BenchMark Wireline Products
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DRUM DEMAGNETIZING PANEL

ADDMA101

OPERATIONS AND MAINTENANCE MANUAL

TABLE OF CONTENTS

1.0 GENERAL INTRODUCTION

MAGNETISM IN HOISTING EQUIPMENT

Magnetism in wireline cable hoisting equipment and the truck or skid to which the equipment is attached can seriously degrade spontaneous potential (SP) logs. A magnetized drum can cause SP 'noise' that shows on the log every rotation of the drum or every pi * (diameter of the line + drum.) If the line + drum diameter is 3 feet, the noise on the log would occur every 3.14 * 3 ~ 9.4 feet.

Strong magnetism can also affect DC CCL detection since the small DC signal returns on cable armor.

This manual describes equipment magnetization and specifies procedures for detecting and eliminating it.
The equipment required is the ADDMA101 Drum Demagnetizing panel and a cable to connect from the panel to the collector ring on the drum. The panel demagnetizes wireline drums by passing a DC current through the wireline with the whip end shorted to armor.

The panel circuits serve 2 purposes:

1. To indicate the presence and magnitude of induced electrical current in the logging cable conductors
   Induced currents in the logging cable conductors pass to the panel via the collector or slip ring cable connector mounted on the drum. This signal is processed by the operational amplifier for display on the MILLIVOLTS meter.
2. To provide demagnetizing force in the form of decaying dc current through the logging cable conductors to the cable armor.

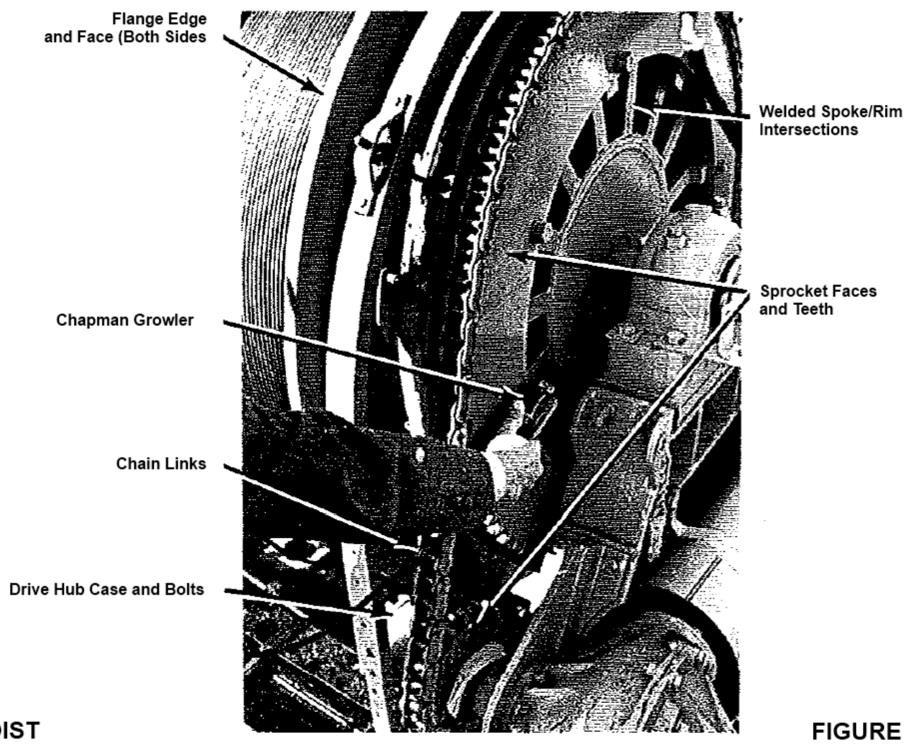
   Electrically this looks like a many turn coil since the armor is effectively shorted or looks like 1 turn. The current is switched between positive and negative every minute and reduced 5% each time the polarity is switched.

Detection

In most cases, magnetized areas exist as localized hot spots where chain sprocket spokes, teeth, and rim intersect; in or near a mounting bolt for a pillow bearing; on the face of a drum flange, or in the links of the drive chain. Figure 1-2 illustrates these and other typical occurrences of magnetism. Routine detection and demagnetization procedures utilize the Benchmark ADDMA101 panel, hand-held field strength meters, and logging signal recordings.

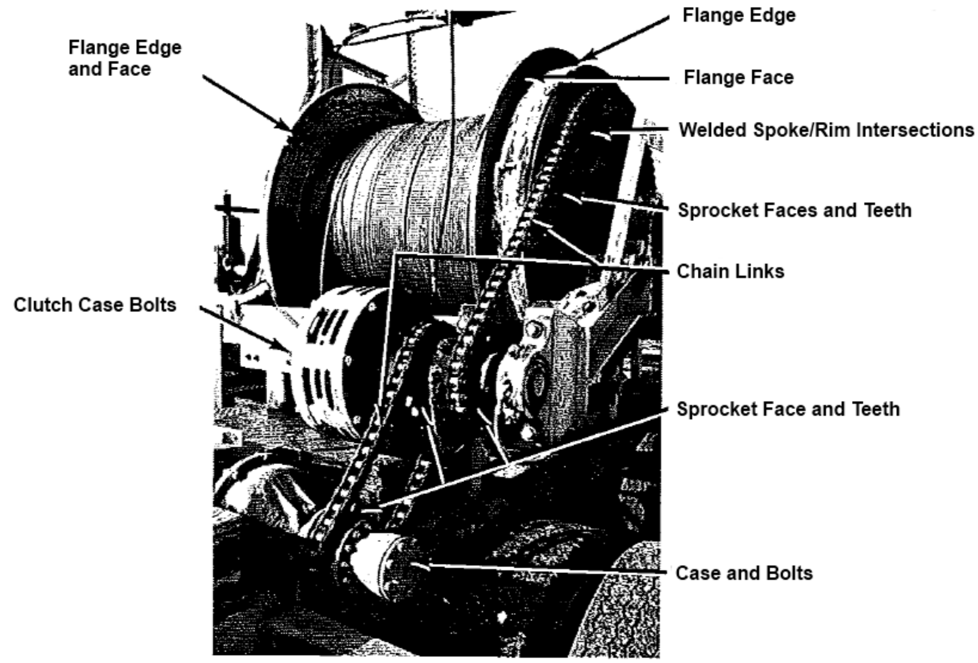
Both the Benchmark ADDMA101 panel and the logging signal recorder respond to inputs from the logging cable conductors themselves. Whenever these two methods are employed, the cable drum must be rotated so that current can be induced into the cable conductors by movement through the flux lines of magnetized areas.

The resulting induced currents will produce periodic deflections on the panel meter and the recorded logging signal traces. On the other hand, the cable drum and drive train components can remain stationary when the hand held magnetometer is used. Needle deflections will occur on the face of the magnetometer whenever it is held close to or passed by a magnetized area. Procedures in this publication describe the use of these detection instruments.



SKID HOIST

FIGURE 1-2


Flange Edge
Flange Edge and Face
Flange Face
Welded Spoke/Rim Intersections
Sprocket Faces and Teeth
Chain Links
Clutch Case Bolts
Sprocket Face and Teeth
Case and Bolts

Truck Hoist

2.0 OPERATING PROCEDURES

The following procedures cover detection and elimination of magnetized areas in hoisting equipment on skids and trucks.

2.1 SAFETY – CAUTION

While working on or around the hoisting drum, always have a qualified hoist drum operator posted in the operator's compartment.

2.2 DRUM AND CABLE PREPARATION PROCEDURES

In a routine demagnetizing operation, all logging cable conductors are shorted together at the cable head end of the logging cable. This end is then secured to the cable layers on the hoisting drum using tape or other method. The other end of the logging cable is routed via the collector ring or slip ring connector to the 'REEL' connector on the demagnetizing panel. Line voltage for the panel applies across an isolation transformer which protects the line voltage source from the loading caused by the high output currents generated by the panel. The panel is then energized and calibrated.

2.2.1 Secure the bared ends of the cable conductors to each other and to logging cable armor. Tape the cable head end of the cable to the drum as follows:

2.2.2 Tack the loose end of the cable to the drum with a tape segment. Engage the drum drive system and turn the drum in an up hole direction slowly. Allow the rotating drum to pull several layers of tape from the tape roll.

2.2.3 Stop the drum long enough to insert a piece of masking tape as a marker in the tape layers.

2.2.4 Turn the drum again to add a few more tape layers.

2.3 TESTING FOR MAGNETISM

2.3.1 While the drum is stationary, use the Benchmark gauss meter to determine the overall magnetism. When the meter is positioned at the center of the drum it should read 0. As it is moved right or left to the flanges of the drum the meter should deflect positive and negative. Make a note of the maximum deflection.

2.3.2 Next use the gauss meter to locate magnetized areas in the drum flanges, gearbox, drive chain, chain sprocket spokes and teeth, drum support fixtures, and drum axle bearings. Needle deflections gauss scale division or more signify an unacceptable level of magnetism. Use a. non-permanent marker to indicate such hot spots for future reference.

2.3.3. Engage the drum drive train end turn the drum up hole at one revolution every eight seconds. As the drum turns, carefully search for areas of excessive magnetization on the cable, drum flanges, drive chain and sprockets, drum axle and axle bearing, and right angle drive components.

NOTES

a. Broken cable conductors and insulation breakdowns between the conductors and the cable armor can cause false magnetism indications.

b. Broken cable conductors and cable deformities ban also cause false magnetism indications.

c. Observing the normal hoist operator procedures and precautions, start the drum drive engine and allow the usual warm up period. Ensure that the drum is mechanically prevented from turning.

2.3.4 Set the panel to MONITOR (refer to 2.4) and turn the drum at SP logging speed and monitor for signs of induced currents in the cable conductors. These currents can deflect the meter needle both ways as the cable conductors rotate through magnetized areas in the hoisting equipment.

2.3.5 Set the panel to DEMAG (refer to 2.4) for demagnetization, the drum speed is increased and the panel controls are arranged to supply decaying current to the cable conductors and hand-held growlers.

These currents apply from a panel Switching circuit that automatically reduces the current strengths in seven successive steps. Each step applies current for 60 seconds and reverses the dc current flow. The changing magnetic flux established around the cable conductors by the dc currents generally eliminates or significantly reduces the field strengths of magnetized areas.

2.4 PANEL OPERATING PROCEDURES

Demagnetizing procedures utilize the Benchmark ADDMA101 panel and hand-held electric growlers. Both of these items generate demagnetizing force in the form of decaying electrical current. The panel applies dc current to the logging cable conductors.

The ADDMA101 panel has two operating modes, basic and expanded.

To use the basic mode turn the panel on. The panel will display

101 A
Auto

After the panel initializes it will display

ScALE
1000

2.4.1 The basic mode is an automatic mode defaulted to when the panel is turned on.

2.4.2 The panel starts in the “Monitor” function with a meter scale of +/- 1000mV.

2.4.3 The two functions, MONITOR and DEMAG are selected using the MENU button. ‘select’ button. To change the scale or change the mode to DEMAG, push the MENU button and release it.

The panel displays

Functn	(function)
NoNitr	(monitor)

Use the +/- switch to toggle between:

NoNitr	(monitor)
dENAG	(demag)

When you have selected the mode you want push the MENU button.

The panel will display

AccEPt	(accept)
PLuS -	(plus or minus)

Selecting the + option by toggling the plus toggle accepts the new mode. Selecting the ‘-‘ option by toggling the minus toggle cancels the new mode.

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2.4.4 The MONITOR position sets the meter to a 5mV scale. The panel will display ScALE 5. This indicates the meter scale is +/- 5 mV

The meter displays the voltage seen on the shorted line when the reel is rotated. The meter displays the signal induced on the. With no magnetism there should be no voltage induced on the wireline.

2.4.5 When DEMAG is selected, the panel starts the demagnetization process by putting DC current on the line. The current through the line is displayed on the meter. The scale is +/- 5A.

The panel will display: NiNuS (minus)
60 (60%)

The meter displays current in this mode, about +/-5Amps.
The panel will output a negative rectified sine wave to the line for a minute. The panel will pause for 5 seconds and then display

PLuS (plus)
55 (55%)

The panel will output a positive rectified sine wave to the line for a minute. The panel will pause for 5 seconds and then display

NiNuS (minus)
50 (50%)

The panel will continue to alternate between plus and minus, decrementing 5% each time until it reaches zero.

At this time re-check the magnetism on the drum (refer to 2.3). If it is still present, repeat this step.

2.4.6 The other mode of operation is a “Manual” mode which expands the available options. To use the Expanded Mode, turn on the panel while holding the +/- toggle switch in the ‘+’ position. The panel displays:

101 A
NAnUAL (manual)

2.4.7 Different scales can be chosen in the ‘monitor’ function of the expanded mode.

To choose monitor mode in the expanded mode use the +/- toggle switch
Functn (function)
NoNitr (monitor)

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You now can select different scales:

ScALE	
1000	(+/-1000mV scale)
500	(+/-500mV scale)
200	(+/-200mV scale)
100	(+/-100mV scale)
50	(+/-50mV scale)
20	(+/-20mV scale)
10	(+/-10mV scale)
5	(+/-5mV scale)

Then use the menu button to advance to AccEPt (accept)
PLuS - (plus minus)

And use the '+' toggle to accept or the '-' toggle to cancel.

2.4.8 In the DEMAG function of the expanded mode additional menu options are now available - position, polarity, intensity, time duration and auto or manual modes can be chosen.

The demag mode a manual or an auto mode. The auto mode is similar to the mode in basic except that you can set some of the parameters.

You can choose the amplitude (10%-90%):

PhA (phase)
10-90 (%)

You can set the time for each step (5-60sec.):

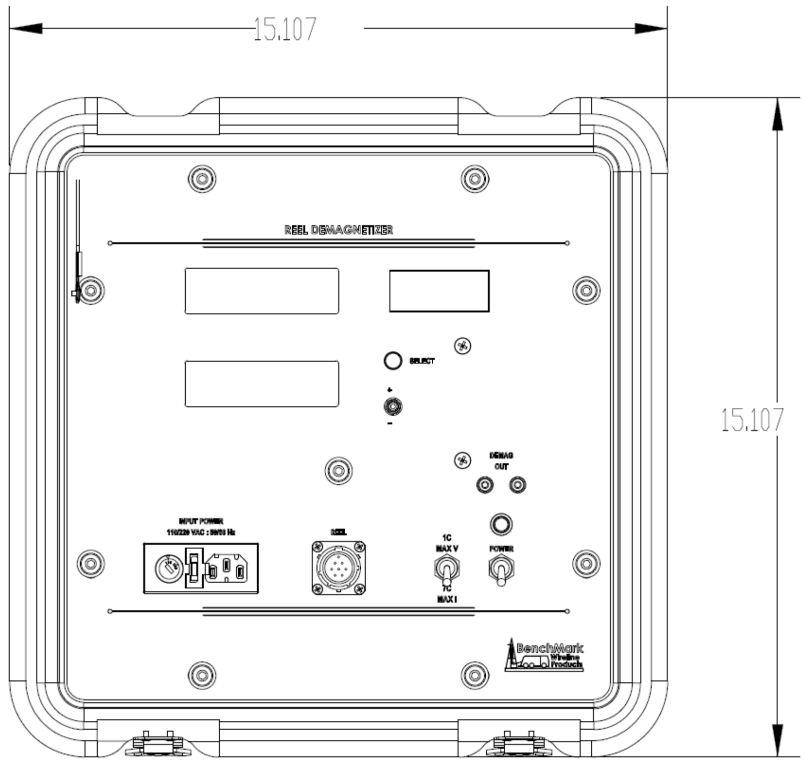
AutoSC (auto seconds)
5-60 (seconds)

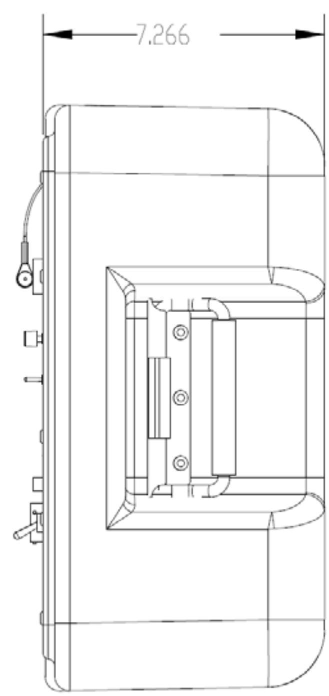
You can choose the polarity:

PoLAri (polarity)

PLuS (plus)
or NinuS (minus)

3.0 TECHNICAL SPECIFICATIONS





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WEIGHT:

PANEL ONLY: 24 LBS 10.88 KG

POWER REQUIREMENTS:

INPUT VOLTAGE: 110/220 VAC

INPUT CURRENT: 100mAMPS – 10 AMPS

OPERATING TEMPERATURE

Min	Max	
32	149	degrees F
-10	65	degrees C

STORAGE TEMPERATURE

Min	Max	
-22	158	degrees F
-30	70	degrees C

3.2 OBTAINING TECHNICAL ASSISTANCE

Call BenchMark Wireline Products Inc. at +1 281 346 4300

Or contact by email mail@benchmarkwireline.com

Or fax in request at +1 281 346 4301

Information is also available on website www.benchmarkwireline.com

Parts can be ordered by email, phone, or fax

Equipment can be returned for repair and maintenance.

Please notify us by Phone, email, or fax before sending any equipment.

To return equipment to BenchMark, ship it to:

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U.S.A.

4.0 INTERNAL SOFTWARE UPDATE PROCEDURE

This panel is controlled by internal software. Periodically software updates are released to add new enhancements and features or improve functionality.

Following is the procedure to install new software into the panel.

The internal processor board can be programmed in the field using a serial cable and hyper terminal.

- Remove the 8 screws holding the front panel.
- Connect an RS232 cable to the DB9 connector tie wrapped in the wiring harness.
- Set the baud rate in hyper terminal to 115200. When the panel is powered it looks for a character on the serial port.
- If it does not receive one it times out and starts the resident program.
- To enter the reprogram code turn on the panel and immediately send a character (not 1, 2, 3, or ?)
- This will cause the panel to execute the reprogram code.
- It will display the following text:

  "\r\nC8051F30x Selective Code Loader Example\r\n"
  "---\r\n"
  Erase the flash page at 0x1000\r\n"
  Receive HEX file\r\n"
  Execute the function at 0x1000\r\n"
  "?. Print Command List\r\n"

- And *** Unknown Command caused by the random character sent.
- Enter 1 and return to erase the old code.
- The panel outputs ‘E’s as it erases the old code.
- Enter 2 and return.
- The panel outputs “Ready to receive HEX file...”
- Click the ‘Transfer’ tab and click the ‘Send text file’ button.
- Navigate to the hex file to be downloaded and double click it. The panel should output ‘G’s.
- Enter 3 and return or turn off the panel and turn it on.
- The new code version should be displayed when the panel is turned on.

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5.0 PANEL CHECKOUT AND WIRING

5.1 CHECKOUT PROCEDURE

This procedure checks the wiring and functions of the ADDMA101 panel. Refer to the wire list and ADDMAWIRELIST_REFERENCE.

Remove the transformer wires on terminals 1-4. They are colored BLK, WHT, BRN, ORN (1 to 4). Remove the plugs to the circuit boards. Remove the plugs to the 12V power supply.

With an ohmmeter check that terminals 1 and 3 are shorted and terminals 2 and 4 are shorted when the 110/220 switch is in the 110 position. Check that there is no continuity between term 1 and 2 or 4 and no continuity between term 3 and 2 or 4.

Place the 110/220 switch in the 220 position. Check that there is continuity between terminals 2 and 3 and none between terminals 1 and 4 to 2 or 3.

Insert a 3A slo-blo fuse (AMS5P021) in the AC connector fuse holder. Apply power and check that there is 120VAC between terminals 1 and 4. Remove power from the panel.

Replace the transformer wires term 1 – BLK, term 2 – WHT, term 3 – BRN, term 4 – ORN. Put the MAX-V MAX-I switch in the MAX-I position (down.) Apply power to the panel and check that there is 120VAC between terminals 5 and 6. Turn off the power and place the MAX-V MAX-I switch in the MAX-V position (up.) Turn on power and check that there is 220VAC on terminals 5 and 6.

Turn off power and switch to MAX-I. Turn on power and check 120VAC terminals 1-2. This is the input power for the 12VDC power supply. Remove power, plug in the input to the power supply and turn on power. The LED on the board should illuminate. Power to the circuit boards is routed via shorted pins on the boards. On ADDMA021 pins 15 and 16 are 12V. Pins 8, 9, 11 are ground. On ADDMA020 pins 15 and 16 are 12V. Pins 3, 4, 9, 10 are ground. Plug in the 12VDC connector on the power supply and turn on power. The 12V power light on the front of the panel should turn on. Turn off power and plug in the three 16 pin connectors on the circuit boards. Turn on power and the displays (programmed previously) should display the revision level and mode.

To check out the monitor function of the panel, remove the wires at term 5B and term 6B. This ensures the signal generator will not be demagnetized. Connect the signal generator signal + to the red test point or the REEL connector A – G. Connect the signal generator ground to the REEL connector H or to the REEL connector H.

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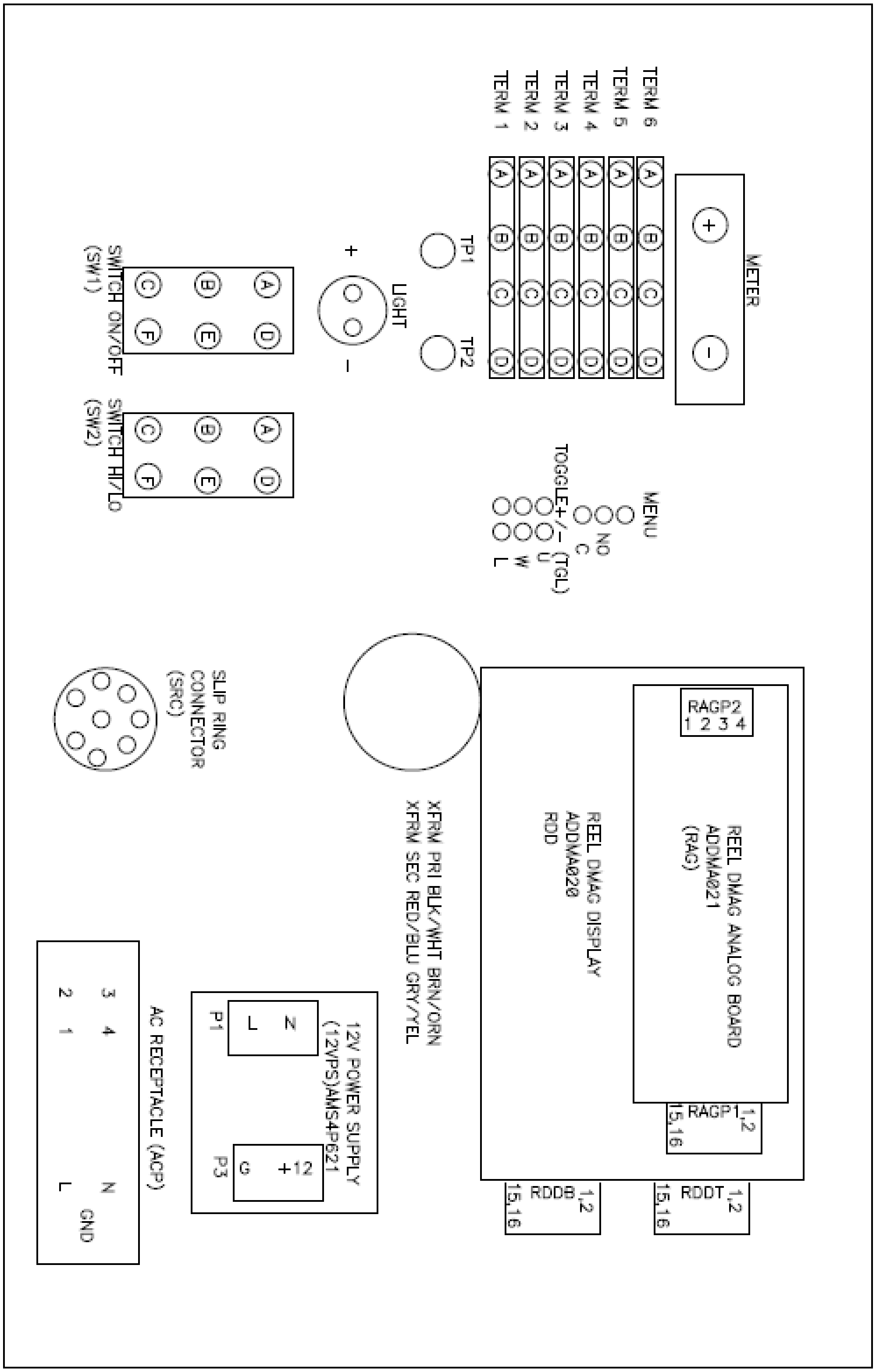
5.2 PCBOARD LAYOUT

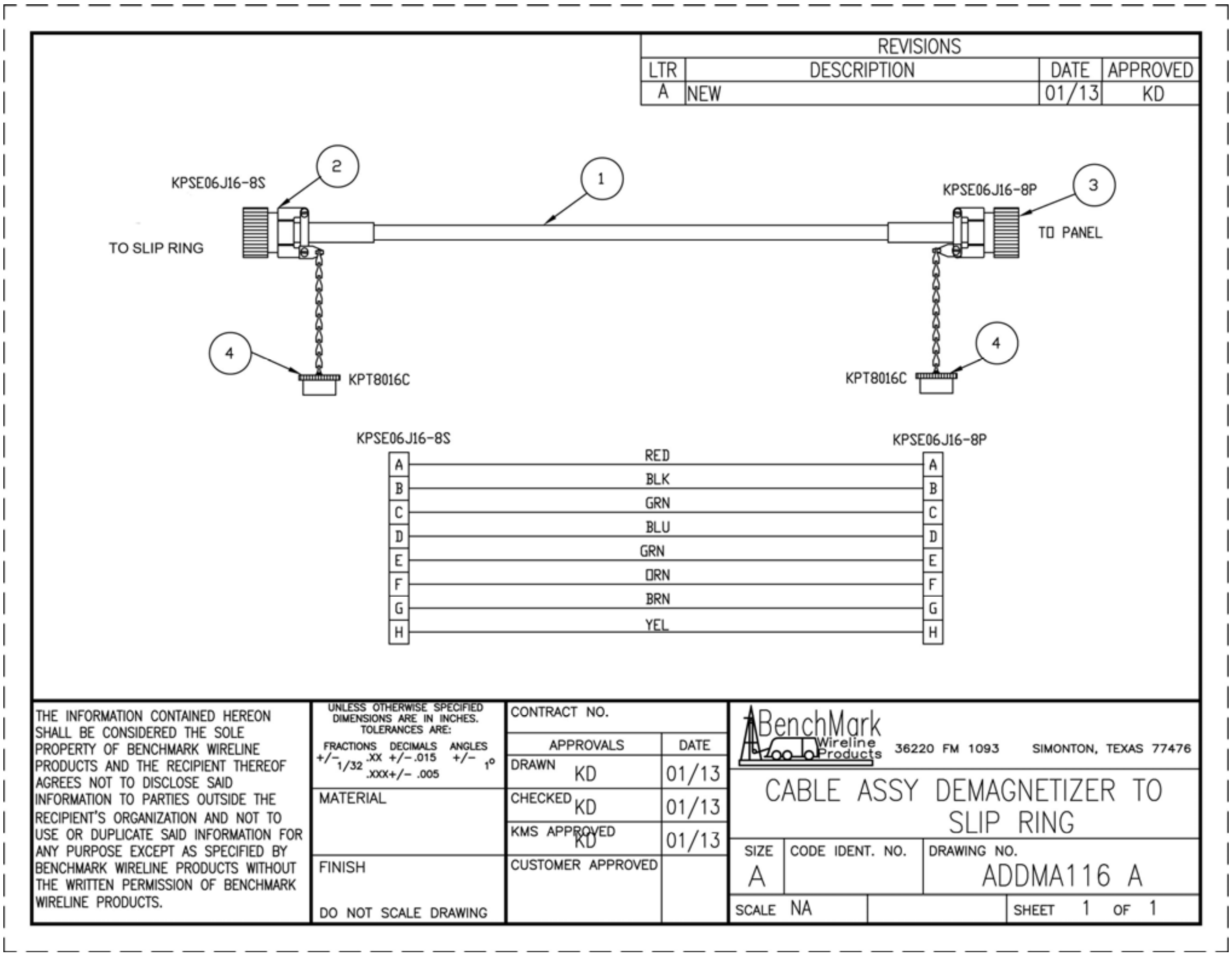


5.3 WIRELIST

REELDMAG ANALOG BOARD (RAG)			
P1-1		METER+	METER+
P1-2		2.5V	METER-
P1-3		TXD0	RDDB-7
P1-5		GND	ACP-GND
P1-8		GND	MENU-C, TGL-W
P1-9		GND	RDBB-10
P1-11		GND	12VPS-P3-G
P1-12		TOGGLE+	TGL-L
P1-13		TOGGLE-	TGL-U
P1-14		MENU	MENU-NO
P1-15		12V	RDDB-16
P1-16		12V	12VPS-P3-+12
ADDMP020 REELDMAG DISPLAY BD TOP (RDDT) CONNECTOR			
P1-8		RXD0	RDDB-8
P1-10		GND	RDDB-9
P1-16		12VDC	RDDB-15
ADDMP020 REELDMAG DISPLAY BD BOTTOM (RDDB) CONNECTOR			
PUSHBUTTON (MENU)			
TOGGLE (TGL)			
METER (M)			
POWER SWITCH (SW1)			
SW1-B	AC NEUTRAL	ACP-N	
SW1-E	AC HOT	ACP-L	
HI/LO SWITCH (SW2)			
SW2-B		XFRM-RED,TERM6-B	SEC_1H
SW2-A		SW2-F,XFRM-GRY	
SW2-C		NO CONNECTION	
SW2-E		SEC_1L	SEC_1L

SW2-D		XFRM-YEL,TERM5-B	
SW2-F		SW1-A,XFRM-GRY	
SW2-F		SW2-A	
TRANSFORMER (XFRM)			
RECEPTACLE 115/240 VAC FUSED (ACP)			
TEST POINTS			

5.4 CABLE BETWEEN PANEL AND SLIP RING



6.0 PRODUCT IMAGES AND ACCESSORIES

6.1 Panel Face

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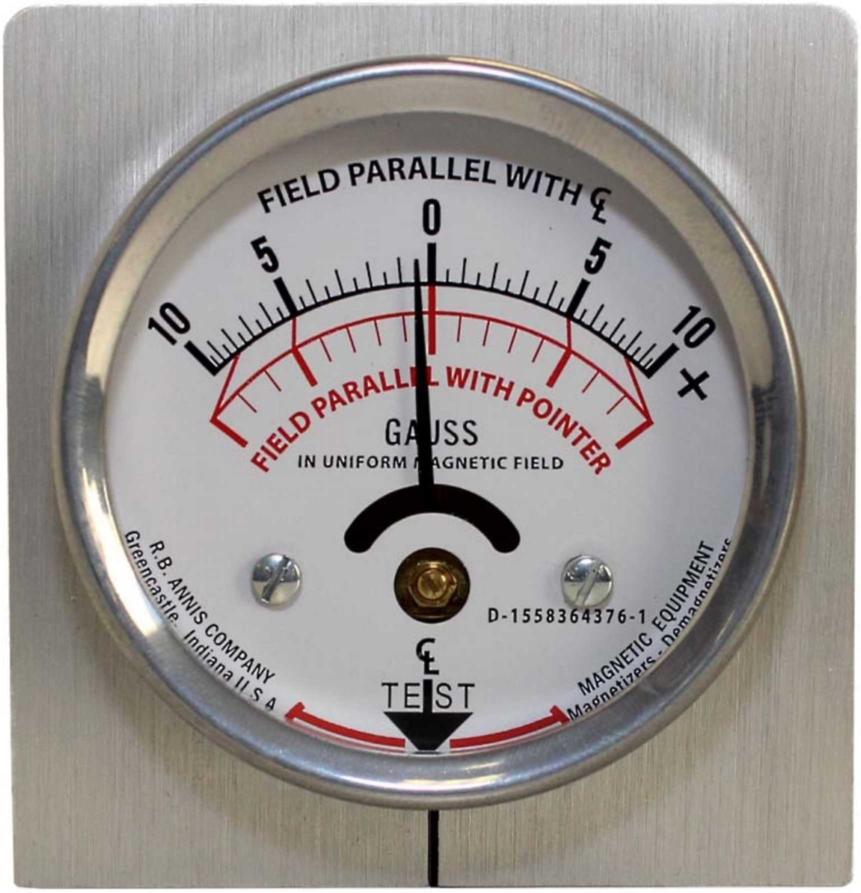
6.2 PANEL INSIDE CASE

6.3 CASE CLOSED

6.4 Gauss Meter

BenchMark p/n AMS5A001



7.0 DEMAGNETISM CAUSES AND THEORY

CAUSES OF MAGNETISM

Hoisting equipment, trucks, and skids are constructed mainly from ferromagnetic metals (i.e., metals that will attract or repel under the influence of a magnetic field). The degree to which these metals can be magnetized depends on their respective metallurgies which, in turn, control the following properties:

a. Permeability: the ease with which the metal accepts induced magnetic flux. Metals which do not carry magnetic lines of flux, such as aluminum and copper, will not become magnetized.

b. Retentively: the ability of the metal to retain induced magnetic flux. As a general rule, softer ferromagnetic metals are less retentive than harder ferromagnetic metals.

c. Reluctance: the opposition offered by ferromagnetic metal to the establishment of magnetic flux. The relationship between reluctance and magnetic flux lines in a metal is analogous to the relationship between resistance and current flow in an electrical circuit.

d. Ferromagnetic: hoisting equipment can become magnetized either mechanically or electrically. Mechanical magnetization occurs through simple exposure to the earth's magnetic field during normal operation, extended storage in one orientation, or transport from one geographical location to another. Repeated stroking in the same direction or the shocks and jars associated with production, maintenance, and repair processes can also magnetize equipment. Electrical magnetization occurs whenever direct current (dc) or alternating current (ac) flows through the equipment, trucks, or skids.

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DEMAGNETIZING

Magnetic fields exist as concentrations of magnetic flux lines. These concentrations are polarized in magnetized metal, with the flux lines running between north and south poles. In fields produced by electrical currents, the flux lines circulate around the current at right angles to its direction of flow. In very simple terms, the degree to which the fields are attractive or repelling depends on the density of the flux line concentration (i.e. the number of lines passing through a unit of space). The strength of a field around an electrical current is directly proportional to the strength of the current. Thus, field strength around a DC current remains relatively constant, whereas field strength around an AC current alternately builds and collapses with each current flow reversal. Flux line circulation around the current also reverses with each flow alternation.

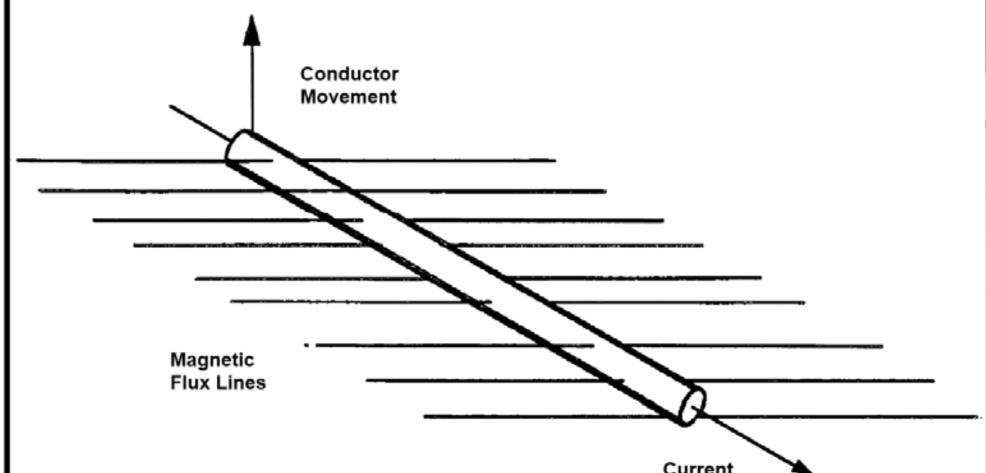
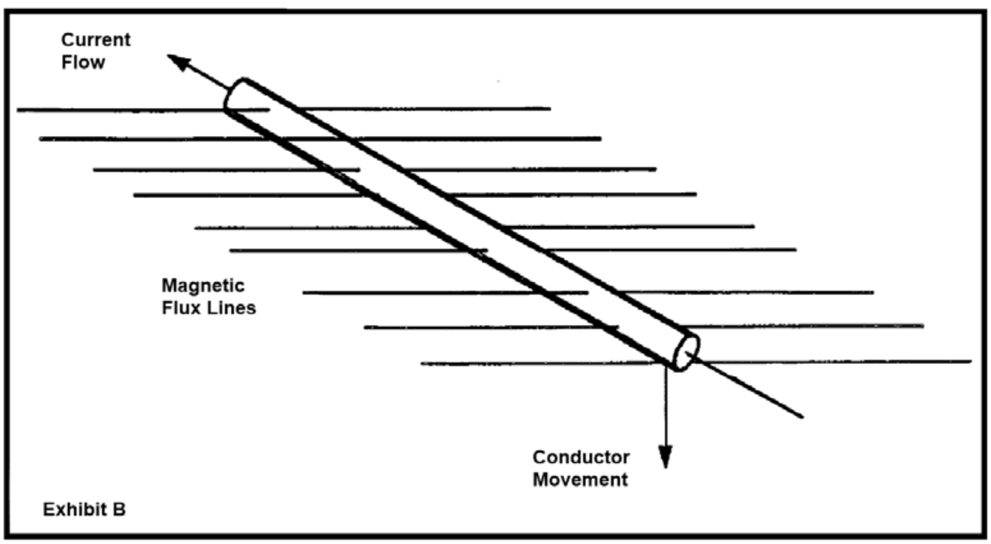


Exhibit A

Ferromagnetic metals generally retain some magnetism after the magnetizing force is removed. This leftover magnetism is called residual magnetism, and its field strength depends on a number of factors, among them the permeability, retentively, and reluctance exhibited by the host metal as well as the strength of the magnetizing force. As shown here, electrical current will be induced in conductors that cut through the flux lines of a residual magnetic field. The induced current will be greatest when the conductor moves through the field at right angles to the lines, and will change direction whenever the movement of the conductor through the field is reversed. No current will he induced into conductors that move through a field parallel to its magnetic flux lines.



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MAGNETISM AND WELL LOGS

Effect on Cable Conductors

Current can be induced into logging cable conductors whenever cable drum rotation moves them through magnetized areas in the hoisting equipment. The strength of the induced current depends on:

1. the rotational speed of the drum (which determines the number of flux lines cut per unit of time)
2. the density of the field
3. the angle at which the conductors cut through the lines.

The flow direction of an induced current depends on the polarity of the magnetic field that produced it. Because several magnetized areas can exist simultaneously in different densities and polarity orientations, induced current flows can vary in strength and change direction during each drum rotation.

SP logging signal currents and induced currents will add algebraically. Therefore log traces will be the net result of interaction-1 between the two currents during each cable drum rotation. Conceivably, during one drum rotation, one magnetized area could induce opposing current that is much greater than the logging signal current. In this case, the resulting galvanometer log trace would indicate a subsurface condition completely opposite to that detected by the logging instrument. Another magnetized area could induce current that adds to the strength of the signal current, and the associated log trace would signify much greater spontaneous potential than was actually detected. The magnetized areas in two or more drive train components, such as the drive chain, sprocket, and drum flange, could come into proximity with each other. The field strength and polarity resulting from the interaction of these fields could produce a totally unique effect on signal current that would not appear again on the galvanometer log until the same areas line up in the same way several drum rotations later.

Logging cables, cable drums, drive train components, skids and trucks are all checked for magnetism during their respective fabrication phases as well as just before shipment to the field. In spite of these precautions, mechanical stresses imposed by hoisting and spooling as well as the welding and hammering associated with normal repair and maintenance can magnetize hoisting equipment to levels that affect SP logs. Accordingly, trucks and skids should be checked regularly for induced magnetism.

DEMAGNETIZING - Theory

Understanding how iron and steel become magnetized is the first step towards developing successful demagnetization practices and procedures. The key to understanding is the hysteresis curve shown in exhibit A. This curve portrays the induction and elimination of magnetism by an outside force into previously magnetized metal. On the graph in the figure, induced magnetism is plotted along axis B and the magnetizing force is plotted along axis H.

As the magnetizing force increases to the right along axis H, the induced magnetic field gathers strength along the dotted line until it reaches saturation point (a). This point marks the maximum limit of flux line density possible in the metal.

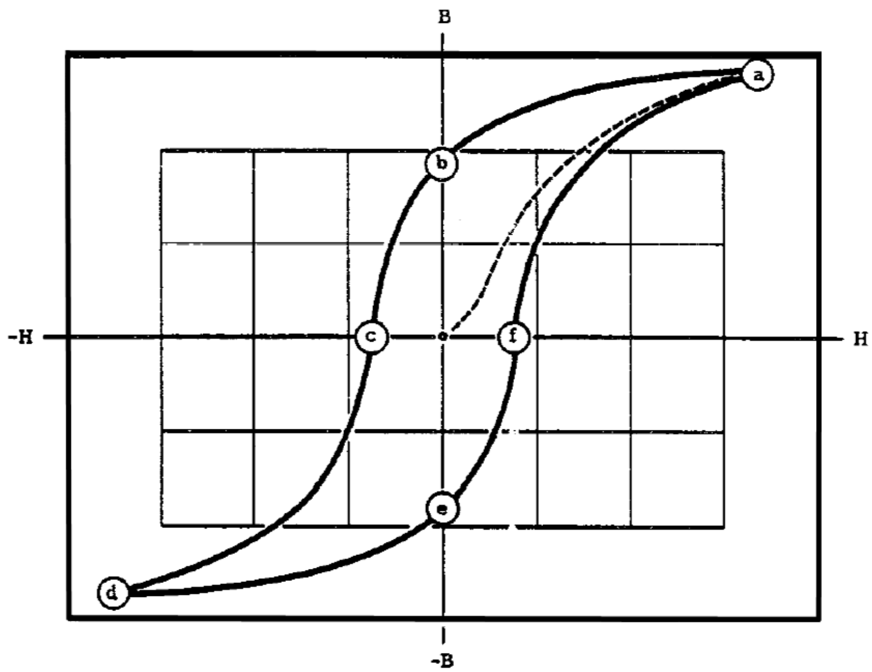
Regardless of any additional increase in the magnetizing force, no further increase in density is possible other than that which may occur in ambient non-magnetic air or material.

As the magnetizing force returns to zero along axis H, the induced field strength decreases from (a) along the hold line to point (b). The distance between this point and zero represents the strength of the residual field that remains after the magnetizing force has been removed. The residual field can only be eliminated by applying a magnetizing force having a polarity opposite to that of the initial magnetizing force. As this second force increases to the left along axis H, the residual magnetism decreases along the curve between points (b) and (c).

The demagnetizing force required to eliminate the residual field is called coercive force and its magnitude is represented by the distance between point (c) and zero on the H axis.

As the reverse magnetizing force increases, induced magnetism grows from zero towards saturation at point (c). By again reversing the polarity of the magnetizing force and increasing its strength along the H axis to the right, the intensity of the newly induced field decreases along the curve running between points (d) and (i). Point (e) on this curve represents residual field intensity and point (f) indicates the coercive force required to eliminate the residual field and demagnetize the metal.

Exhibit A
Hysteresis
Loop Development



DEMAGNETIZING

Hysteresis curves illustrate two facts that are basic to demagnetizing procedures and equipment.

First, two magnetic fields having different flux line directions cannot occupy the same space at the same time. The simultaneous imposition of two such fields into the same space produces a resultant field which is the vectorial sum of the flux line directions in the two fields. However, if two fields are impressed successively, the last field will eliminate the remnant field from the previous magnetization (if the last field is strong enough to establish itself in material occupied by the remnant field).

Secondly, changes in induced fields lag the changes in the magnetizing feces that produce them, and induced field strengths do not reach the field strengths of the magnetizing forces.

Thus, it is possible to eliminate an established magnetic field with a magnetizing force of the appropriate flux line orientation and field intensity. Demagnetizing procedures apply magnetizing forces that undergo periodic intensity reductions and polarity reversals. The graph in exhibit B shows how these forces eliminate induced magnetism. As in exhibit A, the graph in exhibit B plots induced magnetic flux along axis B. Demagnetizing force plots along axis H.

The curve in the lower left quadrant of the graph traces the applied demagnetizing force; associated hysteresis curves appear in the upper left quadrant; and induced magnetic field strength is shown in the upper right quadrant. Note the direct correlation between intensity and polarity changes in the demagnetizing force and the induced magnetic field. This correlation illustrates the progressive erosion of induced flux line density by the coercive forces and field intensity reductions occurring with each polarity reversal of the demagnetizing force.

The frequency of polarity reversals also bears on the effectiveness of a demagnetizing force. As reversal frequencies increase, the penetration of the demagnetizing force decreases. Therefore, demagnetizing forces having relatively low frequency reversals are more effective for deep seated magnetic fields in larger equipment items. The procedures in this publication specify the 60 Hz reversals in common single phase line voltage for field demagnetization efforts.

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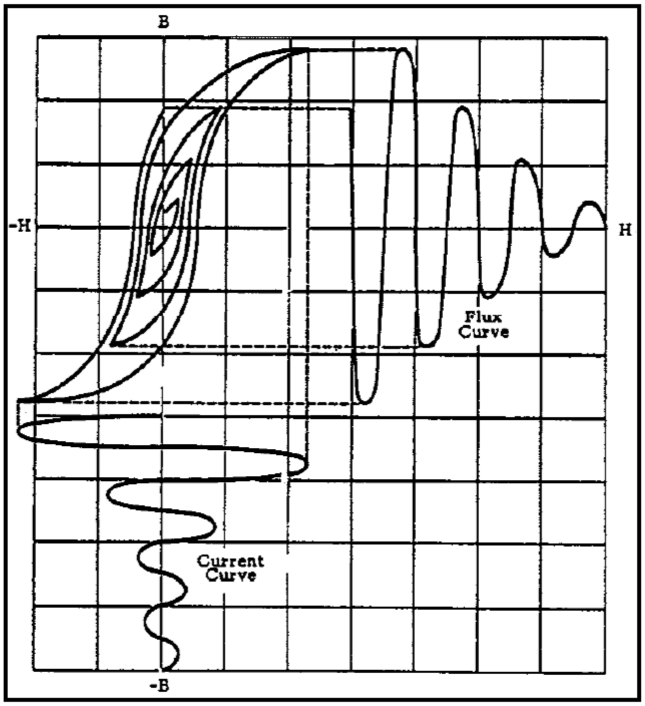

Exhibit B
Flux Curve During Demagnetization
(Projected from Hysteresis Loop)