OPERATING INSTRUCTIONS
FOR
MAGNAFLUX* EQUIPMENT
TYPE H-700, H-710, H-720, and H-730
With Infinitely Variable Self Regulating Current Control

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** DANGER **
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** PERSONNEL FAILING TO COMPLETELY READ AND UNDERSTAND THESE **
** INSTRUCTIONS BEFORE PROCEEDING WITH THE INSTALLATION, OPERATION **
** OR MAINTENANCE OF THIS EQUIPMENT RUN THE RISK OF INJURY. **
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CAUTION

Although guards have been installed, wherever practical, to minimize dangerous contact between machine and personnel, it is not possible to place a guard on every machine component without negating the purpose of the machinery itself. Therefore, Magnaflux cautions that, before, energizing the equipment, personnel take a position away from all moving parts. As with any production equipment of similar nature, continued caution should be exercised at all times after equipment has been successfully recycled and placed in production operation.

H Units are designed for general purpose Wet Method Magnaflux Inspection providing low-voltage, high-amperage D.C. for magnetizing. The rated maximum output is 4000 amperes for the H-700, 5000 amperes for the H-710 and 6000 amperes for the H-720 and H-730.

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* MAGNAFLUX, Registered U.S. Patent Office, a trademark of Magnaflux Corporation applied to its equipment and materials for magnetic particle inspection. Processes and methods used in magnetic particle inspection are covered by various U.S. Letters Patent. **

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- 1 -
Magnaflux Wet Method Instructions cover the subject of bath preparation. Wiring diagrams for the various units contain part numbers of electrical components.

**GENERAL DESCRIPTION**

The H Units are standard all purpose equipment featuring both circular and longitudinal magnetization over a wide range of parts. The headstock, mounted on the left side, is stationary. The tailstock is movable from the right side and may be clamped in any position required to inspect a variety of part lengths up to 52 inches for H-700 and H-710; 100 inches for the H-720 and 144 inches for the H-730. The coil is mounted between the contacts on a roller base and may also be clamped in any desired position. Headstock, tailstock and coil are mounted on rails which run the entire length of the unit.

Clamping action of the headstock is performed by an air cylinder and controlled by a foot switch and solenoid operated air valve on all H Units.

The inspection bath is contained in a built-in tank, agitated and recirculated by a wide clearance impeller type pump. Application of the inspection bath is by hand hose. A set of grilles provides a work area above the tank. The various units can be equipped with an (optional) Magnaglo hood for near ultraviolet fluorescent particle inspection.

Power transformer, rectifiers, and other electrical components are located below the tank.

**SAFETY PRECAUTIONS**

a. "DANGER - Ground before operating" Failure to ground this machine properly may result in an electrical shock hazard. See operating instructions for detailed information. Use line size wire and check ground with ohm meter to be assured of proper ground.

b. "CAUTION" - Use safety glasses when operating this equipment.

c. "Notice" - Refer to information and/or instructions appearing on the testing material package.

d. In the event the optional Magnaglo Hood is provided, "CAUTION HOT" under no circumstances should the black light be operated without the proper filter. Unfiltered ultraviolet light can injure the eyes and skin.

e. "CAUTION" - Before filling lubricator, adjust air pressure regulator so gauge reads 0 to relieve pressure. (Attempt to cycle headstock cylinder several times to assure zero pressure.)
f. "CAUTION" - Lubricator bowl and sight glass should be cleaned with household soap only. Other cleaning methods may weaken bowl leading to sudden dangerous shattering.

g. "CAUTION" - To minimize the chances of dermatitis, protect exposed skin areas on hands and arms with a suitable protective hand cream. Do not work wearing clothing saturated with the inspection bath.

h. Line current must be disconnected when panels are removed for any reason. Only qualified electrical personnel, using the unit wiring diagram, should attempt electrical service since electric shock can cause death.

i. In no event shall the rails be subjected to loads, concentrated or otherwise, in excess of 300 pounds.

ELECTRICAL FEATURES

The H Units are normally built to operate on either 230 or 460 volts, 60 Hertz, three phase current. Changeover between 230 and 460 volts is possible by proper reconnection of transformer leads as shown on the wiring diagram. They may also be constructed for other voltages and frequencies but not less than 208 volts. Refer to Magnaflux data plate on the control panel for correct line voltage.

TRANSFORMER CIRCUITS

The power transformer in connection with fan-cooled, silicon rectifiers, transforms the high-voltage, low-amperage A.C. line input to high-amperage, low-voltage D.C. for magnetizing purposes. A saturable reactor is used in connection with a current control potentiometer and reactor control to regulate the amperage of the magnetizing current. An isolation type transformer is used to obtain 115 volts for the control circuit.

INSTALLATION

Location of the unit will be influenced by considerations of handling materials, proper ventilation and servicing. The following sequence of installing operations is recommended:

1. Set unit on a firm level floor and bolt down, being sure to allow ventilation at rear of unit. Traverse rails for the coil and tailstock should be level.

2. Install air filter, pressure regulator and gauge assembly to air inlet of unit. Note direction of inlet arrow on filter body. Connect to 80 to 100 P.S.I. compressed air supply line. Adjust pressure regulating valve on unit to provide adequate clamping pressure without distorting test piece.

3. HEADSTOCK LUBRICATOR - To fill, remove either of the two fill plugs and fill with oil to within 1/4" of the top of the bowl. For most conditions, the use of a high quality S.A.E. #10 (S.U.V. 150-200 sec. @ 100°F.) is recommended.
3. (Cont.)

Other oils, as specified by the maker of the equipment to be lubricated, may be used, if not heavier than S.A.E. #30. Caution is advised in the use of oils containing additives as many such agents are not compatible with plastic bowls. Start equipment and operate in a few minutes to permit system to fill. Adjust valve for approximately one drop of oil per 10 to 20 strokes of piston. Check lubrication of the equipment by holding the thumbnail or a mirror near the exhaust cycle. A heavy film indicates over-lubrication and drops per minute should be reduced by turning adjusting screw clockwise. Clockwise rotation increases lubrication. DO NOT turn adjusting screw more than 1-1/2 turns counter-clockwise from the closed position.

(CAUTION: Relieve air pressure in line before filling lubricator.)

4. Clean tank, agitator, and sump carefully. Flush with kerosene or other light oil if necessary, or water if water bath is to be used. Close drain valve at right rear of unit.

5. Consult Magnaflux Wet Method Operating Instructions for preparation of the inspection bath. Ten (10) gallons should provide an adequate level for H-700 and H-710; fifteen (15) gallons for H-720 and twenty (20) gallons for H-730.

6. Note that all switches are in "off" position.

7. Make temporary electrical connection to the junction box of sufficient capacity as specified on nameplate. Line connection should be made through fused disconnect switch of proper rating. Ground unit using attached ground lug in junction box. Use line size wire. Check ground with OHM meter to be assured of proper ground.

8. On all units, install foot switch cable in its receptacle.

9. Check accuracy of the "self-regulating current control" circuit by setting the "current control" knob to approximately 3/4 of full scale (3000 amps for H-700; 3700 amps for H-710; 4500 amps for H-720 and H-730). Clamp a 1" x 12" copper or steel bar between the heads. Set "contacts-coil" selector switch to "contacts". Depress the "magnetizing current" pushbutton switch to give a timed current shot.

   a. If ammeter reading is within ± 100 amps of "current control" setting, proceed to paragraph 10.

   b. If ammeter reading differs from "current control" setting by ± 300 to 400 amps it will be necessary to interchange any two of the three input line wires to the unit. Ammeter reading should now be within ±100 amps of "current control" setting. If so, proceed to Paragraph 10.
c. It is possible that ammeter reading and "current control" setting may now differ by more than ± 300 to 400 amps. In this case, change the input line wires back to their original configuration. Set "current control" knob to 1/2 of full scale (2000 amps for H-700; 2500 amps for H-710; 3000 amps for H-720 and H-730). Remove reactor control cover, loosen potentiometer locknut and adjust potentiometer until the ammeter reading and "current control" setting agree. Check over the entire "current control" range. Tighten potentiometer locknut, replace reactor control cover and proceed to paragraph 10.

10. Make permanent electrical connections to the junction box of unit of sufficient capacity as specified on nameplate. Line connection should be made through fused disconnect switch of proper rating. Ground unit using attached ground lug in junction box. Use line size wire. Check ground with OHM meter to be assured of proper ground.

CONTROLS - ELECTRICAL

CONTROL CABINET

The control cabinet contains the electrical control components. (Located behind left front panel.)

"CURRENT CONTROL" Potentiometer

The current control potentiometer is used in conjunction with the reactor control and saturable reactor to automatically maintain the output current at the level set on the current control dial.

CURRENT CONTROL LOCK

This knob, located under the "current control" knob, when rotated clockwise will lock the "current control" knob at any setting. The locking knob must be turned counterclockwise to unlock the current control knob to change current level settings.

AMMETER

The ammeter indicates the magnitude of output current at the contacts or coil.

"CONTACTS - COIL" SELECTOR SWITCH

This switch transfers magnetizing current of either contacts or coil.

MAGNETIZING CURRENT SWITCH (MUSHROOM BUTTON)

This switch initiates the timed current shot which should be adjusted for 1/2 second duration.

MAGNETIZING CURRENT PUSHBUTTON OPERATING BAR

This bar, extending the length of the unit functions to allow operation of the magnetizing current pushbutton from any position. The actuator can be disengaged to make the bar inoperative. (Standard equipment on all H Units).

FOOT SWITCH

All H Units are equipped with a foot switch. This switch functions through a solenoid operated valve to operate the headstock clamping air cylinder.
PUMP SWITCH

This starting switch with overload protection controls the pump motor.

PILOT LIGHTS

The red pilot light will glow when line current is applied to the machine. The green pilot light will glow for the duration of flow of magnetizing current.

115 VOLT RECEPTACLE

This is a convenience receptacle for use with auxiliary equipment such as a black light, etc.

THREE POLE TWIST LOCK RECEPTACLE

This receptacle on all H Units accommodates the foot switch control cable.

FOUR PRONG TWIST LOCK RECEPTACLE (Automatic Mag.)

This receptacle is for the foot switch which operates the Automatic Mag. feature. (Optional.)

FOUR PRONG TWIST LOCK RECEPTACLE (Control Cable)

This receptacle is for the accommodation of an (optional) remote control switch for operation of the continuous current circuit, standard on all H units. In conjunction with a thermal overload relay its use permits drawing magnetizing current beyond the 5 second interval of the maximum timed current shot (See "Operation").

CONTROLS - PNEUMATIC

AIR GAUGE & VALVE

The air gauge and valve are located at the left rear of the H Units. The valve regulates the pressure from the main air line into the machine. The gauge is the visible index.

SPEED CONTROL VALVE

The clamping action of the headstock is controlled by a needle valve in the headstock air supply line. Opening or closing this valve regulates the speed of the clamping stroke.

CONTROLS - MECHANICAL

H Units are equipped with a pair of rails extending the length of the units, carrying the coil support assembly and the tailstock. Adjustment of these components is as follows:

TAILSTOCK ADJUSTMENT

This adjustment is by a rack and pinion gear, operated by a hand crank on the back of the tailstock assembly. A hand knob is used to lock the tailstock in position.
COIL TRAVERSE

The coil support assembly, roller mounted on the rails, allows movement of the coil over the length of the unit. A hand knob mounted on the roller assembly provides the means of locking the coil in a fixed position.

SET-UP

Set-up and adjustment of H Units will depend upon the part to be inspected and the nature of the test as being either longitudinal or transverse.

The following sequence of operations is recommended:

1. Close fused disconnect switch to bring current into unit.
2. The Magnaflux bath should be at an adequate level, (see "Installation" instructions for various units) thoroughly mixed and of proper concentration. Allow bath to circulate through the hand hose for 10 to 15 seconds to clear hose of settled bath before use.
3. Check air pressure on gauge. Adjust air pressure regulating valve to provide adequate clamping pressure without distorting test piece.
4. Set current control knob to desired magnetizing current level.
5. Set "contacts-coil" selector switch for longitudinal (coil) or circular (contacts magnetization).
6. Insert foot switch cable plug in the "foot switch" receptacle to control headstock clamping.

OPERATION

CAUTION: Use safety glasses when operating this equipment.

CONTINUOUS CURRENT FEATURE

H Units are provided with a continuous current circuit that by-passes the timer and allows a magnetizing current application of longer duration than the maximum timed 5 second current shot. This circuit is operated by a remote control switch that can be furnished as optional equipment.

The units are protected from damage by a control system incorporating a thermal overload relay. The appended graphs contain curves showing the approximate "on" time for the various units within their range of current output, the "on" time varying inversely with the current output.

The overload relay will open the circuit at any given current value if "on" time for the value is exceeded. Reset is automatic after an "off" time of sufficient duration (approximately 2 minutes.)

The continuous current circuit operating through the contacts may be adapted for use with a contact block and magnetizing cables.
MAGNETIZING WITH CONTACTS - CIRCULAR MAGNETIZATION

1. Set selector switch to "contacts" position.

2. Set current control to current required for particular part.

(NOTE: Experience will dictate the optimum current requirements for various parts. Use minimum current that will give good indications.)

3. Adjust tailstock and lock in position so that part to be inspected rests on shelves.


5. Flood part with hand hose and press magnetizing current pushbutton operating bar or current switch when part is drenched. This technique is generally termed the Wet Continuous Method, and in practice the spray is stopped just before the current shot is applied. The alternate technique of current followed by spray is termed the Wet Residual Method and is only used with parts of good magnetic retentivity. Long parts should be processed in sections of not over 12 inches.

(NOTE: The current shot should be timed at 1/2 second, for most applications. The timer is adjustable, however, allowing a shot time of up to 5 seconds. For current applications of longer duration the continuous current circuit should be used.)

6. Depress and release foot switch to unclamp and inspect part.

MAGNETIZING WITH COIL - LONGITUDINAL MAGNETIZATION

1. Set selector switch to "coil" position.

2. Set current control to current required for particular part.

(NOTE: Experience will dictate the optimum current requirements for various parts.)

3. Adjust tailstock so that part to be inspected rests on shelves. (small parts can be placed on the bottom I.D. of the coil).

4. Locate coil over left end of part not over 4 inches from the end. Flood part with hand hose and press magnetizing current pushbutton operating bar, or current switch when part is drenched. This technique is generally termed the Wet Continuous method and in practice the spray is stopped just before the current shot is applied. The alternate technique of current shot followed by spray is termed the Wet Residual Method and is only used with parts of good magnetic retentivity.

5. In testing long parts, repeat #4 moving the coil to the right approximately 12 inches at a time.
USE OF CABLES

Inspection of parts too large or heavy to be placed between the contacts is accomplished through the use of a contact block (Magnaflux #1830) and auxiliary cable that can be furnished as optional equipment. 

Units are equipped with a four pole "twist lock" receptacle for operation of a remote control magnetizing cable switch.

The contact block is clamped between the headstock and tailstock and optional lengths of #4/0 cable connected to the contacts. Magnaflux #1570 or #1571 contact prods are used to induce circular magnetization in the part. Magnetizing current is applied by means of a switch in the prod handle connected to the four pole twist lock receptacle.

Longitudinal magnetization is induced in the part by wrapping with a few turns of a cable to form a coil. Magnetizing current is applied with the auxiliary remote control cable switch.

Magnetic particles are applied in powder form, either by powder blower or bulb; or by spraying, using one of the several portable spray guns.

CAUTION: In using the continuous current feature in connection with the magnetizing cables, observe the "on" times indicated in the attached graphs, otherwise overload relay will trip open. A cooling period will then be required; thus causing an interruption in the work cycle.

MAINTENANCE

Regularly scheduled maintenance is a must with highly specialized equipment such as the Magnaflux H Series, if costly "down" time for repairs is to be avoided. The units are constructed to allow necessary maintenance to be performed in a minimum of time. The following schedule of regular maintenance is recommended as being conducive to trouble free operation.

DAILY

1. Remove and clean sump strainer and check agitator tube.

2. Check concentration of inspection bath using centrifuge tube method described in Wet Method Operating Instructions. Normal operation progressively lowers the bath concentration through "carry-off" of magnetic particles on parts tested. In initial operation frequent checks of the inspection bath should be made until the proper test interval is determined.

WEEKLY

Air Filter - to maintain maximum filtering efficiency and to avoid excessive pressure drop, the air filter must be kept clean.

NOTE: Included with these instructions are copies of the maintenance bulletins covering the pneumatic components used on this equipment. Please note it is necessary to identify the make and model of the components in question and then refer to the proper manufacturers bulletin. Some of the bulletins cover not only the items utilized, but, also others that are not applicable.
MONTHLY
Drain tank of unit. Clean agitator pipes, spray hose and nozzle and magnetizing area generally. Flush with clean oil or water and refill with cleaned mixed bath. (Refer to Wet Method Operating Instructions).

When using water base bath, the lead contacts should be removed from both the headstock and the tailstock and all mating surfaces thoroughly cleaned. Use a wire brush on the lead surfaces and a coarse grade of emery paper on the copper.

SIX MONTHS
Depending upon ambient conditions rectifier plates may become coated with an accumulation of air-borne materials, periodic blow-off with an air hose may be sufficient to remove normal accumulations. However, an excessive coating may cause overheating of rectifier plates through its insulating action. In the event that this occurs, the plates may be wiped with a damp cloth.

LUBRICANTS
Air cylinder lubricator
S.A.E. #10 oil

SERVICE DATA
Each unit is thoroughly tested before it leaves the factory and all adjustments necessary for proper operation have been made. However operators and maintenance department should be familiar with these adjustments and the functioning of the electrical circuits.

DRAIN VALVE
The drain valve for the tank is located at the right rear of the unit.

FUSES
Located behind the hinged front panel. Consult wiring diagram for proper fuse sizes.

ELECTRIC TIMER
The electric timer is located in the instrument box below the ammeter. It is calibrated and adjustable to give current shots from 2/0 to 5 seconds. The current shot should be timed at 1/2 second for most applications.

The unit is protected from use beyond its rated duty cycle by a thermal overload relay.