INTER PLANT STANDARD IN STEEL INDUSTRY		
IPSS	**CODE OF PRACTICE FOR LAYING OF ELECTRICAL CABLES ON E O T CRANES**	**IPSS: 2-02-006-18 (Second Revision)**
	Corresponding IS does not exist	Formerly: IPSS: 2-02-006-01 (First Revision)

0. FOREWORD

0.1 Interplant standardization in steel industry has been initiated under the aegis of the Indian Standards Institution (ISI) and the Steel Authority of India Limited (SAIL). This Interplant Standards is prepared by the Standard Committee on E O T Cranes, IPSS 2:2 with the active participation of the representatives of all the steel plants and leading consultants and was first revised in June, 2001. Thereafter, standard second revision done by the Standard Committee in March, 2018.

0.2 Interplant standardization for steel industry primarily aims at achieving rationalization and unification of parts and assemblies of process and auxiliary equipment used in steel plants and these are intended to provide guidance to the steel plant engineers, consultants and manufacturers in their design activities. It is not desirable to make deviations in technical requirements.

0.3 Electric cables for use on E O T Cranes shall be selected in accordance with IPSS: 2-02-005-18 “Code of practice for selection of electric cables for use on EOT Cranes (Latest revision)”.

0.4 Various Indian Standards and IPSS standards referred to in this standard have undergone revision over a period of time. This revision has been carried out to incorporate these changes.

1. SCOPE

This interplant standard provides guidance on laying of electric cables on E O T Cranes for use in steel industries.

2. GENERAL

2.1 Method of selection of cables and rating factors shall be based on IPSS: 2-02-005-18.

2.2 Cables of different working-voltages and also control and power cables shall be laid separately. If unavoidable, insulated barriers shall be provided.

2.3 The cable laying inside operator's cabin shall be such that in no case operator's view is obstructed.

2.4 The layout of the cable and the routes selected for running the cables shall be such as to cause minimum interference with maintenance, repair work or removal of any mechanical part of the crane.

2.5 While laying cables, walkway crossing shall be avoided as far as practicable. If it is absolutely necessary, adequate metal cover shall be provided.

2.6 For three phase ac power cables, if single core cables are used for size limitations, efforts shall be made to lay the cables in trefoil formation.

2.7 No joining of cables, either power or control, shall be allowed at intermediate points. Joints shall be avoided as far as practicable. Any unavoidable joint shall be made in the junction box provided between two sections of the cable.

2.7.1 Junction boxes shall have bolted and easily removable covers. Cables inside junction boxes shall be terminated on copper brass studs of adequate size mounted on rigidly supported insulated bars and marked according to circuit diagrams. Minimum clearance in air between two terminals and any live terminal and earth shall be 20 mm.

2.8 Passing of cables through sharp edges shall be avoided. If unavoidable, protection of insulating boards shall be provided.

2.9 All cables shall be provided with permanently identifiable tags at both ends according to cable schedule and preferably metallic. If plastic ferrules are

used, it shall be slipped over the cable and netted to it. For single core ac cables, the tags shall be of non-metallic type. The individual cores of each cable shall be tagged with preformed printed sleeve type PVC tag or interlock type numbering ferrules in case PVC tags are not available.

2.10 Proper sizes of bushings made of rubber, wood, etc and lined with phenolic resin or any other equivalent material shall be provided at all entry points of the cable, such as for controllers, switches, etc. Compression type glands shall be used for ac crane, single or double compression depending on the requirement of the customer.

2.11 All terminations of junction boxes, control panels, controller, limit switches, motors, etc also shall have permanently identifiable tags as specified at clause no. 2.9 as above.

2.12 The crane structure, motor frames and metal frames of all electrical equipment including metal conduits, cable trays, etc shall be effectively connected to the earth by independent earthing strips to conform to the requirements of the Indian Electricity Rules. Equipment fed by flexible cables shall be earthed by means of spare core provided. Ultimately, the earthing of the crane shall be provided through 4^{th} collector of the down shop lead. In case of unearthed supply system, the gantry rails may be considered as medium of earthing, provided proper precautions are taken for earthing the rails. The following size of earthing strips shall be used:

a) Up to 300 kVA system, 40x6 mm G.I. strips; and

b) Above 300 kVA system, 50x8 mm G.I. strips.

2.12.1 For dc cranes, having unearthed supply system, the necessity of separate earthing shall be decided in consultation with the purchaser.

2.13 The crane supplier shall submit, for prior approval, a detailed drawing of cable routing indicating for each drive cable sizes, cable identification, number of cores, type of cables used, voltage grade as well as approximate lengths of each run from one termination to another.

3. LAYING OF CABLES ON E O T CRANES

Crane cables shall be laid on E O T Cranes in trough or metal trays or in conduits or on flats.

3.1 **Trough Wiring** – For trough wiring unarmoured cables shall be used.

3.1.1 The cables shall be laid in 2.0 mm thick sheet steel U/rectangular shaped troughs of convenient lengths and provided with bolted covers. The top covers shall run the entire length of the trough and shall be in section which can be easily opened.

3.1.2 Troughs shall not be welded directly to the structural members of the crane. Supports of cable troughs, however, can be welded to the structural members.

3.1.3 All the power cables, aid in a trough, shall be neatly arranged circuit-wise. Laying of cables shall preferably be done in one layer. However, for ac wound rotor motor, primary cables and secondary cables, if single core cables are used, shall be laid in trefoil formation as far as practicable to avoid trunk heating. If it is necessary to lay cables in more than one layer for want of space, the case has to be approved by purchaser.

3.1.4 Means shall be provided to retain the cables in position and prevent their relative displacement either due to vibration caused by the movement of the crane or due to electro-dynamic stresses caused by surges of motor currents.

3.1.5 As far as practicable, cables shall be laid in trough without overlapping and crossing. If it is unavoidable, sufficient additional insulation shall be introduced between the crossing layers of cables to prevent short circuit.

3.1.6 All levels in the troughs shall be smooth without any sharp edges which may cause damage to the sheathing and insulation of cables.

3.1.7 The trough wiring and trough layout shall be so designed as to permit easy removal and/or replacement of any or all of the cables contained in any section of the trough system.

3.1.8 Short lengths of flexible steel conduit with protective jacketing shall be used to make connections to devices, such as motors, limit switches, control switches, etc from the trough.

3.1.9 Electrical continuity between different trough lengths and terminal ends shall be ensured.

3.1.10 All the troughs, trough covers and junction boxes shall be painted with two coats of rust proof paint both inside and outside before they are installed on the crane. Further, the inside surface of the troughs, junction boxes and their covers shall be given an additional coat of insulating varnish prior to laying of cables.

3.2 **Armoured Cabling on Perforated Metal Trays/Flats** – Armoured cabling on perforated metal trays/flats shall be done in indoor cranes if so desired by the purchaser.

3.2.1 Armoured cables shall be laid on perforated metal trays of minimum 2.0 mm thickness or flats of thickness not less than 5 mm. The width of tray/number of flats shall be decided by the number of cables and cable sizes. The trays/flats shall have smooth surfaces and no sharp edges.

3.2.2 The cables shall be clamped at regular intervals, not more than 1.5 m on horizontal laying and not more than 0.75 m while laid in vertical stack, with the help of hoop iron clamps or of adequately strong aluminium saddles with minimum 1 mm thick PVC insulation below the clamps.

3.2.3 The trays/flats shall be laid in such a way that bends in cables shall not have radius less than twelve times the overall diameter of the cables.

3.2.4 The trays/flats shall be made electrically continuous and if necessary separate electrical connections may be made at joints of flats/trays. This is necessary as all earth fault currents will return through armour unless there is parallel bonding connection to relieve the armour of some of the fault currents.

3.2.5 Each tray/flat system shall be earthed separately at least at two places. The bolting of trays to the crane structure shall not be taken as earthing.

3.2.6 Provision shall be made for earthing of armour to the main earth system at the supply end by means of a metallic bond of adequate conductance, the bonding connection being as short and straight as possible. It is also desirable to earth the armour at additional points, such as joints.

3.2.7 While jointing, it is necessary to ensure that there is no discontinuity in the return circuit via the armour and no local spot of high resistance. Careful attention shall be paid to the design of all bonding clamps in joints and terminations.

3.2.8 While laying cable, it shall be ensured that all armour and all faces of armour clamps or connectors making contact with armour are thoroughly cleaned during installation and that the clamps are adequately tightened to ensure good contact.

3.3 **Conduit Wiring** – Conduit wiring or wiring by armoured cables as mutually agreed upon between the supplier and the purchaser, shall be used on all cranes meant for outdoor service and also on some parts of indoor cranes.

3.3.1 Conduit and conduit fittings shall be of standard design and shall conform to the following Indian Standards:

a) IS 2667:1995 `Fittings for rigid steel conduits for electrical wiring (first revision)'

b) IS 3837:1976 `Accessories for rigid steel conduits for electrical wiring (first revision)'

c) IS 3480:1966 `Flexible steel conduits for electrical wiring (amendment 1)' and

d) IS 9537(Part 1):1980 `Conduits for electrical installations (Part 1) General requirement (amendment 1) and (Part 2):1981 Rigid steel conduits (amendments 2)'.

3.3.2 All conduits used shall be of hot-dip galvanized threaded type-rigid steel conduits. Short length flexible steel conduit with protective jacketing may be used to make connections to control devices, such as master switches, limit switches or equipment subject to vibration and where specifically approved by the purchaser, at the terminal end of rigid conduit.

3.3.3 Minimum diameter of conduits used shall be 25 mm.

3.3.4 All conduits shall be rigidly attached to the crane to withstand vibration. Welding of conduits to structural members is not permitted. However, conduit

supports may be welded to structural members except critical tension members.

3.3.5 For outdoor cranes, junction boxes are to be avoided. However, if it becomes absolutely necessary, provisions as specified at 2.7, 2.7.1 and 3.1.9 shall apply.

3.3.6 Connection between conduits and junction boxes shall be made by flanges on the conduit and not by threaded joints.

3.3.7 Proper sizes of bushings lined with phenolic insulating material or any other equivalent material shall be used at the ends of all conduits to prevent abrasion or damage to insulation of the cable.

3.3.8 Factory bends shall be used as far as possible and field bends shall be kept to a minimum. Sharp bends on elbows shall not be used and bends should be such that easy drawing of cable is possible.

3.3.9 The conduit wiring shall be so designed that it shall permit easy dismantling of any section of the conduit and cable run for the convenience of repair work.

3.3.10 Only 50 percent of the conduit inside space shall be occupied by the cables. Cables carrying ac and dc powers of different voltages shall be installed in separate conduits.

3.3.11 Each motor shall be wired independently in separate conduits without common return. ac wound rotor motor circuits shall have primary leads in one conduit and secondary leads in another conduit. Power, control and shunt field leads shall be in separate conduits.

3.3.12 For 3-phase ac systems, if single core cables are used and taken through one conduit, efforts shall be made to tie the cables in trefoil formation to minimize heating of conduit walls.

3.3.13 All conduit lengths including junction boxes and flexible ends shall be electrically continuous.

———————————