WIRE JOINTS

Making Simple Conductor Joints

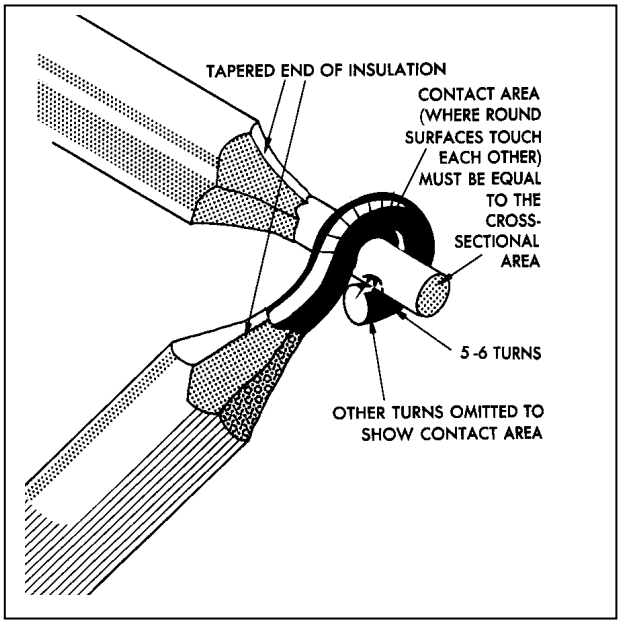
Although the new solderless connectors have reduced to a minimum the need for hand-formed conductor joints, the making of a reliable joint still remains one of the most essential hand skills in the electrical shop.

The three joints most commonly used for splicing conductors are the rat-tail joint, the tap joint, and the western union joint.

A rat-tail joint is made when two or more conductors must be joined inside a fixture or junction box.

The tap joint is used for connecting a branch conductor to one that "runs through" without any physical break, forming a T shape.

The western union joint is the strongest of the three types; it is used for splicing breaks in straight line and for extending existing conductor runs.



The electrical safety code requires that conductor joints be "mechanically and electrically secure" and "covered with insulation approved for the purpose."

Mechanically secure means that the conductors must be tightly twisted together, with no loose turns or gaps between the turns. It usually also means that hand-formed joints must be soldered for maximum strength and protection against oxidization.

Electrically secure means that the completed joint must conduct an electric current as effectively as the unbroken conductors. To make sure that this is the case, the conductor surfaces must be absolutely clean, and enough twists or turns must be made to provide sufficient contact area for the electric current to flow from one conductor to the other (see diagram).

Covered with approved insulation means that the completed joint must be insulated with approved electrical insulating tape or similar material. This insulation must be of the same quality and thickness as the original insulation on the conductors.

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Making a Rat-Tail Joint

Purpose:

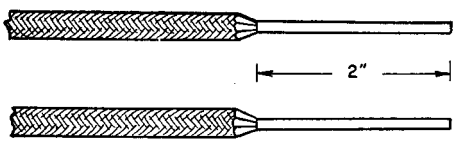
A rat-tail joint is made when two or more conductors must be joined inside a fixture or junction box.

Materials:

Two, 7 inch (18 cm.) lengths of solid, insulated copper wire, size AWG 14 for each joint.

Procedure:

(a)Remove 1 ½-2 inches (3.7-5cm.) of insulation from each wire. Hold the wires tightly parallel with your left hand and bend one end up and the other down, so that the wires will cross 1/8 of an inch (.3 cm.) from the end of the insulation Now, keeping a firm hold on the wires, twist the ends in a clockwise direction with your right hand, forming 5 tight turns. Cut off the wire ends with diagonal cutters.

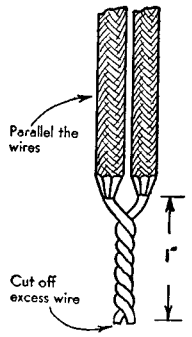


a. Skin both wires about 2" from the end. Clean well.

(b)The completed joint should be so tightly wound that the wires cannot be moved within it.

If wire sizes below AWG 16 are used, the joint can no longer be formed by hand. Pliers must be used for twisting the wires, but extreme care must be taken not to damage the conductors.

Make a 4 wire pyramid joint for full marks and keep them for soldering later on. Make sure it is cut off on the end at a 45 degree angle allowing the wire marett to cover the copper completely and twist until insulated wire is also twisted for support strength to whole joint.



b. Make twists and complete splice.

Assignments:

1. Name a typical use for the rat-tail joint.
2. List the physical features of a rat-tail joint.
3. Why should there be at least five twists in a well-made rat-tail joint?
4. What is the purpose for having the insulation twisted also when tightening up a marett?

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Making a Tap Joint

Purpose:

The tap joint is used for connecting a branch conductor to one that "runs through", as a main wire without cutting the main wire. This type of joint is commonly found in the automotive market with additional electronic components added.

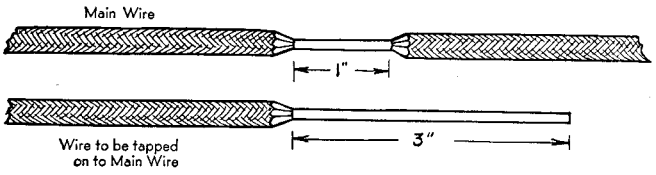
Materials:

Two, 8-inch (20 cm.) lengths of solid, insulated copper wire, size AWG 14 or 16, for each joint.

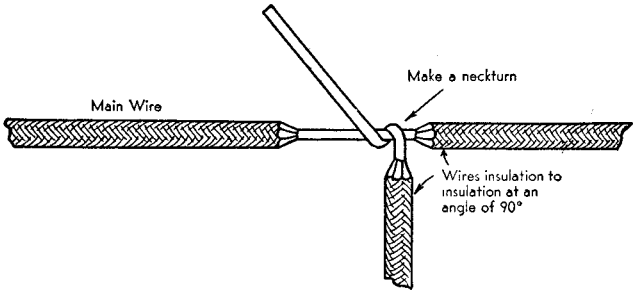
Procedure:

(a)Remove 1 inch (2.5 cm.) of insulation from the centre of one conductor, and 3 inches (7.6 cm.) from one end of the second conductor. (b)Hold the bare end of the second conductor tightly against the left side of the gap in the long-run conductor. Bend the bare wire upward

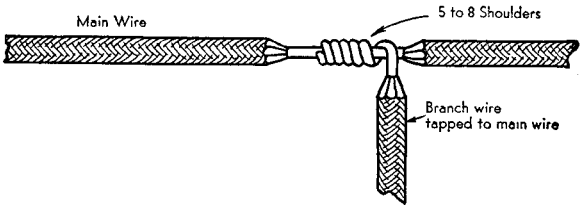
(c)Now, without releasing your left-hand hold, make 5 tight turns around the long-wire run. With diagonal pliers, cut off the stubby end of the branch conductor and bend it down carefully. Finally, bend the branch conductor downward until it makes a 90-degree angle with the long-run wire. Make two T's on your pyramid



a. Skin the wires as shown. Clean copper well.



b. Cross wires and make a neckturn.



c. Complete shoulders to finish splice.

Assignments:

1. List the physical features of the tap joint.

2. State two reasons for making five, tight turns, around the long-run wire.

3. Why must you be especially careful in removing the insulation from the long-run wire?

4. Where would you find this joint commonly used today?

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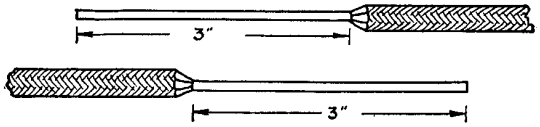
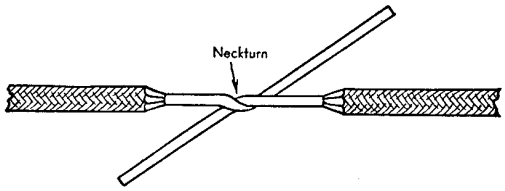
Making a Western Union Joint

Purpose:

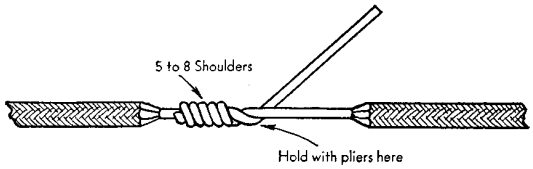
The western union joint is the strongest of the three types; it is used for splicing breaks in long-run conductors and for extending existing conductor runs in opposite directions. This joint is the strongest of all hand-formed joints. It was used originally, by the linemen of the Western Union telegraph company, to fix breaks in telegraph wires.



a. Remove 3" of insulation from both wire ends — clean copper well.



b. Cross skinned wires at a point about ¾" from insulation and make a neckturn as shown.



c. Make from 5 to 8 shoulders using thumb and forefinger.

d. Shoulders completed on both sides of neckturns.

Materials:

Two 8-inch (20 cm.) lengths of solid insulated copper wire, AWG 14 or 16, for each joint.

Procedure:

(a)Remove 3 inches (8 cm.) of insulation from one end of both wires. (b)Cross the bare ends ¾ of an inch (1.8 cm.) away from the insulation and press them together tightly with your left hand. (c)Without releasing your tight hold on the cross-over point, wrap the free end of the left wire tightly around the right wire in a clockwise direction, forming 5 turns. There must be no gaps between the individual turns.
(d)Now, holding the finished turns with your right hand, wind the right wire counterclockwise into 5 tight turns around the left wire.
Cut off the remainder of the wire ends with a diagonal cutter and squeeze them gently into place with a pair of pliers. But be careful not to damage the copper surfaces. The finished joint should be so tightly wound that the wires cannot be moved within the joint.

Assignments:

1. Describe the Western's principle use and its features.
2. Why must the wires be tight and unmovable in the completed joint?
3. Give and example of where you would commonly find this joint today?