JOB ROLE – **Cable Jointer Electrical Power System**

Sector: Power
(Qualification Pack Code : CON/Q1002)

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Unit 5: Joining of the Cable joints

Session 1: Typical electrical cable jointing methods

Content

Session Objectives

1. The student will be able to explain electrical cable jointing methods

Introduction

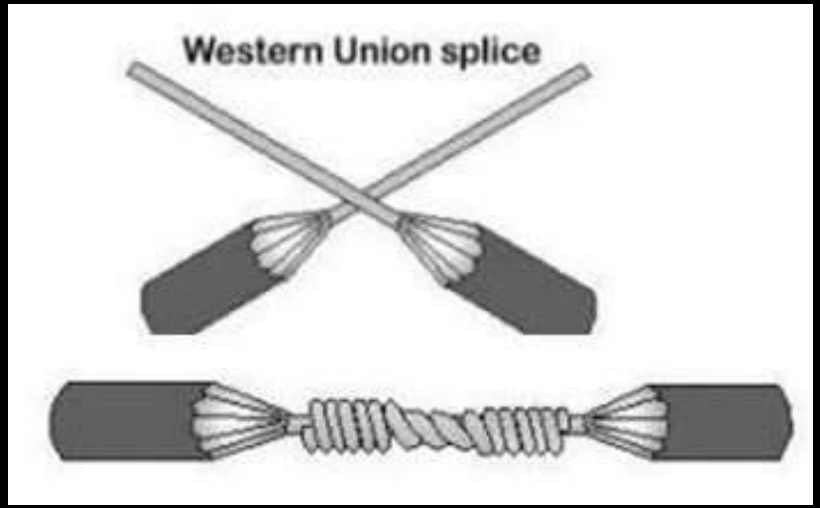
Electrical joints and terminations provide the required electrical connection as well as the mechanical support and physical protection of the cable. The cables joining system is really significant to suit the service and operational requirements for all industrial cable jointing environments and applications. These devices are really important in jointing cables and wires. A good cable jointing and installation provides a better supply of power. The cable jointing has become the preferred pick over conventional systems for Cable Termination, Cable Abandonment, Low Voltage Cable Jointing, and Cables Repair. The Cable Termination & Jointing Kits are often specialized in wire installations worldwide.

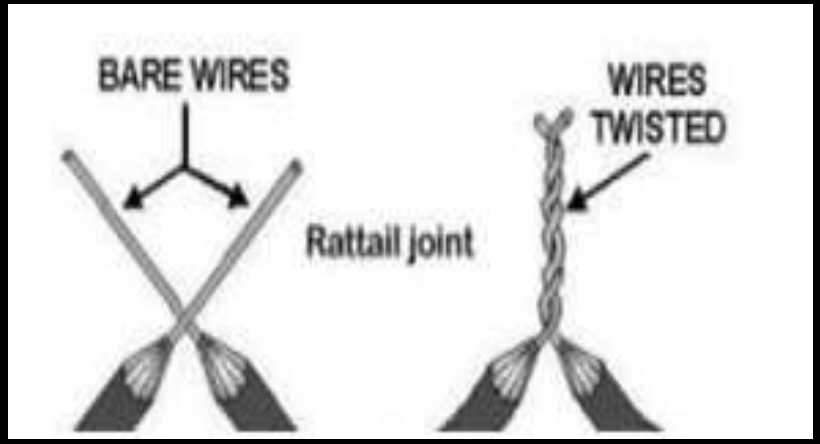
Cables play very important role in distribution system of power. There are so many type of cable like LT cable, 11 KV cable and 33 KV cable. Cables are used in places where bare conductor cannot be used due to narrow roads. Cables are costly than the conductor and the same cannot be replace often.

Various Types of joint

Joining of electrical power cables can be as simple as twisting the wires and taping them or more detailed using a variety of inline adapters and connectors. The method used for a cable joint depends on the voltage, type of cable, type of joint, type of connector, application and other factors. It is important to have the proper tools and materials. Important factors that ensure clean, safe and reliable connections are ;

a. Using the proper size of the connector for the particular cable
b. Proper tools
c. Clean cuts and stripping
d. Restoring the insulation, armor and outer-sheath
e. Proper technique


Western Union splice


BARE WIRES
WIRES TWISTED
Rattail joint

Fixture joint

This is a type of branch joint connecting a small-diameter wire to the large diameter conductor, such as those used in lighting fixtures.

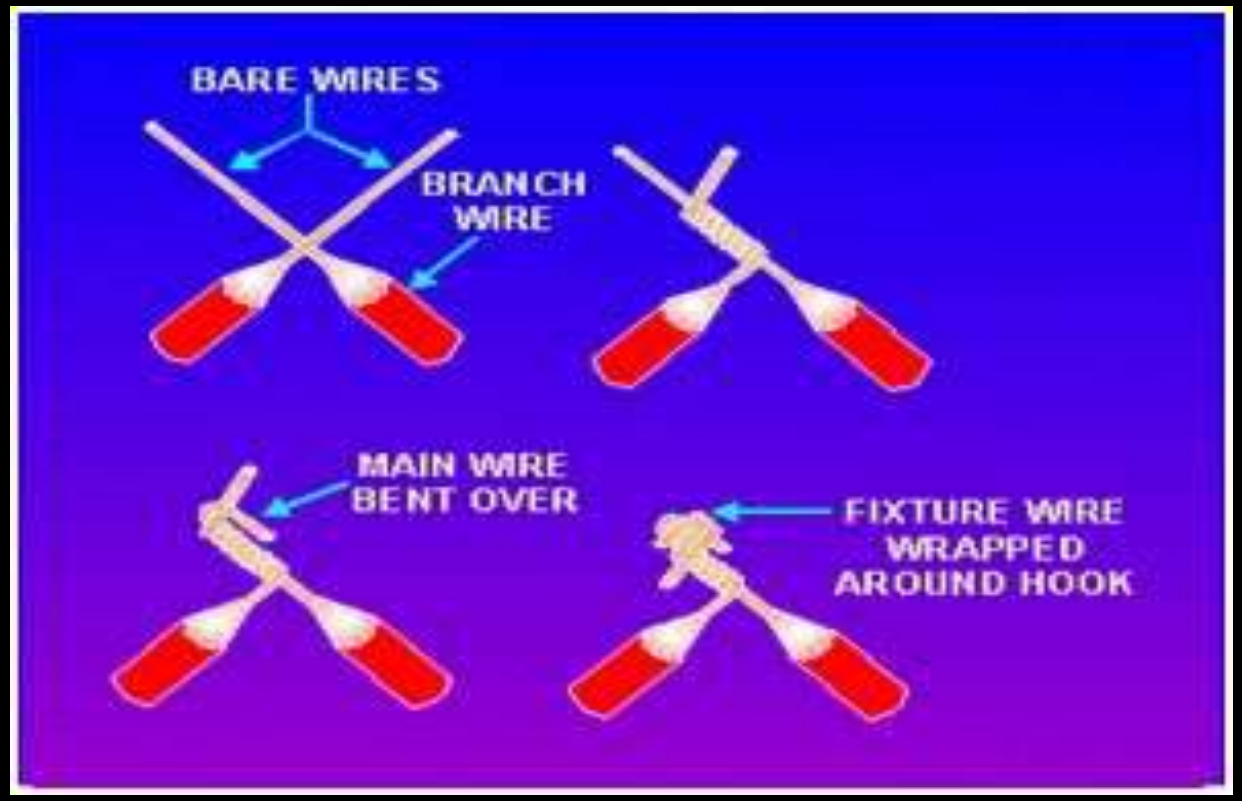
Remove the insulation

Wrap the fixture wire around the branch wire

Bend the branch wire over the completed turns

Wrap the remaining fixture wire over the bent branch wire

This can be followed by soldering and taping, or simply taping of the joint.


BARE WIRES
BRANCH WIRE
MAIN WIRE BENT OVER
FIXTURE WIRE WRAPPED AROUND HOOK

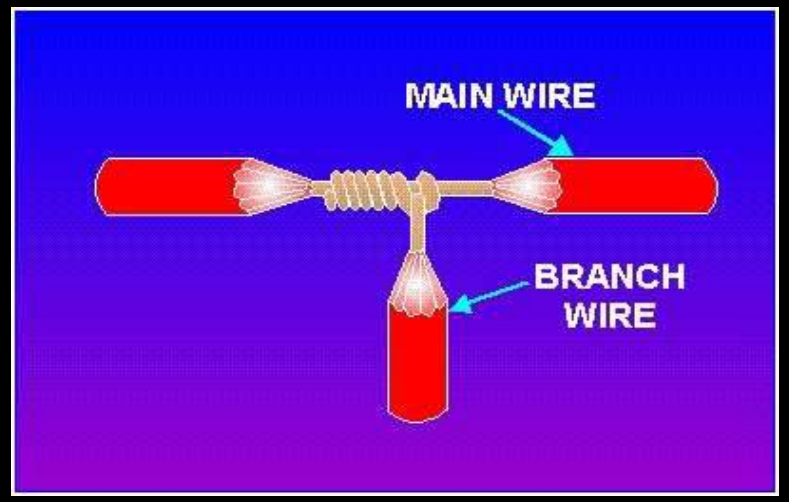
Knotted tap joint

The knotted tap joint is used to for branch joints to connect a branch wire to a continuous wire.

Remove about 1 inch of insulation from the main wire and about 3 inches from the branch wire.

Place the branch wire behind the main wire so that three-fourths of its bare wire extends above the main wire.

Bring the branch wire over the main wire, around itself, and finally over the main wire so that it forms a knot. Wrap the wire around the main conductor in short, tight turns and trim its end.



Joints using wire nut and split bolt

The wire nut replaces the rattail joint splice. The nut is usually housed in a plastic insulating casing. To make a joint,

Strip the conductors

Place the two to be joined into the wire nut

Twist the nut

Split bolt connector

The split bolt is mainly used to joint large conductors. This replaces the knotted tap joint and can be used to join three ends or join a branch wire to a continuous conductor.

The bare wires are placed through the space between the two bolts, after which the nut is tightened to ensure a sound joint.

Cable Jointing

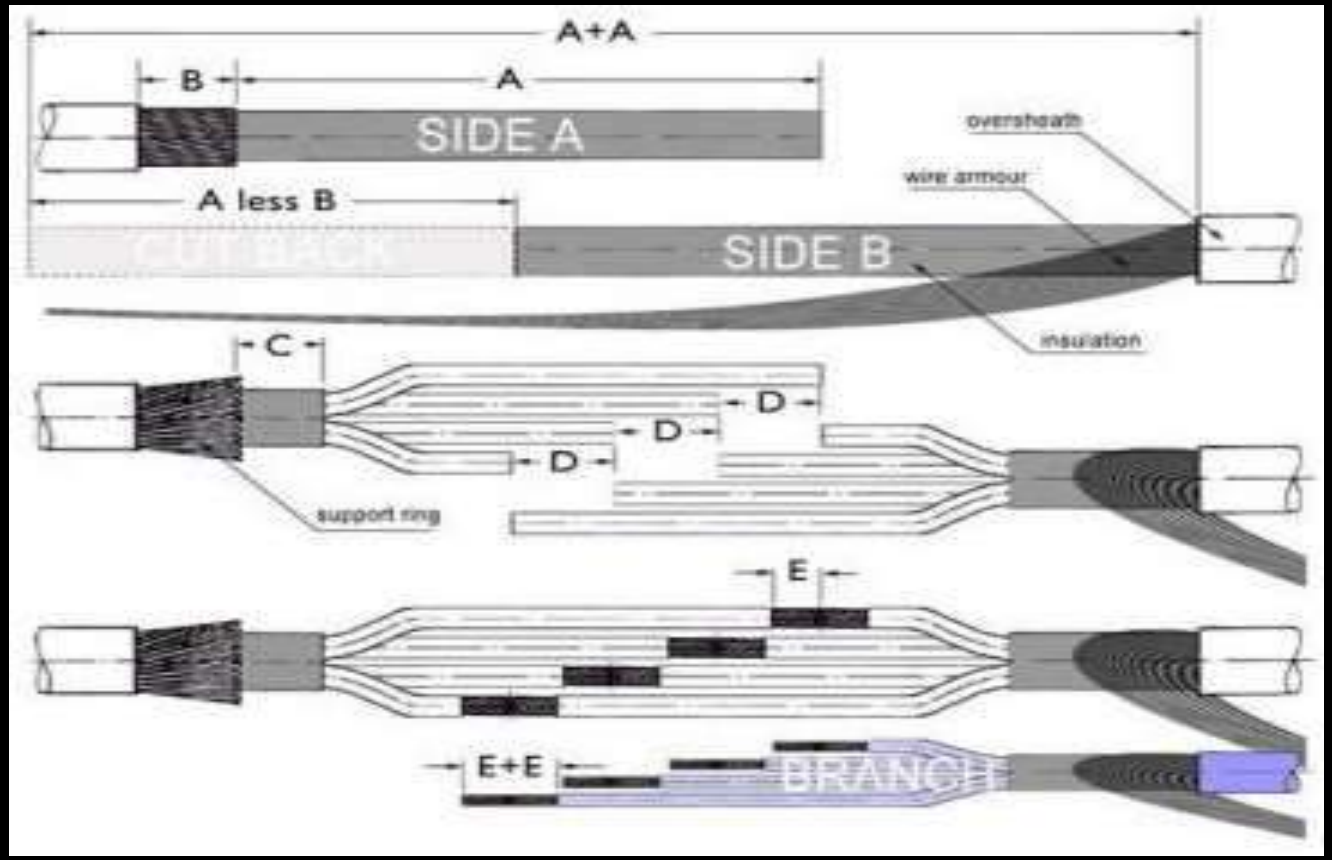
Making straight or branch Joints for steel wired armor cables are required:

- Connectors Mechanical or crimp
- Copper mesh tape
- Constant force springs to hold the wire armor and copper mesh tape
- Standard PVC/Vinyl tape: provide a mechanical barrier between the over sheath layer and the armor layer.

Preparing the cable

1. Remove the oversheath and the wire-armor

2. Separate the wire armor and bend the wires away from the cable, place the support ring under the armor at each side of the joint.
3. Cut back the cable insulation.
4. Remove the insulation from each of the conductors



Crimp and insulate each cable

Once the cable is ready, connect each end of the three conductors to a suitable mechanical connector or the crimp. Tightly fix the matching connectors and test the connection.

Tape the crimped connectors, wrap around and extend to cover at least 25mm of the cable insulation of the conductor entering the connectors

Bind the cables

Bind the wires tightly and then tape them together. When insulating both individual cables and the whole bunch, fill in the voids to create an even taper end to end.

Restore Armor and apply mesh tape

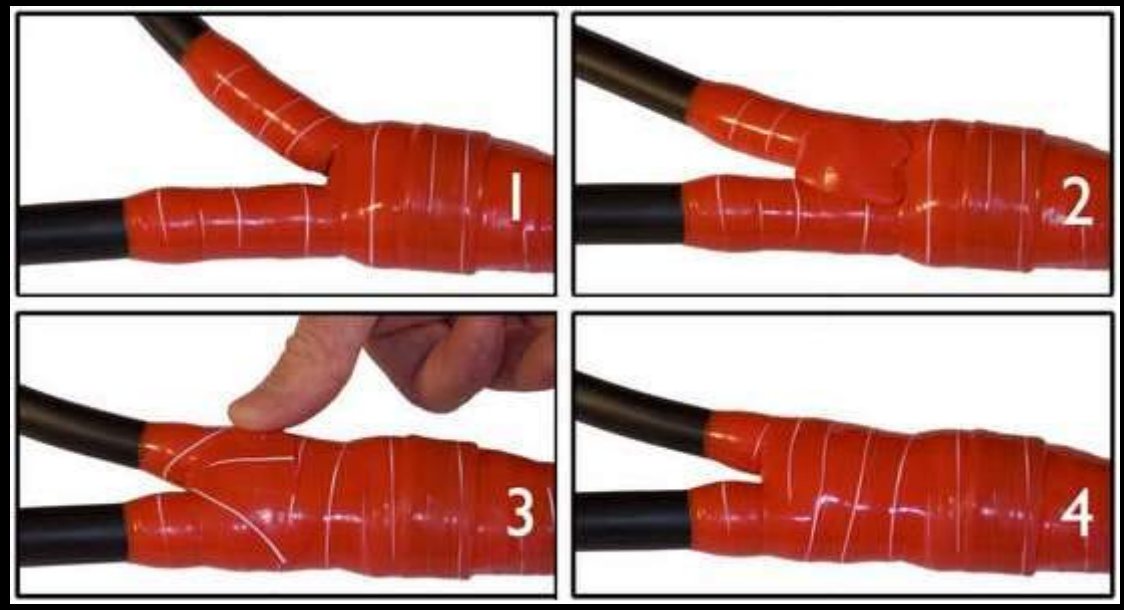
1. Tightly wrap the cable from armor to armor while applying adequate tension around the insulation.

2. Join the wire armor from one end to the other end and cut excess wire to the correct length. Ensure the armor spread evenly over the entire joint.
3. Wrap the cable with the mesh tape and then use the standard vinyl/PVC tape to wrap over the mesh to provide a mechanical barrier against stray wire ends. For the branch joint, bring both the main and branch cables together before wrapping.

Next, use standard vinyl or PVC tape to wrap over the constant force springs placed over the under-armor rings. The tape provides a barrier against sharp edges.

Re-establish the over sheath

1. Use a self fusing tape to wrap over the cable and establish the outer sheath. Start in the center and apply one layer of tape to one end, wrapping over the jacket with for at least 25 mm. Apply the tape from the end towards the center so that you have two layers on each side.


1
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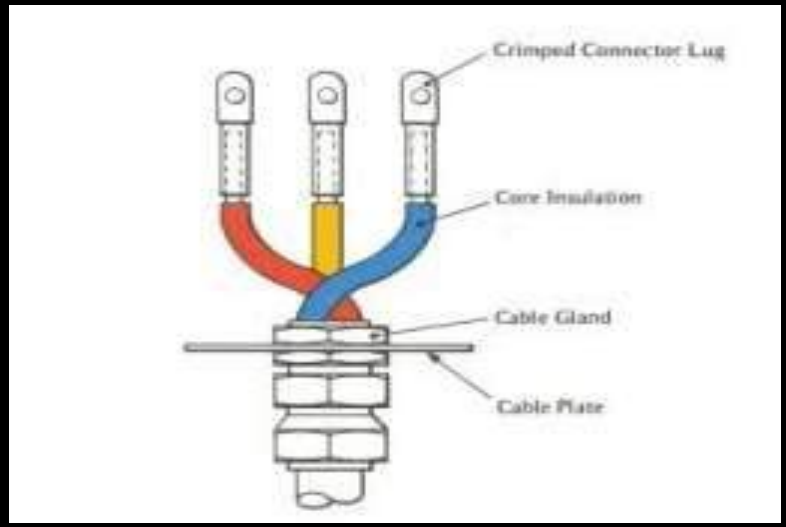
Electrical power cable terminations

The electrical cable termination is the physical and electrical connection of a cable end that connects to another cable, or to the terminal of the equipment. The cable terminations are often designed to enable the physical and electrical interconnecting of two cable ends, or a cable end and a terminal on the equipment.



The electrical connection requirements relate to the voltage drop, current carrying capacity, compatibility of the materials, etc. The physical requirements relate to the environmental protection as well mechanical security.

The methods used to terminate the cables vary according to the type of cable, type of connector and application. The common type of terminations are crimp connection, soldered connection, compression termination, and wire-wrapping connection, direct connection, loop or eye connection. Some of the factors that determine the type are:

. Outdoor or indoor use
. Voltage

. Current
. Overhead, or underground
. Type of Connector on the equipment where the cable will be connected.

Cable Joints

A power cable is an assembly of two or more electrical conductors, usually held together with an overall sheath. The assembly is used for transmission of electrical power. Power cables may be installed as permanent wiring within buildings, buried in the ground, run overhead, or exposed. Cables consist of three major components: conductors, insulation, and protective jacket. The makeup of individual cables varies according to application. Power cables use stranded copper or aluminium conductors, although small power cables may use solid conductors.

Ever since electricity cables were first used, the problem has arisen of how to join them together. In order to achieve the degree of insulation, tensile and crushing strengths, conductivity and accessibility required in practice the traditional solution has been some form of junction box. The junction box typically incorporates: a method of securing the cable conductors (usually by soldering, screw-clamps or compressed ferrules); a method of insulation, which may be air, oil, bitumen or insulation applied in the form of tapes; and a method of enclosure and protection applicable to the environment.

The Electricity at Work Regulations 1989 requires in Regulation 10, that every joint and connection shall be mechanically and electrically suitable for use. In this respect the joint or connection should be of proper construction as regards conductivity, insulation, mechanical strength and protection.

Joints in Non-flexible Cables

Underground cables are joined by ferrules (sweated or crimped) and the outer protection enclosure or box is usually filled with a plastic or bituminous compound. Such joints are often used above-ground for non-flexible cables and are adequately protected and supported. Modern versions of these joints use themo-shrink sleeving as the insulating and/or sheathing material but the principle remains the same.

Other cables in fixed wiring installations are generally joined by making them off in some form of enclosed junction box which, in many cases, does not incorporate any method of securing the cable against strain.

Joints in Flexible Cables

Home-made joints in flexible cables are not usually satisfactory because:

1. Stranded conductors do not lend themselves to certain methods of jointing;
2. Mechanical tensile strength and resistance to crushing are difficult to maintain; and
3. Fatigue damage may occur where the flexible cable enters a rigid joint.

Some proprietary joints and cable connectors are much more acceptable; these incorporate terminals or compression fittings suitable for stranded conductors, cable clamps of a design similar to those used for plugs, and sleeving to reduce the flexing of the cable where it enters the connector. Where these features are present and the cables are properly terminated it would be difficult to show that the joint does not meet the requirements of Regulation 10 in respect of conductivity, insulation and mechanical strength. The adequacy of the mechanical protection afforded by the enclosure depends on the environment in which it is issued. Heat-shrinkable or pre-stretched sleeving may be adequate in some cases but other circumstances may demand additional protection.

Types of Cable Joints and Equipment

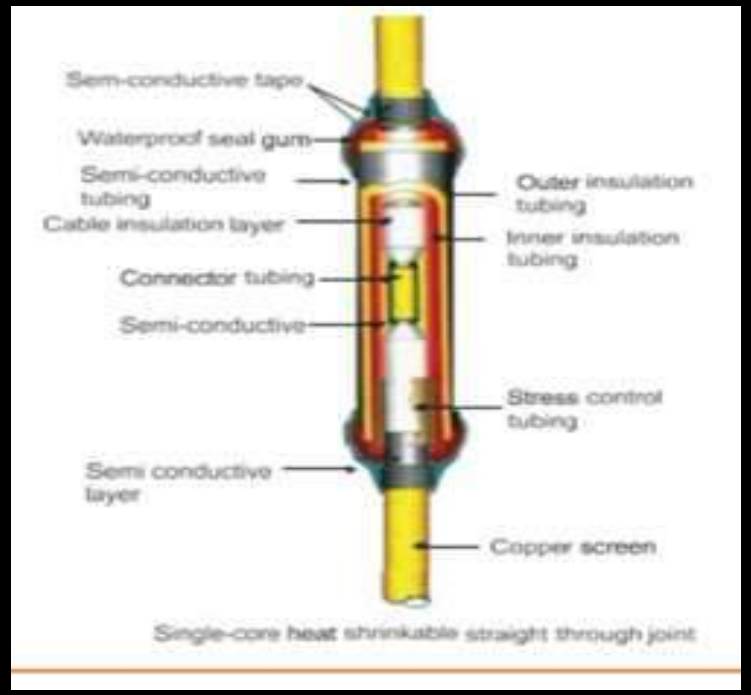
A great majority of failure in cable network is associated with faulty cable jointing. It is, therefore, essential to use proper jointing technique, good quality insulating material and standard accessories for cable jointing. Cable joints are of three types:

Straight Through Joint: Straight Through Joints form an integral part of today's power cable networks.
These joints offer reliability and flexibility to meet the demands of cable network operators.

Straight Through Joint provides:

- Quick cable preparation
- High electrical insulation
- No moisture ingress
- Good mechanical strength
- Compact dimensions
- Suitable for all conductor, shape and material.

Straight Through Joints are made by metal joining processes such as welding and soldering.



T- Joint: these types of joints are used to for branching of a service cable from a main cable. T- Joints are helpful as turning and twisting of cable damages its outer core.

Terminal Joint: These type of joints connect cable to switch gear, transformer terminal or to an overhead line.

Conductor Jointing

It means joining two conductors each other.

Necessity.

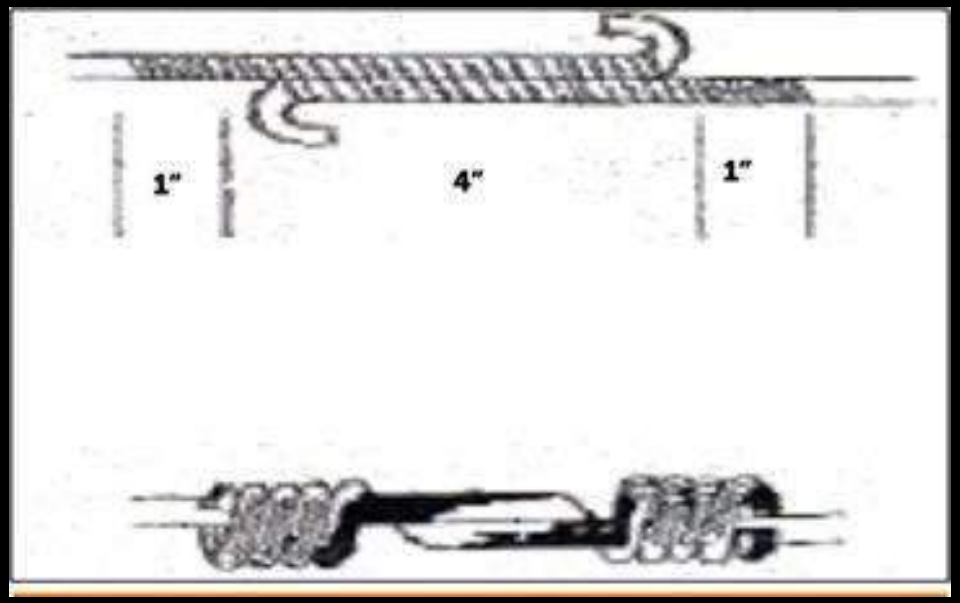
1. While construction of new line, one conductor coil is insufficient; the other has to be laid in continuation.
2. The conductor breaks by some reason.

Types of Joints :

(1) Britannia, (2) Telephone, (3) Meried Joint, (4) 'T" joint, (5) Sleeve joints,

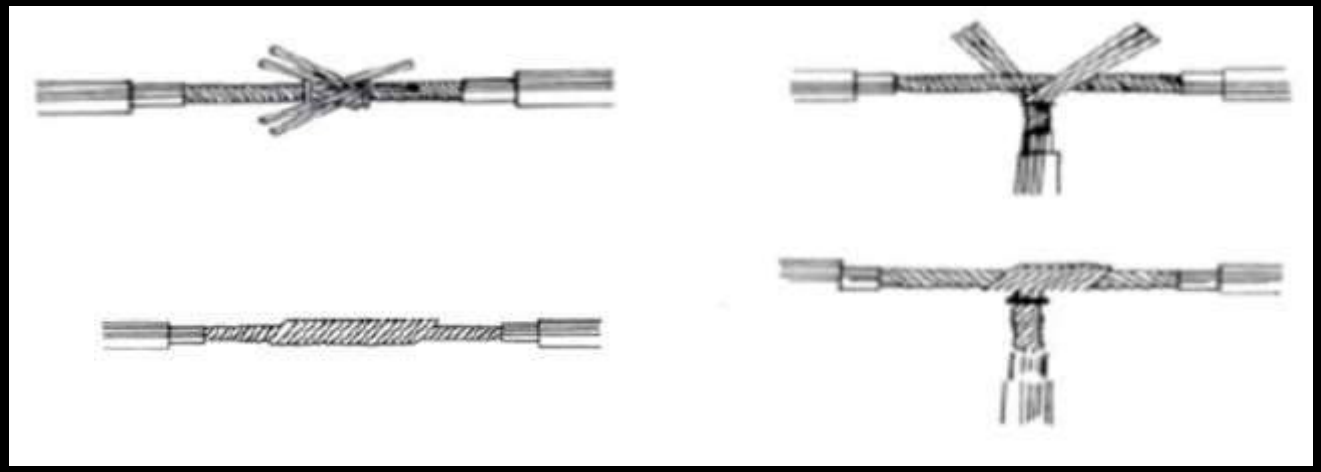
(6) Compression joint.

Britannia Joint: This type of joint is made only on solid conductors and cannot be made on stranded conductor. Two conductors to be joined are brought in front of each other. 6inch(150 mm) length of each conductor is cleaned by wire brush or sand paper. This will clear the rust and will be clean. Then it is washed with soft soda water. If the conductor is of copper; it should so as to make good electrical connection. Then ends of both conductors are bent through half centimetre and placed on each other. The length of contact portion should be min. 100 mm. This joint should be bound by 14 mm copper wire as shown in figure.



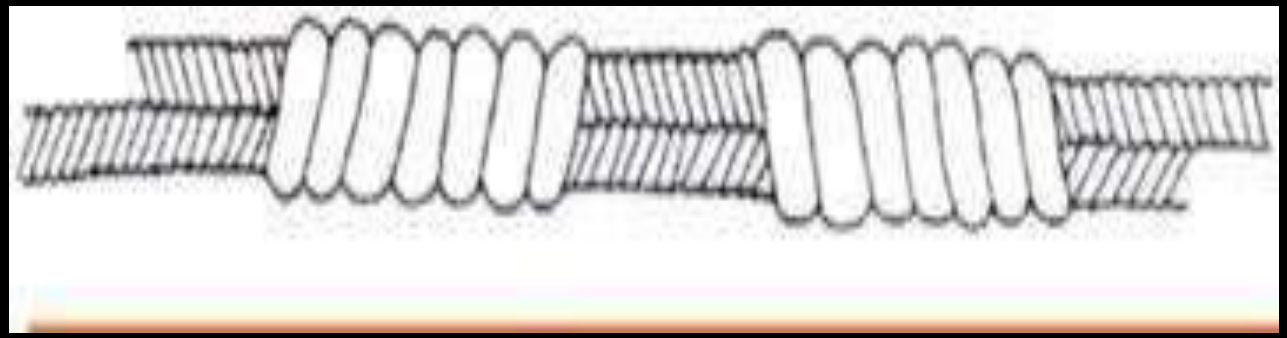
Telephone Joint (Western Union): This is used only for solid conductors. It is used for conductors of size 8 No. or higher. First bend is given at 100 to 125 mm from the edge and are placed over each other. Then each one is twisted with another conductor. The conductor is to be cleaned for 200 to 250 mm length.

Meried Joints: This joint is made between copper conductors having central strand of G.I. wire. It should not be made between Al .conductors. Approximately 175 to 200 mm length conductor strands are unwound and every strand is well washed and brushed. The G.I. strand of both conductors should be broken up to 175 m min length. Both conductors should be brought in front of each other and their strands should be woven in each other. The strand of one conductor is twisted on other conductor, and strand of other conductor is twisted on the first. Likewise all the strands twisted and then soldered. This is used only for small span length.



'T' Joint: This joint is made with stranded conductor. This joint cannot take tension. It is used for Jumper or tapping in S/s. The conductor strands to be separated up to 100 mm. Then middle steel strands are cut. Then it shall be placed to horizontal conductor with 3 strands each on either side and shall be twisted over the horizontal conductor.

Sleeve Joint:-It can be made with any type of Aluminium conductor. First the conductor should be washed with caustic soda solution and wiped off cleanly. Graphite Greece is applied over the conductor and as shown in figure two Al. sleeves should be taken. These sleeves should be placed on the conductor as shown. Sleeves should be twisted by twisting wrench. This joint is made for L.T., H.T., ACSR, AAC conductor up to 0.06cm2size.

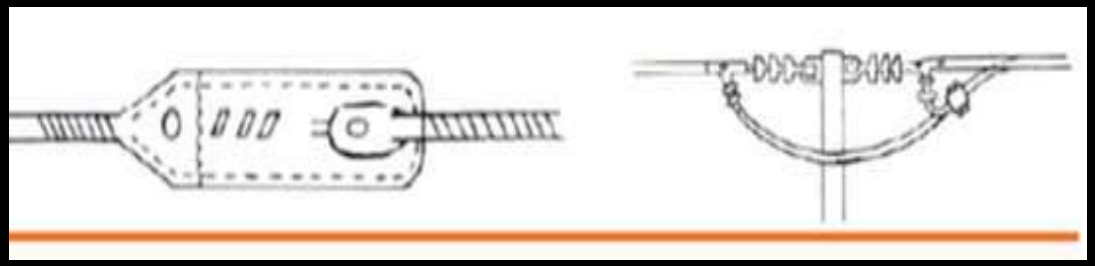


Compression Joint:- This is used for conductors of more than 0.06cm 2sizes. For jointing, two different sleeves are used. Steel sleeve is used for steel conductor strands and Al. sleeve is used for Al. conductor strands. There are two holes in Al. sleeve. Rebating is done through these holes. First both sleeves should be cleaned and dried. Then Al. sleeve to be mounted on one side. The length of steel sleeve is then measured. Its half distance is taken. Suppose it is 'X' cm. Then the ends which are to be joined and more to 'X' cm. distance is taken on the conductor is banded there. The Al. strands are opened up to that point and cut. Steel strand should not be touched while this. Then the steel sleeves are cleaned without opening. They are placed in the steel sleeve. They should be kept in front of each other. Then the center of steel sleeve is compressed in

Compression machine. Then on the half portion of the right side sleeve be compressed and then on the left half portion. Due to compression the length of sleeve will be increased by 6mm on both sides and it will reach Al. strands. Then Al. sleeve should be measured. It should be halved. Suppose it is 'Y' cm.[Symbol][Symbol]25 mm then 'Y' cm. should be measured and marked on both sides of conductor measured from center of steel sleeve. Both parts of conductor are brought in sleeve in front of each other. The filler parts should be filled in the sleeve by Grease until it comes out the holes. Both the holes are then closed by rivets and hammered by hammer. There is one stencil mark on Al. sleeve. Then first compression will be there; afterwards it should be compressed up to one end. Similarly other part is compressed up to other end.

Jumpering

Connecting two conductors or wires is called Jumpering.



Jumper should not be connected to main conductor .The jumper should always be connected by P.G. clamps as shown.
When the jumpers are near metallic portion, all such jumpers are covered with alkathine pipe.

Conductor joint are marked on A.C.S.R. conductor when dispatched. Mid span joint should be made before stringing because the steel strand is not kept continuous. Hence it is necessary to replace the company joint.

Care should be taken that mid span joint will not be less than 40 ft. from pole.

Every joint should be done carefully.

Where conductor strands are cut, repair sleeve is used.

Conductor joint strength should be 95% that of conductor, and resistance should be that of main conductor.

Typical HV Cable Jointers Tools Applications

. Cable cutting for power, control, instrumentation cables (SWA)
. Cable crimping copper/aluminium cables (hydraulic, battery, ratchet)
. Cable spiking tools for LV-HV cables (cartridge/hydraulic)
. Heat shrink gas torches for LV-HV jointing
. Screen scoring tools for bonded/easy peel HV cables
. Outer sheath stripping tools, LV-HV cables
. Insulation (XLPE) stripping tools, HV cables
. Insulated tools for live-working
. Cable laying rollers, socks, jacks and pulling equipment
. Conduit duct rods

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