

Public Utilities Commission
State of California

June 9, 1976

Mr. George Mocharko
Office of Pipeline Safety Operations
2100 Second Street S.W.
Washington, D.C. 20590 (MTP-30)

File No. : G.O. 112-C

Subject: Docket No. CA76-1, Request for Waiver of Section 192.455 (a) of Part 192, 49 CFR Relating to Use of Stainless Steel AMP-FIT Fittings.

Dear Mr. Mocharko:

In accordance with your telephone conversation today with Mr. Irving Hogan of the Commission's staff, a copy of subject request, together with the supporting technical data received from the operator (Pacific Gas and Electric Company), is forwarded herewith.

Please note that this Commission has not yet acted upon subject request and that the enclosed material is being furnished only as advance information in the hope that it may prove useful to you in your rule-making activities concerning stainless steel fittings.

This Commission and its staff are pleased to provide this material and would be happy to furnish any additional information which you might want.

Very truly yours,

PUBLIC UTILITIES COMMISSION

By (*signature*)
WILLIAM R. JOHNSON
Executive Director

Enclosure
No copies of the enclosure were in the file.

Public Utilities Commission
State of California

File No. G.O. 112-C

October 6, 1976

(Received 10/08/76)

Mr. Cesar DeLeon, Acting Director
Office of Pipeline Safety Operations
Materials Transportation Bureau
Department of Transportation
Washington, D.C. 20590

Subject: Docket No. CA76-1, Request for Waiver of Section 192.455 (a), Part 192, 49 CFR, Relating to Use of Stainless Steel AMP-FIT Fittings.

Dear Mr. DeLeon:

In conformance with Section 3 (e) of the Natural Gas Pipeline Safety Act of 1968 we are enclosing a copy of this Commission's Resolution No. G-1967, dated October 5, 1976, which grants to the Pacific Gas and Electric Company (PG&E) a waiver of Section 192.455 (a), Part 192, Title 49 CFR. Specifically, the waiver authorizes the use of plastic pipe connectors made of Type 316 non-sensitized stainless steel without coating or cathodic protection.

Also enclosed are a copy of PG&E's original petition, dated May 11, 1976, together with the text of the report which accompanied that petition; a copy of PG&E's letter of additional information, dated June 23, 1976, which was requested by the Commission staff; and a copy of the staff's Memorandum to the Commission, dated October 5, 1976, which explains the basis for the staff's recommendation that the waiver be granted. The photographic portion of PG&E's report has previously been transmitted to Mr. George Mocharko of your office by our letter of June 9, 1976.

Please note that Resolution No. G-1967 calls for a statistical sample of those connectors in service three years after its effective date to be excavated and examined for corrosion. If no corrosion is found, the type of sampling specified in the Resolution would provide a 95-percent "level of confidence" that less than 0.949 percent of all connectors in service could show any evidence of corrosion. The Commission staff believes that such further testing is desirable regardless of the outcome of the proposed rulemaking currently under consideration in your Docket No. OPSO-37.

You will further note that the Resolution limits the connector size to a maximum of two-inch nominal and the operating pressure to 60 psig. These conservative limitations were imposed primarily because they represent the maxima expected to be encountered by PG&E in its system. However, the size limitation also reflects the staff's opinion that smallness is an important factor in corrosion prevention.

If your office agrees to the granting of subject waiver, we would appreciate being advised as soon as possible so that PG&E can be allowed to proceed with its stainless steel program.

Very truly yours,

PUBLIC UTILITIES COMMISSION

By (*signature*)
WILLIAM R. JOHNSON
Executive Director

Enclosures

Enclosure to the incoming letter dated 10/06/76 from the Public Utilities Commission

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Copy for:
Orig. and Copy
..... to Executive Director
..... Director

RESOLUTION NO. G-1967

R E S O L U T I O N

UTILITIES DIVISION
BRANCH/SECTION: Gas
DATE: October 5, 1976

..... Numerical File
..... Alphabetical File
..... Accounting Officer

Order Authorizing Deviation from Section 192.455 (a) of General Order No. 112-C,
SUBJECT: Rules Governing Design, Construction, Testing, Maintenance and Operation of Utility Gas
Gathering, Transmission and Distribution Piping Systems.

WHEREAS: Section 3 (e) of the Natural Gas Pipeline Safety Act of 1968 authorizes any State agency certified under Section 5 (a) to waive compliance with any standard if the agency determines that the waiver is not inconsistent with gas pipeline safety; and

WHEREAS: The Pacific Gas and Electric Company, by letter dated May 11, 1976, requests that it be granted a deviation from Section 192.455 (a) of General Order No. 112-C, which requires that each buried pipeline installed after July 31, 1971 be coated and cathodically protected within one year after completion of construction; and

WHEREAS: The utility has provided the Commission staff with a study it has made demonstrating the non-corrosive properties of uncoated and unprotected Type 316 non-sensitized (annealed) stainless steel, which it has used for approximately 500,000 plastic pipeline connector installations; and

WHEREAS: The Commission, as a result of its staff's analysis and evaluation of said study, concludes that coating and cathodic protection of said steel in said application are not necessary for gas pipeline safety, and that compliance with said portion of the General Order would be inordinately expensive with no appreciable increase in pipeline safety; therefore, good cause appearing,

IT IS ORDERED that the Pacific Gas and Electric Company is hereby granted the requested deviation from Section 192.455 (a) of General Order No. 112-C for plastic pipe connector sizes up to and including two-inch nominal and for operating pressures up to and including 60 pounds per square inch gauge.

IT IS FURTHER ORDERED that three years from the effective date hereof the utility shall excavate and examine for corrosion a sample of the connectors then in operation, and shall report to the Commission the results of such examination. Such sampling shall be in accordance with Military Standard 105D, using General Inspection Level I, Double Sampling, and an Acceptable Quality Level of 0.10 Percent. The effective date of this order shall be sixty-five days from the date of adoption shown below.

Pursuant to the requirements of Section 3 (e) of the Natural Gas Pipeline Safety Act of 1968, a copy of this Resolution shall be forwarded to the Office of Pipeline Safety Operations, Department of Transportation, Washington, D.C. 20590.

I hereby certify that the foregoing Resolution was duly introduced, passed and adopted at a regular conference of the Public Utilities Commission of the State of California, held on the 5th day of October, 1976, the following Commissioners voting favorably thereon:

D.W. HOLMES, President
WILLIAM SYMONS, JR., VERNON L. STURGEON
LEONARD ROSS, ROBERT BATINOVICH, Commissioners

William R. Johnson (signature)
Executive Director

State of California
MEMORANDUM

File No.: G.O. 112-C
Date: October 5, 1976
Conference

To: THE COMMISSION
Subject: Order Authorizing Deviation
from Section 192.455 (a) of
General Order No. 112 -C
Requiring Resolution

From: Public Utilities Commission-San Francisco -- G.L. Way, Chief Gas Engineer

ISSUE: Granting of authority to Pacific Gas and Electric Company (PG&E) to deviate from Section 192.455 (a) of General Order No. 112-C and to install and operate certain underground gas pipeline components without coating or cathodic protection when such components are constructed of Type 316 stainless steel.

FACTS: PG&E, by letter of May 11, 1976, has requested authority to deviate from Section 192.455 (a) of General Order No. 112-C, which requires all gas pipeline installations made after July 31, 1971, to be coated and cathodically protected. PG&E asks, specifically, to be allowed to use Type 316 non-sensitized (annealed) stainless steel plastic connector fittings underground without cathodic protection, and has submitted a report describing a test program involving some 200 such installations. The Commission staff has analyzed the report and additional information submitted by PG&E.

DISCUSSION: The finding of major importance in PG&E's test program is that none of the 200 installations examined showed any evidence of corrosion. This, together with other information submitted, is presented in greater detail in the attached additional discussion.

CONCLUSIONS AND RECOMMENDATIONS: Based on its evaluation of the data submitted, the staff concludes that Type 316 non-sensitized (annealed) stainless steel can be used for underground pipeline components without coating or cathodic protection.

The staff recommends that the deviation be granted. The required resolution, including conditions deemed necessary by the staff, has been prepared for the Commission's approval and is attached hereto.

IJH:ST
Attachments

Attachment to the State of California

memorandum dated 10/05/76

ATTACHMENT

ADDITIONAL DISCUSSION: PG&E had been utilizing plastic connectors incorporating non-sensitized (annealed) Type 316 stainless steel parts since 1969, following extensive testing by its Engineering Research Department. After July 18, 1972, when the cathodic protection requirement became part of G.O. 112-C, the company continued their use under the misapprehension that the stainless steel rings employed in these connectors were not subject to the new regulations since the rings were not a pressure-carrying part of the system. Until June, 1975, when their use was discontinued, PG&E had installed over 500,000 such connectors throughout its system.

In support of its request, PG&E has submitted a report describing the results of its examination of some 200 such installations which have been in service from one to five years throughout the PG&E system. About 50 of these connectors had been installed bare, and the remainder had been wrapped with protective tape. The soil encountered at each location was tested for electrical resistivity and for acidity. Resistivity of the soils tested

ranged from 500 to over 25,000 ohm-centimeters, and pH from 2.6 to 9.9. These values represent soils ranging from highly corrosive to non-corrosive. The report indicates that none of the 200 fittings examined showed any signs of corrosion.

In its request, PG&E also points out that the small size of the stainless steel parts used in these connectors would mitigate against any electrolytic corrosion occurring. In order for buried metal to experience this type of corrosion, different portions of the metal must be in contact with soils of differing electrical characteristics; this is extremely unlikely, given the smallness of the connectors metallic parts (largest dimension varies from less than one inch to three inches).

At the staff's request, PG&E has submitted additional information regarding the economic feasibility of the several available alternatives to the deviation being sought. Cathodic protection of all existing installations would cost about \$19,600,000 plus \$380,000 annually. Replacement with heat-fusion plastic joints would cost approximately \$18,500,000. Cathodic protection of future stainless steel installations would cost about \$1,800,000 per year, while making all future installations of heat-fusion plastic would cost approximately \$230,000 more per year than the cost of unprotected stainless steel.

Coincidentally with the receipt of PG&E's deviation request, a report was received from Southern California Gas Company (SCG) describing that company's three-year test program for unprotected Type 316 stainless steel service risers. The results of SCG's testing support those of PG&E and have been considered by the staff in its evaluation of PG&E's request.

The staff has come to the following conclusions:

- (1) Type 316 non-sensitized (annealed) stainless steel can provide corrosion-free service in underground pipeline components without coating or cathodic protection.
- (2) The cost of either cathodically protecting PG&E's existing stainless steel installations or replacing them with heat-fusion plastic joints cannot be justified on the grounds of public safety.
- (3) While the increased cost of using heat-fusion joints in all future installations is not very great compared to that for stainless steel fittings, there appears to be no real safety advantage in using heat-fusion. In fact, there may be some safety advantage in the stainless steel fittings, since less skill is required by the workmen performing the installation.
- (4) From the theoretical standpoint, electrolytic corrosion of the stainless steel connectors should be extremely unlikely, due to the small size of the metallic parts involved.
- (5) The excellent results of SCG's three-year test of Type 316 stainless steel service risers corroborates and supports the staff's opinion of the suitability of this metal for unprotected underground pipeline components.
- (6) PG&E's request for this deviation should be granted, conditioned on the company's examining a representative sample of the connectors in service after an additional three years and reporting the results of such examination to the Commission.

Attachment to the State of California

memorandum dated 10/05/76

PACIFIC GAS AND ELECTRIC COMPANY

77 Beale Street San Francisco, California 94106 (415) 781-4211

June 23, 1976

(Received 06/24/76)

Public Utilities Commission
State of California
State Building, Civic Center
350 McAllister Street
San Francisco, CA 94102

Re: Additional Information in Support of
Deviation from Section 192.455 (a)
CPUC General Order No. 112-C

Gentlemen:

As requested in your May 19, 1976 letter, the following additional information is submitted to support the Pacific Gas and Electric Company request for a deviation from Section 192.455 (a) of General Order 112-C. Answers to the specific questions in your letter are as follows:

QUESTION 1a: State the reason(s) why it would be impracticable to bring into compliance the stainless steel fittings already installed.

1. It would cost approximately \$19,600,000 (Attachment III, Page 2) to provide cathodic protection for the existing AMP-FIT fittings, to comply with Section 192.455 (a) of General Order 112-C. Also, there would be a continuing annual expense of about \$381,400 to monitor the level of protection on these fittings, to comply with Section 192.455 (a).
2. It would cost approximately \$18,501,600 (Attachment III, Page 1) to replace the AMP-FIT fittings with heat fusion fittings which have no metallic parts and require no cathodic protection.

While either of the above alternatives would bring the installed AMP-FIT fittings into compliance with the requirements of Section 192.455 (a), the expenditure would not result in any increase in public safety. For this reason, we believe that compliance is impracticable.

QUESTION 1b: State the reason(s) why it would be impracticable to make all future installations in compliance with subject section.

1. Cost is the primary reason for not making future installations of AMP-FIT fittings in compliance with Section 192.455 (a) of General Order 112-C. The additional installed cost per fitting would be:

Cost of Cathodic Protection	\$ 3.70 Attachment IV
Cost of Provisions for Future Monitoring	<u>14.15</u> Attachment IV \$17.85

This is more than 7 times the cost of the average AMP-FIT joint, which is estimated to be \$2.34 (Attachment II, Page 2). Based on an estimated usage of 100,000 units per year, it

would cost an additional \$1,785,000 annually, to provide cathodic protection for fittings which have an installed cost of \$234,000.

In addition, there would be an average cost of \$1.00 per year per unit for monitoring the level of cathodic protection (Attachment VI). This cost plus annual labor increases, would continue for the life of the fitting. As additional fittings were installed, the total cost of monitoring the cathodic protection would continue to grow.

2. The alternative to providing cathodic protection for the AMP-FIT fittings would be to change to heat fusion type plastic fittings. The average unit savings using AMP-FIT fittings versus heat fusion fittings is about \$2.28 (Attachment I, Page 1). Based on a usage of 100,000 units per year, this would amount to an annual increase in installation costs of \$228,000. However, this is \$1,557,000 less than the cost of providing cathodic protection for the AMP-FIT fittings, and there would be no continuing cost for monitoring the level of cathodic protection.

Based on these comparative costs, the only viable alternative to the requested deviation from Section 192.455 (a) would be to change to the heat fusion method of joining small diameter plastic pipe, with an increased annual expenditure of \$228,000, plus an additional one-time expenditure of \$203,250 to equip crews with heat fusion tools. (Attachment V)

QUESTION 2: If you believe that the granting of subject deviation would result in improved safety of pipeline installations, please provide technical data to support this view.

While the reasons for using the AMP-FIT fittings are primarily economic, Pacific Gas and Electric Company believes that the granting of the deviation will result in a small increase in public safety. This statement is supported by the following information.

We wish to emphasize that both the AMP-FIT and the fusion joint, when properly made, will produce a joint which is stronger than the pipe being joined. This is supported by tests conducted by the PGandE Company Department of Engineering Research, as well as by tests conducted by other organizations. However, our experience has shown that while the AMP-FIT joint is simple to make, and requires only a minimal amount of instruction, making a heat fusion joint on smaller sized plastic pipe is a more complex and exacting procedure requiring considerable training. Also, an improperly made AMP-FIT joint is easy to detect by inspection, while similar problems with a heat fusion joint are not as readily apparent, and are subject to interpretation and judgment.

We firmly believe that present company standards and procedures, with regard to training and quality control, are adequate to eliminate faulty joints. However, it is recognized that the procedure for making a fusion joint allows a greater margin for potential problems. The above is our basis for stating that granting the deviation would result in an increase in public safety.

We would be pleased to discuss any of this material in more detail or to answer any additional questions you may have with reference to our request for a deviation.

Sincerely,

(signed)
MALCOLM H. FURBUSH

PALathrop:rsb
Attachments

Attachment to the State of California

PACIFIC GAS AND ELECTRIC COMPANY

77 Beale Street San Francisco, California 94106 (415) 781-4211

May 11, 1976

Public Utilities Commission
State of California
State Building, Civic Center
350 McAllister Street
San Francisco, CA 94102

Re: Deviation from Section 192.455 (a)
CPUC General Order 112-C

Gentlemen:

Pacific Gas and Electric Company has utilized plastic connectors incorporating non-sensitized Type 316 stainless steel parts since about 1969. Specifically, we have used crimp on fittings manufactured by AMP Special Industries of Valley Forge, Pennsylvania, under the trade name of AMP-FIT fittings. We believe they provide one of the best methods available for joining small diameter plastic pipe. To date, we have installed in excess of 500,000 of these units. Their use was initiated after extensive testing by our Department of Engineering Research, prior to the time 49 CFR Part 192 and G.O. 112-C became effective. We continued to use them without cathodic protection after Subpart I was adopted on July 18, 1972, because the Type 316 stainless steel rings were not actually a pressure carrying part of the system. Only after reviewing the transcript of hearing by the Tennessee Public Service Commission on this matter did we become aware that the Office of Pipeline Safety Operations had specifically ruled that Section 192.455 (a) also applied to the Type 316 stainless steel rings used as a part of such a connector. Pacific Gas and Electric Company has now discontinued the use of the AMP fittings until such time as a deviation from Section 192.455 (a) is granted.

We are aware that the California Public Utilities Commission Resolution No. G-1591 dated September 5, 1973, granted the Southern California Gas Company a deviation from Section 192.455 (a) of General Order 112-C for the use of items manufactured from Type 316 stainless steel for:

- a. Service risers for plastic services;
- b. Plastic to steel connectors; and
- c. Plastic to plastic connectors.

Items (b) and (c) would cover the AMP-FIT fittings.

By letter dated October 30, 1973, the Office of Pipeline Safety limited this waiver to three years and directed the Southern California Gas Company to submit a report three months prior to termination of the waiver, regarding the success or failure of the use of Type 316 stainless steel for these items. It is our understanding that the Southern California Gas Company report will be only on risers. Pacific Gas and Electric Company is submitting the attached report covering the use of Type 316 stainless steel in plastic connector fittings to supplement the report required from the Southern California Gas Company. We believe that our report clearly demonstrates that Type 316 stainless steel parts can be used as connectors in corrosive soils without the need for cathodic protection, and that the deviation granted by Resolution No. G-1591 for plastic connectors is fully justified.

The attached report is the result of a study initiated in the summer of 1975 to develop factual information on the corrosion resistance of Type 316 stainless steel parts used in AMP-FIT fittings. A statistical sampling of two hundred AMP-FIT fittings which had been in service from one to five years were exposed and carefully inspected for evidence of corrosion. The 200 fittings were selected to illustrate experience with the various types of soils and soil conditions which occur throughout the PGandE system. Within the above limitations, the fittings exposed were selected on a random basis. Many of the fittings had been buried for up to five years in what would normally be considered an extremely aggressive soil condition, without cathodic protection. None of the fittings exposed showed any evidence of corrosion.

Based on data contained in its report, Pacific Gas and Electric Company submits the attached request for a deviation from Section 192.455(a) of General Order 112-C to permit the Company to use plastic connectors containing parts manufactured from Type 316 stainless steel, without the need for cathodic protection. We believe that this deviation is in the public interest. It will permit the use of a fitting that is safe, economical and equal to or better than other methods currently available for joining small diameter plastic pipe. No reduction in public safety will result from this deviation, since it has been established that Type 316 stainless steel will not corrode in this type of service.

Through ASME Gas Piping Standards Committee work, Pacific Gas and Electric Company recently became aware that the Office of Pipeline Safety Operations is considering a change to Section 192.455(a) of 49 CFR Part 192, which would permit the use of AMP type fittings without cathodic protection. If the Commission Staff agrees that the attached deviation request is justified it may be possible for the CPUC to join Pacific Gas and Electric Company in petitioning OPSO in support of such a change to part 192. The attached report could be used as the basis for this petition. We have also included suggested revisions to the wording of Section 192.455 (a) which would permit the use of the Type 316 stainless steel in fittings without the need for cathodic protection.

Pacific Gas and Electric Company would be pleased to meet with you or members of the staff to discuss this matter further, if you should determine this to be helpful.

Sincerely,

(signed)

MALCOM H. FURBUSH

Attachments

May 5, 1976

REQUEST FOR DEVIATION FROM SECTION 192.455(a) G.O. 112-C
REQUEST FOR PETITION TO CHANGE SECTION 192.455(a) 49 CFR PART 192.

- (1) Pacific Gas and Electric Company requests the CPUC to grant a deviation from the provisions of Section 192.455(a) of G.O. 112-C, with respect to the application of cathodic protection to Type 316 stainless steel parts used in certain fittings for joining plastic pipe.
- (2) Pacific Gas and Electric Company requests the CPUC to petition the Office of Pipeline Safety Operations for a change to Section 192.455(a) of 49 CFR Part 192 to eliminate the cathodic protection requirement for Type 316 stainless steel parts used in plastic fittings for buried pipeline service.

AMP Special Industries of Valley Forge, Pennsylvania, manufactures fittings for joining plastic pipe, marketed under the trade name of AMP-FIT. These are widely used by the gas industry because they provide a positive and trouble-free method of joining small diameter plastic pipe. The pressure carrying portion of the fitting consists of a molded nylon body. However, Type 316 stainless steel crimp rings are used to hold the plastic pipe on to the fitting. While not a pressure carrying member, the Type 316 stainless steel rings are necessary to maintain a pressure tight seal between the pipe and the fitting.

Section 192.455 of G.O. 112-C requires that (a) except as provided in Paragraphs (b) and (c) of this section, each buried or submerged pipeline installed after July 31, 1971 must be protected against external corrosion including the following:

- (1) It must have an external protective coating meeting the requirements of Section 192.461.
- (2) It must have a cathodic protection system designed to protect the pipeline in its entirety in accordance with this subpart, installed and placed in operation within one year after completion of construction.

Section 192.465 of General Order 112-C requires the monitoring of cathodic protection systems, and to take remedial action to correct any deficiencies indicated by the monitoring.

A letter from Mr. Joseph Caldwell, Director of the Office of Pipeline Safety, written some time in late May or June of 1975, stated:

"In response to your inquiry dated May 22, 1975, if a stainless steel band necessary for making a mechanical joint in plastic pipe is installed as part of a gas pipeline after July 31, 1971, then it must comply with the requirements of 49 CFR Section 192.455(a)."

Although the 316 stainless steel parts can be wrapped as required by Subsection 192.455 (a) (1), and cathodic protection can be provided as required by Subsection 192.455(a) (2), the cost involved plus the cost of monitoring cathodic protection makes their use completely prohibitive.

Tests conducted by Pacific Gas and Electric Company, other utilities, and The National Bureau of Standards, all demonstrate that non-sensitized Type 316 stainless steel does not corrode when buried or

submerged. Because of this, cathodic protection is unnecessary, and the application of the requirements in Subsection 192.455(a) (2) to the stainless steel parts of a fitting is not justified.

The basic stability of Type 316 stainless steel is well documented in the National Bureau of Standards Circular 579. This circular was published in 1957. Tests on which this report were based are still being conducted, and continue to demonstrate that the Type 316 stainless steel performs satisfactorily when buried in a variety of soils.

Pacific Gas and Electric Company has utilized the AMP fittings with Type 316 stainless steel parts since about 1969. Over 500,000 of these units have been installed to date in joining small diameter plastic pipe (up to 1 1/4" O.D.). The installations are limited to distribution system pressure (60 psig MAOP or less) in Class 1, 2 and 3 areas. Prior to using these fittings, they were thoroughly tested by the PGandE Company Department of Engineering Research to establish that they were suitable for this type of service. We believe them to be one of the best methods currently available to us to join small diameter plastic pipe. Use of the AMP fittings was started prior to the time 49 CFR Part 192 and General Order 112-C became effective.

During the past year, Pacific Gas and Electric Company has exposed and inspected 200 AMP-FIT fittings which were installed at various points throughout its system. These had been in service for periods varying from one to five years, in a great variety of soil conditions, some of which are classified as extremely aggressive. The results of this study, including information on the soil resistivity and pH in which the Type 316 stainless steel parts were buried is included in the attached report. None of the parts were under cathodic protection. About 150 of the 200 fittings had been wrapped with plastic pipe, in accordance with established procedures for other types of steel fittings. The wrapping was used to maintain consistency in our standards, for installation procedures for underground metallic facilities. A careful and thorough inspection of the Type 316 stainless steel rings on all 200 AMP fittings did not disclose any evidence of surface corrosion after exposure to the underground environment. There was no difference in the appearance of the wrapped and bare rings.

Another factor should be considered concerning the use of the Type 316 stainless steel rings. The very small size of these rings would further reduce the potential for corrosion to occur. Corrosion on underground metallic structures results from the flow of DC current. This can be stray current from various types of DC equipment such as electric railways, or DC current generated by a galvanic cell where a metallic structure passes through different types of soils. The small size of the stainless steel rings on the AMP-FIT fittings would not provide any appreciable path for stray current, and the soil conditions surrounding the small unit would be homogeneous, so any galvanic cell would be unlikely.

The deviation requested by Pacific Gas and Electric Company from Section 192.455 (a) would apply only to the application of cathodic protection to the Type 316 stainless steel parts on AMP-FIT or comparable fittings. We would, if directed, continue to wrap these units with tape, even though we are convinced that it is unnecessary from the standpoint of corrosion protection. We would also continue to monitor the performance of these fittings to assure that they are continuing to perform satisfactorily.

Resolution No. G-1591 adopted by the CPUC on September 5, 1973, and approved by the Office of Pipeline Safety with certain restrictions on October 30, 1973, permitted the Southern California Gas Company to install bare non-sensitized Type 316 stainless steel risers and fittings without cathodic protection. The Office of Pipeline Safety limited the waiver to three years, and required the Southern California Gas Company to submit a report to your office three months prior to the termination of the waiver, stating whether the use of this material was satisfactory. The waiver covered both fittings and stainless steel risers. However, we understand that the Southern California Gas Company report will be confined to the use of Type 316 stainless steel for service risers. We are not aware that they have used the plastic connectors. In addition to supporting the Pacific Gas and Electric Company deviation request, the report on the test program can be used to supplement the Southern California Gas Company report. This data demonstrates that the experience with the Type 316 stainless steel parts on connectors has been satisfactory; and that the continued use of Type 316 stainless steel connectors without cathodic protection is in the interest of public safety.

If the Commission staff approves the requested deviation from Section 192.455(a) of General Order 112-C, Pacific Gas and Electric Company proposes to request the Office of Pipeline Safety Operations to change the wording of Section 192.455 of 49 CFR Part 192, to permit the installation of Type 316 stainless steel parts in fittings, without the need for cathodic protection. If possible, we would like to obtain the support of the CPUC for this change.

Suggested wording for such a rule change is as follows:

In Paragraph 192.455(a), delete the words "and (c)" after "(b)" in the first line and insert the wording "(c) and (f)" so that the first line of Paragraph 192.455(a) would read as follows:

"Except as provided in Paragraphs (b), (c) and (f) of this section".

Add the following Subsection to Paragraph 192.455:

"192.455(f) An operator need not comply with Paragraph (a) or (d) of this section, if the operator can demonstrate by tests, investigation or experience that a corrosive environment does not exist for pipeline components fabricated from non-sensitized Type 316 stainless steel."

Pacific Gas and Electric Company believes the requested deviation from Section 192.455(a) of General Order 112-C and the rule change to Section 192.455 of 49 CFR Part 192 are consistent with the intent of the Natural Gas Pipeline Safety Act.

This law is stated in performance type language, which permits the use of new materials or methods, where they will result in equal or increased public safety. We firmly believe the use of the AMP-FIT fittings provide a less expensive method for joining plastic pipe, and that the resulting joints are as good or better than alternate methods currently available. Further, our tests have demonstrated that the use of cathodic protection on the Type 316 stainless steel portions of these fittings is unnecessary and is a requirement which effectively prohibits the use of this method of joining plastic pipe.

Attachment to 05/11/76 PG&E letter

A
CORROSION EVALUATION
OF
316 STAINLESS STEEL AMP-FIT COMPRESSION FITTINGS COMPONENTS
BY
PACIFIC GAS AND ELECTRIC COMPANY
GAS DISTRIBUTION DEPARTMENT
APRIL 1976

*A complete, paper copy of this report,
including tables and figures, is available in
the Office of Pipeline Safety files*

TABLE OF CONTENTS

	<u>PAGE</u>
Introduction	1
Summary	1
Compression Fitting	1
Test Program	1 - 2
Statistical Sampling	2
Test Conducted	3
Test Results	3
<hr/>	
	<u>FIGURE</u>
Typical Amp-Fittings Photo	1
Fittings Inspected vs. Installation Date	2
Fittings Inspected vs. Division	3
Test Program Location Map	4
Test Coupon Site Photos	5
Resistivity of Soil Samples	6
Actual Soil Resistivity vs. Time in Service	7
Saturated Soil Resistivity vs. Time in Service	8
pH of Soil Samples	9
Soil pH vs. Time in Service	10
<hr/>	
	<u>APPENDIX</u>
Photos of Test Fittings	A
Test Data Summary	B

INTRODUCTION:

This report summarizes Pacific Gas and Electric Company's experience with Type 316 stainless steel components on a plastic compression fitting. These fittings are used to mechanically join 1/2" through 1-1/4" plastic gas pipe underground.

Between 1969 and the end of 1975, 524,300 such fittings have been installed throughout the Company's 13 operating divisions. There are 26,000 miles of distribution piping and services in an area covering 94,000 square miles of service territory. These installations have given us the opportunity to evaluate this fitting in a broad range of soil conditions.

The Type 316 stainless steel component is not cathodically protected and has been installed both bare and coated. The coating consists of a single tape wrap applied without primer.

SUMMARY:

The data show that even though aggressive soils were encountered (resistivity as low as 500 ohm-cm.; pH as low as 2.6) none of 316 stainless steel compression rings examined exhibited any corrosion attack.

COMPRESSION FITTING:

The fitting is manufactured by Amp Special Industries and utilizes a nylon body with Type 316 stainless steel non-sensitized compression rings. Typical fittings are shown on Figure 1.

TEST PROGRAM:

The fittings excavated and inspected have been in service from one to five years (see Figure 2). The locations of the fittings inspected were in 10 of 13 Company operating divisions (See Figure 3). Fittings were not inspected in three divisions either because the soil in the area had a history of being relatively non-corrosive or the use of the AMP fitting had been minimal.

PGandE's evaluation of the corrosion resistant characteristics of Type 316 stainless steel underground consists of two programs:

1. Excavation and inspection of 200 existing, in-service fittings, and
2. Installation of "test coupon" fittings at eight locations for future monitoring and evaluation.

Fittings at 200 existing, in-service locations were excavated and visually inspected for any evidence of corrosion. The 200 locations were distributed throughout PGandE's operating area (see Figure 4). Each exposed fitting was photographed (see Appendix A).

At each location, soil samples were obtained and measured to determine soil resistivity and pH. These data, the installation dates and detailed locations are tabulated on Appendix B and are numbered one through 200.

Regardless of whether fitting was bare or wrapped, all exposed fittings were left bare after inspection. The fittings at these locations can be reevaluated at any time.

The second part of PGandE's program consisted of installing twelve (12) fittings each at eight (8) locations. The twelve (12) fittings were installed in groups of three (3). Each set consists of one-half-inch, one-inch and two-inch fittings. The fittings were installed so that sets can be retrieved without disturbing others. (See Figure 5 for typical installation).

Each set of test coupon fittings can be removed easily for detailed analysis as required. Test locations are also tabulated in Appendix B and are numbered 301 through 308.

STATISTICAL SAMPLING:

When this evaluation began in July 1975, approximately 500,000 of the AMP fittings had been installed. It was determined statistically that if 200 fitting locations were inspected and no corrosion was in evidence, there would be a 95 percent confidence that less than 1.51 percent could show any evidence of corrosion.

The sampling selected was derived from Military Standard 105D, Sampling Procedures and Tables for Inspection by Attributes.

TESTS CONDUCTED:

All soil resistivity measurements were made using a Vibroground, Model 293, with a Putnam Cube. This instrumentation has a maximum measurement capability of 25,400 ohm-cm. All soil samples were measured as excavated and again after being saturated with distilled water. This was done to indicate the most corrosive condition of the soil sample which may have dried out seasonally.

Most of the pH measurements were made using an antimony, copper-copper sulfate electrode combination. Some pH measurements were made using a Beckman Electromate pH meter.

TEST RESULTS:

Soil resistivity values, Figure 6, are from 500 to over 25,400 ohm-cm. A wide range of soil conditions was encountered and as Figures 7 and 8 show, there was a wide range of service life in most soil resistivities. The predominance of soil resistivity values shown are in the range of 1000 to 500 ohm-cm. and are considered relatively corrosive. The average time in service from date of installation to January 1976 of all 200 fittings is 2.9 years.

Figure 9 shows pH measurements are in the range of 2 to 9 with most samples being 5 and 6. The test data represents a wide range of exposure in both pH values and fitting service life (see Figure 10).

The wide range of pH and soil resistivity data was measured in soil conditions ranging from San Francisco bay salt water fill to well drained rocky sand. A close detailed inspection of each fitting exposed did not disclose any evidence of corrosion even in the most corrosive environment.

DEPARTMENT OF TRANSPORTATION

MATERIALS TRANSPORTATION BUREAU

Washington, D.C. 20590

October 14, 1976

Mr. William R. Johnson
Executive Director
Public Utilities Commission
State of California
California State Building
San Francisco, California 94102

Dear Mr. Johnson:

This is to acknowledge receipt on October 8, 1976, of your letter dated October 6, 1976, notifying us that the Commission has granted the Pacific Gas and Electric Company (PG&E) a waiver from compliance with 49 CFR 192.455(a), regarding the use of plastic pipe connectors made of Type 316 stainless steel without cathodic protection. We have assigned your letter Docket No. CA-76-1.

As noted in your letter, pursuant to Sec. 3(e) of the Natural Gas Pipeline Safety Act of 1968, based on the date we received notice of the waiver, it cannot become effective until December 6, 1976, unless we notify you before that date that we have no objection to the waiver.

Sincerely,

/Signed/

Cesar DeLeon
Acting Director
Office of Pipeline
Safety Operations

TELEGRAPHIC MESSAGE

NAME OF AGENCY
DOT/OST/MTB

ACTION: PRIORITY

DATE PREPARED
12/6/76

NAME
L.M. Furrow

TO:
Mr. William R. Johnson
Executive Director
Public Utilities Commission
State of California
California State Building
San Francisco, California 94102

Dear Mr. Johnson:

We have reviewed the Commission's Resolution No. G-1967 dated October 5, 1976 (OPSO Docket No. CA-76-1), granting the Pacific Gas and Electric Company (PG&E) a waiver from compliance with the corrosion control requirements of 49 CFR 192.455(a) for Type 316 stainless steel fittings manufactured by AMP, Inc. for use in plastic pipelines.

On September 27, 1976, the Materials Transportation Bureau (MTB) published a notice of proposed rulemaking (Notice 76-1) to amend 49 CFR 192.455 to allow the installation of small electrically isolated alloy fittings in plastic pipelines without coating and cathodic protection if (1) an operator can show by tests, investigation, or experience in the area of application, that corrosion control is provided by alloyage, and (2) the fitting is designed to prevent leakage by localized corrosion pitting.

Based on our review of the record and all other relevant information, we find that PG&E's waiver request is in accord with the purpose of the proposed amendment and granting the waiver is not inconsistent with pipeline safety. Nevertheless, because of uncertainties regarding the duration of protection afforded by the Type 316 fittings, in accordance with Sec. 3(e) of the Natural Gas Pipeline Safety Act of 1968, we object to the waiver unless the following additional conditions to those imposed by Res. No. G-1967 are imposed:

- A. Each fitting installed under this waiver--
 - 1. Must be designed to prevent leakage caused by localized corrosion pitting;
 - 2. Must be electrically isolated when installed; and
 - 3. As to fittings installed after the effective date of the waiver, must have its location identified in a manner that will assure future identification of that location.

- B. PG&E must immediately report to the Commission any failure of a fitting installed under this waiver resulting from corrosion.

Also, since a final rule resulting from Notice 76-1 is intended to apply to fittings installed after July 31, 1971, to ensure that fittings installed under the waiver will only be subject to the provisions of that final rule, we further object unless the waiver to PG&E terminates upon the effective date of the final rule.

Cesar DeLeon
Acting Director
Office of Pipeline
Safety Operations