

**ORIGINAL**

Decision No. 69071

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

In the Matter of the Application of SOUTHERN CALIFORNIA EDISON COMPANY for an order amending General Order No. 95, "Rules for Overhead Electric Line Construction", to permit the use of polyvinyl chloride conduit under specified conditions.

Application No. 46916  
(Filed August 24, 1964)

Rollin E. Woodbury, Harry W. Sturges, Jr., John R. Bury, by John R. Bury, for applicant. F. T. Searls, John C. Morrissey and Ross Workman, by Ross Workman, for Pacific Gas & Electric Company; Chickering & Gregory, by Sherman Chickering, C. Hazden Ames, and Stanley Jewell, for San Diego Gas & Electric Company; George Harris and Thomas B. Hughes, for Division of Industrial Safety; Patrick J. Burns, for Local Union 18, I.B.E.W.; and M. A. Walters, for Local Union 1245, International Brotherhood of Electrical Workers; interested parties. N. R. Johnson and Eugene S. Jones, for the Commission staff.

O P I N I O N

By this application changes in General Order No. 95 are requested to permit the expanded use of polyvinyl chloride conduit (PVC) as a suitable protective covering.

The matter was heard before Examiner Patterson in Los Angeles on December 9, 1964 and January 27, and 28, 1965, and was submitted upon receipt of statements from applicant and the staff as to the definitive changes each was recommending in General Order No. 95.

In recent years, as improvements have been made in the synthesis and fabrication of plastic materials, the Commission has

authorized the use of certain plastic materials in overhead electric line construction. By Resolution No. E-1088, dated May 1, 1961, the Commission amended Rules 22.2, 54.6-C and 84.6-B. The effect of those amendments, as related to supply lines, was to allow the use of plastic pipe made of rigid unplasticized PVC having the properties specified as Type II, High Impact, in the U. S. Department of Commerce Commercial Standard No. CS 207-60, as a suitable protective covering for conductors in lateral and vertical runs. The use of such plastic pipe was restricted to the light loading district, and Schedule 80 was specified for vertical runs on poles and Schedule 40 was specified for lateral runs under crossarms. The designations Schedule 80 and Schedule 40 denote the required dimensions including wall thickness of plastic pipe in various nominal sizes as enumerated in Commercial Standard CS 207-60. Schedule 40 is considered to be a medium wall pipe and Schedule 80 a heavy wall pipe. The standard also specifies dimensions for an extra heavy wall pipe designated as Schedule 120. The dimensions specified in each of these schedules conform to dimensions used for iron and steel pipe. A former U. S. Department of Commerce Commercial Standard CS 237-61 which has now been withdrawn specified a thin wall type of PVC designated as Schedule A.

Applicant's proposal is to expand the use of Type II, High Impact PVC, so as to permit the use of Schedule A in lateral runs under crossarms; Schedule 40 for use in vertical runs on poles; and Schedule 80 for use as riser conduit in place of iron or steel pipe extending from underground up to a minimum height of 8 feet on the pole. The proposal also includes the use of Schedule A as

a suitable protective covering over metal conduit and the use of 1/16 inch thick plastic moulding as a ground wire covering. In addition the proposal requests that Rule 54.6-D be modified so that a vertical run may extend down a pole to within not less than 6 feet of the ground and terminate in an enclosure such as for a meter or switch and not be treated as a riser.

During the course of the proceeding applicant withdrew its request to use plastic moulding for ground wire covering and modified its proposal so as to specify PVC with a minimum wall thickness of 1/16 inch for lateral runs and as a covering over metal conduit rather than the specifications for Schedule A PVC in the withdrawn Commercial Standard CS 237-61.

Applicant presented in Exhibit 1 the results of tests made on the subject plastic material to determine the effects of exposure to weather, short circuits in wires covered by the plastic, long time overload heat tests and impact by vehicles. It is applicant's position that the results of these tests demonstrate that PVC materials of the specifications and dimensions described are suitable and will provide safe installations for the uses requested.

Applicant's chief distribution engineer testified that use of the plastic material could result in substantial economies arising from savings in both labor and material costs and that the favorable cost differential for riser installations would aid in the current rapid expansion of underground facilities.

Pacific Gas and Electric Company and San Diego Gas and Electric Company presented witnesses in support of applicant's proposal.

A Commission staff engineer who administers General Order No. 95 made a study of applicant's proposal, analysed the results

of tests made on plastic material and presented his conclusions and recommendations in Exhibit 2. He concluded that 1/16 inch PVC moulding is unsuitable for use as a ground wire covering because of its flexibility, expansion when heated, susceptibility to gaff penetration and deformation under impact. He testified further that suitability of the PVC material for conduit use is more dependent on the thickness of the conduit wall than on the schedule number. He recommended that minimum acceptable thickness be established of 0.25 inches for risers, 0.15 inches for vertical runs and 0.10 inches for lateral runs. His selection of 0.25-inch wall thickness for risers is based principally upon consideration of strength requirements necessary to resist impacts caused by vehicles striking risers on poles. He noted that as a result of an impact test made by ramming test installations with a 4-ton truck, one of the Schedule 80 2-inch diameter PVC risers, having a minimum wall thickness of 0.218 inches was cracked. His selection of 0.15-inch wall thickness for vertical runs reflects the fact that such installations, since they do not extend to the ground level, are not subject to the same possibilities of physical damage as risers. To protect such vertical runs from gaff penetration and possible climber cut-outs he recommended that PVC vertical runs be set on spacer blocks. For lateral runs since they are in a protected position underneath crossarms he recommended a lesser minimum wall thickness than for vertical runs but sufficient in his opinion to maintain rigidity under high temperature conditions.

The staff witness indicated that as an alternative to protecting PVC vertical runs by setting them on spacer blocks the runs could be excluded from the climbing space. In the statement

filed at the conclusion of the hearing the staff incorporated this alternative by proposing that plastic pipe be installed only outside the climbing space on poles or structures and in addition specified that when the combined diameters of two or more runs or risers exceed 5 inches such runs or risers should be installed on spacer blocks.

In addition, the staff witness testified that in his opinion a vertical run extending within 8 feet but not less than 6 feet of the ground and terminating in an enclosure which provides ample mechanical protection to the run would not be detrimental to public safety.

The staff witness also recommended that any changes authorized for Section V "Supply Lines" in the General Order should be paralleled by changes in Section VIII "Communication Lines".

In considering the record it may be noted that in general the staff's recommendations are more restrictive than applicant's and, in some instances, are more restrictive than the existing requirements of General Order No. 95. The staff's recommendations seem to be concerned mainly with insuring that installation of plastic materials will not endanger a lineman either through danger of falling as a result of his climbers glancing off or cutting out of the hard PVC material or danger of electric shock if his gaff penetrates the PVC material and contacts a conductor or a grounded metal conduit. The record shows that the plastic material is not easily penetrated but that it can with effort be penetrated by a gaff to a depth of almost 0.25 inches.

Use of PVC for vertical runs and risers would generally result in smaller diameter installations than can be accomplished with other materials, particularly in the upper portion of a metal conduit run which must have an insulating covering. It appears from the record that plastic conduit as small as 1/2 inch nominal diameter may be used for some installations. While small diameter

conduit if installed within the climbing space would present less surface for accidental contact by a lineman, it also because of its small diameter could go unnoticed until accidental contact is made.

According to Exhibit 1, exposure to weather produces increasing embrittlement of PVC with age. There was no specific evaluation of this factor and in the absence of any evidence as to the ultimate effects of embrittlement it will be prudent at this time to continue to restrict the use of PVC to the light loading district and also to require that the plastic pipe have sufficient wall thickness to minimize the effects of eventual embrittlement upon the structural properties of the pipe.

Based upon the entire record we find that use of rigid unplasticized polyvinyl chloride having the properties specified as Type II High Impact, Normal Chemical Resistance in United States Department of Commerce Commercial Standard No. CS 207-60 in the manner and to the extent indicated by the modifications to General Order No. 95 incorporated in the following order will result in no undue hazard nor in a lessening of safety to workmen and to the public.

We also find that the extension of a vertical run to within 8 feet but not less than 6 feet of the ground and terminating in an enclosure which provides ample mechanical protection will result in no undue hazard nor in a lessening of safety to workmen and to the public.

We conclude that General Order No. 95 should be modified to the extent set forth in Appendix A attached to this order.

O R D E R

IT IS ORDERED that this Commission's General Order No. 95, "Rules for Overhead Electric Line Construction" is modified to the extent set forth in Appendix A attached to this order.

IT IS FURTHER ORDERED that the Secretary shall cause a copy of this order and its Appendix A to be served upon each electric and telephone utility subject to the jurisdiction of this Commission and further to cause a suitable number of copies to be made available for distribution to such of the general public as may request the same.

The effective date of this order shall be twenty days after the date hereof.

Dated at Los Angeles, California, this 18<sup>th</sup> day of May, 1965.

Frederick B. Hallock  
President

George T. Crover

Augusta

Commissioners

Commissioner William M. Bennett, being necessarily absent, did not participate in the disposition of this proceeding.

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suitable protective covering specified in Rule 22.2-C shall have a minimum wall thickness of 0.15 inches. Such runs shall be located outside of the climbing and working spaces and shall not pass between conductors of different ownership except between the pole pair and at a clearance therefrom of not less than 6 inches.

Vertical runs, where encased in grounded non-climbable metal poles, grounded metal conduit, sheath, or shield, shall be treated as risers.

Conductors installed in the form of vertical runs which extend within 8 feet of the ground shall be treated as risers. Runs which terminate in the top of enclosures which afford ample mechanical protection to the runs may extend within 8 feet of the ground but not less than 6 feet of the ground without being treated as risers.

The radial clearances between conductors, specified in Table 2, Cases 16 and 17, are not required between suitably insulated conductors in the same vertical run."

#### 4. Rule 54.6-E RISERS

This rule is amended to read as follows:

"Risers from underground cables or other conductors shall be encased in securely grounded iron or steel pipe (or other covering of equal strength) from the ground line to a level not less than 8 feet above the ground line (see App. G, Fig. 61).

Risers from underground cables may be encased in plastic pipes in lieu of the grounded iron or steel pipe required by this rule, provided that risers of circuits in excess of 750 volts shall have an effectively grounded metallic shield. Such plastic pipe shall be of material as specified in Rule 22.2-C, designated as Schedule 80, with a minimum nominal pipe size of 2-1/2 inches, or Schedule 120 with a minimum nominal pipe size of 2 inches.

Any riser on the surface of a pole or not more than 18 inches from the center line of a pole shall be covered by a suitable protective covering where within a vertical distance of 8 feet from the level of communication conductors (including cables) or unprotected supply conductors (including leads from the terminal) supported by the same pole or where within a radial distance of 6 feet from conductors not supported by the same pole.

Any riser more than 18 inches from the center line of a pole shall be covered by a suitable protective covering, or by securely supported impregnated fiber conduit without metal pipe, where within a vertical distance of 8 feet from the level of communication conductors (including cables)



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The rules of General Order No. 95 are modified, amended or added to as set forth below:

## 1. Rule 22.2-C

This rule is amended to read as follows:

"PLASTIC PIPE made of rigid unplasticized polyvinyl chloride having the properties and dimensions specified as Type II, High Impact, Normal Chemical Resistance in United States Department of Commerce Commercial Standard No. CS 207-60. The plastic pipe herein specified shall be installed only outside the climbing space on poles or structures within the light loading district as defined in Rule 21.0-C and Rule 43."

## 2. Rule 54.6-C LATERAL CONDUCTORS

Paragraph (1) of this rule is amended to read as follows:

"(1) CONDUCTORS OF 0-750 VOLTS; Lateral runs of conductors of 0-750 volts may be less than the clearances from center line and surface of pole, and from the surface of crossarm, as specified in Table 1, Cases 8 and 9, provided such conductors are suitably insulated and placed along the bottom surface of crossarms and are protected by wood moulding or impregnated fiber conduit of thicknesses not less than as specified in Rule 22.2, or are protected by plastic pipe having the properties of the material designated as Type II in the standard specified in Rule 22.2-C. The plastic pipe shall have a minimum wall thickness of 0.10 inches."

## 3. Rule 54.6-D VERTICAL RUNS

This rule is amended to read as follows:

"Conductors installed in the form of vertical runs on the surface of poles or not more than 18 inches from the center line of a pole shall be suitably insulated and covered throughout by a suitable protective covering (See Rule 22.2 for the definition of a suitable protective covering). The plastic pipe specified in Rule 22.2-C shall have a minimum wall thickness of 0.15 inches. This protective covering is not required over vertical runs in metal conduit attached to metal poles, towers or other structures provided pipe and structure are metallically connected and effectively grounded."

Conductors in the form of vertical runs more than 18 inches from the center line of any pole shall be suitably insulated and covered by a suitable protective covering or by securely supported impregnated fiber conduit without metal pipe. The

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or unprotected supply conductors (including the leads from the terminal) supported by the same pole or within a radial distance of 6 feet from conductors not supported by the same pole.

The portion of any riser between the insulating covering required on the upper section and the metal or plastic covering required on the lower section by the foregoing shall be covered by the extension of either or both of such coverings. Where fiber conduit over metal pipe is used as a protective covering, the fiber conduit shall not extend within 8 feet of the ground line and shall be installed in a workmanlike manner and securely supported in order to prevent it from slipping downward and exposing any upper sections of the metal pipe.

The radial clearances between conductors, specified in Table 2, Cases 16 and 17, are not required between suitably insulated conductors in the same riser.

Protective covering (suitable) is not required over risers encased in effectively grounded non-climbable metal poles or in iron or steel pipe attached to a steel pole, tower or other metal structure, provided the iron or steel pipe is effectively grounded and is metallically connected to such metal structure."

## 5. Rule 54.8-C(2)

This rule is amended to read as follows:

"(2) ON CLEARANCE CROSSARMS: Supply service drops may be supported on a clearance crossarm at a vertical distance less than 48 inches (specified in Table 2, Case 8, Column D, and Case 9, Column C) but not less than 24 inches above or below either supply circuits of 0-750 volts or communication circuits not supported on a messenger, or above communication or supply circuits which are supported on a messenger, provided the supply service drop unprotected conductors are at least 25 inches horizontally from the center line of the pole or are attached to suitable brackets (at least 25 inches from center line of pole) on each end of the clearance arm and carried on the underside of the clearance arm from end to end in fiber or plastic conduit or under wood protective covering as specified in Rule 54.6-C.

The installation of service drops in accordance with this rule will not entail any change in the communication conductors supported on the pole. (See App. G, Fig. 40.)"

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## 6. Rule 84.6-D VERTICAL RUNS

The first paragraph of this rule is amended to read as follows:

Vertical runs of Communication wires or cables supported on the surface of wood poles or structures, shall be covered by a suitable protective covering (see Rule 22.2) where within a vertical distance of 3 feet above or 6 feet below unprotected supply conductors supported on the same pole or structure. Vertical runs of communication wires or cables on the surface of a wood pole shall be covered by a suitable protective covering where within a 6-foot radius of any other pole supporting supply conductors except that those portions of such runs which are more than 3 feet above or 6 feet below the level of unprotected supply conductors need not be covered. The plastic pipe specified in Rule 22.2-C shall have a minimum wall thickness of 0.15 inches. Cable and drop wire runs to or from terminal boxes are excepted from these requirements for covering, under the following conditions:

The remainder of Rule 84.6-D is unchanged except the following paragraph is added:

Runs which terminate in the top of enclosures which afford ample mechanical protection to the runs may extend within 8 feet of the ground but not less than 6 feet of the ground without being treated as risers."

## 7. Rule 84.6-E Risers

The first two paragraphs of this rule are amended to read as follows:

"Risers of wires or underground cables shall be encased in securely grounded iron or steel pipe (or other covering of equal strength) from the ground line to a level not less than 8 feet above the ground line. Risers from underground cables of Class C circuits may be encased in plastic pipes in lieu of the grounded iron or steel pipe required by this rule. Such plastic pipe shall be of material as specified in Rule 22.2-C, designated as Schedule 80, with a minimum nominal pipe size of 2-1/2 inches or Schedule 120, with a minimum nominal pipe size of 2 inches.

Risers shall be covered by a suitable protective covering as defined in Rule 22.2, where within a vertical distance of 3 feet above or 6 feet below the level of unprotected supply conductors supported on the same pole or structure."

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8. Rule 84.8-D(2)

This rule is amended to read as follows:

'(2) ON CLEARANCE CROSSARMS: Communication service drops may be supported on a clearance crossarm at a vertical distance less than as specified in Table 2, Case 9, Column C (48 inches), but not less than 24 inches above or below supply circuits of 0-750 volts, or above supply cables when treated as in Rule 57.8, provided the communication service drop conductors are at least 25 inches horizontally from the center line of pole or are attached to suitable brackets on each end of the clearance arm and carried on the underside of the clearance arm from end to end in fiber or plastic conduit or under wood protective covering as specified in Rule 54.6-C.

Service drops installed in accordance with this rule will not entail any change in the supply conductors supported on the pole.'

9. Appendix G, Figure 61

The note in reference to metal conduit on this figure is amended to read as follows:

'Metal conduit or plastic pipe must be carried at least 8 feet above ground.'

(End of Appendix A)