HUTH

Vertical Tube Benders

Model 3002 & 3006

Operator's and

Maintenance Manual

97314 - $12.50

www.huthbenders.com

TO THE OWNER

INTRODUCTION

Carefully read and understand this manual before operation begins. Every HUTH TUBE BENDER is constructed from the finest materials by highly trained, experienced craftsmen. They have profound interest in your bender's successful performance and have prepared this manual to give you the benefit of their experience.

The manner in which you operate and the care you provide for this bender, will have a direct bearing on its continued successful performance. The manual has been prepared to make it easy for you to learn the methods for proper operation and care.

READ THIS ENTIRE MANUAL. KEEP IT FOR FUTURE REFERENCE.

Huth's policy is to improve its products whenever possible. Huth reserves the right to make changes and/or improvements without incurring any obligation to do so on previously sold products.

This manual relates to benders built after January 1, 2009. For more details on specifics of older benders please call Huth.

WARRANTY OF HUTH PRODUCTS

This warranty is made for the exclusive benefit of the original owner and is not transferable. There is no other warranty applicable to HUTH PRODUCTS, and no representative has any authority to make any representation, promise or agreement except as stated in the warranty.

ONE YEAR WARRANTY*

For one year from the date of invoice the seller will repair the bender if found to be defective in material and workmanship without cost to the purchaser. Following the first 90 days from the date of original invoice, replacement parts are shipped from the seller to the purchaser freight collect. Return parts are shipped prepaid to the seller.

In effecting such repairs, the seller may at its election, repair or replace any part which it finds to be defective.

Tools and dies are warranted for a period of (90) ninety days against defect in material and workmanship.

* During the first 90 days from date of original invoice the seller will pay freight charges for replacement of defective parts.

Model Number _____

Serial Number _____

Date Delivered _____

Huth Equipment
260 Grant Street
P.O. Box 270467
Hartford, WI 53027
USA

Telephone: 1-800-558-7808
In Wisconsin: 262-673-9440
Fax: 262-673-9443

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1. UPON DELIVERY

INTRODUCTION

Upon deliver of the Huth Vertical Bender, check the following:

1. Carefully uncrate and discard all packing material properly.
2. Inspect for signs of damage due to shipment. Report any shipping damage promptly to the carrier.
3. Review enclosed Packing List. Be certain all components have been shipped.
4. **READ AND UNDERSTAND ALL SAFETY WARNINGS AND PROCEDURES BEFORE PROCEEDING OR OPERATING THIS MACHINE.**
5. Install a matched set of dies.
6. Push down on the Red mushroom cap button located on the Operating Control Station to lock the switch in the OFF position.
7. Turn Main power disconnect located on the Electrical Box to the OFF position.
8. Check the voltage, phase and amps information on the identification plate located on the electrical control box. Have a qualified electrician verify that your electrical supply is a match for the power requirements. All Huth Benders operate on 220 volts or more!
9. Connect the main power cord to the verified power supply.
10. Remove the access cover located on top of the adaptor between the electric motor and the pump.
11. Turn the Main power disconnect to the ON position then turn the Red mushroom cap clockwise to release and reset the switch.
12. Press the Green button to start and run the electric motor for a few seconds.
13. Press the Red mushroom cap to stop the motor and watch the direction of rotation of the coupler between the pump and motor as it spins to a stop. **The 3-phase motors must rotate counterclockwise as seen when facing the pump. If needed, have a qualified electrician make the necessary wiring changes to correct the rotation.**
14. Turn the Main power disconnect to the OFF position and install the access cover on the pump and motor adaptor.
15. **HAVE ALL OPERATORS OF THIS MACHINE READ AND UNDERSTAND ALL SAFETY WARNINGS AND PROCEDURES BEFORE PROCEEDING OR OPERATING THIS MACHINE.**

2. IMPORTANT SAFETY INSTRUCTIONS

INTRODUCTION

Common sense should always be used when equipment is operating. Ensure safe usage - **READ AND UNDERSTAND ALL SAFETY WARNINGS AND PROCEDURES BEFORE OPERATION BEGINS.**

1. Make sure electrical connections are good, solid connections. Never use an extension cord! If the power cord becomes damaged or frayed, have a qualified person examine and replace it at once.
2. Ensure an unrestricted power cord. Do not place cord where damage may occur.
3. Never alter electrical components used on this machine.

DANGER

4. Unplug the machine from the power source before servicing. Electrical shock may result if this is not done. Always use proper Lock-Out/Tag-Out Procedures.

WARNING

5. **Risk of explosion. This equipment has internal arcing or sparking parts which should not be exposed to flammable vapors. This equipment should not be located in a confined area.**

WARNING

6. **This equipment uses earth ground protection for operator safety. This equipment must be grounded. If the ground is broken do not use this equipment until it is repaired by a qualified service person.**
7. If tubing being bent comes in contact with an independent piece of metal and sparks are produced, IMMEDIATELY turn the bender off and remove the power cord from the receptacle. A ground wire has been disconnected and needs to be checked and/or reconnected. Have the Bender repaired by a qualified service person.
8. Safety goggles or glasses, and safety shoes should be worn when operating the bender. Everyday eyeglasses only have impact resistant lenses; THEY ARE NOT SAFETY GLASSES.
9. Do not use frayed or loose fitting gloves while operating this machine. Gloves alter the sense of touch and can be caught in moving parts.
10. Keep hair, loose clothing, fingers and all parts of body away from moving parts.
11. Read and understand all decals on the bender and replace decals that are damaged or unreadable.

WARNING

12. **Always setup and program the Operating Controls with the pump OFF.**
13. The Control Pedestal should be positioned at a distance so that the operation controls and bending dies can not be reached simultaneously.
14. There must be a “SAFETY CIRCLE OF SWING” around the bender. There must be adequate space on each side and above the bender so tubing will not encounter any interference during the bend.
15. Once the area has been cleared for bending. Secure your operation area. No one may be allowed to enter the area once the bender has been started.
16. Both hands must be clear of bending area before operating the control. Never use another part of the body to operate the controls.
17. Only one person may operate or be within the operation area of the bender.

DANGER

18. **Use caution while removing and installing bending dies. They are heavy.**
19. Do not operate the bender without dies in their proper position.

DANGER

20. **Keep hands clear when dies are in motion.**
21. Never place your hands or other body parts between bending dies.

WARNING

22. **Before operation, check rotation of hydraulic pump/electric motor. It should rotate counterclockwise as viewed when facing the pump.**
23. Use caution when handling material. Ends and edges of material may be sharp.

WARNING

24. **Never use hands to check for hydraulic leaks. Hydraulic oil under pressure can penetrate skin causing serious injury.**
25. To reduce the risk of fire, do not operate equipment in the vicinity of open containers of flammable liquids.
26. Use machinery only as described in this manual. Use only manufacturer’s recommend attachments.

SAVE THESE INSTRUCTIONS

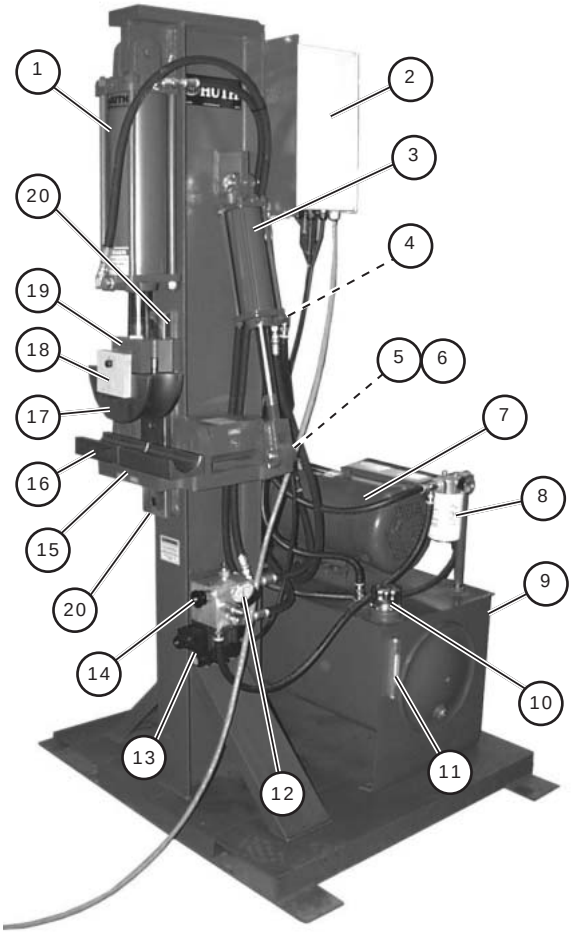
3. BENDER TERMINOLOGY & COMPONENTS

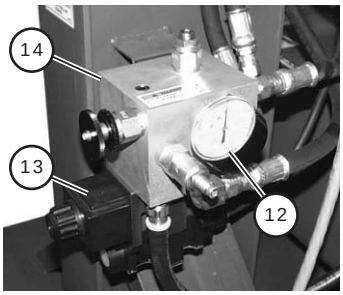
INTRODUCTION

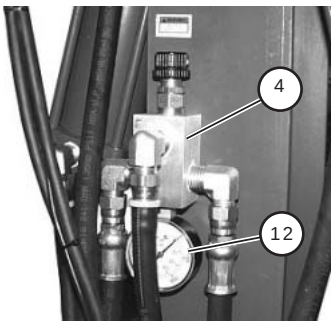
Before bending operations can begin it is important to familiarize yourself with the terms/names and locations of the components used on the Huth Vertical Bender. Study the illustrations on the following pages and read the terms and descriptions that apply to your model.

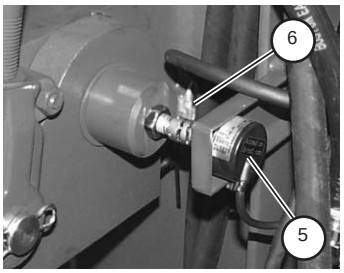
The descriptions are number coded to the numbers on the illustrations. The terms used will be used throughout the manual and this section of the manual may be referred to in order to clarify or illustrate a location.

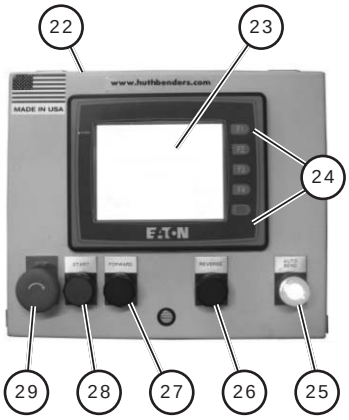
MODEL 3002
COMPONENT LOCATIONS











1.	MAIN CYLINDER
2.	ELECTRICAL BOX
3.	SIDE CYLINDER
4.	PRESSURE MANIFOLD
5.	ENCODER
6.	HOME MICRO SWITCH
7.	MOTOR
8.	HYDRAULIC OIL FILTER
9.	HYDRAULIC RESERVOIR
10.	RESERVOIR FILLER
11.	HYDRAULIC OIL SIGHT GAUGE
12.	HYDRAULIC PRESSURE GAUGE
13.	DIRECTIONAL VALVE
14.	SEQUENCE VALVE
15.	SWING GATE

16.	BACK SHOES
17.	RADIUS DIES
18.	DIE RETAINER
19.	SLED
20.	GUIDE PLATE
21.	MASTER POWER SWITCH
22.	OPERATING CONTROL STATION
23.	OPERATING CONTROL DISPLAY
24.	DISPLAY FUNCTION BUTTONS
25.	AUTO BEND BUTTON
26.	REVERSE BUTTON
27.	FORWARD BUTTON
28.	START BUTTON
29.	STOP CONTROL BUTTON

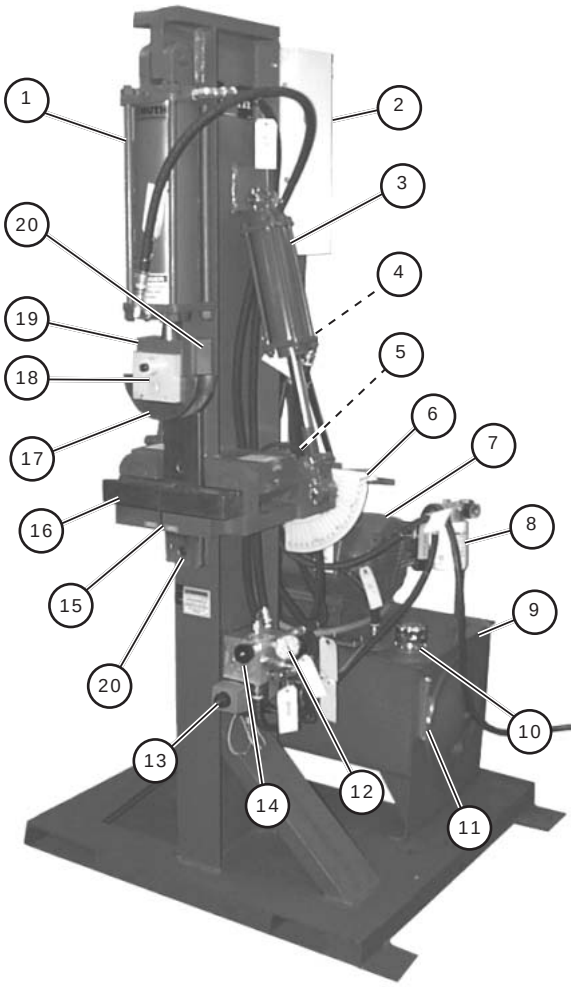
COMPONENT DESCRIPTIONS

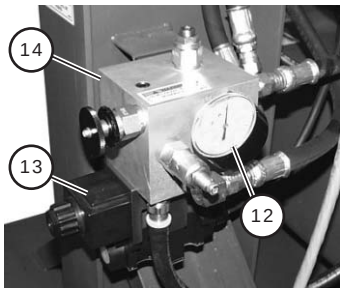
The following list of Model 3002 Vertical Bender component descriptions is keyed to the illustrations on the preceding page. Refer to diagrams to find the location of the components and read the corresponding description from this list.

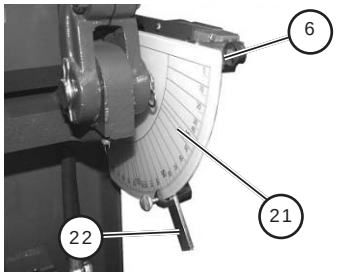
Read and understand each description. The list is not meant to provide operating instructions. To operate the bender see MODEL 3002 OPERATION.

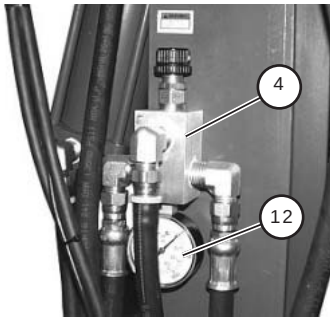
1. **MAIN CYLINDER** - 5" cylinder that controls motion of main bending die.
2. **ELECTRICAL BOX** - The box located at the back of the bender, houses the main electrical connections, controls and components.
3. **SIDE CYLINDERS** - Cylinders maintain pressure on the swing gates to form the bend.
4. **PRESSURE MANIFOLD** - The pressure manifold valve controls overall hydraulic system pressure, which can be read on the pressure gauge below the manifold.
5. **ENCODER** - This sensor signals the angle of the swing gates in degrees. The signal is sent to the ELC to indicate the amount of bend being applied to the material.
6. **HOME MICRO SWITCH** - This switch ensures the digital readout is at 0 degrees when the gates are completely closed.
7. **MOTOR** - Powers hydraulic pump to produce hydraulic pressures. Refer to motor plate for your application.
8. **HYDRAULIC OIL FILTER** - Filters hydraulic oil of bender.
9. **HYDRAULIC RESERVOIR** - The hydraulic reservoir. The temperature - sight gauge is on the right side.
10. **RESERVOIR FILLER** - Remove the filler cap to add oil to the reservoir.
11. **HYDRAULIC OIL SIGHT GAUGE** - The gauge provides a visual method of checking hydraulic oil level and temperature in the reservoir.
12. **HYDRAULIC PRESSURE GAUGE** - Measures the hydraulic pressure present.
13. **DIRECTIONAL VALVE** - Electrical solenoid valve which controls the flow of hydraulic oil to control direction of the main cylinder.
14. **SEQUENCE VALVE ADJUSTING KNOB** - The sequence valve controls pressure to both side cylinders and the valve is adjustable from 0 to 1000 PSI with the use of the adjusting knob.
    To adjust the hydraulic pressure, turn the knob and read the pressure on the adjacent pressure gauge. Normal bending pressure should be 550-600 PSI and not exceed 1000 PSI (NOTE: The pressure can only be read while in the motion of bending).
15. **SWING GATE** - Holds shoes in place while bending.
16. BACK SHOES - A clamping die used to hold the material in position while bending. **WARNING! Back shoe dies must be used with Radius Dies in the same corresponding size. WARNING! Never use the machine as a vice or a press.**
17. **RADIUS DIE** - Die allows the material to be stretched and "pulled" through the bend. Dies come in a variety of OD sizes and radii. **WARNING! Radius Die must be used with Back Shoe Die in the same corresponding size.**
18. **DIE RETAINER** - Holds the Radius die in place.
19. **SLED** - Guides main bending die. **WARNING! Do not operate or move this part without a die in position.**
20. **GUIDE PLATE** - Track that the sled rides on.
21. **MASTER POWER SWITCH** - This switch turns power OFF to the entire machine.
22. **OPERATING CONTROL STATION** - Houses operational controls on a movable pedestal.
23. **OPERATING CONTROL DISPLAY SCREEN** - This screen displays all functions of the ELC (Electronic Logic Controller).
24. **DISPLAY FUNCTION BUTTONS** - These buttons will take you directly to one of four most commonly viewed screens on the display panel.
25. **AUTO BEND BUTTON** - Depress this button to begin an auto bend cycle.
26. **REVERSE BUTTON** - Depress this button to reverse the main cylinder .
27. **FORWARD BUTTON** - Depress this button to move the main cylinder forward.
28. **START BUTTON** - Depress this button to start the electrical motor and hydraulic pump.
29. **STOP CONTROL BUTTON** - Depress this button to completely stop the motor.

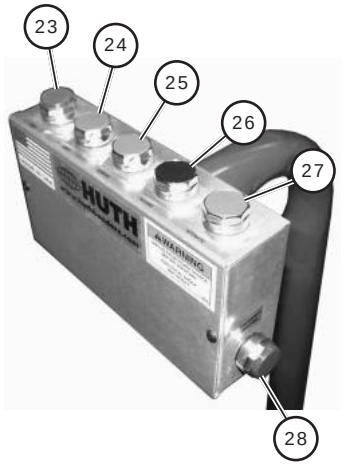
MODEL 3006
COMPONENT LOCATIONS

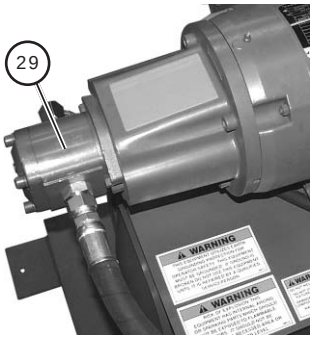


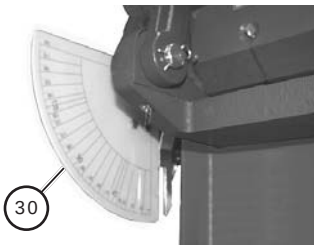












1.	MAIN CYLINDER
2.	ELECTRICAL BOX
3.	SIDE CYLINDER
4.	PRESSURE MANIFOLD
5.	HOME MICRO SWITCH
6.	AUTO DEPTH-OF-BEND SWITCH
7.	MOTOR
8.	HYDRAULIC OIL FILTER
9.	HYDRAULIC RESERVOIR
10.	RESERVOIR FILLER
11.	RESERVOIR SIGHT GAUGE
12.	HYDRAULIC PRESSURE GAUGE
13.	DIRECTIONAL VALVE
14.	SEQUENCE VALVE
15.	SWING GATE

16.	BACK SHOES
17.	RADIUS DIES
18.	DIE RETAINER
19.	SLED
20.	GUIDE PLATE
21.	AUTO DEPTH OF BEND ANGLE SCALE
22.	AUTO DEPTH OF BEND POINTER
23.	STOP BUTTON
24.	START BUTTON
25.	FORWARD BUTTON
26.	REVERSE BUTTON
27.	AUTO BEND BUTTON
28.	EMERGENCY REVERSE BUTTON
29.	HYDRAULIC PUMP
30.	MANUAL DEPTH OF BEND SCALE (LEFT SIDE)

COMPONENT DESCRIPTIONS

The following list of Model 3006 Vertical Bender component descriptions is keyed to the illustrations on the preceding page. Refer to diagrams to find the location of the components and read the corresponding description from this list.

Read and understand each description. The list is not meant to provide operating instructions. To operate the bender see MODEL 3006 OPERATION.

1. **MAIN CYLINDER** - 5" cylinder that controls motion of main bending die.
2. **ELECTRICAL BOX** - The box located at the back of the bender, houses the main electrical connections, controls and components.
3. **SIDE CYLINDERS** - Cylinders maintain pressure on the swing gates to form the bend.
4. **PRESSURE MANIFOLD** - The pressure manifold valve controls overall hydraulic system pressure, which can be read on the pressure gauge below the manifold.
5. **HOME MICRO SWITCH** - This switch ensures 0 degrees when the gates are completely closed and activates the automatic home stop position in an auto bend cycle.
6. **AUTO DEPTH-OF-BEND SWITCH** - The switch reverses motion of the cylinders when the preset bending angle is achieved.
7. **MOTOR** - Powers hydraulic pump to produce hydraulic pressures. Refer to motor plate for your application.
8. **HYDRAULIC OIL FILTER** - Filters hydraulic oil of bender.
9. **HYDRAULIC RESERVOIR** - The hydraulic reservoir. The temperature - sight gauge is on the right side.
10. **RESERVOIR FILLER** - Remove the filler cap to add oil to the reservoir.
11. **HYDRAULIC OIL SIGHT GAUGE** - The gauge provides a visual method of checking hydraulic oil level and temperature in the reservoir.
12. **HYDRAULIC PRESSURE GAUGE** - Measures the hydraulic pressure present.
13. **DIRECTIONAL VALVE** - Electrical solenoid valve which controls the flow of hydraulic oil to control both speed and direction of the main cylinder.
14. **SEQUENCE VALVE ADJUSTING KNOB** - The sequence valve controls pressure to both side cylinders and the valve is adjustable from 0 to 1000 PSI with the use of the adjusting knob.
    To adjust the hydraulic pressure, turn the knob and read the pressure on the adjacent pressure gauge (12). Normal bending pressure should be 550-600 PSI and not exceed 1000 PSI (NOTE: The pressure can only be read while in the motion of bending).
15. **SWING GATE** - Holds shoes in place while bending.
16. **BACK SHOES** - A clamping die used to hold the material in position while bending. **WARNING! Back shoe dies must be used with Radius Dies in the same corresponding size. WARNING! Never use the machine as a vice or a press.**
17. **RADIUS DIE** - Die allows the material to be stretched and "pulled" through the bend. Dies come in a variety of OD sizes and radii. **WARNING! Radius Die must be used with Back Shoe Die in the same corresponding size.**
18. **DIE RETAINER** - Holds the Radius die in place.
19. **SLED** - Guides main bending die. **WARNING! Do not operate or move this part without a die in position.**
20. **GUIDE PLATE** - Track that the sled rides on.
21. **AUTO DEPTH OF BEND SCALE** - This is a protractor used to set the depth-of-bend angle.
22. **AUTO DEPTH-OF-BEND POINTER** - This is used to select the desired degree of bend and is the automatic stop device that ensures accurate bends. As the machine is bending, the arm engages a limit switch that switches the bender to a reverse operation.
23. **STOP CONTROL BUTTON** - Depress this button to completely stop the motor.
24. **START BUTTON** - Depress this button to start the electrical motor and hydraulic pump.
25. **FORWARD BUTTON** - Depress this button to manually start forward motion of the main cylinder. When using this control button, the auto depth-of-bend handle should be moved to the 180° setting to avoid damaging the automatic stop. Use of this control button will override the auto stop and force its adjustment lever around the scale, causing potential damage to the switch.
26. **REVERSE BUTTON** - Depress this button to manually reverse the main cylinder.
27. **AUTO BEND BUTTON** - Depress this button to cycle the bender automatically through the forward and reverse motion of the main cylinder. When using the auto control function, move the depth-of-bend pointer handle to the degree of bend desired and then press the button. The depth-of-bend handle must be moved from the 0° position or this button will not cause the bender to operate.
28. **EMERGENCY REVERSE** - Depress this button to reverse the forward motion of the main cylinder and return it to its original position.
29. **HYDRAULIC PUMP** - Provides hydraulic pressure to operate the main and side cylinders.
30. **MANUAL DEPTH-OF-BEND SCALE** - This protractor is used to read the angle of bend while manually bending material.

BENDING TOOLS

Three types of tools are used to bend tubing:

1. RADIUS DIES
2. BACK SHOES (1 Pair)
3. HALF SHOES or THREE-QUARTER SHOES

All of the tools listed are called Bending Dies. These dies allow the tubing to be stretched and pulled through the bend. Each die is machined and sized according to the outer dimensions of round or square tubing it will be used with. The sizing is stamped on the surface of the dies. The dies come in a variety of O.D. sizes and radii, for example:

1. 3-1/2" radius = 7" Diameter Bend
2. 5" radius = 10" Diameter Bend

NOTE:

The dies are made of hardened steel, but care should still be given to avoid damaging them.

The dies perform better if they are lightly oiled and are free from flaws and foreign material.

Huth has a wide variety of tooling available as well as the ability to manufacture custom tooling to fit your needs. Visit ***www.huthbenders.com*** for complete product details.

DANGER

If obtaining tooling from some source other than Huth, It is your responsibility to use tooling that:

- **Does not pose a threat of harm or injury to personnel**
- **Cause damage to the bender**
- **Change the benders operating characteristics**
- **Are designed and manufactured using sound engineering practices.**

Improper tooling may void warranty.

RADIUS DIE

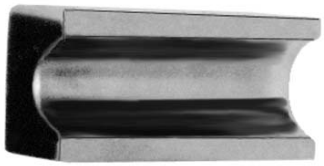
Radius Dies are used to produce the inside radius on the tubing that is being bent. The dies are available in 3-1/2", 4" and 5" center line radii, and a variety of tubing dimensions. The dies are sold separately in combinations with the back shoe dies.

WARNING

Radius Dies are heavy - Handle them with care.

Radius Dies must be used with Back Shoe Dies in the same corresponding size.

BACK SHOES



Back Shoes mount to the swing gates. These dies are used to clamp the tubing into position while bending and they form the outside radius of the tubing that is being bent. The dies are available in a variety of tubing dimension. The dies are sold separately in combinations with the Radius Dies.

WARNING

Back shoe dies must be used with Radius Dies with the same corresponding size.

Never use the machine with or without the Back Shoe Dies in position as a vice or a press.

HALF SHOE AND THREE-QUARTER SHOE DIES

Half Shoe and Three-Quarter Shoe Dies mount to the swing gates. The Half Shoe Dies are exactly ½ the size of a Back Shoe Die. The Three-Quarter Shoe Dies are exactly ¾ the size of a Back Shoe Die. These dies are used only when one bend is less than ten inches from the previous bend. Its position is always on the same side as the last bend; normally, this will be on the left side.

The dies are available in a variety of tubing dimensions. The dies are sold separately in combinations with the Radius Dies.

WARNING

Half Shoe Dies and Three-Quarter Shoe Dies must be used with Radius Dies with the same corresponding size.

4. DESIGN BENDING

INTRODUCTION

Design bending is the process of manufacturing a prototype or sample part for the first time. Because this part has never been produced before, it is exceedingly important to perform this operation using an experienced operator exercising care and caution during the initial bend process.

IMPORTANT:

DO NOT use the auto-bend function of the machine for any initial operation.

The part may be made with the use of a blue print or by using an existing part as a master. After you have determined and selected die sizes and have installed them into the machine, there are three basic elements to consider.

- Measurement to center line of bend
- Rotation- stated in degrees (change of plane).
- Depth-of-Bend - stated in degrees.

It is also recommended that you document the basic information on the part you create. To repeat the part you are designing, it is recommended the following information be recorded:

- Part number
- Type, Size and Dimensions of material
- Measurement to center of each bend
- Bend Angle of each bend
- Rotation of each bend
- Tooling used
- Remarks (tooling changes, setup information, critical dimensions, etc.)

When recording the bend data for a prototype or pattern bent part, a Huth Program Card or similar form can assist in recording the data.

The Huth Program Card (shown below) can easily record the data listed above.

WARNING

DO NOT start or run the pump while setting up a bending operation.

DO NOT operate the ram without having a matched set of bending dies and back shoes properly in place.

WARNING

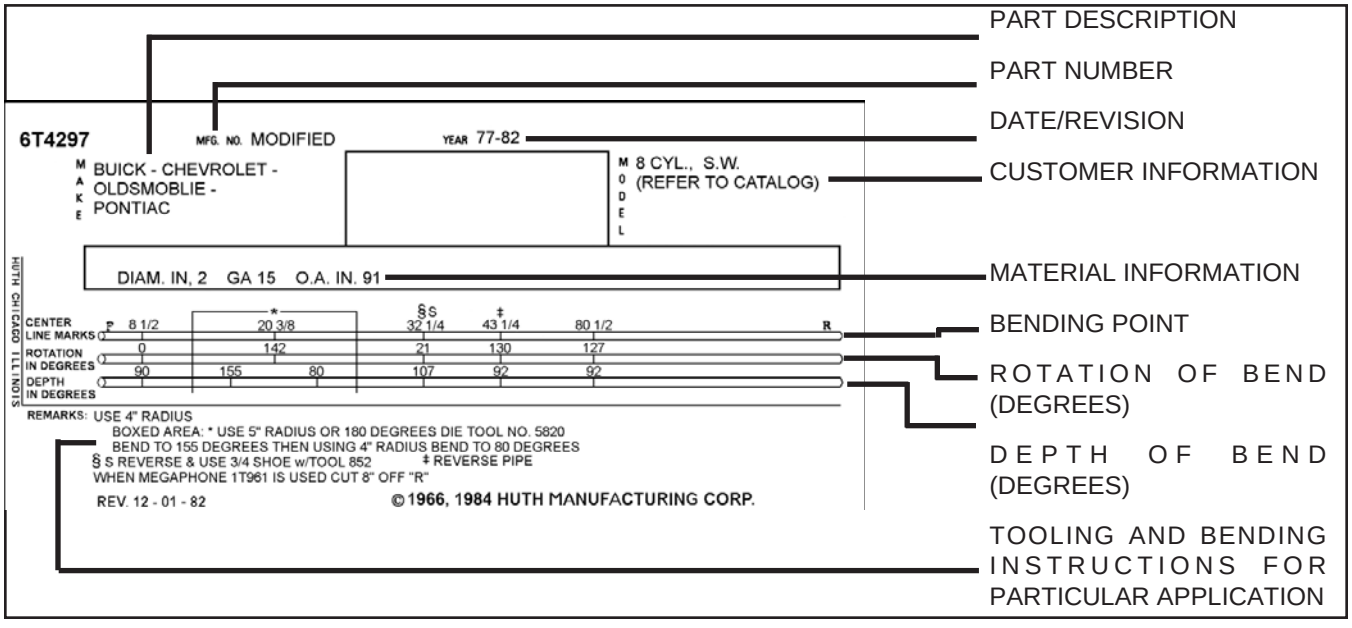
There must be a "SAFETY CIRCLE OF SWING" around the bender. There must be adequate space on each side and above the bender so material will not encounter any interference during the bend.

Once the area has been cleared for bending. Secure your operation area. No one may be allowed to entire the area once the bender has been started.

The Control Pedestal should be positioned at a distance so that the operation controls and bending dies can not be reached simultaneously.

WARNING

Never Design bend at full speed. Injury or damage may occur if a bend has been miscalculated. Jog the FORWARD button and verify the material will not encounter any interference during the bend as well as to control the speed of swing of the material.



SET UP

DANGER!

If obtaining tooling from some source other than Huth Manufacturing, It is your responsibility to use tooling that:

- Does not pose a threat of harm or injury to personnel
- Cause damage to the bender
- Change the benders operating characteristics
- Are designed and manufactured using sound engineering practices.

Improper tooling may void warranty.

Tooling and/or fixtures used with this machine must not interfere with or alter the effects of the guards and shields.

1. Press the Red mushroom cap button in to the locked OFF position.
2. Install the proper tooling for the job to be performed.

WARNING

There must be a "SAFETY CIRCLE OF SWING" around the bender. There must be adequate space on each side and above the bender so material will not encounter any interference during the bend.

WARNING

Once the area has been cleared for bending. Secure your operation area. No one may be allowed to entire the area once the bender has been started.

The Control Pedestal should be positioned at a distance so that the operation controls and bending dies can not be reached simultaneously.

3. Position any fixtures, gauges and material that will be used during the operation of the bending job.
4. Secure the area around the bender were the material will swing as well as the area the operator will be working within.

WARNING

Never Design bend at full speed. Injury or damage may occur if a bend has been miscalculated. Use the FORWARD button and verify the material will not encounter any interference during the bend as well as to control the speed of swing of the material.

5. Set the sequence valve pressure as needed to perform the bending operation. See "SEQUENCE VALVE PRESSURE SETTING" on page 32.

DESIGN BENDING FROM A PRINT

With the set up complete and the area secured, proceed with the following steps to produce the part:

1. Manually bend the part using the FORWARD button.
2. Wipe material to remove excess oil.
3. From the left end of the material, mark off the dimension with a felt tip pen where each bend is to be made. Make your marks heavy and at least halfway around the material. The last mark you will make on the material is the final cutoff or overall length.

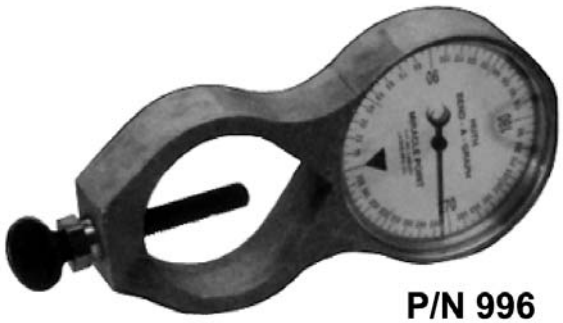
NOTE:

Do not cut the material until after the final bend is made.

4. Twist the Red mushroom cap slightly clockwise to reset the switch and press the green button to turn bender pump ON.
5. Position the tubing in the dies so that the greater part of the tubing is extending out of the right side of the bender and it is positioned on the first mark. Center the mark between back shoes.

NOTE:

These bending instructions are always done by feeding the pipe from the right side of the bender to the left side.



P/N 996

6. If being used, place the rotation dial on the extreme right end of the tubing, at least 12 inches from the final bend, with the numbered side facing the bender. Rotate the dial until the indicator points to zero and secure the dial. The first bend is always 0 degrees.

NOTE:

Do not remove the rotation dial until all bends are completed.

7. Press the FORWARD button to manually move the main cylinder forward to the desired amount of bend.
   - MODEL 3002: The BEND ANGLE INDICATOR on the control panel will provide a readout of the amount of bend being applied.
   - MODEL 3006: The Depth of Bend Plate on the left side will provide a readout of the amount of bend being applied.

8. Press the REVERSE button to retract the main cylinder.
9. Verify the bend data after each bend.
10. Reposition the material so that the second mark is centered between the back shoes. Rotate the material as needed using the rotation dial to indicate the amount of rotation.
11. Press the FORWARD button to manually move the main cylinder forward to the desired amount of bend.
    - MODEL 3002: The BEND ANGLE INDICATOR on the control panel will provide a readout of the amount bend being applied.
    - MODEL 3006: The Depth of Bend Plate will provide a readout of the amount bend being applied.
12. Press the REVERSE button to retract the main cylinder.
13. Repeat steps 10 - 12 for each successive bend.

DESIGN BENDING FROM A PATTERN

With the set up complete and the area secured, proceed with the following steps to produce the part:

1. Manually bend the part using the FORWARD button.
2. Twist the Red mushroom cap slightly clockwise to reset the switch and press the green button to turn bender pump ON.
3. Wipe material clean, then place the new material in the bender with the greater portion of the tubing protruding out the right side of the bender.

NOTE:

These bending instructions are always done by feeding the pipe from the right side of the bender to the left side.

4. Place the master pattern in front of the back shoes so that the first bend is centered between the shoes.
5. Adjust the new material out the left side of the bender so it matches in length with the master pattern. Use the FORWARD button to secure the new material.
6. Measure the distance from the end of the tubing to the center of the back shoes. This is the measurement to the first bend and should be recorded as the first line of data for the “FIRST BEND”.

NOTE:

Do not remove the rotation dial until all bends are completed.

7. If being used, place the rotation dial over the far right end of the tubing so the numbered side faces the bender. Secure it in place when the indicator points to zero degrees. This reading is the rotation of the tubing for each particular bend and should be recorded as the second line of data for the “FIRST BEND”. The first bend is always 0 degrees.
8. You are now ready to make your first bend. Using the FORWARD button, while holding the first bend of the master pattern in front of the back shoes. Gradually extend the ram, opening the back shoes. Continue bending until the back shoes are parallel or open flush with the first bend of the master pattern.
9. Look at the BEND ANGLE INDICATOR. This is the depth of the first bend. Record this degree reading as the third line of data for the “FIRST BEND”.
10. Release the material and feed it to the left through the dies. Place the pattern in front of the back shoes. Line up the center of the second bend of the master pattern with the center of the back shoes. Be sure that the bend of the master pattern lies flat against the front of the dies.
11. Line up the first bend of the new material with the first bend of the pattern and rotate the new material until it lies parallel with the master pattern. Be sure the pattern lies flat in front of the dies with the bend centered. Use the FORWARD button to secure the new material.

12. Your second bend is now correctly located. The measurement for the second bend should now be taken. Since bent material is difficult to measure, it is best to measure from the center of the first bend (between the back shoe dies marks) to the center of the second bend (between the back shoes). This measurement is added to the measurement of the first bend and recorded as the first line of data for the “SECOND BEND”.

13. Look at the rotation dial and take the reading of the material rotation for the second bend. This reading is recorded as the second line of data for the “SECOND BEND”.

14. You are ready to make the second bend. Using the FORWARD button, while holding the second bend of the master pattern in front of the back shoes. Gradually extend the ram, opening the back shoes. Continue bending until the back shoes are parallel or open flush with the second bend of the master pattern.

15. Look at the BEND ANGLE INDICATOR on the Model 3002 control panel or the Model 3006 Depth of Bend Plate. This is the depth of the second bend. Record this degree reading as the third line of data for the “SECOND BEND”.

16. Repeat steps 10 - 15 until all the bends needed have been performed and documented. When all the bends are completed, measure the cutoff length and record this information.

5. VERTICAL BENDER OPERATION

MODEL 3002 SCREEN DISPLAYS

Read this section of the manual carefully before attempting any operation of this unit.

The Model 3002 provides a Electronic Logic Controller (ELC) package allowing for the storage, recall and execution of bend data. It also allows you to choose between manual and programmed bending.

The Electronic Logic Controller (ELC) package is user-friendly; buttons on the touch screen display are used to change displayed pages and enter all information required while programing bend data into the system.

Buttons appear on all control screen pages that allow you instant access to additional page instructions or to return to the general TABLE OF CONTENTS page.

After reading this section, become familiar with all the screen functions. Practice all screen operations with the bender electrical motor and hydraulic pump turned off. Once all control operation is understood, install a set of bending dies and back shoes and perform a few “dry runs” before actually bending material.

When you are ready to practice on actual material, refer to the MODEL 3002 OPERATION section in this manual for additional instruction.

NOTE:

This will be the ONLY time you should operate the bender without material loaded in it for bending.

CAUTION

DO NOT start or run the pump while setting up and programming the controls.

DO NOT operate the ram without having a matched set of bending dies and back shoes properly in place.

OPERATING CONTROL STATION

The operator control station is ON whenever the master power switch (on the electrical box on the rear of the bender) is on. The control station houses the touch screen where multiple screen displays (pages) are used to program and operate the ELC package.

IMPORTANT:

DO NOT use any sharp or pointed tools when pressing the buttons on the touch screen.

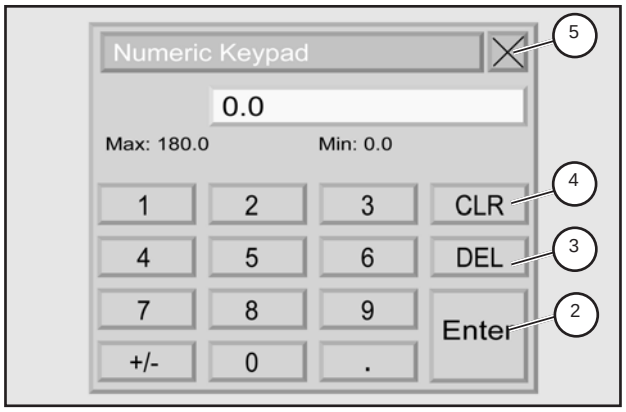
A vertical series of buttons are located on the right side of the display screen. These buttons call specific screens (pages) to the display and are outlined in detail later in this manual. They include (from the top):

- F1 - Opens the HUTH BENDER Page
- F2 - Opens the LIBRARY RUN Page
- F3 - Opens the PROTOTYPE BEND Page
- F4 - Opens the LIBRARY Page
- SYS - There are no current functions assigned to the button.

When the system is initially turned ON, press the appropriate F* button for the page desired or press any F button, followed by the TABLE OF CONTENTS button, to view the system Table of Content page.

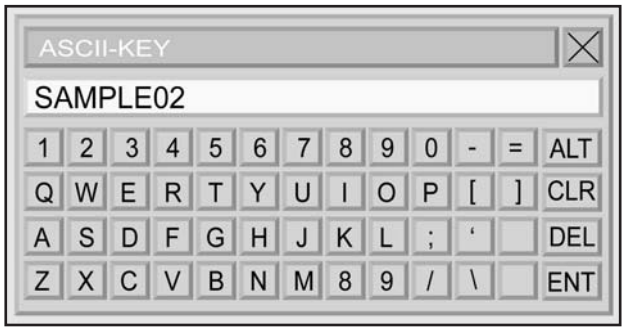
ENTERING DATA INTO THE ELC SYSTEM

Many of the system screens (pages) require the entry of data. Whenever numeric data is required, a keypad window will open on the screen.



Enter the numeric data as required. Press Enter (2) to load the data, DEL (3) to backspace, CLR (4) to clear your entry and X (5) to close the keypad window without saving the entry.

Whenever a text entry is required, a QWERTY style keyboard will open on the screen. All customary letters, numbers and special characters can be used when creating a part numbers for this systems library.

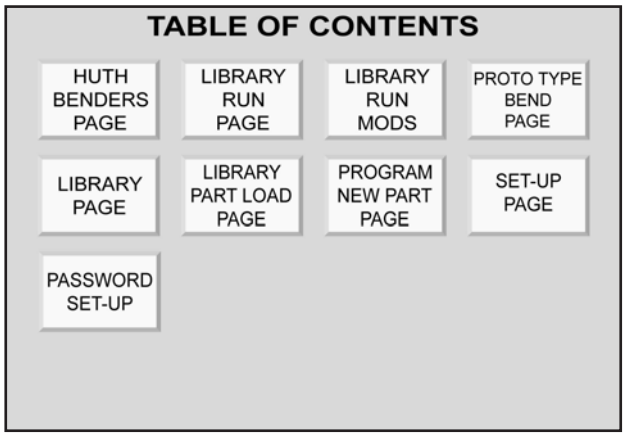


Using the ALT button on the keyboard will open a second view of the keyboard where lower case letters and additional characters are available.

When the text is complete, press the ENT button to save the entry.

TABLE OF CONTENTS PAGE

Pressing the TABLE OF CONTENTS button available on all control pages brings this nine button page to view.

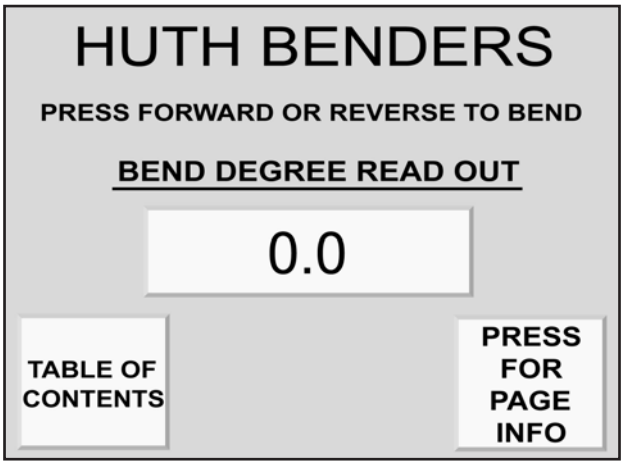


From the upper left, these buttons include:

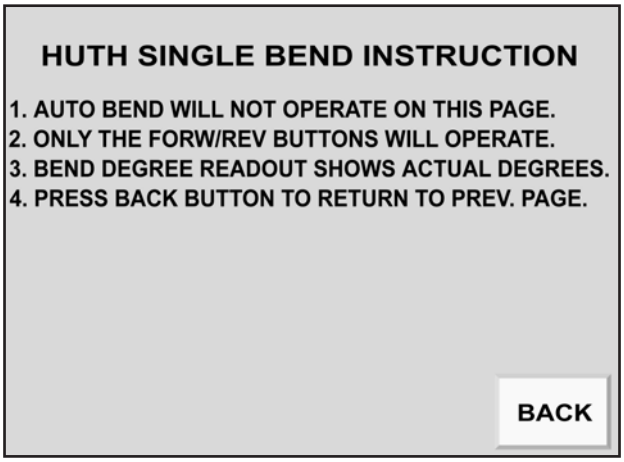
- **HUTH BENDER PAGE** - Manual (single) bend operations.
- **LIBRARY RUN PAGE** - Shows bend specifications for part number selected from library and shows the position of the next bend operation for this part.
- **LIBRARY RUN MODS** - Temporary changes to bend specifications for a part in the library can be performed here.
- **PROTOTYPE BEND PAGE** - Allows an auto bend stepped procedure to a part that is not in the current library.
- **LIBRARY PAGE** - Shows the contents of the system library by part number, 27 numbers at a time.
- **LIBRARY PART LOAD PAGE** - A part number from the library can be loaded into the system, or deleted from the system, from this page.
- **PROGRAM NEW PART NUMBER** - New part numbers and bend specifications are added to the library from selections on this page.
- **SET-UP PAGE** - Default bender parameters for Offset Angles and Time Past Home can be adjusted on this page.
- **PASSWORD SET-UP** - There are no user functions presently available on this page. It is used by the factory should field adjustments or modifications to the ELC ever be required.

HUTH BENDER PAGE

This page displays the degree of bend of a single piece during a manual bend operation using the FORWARD and REVERSE buttons on the operating control station.

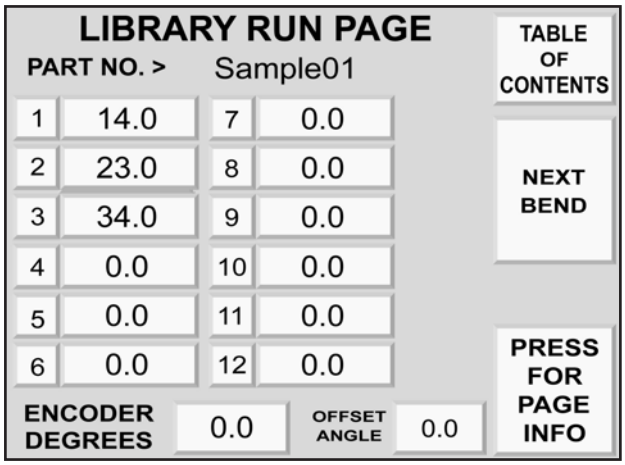


The TABLE OF CONTENTS button on this page is used to access the system Table of Contents page (described earlier). The PRESS FOR PAGE INFO button brings the specific instructions for this page to view (See below).

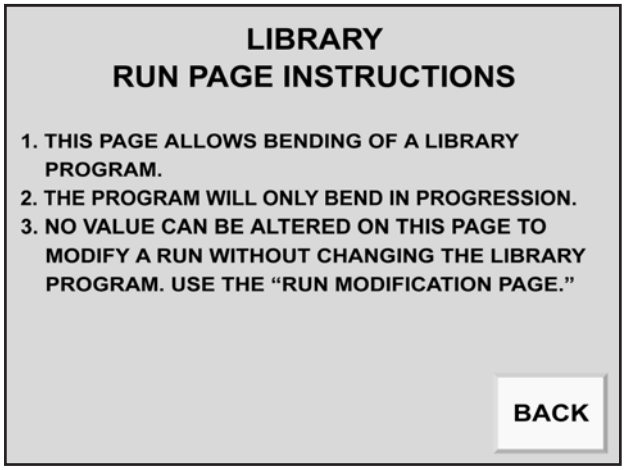


LIBRARY RUN PAGE

Whenever a part number from the library is loaded into the system, this page displays the bend specifications for the part and shows the position of the next bend operation on the part.

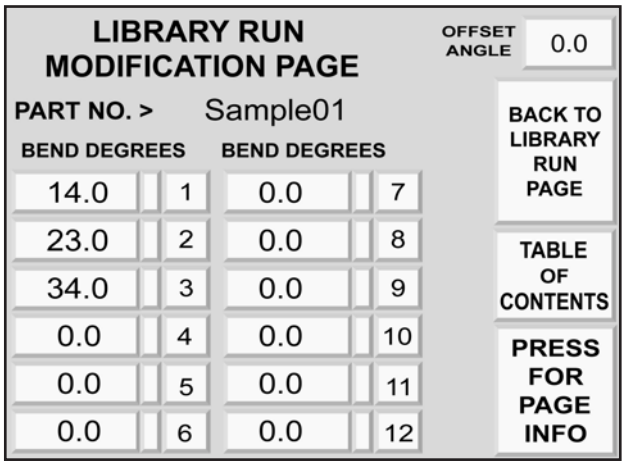


The TABLE OF CONTENTS button on this page is used to access the system Table of Contents page (described earlier). The PRESS FOR PAGE INFO button brings the specific instructions for this page to view (See below).

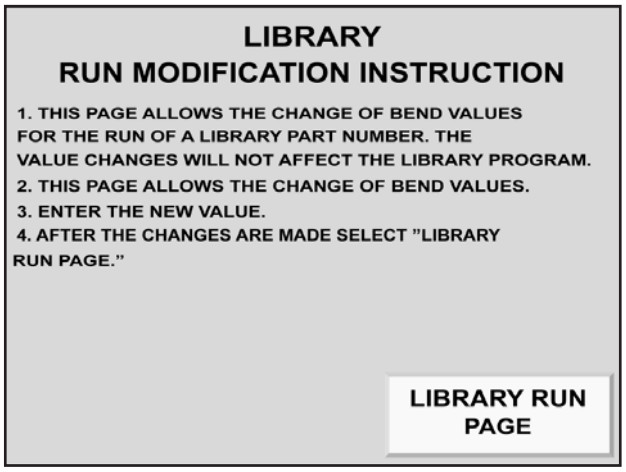


LIBRARY RUN MODIFICATION PAGE

Permanent changes cannot be made to bend specifications of parts residing in the system library. Temporary changes can be made that will allow a custom piece or run of pieces to be bent, but these changes will not be saved to the part specifications file when the bend operations are completed.

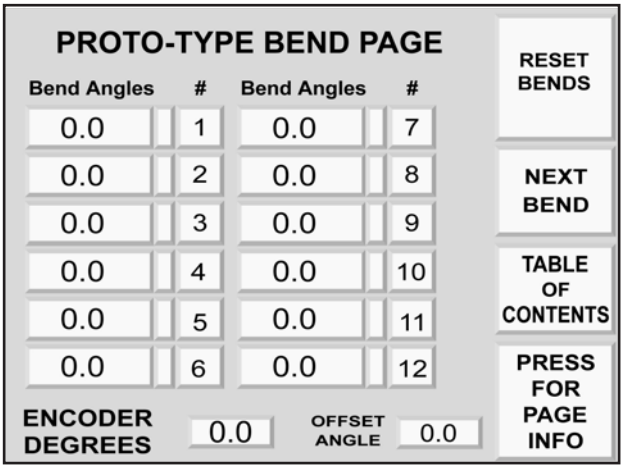


The TABLE OF CONTENTS button on this page is used to access the system Table of Contents page (described earlier). The PRESS FOR PAGE INFO button brings the specific instructions for this page to view (See below).

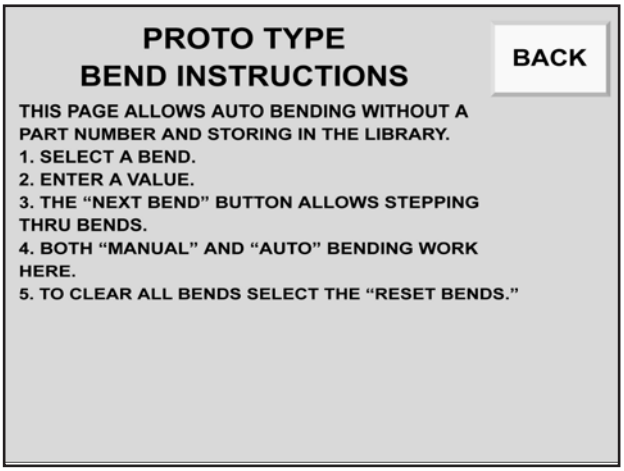


PROTOTYPE BEND PAGE

It may be occasionally necessary to prototype a part or create a one-of-a-kind sample without a need to add the part to the system library. The specifications for each bend are entered on this page, using a numeric keypad that will open when the button for the individual bend number is depressed.

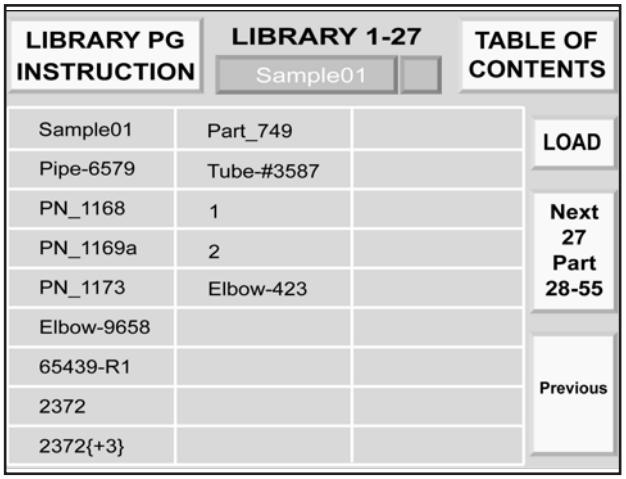


The TABLE OF CONTENTS button on this page is used to access the system Table of Contents page (described earlier). The PRESS FOR PAGE INFO button brings the specific instructions for this page to view (See below).

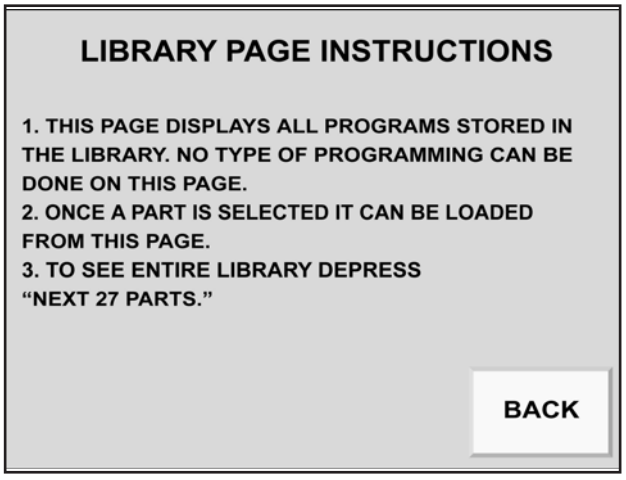


LIBRARY PAGE

The contents on the system library are displayed on this page and are shown in blocks of 27 numbers. Once selected, the part number (with bend specifications) can be loaded into the system.

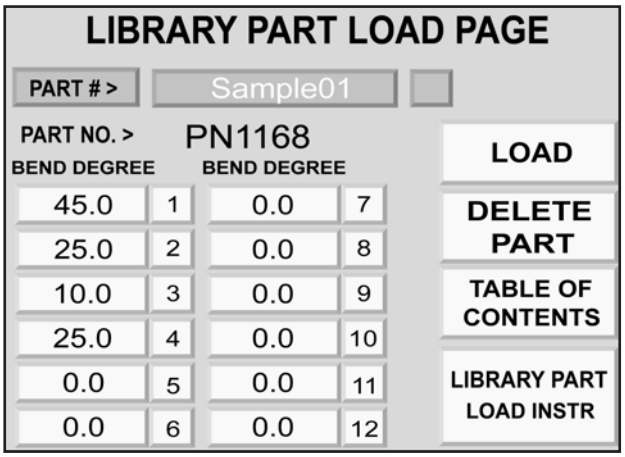


The TABLE OF CONTENTS button on this page is used to access the system Table of Contents page (described earlier). The LIBRARY PG INSTRUCTION button brings the specific instructions for this page to view (See below).



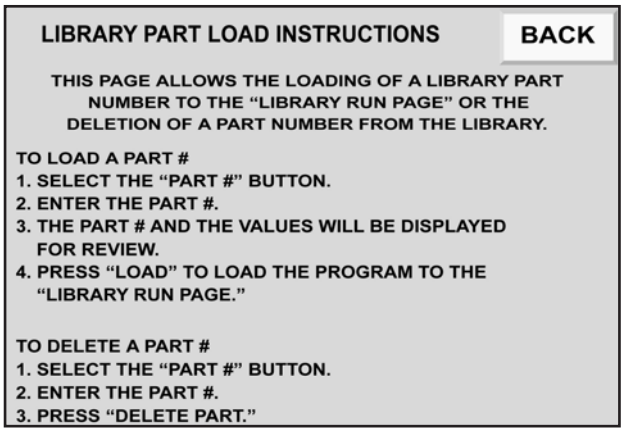
LIBRARY PART LOAD PAGE

A part number from the library can be loaded into or deleted from the system from this page.



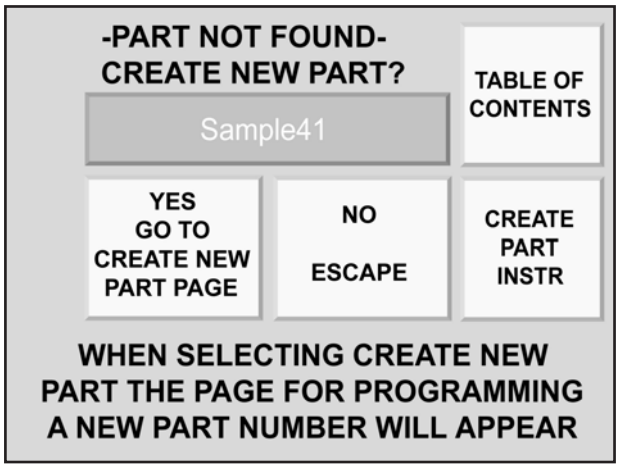
If the DELETE PART button is pressed, a LIBRARY PART DELETE PAGE is opened to request a secondary confirmation before completing the delete operation.

The TABLE OF CONTENTS button on the LIBRARY PART LOAD PAGE is used to access the system Table of Contents page (described earlier). The LIBRARY PART LOAD INSTR button brings the specific instructions for this page to view (See below).

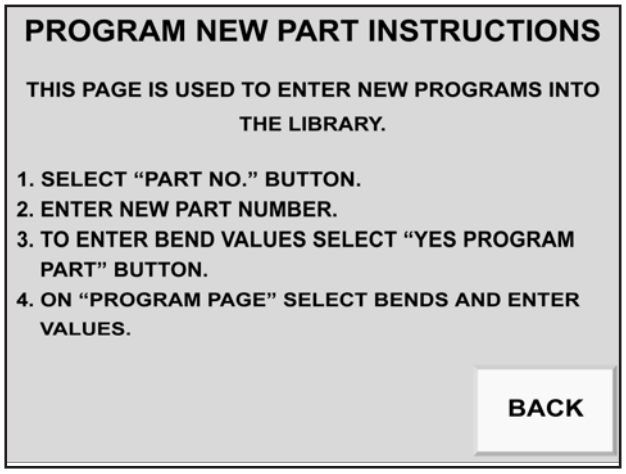


PART NOT FOUND PAGE

Whenever prompted to enter a text based part number in a window, and the number entered does not match any existing number in the library, this window will appear. The operator will be given the opportunity to create the new part number and store it in the library.

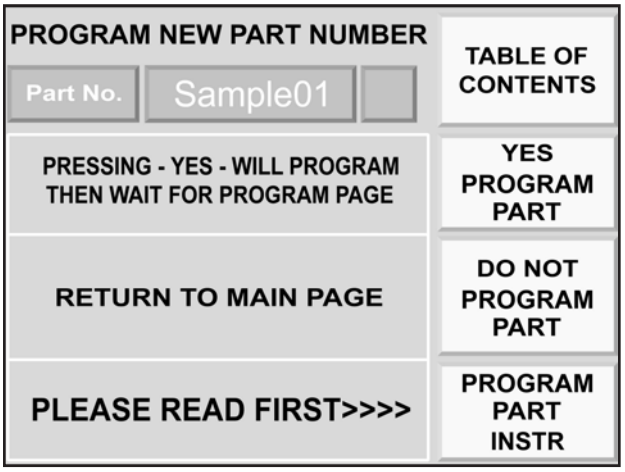


The TABLE OF CONTENTS button on this page is used to access the system Table of Contents page (described earlier). The CREATE PART INSTR button brings the specific instructions for the PROGRAM NEW PART NUMBER page to view (See below and next column).

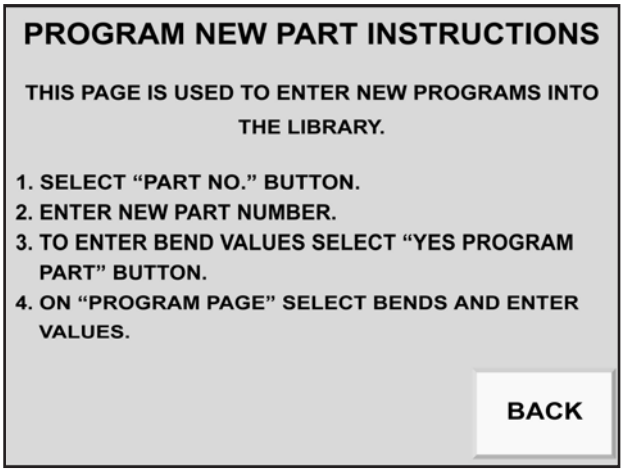


PROGRAM NEW PART NUMBER PAGE

New part numbers with bend specifications can be added to the system library using the YES PROGRAM PART button on this page. When this button is pressed, the PROGRAM PAGE screen (See next column) will appear.

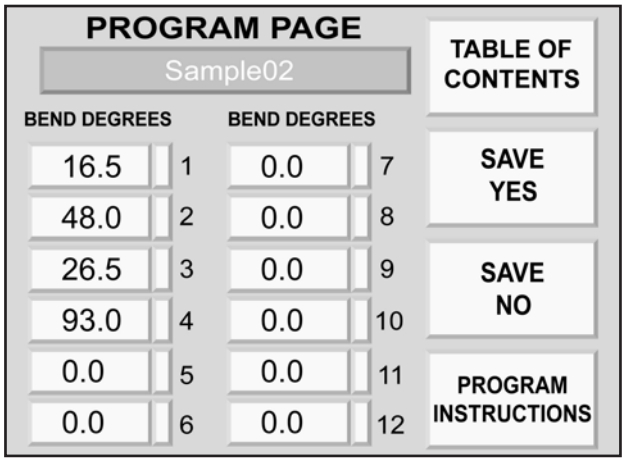


The TABLE OF CONTENTS button on this page is used to access the system Table of Contents page (described earlier). The PROGRAM PART INSTR button brings the specific instructions for this page to view (See below).

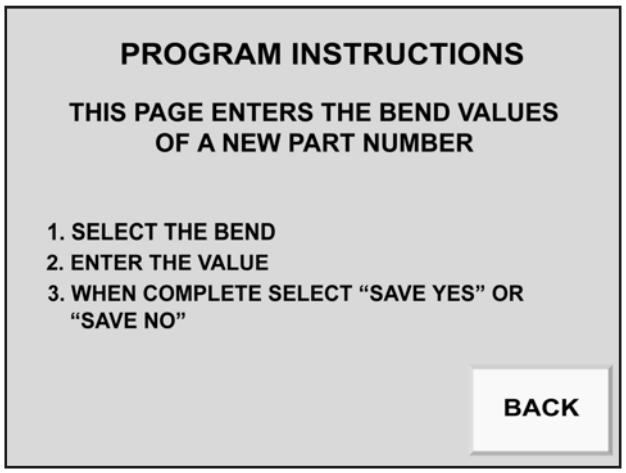


PROGRAM PAGE

New part numbers with bend specifications are added to the system library using this page.

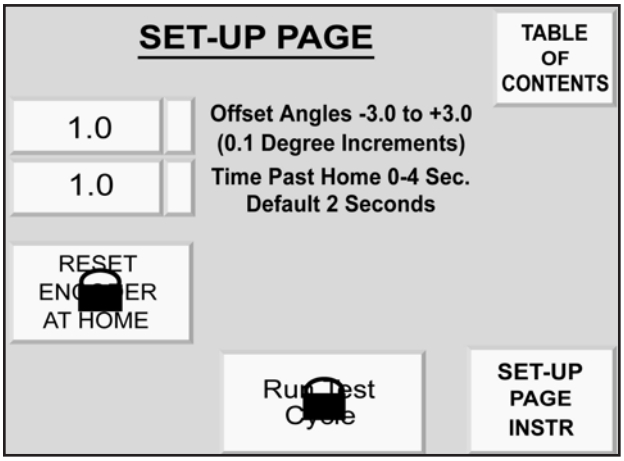


The TABLE OF CONTENTS button on this page is used to access the system Table of Contents page (described earlier). The PROGRAM INSTRUCTIONS button brings the specific instructions for this page to view (See below).

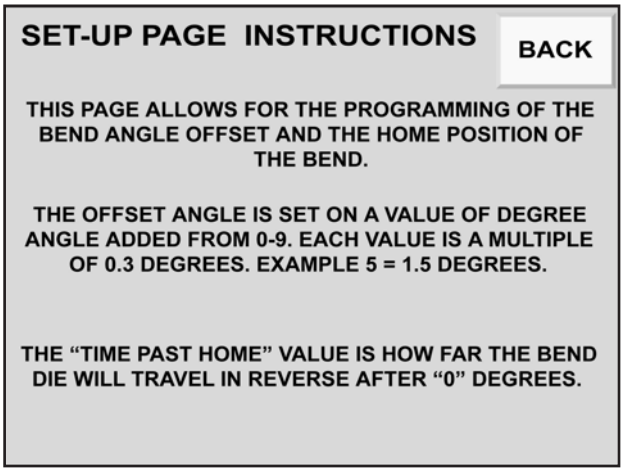


SET-UP PAGE

Default bender parameters for Offset Angles and Time Past Home can be adjusted on this page. Items covered by a padlock outline are locked, and cannot be adjusted.

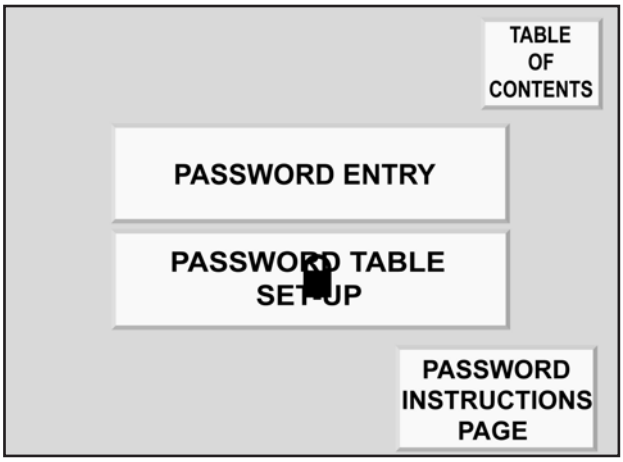


The TABLE OF CONTENTS button on this page is used to access the system Table of Contents page (described earlier). The SET-UP PAGE INSTR button brings the specific instructions for this page to view (See below).



PASSWORD SET-UP PAGE

There are no user functions presently available on this page. It is used by the factory should field adjustments or modifications to the ELC ever be required.



MODEL 3002 OPERATION

SYSTEM START UP

The Control Station has power and can be programmed whenever the power supply cord is plugged in to the appropriate AC power source and the Main power switch on the Electrical Box is turned ON.

WARNING

Always setup and program the Operating Controls with the pump OFF.

There must be a "SAFETY CIRCLE OF SWING" around the bender. There must be adequate space on each side and above the bender so material will not encounter any interference during the bend.

Once the area has been cleared for bending. Secure your operation area. No one may be allowed to enter the area once the bender has been started.

ALL operators must read and understand ALL safety warnings and procedures before operating this machine.

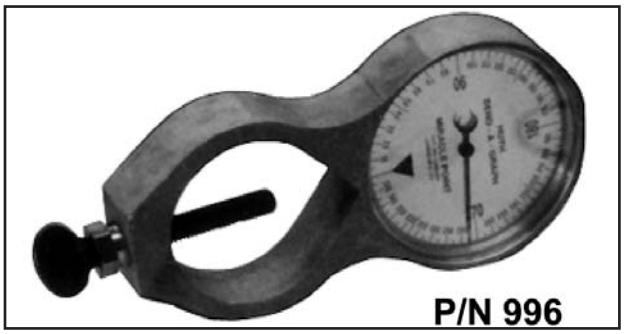
MANUAL BENDING

Bending material without programming bend data is considered Manual Bending. Manual bending is generally performed for sample or prototype material. Each bend is performed using the FORWARD and REVERSE buttons on the Operating Control Station. It is recommended that you record the bend data for the part that you create to verify the original data or plan to repeat the bending operation.

1. Install the proper tooling for the job to be performed. Visit ***www.huthbenders.com*** for complete tooling product details.
2. Position any fixtures, gauges and material that will be used during the operation of the bending job.
3. Secure the area around the bender were the material will swing as well as the area the operator will be working within.
4. Set the sequence valve pressure as needed to perform the bending operation. See "SEQUENCE VALVE PRESSURE SETTING" on page 32.
5. Select straight tubing of the required O.D. size and sufficient length (12" longer than the cut-off point).
6. Wipe tubing to remove excess oil. Place tubing in bender between back shoes and radius die with the greater portion of the tubing extending out the LEFT side of the bender.
7. Rotate tubing so the seam line is facing out. This provides a starting reference point for the rotation dial.
8. Press bender START button to turn motor and hydraulic pump on.
9. Jog the FORWARD button as required to firmly clamp the pipe in the dies.
10. Mark additional bend points on the pipe as indicated by the program cards or as otherwise required to indicate all of the bend locations and final cutoff length.

NOTE:
Do not cut the tubing to final length until the last bend has been made.

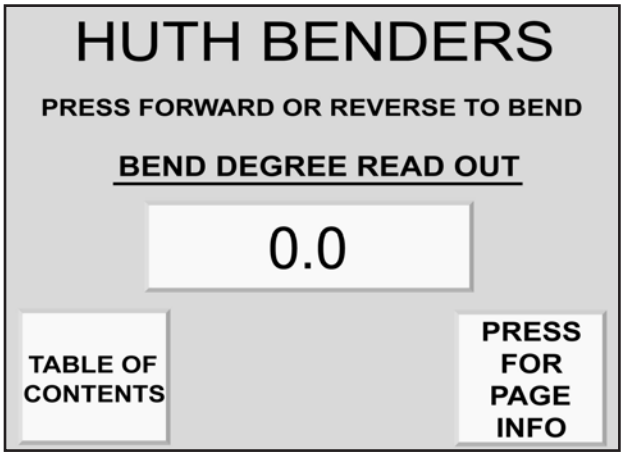
11. Reposition the tubing in the dies so that the greater length of the tube extends out the RIGHT side of the bender. Center the first bend mark between the backshoes and engage the dies until the tube is held firmly in place.



12. Place the rotation dial on the extreme RIGHT end of the tubing, at least 12" from the end of the tube, with the numbered side facing the bender. Rotate the dial until the indicator points to zero and secure the dial. The first bend always begins with the dial at 0 degrees.

NOTE:
Do not remove the rotation dial until all bends are completed.

13. Select the "Huth Bender" page (F1) on the control station to view the manual bend readout.



14. Press the FORWARD (1) button **on the control station** to manually bend the material until the desired degree of bend is indicated on the display.

15. Press the REVERSE (2) button **to** retract the main cylinder
16. Verify the bend data after each bend.
17. Reposition the material as required and repeat the previous steps for each successive bend.
18. Remove the rotation dial.
19. The tube can now be cut to its final length and removed from the bender.

AUTOMATIC BENDING WITHOUT A PART NUMBER IN THE LIBRARY

WARNING

Always setup and program the Operating Controls with the pump OFF.

There must be a "SAFETY CIRCLE OF SWING" around the bender. There must be adequate space on each side and above the bender so material will not encounter any interference during the bend.

Once the area has been cleared for bending. Secure your operation area. No one may be allowed to enter the area once the bender has been started.

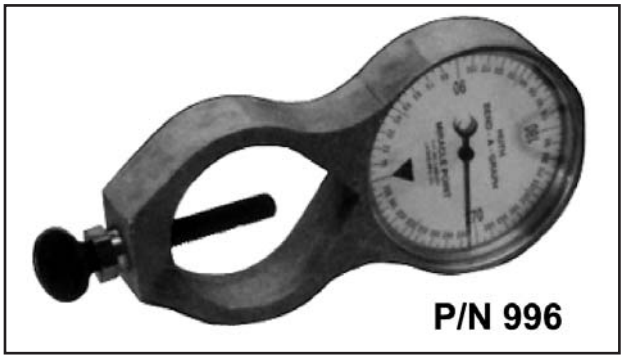
Never bend the first piece with new or changed bend data or unfamiliar material in Auto Bend Cycle. Injury or damage may occur if a bend has been miscalculated.

Use the FORWARD button and verify the material will not encounter any interference during the bend.

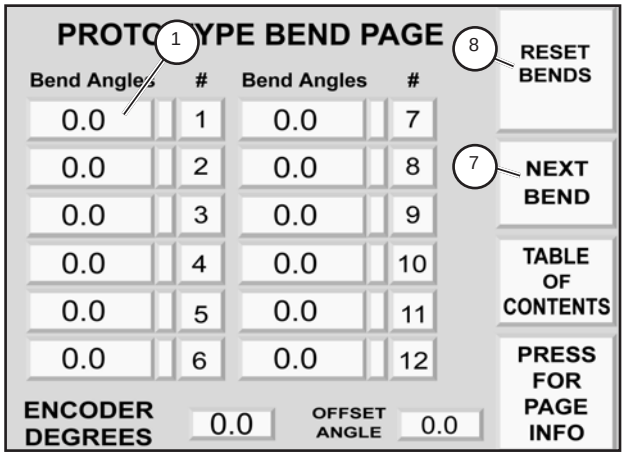
ALL operators must read and understand ALL safety warnings and procedures before operating this machine.

The Control Pedestal should be positioned at a distance so that the operation controls and bending dies can not be reached simultaneously.

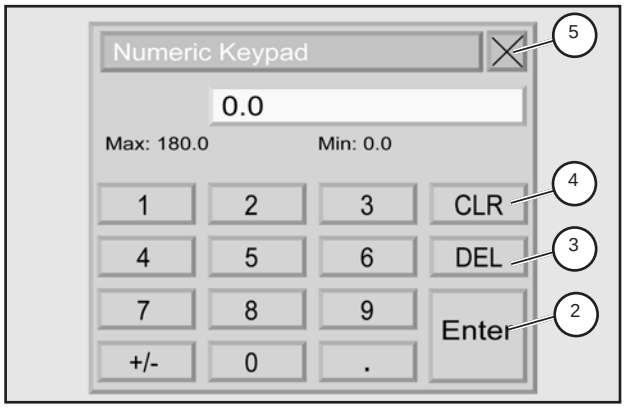
1. Position the material for the first bend.



2. Install a rotational dial on the material and adjust it to read 0 degrees. As the material is rotationed for successive bends, record the rotation angle for each step.
3. Select the "Prototype Bend" page (F3) on the control station.



4. To set the first bend angle, press the screen Bend Angle box (1) to the left of the #1.



5. A numeric keypad window will open. Enter the angle of the first bend (Between 0.0 and 180.0°), then press ENTER (2). You can delete an entry using the DEL (3) button or clear an entry using the CLR (4) button.
6. Press the X (5) button to close the numeric keypad window without saving the entry.
7. Repeat steps 1 through 6 for entering subsequent bend information into the system controller.

8. With all bend information entered, press the AUTO BEND (6) button on the control station to make the first bend.
9. Verify the bend data, reposition the material as required and press the AUTO BEND (6) button for the second bend.
10. Repeat step 9 for each successive bend.

NOTE:

After the last bend in sequence, the display will advance to the BEND 1 position. Repeat this procedure to produce another part from the same data.

11. Press the RESET BENDS (8) button to reset the bend angles data entered.
12. After the last part in the operation has been made, press the RESET BENDS (8) button to clear the display and prevent inadvertent automatic operation.

NOTE:

Do Not operate the bender without dies installed. To avoid damage It is recommended to always leave a set of dies properly installed.

AUTOMATIC BENDING WITH A PART NUMBER STORED IN THE LIBRARY

WARNING

Always setup and program the Operating Controls with the pump OFF.

There must be a "SAFETY CIRCLE OF SWING" around the bender. There must be adequate space on each side and above the bender so material will not encounter any interference during the bend.

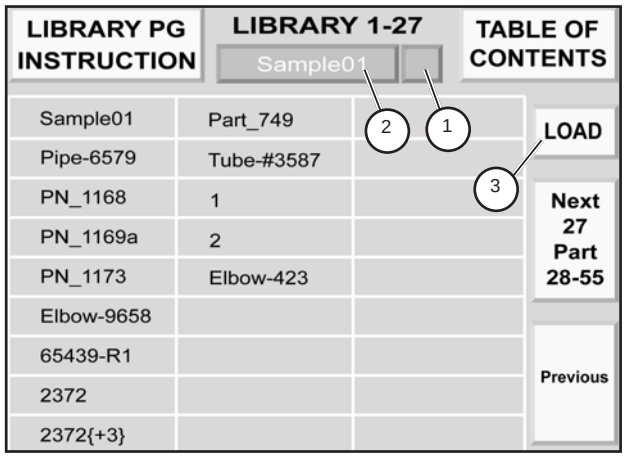
Once the area has been cleared for bending. Secure your operation area. No one may be allowed to entire the area once the bender has been started.

Never bend the first piece with new or changed bend data or unfamiliar material in Auto Bend Cycle. Injury or damage may occur if a bend has been miscalculated.

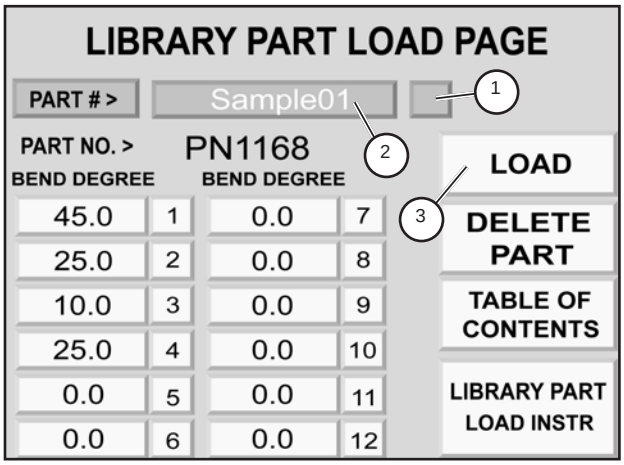
Use the FORWARD button and verify the material will not encounter any interference during the bend.

The Control Pedestal should be positioned at a distance so that the operation controls and bending dies can not be reached simultaneously.

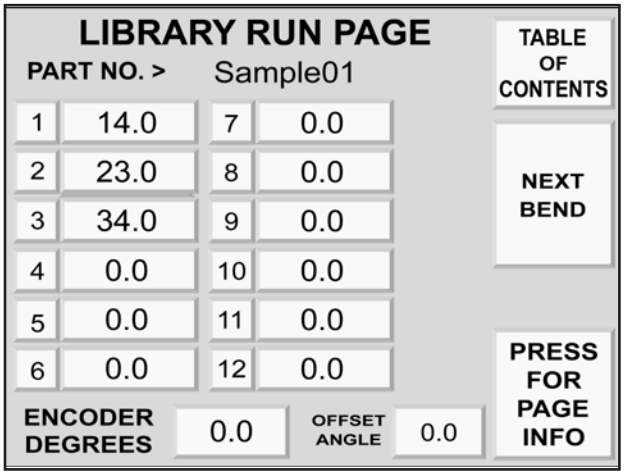
1. There are two methods to select a part number stored in the system library.
   a. Select the "LIBRARY" page (F4) on the control station to view the contents of the system library;



   b. or press the TABLE OF CONTENTS button on any screen, then press the "LIBRARY PART LOAD PAGE" screen button.



   c. Press the data entry (1) button on either page and enter a valid part number into window (2) using the popup ASCII keyboard.
   d. When the desired part number is displayed in either window (2), press the LOAD (3) screen button on that page to place the new part specifications into the system. The LIBRARY RUN screen will appear.



2. Position the material for the first bend.
3. Ensure that the first bend for the part number is highlighted. If necessary, step through the list using the NEXT BEND button until the 1st bend is highlighted.
4. Pressing the AUTO BEND button in the control station will cycle the bender automatically through the forward and reverse motion and perform the bend.
5. Position the material for the next bend and repeat step 6 for each successive bend.

NOTE:

After the last bend in sequence, the display will advance to the BEND 1 position. Repeat this procedure to produce another part from the same data.

6. After the last part in the operation has been made, press the TABLE OF CONTENTS button to change the screen and prevent inadvertent automatic operation.

NOTE:

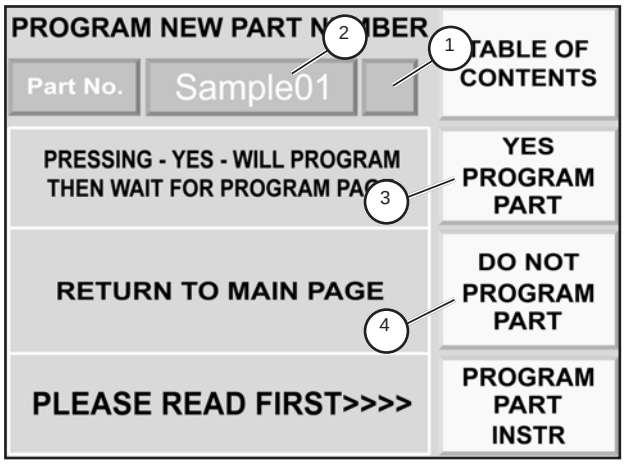
Do Not operate the bender without dies installed. To avoid damage It is recommended to always leave a set of dies properly installed.

CREATE A NEW PART NUMBER IN THE LIBRARY

A maximum of 12 bends (from 0.1º to 180º each) may be entered for any part in the library. Once all bend data for the new part is entered, make a written record of the data for backup or archive purposes.

Each bend is entered with the following procedure:

1. Press the **Table of Contents screen button on any page, then press the PROGRAM NEW PART PAGE button. The Program New Part Page will appear.**



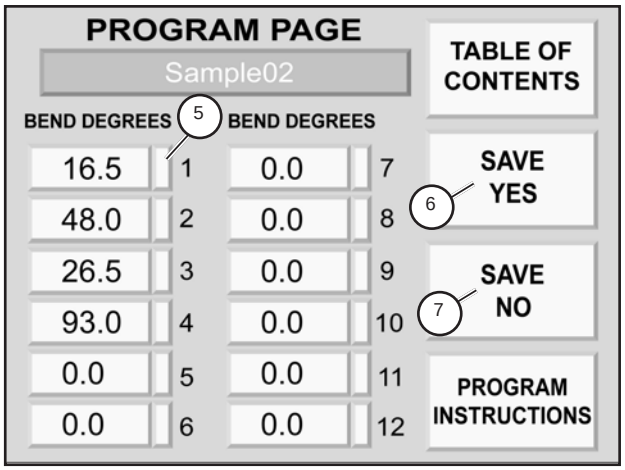
2. Press the **data entry (1) button next to the part n**umber window (2) on the screen and the ASCII keyboard screen will appear.

3. Enter the new part number on the keyboard and press ENT to accept the part number and return to the Program New Part Number screen.

4. Press the YES PROGRAM PART (3) screen button to accept the new part number and go to the PROGRAM PAGE where the actual bend specifications will be entered into the system.

   If the part number entered is not valid, the PART NOT FOUND screen will appear where you will have the option to create a new part.

   You also have the option to press the DO NOT PROGRAM PART (4) screen button to cancel the operation and return to the HUTH BENDER Manual Bend page.



5. Press the data entry button (5) next to the first BEND DEGREE WINDOW and the numeric keypad screen will appear. Enter the bend angle and press ENT to accept the number and close the window.

6. Repeat this step as required until the total bend angles of the part are entered. Press the SAVE YES (6) screen button to accept the specifications and save the part number in the system. You will then be taken to the LIBRARY RUN PAGE where this part information will be displayed and ready to use for an auto bend operation.

7. You also have the option to press the SAVE NO (7) screen button to cancel the operation and return to the HUTH BENDER Manual Bend page.

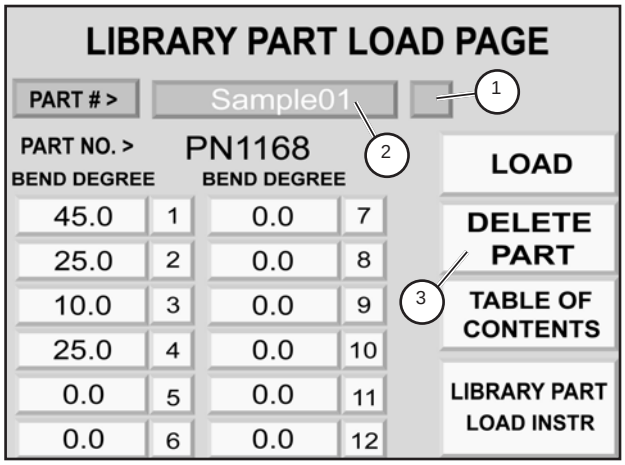
WARNING

At this point, the Model 3200 is now programmed to execute the bends for this part. If the operator has read through and understands all of the operating instructions of the Model 3200 Vertical Bender and if the area has been properly secured then the bends can be executed for this part.

DELETING A PART NUMBER FROM THE LIBRARY

Part numbers in the library cannot be permanently edited or changed in any way. If specifications for a part number change, the original part number and specifications in the library must be deleted, then a new part number with specifications created. Use this procedure to delete a part number:

1. Press the TABLE OF CONTENTS button on any screen, then press the “LIBRARY PART LOAD PAGE” screen button.



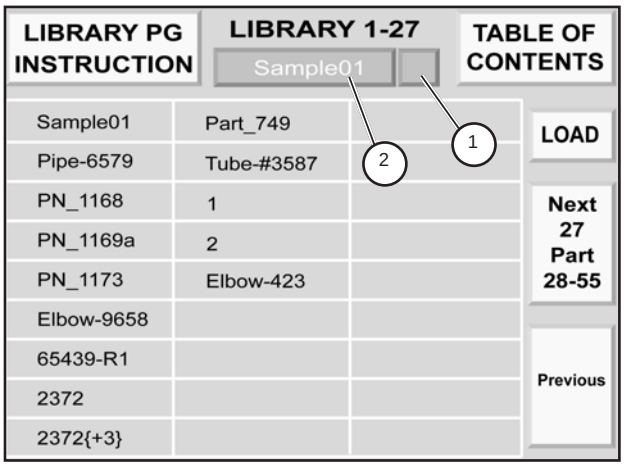
2. Press the data entry (1) button or the part number window (2) on the screen. The ASCII keyboard window will pop-up where a valid part number can be entered.
3. When the desired part number is displayed, press the DELETE PART (3) screen button on that page to remove the part specifications from the system library.

4. The LIBRARY PART DELETE PAGE will appear. It is necessary to press the DELETE PART screen button on this page to actually delete the part and its specifications from the system library.

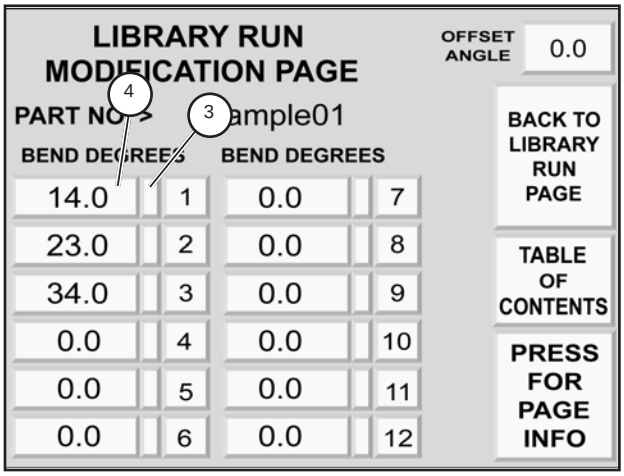
TEMPORARILY CHANGE LIBRARY PART NUMBER SPECIFICATIONS

You can edit the bend data for any part number in the library on a temporary basis without changing the original data. This is most commonly used to make changes while a bending operation is in process. This will assist in compensating for the variables in material, temperature etc.

1. Select the “LIBRARY” page (F4) on the control station to view the contents of the system library.



2. Press the data entry (1) button or the part number window (2) on the screen and the ASCII keyboard screen will appear. Enter the desired part number and press the ENT button.
3. The LIBRARY screen will appear with the desired part number in the part number window. Press LOAD to place the part number specifications into the system.
4. Go to the Table of Contents screen and press the LIBRARY RUN MODS screen button.



5. The LIBRARY RUN Modification screen will appear.

6. Press the data entry (3) button or the part number window (4) on the screen corresponding to the bend angle you want to temporarily change. The numeric keypad will appear.

7. Using the key pad, enter the desired new bend angle and press the ENTER button on the keypad to save it.

NOTE:

Repeat steps 6 - 7 for each additional change desired. If a bend sequence position is changed to 0.0º, the program will move back to the number 1 position when it reaches the 0.0º position during the bending operation skipping those bends that are programmed after the 0.0º value.

8. When finished making the desired changes, proceed to bend the part. (See “AUTOMATIC BENDING WITH A PART NUMBER STORED IN THE LIBRARY” in this section).

The values will return to the original specifications when the part number is changed in the system.

MODEL 3006 OPERATION

SET UP

DANGER

If obtaining tooling from some source other than Huth Manufacturing, It is your responsibility to use tooling that:

- **Does not pose a threat of harm or injury to personnel.**
- **Cause damage to the bender.**
- **Change the benders operating characteristics.**
- **Are designed and manufactured using sound engineering practices.**

Improper tooling may void warranty.

Tooling and/or fixtures used with this machine must not interfere with or alter the effects of the guards and shields.

WARNING

DO NOT start or run the pump while setting up and programming the controls.

WARNING

DO NOT operate the ram without having a matched set of bending dies and back shoes properly in place.

WARNING

There must be a "SAFETY CIRCLE OF SWING" around the bender. There must be adequate space on each side and above the bender so material will not encounter any interference during the bend.

WARNING

Once the area has been cleared for bending. Secure your operation area. No one may be allowed to entire the area once the bender has been started.

The Control Pedestal should be positioned at a distance so that the operation controls and bending dies can not be reached simultaneously.

Prior to beginning your first bend operation, it may be necessary to have specifications for the required bends on hand, or be prepared to document and record this information should repetitive bends be required later. See the Design Bending section of this manual for additional information on the creation or use of a HUTH Program Card.

MANUAL BENDING

1. Install the proper tooling for the job to be performed. Visit ***www.huthbenders.com*** for complete tooling product details.
2. Position any fixtures, gauges and material that will be used during the operation of the bending job.
3. Secure the area around the bender were the material will swing as well as the area the operator will be working within.
4. Set the sequence valve pressure as needed to perform the bending operation. See "SEQUENCE VALVE PRESSURE SETTING" on page 32.
5. Select straight tubing of the required O.D. size and sufficient length (12" longer than the cut-off point).
6. Wipe tubing to remove excess oil. Place tubing in bender between back shoes and radius die with the greater portion of the tubing extending out the LEFT side of the bender.
7. Rotate tubing so the seam line is facing out. This provides a starting reference point for the rotation dial.
8. Press bender START button to turn motor and hydraulic pump on.
9. Jog the FORWARD button as required to firmly clamp the pipe in the dies.
10. Mark additional bend points on the pipe as indicated by the program cards or as otherwise required to indicate all of the bend locations and final cutoff length.

NOTE:
Do not cut the tubing to final length until the last bend has been made.

11. Reposition the tubing in the dies so that the greater length of the tube extends out the RIGHT side of the bender. Center the first bend mark between the backshoes and engage the dies until the tube is held firmly in place.
12. Place the rotation dial on the extreme RIGHT end of the tubing, at least 12" from the end of the tube, with the numbered side facing the bender. Rotate the dial until the indicator points to zero and secure the dial. The first bend always begins with the dial at 0 degrees.

NOTE:
Do not remove the rotation dial until all bends are completed.

13. Press the FORWARD button to manually move the main cylinder forward to within a few degrees of the desired amount of bend.The Depth of Bend plate on the left side of the machine will provide a readout of the amount of bend being applied.
14. Jog the FORWARD button to manually move the main cylinder forward at a slower speed to the desired bend angle.
15. Press the REVERSE button to retract the main cylinder to the desired position.
16. Reset the tubing to the next bend mark and engage the dies to snug the tube but still allow it to rotate.
17. Rotate the tubing if required and make the next bend. Verify the bend data after each bend.
18. Repeat these operations until all bends have been made. Remove the rotation dial.
19. The tube can now be cut to its final length and removed from the bender.

AUTO BENDING

WARNING

Never bend the first piece with new or changed bend data or unfamiliar material in Auto Bend Cycle or at full speed. Injury or damage may occur if a bend has been miscalculated. Jog the FORWARD button as required to verify that the material will not encounter any interference during the bend.

1. Manually bend the first part complete.
2. Check to be sure that the AUTO BEND pointer is positioned at desired degree of bend.
3. Position the second piece of material for the initial bend.
4. Press the **AUTO BEND button** to cycle the bender automatically through the forward and reverse motion and perform the bend. The bender will automatically switch to reverse and retract the main cylinder to the home position allowing the material to be moved for the next bend.

WARNING

Press the EMERGENCY REVERSE button at anytime during the bend cycle to reverse the direction of the main and side cylinders

5. Position the material for the next bend, reset the AUTO BEND lever as required and repeat step 4 for each successive bend.
6. Check part and make any adjustments that may be needed.

6. PERIODIC MAINTENANCE

INTRODUCTION

The following maintenance should be performed regularly to ensure the long life and proper performance of your bender.

AS REQUIRED

Adjust Sequence Valve Pressure

The sequence valve pressure setting used on the sequence valve will affect the performance of the bender and the quality of the bend.

Always bend the material with the as low a pressure setting on the sequence valve as possible and still receive a quality repeatable bend. Generally the lower the pressure setting on the sequence valve the less die marks that will appear on the material after the bend.

The material being bent will also affect the pressure needed to achieve a quality bend.

The following is a general guide for bending various materials:

- Material that is Larger, Heavier or Stronger may use a lower pressure setting.
- Materials that are Smaller, Thinner or Softer may use a higher pressure setting.

Because of the combination of characteristics the pressure will need to be tested and adjusted for each different type of material being used.

1. Install a 5” radius ram die and appropriate back shoes on the bender.
2. Turn on the bender.
3. Advance the dies using the Forward button.
4. When the dies are engaged, read the pressure from the gauge on the sequence valve. The pressure can only be read as the dies are being engaged. Normal pressure for tubing is between 500 and 700 psi. Never exceed 1,000 psi. Always use as low a pressure as possible that will provide a satisfactory bend.
5. Adjust pressure using the pressure regulator dial knob of the sequence valve. Turning the knob clockwise increases the pressure. Turning it counter clockwise decreases the pressure.

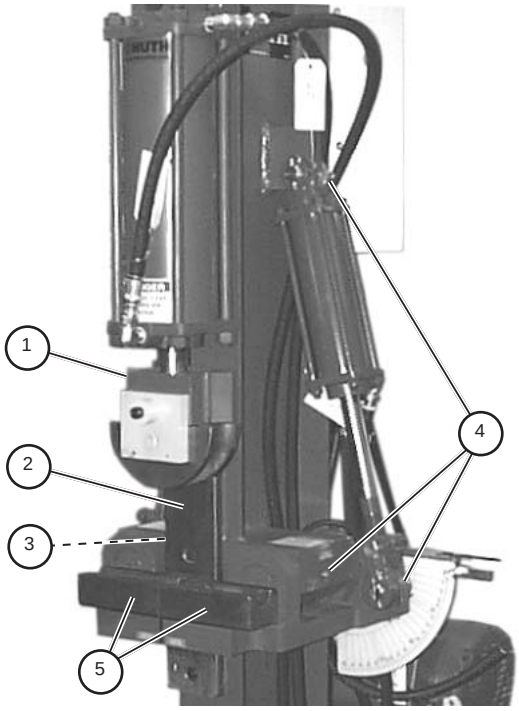
If your pressure gauge does not read zero when the dies are disengaged, verify that the gauge is properly calibrated.

Adjust System Pressure

The system pressure is read on a gauge located on the pressure manifold. The pressure should be adjusted to, but never exceed 3000 psi with the manual valve on the top of the pressure manifold.

DAILY

Clean and lubricate the following:



6. Sled (1) - Keep clean at all times. Never move the sled without a die in position on it.
7. Guide Plate (2) - Lubricate with grease. Remove any nicks or burrs.
8. Riser, Guide Plate (3) - Clean any dirt and grit from around the riser -guide plate to allow free movement of the sled.
9. Grease six grease fittings (4) (three on each side of bender), using a medium weight, all-purpose grease.
10. Gates (5) - Clean away any debris from the gate area. The back shoes must sit flush.

TWICE WEEKLY

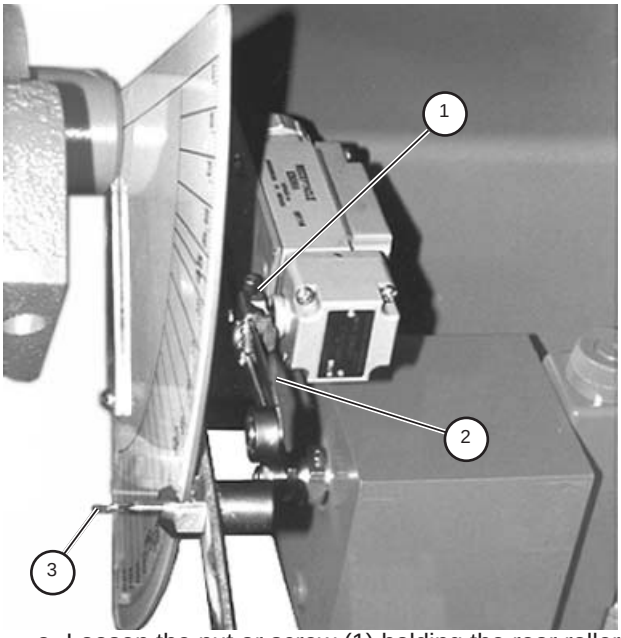
Auto Depth-of-Bend Limit Switch (3006 ONLY)

Check the alignment of the Auto Depth-of-Bend Limit Switch.

1. Install a 5” radius ram die and appropriate back shoes on the bender.
2. Turn on the bender.
3. Advance the dies using the Forward button until the pointer on the depth-of-bend scale reads 90°.
4. Turn the bender OFF.
5. Using a carpenter square, check the alignment of the back gates to ensure a true 90° reading.

To adjust the auto depth-of-bend limit switch, proceed as follows:

1. Align the gates at 90° with a square.
2. Turn the bender OFF.
3. Move the adjustable pointer slowly past the 90° mark on the depth-of-bend scale. As the pointer crosses 90°, you should be able to hear the limit switch trip (click). If the switch does not trip:



   a. Loosen the nut or screw (1) holding the rear roller arm (2) to the limit switch.
   b. Move the roller arm as required and tighten the nut or screw.
   c. Move the adjustable pointer (3) across the 90° mark and listen for the switch to trip. Repeat step 3 as required until the switch trips at the 90° mark.
   d. Turn the bender ON and move the pointer across the 90° mark. The gates should begin to close.

Manual Depth-of-Bend Calibration (3006 ONLY)

Check the calibration as follows:

1. Install a 5” radius ram die and appropriate back shoes on the bender.
2. Turn on the bender.
3. Advance the dies using the Forward button until the pointer on the manual depth-of-bend scale reads 90°.
4. Using a carpenter square, check the alignment of the back gates to ensure a true 90° reading. Align the gates to a true 90° if required.
5. Set the pointer by gently tapping on the scale plate or by loosening its hardware slightly to allow readjustment.

WEEKLY

CAUTION

Do not use strong solvents to clean dirt from the bender; Solvents may damage some components.

1. Using a mild detergent, remove all dirt buildup from the bender. Ensure there is no dirt built up between the gates and the guide plate. Also, check for dirt at the top of the gates and the gate pins. Dirt can cause excessive wear.

CAUTION

Do not use an air hose near the control box.

2. Clean dirt and oil form the bending dies and remove any burrs.
3. Check the cylinder shafts for nicks or burrs and remove them using emery cloth.

CAUTION

Hose fittings are made of soft metal. Overtightening may damage the fittings and cause leaks.

4. Inspect hoses and fittings for leaks. Tighten as required.
5. Check for bolts or nuts that may have loosened.
6. Inspect all the electrical components, i.e. plug, receptacle, cord, conduit, etc. Replace any damaged electrical components immediately.
7. Ensure that the bolts in the guide plate are tight.

MONTHLY

Perform the following maintenance monthly:

1. Check the oil level of the bender. The bender reservoir contains approximately 20 gallons of hydraulic fluid. Check the oil level in the sight gauge located on the left side of the reservoir. Oil should be within the indicator marks.
2. If oil is low, add oil to the full mark on the sight gauge.

NOTE:

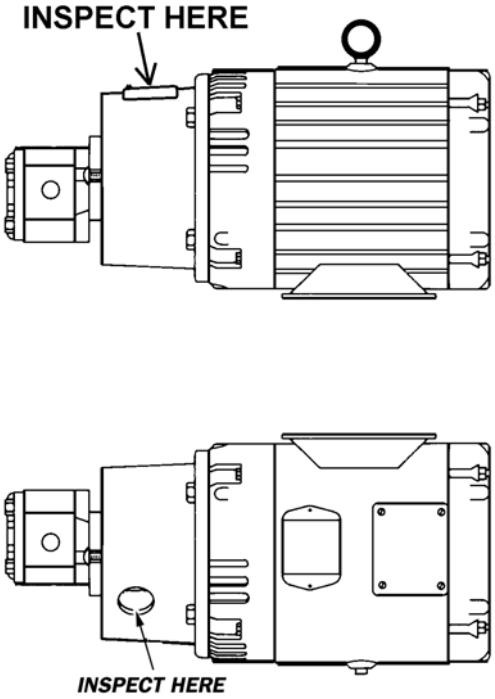
If oil must be added to the system frequently, check for leaks.

Any of these hydraulic oils may be used in the bender:

MAKE	TRADE STYLE
Penzoil	Zoil Medium or No. 10
Chevron	OC Turbine 46
Mobil	DTE Medium
Shell	Shell Turbo 46
Citco	AW46
Texaco	Rando HD 46
Union 76	UNAC AW 46
Conoco	Turbine 46

If none of these oils are available, you can use any 10 medium weight, mineral based hydraulic fluid with non-foaming additive.

3. Clean all tooling to remove old grease and nicks and burrs. A light application of lubricating oil is recommended for bending dies and back shoes.
4. Grease two grease fittings on motor using a medium weight, all-purpose grease.



5. Your bender pump drive uses one of two methods shown above to visually Inspect the coupling between the pump and the motor. Ensure the allen set screws have not loosened and that the two halves of the coupling are separated by the rubber spider.
6. Check and tighten any loose connections in the hose leading from the reservoir to the pump.

NOTE:

A loose connection on this hose may not always show a leak, but it will suck air and cause aeration in the system, causing the bender to react with uneven operation.

YEARLY

Replace the hydraulic oil filter on the reservoir once a year.

EVERY TWO YEARS

Drain the hydraulic oil reservoir and fill to the full mark on the sight gauge with new hydraulic oil. (See MONTHLY maintenance for a list of approved oils.)

7. TROUBLESHOOTING

INTRODUCTION

The troubleshooting procedures charted on the following pages contain the problem, the possible cause and the corrective action to be taken.

There are two basic sections: Hydraulic Troubleshooting and Electrical Troubleshooting.

After identifying the problem, proceed with the appropriate corrective action. The chart is organized from the most simple to the more difficult procedures. Be certain the person performing the work has the necessary ability and skills. Observe all safety rules when working on the bender.

Call Huth Manufacturing for assistance at 1-800-558-7808.

WARNING

Turn OFF the bender and LOCK OUT, TAG OUT power before servicing.

HYDRAULIC TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Loss of bending power	Main pressure setting too low.	Adjust main pressure to 3000 psi. DO NOT exceed 3000 psi. See pressure settings on page 32. If main pressure cannot be set properly, check for possible points of internal leakage, i.e.. Pump, Valves or Main cylinder.
	Sequence valve pressure too high.	Adjust sequence valve pressure to as low a setting as possible and maintain an acceptable bend. See sequence valve pressure setting on page 32.
	Pump not functioning properly.	Key sheared on coupling/coupling loose. Test pump.
	Bender low on oil.	Fill tank
	Tube or fittings from tank to pump loose, sucking air.	Secure fittings.
	Aeration of oil.	Check all hoses and fittings. Stop all leaks.
	Filter clogged.	Remove, clean and replace.
	Low Voltage to motor and/or valves.	Check Fuse.
		Check that bender has its own circuit (separate breaker).
		Check incoming voltage.
		Ensure plug and receptacle make good contact
		Check cord.
		Check internal wiring and conduit and repair or replace damaged or loose wiring.
	Directional valve not operating properly.	Operate valve manually by: Using an allen wrench, push the small button on the end of the coil. Left coil retracts cylinder; right coil extends it. Main cylinder should move. If button will not move, the valve is defective. Replace valve. (See repair section topic “Control Valve(s) Replacement”. If manual operation is possible, check for voltage at coil on valve. If voltage is present, the coil is bad. Replace valve.

HYDRAULIC TROUBLESHOOTING (continued)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Loss of bending power (continued)	Seals in main cylinder are bad.	With a matched set of dies in place, extend the main cylinder to full extension. Trace the hose from the rod end (lower) of the main cylinder back to the manifold. Remove this hose from the manifold and place the end of the hose in a clean container. Press the forward button. If the seals are good, no oil will come out of the hose.
	Material exceeds machines bending capability.	Adjust sequence valve pressure to as low a setting as possible. If an acceptable bend cannot be achieved, material exceeds machine capability.
	Bleed off of hydraulic pressure in directional and/or bypass valve.	One at a time replace each valve and retest bender.
Main cylinder keeps moving until it bottoms at end of cycle.	Dirt in directional causing valve to stick in shifted position.	Attempt to clear the valve. Proceed as follows: 1. Stop Pump. 2. Clear material from bending dies. 3. Start pump and press button to function the bender in the opposite direction. If the valve clears, cycle the bender several times from full retraction to 170º of bend angle. DO NOT over extend the main cylinder.
	Directional valve coils are energized.	Check voltage at the directional valve coils. If energized, trace source of voltage back through switches or relays
Directional control valve will not engage properly.	Low voltage.	Check voltage and machine wiring including plug and receptacle.
	Coil is bad.	Coil has voltage to it but does not magnetize. Replace valve.
Dies drift after completion of bend.	Normal	Drifting, if present, will only be noticed during manual bending, and then normally if the bender is stopped with the main cylinder extended during a bend. The bend angle display may indicate a few tenths of a degree of movement, usually in reverse. During normal amounts of drift, movement on the main cylinder will be difficult to see. If the drift is extreme, the amount of movement of the main cylinder will be easily noticeable.
	Seals worn is side cylinders.	See “Gates move slowly”.
	Sequence valve worn.	Replace valve.
Directional valve leaks.	Valve body is cracked.	Inspect valve and replace if cracked.

HYDRAULIC TROUBLESHOOTING (continued)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Hydraulics are 'jumpy" or erratic.	Air in hydraulic system.	Ensure that all hoses and fittings are tight. Proceed as follows: 1. Top off oil level in reservoir with fresh oil. 2. Run bender through its cycle several times from full retraction to 170º of bend angle until the entire system is purged of air bubbles. DO NOT over extend the main cylinder.
	Oil in reservoir is low.	Add oil.
Gates do not return correctly.	Pressure setting at sequence valve is not correct.	Reset pressure.
	Dirt or grease buildup on gate bearing pins.	Check the gate pivots, be sure they are properly lubricated.
		Clean and lubricate using the following procedures: 1. Remove snap ring from swing gate bearing pin. 2. Press out bearing pin. 3. Remove gate. 4. Clean parts, lubricate and reassemble.
	Debris between or around gates.	Remove any foreign material or build up lodged between or around gates that is not allowing the gates to close.
	Damaged Side Cylinder(s).	Check side cylinders for damage, improper sequence valve pressure, or possible damaged hoses.
	Guide Plate loose.	Tighten cap screws as needed.
	Air in hydraulic system.	Ensure that all hoses and fittings are tight. Proceed as follows: 1. Top off oil level in reservoir with fresh oil. 2. Run bender through its cycle several times from full retraction to 170º of bend angle until the entire system is purged of air bubbles. DO NOT over extend the main cylinder.
	Side cylinders are worn.	Set sequence valve to 100 psi. With gates closed and power off, pry the gates open. If the gates open, the seals in the side cylinders are worn and should be replaced.

HYDRAULIC TROUBLESHOOTING (continued)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Gates move slowly.	Main pressure setting too low.	Adjust main pressure to 3000 psi. DO NOT exceed 3000 psi. See pressure settings on page 32. If main pressure cannot be set properly, check for possible points of internal leakage, i.e.. Pump, Valves or Main cylinder.
	Sequence valve pressure too high.	Adjust sequence valve pressure to as low a setting as possible and maintain an acceptable bend. See "Sequence Valve Pressure Setting" on page 32.
	Side cylinders are worn.	Set sequence valve to 100 psi. With gates closed and power off, pry the gates open. If the gates open, the seals in the side cylinders are worn and should be replaced.
Bender cannot complete bend. Also see "Loss of Bending Power."	Sequence valve pressure too high (Usually on larger material).	Adjust sequence valve pressure to as low a setting as possible and maintain an acceptable bend. See sequence valve pressure setting on page 32.
Material collapses during bending.	Defective material.	Attempt a bend on another piece of material.
	Buildup or caking of material on surface of dies.	Clean dies and lightly oil.
	Wall thickness of material too thin for diameter.	Adjust sequence valve pressure to 1000 PSI. Then adjust sequence valve pressure down 100 PSI at a time to as low a setting as possible to achieve an acceptable bend. See sequence valve pressure setting on page 32. Material may be to light for machine capability.
	Tooling is damaged.	Check tooling for damage. Replace damaged tooling.
	Improper tooling	Check that tooling size and radius are the proper match for the material to be bent.
	Setting on sequence valve is incorrect. (Travel time of sled and die extension and retraction should be the same.)	If extension and retraction travel times are not equal: 1. Loosen jam nut on top of sequence valve. 2. Using an allen wrench, turn the adjustment screw on top of valve. 3. When the extension and retraction speeds match, tighten the locknut to lock adjustment screw in place.
	Side cylinders are worn.	Set sequence valve to 100 psi. With gates closed and power off, pry the gates open. If the gates open, the seals in the side cylinders are worn and should be replaced.

HYDRAULIC TROUBLESHOOTING (continued)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Material collapses during bending. (continued)	Seals in main cylinder are bad.	With a matched set of dies in place, extend the main cylinder to full extension. Trace the hose from the rod end (lower) of the main cylinder back to the manifold. Remove this hose from the manifold and place the end of the hose in a clean container. Press the forward button. If the seals are good, no oil will come out of the hose.
	Gates not operating properly.	Check operation of gates: 1. Place a 3" bumper die on the sled and extend the main cylinder to open the gates. 2. Look at the pivot pins on the gates while the gates are opening. The gate and pin should turn at the same time. If the pins do not turn, the key is worn or sheared. The key must be replaced and the pin, bushings, and gate bore inspected for damage. If either are badly scored, replace them.
	Gates slip or tilt.	Remove side cylinder rod clevis from gate and move gate to check slop in pivot. If slop is significant, check bushings in head block for wear. Replace if needed.
Motor runs but pump does not develop pressure.	Motor rotating in wrong direction. (3-phase only)	TURN OFF MOTOR IMMEDIATELY. Motor should be turning counterclockwise as seen when facing the pump. See "Pump/Motor Rotation" on page 45.
	Coupler between motor and pump is loose.	Tighten coupler. Check keyways. See section 6 - "Periodic Maintenance".
	Low on oil.	Check oil level. Add oil to the full mark as needed.
	Defective pump.	Test pump. See "Loss of Bending Power" in this section.
	Clogged filters.	Clean or replace filters.

ELECTRICAL TROUBLESHOOTING

Motor does not run.	Circuit breaker is off.	Turn breaker on. If circuit breaker has been tripped, have an electrican check for the possible cause and repair at once.
	Main power switch off.	Turn power switch on.
	Incorrect wiring.	Check voltage supply, phase and wiring.
	Poor connection at plug.	Check wiring.
	Cut in power cord.	Check and replace at once.
	Defective start/stop switch.	Test and replace if needed.
	Motor defective.	Test motor - check with local electrical motor supplier for service center. Replace if needed.
	Defective contactor.	Test and replace if needed.
	Fuses blown.	Check fuses and replace as needed.
	Overload relay tripped.	Reset overload.
	Internal wiring has become disconnected.	Check all wiring connections.
	Defective transformer.	Test and replace if needed.
	Defective auxiliary power supply.	Test and replace if needed.
	Defective ELC**	Turn main power off, wait 5 - 10 minuets and turn main power on. After the ELC has rebooted, start motor. If motor does not run and all other items have checked OK, replace ELC. ***** NOTE:*** *If the ELC (Electronic Logic Control) is suspected of improper operation, see page 46 for additional information.*
Motor smokes	Incorrect wiring	Check voltage supply, phase and wiring.
	Hydraulic load too high.	Check hydraulic pressure, adjust pressure if needed (See Periodic Maintenance section on page 32).
	Motor bearings seizing.	Remove motor - service at local service center.
	Motor shorting internally.	Remove motor - service at local service center.
Motor shuts off	Circuit breaker is off	Turn breaker on. If circuit breaker has been tripped, have an electrican check for the possible cause and repair at once.
	Overload relay tripped.	Reset overload relay. If problem persists have an electrican check for the possible cause and repair at once.
	Fuses blown.	Check fuses and replace as needed.
	Defective contactor.	Test and replace if needed.
	Motor defective.	Test motor - check with local electrical motor supplier for service center. Replace if needed.

ELECTRICAL TROUBLESHOOTING (continued)

Bender emits shocks	Lost ground connection.	Check plug-to-receptacle fit.
		Check plug wiring.
		Check cord for damage.
		Check the ground connection at control box.
		The bender or tubing being bent must not come in contact with any other object.
Improper Main Cylinder O peration (Also see Hydraulic Troubleshooting).	Internal wiring has become disconnected.	Check all wiring connections.
	Crossed or shorted wiring	Check all wiring connections.
	Defective ELC**	Turn main power off, wait 5 - 10 minuets and turn main power on. After the ELC has rebooted test bender operation. If main cylinder operation is not correct and all other items have checked OK, replace ELC. ***** NOTE:*** *If the ELC (Electronic Logic Control) is suspected of improper operation, see page 46 for additional information.*
Erroneous Bend Angle number displayed.	Coupler is loose on encoder or gate stud.	Tighten coupler.
	Gates not fully closed	Check for debris lodged between or around gates that is not allowing the gates to close.
		Check the gate pivots, be sure they are properly lubricated.
		Check side cylinders for damage, improper sequence valve pressure, or possible damaged hoses.
	Internal wiring has become disconnected.	Check all wiring connections.
	Encoder wiring or connections defective.	Check encoder wiring and connections **angle displayed** defective.
	Defective encoder.	Test encoder and replace as needed.
	Defective ELC**	Turn main power off, wait 5 - 10 minuets and turn main power on. After the ELC has rebooted, start motor. If motor does not run and all other items have checked OK, replace ELC. ***** NOTE:*** *If the ELC (Electronic Logic Control) is suspected of improper operation, see page 46 for additional information.*

ELECTRICAL TROUBLESHOOTING (continued)

No display at control station.	Circuit breaker is off.	Turn breaker on. If circuit breaker has been tripped, have an electrican check for the possible cause and repair at once.
	Main power switch off.	Turn power switch on.
	Incorrect wiring.	Check voltage supply, phase and wiring.
	Poor connection at plug.	Check wiring.
	Cut in power cord.	Check and replace at once.
	Internal wiring has become disconnected.	Check all wiring connections.
	Defective transformer.	Test and replace if needed.
	Defective auxiliary power supply.	Test and replace if needed.
	Defective control panel or ELC**	Turn main power off, wait 5 - 10 minuets and turn main power on. Does the control panel screen appear after the ELC has rebooted? If the screen does not appear after the ELC has been rebooted, one at a time replace the ELC and then the display panel. ***** NOTE:*** *If the ELC (Electronic Logic Control) is suspected of improper operation, see page 46 for additional information.*
No response at control station.	Wiring quick disconnect between control station and electrical box loose or damaged.	Tighten or repair as required
	Wiring between control station and electrical box damaged.	Check wiring for damage and repair as required.
	Defective control panel or ELC**	Turn main power off, wait 5 - 10 minuets and turn main power on. Does the control panel screen appear after the ELC has rebooted? If the screen does not appear after the ELC has been rebooted, one at a time replace the ELC and then the display panel. ***** NOTE:*** *If the ELC (Electronic Logic Control) is suspected of improper operation, see page 46 for additional information.*

8. HYDRAULIC REPAIR

INTRODUCTION

The following hydraulic repair section contains step-by-step instructions for replace major hydraulic components on your bender. Repair procedures not listed here should be left to qualified service personnel. If you are unfamiliar with hydraulic servicing, contact your distributor for professional service.

WARNING

Serious injury can occur if hydraulic hoses are connected incorrectly. Pump damage may also occur. Always note the location of hydraulic hoses before removing components to ensure that the hose is connected properly during reassembly.

CONTROL VALVE REPLACEMENT

To replace a control valve, proceed as follows:

1. Start bender.
2. Drop hydraulic pressure to 0 on the sequence and pressure manifold valves.

WARNING

LOCK OUT, TAG OUT electric plug. (Secure the plug so that it cannot be plugged into the receptacle or place a warning tag on it to prevent it from being plugged into a receptacle.)

3. Turn off and LOCK OUT, TAG OUT all power to the bender.
4. Tag and disconnect the hydraulic lines and any wiring to the valve which is to be replaced.
5. Remove the attaching hardware that holds the valve in place. Be sure to note the size and quantity of hardware in each location.
6. Remove the valve.

CAUTION

Overtightening of valve attaching hardware may distort or damage the valve body.

7. Install the replacement valve and secure using the original attaching hardware.
8. Connect hydraulic hoses or lines to the valve body. Be careful not to overtighten the fittings on the hose ends. They are usually made of soft metal and can be easily damaged.
9. Connect any wiring (Directional control valves only) that may have been disconnected.
10. Turn the bender on and test the new valve for proper operation. Cycle the valve several times to remove any air which may be trapped inside the valve.
11. Adjust pressure settings as required.

SIDE CYLINDER - REMOVAL

To remove a side cylinder, proceed as follows:

1. Turn the bender on and drop the hydraulic pressure to 0 psi using the sequence valve.
2. Shut off the bender.

WARNING

LOCK OUT, TAG OUT electric plug. (Secure the plug so that it cannot be plugged into the receptacle or place a warning tag on it to prevent it from being plugged into a receptacle.)

3. Turn off and LOCK OUT, TAG OUT all power to the bender.
4. Remove the cotter pins or clips retain the clevis pins.
5. Remove the clevis pins at swing gates.
6. Swing the cylinder away from swing gates.
7. Remove hoses and fittings from the cylinder. Cap or plug hoses.
8. Remove the cotter pins or clips retain clevis pin at the cylinder head end.
9. Remove clevis pin.
10. Remove cylinder.

SIDE CYLINDER - INSTALLATION

To install a side cylinder, proceed as follows:

1. Place head end of cylinder on the bender and secure with a clevis pin.
2. Install pin which retains clevis pin.
3. Swing cylinder into position on the bender.

NOTE:

When installing the cylinder on the bender, you may need to push the rod in to align the holes on the clevis end.

4. Align rod end clevis with swing gate and install clevis pin.
5. Install clevis pin retainer.
6. Install hydraulic hoses. Be careful not to overtighten fittings as the are soft metal and can be damaged easily.
7. Cycle the cylinder several times and perform a bend to ensure proper operation.

NOTE:

Side cylinders will bleed themselves of any trapped air as they are operated through several stroke cycles.

9. ELECTRICAL REPAIR

INTRODUCTION

The following electrical repair section contains schematics and illustrations to aid in electrical repair. Most of the electrical components cannot be repaired and require only removal and replacement. If replacement parts are installed, refer to the figures in this section for the correct connections. All repairs must be done by a certified electrician. Ensure all safety rules have been read and understood before beginning service.

DANGER

Disconnect power at receptacle before performing any electrical repairs High voltage may still be present in the control box after the power has been disconnected. Capacitors in the electrical box retain an electrical charge.

WARNING

LOCK OUT, TAG OUT electric plug. (Secure the plug so that it cannot be plugged into the receptacle or place a warning tag on it to prevent it from being plugged into a receptacle.

CAUTION

Control box contains high voltage.

CAUTION

Do not use an extension cord between bender and receptacle.

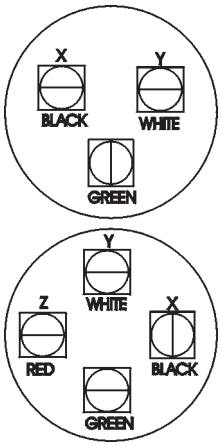
NOTE:

For foreign voltages, ensure voltage, phase and cycle are identical within the electrical power source.

COMPONENT REPLACEMENT

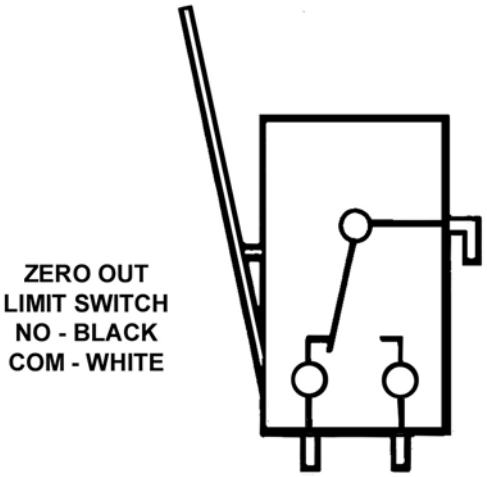
PLUG & RECEPTACLE

For plug and receptacle wiring hook-up, see below:

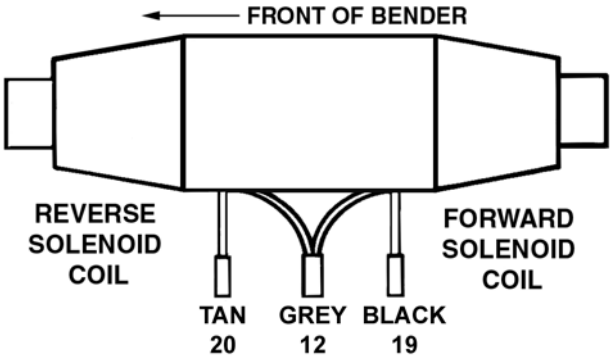


LIMIT SWITCHES

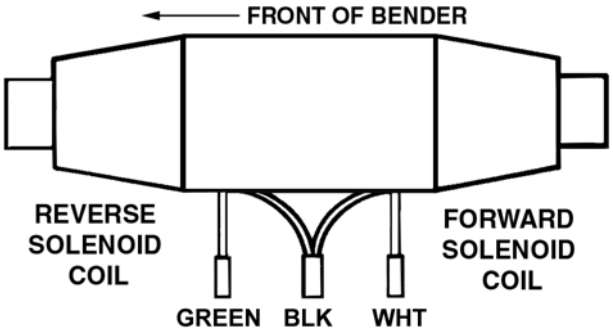
For Model limit switch wiring, see below:



DIRECTIONAL VALVE - MODEL 3002



DIRECTIONAL VALVE - MODEL 3006



MOTOR

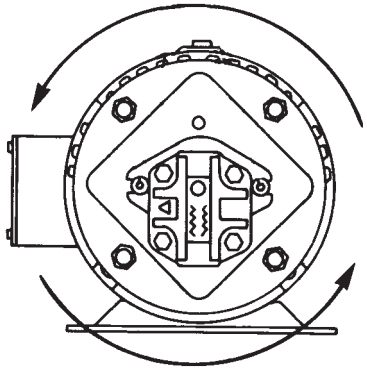
For motor lead connections, refer to the following table:

7.5 HP MOTOR LEAD CONNECTIONS	
Single Phase - 230 Voltage	
1+5	Black Motor Lead
4+8	Black Motor Lead
Three Phase - 230 Voltage	
4+5+6	Together
7+1	Black Motor Lead
8+2	Black Motor Lead
9+3	Black Motor Lead
Three Phase - High Voltage	
6+9	Together
5+8	Together
4+7	Together
3	Black Motor Lead
2	Black Motor Lead
1	Black Motor Lead

10 HP MOTOR LEAD CONNECTIONS	
Single Phase - 230 Voltage	
1+5	Black Motor Lead
4+8	Black Motor Lead
Three Phase - 230 Voltage	
4+5+6	Together
7+1	Black Motor Lead
8+2	Black Motor Lead
9+3	Black Motor Lead
Three Phase - High Voltage	
6+9	Together
5+8	Together
4+7	Together
3	Black Motor Lead
2	Black Motor Lead
1	Black Motor Lead

NOTE:

When starting a 3-phase motor, check motor rotation. It should rotate counterclockwise as seen when facing the pump.

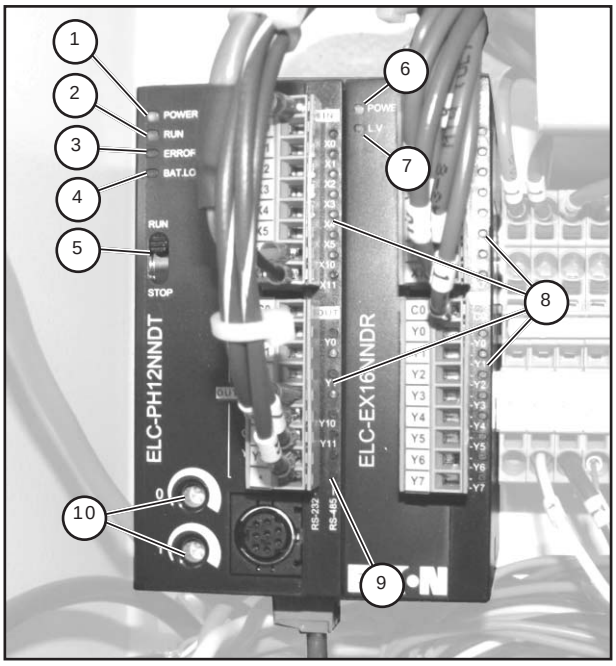


To check the pump/motor rotation:

1. Plug bender power cord into an acceptable receptacle.
2. On 10 hp models only, remove the plastic inspection cover on the drive housing (7.5 hp models have an inspection hole on the drive housing).
3. Turn the bender on briefly and observe the pump shaft rotation.
4. If rotation is in the wrong direction, unplug the power cord.
5. Disassemble the plug and reverse the red and black wires.
6. Reassemble the plug and test again.
7. On 10 hp models only, replace the inspection cover on the drive housing.

ELECTRONIC LOGIC CONTROL (ELC) - MODEL 3002 ONLY

STATUS INDICATOR LIGHTS



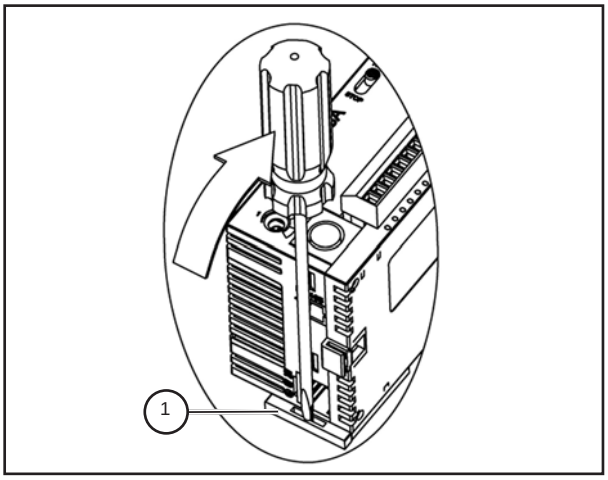
Electronic Logic Control (ELC)

1. **PWR** - Indicates 24 VDC is available to the ELC.
2. **RUN** - Indicates the ELC is functioning.
3. **ERROR** - This indicates an ELC internal error has occured. Turning the RUN/STOP switch OFF and back ON may restore normal operation.
4. **BAT LOW** - This indicates the ELC internal battery is failing. It must be replaced immediately.
5. **RUN/STOP** - The normal position for this switch is the RUN position.
6. **PWR** - Indicates 24 VDC is available to the ELC expansion module.
7. **LV** - Indicates a voltage drop in the 24VDC power supply.
8. **X & Y INPUTS/OUTPUTS** - These indicators will illuminate whenever the respective port is active (ON-OFF).
9. **RS485** - This indicator will blink constantly to indicate a communication connection. If the indicator blinks ON and OFF with long delays in between, or the indicator stays ON or OFF, a faulty connection exists in the 24 VDC control system.
10. **POTENTIONOMETERS** - These potentiometers are not programmed for this ELC application, so their adjustment has no affect on the benders operation.

Power Supply (Not shown)

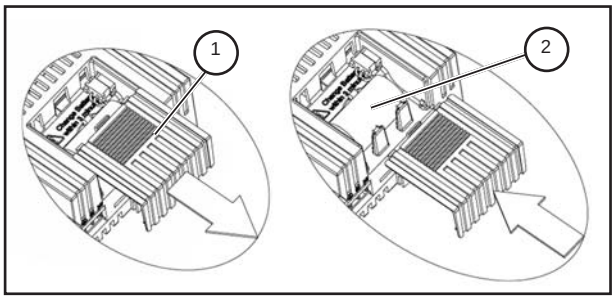
11. **DC ON** - This indicator will be ON when the power supply is working.

ELC/Expansion Module Removal



The ELC/Expansion module assembly is secured to the DIN rail with a small retaining clip (1) located on ther bottom of the housing. To remove the ELC assembly, pull the retaining clip away from the housings and gently lift it from the rail. To install the assembly, push it onto the rail until the retaining clip engages.

ELC Battery Replacement



1. Remove the ELC assembly from the DIN rail.
2. Slide the battery cover (1) from the ELC and remove the battery (2).

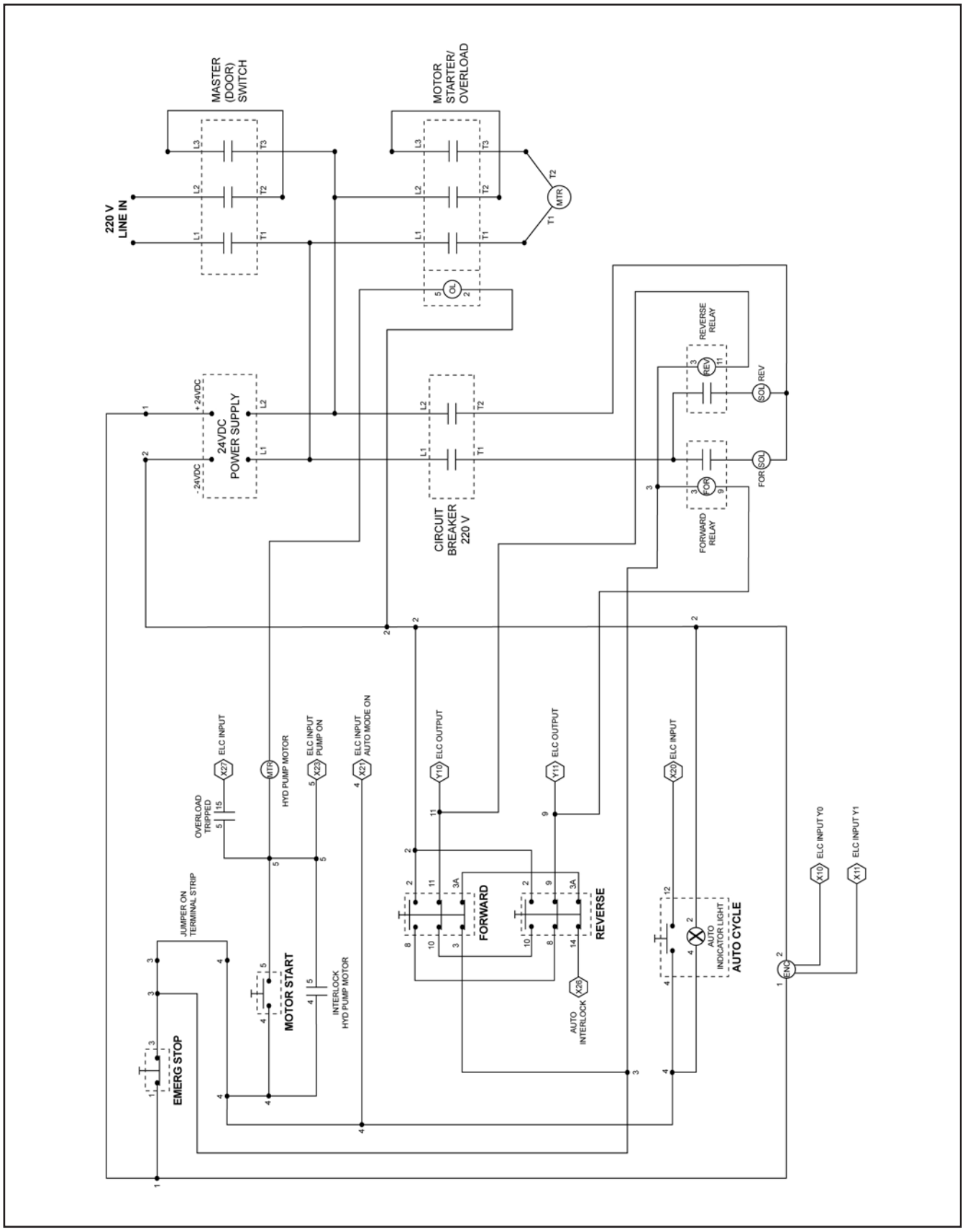
NOTE:

The battery must be replaced within three minutes or the ELC programming may not be accessible.

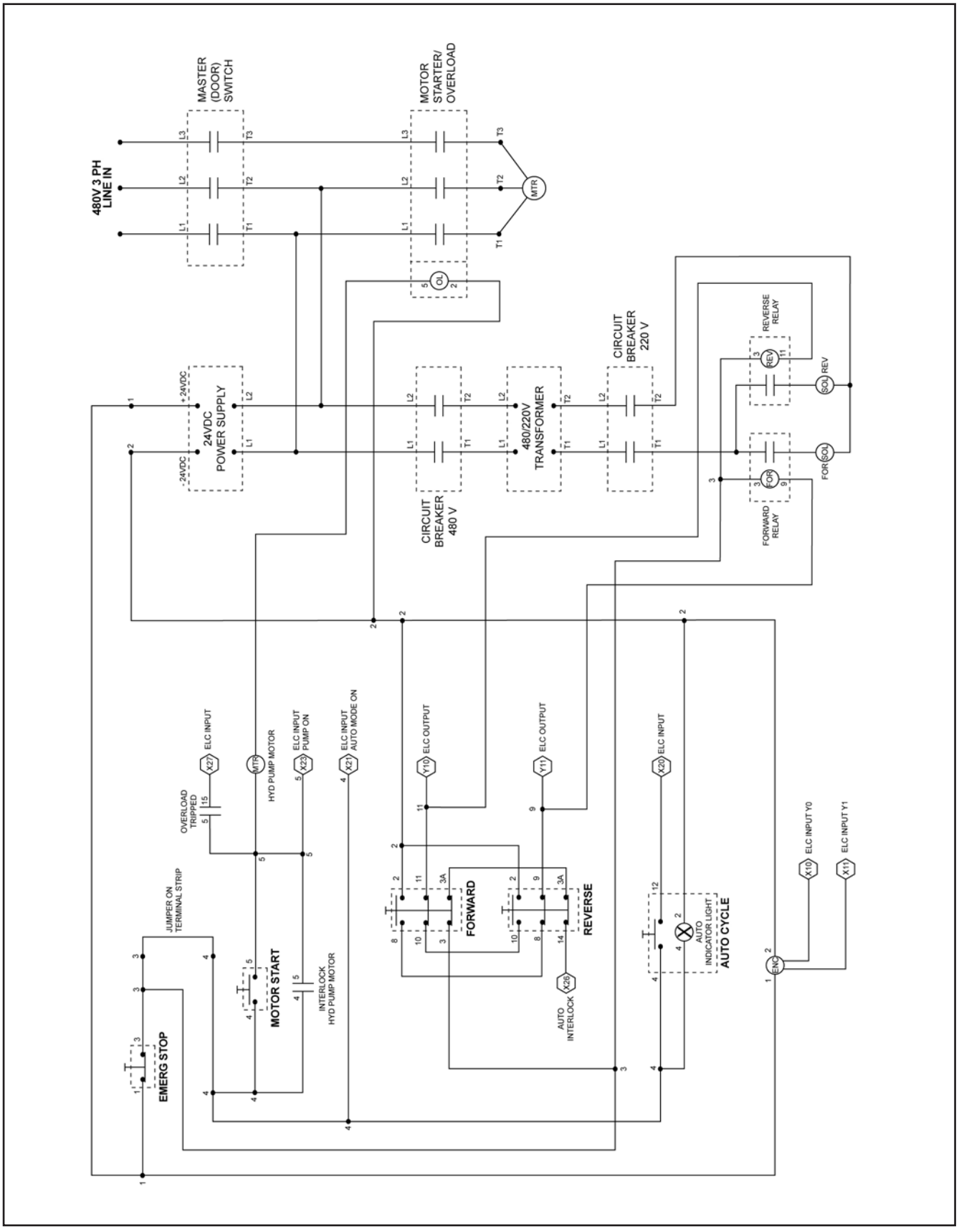
3. Install a new battery, replace the battery cover and attach the ELC to the DIN rail.

NOTES

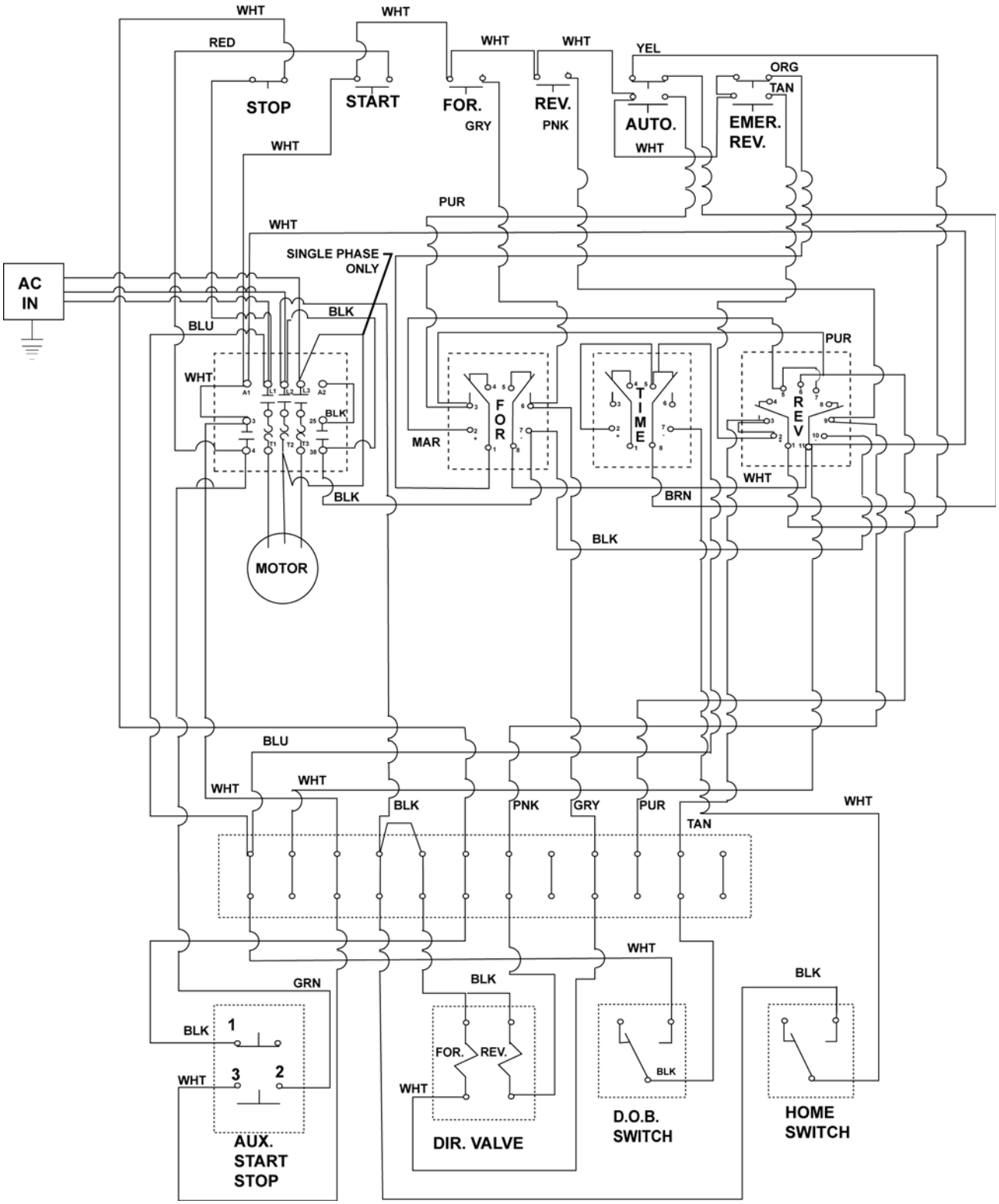
MODEL 3002 SCHEMATIC DIAGRAM - 220V



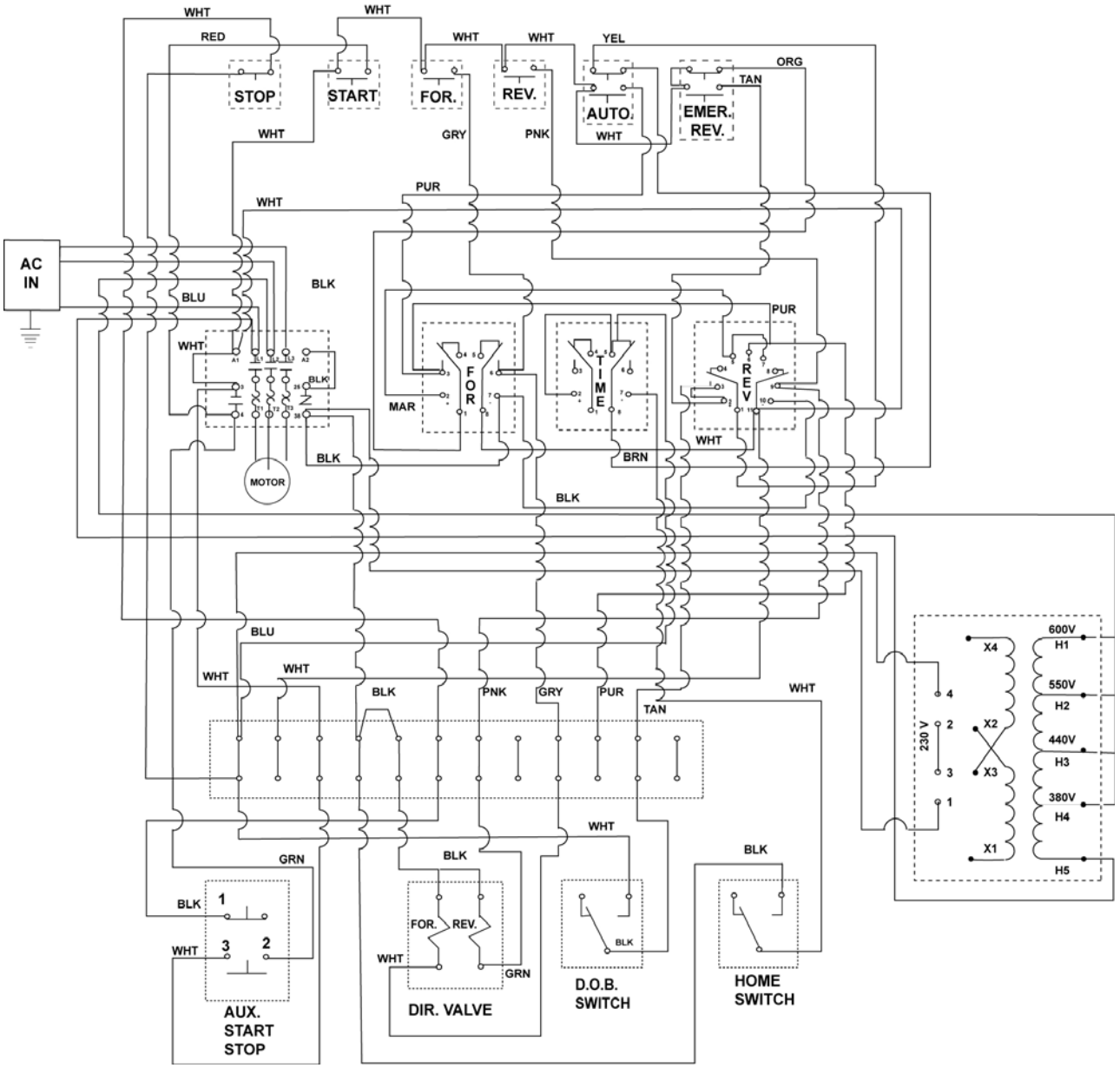
MODEL 3002 SCHEMATIC DIAGRAM - 480 V 3 PHASE



MODEL 3006 SCHEMATIC DIAGRAM - 220V



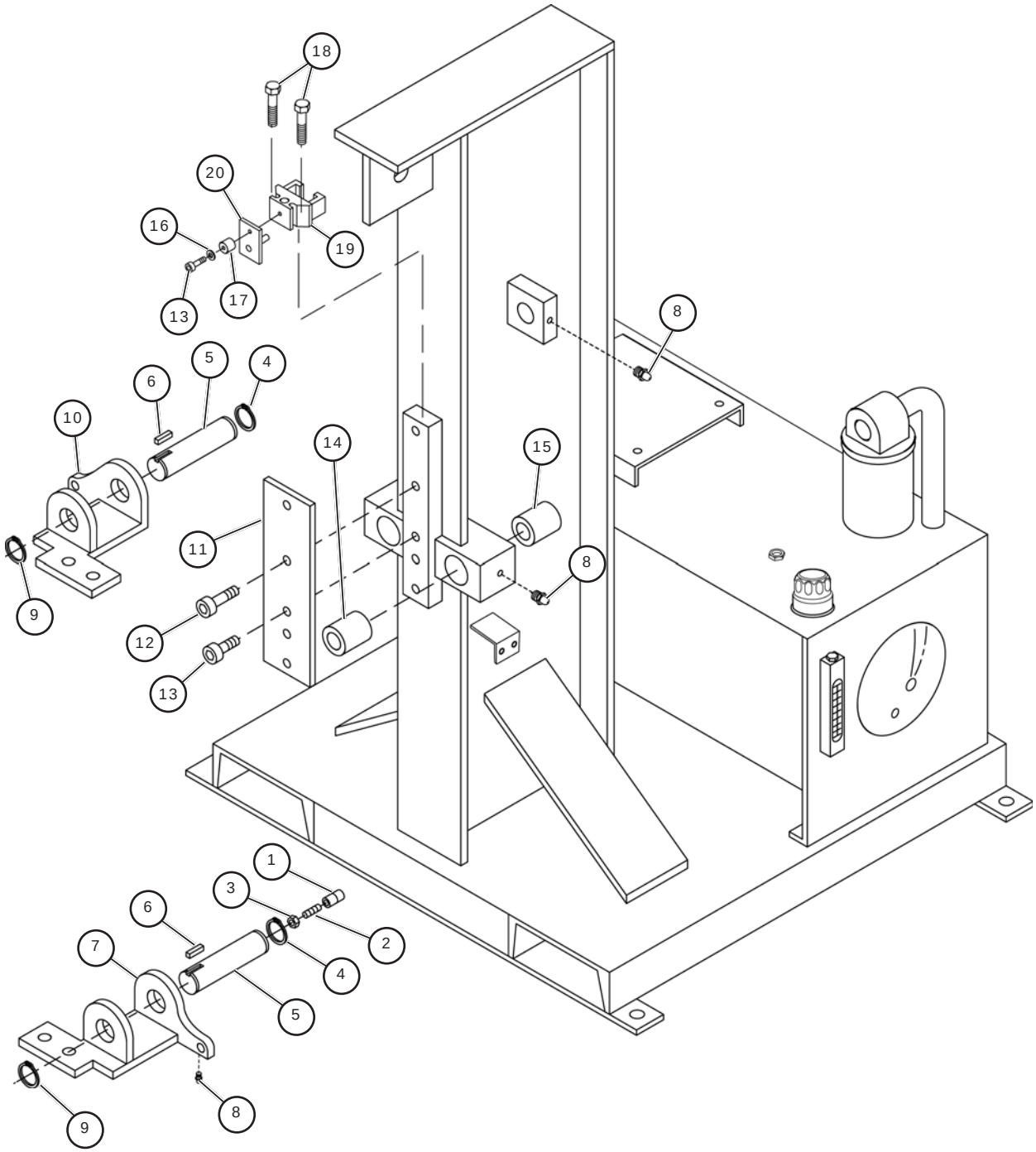
MODEL 3006 SCHEMATIC DIAGRAM - HIGH VOLTAGE



10. PARTS

FRAME

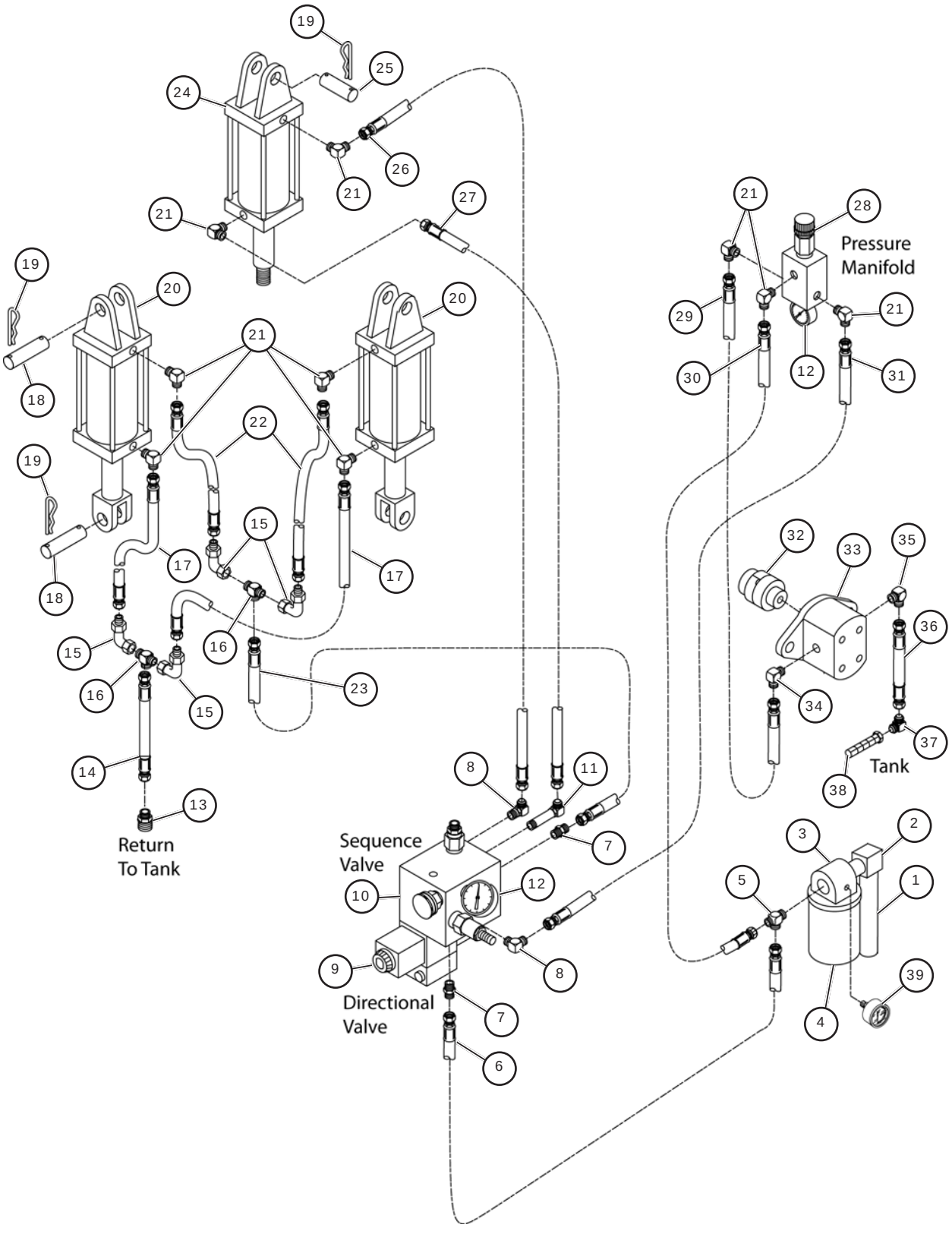
MODEL 3002



REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	95600	Encoder Coupler	1	
2	97286	Encoder Stud	1	
3	97208	Jam Nut 1/2-13	1	
4	90094	Snap Ring, Outside	2	
5	91042	Gate Pin	2	
6	90092	Keyway	2	
7	91035	Gate, Right	1	
8	97234	Grease Zerk	6	
9	90093	Snap Ring, Inside	2	
10	91034	Gate, Left	1	
11	91047	Guide Plate	1	
12	97204	Screw, Socket Head, 1/2-13x1	3	
13	97205	Screw, Socket Head, 1/2-13x2-1/4	3	
14	91053	Bushing, Heavy Duty	2	
15	91050	Bushing, Head Block	2	
16	97405	Flat Washer, 1/2”	1	
17	41023	Retainer Spacer	1	
18	97251	Bolt, 3/4-10x3-1/2	2	
19	91037	Sled, Vertical	1	
20	41048-02	Die Retainer, Vertical	1	

HYDRAULIC COMPONENTS

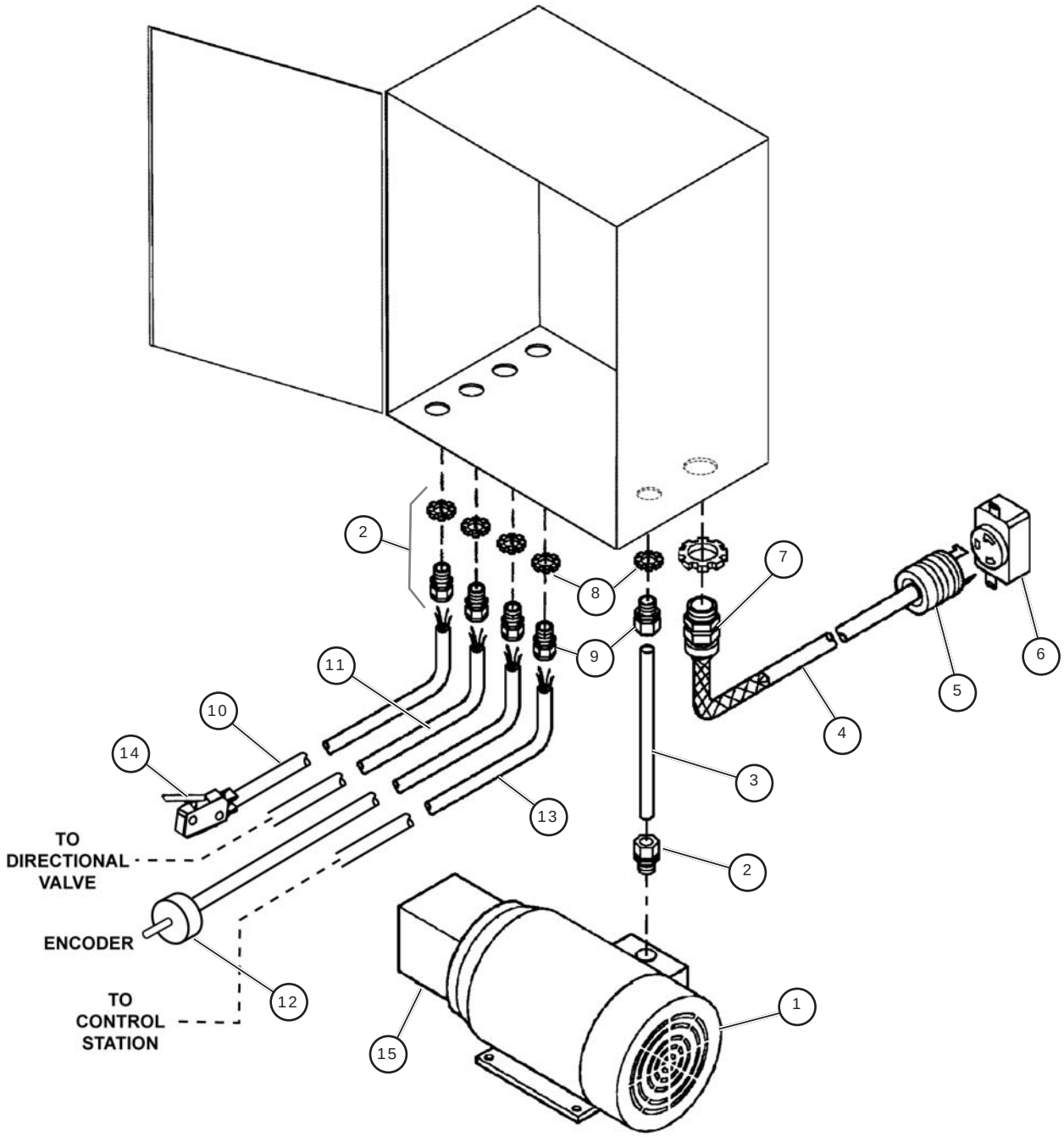
MODEL 3002



REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	92088	3/4 NPT Straight Pipe	1	
2	92087	1/2 Male NPT x 3/4 Female NPT, 90°	1	
3	92289	Filter Assembly	1	Includes Gauge 92292
4	92290	Filter	1	
5	92086	1/2 Male Run T	1	
6	92352	1/2” Return Hose, 38”	1	
7	92013	1/2 SAE O-ring x 1/2 Male JIC, Straight	2	
8	92014	1/2 SAE O-ring x 1/2 Male JIC, 90°	2	
9	92118	Directional Valve	1	
10	92054	Sequence Valve	1	
11	92082	1/2 SAE O-ring x 1/2 Male JIC, 90°, Long	1	
12	92100	Pressure Gauge	2	
13	92085	1/2 Male JIC x 3/4 Male NPT, Straight	1	
14	92351	1/2” Return Hose, 21”	1	
15	92083	1/2 Male JIC x 1/2 Female Swivel JIC, 90°	4	
16	92084	1/2 Male JIC, Union T	2	
17	92350	1/2” Return Hose, 14”	2	
18	92202	Pin, Side Cylinder	4	Included with Cylinder
19	854	Clip	1	
20	92173	Side Cylinder	2	
21	92010	1/2 Male NPT x 1/2 Male JIC, 90°	9	
22	92349	1/2” High Pressure Hose, 27”	2	
23	92348	1/2” High Pressure Hose, 22”	1	
24	92172	Main Cylinder	1	
25	92203	Pin, Main Cylinder	1	Included with Cylinder
26	92346	1/2” High Pressure Hose, 62”	1	
27	92347	1/2” High Pressure Hose, 81”	1	
28	92166	Pressure Manifold	1	
29	92343	1/2” High Pressure Hose, 56”	1	
30	92344	1/2” Return Hose, 36-1/2”	1	
31	92345	1/2” High Pressure Hose, 41”	1	
32	92342	Coupler	1	
33	92113	Pump	1	
34	92078	1/2 SAE O-ring x 5/8 NPT, 90°	1	
35	92081	3/4 SAE O-ring x 3/4 Male JIC, Straight	1	
36	92245	3/4 Suction Hose, 27”	1	
37	92076	3/4 Male JIC x 1/2 Male NPT, 90°	1	
38	92045	Suction Strainer	1	
39	92292	Filter Gauge	1	

CONTROL BOX WIRING

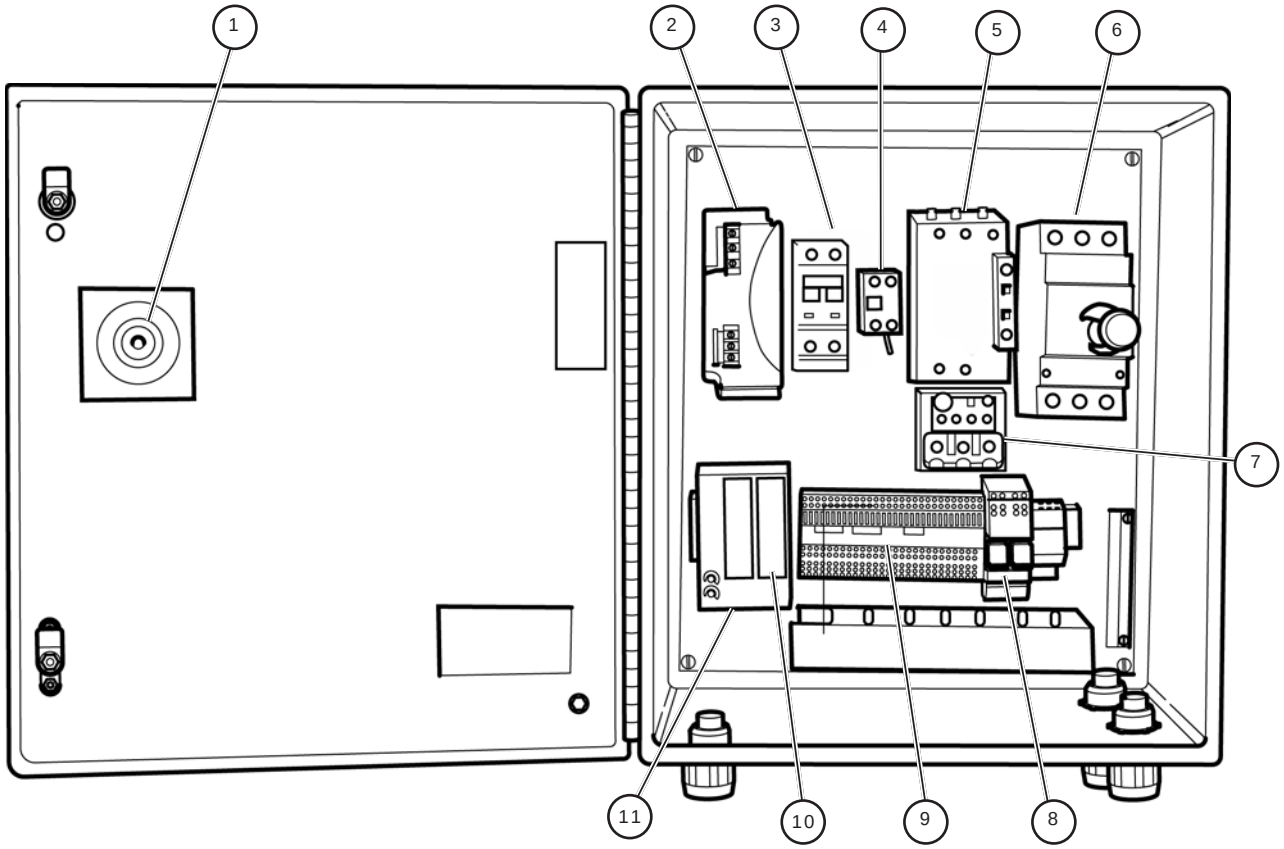
MODEL 3002

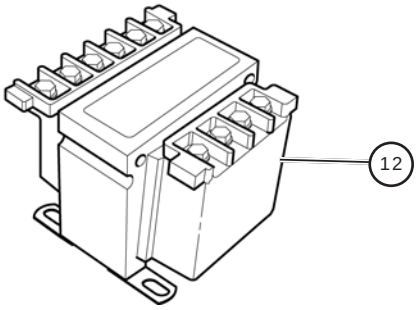


REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	95067	Motor, 10 HP, Single Phase	1	
	95068	Motor, 10 HP, Three Phase	1	
2	95459	Cord Grip	3	
3	95367	Power Cord, Single Phase, 20 ft.	1	Sold by the Foot
	95371	Power Cord, Three Phase, 20 ft.	1	Sold by the Foot
4	95367	Power Cord, Single Phase, 20 ft.	1	Sold by the Foot
	95371	Power Cord, Three Phase, 20 ft.	1	Sold by the Foot
5	95201	Plug, Single Phase, 230 V	1	
	95214	Plug, Three Phase, 230 V	1	
	95205	Plug, Three Phase, High Volt	1	
6	95200	Receptacle, Single Phase, 230 V	1	
	95215	Receptacle, Three Phase, 230 V	1	
	95204	Receptacle, Three Phase, High Volt	1	
7	95172	Kellum Grip	1	
8	95429	Lock Nut	3	
9	95449	Cord Grip	3	
10	95508	16-3 Cord, 4 ft.	1	Sold by the Inch
11	95364	16-4 Cord, 6 ft. 6 in	1	Sold by the Inch
12	95601	Encoder	1	
13	95602	Multi-Conductor Control Cable, 12 ft.	1	
14	95420	Micro Switch	1	
15	95077	Motor-Pump Adaptor	1	

ELECTRICAL BOX COMPONENTS

MODEL 3002





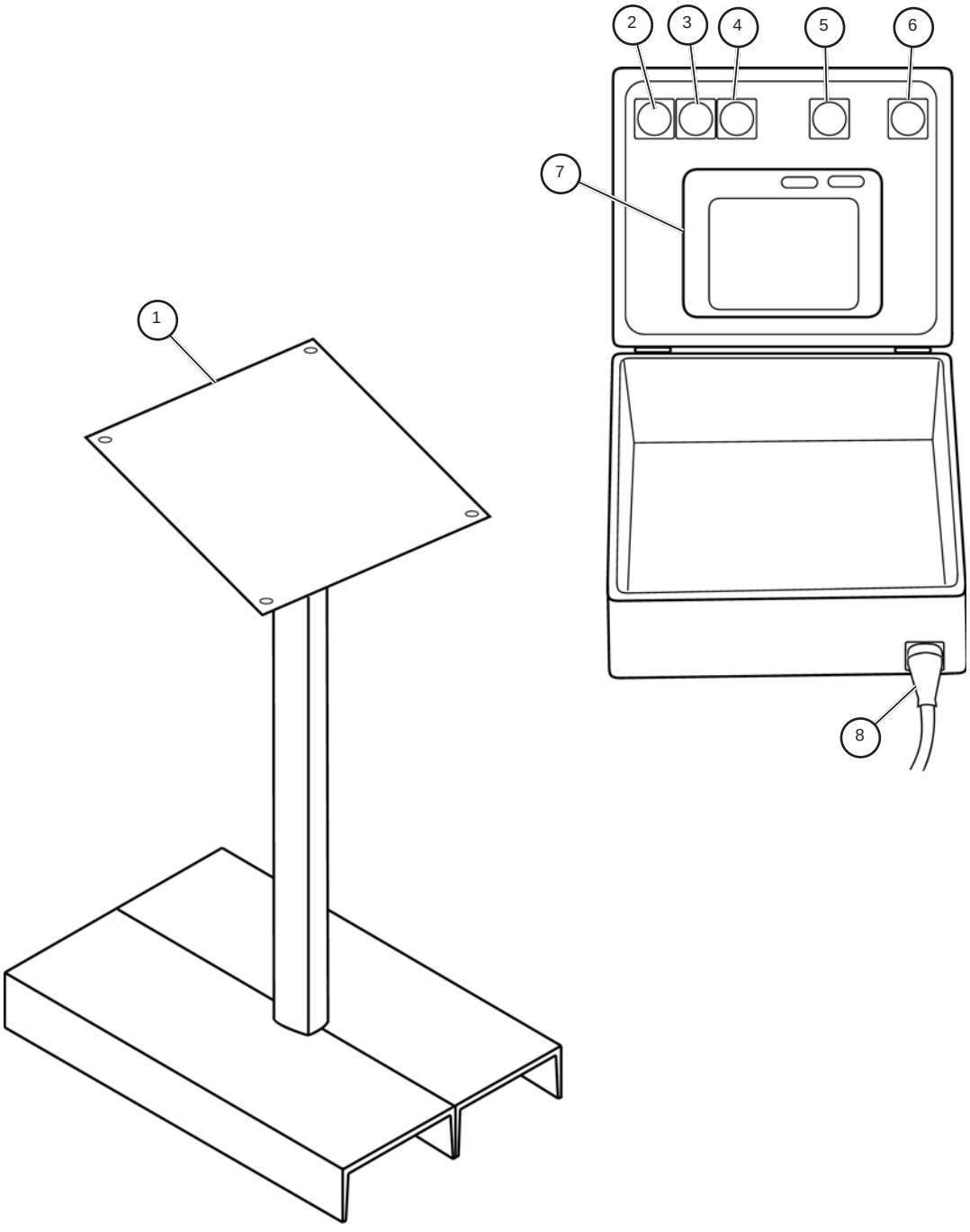
ELECTRICAL BOX COMPONENTS

MODEL 3002

REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	95603	Handle with Rod Assembly	1	
2	95604	Control Transformer, 24V	1	
3	95605	Supplementary Breaker	1	
4	95609	Auxiliary Contact, Single Phase, 230 V	1	
	95610	Auxiliary Contact, Three Phase, 230 V	1	
	95611	Auxiliary Contact, Three Phase, High Volt	1	
5	95606	Contactor, Single Phase , 230 V	1	
	95607	Contactor, Three Phase , 230 V	1	
	95608	Contactor, Three Phase , High Volt	1	
6	95612	Main Motor Protector, Single Phase	1	
	95613	Main Motor Protector, Three Phase	1	
7	95614	Overload, Single Phase, 230 V	1	
	95615	Overload, Three phase 230 V	1	
	95616	Overload, Three Phase, High Volt	1	
8	95617	Control Relays	1	
9	95618	Three Pole Terminal Block	1	
10	95619	ELC Expansion Module, 3002	1	
11	95620	Electronic Logic Control (ELC) 3002	1	
12	95621	Transformer, High Volt	1	

OPERATING CONTROL STATION

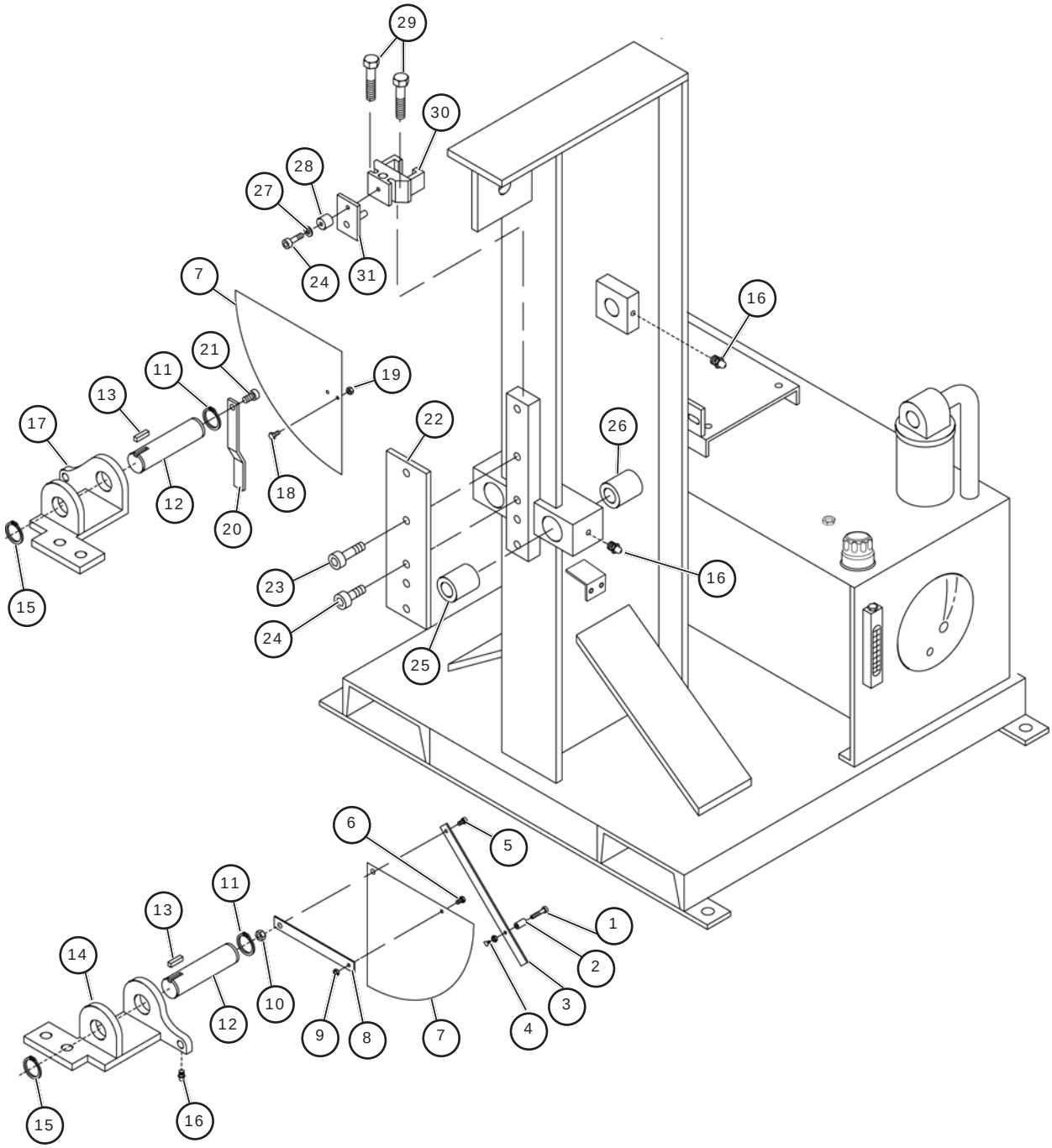
MODEL 3002



REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	35502-02	Control Pedestal	1	
2	95622	Push Lock Stop Button Assembly	1	
3	95623	Start Button Assembly	1	
4	95624	Forward Button Assembly	1	
5	95625	Reverse Button Assembly	1	
6	95626	Auto Bend Button Assembly	1	
7	95627	Touch Screen Control	1	
8	95628	Multi-Pin Control Connector	1	Plug and Receptacle

FRAME

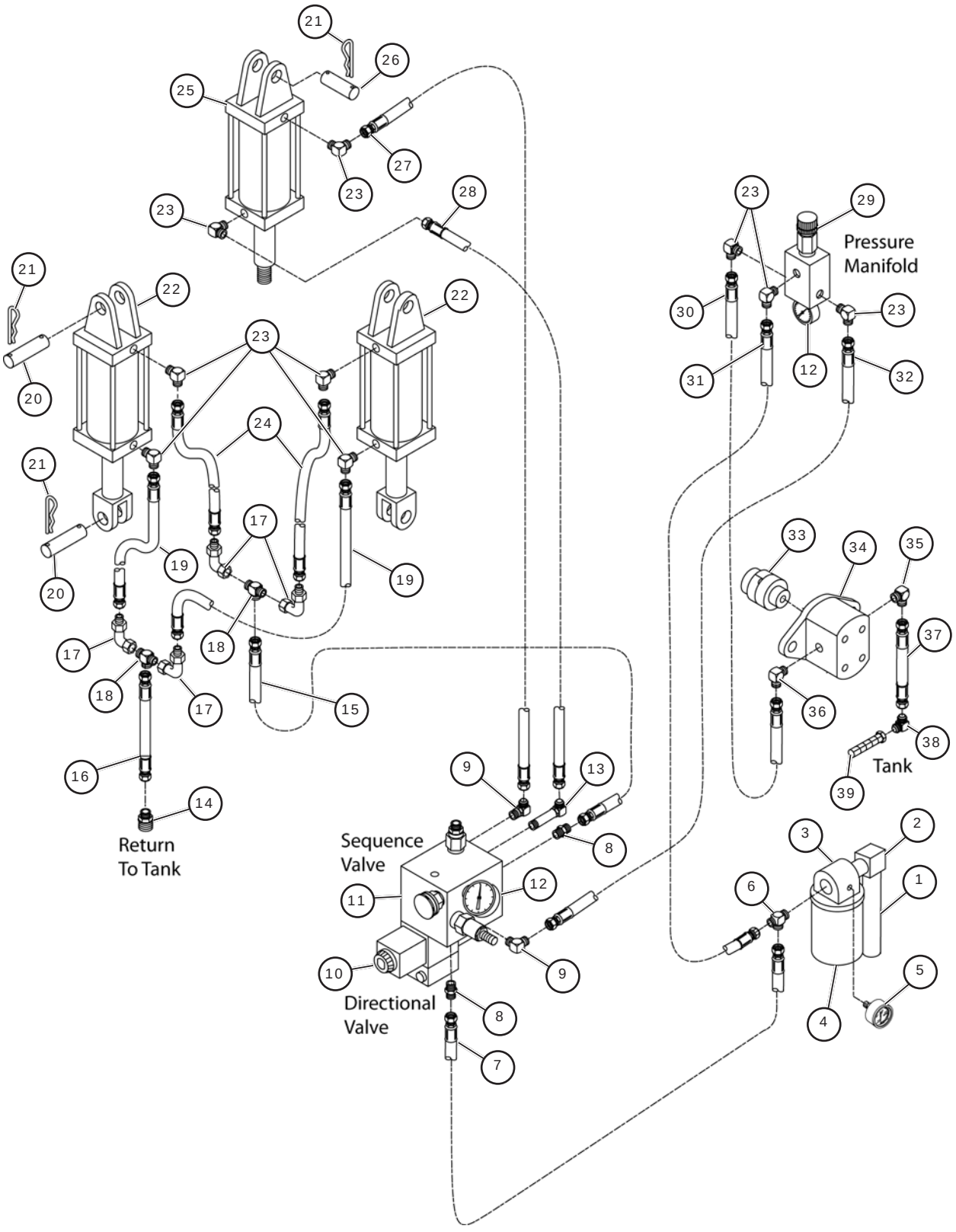
MODEL 3006



REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	97226	Screw, Socket Head, 1/4-20 x 7/8	1	
2	97000	Cam	1	
3	91152	Handle	1	
4	91150	Pointer	1	
5	97211	Bolt, 1/2-13 x 1-1/2	1	
6	97239	Screw, 10-32 x 1/2	1	
7	91160	Depth of Bend Plate	2	
8	91151	Depth of Bend Support	1	
9	97224	Locknut, 10-32	1	
10	97222	Locknut, 1/2-13	1	
11	90094	Snap Ring, Outside	2	
12	91042	Gate Pin	2	
13	90092	Keyway	2	
14	91035	Gate, Right	1	
15	90093	Snap Ring, Inside	2	
16	97234	Grease Zerk	6	
17	91034	Gate, Left	1	
18	97260	Bolt, 1/4-20 x 3/4	2	
19	97210	Locknut, 1/4-20	2	
20	91153	Pointer	1	
21	97400	Bolt, 1/3-13 x 3/4	1	
22	91047	Guide Plate	1	
23	97204	Screw, Socket Head, 1/2-13 x 1	3	
24	97205	Screw, Socket Head, 1/2-13 x 2-1/4	3	
25	91053	Bushing, Heavy Duty	2	
26	91050	Bushing, Head Block	2	
27	97405	Flat Washer, 1/2”	1	
28	41023	Retainer Spacer	1	
29	97251	bolt, 3/4-10 x 3-1/2	2	
30	91037	Sled, Vertical	1	
31	41048-02	Vertical Die Retainer	1	

HYDRAULIC COMPONENTS

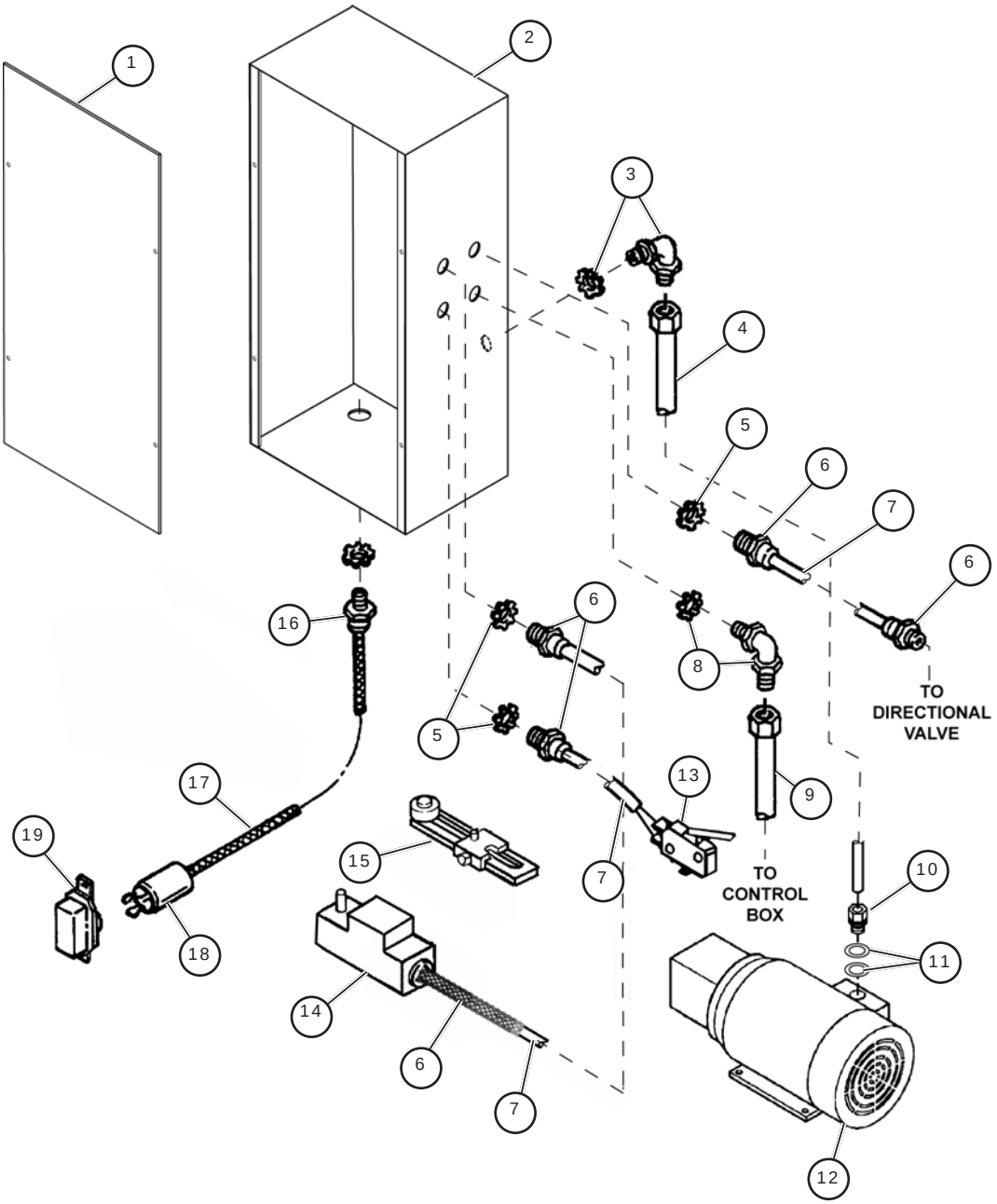
MODEL 3006



REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	92088	3/4 NPT Straight Pipe	1	
2	92087	1/2 Male NPT x 3/4 Female NPT, 90°	1	
3	92289	Filter Assembly	1	Includes Gauge
4	92290	Filter	1	
5	92292	Filter Gauge	1	
6	92086	1/2 Male Run T	1	
7	92352	1/2” Return Hose, 38”	1	
8	92013	1/2 SAE O-ring x 1/2 Male JIC, Straight	2	
9	92014	1/2 SAE O-ring x 1/2 Male JIC, 90°	2	
10	92118	Directional Valve	1	
11	92054	Sequence Valve	1	
12	92100	Pressure Gauge	1	
13	92082	1/2 SAE O-ring x 1/2 Male JIC, 90°, Long	1	
14	92085	1/2 Male JIC x 3/4 Male NPT, Straight	1	
15	92348	1/2 High Pressure Hose, 22”	1	
16	92351	1/2 Return Hose, 21”	1	
17	92083	1/2 Male JIC x 1/2 Female Swivel JIC, 90°	4	
18	92084	1/2 Male JIC Union T	2	
19	92350	1/2 Return Hose, 14”	2	
20	92202	Pin, Side Cylinder	4	
21	854	Clip	8	
22	92173	Side Cylinder	2	
23	92010	1/2 Male NPT x 1/2 Male JIC, 90°	9	
24	92349	1/2 High Pressure Hose, 27”	2	
25	92172	Main Cylinder	1	
26	92203	Pin, Main Cylinder	1	
27	92346	1/2 High Pressure Hose, 62”	1	
28	92347	1/2 High Pressure Hose, 81”	1	
29	92166	Pressure Manifold	1	
30	92343	1/2 High Pressure Hose, 56”	1	
31	92344	1/2 Return Hose, 36-1/2”	1	
32	92345	1/2 High Pressure Hose, 41”	1	
33	92357	Coupler	1	For Pump 92117
34	92117	Pump	1	For 7-1/2 HP Motor
35	92081	3/4 SAE O-ring x 3/4 Male JIC, Straight	1	
36	92078	1/2 SAE O-ring x 5/8 NPT, 90°	1	
37	92245	3/4 Suction Hose, 27”	1	
38	92076	3/4 Male JIC x 1/2 Male NPT, 90°	1	
39	92045	Suction Strainer	1	

CONTROL BOX WIRING

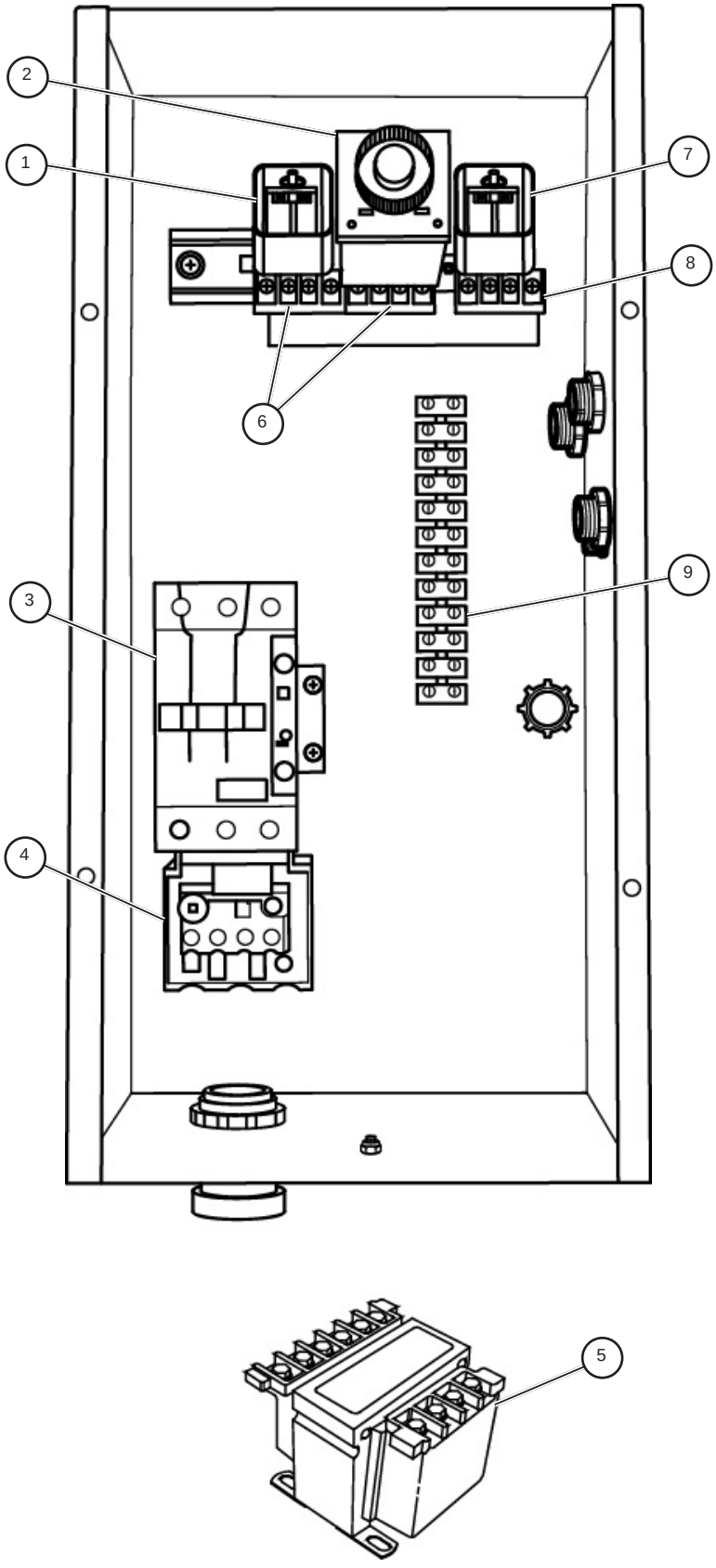
MODEL 3006



REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	95161	Control Box Lid	1	
2	95160	Control Box	1	
3	95236	90° Elbow, 3/8”	1	
4	95234	3/8” Conduit	1	Sold by the Inch
5	95429	Locknut	3	
6	95449	Cord Grip	4	
7	95508	16-3 Cord	1	Sold by the Inch
8	95227	90° Elbow, 1/2”	1	
9	95228	1/2” Conduit	1	Sold by the Inch
10	95235	Straight Connector, 3/8”	1	
11	97248	Reducing Washer	1	
12	95011	Motor, 7-1/2 HP, Single Phase	1	
	95010	Motor, 7-1/2 HP, Three Phase	1	
13	95420	Micro Switch	1	
14	95522	Limit Switch	1	
15	95523	Roller Arm	1	
16	95172	Kellum Grip	1	
17	95367	Power Cord, Single Phase	1	Sold by the Foot
	95371	Power Cord, Three Phase	1	Sold by the Foot
18	95201	Plug, Single Phase, 230 V	1	
	95214	Plug, Three phase, 230 V	1	
	95205	Plug, Three phase, High Volt	1	
19	95200	Receptacle, Single Phase, 230 V	1	
	95215	Receptacle, Three Phase, 230 V	1	
	95204	Receptacle, Three Phase, High Volt	1	

ELECTRICAL BOX COMPONENT

Model 3006

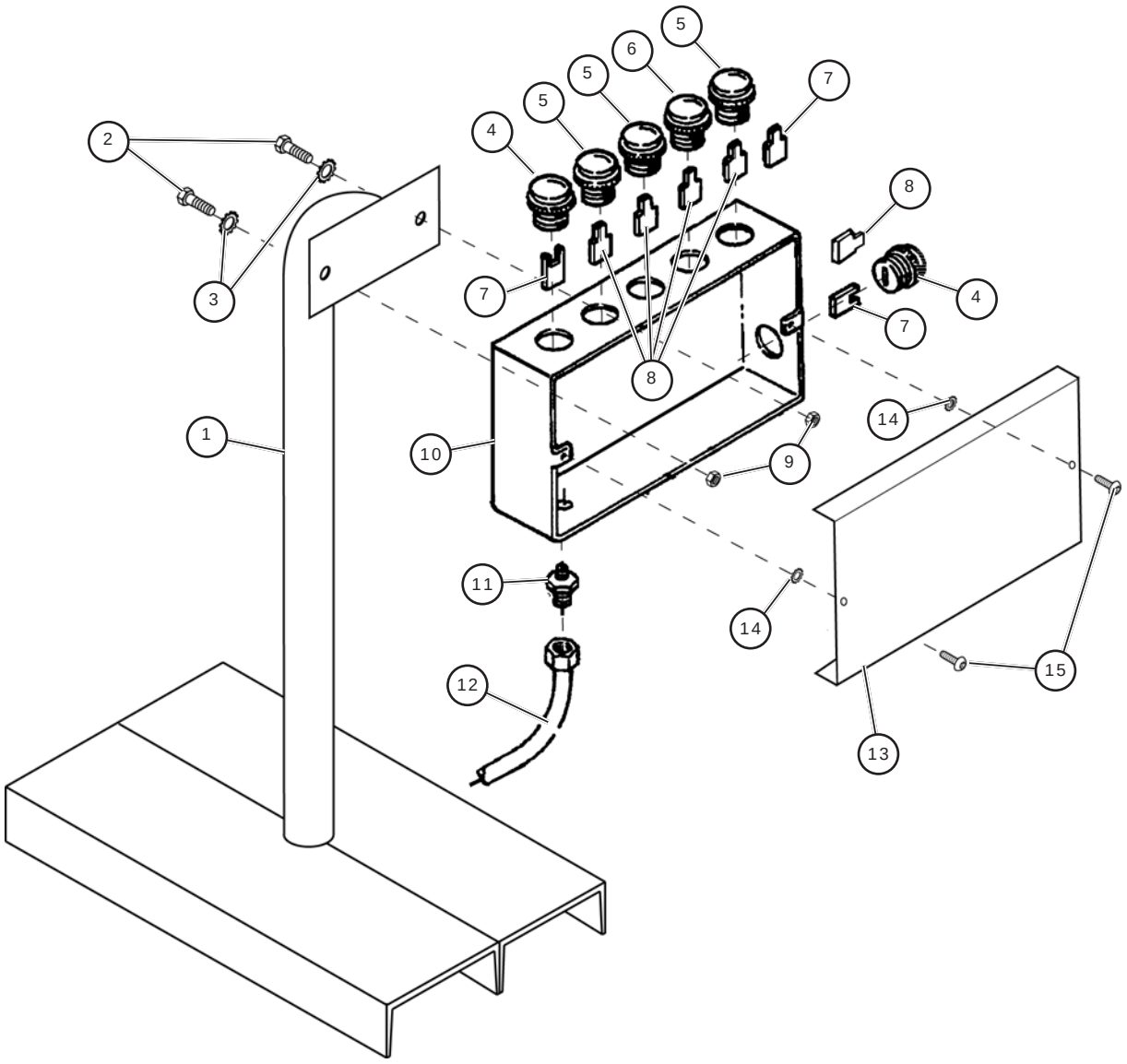


ELECTRICAL BOX COMPONENTS
MODEL 3006

REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	95460	Eight Pin Relay	1	
2	95461	Timer Relay	1	
3	95520	Contactor, Single Phase	1	
	95502	Contactor, Three Phase	1	
4	95521	Overload, Single Phase	1	
	95536	Overload, Three Phase	1	
5	95377	Transformer	1	
6	95462	Eight Pin Relay Socket	2	
7	95435	Eleven Pin Relay	1	
8	95463	Eleven Pin Relay Socket	1	
9	95507	Terminal Strip	1	

OPERATING CONTROL STATION

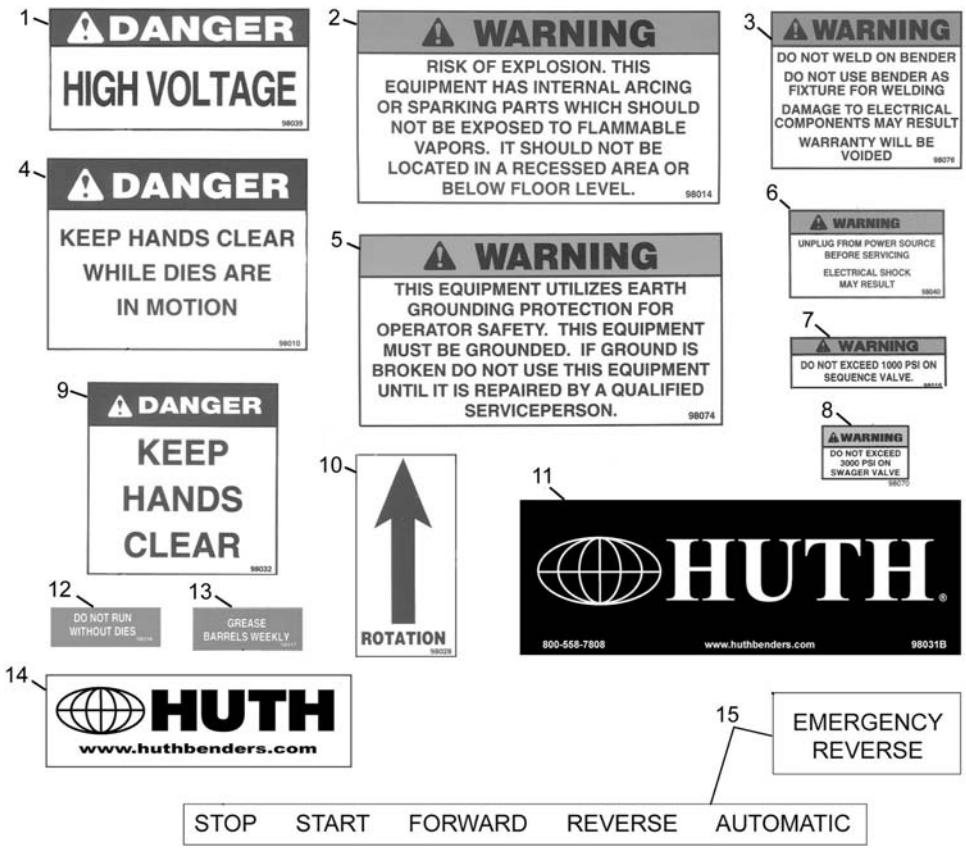
MODEL 3006



OPERATING CONTROL STATION
MODEL 3006

REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
1	35502-06	Control Station Pedestal	1	
2	97260	Bolt, 3/4-20 x 3/4	2	
3	97255	Star washer, 1/4	2	
4	95511	Red Pushbutton	2	
5	95512	Green Pushbutton	3	
6	95513	Black Pushbutton	1	
7	95514	Closed Contact	3	
8	95515	Open Contact	5	
9	97210	Locknut, 1/4-20	2	
10	95105	Button Box	1	
11	95227	Straight Connector, 1/2”	1	
12	95228	Conduit, 1/2”	1	
13	95106	Button Box Lid	1	
14	97259	Star washer	2	
15	97282	Screw, Allen	2	

COMMON COMPONENTS
DECALS



REF.	PART NO.	DESCRIPTION	QUANTITY	REMARKS
	98079	Decal Kit, Vertical	1	
1	98039	Decal, DANGER	1	
2	98014	Decal, WARNING	1	
3	98076	Decal, WARNING	1	
4	98010	Decal, DANGER	1	
5	98074	Decal, WARNING	1	
6	98040	Decal, WARNING	2	
7	98016	Decal, WARNING	1	
8	98070	Decal, WARNING	1	
9	98032	Decal, DANGER	2	
10	98028	Decal, Rotation	1	
11	98031B	Decal, HUTH Large	2	
12	98018	Decal, Do Not Run	2	
13	98017	Decal, Grease	2	
14	98088	Decal, HUTH Small	2	
15	98089	Decal, Control Panel	1	
16	98067	Decal, MADE IN USA (Not Shown)	2	

NOTES