OPEN WIRE
EMERGENCY RESTORATION OF SERVICE

Contents

1. GENERAL

1.01 This section describes expedient construction methods which have been found adequate for emergency restoration of damaged toll or exchange open wire lines.

1.02 A frequently used method of restoring open wire facilities which have been seriously damaged by such disasters as storms, floods, or fires is by the temporary use of insulated wire, and it is with this method that this practice is primarily concerned.

1.03 In some types of damage a few open wire pairs can be restored to working order more quickly than insulated wire can be obtained and installed. An example of this possibility would be ice storm damage in which wire damage is heavy but the supporting structure is intact. One or two groups on the top arm might be repaired and restored to service. The more important circuits, particularly those with the greatest number of carrier channels, could be assigned to these pairs and the remaining circuits restored with insulated wire or held for further open wire repairs. Even though permanent repairs might involve replacement of portions of this wire due to damage at the ties, kinks in the span, or excessive stretching, the objective of early restoration of service would have been realized.

1.04 Standard construction methods and materials should be used to complete the restoration of damaged plant facilities and to replace, as soon as practicable, the temporary plant constructed for emergency restoration.

1.05 Emergency restoration work will generally involve some hazardous conditions. In any case, all necessary precautions should be taken to ensure safety to workmen and the public.

2. PRECAUTIONS

2.01 Extensive plant damage is accompanied, usually, by hazardous conditions and all necessary precautions should be observed in emergency restoration work. The following are illustrative of hazards that may be encountered in emergency restoration work:

(a) Electric lines in contact with telephone lines or down on ground.
(b) Sagging electric lines which might later cause contacts.
(c) Insecure footing due to ice, snow, or mud.
(d) Snow blindness caused by reflection of sunlight on ice and snow.
(e) Difficult climbing due to ice on poles.
(f) Difficult climbing due to leaning poles.
(g) Broken poles which may appear sound.
(h) Unbalanced loads on poles due to anchor failures or failure of adjacent poles.
(i) Breakage and falling of wires and equipment, and falling ice.
(j) Difficult traveling due to snow-blocked, icy or muddy roads, and poor visibility.
(k) In some types of disaster conditions, unusually heavy or fast traffic.
(l) In fire damage cases, possibility of explosive substances being present.
(m) In flood conditions, caving banks or washing away of footings.

2.02 All applicable safety precautions as outlined in other sections of the practices should be observed. Those which will apply particularly to the usual instance of damaged plant are contained in "Precautions-General," "Precautions-Aerial Work," and the "Wire Stringing Precautions" sections. Some of the most important precautions are listed below:

(a) Warning flares, lights, flags, signs and guards, as required, should be placed at all locations where the safety of the workmen or general public is endangered.
(b) Plant in the area of damage should be inspected for actual and potential hazards to workmen or the general public. This will ordinarily be combined with the initial inspection to determine the extent of the damage, but inspections should be continued as restoration work progresses, in order that any changed conditions may be detected.
(c) The initial inspection of the plant should include notation of locations where further damage, or the creation of additional hazards, might be avoided by temporary protective measures.
(d) Particular attention should be paid to inspection for electric power contacts which are existing or might develop. Such inspections, particularly following ice or wind storms, should cover not only the area of actual damage to telephone plant but should extend to the limits of the storm area.
(e) All forces must be alert for evidence of electric power contacts. In addition to visual discovery of the actual contact, there are several indications which may be observed at locations other than the point of contact. Some of these are listed below:
  (1) Burns in bridle wires or drop wires.
  (2) Protectors operated at junction of open wire with cable.
  (3) Fuses and blocks operated at station protector.
  (4) Central office heat coils operated.
  (5) Testboard finds foreign potential on line.
  (6) Testboard hears 60-cycle hum on line.
(f) Available information regarding the extent of the storm and any known damage should be exchanged with the power company and other wire-using companies, and arrangements made for current exchange of data as the inspection and restoration work progresses.
(g) All power wires should be assumed to be energized. Work on telephone plant should not be started until all contact with power wires in the damage area has been eliminated, and assurance is obtained that there will be no feedback of power voltages into the damage area from contacts in other locations. Power wires should not be handled by telephone personnel.
(h) If there are any power line crossings, conflicts, or other instances of proximity in the affected area, workmen should wear rubber gloves when handling line wire or drop wires during emergency restoration work and should avoid contact with the wire by other parts of the body.
(i) Because of the unusual nature of some of the work operations, and the hazards that may be encountered, emergency restoration work should be supervised closely. Work should be carefully planned with the workmen and brief group discussions held to be sure that all hazards are specifically pointed out and that each man understands the procedures to be followed.

3. PRELIMINARY WORK OPERATIONS

3.01 Following the inspection discussed in preceding paragraphs, certain preliminary operations should be completed before proceeding with detailed restoration work. These operations are important in providing safe working conditions, in organizing the emergency restoration program for the earliest practicable completion, and for efficient use of manpower and supplies.

3.02 Part of these preliminary operations will be carried out by such restoration organization as may be established, or by the district or division level supervisory group. A part will be carried out by the field forces, and by the plant engineers. Careful coordination of the operations of these groups is required in order to obtain maximum efficiency.

3.03 The following sequences of preliminary measures may be used as a guide:

(a) As mentioned under Precautions, above, place warning signs, lights and guards as required for the protection of workmen or the public.

(b) Take immediate action to have power contacts cleared and other electrical hazards eliminated or reduced. This should include any unsafe power poles or other potential hazards.

(c) Place temporary guys or braces as required to prevent further damage or hazards.

(d) Either take down or brace any damaged pole plant which is not in safe condition.

(e) In adjacent sections, where open wire circuits are to be continued in service, inspect for plant damage and make any necessary temporary repairs to prevent further damage or circuit failure.

(f) As a part of the initial information gathering and planning operation, contacts will have been established with the electric utility companies affected. In addition to this, contact should be established with all other wire using companies, such as Connecting Telephone Companies, pipe line companies, railways, and telegraph companies, whose plant is affected. This contact should cover not only exchange of information concerning damage, but should include arrangements for coordination of restoration work at crossings and other instances of proximity.

4. MATERIALS

4.01 HD wire is the commonly used type of insulated wire for temporary restoration and will usually be available from emergency stocks. The transmission characteristics of this wire are superior to other types of available insulated wire or cables.

4.02 In some cases where HD wire can not be obtained immediately, it may be expedient to use other available types of wire, particularly if the length of the damaged section is short. The decision as to whether these other types of wire can be used will normally be based upon transmission requirements. Some of the possible substitutes for HD wire are listed below:

B Rural Distribution Wire
B Underground Wire
C Underground Wire
C Drop Wire
B Multiple Drop Wire
Polyethylene Insulated Conductor Cable

5. EXPEDIENT CONSTRUCTION METHODS

5.01 The objective of emergency restoration is to restore facilities to service in the shortest practicable time.

5.02 A first requirement of the construction method chosen is that any temporary plant be placed in a manner that will not jeopardize the safety of the workmen or public, either in connection with the placing operation or during the period while the temporary plant remains in service.

5.03 The temporary plant should be placed in a location in which it will be protected from physical damage during its period of use.

5.04 The methods to be used in construction of the temporary plant will be influenced by the materials to be used, tools and equipment available, need for physical protection, and the length of time during which the temporary facilities will remain in service.

5.05 Transmission requirements will control decisions as to whether insulated wire can be submerged in water or laid in mud or wet snow; whether wires must be separated, or "spaced," or can be "bunched," or tied together in a group; whether wires need to be attached to insulators or knobs, or can be tied directly to the supporting structure; and whether or not 24A autotransformers will be used. A rather large transmission loss results when wires are immersed in water, but if the immersed section is short this can frequently be tolerated. There is a small transmission advantage in the use of insulators. The spacing, or configuration, of the wires on supporting structures or on the ground will be influenced by the length of the temporary section, moisture conditions, the presence of phantom circuits, and the type of carrier facilities on the line.

5.06 Some of the commonly used expedient construction methods are discussed below:

(a) Lay wire on the ground. This requires a location where the wire will not be subject to damage and which will not be traversed by vehicles, pedestrians or livestock. Typical locations would be along fences, hedge rows, or ditch banks.

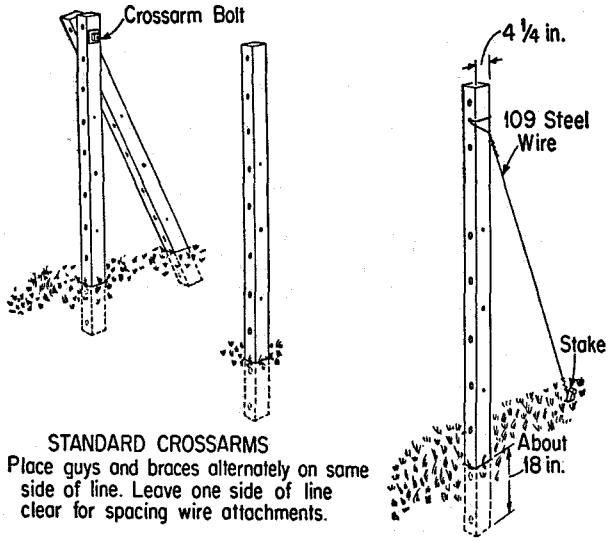
(b) Support wire aerially on poles, trees, buildings or other structures. Such support may be required for protection, to obtain needed ground clearance, or to obtain wire separations made necessary by transmission requirements. In the latter case, if ground clearance is not a factor, wire may be attached to fence posts, or temporary supporting structures may be erected from crossarms or other timbers, as discussed in succeeding paragraphs.

(c) Lay wire on the bottom of lakes or rivers, or through marshes, flood waters, etc. Protection from physical damage should be provided at approaches to the water, and additional protective measures may be required as the wire is exposed by receding flood waters.

(d) Bury wire in ground. If there is no suitable location where the wire may be laid on the ground or supported aerially, protection may be obtained by plowing a shallow furrow and burying the wire. Examples of this possibility might be at train wrecks, fire damage, or other catastrophes where there is much activity.

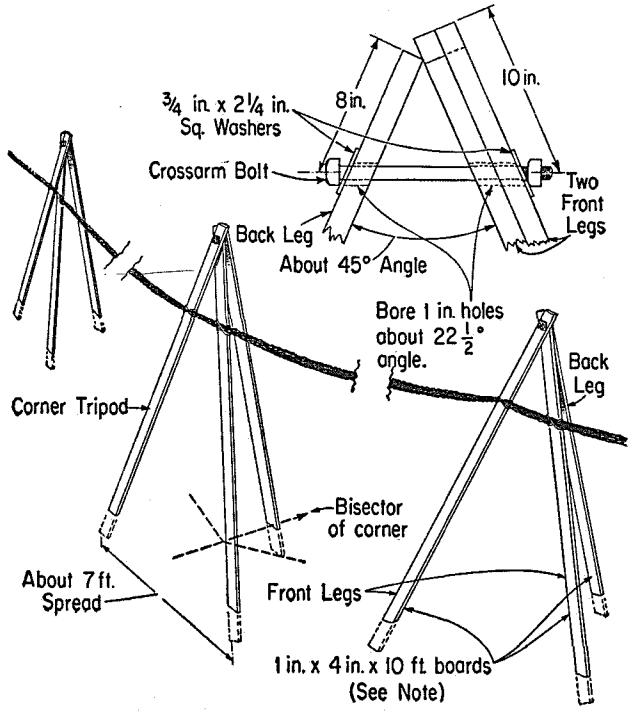
6. TEMPORARY SUPPORTING STRUCTURES

6.01 Crossarms or timbers of similar or larger size may be used to erect a temporary pole line. Side guys or braces should be placed at frequent intervals, particularly if ground is soft. The following sketch illustrates a suggested method for this type of construction:



STANDARD CROSSARMS
Place guys and braces alternately on same side of line. Leave one side of line clear for spacing wire attachments.

6.02 Temporary supporting structures may be constructed from available materials. To obtain added strength from light materials, or to obtain support on rock or hard frozen ground, use may be made of a tripod type of structure. Crossarms may be used in this manner where hole digging is difficult. If crossarms are not available, commercial lumber can usually be readily obtained. One possibility for this type of construction is illustrated in the following sketch.



Note – Tripod used at straight line positions when required for clearance or stability. When available use 2 in. x 4 in. x 10 ft. tripods for corners.

7. DEAD ENDS

7.01 A sound pole of adequate strength should be selected at each end of the break for temporarily dead-ending the undamaged section of the line. Temporary head guys and crossarm guys should be placed at this point.

7.02 The line wire may be dead-ended in accordance with standard practices or in an expedient manner such as wrapping the wire around the insulator and twisting the tail around the main wire. This method should not be attempted with 109E wire and should be used only with extreme caution with 109H wire. The inherent stiffness of these types of wire makes them difficult to form and increases the possibility of a loose wire end flying up and causing an injury.

7.03 Insulated conductors may be bridged directly on the line wire or may be terminated in a wire terminal to provide facilities for opening the circuit for testing.

8. ATTACHING WIRE TO SUPPORTS

8.01 Except where modified by transmission requirements, the usual method of attaching insulated wires to supports will be to "bunch" the wires (tie them together in a group) at the support and secure them to the support with ties. The wires should not be bunched at short intervals, but should be allowed to hang separately between supports, in order to maintain some separation between pairs. Houseline, insulated wire, or friction tape may be used to bunch and attach the wire. Attachments should be made with care to avoid damage to the insulation. Bare wire should not be used for these attachments.

8.02 It will frequently be expedient to bunch all wires initially, in order to establish service as quickly as possible, and later to provide spacing between some of the wires to obtain transmission improvements in certain circuits.

8.03 It may be necessary, for transmission reasons, to attach the paired wires individually at the supports with the maximum practicable separation between pairs.

8.04 In this type of "spaced" construction, the wires should usually be attached to insulators or T knobs, if practicable. Transmission requirements will determine whether insulators or knobs can be omitted. For "spaced" construction, the insulated wire pairs should be attached to the supporting structures with a minimum separation between pairs of four inches.

8.05 Where permitted by transmission requirements, one insulated wire pair will be used for each open wire pair. This is referred to as "Pair-per-Pair" construction.

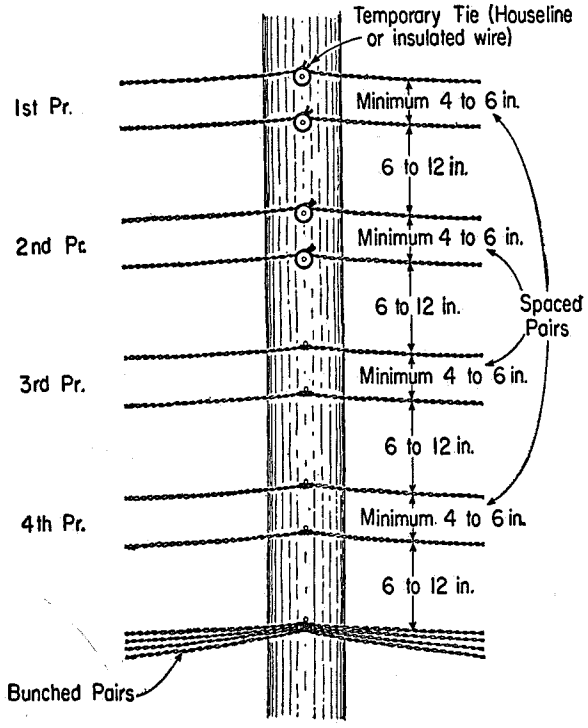
8.06 If C Drop Wire, or other types of parallel wire are used with the Pair-per-Pair method, twists should be placed in the wire in the manner specified in the drop wire practices.

8.07 Under some transmission conditions, it will be necessary to use one insulated wire pair for each open wire conductor. The two conductors of the insulated wire are connected in parallel. This is called "Pair-per-Wire" construction. The paired wires should be attached to supporting structures with a minimum spacing of four to six inches between the wires corresponding to an open wire pair and six to twelve inches between different pairs.

8.08 With Pair-per-Wire construction the wires should be transposed in the same pattern and at approximately the same locations as the open wires which they replace. The testboard will have information available, or can obtain it from the plant engineers, regarding the transposition system in use, or can advise if transpositions can be omitted from the insulated wire.

8.09 Twists are not required in parallel drop wire used in Pair-per-Wire construction.

8.10 An illustration of some of the above types of construction is shown in the following sketch:



9. AUTOTRANSFORMERS

9.01 Transmission requirements may necessitate the use of 24A autotransformers at the junctions between the insulated wire and open wire. Instructions covering the installation and wiring of these autotransformers are contained in other sections of the practices.