PACIFIC

HYDRAULIC PRESS BRAKES

GENERAL INSTRUCTIONS

INSTALLATION, MAINTENANCE AND OPERATION

MEDIUM-DUTY SERIES

CATALOG NO. 3663

PACIFIC PRESS & SHEAR CORP.
MT. CARMEL, ILLINOIS

INSTRUCTION BOOK
MEDIUM DUTY FOR PACIFIC HYDRAULIC
PRESS BRAKES

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MEDIUM - DUTY
PACIFIC HYDRAULIC PRESS BRAKES

BASIC DATA AND CHARACTERISTICS

Date 7-14-63

Customer CROUSE - HINDS
Location SYRACUSE, N. Y.
Dealer SAYER & MC NAIR

Press Serial No.	2573	
Model No.	40 - 10/8	
Bending Capacity (maximum)	40	Tons
Punching Capacity (maximum) (2/3 of Bending Capacity)	26	Tons
Oil Quanity required	30	Gallons

Motor: For use on 440/ Volts, 3 phase, 60 Cycle
Controls (Relays and valves) For Use on 110 Volts, 1 ϕ 60 Cycle

Outline Drawing No.	C14755/10
Foundation Drawing No.	C14756/10
Hydraulic and Electrical Drawing No.	B15592
Motor Control Hook up	B5062M

Special Features.

MEDIUM DUTY - INSTRUCTIONS
GENERAL - PART I

1. This handbook contains description, operation and service instructions for the medium duty series Pacific Hydraulic Press Brakes which are manufactured by the Pacific Industrial Mfg. Company of Oakland, California and by the Pacific Press and Shear Corp. of Mt. Carmel, Illinois.

2. The Pacific Hydraulic Press Brake is used in bending, drawing, punching, blanking, corrugating and straightening metal sheets of various sizes and thichnesses as well as certain structural members.

3. To better understand your machine and to use it to your best advantages, we recommend that you study this book thoroughly at the same time refer to the electrical, hydraulic and outline drawings included for your particular machine. Bear in mind that this instruction book must be somewhat general and typical and that some of the features and descriptions in this book may not apply to your machine. However, it covers the basic principles of the operation and maintenance of the Pacific Hydraulic Press Brake.

4. All Pacific Hydraulic Press Brakes follow a basic direct acting design consisting of two large hydraulic cylinders, two side housings, a ram, a stationary bed or lower blade, a hydraulic power unit and an electrical control system.

5. The moving parts mainly consist of the pistons, ram, motor, pumps, and valves. The travel of the ram is controlled by adjustable stops on the stroke adjusting scale. Thus, the length of the stroke may be adjusted to the minimum required for each job, and this stroke length may be used anywhere within the range of the maximum stroke. The depth stop is provided with a micrometer for very accurate adjustment. Where possible, the working load should be centered between the cylinders; however, the Pacific hydraulic control circuit will allow working "off center" with a corresponding reduction in capacity.

   The ram is supplied with spring-loaded clamp bars along its lower edge which provide a 1/2" x 7/8" clamping groove to take standard press brake dies.

6. The bed normally consists of a heavy deep lower blade with its upper edge machined to receive dies, etc. On medium length presses the standard bed plate is flush with the floor. On longer machines, the bed plate will extend below the floor.

   The upper edge of the bed is provided with a 5/8" x 7/8" full length center groove and a series of drilled and tapped holes leading into this groove from the front and back vertical faces of the platen. Set screws in these holes are provided for alignment of lower dies in this center groove. Holes for bolts on 12" centers are drilled through the bed plate about 1-5/8" below the top surface for attaching gauges, support brackets, etc.

7. The left and right side housings provide the basic structural supports for the ram and bed. It is recommended that the side housings be bolted to anchor bolts set into the concrete foundation.

8. The ram is connected to the hydraulic cylinder piston rods by special cylindrical pressure blocks. The ram is guided at each end by 2 rollers attached to a bracket on the ram and riding on a steel roller bar attached to the side housing. The front-to-back position of the ram is maintained by the setting of the eccentric shafts on which the hardened rollers are mounted.

9. The hydraulic system of this press consists of an electric motor on which the hydraulic pump is mounted; one set of hydraulic valves which direct and regulate the flow of oil; and a special hydraulic level-control valve.

   The controls provide a Rapid-Advance Speed which is cam-actuated (adjustable cam), and a pressing speed which is adjustable from about 1 inch/second to about 1/4 inch/second on 40 Ton presses.
   (3/4"/Second to 1/4"/Second on 70 Ton presses)

   The speed control handle is located on the right-hand side housing. (Note, the speed adjustment affects only the pressing or working portion of the stroke. The approach speed (Rapid advance) and the return speed are not changed and will thus allow high productivity.)

PART II
INSTALLATION AND INITIAL START UP

GENERAL

Each Pacific Hydraulic Press Brake is completely assembled and given a thorough operational run-in and test in our factory. All components are inspected and adjusted for performance according to manufacturing specifications. Slideway rollers are set and locked in position. Valve restriction pressures are gauged and their adjusting screws are pinned. Lubrication points are correctly serviced. After testing, the press is prepared for shipment.. Rust preventative is applied to exposed machined surfaces. such parts as foot switch, and level control band may be removed and packed in a separate box.

INSTALLATION.

The foundation drawings show limiting dimensions and recommended construction details. Reinforced concrete details are to be furnished by the customer to suit local conditions. See foundation drawing.

After the press is delivered it should be thoroughly cleaned before installation. Protective coatings of rust-preventative and grease should be removed with solvent. The roller guide assemblies should be carefully cleaned to remove dirt or grit. Lubrication points on these assemblies should be pumped with fresh grease to force out old grease and any dirt which may have accumulated during transit. The press should now be placed in position to be lowered over the foundation bolts.

Install the machine on the foundation in accordance with the foundation drawing accompanying the machine and proceed as follows:

1) Move the machine into place and remove the skids.
2) Lower the machine over the foundation bolts.
3) Level the machine in both directions with a precision level, using pairs of broad steel wedges and plate shims under the side housings as required. (See Figure 1.)
4) Tighten the foundation bolts. Recheck the level of the machine during this procedure in accordance with step 3 above.
5) The allowance for grout should be 1/2" to 3/4". Do not grout under the bed plate. Grout under side housing lugs only.

PIPING BETWEEN POWER UNIT AND PRESS

The piping between the press and the Spreader Tank Power Unit is made up at the factory. The pipe and hoses have been properly fitted and bracketed and when the press is shipped set-up, the power unit is usually in place so that no re-connection is necessary.

STROKE ADJUSTING SCALE AND LEVEL BAND

If they have been removed for shipment, install the stroke adjusting scale and the level control band as shown on the reeving drawing, Figure 11.

HYDRAULIC OIL.

For complete oil specs., see the following paragraph. Fill the tank with oil. It is essential that no water or dirt enter the tank while it is being filled. Before filling with oil open the drain plug to clean out any condensation or accumulated moisture. The tank and piping have been thoroughly cleaned at the factory prior to shipment. Remove the filler cap and pour oil through a fine screen into the tank until the oil level reaches the top line on the dipstick. The calibration of the dipstick is based on the ram being in the top position.

Oil Specifications:

a. The viscosity of the oil used in the Pacific Hydraulic Press Brake Power Unit depends on the type of pump used and should be as follows:

Vickers Vane type pumps------150 to 225 SSU @ 100° F

b. Other than the correct viscosity, the most important factors are that the oil be of high quality, that it be manufactured specifically for hydraulic machines, and that it be clean. It is recommended that you consult the representative from your preferred oil company and get his recommendations.

c. The oil should have rust and oxidation inhibitors and antifoaming characteristics. The Viscosity Index should be above 85, which indicates an oil that undergoes a minimum change in viscosity for given change in temperature.

d. The Pour Point must be at least 30° F below the minimum starting temperature that will be encountered in your plant. This point indicates the lowest temperature at which oil is fluid, and it is important for extremely cold conditions.

e. The Neutralization Number must be below .06. This is an indication of acidity and tendency to sludge. A good oil should maintain this low neutralization number while in service.

f. The Steam Emulsion Number should be below 125. Hydraulic oils are subjected to water condensation trouble due to temperature differences. A low steam emulsion number indicates that an oil has good water separation characteristics, and good film strength.

OIL SPECIFICATIONS (Continued)

g. The Oxidation Factor must be as low as possible. This is a measurement of the rate at which the oil oxidizes at high temperature. Oxidation causes the viscosity to increase, and causes both gum and sludge to form. Sludge causes excessive wear on the valves and pumps, and may restrict orifices in valves.

h. In addition to the above checkpoints, IT IS VERY IMPORTANT THAT THE OIL BE CLEAN. All precaution should be taken to keep the oil clean, free from chips, dirt, water, sludge, coolants, cutting oil, etc. Use a high quality oil, strain it carefully when putting it into the tank, and replace it when it sludges. The oil level should be checked daily.

MOTOR CONNECTION.

The motor starter and push button are not ordinarily furnished with the unit and are usually supplied by the customer. A standard magnetic starter, which includes short-circuit, overload and under voltage protection, as well as a convenient disconnect switch, is recommended. (Check your local code requirements) It should be mounted on or adjacent to the press. Mount the push button at a convenient operating point on the press frame. Check the starter connections for correct operation before connecting the motor. It is very important that the starter relay drop out when the stop button is depressed. See Caution below.

Run the power leads in a conduit from the starter to the motor on the power unit. Ample size wire must be used to insure a minimum voltage drop under occasional overload conditions. Check the motor wiring for proper grouping of the leads coming from the motor.

CAUTION

DO NOT RUN THE MOTOR OR CHECK ROTATION UNTIL THE TANK HAS BEEN FILLED WITH OIL. Do not run the Motor backwards as the pumps can be permanently damaged in a very few seconds.

ELECTRICAL CONNECTION.

In addition to the motor wiring, additional electrical connections to be made are as follows:

1) Single phase 110 volt control power must be connected into the control panel. The control power is usually taken from the transformer or other 110 volt source and fed through an "on-off" control power switch.

2) The foot switch cable is usually factory connected into the control panel and cable of a sufficient length is supplied to enable placement of the foot switch at any convenient point for operation in front of the press. Occasionally, however, the foot switch is shipped disconnected, with its' wires marked for connection to the correspondingly marked terminals in the control panel.

ELECTRICAL CONNECTION (Continued)

3) Control Wires and conduit from control panel to power unit must be reconnected in case of Knocked-Down shipment. Do this by number coding.

ELECTRICAL CHECK.

The complete electrical control system should be carefully checked before starting the press. The steps and procedure are as follows:

1) The motor is to remain off during the test.

2) The inch switch should be in the "cycle" position.

3) Raise the micrometer depth stop and lower the back travel stop so that they are not contacting their respective switches. With the control power on, control relay should actuate.

4) Depress the foot pedal to the bottom and momentarily operate the back travel limit switch by hand. The control relay should actuate.

5) Hold the foot pedal in the bottom position and operate the depth limit switch by hand. The control relay should actuate.

INITIAL POWER UNIT START UP.

It is assumed that the tank is filled with oil, and the electrical check is completed. Turn control power "off." Jog the motor to check rotation. The correct rotation is indicated by arrows on the pumps and the motor. If the rotation is wrong, reverse two of the three motor leads. The motor should be started, rotation rechecked, run up to speed, and then stopped several times. (Note that the control power must be turned off during this operation to prevent premature operation of the ram.) For press startup see later paragraph.

CHECK LIST BEFORE STARTING PRESS.

Before starting the press the following items should be checked:

1) Rust preventative washed out of the roller guides.

2) Slideway rollers and pressure blocks greased.

3) Press properly leveled and grouted in place.

4) Scale and stops installed.

5) Level Control Band correctly installed.

6) Oil in the tank at proper level.

7) Pumps greased, if necessary.

CHECK LIST BEFORE STARTING PRESS (Continued)

8) Correct rotation of the motor.

9) Pumps lubricated by operating power unit intermittently.

10) Hoses connected correctly.

11) Electrical control system checked out.

12) No dies in the press.

13) Clear understanding of the section on level control.

INITIAL PRESS START UP.

It is very important that this operation be followed in exact sequence if the press is to operate satisfactorily.

After a complete inspection of the items listed in the above Check List, the press is ready to start up. Throw the inch switch to "cycle". Turn the control power off. Start the motor. Let the motor come up to speed and then stop it several times. Turn the control power on. The ram should move up to the back travel stop. This is important as oil should be supplied under pressure to the lower side of the pistons first before attempting to advance the ram. This will provide a holding pressure under the pistons to prevent any chance for the ram to drop. After the ram is moved up initially, remove the temporary blocks which supported the ram during transit or assembly. Depress the foot pedal. The ram should go down; however, it may be out of level due to air in the system, release the foot pedal and allow the ram to return. Depress the foot pedal again and repeat the above. Air below the piston of the right hand cylinder is exhausted by an automatic air vent. This cycling should be repeated until the ram remains level. This may take a dozen or more cycles. The ram should not be allowed to go to the bottom of the stroke and hit the depth limit switch. This should cause the ram to return to the back travel stop regardless of the operation of the foot pedal.

After removing air from the system, check the oil in the supply tank with the ram at the top of the stroke. Add more, if necessary, to bring the level to the mark on the dipstick. The press should now be cycled 20 times at the bottom 2" to remove the air beneath the piston.

CHECKING INCH CIRCUIT.

The inch switch should be thrown to the "inch" position. Depress the foot pedal, and the ram will go down. At any point in the advance stroke the foot pedal may be released, and the ram should stop and not return upwards. With the foot pedal released, place the inch switch on "cycle" and the ram will return immediately to the back travel stop.

CHECKING TWO SPEED CIRCUIT.

Depress the foot pedal to the down position. The ram should advance with a distinct change of speed from rapid advance to normal press as the cam operates the roller microswitch. The ram may tend to go out of level at the point of speed change until all of the air in the system is exhausted. THE RAPID ADVANCE SPEED IS PRIMARILY AN APPROACH SPEED ONLY AND IS NOT TO BE USED AS A PRESSING SPEED.

CHECKING VARIABLE SPEED.

Adjust the speed-change cam on the scale so that full contact is made with the roller microswitch.

Depress the foot pedal so that the ram moves downward in the normal pressing speed. Observe the speed. Continue stroking the ram. Now rotate the speed control lever (mounted on right hand side housing) and observe the distinct change in pressing speed.

The slow-speed has an important advantage in reducing "whip-up" of long sheets when forming over small die openings, as well as providing increased accuracy.

When forming, note that after setting the speed control handle for the desired speed, the depth stop must then be set for the desired bend to be made in the part. Any further change in speed will require a further adjustment of the depth stop.

* In other words the faster the pressing speed the more "override" is encountered at the depth stop and an allowance for this override must be made in the setting of the depth stop.

PART III
OPERATION

PRESS CAPACITY (Figure 13, Tables of Pressure).

The rated bending capacity of the machine is determined by the length of a particular thickness of sheet which the press will "air bend" to a 90° angle over a given die opening, such sheet having an ultimate tensile strength of not over 60,000 psi. Note that this tonnage is somewhat under the nominal rating of the press. The rated bending capacity may be exceeded but the nominal tonnage rating cannot be exceeded because the relief valve will open when the press develops its maximum tonnage. The relief valve will remain open while that tonnage is maintained. The maximum relief valve pressure setting for this machine is shown on the Hydraulic drawing. When doing punching or blanking operations, it is necessary to hold to the arrangement as outlined in that section.

STROKE-ADJUSTMENT.

OPEN HEIGHT 13"
SHUT HEIGHT 7"
STROKE 6"

The stroke-adjustment scale is attached to and moves with the ram. The depth and back travel switches are attached to the side housing. The upper and lower limits of the stroke, and the length of the stroke, can be set quickly by moving the micrometer depth stop and back travel stop. It is only necessary to use as much stroke as the work being handled requires for: feeding the press; making the bend; and taking out the finished part. The length of the stroke determines the number of strokes per minute, the latter varying inversely with the length of stroke. The micrometer depth stop, which controls the depth of the stroke, provides both a coarse and fine adjustment, permitting rapid set-up with extreme accuracy. Fixed limit stops are provided so that the pistons will not hit the ends of the cylinder is either direction.

IN

There are three devices which control the movement of the ram:

a) The stroke adjusting device controls the top and bottom limits of the stroke. The adjustable stop with the micrometer attachment is the depth control, which limits the downward travel of the ram. The other adjustable stop limits the back travel of the ram.

b) The foot switch starts the down-stroke; or stops the ram at any point in the advance stroke between the adjustable stops. Once the return stroke has been started, it will continue in its upward direction until the back travel limit switch is operated.

c) The tilt device controls the angle between the ram and the bed by raising or lowering of the left end of the ram. It is useful for tapering operations, to compensate for unbalanced loading of the ram where center loading is impossible, and to make adjustments for die parallelism.

INSTALLING DIES

Pacific can supply dies and die sets for any reasonable requirement (See Figure 21). Clamp bars are provided on the ram to secure the top die. The bed of the press is provided with a 5/8" wide full length center slot with adjusting screws. The standard lower die has a 1/2" tongue. This slot, therefore, provides 1/16" either way for alignment with the top die. The top die should be secured to the ram and lowered until it hits the bottom die before securing the adjusting screws in the bed. This will insure accurate line-up between dies. After the adjustment has been made for the depth of the stroke, the tilt device may have to be adjusted so that the dies are parallel under the load required for this particular job. This final adjustment is determined by checking the finished part. The operator should soon be able to estimate the magnitude of the adjustment necessary.

Pacific Indexing Die. (Optional Equipment) Pacific has developed a special multiple V opening lower die and raising block. By moving the Index handle to the right the whole die is raised off its seat in the raising block. Rotating the Index handle to the right or left places one of the several V openings or the flat face of the die in the working position. Moving the handle back to the left lowers the die into its working seat and the desired die face is in position.

The special raising block for the above multiple die is equipped with special wedges along its lower face to compensate for slight deflection of the bed and ram and to eliminate the necessity of shimming of certain dies. Adjusting the screws from the front of the press moves both the front and back wedges equally.

TILT DEVICE.

The normal permissible range of tilt of the ram is one inch in twelve feet in either direction. To set the ram for the desired tilt, rotate the adjusting nut on the tilt device slowly while cycling the ram. Note that when the ram is tilted the maximum amount, the available stroke is reduced by one inch per twelve feet of ram length. Therefore relocate stroke stops to prevent "bottoming" on cylinders.

The tilt device may be of several types. One type is located on the left-end at the end of the level control cable. Another type may be a "dial type" located near the right hand end of the ram. (This type is usually a fine adjustment only.)

The numbers on the tilt adjustment scale are approximate and are intended for reference for repeat settings of the ram tilt.

BLOCKING THE RAM. (Control power and main Power "off")

Whenever the press is not in use, even for as short a time as 30 minutes, the ram should be left with the dies in the closed position or blocked so that the weight of the ram is supported. It is recommended that large hardwood

BLOCKING THE RAM. (Control Power and main Power "off") (Continued)

blocks, placed directly below the cylinders, be used for blocking. The ram should be at the top of the stroke when the press is blocked for long periods, in order to keep the piston rod clean and free from dirt or rust. Blocking will prevent the ram from getting out-of-level due to possible leakage of the control valves, or the cylinder cup packing.

PUNCHING.

The Pacific Hydraulic Press Brake can be used for multiple punching, providing proper consideration be given to the design and arrangement of the punches and the point of break through. Punches or blanking dies must be designed with ample shear. In case of multiple punches, they must be stepped at different elevations so that the punching load at the final break through has been reduced to less than 2/3 of the rated capacity of the press. Consideration must also be given to the arrangement, design and location of the punches and the blanking dies on the press, so that the load is always balanced with relation to the longitudinal center line of the ram and bed. With a number of punches in line, those at the center of the press should operate first, followed by approximately equal numbers of punches on either side of this center group, with the punches at the ends of the row punching through last. This arrangement is recommended for two reasons. First, it eliminates binding of the punches due to creeping or elongation of the sheet if the center holes are punched last, and secondly, any deflection of the bed and ram due to the center load will be dissipated by the time the extreme end punches break through.

REQUIREMENTS FOR SATISFACTORY BENDING:

Material must be formed to the proper angle within a reasonable tolerance for the job on which the part is to be used.

A. Satisfactory brake work cannot be done in a die that is not deep enough to allow for spring back of the material. The die must have clearance under the material being bent so the bend can be completed without the material bearing anywhere except on the outside edges of the V die opening. This is the basic concept of "Air Bending".

B. Material Thickness, length of bend, grain direction, and the hardness of the material, all have an important effect on the angle of bend.

Note:

If an operator has a number of pieces to run he should give the following a great deal of consideration.

a. Material will always vary. If an operator will bend a piece and check the angle of bend and find it is not perfect, then make a correction for the next bend, he is correcting the error for the piece he just bent.

Instead, he should "mike" the material and adjust the depth of stroke for the material to be bent. The thinner the material the greater the depth required.

b. In order to get uniform bends from one end of the piece to the other, it is necessary to compensate for the deflection of the machine. If the work is done midway between the side housings, the side housings deflection will be equal and the only deflection which will effect the bend will be in the bed and ram. To compensate for this, die shimming or raising block adjustment is required. When it is necessary to do work which is concentrated under one cylinder, the ram may require a tilt adjustment to compensate for the uneven deflection of the side housings. When working on one end of the press, the tonnage available is reduced by the fact that one cylinder will develop only one-half the full rated tonnage of the machine.

c. Procedure for Setting-Up and Running a Job Consisting of one or more pieces.

Select and set up, in the machine proper, dies to make the required bend. A die opening of 8 times the thickness of material is usually standard.

Inching: The ram may be inched down in small increments to complete the job but when the depth limit is used, the last 1/8" should be in one continuous movement until the depth limit switch is actuated and the return cycle is started.

(Selector switch at inch. Depth stop out of way.)
Center the bend line over the bottom die opening or under the knife. Inch the knife die down on the work. As the work is bent and approaches completion, inching can be done in small increments. When this bend is almost complete, the knife will hold the work, the setting of the depth stop can be made for the second piece. Move the stop down until the "mike" just touches the switch plunger. Then screw the "mike" down compressing the plunger the amount of the normal overtravel. This amount will be individual for your machine and its speed, and will be determined by the operator's experience, possibly .025" to .065". Step on the pedal. The ram will go up. Gauge your piece. If it is not bent enough, hit it with a full stroke at the same setting, then make micrometer adjustment if necessary to get required angle. Your second piece might bend a little differently in one hit but will need only a slight adjustment.

When bending large pieces by the inching method, for the last hit there should be about 1/8" travel between the depth stop and the depth limit switch so that the final hit will make the desired bend.

d. When a piece of steel will not bend over the proper die opening and yet is shown on the tonnage chart as being within the capacity of the machine, you can assume that the tensile strength of the material is above that of mild

steel and it will be necessary to use a larger die opening to do the job. Then, caution should be taken to insure that no casualty occurs in the event the piece has a tendency to break.

SOME SIMPLE RULES AND NOTES.

a. The width of the lower die opening should always be at least eight times the thickness of the plate. Lighter plate can be flanged where a bend is specified less than 5t from the edge by using a narrower than 8 - 1 die opening. Allow at least 1t as the amount the plate rests on the V die beyond the edge of the V opening. (t - thickness of material).

b. The nose radius of the knife die should be equal to or less than the thickness of the plate for a standard inside radius. A very sharp knife die will still form an inside radius of about 1t but will make a noticeable mark in the material. It is evident that, for economics sake, a compromise is made in the nose die radius to have it suitable for several plate thicknesses.

c. Air bend tonnages are taken directly from the chart. Bottom bends will take the full tonnage of an hydraulic press and may damage the part, depending on its thickness, length, die set detail and the rated capacity of the press.

PART IV
MAINTENANCE

GENERAL

This part contains information on lubrication; hydraulic oil requirements; maintenance of valves, pumps, packings; and a monthly maintenance check.

LUBRICATION

As with other types of machinery correct lubrication is important. Most of the moving parts of the Pacific Hydraulic Press Brake operate in oil, however there are a few points which must be regularly serviced. Namely, the guide rollers and the ram bearing blocks. Rollers are pregreased and should not require further lubrication and attention other than occasional cleaning of exterior guide surfaces. A light grease film on guides is desireable. Piston bearing blocks should be loosened and given light grease coating yearly or as required.

REQUIREMENTS FOR LUBRICATING BEARINGS ON ELECTRIC motors vary with manufacturer and model. The customer should definitely understand lubrication requirements. Some motors have sealed bearings; others require periodical service. Bearings should be neither neglected nor overgreased.

ADJUSTMENT OF VALVES.

It is our general experience that users of Pacific Hydraulic Press Brakes will have less trouble if they do not touch any valve adjustments, but call our dealer's service man. The entire operation of the press is dependent upon balancing a few adjustments, and it is essential that the service man doing this work understand the entire operation of the press. Adjustment of any of the valves on this press to a higher setting than recommended by Pacific will void the guarantee.

LEVEL CONTROL VALVE.

The levelling of the ram of this press is controlled by a special Pacific Level Valve. In the event of malfunction or failure of this valve, it must be returned to the Pacific Industrial Manufacturing Company, Oakland, California or Pacific Press & Shear Corp., Mt. Carmel, Illinois, for exchange or repair. Please include with the shipment a letter giving the press brake serial number and details of failure or malfunction of the valve.

PACIFIC RELIEF VALVE.

There are three possible sources of trouble with the relief valve. Foreign material may prevent the pilotcone from seating, or clog the orifice in the spool. It is also possible that the spool may stick. Any of these will result in erratic operation of the press. The entire pilotcone assembly, as well as the valve head, can be removed without affecting the adjustment of the valve. The proper check procedure is as follows:

PACIFIC RELIEF VALVE. (Continued)

If foreign material is under the pilotcone, loosen the adjusting screw assembly, and remove the particle by allowing the oil to flow through the pilotcone seat.

If it is necessary to disassemble the top head of the relief valve, proceed as follows: (See Figure 9)

1. Unscrew adjusting screw assembly #1-2-3. The setting will not be changed if pin #2 in lock nut #3 is not disturbed.

2. Remove the pilotcone guide #4 by screwing a 6-32 screw about 2" long into the tapped hole in the end of the pilotcone guide.

3. Punch mark the head and its mating part for correct reassembly.

4. Remove the valve head.

5. Thoroughly clean all parts, particularly pilotcone #6, pilotcone seat #8, and the orifice in main spool.

6. To reassemble, hold the plunger assembly by the 6-32 screw in a vertical position, with spring #7 and the pilotcone balanced in place. Holding the head upside down, insert the assembly vertically into the proper hole. The pilotcone will then be correctly centered. Remove the 6-32 screw at this time. Replace the adjusting screw assembly. It should very seldom be necessary to clean the bottom head. However, if desired this may be done at this time.

CAUTION: Be sure when replacing the valve head that the ports match. (Punch mark all heads when they are removed)

NOTE

The relief valve settings should not exceed those recommended. To do so could overstress the members of the press with the possibility of damage and loss of accuracy. It could also dangerously overload the motor, the pumps, pipe and valves, as well as the packing of the cylinders. Therefore, if the relief valve settings are increased without factory approval, our guarantee will be immediately voided.

FOOT SWITCH

Move the pedal slowly through its various operation positions, listening for the on and off clicks of the microswitches. Adjust the screws so that the down switch clicks on and off while the pedal is on the heavy bottom spring and the up switch clicks on and off while the pedal is on the light top spring. The goal in adjusting the switches is to have as large a center or neutral position as possible and still have the switches operate.

PUMP MAINTENANCE.

High pressure hydraulic pumps are built with very close clearances. It is possible to completely ruin an expensive pump in a very few minutes, merely by changing the tension on the head plate capscrews, restarting a pump improperly, etc. It is strongly urged that the enclosed pump instruction sheet be studied carefully before attempting any adjustment of the pump, or before restarting any pump that has been repaired. Should there be any doubts about the details of the pump adjustment, contact the pump manufacturer's service man or your Pacific Hydraulic Press Brake Dealer.

ROD PACKING.

The pistons rod packing is adjustable and should keep the rod surfaces almost dry. A very thin oil film is desired. If the rod is too dry or if the packing squeals the gland should be loosened slightly. However, if the packing tends to leak it should be tightened. When either loosening or tightening the packing, care should be taken to see that the adjustment is uniform. The capscrews should be adjusted by quarter turns at 180 degree intervals, and the adjusted packing tested for correct performance. The distance between the lower surface of the cylinder head and the lower surface of the gland should be carefully measured at intervals around the gland and these measurements, should be kept equal within 1/64". After several years it may become necessary to add an extra Chevron ring. Proceed as follows:

1) Place the inch switch in the "inch" position and run the ram down to the bottom of the stroke and block both ends of ram.

2) Turn off all power to the press.

3) Remove the gland capscrews and slide the gland down.

4) If it is desired to add one ring to the existing packing, carefully lower the first packing ring using a suitable sharp pointed tool; be careful not to jab the tool through the ring. Carefully place the new packing ring around the piston rod with the "V" up. (Split this ring at 45° if necessary.) Raise into place along with the existing lower packing ring.

5) When the rings are snugly in place raise the gland and replace the gland capscrews. Give the new packing a preliminary adjustment sufficient to prevent gross leakage. Do not tighten excessively.

6) Stroke the ram until the air in the system is expelled. This should require about thirty strokes (using maximum stroke).

7) Correctly adjust the gland and packing as mentioned above. Wire the heads of the gland capscrews.

PISTON (CUP) PACKING.

If the Piston packings leak they must be replaced. Excessive packing leakage will be indicated by a loss of power or excessive dropping of the ends of the ram.

PISTON (CUP) PACKING. (Continued)

To replace the cups, proceed as follows:

Remove the hydraulic cylinder from the press and place the cylinder vertically on the floor or bench with the piston rod up. Secure the cylinder rigidly to a bench or column where hoist facilities are available for handling the piston. Remove the cylinder head.

The piston rod assembly may be lifted out of the cylinder as a complete unit. The cup packing is snapped in place over a bead turned in the packing groove. Remove old packing and install new packing. Make certain that the entire assembly is clean and the cylinder walls are in good condition. If there is any galling of the cylinder walls, they should be smoothed up with a hone. Reassemble the piston in the reverse order as outlined above, using extreme care not to damage the cup packings as they enter the cylinder.

ADJUSTMENT OF THE LEVEL SYSTEM.

In the event it becomes necessary to adjust the level control system, follow the procedure listed below.

The ram of these presses is held level or tilted with reference to the upper surface of the bed by means of the level control valve as indicated in the hydraulic circuit. This valve should not be tampered with, and in the event of malfunction, contact the factory at once and arrange for a complete replacement valve from stock. There will be a nominal replacement or servicing charge.

The other parts of this level control system consists of a steel band, a set of small sheaves, a safety spring and link connecting to the spool of the above valve and the tilt device as previously described.

a. Check the level control band safety spring. This spring should hold the rod with sufficient tension to pull the valve spool to its maximum down position before the rod moves within the spring.

b. Adjust the band by tightening or loosening the knurled adjusting nut so that all slack or sag has been removed.

c. It should be noted that it may be necessary to make a special tilt adjustment for each job depending on its position in the press.

RENEWAL PARTS

Part names or numbers have been listed on Hydraulic and Electrical drawings. When ordering parts, be sure to list them by name, figure number, and item number, and give the rating and serial number of the press. We recommend the following spare parts to be carried in stock.

RENEWAL PARTS (Continued)

Two Sets of Contact Tips for Relays

One Microswitch for Depth or Back Travel limit Switch, BZE-RQ-66.

Two Back Travel Stops.

One Level Control Band Spring.

50' Level Control Band.

MONTHLY MAINTENANCE CHECK

In order to insure long and trouble free service, the following maintenance check should be made every month. This will assist in locating minor troubles before they can cause breakdowns. If a breakdown does occur, carefully note the symptoms and refer to TROUBLE SHOOTING Section.

VISUALLY INSPECT THE PRESS.

a. Turn off all power to the press.

b. Visually inspect the band safety spring. This spring should hold the rod with sufficient tension to pull the valve spool to its maximum down position before the rod moves within the spring.

c. Inspect the level control for:

   1. Correct reeving.

   2. Paint or dirt on the band or sheaves. (Pulley)

   3. Alignment of the band on band mounting bracket and the end sheaves.

   4. Freedom of movement of the sheaves.

d. Inspect the stroke adjustment scale and travel limit switches as follows:

   1. Operate the back travel limit switch and listen for a click. Check for cleanliness, especially for oil or water.

   2. Operate the depth limit switch and listen for a click. Check for cleanliness, especially for oil or water.

   3. Check that both top and bottom limit stops are in place.

   4. Tighten the scale mounting screws.

   5. Check the micrometer head to see that it is tight.

6. Operate the roller microswitch (if there is one), and listen for a click. Be sure that the cam fits tightly.

f. Check the following capscrews and nuts for wrench tightness:

1. Cylinder capscrews (holding cylinder to side housing).

2. Roller guide nuts.

3. Piston-Ram connection spanner nuts.

g. Open the electrical control box for a visual inspection. (Make Certain that the power is off)

1. Check for cleanliness and freedom from oil. Any oil must be removed with a non-flammable solvent.

2. Tighten all terminal screws.

3. Check for burned out relay coil. This will be obvious from the odor.

4. Remove arc chutes and inspect the contact points. Replace any that are badly burned. Tighten all contacts.

5. Manually close the contacts to be sure that they close and have good spring tension.

6. Inspect shading coils. These are rectangular loops of copper clamped to the lower end of the laminated magnet poles. These must be crimped tight and not broken.

h. Visually inspect the power unit.

1. Rotate the motor by hand if possible. Check for noisy pump bearings and for freedom of rotation.

2. Check the oil for correct level and cleanliness. If there are any signs of the slightest amount of dirt in the oil, replace or filter it. If the oil is dirty the filter element should be changed.

3. Check for oil pools indicating bad leaks.

4. Check that the jam nuts on the relief valves and foot valves are tight.

5. Grease the pump (if required).

6. Loosen tank plug to check for water in the oil. This should be checked before morning start-up. Drain all water from bottom of tank and tighten plug.

VISUALLY INSPECT THE PRESS. (Continued)

i. Visually inspect the foot switch. Remove any obstructions from under foot pedal. Listen for the click in each microswitch and note the dual spring pressures. In raising the pedal the down microswitch should click off just before the pedal transfers from heavy tension to light tension. The up microswitch should click on just before the end of the pedal up travel.

ELECTRICAL CONTROL CHECK.

The purpose of this Section is to check the operation of the basic electrical control circuit. This includes components as follows: The back travel relay, the foot pedal, the depth limit microswitch, the back travel limit microswitch, the level control valve, and the various other microswitches and wiring.

a. Make certain that the power to the motor(s) is off, the inching switch is in the cycling position and the micrometer depth stop and the back travel stop are moved away from their respective limit switches.

b. Turn on the control power. Check the power unit to see that the control relay is energized. If none of these are energized, check the fuses and incoming control power.

PART V
TROUBLE SHOOTING

The following table is included as a convenience in readily locating the source of almost any conceivable operating difficulty. It is organized by symptoms observable from work quality or obvious malfunction, with possible causes and remedies. You should familarize yourself with all the press components and functions as listed in previous sections.

Almost all of the problems reported to us are due to such simple causes as burned out valve solenoids, defective limit switches, loose wires, worn pump seals, and the like. All these can be readily located and repaired with very little down-time or maintenance cost. Before referring to "TROUBLE SHOOTING", be sure to observe the press action or malfunction very carefully. It is obvious that if enough is known about a condition, it largely ceases to exist as a problem and then becomes merely a maintenance action.

TROUBLE SHOOTING
VARIATION IN BEND ANGLES BETWEEN SUCCESSIVE PIECES (REPEAT ACCURACY)

POSSIBLE CAUSES	HOW TO FIX IT
Air in cylinders (check for source of air; this is usually obvious from corresponding oil leakage)	Oil Level low-add oil to mark on dipstick
	If worn pump seals or pump head gasket, replace.
	If loose or broken pump intake pipe, tighten or replace.
	If defective O-ring at flange or other connection, replace and inspect for cause of failure of O-ring.
Defective depth limit switch	Replace unit inside enclosure with BZE-RQ-66 microswitch.
Relay shading coil broken	Replace shading coil.

VARIATION IN BEND ANGLES BETWEEN SUCCESSIVE PIECES (REPEAT ACCURACY) (Continued)

POSSIBLE CAUSES	HOW TO FIX IT
Relay points burned or welded	Replace points and springs.
V-die opening too shallow; material forms radius during bending which bears against V-opening; material brakes inaccurately.	Deepen V-opening to eliminate bottoming effect, form by Air-bending.
Material thickness varies. Hard spots, grain direction, tensile strength variation.	Check material.
General	See section on "Adjustment of the level system," and make recommended "Monthly maintenance check."

VARIATION IN BEND ANGLE ALONG INDIVIDUAL PIECE (LEVEL ACCURACY)

General Case:
End angles unequal; angle changes uniformly end-to-end.

POSSIBLE CAUSES	HOW TO FIX IT
Material thickness varies. Hard spots, grain direction.	Check material.
Ram not levelled; load not evenly distributed along ram.	Adjust to level position by tilt adjustment-check for uniform bend with test strips or from work results. Center Load.
Level-control valve defective	Return to factory for repair or replacement.

Special Case:
End angles equal; different angle in center of piece.

POSSIBLE CAUSES	HOW TO FIX IT
Dies not shimmed properly	Shim under middle of lower die, when setting up, for normal deflections of bed and ram.

TROUBLE SHOOTING
RAM WILL NOT STOP
OVERRIDES ON ADVANCE OR RETURN STROKES

POSSIBLE CAUSES	HOW TO FIX IT
Defective limit switch (Depth limit switch or back travel limit switch)	Replace with BZE-RQ-66.
Loose or broken wire	Check for loose or broken wires or terminals on limit switches and relays; check inside junction boxes for broken or greasy connections. Test wires with test lamp if necessary, using certified Pacific circuit drawings for this.
Relay armature binding.	Remove cause of binding.
Welded Relay contact	Replace contacts and springs

RAM WILL NOT ADVANCE OR RETURN

Ram level but will not advance and/or return.

POSSIBLE CAUSES	HOW TO FIX IT
No control power	Check switch and fuses, inspect for loose or broken wire.
Defective limit switch (back travel or depth limit)	Replace with BZE-RQ-66 microswitch.
Foot pedal inoperative	Check switches, look for loose terminal or broken wire. Check pedal adjustment.
Motor not operating	Check switch, fuses, starter, and main power line.

TROUBLE SHOOTING
RAM WILL NOT ADVANCE OR RETURN (Continued)

POSSIBLE CAUSES	HOW TO FIX IT
Defective relay	Check coil; replace if burned out. Check contacts; replace if burned or dirty. Check armature for binding. Check for loose or broken wires or terminals.
Broken pump shaft	Replace pump shaft (also bearings and seal).
Relief valve not closing	Clean out small orifice in valve spool. Check for dirt in pilot-cone assembly.
Level control band broken (ram at extreme out-of-level position).	Replace level control band-check for cause of break; dirt or paint on pulleys; or misaligned pulleys.
Level Control safety spring stretched (same position as above.)	Replace spring.

ERRATIC RAM MOTION

Ram settles excessively (settling should not be noticeable for several minutes after ram stopped.)

POSSIBLE CAUSES	HOW TO FIX IT
Settling one side only. Remains level during advance, pressing and return. If two speed, will lag on this side in rapid advance speed.	Level valve may leak and need replacing. Air-bleed in right hand piston not functioning. Remove cylinder and check.
Settling evenly, both sides	Foot-valve leaking. Remove and inspect.

TROUBLE SHOOTING
INSUFFICIENT TONNAGE

POSSIBLE CAUSES	HOW TO FIX IT
Trying to bend material over too narrow die opening, or too high tensile material.	Use larger die opening, etc.
V-die opening too shallow, material forms radius during bending which bears against side V-opening, thereby reducing effective die-opening.	Make V-opening deeper; form by air bending.
Relief valve dirty	Check and clean upper head and main spool.

INCORRECT SPEEDS OR WILL NOT CHANGE SPEED

POSSIBLE CAUSES	HOW TO FIX IT
Incorrect pump parts installed	Be sure to provide exact duplicates for repair parts.
Will not go into rapid advance speed	Check rapid advance roller micro-switch (contacts normally closed.) Check for loose or broken wires. Check solinoids.

OIL LEAKS
(Source is usually obvious)

POSSIBLE CAUSES	HOW TO FIX IT
Pump shaft seal	Replace, check bearings and shaft for wear.
Defective O-ring seal	Replace with exact duplicate.
Cylinder packing gland	Be sure that gland capscrews are tightened uniformly, that gland and surface of cylinder are parallel, and gland not tightened excessively. Should be thin oil film on piston rod, but not leaking.

TROUBLE SHOOTING
UNUSUAL NOISE

POSSIBLE CAUSES	HOW TO FIX IT
Rattle in pumps due to air	Check for source of air, probably seals; replace. May also be due to loose intake pipe or low oil level. Check oil (Refer to oil specifications)
Squeal from cylinders	Rod packing excessively tight; adjust properly.
Solenoids in control relays or control valves noisy	Check armature travel and seating; remove cause of binding.

MOTOR STALLS OR FAILS TO START

Fails to start.

POSSIBLE CAUSES	HOW TO FIX IT
Main switch not turned on	Check all switches.
Circuit breaker cover not closed	Close cover; turn handle to "on" position.
Fuses blown	Check for short circuit; replace or repair fuses.
Heaters kicked out	Reset, check for source of overload.
Starter button defective	Repair or replace
(If 110 volt starter coils) 110 volt disconnect may be open	Check all switches
Defective starter coils	Replace

TROUBLE SHOOTING
MOTOR STALLS OR FAILS TO START (Continued)

POSSIBLE CAUSES	HOW TO FIX IT
Burned out transformer (if starter coils 110 v)	Replace.

Stalls under load.

POSSIBLE CAUSES	HOW TO FIX IT
Relief valve setting too high	Adjust down immediately to correct setting; This setting should never be exceeded, as this may damage the press frame.
Low voltage condition (continuous or intermittent)	Provide adequate voltage.
Weak or burned motor	Contact manufacturer's representative for motor check.
Loose or broken wires	Repair.

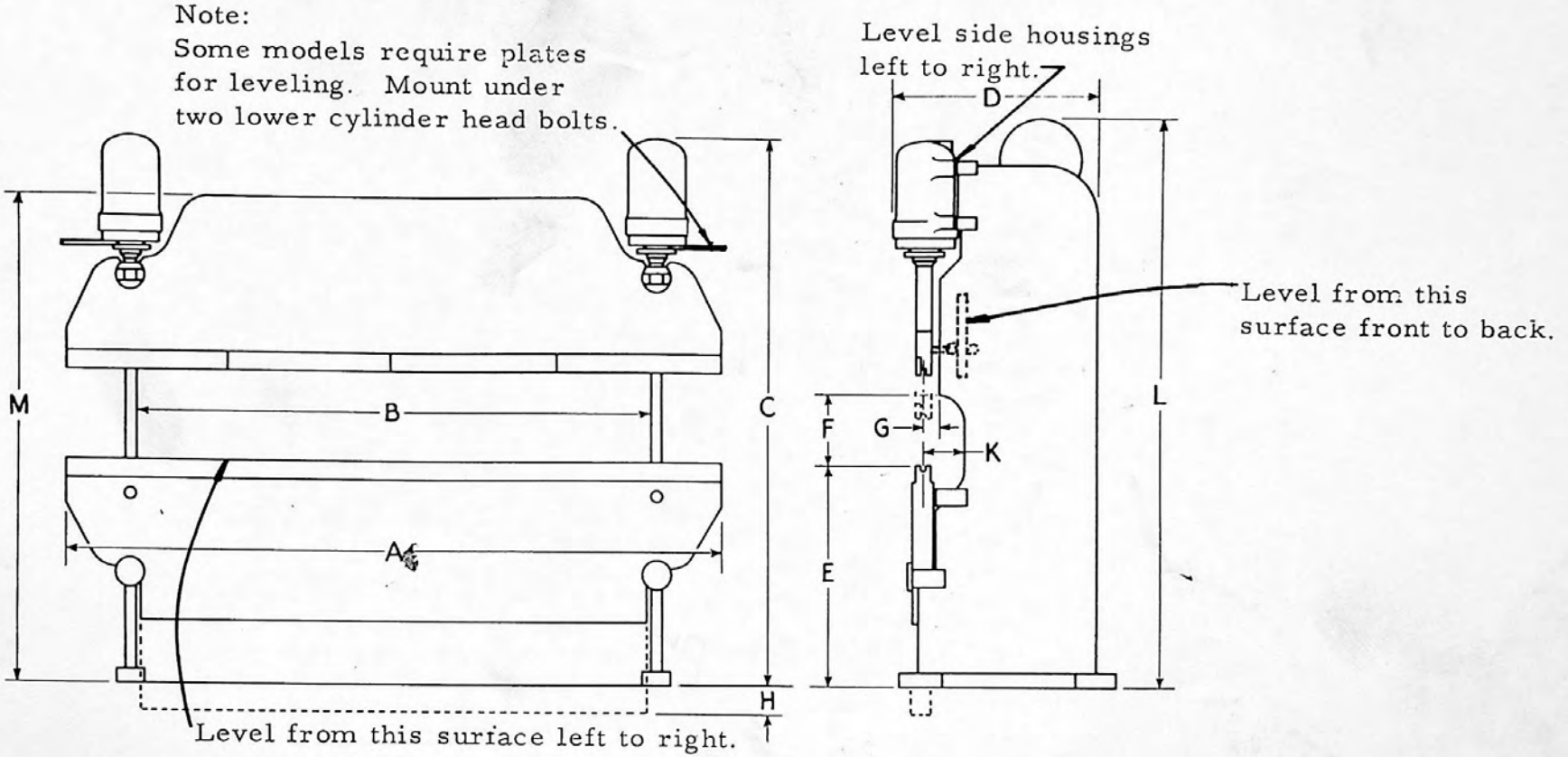
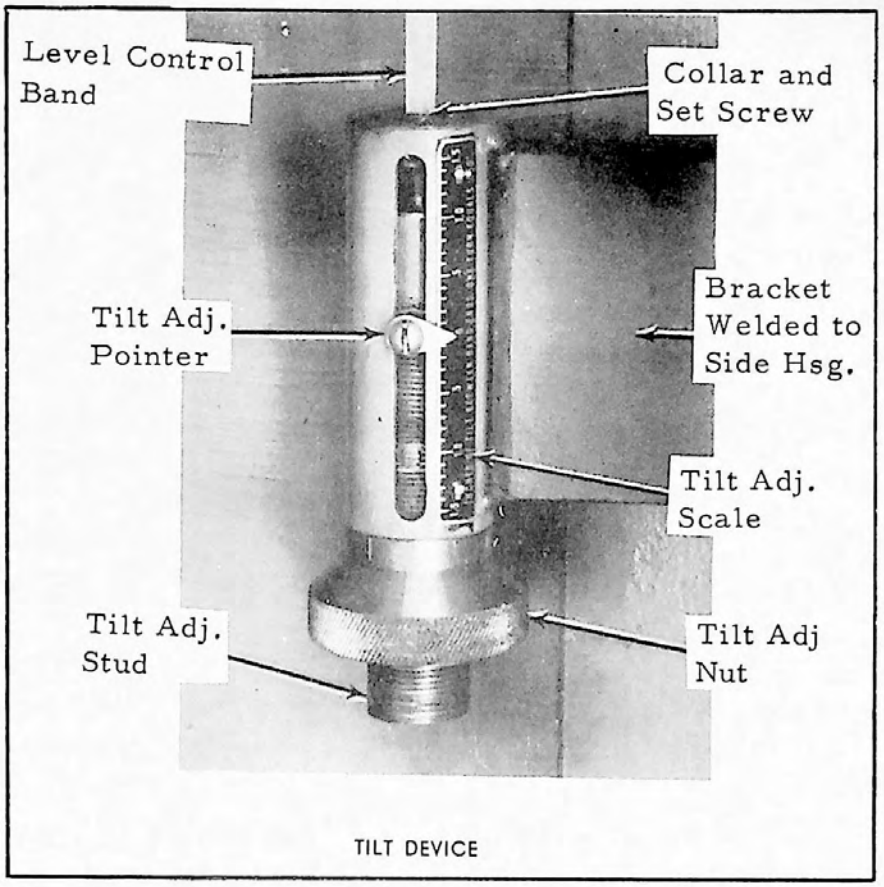
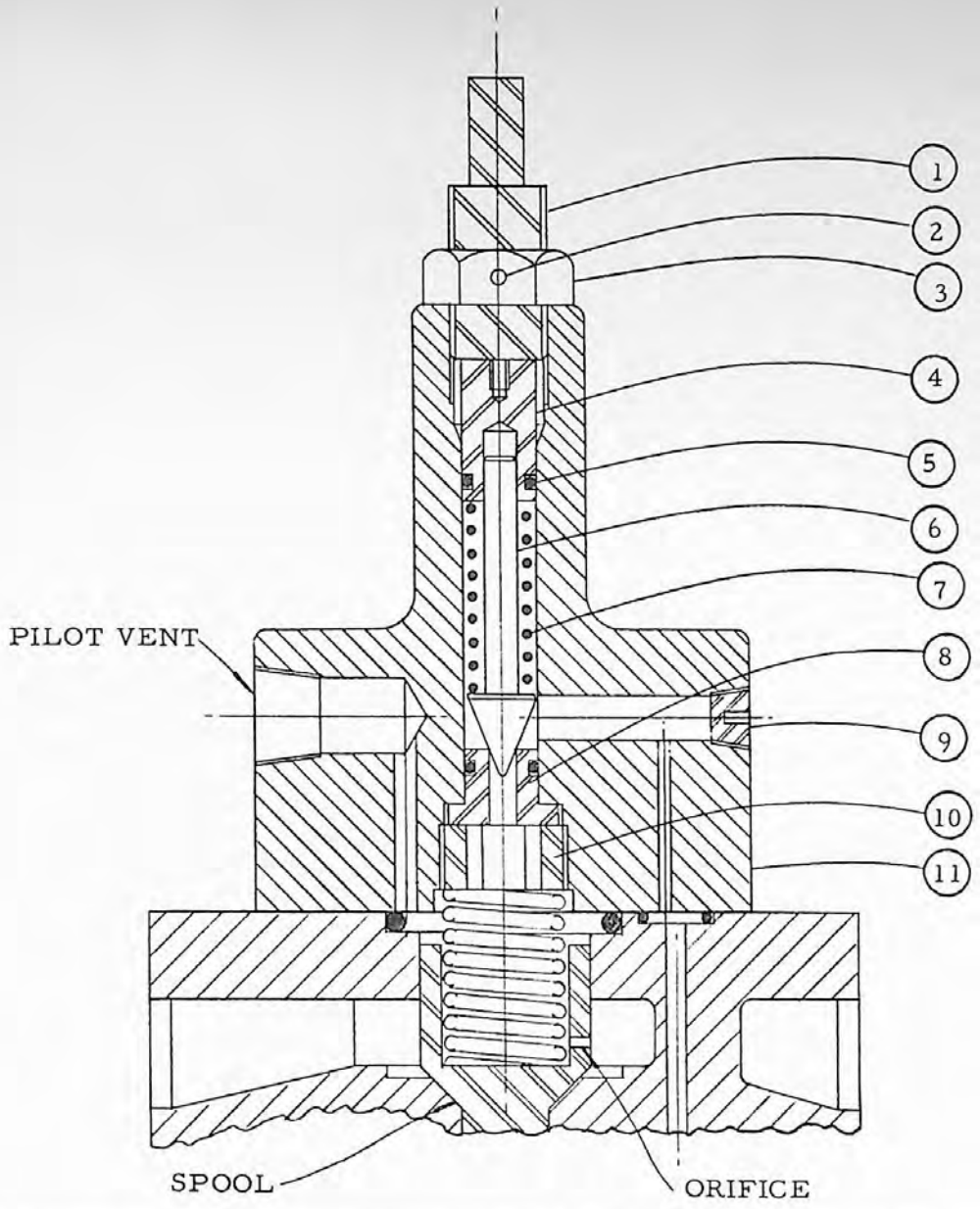

Note:
Some models require plates for leveling. Mount under two lower cylinder head bolts.
Level side housings left to right.
D
Level from this surface front to back.
M
B
C
L
F
G
K
E
A
H
Level from this surface left to right.

Figure 1



TILT DEVICE

Figure 7

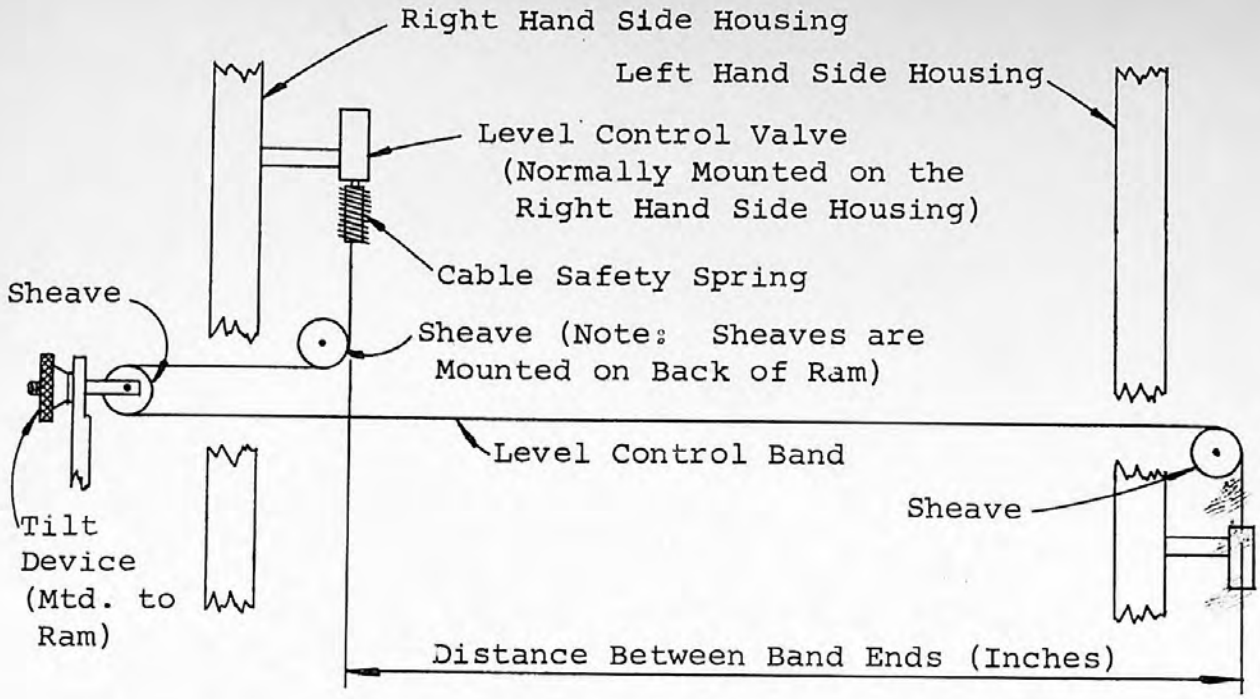


ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	ADJUSTING SCREW		
2	PIN	11	PILOT CONE HEAD
3	9/16"-18" NF LOCKNUT	10	3/4"-16 NF HOLO-K-PLUG
4	GUIDE	9	1/16" SOC. HEAD PIPE PLUG
5	"O" RING	8	SEAT
6	PILOT CONE	7	PILOT CONE SPRING

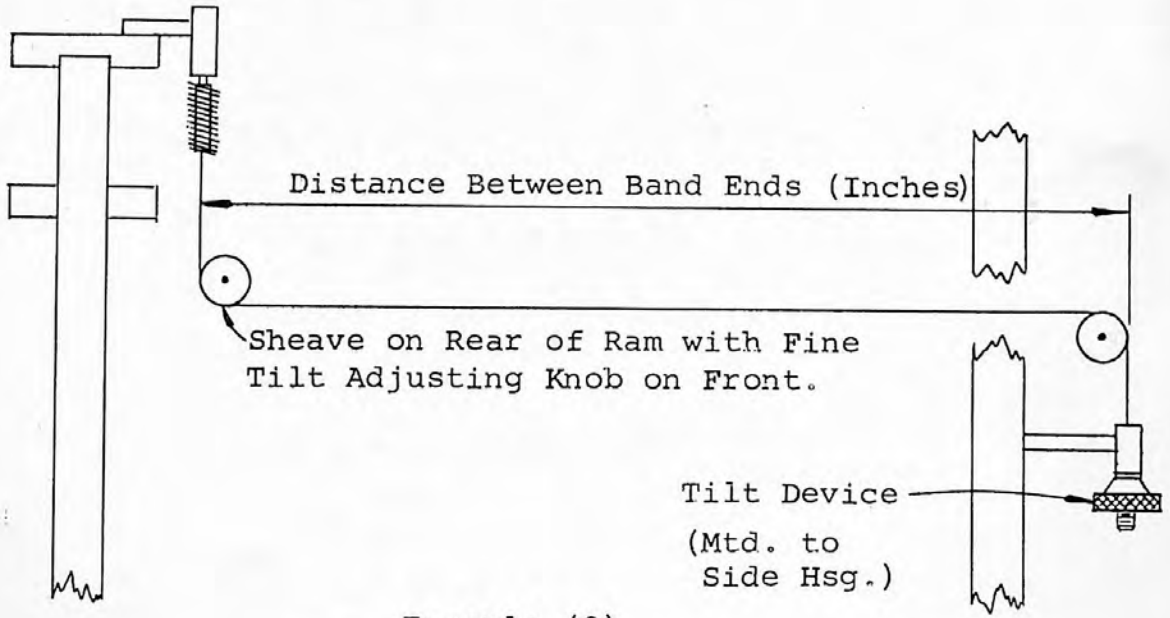
TYPICAL ADJUSTABLE HEAD ASSEMBLY FOR 3/4" VALVES USED ON RELIEF VALVE AND TWO-UP VALVE, DEPENDING ON SYSTEM USED.

NOTE: 1 1/4" PACIFIC VALVES HAVE DIFFERENT DESIGN HEADS BUT THE INNER PARTS AND THE OPERATION ARE SIMILAR.

Figure 9



Example (1)



Example (2)

The maximum allowable tilt of 1" in 12'-0" should not be exceeded.

The reeving diagrams shown are typical. Refer to the one suited to your particular Press.

Reeving of Level Control Band. (Rear View)

Figure 11
5/29/63

TABLES OF PRESSURE

AIR BENDING PRESSURES REQUIRED PER LINEAR FOOT

Pressure in Tons for Mild Steel (60,000 PSI Ult. Tensile Strength) on Standard Dies.

Thickness of Metal		Width of Vee Die Opening																				
Gauge	Inches	1/4	5/16	3/8	7/16"	1/2"	5/8"	3/4"	7/8"	1"	1⅛"	1¼"	1½"	2"	2½"	3"	3½"	4"	5"	6"	7"	8"	10"	12"
20	.036	3.1	2.3	1.7	1.4	1.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	.048	5.3	4.0	3.0	2.5	2.2	1.7	1.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16	.060	9.6	7.1	5.6	4.5	3.8	2.8	2.2	1.8	1.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	.075	.....	11.9	9.2	7.6	6.3	4.7	3.5	3.0	2.5	2.1	1.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	.105	.....	.....	.....	16.7	13.1	9.7	8.0	6.5	5.6	4.6	4.1	3.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11	.120	.....	.....	.....	.....	19.2	14.2	11.1	9.0	7.5	6.3	5.5	4.4	2.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	.135	.....	.....	.....	.....	.....	18.6	14.5	11.9	9.9	8.5	7.3	5.8	4.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3/16	.188	.....	.....	.....	.....	.....	.....	27.4	23.1	19.3	16.4	14.3	11.2	7.5	5.7	4.4	.....	.....	.....	.....	.....	.....	.....	.....
1/4	.250	.....	.....	.....	.....	.....	.....	.....	.....	39.4	33.3	29.5	22.7	15.4	11.4	9.0	7.4	6.1	.....	.....	.....	.....	.....	.....
5/16	.313	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.4	39.8	27.0	19.7	15.3	12.7	10.5	7.7	.....	.....	.....	.....	.....
3/8	.375	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	61.6	42.3	30.9	24.0	19.6	16.3	12.3	9.5	.....	.....	.....	.....
7/16	.438	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	61.7	45.8	35.4	28.6	24.4	17.3	14.8	11.2	.....	.....	.....
1/2	.500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	85.2	63.6	48.8	39.7	33.3	24.6	19.4	15.9	13.1	.....	.....
5/8	.625	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	110.0	86.2	70.0	58.3	43.1	33.3	27.4	23.3	16.9	.....
3/4*	.750	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	138.0	110.0	93.0	68.7	53.5	43.6	36.5	27.1	21.0
7/8*	.875	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	165.0	137.0	104.0	80.7	64.6	52.9	39.7	31.6
1*	1.000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	197.0	143.0	113.0	91.2	76.2	56.3	44.2

The tonnages shown in bold face type are for Vee Die openings of 8 times the thickness of the metal.

With an 8 to 1 die ratio the inside radius of a right angle bend is approximately equal to the thickness of the material.

Bending pressures for other metals, as compared to mild steel on chart, are as follows: Soft brass — 50% of pressure shown; soft aluminum — 50% of pressure shown; aluminum alloys heat-treated — same as steel; stainless steel — 50% more than steel; chrome molybdenum — 100% more than steel.

All of the above bending pressures are nominal and represent average conditions. These values are dependent upon the radii of the dies, the yield strength of the material, the temper of the material, the direction of the rolling strains, etc. Therefore a safety factor of at least 20% should be provided in selecting a press for a given job.

* See Dimension Chart for recommended Vee Die openings.

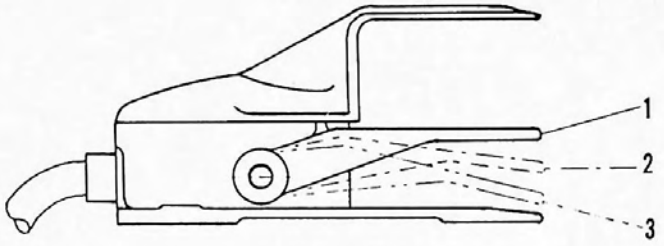
PUNCHING PRESSURES REQUIRED

Pressure in Tons per Punch with Mild Steel (55,000 to 60,000 PSI Ult. Tensile Strength).

Thickness of Metal		Hole Diameter														
Gauge	Inches	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	11/16"	3/4"	13/16"	7/8"	15/16"	1"
20	.036	.35	.53	.71	.88	1.1	1.2	1.4	1.6	1.8	1.9	2.1	2.3	2.5	2.7	2.8
18	.048	.47	.71	.94	1.2	1.4	1.7	1.9	2.1	2.4	2.6	2.8	3.1	3.3	3.5	3.8
16	.060	.59	.89	1.2	1 5	1.8	2.1	2.4	2.7	2.9	3.2	3.5	3.8	4.1	4.4	4.7
14	.075	.74	1.1	1.5	1.9	2.2	2.6	2.9	3.3	3.7	4.1	4.4	4.8	5.2	5.5	5.9
12	.105	1.0	1.6	2.1	2.6	3.1	3.6	4.1	4.7	5.2	5.7	6.2	6.7	7.2	7.7	8.3
11	.120	1.2	1.8	2.4	3.0	3.5	4.1	4.7	5.3	5.9	6.5	7.1	7.7	8.3	8.8	9.4
10	.135	.....	2.0	2.7	3.3	4.0	4.6	5.3	6.0	6.6	7.3	8.0	8.6	9.3	10.0	10.6
3/16	.187	.....	2.8	3.7	4.6	5.5	6.5	7.4	8.3	9.2	10.2	11.1	12.0	12.9	13.8	14.8
1/4	.250	.....	.....	4.9	6.2	7.4	8.6	9.8	11.0	12.3	13.5	14.8	16.0	17.2	18.5	19.7
3/8	.375	.....	.....	.....	.....	11.1	13.0	14.8	16.6	18.5	20.3	22.1	24.0	25.8	27.7	29.5
1/2	.500	.....	.....	.....	.....	.....	17.2	19.7	22.1	24.6	27.1	29.5	32.0	34.4	36.9	39.4
5/8	.625	.....	.....	.....	.....	.....	.....	.....	.....	30.8	33.8	36.9	40.0	43.0	46.1	49.2
3/4	.750	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44.3	48.0	51.7	55.4	59.0

For smooth trouble-free operation, the punching tonnage should not exceed two-thirds of the rated capacity of the press.
In multiple punching set-ups, the punches should be stepped by setting punches at different levels. If the punches are on two levels, the punching pressure required may be divided by two. If they are set on three levels, the pressure may be divided by three.

Figure 13



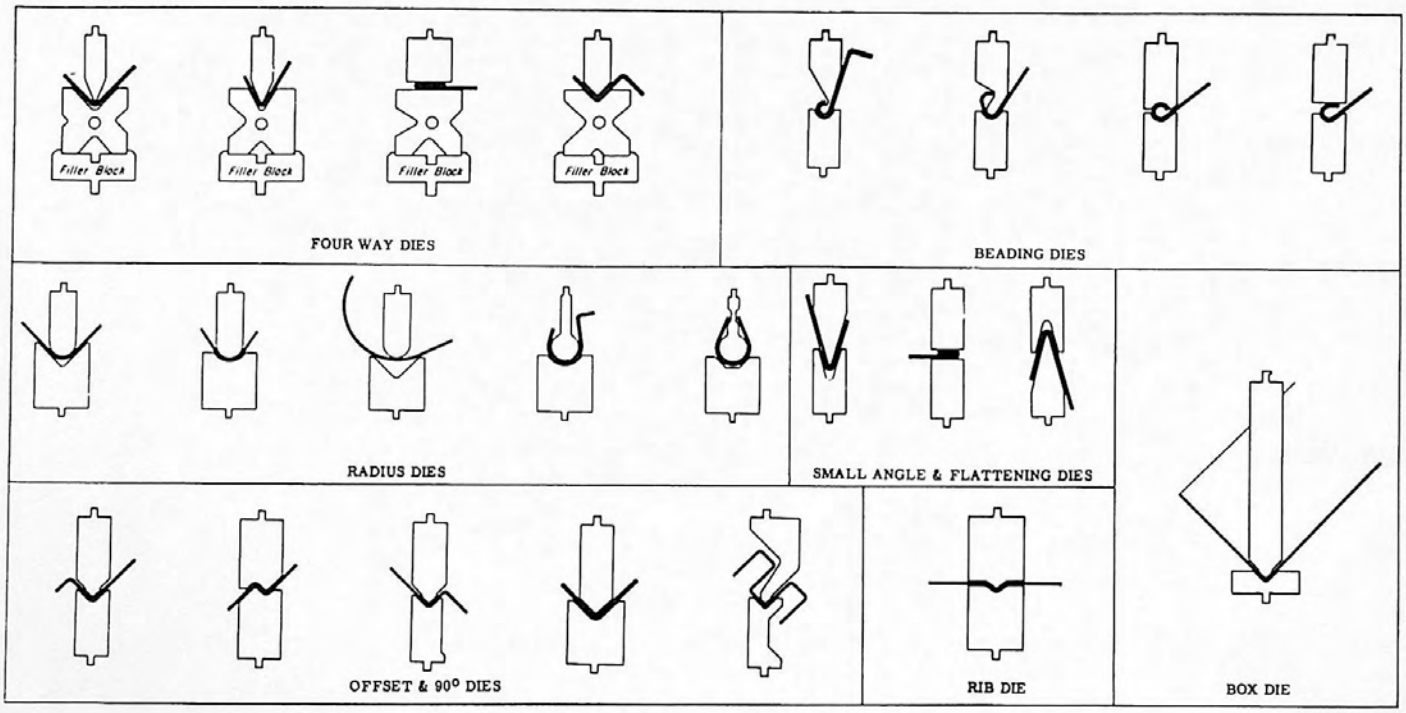
Position 1 In this position, the blade returns to its upper limit and stops.

Position 2 In the center position, the blade stops at any point along the advance stroke

Position 3 In the bottom position, the blade travels downward until the lower limit of travel is reached, then returns and will oscillate between upper and lower travel limits as long as the pedal is held in this position.

• FOOT SWITCH

Figure 20



• TYPICAL DIE SETS

Figure 21