INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**CODE OF PRACTICE FOR END TERMINATION AND JOINTING OF CABLES BY COMPRESSION MEHOD AND SPECIFICATION FOR DIELESS HYDRAULICALLY OPERATED CRIMPING TOOL** (*First Revision*)	**IPSS: 1-10-019-08**
	Corresponding IS does not exist	Formerly : IPSS: 1-10-019-00

0. FOREWORD

0.1 This Inter Plant Standard (*First Revision*) has been prepared by the Standards Committee on Electrical Components and Equipment, IPSS 1:10 with the active participation of the representatives of the steel plants, reputed consulting organizations was adopted in May 2008.

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 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 However, this standard (COP) is intended to adopt the best available practices amongst the steel plants for end termination and jointing of cables by compression method as well as the equipment for crimping tools.

0.4 This First Revision has been carried out after reviewing the standard based on the experiences of user steel plants.

1. SCOPE

1.1 This standard covers the code of practice for termination and jointing of cables of all types and all voltage grades generally used in steel plants & requirement of die-less hydraulically operated crimping tool.

2. STANDARDS FOR REFERENCE

i) IS 1255:1983 `Code of practice for installation and maintenance of power cables upto and including 33 kV rating (*second revision*)'

ii) IS 1897:1983 `Copper strip for electrical purposes (*second revision*)'.

iii) IS 5082:1998 `Wrought aluminium and aluminium alloy bars, rods, tubes, sections for electrical purposes (*second revision*)'

iv) IS 8309:1993 `Compression type tubular terminal ends for alumimium conductors of insulated cables (*first revision*)'

v) IS 8337:1976 `Performance requirements of compression joints of aluminium conductors in insulated cables'.

vi) IS 8394:1977 `Soldering and welding type terminal ends for conductors of insulated cables'.

vii) IS 8438:1987 `Moulds of cast resin based straight through joints for cables for voltages upto and including 1100 V (*first revision*)'.

viii) IS 9553:1987 `Moulds suitable for cast resin based terminations for cables for voltages upto and including 1000 V (*first revision*)'.

ix) BS:91 `Electric cable soldering sockets'

x) BS:1977 `Specification for high conductivity copper tubes for electrical purposes'.

3. MATERIAL REQUIRED

i) Solderless crimping type terminal end of suitable material and size in case of end terminations.

ii) Solderless crimping type in-line connector of suitable material and size in case of jointing.

iii) Corrosion resisting compound

iv) PVC tape (for LT cable) and HT tape (for HT cables)

v) Complete kit for termination/jointing supplied by the manufacturer.

4. TOOLS REQUIRED

i) Crimping tool of proper capacity and suitable for the terminal end/in-line connector.

ii) Die of proper capacity and suitable for the crimping tool.

iii) Wire cutter, insulation stripper, blow lamp, pliers, knife, etc.

5. SOLDERLESS CRIMPING TYPE TERMINAL ENDS (CONSTRUCTIONAL FEATURES)

i) Solderless crimping type terminal ends may be made either of copper or of aluminium alloy.

ii) Aluminium alloy lugs have two varieties viz. Heavy duty lugs and General purpose lugs.

iii) Solderless crimping type lugs are of two varieties viz; shorter length and longer length. These different lugs shall be used depending on crimping tool and depending upon duty application. Generally longer length variety is preferred for use to have more crimping area in a given length. It may be noted that crimping tool may either have cross-sectional crimping dies or longitudinal die.

6. CRIMPING TOOL

6.1 Crimping tools may be of the following three types :

i) Hand operated crimping tool

ii) Hand operated hydraulic crimping tool
Details of the crimping tools shall be as in item 8.0 below.

iii) Gear operated type crimping tool.

7. TERMINATION / JOINTING BY COMPRESSION METHOD

7.1 Details of Termination/Jointing - This method is often called “solderless crimping” technique or “cold compression” technique. In this method, no direct or indirect heat is involved in the process of termination or jointing unlike soldering and welding. Here, the jointing or termination of the conductor is achieved by forming a permanent connection, by pressure forming or re-shaping the terminal and or connection barrel and the conductor to establish a good electrical and mechanical contact. In this method, after the usual process of cleaning of the conductor by mechanical abrasion, the corrosion inhibiting compound is applied over the conductor portion and to ensure that the end/in-line connector is also filled with the same. The stripped out portion of the conductor is tightly fitted fully inside the terminal end/in-line connector and whatever compound comes out is wiped and terminal connector cleaned and then the compression is carried out with the crimping tool and dies as recommended by the manufacturer of terminal end/in-line connector. Depending upon the length of crimping lug, the crimping may be done at two or more places uniformly distributed over the length.

7.2 General Guidelines for termination and jointing

i) In case of termination, copper solderless crimping type terminal end is to be used for copper conductor. However, for aluminium conductor, either copper applying corrosion inhibiting compound or aluminium terminal ends may be used.

ii) In case of jointing, copper tubular in-line connector is to be used for solderless crimping to copper conductor. However, for aluminium conductor either copper applying corrosion inhibiting compound or aluminium in-line connector may be used. In case the user desires then inhibiting compound may be used for copper to copper and aluminium to aluminium.

iii) HT tape for high voltage cable and PVC tape for medium voltage cable is to be applied.

iv) Earth leads of both the cables are to be connected in case of jointing, where applicable.

v) In case of high voltage cable, mould for termination/jointing shall be placed and epoxy compound and hardener shall be poured and allowed to settle. Heat sinkable type termination/jointing may also be used.

vi) Always terminal end/in-line connectors of proper size is to be used.

vii) Conductor forming die for conductor sizes 50 mm^2 and above is to be used before crimping for LT cables and for HT cables of all sizes.

viii) Keeping in view the material (Cu/Al) of conductor/lug as per manufacturer's recommendation, before the work, the correctness of the capacity of crimping tool and die is to be ensured.

ix) After selection of proper lug suitable for the cable size, strands of cable should not be cut or removed for ease of inserting in the lug.

8. DIELESS HYDRAULICALLY OPERATED CRIMPING TOOL

8.1 **Sizes -** For the convenience of lugging and jointing, the crimping tool shall be of three sizes :

Type	Size Range
A	Upto 300 mm^2
B	Upto 400 mm^2
C	Upto 630 mm^2

8.2 General Requirements

i) The crimping head shall be universally rotatable by 360^{o} and a hydraulic pump fitted with an automatic "Blow OFF Valve" preset at 600 kg/cm^2 (60 MPa) pressure. The handle shall have arrangement of setting jaws for required strokes to avoid idle strokes during repetitive crimpings.

ii) The release pin shall be provided at convenient position which shall on operation bring back crimping jaws at preset position. The release pin shall be operative by handle.

iii) Crimping head should be detachable type suitable for straight through joints.

8.3 Technical Requirements

i) The hydraulic pump of the crimping tool shall be incorporated with a 150 mesh filter to avoid any dirt particle entering in the hydraulic system.

ii) For additional Safety of pump system a magnet shall be provided in the reservoir to arrest any steel particle.

iii) The machine shall have provision for easy removal of air locking.

8.4 Material - The material used in crimping tool shall be such as to withstand normal wear and chemical corrosion proof and non-rusting. Crimping jaws, plunger, cylinder, piston shall be properly heat-treated. The total weight of tool shall not exceed 6.0 kg.

8.5 Testing - The joint made with the crimping tool shall conform to the test laid down in IS 8337:1976 `Performance requirements of compression joints of aluminium conductors in insulated cables' for both initial resistance test and heating cycle test. The supplier shall provide the necessary test certificate mentioning the compliance of the above tests applicable for the tool.

8.6 Packing - The crimping tool shall be supplied in a carry bag along with operating instructions.

8.7 Marking - The crimping tool shall be marked with the trade mark of manufacturer as well as size, serial number, year of manufacture, model number, etc of the tool so that the procurement of spares are simplified.