



OPERATOR'S MANUAL

Metal Working



ROTARY DRAW BENDER MODEL: RDB-150 & RDB-150-AS

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THANK YOU & WARRANTY

Thank you for your purchase of a machine from Baileigh Industrial Holdings LLC. We hope that you find it productive and useful to you for a long time to come.

Inspection & Acceptance. Buyer shall inspect all Goods within ten (10) days after receipt thereof. Buyer's payment shall constitute final acceptance of the Goods and shall act as a waiver of the Buyer's rights to inspect or reject the goods unless otherwise agreed. If Buyer rejects any merchandise, Buyer must first obtain a Returned Goods Authorization ("RGA") number before returning any goods to Seller. Goods returned without a RGA will be refused. Seller will not be responsible for any freight costs, damages to goods, or any other costs or liabilities pertaining to goods returned without a RGA. Seller shall have the right to substitute a conforming tender. Buyer will be responsible for all freight costs to and from Buyer and repackaging costs, if any, if Buyer refuses to accept shipment. If Goods are returned in unsalable condition, Buyer shall be responsible for full value of the Goods. Buyer may not return any special-order Goods. Any Goods returned hereunder shall be subject to a restocking fee equal to 30% of the invoice price.

Specifications. Seller may, at its option, make changes in the designs, specifications or components of the Goods to improve the safety of such Goods, or if in Seller's judgment, such changes will be beneficial to their operation or use. Buyer may not make any changes in the specifications for the Goods unless Seller approves of such changes in writing, in which event Seller may impose additional charges to implement such changes.

Limited Warranty. Seller warrants to the original end-user that the Goods manufactured or provided by Seller under this Agreement shall be free of defects in material or workmanship for a period of twelve (12) months from the date of purchase, provided that the Goods are installed, used, and maintained in accordance with any instruction manual or technical guidelines provided by the Seller or supplied with the Goods, if applicable. The original end-user must give written notice to Seller of any suspected defect in the Goods prior to the expiration of the warranty period. The original end-user must also obtain a RGA from Seller prior to returning any Goods to Seller for warranty service under this paragraph. Seller will not accept any responsibility for Goods returned without a RGA. The original end-user shall be responsible for all costs and expenses associated with returning the Goods to Seller for warranty service. In the event of a defect, Seller, at its sole option, shall repair or replace the defective Goods or refund to the original end-user the purchase price for such defective Goods. Goods are not eligible for replacement or return after a period of 10 days from date of receipt. The foregoing warranty is Seller's sole obligation, and the original end-user's exclusive remedy, with regard to any defective Goods. This limited warranty does not apply to: (a) die sets, tooling, and saw blades; (b) periodic or routine maintenance and setup, (c) repair or replacement of the Goods due to normal wear and tear, (d) defects or damage to the Goods resulting from misuse, abuse, neglect, or accidents, (e) defects or damage to the Goods resulting from improper or unauthorized alterations, modifications, or changes; and (f) any Goods that has not been installed and/or maintained in accordance with the instruction manual or technical guidelines provided by Seller.

EXCLUSION OF OTHER WARRANTIES. THE FOREGOING LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. ANY AND ALL OTHER EXPRESS, STATUTORY OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED. NO WARRANTY IS MADE WHICH EXTENDS BEYOND THAT WHICH IS EXPRESSLY CONTAINED HEREIN.

Limitation of Liability. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER OR ANY OTHER PARTY FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR DOWN TIME) ARISING FROM OR IN MANNER CONNECTED WITH THE GOODS, ANY BREACH BY SELLER OR ITS AGENTS OF THIS AGREEMENT, OR ANY OTHER CAUSE WHATSOEVER, WHETHER BASED ON CONTRACT, TORT OR ANY OTHER THEORY OF LIABILITY. BUYER'S REMEDY WITH RESPECT TO ANY CLAIM ARISING UNDER THIS AGREEMENT IS STRICTLY LIMITED TO NO MORE THAN THE AMOUNT PAID BY THE BUYER FOR THE GOODS.



Force Majeure. Seller shall not be responsible for any delay in the delivery of, or failure to deliver, Goods due to causes beyond Seller's reasonable control including, without limitation, acts of God, acts of war or terrorism, enemy actions, hostilities, strikes, labor difficulties, embargoes, non-delivery or late delivery of materials, parts and equipment or transportation delays not caused by the fault of Seller, delays caused by civil authorities, governmental regulations or orders, fire, lightening, natural disasters or any other cause beyond Seller's reasonable control. In the event of any such delay, performance will be postponed by such length of time as may be reasonably necessary to compensate for the delay.

Installation. If Buyer purchases any Goods that require installation, Buyer shall, at its expense, make all arrangements and connections necessary to install and operate the Goods. Buyer shall install the Goods in accordance with any Seller instructions and shall indemnify Seller against any and all damages, demands, suits, causes of action, claims and expenses (including actual attorneys' fees and costs) arising directly or indirectly out of Buyer's failure to properly install the Goods.

Work By Others; Safety Devices. Unless agreed to in writing by Seller, Seller has no responsibility for labor or work performed by Buyer or others, of any nature, relating to design, manufacture, fabrication, use, installation or provision of Goods. Buyer is solely responsible for furnishing, and requiring its employees and customers to use all safety devices, guards and safe operating procedures required by law and/or as set forth in manuals and instruction sheets furnished by Seller. Buyer is responsible for consulting all operator manuals, ANSI or comparable safety standards, OSHA regulations and other sources of safety standards and regulations applicable to the use and operation of the Goods.

Remedies. Each of the rights and remedies of Seller under this Agreement is cumulative and in addition to any other or further remedies provided under this Agreement or at law or equity.

Attorney's Fees. In the event legal action is necessary to recover monies due from Buyer or to enforce any provision of this Agreement, Buyer shall be liable to Seller for all costs and expenses associated therewith, including Seller's actual attorney fees and costs.

Governing Law/Venue. This Agreement shall be construed and governed under the laws of the State of Wisconsin, without application of conflict of law principles. Each party agrees that all actions or proceedings arising out of or in connection with this Agreement shall be commenced, tried, and litigated only in the state courts sitting in Manitowoc County, Wisconsin or the U.S. Federal Court for the Eastern District of Wisconsin. Each party waives any right it may have to assert the doctrine of "forum non conveniens" or to object to venue to the extent that any proceeding is brought in accordance with this section. Each party consents to and waives any objection to the exercise of personal jurisdiction over it by courts described in this section. Each party waives to the fullest extent permitted by applicable law the right to a trial by jury.

Summary of Return Policy.

- 10 Day acceptance period from date of delivery. Damage claims and order discrepancies will not be accepted after this time.
- You must obtain a Baileigh issued RGA number PRIOR to returning any materials.
- Returned materials must be received at Baileigh in new condition and in original packaging.
- Altered items are not eligible for return.
- Buyer is responsible for all shipping charges.
- A 30% re-stocking fee applies to all returns.

Baileigh Industrial Holdings LLC makes every effort to ensure that our posted specifications, images, pricing and product availability are as correct and timely as possible. We apologize for any discrepancies that may occur. Baileigh Industrial Holdings LLC reserves the right to make any and all changes deemed necessary in the course of business including but not limited to pricing, product specifications, quantities, and product availability.

For Customer Service & Technical Support:

Please contact one of our knowledgeable Sales and Service team members at:
(920) 684-4990 or e-mail us at sales@baileigh.com



INTRODUCTION

The quality and reliability of the components assembled on a Baileigh Industrial Holdings LLC machine guarantee near perfect functioning, free from problems, even under the most demanding working conditions. However, if a situation arises, refer to the manual first. If a solution cannot be found, contact the distributor where you purchased our product. Make sure you have the serial number and production year of the machine (stamped on the nameplate). For replacement parts refer to the assembly numbers on the parts list drawings.

Our technical staff will do their best to help you get your machine back in working order.

In this manual you will find: (when applicable)

- Safety procedures
- Correct installation guidelines
- Description of the functional parts of the machine
- Capacity charts
- Setup and start-up instructions
- Machine operation
- Scheduled maintenance
- Parts lists

GENERAL NOTES

After receiving your equipment remove the protective container. Do a complete visual inspection, and if damage is noted, **photograph it for insurance claims** and contact your carrier at once, requesting inspection. Also contact Baileigh Industrial Holdings LLC and inform them of the unexpected occurrence. Temporarily suspend installation.

Take necessary precautions while loading / unloading or moving the machine to avoid any injuries.

Your machine is designed and manufactured to work smoothly and efficiently. Following proper maintenance instructions will help ensure this. Try and use original spare parts, whenever possible, and most importantly; **DO NOT** overload the machine or make any modifications.



Note: This symbol refers to useful information throughout the manual.



IMPORTANT

PLEASE READ THIS OPERATORS MANUAL CAREFULLY

It contains important safety information, instructions, and necessary operating procedures. The continual observance of these procedures will help increase your production and extend the life of the equipment.



SAFETY INSTRUCTIONS

LEARN TO RECOGNIZE SAFETY INFORMATION

This is the safety alert symbol. When you see this symbol on your machine or in this manual, **BE ALERT TO THE POTENTIAL FOR PERSONAL INJURY!**



Follow recommended precautions and safe operating practices.

UNDERSTAND SIGNAL WORDS

A signal word – **DANGER**, **WARNING**, or **CAUTION** – is used with the safety alert symbol. **NOTICE**, which is not related to personal injury, is used without a symbol.

DANGER: Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING: Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE: Indicates a situation which, if not avoided, could result in property damage.



DANGER



WARNING



CAUTION



NOTICE

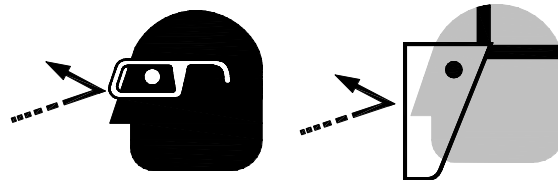


SAVE THESE INSTRUCTIONS.
Refer to them often and use them to instruct others.



PROTECT EYES

Wear safety glasses or suitable eye protection when working on or around machinery.



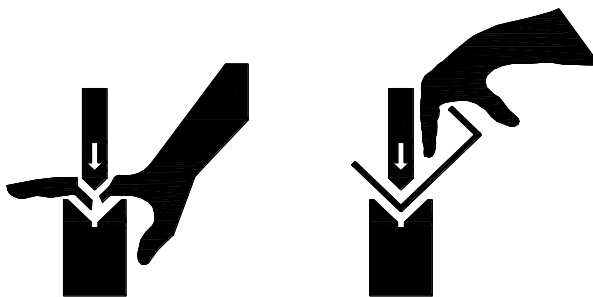
PROTECT AGAINST NOISE

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear suitable hearing protective devices such as ear muffs or earplugs to protect against objectionable or uncomfortable loud noises.



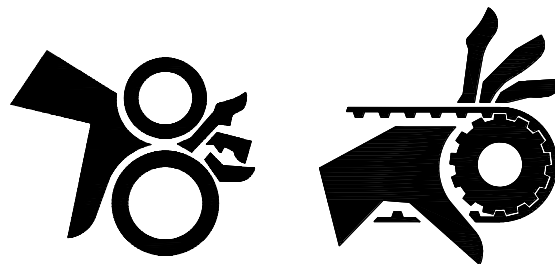
BEWARE OF CRUSH HAZARD

NEVER place your hands, fingers, or any part of your body in the die area of this machine. Be aware of the area on either side of the dies for crush points created by material movement.



BEWARE OF PINCH POINTS

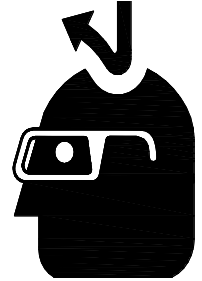
Keep hands and fingers away from the drive mechanisms, cylinders, ratchets, and other moving linkage while the machine is in operation.





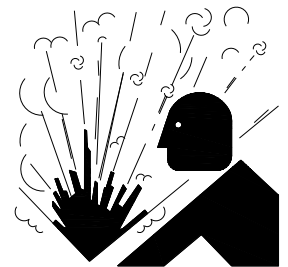
KEEP CLEAR OF MOVING OBJECTS

Always be aware of the position of the material and the swing area in which the material will travel. The material will swing with significant force. This swing area will create pinch points and the force of the material movement may cause serious bodily injuries.



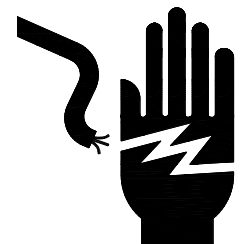
HYDRAULIC HOSE FAILURE

Exercise **CAUTION** around hydraulic hoses in case of a hose or fitting failure.



HIGH VOLTAGE

USE CAUTION IN HIGH VOLTAGE AREAS. DO NOT assume the power to be off.
FOLLOW PROPER LOCKOUT PROCEDURES.



CALIFORNIA PROPOSITION 65

WARNING: Cancer and Reproductive Harm.
www.P65Warnings.ca.gov





SAFETY PRECAUTIONS



Metal working can be dangerous if safe and proper operating procedures are not followed. As with all machinery, there are certain hazards involved with the operation of the product. Using the machine with respect and caution will considerably lessen the possibility of personal injury. However, if normal safety precautions are overlooked or ignored, personal injury to the operator may result.

Safety equipment such as guards, hold-downs, safety glasses, dust masks and hearing protection can reduce your potential for injury. But even the best guard will not make up for poor judgment, carelessness or inattention. **Always use common sense** and exercise **caution** in the workshop. If a procedure feels dangerous, don't try it.

REMEMBER: Your personal safety is your responsibility.



WARNING: FAILURE TO FOLLOW THESE RULES MAY RESULT IN SERIOUS PERSONAL INJURY

Dear Valued Customer:

- All Baileigh machines should be used only for their intended use.
- Baileigh does not recommend or endorse making any modifications or alterations to a Baileigh machine. Modifications or alterations to a machine may pose a substantial risk of injury to the operator or others and may do substantial damage to the machine.
- Any modifications or alterations to a Baileigh machine will invalidate the machine's warranty.

PLEASE ENJOY YOUR BAILEIGH MACHINE!PLEASE ENJOY IT SAFELY!

1. **FOR YOUR OWN SAFETY, READ INSTRUCTION MANUAL BEFORE OPERATING THE MACHINE.** Learn the machine's application and limitations as well as the specific hazards.
2. **Only trained and qualified personnel can operate this machine.**
3. **Make sure guards are in place and in proper working order before operating machinery.**
4. **Remove any adjusting tools.** Before operating the machine, make sure any adjusting tools have been removed.
5. **Keep work area clean.** Cluttered areas invite injuries.
6. **Overloading machine.** By overloading the machine, you may cause injury from flying parts. **DO NOT** exceed the specified machine capacities.



7. **Dressing material edges.** Always chamfer and deburr all sharp edges.
8. **Do not force tool.** Your machine will do a better and safer job if used as intended. **DO NOT** use inappropriate attachments in an attempt to exceed the machine's rated capacity.
9. **Use the right tool for the job. DO NOT** attempt to force a small tool or attachment to do the work of a large industrial tool. **DO NOT** use a tool for a purpose for which it was not intended.
10. **Dress appropriately. DO NOT** wear loose fitting clothing or jewelry as they can be caught in moving machine parts. Protective clothing and steel toe shoes are recommended when using machinery. Wear a restrictive hair covering to contain long hair.
11. **Use eye and ear protection.** Always wear ISO approved impact safety goggles. Wear a full-face shield if you are producing metal filings.
12. **Do not overreach.** Maintain proper footing and balance at all times. **DO NOT** reach over or across a running machine.
13. **Stay alert.** Watch what you are doing and use common sense. **DO NOT** operate any tool or machine when you are tired.
14. **Check for damaged parts.** Before using any tool or machine, carefully check any part that appears damaged. Check for alignment and binding of moving parts that may affect proper machine operation.
15. **Observe work area conditions. DO NOT** use machines or power tools in damp or wet locations. Do not expose to rain. Keep work area well lighted. **DO NOT** use electrically powered tools in the presence of flammable gases or liquids.
16. **Keep children away.** Children must never be allowed in the work area. **DO NOT** let them handle machines, tools, or extension cords.
17. Keep visitors a safe distance from the work area.
18. **Store idle equipment.** When not in use, tools must be stored in a dry location to inhibit rust. Always lock up tools and keep them out of reach of children.
19. **DO NOT operate machine if under the influence of alcohol or drugs.** Read warning labels on prescriptions. If there is any doubt, **DO NOT** operate the machine.
20. **Turn off** power before checking, cleaning, or replacing any parts.
21. Be sure **all** equipment is properly installed and grounded according to national, state, and local codes.
22. Inspect power and control cables periodically. Replace if damaged or bare wires are exposed. **Bare wiring can kill! DO NOT** touch live electrical components or parts.
23. **DO NOT** bypass or defeat any safety interlock systems.



TECHNICAL SPECIFICATIONS

Maximum Center Line Radius (CLR)*	8" (203mm)
Minimum Center Line Radius (CLR)*	.5" (12.7mm)
Minimum OD	.25" (6.35mm)
Mild Steel Pipe (Schedule 40)	2" (50.8mm)
Aluminum Pipe (Schedule 40)	2" (50.8mm)
Stainless Steel Pipe (Schedule 40)	1.5" (38.1mm)
Mild Steel Round Tube (Wall)	2.5" (.125) (63.5mm [3.175mm])
Aluminum Round Tube (Wall)	2.5" (.156) (63.5mm [3.96mm])
Stainless Steel Round Tube (Wall)	2.375" (.125) (60.325mm [3.175mm])
Chromolly Round Tube (Wall)	2" (.125) (50.8mm [3.175mm])
Mild Steel Solid Rod	1.25" (31.75mm)
Mild Steel Square Tube (Wall)	2" (.125) (50.8mm [3.175mm])
Power Supply	115VAC, 20A, 1ph, 60Hz
Motor	2hp (1.5kw) 115VAC, 18A, 1ph, 60Hz
Sound level	<70db
Shipping Weight (Lbs.)	700lbs. (318kg)
Shipping Dimensions (L x W x H)	68 x 60" x 44" (1727 x 1524 x 1118mm)
Based on a material tensile strength of 64000 PSI – mild steel	

*CLR will vary based upon actual material and wall thickness.

TECHNICAL SUPPORT

Our technical support department can be reached at 920.684.4990, and asking for the support desk for purchased machines. Tech Support handles questions on machine setup, schematics, warranty issues, and individual parts needs: (other than die sets and blades).

For specific application needs or future machine purchases contact the Sales Department at: sales@baileigh.com, Phone: 920.684.4990, or Fax: 920.684.3944.



Note: *The photos and illustrations used in this manual are representative only and may not depict the actual color, labeling or accessories and may be intended to illustrate technique only.*



Note: *The specifications and dimensions presented here are subject to change without prior notice due to improvements of our products.*



UNPACKING AND CHECKING CONTENTS

Your Baileigh machine is shipped complete. Separate all parts from the packing material and check each item carefully. Make certain all items are accounted for before discarding any packing material.

⚠ WARNING: SUFFOCATION HAZARD! Immediately discard any plastic bags and packing materials to eliminate choking and suffocation hazards to children and animals.
If any parts are missing, **DO NOT** place the machine into service until the missing parts are obtained and installed correctly.

Cleaning

⚠ WARNING: DO NOT USE gasoline or other petroleum products to clean the machine. They have low flash points and can explode or cause fire.

⚠ CAUTION: When using cleaning solvents work in a well-ventilated area. Many cleaning solvents are toxic if inhaled.

Your machine may be shipped with a rustproof waxy coating and/or grease on the exposed unpainted metal surfaces. Fully and completely remove this protective coating using a degreaser or solvent cleaner. Moving items will need to be moved along their travel path to allow for cleaning the entire surface. For a more thorough cleaning, some parts will occasionally have to be removed. **DO NOT USE** acetone or brake cleaner as they may damage painted surfaces.

Follow manufacturer's label instructions when using any type of cleaning product. After cleaning, wipe unpainted metal surfaces with a light coating of quality oil or grease for protection.



Important: This waxy coating is **NOT** a lubricant and will cause the machine to stick and lose performance as the coating continues to dry.



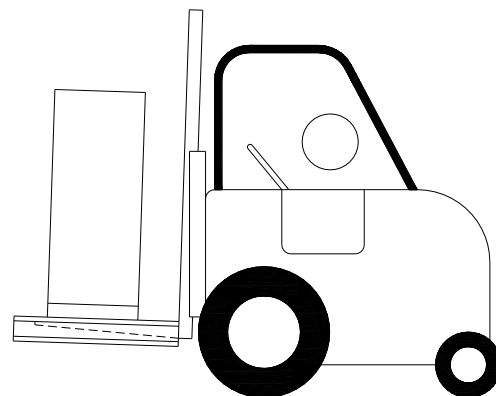


TRANSPORTING AND LIFTING

NOTICE: *Lifting and carrying operations should be carried out by skilled workers, such as a truck operator, crane operator, etc. If a crane is used to lift the machine, attach the lifting chain carefully, making sure the machine is well balanced.*

Follow these guidelines when lifting with truck or trolley:

- The lift truck must be able to lift at least 1.5 – 2 times the machines gross weight.
- Make sure the machine is balanced. While transporting, avoid rough or jerky motion, and maintain a safe clearance zone around the transport area.
- Use a fork lift with sufficient lifting capacity and forks that are long enough to reach the complete width of the machine.
- Remove the securing bolts that attach the machine to the pallet.
- Approaching the machine from the side, lift the machine on the frame taking care that there are no cables or pipes in the area of the forks.
- Move the machine to the required position and lower gently to the floor.
- Level the machine so that all the supporting feet are taking the weight of the machine and no rocking is taking place.



Follow these guidelines when lifting crane or hoist:

- Always lift and carry the machine with the lifting holes provided at the top of the machine.
- Use lift equipment such as straps, chains, capable of lifting 1.5 to 2 times the weight of the machine.
- Take proper precautions for handling and lifting.
- Check if the load is properly balanced by lifting it an inch or two.
- Lift the machine, avoiding sudden accelerations or quick changes of direction.
- Locate the machine where it is to be installed, then lower slowly until it touches the floor.



INSTALLATION

IMPORTANT:

Consider the following when looking for a suitable location to place the machine:

- Overall weight of the machine.
- Weight of material being processed.
- Sizes of material to be processed through the machine.
- Space needed for auxiliary stands, work tables, or other machinery.
- Clearance from walls and other obstacles.
- Maintain an adequate working area around the machine for safety.
- Have the work area well illuminated with proper lighting.
- Keep the floor free of oil and make sure it is not slippery.
- Remove scrap and waste materials regularly, and make sure the work area is free from obstructing objects.
- If long lengths of material are to be fed into the machine, make sure that they will not extend into any aisles.
- **LEVELING:** The machine should be sited on a level, concrete floor. Provisions for securing it should be in position prior to placing the machine. The accuracy of any machine depends on the precise placement of it to the mounting surface.
- **FLOOR:** This machine distributes a large amount of weight over a small area. Make certain that the floor is capable of supporting the weight of the machine, work stock, and the operator. The floor should also be a level surface. If the unit wobbles or rocks once in place, be sure to eliminate by using shims.
- **WORKING CLEARANCES:** Take into consideration the size of the material to be processed. Make sure that you allow enough space for you to operate the machine freely.
- **POWER SUPPLY PLACEMENT:** The power supply should be located close enough to the machine so that the power cord is not in an area where it would cause a tripping hazard. Be sure to observe all electrical codes if installing new circuits and/or outlets.



Tank Filling

The hydraulic oil is the primary medium for transmitting pressure and also must lubricate the running parts of the pump.

After installation of the machine and before machine startup, bring the oil level up to 90% of capacity. Refer to any labels or marking affixed to the outside of the machine, If none exist, use SHELL BRAND #46 or #68 hydraulic oil or an equivalent with similar specifications. (Based upon location temperature and availability.)

Verify that any cylinder rams are in the retracted position to prevent overfilling of the tank. Recheck the oil level after the first few hours of operation and again after the first full week of operation.

A shortage of hydraulic oil can cause hydraulic system breakdown and damage to major mechanical parts due to overheating.

ASSEMBLY AND SET UP



WARNING: For your own safety, DO NOT connect the machine to the power source until the machine is completely assembled and you read and understand the entire instruction manual.

1. Remove the machine from the skid it was shipped on and install the casters and wheels.
2. Check the oil level and top off if necessary.
3. Read through the remainder of the manual and become familiar with the die installation and settings as well as normal operation.
4. Position the machine as desired following the installation guidelines.
5. Follow the electrical guidelines to connect the machine to a power supply.



GETTING TO KNOW YOUR MACHINE





Item	Description	Function
A	Forward Foot Pedal	Will operate the machine in the cw direction
B	Reverse Foot Pedal	Will operate the machine in the ccw direction
C	Power Switch	For turning power on/off to the bender
D	Allen Wrench	Used for adjusting and tightening the slide plate.
E	Hydraulic Cylinders	Supply the bending force to rotate the forming die.
F	Upper Bend Angle Indicator	Indicates the bend angle that the spindle is currently positioned at.
G	Quick Release (shown with a counter die installed)	For pivoting counter die away from bend die to remove material quickly.
H	Main Spindle and Drive Pins (shown with a square tube forming die installed)	For supporting and driving the forming die.
I	Upper Bend Angle Scale	A graduated scale plate is used to indicate the bend angle that the spindle is currently positioned at.
J	Grease Zerk	For greasing main spindle bearing
K	Lower Autostop Bend Angle Scale. AS Model Only.	A graduated scale plate which can rotate and be set to stop the bending at preset degrees of rotation of the spindle.
L	Autostop Limit Switch (hidden). AS Model Only.	A roller limit switch which rides along the edge of the autostop bend angle scale which stops the bending rotation when the roller enters the scales detent.

GENERAL DESIGN DESCRIPTION

You have made a practical choice in purchasing the RDB-150 Hydraulic 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.


The RDB-150 is an electric powered hydraulically operated "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 rotates about the same axis, forcing the material to conform to the radius and shape of the bending die.


The RDB-150 Bending Machine you have purchased is built of solid steel ensuring maximum rigidity. Tongue and groove design with grade 8 bolts throughout provide very high rigidity and stability.

Throughout this manual are listed various 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 injury to the operator.



ELECTRICAL

 **CAUTION:** HAVE ELECTRICAL UTILITIES CONNECTED TO MACHINE BY A CERTIFIED ELECTRICIAN!
Check if the available power supply is the same as listed on the machine nameplate.

 **WARNING:** Make sure the grounding wire (green) is properly connected to avoid electric shock. DO NOT switch the position of the green grounding wire if any electrical plug wires are switched during hookup.


Power Specifications

Your machine is 115 volts, 60hz alternating current. Before connecting the machine to the power source, make sure the power source is OFF.

Before switching on the power, you must check the voltage and frequency of the power to see if they meet with the requirement, the allowed range for the voltage is $\pm 5\%$, and for the frequency is $\pm 1\%$.

Considerations

- Observe local electrical codes when connecting the machine.
- The circuit should be protected with a time delay fuse or circuit breaker with an amperage rating slightly higher than the full load current of machine.
- A separate electrical circuit should be used for your machines. Before connecting the motor to the power line, make sure the switch is in the "OFF" position and be sure that the electric current is of the same characteristics as indicated on the machine.
- All line connections should make good contact. Running on low voltage will damage the motor.
- In the event of a malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This machine is equipped with an electric cord having an equipment-grounding conductor and a grounding plug. The plug must be plugged into a matching outlet that is properly installed and grounded in accordance with all local codes and ordinances.

 **WARNING:** In all cases, make certain the receptacle in question is properly grounded. If you are not sure, have a qualified electrician check the receptacle.



- Improper connection of the equipment-grounding conductor can result in risk of electric shock. The conductor with insulation having an outer surface that is green with or without yellow stripes is the equipment-grounding conductor. If repair or replacement of the electric cord or plug is necessary, do not connect the equipment-grounding conductor to a live terminal.
- Check with a qualified electrician or service personnel if the grounding instructions are not completely understood, or if in doubt as to whether the machine is properly grounded.
- Repair or replace damaged or worn cord immediately.

Extension Cord Safety

Extension cord should be in good condition and meet the minimum wire gauge requirements listed below:

AMP RATING	LENGTH		
	25ft	50ft	100ft
1-12	16	16	14
13-16	14	12	12
17-20	12	12	10
21-30	10	10	No
WIRE GAUGE			

An undersized cord decreases line voltage, causing loss of power and overheating. All cords should use a ground wire and plug pin. Replace any damaged cords immediately.

Power cord connection:

1. Turn the main disconnect switch on the control panel to the OFF position.
2. Unwrap the power cord and route the cord away from the machine toward the power supply.
 - a. Route the power cord so that it will NOT become entangled in the machine in any way.
 - b. Route the cord to the power supply in a way that does NOT create a trip hazard.
3. Connect the power cord to the power supply and check that the power cord has not been damaged during installation.
4. When the machine is clear of any obstruction. The main power switch may be turn ON to test the operation.
5. Turn the switch OFF when the machine is not in operation.



OPERATION

⚠ CAUTION: Always wear proper eye protection with side shields, safety footwear, and leather gloves to protect from burrs and sharp edges.

⚠ CAUTION: Keep hands and fingers clear of the dies and swing arms. Stand to the front of the machine to avoid getting hit with the material during the bending process. When handling large heavy materials make sure they are properly supported.

Dry Running Machine

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 to approximately 220 degrees. If equipped.
2. With no material in the machine, press the forward foot pedal until the hydraulic cylinders are fully extend and “deadheads”. Then press the reverse foot pedal until the hydraulic cylinders are fully retracted and “deadhead” in the home position. The overload relief valve will make a squealing noise when the cylinders “deadhead”; this is normal and will not hurt the function of the machine.
3. Repeat this sequence as many times as necessary (usually 5-6 full cycles) to remove any trapped air and to synchronize the cylinders.
4. The foot pedals have function to provide Forward and Reverse operation. The pedals are spring release and must be held in the Forward or Reverse positions to move the cylinders.





DIE SELECTION AND INSTALLATION

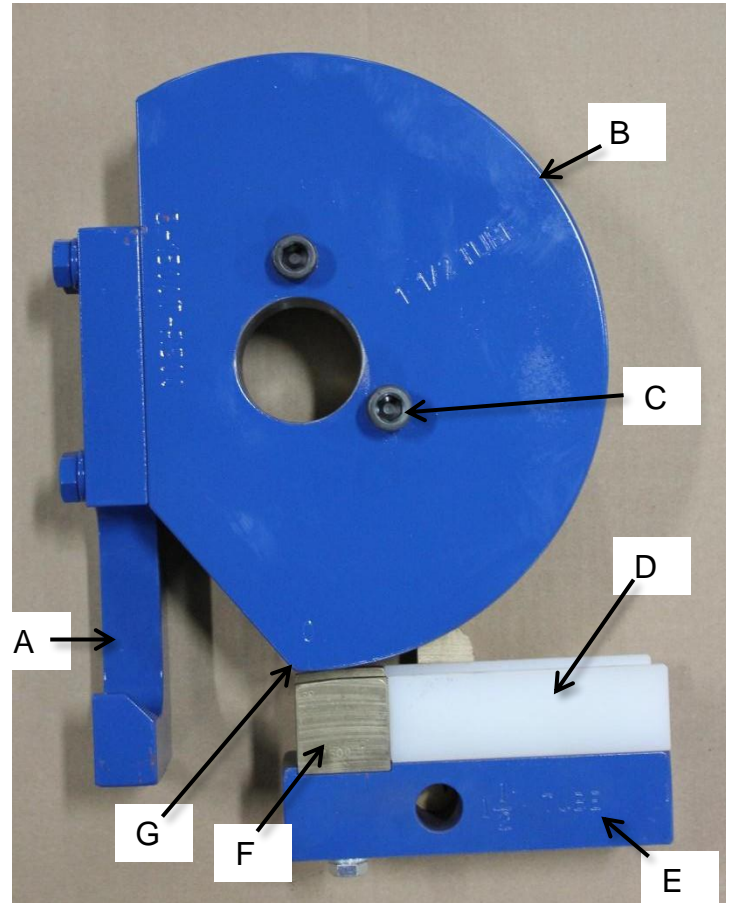
Before any bending can take place, the proper die set must be chosen to match the material being bent. (EX) 1-1/2" diameter tubing requires a die set marked 1-1/2" tube.

- A Hook Arm
- B Bend Die
- C Hold down Bolts
- D Plastic Slide
- E Counter Die Mount
- F Bronze Counter Die Insert
- G "0" Mark



Note: Pipe and Tube are not the same, (see table 1) for nominal pipe sizes. All BAILEIGH dies are color coded to avoid confusion between pipe and tube (see table 2).

NOTICE: 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. When handling large heavy dies and/or material, make sure it is properly lifted and supported.



1. 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.

2. When the drive pins line up the die will drop all the way down to the spindle.

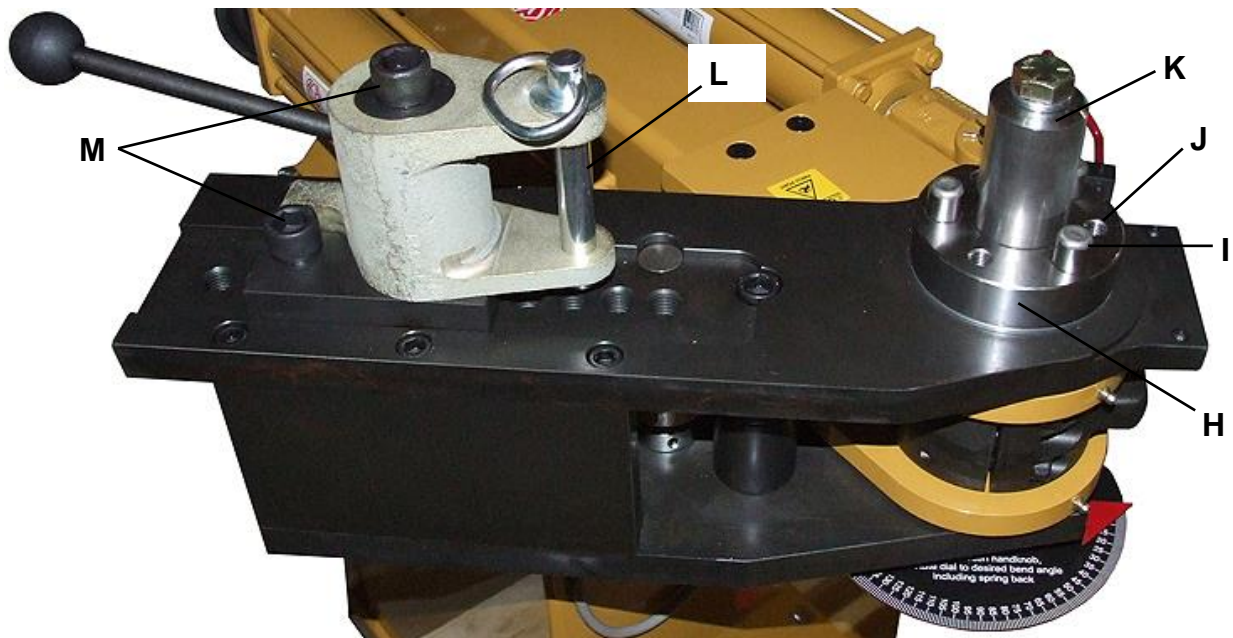
NOTICE: Failure to properly bolt down die will result in damage to machine and tooling. Bend material greater than capacity will damage the machine. THESE CONDITIONS ARE NOT COVER UNDER WARRANTY.



3. Install and tighten the 1/2-13 socket head bolts provided with the die. Tighten these bolts enough to hold the die firmly down to the spindle. Approximately 30-40ft-lb. (40-50N•m).

- H Spindle
- I Die Drive Pins
- J 1/2-13 Tapped holes for bolting down dies
- K Center Pin
- L Hitch Pin
- M Positioning Bolts

- 4. To install the counter die, remove the hitch pin (L) and insert the counter die in the opening in the counter die mount until the 3/4" holes line up.
- 5. 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.
- 6. The counter die should be positioned approximately 1/8" (3mm) away from the die. This is accomplished by a combination of the slide plate position and changing between the two provided quick releases. See the Counterdie Placement Chart near the end of the manual.
- 7. In combination, install the recommended quick release (silver [shown] or gold) and then position the slide plate in the recommended holes.
- 8. Tighten the two socket head bolts (M) to 200lbf ft. (27Nm).



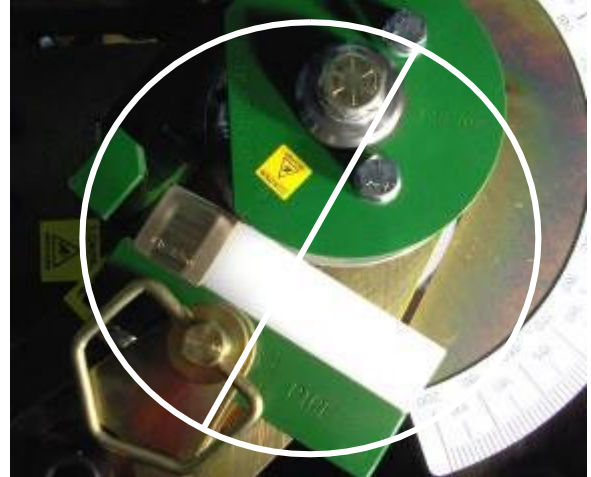
NOTICE: The two 3/4-10 bolts hold the slide plate mechanism in place against the force generated during bending.



Incorrect Counterdie Position



Too far away from die



Touching die

Correct Counter Die Position



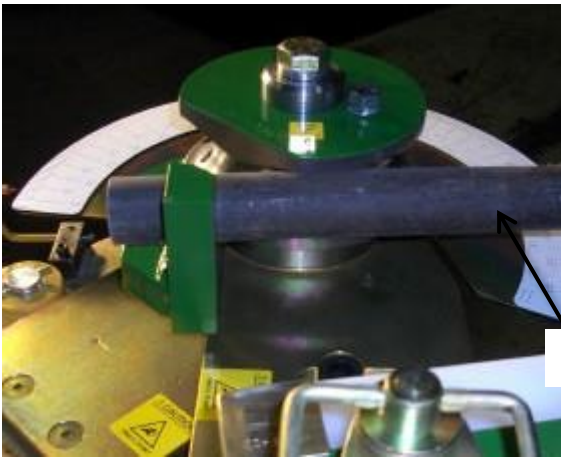
Approximately 1/8" (3mm) away

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



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.



Inserting material to start



Lubricating counter die bending



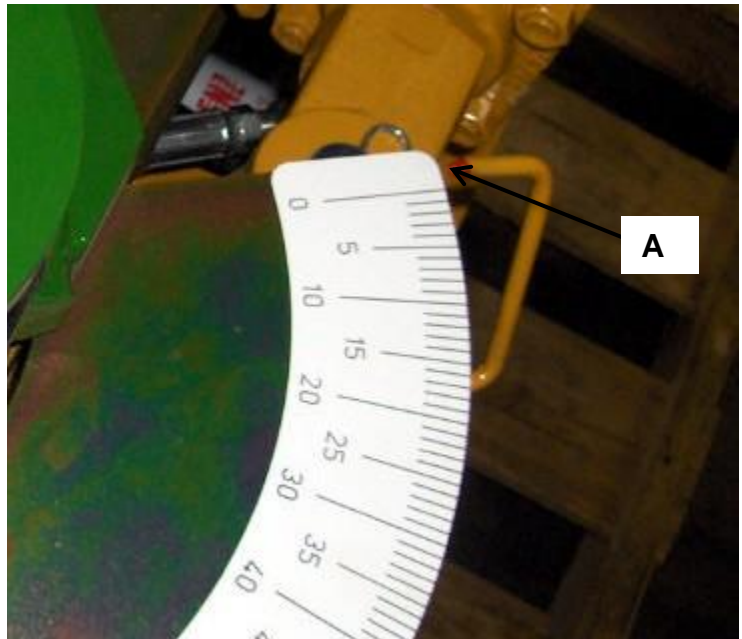
Important: Liberally apply lubricant along the counterdie and the 1/2 of the material that contacts the counter die (A) with a WD-40 style lubricant or equivalent. Do not lubricate the bending die. Lubricating the bending die will encourage slipping of material in the bending die.

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 foot pedal is activated the material will force its way into the die and bend properly.



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.
4. Press the right foot pedal switch to rotate the die forward. Keeping the foot pedal activated, visually watch the degree dial (A). 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.
5. If the bend requires more degrees. Increase the degrees by further activating the forward foot pedal switch. This allows the operator to gradually reach a bend angle, on the first set up piece.
6. 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 (A) position. For example, to a achieve a 90° on the piece in the picture, 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.





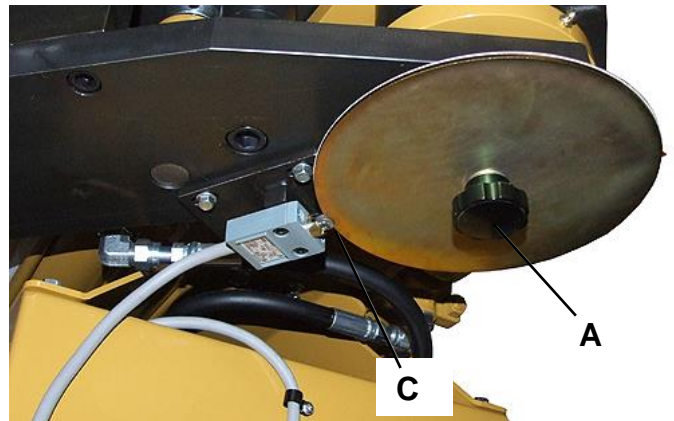
Using the auto stop feature – if equipped, (Setting the automatic stop position)

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 (A) to adjust the dial.

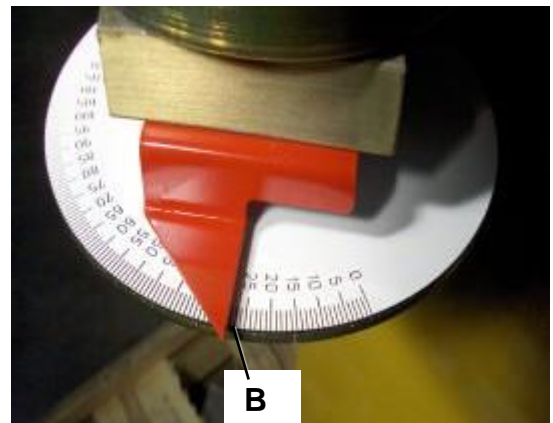
1. Method #1: Using the lower degree dial, set the lower pointer to the desired degrees by loosening the black knob (A) and rotating the degree dial until the desired bend angle plus spring back is displayed (B).
2. Example: 105deg = 100deg bend, 5degrees of spring back.
3. Method #2: You can set the lower degree dial after a bend is complete also.



Example: Bend a piece of material to a desired angle using the top degree dial only. Once you are at the final bend position, Stop with the material still in the machine. Loosen and rotate the lower degree dial to “0” degrees (B). You will feel a definite click latching the dial in position; this is the spring-loaded micro switch (C) holding the dial in 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.

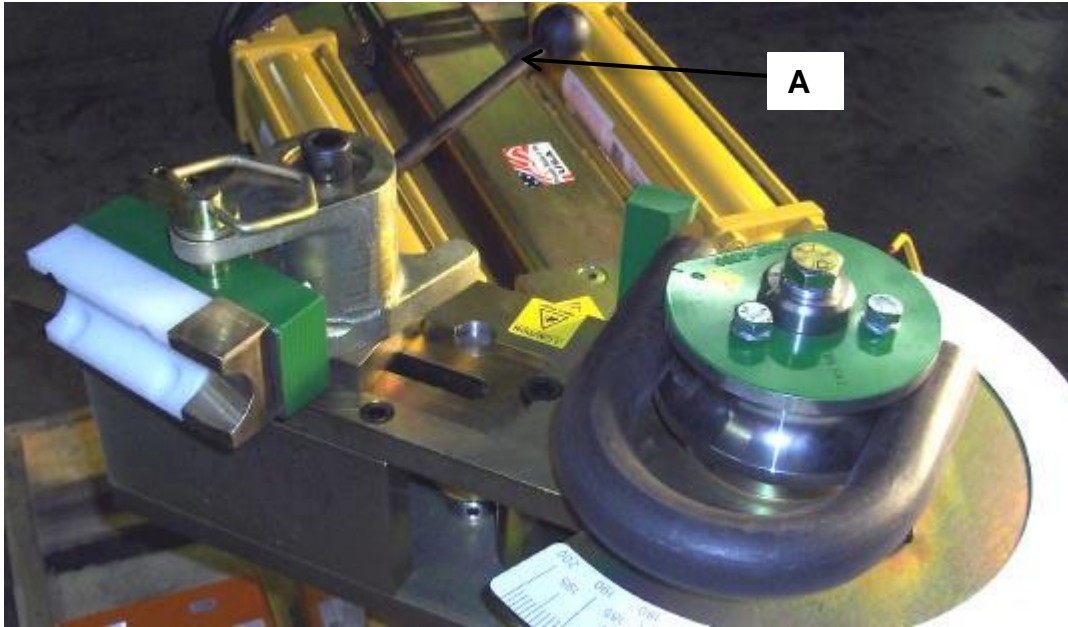


4. If the lower degree dial is set and the desired angle is more or less degrees than planned / calculated for, simply advance or retard the lower degree dial to compensate for the difference.



Material Removal

1. After reaching the desired angle, the material needs to be removed.
2. Press the reverse (left) foot pedal. Both the die and the counter die will retract simultaneously. Run in reverse until all bending pressure is released from the bend.



Activating the quick release lever

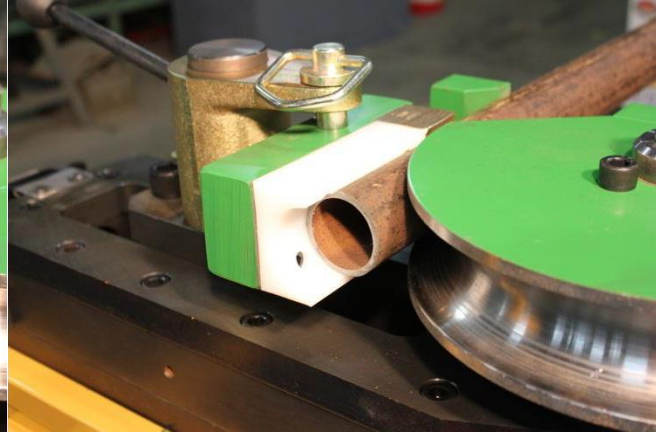
3. Activate the quick release counter die lever (A) and completely remove the material.
4. After the material is safely removed, press the reverse (left) foot pedal keeping hands clear until both cylinders fully retract.
5. The machine is now at the "home" position and can be reloaded for the next bend.
6. Repeat previous steps.



Material Insertion Limitations



Left



Right

- The left figure shows the recommended minimum / correct amount of material remaining to be fully supported in plastic slide.
- The right figure shows the maximum amount the material can be pulled through the counter die. Pulling the material further than shown into the counter die, it will destroy the plastic slide.
- 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. In the left figure, there is not enough material to complete a 90deg. bend. This bend will damage the dies.



NOTICE: Orienting your material in this fashion will cause damage to your tooling and machine!! DO NOT pull bent material into the counter die! Make sure you have enough straight material on the draw side of the material to create your bend.



Bending More than 180 Degrees

- This machine is capable of bending more than 180 degrees. Contact BAILEIGH INDUSTRIAL HOLDINGS LLC about your application.
 - It will require a password to make the machine go past 200 degrees.
 - Requires special tooling to allow removal of bent part. If standard tooling is used, the material will be locked onto the die.

UNDERSTANDING SPRINGBACK

Springback can be difficult to understand. As material is bent, the materials yield strength resists being formed. As a final degree is reached, the machine will have enough power to hold the bend at a set degree, but as the pressure of the machine is released, the material has a resistance built in, so it “springs back”

Springback will vary with every size, type and wall thickness, so it will never be consistent from size to size.

The best way to determine a materials springback is to do sample bends to 90 degrees until a perfect 90 is obtained.

- At that point document the actual machine degrees.
- Full manual mode is the best place to do these tests.
- Use the overbend amount and enter that value into the springback field.

MATERIAL SELECTION

⚠ CAUTION: It must be determined by the customer that materials being processed through the machine are NOT potentially hazardous to operator or personnel working nearby.

When selecting materials keep these instructions in mind:

- Material must be clean and dry. (without oil)
- Material should have a smooth surface, so it processes easily.
- Dimensional properties of material must be consistent and not exceed the machine capacity values.
- Chemical structure of material must be consistent.
- Buy certificated steel from the same vendor when possible.



Material Layout

In order to create accurate parts, you will have to lay out 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 #3 to determine the arc lengths for the die in use. Or use the following formula:

Alternate arc length formula:

Example: $6.0 \text{ clr} \times 2 = 12$ $12 \times 3.14 = 37.699$ $37.699 / 360 = 0.1047$ " per degree
 $0.1047 \times 90 \text{ degrees} = 9.425$ " of material used for a 90-degree bend.

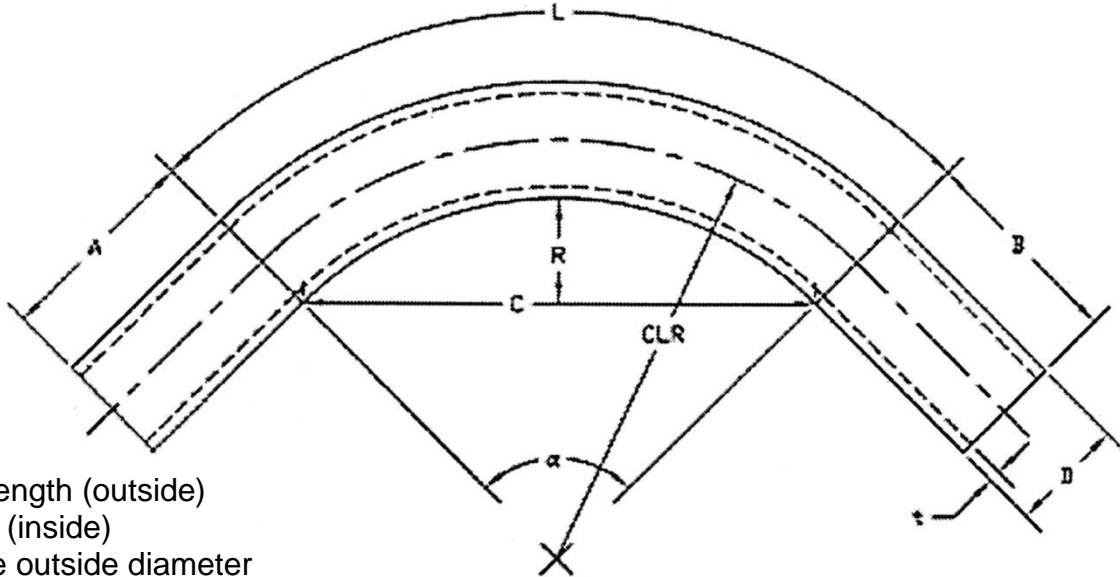
Once the arc lengths are determined you can begin layout of the material using Diagram #1 as a reference.

- Diagram #1 shows a simple part bent on the same plane in the same direction.
- Diagram #2 shows bending based off of a centerline in two directions.
- For symmetrical bends, centerline bending is easiest.
- For non-symmetrical bends, continuous one direction bending is best.

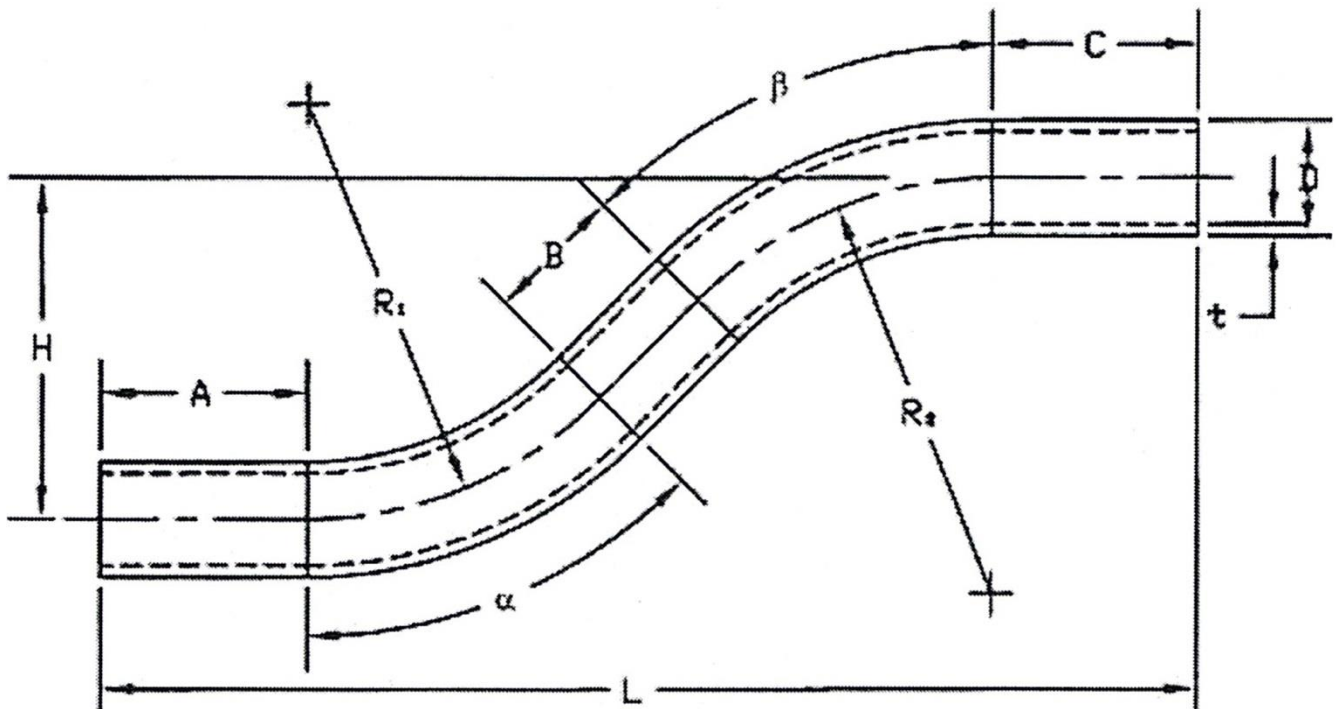
- Another way to layout material is to draw them in a 2D computer software program like Auto Cad. There are many free programs on the internet. In a 2D program you will draw the parts centerline only with corresponding clr's. Then you will be able to list individual segments of the bent part. This data can be directly entered into the control.
- Another program available is BEND-TECH which is a program specifically designed for tube bending and will give you all of the required data to make a part. This software is available from BAILEIGH INDUSTRIAL HOLDINGS LLC.
- Bending with a rotary draw bender requires determining the start of bend point which will line up with the "0" mark on the die. The portion of the tube toward the hook arm will be locked to the die, the portion toward the counter die is the draw side and will slide along the counter die and conform to the dies shape/radius.



PIPE AND TUBE BENDING DIAGRAMS



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



BENDING GLOSSARY

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 nor 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 centerline 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.



BENDING SUGGESTIONS

Die Types and Bend Results

Standard Elliptical

- Meant to get thinner wall tubing, to a tighter radius, without the tube collapsing.
- Function over form
- This die will distort the tubing

Standard Elliptical with Revised Counter Die

- “Middle ground” die configuration
- Won't bend as tight of a radius as the standard elliptical die, but will bend tighter than the true radius
- Less distortion, but still visible (as compared to the standard elliptical die configuration)

True Radius

- Minimal to no distortion
- Aesthetically pleasing bend
- Needs larger radius to bend without collapsing (as compared to the other two configurations)

Aluminum Bending

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

- Johnson Paste Wax (seems to work the best)
- High Pressure grease
- Highly rich dish soap
- The bronze counter die must be polished and have no aluminum deposits or it will continue to pick up metal.
- If using BAILEIGH INDUSTRIAL HOLDINGS LLC's standard counter die is not producing desired results, roller counter dies are also available.
- BAILEIGH INDUSTRIAL HOLDINGS LLC has both steel rollers as well as plastic rollers. Plastic rollers are used primarily for polished aluminum. Steel rollers would be used for non-polished materials.
- 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. Aluminum will age harden so if possible, try to get freshly run material.



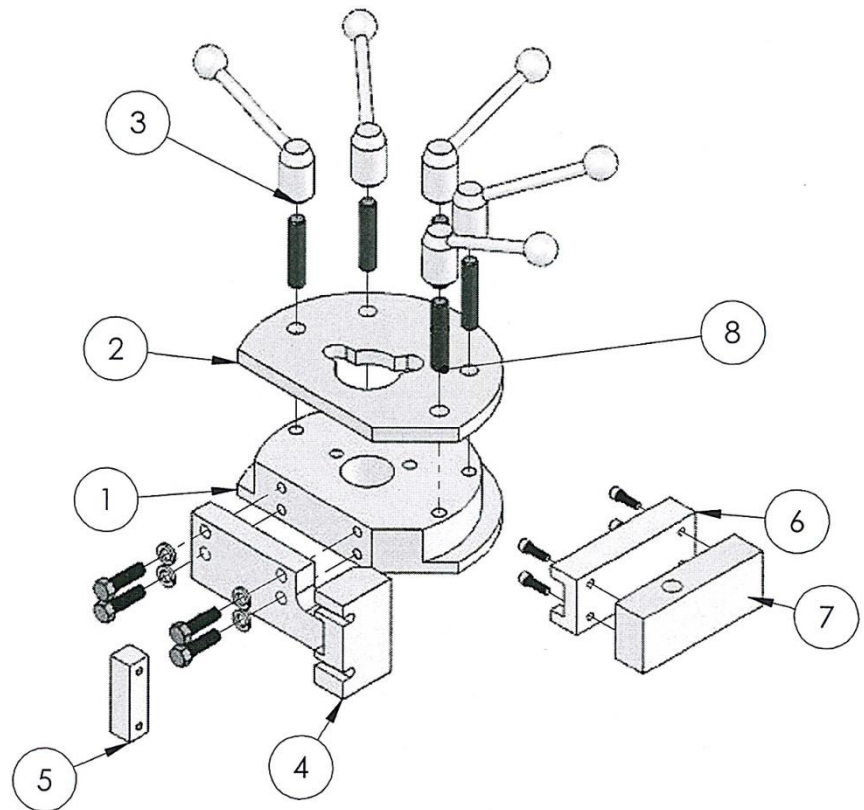
Heavy Wall DOM tubing

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

- Use a vise clamp on the outside of the hook arm to “lock” the material in place.
- Use a piece of two-sided coarse emery cloth in between the hook arm and the material, this works very well.
- In only this application, high pressure grease applied to the DIE GROOVE also helps.
- BAILEIGH INDUSTRIAL HOLDINGS LLC can make special clamps to hold material in place.

Bending with Square Dies

- Die Parts
- | | |
|---|-----------------------|
| 1 | Main Bending Die |
| 2 | Die Cap |
| 3 | Quick Release Handles |
| 4 | Hook-Arm |
| 5 | Hook-Arm Clamp |
| 6 | Plastic Slide |
| 7 | Slide Mount |
| 8 | Quick Release Studs |



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. 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 counter-die mount during bending.



4. Insert the material into 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).

NOTICE: Do not lube the bending die surfaces. This will increase the possibility for slippage. 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.

6. If the material slips during the bending operation, install the hook arm clamp (5). Do not use it unless you have to.
7. Activate the bender and bend to the desired angle.
8. 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-slug the cap clamps.
9. Install the next piece of material to be bent and repeat these steps.

Large Size Square

When bending larger than 1.5" (38.1mm) thinner wall square tubing, the counter die position seems to work better between 1/2" and 1" (12.7-25.4mm) farther away from the die. This seems to reduce side wall distortion and inner wrinkling. Although this suggestion is to help on large size, 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.

BAILEIGH INDUSTRIAL HOLDINGS LLC offer crush bend dies to form a concave crease on the inside of square bends to reduce the possibility of wrinkling.



LUBRICATION AND MAINTENANCE



WARNING: Make sure the electrical disconnect is OFF before working on the machine.

Maintenance should be performed on a regular basis by qualified personnel.

Always follow proper safety precautions when working on or around any machinery.

- Check daily for any unsafe conditions and fix immediately.
- Check that all nuts and bolts are properly tightened.
- On a weekly basis clean the machine and the area around it.
- Lubricate threaded components and sliding devices.
- Apply rust inhibitive lubricant to all non-painted surfaces.

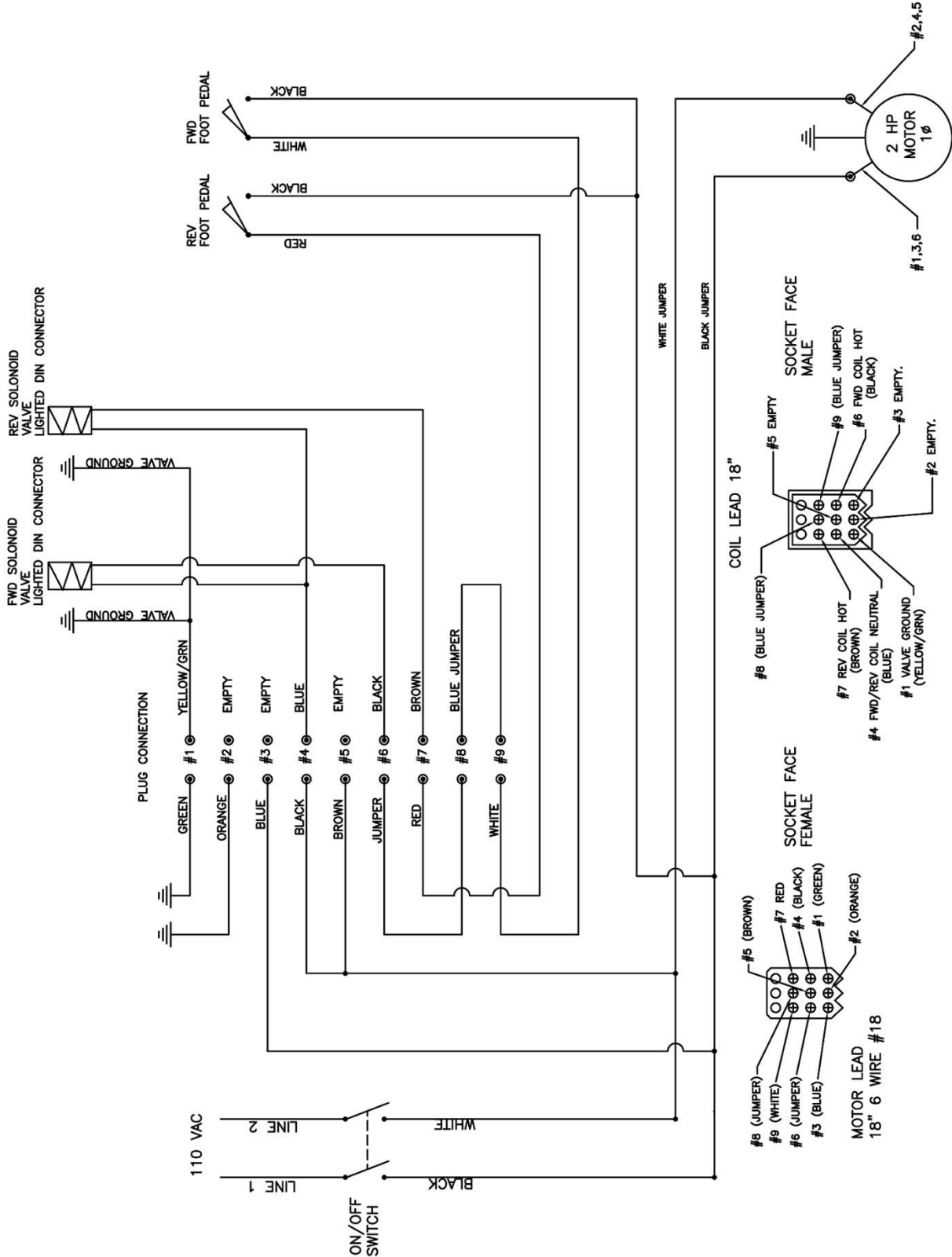


Note: *Proper maintenance can increase the life expectancy of your machine.*

- The fluid level in the power unit's reservoir should be checked monthly. If the level is below 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".
- Check periodically for leaks. If a leak is detected, consult BAILEIGH INDUSTRIAL HOLDINGS LLC.
- 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.
- Check for any loose or worn parts
- If hoses or fittings are replaced, they must be rated for 4000psi (275 bars, 282 kg/cm).

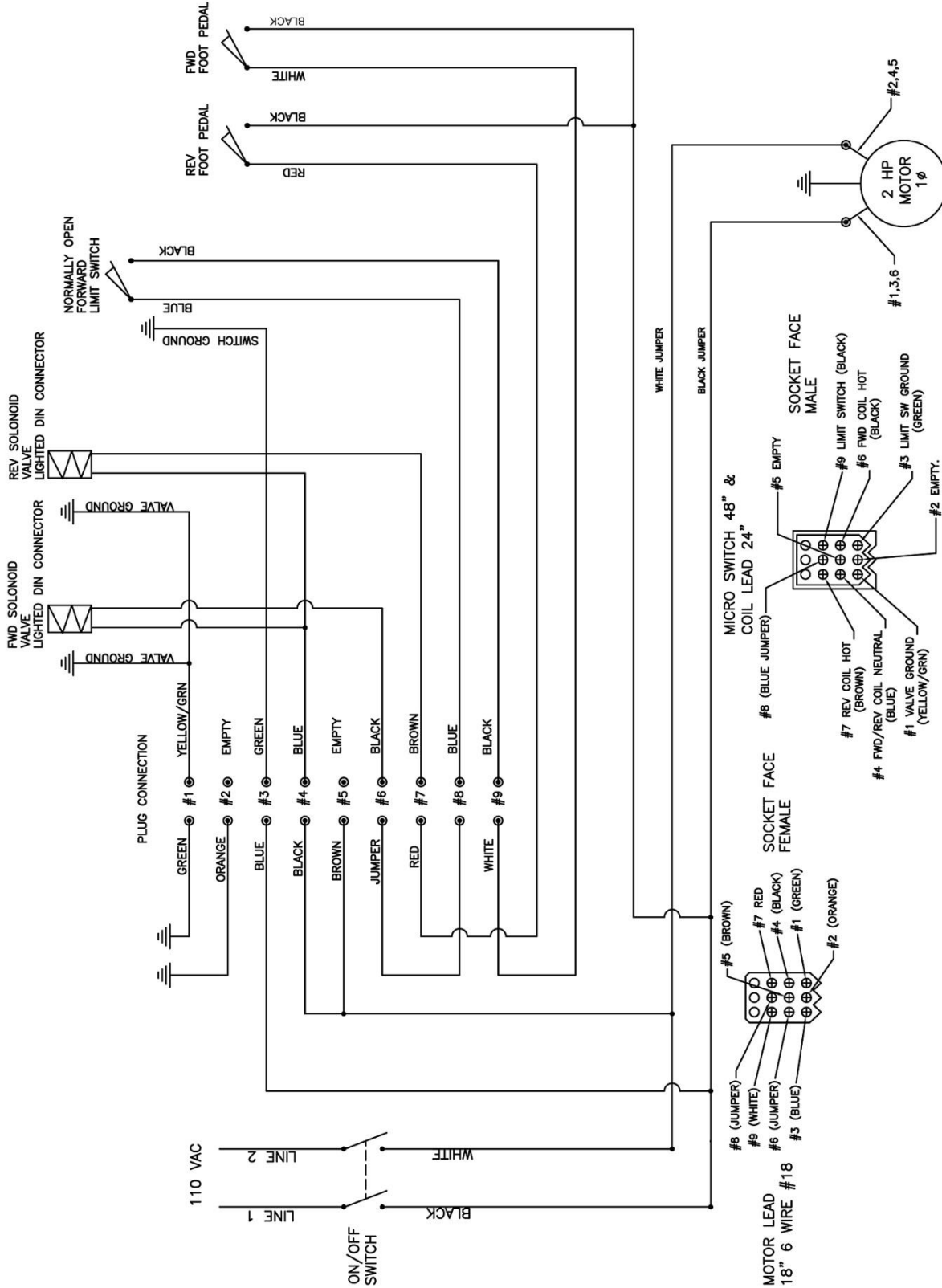


RDB-150 ELECTRICAL SCHEMATIC



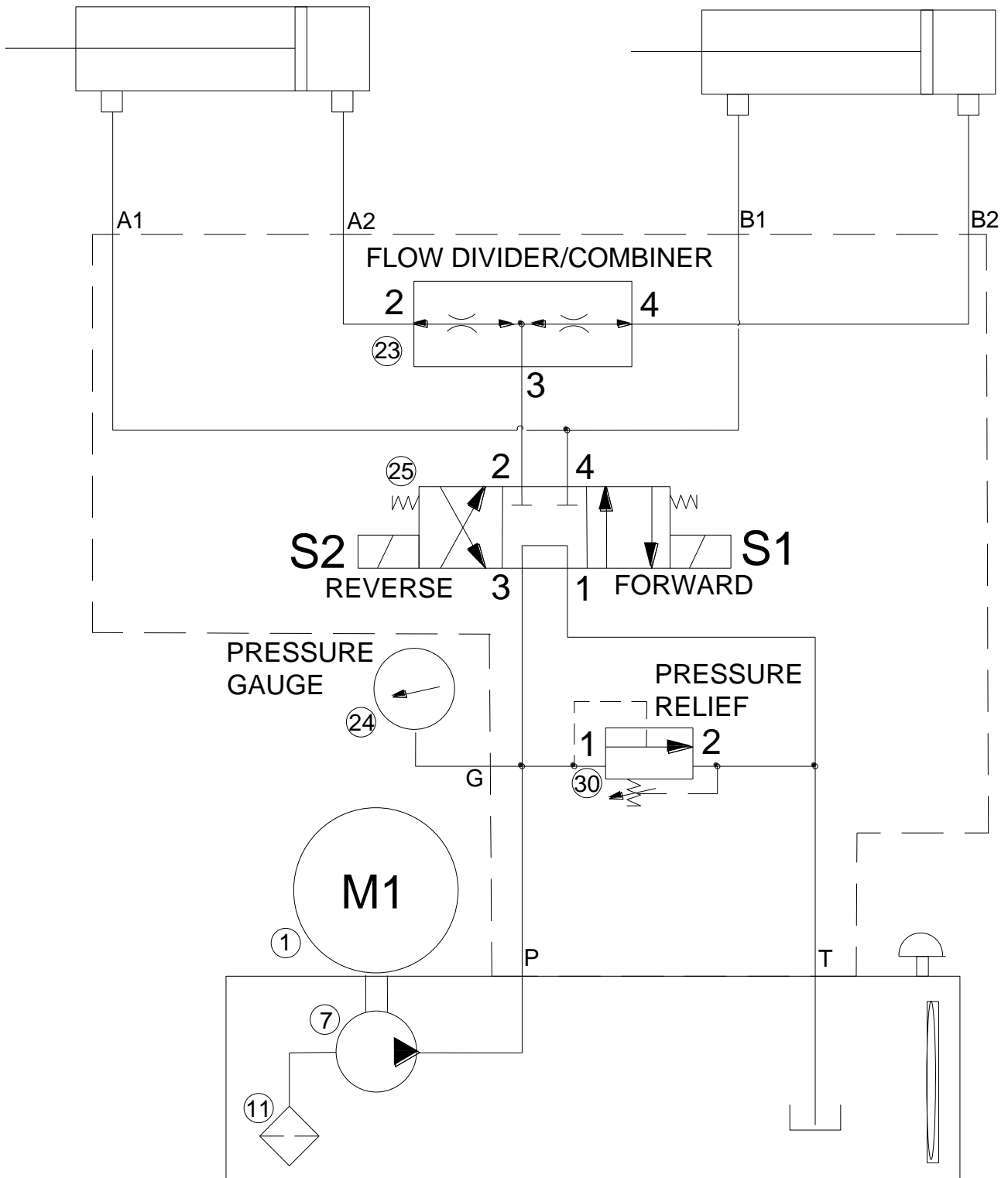


RDB-150-AS ELECTRICAL SCHEMATIC







HYDRAULIC DIAGRAM





TROUBLESHOOTING

⚠ WARNING: Make sure the electrical disconnect is OFF before working on the machine.

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
	<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 in line 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> 
Machine doesn't move forward or moves forward slowly and does not build up pressure	<p>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 to the detent position and the pressure should drop to "0" Psi.</p> 
Machine doesn't bend at pressure (2000 Psi)	<p>Solenoid switch</p> <p>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 machine's capacity.</p>



Material slips in the hookarm	Too much lube on material and is transferring to the bend die clean the bend die with degreaser.
	The counter die should be lubed only
	The material may need to be clamped
	Wrong material for the die set
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	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 pipe sizing chart
	Wall thickness is too thin



TABLES, CHARTS, & DIAGRAMS

Table 1 Standard Pipe Sizes and Schedules

PIPE SIZES	O.D.	Pipe Schedules and Wall Thickness					
		5	10	40	80	160	XX STRONG
1/8	0.405	0.400	0.050	0.068	0.095		
1/4	0.540	0.500	0.070	0.088	0.119		
3/8	0.675	0.500	0.070	0.091	0.126		
1/2	0.840	0.700	0.080	0.109	0.147	0.188	0.294
3/4	1.050	0.700	0.080	0.113	0.154	0.219	0.308
1	1.315	0.700	0.110	0.133	0.179	0.250	0.358
1-1/4	1.660	0.700	0.110	0.140	0.191	0.250	0.382
1-1/2	1.900	0.700	0.110	0.145	0.200	0.281	0.400
2	2.375	0.700	0.110	0.154	0.218	0.344	0.436
2-1/2	2.875	0.800	0.120	0.203	0.276	0.375	0.552

Table 2 Die Color Code Chart

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



Table 3 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 90deg, 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



Table 4 Counter Die Placement Chart

CLR (Centerline Radius)	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

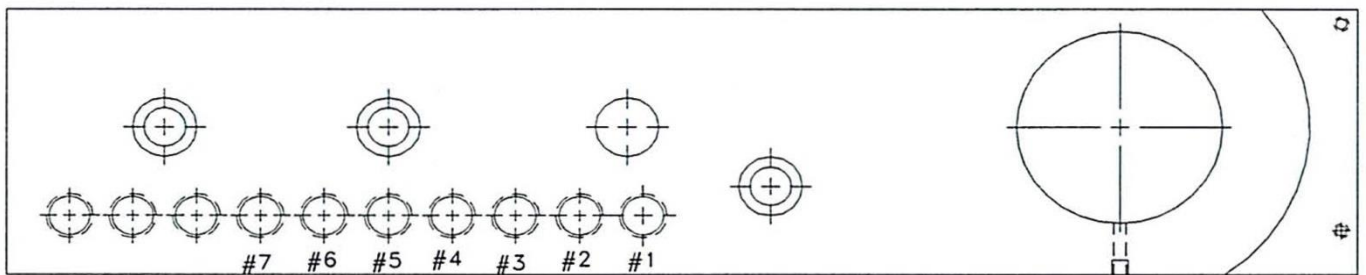
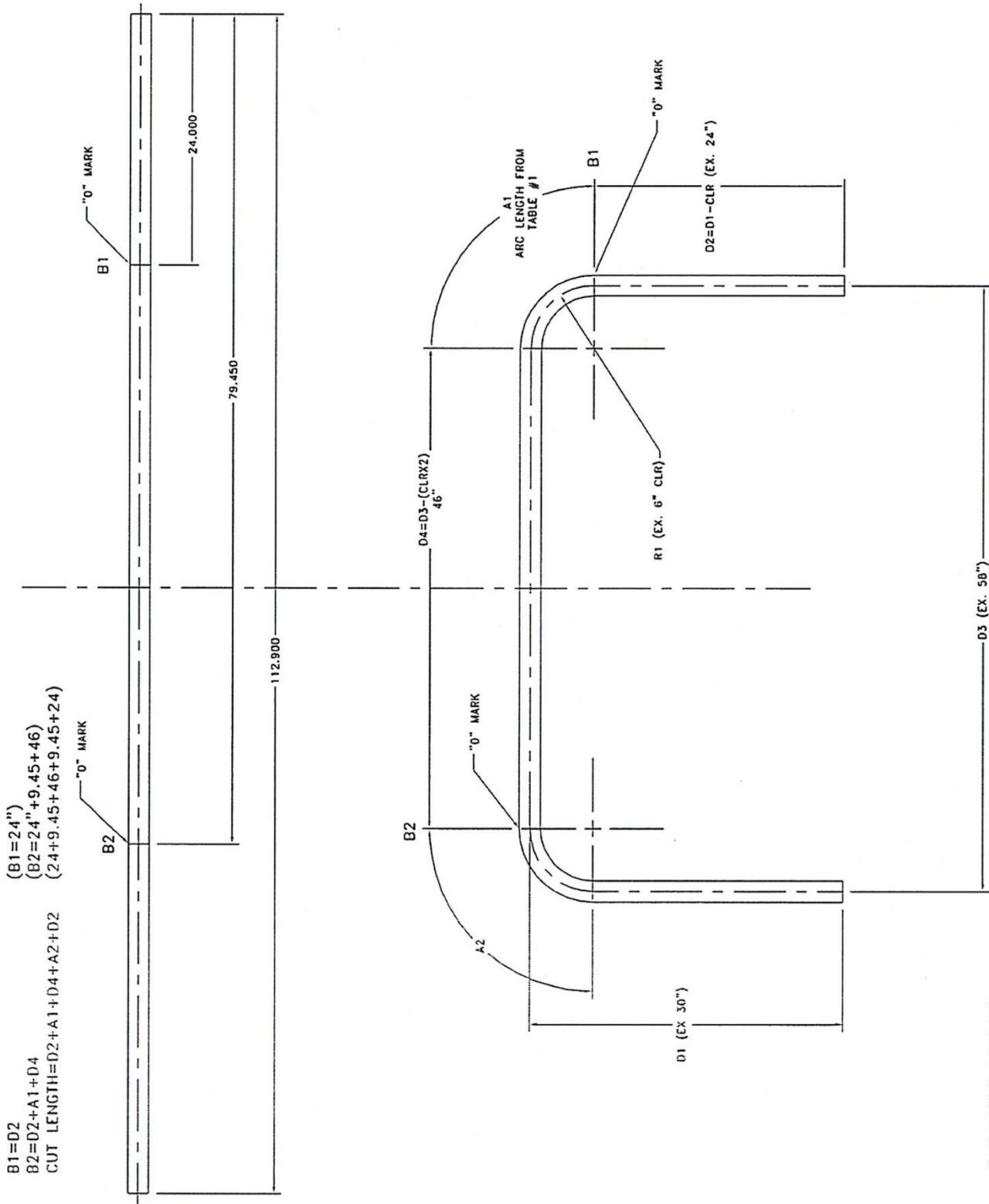




Diagram 1



CONTINUOUS LAYOUT

DIAGRAM #1



Diagram2

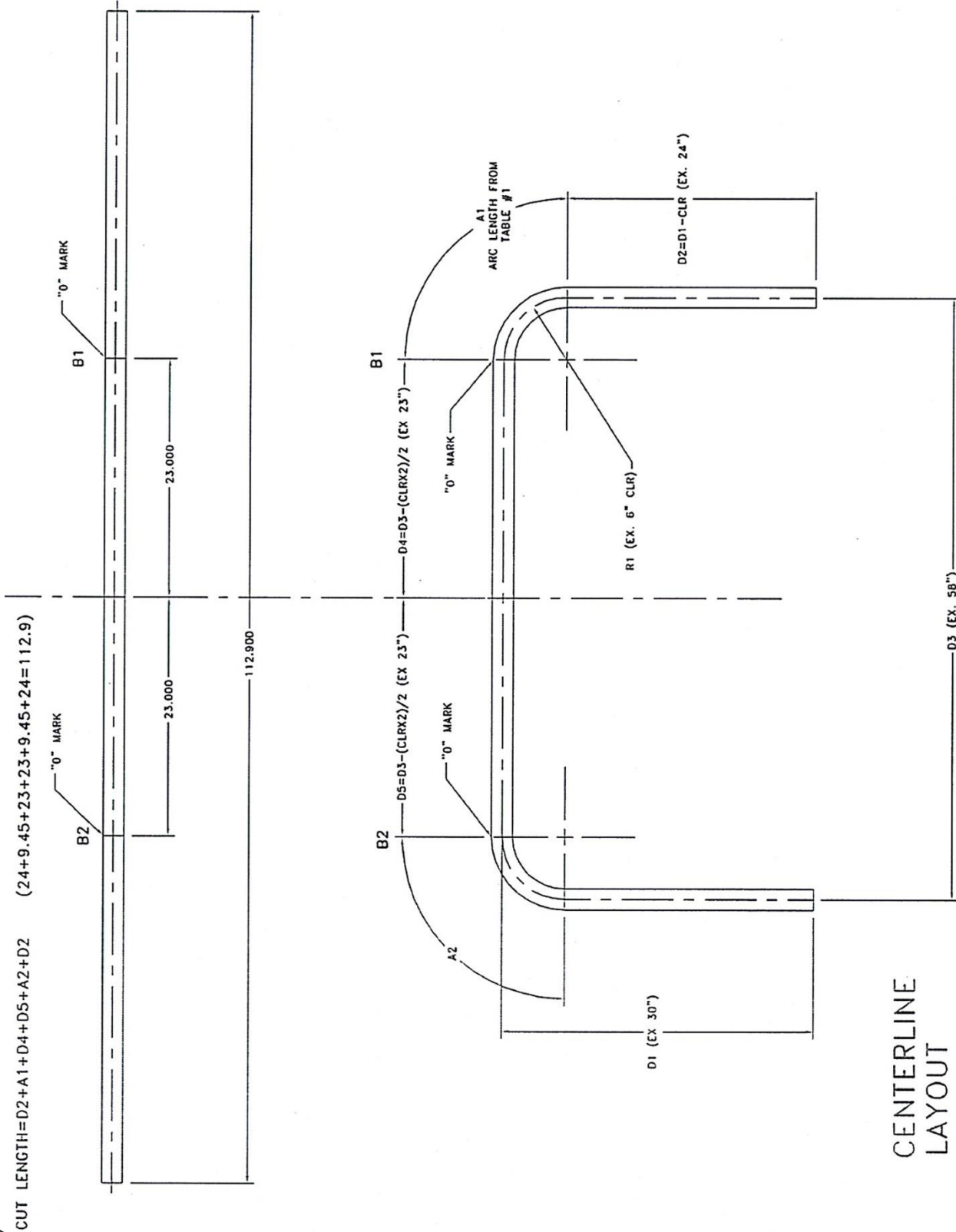
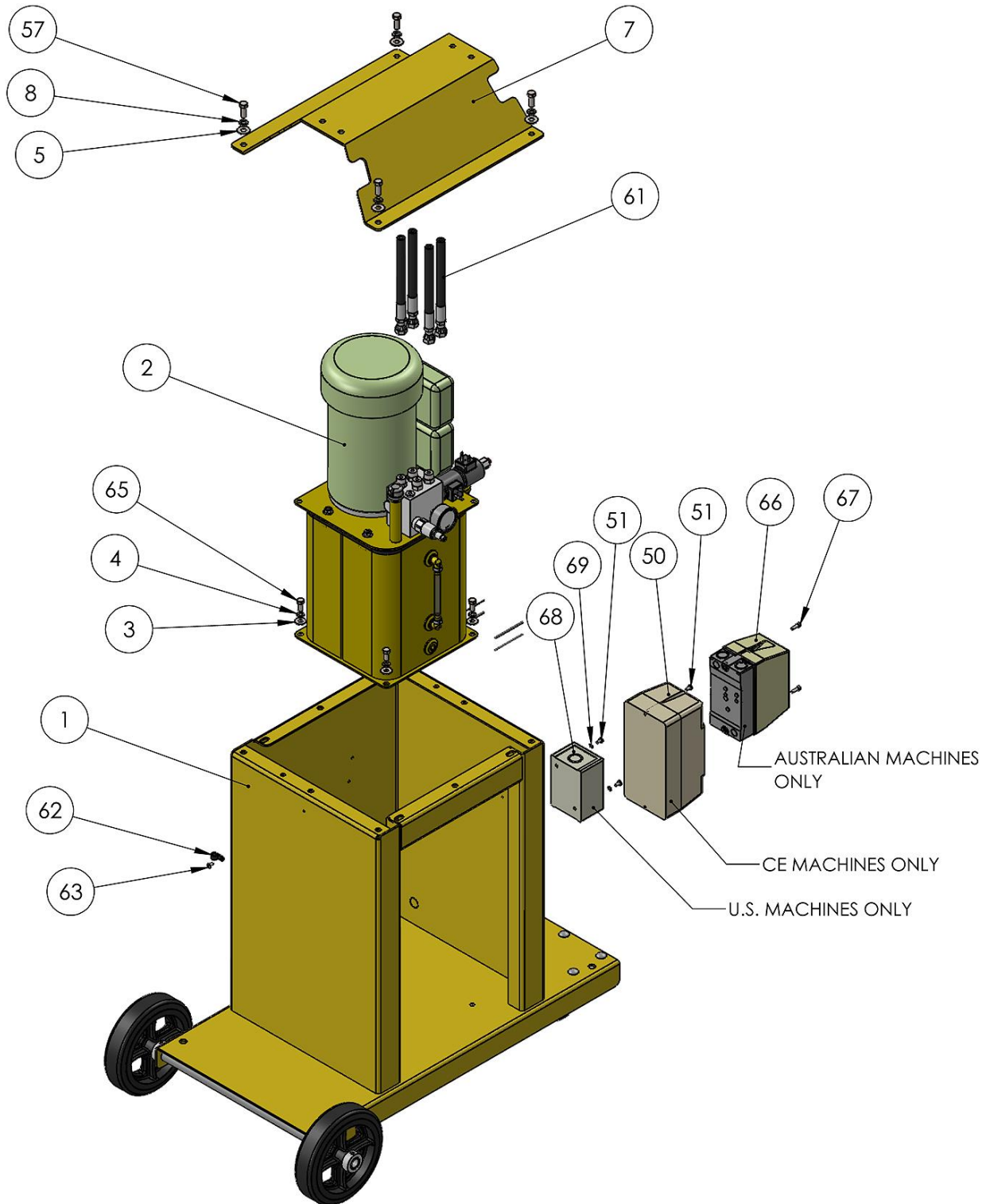


DIAGRAM #2



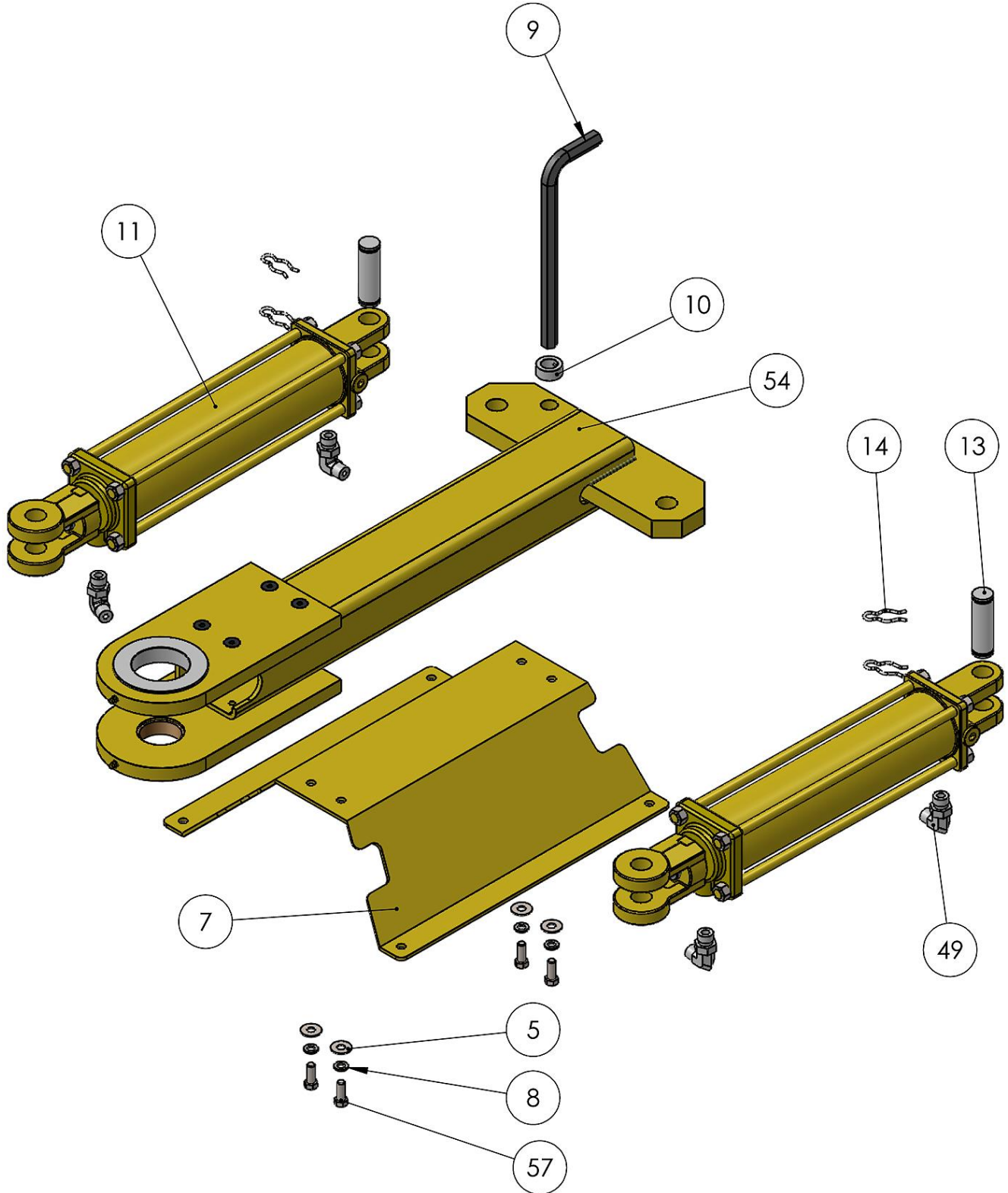
PARTS DIAGRAM

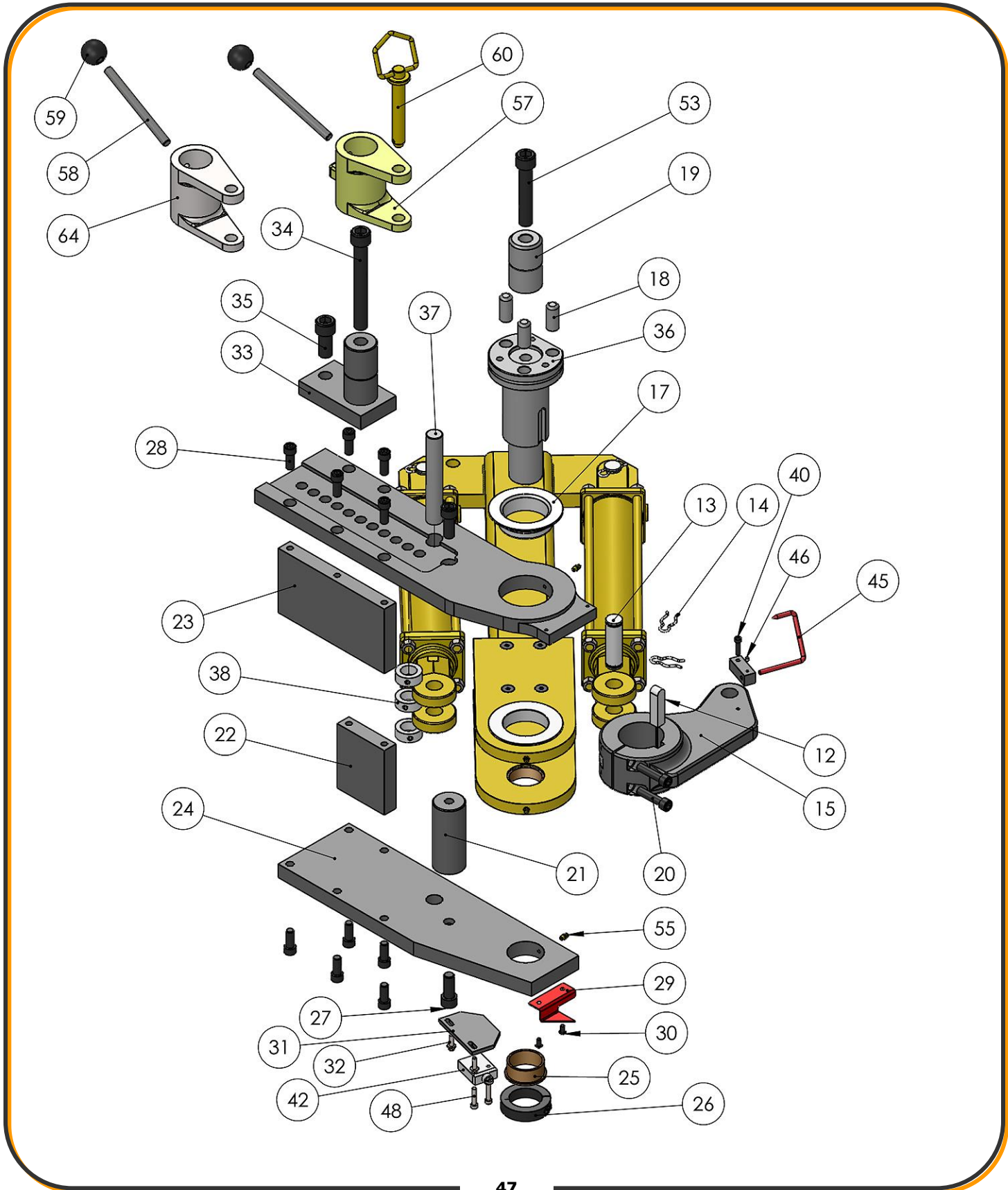
Power Unit and Cart Assembly Parts Diagram





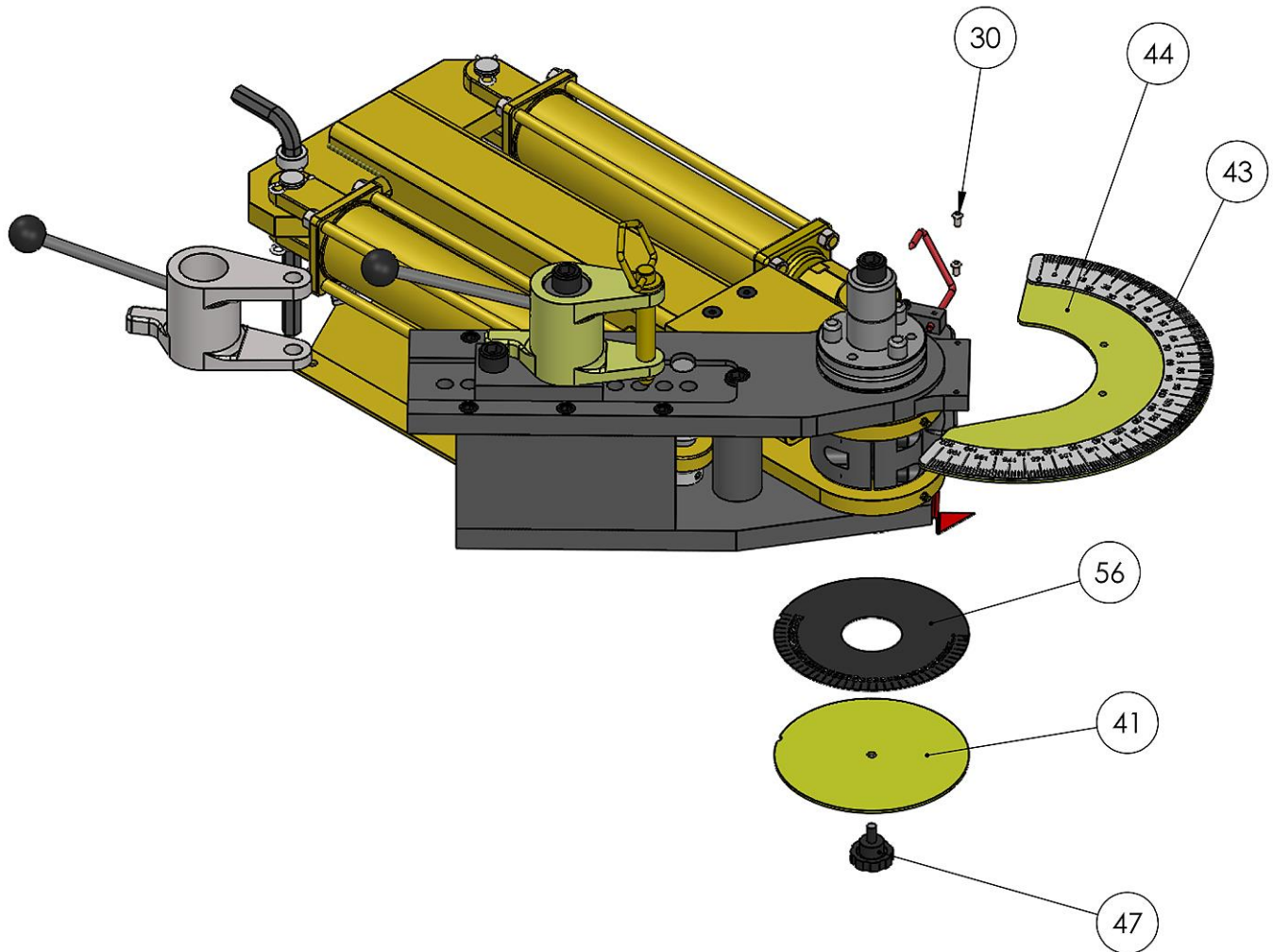
Main Tube and Cylinders Assembly Parts Diagram







Degree Dials Parts Diagram





Parts List

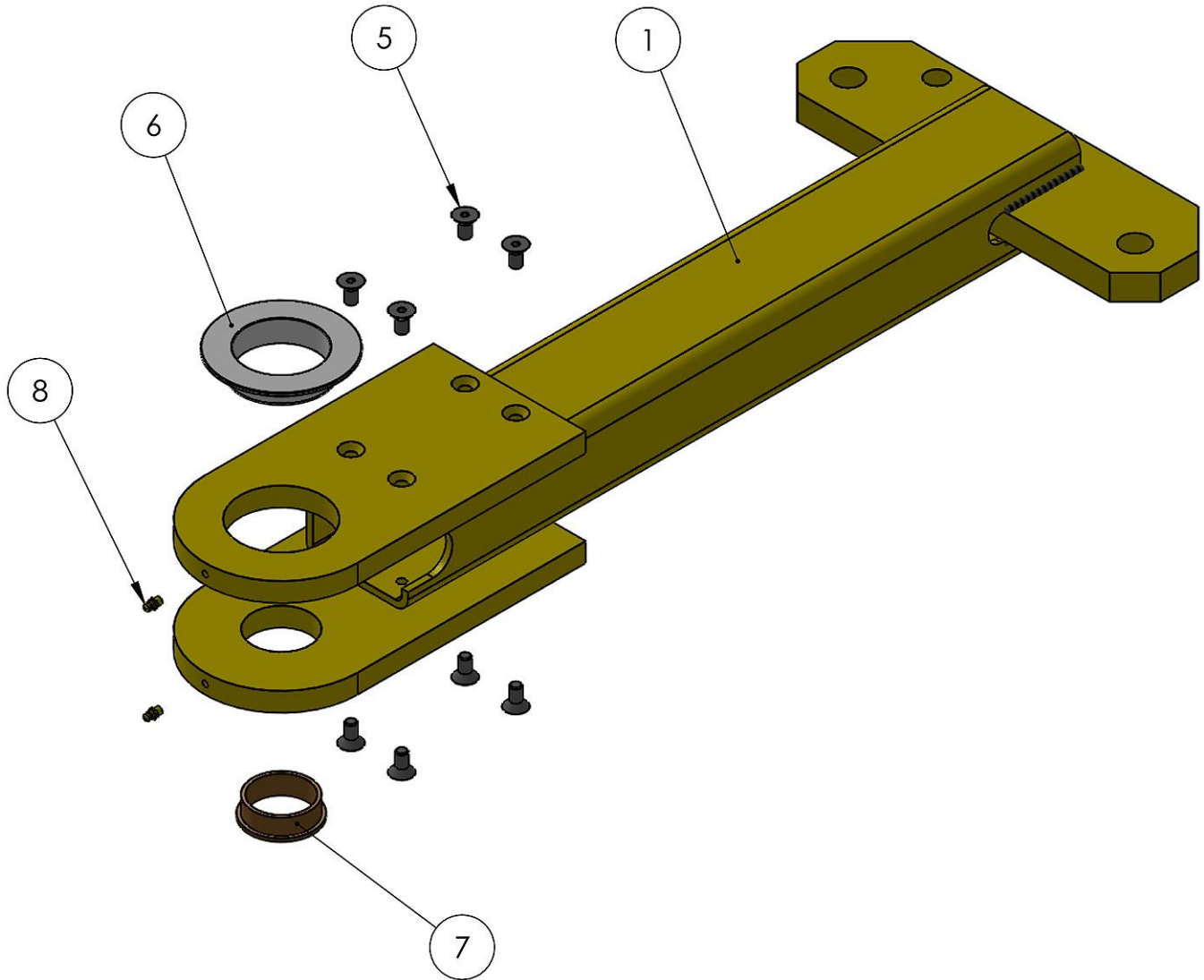
Item	Part Number	Description	Qty.
2	PP-1249	M150 Power Unit	1
3	BS-0082	5/16" Flat Washer	4
4	BS-0073	5/16" Lockwasher	4
5	BS-0083	3/8" Flatwasher	8
6	M150-6A035	Cross Bar	1
7	M175-6A016	Riser	1
8	BS-0074	3/8" Lockwasher	8
9	PP-1430	17mm Hex Key	1
10	PP-1494	20mm Set Screw Collar	1
11	PP-0403	3" x 12" Hydraulic Cylinder	2
12	M150-6A019	Drive Key	1
13	PP-1343	Pin	3
14	PP-1321	Hairclip	6
15	ME-M150-5A005	Torque Arm	1
16	ME-M150-6A052	Top Pivot Plate	1
17	M150-7A014	Top Bushing	1
18	PP-1071	3/4" Dowel Pin	3
19	ME-M300-7A003	Center Pin	1
20	BSM-0026	M12 x 1.75 x 50 SHCS	2
21	ME-M150-7A011	Spacer Shaft (Metric)	1
22	ME-M175-6A004	Tie Bar (Short)	1
23	ME-M175-6A008	Tie Bar (Long)	1
24	ME-M175-6A012	Lower Pivot Plate	1
25	PP-0295	Flanged Sleeve Bearing	1
26	PP-0293	2.0 Split Clamp Collar	1
27	BSM-0030	M16 x 2.0 x 40 SHCS	2
28	BSM-0023	M12 x 1.75 x 30 SHCS	10
29	M175-6A010	Auto Stop Pointer	1
30	BSM-0138	M6 x 1.0 x 12 BHCS	4
31	ME-M150-5A008	Switch Mount (Metric)	1
32	BSM-0046	M6 x 1.0 x 20 Hex FLG	2
33	ME-M150-5A016	Pivot Assembly (Metric)	1
34	BSM-0144	M20 x 2.5 x 160 SHCS	1



Item	Part Number	Description	Qty.
35	BSM-0040	M20 x 2.5 x 45 SHCS	1
36	ME-M175-7A005	Spindle	1
37	M175-7A004	Cylinder Pin (Long)	1
38	PP-0035	1" Set Screw Collar	3
39	ME-M150-6A020	Pointer Block	1
40	BSM-0003	M6 x 1.0 x 25 SHCS	1
41	M150-6A024	Auto Stop Disc	1
42	PP-0136	Auto-Stop	1
43	M175-6A017	Adhesive Backed Degree Dial	1
44	M175-6A007	Top Degree Dial Backing Plate	1
45	M175-6A018	M175 Pointer	1
46	BSM-0145	M5 x 0.8 x 6 Set Screw	1
47	PP-0413	Auto-Stop Knob	1
48	BSM-0004	M6 x 1.0 x 30 SHCS	2
49	PP-0853	-8 To -6 Elbow	4
50	PP-1294	WEG Euro Switch	1
51	BSM-0132	M5 x 0.8 x 10 PPMS	4
57	BS-0041	3/8"-16 x 1" HHCS	8
53	BSM-0175	M20 x 2.5 x 110 SHCS	1
54	ME-M150-5A006	Main Tube Assembly	1
55	BS-0070	.25-28 Grease Zerk	2
56	M150-6A049	Auto-Stop Dial	1
57	M150-5A001	Quick Release Casting (Short)	1
58	M150-7A013	Quick Release Shaft	2
59	PP-0133	Black Ball Knob	2
60	PP-0476	Hitch Pin Assembly (Short)	1
61	PP-0750	24" Hydraulic Hose	4
62	BS-0178	3/8" Cable Clamp	1
63	BSM-0205	M5 x .8 x 8 PPMS	1
64	M150-5A011	Quick Release Casting 1/2" Offset	1
65	BS-0039	5/16"-18 x .75" HHCS	4
66	PP-2075	Aus. Motor Starter	1
67	BSM-0186	M5 x 0.8 x 16 SHCS	2
68	PP-0152	On/Off Switch (US)	1
69	BSM-0197	M5 Star Washer	2



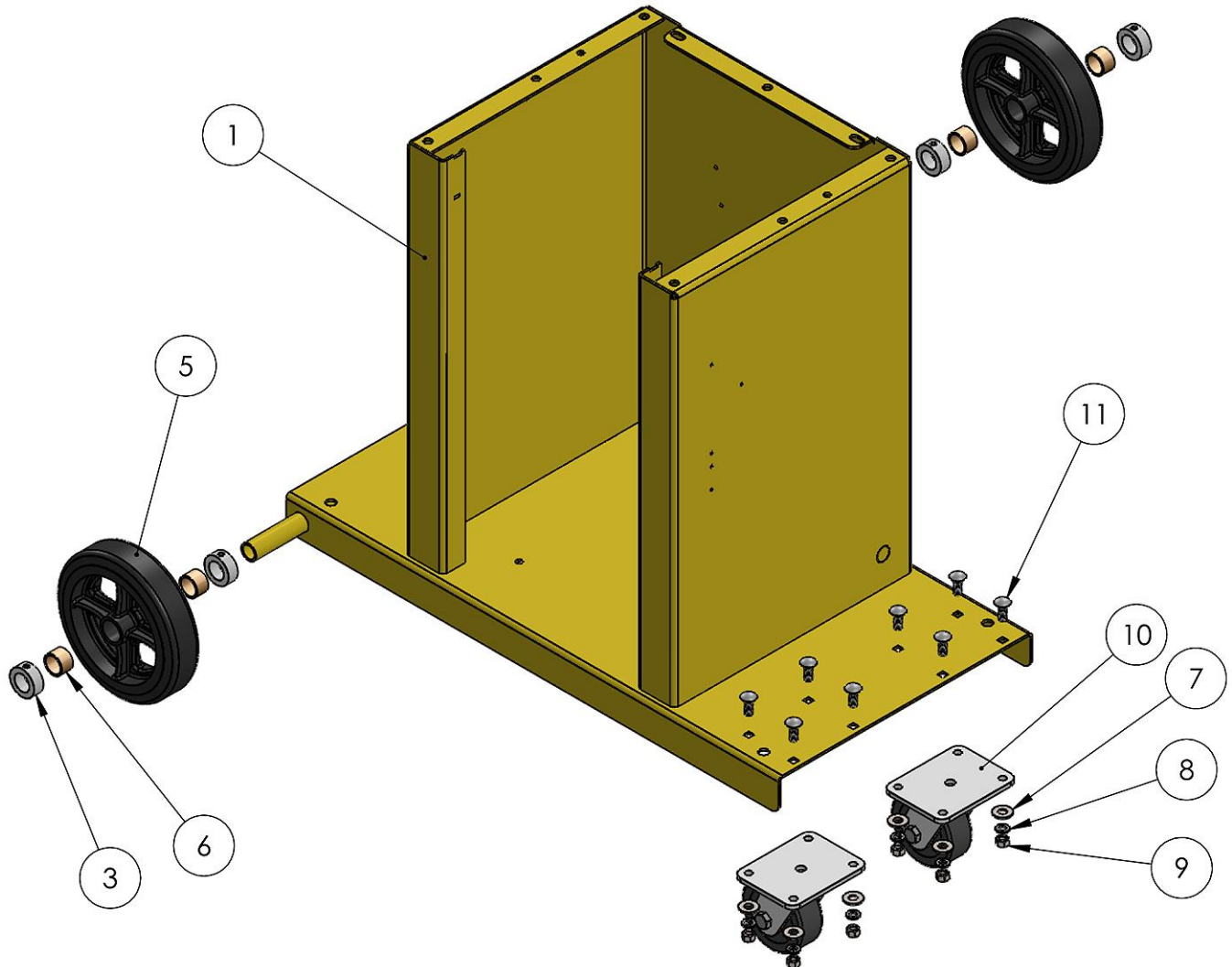
Main Tube Assembly Parts Diagram



Item	Part Number	Description	Qty.
1	M150-6A013	Main Tube	1
5	BS-0329	3/8"-16 x .75" SHCS	8
6	M150-7A015	Flanged Sleeve Bushing	1
7	PP-0294	Flanged Sleeve Bearing	1
8	BS-0070	.25-28 GREASE ZERK	2



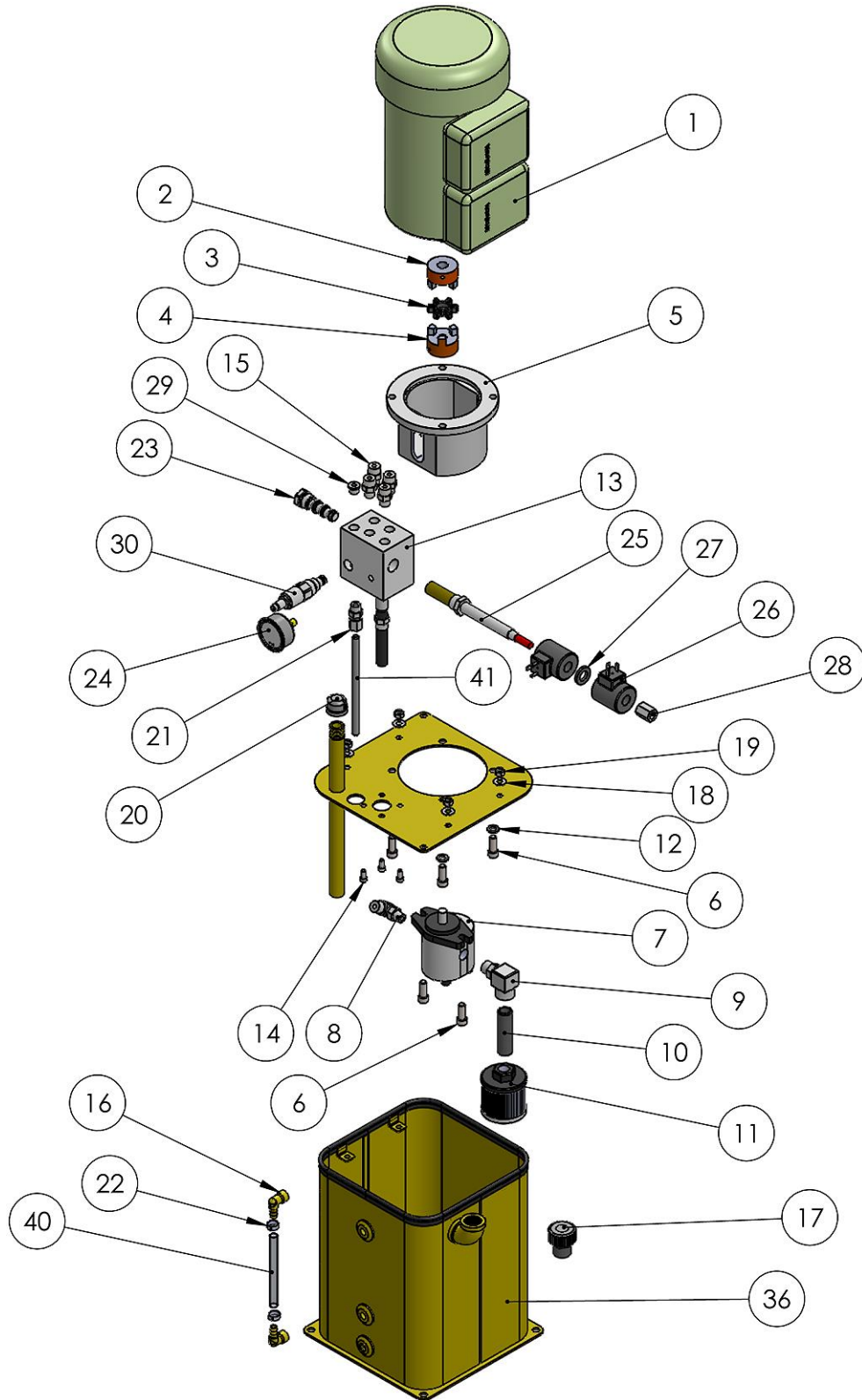
Cart Assembly Parts Diagram



Item	Part Number	Description	Qty.
1	M150-5A007	Upright, Base	1
3	PP-0035	1" Set Screw Collar	4
5	PP-0064	8" Rubber Wheel	2
6	PP-0043	1.0" ID x 1.1875" OD x 0.75" LG Bushing	4
7	BS-0083	3/8" Flatwasher	8
8	BS-0074	3/8" Lockwasher	8
9	BS-0125	3/8"-16 Nut	8
10	PP-0048	4.0" Caster	2
11	BS-0108	3/8"-16 x 1" Carriage Bolt	8



Hydraulic System Parts Diagram





Parts List

Item	Part Number	Description	Qty.
1	PP-1075	2hp Single Phase Motor	1
2	PP-1101	5/8"ID Motor Coupling	1
3	PP-1103	Rubber Coupling Insert	1
4	PP-1252	1/2"ID Pump Coupling	1
5	PP-1250	M150 Pump/Motor Adaptor	1
6	BS-0016	3/8"-16 x 1.0" SHCS	6
7	PP-1253	M150 Pump	1
8	PP-1276	#6 Threaded Elbow	1
9	PP-1268	#8 Elbow To .5 NPT	1
10	PP-1267	3" Black Pipe	1
11	PP-1113	Strainer	1
12	BS-0074	.375" Lock Washer	4
13	PP-1251	Manifold	1
14	BS-0005	1/4"-20 x .50" SHCS	3
15	PP-0858	#6 To #6 Straight Face Seal	5
16	PP-1128	Brass Barb Elbow	2
17	PP-1114	Fill Cap	1
18	PP-1138	Nylon Washer	4
19	BS-0148	5/16"-18 Hex Nut	4
20	PP-1270	.5" Pipe Cap	1
21	PP-1266	Tube Compressor	1
22	PP-1139	Tube Clamp	2
23	PP-1306	M150 Flow Divider	1
24	PP-1112	Pressure Gauge	1
25	PP-1203	Solenoid Valve	1
26	PP-1404 (US), PP-0940 (CE)	Solenoid (US 115V, CE: 240V)	2
29	PP-1269	#6 Plug	1
30	PP-1110	Pressure Release Valve	1
36	M175-5A005	Hydraulic Tank	1
40	PP-1125	Sight Glass Tube	1
41	M150-7A022	Return Tube	1
42	PP-1126	Hydraulic Hose	1



NOTES



NOTES



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