INTER PLANT STANDARD IN STEEL INDUSTRY		
IPSS	**GENERAL CODE OF PRACTICE FOR RADIO REMOTE CONTROL SYSTEM FOR E O T CRANES**	**IPSS: 2-02-012-18 (First Revision)**
	Corresponding IS does not exist	Formerly: IPSS: 2-02-012-98

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 adopted in August 1998. Thereafter, standard was first revised 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 The use of Radio Remote Control for electrically operated cranes increases manpower utilization, results in better working conditions for the shop floor personnel and helps in operation of the crane in hazardous areas, so common in our steel plants. Of late, the system has been gaining popularity in various industries in India. Many steel plants have tried this system successfully. It was therefore, felt that a standard on this subject was necessity and would help steel plant engineers.

0.4 In this standard, the stress has been given on the selection of equipment to provide protection against mal-functioning, safety, long life of equipment, minimum requirement of spaces as well as compatibility of the system for adoption to existing standard crane controls. The other related standards to be used in conjunction with this standard are given in Appendix – A.

0.5 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

1.1 This Inter Plant Standard provides guidelines regarding basic considerations for Radio remote Control equipment such as Transmitter/ Encoder, Receiver/ Decoder, Interface Panels, Battery Charger, other control gears and system design.

1.2 This system does not cover the requirement of Remote Control of cranes through Infra-red Sensors.

2. REFERENCE

2.1 For the purpose of design of the system, references have been drawn from clause 31.7 of BSS: 466-1984 (Non-conductive controls) and clause 5.6.11 of CMAA (Crane manufacturer's Association of America) for radio remote Control.

3. SERVICE CONDITIONS

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

Ambient Temperature	The reference ambient temperature shall be from -20 deg C to + 60 deg C
Altitude	Shall not exceed 1000 m
Ambient Air	The ambient air may contain fair amount of conductive dust
Humidity	The maximum relative humidity shall be 100 %. However, both maximum temperature and maximum relative humidity may not occur simultaneously

3.2 The control equipment shall be designed to withstand vibrations and shocks encountered in the normal uses of EOT cranes, transfer cars, human handlings and any other mobile equipment and shall be able to withstand vertical impact of 2g and horizontal impact of 1g.

3.3 The manufacturers shall supply de-rating factors for higher ambient temperatures if specified by the Purchaser.

4. ELECTRICAL CHARACTERISTICS OF THE SYSTEM

4.1 Rated voltage of the main circuit :

a. 220V ac, single phase, 50Hz. The tolerance on the voltage shall be + 6 % and – 10 %.

b. 220 V dc with tolerance on voltage + 6 % and – 10 %.

4.2 Rated voltage of control circuit – 110 V ac, single phase, 50Hz with tolerance + 6% and – 10 %.

4.3 Rated frequency of the control system – The frequency range for the carrier frequency shall be selected from any of the following :

a. 70 – 80 MHz

b. 140 – 180 MHz

c. 400 – 470 MHz

d) Any other frequencies as sanctioned by Ministry of Communication, DoT (W.P.C Wing) from time to time.

5. OPERATING RANGE

5.1 The safe operating range for working of the crane shall be within a radius of 50 m and maximum 250 m from the location of the transmitter unit.

6. WORKING PRINCIPLE

6.1 The system of working of Radio – frequency Remote Control arrangement shall follow the steps of Transmission, Reception, Decoding and Interfacing for coupling to the normal electrical control system of the crane.

6.2 All units like Transmitter (consisting of oscillator and modulator) units, Decoder, Interface units etc. shall include items like control switch (either push button or joy-stick), Logic card, RF/regulator cards, Receiver/ Processor cards, I/O Relay cards, Transmitter and Receiver Antenna, Ni-cd Battery with chargers, Trouble shooting diagnostics cards and safety measures/ interlocks. All units and cards shall be in solid state configuration. The transmitter and receiver shall be micro-processor based systems.

7. DESIGN CRITERIA

7.1 The complete Radio remote Control system shall include the following:

Transmitter	This shall consist of conversion system for stepped control switch information into Radio-frequency signals through binary coded serial data stream. It shall be of joy-stick type or push-button type console with or without shoulder belt. Minimum 4 and 5 stepped system shall be envisaged except for creep speed.
Receiver	This shall consist of Radio-frequency signal receiver, signal processor card to convert this signal into binary coded data stream and then feed this control information to I/O relay cards through decoding of this serial data stream.
Interface Panel	This shall consist of I/O relay cards for receiving stepped commands from receiver and feed them directly to crane control circuits or to auxiliary relay interface panel for energizing crane control relays as in manually done by the master controller or push-buttons.

8. SAFETY FEATURES

8.1 The system shall incorporate all the safety requirements given in clause 31.7 of BSS: 466 and clause 5.6.11 of CMAA. Also the additional features mentioned below shall be incorporated to provide a smooth and trouble free operation:

a. The receiver FM band shall be sufficiently narrow to allow only passing of desired frequency. It shall be highly error detecting system and through a decoder accept only valid commands. Successive invalid

commands shall drop the system giving diagnostic signals and shutdown shall occur within 2 seconds.

b. Carrier signal strength shall be of sufficient amplitude to allow for easy decoding of serial data stream.

c. The system shall be microprocessor based and have its own security code to identify the correctness of frequency and address code and then execute the commands.

d. The system shall have its own diagnostic feature to identify the cause of failure and provide signals for remedy from the diagnostic chart and also shall have its own fail-safe robotics to provide safety in the following cases :

   i. Transmitter ceases functioning

   ii. Receiver ceases functioning

   iii. Faulty transmitter functioning

   iv. Faulty receiver functioning

   v. Interference on the frequency from any external source and

   vi. Any extraneous signal that may travel through receiver

e. The system shall have the quickest response time to the tune of 80 to 100 milliseconds in order to avoid any jerks on the motion controlled.

f. The system shall be suitable for simultaneous control of 4/5 drives without any interference or malfunctioning.

g. The system shall have its own battery power package through Ni-Cd battery packs and its online rechargeable kits. The transmitter shall become non-functional when the battery is half discharged.

h. All indications for system, whether transmitter or receiver or fault diagnostics or charger shall be through LED’s / flashing LEDs with digital displays.

i. Selection switch for remote/ manual (conventional) operation if needed by the Purchaser.

j. The transmitter shall only be switched on when all command switches are in “ÖFF” position.

EXTRAXT FROM BSS: 466-1984

Clause 31.7

Non-conductive controls:

Equipment that operates the crane by radio, induction or other non-conductive means shall include the following:

a. A key switch or equivalent security device or the transmitter that can be used to prevent unauthorized use of the transmitter.

b. The sending of a continuous or continuously repeated secure signal when the transmitter is in use, which the crane receiver can identify.

Note 1: A signal is regarded as secure when it includes at least three characteristics separately recognizable by the receiver.

c. Automatic shutdown of crane operation if the secure signal is not identified by the receiver during a period of 2s.

d. An emergency stop device, the system used for © shall only be used for emergency stop where introduce no additional in-built time delay.

e. A carrying harness, belt should strap or lanyard on the transmitter.

Note 2: It is recommended that a device is fitted to the crane to give warning that the crane is under non-conductive control.

Note 3: Consideration should be given to the need for safety reasons to incorporate a limited range featured so that the crane will stop when the extent of the range is reached. The range should be capable of being present by means not available to the operator.

Note 4: The transmitter should be constructed so that it is capable withstanding rough handling.

EXTRACT FROM CMAA: 1975

Clause 5.6.11

Remote radio cranes shall be provided with a permissible radio signal in addition to a crane motion radio signal and both signals shall be present in order to start and maintain a crane motion.

9. CONSTRUCTION

9.1 The panels and other enclosures shall be designed and manufactured to give efficient and reliable service in steel plants both indoor and outdoor, where continuity of operation is of prime consideration. This shall be manufactured from materials capable of performing satisfactorily the intended duty factor under such variations of load, pressure and atmospheric conditions as may occur at site including sharp rise of temperature and transient conditions of short circuit.

9.2 All electronic parts shall be designed with the concept of solid state configuration having cards with plug-in facility to provide potential free junctions. As far as possible, cards shall be made identical and interchangeable when used for controls of different motions.

9.3 For the design of the control equipment enclosure, refer to clause 5.2 and 5.3 of IPSS: 1-04-041-03, 1-04-042-03 and 1-04-043-03.

9.4 **Documentation** :

a. Each system of radio frequency control unit shall be provided with schematic diagram of the unit, clearly legible and shall be pasted inside the front door of the panel or supplied with the equipment in a folder for use by the purchaser while maintaining the equipment.

b. The list of documents shall also include catalogues, instruction sheets, instruction manuals for erection, operation and maintenance.

c. Allotted frequency shall also figure in the final documents submitted by the supplier.

10. **TESTS**

10.1 The equipment shall be subjected to simultaneous tests in front of the purchaser/ purchaser's representative for satisfying the sequence of operation, error detecting, fault annunciation, diagnostic display, safety interlocks etc. before leaving the factory. Other electrical/ individual electronics/ radio frequency/ electromagnetic interface tests as necessary by relevant codes shall be performed and test certificates furnished in that respect.

A P P E N D I X – A

(Clause 0.4)

LIST OF PREFERENCE STANDARDS

Sl. No.	Standards Number	Description
1.	IS : 3177-1999	Code of practice for electronic overhead travelling cranes and gantry cranes other that steel works cranes (latest revision)
2.	IS : 4137-2015	Code of practice for heavy duty electric overhead travelling cranes including special service machines for use in steel works (first revision)
3.	IPSS :2-02-004-18	General code of practice for design of EOT cranes (electrical aspects)
4.	IPSS :1-04-041-03	General requirements for control panels for cranes
5.	IPSS :1-04-042-03	Particular requirements for control panels for ac cranes
6.	IPSS :1-04-043-03	Particular requirements of control panels for dc cranes
7.	BSS : 466-2006	Power driven overhead travelling cranes, semi-goliath and goliath cranes for general use
8.	CMAA : 1975 *	Specification for electric overhead travelling cranes

* Crane Manufacturers Association of America