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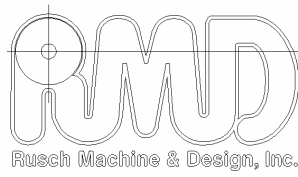
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MACHINE SERIAL NUMBER: _____

A COPY OF THE INSTRUCTION MANUAL AND WARRANTY HAS BEEN
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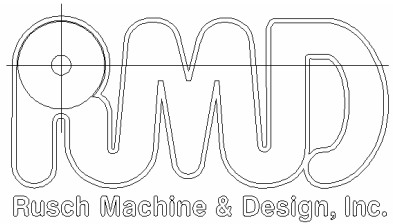
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**INSTRUCTION MANUAL
MODEL #150-110
HYDRAULIC ROTARY DRAW TUBE AND PIPE BENDER**



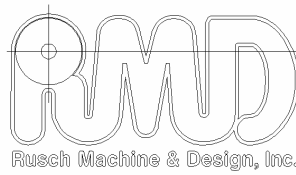


SERVICE BULLETIN FOR ALL RMD TUBE BENDERS 4-MAR-04

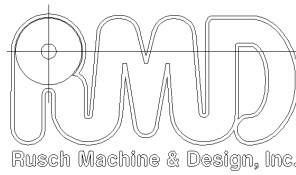
When bending with tooling larger than 4" center line radius and any material larger than 1-1/4" pipe, it is very important that the forming die which fits on the spindle is bolted down using the supplied bolt down holes in the dies.

Failure to do so can result in the tooling lifting off of the spindle applying an excess load to the drive pins resulting in pin failure, voiding the warranty.

If you have questions or concerns please contact the factory.



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1) IMPORTANT INFORMATION AND CONTACTS

Machine Information

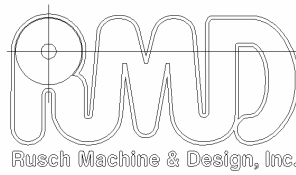
Model #150-110
110v 60 Htz
510 lbs/ 232 kg
Maximum Sound level < 70Db

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2) INTRODUCTION

- a) You have made a practical choice in purchasing an RMD, INC. Model #150 Electric Bending Machine. 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.
- b) The Model #150 is an electric powered “Rotary Draw” bending machine. To bend material, a bending die and counter die are required. The material is hooked by the bending dies’ hook arm and is powerfully rotated in the clockwise direction. As the bending die rotates, the counter die arm also rotate about the same axis, forcing the material to conform to the radius and shape of the bending die. The Model #150 is capable of producing 180 degree bends in one shot. (200 deg max.)
- c) The Model #150 Bending Machine you have purchased is built of solid steel ensuring maximum rigidity. Grade 8 bolts used throughout, provides very high rigidity and stability.
- d) 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 to the machine or the operator.



3) SAFETY PRECAUTIONS

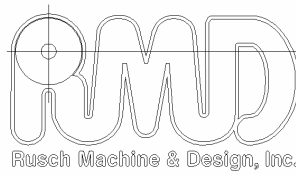
a) Safety Guide

- 1) Read this manual before operating the machine.
- 2) Keep this manual handy for answers to any questions you may have. Store it near the machine to be usable in the future.
- 3) Operators and maintenance workers shall not depend on only the safety equipment. They shall familiarize and understand the machine before operating and maintaining the machine.

b) Safety Precautions

- 1) 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) During operation, please do not expose any of your body parts near to the moving parts of the machine.
- 3) Never touch workpiece, tooling or spindle unless completely stopped.
- 4) Before starting the machine, make sure that workpieces and die tooling are properly installed to avoid accidents.
- 5) Operators should wear safety glasses, and remove rings, watches, jewelry and loose fitting clothing for their own protection while operating the machine.
- 6) Before operating, make sure all hose connections are tight and free from leaks
- 7) "CAUTION": DO NOT OPERATE IF HOSES ARE DAMAGED OR LEAKING
- 8) There must be no obstacles to obstruct the operator while in the working area





- 9) If machine is going to be left unattended, the operator should turn power off, to the power unit.
- 10) Please do not put any tools or measuring devices on the moving parts of the machine.
- 11) Identify and make sure of all the switches and levers
- 12) Inspect drive pins for signs of wear or damage, replace immediately if damage or wear is found. This will prolong the life of your tooling.

4) UNPACKING

- 1) After receiving machine, visually inspect for damage
- 2) The machine weight is approximately 510 pounds. Extreme care should be taken when unloading from skid. A forklift is the best way to remove machine from the skid.

5) INSTALLING

- 1) Once unloaded, install the (2) casters and the (2) 8" wheels, using hardware found in wheel and caster kit.
- 2) Be sure to rest machine on a flat surface.
- 3) The hydraulic system is full of oil and tested at the factory before shipping. Be careful not to kink or damage the hoses during unpacking.
- 4) Have a certified electrician verify that the power source is correct for the machine's specifications, and that the plug is correct and properly grounded to an earth ground.

6) POWER REQUIREMENTS

- 1) AC Voltage 20 Amps 110v (Single Phase)
- 2) Frequency 60 Hz
- 3) The power source cable should be protected by fuse or circuit breaker, and dedicated to this machine only.

7) MAINTAINANCE

- 1) The fluid level in the power unit's reservoir should be checked monthly. If the level is below $\frac{1}{2}$ full, fill to the top with AW-46 hydraulic fluid. Hydraulic fluid and the filter should be changed when the filter gauge reads "Change Filter".
- 2) Check periodically for leaks. If a leak is detected, consult RMD, Inc.
- 3) There are four grease zerks on the machine, at the main spindle pivots. Grease these zerks every month with only two pumps from a standard grease gun.
- 4) Check for any loose or worn parts
- 5) If hoses or fittings are replaced, they must be rated for 4000psi (275 bars, 282 kg/cm).

8) OPERATION

a) Dry running machine

- 1) Before actually bending, several "dry runs" should be performed. This will remove any trapped air from the cylinders and hoses. Also, this will familiarize you with the controls and functions of the machine. To do this, follow the next steps.

(1) Set the autostop dial (Optional Equipment) to approximately 220 degrees.

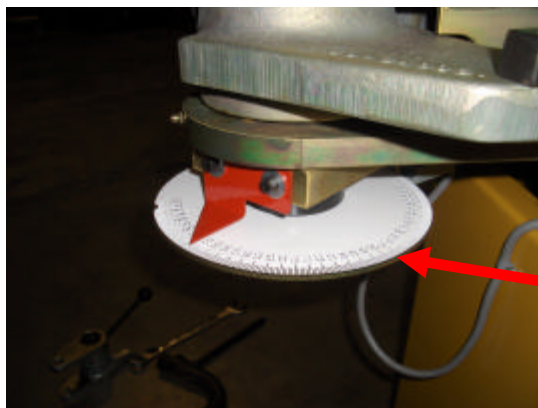
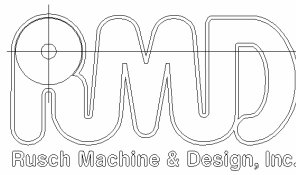


Figure 1 Autostop dial

- (2) With no material in the machine, press forward on the control handle until the hydraulic cylinders "deadhead" in the most forward direction, then reverse the direction until the hydraulic cylinders "deadhead" in the home position. The overload relief valve will make a squealing noise; this is normal and will not hurt the function of the machine.



(3) Repeat this sequence as many times as necessary to remove any trapped air and to synchronize the cylinders.

2) The main control valve has two functions: Forward and Reverse, the control valve is spring loaded and must be held in the Forward or Reverse positions to move the cylinders.

b) 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.

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.

Note: Pipe and Tube are not the same, see chart in appendix c for nominal pipe sizes. All RMD dies are color coded to avoid confusion between tube and pipe.

Material	Color
Pipe	Green
Tube	Blue
Metric	Red
Square or Rectangle	Gray



Caution: When installing large dies use either a mechanical lift or a fork lift to prevent serious personal injury.

2) To install the die, slip the die over the centering pin until the three unequally spaced drive pins engage the receiving holes formed in the die (Note: The die will only fit one way). When the drive pins line up the die will drop all the way down to the spindle. If bolt holes are provided in the die ensure that the die is bolted to the spindle with the 1/2-13 bolts and lock washers provided with the die.

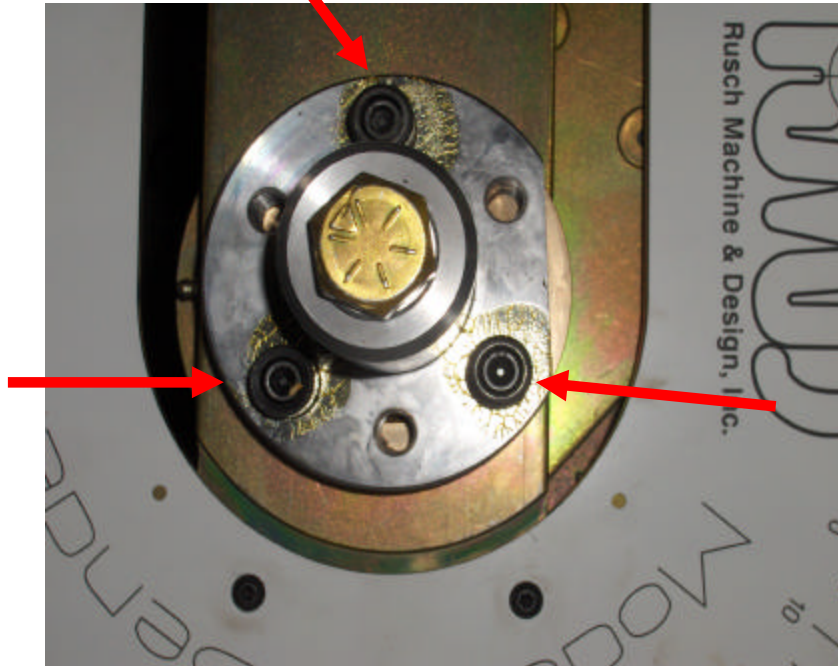


Figure 2 Drive pins and bolt down holes for installing die

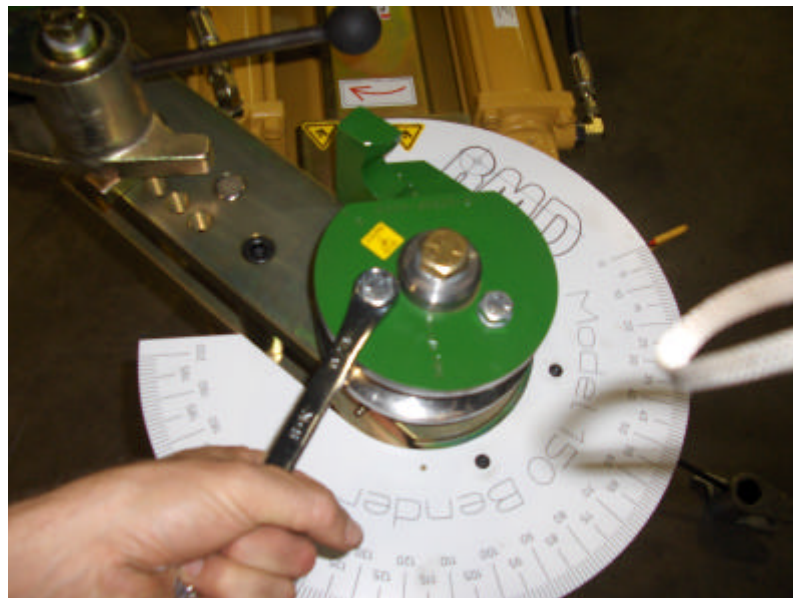


Figure 3 Tightening hold down bolts for die



Failure to properly bolt down die will result in damage to machine.

- 3) To install the counter die, Remove the hitch pin & insert the counter die between the opening in the counter die mount until the $\frac{3}{4}$ " holes line up.

Now insert the hitch pin through all the holes, reinstall clip on the hitch pin with the engraved side of the counter die facing up.

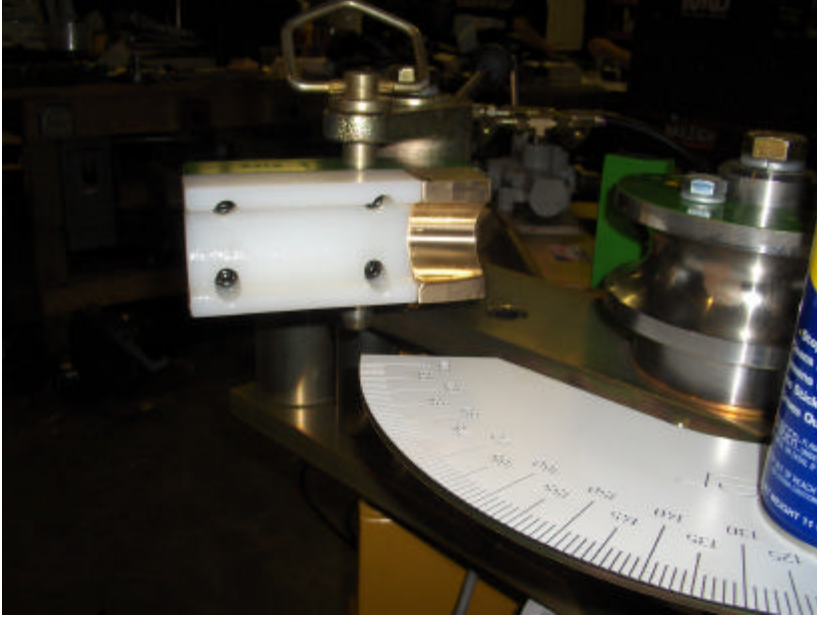


Figure 4 Setting up Counterdie

- 4) The counter die should be positioned approximately 1/8" (3mm) away from the die. This can be accomplished through a combination of hole placement of the counter die pivot pin and the counter die mount used; silver (M150-5A011) or gold (M150-5A001).



Figure 5 Incorrect counterdie position
(Too far away from die)

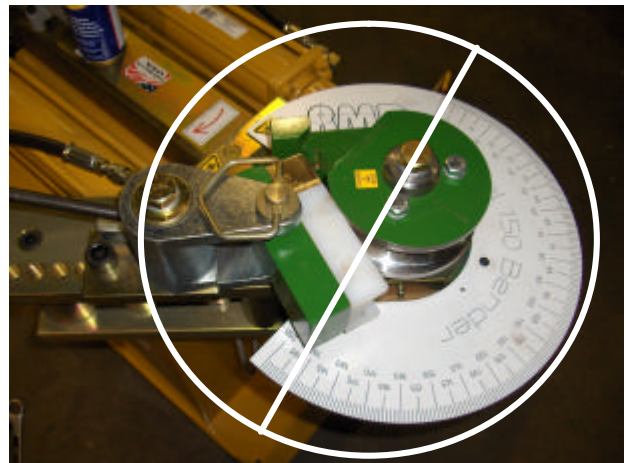


Figure 6 Incorrect counter die Position
(Touching die)

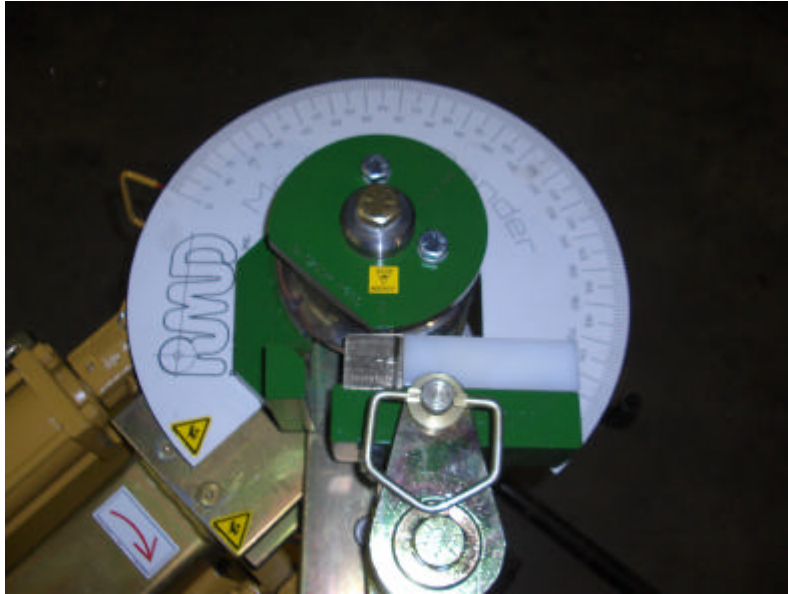


Figure 7 Correct counter die position (Approximately 1/8" (3mm) away)

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

c) Material Insertion

- 1) Once the die set is properly installed, the material that matches the die can be inserted (I.E. 1-1/4" tube would go into a die mark D-1250T-R***).
- 2) Open the counter die quick release assembly and insert the material past the hook arm. The start of bend mark is engraved with an "O" on the top of the die. Once the material is placed properly, the counter die slide block assembly can be tightened.



Figure 8 Inserting material to start bending



Figure 9 Lubricating counter die

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

- 3) Rotate the quick release counter die assembly until it firmly stops against its stop bolt.

In some cases usually with pipe the quick release will not close all the way. This is ok, as the forward lever is activated the material will force its way into the die and bend properly.

d) Bending using main degree wheel

- 1) After the material is installed, bending can take place.
- 2) Turn on the power switch
- 3) Keep hands away from the bending zone.

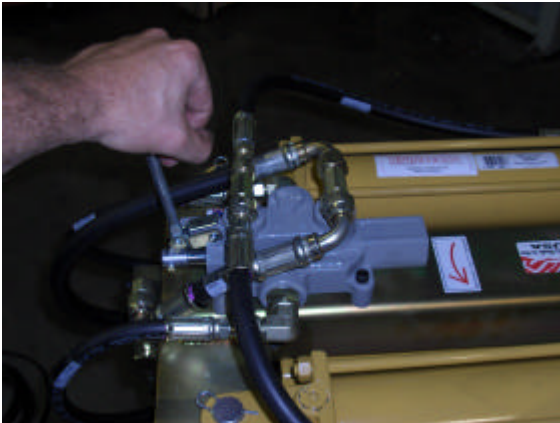


Figure 10 Forward/ clockwise control position

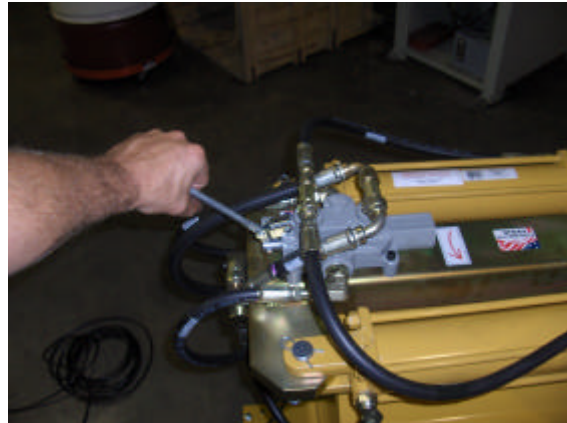
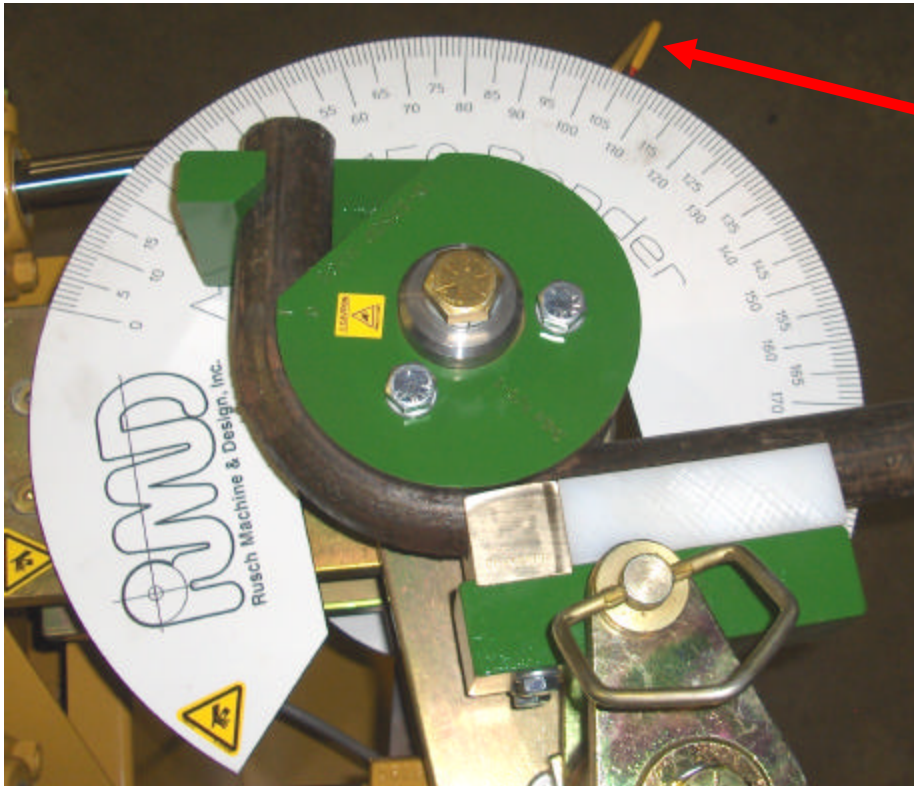


Figure 11 Reverse/ counterclockwise control position

- 4) Press the control valve lever in the forward direction. Keeping the lever activated, visually watch the degree dial. Hold until the desired degree is displayed on the large degree dial, bumping along as needed. Material will need to be bent past desired degree as all material has some degree of “springback”. This varies by material and can even vary between the same grades of material.



**Bend
degree
indicator**

Figure 12 Bend Angle (Large degree dial)

- 5) If the bend requires more degrees, increase the degrees by further activating the Forward lever. This allows the operator to gradually reach a bend angle, on the first set up piece. To determine the amount of springback for a certain material, it is necessary to bend a sample piece. Using a framing square or the like, bend a piece of material until a perfect 90° bend is achieved, when checked with a square. At that point, document the main degree dial's position. For example to a achieve a 90° on the piece in figure 12, 105 degrees was the total bend amount or 15 degrees of springback. Now you can add 15 degrees to any nominal bend angle to achieve accurate results for this material.

e) Using the auto stop feature, (Setting the automatic stop position) (Optional Equipment)

Note: the cylinders must be fully retracted and the main (top) degree dial must read "0" deg before setting the lower degree dial.

Note: Do not adjust the micro switch mounting bracket; this is preset from the factory. Use only the black Autostop adjusting knob to adjust the dial.

- 1) Method #1 Using the lower degree dial, set the lower pointer to the desired degrees by loosening the black knob and rotating the degree dial until the

desired bend angle plus spring back is displayed (ex; 105deg = 100deg bend, 5degrees of spring back)



Figure 13 Autostop adjusting knob

- 2) Method #2 You can set the lower degree dial after a bend is complete also. Ex; Bend a piece of material to a desired angle using the top degree dial only, once you are at the final bend position, with the material still in the machine, set the lower degree dial to "0" degrees. You will feel a definite click latching the dial in position; this is the spring loaded micro switch holding the dial in position.

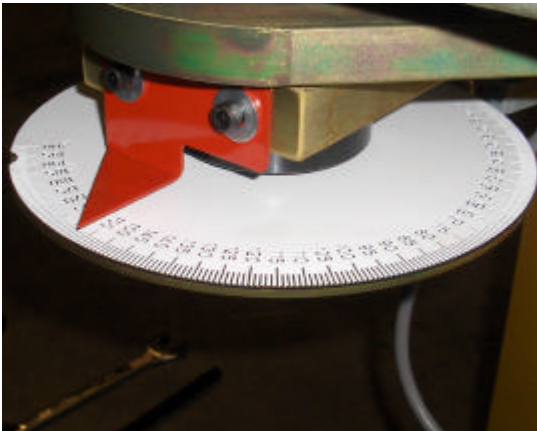


Figure 14 Autostop degree dial disc

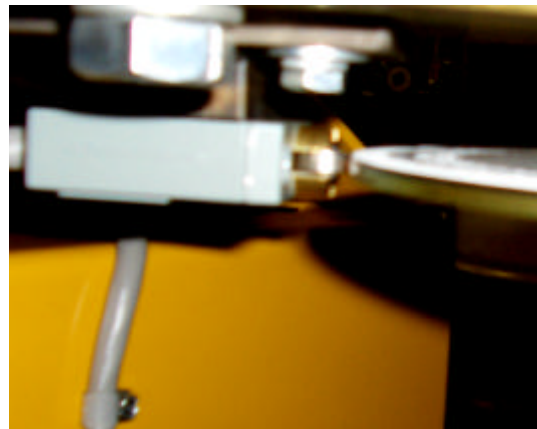


Figure 15 Micro switch in correct position

Note: The auto-stop feature only functions properly when the machine is bending material. The system needs pressure to function. You will not damage anything by running without material, as the micro switch is activated by the degree dial. The machine will hesitate and then continue, but will not stop unless you are bending material.

- 3) If the lower degree dial is set and the desired angle is more or less degrees than figured for, simply advance or retard the lower degree dial to compensate for the difference.

f) Material Removal

- 1) After reaching the desired angle, the material needs to be removed.
- 2) Press the control valve lever in the reverse direction. Both the die and the counter die will retract simultaneously. Run in reverse until all bending pressure is released from the bend.

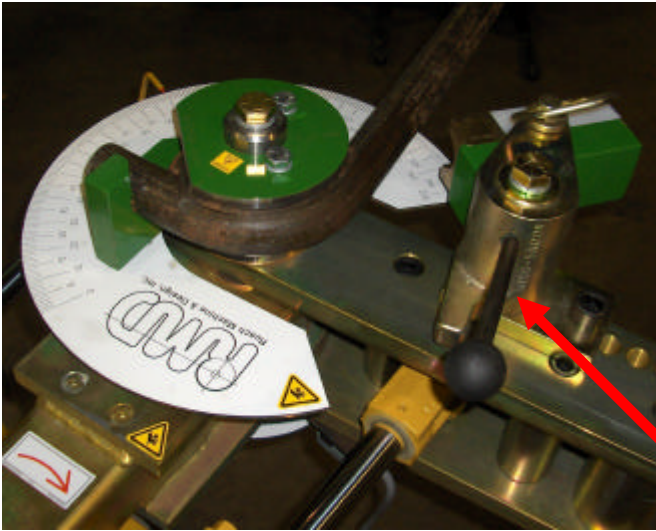


Figure 16 Activating the quick release lever

- 3) Activate the quick release counter die lever and completely remove the material.
- 4) After the material is safely removed, activate the Reverse lever keeping your hands clear until both cylinders fully retract.
- 5) The machine is now at the “home” position and can be reloaded for the next bend.
- 6) Repeat previous steps.

To get the longest use out of your counterdie ensure that there is enough material left after the bend. If material is cut short the counter die may be damaged.

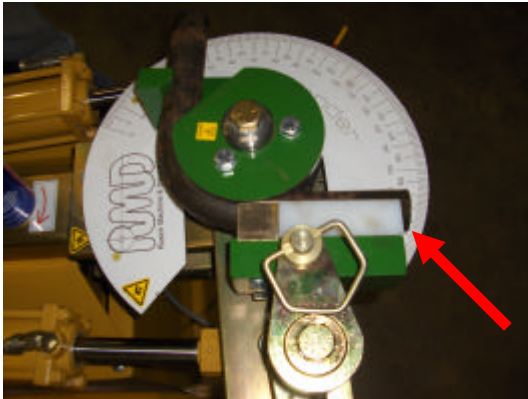


Figure 17 Correct amount of material left

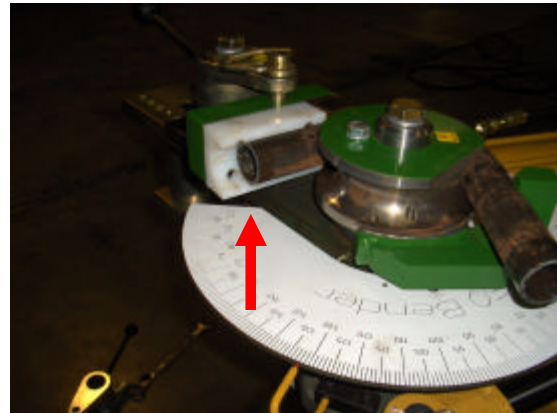


Figure 18 Maximum amount material can
Be pulled through the counterdie

If the material gets pulled further through the plastic insert on the counterdie than is shown in the picture, the plastic will be destroyed.

g) Multiple bends on the same workpiece

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.





Figure 19 Not enough material to complete the bend without crashing

10) MATERIAL LAYOUT

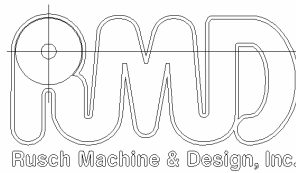
In order to create accurate parts, you will have to layout the material in flat form. First you will need to determine how much material is used per degree of bend. Use the multiplier table on Table #1 to determine the arc lengths for the die in use. Or use the following formula:

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

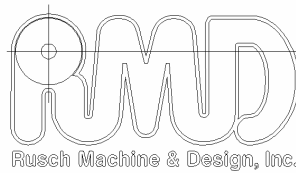
- i) Once the arc lengths are determined you can begin layout of the material using Diagram #1 as a reference.
- ii) Diagram #1 shows a simple part bent on the same plane in the same direction
- iii) Diagram #2 shows bending based off of a centerline in two directions
- iv) For symmetrical bends, centerline bending is easiest.
- v) For non-symmetrical bends, continuous one direction bending is best.

11) BENDING SUGGESTIONS

- a) 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:
 - i) Johnson Paste Wax (seems to work the best)
 - ii) High Pressure grease
 - iii) Highly rich dish soap
 - iv) The bronze counter die must be polished and have no aluminum deposits or it will continue to pick up metal.



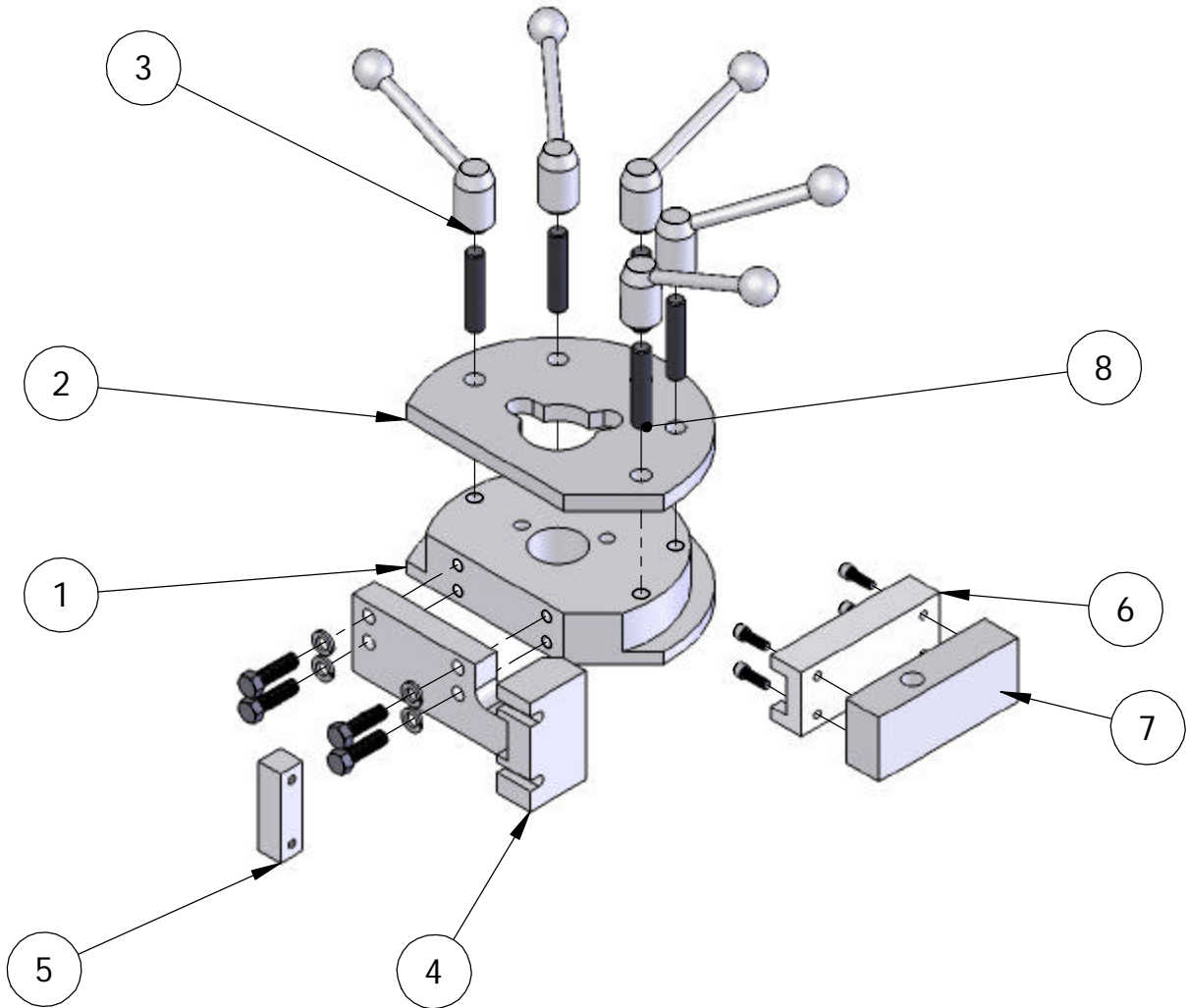
- v) If using RMD's standard counterdie is not producing desired results, roller counter dies are also available.
 - vi) Some aluminum will crack as it is being bent, 6061-T6 is very hard and may need to be annealed or ordered in the "T-0" condition.
- a) **HEAVY WALL DOM TUBING:** If heavy wall materials are bent to a tight radius, they can tend to slip in the hook arm causing a poor bend result, below are some suggestions
- i) Use a vise clamp on the outside of the hook arm to "lock" the material in place.
 - ii) Use a piece of two sided coarse emery cloth in between the hook arm and the material, this works very well.
 - iii) In only this application, high pressure grease applied to the DIE GROOVE also helps.
- b) Bending with square dies
- i.) Die parts
 - 1) Main bending die
 - 2) Die cap
 - 3) Quick release handles
 - 4) Hookarm
 - 5) Hookarm clamp
 - 6) Plastic slide
 - 7) Slide mount
 - ii.) **Square Tooling Setup**
 - 1) Install the bending die (1) on to the spindle. Be careful not to pinch your fingers as you lower the die on to the spindle. The die will only fit on the spindle one way. If larger than 1-1/4 material, bolt the die to the spindle using the holes in the die.
 - 2) Install the plastic counter die assembly (6, 7) with the long end pointing away from the hook arm
 - 3) Snug up the cap clamps (3). Do not over tighten! Or they will be overly difficult to loosen after the bend is complete. Note: tighten clamps without material in the die. The clamps are lift and turn, so you can position them anywhere. This allows the handles to clear the counterdie mount during bending.
 - 4) Insert the material in to the hook arm (4) and pull in to the die. It may be a tight fit. Continue to pull until the material is fully seated in the die's groove.
 - 5) Lube the counter die and the material that will slide along the counter die. Bring the plastic counter die assembly up to the material, leaving



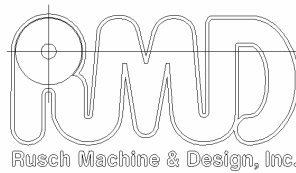
about 1/8" to 1/4" gap. (Note: on some thinner material it helps to keep the counter die approx 1" away from the material)

- 6) Important: do not lube the bending die surfaces. This will increase the possibility for slippage.
 - 7) Caution: make sure all the die cap clamp handles (3) are inside the die diameter. They could catch the counter die mounting assembly and break off.
 - 8) If the material slips during the bending operation, install the hook arm clamp (5). Do not use it unless you have to.
 - 9) Activate the bender and bend to the desired angle.
 - 10) To remove the material, open the counter die and return bender to the "home position". Using a soft mallet, gently tap the cap clamps open and the material will spring out of the die (1). Remove the material and re-snug the cap clamps.
 - 11) Install the next piece of material to be bent and repeat steps 1-9.
- c) **LARGE DIAMETER SQUARE:** When bending large diameter thinner wall square tubing, the counter die position seems to work better between 1/2 and 1" farther away from the die. This seems to reduce side wall distortion and inner wrinkling. Although this suggestion is to help on large diameter, the same steps can be used for any square, if trying to achieve better results. If the square material slips in the hook arm, use the supplied clamp and bolts to hold in place.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	D-1500S-R500	1.500 SQUARE DIE	1
2	DC-R500-625	5.0 RADIUS DIE CAP	1
3	.625 HANDLE	.625 HANDLE	5
4	H-1500S-R500	1.5 X 5.0 CLR HOOK ARM	1
5	HC-1500S	1.500 HOOK CLAMP	1
6	PS-1500S	1.5 SQUARE SLIDE	1
7	CDM-0016	2.5 THICK SQ C'DIE MOUNT	1
8	.625 X 3.0 STUD	.625 X 3.0 STUD	5



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			MATERIAL Material <not specified>	DRAWN	CHRIS RUSCH			
			FINISH	CHECKED				
				ENG APPR.				
	NEXT ASSY	USED ON		MFG APPR.				
	APPLICATION		DO NOT SCALE DRAWING	Q.A.				
				COMMENTS:				
				SIZE	DWG. NO.	REV.		
				A	DH-1500S-R500	0		
				SCALE:1:8	WEIGHT: 58.54	SHEET 1 OF 1		



12)WARRANTY

a) Coverage

Rusch Machine & Design, Inc. warrants to the original purchaser for use that the products sold by RMD, Inc. will be free from defects in workmanship and material for a period of one year from the date of purchase provided such goods are installed, operated, maintained and used in accordance with RMD, Inc.'s written instructions.

b) Exclusions from warranty

Ordinary wear and tear, and damage from abuse, neglect or alterations are not covered by this warranty. **THIS WARRANTY IS NULL AND VOID IF INSTRUCTIONS AND OPERATING PROCEDURES ARE NOT FOLLOWED.**

Die sets are excluded from warranty.

Machine maintenance, adjustments, setups or downtime costs are excluded from warranty.

Rusch Machine & Design, Inc. will in no event be liable for incidental or consequential damages.

c) Conditions

All warranty work must be approved by RMD, Inc.

All defective items must be returned to RMD, Inc. for inspection.

Customer pays freight, travel and all other associated costs other than parts and labor

EXTENDED PARTS WARRANTY

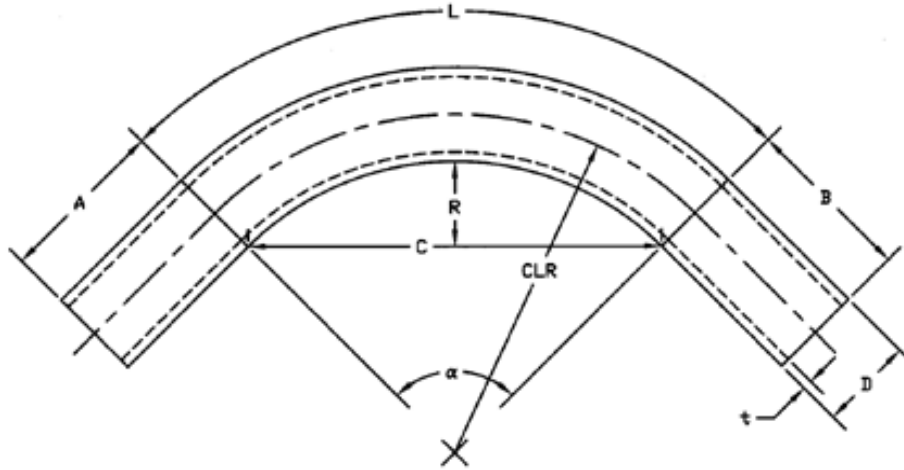
All hydraulic components carry a one-year replacement warranty from manufacturer, if defective.

Replacement labor not included. Customer pays freight costs.

Any questions pertaining to this limited warranty should be addressed to:

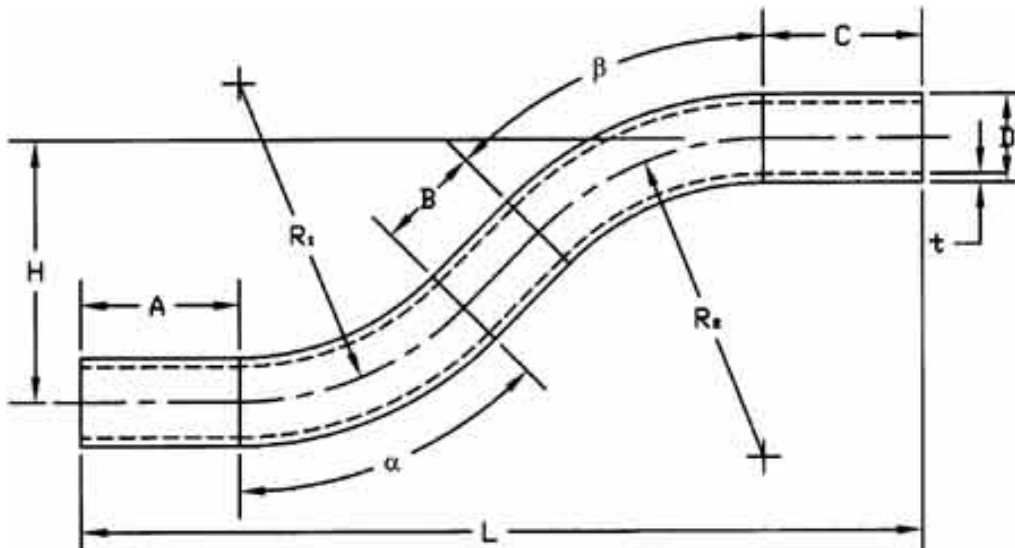
Rusch Machine & Design, Inc.
P.O. Box 375
Two Rivers, WI 54241

Appendix A. Pipe bending and Tube bending Diagrams



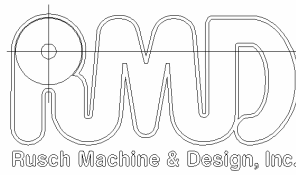
Legend

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



Appendix B. 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

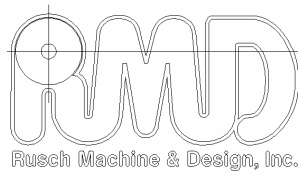
Springback – Amount of degrees material will return after bending pressure is released

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.





Appendix C. Pipe OD and Wall Thickness Chart

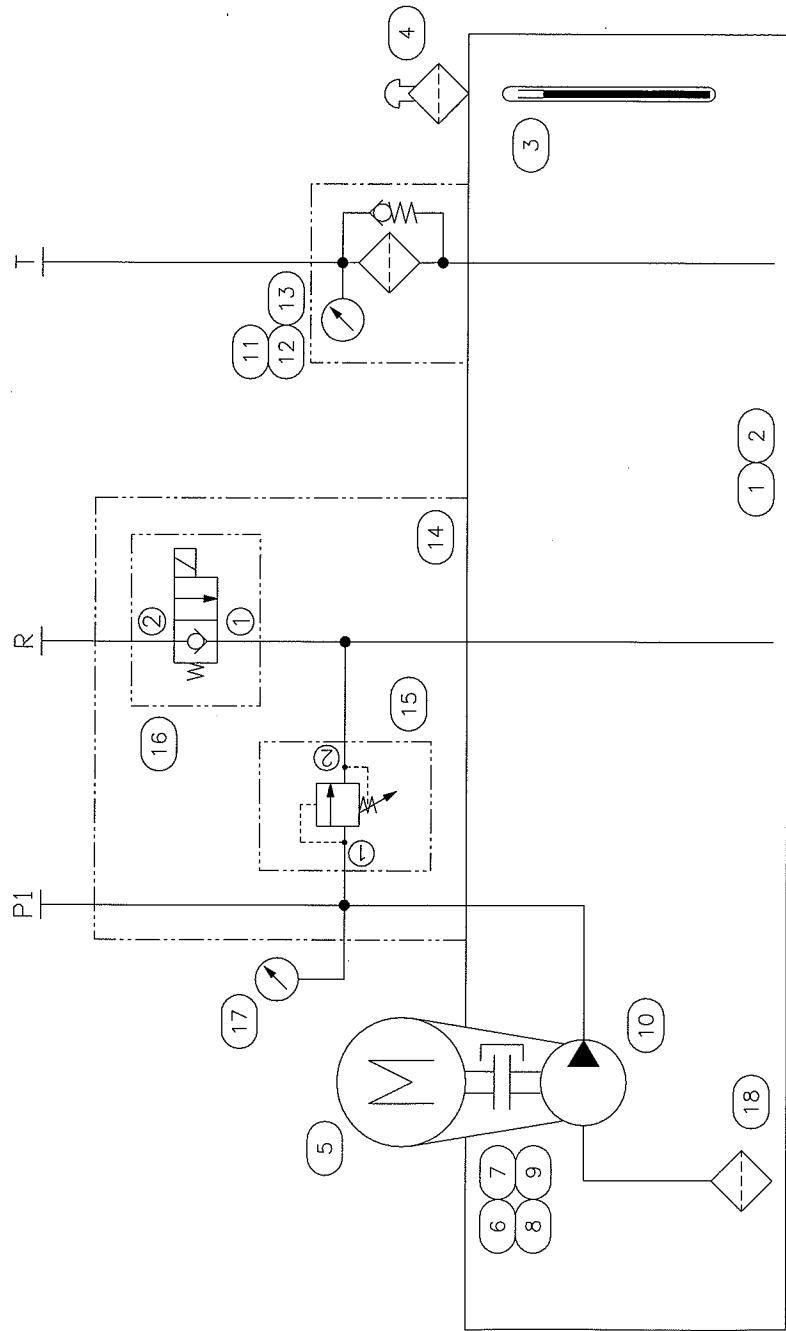
Pipe Sizes	O.D.	Pipe Schedules and Wall Thickness									
		5s	5	10s	10	40s & Std	40	80s & E.H.	80	160	Dbl. E.H.
1/8	0.405	-	0.040	0.050	0.050	0.068	0.070	0.095	0.100	-	-
1/4	0.540	-	0.050	0.070	0.070	0.088	0.090	0.119	0.120	-	-
3/8	0.675	-	0.050	0.070	0.070	0.091	0.090	0.126	0.130	-	-
1/2	0.840	0.070	0.070	0.080	0.080	0.109	0.110	0.147	0.150	0.190	0.294
3/4	1.050	0.070	0.070	0.080	0.080	0.113	0.110	0.154	0.150	0.220	0.308
1	1.315	0.070	0.070	0.110	0.110	0.133	0.130	0.179	0.180	0.250	0.358
1 1/4	1.660	0.070	0.070	0.110	0.110	0.140	0.140	0.191	0.190	0.250	0.382
1 1/2	1.900	0.070	0.070	0.110	0.110	0.145	0.150	0.200	0.200	0.280	0.400
2	2.375	0.070	0.070	0.110	0.110	0.154	0.150	0.218	0.220	0.340	0.436
2 1/2	2.875	0.080	0.080	0.120	0.120	0.203	0.203	0.276	0.280	0.380	0.552

All sizes are in inches

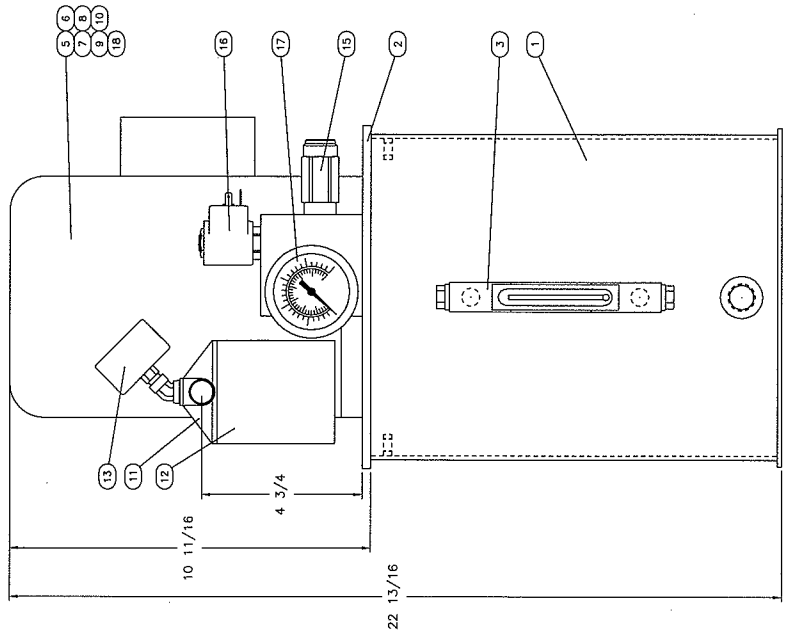
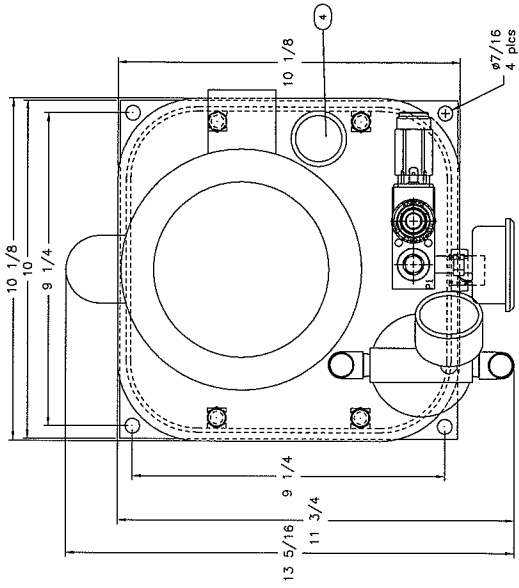
Appendix D. Trouble Shooting

Problem	Solution
Cylinders not retracting all the way or not in sequence	Do the dry run sequence as outlined in section 8 of the manual under operation
Machine doesn't move forward or moves forward slowly and does not build up pressure	<p>Check to make sure the autostop dial has the micro switch roller riding on the outside of the perimeter of the dial. The micro switch must be depressed for the machine to work, if the roller is in the detent position or not inline with the autostop dial the machine will be in the stop position. Tighten autostop adjusting knob until the autostop dial plate comes into the same plane as the micro switch roller.</p>  <p>Figure 20 Incorrect autostop switch position</p>

	<p>Check that the solenoid valve has its wires connected. To check it's functionality extend the cylinder all the way, let the machine deadhead and build up pressure approximately 2000 (Psi). At that point rotate the autostop dial the detent position and the pressure should drop to "0" Psi.</p>  <p>Figure 21 Solenoid switch</p>
Machine doesn't bend at pressure (2000 Psi)	If trying to bend material and the machine builds up pressure and stalls this usually means: The material is too thick, the material has too high of a yield strength, or the material is over the machines capacity.
Material slips in the hookarm	<p>Too much lube on material and is transferring to the bend die clean the bend die with degreaser.</p> <p>The counter die should be lubed only</p> <p>The material may need to be clamped</p> <p>Wrong material for the die set</p>
Spindle drive pins are damaged	If the bend dies are not bolted down properly the drive pins will get damaged. Replace drive pins.
Poor Bend Results	<p>Check proper tooling for material IE Pipe Vs Tube. Green for pipe, Blue for tube, Red for metric and Gray for square or rectangle tubing. See Appendix C for pipe sizing chart</p> <p>Wall thickness is too thin</p>



DRAWN	PMV	03/21/06	JOB#	-
CHECK	-	-	SCALE	-
APPROV.	-	-	SHEET	1 OF 1
DWG NO	206020301-10			REV B



TITLE

HYDRAULIC POWER UNIT
LAYOUT, 60 HZ Version

DRAWN

PWV

CHECK

APPROV.

DWG NO

REV

03/21/06

JOB#

SCALE

SHEET 1

OF 1

REV

206020301

30

1

1

1

1

30

30

30

30

30

30

TABLE 1

ARC LENGTH TABLE

EXAMPLE: ARC LENGTH = CONSTANT X BEND RADIUS

EXAMPLE: 90DEG BEND WITH 6" CLR

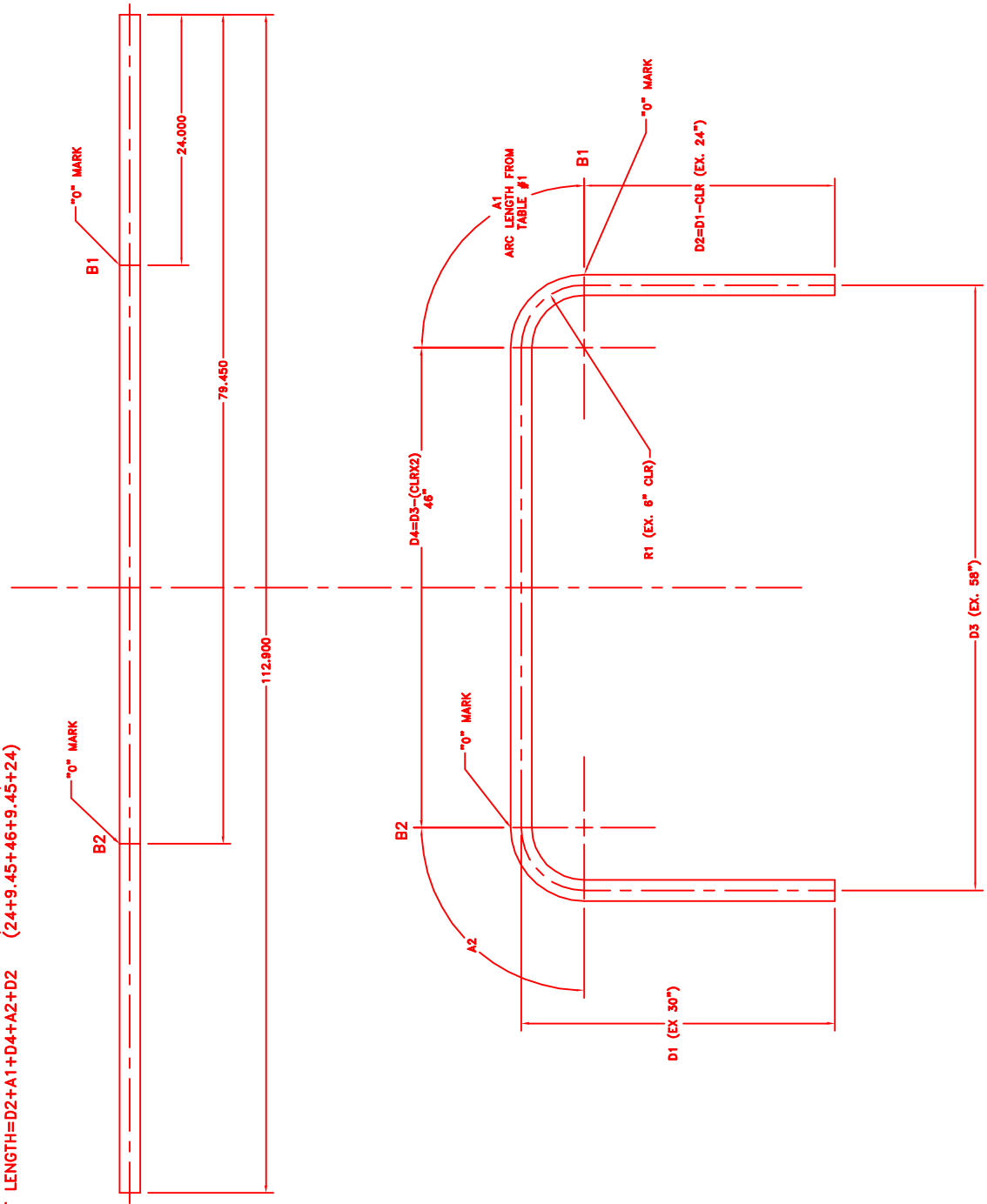
EXAMPLE: 1.575 (FROM TABLE) X 6" (CLR) =9.45" (ARC LENGTH)

FOR BENDS MORE THAN 90 DEG, CONSTANTS CAN BE ADDED TOGETHER

DEGREES	CONSTANT	DEGREES	CONSTANT	DEGREES	CONSTANT
1	0.0175	31	0.5410	61	1.0645
2	0.0349	32	0.5584	62	1.0819
3	0.0524	33	0.5759	63	1.0994
4	0.0698	34	0.5933	64	1.1168
5	0.0873	35	0.6108	65	1.1343
6	0.1047	36	0.6282	66	1.1517
7	0.1222	37	0.6457	67	1.1692
8	0.1396	38	0.6631	68	1.1866
9	0.1571	39	0.6806	69	1.2041
10	0.1745	40	0.6980	70	1.2215
11	0.1920	41	0.7155	71	1.2390
12	0.2094	42	0.7329	72	1.2564
13	0.2269	43	0.7504	73	1.2739
14	0.2443	44	0.7678	74	1.2913
15	0.2618	45	0.7853	75	1.3088
16	0.2792	46	0.8027	76	1.3262
17	0.2967	47	0.8202	77	1.3437
18	0.3141	48	0.8376	78	1.3611
19	0.3316	49	0.8551	79	1.3786
20	0.3490	50	0.8725	80	1.3960
21	0.3665	51	0.8900	81	1.4135
22	0.3839	52	0.9074	82	1.4309
23	0.4014	53	0.9249	83	1.4484
24	0.4188	54	0.9423	84	1.4658
25	0.4363	55	0.9598	85	1.4833
26	0.4537	56	0.9772	86	1.5007
27	0.4712	57	0.9947	87	1.5182
28	0.4886	58	1.0121	88	1.5356
29	0.5061	59	1.0296	89	1.5531
30	0.5235	60	1.0470	90	1.5705

$B1 = D2$
 $B2 = D2 + A1 + D4$
 $CUT\ LENGTH = D2 + A1 + D4 + A2 + D2$

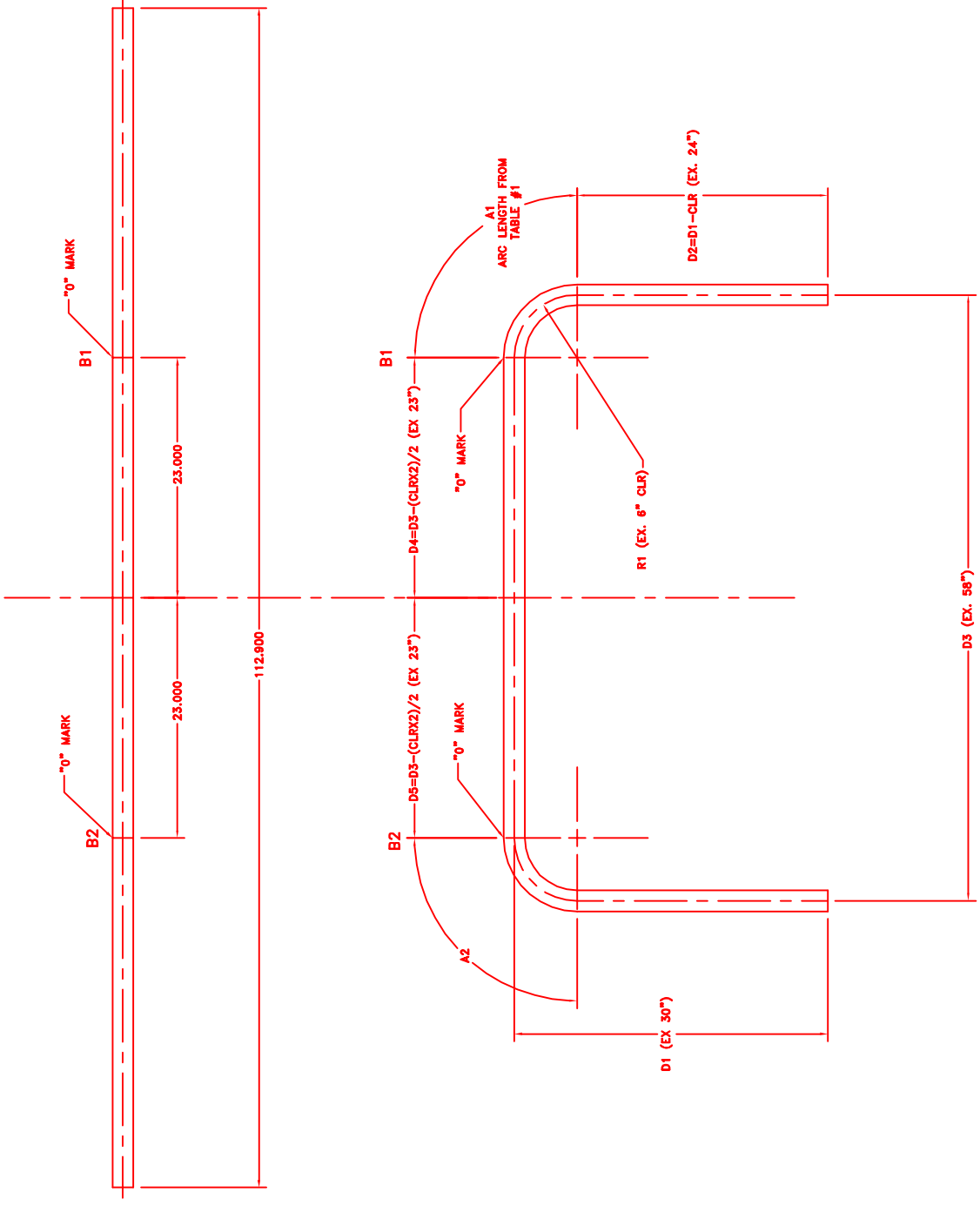
$(B1 = 24")$
 $(B2 = 24" + 9.45 + 46)$
 $(24 + 9.45 + 46 + 9.45 + 24)$



CONTINUOUS LAYOUT

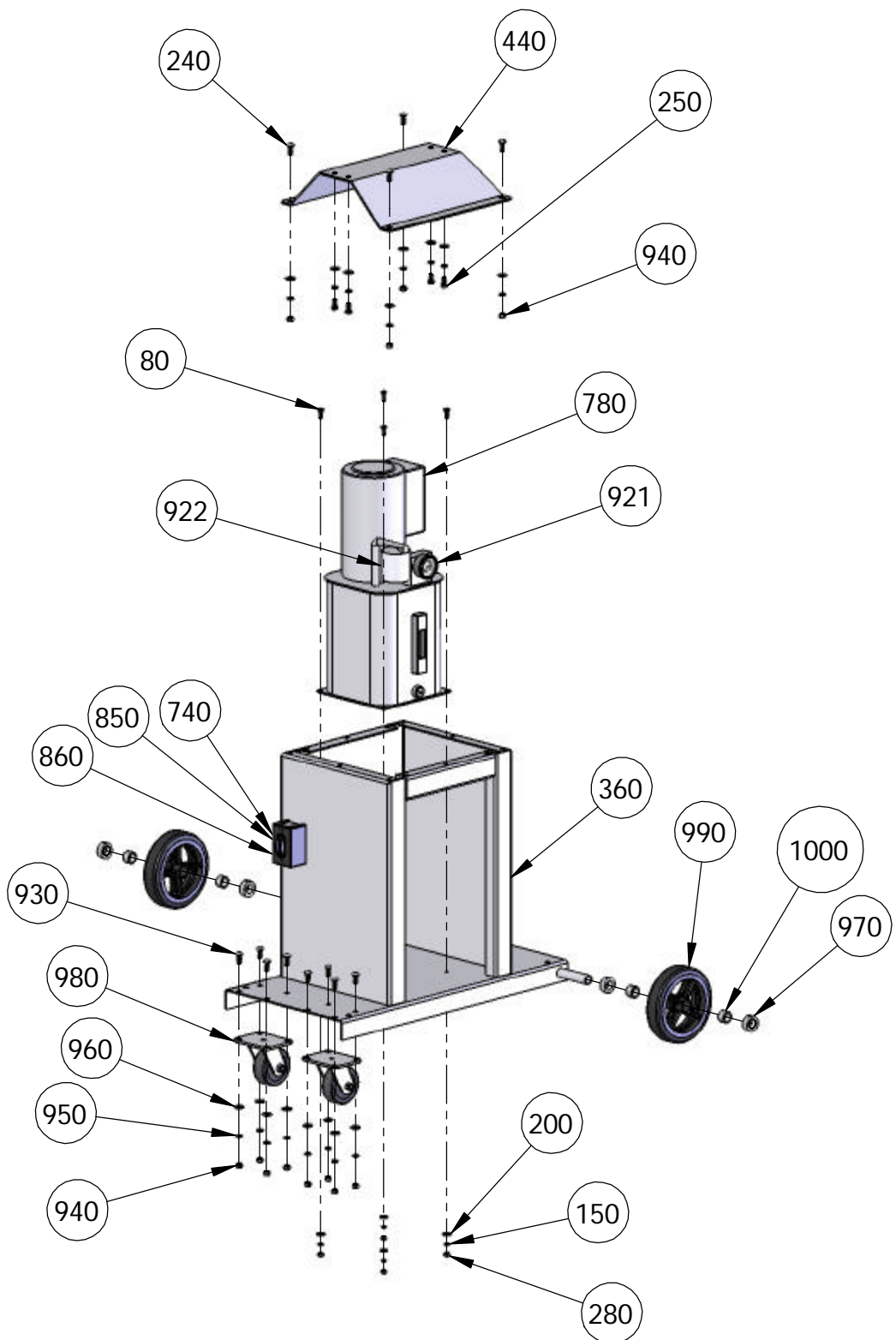
DIAGRAM #1

CUT LENGTH=D2+A1+D4+D5+A2+D2 (24+9.45+23+23+9.45+24=112.9)

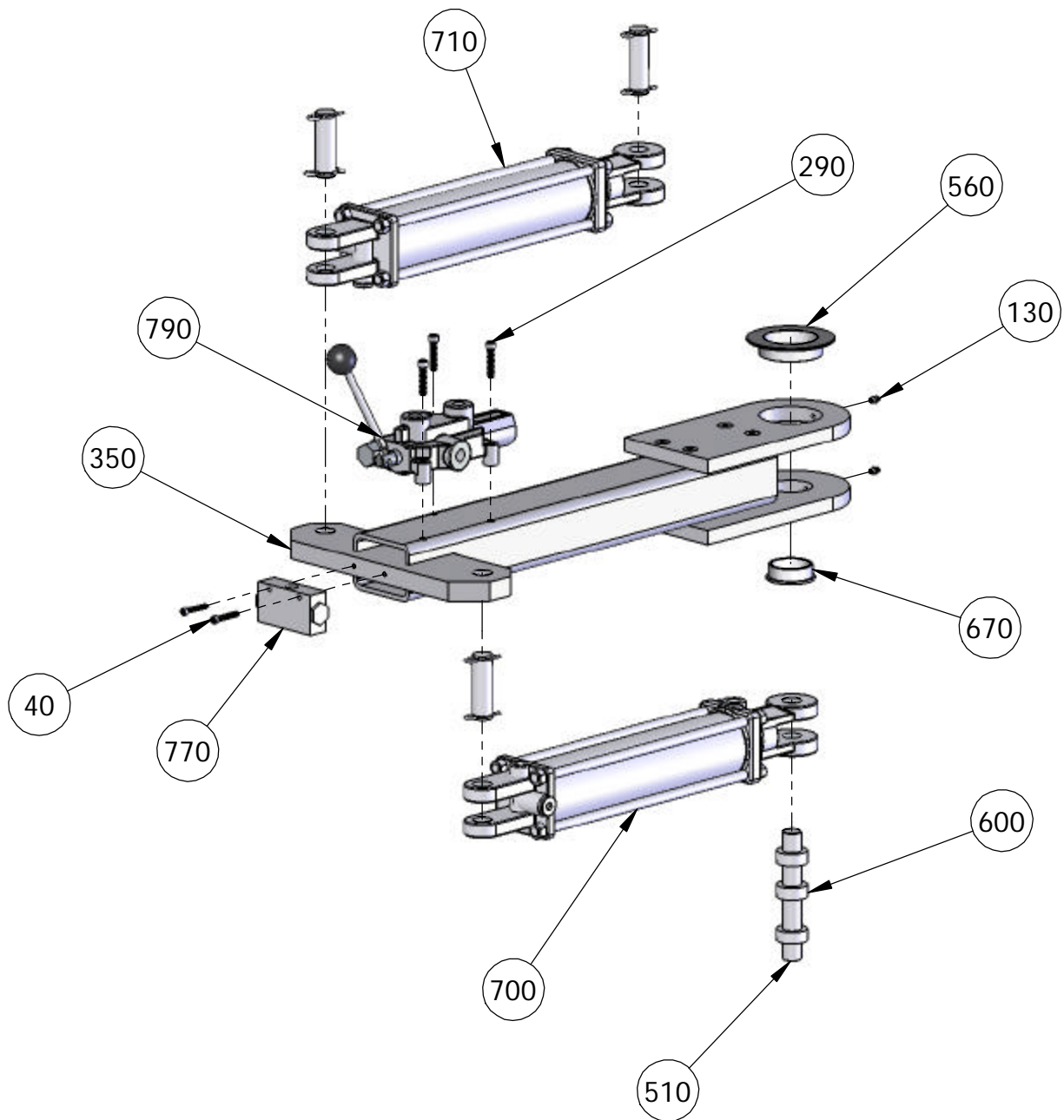


CENTERLINE LAYOUT

DIAGRAM #2

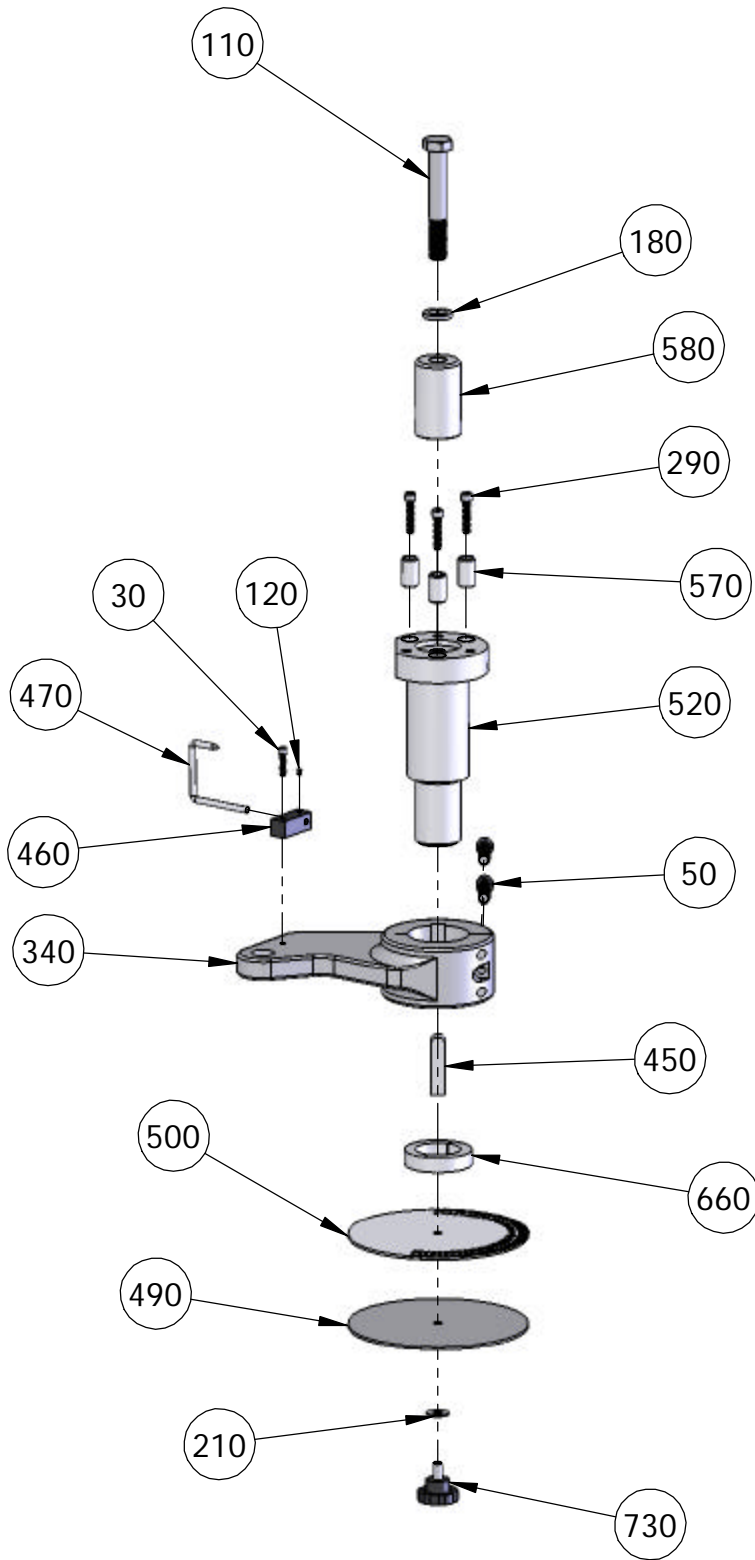


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			FINISH	CHECKED				
	NEXT ASSY	USED ON		ENG APPR.				
	APPLICATION	DO NOT SCALE DRAWING		MFG APPR.				
			COMMENTS:	Q.A.		SIZE	DWG. NO.	REV.
						A	M150-BV1	0
						SCALE: 1:16	WEIGHT: 284.59	SHEET 1 OF 1



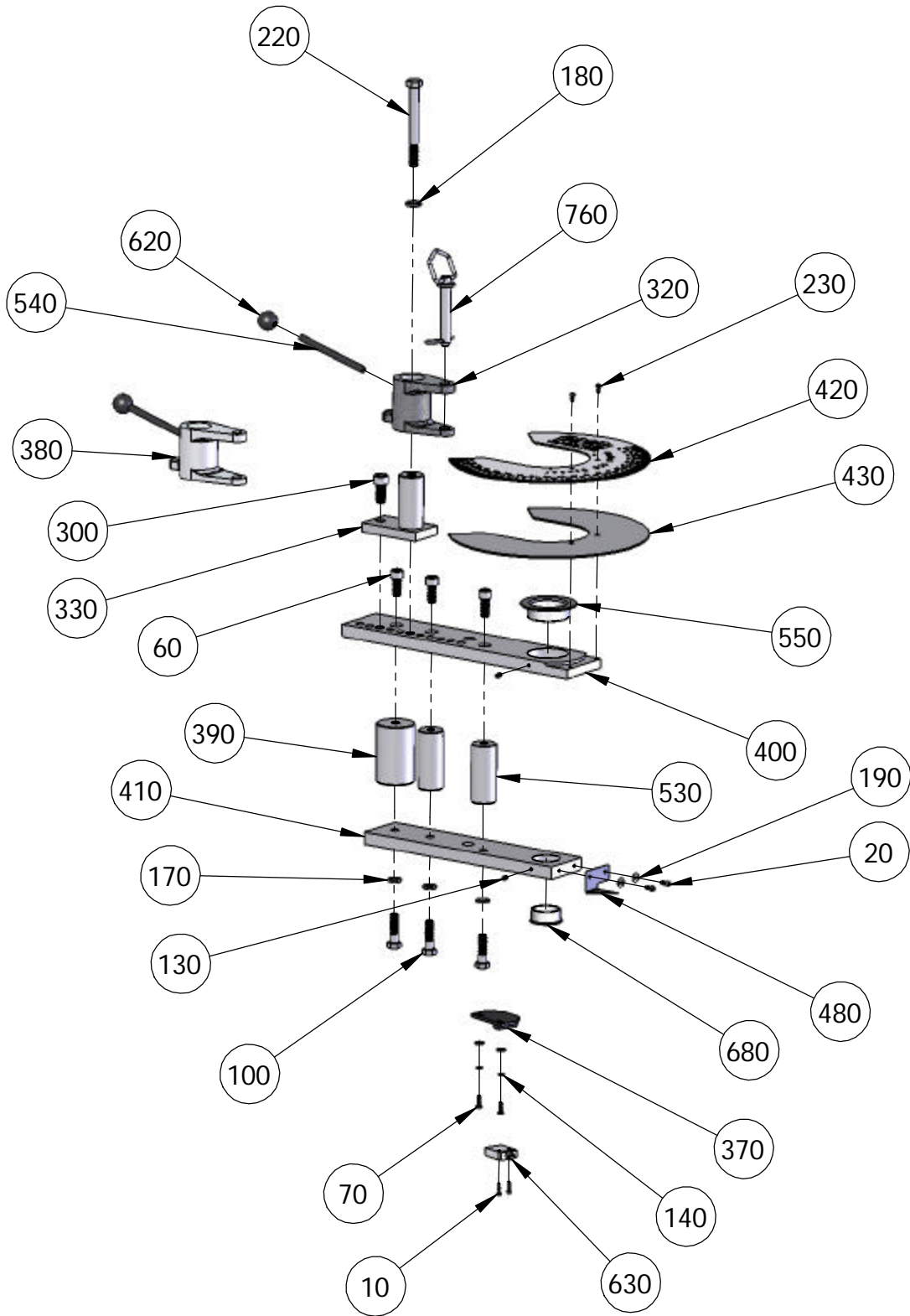
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		ANGULAR: MACH ± BEND ±		ENG APPR.		
		TWO PLACE DECIMAL ±		MFG APPR.		
		THREE PLACE DECIMAL ±		Q.A.		
		MATERIAL		COMMENTS:		
NEXT ASSY	USED ON	FINISH				SIZE DWG. NO.
APPLICATION		DO NOT SCALE DRAWING				M150-TV1
						REV. 0
				SCALE: 1:8		WEIGHT: 142.02
						SHEET 1 OF 1

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		TOLERANCES:		DRAWN	JOSH KENNEKE 8-28-06	
		FRACTIONAL ±		CHECKED		SPINDLE ASS'Y
		ANGULAR: MACH ± BEND ±		ENG APPR.		
		TWO PLACE DECIMAL ±		MFG APPR.		
		THREE PLACE DECIMAL ±		Q.A.		
		MATERIAL		COMMENTS:		
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APPLICATION		DO NOT SCALE DRAWING				M150-TV2
						REV. 0
				SCALE: 1:8		WEIGHT: 39.91
						SHEET 1 OF 1

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		DIMENSIONS ARE IN INCHES		NAME	DATE	RUSCH MACHINE & DESIGN
		TOLERANCES:		DRAWN	JOSH KENNEKE	
		FRACTIONAL ±		CHECKED		ARM ASS'Y
		ANGULAR: MACH ± BEND ±		ENG APPR.		
		TWO PLACE DECIMAL ±		MFG APPR.		
		THREE PLACE DECIMAL ±		Q.A.		
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NEXT ASSY	USED ON	FINISH				
APPLICATION		DO NOT SCALE DRAWING				

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COUNTER DIE PLACEMENT CHART

CLR 1" THICK COUNTERDIES 1.5" THICK COUNTERDIES 2" THICK COUNTERDIES

1	#N/A	#N/A	SILVER HOLE # 1
1.5	#N/A	SILVER HOLE # 1	GOLD HOLE # 1
2	SILVER HOLE # 1	GOLD HOLE # 1	SILVER HOLE # 2
2.5	GOLD HOLE # 1	SILVER HOLE # 2	GOLD HOLE # 2
3	SILVER HOLE # 2	GOLD HOLE # 2	SILVER HOLE # 3
3.5	GOLD HOLE # 2	SILVER HOLE # 3	GOLD HOLE # 3
3.75	SILVER HOLE # 3	GOLD HOLE # 3	SILVER HOLE # 4
4	SILVER HOLE # 3	GOLD HOLE # 3	SILVER HOLE # 4
4.5	GOLD HOLE # 3	SILVER HOLE # 4	GOLD HOLE # 4
5	SILVER HOLE # 4	GOLD HOLE # 4	SILVER HOLE # 5
5.5	GOLD HOLE # 4	SILVER HOLE # 5	GOLD HOLE # 5
6	SILVER HOLE # 5	GOLD HOLE # 5	SILVER HOLE # 6
6.5	GOLD HOLE # 5	SILVER HOLE # 6	GOLD HOLE # 6
7	SILVER HOLE # 6	GOLD HOLE # 6	SILVER HOLE # 7
7.5	GOLD HOLE # 6	SILVER HOLE # 7	GOLD HOLE # 7
8	SILVER HOLE # 7	GOLD HOLE # 7	SILVER HOLE # 8

