

DOE FILE COPY

DOE/SF/10501-016
(STMP0-493)

SOUTHERN CALIFORNIA EDISON COMPANY
Rosemead, California

SPECIFICATION NO. A1-1979
(Revision of A1-1978)

MEDIUM POWER TRANSFORMERS, 115 KV AND BELOW
WITH AND WITHOUT LTC

A1-1979

MEDIUM POWER TRANSFORMERS
115 kv and Below

March 23, 1979

SOUTHERN CALIFORNIA EDISON COMPANY
Rosemead, California

SPECIFICATION NO. A1-1979
(Revision of A1-1978)

MEDIUM POWER TRANSFORMERS
115 KV AND BELOW WITH AND WITHOUT LTC

LIST OF MANUFACTURERS

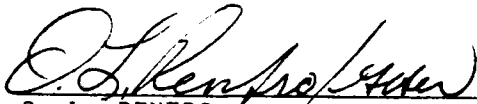
<u>Manufacturer</u>	<u>Transformer Class</u>		
	<u>34.5 kV & Below</u>	<u>69 kV</u>	<u>115 kV</u>
Federal Pacific Elect. Co.	Approved	Approved	Approved
General Electric Company	Approved	Approved	Approved
H. K. Porter (2)	Cond. Appr.	Cond. Appr.	Cond. Appr.
Kuhlman Electric Company (1)	Approved (1)	Cond. Appr.(1)	-----
McGraw-Edison	Approved	Approved	Approved
RTE-ASEA	Approved	Approved	Approved
Westinghouse Electric Corp. (3)	Approved	Approved	Approved

(1) Approved for all units 69 kV and below, and 12.5 MVA and below, with or without LTC. Also conditionally approved for no more than two (2) 15/20/22.4 MVA, 69 kV units.


(2) Conditionally approved for one transformer per memo from S. H. Gold to R. B. Marlatt dated December 29, 1978.

(3) Approved only for transformers made in Sharon, PA.

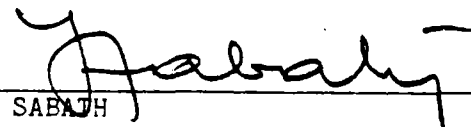
APPROVAL OF SPECIFICATION




O. L. RENFRO
MANAGER OF SUBSTATIONS




S. H. GOLD
CHIEF APPARATUS ENGINEER



J. SABATH
CHIEF OF SUBSTATION DESIGN
ENGINEERING



H. F. SALIGER, JR.
MANAGER OF MATERIAL SERVICES



R. V. KNAPP
MANAGER OF SYSTEM OPERATIONS

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
<u>SECTION 3</u>		
<u>TECHNICAL REQUIREMENTS</u>		
3.1	Scope	3-1
3.2	Standards	3-1
3.3	Type	3-1
3.4	Cooling Class	3-1
3.5	Ratings, Phases, Windings and Connections	3-2
3.6	Limiting Dimensions of 69 kV Transformers	3-2
3.7	Temperature Rise	3-2
3.8	Transformer Loading Capability	3-3
3.9	Average Sound Level	3-3
3.10	Impedance	3-3
3.11	Angular Displacement	3-4
3.12	No-Load Tap Changers	3-4
3.13	Load Tap Changers	3-4
3.14	Transformers with FA Ratings	3-7
3.15	Transformer Short-Circuit Capability	3-8
3.16	Bushings	3-8
3.17	Bushing Current Transformers	3-11
3.18	Zig-Zag and Y Connections	3-11
3.12	Cores	3-11
3.20	Tanks, Covers, and Radiators	3-12
3.21	Oil and Oil Preservation Systems	3-14
3.22	Inert-Gas Regulating Equipment	3-15
3.23	Accessories	3-15
3.24	Wiring, Conduits, Boxes, and Terminal Blocks	3-18
3.25	Nameplates	3-20
3.26	Painting	3-20
3.27	Seismic Capability	3-20
3.28	Factory Tests	3-21
3.29	Preparation For Shipment	3-22
3.30	Erection Assistance	3-22
3.31	Qualification	3-23
3.32	Evaluation of Quoted Costs	3-24
3.33	Data, Drawings, Manuals, and Test Reports	3-25
3.34	Spare Parts	3-27
Table 3-1	Documentation Submittal Schedule	3-28/29
Table 3-2	Single Phase OA Ratings of Power Transformers Which May Be Required By Company	3-30
Table 3-3	Three Phase OA Ratings of Power Transformers Which May Be Required By Company	3-31

SPECIFICATION A1-1979
Med. Power Transformers

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
Figure 1	50% Probable Curve Smoothed Maximum Horizontal Response Spectrum	3-32

PROPOSAL REQUIREMENTS

A.1	Drawings To Be Furnished With Proposal	A-1
A.2	Information To Be Furnished With Proposal	A-1

SPECIFICATION A1-1979
Med. Power Transformers

1 SOUTHERN CALIFORNIA EDISON COMPANY

2 SECTION 1 - GENERAL TERMS AND CONDITIONS

3 Category I - Fixed Price Material

4 The parties agree to enter into a contract for Supplier to sell
5 and for Company to purchase the Material specified in the Purchase
Order of which these General Terms and Conditions are a part.

6 1.1 DEFINITIONS:

7 1.1.1 Bidder: The entity submitting a proposal pursuant to
this Specification.

8 1.1.2 Change Order: Document issued by Company to Supplier to
9 change the Purchase Order.

10 1.1.5 Company: Southern California Edison Company, or where other
11 participants are set forth in Section 2, Southern California
Edison Company acting as principal in its own behalf and as
agent for such other participants.

12 1.1.4 Delivery Date: The date the Material is to be received
13 at the "Ship To" address specified in the Purchase Order.

14 1.1.5 Material: All apparatus, materials, products, supplies and
15 documentation to be provided by Supplier pursuant to the
Purchase Order. Supplier's standard product is acceptable if
16 it meets all of the requirements of the Purchase Order.

17 1.1.6 Proposal Requirements: Commercial and technical requirements
to be submitted in Bidder's proposal.

18 1.1.7 Purchase Order: Document issued by Company to Supplier in-
19 corporating by reference this set of General Terms and Con-
ditions and other applicable documents, with the following
20 priority in the event of conflicting provisions: Purchase
Order, Sections 2, 1, and 3 of the Specification.

21 1.1.8 Specification: Document issued by Company containing these
22 "General Terms and Conditions" as Section 1, the "Supplemen-
tal Requirements" as Section 2, the "Technical Requirements"
23 as Section 3, and supplements, drawings, and data sheets
attached thereto or incorporated by reference.

24 1.1.9 Supplier: The entity to which the Purchase Order is
25 addressed.

26 1.1.10 Work: All obligations of Supplier to be performed as speci-
fied in the Purchase Order, including the Material, and its
27 design, fabrication, inspection, testing, documentation, and
technical assistance.

28

1 1.2 DELIVERY: Delivery shall be "FOB Point of Shipment" unless
2 otherwise specified in the Purchase Order. Delivery of the
3 Material and specified documentation by the Delivery Date is
4 essential to maintain the operating schedule of Company facilities.
5 Deliveries may be expedited by Company. Supplier shall notify
6 the Buyer promptly of any condition affecting the Delivery Date.
7 Company may, at its sole option, accept or return deliveries
8 which vary from the specified Delivery Date or quantities.

9 When the value of a shipment exceeds \$100,000 and except
10 when Supplier retains risk of loss, Supplier shall notify
11 Company's Manager of Traffic and Transportation of such shipment
12 and of the carrier billing reference data at the time such
13 Material is accepted by the carrier for shipment.

14 1.3 TITLE AND RISK OF LOSS: Title and risk of loss or damage to
15 the Material shall pass from Supplier to Company at point of ship-
16 ment or at shipment destination as determined by the shipping
17 terms set forth in the Purchase Order. Title shall be free and
18 clear of any and all liens and encumbrances whatsoever.

19 When "FOB Point of Shipment," if Material is received at
20 destination in a damaged condition and a claim for such damage is
21 denied by the carrier on the basis that such damage was attribut-
22 able to the Supplier, the Supplier shall repair or replace such
23 damaged Material at no cost to the Company.

24 In any event, Supplier shall assist Company in establishing
25 carrier liability for Material damage by supplying evidence that
26 the Material was properly manufactured, packaged, and secured to
27 withstand normal transportation conditions.

28 Supplier shall be liable for any uninsured loss or damage in
transit, not chargeable to the carrier, resulting from Supplier's
failure to provide timely notice of shipment as required in
Section 1.2.

1.4 PACKAGING: Material shall be packaged and shipped in accord-
ance with good shipping practices. All items or their containers
shall be piece marked with material code or description, Purchase
Order Number and Release Number if available. Items disassembled
for shipment shall be match-marked. Unpainted surfaces and open-
ings shall be protected from impact and weather damage.

1.5 PAYMENT: Invoices shall be paid within 30 days after receipt
of the Material at the destination set forth in the Purchase Order.
For any portion of the Material which does not conform to the
requirements of the Purchase Order, a corresponding portion of the
price may be withheld until such nonconformance is corrected.

Payment shall not forfeit Company's right to inspect and accept
the Material and its documentation, nor shall the withholding of
any payment, or portion thereof, preclude Company from pursuing
any other rights or remedies it may have under the Purchase Order.

Invoices shall separately identify sales or use taxes, and
any freight charges for shipments other than "FOB Destination."
All freight charges shall be supported by a copy of the applic-
able freight bill. Sales and use taxes are not applicable to
freight charges.

1 Except for sales and use tax, the Purchase Order price for
2 the Material is inclusive of all other taxes, fees, excises and
3 charges which are now or hereafter imposed by federal, state,
4 municipal, or other local public authority.

5 1.6 ACCEPTANCE: Company shall accept the Material after suffi-
6 cient tests and inspections have been made by Company, within a
7 reasonable time after receipt of the Material, to determine that
8 the Material meets all the requirements of the Purchase Order.
9 If such inspection and tests show the Material, or any part
10 thereof, not to be as specified in the Purchase Order, Company
11 may reject such Material and Supplier shall be so advised and
12 shall promptly correct or replace such rejected Material at
13 Supplier's sole expense or, at Company's option, shall issue
14 credit for monies paid.

15 Company shall be allowed access to Supplier's facilities to
16 inspect workmanship, observe tests and inspections, expedite manu-
17 facture, and obtain required information for the Material.

18 1.7 WARRANTY: Supplier warrants that, for the period stated in
19 Section 2 after acceptance by Company, the Material shall be free
20 from defects in workmanship, materials, and design if by Supplier,
21 and shall conform to the requirements of the Purchase Order. Sup-
22 plier shall, at its sole expense and promptly after notification
23 by Company, correct or replace such defective Material, FOB Desti-
24 nation. Company shall have the right to use such defective Mater-
25 ial until it can be removed from operation for correction or
26 replacement, however, any additional damage due to such continued
27 use shall be at Company's expense. Supplier shall comply with all
28 existing jobsite labor agreements in performance of corrective
Work at the jobsite. The warranty period for such corrected or re-
placed Material shall be of an equal duration as the original
warranty period and shall start upon acceptance of such corrected
or replaced Material.

1.8 STATUTES AND CODES: The Work shall comply with the applicable
requirements of all statutes, acts, ordinances, regulations, codes
and standards of legally constituted authorities having jurisdic-
tion as of the date of the Purchase Order.

1.9 CHANGES: Company may make changes in any of the provisions of
the Purchase Order by issuance of a Change Order. If such changes
affect the Delivery Date or price, Supplier shall promptly notify
the buyer and an equitable adjustment shall be negotiated.

1.10 TERMINATION: Company may terminate the Purchase Order at any
time by the issuance of a Change Order. Any charges resulting from
such termination shall be equitably negotiated by the parties or
shall be per a schedule of termination charges if set forth in the
Purchase Order. Company, at its option, may take possession of
any Material fabricated or procured to date of termination with a
corresponding adjustment in such termination charges. The provi-
sions of this Section 1.10 shall be Supplier's sole remedy result-
ing from such termination.

1 1.11 CONSEQUENTIAL DAMAGES: Supplier shall not be liable to
2 Company for loss of or use of Company's facilities, loss of rev-
3 enue, cost of replacement power, and claims of any customer of
4 Company arising out of Company providing electric service to such
5 customer, resulting from Supplier's performance or nonperformance
6 of its obligations under the Purchase Order.

7 Company shall not be liable to Supplier for loss of antici-
8 pated profits, and loss of use of or under-utilization of Sup-
9 plier's labor or facilities, resulting from Company's performance
10 or nonperformance of its obligations under the Purchase Order, or
11 in the event of termination of the Purchase Order.

12 1.12 PATENTS: If any action or proceeding brought against Company
13 is based on a claim of patent infringement arising out of Sup-
14 plier's performance of the Work or Company's use of the Material
15 and, if Company promptly notifies Supplier in writing of any such
16 action or proceeding, Supplier shall, at its own expense, do the
17 following to assure continuation of the Work or of the use of the
18 Material: (i) defend such action or proceeding and pay all
19 damages, costs, losses, claims, awards, settlements, attorney's
20 fees and expenses, or any of them, arising out of such action or
21 proceeding; (ii) procure for Company the right to continue to use
22 any part of the Material affected by such action or proceeding,
23 or replace or modify, with Company's approval, any infringing
24 Material such that the infringement is removed; (iii) if in any
25 such action or proceeding a temporary restraining order or pre-
26 liminary injunction be granted, Supplier shall, by giving a
27 satisfactory bond, or otherwise, endeavor to secure the suspension
28 of such restraining order or preliminary injunction.

Company shall cooperate reasonably with Supplier at no cost
to Supplier in any defense of the actions and proceedings. Sup-
plier shall give Company prompt written notice of any potential
patent infringement problems of which it becomes aware.

1.13 UNCONTROLLABLE FORCES: Supplier shall not be liable for
delay in the Delivery Date or failure to perform the Work due to
any cause beyond its reasonable control, such as strike, flood,
fire, lightning, epidemic, quarantine restriction, war, sabotage,
act of a public enemy, earthquake, or material availability;
provided that Supplier promptly notifies Company in writing of
the nature, cause, date of commencement and expected impact of
the event and has exercised due diligence in proceeding to meet
the Delivery Date, then Company shall extend the Delivery Date
for an equitable period due to such causes.

1.14 NON-WAIVER: The failure of Company to enforce any of the
terms and conditions, or to exercise any right or privilege in the
Purchase Order, shall not be construed as thereafter waiving any
such terms and conditions or right or privilege and the same shall
continue and remain in force and effect as if no such failure to
enforce or exercise had occurred. No waiver by Company shall be
valid unless waived by a Change Order.

1 1.15 GOVERNING LAW: The Purchase Order shall be interpreted,
2 governed and construed under the laws of the State of California
3 as if executed and to be performed wholly within the State of
4 California.

5 1.16 ASSIGNMENT: Neither the Purchase Order nor any interest
6 under it shall be assigned to any entity without the prior written
7 consent of Company. The Purchase Order shall not be deemed an
8 asset of Supplier. If Supplier enters into any voluntary or
9 involuntary receivership, bankruptcy, or insolvency proceedings,
10 the Purchase Order may be cancelled at Company's option upon five
11 days written notice to Supplier.

12 1.17 NOTICES: Any notice pertaining to the Purchase Order shall
13 be in writing and sent registered or certified mail, postage pre-
14 paid, to Company or to Supplier, as appropriate, at their respec-
15 tive addresses appearing in the Purchase Order.

16 1.18 PUBLICATIONS: No publication concerning the Work shall be
17 made by Supplier without prior written authorization by Company.

18 1.19 EMPLOYMENT PRACTICES: The employment practices preprinted
19 on the back of the Purchase Order form shall apply.

20
21
22
23
24
25
26
27
28

SECTION 2

SUPPLEMENTAL REQUIREMENTS

2.1 SCOPE

This Specification covers the requirements for furnishing medium power transformers, 115 kV and below, with and without load-tap-changers.

2.2 DEFINITIONS

The specific terms used herein, whether in the singular or in the plural, shall have the following meanings:

Material/Apparatus - The terms Material and Apparatus are used synonymously within this Specification.

Supplier/Manufacturer - The terms Supplier and Manufacturer are used synonymously within this Specification.

2.3 GENERAL REMARKS

A. This Specification is the revision of A1-1978. Suppliers are advised to read Specification A1-1979 in its entirety.

B. Circles in the right margins of pages in this Specification are for Company's use when preparing a proposal request or Purchase Order.

2.4 WARRANTY

The warranty period shall be a minimum of one year.

2.5 VALUE OF TRANSFORMER LOSSES

The dollar amount which Supplier shall reimburse Company for actual transformer losses in excess of the guaranteed losses shall be calculated as set forth in Section 3.32.

SUBSECTION 2A

DOCUMENTATION

2A.1 DOCUMENTATION REQUIREMENTS

All Documentation specified in Table 3-1, Section 3, shall be provided by Supplier in the form and quantity specified.

A. All Documentation submitted shall be accompanied by a letter of transmittal which shall provide the following:

1. Company Project Name(s)
2. Company Purchase Order Number
3. This Specification Number
4. The Item Number as Referenced on the Documentation Submittal Schedule, Table 3-1
5. The Document Identification Number, Title, Revision and Date
6. Supplier's Description and Quantities of Items Sent
7. Supplier's Correspondence Identification
8. Updated Drawing List

B. Submittals shall be addressed as follows:

Southern California Edison Company
Engineering Data Management (EDM)
Administration Services Department
P. O. Box 800
Rosemead, California 91770

C. Drawings shall be submitted in sets and each set shall be accompanied by a drawing list which shall list each drawing in the set with its number, title, revision identification and release date.

D. A Master Drawing List shall identify, in numerical order, all the drawings used in the design and manufacture of the Work defined by this Specification. All drawings shall be listed by drawing number, title, revision identification and date, and status.

E. Unless otherwise specified in writing by Company, all documents submitted to Company for approval shall be returned to Supplier not later than 30 days after receipt by Company. Company shall indicate approval status and action required.

F. Company-approved documents shall not be changed without prior written approval from Company. Approved changes shall be incorporated into the applicable documents and transmitted in the final form to Company.

SPECIFICATION A1-1979
Med. Power Transformers

DOCUMENTATION

G. Supplier's drawings shall be reviewed and approved by Company only as to arrangement and conformance to Specification. Such approval shall not be construed to relieve or mitigate Supplier's responsibility for accuracy or adequacy of design, materials and/or equipment represented thereon.

H. Catalogs, bulletins and other published documents shall not be microfilmed. They shall be prepared in the best commercial practice and be suitable for microfilming to the quality requirements specified herein. In general, these documents shall conform to the quality requirements for hard copy specified in Section 2A.2.A.

2A.2 DOCUMENTATION QUALITY REQUIREMENTS

All submittals of Documentation shall be in one or the other of the following forms. The preferred form is shown in Table 3-1.

A. Hard Copy Documents

1. Legibility and contrast of the documents shall be such that every line, number, letter and character shall be clearly legible.
2. Reproductive quality shall be of such clarity as to produce a third generation copy which will meet the legibility requirements of Item 1.
3. Documentation shall be right reading from the image side and shall have dark lines on a light background (positive).
4. Documentation may be reproducible (translucent or transparent) or nonreproducible (opaque).
5. Insofar as practicable, Documentation shall be typed and arranged in a neat and professional manner. Handwritten documents shall conform to the legibility requirements of Item 1, above, and the quality requirements of Item 2, above.
6. Documents, when applicable, shall contain a table of contents, list of figures, and tables of applicable, referenced or complementary documents.

B. Aperture Cards (35 mm)

1. Microfilm shall be silver halide type in negative form. (Clear lines on a black background.)

DOCUMENTATION

2. The frame size shall remain constant at 1.250 inch, plus .000 inch minus .032 inch, across the width of the microfilm by 1.750 inch, plus 0.62 inch minus .000 inch, along the length of the microfilm. The frame shall be centered across the width of the microfilm.
3. Film chip shall cover the entire aperture of the card.
4. The document image area shall not occupy an area larger than 1.197 inch by 1.615 inch in the microfilm frame.
5. The reduction ratio shall be as follows and be included in the image area:

Width \leq 18 inches	14.5X or 16X
Length \leq 24 inches	

18 inches < Width \leq 24 inches	24X
24 inches < Length \leq 36 inches	

Width < 24 inches	29X or 30X
Length < 36 inches	

Drawings more than 34 inches but not more than 48 inches in width shall be rotated 90° when microfilming.

6. The background density of processed microfilm shall be 0.90 through 1.20. All densities are gross densities.
7. Each frame of microfilm shall be exposed and processed so that every line and character on the document appears on the microfilm with sufficient clarity to permit reproducibility through three successive microfilm reproductions. Film shall be free of scratches, light patches, fogged areas, water marks and air bells.

The third generation microfilm shall be used to make paper prints using any enlargement ratio in the range of 14X through 16X. The quality of this print shall be such that every line, number and character be clearly legible.

8. The microfilm shall meet the conditions for residual hypo content as specified by ANSI Standard PH4.8-1971. If one or more of the samples fail to pass the hypo residual test, the lot shall be rejected.

DOCUMENTATION

9. Each microfilm aperture card shall be clearly and legibly identified as follows:

<u>Supplier's</u> <u>Drawing No.</u>	<u>Revision</u> <u>Number</u>	<u>Date</u>	<u>Company's Purchase</u> <u>Order Number</u>
---	----------------------------------	-------------	--

END OF SUBSECTION 2A

SPECIFICATION A1-1979
Med. Power Transformers

SECTION 3

TECHNICAL REQUIREMENTS

3.1 SCOPE

Technical requirements for the design, manufacture, and test of outdoor, oil-immersed, 60 Hz, Class OA, OA/FA, and OA/FA/FA, single and three-phase, medium power transformers are specified.

3.2 STANDARDS

The Apparatus shall conform to the standards listed below, or to their most current revision, to the extent specified herein.

- | | |
|---------------------------|---|
| A. ANSI C57.12.00-1973 | General Requirements for Distribution, Power, and Regulating Transformers. |
| B. ANSI C57.12.10-1977 | Requirements for Transformers, 230,000 Volts and Below |
| C. ANSI C57.12.30-1971 | Requirements for Load-Tap-Changing Transformers 138,000 Volts and Below |
| D. ANSI C57.12.90-1973 | Test Code for Distribution, Power, and Regulating Transformers |
| E. ANSI C76.1-1976 | General Requirements and Test Procedures for Outdoor Apparatus Bushings |
| F. ANSI C76.2-1977 | Standard Electrical, Dimensional, and Related Requirements for Outdoor Apparatus Bushings |
| G. NEMA Pub. No. TR1-1974 | Transformers, Regulators, and Reactors |

3.3 TYPE

Transformers shall be oil-immersed for outdoor service with or without load-tap-changers as specified in the proposal request and Purchase Order.

3.4 COOLING CLASS

Table 3-2 lists Class OA single-phase transformers and Table 3-3 lists Class OA three-phase transformers. The proposal request and Purchase Order will specify when Class OA/FA or OA/FA/FA transformers are required, or when transformers with provisions only for future FA ratings are required.

SPECIFICATION A1-1979
Med. Power Transformers

TECHNICAL REQUIREMENTS

3.5 RATINGS, PHASES, WINDINGS AND CONNECTIONS

The proposal request and Purchase Order will specify the ratings required.

3.5.1 Single-Phase Transformers

- a. For Voltage, kVA, and BIL ratings, and insulation class of windings see Table 3-2. The rated high-voltage of the transformers shall be the mid-tap voltage. Performance characteristics shall be based on mid-tap voltage.
- b. All taps shall be full-capacity taps.

3.5.2 Three-Phase Transformers

- a. For Voltage, kVA, and BIL ratings, and insulation class of windings see Table 3-3. The rated high-voltage of the transformers shall be the mid-tap voltage. Performance characteristics shall be based on the mid-tap voltage.
- b. All taps shall be full-capacity taps, whether load-tap-changing or no-load-tap-changing.
- c. Y/Y connected transformers shall have a 35 percent capacity tertiary winding, adequate for application on a 115 kV system with a short circuit duty of 5000 MVA and a grounding factor (X_0/X_1) of 1.

3.6 LIMITING DIMENSIONS OF 69-KV TRANSFORMERS

Overall Dimensions When Completely Assembled: When assembled complete with bushings, radiators, and other appendages, 69-kV transformers 15/20 MVA and below, with low voltages of 12 kV and 16 kV, without LTC, shall not exceed 192 inches in length, 132 inches in width, and 180 inches in height.

- A. No appendage shall extend more than 96 inches from the line bisecting the long dimension of the transformer tank.
- B. No appendage shall extend more than 66 inches from the line bisecting the short dimension of the transformer tank.

3.7 TEMPERATURE RISE

The average winding temperature rise at any tap position and rated kVA shall not exceed 65°C when measured by the resistance method. The hot-spot temperature rise shall not exceed 80°C.

SPECIFICATION A1-1979
Med. Power Transformers

TECHNICAL REQUIREMENTS

3.8 TRANSFORMER LOADING CAPABILITY

The transformer shall be capable of being loaded in accordance with Company's planning loading limits for distribution substation power transformers which allow for seasonal daily peak loads of 130 percent of top nameplate rating. The daily load profile during seasonal peak conditions can be represented by the following equivalent load cycle:

<u>DURATION OF LOAD</u> (Hours)	<u>LOAD</u> (% of Maximum Nameplate)
10	65
6	115
2	130
6	110

The ambient air temperature shall be in accordance with ANSI Standard conditions which assume a 30°C daily mean with a 40°C maximum temperature.

When loaded as above, the top-oil temperature shall not exceed 110°C and the loss of insulation life for the entire 24-hour load cycle shall not exceed 0.5 percent. (Refer to IEEE Draft Document 507/D5 for loss-of-life calculation methods.)

Leads, connectors, bushings, load and no-load and tap changers and any other ancillary current carrying components shall be capable of being overloaded to a degree equal or exceeding the overload capability of the windings.

3.9 AVERAGE SOUND LEVEL

The average sound level of the transformers shall be 6 dB below the values specified in NEMA Pub. No. TR1.

The transformer nameplate and test report shall provide the measured average sound level in decibels. If a different level is required, it will be so stipulated in the proposal request and Purchase Order.

3.10 IMPEDANCE

- A. The impedance of transformers with or without load tap changing gear shall be in accordance with ANSI C57.12.10 and ANSI C57.12.30.
- B. The low voltage winding to tertiary winding impedance on Y-Y connected transformers shall be 50 to 100 percent of the low voltage winding to high voltage winding impedance when expressed on a common kVA base.

SPECIFICATION A1-1979
Med. Power Transformers

TECHNICAL REQUIREMENTS

3.11 ANGULAR DISPLACEMENT

The angular displacement between the voltages of the high-voltage and low-voltage windings shall conform to ANSI C57.12.00, except that transformers rated 115-12 kV (Line 1, Column G of Table 3-3) shall have an angular displacement of 180°.

3.12 NO-LOAD TAP CHANGERS

- A. Only externally operated no-load tap changer designs previously approved by Company's Chief Apparatus Engineer are acceptable. Modifications to previously approved tap changers shall also require Company approval. Taps shall be located in the high-voltage windings. The tap changers shall be capable of carrying the full transformer short-circuit current without damage or contact separation.
- B. Tap changers on three-phase transformers shall be gang-operated.
- C. Tap changers shall meet the requirements of ANSI C57.12.10, except that:
 - 1. If it is not convenient on transformers rated 10,000 kVA and below to locate the tap-changer handle on the side wall of Segments 1 or 4, it may be located on the side wall of Segment 2.
 - 2. On transformers rated above 10,000 kVA the tap-changer handle shall be located on the side wall in any of the four segments.

3.13 LOAD TAP CHANGERS

3.13.1 General

- A. Only load-tap-changer designs previously approved by Company's Chief Apparatus Engineer are acceptable. Any modifications to previously approved tap changers shall require Company approval. Load-tap-changing apparatus shall conform to ANSI C57.12.30.
- B. Single-phase transformers with load-tap-changers are not covered by this Specification.
- C. Unless otherwise specified in the proposal request and Purchase Order, load-tap-changers shall be in the low-voltage winding and shall have seventeen full capacity steps.

3.13.2 Operations

Each load-tap-changer shall be capable of performing not less than 200,000 no-load operations without replacing or rebuilding any of its components. Also, each tap changer shall be capable of performing

TECHNICAL REQUIREMENTS

not less than 20,000 load operations at 1.1 times rated current at the maximum 65°C rating and at rated step voltage without replacing any arcing contacts or other parts involved in the current interruption operation.

- a. For each load-tap-changer, a type-test certificate shall be provided to Company as verification of the above-specified capabilities. The certificate shall be accompanied by computations and supporting documentation.
- b. When a reactor is used as transition impedance, easy access shall be provided, particularly to the tie rods or jack screws, where applicable.

3.13.3 Compartments

- a. The load-tap-changer, including the selector and transfer switches, shall be in separate, oil-filled compartments which are attached to the main tank. The barrier between the tap-changer compartments and the main tank shall be capable of withstanding the forces imposed by the full-vacuum filling on either side. Internal inspection within the tap-changer compartment shall not require lowering the oil level in the main tank.
- b. The transfer switch compartment of the load tap changer shall be furnished with a pressure-relief device and a breather to vent switching gases.
- c. Provisions shall be made in the voltage control compartment for holding an instruction book which shall be shipped with each transformer.

3.13.4 Controls

- a. Load-tap-changer controls, unless otherwise specified in the proposal request and Purchase Order, shall be automatic. The necessary means to parallel the control circuit of the transformer with a similar transformer by means of the circulating-current method shall be furnished. Control circuit current shall be 0.2 amperes.
 1. Load-tap changing transformers with 34.5 kV low voltage windings shall be equipped with current transformers for line-drop compensation. The CT's shall be installed on both the X1 and X2 bushings.
 2. Potential and control power for the LTC apparatus will be furnished by Company and be external to the transformer.

TECHNICAL REQUIREMENTS

- b. The tap-changer controls on the transformers, including the hand crank for manual operation, shall be operable from ground level. The drive shaft shall be protected from accidental contact by personnel.
 1. The tap position indicator shall be visible from the operating position.
 2. The motor for the load-tap-changing mechanism shall be designed for 60 Hz operation and, unless otherwise specified in the proposal request and Purchase Order, shall be suitable for operation from a 230-volt source.
 3. All control knobs except AUTO-MANUAL-OFF and MANUAL-RAISE-LOWER shall have suitable locking devices to prevent accidental changes in adjustments.
 4. End limit switches installed in externally mounted position indicators are not acceptable.
- c. The automatic control equipment for the LTC shall consist of all necessary devices and accessories, and shall include the following:
 1. MANUAL-AUTOMATIC transfer switch.
 2. Voltage testing terminals.
 3. Voltage sensing device.
 4. Control and time-delay relays.
 5. Reversing relay.
 6. Line-drop compensator elements.
 7. Reactance reversing switch for reversing the reactance of the line-drop compensator.

TECHNICAL REQUIREMENTS

3.14 TRANSFORMERS WITH FA RATINGS

- A. When specified in the proposed request and Purchase Order, transformers with OA/FA or OA/FA/FA ratings or future OA/FA or OA/FA/FA ratings shall be equipped with thermally operated control devices. The thermal elements shall be mounted in wells and responsive to top-oil temperature. The top-oil temperature indicator shall be equipped with three non-grounded contacts. In addition, transformers with OA ratings of 10 MVA and above shall be equipped with a hot-spot indicator with three non-grounded contacts.
- B. Unless otherwise specified in the proposal request and Purchase Order, the fans shall have 230 volt, single-phase motors. Fans shall be individually protected with a suitable thermal device. The supply source shall be a three-phase, 230 volt circuit protected by a suitable thermal magnetic device. The load of the single-phase fans shall be distributed between the three phases of the supply.
- C. The FA ratings for single-phase and three-phase transformers covered by ANSI shall be in accordance with ANSI C57.12.10.
- D. When provisions for "future" class FA or FA/FA ratings are specified in the proposal request and Purchase Order, these provisions shall include:
 1. Thermally operated control device(s) as specified in Section 3.14A.
 2. The necessary mechanical arrangements and facilities for mounting control cabinets, conduit, and fans.
 3. All other necessary changes to accommodate the FA or FA/FA rating(s) of the transformers.
- E. Cooling fans which are located such that any moving parts thereof are seven feet or less above the bottom of the transformer base shall be equipped with metal guards in accordance with the following:
 1. Where the guard is within four inches of moving parts, openings through the guard shall be of such size to prohibit the passage of any object greater than one-half inch in diameter.
 2. Where the guard is more than four inches from moving parts, the maximum opening shall not be more than two inches, and when slatted guards are used, the width of the opening shall not be greater than one inch.

SPECIFICATION A1-1979
Med. Power Transformers

TECHNICAL REQUIREMENTS

3.15 TRANSFORMER SHORT-CIRCUIT CAPABILITY

The transformers shall be capable of withstanding, without injury, the mechanical and thermal stresses caused by short circuits on the external terminals of any winding or windings, in accordance with ANSI C57.12.00. In determining the maximum short-circuit current, only the impedance of the transformer will be considered.

3.16 BUSHINGS

3.16.1 General

- A. All bushings furnished with the transformers shall meet the following requirements:
1. They shall be Company-approved, with threaded studs. External bushing studs shall be silver plated. Bushing shells shall be of wet-process porcelain.
 2. Unless otherwise specified in the proposal request and Purchase Order, bushings rated 2000 amperes and below shall be furnished without terminal connectors. Bushings with current ratings above 2000 amperes with stud diameters greater than two inches shall be furnished with terminal connectors having a single spade which shall be silver- or tin-plated.
 3. Bushings of the 15 kV insulation class and below shall have nameplates which show, as a minimum, the following information: Supplier's name, catalog number, and voltage and current ratings.
 4. Bushings of the 23/25 kV insulation class and above shall have nameplates which show, as a minimum, the information listed in ANSI C76.2.
 5. The current ratings of the bushings and bushing leads shall be suitable not only for the maximum rating of the transformers, but also the overload capability as provided in Section 3.8.
 6. Bushings furnished on transformers covered by this Specification shall meet the temperature limitations specified in ANSI C76.1. Proof of compliance with this requirement shall be furnished.
 7. Flashover protective electrode gaps shall not be furnished.

TECHNICAL REQUIREMENTS

B. In addition to the above requirements, 34.5, 69, and 115 kV bushings shall meet the following requirements:

1. Have no cemented joints, consist of one-piece porcelain units and have porcelain in compression only.
2. Have one of the following: (1) sealed reservoir with magnetic oil gauge, (2) Company-approved Ohio Brass prism-backed amber oil-sight gauge, (3) Company-approved Lapp or General Electric glass bowl reservoir, or (4) Company-approved General Electric prismatic oil-sight gauge.
3. Be of the oil-impregnated, paper-insulated capacitor type with a common or interconnecting insulating oil supply above and below the mounting flange.
4. Be cover mounted and have electrical characteristics which conform to ANSI C76.2.
5. Meet the dimensional requirements of ANSI C76.2.

C. In addition to the requirements of Section 3.16A, 25 kV bushings shall meet the following:

1. 23/25 kV bushings shall have no cemented joints, consist of one-piece porcelain units and have porcelain in compression only.
2. The 23/25 kV bushings which are of the capacitor type and insulated with oil-impregnated paper shall have a common or interconnecting insulating oil supply above and below the mounting flange. They shall have one of the following: (1) sealed reservoir with magnetic oil gauge, (2) Company-approved Ohio Brass prism-backed amber oil-sight gauge, (3) Company-approved Lapp or General Electric glass bowl reservoir, or (4) Company-approved General Electric prismatic oil-sight gauge.
3. Bushings of the resin-bonded, paper-insulated type shall be oil filled above the mounting flange and shall be provided with means for checking the level of oil.
4. 23/25 kV bushings shall have threaded studs.

TECHNICAL REQUIREMENTS

5. 23/25 kV bushings shall have electric characteristics which conform to ANSI C76.2.
6. 23/25 kV bushings shall meet the dimensional requirements of ANSI C76.2.

3.16.2 Bushings for Transformers with 110 kV EIL Windings:

On all transformers with 110 kV BIL, high-voltage or low-voltage windings, Supplier shall furnish bushings as follows:

- A. Transformers which have 110 kV EIL windings and continuous line current ratings 1200-amperes and below shall have, for those windings, 23/25 kV class bushings which conform to ANSI C76.1 and C76.2.
- B. Transformers which have 110 kV BIL windings and continuous line current ratings above 1200 amperes shall have, for those windings, Company-approved bushings with a minimum creepage distance of 15 inches and electrical characteristics specified for 15 kV class bushings in ANSI C76.2. These bushings shall be mounted with or without adapters on transformer bushing flanges with six equally spaced 7/8" bolt holes on 9 1/4" bolt circles.
- C. Cover-and wall-mounted bushings shall have threaded, externally silver-plated studs.

3.16.3 Bushings for Transformers with 450 kV EIL Windings:

The high-voltage bushings shall be of the 115 kV insulation class, 550 kV BIL.

- A. The neutral bushing shall be of the 69 kV insulation class, 350 kV BIL.
- B. The low-voltage bushings shall, for a 34.5 kV winding, be of the 34.5 kV insulation class, 200 kV BIL. For 12,470 volt windings, the bushings shall be as specified in Section 3.16.2.
- C. The minimum external clearances shall be as specified in NEMA Pub. No. TR 1.

TECHNICAL REQUIREMENTS

3.17 BUSHING CURRENT TRANSFORMERS

- A. When specified in the proposal request and Purchase Order, 69 and 115 kV transformers shall be furnished with multi-ratio current transformers on the high-voltage bushings; the current ratio shall be either 600:5 or 1200:5, as specified.
- B. The bushing current transformers shall meet the requirements of ANSI C57.13, and shall have 5 taps.
- C. When current transformers of different ratios are furnished, the ratios and locations shall be as specified in the proposal request and Purchase Order.
- D. The accuracy class of 600:5 bushing current transformers shall be C200; that of 1200:5 current transformers shall be C400. When connection is made to the 120-turn tap, the 1200:5 bushing current transformers shall produce 100 volts with an excitation current of 0.15 ampere or less, and 50 volts with excitation of 0.075 ampere or less.

3.18 ZIG-ZAG AND Y CONNECTIONS

When zig-zag or Y connections for three-phase transformers are specified, the neutrals shall be made available as follows:

- A. The neutrals for high-voltage windings 69 kV and below, with cover-mounted high-voltage line bushings shall be brought out through cover-mounted, bushings having the same insulation class as the line bushings.
- B. The neutrals for low-voltage windings with cover-mounted, low-voltage line bushings shall be brought out through cover-mounted bushings of the same insulation class as that of the low-voltage line bushings.

3.19 CORES

- A. On core-type transformers the core shall be grounded at one point only through a removable connection. The removable connection shall be readily accessible through a handhole or manhole and made up in such a way that it may be conveniently opened to check the core insulation. When the connection is removed, the insulation resistance between the core and ground shall not be less than one hundred megohms.

TECHNICAL REQUIREMENTS

B. The core assemblies and the clamping or supporting structures shall be such that the completely assembled transformers shall meet the average sound level requirements of Section 3.9. The cores shall be clamped and braced to resist distortion caused by short-circuit stresses or transportation handling, and to prevent the shifting of core laminations. The nuts and bolts of the clamping structures shall be secured so that they will not be loosened by vibration incident to transportation and operation.

C. Wound transformer cores are not acceptable.

3.20 TANKS, COVERS, AND RADIATORS

3.20.1 General

Transformer tanks, covers, and manhole covers of the transformers shall be of substantial construction and capable of withstanding, without injury, the stresses incident to shipment and operation. The tanks, covers, and manhole covers of all 34.5, 69, and 115 kV transformers and of all transformers 10,000 kVA and above, regardless of the high-voltage rating, shall be capable of withstanding the forces resulting from essentially full vacuum.

3.20.2 Covers

The covers of all transformers shall have handholes or manholes, or both, to afford adequate access to the internal parts. The diameter of the manholes shall be not less than 24 inches. Manhole covers shall have at least two handles for lifting. At or near the intersection of the centerlines of the tank covers on all transformers, a boss shall be welded to the cover for the purpose of mounting a pressure-sensing element.

- a. The boss shall be drilled and tapped for the number of holes in the pressure-sensing element. The approved Westinghouse device referred to in Section 3.23.1 has eight mounting holes.
- b. The drilled and tapped mounting holes shall not extend beyond the thickness of the boss and into the tank cover.
- c. The boss and tank cover shall be drilled for connection to the gas space. The hole shall be not less than one inch in diameter.

TECHNICAL REQUIREMENTS

- d. The pressure-sensing device shall be packaged and shipped as part of the transformer accessories. The transformer shall be shipped with a gasketed plate bolted to the boss. The number and size of holes in the plate shall be the same as those in the pressure-sensing device.

3.20.3 Gaskets

All gaskets shall be Nitrile rubber, Armstrong DC 100 or DC 181 corprene. Metal surfaces to which gaskets are applied shall be smooth, and shall have sufficient rigidity to assure proper compression of the gaskets. Stops shall be provided so that over-compression of the gaskets cannot occur. All seams and joints in the transformers shall be oil and gas tight.

3.20.4 Tanks

Transformer tanks shall be clean and free of all mil scale, corrosion, and foreign substances.

- A. Suitable means shall be provided to facilitate tanking and untanking without damaging the windings, cores, or tanks. These devices shall also prevent movement of the core assembly in transit and during seismic disturbances.
- B. Transformer covers, tanks, core and coil assemblies, and radiators shall be provided with means for lifting and handling.
- C. Both ends of the tanks shall be provided with eyes for pulling the fully assembled transformer in either direction. Proper clearances shall be provided between the pulling eyes and radiators and other appurtenances so as not to interfere with pulling cables.
- D. Jack ports or lugs shall be provided on all tanks, regardless of the kVA rating of the transformers. The ports or lugs shall conform to ANSI C57.12.10. The jacks, when in place, shall not interfere with the placing of skids.

3.20.5 Radiators

- A. On transformers having OA ratings of 15,000 kVA or less radiators which are welded to the tanks are preferred over bolted-on radiators.

TECHNICAL REQUIREMENTS

- B. Radiators shall be braced to withstand the vibrations and impacts which occur during shipment and operation. If radiators are removable, they shall be supplied with shut-off valves at both top and bottom. Shut-off valves shall be designed so that packing glands can be serviced without removing the valves.

3.21 OIL AND OIL PRESERVATION SYSTEMS

3.21.1 Oil

Oil furnished by Supplier shall meet the requirements of ASTM Standard D3487-76 for mineral insulating oil.

- A. Company shall not accept additional field processing of the oil as a requirement for the installation of the transformers, or as a requirement after any future servicing of the transformers.
- B. For Suppliers who do not have their own Company-approved oil, the following are Company-approved oils which meet the requirements of Company Specification No. A21, Electrical Insulating Oil.
 - 1. Shell Oil Company - Diala AX, Inhibited.
 - 2. Standard Oil Company of California - Chevron Inhibited.
 - 3. Witco Chemical Golden Bear Division - GB 60M Type II.
- C. If Company elects to supply oil, it shall meet the requirements of Company Specification No. A21, Electrical Insulating Oil, and shall not affect warranty provisions as stated in Section 1.7, "Warranty".

3.21.2 Oil Preservation

Oil preservation for transformers rated 15,000 kVA and below shall be accomplished by means of a sealed-tank system. Oil preservation for transformers rated above 15,000 kVA shall be by means of a sealed-tank system or inert-gas pressure system.

TECHNICAL REQUIREMENTS

3.22 INERT-GAS REGULATING EQUIPMENT

The inert-gas regulating equipment shall be furnished by Supplier and shall be contained in a weatherproof, steel cabinet, the top of which shall be not more than six feet above the base level of the transformer tank. The cabinet shall be supported with flexible mountings designed to keep normal transformer vibrations from reducing the life of the instruments. The inert-gas piping shall be supported to prevent resonant vibration of the pipe. The cabinet shall be provided with a glass window to facilitate inspection of the pressure gauges and shall contain the following equipment:

- A. One nitrogen cylinder with CGA No. 580 valve outlet connection for dry nitrogen per ANSI B57.1. The inlet thread designation for this connection is .965"-14NGO-RH-INT. The bottle shall be approximately 51 inches long, nine inches in diameter, and with the centerline of the valve handle 54 3/4 inches from the bottom of the bottle.
- B. One three-stage reducing valve equipped on the high side with a pressure gauge to indicate cylinder pressure. The gauge shall have low-pressure alarm contacts conforming to ANSI C57.12.10.
- C. One compound gauge with alarm contacts for transformer pressure indication which conforms to ANSI C57.12.10.
- D. One pressure-vacuum bleeder device.
- E. One sampling valve with shut-off valve.

A smaller, weatherproof, steel cabinet may be furnished in lieu of the cabinet specified, by mounting the nitrogen cylinder external to the steel cabinet. A support shall be provided at the base of the transformer tank for the nitrogen cylinder, and a chain and fittings shall be provided for securing the cylinder to the transformer tank wall.

3.23 ACCESSORIES

3.23.1 Fault Pressure-Sensing Elements and Sudden-Pressure Relays

Transformers, 10,000 kVA and above, shall be equipped with a Westinghouse sudden pressure relay with pressure-sensing element and microswitch, Style 251D045G03. The device shall be mounted on top of the transformer in accordance with the requirements of Section 3.20.2. The leads from the device shall be conduit-enclosed and terminated on terminal blocks in either the transformer control cabinet or in an auxiliary weatherproof cabinet mounted on the low-voltage side of the transformer. The leads shall not pass between the low voltage bushings.

TECHNICAL REQUIREMENTS

3.23.2 Pressure-Relief Device

Transformers shall be equipped with at least one cover-mounted, gas-tight, mechanical pressure-relief device to permit the escape of gas when the internal pressure becomes abnormal.

- A. The pressure at which this device opens shall be lower than the maximum pressure that the tanks and cover can safely withstand.
- B. The pressure-relief device shall be such that when pressure has been relieved the relief cover will reseal itself to keep out moisture.
- C. The device shall be equipped with alarm contacts which conform to ANSI C57.12.10.
- D. A cable or conduit shall be provided between the contacts of the pressure relief device and the terminals in the terminal box.
- E. To prevent rapid deterioration of the pressure-relief device gasket, the device shall be bolted to a boss and not directly to the flat surface of the cover of the transformer.

3.23.3 Temperature Indicators

Standard accessories, as specified in ANSI C57.12.10, shall be furnished on all transformer tanks and covers, except that:

- A. The temperature indicators on all transformers shall be equipped with nongrounded alarm contacts which meet the requirements of ANSI C57.12.10.
- B. The dial markings of the liquid temperature indicators on all transformers shall cover a range of 0°C to 160°C. The alarm contacts shall be set at 100°C. Fan control shall be initiated at 65°C and switched off at 55°C for OA/FA transformers and for the first stage of forced cooling for OA/FA/FA transformers. The second stage of forced cooling for OA/FA/FA transformers shall be initiated at 75°C and switched off at 65°C.

TECHNICAL REQUIREMENTS

- C. The dial markings of the winding temperature indicators shall cover a range of 0°C to 220°C. The alarm contacts shall be set at 110°C. The other two contacts shall be adjustable over a range of 120°C to 220°C for future Company use.
- D. A $\pm 2.5^\circ\text{C}$ tolerance on the above temperature settings is permissible.
- E. The temperature indicators shall be mounted not more than eight feet above the transformer base. Dial thermometers with a bimetal sensing element may be furnished if the above mounting limitations can be met.

3.23.4 Pressure-Vacuum Gauge and Bleeder

The pressure-vacuum gauge and bleeder shall be connected to the gas space above the maximum oil level. The gauge shall be mounted not more than eight feet above the transformer base.

3.23.5 Valves

Three phase transformers, with OA ratings of 15,000 kVA and above, shall be equipped with the following valves:

- A. One 2-inch globe-type valve located in the sidewall of the tank, at the same height as the upper radiator headers, above one of the valves specified in B below.
- B. Two 2 inch drain valves of the globe type located on opposite sides of the tank and plugged with pipe plugs, each equipped with a sampling device.
- C. One 2 inch globe-type valve for the upper filter press connection. The upper filter valve shall be located not more than three inches below the top edge of the tank wall.
- D. Each oil-filled compartment of the load tap changer shall be furnished with a 2 inch drain valve of the globe type and with globe valves or plugs to vent the compartments when filling with oil. A pipe connection shall be provided such that a vacuum can be pulled on either compartment separately or all compartments simultaneously.

TECHNICAL REQUIREMENTS

3.23.6 Liquid Level Indicator

Liquid level indicators, as specified in ANSI C57.12.10, shall be furnished and equipped with a low-level alarm contact.

3.24 WIRING, CONDUITS, BOXES, AND TERMINAL BLOCKS

3.24.1 Wiring

- A. All devices mounted on each transformer, including current transformer secondary circuits, shall be wired to the control cabinet or terminal box using single conductor type XHHW cable or multi-conductor cable having XLP insulated conductors with an overall PVC jacket. The cable shall be rated 600 volts and 90°C.

Corrosion-resistant, plug-type, threaded, watertight connectors shall be furnished for cable connections at the devices.

- B. Wiring inside control cabinets shall be type XHHW or type MTW rated 600 volts and 90°C.
- C. Conductors shall be stranded tinned copper having a minimum size of No. 14 AWG. Current transformer secondary circuits shall be wired with a minimum wire size of No. 12 AWG.
- D. All wires shall be terminated with crimp-type tinned copper ring-tongue terminals having insulated ferrules. Company approved ring-tongue terminal manufacturers and types are as follows:

<u>Wire Size (AWG)</u>	<u>Stud Size (AWG)</u>	<u>AMP</u>	<u>Hollingsworth</u>	<u>Penn-Union</u>	<u>3M</u>	<u>Triangle</u>
12	10	35109	R5109	R5C-10	D-01-606	13-10-PB
14	10	31903	R1903S	R5B-10	C-01-610	12-10-PB

SPECIFICATION A1-1979
Med. Power Transformers

TECHNICAL REQUIREMENTS

3.24.2 Conduits and Fittings

Rigid, galvanized steel conduit shall be used to support and protect interconnecting cables. Conduit connections shall be made either at the bottom or sides of terminal boxes. Condulets with gasketed covers shall be used at bends. In lieu of conduits, structural channels on the tank may be used for wireways. Watertight, clamp-type bushings shall be used for cables entering conduits and wireways. Cable without conduit may be used at devices to facilitate maintenance and reduce vibration; however, the cable shall be multi-conductor type with an overall jacket and the length of unsupported cable shall not exceed three feet.

3.24.3 Boxes

- A. Junction boxes with gasketed covers shall be provided where required to make connections between devices and the control cabinet or terminal box. Splices in conduits or condulets are not acceptable.
- B. Transformers without a control cabinet shall be furnished with a weatherproof terminal box for the termination of wiring of all devices on the transformer, including alarm circuits, fault relays, and current transformer secondary circuits.

3.24.4 Terminal Blocks

Company approved molded-plastic, No. 10 size or larger, screw-type terminal blocks rated 600 volts shall be provided for all wiring. Short-circuiting type terminal blocks shall be used for current transformer circuits. Terminal blocks shall be fastened in position with bolts. All terminals shall be identified. No more than 2 wires shall be terminated at one terminal. A minimum of 20 percent spare, unused terminals shall be provided in the terminal blocks. Company-approved terminal block manufacturers and types are as follows:

<u>Number</u> <u>Terminals</u>	<u>Allis-Chalmers</u>	<u>Buchanan</u>	<u>Penn-Union</u>
8	18-103-751	B108	6008
12	18-103-750	B112	6012

3.24.5 Alternates

If Supplier prefers to furnish an alternative type of control wire, ring-tongue terminal, or terminal block, Supplier shall submit a sample of the alternative and shall obtain approval of the deviation, in writing, from Company's Chief Apparatus Engineer.

SPECIFICATION A1-1979
Med. Power Transformers

TECHNICAL REQUIREMENTS

3.25 NAMEPLATES

Each transformer shall be furnished with a non-corrosive, stainless steel nameplate, permanently attached with stainless steel hardware. The nameplate shall contain the information specified in ANSI C57.12.00. The information shall be for operation at a temperature rise of 65°C. Nameplates shall also show transformer ratings for operation at temperature rise of 55°C, the sound level and the measured zero sequence impedance.

3.26 PAINING

Transformers shall be thoroughly cleaned by particle blasting and painted with at least one corrosion inhibiting primer and one finish coat to give a total dry-film thickness of no less than 3 mils. The finish coat shall be Supplier's standard gray, ANSI-70. All paint applied by Supplier shall be dry before shipping the Apparatus. Two gallons of finish paint shall be furnished with each transformer. The inside of each transformer shall be painted with a light colored paint.

3.27 SEISMIC CAPABILITY

3.27.1 Seismic Design Criteria

- A. The Apparatus shall remain functional and operable during and subsequent to the application of the seismic loading.
- B. A structure response spectra indicating the response that the Apparatus is expected to experience during a seismic event is shown by Figure 1. The zero period accelerations (ZPA) indicated by site response spectra will be specified in the proposal request and Purchase Order.

3.27.2 Seismic Qualification

- A. Supplier shall perform analysis, tests, or a combination of both, to verify compliance with the seismic requirements. All seismic calculations and tests shall be documented in a form readily verifiable by persons trained in seismic analysis. IEEE Standard 344-1975 may be used as a guide for analysis and testing.
- B. For seismic calculations, loading shall be the combination of dead-weight and operating (live) loads with the loads due to vertical and horizontal seismic accelerations. The resultant force vector for each resonant mode shall be calculated by the square root of the sum of the squares

TECHNICAL REQUIREMENTS

(SRSS) method using two horizontal orthogonal loads simultaneously with the vertical load. All significant resonant modes shall be combined by the SRSS method. The resultant loads shall be considered as being applied through the center of gravity of the major components of equipment.

- C. For seismically stiff components Supplier may use the unamplified zero period acceleration if it submits calculations or test data which verify that the component resonance occurs above 33 Hz. Otherwise, a simplified pseudodynamic approach using a conservative amplification factor or other Company-approved method may be used for analysis.
- D. The resultant stresses shall not exceed the lesser of: 90% of yield stress at 0.2% offset, 90% of yield stress, or 133% of stress allowed by applicable codes during normal operation.
- E. Supplier shall submit to Company a certificate of compliance attesting to the completeness, accuracy and compliance with the seismic requirements of the specification.
- F. The certificate of compliance shall be signed by a duly authorized representative of Supplier and a registered professional engineer qualified in the field of seismic vibration.

3.28 FACTORY TESTS

3.28.1 Routine Tests

Each transformer shall be completely assembled and given routine tests in accordance with ANSI C57.12.00 and ANSI C57.12.90. Bushings that the Supplier intends to furnish with the transformers shall be installed on the transformer during routine tests.

Transformers with one wye or zig-zag connected winding shall have the zero sequence impedance measured and shown on the nameplate. Transformers with two or more wye or zig-zag connected windings shall have the zero sequence impedances measured and shown in the certified test report.

3.28.2 Design Tests

The following tests shall be performed on one transformer of each rating or design. In lieu of the specified tests, certified tests made on an identical transformer are acceptable.

TECHNICAL REQUIREMENTS

- A. Temperature test in accordance with ANSI C57.12.90.
- B. Audible sound level test in accordance with NEMA Pub. No. TR1.
- C. Bushing temperature test in accordance with ANSI C76.1.

3.28.3 Additional Tests

- A. Impulse tests shall be performed on transformers having high voltage windings of 115-kV, in accordance with ANSI C57.12.00 and ANSI C57.12.90.
- B. Single-phase excitation current measurements shall be performed on each phase of the high voltage winding at 10-kV and 60 Hertz. If the exciting current at the above voltage exceeds 200 milliamperes, the measurements shall be performed at 2.5 kV. Low voltage excitation current measurements shall be performed on each transformer and the results shall be made available to Company prior to the transformer's arrival at site.
- C. A special heat run test, to verify loading capability in accordance with Section 3.8, shall be performed when specified in the proposal request and Purchase Order.

3.29 PREPARATION FOR SHIPMENT

- A. Transformers shipped without oil shall be filled with dry gas and sealed at the factory, and provided with sufficient gas to maintain a positive internal pressure to the point of delivery.
- B. Gas pressure and moisture content shall be measured and recorded prior to shipment, and submitted to Company when the transformer is shipped.
- C. Radiators and coolers shall be sealed to prevent the entrance of moisture.
- D. Transformers and all components shall be prepared for shipment to prevent damage during handling and in transit and shall be suitable for outdoor storage at the Jobsite.
- E. A two-way or three-way impact recorder shall be provided on each transformer 15 MVA and larger if shipped by rail.

3.30 ERECTION ASSISTANCE

Supplier shall furnish technical assistance during erection, adjustment, and energization of transformers at the request of Company.

SPECIFICATION A1-1979
Med. Power Transformers

TECHNICAL REQUIREMENTS

3.31 QUALIFICATION

- A. In order to qualify transformer designs for Company's use, certified test data and supplemental information shall be furnished. Supplier shall furnish design calculations.
- B. If changes have been made or are proposed on any previously qualified transformer design, Supplier shall, in writing, describe the changes in detail and furnish sketches, calculations, drawings, and photographs to fully describe the change(s). If any of the changes affect the short-circuit performance of the transformer, Supplier shall resubmit complete certified test data and supplementary information in accordance with Section 3.32B.
- C. The following subparagraphs describe, outline, or otherwise define the certified test data and supplemental information which shall be submitted for design approval:
 1. To permit Company to fully evaluate each particular transformer design, Supplier shall furnish data in the form of design calculations, test reports, drawings, photographs, together with information on winding designs, coil support methods, and materials used. In addition, each Supplier shall furnish, in writing, a statement which contains the reasons why it believes its transformer(s) meet the requirements of this Specification.
 2. Proof of short-circuit capability shall be submitted in the form of design test reports, or test reports of full-current tests performed on production units or prototypes of winding designs and mechanical coil support methods for each of the various basic transformer designs. The test reports shall include test parameters, descriptions of test facilities and instrumentation, test procedures, oscillograms, and an analysis showing how mathematical computations compare with the test results. In addition, sufficient details and drawings shall be furnished to permit identification of each basic transformer design.
- D. At Company's discretion, a short-circuit test on a representative transformer at Company's facilities may be required to further qualify a transformer design.
- E. Should Company elect to test a transformer to determine the validity of Supplier's design and test data, the initial test shall be at Company's expense. Should the outcome of the test be unsatisfactory, any subsequent testing on that transformer or on similar transformers shall be at Supplier's expense.

TECHNICAL REQUIREMENTS

3.32 EVALUATION OF QUOTED COSTS

3.32.1 Evaluated Costs

In the analysis of each Supplier's proposal, Company shall evaluate the quoted costs, and the transformer operating costs on the following basis:

Annual Costs

A. Basis for Annual Costs:

1. Transformer Carrying Charge: This is 20% percent of the quoted cost.
2. Loss Demand Charge: This is derived from carrying charges on installed generation costs. This is currently \$160.00/kW.
3. Load-Loss Energy Charge: This is based on a cost of \$0.06/kWh and a load loss factor of 0.36.

B. The following are the equations for Items 1 through 3, above.

1. (Quoted Cost) (0.20) _____
 2. (Total max. loss at FA 65°C load
in kW) (\$160.00) _____
 - 3a. (Core loss in kW) (8760h) (\$0.06) _____
 - 3b. (Total max. losses at FA 65°C load
minus core loss in kW) (3150h) (\$0.06) _____
- Total Evaluated Annual Cost \$ _____

TECHNICAL REQUIREMENTS

3.32.2 Reimbursement

Failure to meet the guaranteed losses shall require reimbursement to Company for an amount equal to the present cost of the difference between the guaranteed and actual loss evaluation. The amount to be reimbursed to Company will be calculated on the following basis:

- A. Total evaluated annual cost based on actual losses _____
- B. Less total evaluated annual cost based on guaranteed losses _____
- C. Difference (A-B) _____
- D. Difference divided by carrying charge _____
- E. Amount to be reimbursed _____

3.33 DATA, DRAWINGS, MANUALS AND TEST REPORTS

3.33.1 Data and Drawings

Supplier shall furnish three full sets of outline, nameplate, and bushing drawings; detailed terminal board drawings when wye-delta or series-parallel connections are specified; wiring diagrams, conduit and terminal details for all control and auxiliary equipment; and any other drawings required for installation of the transformers. Drawings shall be furnished in accordance with Table 3-1.

If Supplier has on file with Company's Transmission/Substation Standards Group an approved set of bushing drawings for all transformers covered by this specification, it will not be necessary to furnish bushing drawings for review. However, it shall be the responsibility of Supplier to state that his bushing drawings are on file.

Outline drawings shall include the following information:

- A. Projected floor space of the transformer, including radiators and expansion tanks.
- B. Height of transformer from floor level to top of high-voltage bushing.
- C. Height of transformer from floor level to top of low-voltage bushing.

TECHNICAL REQUIREMENTS

- D. Height of transformer from floor level to top of tank, and to the highest nonremovable part.
- E. Height above floor necessary to untank.
- F. Weight of core and windings.
- G. Weight of tank and fittings.
- H. Number of gallons of oil and total weight in the oil.
- I. Total weight of the assembled transformer including oil.
- J. The gas volume of the transformer tank at 25°C; also, when furnished, the auxiliary tank on load-tap changing transformers.
- K. Power requirements for all control and auxiliary equipment.
- M. Approximate base dimensions of the transformer.
- N. Approximate center of gravity.

3.33.2 Manuals

Supplier shall submit complete instruction manuals, including parts lists, for the transformers and all devices and equipment furnished with the transformers. The manuals shall give complete and detailed instructions for erection, installation, operation, adjustment, and maintenance. Copies shall be submitted as specified in Table 3-1. Also, one instruction book shall be shipped with each transformer. The instruction book shall be located in a pocket attached to the inside of the door of the control cabinet.

3.33.3 Test Reports

Supplier shall submit certified test reports for all specified tests. Copies shall be submitted as specified in Table 3-1.

3.33.4 Photographs

For units rated 15,000 kVA OA and above Supplier shall furnish one set of 8 x 11 inch glossy photographs taken during assembly of the transformers which clearly show the following views:

- A. The inside of the tank bottom.
- B. Stacking the core iron.

TECHNICAL REQUIREMENTS

- C. Winding assembly.
- D. Final assembly and lead support.
- E. Super structure and lead support.
- F. Tap-changer assembly.
- G. External views.

3.34 SPARE PARTS

Supplier shall furnish, on request, repair or replacement parts for a period of at least 10 years, by maintaining in storage all necessary spare parts or templates, gauges, patterns, records, and special machinery from which necessary spare parts may be made.

ITEM	TYPE OF DOCUMENTATION REQUIRED	REFERENCE SECTION	NUMBER AND TYPE OF SUBMITTALS AFTER AWARD OF CONTRACT				APPROVAL DOCUMENTS REQUIRED NO. OF DAYS AFTER AWARD	REMARKS
			FOR APPROVAL		AFTER APPROVAL			
			QTY.	PREF. FORM	QTY.	PREF. FORM		
1.	Outline drawings	3.33.1	3	N	1	R	90*	**"After approval" copies required at time of transformer delivery. **Copies required 45 days prior to transformer F.O.B. date. ***Copies required 15 days prior to transformer F.O.B. date. ****Copies required at time of transformer delivery. 8 instruction books for each rating given on a Purchase Order.
2.	Base details	3.33.1	3	N	1	R	45*	
3.	Bushing drawings	3.33.1	3	N	1	R	90*	
4.	Nameplate drawings	3.33.1	3	N	1	R	90*	
5.	Terminal Board drawings excitation curves for each type relay BCT	3.33.1	3	N	1	R	90*	
6.	General Arrangements	3.33.1	3	N	1	R	45*	
7.	Device Detail Drawings	3.33.1	3	N	1	R	45*	
8.	Schematic diagrams	3.33.1	3	N	1	R	90*	
9.	Wiring diagrams	3.33.1	3	N	1	R	90*	
10.	Motor data	3.33.2	3	N	5	N	90*	
11.	List of Special Tools		3	N			45*	
12.	Test Reports	3.33.3			5	N	***	
13.	Manuals	3.33.2	5	N	8+	N	****	

LEGEND: N - Nonreproducible, R - Reproducible, A - 35 mm Aperture Card

TABLE 3-1 DOCUMENTATION SUBMITTAL SCHEDULE

ITEM	TYPE OF DOCUMENTATION REQUIRED	REFERENCE SECTION	NUMBER AND TYPE OF SUBMITTALS AFTER AWARD OF CONTRACT				APPROVAL DOCUMENTS REQUIRED NO. OF DAYS AFTER AWARD	REMARKS
			FOR APPROVAL		AFTER APPROVAL			
			QTY.	PREF. FORM	QTY.	PREF. FORM		
14.	Instruction for Field Assembly of Tank (if applicable)				10	N	**	See notes on page 1 of Table 3-1.
15.	Recorded Gas Pressure and Moisture Content				5	N	****	
16.	Photographs	3.33.4			1 set	N	****	

LEGEND: N - Nonreproducible, R - Reproducible, A - 35 mm Aperture Card

TABLE 3-1 DOCUMENTATION SUBMITTAL SCHEDULE

(1) (6) THREE PHASE OA RATINGS OF POWER TRANSFORMERS WHICH MAY BE REQUIRED

COLUMN: (3) Transformer High-Voltage				(2) (3) Kilovolt-Ampere Ratings and Low-Voltage Ratings																		
Line No.	Class (kV)	BIL (kV)	Rating (Volts)	Full-Capacity Taps	Insulation H.V.																	
					A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	
					34500	17280Y/ 9975	17280	13800Y/ 7980: 12470Y 7200	12600	7200/ 12470Y/ 7200X 14400	12470Y/ 7200	2400/ 4160Y 2400X 7200	4160Y/ 2400X 7200	4800	2520/ 4360Y/ 2520	4360Y/ 2520	4360Z-Z/ 2520	2400/ 4160Y/ 2400	4160Y/ 2400	480	480Y/ 277	
					L.V. BIL - 200	150	150	110	110	110	110	110	110	110	95	75	75	75	75	75	45	45
1	92	450	115000Y/ 66400	120750/117875/112125/ 109250	30000	---	---	---	---	---	10000- 15000	---	---	---	---	---	---	---	---	---	---	---
2	69	350	69000	72000/70500/67500/66000	---	1500- 30000	---	---	---	---	---	---	---	---	1500- 7500	1500- 7500	10000	---	1500- 7500	---	---	---
3	69	350	69000Y/ 39900	72000Y/41570;70500Y/40705 67500Y/39015;66000Y/38100	---	---	1500- 30000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4	69	350	67000	70600/68800/65200/63400	---	---	---	1500- 30000	---	1500- 30000	1500- 30000	(5)1500- 30000	1500- 30000	---	---	---	---	---	---	1500- 10000	---	2500- 5000
5	69	350	67700Y/ 39135	71340Y/41235;69520Y/40185; 65880Y/38080;64060Y/37030	---	---	---	---	1500- 30000	---	---	---	---	---	---	---	---	---	---	---	---	---
6	34.5	200	34400	36200/35300/33500/32600	---	---	---	1000- 10000	---	1000- 10000	1000- 15000	---	1500- 10000	1000- 10000	(5)1000- 7500	1000- 7500	---	---	---	---	---	1500- 10000
7	25	150	(4)16500	17280/16890/16110/15720	---	---	---	---	---	---	---	---	---	---	---	1000- 7500	---	---	---	---	---	---
8	15	110	12000	12600/12300/11700/11400	---	---	---	---	---	---	---	---	---	---	---	750- 7500	---	(5)750- 7500	---	750- 3750	750- 2500	---

- NOTES: (1) Transformers are outdoor type, oil immersed, self-cooled (Class OA), 60 Hz. See Section 3.14 for Class OA/FA and OA/FA/FA transformer requirements.
 (2) Standard kVA ratings are 750, 1000, 1500, 2500, 3750, 5000, 7500, 15,000, 10,000, 18,000, 20,000 and 30,000. In the above table, a dash (-) between kVA indicates that all intervening ratings are included.
 (3) All voltages are Delta unless otherwise indicated.
 (4) Line 7: This is an alternate AN Standard high-voltage rating in the 25-kV insulation class.
 (5) Line 4, Column H; Line 6, Column L; and Line 8, Column P: To be furnished with wye-delta terminal boards.
 (6) The three phase ratings of power transformers listed in this table must be multiplied by 1.12 to obtain the 65C rating required by company.

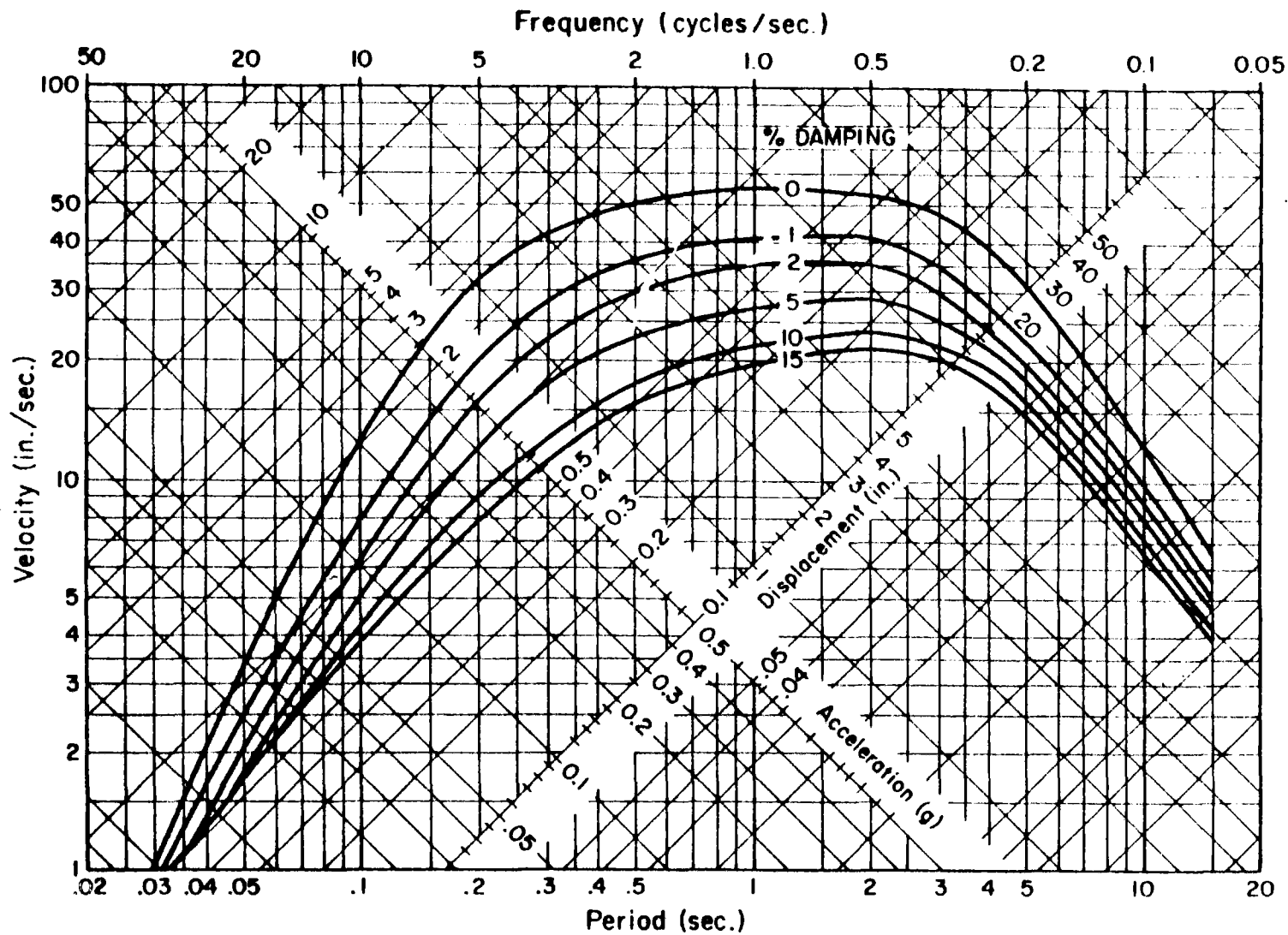
TABLE 3-3
 (Three-Phase Power Transformers)

(1) (5) SINGLE PHASE OA RATINGS OF POWER TRANSFORMERS WHICH MAY BE REQUIRED

COLUMN:				A	B	C	D	E	F	G	H	J	K	M	
(3) Transformer High-Voltage				(2) (3) Kilovolt-Ampere Ratings and Low-Voltage Ratings											
Line No.	Class (kV)	BIL (kV)	Rating (Volts)	Full-Capacity Taps	9975/17280Y L.V. BIL-150	17280 150	7200/12470Y x 14400 110	12600 110	7200/12470Y 110	2400/4160Y 7200/12470Y 110	4800 95	2520/4160Y 75	1453-1453/ 4360 zig-zag 75	2400/4160Y 75	277/480 45
1	69	350	66000	69000/67500/64500/63000	833-10000	---	---	---	---	---	---	833-2500	2000, 3000	833-2500	---
2	69	350	39900/69000Y	41570/72000Y; 40705/70500Y 39015/67500Y; 38100/66000Y	---	833-10000	---	---	---	---	---	---	---	---	---
3	69	350	67000	70600/68800/65200/63400	---	---	833-10000	---	833-10000	833-10000	---	---	---	833-5000	---
4	69	350	39135/67700Y	41235/71340Y; 40185/69520Y 38080/65880Y; 37030/64060Y	---	---	---	833-10000	---	---	---	---	---	---	---
5	34.5	200	34400	36200/35300/33500/32600	---	---	833-3333	---	833-3333	833-3333	833-2500	833-3333	---	---	833-1250
6	25	150	(4) 16500	17280/16890/16110/15720	---	---	---	---	---	---	---	833-2500	---	---	---
7	15	110	12000	12600/12300/11700/11400	---	---	---	---	---	---	---	833-2500	---	833-2500	833-1250

- NOTES: (1) Transformers are outdoor type, oil immersed, self-cooled (Class OA), 60 Hz. See Section 3.14 for Class OA/FA and OA/FA/FA transformer requirements.
- (2) Standard kVA ratings are 833, 1250, 1667, 2500, 3333 and 5000. Ratings above 5000 kVA are 6667, 8333 and 10,000. In the above table a dash (-) between kVA ratings indicates that all intervening ratings are included.
- (3) All voltages are Delta unless otherwise indicated.
- (4) This is an alternate ANSI high-voltage rating in the 25-kV insulation class.
- (5) The Single Phase ratings of power transformers listed in this table must be multiplied by 1.12 to obtain the 65C rating required by company.

TABLE 3-2



										Location	
										50% PROBABLE CURVE SMOOTHED MAXIMUM HORIZONTAL RESPONSE SPECTRUM	
										Southern California Edison SOE	
Reference Drawings	No.	Revisions	Date	Approved	O.K.	O.K.	C&I	Made	J.O. No.		
	Scale										

SPECIFICATION NO. A1-1979
(Revision of A1-1976)

MEDIUM POWER TRANSFORMERS, 115 KV AND BELOW
WITH AND WITHOUT LOAD-TAP-CHANGERS

PART A
PROPOSAL REQUIREMENTS

A.1 DRAWINGS

A.1.1 Bushing Drawings

Each Bidder shall furnish three sets of detailed drawings of the bushings. The drawings shall include the current rating and the creepage distance. If a Bidder has on file with Company's Transmission/Substation Standards Group an approved set of bushing drawings, it will not be necessary to furnish the drawings with its proposal.

A.1.2 Outline Drawings

Each Bidder shall furnish three sets of outline drawings of the transformers. The outline drawings shall contain the information specified in Section 3.33.1.

A.2 INFORMATION

A.2.1 Qualification Data

Unless previously furnished, each Bidder shall furnish the qualification data called for in Section 3.31.

A.2.2 Information and Data

Each Bidder shall furnish three copies of the information requested below.

- a. High-voltage rating.
- b. Low-voltage rating.
- c. Kilovolt-ampere rating and class.
- d. Guaranteed total loss at 100% voltage and FA 65°C load.
- e. Guaranteed total losses at extreme tap positions.
- f. Guaranteed no-load loss at rated voltage.
- g. Guaranteed no-load loss at 110% voltage.

PROPOSAL REQUIREMENTS

- h. Guaranteed exciting current at 100% voltage.
- j. Guaranteed exciting current at 110% voltage.
- k. Guaranteed percent impedance.
- l. Guaranteed impedance between windings X1 - X2 and X3 - X4 when single-phase transformers for zig-zag operation are specified.
- m. Calculated zero-sequence percent impedance on all zig-zag, wye-wye, and delta-wye, three-phase transformers.
- n. Guaranteed maximum audio sound levels of OA transformers in decibels.
- p. Guaranteed audio sound levels of OA/FA transformers in decibels if FA or "future" FA Class is specified.
 - 1. At the OA rating.
 - 2. At the FA rating with fans running.
- q. Total shipping weight.
- r. Type of oil preservation system.
- s. Method of mounting radiators; that is, removable or integral with the tank.
- t. Information as to whether the transformers will be shipped oil or gas filled.
- u. Bushing temperature rise test reports as specified in Section 3.28.



DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No.	DE-AC03-77SF10501
Subcontract No.	NA
Report No.	(STMPO 493)
DOE/SF/10501-016	
Date of Report	March 1979
Name & Phone No. of DOE Technical Representative	Mike Lopez (415) 273-4264

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM: Southern California Edison
P.O. Box 800
Rosemead, CA 91770

1. Document Title: Medium Power Transformers, 115kv
and Below with and without Load Tap Changers

2. Type of Document: Technical Report, Conference Paper, Journal Article, Abstract or Summary,
 Copy of Oral Presentation, Other (please specify): _____

3. In order to meet a publication schedule or submission deadline, patent clearance by (Routine)
would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:
- a. Attention should be directed to pages _____ of this document.
 - b. This document describes matter relating to an invention:
 - i. Contractor Invention Docket No. _____
 - ii. A disclosure of the invention was submitted to DOE on _____ (date)
 - iii. A disclosure of the invention will be submitted shortly _____ (approximate date)
 - iv. A waiver of DOE's patent rights to the contractor:
 - has been granted, has been applied for; or will be applied for _____ (date)

5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.
Please Provide copy of clearance to: Southern Calif. Edison Company
P.O. Box 800
Rosemead, Ca. 91770

6. Remarks: %Joyce Wells Room 497

Reviewing/Submitting Official: Name (Print/Type) Bill von KleinSmid Title Solar One Program Director
Signature William von KleinSmid Date 9-25-84

TO: INITIATOR OF REQUEST
FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

- No patent objection to above-identified release.
 Please defer release until advised by this office.

Signed Harold M. Dixon Date Mailed 10/9/84