INSTRUCTION MANUAL

MODEL 8515D

DEMAGNETIZER

REV.1 BEGINNING WITH SERIAL # 37199

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IMPORTANT

THE FIXTURE MUST BE CONNECTED BEFORE TURNING ON THE DEMAGNETIZER. THE DEMAGNETIZER WILL NOT FUNCTION UNLESS A FIXTURE IS PROPERLY CONNECTED.

BEFORE FIRST USE, INSPECT THE MACHINE AND DEMAGNETIZING FIXTURE CAREFULLY FOR ANY SIGNS OF SHIPPING DAMAGE. IF DAMAGE IS EVIDENT NOTIFY THE CARRIER AND MAGNETIC INSTRUMENTATION, INC. IMMEDIATELY.

SERVICE AND MAINTENANCE OF THIS EQUIPMENT REQUIRES TRAINED PERSONNEL.

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I. GENERAL DESCRIPTION

The Model 8515D is a high voltage, capacitive discharge-type ringing demagnetizer capable of processing all alnico, ferrite, and rare earth magnetic materials. The Model 8515D is easily adapted to a wide variety of production and laboratory requirements.

A modern, solid state electronics control circuit makes this demagnetizer a highly reliable, low maintenance unit. The electronic voltage control circuit prevents the unit from being discharged before the preset energy level has been reached, thereby preventing incomplete demagnetization.

The Model 8515D, with all electronic circuitry and capacitors enclosed in a metal cabinet, is also designed for maximum operator safety when used with Magnetic Instrumentation, Inc. Demagnetizing Fixtures.

II. ELECTRONICS CABINET

A. Specifications

Demagnetizing Current	Maximum rated output current 5,000Amps
Stored Energy	550 Joules (600 Micro-Farads at 1,350 Volts)
Output Voltage	0 Volts to 1350 Volts (set by user) Note: The maximum voltage may have been limited to less than 1350 Volts to prevent damage to the Demagnetizing Fixture or the Machine. Contact Magnetic Instrumentation, Inc. before attempting to alter the factory set maximum voltage.
Power Input	115 Volts 50/60 Hz 15Amps
Physical Dimensions	160 lb.s. H 19.5" X W 20.5" X D 24" (Not including Demagnetizing Fixture)

B. Front Panel Components

Power ON-OFF Switch

The switch is used to turn power on and off to all electronics in the machine. The switch is capable of being "Locked-Out" by service or maintenance personnel to prevent accidental turn-on.

Fan

The fan provides cooling for all of the internal circuitry. The filter may be cleaned with water if necessary to provide unrestricted air flow through the cabinet.

Fuse

The ¼ Amp Slo-Blo fuse protects the control circuitry and low voltage power supply on the rear panel 10 pin connector.

Panel Meter

The panel meter is a 0 to 2KV analog meter. It continuously monitors the voltage of the energy storage capacitor bank.

Voltage Control

The potentiometer is used to control the voltage to which the energy storage capacitor bank is charged. Voltage may be increased by turning the knob clockwise. Voltage may be decreased by turning off the power-on switch or by initiating the demagnetize function, thereby discharging the capacitor bank through the fixture. NOTE: When initially setting the voltage it is best to start with the voltage control knob at minimum and slowly adjust this control clockwise so as not to overshoot the desired level.

Lights / Push-Button Switches (Charge and Demagnetize)

The lights act as ready indicators. If the blue light is illuminated, it indicates that the demagnetizer is ready-to-charge. If the green light is illuminated, it indicates the demagnetizer is at the preset voltage and is ready-to-discharge. The lights also act as push-buttons and provide a means of initiating the desired function. The Charge light / push-button is active only when the demagnetizer is ready-to-charge, as indicated by the blue light. The Demagnetize light / push-button is active only when the demagnetizer is ready-to- discharge, as indicated by the green light.

Function Select Switch

Manual (Center Position)

In this mode of operation a manual initiation of the Charge and Demagnetize functions is required. Press the Charge light / push-button when the blue ready-to-charge light is on. The demagnetizer will charge to the preset voltage level, as set by the Voltage Control knob, and turn on the green ready-to-demagnetize light while maintaining the desired charge level. Voltage may be increased by turning the Voltage Control knob clockwise, or the demagnetizer may be discharged by pressing the Demagnetize light / push-button, provided the green ready-to-demagnetize light is illuminated.

Auto Demagnetize (Left Position)

In this mode of operation the charge function must be initiated by pressing the Charge light / push-button. Upon reaching the preset voltage level the demagnetizer will automatically discharge.

Auto Charge (Right Position)

In this mode of operation the demagnetizer will automatically charge to the preset voltage level and maintain this level until the Demagnetize light / push-button is pressed. After a short period of "off time" the demagnetizer will recharge automatically and be ready for the next cycle.

C. Rear Panel Components

Power Cord
The power cord has a standard 15 Amp molded plug that will fit into any standard 115VAC outlet.

Fuse
The 15 Amp Slo-Blo fuse protects the charging circuit and all major components of the Demagnetizer.

10 Pin Input / Output Connector
The 10 pin connector allows the Demagnetizer to be operated from a remote location. It is ideally suited to interface with external relays or an OPTO Rack. See page 5 for an explanation of its functions

Maximum Cycle Rate Adjustment
The locking potentiometer located on the rear of the Demagnetizer Control Chassis is only accessible by removal of the louvered rear panel on the machine. It controls an internal timing circuit to prevent the Demagnetizer from being operated faster than the Maximum Suggested Cycle Rate for the Demagnetizing Fixture (See: Fixture Conformance Tag on the Demagnetizing Fixture). It is adjustable from approx. 1 to 30 sec. **IMPORTANT: This adjustment should only be attempted by trained personnel. High Voltage is present on many of the exposed connections inside this machine. Make sure the machine is not charged and unplugged before attempting to alter its setting.**

D. Connections

Demagnetizing Fixture (Front Panel)

To install a Demagnetizing Fixture on the Demagnetizer, remove the cover on the rectangular box by loosening the 4 corner screws. Attach the wires from the Demagnetizing Fixture to the copper bars protruding through the front panel and secure the strain reliefs. Replace the interlocked cover and tighten the 4 corner screws. The initial polarity of the demagnetizing field is dictated by the direction of current flow through the windings of the Demagnetizing Fixture. Reversing the connections reverses the initial polarity of the field produced.
IMPORTANT: When connecting a Demagnetizing Fixture to the Demagnetizer, observe the cabling and copper bars for signs of wear. Connecting a badly worn Fixture to the Demagnetizer may pose a hazardous condition to the operator. Make sure these connections are firmly seated. A poor connection may cause electrical arcing and/or a low demagnetizing field within the fixture.

Rear Panel 10 Pin Connector

The connector located on the rear panel of the machine provides a means of external operation without the need of an external power supply. Dry contact closures are required for the Charge and Demagnetize functions and dry contact closures are provided for the Ready-to-Charge and Ready-to-Demagnetize outputs. A +24VDC supply is also provided for the purpose of running control relays or an OPTO rack.

External Charge — A dry contact closure between pins **A** and **B** will provide a charge input. (The same as pressing the blue Charge light / push-button on the front panel of the control chassis.)

External Demagnetize — A dry contact closure between pins **C** and **D** will provide a Demagnetize input. (The same as pressing the green Demagnetize light / push-button on the front panel of the control chassis.)

External Ready-to Charge — A dry contact closure will be seen between pins **E** and **F** when the demagnetizer is ready-to-charge. (This contact will be closed when the blue Ready-to-Charge light / push-button on the front panel is illuminated, and will be open when the light is off.)

External Ready-to Demagnetize — A dry contact closure will be seen between pins **G** and **H** when the Demagnetizer is ready-to-demagnetize. (This contact will be closed when the green Ready-to-Demagnetize light / push-button on the front panel is illuminated, and will be open when the light is off.)

+24VDC Output — A +24VDC power supply is provided between pins **I** and **J**. Pin **I** is +24VDC, and pin **J** is ground. This supply is not regulated (± 2.5VDC) and is capable of driving up to 200 milli-amps.

III. SET UP INSTRUCTIONS

This step-by-step set-up procedure must be followed to insure long, reliable equipment performance.

1. Place both the electronics cabinet and Demagnetizing Fixture in their final operating location.

2. Connect water source to Fixture, if required.

3. Connect the Demagnetizing Fixture's cables to the fixture connector on the electronics cabinet. See Section D. Connections (page 4).

4. Set Voltage Control at minimum voltage (full counter-clockwise), and function select switch to Manual (center) position.

5. Connect AC power cord to a 120 volt, 50/60 Hz grounded power outlet capable of supplying 15 amps of continuous power.

6. Turn on electronics cabinet power switch.

7. The fan and the blue Ready-to-Charge light should come on. Press the blue Charge light / push-button. The green Ready-to-Demagnetize light should come on. Slowly turn the Voltage Control knob clockwise until the capacitor bank charges to approximately 50 volts as indicated on the voltmeter. This will be the first division on the analog meter.

8. Press the green Demagnetize light / push-button. The Demagnetizer will discharge through the Fixture and remain idle for the time set by the maximum cycle rate adjustment. See Section C. Rear Panel Components (page 4).

9. After this short period of off-time the blue light will come back on, allowing the cycle to be reinitiated.

IV. BASIC DEMAGNETIZER CIRCUIT DESCRIPTION

Note: All of the major components' circuit designations in the following section of this manual are in bold and correspond to the Electrical Schematic sheet 4 of the drawing set.

A Capacitive Discharge Demagnetizer functions by supplying a large amount of energy in a short time to a demagnetizing fixture. This demagnetizing pulse is a gradually decaying alternating current milliseconds in length. The oscillating frequency and amplitude of demagnetizing field produced is dictated by the total impedance of the discharge circuit and the operating voltage. The basic demagnetizer consists of a capacitor charging and discharging circuit both of which are controlled by the logic circuit within the control chassis. (See: Section V. and the schematics provided for complete circuit details.)

A. Capacitor Charging Circuit

The capacitor bank is charged by drawing small amounts of power from the power line over several seconds. The capacitor charging circuit consists of a Solid State Relay (**1SSR**), a Current Limiting Inductor (**1L**), a Step-up Transformer (**1T**), a Rectifier Board (**1DB**), and the Capacitor Bank (**1C-2C-3C**). The charging circuit is controlled by the Solid State Relay providing primary power to the Step-up Transformer through the Current Limiting Inductor. The secondary voltage of this transformer is rectified by the Rectifier Board that is connected directly to the Capacitor Bank.

B. Discharge Circuit

The discharge circuit, which provides the oscillating current, consists of an electrically matched SCR/Diode Assembly (**1SCR**), SCR Fire Control Board (**3PCB**), and the Demagnetizing Fixture. Provided the Capacitor Bank is charged to the preset voltage level and the Demagnetize function has been initiated, the Control Chassis sends a logic signal to the SCR Fire Control Board. This circuit board gates on the SCR with a conditioned signal allowing the energy stored in the Capacitor Bank to discharge into the Demagnetizing Fixture. The collapsing current in the Demagnetizing Fixture recharges the capacitor bank in the opposite polarity and to a slightly lesser amplitude of the initial charge. The Diode is then forward bias and conducts this reverse charge through the Demagnetizing Fixture. The SCR is maintained on during the entire cycle allowing the oscillation to continue until all available energy is dissipated.

V. Technical Description

The following technical descriptions are for the circuit boards located within the Demagnetizer Control Chassis. See the schematics for complete details.

General Description – 8515D Charge Demag Control Board # 10420275

This board is used for capacitive discharge systems.

The charging circuit uses a comparator IC, and Transistor Logic to control an externally mounted Solid State Relay. This Solid State Relay is used to control the primary of the step-up transformer used for charging the capacitor bank.

The discharge timing circuit uses a 3-Timer (IC's) Chain that is controlled by an external relay. The timing sequence provides enough time to allow the charge circuit to become inactive before discharging the capacitor bank. Actual discharge of the capacitor bank is not performed by this board, but it does provide a logic signal that can be utilized to start an interfacing circuit to the actual discharge device.

The capacitor bank reference voltage is 0 to -8 vdc to both circuit and chassis ground.

Technical Description – 8515D Charge Demag Control Board #10420275

Charge Circuit:

The reference voltage from the capacitor bank, (0 to -8vdc), is connected to pin 1 of the header connector, and is fed through R327 430 ohm to the inverting input of comparator AR301, pin 3. D304 prevents the capacitor bank reference input voltage to AR301 from exceeding -12 vdc. A reference from a voltage control circuit, pins 23 & 24 of header connector, is fed through R324, 430Ω, to the non-inverting input of comparator AR301. These two inputs must both be negative with respect to circuit and chassis ground. The output of AR301, pin 7, will be low, zero volts, when the capacitor bank is below the level set by the voltage reference circuit, or high, +15V if the capacitor bank is above the level set by the voltage reference circuit. Hysteresis of this comparison is controlled by R325, 200K nominal. Transistor Q308 is used to buffer and invert the output of AR301.

The collector of Q308 feeds two circuits:

1. Q307 inverts the logic level on the collector of Q308. The collector of Q307 is used to drive Q303 that makes up half of the two transistor "AND" circuit that enables a demagnetize condition. Q303 must be on, signifying the capacitor bank is not charging, before the collector of Q302 will be allowed to go low upon the initiation of the demagnetize signal (+24V applied to Pin 17 of header connector). This assures that the capacitor bank is at the correct voltage level and is not charging before allowing the demagnetize or discharge function to be initiated.

2. Q308 also drives the circuit that provides the control signal to the Solid State Relay, (providing primary power to the charging transformer) from Pin 7 of the header connector. To enable a charge condition, ground (supply common) must be applied to Pin 6 of the header connector, allowing the collector of Q311 to go low. A low level on the collector of Q311 turns on Q312 allowing the +24V supply to be seen through R333 to Pin 7 of header connector. When Q312 is off the -24V supply through R334 and R333 creates a slightly negative potential at Pin 7 of header connector holding the Solid State Relay off. Q309 is used to drive an at-voltage (ready to demagnetize indicator or relay coil) signal. If ground (supply common) is applied to Pin 8 of the header connector (emitter of Q309), and the -24V supply through a relay coil or an indicator is applied to Pin 5 of header connector, this coil/indicator will be on when Q312 is off.

Discharge Circuit:

Pin 17 of the header connector is used to initiate the discharge function. When the +24VDC supply is applied to Pin 17 of the header connector Q302 will be turned-on and provided Q303 is on, (signifying the charge circuit is not-active), ground (supply common) is seen at Pin 12 of header connector. Pin 12 of header connector is used to start the discharge timing sequence. When Pin 12 of the header connector goes low, 2 conditions have happened.

1. The capacitor bank has been charged to the preset voltage level and the charge function is not currently active.
2. A demagnetize signal has been provided.

At the same time Pin 12 of the header connector goes low, Q310 is turned on holding Q312 (charging transistor) off, disabling the charge function. The 3-Timer Chain IC301, IC302, IC303 is enabled by Pin 10 of header connector, (Ov on Pin 10 = Disable +15V on Pin 10 = Enable), and triggered by Pin 19 of header connector (Ov = trigger).

Timing sequence:

Provided the timers are enabled, (Pin 10 of header connector at +15V), a low (Ov) applied to Pin 19 of header connector turns off Q301 allowing C303 to discharge. This starts timers IC301 and IC 302. IC301 turns on Q304 disabling the charge circuit through Q310, and maintains the low at Pin 12 of header connector. IC301 also turns on Q305 activating the first half of a two transistor "AND" circuit. IC301's output Pin 3 will remain active (+15V) for the entire discharge cycle. And is adjustable by the RC time constant of C301 75µfd, R307 39K, and an external resistor or potentiometer between Pins 18 and 20 of header connector. This timer remaining active is what provides the delay between the discharge of the machine and the ability to recharge for the next cycle. Timer IC302 is used to provide a delay between the start of the discharge cycle and actual discharge of the capacitor banks to allow the charge circuit enough time to shut-off (approx.: 100ms). When IC302's output returns to a low (timing cycle completed) C306 discharges and provides a trigger to IC303. Upon seeing the trigger the output of IC303 goes high (+15V) and turns on the second half of the "AND" circuit Q306. This allows the collector of Q305 to go low providing a low impeadence path to ground (supply common) to be seen at Pin 2 of the header connector. Pin 2 of the header provides the start signal used to trigger the circuit board that drives the discharge device (typically an SCR driver board).

General Description – ±15/±24 VDC Power Supply and Relay Board # 10401433

This board is a combination of board # 10401415 and board # 10401416. All references to the header connector pin numbers of # 10401415 should be considered 1CN, and all references to the header connector pin numbers of 10401416 should be considered 2CN.

General Description – ± 15VDC/ ± 24VDC Power Supply # 10401415

To provide normal operation for this board an external transformer (36 VAC center-tapped) must to be used. This board is used to supply unregulated ±24 VDC and regulated ±15 VDC. The +15 output is adjustable from approximately 6.5 VDC to 16 VDC and must be adjusted prior to use.

Technical Description:

The power supplied to this board must be provided by an externally mounted transformer connected to Pins 5 and 6, center tap to Pin 7 or 8, of header connector. This transformer should provide 18 VAC between Pins 5 and 7 or 8, and 18 VAC between Pins 6 and 7 or 8, 36 VAC should be seen between Pins 5 and 6. The center tap of this transformer is connected to circuit common. Full wave bridge rectifier DB 201 (1 amp max) serves to provide +24 VDC and -24 VDC with respect to circuit common approximately 50 VDC may be from the negative to the positive side of this bridge. The +24 VDC output (Pin 4 of header connector) is filtered by C202 (2200µfd) and the -24 VDC output (Pin 3 of header connector) is filtered by C203 (500 µfd). The +24 VDC output also supplies the input to adjustable regulator IC 201 (1.5 amp max) to provide the +15 VDC output (Pin 1 of header connector). This regulator may be adjusted from approximately +6.5 VDC to +16 VDC (with respect to circuit common) by POT 201 (500 Ω 1 turn). The -24 VDC output supplies the input to regulator IC 202 used to provide the -15VDC output Pin 2 of header connector. The ± 24 VDC outputs are non-regulated and may vary with input AC voltage and/or load. The ± 15 VDC outputs are regulated and should not vary more than ± 500 mv. The limiting factor for available output current may be dictated by the external transformer connected to this power supply. All of the components used are rated for a minimum of 1 Amp. However, if the transformer used is rated for less than 1 Amp, the rating of the transformer will dictate available output current.

General Description – Relay Board # 10401416

This board houses 2-4 Pole double throw 24 VDC (coil) relays. Each contact set on both relays are electrically isolated from each other.

Technical Description:

Relay CR201's coil and contacts run to Pins 15 through 28 of the header connector; relay CR202's coil and contacts run to Pins 1 through 14 of the header connector. A diode is mounted in parallel with each relay coil to eliminate an induced surge generated by turning off the inductive load of the relay's coil. This diode also dictates the polarity with which each coil is powered. CR202's coil is connected to Pins 1 and 3 of the header connector. The diode in parallel with CR202 is D203. The anode of D203 is connected to Pin 1, and the cathode of D203 is connected to Pin 3 of the header connector. The polarity of the power used to turn on CR202 must make the diode (D203) reversed bias. (Pin 1 of the header connector must be negative with respect to Pin 3 of the header connector.)

The contacts of CR202 are as follows:

Header Connector Pin Number	**Contact** Configuration
7	Normally Open (N.O.)
5	Common (C.) (shared by Pins 7 & 8)
8	Normally Closed (N.C.)
6	N.O.
4	C. (shared by Pins 6 & 9)
9	N.C.
13	N.O.
2	C. (shared by Pins 13 & 10)
10	N.C.
12	N.O.
14	C. (shared by Pins 12 & 11)
11	N.C.

CR201's coil is connected to Pins 26 & 28 of the header connector. The diode in parallel with CR201 is D202. The anode of D202 is connected to Pin 26 and the cathode of D202 is connected to Pin 28 of the header connector. The polarity of the power used to turn on CR201 must make the diode (D202) reversed bias. (Pin 26 of the header connector must be negative with respect to Pin 28 of the header connector)

The contacts of CR201 are as follows:

Header Connector Pin Number	**Contact** Configuration
22	Normally Open (N.O.)
24	Common (C) (shared by Pins 22 & 21)
21	Normally Closed
23	N.O.
25	C. (shared by Pins 23 & 20)
20	N.C.
16	N.O.
27	C. (shared by Pins 16 & 19)
19	N.C.
17	N.O.
15	C. (shared by Pins 17 & 18)
18	N.C.

VI. DEMAGNETIZING FIXTURE

Demagnetizing Fixtures are available from Magnetic Instrumentation, Inc. for use with the Model 8515D Demagnetizer. Be sure to follow the suggested operating perameters for each fixture. Failure to do so may lead to premature failure of the Demagnetizer and /or the Demagnetizing Fixture.

NOTE: Due to the high amount of magnetic field (opposing the polarity of the magnet's retained field) produced in the Demagnetizing Fixture, it is important to position and hold the part to be demagnetized carefully. Properly locating and holding the part will prevent it from being launched out of the Demagnetizing Fixture and may prevent it from being properly demagnetized. **It is not recommended that the part is held by hand.** Part locators for Demagnetizing Fixtures are available from Magnetic Instrumentation, Inc. and are recommended for use with Magnetic Instrumentation, Inc. Demagnetizing Fixtures.

SHIELDING OF THE OPEN END OF THE DEMAGNETIZING FIXTURE IS RECOMMENDED: AND MUST BE MADE OF NON-METALIC MATERIAL

Fixtures not designed by Magnetic Instrumentation, Inc. should meet the specifications of the Demagnetizer. Magnetic Instrumentation, Inc. assumes no liability for the performance or safety of fixtures not designed and manufactured by Magnetic Instrumentation, Inc.

VII. SERVICE AND MAINTENANCE

NOTE: Service and maintenance of this equipment requires trained personnel. Care is required for safety of service personnel. High Voltage isexposed with panels removed. This unit should be operated with the panels removed ONLY if absolutely required for repair.

A. General Instructions

The Model 8515D Demagnetizer is a combination of electrical and electronic components. Procedures consistent with safety and standard practices for each area should be used.

Regular service should be performed to insure proper connection of all terminals.

If water is used for cooling, all water connections should be inspected regularly for leaks or obstructions.

A regular inspection of the drain will prevent component failure due to overheating.

B. Test Equipment

Trouble-shooting and repair must be carried out by qualified personal using properly rated test equipment. Failure to do so may result in damage to the Demagnetizer and/or test equipment.

C. Panel Removal

NOTE: Panels should be removed only by trained personnel. Care must be used when removing panels. Panels should be removed only with equipment disconnected from the AC line. Always check the Capacitor Bank voltage prior to beginning any repair. If the voltage is not zero, discharge the capacitors in a safe and proper manner before proceeding.

The electronics cabinet has a removable rear panel for access to circuits. The control chassis can be taken out by removing the front panel screws.

D. Adjustments

Maximum voltage setting, power supply voltage, and minimum cycle rate adjustments are factory set and should not be tampered with in any way without consulting Magnetic Instrumentation, Inc.

E. Trouble Shooting

Prior to beginning any trouble shooting, all connections should be checked. This includes AC power to the electronics cabinet and water supply if required. All trouble shooting should be done at low voltage.

VIII. REPLACEMENT PARTS

Quantity	Circuit Designation	Part Number	Description
3	1C 2C 3C	36110975	200µFD 2000VDC CAPACITOR
1	1CR	52603004	1PST N.C. VACUUM RELAY
1	1DB	10007479	DIODE BOARD ASSEMBLY
1	1FUSE	57606154	15AMP SLO-BLO FUSE (REAR PANEL)
1	1L	60406508	.021H CURRENT LIMITING INDUCTOR
1	3PCB	10416762	SCR FIRE CONTROL BOARD
2	1R 2R	30505798	10KΩ 70/50WATT 5%
1	1SCR	42603479	SCR & DIODE ASSEMBLY
1	1SSR	52601633	110A 480VAC SOLID STATE RELAY
1	1T	60315417	120/240VAC TO 2100VAC TRANSFORMER
1	2D	40403375	1000V 1AMP DIODE
1	2PCB	10416290	VOLTAGE DIVIDER BOARD
1	1PCB	10420595	2000/1000/500 – 10V DIVIDER BOARD
1	3R	30200062	1KΩ 1/2WATT 5%
1	1FAN	91013751	COOLING FAN 3.15 in. 115VAC
1	3	91014123	FINGER GUARD & FILTER FOR FAN
1	1DISC	90311911	63AMP 660VAC IEC DISCONNECT
1	2	90312076	HANDLE FOR DISCONNECT
1	1CON	63104383	10 PIN FEMALE CONNECTOR (REAR PANEL)
1	1SA	10016243	FIXTURE CONNECT BOX
1	1CH	15218103	DEMAG. CONTROL CHASSIS

PARTS FOR 1CH:

1	1CB	10420275	CHARGE/DEMAG CONTROL BOARD
1	1PS	10401433	POWER SUPPLY/RELAY BOARD
1	1RB	10401416	RELAY BOARD
1	1POT	32903868	10KΩ 2WATT VOLT. CONTROL POT.
1	2POT	32900274	350KΩ 2WATT -OFF TIME- POT.
1	1SW	55200548	3 POS. -ON- TOGGLE SWITCH
1	1FUSE	57600600	1/4AMP SLO-BLO FUSE
1	1M	59116234	0-2KV 2ma F.S. ANALOG METER
1	1PBL	90515610	PUSH-BUTTON BLUE 24V LED
1	2PBL	90515611	PUSH-BUTTON GREEN 24V LED
1	1T	60100686	117V TO 36VCT 550ma TRANSFORMER

MATE FOR REAR PANEL 10 PIN I/O CONNECTOR NOT SUPPLIED WITH THE MACHINE:

1	63104382	10 PIN MALE PLUG CABLE MOUNT