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ORIGINAL

Decision No. 71094

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

In the Matter of the Application of PACIFIC GAS AND ELECTRIC COMPANY for an order amending General Order No. 95 so as to permit the use of 12/20.8 kv four-wire wye common neutral overhead electric distribution lines. (Electric)	Application No. 47540

F. T. Searls, John C. Morrissey and Ross Workman, for applicant.
Brundidge & Hackler, by Daniel Feins, assisted by M. A. Walters, for IBEW Local Unions; interested parties.
N. R. Johnson, for the Commission staff.

OPINION ON REHEARING

By its application filed April 30, 1965, applicant sought amendment of this Commission's General Order No. 95 in order to permit the use of "12/20.8 kv four-wire wye common neutral overhead electric distribution lines." After public hearing the Commission, on March 29, 1966, issued Decision No. 70489 by which a large number of the rules of General Order No. 95 were amended or modified in such manner as would permit the proposed type of construction.

On April 15, 1966, the International Brotherhood of Electrical Workers Locals Nos. 18, 47, 465, 1245 (IBEW) petitioned for a rehearing of the matter, claiming, in essence, that certain of the clearances provided by the rules as amended would result in increased hazards to workmen, that the Commission had acted arbitrarily and contrary to the evidence and that petitioner had

not been afforded an opportunity to present evidence respecting the effect of such reduced clearances.

On April 18, 1966, applicant Pacific Gas and Electric Company (PG&E) also petitioned for rehearing and asked that the Commission either clarify that portion of its opinion respecting a definition of "voltage" or modify the decision so as to permit common-neutral system voltages of 22,000 volts.

The Commission granted rehearing on May 17, 1966, and on June 13, 1966 rehearing was held before Examiner Emerson at San Francisco, at the conclusion of which the matter was again submitted.

The rehearing consisted primarily of an exchange of views between the Examiner, counsel, staff and engineering experts, all as a matter of further clarifying the respective positions of the parties, and concluded with an agreement among the parties as to the extent of the required modification of the General Order. Such agreement may be summarized by stating that the IBEW opposes any modification of Table 2 clearances and that PG&E finds that modification of Table 2 is not needed in order to put the proposed common-neutral system to practical use. The record developed the fact that the so-called "12/20.8 kv" system may, during temporary conditions, actually reach a maximum voltage (between phase conductors) of somewhat more than 22,000 volts, a situation not disclosed by PG&E at the original hearing. Staff experts suggest that in view of the existing definition of "voltage" (Rule 23.2) and the Commission's apparent intent to authorize the use of the proposed system in California, the practical point at which voltage classifications should change, in order to provide for this type of system, should be 22,500 volts instead of the 21,000 volts authorized by Decision No. 70489.

In view of the entire record in this proceeding the Commission finds and concludes that Decision No. 70489 heretofore issued in this matter should be modified to the extent set forth in the following order. It should be particularly noted that no changes in Table 2 clearances are being authorized herein.

O R D E R

IT IS ORDERED that Decision No. 70489 is modified as follows:

1. Finding No. 1 in the opinion of said decision is hereby modified to read: "The public interest, including safety to workmen and the public generally, will not be adversely affected by the use of common-neutral systems up to but not above a circuit voltage of 22,500 volts."

2. Appendix A, attached to said decision is hereby replaced in toto by the appendix attached to this order, which latter appendix as a matter of convenience will be titled "Appendix B".

IT IS FURTHER ORDERED that in all other respects Decision No. 70489 shall remain in full force and effect.

The effective date of this order shall be the date hereof.

Dated at San Francisco, California, this 9th day of AUGUST, 1966.

President

Commissioner Frederick B. Holoboff, being necessarily absent, did not participate in the disposition of this proceeding.

Commissioner A. W. Gatov, being necessarily absent, did not participate in the disposition of this proceeding.

Commissioners

APPENDIX B

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

1. Rule 20.7

This rule is amended to read as follows:

"COMMON NEUTRAL SYSTEMS mean those electrical supply distribution systems wherein the same specially grounded conductor is utilized as a neutral conductor of primary circuits of less than 22,500 volts and secondary circuits of 0-750 volts supplied therefrom."

2. Rule 32.4-A2

This rule is amended to read as follows:

"(2) 0-750 VOLTS AND MORE THAN 7500 VOLTS: Supply circuits of 0-750 volts shall not be carried on the same cross-arm with circuits of more than 7500 volts, except that, on transformer structures, bus conductors of 0-750 volts and bus conductors of 7500-22,500 volts may be supported on opposite ends of the same bus-supporting timbers provided the horizontal separation between conductors of different classifications supported on the same arm is not less than 36 inches, the bus conductors of 7500-22,500 volts are not extended longitudinally as line conductors, service drops are not supported on arms which support conductors of 7500-22,500 volts, and conductors on related buck arms are not less than 4 feet vertically from such bus timbers."

3. Rule 33.1

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

"Neutral conductors of supply circuits, other than in distribution systems of 22,500 volts or less with common primary and secondary grounded neutrals, shall be considered as carrying the same voltage as the other conductors of the circuit."

4. Rule 37, Table 1.

The heading of Column E of Table 1 is amended to read: "Supply conductors and supply cables, 750-22,500 volts."

The heading of Column F of Table 1 is amended to read: "Supply conductors and supply cables, more than 22,500 volts."

References to "20,000" volts in footnotes p and t are amended to read "22,500 volts."

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5. Rule 33.3-B

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

"Ground connections for equipment of any one of the types listed in Rule 33.3-A shall not be interconnected with ground connections for equipment of any other type listed therein, except:
In common neutral systems the neutral conductors of 0-750 volt supply circuits and of supply circuits of 750-22,500 volts may be interconnected and grounded in accordance with the provisions of Rule 59; and"

6. Rule 51.6-A

Beginning with the third paragraph of this rule, the rule is amended to read as follows:

"The provisions of this Rule, 51.6-A, shall not apply to the marking of poles at the levels of supply circuits of more than 22,500 volts in rural districts.

See Rule 65 for the marking of towers."

7. Rule 52.4-B2c

This rule is amended to read as follows:

"c) Supporting Conductors of 7500-22,500 Volts at Certain Locations: At all crossings over public thoroughfares and at locations adjacent to structures such as water tanks, windmills and buildings, adjacent to wells, and at similar locations, crossarms supporting conductors of 7500-22,500 volts shall be marked as high voltage."

8. Rule 52.4B2e

This rule is amended to read as follows:

"e) Supporting Conductors of 7500-22,500 Volts on the Same Structure with Conductors of 750 Volts or Less: Where, on the same structures in rural districts, crossarms supporting conductors of 7500-22,500 volts are above conductors of 750 volts or less, the crossarm supporting conductors of 7500-22,500 volts next above the conductors of 750 volts or less shall be marked as high voltage. All crossarms supporting conductors of 7500-22,500 volts below conductors of 750 volts or less supported on the same structures shall be marked as high voltage."

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9. Rule 52.4-B3

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

"(3) ON GUARDED METAL POLES: On latticed metal poles which are guarded with barriers as required in Rule 51.6-B, the following crossarms shall be marked as high voltage:
Crossarms supporting conductors of 750-7500 volts;
Crossarms supporting conductors of 7500-22,500 volts next above the level of conductors of 7500 volts or less;
Crossarms supporting conductors of 7500-22,500 volts below the level of conductors of 7500 volts or less; and
Crossarms supporting any conductor of more than 7500 volts within 15 feet of walls, fire escapes, exits, windows and similar objects."

10. Rule 54.4-A1

The first sentence of this rule is amended to read:

"(1) ACROSS ARID OR MOUNTAINOUS AREAS: Across arid or mountainous areas supply circuits carrying 22,500-30,000 volts, inclusive, may have a clearance of less than 30 feet (Table 1, Case 4, Column F) but not less than 25 feet above ground subject to a reduction of not more than 10 per cent because of temperature and loading as specified in Rule 43."

11. Rule 54.4-A2a

This rule is amended to read:

"a) Crossing Roads or Driveways: In rural districts the minimum clearance of 25 feet specified in Table 1, Case 3, Column E may be reduced to 22 feet above ground for conductors not exceeding 20,000 volts crossing or overhanging traversable portions of public or private roads or driveways. This modified minimum clearance of 22 feet shall in no case be reduced because of temperature or loading at conditions less than maximum loading or temperature specified in Rules 43.1 and 43.2."

12. Rule 54.4-A2b

The first sentence of this rule is amended to read:

"b) Above Agricultural Areas and Along Roads: In rural districts the minimum clearance of 25 feet specified in Table 1, Case 4, Column E may be reduced to 18 feet above ground for lines not exceeding 20,000 volts across areas capable of being traversed by agricultural equipment and along roads where no part of the line overhangs any traversable portion of a public or private roadway."

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13. Rule 54.4-C4c

The figures "750-20,000 volts" in this rule are changed to read "750-22,500 volts".

14. Rule 54.4-D2

The figures "7500-20,000 volts" in the second paragraph of this rule are amended to read "7500-22,500 volts".

15. Rule 54.4-D8b

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

"b) More than 7500 Volts: A single conductor of a circuit of more than 7500 volts may be attached directly to the top of a pole or to a crossarm at the top of a pole at a distance less than as specified in Table 1, Case 8, provided no apparatus carried on the pole is connected to the circuit so arranged except lightning arresters, a pole-top switch, or a transformer. Where a transformer is connected to a circuit so arranged, a vertical clearance of not less than 30 inches shall be maintained between the primary conductor directly above and the unenergized metal parts of the transformer, as specified in Rule 58.3-B3c."

16. Rule 54.4-H2

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

"(2) ATTACHED CONDUCTORS: Unprotected conductors not exceeding 22,500 volts may be supported by attachments to buildings, bridges and other structures. To conductors of 0-750 volts so supported, the clearances of Table 1, Case 7, Column B, C and D shall apply. To conductors of 750-22,500 volts so supported a minimum horizontal clearance of 8 feet shall apply."

17. Rule 54.4-I

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

"Conductors of 0-22,500 volts, passing under or through bridges, viaducts or similar structures, may be attached thereto in accordance with the provision of Rule 54.4-H2."

18. Rule 54.6-F

The fourth paragraph of this rule is amended by replacing the phrase "(750-20,000 volts in vertical configuration on non-climbable poles)," with the phrase "(750-22,500 volts in vertical configuration on non-climbable poles)."

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19. Rule 56.4-E

This rule is amended to read as follows:

"Where passing guys are less than 15 inches from surface of pole and less than 8 feet below supply conductors of less than 22,500 volts supported on the same pole, such guys shall be sectionalized, in addition to the normal sectionalization required by Rule 56.6, by means of insulators in accordance with Rule 56.6-A as though attached to the pole or structure."

20. Rules 56.6-A, 56.6-B, 56.6-D, 56.6-E

In these four rules, each time the figures "20,000" appear said figures are amended to read "22,500".

21. Rule 58.3-B3 e (New Rule)

The general order is amended by adding thereto the following new section to Rule 58.3-B3:

"e) From 7500-22,500 Volt Conductors Above: The clearance between unenergized metal parts of transformers and 7500-22,500 volt conductors above shall be not less than 18 inches vertically or 18 inches horizontally except that the vertical clearance shall be not less than 30 inches from a conductor at the top of pole as in Rule 54.4-D8b."

22. Rule 58.3-E (New Rule)

The general order is amended by adding thereto the following new section to Rule 58.3:

"E. CONNECTIONS BETWEEN WINDINGS
Any metallic connection between the primary and secondary windings of a distribution transformer (as in common neutral systems) shall be made externally and not within the transformer case."

23. Rule 59.2

This rule is amended to read as follows:

"The following rules cover certain special details for common neutral systems where the neutral conductor is common to primary circuits of less than 22,500 volts and secondary circuits of 0-750 volts supplied therefrom. These rules are supplemental to the rules given for supply lines in general and to other detailed construction requirements for supply lines."

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24. Rule 59.3-B, Table 14

Table 14 in Rule 59.3-B is amended by inserting therein a primary conductor size of 715,500 circular mils and a related neutral conductor size of 350,000 circular mils.

25. Rule 59.3-D

This rule is amended to read as follows:

"D. NEUTRAL CONDUCTORS

The arrangement and continuity of common neutral conductors shall conform to the following requirements:

Cross ties of the neutral conductor shall be made to form a continuous interconnected grid network and there shall be not less than two separate and continuous metallic return conductors from the grid network to the substation constituting the source of supply thereto.

If two return conductors only are used, each shall have a minimum conductivity of approximately 50 per cent of the conductivity of the primary phase conductor of the largest overhead feeder serving the area (see Table 14 of Rule 59.3-B for minimum sizes).

If more than two return conductors are used the current-carrying capacity of the return system shall be such that a break in any one path shall leave two or more return paths which, combined, shall have a minimum conductivity of approximately 50 per cent of the conductivity of the primary phase conductor of the largest overhead feeder serving the area thus providing adequate current-carrying capacity for full load current (see Table 14 of Rule 59.3-B for minimum sizes).

Primary neutral conductors or secondary neutral conductors, where continuous, may be used as a return loop from a common neutral provided they are of sufficient current-carrying capacity as specified in Rule 59.3-B and provided that they are grounded throughout in accordance with the requirements for common neutral line conductors as specified in Rule 59.4-B. Primary or secondary neutral line conductors so used shall be carried in their normal primary or secondary positions, respectively."

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26. Rule 59.4-A2

This rule is amended to read as follows, with sections a) and b) thereof thus being deleted:

"(2) GROUND ELECTRODES: Ground electrodes on common neutral systems shall be one-piece corrosion-resisting metal rods or pipes (or equivalent in physical and electrical properties) not less than 5/8-inch in diameter by 8 feet in length and driven to a minimum depth of 8 feet below the surface of the ground. Pole-butt plates or wrappings shall not be used either in lieu of the aforesaid rods or pipes or as electrodes supplementary thereto.
The driven ground rod, pipe or equivalent shall be located not less than 2 feet from the surface of the pole. Where two or more such rods are installed, they shall be located at not less than 6-foot centers and the separation required from the surface of the pole shall not be held to apply to the connection between rods."

27. Rules 59.4-A2a and 59.4-A2b are deleted.

28. Rule 59.4-B1

This rule is amended to read as follows:

"(1) LOCATION: The common neutral grid system shall be grounded at intervals not greater than 1000 feet. On branch circuits extending from a grid, where return loop paths are not available, the common neutral line conductor shall be grounded at intervals not greater than 500 feet. Each transformer installation on a branch circuit without a loop return shall be so located that there will be one or more grounds, of a combined resistance not greater than 3-1/2 ohms, on each side of the transformer installation."

29. Rule 59.4-C

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

"On common neutral systems, each transformer installation on a branch circuit without a loop return shall be so located that there will be one or more grounds, of a combined resistance not greater than 3-1/2 ohms on each side of the transformer installation."

30. Rule 86.4-E

The figure "20,000 volts" in this rule is amended to read "22,500 volts".

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31. Rule 86.6-A
Rule 86.6-B
Rule 86.6-C
Rule 86.6-D

In each of these rules, the figures "20,000" are amended to read "22,500".

32. Rule 86.7-A1
Rule 86.7-A2

In each of these rules, the figures "20,000" are amended to read "22,500".

33. Appendix G
The illustrative diagrams in Appendix G are modified as follows:

Fig. 6 The figures "20,000 volts" are changed to read "22,500 volts".

Fig. 43 The primary conductor level is changed from "More than 750 Volts" to "750-20,000 Volts".

Fig. 45) All references to "20,000 volts" are
Fig. 46) changed to read "22,500 volts".
Fig. 47)
Fig. 52)

Fig. 87 Change "750-20,000 volts" to read "750-22,500 volts".

END OF AMENDMENTS