INTER PLANT STANDARD - STEEL INDUSTRY		
IPSS	**SPECIFICATION FOR MAGNET PANELS FOR CRANES** (*First Revision*)	**IPSS:1-04-037-99**
	Based on IS 8623 (Part 1):1993	Formerly: IPSS:1-04-037-93

0. FOREWORD

0.1 This Interplant Standard has been prepared by the Standards Committee on Switchgears and Controlgears, IPSS 1:4 with the active participation of the representatives of the steel plants/units, reputed consultancy organizations and established manufacturers of Magnet Panel for Cranes; and was adopted in March 1999.

0.2 Interplant Standards for steel industry primarily aim at achieving rationalization and unification of parts and sub-assemblies used in steel plant equipment (or while placing orders for additional requirements) and accessories and provide guidance in indenting stores or equipment for existing or new installations by individual steel plants. For exercising effective control on inventories, it is advisable to select a fewer number of sizes (or types) from among those mentioned in this standard for the purpose of company standards of individual steel plants. It is not desirable to make deviations in technical requirements.

0.3 This standard is generally based on IS 8623 (Part 1):1993 `Low voltage switchgear and controlgear assemblies:Part 1 Requirements for type-tested and partially type-tested assemblies (*first revision*)'

1. SCOPE

1.1 This Interplant Standard covers the requirements of magnet panels for controlling the operation of dc electromagnet with rated main circuit voltage up to 460 V dc for cranes keeping in view the specific needs of the Steel Industry.

1.2 Magnet panels shall comply with all relevant requirements of IPSS:1-10-010-84 `General requirements of control panels for cranes (*with amendment 1*)', if not otherwise indicated in this standard and shall comply with particular requirements specified in this standard.

1.3 This standard also covers the general scheme for magnet panel with an aim to standardize it.

1.4 This standard is intended for enclosed type of magnet panels.

1.5 Individual devices and components incorporated inside the control panel shall conform to the relevant Indian Standards or Inter Plant Standards for steel industry. Provisions for the same are not covered in this standard.

1.6 This standard does not apply to magnet panels for use in hazardous/explosive atmosphere.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS 1885 (Part 17):1979 `Electrotechnical vocabulary: Part 17 Switchgear and Controlgear (*first revision*)' and IS 8623 (Part 1):1993 shall apply.

3. SERVICE CONDITIONS

3.1 **Site Conditions** - The following shall constitute the normal site conditions:

a) *Ambient temperature* - The reference ambient temperature shall be 40°C.

b) *Altitude* - The altitude shall not exceed 1000 m.

c) *Ambient Air* - The ambient air may contain fair amount of conductive dust.

d) *Humidity* - The maximum relative humidity shall be 100% However, both maximum temperature and maximum relative humidity may not occur simultaneously.

3.2 The control panels shall be designed to withstand vibrations and shocks encountered in the normal usage of EOT Cranes, transfer cars, ground charge and any other such mobile equipment, and shall be able to withstand vertical impact 2g, and horizontal impact 1g.

3.3 The manufacturer shall supply derating factors for higher ambient temperatures. However, magnet panel shall reliably function upto a maximum ambient temperature of 50°C.

4. ELECTRICAL CHARACTERISTICS OF MAGNET PANEL

4.1 **Rated voltage of the main and control circuit** - The rated voltage will be 460 V/220 V dc. The tolerance on the voltage shall be ±10%.

4.2 **Rated Current** - Rated current shall be 75 A, 150 A and 300 A.

4.3 **Rated Short Circuit Current** - Rated short circuit current shall be 35 kA.

5. DESIGN AND CONSTRUCTION

5.1 **General** - The magnet panels for cranes shall be designed and manufactured to give efficient and reliable service in steel plants, where continuity of operation is of prime consideration. They shall be constructed only from materials capable of performing satisfactorily the intended duty under such variations of load, pressure and atmospheric conditions as may occur at site including transient conditions of short circuit.

5.2 **Mechanical Design**

5.2.1 Sheet steel used for fabricating the metal cabinet of the magnet panels shall be of cold rolled type and of thickness not less than 2 mm. Non-load bearing side doors and main doors may be of 1.6 mm thick sheets. Doors with sheet of 1.6 mm shall be of double flap type.

5.2.2 The magnet panel shall be of base mounting design and shall be provided with removable hinged doors with good latching arrangement operated by a front handle. A typical latching arrangement is illustrated in *Fig-1*. Provision shall be made on the doors for locking the panel with a padlock.

5.2.2.1 The magnet panel shall have arrangements for mounting it rigidly on the crane to take care of the jerks and the possibility of the panel falling off from the mounted position in the normal usage of the crane.

5.2.2.2 Each panel shall have sheet steel hinged doors with minimum 2 numbers of hinges spaced not more than 500 mm apart and the width of the door shall not exceed 500 mm unless specified otherwise by the purchaser.

5.2.2.3 All the foundation and other fixing bolts, nuts, plates and other hardwares necessary for the erection of equipment shall form part of the control panel and shall be of cadmium/zinc coated finish.

5.2.2.4 Adequate number and size of lifting hooks/angles shall be provided at the top of the panel structure for handling the panel.

5.2.3 The enclosed magnet panels shall be arranged singly or in suitable combination of panels side by side as required by the particular control scheme.

5.2.3.1 When more than one magnet panel for an individual drive is arranged side by side, there shall be no partition between the panels.

5.2.3.2 The magnet panels when arranged side by side, shall be of uniform height and depth.

5.2.4 Non-ageing gaskets shall be provided for the doors and the partitions between adjacent units. The gaskets shall be adequately supported mechanically so that these may not come out.

5.2.5 Opening shall be provided near the base walls and in the bottom of the cabinet for bringing in the external wiring. These openings shall be blanked by removable cable gland plates of thickness not less than 2 mm in which holes may be drilled as required. Entrance boxes may have to be used in case large number of cables are to be brought in.

5.2.6 The enclosure of the magnet panel shall be sprayed with one coat of corrosion resistant primer and two coats of final paint and shall be stove enamelled after primer coat and finish coats. Before painting, the surfaces shall be satisfactorily cleaned/degreased to remove rust. Any other improved method of painting, to give equivalent or better protection towards anti-corrosive property may also be allowed, if agreed to between the purchaser and the manufacturer. The exterior finishes shall be as per the colour code specified in the respective cases.

5.3 Enclosures and Degrees of Protection

5.3.1 The degree of protection provided by the enclosures on magnet panel against contact with live parts, ingress of solid foreign bodies and liquid shall be IP 51 for indoor and IP 54 for outdoor installations according to 7.1.10 of IS 13947 (Part 1):1993 'Low-voltage switchgear and controlgear:Part 1 General rules (superseding IS 4237)', unless specified otherwise by the purchaser. The resistors shall be housed in a separate IP 33 enclosure with a weather-proof canopy.

5.4 Dimensions of Magnet Panels

5.4.1 The overall size of the control panel excluding lifting hooks, angles, etc, shall not exceed the following:

a) Overall height : 1500 mm
b) Overall length : 1300 mm
c) Overall depth : 550 mm

5.5 Apparatus inside Magnet Panel

5.5.1 All apparatus required for controlling the magnet shall be enclosed in a single panel.

5.5.2 The recommended main constituents of the magnet panel shall be as follows:

a) Isolating switch of 100 A/200 A/300 A capacity for isolating the main dc power. The switch shall have a continuous rating not less than the continuous rating of the contactors used.

b) A two pole load break switch of 60 A capacity for isolating the control circuit.

c) High breaking capacity (HBC) fuses of adequate capacity for the main and control circuits.

d) Two single pole contactors of suitable rating in the positive and negative lines of the main dc power.

e) Demagnetizing contactor of 75 A dc.

f) A Silicon diode of rating 100 A, 150 A dc; 1800/2000 PIV, mounted on a heat sink.

g) Terminal block for control circuit and stand-type terminal for power circuits. Power circuit terminals shall be provided with insulated separators.

5.5.3 In the enclosed type of panels, all the circuit elements shall be arranged as follows:

a) Separately insulated elements shall be fixed on mild steel channel/mounting plate, and

b) Uninsulated elements shall be fixed on insulating boards.

5.5.3.1 Materials of the insulating board used for mounting uninsulated circuit elements as in clause 5.5.3 (b), shall comply with IS 4248:1967 `Non-ignitable and self-extinguishing boards (with mineral base) for electrical purposes' and shall be of thickness not less than 25 mm.

5.5.3.2 The type of mounting circuit elements shall conform to relevant provisions of IPSS:1-10-010-84 `General requirements for control panels for cranes (*with amendment 1*)'

5.5.4 Load break switches, contactors and fuses shall be mounted at the upper portion of the panel at a convenient height and position.

5.5.4.1 Bottom most row of the equipment shall be fixed at a height not less than 250 mm from the base.

5.5.5 The control panel and the layout of the apparatus shall be so designed as to allow free access to facilitate connection, inspection, maintenance and repair.

5.5.5.1 All the apparatus shall be front mounted, front wired and removable from the front without approaching from the back side. Back wired panels may be provided when specifically required by the purchaser, if adequate space is available for opening from the back side.

5.5.6 Clearance, creepage and isolating distances shall be in accordance with 7.1.2 of IS 8623 (Part 1):1993.

5.6 The control panel may also have the following in-built features if required by the user:

a) Facility for connection to the magnet either over master controller or two-position selector, and

b) Facility of drop the loose material or past discharge the load.

6. PANEL WIRING

6.1 All power wiring shall be done by preferably insulated copper bus bars or by 1100 V copper conductored cables with heat resisting Insulation Grade IE2/IE3 conforming to IS 6380:1984 `Elastomeric insulation and sheath of electric cables (*first revision*)'.

6.2 All control wiring shall be done by 1100 V grade HR PVC insulated single core multi-strand copper cables of size not less than 2.5 mm^2 conforming to IS 694:1990 `PVC insulated cables for working voltages upto and including 1100 V (*third revision*) (*amendment 1*)'. For special applications such as high working temperature, oil fumes, steam, etc; the use of cable shall be agreed upon between the manufacturer and the purchaser.

6.3 All cables shall be laid and fixed neatly to allow clear access to all components. They shall not rest or rub against sharp edges and also shall not rest against live parts. The wiring shall be done in such a manner that there is no strain on the terminations. Wiring between two devices shall have no joints. Connections shall be made at fixed terminals only.

6.4 The magnet panel wiring shall be neatly arranged and clamped with an insulating material placed between the wire and the clamps at every 25 cm. Where this is not possible, the wire may be laid on troughs. Inside of the insulated trough shall be smooth and entirely free from sharp edges, burrs, fins, etc, that may cause abrasion damage on the insulation of cables.

6.5 Each insulated conductor shall be identified by numbered ferrules at both ends in accordance to the wiring diagram. For the sake of easy identification, the insulated conductors shall not be bunched, but instead, shall be clipped flat on the surface with the provision for intermediate ferruling.

6.6 Arrangement of busbars, auxiliary wiring and marking on the same shall conform to relevant provisions of IS 5578:1984 `Guide for marking of insulated conductors (*first revision*) (*amendment 1*)' and IS 11353:1985 `Guide for uniform system of marking and identification of conductors and apparatus terminals'.

7. TERMINATION

7.1 All connections external to the cubicle shall be brought to readily accessible terminals.

7.2 All terminals shall be of adequate current rating to suit individual feeder/control circuit requirement.

7.3 The stud bolt of the power terminal block shall be made of Cd/Zn coated mild steel. They shall be of adequate size to accommodate aluminium cables as well. The minimum of the terminals shall be suitable for 25 mm^2 cable. Terminals shall preferably be brought to the bottom of the panel and mounted on insulating boards as per IS 4248:1967.

Thickness of the insulating board shall be 10 mm minimum and the distance between adjacent power studs shall conform to IS 13947 (Part 1): 1993.

In case the components are mounted directly on an insulating board, it shall have the provision for replacing the components without removing the board. The external connections shall be directly made at the appropriate points on the panel and not on terminals brought at the bottom of the board.

7.4 Whenever cable terminations are brought to the terminal block, the terminal block shall be of open type. The minimum size of each terminal for control cable shall be suitable for size of 10 mm^2 cable. Terminal blocks shall have 10% of the terminals or 4 number, whichever is more, as spare.

7.4.1 Power terminals for small sizes may also be brought on to the terminal block.

7.5 All connections to the terminals shall be arranged in a logical manner which shall be identical for all similar units. All power and magnet terminals shall be properly segregated and shall have indelible terminal number marked on them to tally with the number indicated in the circuit diagram. Power and magnet cables shall be terminated with copper lugs which shall be adequately rated, and crimped on to the conductors.

8. SPECIFICATION OF COMPONENTS

8.1 Unless otherwise specified, components/apparatus incorporated in the magnet panels shall comply with the relevant IPSSs or ISs, in that order.

9. EARTHING

9.1 The earthing shall be done in accordance with the relevant provisions of the Indian Electricity Rules, 1956.

10. INFORMATION TO BE GIVEN WITH MAGNET PANEL

10.1 Name Plate - Each magnet panel shall be provided with one or more name plates containing the following information:

a) Manufacturer's name or trade mark

b) Type designation or identification number and year of manufacture

c) Reference to this Interplant Standard i.e. IPSS:1-04-037-99

d) Rated voltage of the main circuit

e) Rated voltage of the control circuit

f) Rated current

g) Rated short circuit current [*see 4.5 of IPSS:1-10-011-84, Particular requirements of control panels for ac cranes (with amendment 1)*]

h) Degree of protection

i) Dimensions

j) Weight of panel, and

k) Schematic diagram on anodized aluminium plate.

10.2 Marking - Inside the magnet panel, it shall be possible to identify individual circuits and their protective devices by indelible marking on the mounting base of the components.

10.2.1 Each component or apparatus inside the panel shall be properly identified and marked on the base mounting. The marking of the symbol given shall tally with those used in the circuit diagrams. The size of the marking used shall be suited to the component and shall be clearly visible.

10.2.2 The manufacturer shall also provide circuit/wiring diagrams with complete cable and component specifications along with instructions for installation, operation and maintenance.

10.2.3 An instruction manual shall be provided, containing schematic and wiring diagram with step by step operational explanation of the circuit, and complete specifications in detail.

11. TESTS

11.1 The tests given in 8.1 of IS 8623 (Part 1):1993 shall apply for the purpose of this IPSS.

11.2 The components/apparatus shall comply with the tests specified in the relevant IPSSs or ISs, in that order.

12. MAGNET SCHEME

12.1 Three typical schematic diagrams of magnet panel are shown at *Fig-2, Fig-3 and Fig-4*.

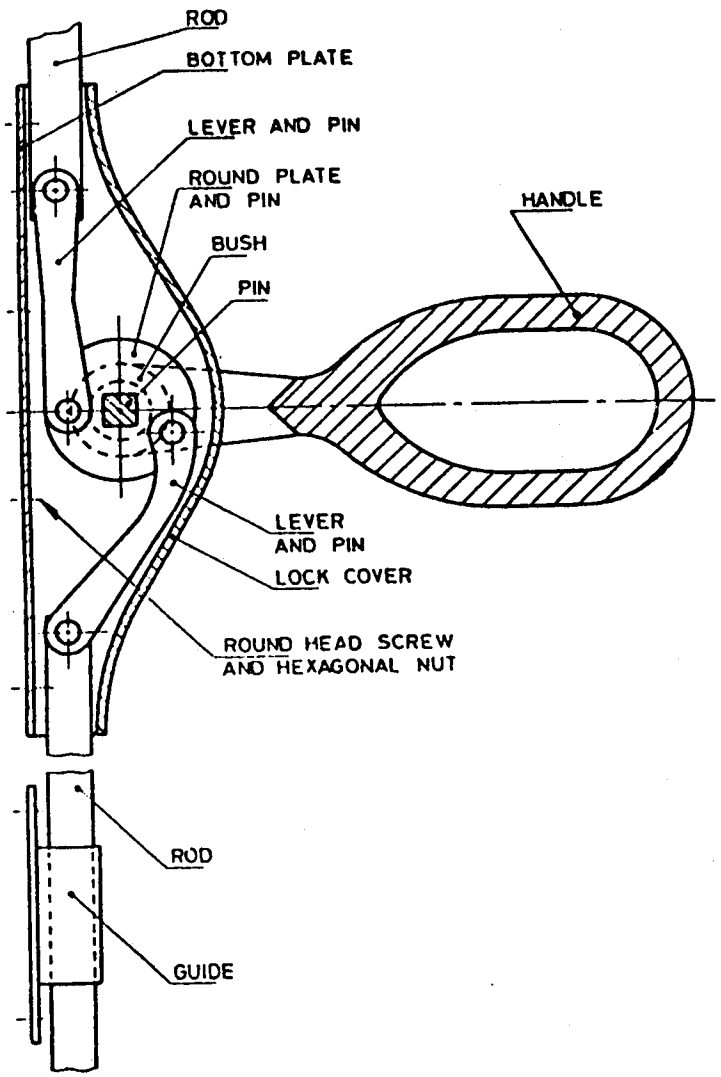
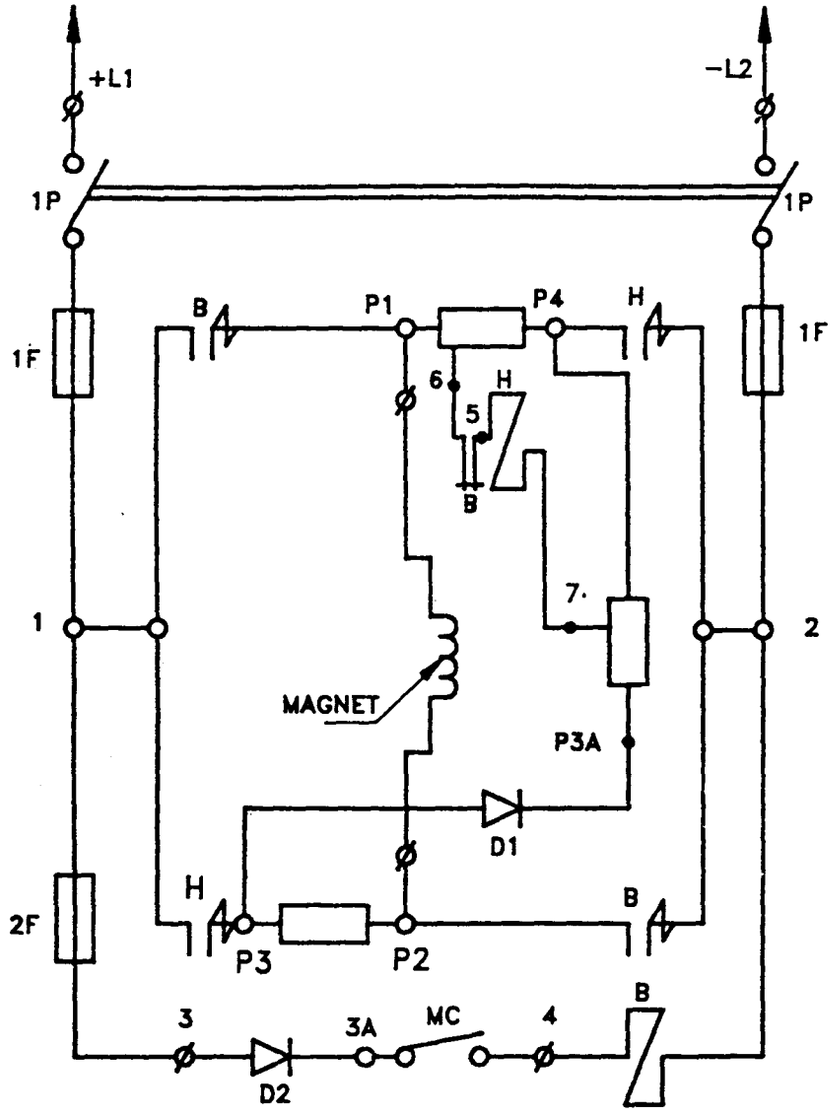


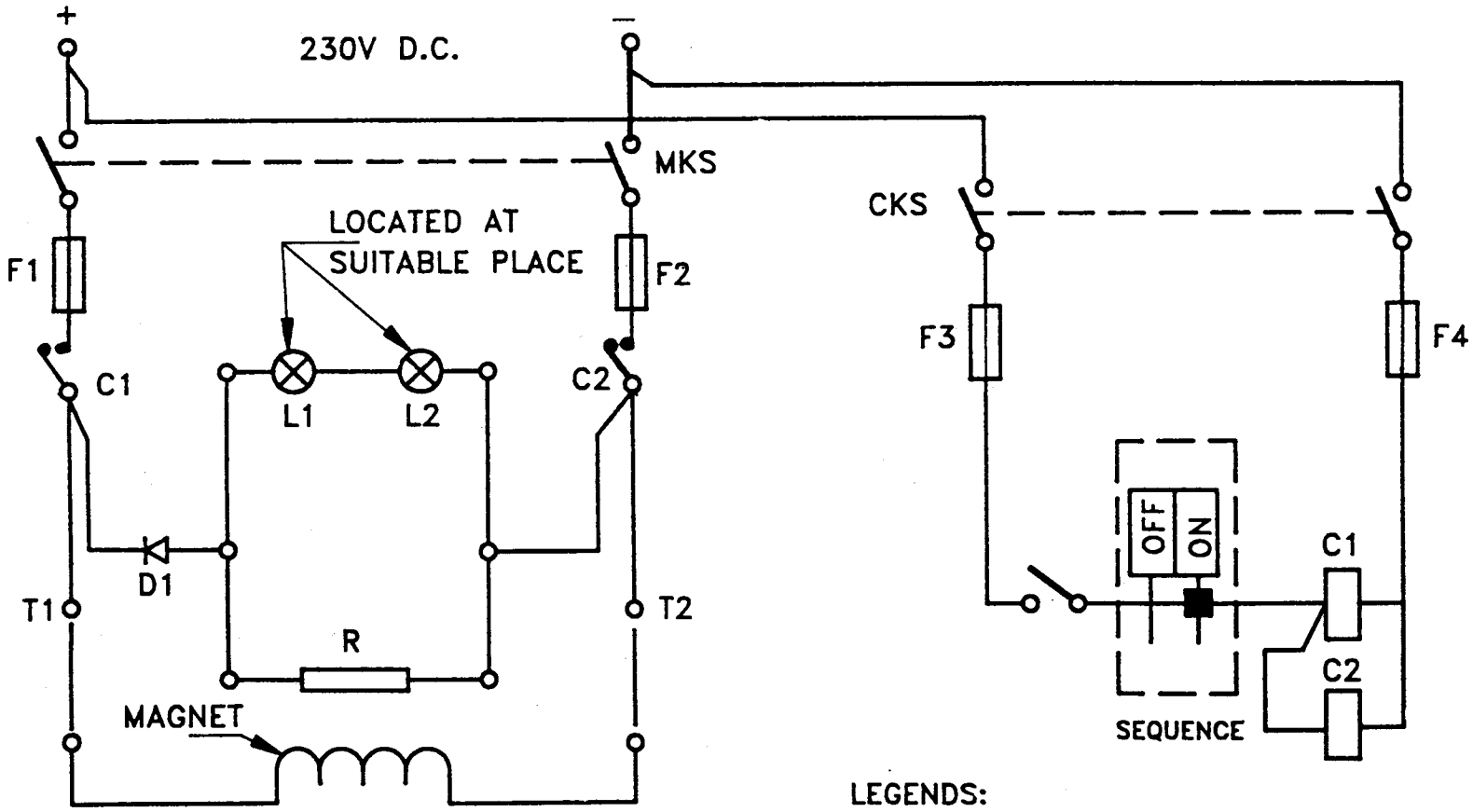
FIG. 1 TYPICAL LATCHING ARRANGEMENT



SL NO.	ELEMENTS	DESCRIPTION	QTY.
1	1P	200 AMP DOUBLE POLE SINGLE THROW KNIFE SWITCH	1
2	1F	MAIN FUSE	2
3	2F	CONTROL FUSE 5 AMPS.	1
4	B	MAIN CONTACTOR 150A/300A D.C.	1
5	H	DEMAGNETISING CONTACTOR 15 A DC	1
6	P1–P4 P4–P3A P2–P3	DISCHARGE RESISTANCE	
7	D1	MAIN DIODE 100A, 1200 PIV WITH HEAT SINK	1
8	D2	CONTROL DIODE, 10A;1200PIV	1

FIG. 2 TYPICAL SCHEMATIC CIRCUIT DIAGRAM FOR MAGNET PANEL

IPSS: 1-04-037-99



NOTE:

1. THE DIODE SHALL BE REVERSE CONNECTED, SO THAT NO CURRENT FLOWS THRO' THE DISCHARGE RESIST, WHEN MAGNET IS ENERGISED.
2. THE LAMPS SHALL GLOW ONLY MOMENTARILY DURING THE DISCHARGE

LEGENDS:

MKS	=	MAIN KNIFE SWITCH
CKS	=	CONTROL KNIFE SWITCH
C1&C2	=	CONTACTORS,230VD.C.,150A.
F1&F2	=	MAIN FUSES
F3&F4	=	CONTROL FUSES
L1&L2	=	PILOT LAMPS
R	=	DISCHARGE RESISTANCE
D1	=	SILICON DIODE WITH HEAT SINK

FIG. 3 TYPICAL SCHEMATIC CIRCUIT DIAGRAM OF THE MAGNET PANEL

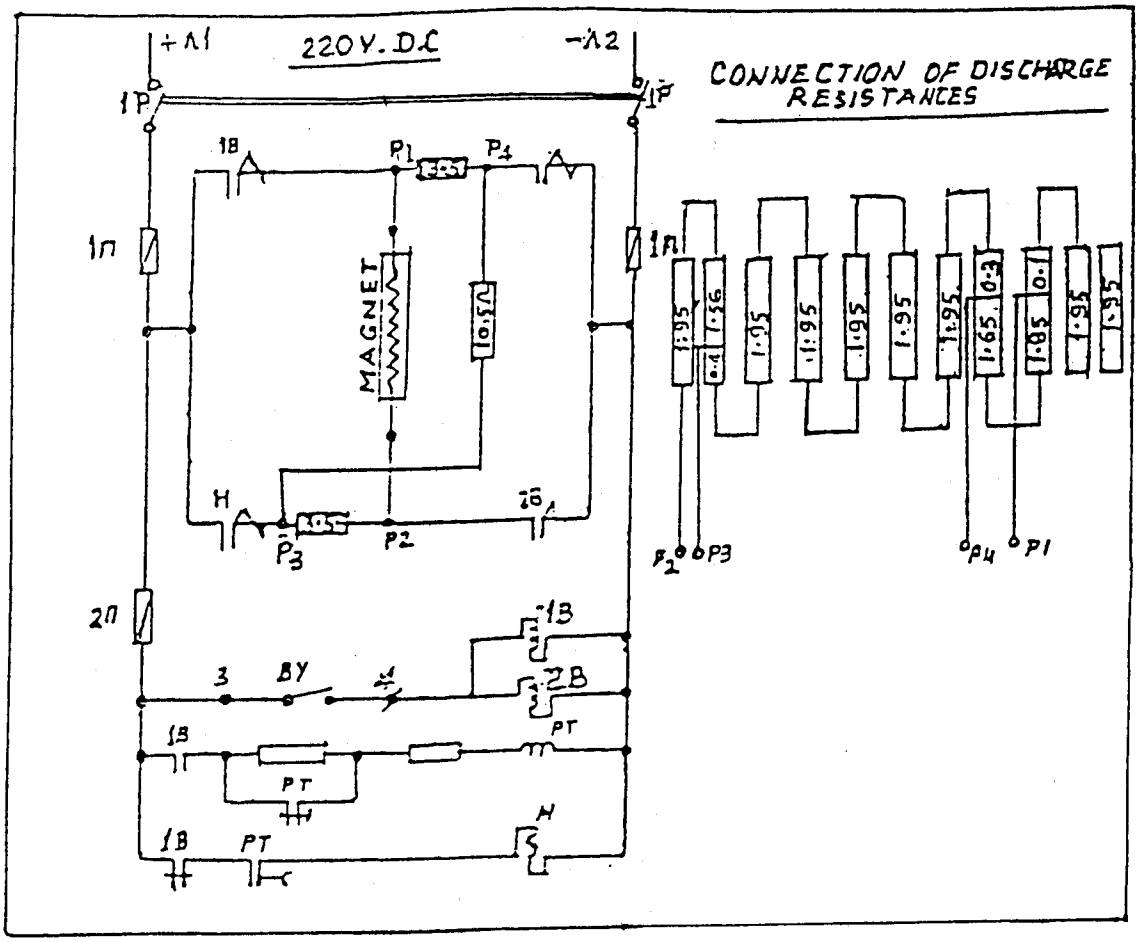


FIG. 4 : TYPICAL SCHEMATIC CIRCUIT DIAGRAM OF 10T EOT MAGNET CRANE