INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**GENERAL REQUIREMENTS FOR CONTROL PANELS FOR CRANES** (*First Revision*)	**IPSS:1-04-041-03**
		Formerly : IPSS: 1-10-010-84
	Based on IS 8623 (Part-1):1993	

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, concerned organizations and established manufacturers of Cranes; and was adopted in December 2003.

0.2 Inter Plant Standards for steel industry primarily aim at achieving rationalization and unification of parts and assemblies used in steel plant equipment and accessories, and provide guidance in indenting stores or equipment (or while placing orders for additional requirements) by individual steel plants. For exercising effective control on inventories, it is advisable to select a fewer number of sizes/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 The requirements of control panels for cranes are being covered in three separate Inter Plant Standards as follows :

a) 1-04-041-03 General requirements for control panels for cranes *(first revision)*

b) 1-04-042-03 Particular requirements for control panels for ac cranes *(first revision)*

c) 1-04-043-03 Particular requirements of control panels for dc cranes *(first revision)*

Consequently these Inter Plant Standards are to be read in conjunction with one another.

0.4 The provisions of the Indian Electricity Rules, 1956 and other statutory regulations of the government of India and the relevant State Govt shall apply in addition to the various requirements specified in the Inter Plant Standards indicated in 0.3.

0.5 This standard is generally based on IS 8623 (Part-1):1993 `Specification for low voltage switchgear & controlgear assemblies – Part 1 Requirements for type tested & partially type tested assemblies (first revision) .

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1. SCOPE

1.1 This Interplant Standard covers the general requirements of control panels for EOT cranes with rated main circuit voltage up to and including 1000 V for ac cranes and upto & including 1200 V for dc cranes.

1.2 This Inter Plant Standard does not include the special requirements of control panels for ac and dc cranes and does not cover the control schemes employed for the operation of different mechanisms of the cranes. These are covered in the following Inter Plant Standards and shall be complied with as appropriate :

a) 1-04-042-03 Particular requirements for control panels for ac cranes *(first revision)*

b) 1-04-043-03 Particular requirements of control panels for dc cranes *(first revision)*

1.3 This standard is intended for enclosed type of control panels only. However, this standard may apply to open type control panels also with relevant modifications, to be agreed upon between the manufacturer and the purchaser.

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

1.5 This standard does not apply to control panels of cranes used 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 1 000 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 2 g, and horizontal impact 1 g.

3.3 The manufacturer shall supply derating factors for higher ambient temperatures, if specified by the purchaser.

4. ELECTRICAL CHARACTERISTICS OF CONTROL PANEL

4.1 **Rated voltage of the main circuit** - The rated voltage of the main circuit of the control panel shall be as follows :

a) *For ac cranes* - 415 V ac, 3 phase, 50 Hz and
b) *For dc cranes*- 230 V or 460 V dc.
The tolerance on the voltage shall be + 6% and - 10%.

4.2 **Rated voltage of the control circuit** - The rated voltage of the control circuit shall be as follows :

a) For ac control system : 110 V, 240 V and 415 V ac; and
b) For dc control system : 110 V , 230 V or 460 V dc.
The tolerance on the voltage shall be + 6% and - 10%.

4.3 **Rated Thermal Current** - The provisions of 4.4 of IPSS:1-04-042-03 or 4.2 of IPSS:1-04-043-03 shall apply as appropriate.

4.4 **Rated Short Circuit Current** - The provisions of 4.5 of IPSS:1-04-042-03 shall apply.

5. DESIGN AND CONSTRUCTION

5.1 **General** - The control 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 control 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.

5.2.2 The control panels 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, Hooks shall be provided on the doors for locking the panel with a padlock.

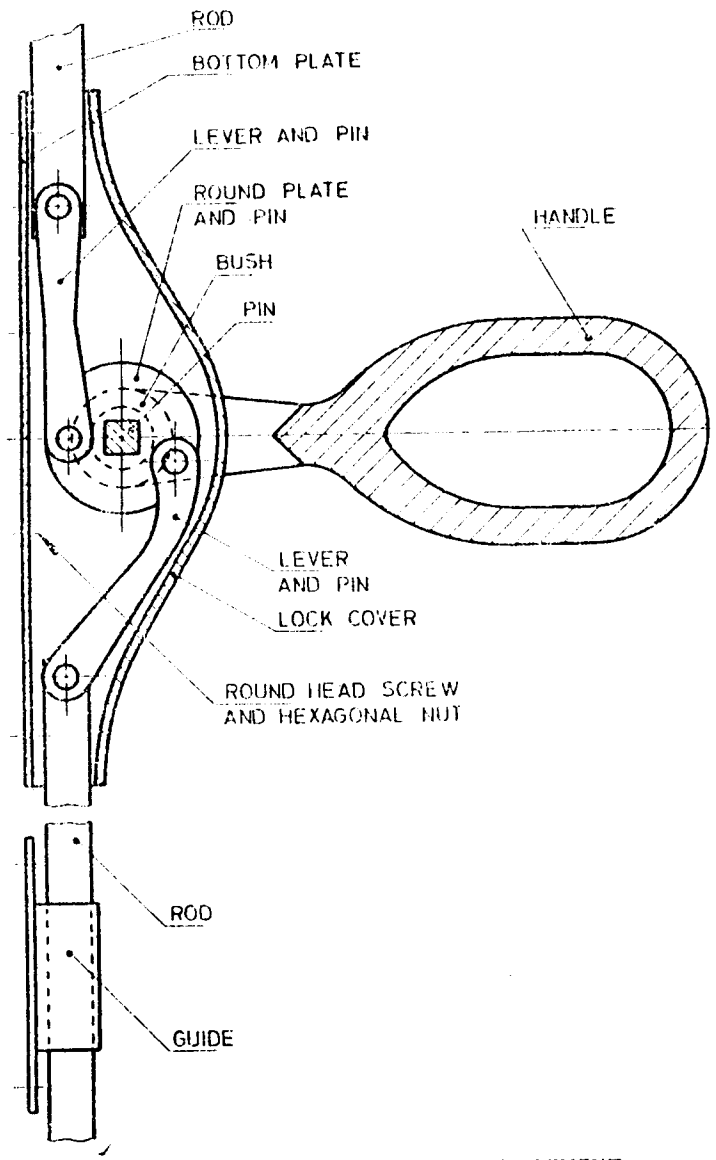

FIG. 1 TYPICAL LATCHING ARRANGEMENT

5.2.2.1 The control 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 650 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 control 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 control panel for an individual drive is arranged side by side, there shall be no partition between the panels.

5.2.3.2 The control 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 control panels 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 anticorosive property may also be allowed. The exterior finishes shall conform to 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 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 IS 13947 (Part 1) : 1993 `Specification for low voltage switchgear & controlgear – Part 1 : General Rules (superseding IS 2147 and 4237)', unless specified otherwise by the purchaser.

5.4 Dimensions of Control Panels

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

	For ac Control Panels mm	*For dc Control Panels* mm
a) Maximum Overall height :	1 800	1 800
b) Maximum Overall length :	750	1 300
c) Maximum Overall depth :	550	550

5.5 Apparatus inside Control Panel

5.5.1 All the apparatus meant for a single operation on the crane shall be located inside the same control panel There shall be normally one panel for each of the operations of the crane like hoist, long travel and cross travel. In case of the operations ensured by two motors and it also being possible to use a single motor, the design of layout of apparatus inside the control panel shall provide for change from one mode to another.

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

a) Two/three pole knife switch /fuse switch/air circuit breaker with high breaking capacity fuses or with moulded case circuit breakers for isolation of main circuit power supply;

b) Two pole knife switch miniature circuit breaker for isolation of control circuit power suppiy;

c) Fuses or main circuit and miniature circuit breakers for control circuits, whenever required;

d) Requisite number of single-, two- or three-pole power contactors of adequate capacity as needed by the scheme to serve as main contactors;

e) Time delay relays for cutting off the accelerating contactor;

f) Over current relays, directly operated;

g) Other relays and contactors meant for breaking neutral position contactor, intermediate contactor etc

h) Terminal block 10/15 A rating;

i) Lighting arrangement and plug point, as specified by the purchaser;

j) Any other parts as required by the control scheme, and

k) Isolating transformer of suitable rating, for control supply, conforming to relevant Indian Standard

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, or

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 `Specification for non-ignitable and self-extinguishing boards (with mineral base) for electrical purposes' and shall be of thickness not less than 25 mm upto and including 300 A and not less than 38 mm for more than 300 A rating.

5.5.3.2 If the type of mounting of circuit element is in conformity with 5.5.3 (a), the following conditions shall be complied with:

Contactors of rating 160 A and above shall be mounted on angle iron of minimum 6 mm size or appropriate nuts or threaded blocks welded/rivetted in position on minimum 2.0 mm thick steel plate. Contactors of rating up to 160 A and all relays shall be fixed on mounting plates of thickness not less than 4 mm or alternately 2.0 mm thick plate with appropriate nut or threaded blocks welded/rivetted in positions.

For dc control, accelerating contactors shall have either screwed adjustable reluctance path on the holding coil such that adequate timing for closing the contactor can be achieved, or flux decay type time delay relays.

5.5.4 For open type control panels, control circuit and main circuit shall be operable independently unless specified otherwise by the purchaser.

f) Over current relays, directly operated;

g) Other relays and contactors meant for breaking neutral position contactor, intermediate contactor etc

h) Terminal block 10/15 A rating;

i) Lighting arrangement and plug point, as specified by the purchaser;

j) Any other parts as required by the control scheme, and

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For dc control, accelerating contactors shall have either screwed adjustable reluctance path on the holding coil such that adequate timing for closing the contactor can be achieved, or flux decay type time delay relays.

5.5.4 For open type control panels, control circuit and main circuit shall be operable independently unless specified otherwise by the purchaser.

5.5.5 Each mechanism is envisaged to have its own over current relays and these shall be mounted in the panel itself.

5.5.6 Knife switches, no-volt relays, voltage and current relays shall be mounted at the upper portion of the panel at a convenient height and position.

5.5.6.1 Bottom most row of the equipment shall be fixed at a height not less than 350 mm from the base.

5.5.7 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.

5.5.7.1 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.

5.5.8 Clearance, creepage and isolating distances shall be in accordance with clause 6.1.2 of IS 8623 (Part-1):1993.

5.5.9 *Selection of components*

5.5.9.1 Overload relays shall be of electromagnetic type. Alternative type of overload relays may also be used if agreed to by the purchaser and the supplier.

5.5.9.2 Flux decay / pneumatic type electromagnetic timers shall be used. Alternative type of timer may also be used if agreed to by the purchaser and the supplier.

5.5.9.3 Only open type terminals with barrier shall be used as terminal block.

6. PANEL WIRING

6.1 All power wiring below 200 A shall be done by copper conductor cables with butyle rubber insulation and EPR/CSP sheath conforming to IS 6380:1984 'Elastomeric insulation and sheath of electric cables (first revision)'. For current rating 200 A and above, power wiring shall be by the use of PVC sleave insulated copper bus bars of size not less than 25 x 5 mm^2 or equivalent.

6.1.1 The copper bus bars at the point of connection shall be of electrolytic grade and shall be coated with tin, cadmium or silver. They shall be supported on tough, non-hygroscopic and self extinguishing insulators. Insulating separators shall also be provided between the bus bars to prevent the bus bars coming close to each other in the event of a through fault or due to vibration.

6.2 All control wirings shall be done by 1100 V grade PVC insulated single core multi-strand copper cables of size not less than 2.5 mm^2 conforming to IS 694:1990 `Specification for PVC insulated cables for working voltages upto and including 1100 V (third revision)'. 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 control 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 : 1985 `Guide for marking of insulated conductors (first revision)' / 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 size of the terminals shall be 25 mm. These shall preferably be brought to the bottom of the panel and mounted on insulating boards in conformity with 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 of the panels for dc cranes in which the components are mounted directly on an insulating 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 Control terminations shall be brought to the terminal block. The terminal block shall be of open type suitable for mounting on a `C' channel. The minimum size of each terminal shall be suitable for size of 10 mm^2. 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 control 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 control cables shall be terminated with copper lugs which shall be amply rated, and crimped on to the conductors.

8. SPECIFICATION OF COMPONENTS

8.1 Unless otherwise specified, components/apparatus incorporated in the control panels shall comply with the relevant IPSS or ISs.

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 CONTROL PANEL

10.1 **Name Plate** - Each control 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

d) Rated voltage of the main circuit, ac/dc

e) Rated voltage of the control circuit, ac/dc

f) Rated current

g) Rated short circuit current (See clause 4.5 of IPSS:1-04-042-03)

h) Degree of protection

i) Dimensions, and

j) Weight of panel

10.2 **Marking** - Inside the control panel, it shall be possible to identify individual circuits and their protective devices. For this purpose, metal engraved marking shall be permanently fixed on the mounting base of the components.

10.2.1 An identification, name-plate/marking by inscription indicating the panel designation, that is the operation of the crane for which it is intended, shall be provided approximately at the centre of the panel. The inscription shall be in English and Hindi languages with the height of letters not less than 10 mm.

10.2.2 Each component or apparatus inside the panel shall be properly identified and marked on the base mounting. The marking or 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.

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

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

10.2.5 A schematic diagram for different schemes shall be provided on respective panels preferably metallographed or printed.

11. TESTS

11.1 The tests given in clause 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 IPSS or ISs.
