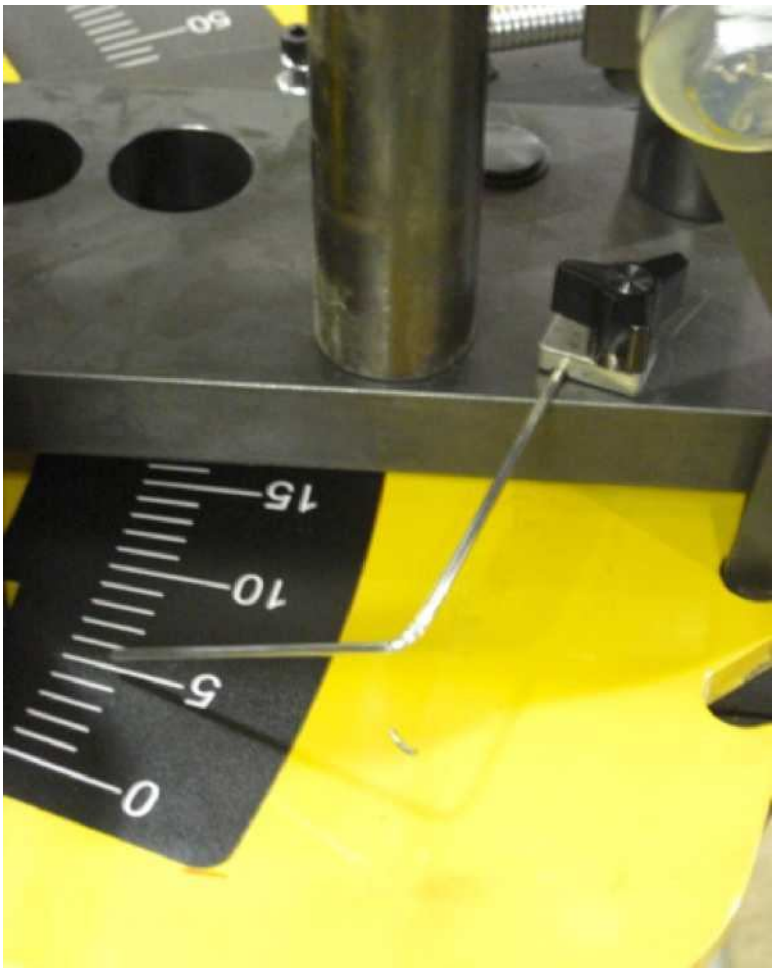
4.34.5 Small die counter die pivot pin 3/4” dia.

4.34.6 Speed change pin 3/4” dia.

4.35 Now that the majority of the machine is assembled slide the main die pin through the center axis of the machine as well as all of the other pins. Now the 3 main bolts can be torgued to 100ft lbs. next

torgue the lower special hex nut to 80 ft lbs. After tightening. all pins should slide in and out easily. (DO NOT TRY TO BEND ANYTHING UNTIL ALL BOLTS ARE TIGHT)

4.36 Finally the pointer. pointer clamp and hand knob can be installed as shown below



5. MAINTENANCE

5.1 The machine should be disassembled yearly to re-grease the main pivot point. and replace any worn bushings

5.2 The main drive pin which engages the ratchet wheel is the main part that will see wear

5.3 All of the pivot bushings are oil impregnated bronze and are very

inexpensive to replace. The machine will function with worn bushings so it is up to the owner to determine when they need replacing

6. OPERATION

6.1 Bending and dry running

6.1.1 before actually bending. Several “dry runs” should be performed to familiarize yourself with all of the machine functions.

6.1.2 Keep hands a way from the bending zone.

6.1.3 With the drive lever and the ratchet wheel in the home position. bending or dry running can take place.

6.1.4 Depending on the material size, you will need to choose a bending Speed 1.2 or 3. Until you are familiar with the machine always start bending using Speed one. you can change speeds at anytime. If it is easy for the user to pull on the bending handle, then the speed can be increased if desired.

6.1.5 Each pull of the handle equals the degrees listed below.

6.1.5.1 4 deg in speed 1

6.1.5.2 8 deg in speed 2

6.1.5.3 12 deg in speed 3

6.1.5.4 Increasing speed increases pulling effort of the bending handle.

6.1.6 When the machine is in the home position. Engage the anti-spring back lever.

6.1.7 Next engage the ratchet release lever.

6.1.8 without material in the machine. pull on the ratchet wheel clockwise, you will hear a “click” every time the lever is cycled through one stroke in speed 1. Return the lever counter clockwise and you will hear another "click". You just engaged another tooth on the ratchet wheel, continue though these cycles and you can “bend” or “ratchet' all the way to 200 deg.

6.1.9 If you select speed two. you will hear 2 clicks each stroke and 3 clicks on speed three.

6.1.10 When at the desired degree position is reached, the anti spring back lever needs to be deactivated first. If the machine has a heavy bending load on it. you may have to pull the bending lever forward to relieve pressure allowing you to release the anti spring back lever.

It is important to release pressure gently. If the anti spring back lever is released without caution, the handle assembly and ratchet wheel can violently whip around possibly causing injury.

6.1.11 Now that the pressure is released, you can disengage the ratchet release lever.

6.1.12 The ratchet wheel is now free to rotate back to the home position

6.1.13 To bend with material, go to the next step for instruction on how to choose and install the bending dies

6.1.14 After the dies are installed, insert material through the hook

sleeve aligning the start of bend with the”0” mark on the die.

6.1.15 Select a speed and follow the above steps and begin ratcheting the machine until the you feel tension on the pull lever, as your tubing just begins to bend. position your pointer to the “0" on the degree dial, this will compensate for most of your “spring back"

6.2 Die Selection and Installation

Damaged or worn tooling should be replaced before attempting to bend material. This will ensure that bends are correct and provide a longer life to machine components.

6.2.1 Before any bending can take place. the proper die set must be chosen to match the material being bent. (EX) 1-1/2” diameter tubing requires a die set marked 1-1/2” tube.

6.2.2 Two different types of dies are available. 120 deg and 240 deg dies. The 240 deg dies allow you to bend to a full 180 degrees. and the 120 deg will allow you to bend to approx 120 degrees

6.2.3 “Pipe” and “Tube” are not the same, so all of the dies will be marked in actual outside diameter of the material, and will relate to "Tube"

Caution: When installing large dies use another person to help load into the machine.

1) To install the die. remove all of the pivot pins and install them in their storage area to the left of the ratchet wheel

2) Choose a die. either a 120 or 240 degree variety. Locate the dies center hole with the center of the machine, install the 1” diameter main die pin through the center, all the way until the snap ring bottoms out.

3) Next install the 7/8” die drive pin into the holes that line up with the respective machine hole.

4) Locate the proper hook sleeve holder and position it so the center of the assembly lines up with the centerline radius of the die. and install the 3/4” hook pin. There are two different hook sleeve holders, one for nominal clr dies (fie: 4.0 clr) and one for 0.5 increment dies (fie: 4.5 clr)

5) Choose a counter die that matches your bend die and install the 1 - 1/4” counter die pin. so the gap between the die and the counter die is approx 1/8”. For dies under 3.5 clr. The 3/4” die c’die pin supplied

with the machine will be used.

Figure 1 Correct counter die position (Approximately 1/8”) a wav from the bend die

CAUTION: It is critical that all of the pins are fully down all of the way to the snap ring. If you attempt to bend without making sure the pins are fully down machine damage will occur and this will not be covered under warranty.

IMPORTANT: Lubricate the material and counter die with a WD-40 style lubricant or equivalent. Do not lubricate the die. lubricating the bend die will encourage slipping

IMPORTANT: Be sure the long end of the counter die points away from the hook arm. or to the right of machine.

6) Now you can go back to sec 6.1 and follow Stepsfor bending

6.3 Multiple bends on the same work piece

Extreme care must be taken when bending material with an existing bend. There must be enough straight material to complete the bend. If there is not enough material the bent part of the material will crash into the counter die and damage the machine and tooling

7. MATERIAL LAYOUT

In order to create accurate parts, you will have to layout the material in flat form. First you will need to determine how much material is used per degree of bend. Use the multiplier table on Table #1 to determine the arc lengths for the die in use. Or use the following

formula:

Alternate arc length formula $\left[\frac{\text{clr} \times 2 \times \text{pi}}{360} \times \right]$ degree of bend

7.1 Once the arc lengths are determined you can begin layout of the material using diagram #1 as a reference,

7.2 Diagram #1 shows a simple part bent on the same plane in the same direction

7.3 Diagram #2 shows bending based off of a centerline in two directions

7.4 For symmetrical bends, centerline bending is easiest.

7.5 For non-symmetrical bends, continuous one direction bending is best

8. BENDING SUGGESTIONS

8.1 ALUMINUM: if bending aluminum, lubrication is very important. if the results are less than desirable with wd-40 other lubricants can be used such as:

8.1.1 Johnson Paste Wax (seems to work the best)

8.1.2 High Pressure grease

8.1.3 Highly rich dish soap

8.1.4 The bronze counter die must be polished and have no aluminum deposits or it will continue to pick up metal.

8.1.5 If using RMD's standard counter die is not producing desired results, roller counter dies are also available.

8.1.6 Some aluminum will crack as it is being bent. 6061-T6 is very

hard and may need to be annealed or ordered in the “ T-0” condition.

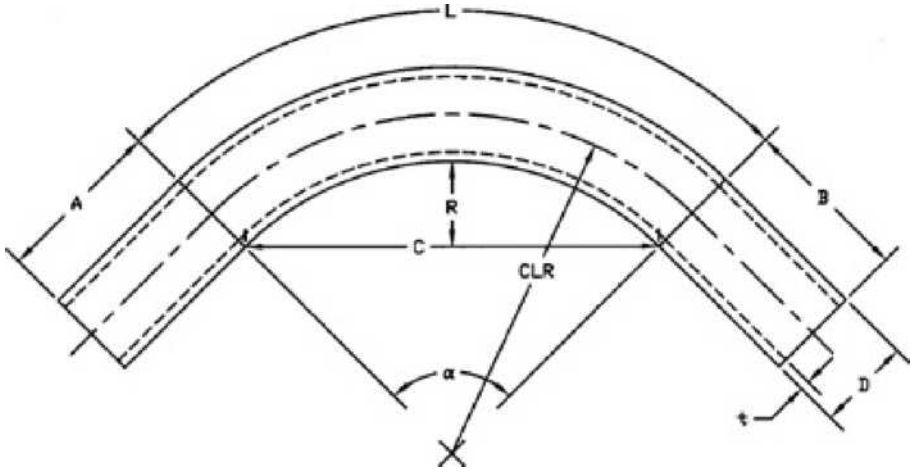
8.2 HEAVY WALL DOM TUBING: if heavy wall materials are bent to a tight radius, they can tend to slip in the hook arm causing *a* poor bend result, below are some suggestions

8.2.1 Use *a* vise clamp on the outside of the hook arm to “ lock” the material in place.

8.2.2 Use a piece of two sided coarse emery cloth in between the hook arm and the material, this works very well

8.2.3 In only this application. high pressure grease applied to the DIE GROOVE also helps

9. PIPE BENDING AND TUBE BENDING DIAGRAMS



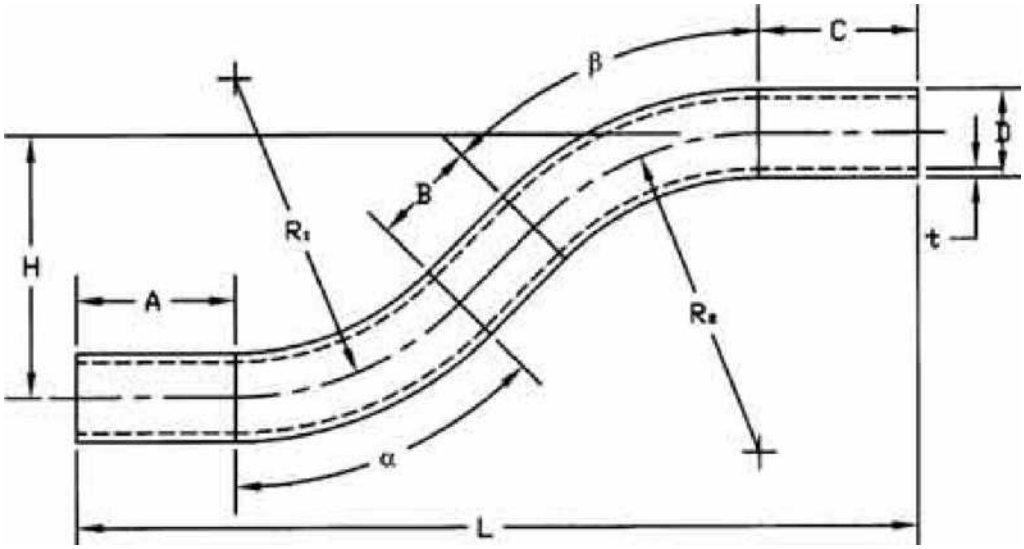
Legend

L = Arc length (outside)

R = Rise (inside)

D = Tube outside diameter

t = Tube wall thickness



a= First bend arc angle b= Second bend arc angle

A= First tangent B= Straight between bends

C= Second tangent D= Tube outside diameter

H= Height of offset L = Length of offset

R1= First radius R2= Second radius

t= Tube Wall Thickness

10. GLOSSARY OF COMMONLY USED TERMS

Arc Length - The length of material along the centerline of the tubing

Centerline Radius (CLR) - Distance in inches from the center of curvature to the centerline axis of the tube bending or pipe bending bends. Abbreviated as CLR. See Tube Bending and Pipe Bending Diagram

Degree - Angle in degrees to which the tube/pipe bends are formed (i.e. 45 degrees. 90 degrees. 180 degrees. etc.)

Easy Way (EW) - Bending of a rectangular tube with its short side in the plane of the tube or pipe bend

Hard Way (HW) - Bending of a rectangular tube with its long side in the plane of the tube or pipe bend

I.D. - Inside diameter of the tube or pipe bends

Minimum Tangent- The minimum straight on the end of pipe bends required by the bending machine to form the bend

Neutral Axis - That portion of the pipe or tube that is neither in compression or tension.

O.D. - Outside diameter in inches of the tube or pipe

Out of Plane - The deviation of the horizontal plane of a single pipe bend between its tangent points. based on the theoretical center-line of the pipe bend

Ovality - The distortion or flattening of pipe or tube from its normal, round shape caused by the pipe bending process

Spring back - Amount of degrees material will return after bending pressure is released

Tangent-The straight portion of material on either side of arc of bending bends. See Tube Bending and pipe Bending Diagrams.

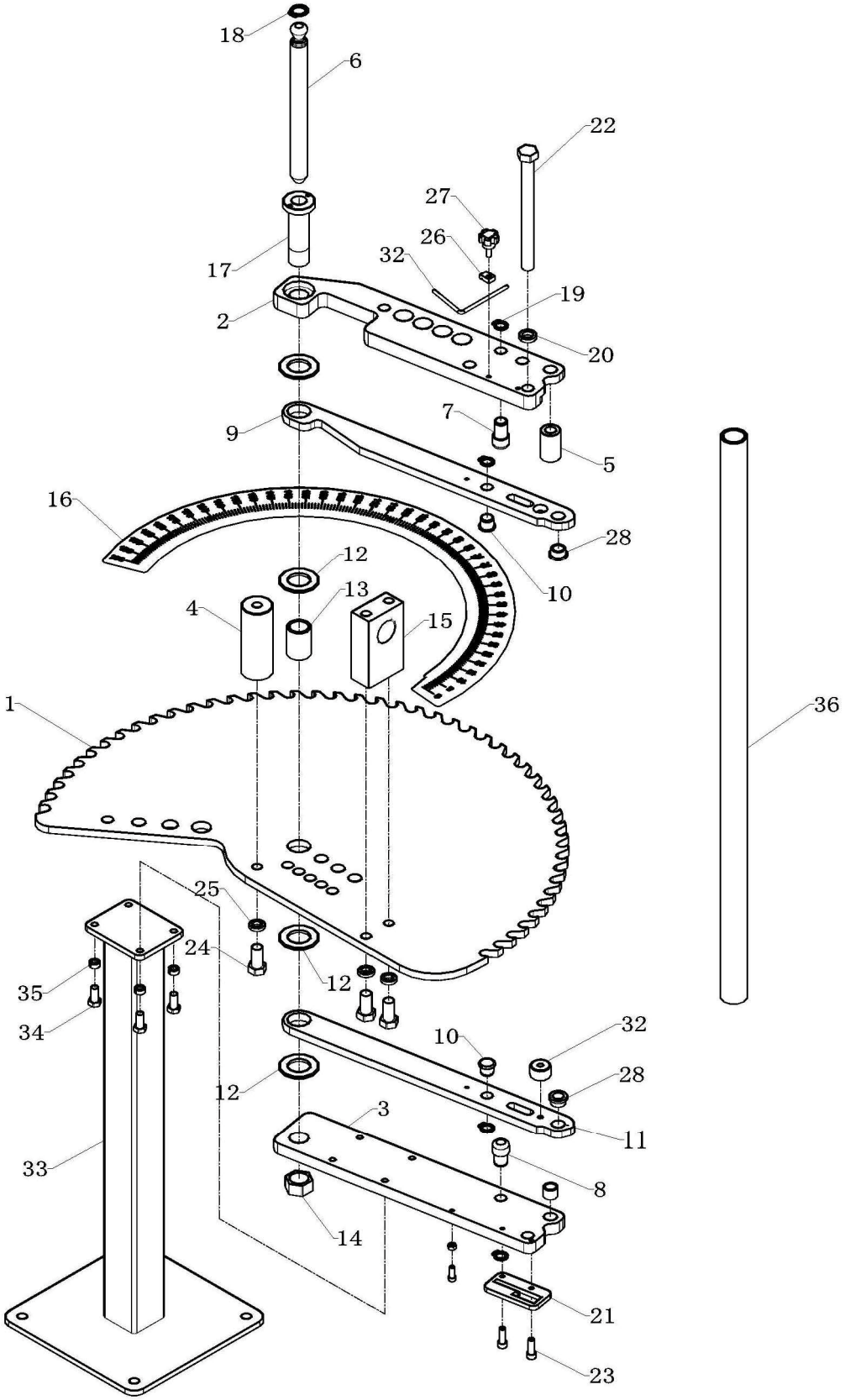
Tangent Point - The point at which the bend starts or ends. See Tube Bending and Pipe Bending Diagrams.

Wall - The thickness in inches of tubular pipe bending material.

Wrinkles - Waving or corrugation of pipe bending bends in the inner radius

11. DRAWING AND PART LIST

11.1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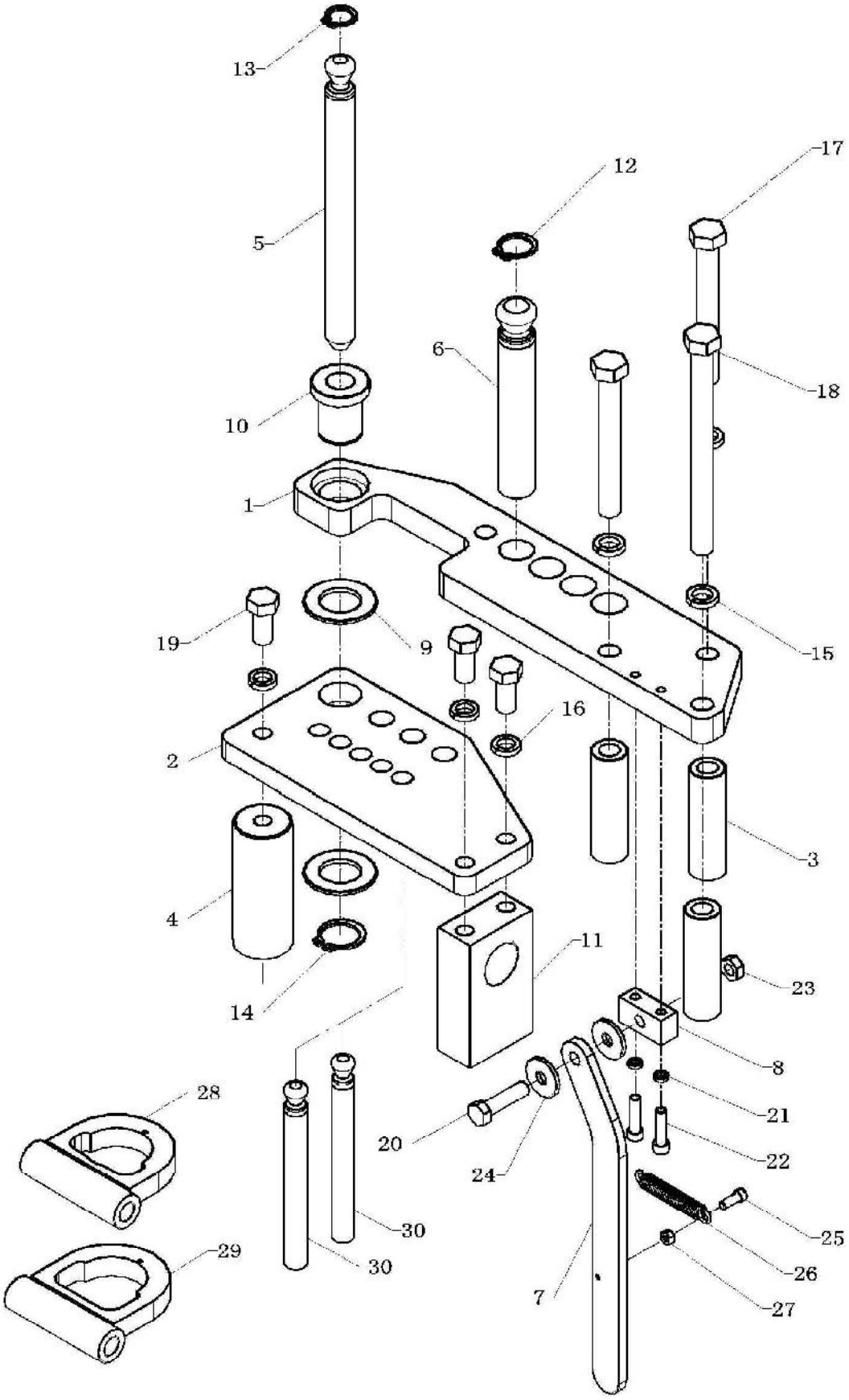
Item.	Name	Qty
1	Ratchet Wheel	1
2	Middle Support Plate	1
3	Bottom Plate	1
4	Support Spacer	1
5	Tube Spacer	1
6	Long Die Pin	1
7	Bumper Pin	1
8	Bumper Pin	1
9	Drive Bar (upper)	1
10	Bumper Pin	2
11	Drive Bar (lower)	1
12	Thrust Washer	4
13	Pivot Sleeve	1
14	Special Hex Nut	1
15	Rectangular Spacer	1
16	Degree Sticker	1
17	Thread Bushing	1
18	Snap Ring	1
19	Snap Ring	4
20	Spring Washer	1
21	Latch Plate	1
22	Hex. Bolt	1
23	Socket Head Bolt	2
24	Hex. Bolt	3
25	Spring Washer	3
26	Stop Block	1
27	Hand Knob	1
28	Sleeve Bushing	2
29	Socket Head Bolt	1
30	Hex. Nut	1
31	Sleeve Bushing	1
32	Pointer	1
33	Stand	1
34	Hex. Bolt	4
35	Spring Washer	4
36	Stress Handle	1

11.2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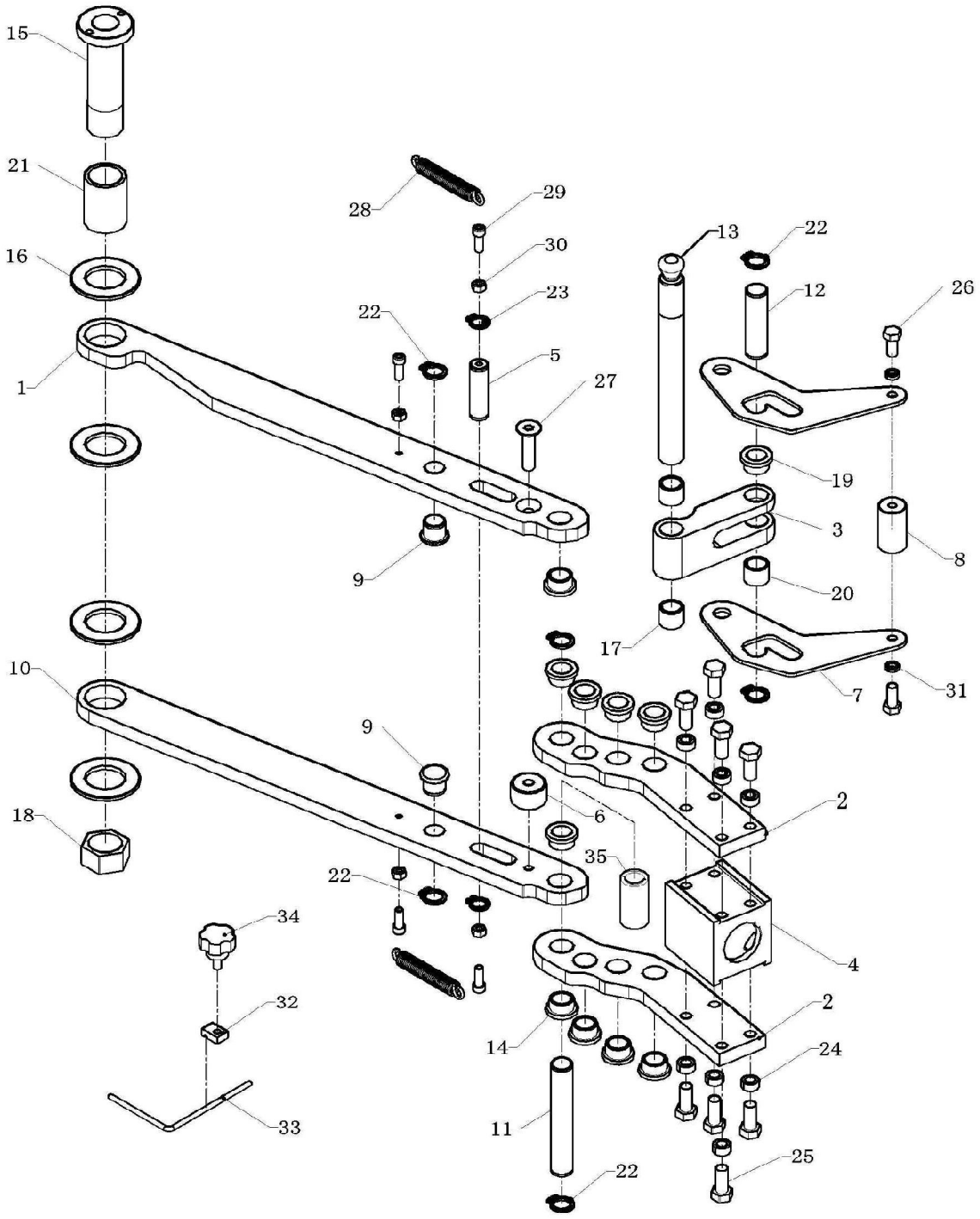
Item.	Name	Qty
1	Top Support Plate	1
2	Fixed Plate	1
3	Spacer Tube	3
4	Support Spacer	1
5	Long Die Pin	1
6	Short Die Pin	1
7	Lever	1
8	Fixed Block	1
9	Thrust Washer	2
10	Pivot Sleeve	1
11	Rectangular Spacer	1
12	Snap Ring	1
13	Snap Ring	1
14	Snap Ring	1
15	Spring Washer	3
16	Spring Washer	3
17	Hex. Bolt	2
18	Hex. Bolt	1
19	Hex. Bolt	3
20	Hex. Bolt	1
21	Spring Washer	2
22	Socket Head Bolt	2
23	Nut	1
24	Big Washer	2
25	Socket Head Bolt	1
26	Spring	3
27	Hex. Nut	1
28	Clip	1
29	Clip	1
30	Die Pin	2

11.3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Item.	Name	Qty
1	Drive Bar (upper)	1
2	Drive Link	2
3	Connecting Link	1
4	Shaft Block	1
5	Drive Pin	1
6	Spacer	1
7	Lock Tab	2
8	Release Spacer	1
9	Bumper Pin	2
10	Drive Bar (lower)	1
11	Pivot Pin	1
12	Pivot Pin	1
13	Die Pin	1
14	Sleeve Bushing	8
15	Thread Bushing	1
16	Thrust Washer	4
17	Sleeve Bushing	2
18	Hex. Nut	1
19	Sleeve Bushing	1
20	Sleeve Bushing	1
21	Sleeve Bushing	1
22	Snap Ring	6
23	Snap Ring	2
24	Spring Washer	8
25	Hex. Bolt	8
26	Hex. Bolt	2
27	Hex. Nut	1
28	Spring	2
29	Socket Head Bolt	4
30	Hex. Nut	4
31	Spring Washer	2
32	Stop Block	1
33	Pointer	1
34	Hand Knob	1

Note: This manual is only for your reference. Owing to the continuous improvement of the machine, changes may be made at any time without obligation on notice. And please note the local voltage while operating this electric machine.