Morehouse

Universal Calibrating Machines
Bulletin 1933

(pictured above 300,000 LBF Universal Calibrating Machine setup with 200,000 LBF Series 1000 Proving Ring, Hydraulic Power Control, Morehouse Calibration Meter and Morehouse software which converts mV/V values using coefficients generated from a curve fit equation to allow true direct reading in LBF, N or KG.)

Universal Calibrating Machines

In Industry today, more and more load sensing elements, usually called load cells, are being used in weighing and force measurement systems. These load cells, while designed and constructed for accuracy, are subject to some of the worst operating conditions in the industry and require periodic calibration. This calibration is usually accomplished with a Morehouse Proving Ring or Morehouse Load Cell, which are certified precision load instruments.

The load cells in some systems may be calibrated while mounted in their normal operating position. In these cases, there is usually some provision made in the system for mounting one or more proving rings so that they will indicate the applied loads. In many systems, however the load cells must be removed and calibrated individually. In order to facilitate this calibration of individual load cells, Morehouse manufactures the Universal Calibrating Machine.

The Universal Calibrating Machine is simply a device in which a load cell and a proving ring can be positioned and loaded in series with a mechanical force. A special hydraulic jack activated by a precision, dead-weight tester type, two-speed pump, produces the mechanical force.

The machine is designed so that it can quite easily be adapted to calibrate either compression-type or tension type load cells.

It is available in many different capacities from 10,000 lbs. to 1,000,000 lbs. Special capacities are designed and made to order.

Morehouse Instrument Company
1742 Sixth Ave. York, P.A. 17403-2675, U.S.A.
Tel: 717/843-0081 Fax: 717/846-4193
Web Address: www.mhforce.com

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Construction

The calibrating machine consists primarily of three major parts…the stationary frame, the movable frame or yoke, and the hydraulic jack (see figure 2). While a proving ring is essential to the function of calibration, it is not supplied as part of the machine.

The entire design of the machine has one purpose-ultimate accuracy. Friction between the calibration standard (proving ring, etc.) and load cell has been completely eliminated. This is essential as even slight friction found in some types of calibrating machine results in gross inaccuracies. Another factor contributing to inaccurate calibrations, non-axial loading is likewise eliminated by the design of the machine and its accessories.

All loading surfaces are ground flat and parallel. The stationary frame rests on adjustable leveling feet.

The upper platen of the yoke is adjustable to compensate for various size load cells and to facilitate lifting the yoke during calibration setups.

The lower platen of the stationary frame and the lower yoke platen have center holes. These holes provide a means by which the load cells can be attached to the machine with suitable studs or tension members. The upper yoke platen has a small ball seat, which allows a hardened steel ball to be positioned between the yoke platen and the proving ring to assure axial loading.

Additional construction details will become evident in the discussion of the operation of the machine. Dimensional data on calibrating machines of standard capacities are tabulated on the accompanying drawings.

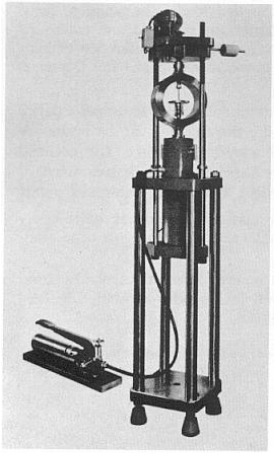

FIGURE 3—Suggested compression calibrating set-up for all capacity machines.

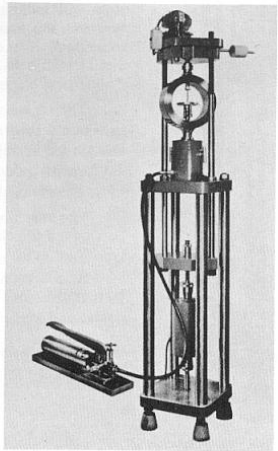

FIGURE 4—Suggested tension calibrating set-up for all capacity machines.

Shown here is a 100,000 lb. capacity machine with motorized yoke.

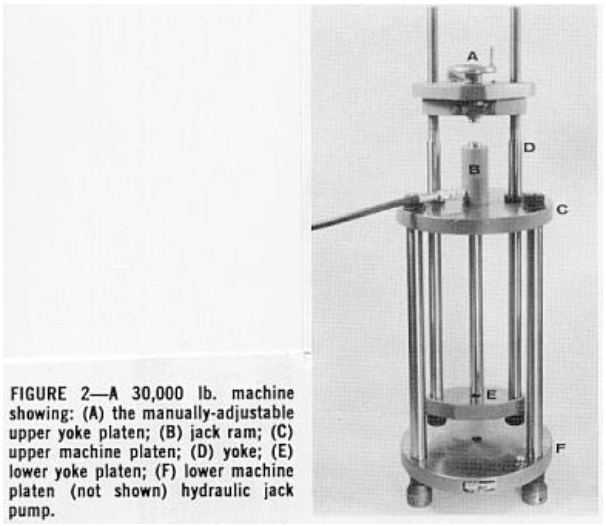

FIGURE 2—A 30,000 lb. machine showing: (A) the manually-adjustable upper yoke platen; (B) jack ram; (C) upper machine platen; (D) yoke; (E) lower yoke platen; (F) lower machine platen (not shown) hydraulic jack pump.

While the Universal Calibrating Machine may be used wherever it is necessary to apply an accurate amount of mechanical force, its most common use is in the calibration of load cells. For this reason the discussion of its application will pertain primarily to load cell calibration.

The three major parts of a calibrating machine have been described and shown in Figure 2. Suitable arrangements of these parts provide various calibration setups.

In a standard compression calibration, the jack is mounted to the top of the upper machine platen and the proving ring is positioned between the jack and the upper yoke platen

Operation

The operation of the Universal Calibrating Machine is best described in two steps…preparation and calibration. The preparation consists of positioning the load cell and proving ring in the machine. The calibration includes the application of force, the reading of the proving ring and the corresponding load cell reading.

Prior to any calibration, the machine should be set on a solid surface and leveled by adjusting the feet. Selection of a location where an even temperature prevails will facilitate the calibration.

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Compression

The standard compression setup is detailed in Figure 8 on page 4. Positioning the proving ring and then mounting the load cell accomplish it.

To position the proving ring, raise the yoke and place the ring on the jack ram. To raise the yoke, the collars on the yoke tie bars are placed against the topside of the upper machine platen and locked there by the setscrews. With the yoke thus suspended, turning the hand wheel or operating the motor until there is enough space to insert the proving ring raises the upper yoke platen. It is advisable to use a ring alignment bushing on the jack ram to locate and hold the lower ring boss. (See figure 5) Place a hardened steel-loading ball with ball retainer clip in the ball seat provided in the upper yoke platen until the ball seat rests on the ball. (See Figure 6)

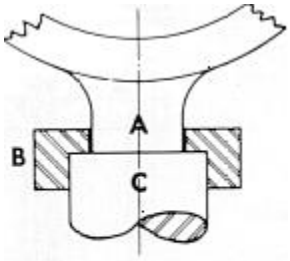


FIGURE 5—(A) lower boss of proving ring; (B) ring alignment bushing; (C) jack ram.

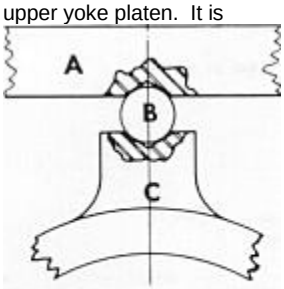


FIGURE 6—(A) upper yoke platen; (B) steel ball; (C) upper boss of proving ring. Retainer clip not shown.

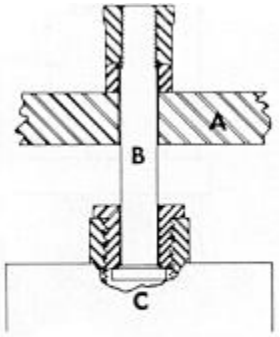
With the proving ring in place and the yoke lowered to rest on the steel-loading ball, release the lock collars and measure the distance between the upper machine platen and lower yoke platen. The distance should be approximately the height of the load cell plus the height of the load cell plus the height of any accessories. If it is not, raise or lower the adjustable upper yoke platen until the correct space is achieved.

Next, mount the load cell to the lower yoke platen. Load cells having a tapped central hole in their base should be mounted by an alignment plug to assure location of the cell on the loading axis of the machine. Load cells with a circle of tapped mounting holes in their base are first mounted to a cell adaptor plate, which, in turn, is mounted to the platen. Be sure the adaptor plate is counterbored so that all the bolt heads will be completely recessed. When am adaptor plate is used, remember to allow for its thickness when measuring the height of the load cell.

Tension

Preparation for a tension calibration is much the same as that of a compression setup (See Figure 9) on page 4.

The only difference is the manner in which the load cell is mounted in the machine. For a tension calibration, the load cell is suspended between the lower yoke platen and the lower machine platen by means of tension member assemblies. Tension member assemblies are available from Morehouse if the load cells were not supplied with satisfactory assemblies (See Catalog numbered 271). These tension member assemblies will have spherical connections at both ends to help assure axial loading.



(A) machine platen; (B) tension member; (C) load cell.

Compression Calibration

Open the knurled reservoir vent underneath the pump handle and close the relief valve. Be sure the tie rods of the yoke assembly do not touch the sides of the holes in the upper machine platen as the resulting friction would reduce the accuracy of the calibration. Work the pump handle until the desired load is applied and take a ring reading.

Remove the load and take a zero load reading. Make any necessary zero adjustments on the load cell's indicator and take a no-load reading of the cell.

Apply the load to setup by working the pump handle until the desired load cell reading is almost reached. Complete the loading to the exact force required by using the auxiliary screw piston (star hand wheel). Take a proving ring reading at the reading at this point and then proceed to the next load if it is a sequential loading calibration. If the calibration procedure release the load and take another zero load reading on the ring.

Tension Calibration

After checking the alignment of the proving ring and the clearance of the yoke tie rods, raise the jack by working the pump until the desired load is applied. Take a ring reading. Remove the load and take a zero load reading. Make any necessary zero adjustments on the load cell's indicator and take no-load reading of the cell.

Be sure the tie rods of the yoke assembly do not touch the sides of the holes in the upper machine platen as the resulting friction would reduce the accuracy of the calibration.

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Typical calibrating machine setups

Because of many variations in load cells, many different accessories for mounting load cells in calibrating machines are available. Please request bulletin no. 271 If you do not already have a copy. The following exemplifies typical mountings of load cells and dynamometers in calibrating machines.

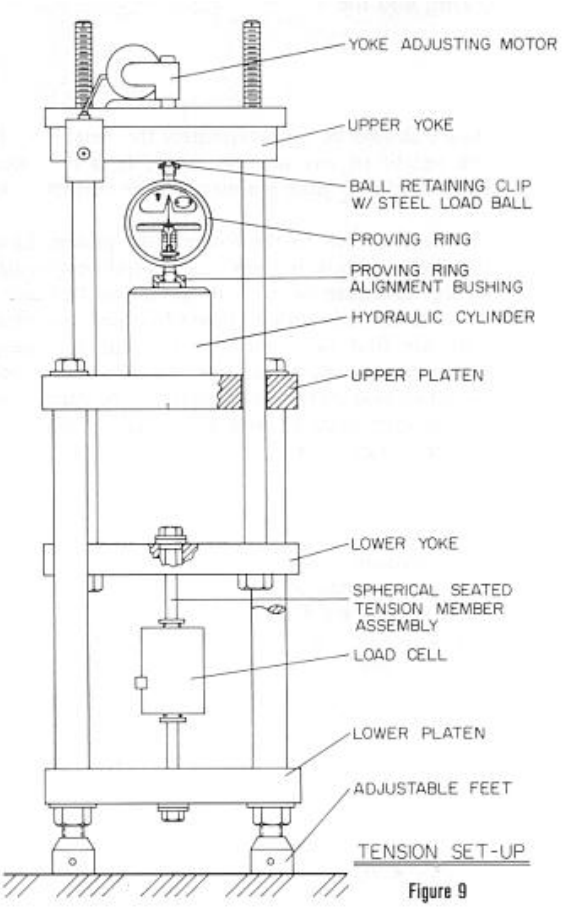

Figure 9

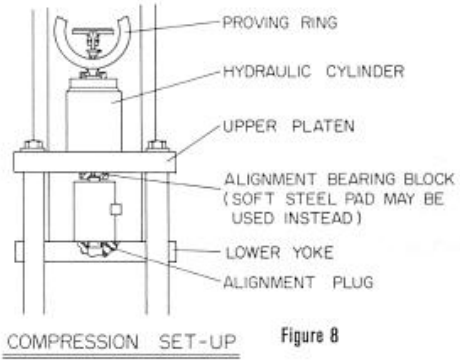

Figure 8

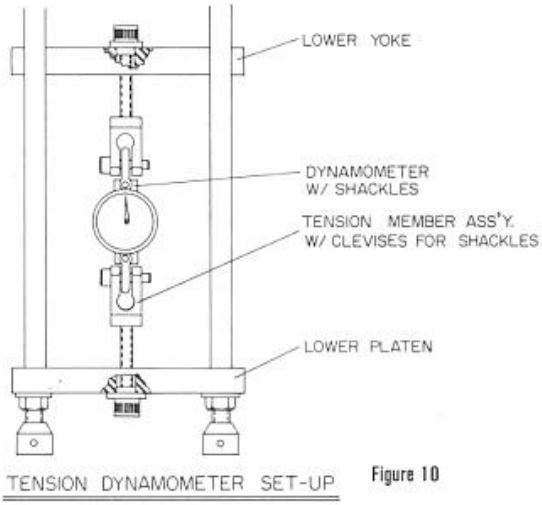

Figure 10

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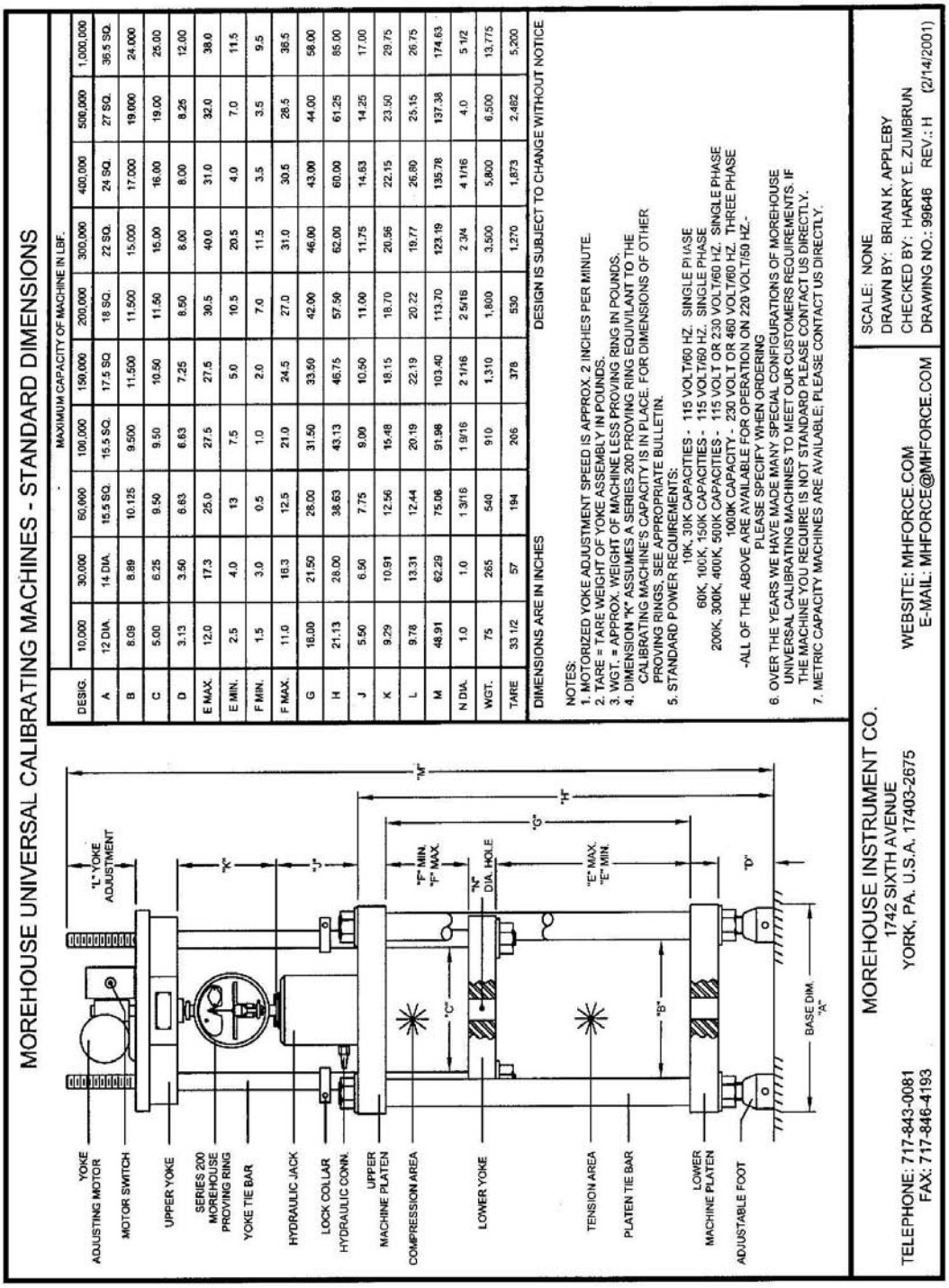

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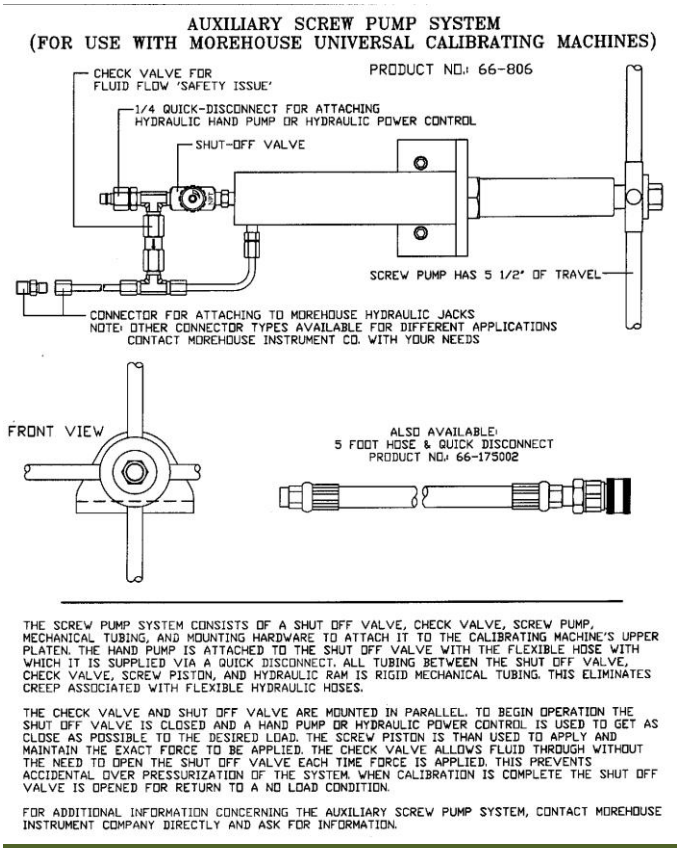
Universal Calibrating Machines Optional Parts (sold separately)

(Pictured Above 30,000 LBF Universal Calibrating Machine System. System includes Morehouse Model 4215 Indicator, Laptop Computer Interface with software that converts mV/V to direct engineering units in LBF, KGF or N using coefficients from the calibration report , 10,000 LBF Morehouse Ultra Precision Load Cell with special ball adaptor and Auxiliary screw pump which allows for tighter more accurate control of force being applied.)



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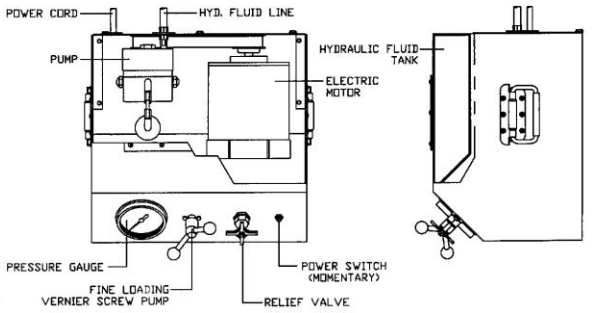
HYDRAULIC POWER CONTROL
FOR FORCE CALIBRATION WORK



MOREHOUSE HYDRAULIC POWER CONTROL
PART MODEL NO.: 398000

MAX. WORKING PRESSURE: 3,000 P.S.I. TO 5,000 P.S.I.
PUMP RATE OF FLOW: 2 CU. IN./MIN.
RESERVOIR CAPACITY: 1 1/2 GALLONS
POWER: 120 VOLT/60 HERTZ OR 220 VOLT/50 HERTZ
SIZE: 17" L. x 15" W. x 13" H. WEIGHT: 98 POUNDS
SUPPLIED WITH A LENGTH OF HOSE WITH A QUICK DISCONNECT COUPLING

THE MOREHOUSE HYDRAULIC POWER CONTROL IS SPECIFICALLY DESIGNED WITH A LOW RATE OF FLOW TO CONTROL THE HYDRAULIC CYLINDERS OF MOREHOUSE UNIVERSAL CALIBRATING MACHINES. IT CAN ALSO BE USED WHEREVER THE LOADING OF HYDRAULIC CYLINDERS MUST BE PRECISELY CONTROLLED, SUCH AS IN NON-DESTRUCTIVE TESTING OF STRUCTURES.

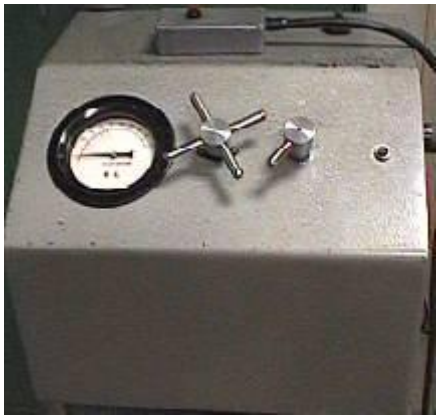
THE HYDRAULIC POWER CONTROL CONSISTS OF A RADIAL PISTON PUMP DRIVEN BY AN ELECTRIC MOTOR THROUGH A GEAR REDUCTION UNIT, A HYDRAULIC GAUGE, AND A MANUALLY OPERATED VERNIER SCREW PISTON PUMP.

IN OPERATION, THE ELECTRIC MOTOR DRIVEN PUMP IS USED TO APPROACH A SPECIFIC PRESSURE OR FORCE, AND THEN THE VERNIER SCREW PISTON PUMP IS USED TO ACCURATELY APPROACH AND MONITOR THE DESIRED PRESURE OR FORCE. THE HYDRAULIC GAUGE MAY BE CALIBRATED TO READ IN PRESSURE, OR WHEN USED IN CONJUNCTION WITH A SPECIFIC HYDRAULIC CYLINDER, OR SERIES OF HYDRAULIC CYLINDERS, ACCURATELY CALIBRATED TO READ IN TERMS OF POUNDS FORCE.

BECAUSE THE PUMP OF THE MOREHOUSE HYDRAULIC POWER CONTROL IS DESIGNED TO OPERATE AT A RELATIVELY LOW SPEED, IT IS EXTREMELY QUIET IN OPERATION.

THE STEEL CABINET WHICH HOUSES THE HYDRAULIC POWER CONTROL IS FITTED WITH SPRING LOADED CHEST HANDLES TO MAKE THE CONTROL EASILY PORTABLE.

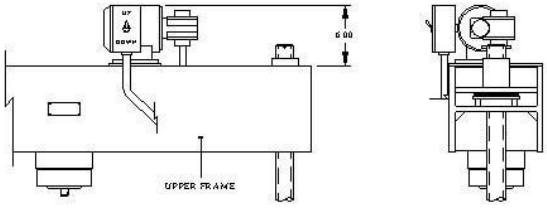
FOR ADDITIONAL INFORMATION CONCERNING THE HYDRAULIC POWER CONTROL, CONTACT MOREHOUSE INSTRUMENT COMPANY AND ASK FOR BULLETIN 245.



The Morehouse Hydraulic Power Control (pictured above) is specifically designed with a low rate of flow to control the hydraulic cylinders of Morehouse Universal Calibrating Machines. It additionally would have application wherever the loading of hydraulic cylinders must be precisely controlled, such as in non-destructive testing of structures. The Hydraulic Power Control consists of a radial piston pump driven by an electric motor through a gear reduction unit, a hydraulic gauge, and a manual operated vernier screw piston pump.

Option: Motor Adaptor Kit

A motor adaptor kit is available (Part No.: 99937) is available to replace the standard hand crank. It is available in either a 120 volt / 60 Hz. or 220 volt / 50 Hz. configuration. This kit also includes all hardware and a chain guard. It can be installed by the user on machines already supplied with a hand crank.



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