Distribution Transformers

ALSTOM

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Terms and Conditions of Sale

STANDARD CONDITIONS OF SALE:
All products sold by ALSTOM USA INC., hereafter referred to as the Company are subject to these terms and conditions of sale.

PRICES:
Prices are subject to change without notice.

PRICE POLICY:
Prices are firm for shipment within six months from date of quotations unless stated otherwise.

QUOTATIONS:
Quotations, written or verbal, are subject to the terms and conditions of sale contained herein. Written quotations automatically expire thirty days from the date issued and are subject to withdrawal by notice within that period. Verbal quotations automatically expire twenty-four hours from the time issued.

ACCEPTANCE OF ORDERS:
All orders are subject to acceptance at the factory.

EQUIPMENT DESTINED FOR FEDERAL, STATE OR LOCAL GOVERNMENT:
The Company is not bound to honor quotations for equipment destined for Federal, State or local government unless the Company knows at time of quoting that it is a government job, as these orders frequently involve higher administrative costs.

TAXES:
Prices quoted do not include any Federal, State or local property, license, privilege, sales use, excise, gross receipts or other like taxes which may now or hereafter be applicable to, measured by or imposed upon or with respect to the transaction, the property, its sale, its value or its use, or any services performed in connection therewith. Purchaser agrees to pay or reimburse any such taxes with the Company or the Company's subcontractors suppliers are required to pay.

ERRORS:
All stenographic and clerical errors are subject to correction.

MINIMUM BILLING:
Orders amounting to less than $100.00 net will be billed at $100 plus transportation costs.

STANDARD TERMS OF PAYMENT:
Standard terms of payment are net within thirty days from the date of shipment.

There will be no reduction in price for payments more favorable to the Company than the standard terms.

If payments are not made in conformance with the standard terms, the quoted price shall without prejudice to the right of ALSTOM USA INC. to immediate payment, be increased by a service charge of 2% per month on the unpaid balance, or the highest lawful service charge, whichever is lesser.

If in the opinion of the Company, the financial position of the purchaser, at any time during the manufacturing period, or at any time the product is ready for shipment, does not justify the terms of payment specified, the Company may require full or partial payment in advance.

If shipments are delayed by the purchaser, payment shall become due from the date when the Company is prepared to make shipment. If manufacture is delayed by the purchaser, payment shall be made based on the contract price and percent of completion and purchaser shall reimburse the Company for any additional costs resulting from such delay. Products held for the purchaser shall be at the risk and expense of the purchaser.

ATTORNEY'S FEES:
In the event of any controversy concerning any term or condition contained in this agreement and in the event a suit or action is filed as a result thereof, then the prevailing party shall be entitled to be awarded, in addition to damages which would otherwise be recovered and in addition to all court costs, reasonable attorney's fees to be set by the court or courts in which the matter is tried or heard, including any appeal thereon.

DELIVERY:
F.O.B. - P/A - FRT/Ppd. This apparatus is sold F.O.B. point of shipment, freight, prepaid, and included in the price.

Shipments to destinations outside of the continental United States will be: to the accessible common carrier point of departure within the continental United States.

CARTAGE (STORE DOOR) DELIVERY:
Transportation charges incurred from the nearest common carrier point to final destination (or to shipside) are the responsibility of the customer unless the common carrier furnishes store door delivery at no charge.

Transportation charges on local shipments from warehouses will be borne by the Company to the same extent as common carrier furnishes store door delivery at no extra charge.

WARRANTY:
The warranty period for products sold hereunder shall terminate one year after the completion of installation, or 18 months after the date of shipment, whichever occurs earliest.

The Company warrants that the products supplied hereunder will be free from defects in the workmanship and materials. If purchaser notifies the Company of any failure to conform to this warranty within the warranty period and delivers the defective product to the location designated by the Company, freight prepaid, the Company will correct the nonconformity, at its option, by repairing or replacing the defective part or parts and delivering the product to the purchaser F.O.B. point of shipment with freight prepaid to the accessible carrier point nearest the first destination designated by purchaser. Correction of nonconformities in the manner and for the period of time provided above shall constitute a fulfillment of all liabilities of the Company with respect to or arising out of such products.

This warranty applies to all products sold and delivered to destinations within the continental United States.

EXPORT WARRANTY:
The warranty period for products sold hereunder shall terminate one year after the date of completion of installation, or 18 months after the date of shipment, whichever occurs earlier

The Company warrants that the products supplied hereunder will be free from defects in workmanship and materials. If purchaser notifies the Company of any failure to conform to this warranty within the warranty period and delivers the defective product to the manufacturing plant, freight prepaid, the Company will correct the nonconformity, at its option by repairing or replacing the defective part or parts and delivering the product to the purchaser F.O.B. point of shipment with freight prepaid to the accessible common carrier point of departure within the continental United States. Purchaser will be required to accept C.I.F. charges from that point. This warranty does not include field service trips outside of the continental United States. Purchasers requiring field service will be billed for such service based on price in effect at time of request. Correction of nonconformities in the manner and for the period of time provided above shall constitute a fulfillment of all liabilities of the Company with respect to or arising out of such products.

This warranty applies to all products sold with ultimate destination outside of the continental United States.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY WHETHER WRITTEN, ORAL OR IMPLIED INCLUDING BUT NOT LIMITED TO ANY WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR PURPOSE.

LIMITATIONS OF LIABILITY:
The Company shall not be liable in contract or in tort for special, indirect, incidental, or consequential damages, such as, but not limited to, loss of profits or revenue, loss of use of power system, cost of capital, cost of purchased or replacement power, or claims of customers of purchase for service interruptions. The remedies of the purchaser as set forth herein are exclusive, and the liability of the Company with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, installation or technical direction of installation, repair or use of any equipment covered by or furnished under this contract whether in contract, in tort, or otherwise shall not exceed the price of the equipment or part on which such liability is based.

Effective Date: January 1, 1994

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ALSTOM

UNLOADING AND DEMURRAGE:
Unless stated otherwise in our quote, it is the customer's responsibility to unload all shipments whether by rail or truck. All demurrage charges are the customer's responsibility. The Company recognizes that sometimes the size or weight of shipments requires the customers to make prior unloading arrangements. In such cases the customer shall advise the Company prior to shipment the hours during which shipments can be received and the notice required before delivery. The Company will then reflect these arrangements on the Bill of Lading.

ORIGIN, METHOD OF SHIPMENT AND ROUTING:
The Company will determine the point of origin of shipment, the method of transportation and the routing of shipment. Purchasers requiring shipment by a method of routing other than that of the Company's selection, will be billed any difference in transportation charges. If the Company elects to ship by other than common carrier, the full transportation costs will be prepaid.

In no case will the Company absorb transportation charges in excess of the actual amount received by the carrier for its service.

PURCHASER PICK-UP:
No allowance will be made in lieu of transportation if the purchaser accepts shipment at the factory, warehouse or freight station. Transportation charges will not be deducted from a selling price.

U.S. GOVERNMENT:
When U.S. Government specifications require a government Bill of Lading, quotation will be F.O.B. point of shipment, freight not allowed.

FORCE MAJUERE LOSS, DAMAGE OR DELAY:
The Company will not be liable for failure to perform or for delay in performance due to fire, flood, strike, or any other labor difficulty, act of any governmental authority or of the purchaser, riot embargo, car shortage, wrecks or delay; in transportation, inability to obtain necessary labor, materials, or manufacturing facilities from usual sources or due to any other cause beyond its reasonable control.

In the event of delay in performance due to any such cause, the date of delivery or time for completion will be postponed by such length of time as may be reasonably necessary to compensate for the delay.

PATENTS:
Subject to the following provisions, the Company shall at its own expense, defend or at its option settle any claim, suit or proceeding brought against the purchaser, and/or its vendees, mediate and immediate, so far as based on an allegation that any goods, equipment, device or article (hereinafter referred to as product) or any part thereof furnished hereunder constitutes a direct or a contributory infringement on any claim of any patent of the United States. This obligation shall be effective only if purchaser shall have made all payments then due hereunder and if the Company is notified promptly in writing and given authority, information and assistance for the defense of said claim, suit or proceeding. The Company shall pay all damages and costs awarded in such suit or proceedings so defended. In case the product or any part thereof furnished hereunder becomes the subject of any claim, suit or proceeding for infringement of any United States patent, or in the event of an adjudication that such product or part infringes any United States patent, or if the use or sale of such product or part is enjoined, the Company shall, at its option and its own expense, either.

(A) procure for the purchaser the right to continue using said product or part thereof; or

(B) replace it with a non-infringing product; or

(C) modify it so it becomes non-infringing ; or

(D) as a last resort remove it and refund the purchase price and the transportation and installation costs thereof.

The foregoing indemnity does not apply to the following:

1. Patented processes performed by the product, or another product produced thereby.
2. Products supplied according to a design other than that of the Company and which is required by the purchaser.
3. Combinations of the product with another product not furnished hereunder unless the Company is a contributory infringer.
4. Any settlements of a suit or proceeding made without the Company's written consent.

The foregoing states the entire liability of the Company with respect to patent infringement by said product or any part thereof.

If a suit or proceeding is brought against the Company solely on account of activities enumerated in paragraphs 1,2 and 3 above, purchaser agrees to indemnify the Company in the manner and to the extent the Company indemnified purchaser in the preceding paragraph in so far as the terms are appropriate.

TITLE - RISK OF LOSS:
The product sold shall remain the property of the Company and shall remain personal property until fully paid for in cash, and the purchaser shall perform all acts which may be necessary to perfect and assure retention of title to such product by the Company. Risk of loss of the product, or any part of same, shall pass to the purchaser upon delivery of such equipment or part, F.O.B., point of shipment.

CANCELLATION:
Any order or contract may be cancelled by the purchaser only upon payment of reasonable charges based on the following table:

A. Where order is in process, but apparatus is not released for manufacture - 10% of apparatus price.

B. Where order is in process with production space reserved and materials being readied for assembly:
Engineering Complete 25%
Purchasing Complete 50%
Material Received in House 75%
Production Started 100%

RETURNING APPARATUS:
A. In no case are goods to be returned without first obtaining the Company's written permission.

B. Any material returned and not authorized will remain the property of the sender and we cannot be held responsible for its loss by fire, theft or damage.

C. Only unused material as currently manufactured which has been invoiced to customer within one year will be considered for return.

D. We reserve the right to refuse any material returned for credit if our factory conditions warrant such refusal.

E. Material accepted for credit is subject to a MINIMUM service charge of 15% plus all transportation charges paid by us.

F. Material built to order is not subject to return for credit under any circumstances.

G. If return is caused by fault of the Company, full credit will be allowed including all transportation charges.

H. Goods must be securely packed to reach us without damage. Any cost incurred by us to put goods in first class condition will be charged to the purchaser.

EXPORT PACKING:
Prices shown in price lists are based on domestic packing only. Where packing for overseas shipments is required, refer to the factory.

PENALTY OR LIQUIDATED DAMAGES:
Contracts which include penalty or liquidated damage clauses for failure to meet shipping promises must be specifically accepted by the Company.

VARIATION IN QUANTITY:
Specified quantities may be increased or decreased no more than 10% at the direction of the purchaser within 30 days after an order has been placed. The total price will be increased, as the case may be, at the unit price specified in the order.

APPLICABLE LAW:
These terms and conditions and the legal relations between the purchaser and the Company shall be governed by and in accordance with the laws of the State of Oregon.

ALSTOM USA INC.
Transformers
300 West Antelope Road, Medford, Oregon U.S.A. 97503-1089
Tel.: (541) 826-2113 Fax: (541) 826-8847

Distribution Transformers

Padamount type

75 to 5000 kVA

ALSTOM

Application

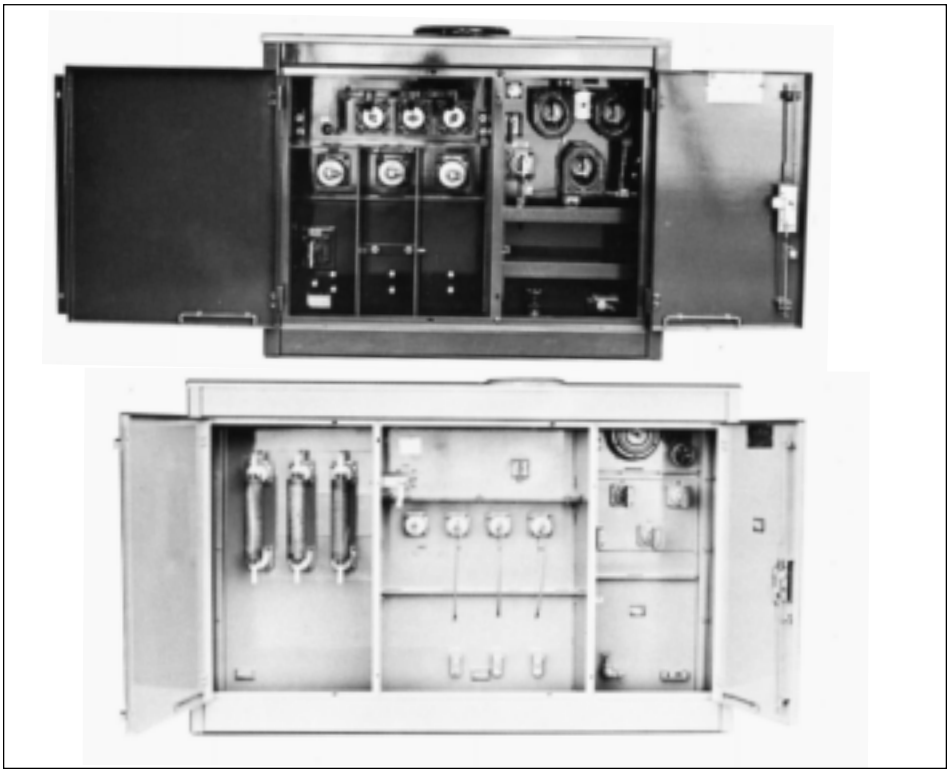
Alstom's distribution padmounted transformers are designed for use in distribution applications and are designed for ease of installation and first cost savings.
All ratings are designed in accordance with applicable ANSI, NEMA and IEEE standards.

Standard Features

- De-energized tapchanger if required
- Secondary spade connectors
- Primary clamp type eyebolt connectors
- Combination drain and sampler (750 kVA and above)
- Pressure test and upper filter press connection - 1" pipe plug
- NEMA two hole ground pad
- Corrosion resistant nameplate
- Provisions for jacking and lifting
- Base suitable for rolling or skidding
- Pressure relief valve
- Rugged steel plate tank reinforced with steel channel selections for strength and rigidity
- Undercoated base
- Modular construction for maximum flexibility
- Door has three-point locking mechanism
- Externally clamped high and low voltage bushings
- Primary compartment accessible only after low voltage door is opened
- 1/2" liquid level plug
- Musell#7GY3:29/1.5 green alkyd enamel finish to three mils minimum thickness
- Welded cover with handhole

Ratings

- kVA ratings - 75 kVA to 5000 kVA
- Primary Voltage - all voltages through 34.5kV - 200 BIL
- Secondary Voltage - all voltages through 5 kV
- Frequency - 60Hz
- Temperature rise 65 C
- Consult factory for ratings not shown



These photographs show typical configurations

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Standard Tests

Each unit is subjected to the following tests:

- Resistance
- Ratio
- Polarity
- Phase relation
- Core loss
- Exciting current
- Impedance
- Load loss
- Applied potential test
- Induced potential test
- Quality control impluse test
- Pressure leak test

Optional Features

- 50 cycle
- 55/65 C temperature rise
- High fire point liquid
- Loop feed construction
- Dead front construction
- Lightning arrestors
- Dial type thermometer
- Liquid level gauge
- Pressure vacuum gauge
- Pressure vacuum gauge with bleeder
- Combination drain and sampler
- Pressure relief device
- Bay-o-net fuses
- Weak links
- Current limiting fuses
- Loadbreak oil switch(es)
- Loadbreak air switch(es)
- Secondary current transformers
- Secondary molded case breakers
- Potheads
- Gauges furnished with alarm contacts
- Bolted cover with handhole

These photographs show typical configurations

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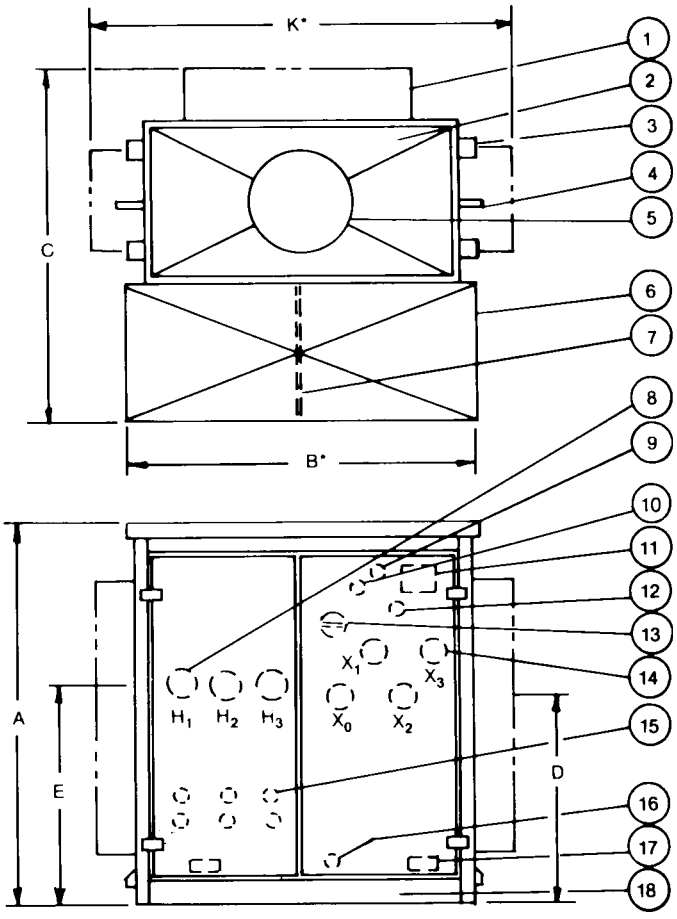
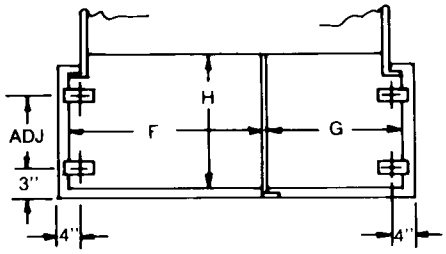
Compartmental Padmounted Distribution Transformer

LIVE FRONT RADIAL FEED

STANDARD ACCESSORIES

1. Cooling panels
2. Tank with welded-on cover
3. Lifting lugs
4. Jacking Lugs
5. Handhole
6. Compartment
7. Steel divider
8. H.V. bushings
9. 1" fill plug and filter press connection
10. Pressure relief valve
11. Corrosion resistant nameplate and connection diagram
12. Liquid level plug
13. De-energized tapchanger
14. L.V. bushings
15. Arrester mtg. provisions
16. 1" drain plug – supplied with drain valve and sampling device 750 KVA and above
17. Ground pad per ANSI standards
18. Removable front sill





CABLE ENTRANCE DETAIL

NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE – NOT TO BE USE FOR CONSTRUCTION**

KVA	A	B	C	D	E	F	G	H	K	GAL. LIQUID	APPROX. TOTAL WEIGHT WITH OIL
75	49	49 1/4	38	25	24	29	17	16 1/2	53	112	2300
112.5	49	49 1/4	48	25	24	29	17	16 1/2	53	115	2350
150	49	49 1/4	50	25	24	29	17	16 1/2	53	112	2350
225	49	53 1/4	59	25	24	29	21	18 1/2	57	168	3300
300	49	53 1/4	63	25	24	29	21	18 1/2	57	163	3500
500	49	53 1/4	68	25	24	29	21	18 1/2	57	149	4000
750	58	57	75	36	36	29 1/2	24	24 1/2	60	263	6340
1000	58	57	81	36	36	29 1/2	24	24 1/2	60	258	7010
1500	61	64 1/2	81	36	36	37	24	24 1/2	69	335	8500
2000	75	64 1/2	91	48	48	37	24	24 1/2	69	418	11845
2500	75	64 1/2	91	48	48	37	24	24 1/2	69	420	12580

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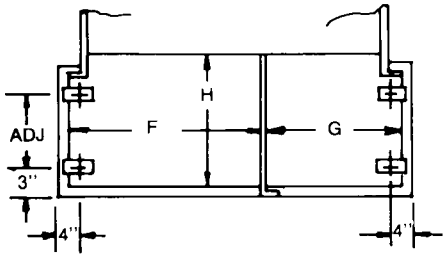
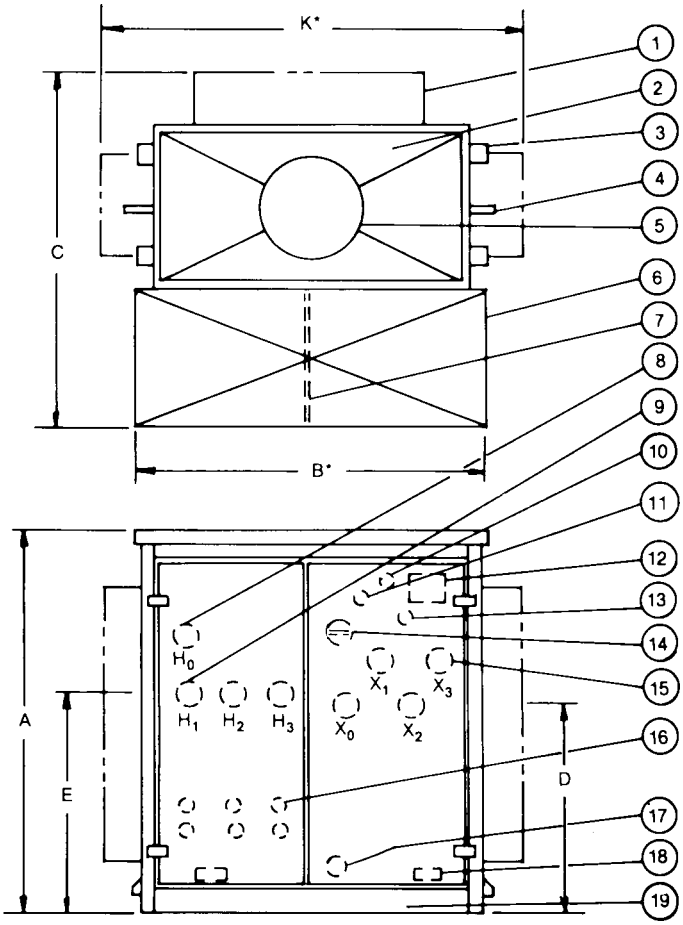
Compartmental Padmounted Distribution Transformer

LIVE FRONT RADIAL FEED WITH “HO” BUSHING

STANDARD ACCESSORIES

1. Cooling panels
2. Tank with welded-on cover
3. Lifting lugs
4. Jacking Lugs
5. Handhole
6. Compartment
7. Steel divider
8. H.V. neutral bushing
9. H.V. bushings
10. 1” fill plug and filter press connection
11. Pressure relief valve
12. Corrosion resistant connection diagram nameplate
13. Liquid level plug
14. De-energized tapchanger
15. L.V. bushings
16. Arrester mtg. provisions
17. 1” drain plug – supplied with drain valve and sampling device 750 KVA and above
18. Ground pad per ANSI standards
19. Removable front sill





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KVA	A	B	C	D	E	F	G	H	K	GAL. LIQUID	APPROX. TOTAL WEIGHT WITH OIL
75	49	49 1/4	38	25	24	29	17	16 1/2	53	112	2300
112.5	49	49 1/4	48	25	24	29	17	16 1/2	53	115	2350
150	49	49 1/4	50	25	24	29	17	16 1/2	53	112	2350
225	49	53 1/4	59	25	24	29	21	18 1/2	57	168	3300
300	49	53 1/4	63	25	24	29	21	18 1/2	57	163	3500
500	49	53 1/4	68	25	24	29	21	18 1/2	57	149	4000
750	58	57	69	36	36	29 1/2	24	18 1/2	60	263	6340
1000	58	57	75	36	36	29 1/2	24	18 1/2	60	258	7010
1500	61	64 1/2	75	36	36	37	24	18 1/2	69	335	8500
2000	75	64 1/2	91	48	48	37	24	24 1/2	69	418	11845
2500	75	64 1/2	91	48	48	37	24	24 1/2	69	420	12580

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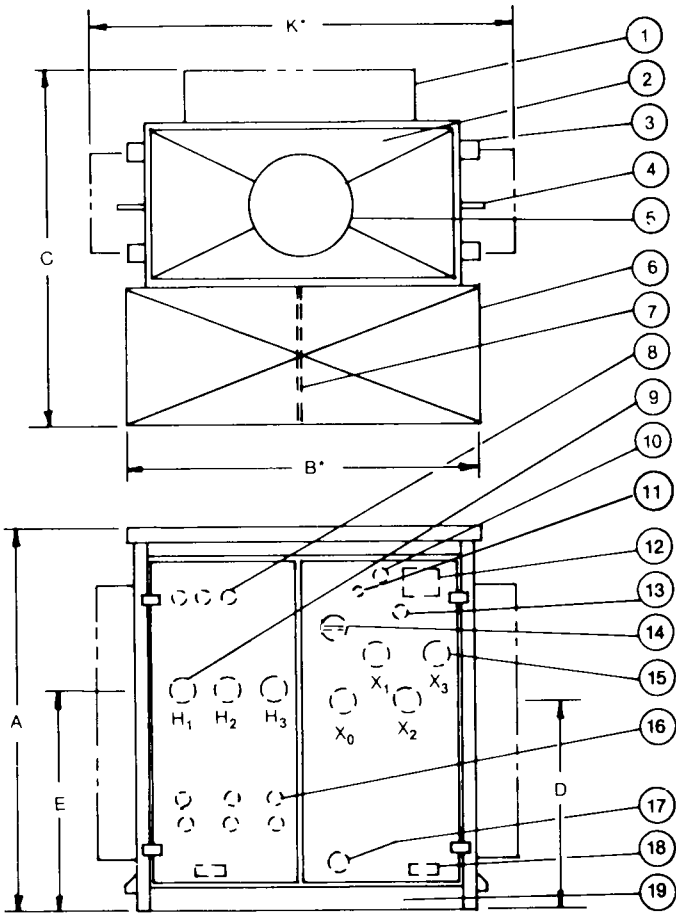
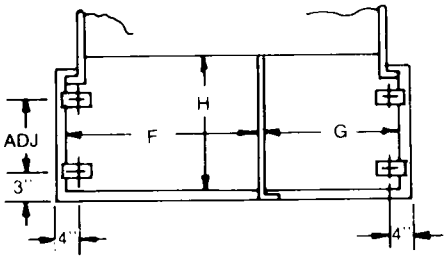
Compartmental Padmounted Distribution Transformer

LIVE FRONT RADIAL FEED WITH BAY-O-NET FUSING

STANDARD ACCESSORIES

1. Cooling panels
2. Tank with welded-on covers
3. Lifting lugs
4. Jack Lugs
5. Handhole
6. Compartment
7. Steel divider
8. Bay-O-Net fuses
9. H.V. bushings
10. 1" fill plug and filter press connection
11. Pressure relief valve
12. Corrosion resistant nameplate and connection diagram
13. Liquid level plug
14. De-energized tapchanger
15. L.V. bushings
16. Arrester – mounting provisions
17. 1" drain plug – supplied with drain valve and sampling device 750 KVA and above
18. Ground pad per ANSI standards
19. Removable front sill





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112.5	49	49¼	48	25	24	29	17	16½	53	115	2350
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2500	75	64½	91	48	48	37	24	24½	69	420	12580

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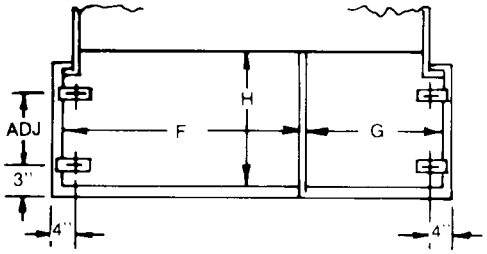
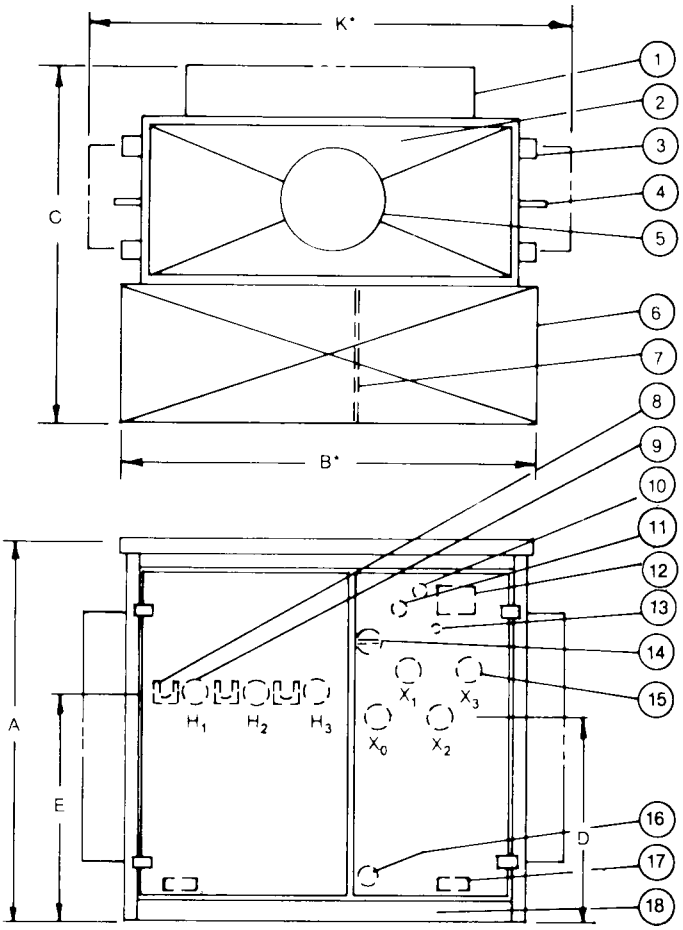
Compartmental Padmounted Distribution Transformer

DEAD FRONT RADIAL FEED ANSI PART 1

STANDARD ACCESSORIES

1. Cooling panels
2. Tank with welded-on cover
3. Lifting lugs
4. Jacking Lugs
5. Handhole
6. Compartment
7. Steel divider
8. Parking stand
9. H.V. bushings wells
10. 1" fill plug and filter press connection
11. Pressure relief valve
12. Corrosion resistant nameplate and connection diagram
13. Liquid level plug
14. De-energized tapchanger
15. L.V. bushings
16. 1" drain plug – supplied with drain valve and sampling device 750 KVA and above
17. Ground pad per ANSI standards
18. Removable front sill





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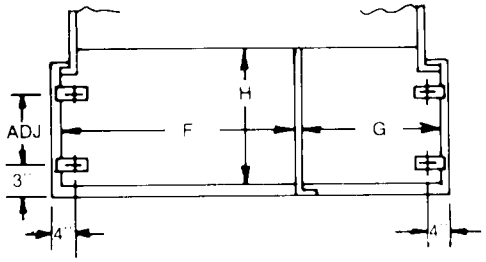
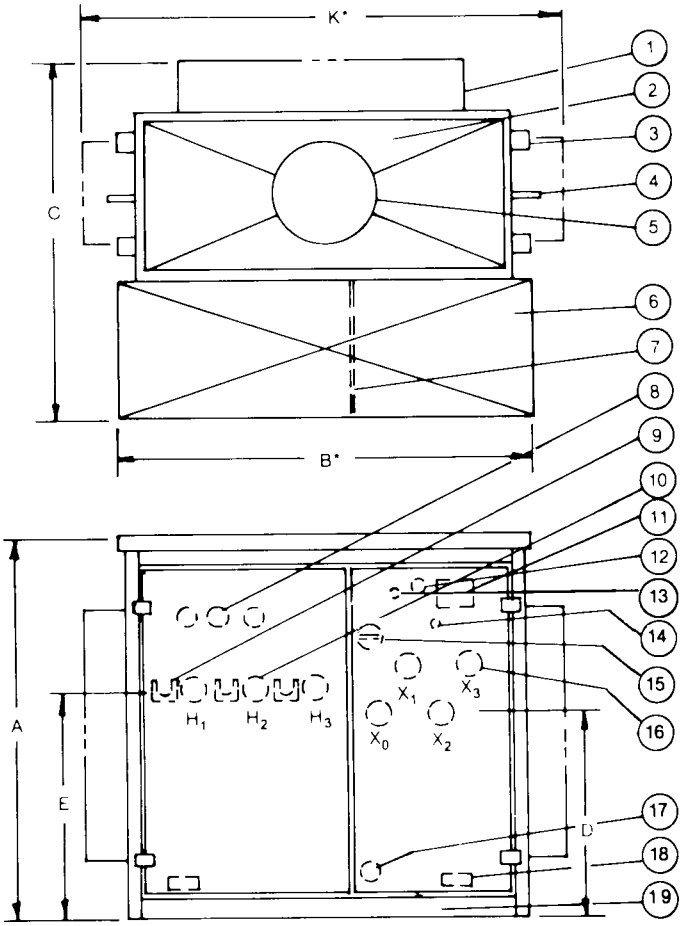
Compartmental Padmounted Distribution Transformer

DEAD FRONT RADIAL FEED WITH BAY-O-NET FUSING
ANSI PART 1

STANDARD ACCESSORIES

1. Cooling panels
2. Tank with welded-on cover
3. Lifting lugs
4. Jacking Lugs
5. Handhole
6. Compartment
7. Steel divider
8. Bay-O-Net fuses
9. Parking stands
10. H.V. bushings
11. Corrosion resistant nameplate and connection diagram
12. 1" fill plug and filter press connection
13. Pressure relief valve
14. Liquid level plug
15. De-energized tapchanger
16. L.V. bushings
17. 1" drain plug – supplied with drain valve and sampling device 750 KVA and above
18. Ground pad per ANSI standards
19. Removable front sill





CABLE ENTRANCE DETAIL

NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE – NOT TO BE USE FOR CONSTRUCTION**

KVA	A	B	C	D	E	F	G	H	K	GAL. LIQUID	APPROX. TOTAL WEIGHT WITH OIL
75	49	49 1/4	38	25	24	29	17	16 1/2	53	112	2300
112.5	49	49 1/4	48	25	24	29	17	16 1/2	53	115	2350
150	49	49 1/4	50	25	24	29	17	16 1/2	53	112	2350
225	49	53 1/4	59	25	24	29	21	18 1/2	57	168	3300
300	49	53 1/4	63	25	24	29	21	18 1/2	57	163	3500
500	49	53 1/4	68	25	24	29	21	18 1/2	57	149	4000
750	58	57	69	36	36	29 1/2	24	18 1/2	60	263	6340
1000	58	57	75	36	36	29 1/2	24	18 1/2	60	258	7010
1500	75	64 1/2	81	36	36	37	24	24 1/2	69	335	8500
2000	75	64 1/2	91	48	48	37	24	24 1/2	69	418	11845
2500	75	64 1/2	91	48	48	37	24	24 1/2	69	420	12580

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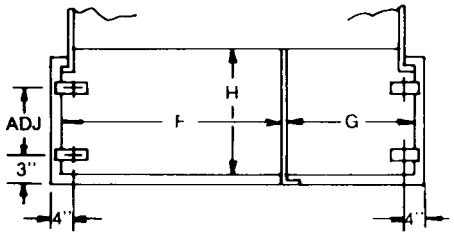
ALSTOM

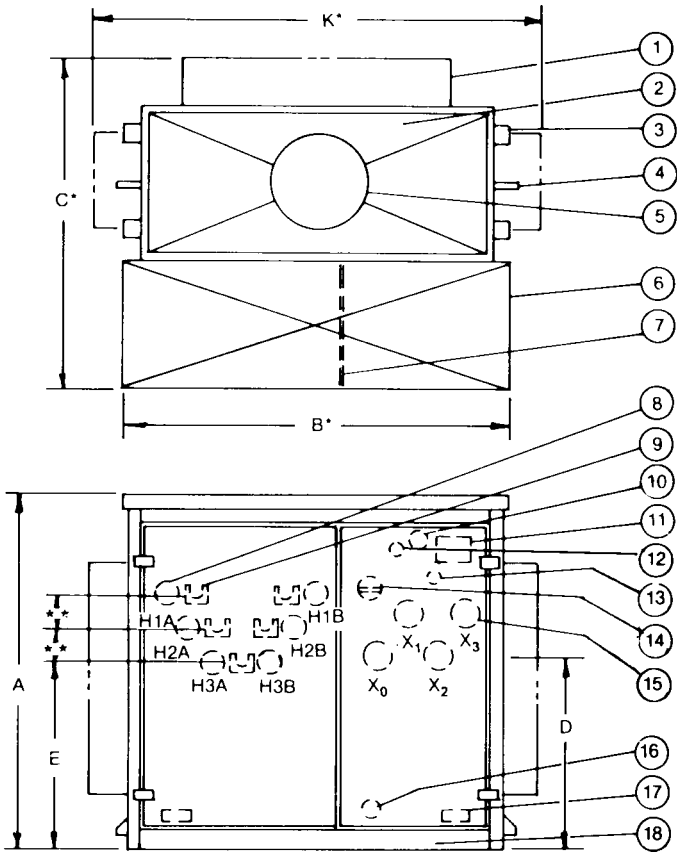
Compartmental Padmounted Distribution Transformer

DEAD FRONT LOOP FEED ANSI PART 1

STANDARD ACCESSORIES

1. Cooling panels
2. Tank with welded-on covers
3. Lifting lugs
4. Jacking Lugs
5. Handhole
6. Compartment
7. Steel divider
8. H.V. bushings
9. Parking Stands
10. 1" fill plug and filter press connection
11. Corrosion resistant nameplate and connection diagram
12. Pressure relief valve
13. Liquid level plug
14. De-energized tapchanger
15. L.V. bushings
16. 1" drain plug – supplied with drain valve and sampling device 750 KVA and above
17. Ground pad per ANSI standards
18. Removable front sill





CABLE ENTRANCE DETAIL

NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE – NOT TO BE USE FOR CONSTRUCTION**
**** 75-2500 – 4"**

KVA	A	B	C	D	E	F	G	H	K	GAL. LIQUID	APPROX. TOTAL WEIGHT WITH OIL
75	49	49¼	38	25	24	29	17	16½	53	112	2300
112.5	49	49¼	48	25	24	29	17	16½	53	115	2350
150	49	49¼	50	25	24	29	17	16½	53	112	2350
225	49	53¼	59	25	24	29	21	18½	57	168	3300
300	49	53¼	63	25	24	29	21	18½	57	163	3500
500	49	53¼	68	25	24	29	21	18½	57	149	4000
750	58	57	69	36	36	29½	24	18½	60	263	6340
1000	58	57	75	36	36	29½	24	18½	60	258	7010
1500	61	64½	75	36	36	37	24	18½	69	335	8500
2000	75	64½	91	48	48	37	24	24½	69	418	11845
2500	75	64½	91	48	48	37	24	24½	69	420	12580

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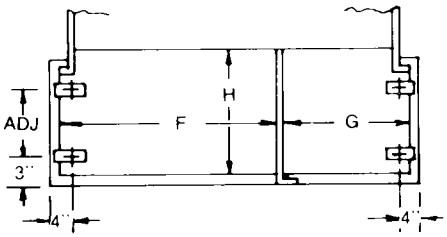
ALSTOM

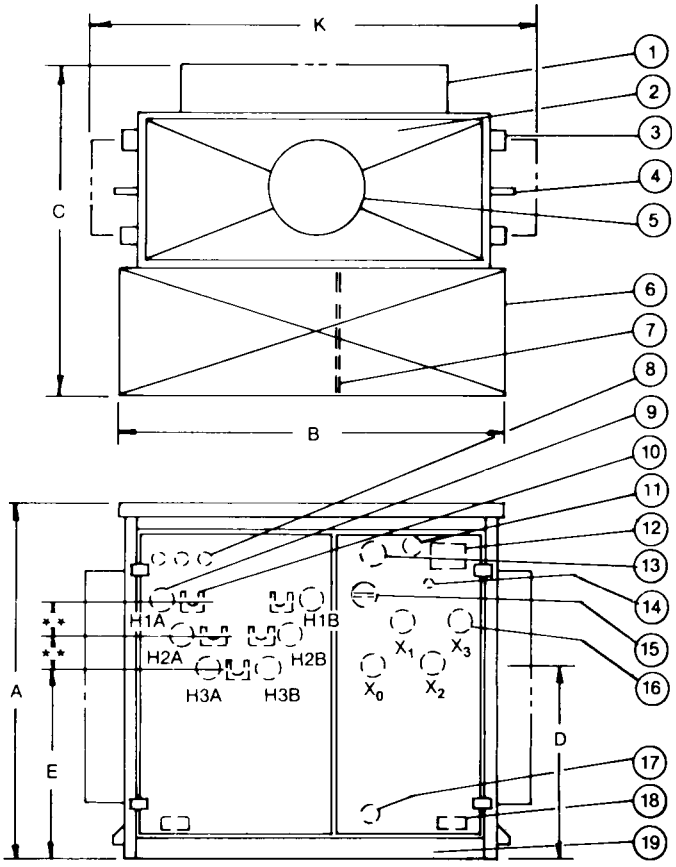
Compartmental Padmounted Distribution Transformer

DEAD FRONT LOOP FEED WITH BAY-O-NET FUSING
ANSI PART 1

STANDARD ACCESSORIES

1. Cooling panels
2. Tank with welded-on cover
3. Lifting lugs
4. Jacking Lugs
5. Handhole
6. Compartment
7. Steel divider
8. Bay-O-Net fuses
9. H.V. bushings wells
10. Parking stands
11. 1" fill plug and filter press connection
12. Corrosion resistant nameplate and connection diagram
13. Pressure relief valve
14. Liquid level plug
15. De-energized tapchanger
16. L.V. bushings
17. 1" drain plug – supplied with drain valve and sampling device 750 KVA and above
18. Ground pad per ANSI standards
19. Removable front sill





CABLE ENTRANCE DETAIL

NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE – NOT TO BE USE FOR CONSTRUCTION**
**** 75-2500 – 4"**

KVA	A	B	C	D	E	F	G	H	K	GAL. LIQUID	APPROX. TOTAL WEIGHT WITH OIL
75	49	49¼	38	25	24	29	17	16½	53	112	2300
112.5	49	49¼	48	25	24	29	17	16½	53	115	2350
150	49	49¼	50	25	24	29	17	16½	53	112	2350
225	49	53¼	59	25	24	29	21	18½	57	168	3300
300	49	53¼	63	25	24	29	21	18½	57	163	3500
500	49	53¼	68	25	24	29	21	18½	57	149	4000
750	58	57	69	36	36	29½	24	18½	60	263	6340
1000	58	57	75	36	36	29½	24	18½	60	258	7010
1500	61	64½	81	36	36	37	24	24½	69	335	8500
2000	75	64½	91	48	48	37	24	24½	69	418	11845
2500	75	64½	91	48	48	37	24	24½	69	420	12580

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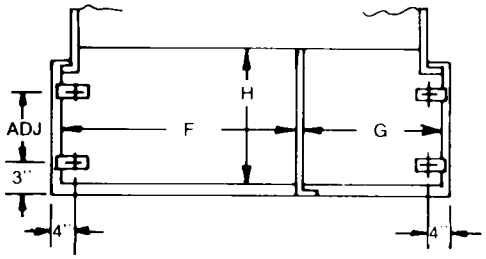
ALSTOM

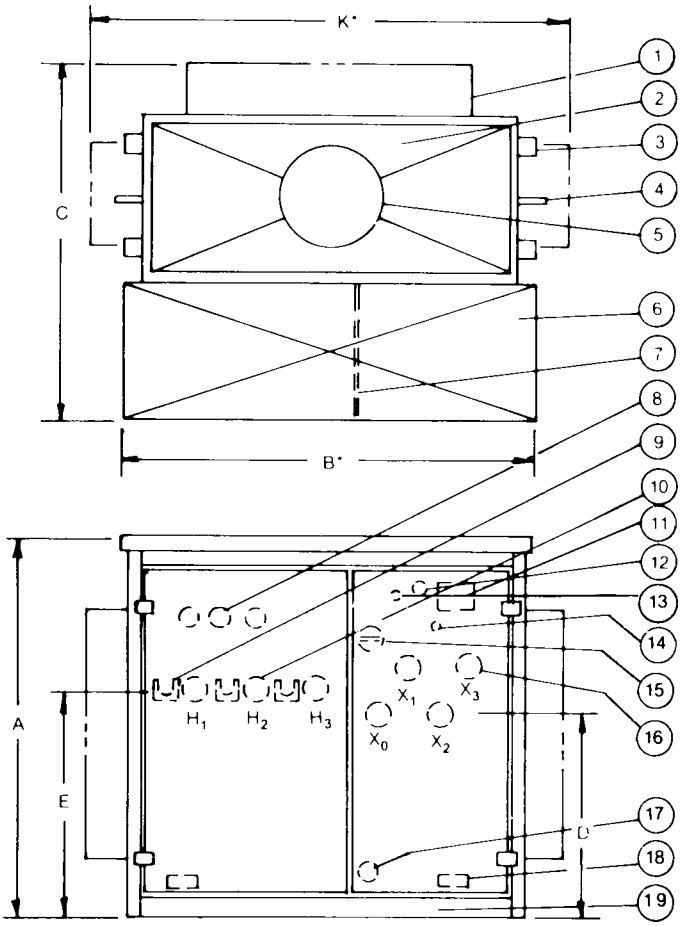
Compartmental Padmounted Distribution Transformer

DEAD FRONT RADIAL FEED WITH DRY WELL CANISTERS AND CURRENT LIMITING FUSES

STANDARD ACCESSORIES

1. Cooling panels
2. Tank with welded-on covers
3. Lifting lugs
4. Jack Lugs
5. Handhole
6. Compartment
7. Steel divider
8. Dry well canisters
9. Parking stands
10. H.V. bushings wells
11. Corrosion resistant nameplate and connection diagram
12. 1" fill plug and filter press connection
13. Pressure relief valve
14. Liquid level plug
15. No-load tapchanger
16. L.V. bushings
17. 1" drain plug – supplied with drain valve and sampling device 750 KVA and above
18. Ground pad per ANSI standards
19. Removable front sill





CABLE ENTRANCE DETAIL

NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE – NOT TO BE USE FOR CONSTRUCTION**

KVA	A	B	C	D	E	F	G	H	K	GAL. LIQUID	APPROX. TOTAL WEIGHT WITH OIL
75	49	49¼	38	25	24	29	17	16½	53	112	2300
112.5	49	49¼	48	25	24	29	17	16½	53	115	2350
150	49	49¼	50	25	24	29	17	16½	53	112	2350
225	49	53¼	59	25	24	29	21	18½	57	168	3300
300	49	53¼	63	25	24	29	21	18½	57	163	3500
500	49	53¼	68	25	24	29	21	18½	57	149	4000

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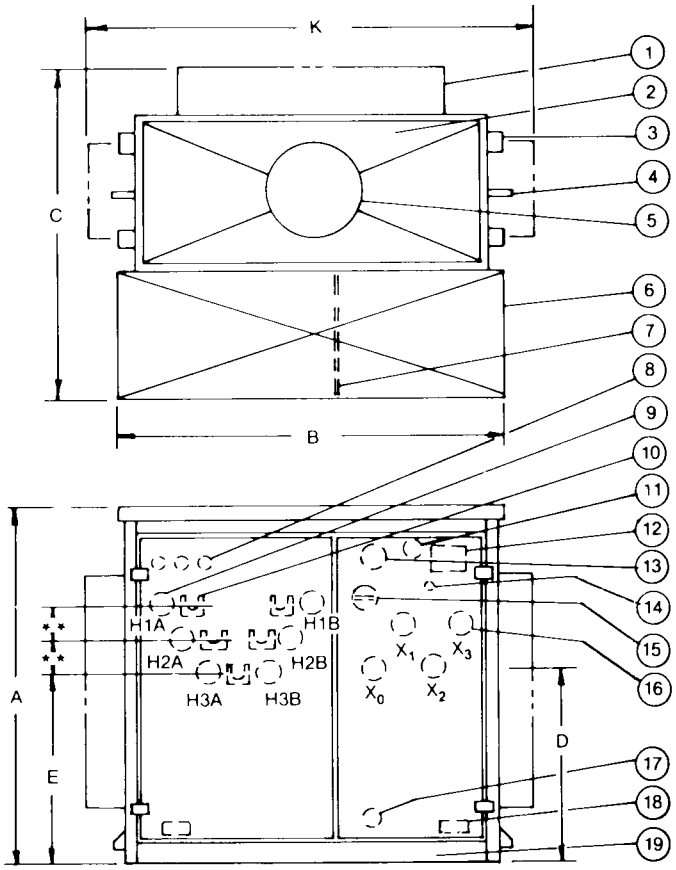
ALSTOM

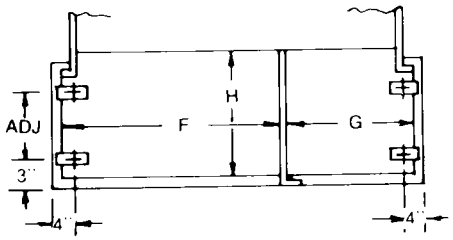
Compartmental Padmounted Distribution Transformer

DEAD FRONT LOOP FEED WITH DRY WELL CANISTERS AND CURRENT LIMITING FUSES

STANDARD ACCESSORIES

1. Cooling panels
2. Tank with welded-on covers
3. Lifting lugs
4. Jack Lugs
5. Handhole
6. Compartment
7. Steel divider
8. Dry well canisters
9. H.V. bushings wells
10. Parking stands
11. 1" fill plug and filter press connection
12. Corrosion resistant nameplate and connection diagram
13. Pressure relief valve
14. Liquid level plug
15. De-energized tapchanger
16. L.V. bushings
17. 1" drain plug – supplied with drain valve and sampling device 750 KVA and above
18. Ground pad per ANSI standards
19. Removable front sill





CABLE ENTRANCE DETAIL

NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE – NOT TO BE USE FOR CONSTRUCTION**
**** 75-2500 – 4"**

KVA	A	B	C	D	E	F	G	H	K	GAL. LIQUID	APPROX. TOTAL WEIGHT WITH OIL
75	49	49¼	38	25	24	29	17	16½	53	112	2300
112.5	49	49¼	48	25	24	29	17	16½	53	115	2350
150	49	49¼	50	25	24	29	17	16½	53	112	2350
225	49	53¼	59	25	24	29	21	18½	57	168	3300
300	49	53¼	63	25	24	29	21	18½	57	163	3500
500	49	53¼	68	25	24	29	21	18½	57	149	4000

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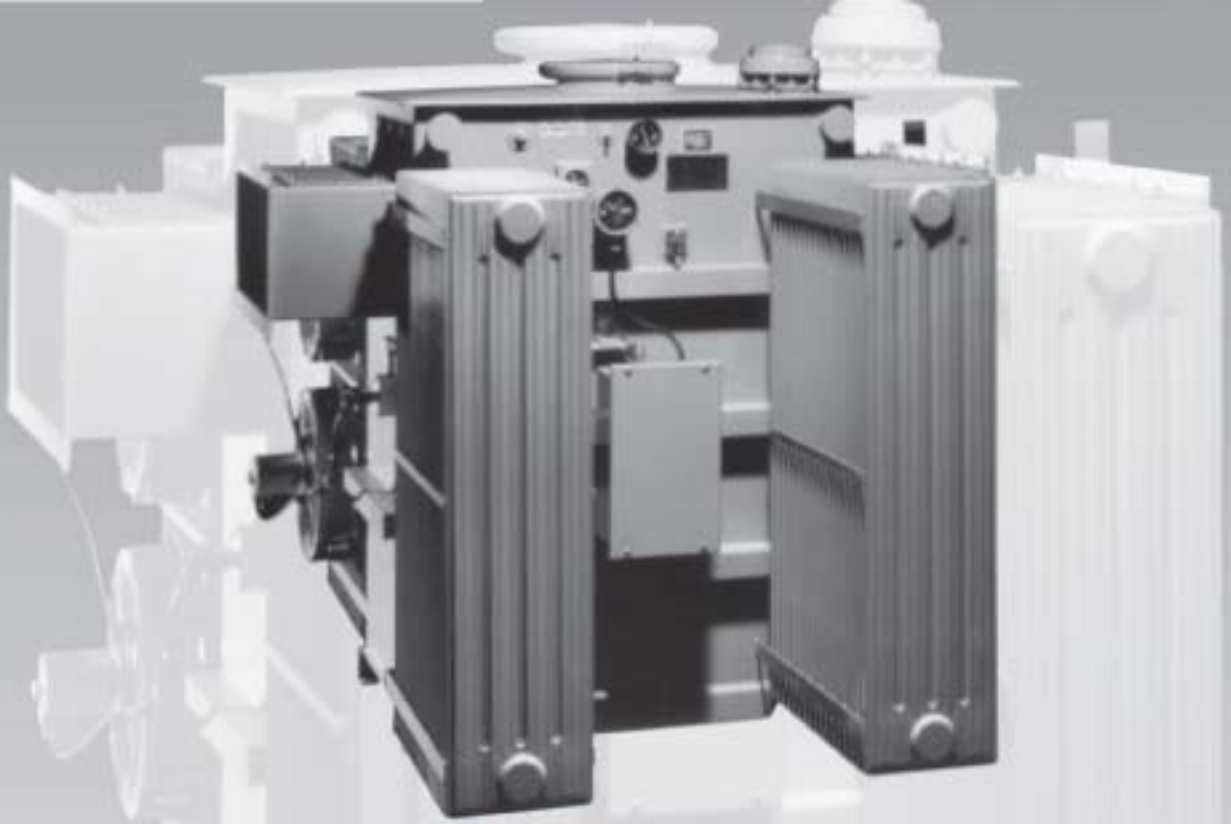
ALSTOM



Distribution transformers
Secondary unit substation type
75 to 5000 kVA

ALSTOM

Application

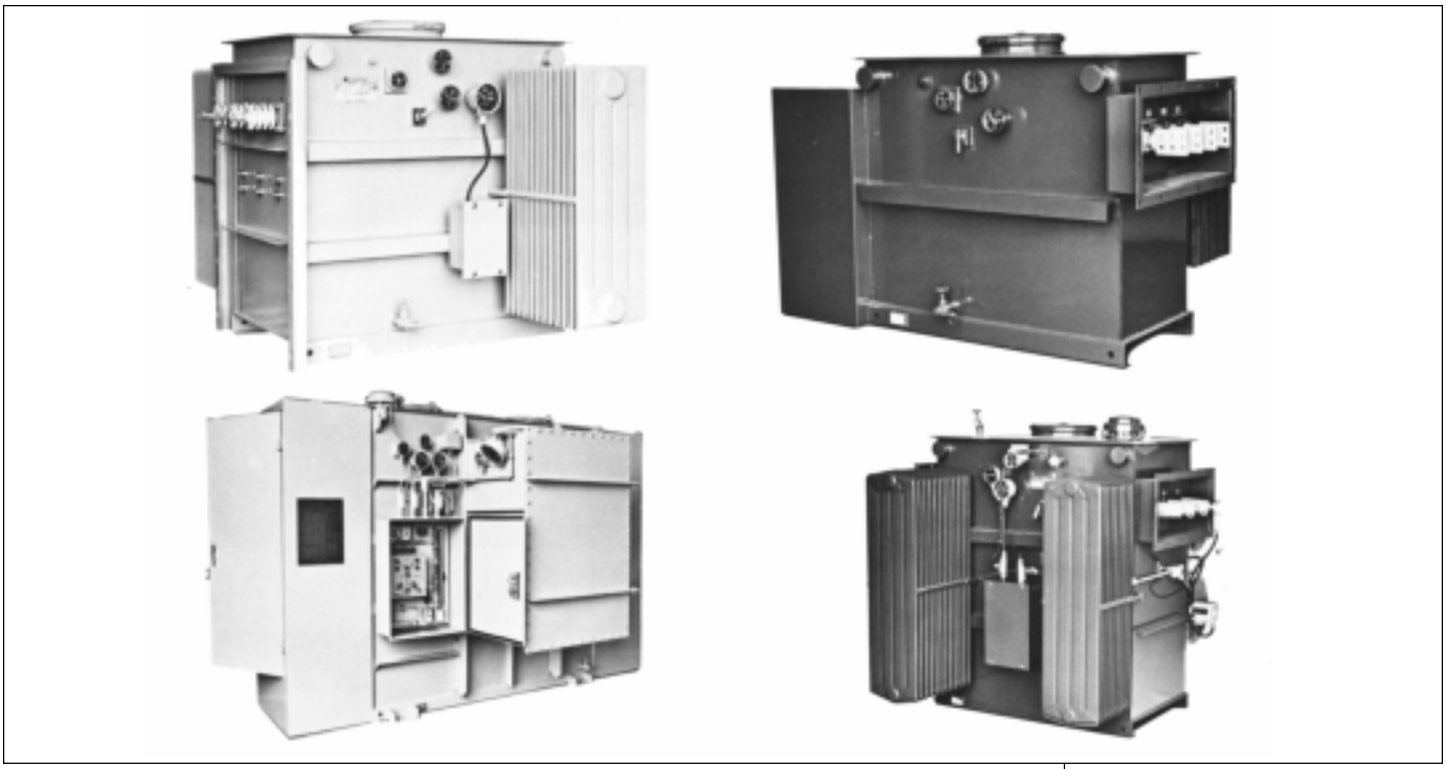
Alstom's secondary substation transformers are designed for use in distribution applications and are designed for ease of installation and first cost savings.
All ratings are designed in accordance with applicable ANSI, NEMA and IEEE standards.

Standard Features

- Magnetic liquid gauge
- Dial type thermometer
- Pressure vacuum gauge
- No-load tapchanger when required
- Secondary spade connectors
- Primary clamp type eyebolt (5/8") connectors
- Pressure test and upper filter press connection - 1" pipe plug
- NEMA two hole ground pad
- Corrosion resistant nameplate
- Provisions for jacking and lifting
- Base suitable for rolling or skidding
- Welded cover with handhole
- Rugged steel plate tank reinforced with steel channel selections for strength and rigidity
- Five legged core for wye-wye connections
- Externally replaceable high and low voltage bushings
- 1" drain plug - supplied with drain valve and sampling device 750 kVA and above hole

Ratings

- kVA ratings - 75 kVA to 5000 kVA
- Primary Voltage - all voltages through 34.5kV - 200 BIL
- Secondary Voltage - all voltages through 5 kV
- Frequency - 60Hz
- Temperature rise 65° C
- Consult factory for ratings not shown



These photographs show typical configurations

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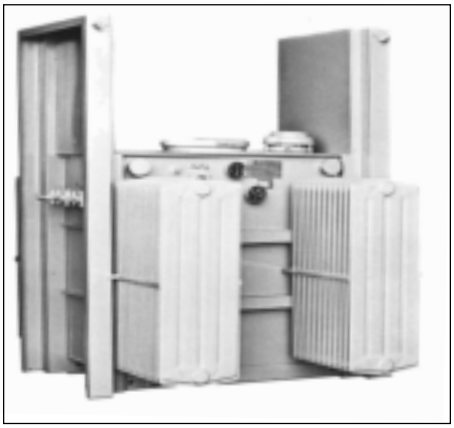
Standard Tests

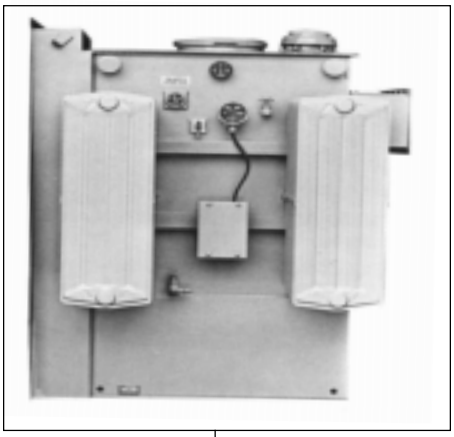
Each unit is subjected to the following tests:

- Resistance
- Ratio
- Polarity
- Phase relation
- Core loss
- Exciting current
- Impedance
- Load loss
- Applied potential test
- Induced potential test
- Quality control impluse test
- Pressure leak test

Optional Features

- 50 cycle
- 55/65° C temperature rise
- High fire point liquid
- Primary or secondary throats
- Primary or secondary terminal chambers
- Full length primary or secondary chambers
- Primary and secondary full-length flanges
- Pressure relief device
- Wind temperature indicator
- Sudden pressure relay
- Gauges and relief devices with alarm contacts
- Provisions for forced air cooling
- Forced air cooling minus fans
- Forced air cooling
- Delta-wye switch
- Loadbreak terminals
- Stress cones
- Lightning arresters
- Internal loadbreak switch - 600 amp and below
- Primary fusing - current limiting
- Primary fused interrupter switch
- Potheads and terminators
- Secondary molded case breakers





These photographs show typical configurations

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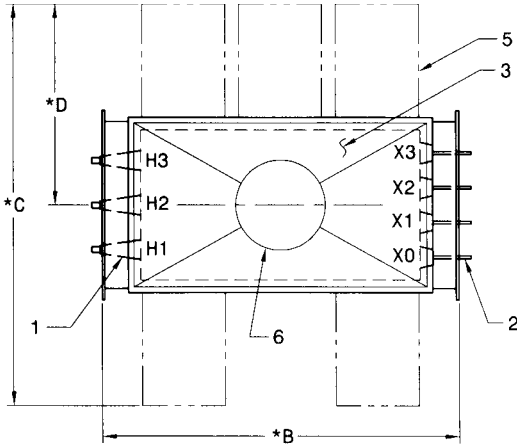
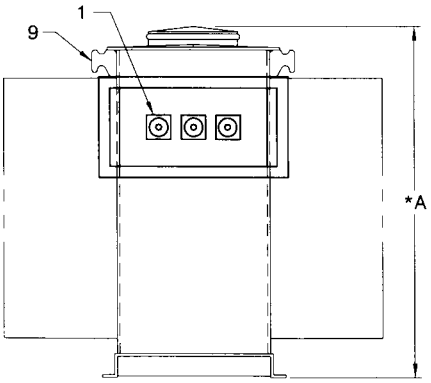
Secondary Unit Sub-Station
Distribution Transformer

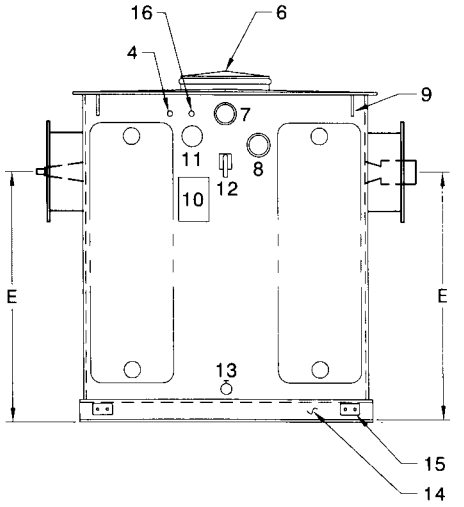
LEFT HAND UNIT
STANDARD THROAT / THROAT CONNECTED



STANDARD FEATURES

1. H.V. bushings – 5/8" eyebolt
2. L.V. bushings – spade
3. Tank with welded-on cover
4. 1" fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Dial-type thermometer
9. Lifting lugs
10. Corrosion resistant nameplate and connection diagram
11. Liquiud level gauge
12. De-energized tapchanger
13. 1" drain valve and sampling device
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad
16. Gas sample valve





NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION.**

KVA	*BASE DIMS. WD	LG	65° RISE A	B	C	D	E	GAL. LIQUID	TOTAL WEIGHT	55/65° RISE A	B	C	D	E	GAL. OIL	TOTAL WEIGHT OIL
112.5	25 1/2	42	45	52 3/8	38	21	29	86	2000	45	52 3/8	44	26	29	89	2100
150	25 1/2	44	45	54 3/8	40	23	29	89	2100	45	54 3/8	40	23	29	92	2200
225	27 1/2	46	45	56 3/8	45	28	29	105	2710	45	56 3/8	48	31	29	106	2750
300	27 1/2	46	45	56 3/8	48	31	29	103	3000	45	56 3/8	62	31	29	109	3100
500	27 1/2	52	55	62 3/8	48	31	39	161	3800	55	62 3/8	48	31	39	168	3970
750	32 1/2	53	55	63 1/2	51	34	39	201	5950	55	63 1/2	73	34	39	210	6170
1000	32 1/2	55	61	65 1/2	57	40	45	253	6950	61	65 1/2	78	39	45	264	7530
1500	32 1/2	59	73	69 1/2	57	40	55	320	8800	73	69 1/2	78	39	55	350	9550
2000	35 1/2	59	73	69 1/2	76	41	55	375	10250	75	69 1/2	100	50	55	407	10650
2500	35 1/2	59	73	69 1/2	82	41	55	355	13730	75	69 1/2	108	54	55	379	14250

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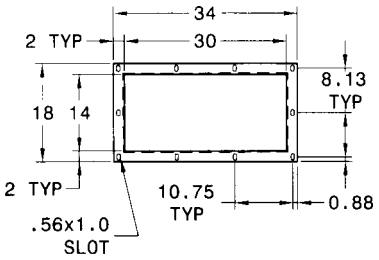
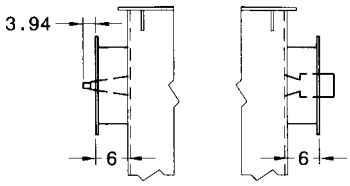
ALSTOM

Detailed Information



HV AND LV THROAT FLANGE DETAIL

KVA	208Y/120	240	480Y/277	480
112	FIG. 3-5	FIG. 1-5	FIG. 3-5	FIG. 1-5*
150	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
225	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
300	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
500	FIG. 3-7	FIG. 1-7	FIG. 3-5*	FIG. 1-5*
750	FIG. 2-6	FIG. 4-7	FIG. 2-5	FIG. 4-5
1000	FIG. 2-6	FIG. 4-6	FIG. 2-7	FIG. 4-7
1500	--	--	FIG. 3-7	FIG. 4-7
2000	--	--	FIG. 3-6	FIG. 4-6
2500	--	--	FIG. 3-6	FIG. 4-6



REFERENCE L.V. BUSHING FIGURES BELOW

FIG. #1 TANK CL

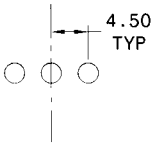


FIG. #2 TANK CL

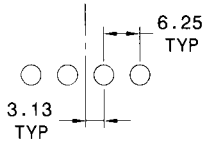


FIG. #3 TANK CL

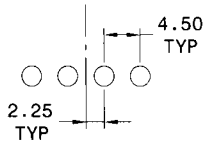
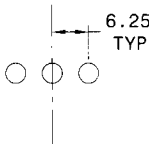


FIG. #4 TANK CL



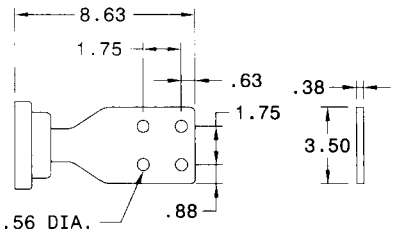


FIG. #5
BUSHING No.
48-111-0014-46

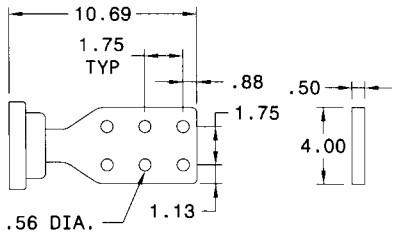


FIG. #6
BUSHING No.
48-111-0003-27

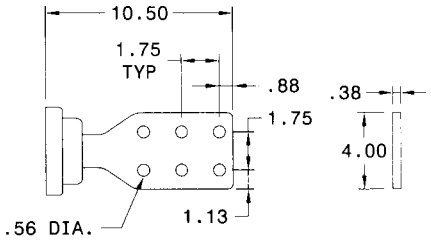


FIG. #7
BUSHING No.
48-111-0003-26

STANDARD TESTS

Resistance
No load losses
Load losses
Impedence
Exciting current
Polarity
Phase rotation
Applied potential
Induced potential
Impulse test

OPTIONAL TESTS

Temperature Test
Sound level test
Corona level test
Sudden pressure relay

OPTIONAL FEATURES

55/65° C rise
Pressure relief device
High fire point fluid
Forced air cooling

REQUIRED ORDERING INFORMATION

CUSTOMER:				P.O. NO.:			AGENT				
QUAN.	KVA RATING	COOLING	TEMP. RISE	PHASE	FREQ.	INSULATING LIQUID	%IMP.	SOUND LEVEL	BIL	DESTINATION	
PRIMARY:		TAPS:		SECONDARY:			PAINT:				
APPROVAL DWGS.	RECORD DWGS.	CERTIFIED TEST REPORTS		FACTORY INSP. REQD.			REQD. DELIVERY:				

SPECIAL FEATURES OR CONDITIONS:

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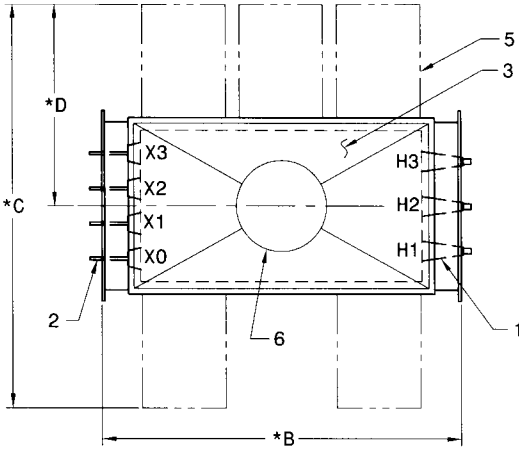
ALSTOM USA INC.
Transformers
300 West Antelope Road, Medford, Oregon U.S.A 97503-1089
Tel.: (541) 826-2113 • Fax: (541) 826-8847

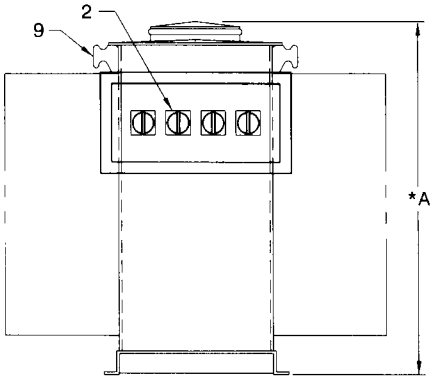
Secondary Unit Sub-Station
Distribution Transformer

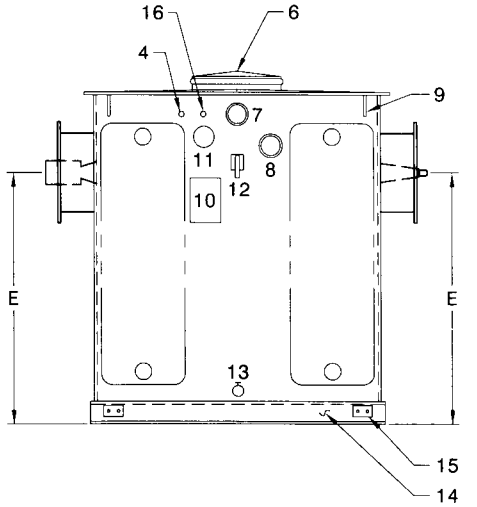
RIGHT HAND UNIT
STANDARD THROAT / THROAT CONNECTED



STANDARD FEATURES

1. H.V. bushings – 5/8" eyebolt
2. L.V. bushings – spade
3. Tank with welded-on cover
4. 1" fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Dial-type thermometer
9. Lifting lugs
10. Corrosion resistant nameplate and connection diagram
11. Liquid level gauge
12. De-energized tapchanger
13. 1" drain valve and sampling device
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad
16. Gas sample valve





NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION.**

	*BASE DIMS.			65° RISE				GAL.	TOTAL	55/65° RISE					GAL.	TOTAL
KVA	WD	LG	A	B	C	D	E	LIQUID	WEIGHT	A	B	C	D	E	OIL	WEIGHT OIL
112.5	25 1/2	42	45	52 3/8	38	21	29	86	2000	45	52 3/8	44	26	29	89	2100
150	25 1/2	44	45	54 3/8	40	23	29	89	2100	45	54 3/8	40	23	29	92	2200
225	27 1/2	46	45	56 3/8	45	28	29	105	2710	45	56 3/8	48	31	29	106	2750
300	27 1/2	46	45	56 3/8	48	31	29	103	3000	45	56 3/8	62	31	29	109	3100
500	27 1/2	52	55	62 3/8	48	31	39	161	3800	55	62 3/8	48	31	39	168	3970
750	32 1/2	53	55	63 1/2	51	34	39	201	5950	55	63 1/2	73	34	39	210	6170
1000	32 1/2	55	61	65 1/2	57	40	45	253	6950	61	65 1/2	78	39	45	264	7530
1500	32 1/2	59	73	69 1/2	57	40	55	320	8800	73	69 1/2	78	39	55	350	9550
2000	35 1/2	59	73	69 1/2	76	41	55	375	10250	75	69 1/2	100	50	55	407	10650
2500	35 1/2	59	73	69 1/2	82	41	55	355	13730	75	69 1/2	108	54	55	379	14250

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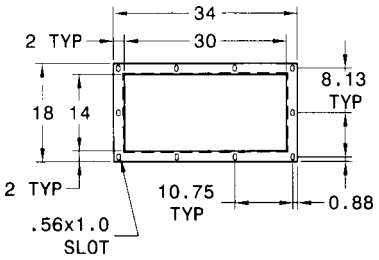
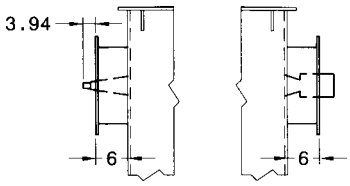
ALSTOM

Detailed Information



HV AND LV THROAT FLANGE DETAIL

KVA	208Y/120	240	480Y/277	480
112	FIG. 3-5	FIG. 1-5	FIG. 3-5	FIG. 1-5*
150	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
225	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
300	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
500	FIG. 3-7	FIG. 1-7	FIG. 3-5*	FIG. 1-5*
750	FIG. 2-6	FIG. 4-7	FIG. 2-5	FIG. 4-5
1000	FIG. 2-6	FIG. 4-6	FIG. 2-7	FIG. 4-7
1500	--	--	FIG. 3-7	FIG. 4-7
2000	--	--	FIG. 3-6	FIG. 4-6
2500	--	--	FIG. 3-6	FIG. 4-6



REFERENCE L.V. BUSHING FIGURES BELOW

FIG. #1 TANK CL

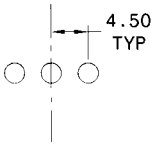


FIG. #2 TANK CL

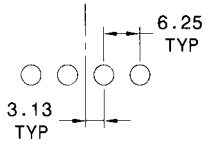


FIG. #3 TANK CL

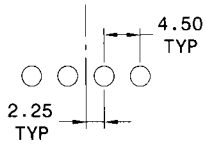
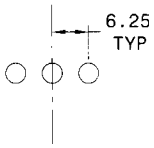


FIG. #4 TANK CL



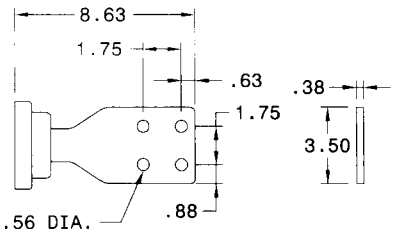


FIG. #5
BUSHING No.
48-111-0014-46

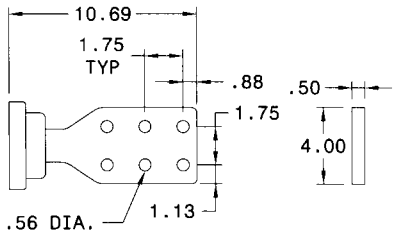


FIG. #6
BUSHING No.
48-111-0003-27

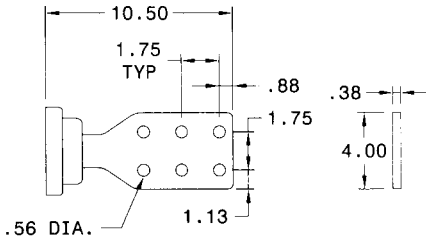


FIG. #7
BUSHING No.
48-111-0003-26

STANDARD TESTS

Resistance
No load losses
Load losses
Impedence
Exciting current
Polarity
Phase rotation
Applied potential
Induced potential
Impulse test

OPTIONAL TESTS

Temperature Test
Sound level test
Corona level test
Sudden pressure relay

OPTIONAL FEATURES

55/65° C rise
Pressure relief device
High fire point fluid
Forced air cooling

REQUIRED ORDERING INFORMATION

CUSTOMER:				P.O. NO.:			AGENT				
QUAN.	KVA RATING	COOLING	TEMP. RISE	PHASE	FREQ.	INSULATING LIQUID	%IMP.	SOUND LEVEL	BIL	DESTINATION	
PRIMARY:		TAPS:		SECONDARY:			PAINT:				
APPROVAL DWGS.	RECORD DWGS.	CERTIFIED TEST REPORTS		FACTORY INSP. REQD.			REQD. DELIVERY:				

SPECIAL FEATURES OR CONDITIONS:

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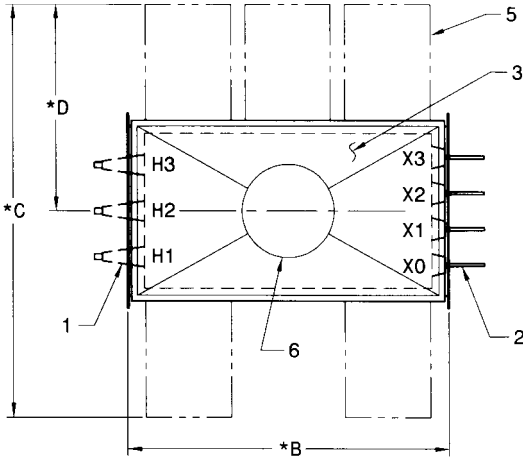
ALSTOM USA INC.
Transformers
300 West Antelope Road, Medford, Oregon U.S.A 97503-1089
Tel.: (541) 826-2113 • Fax: (541) 826-8847

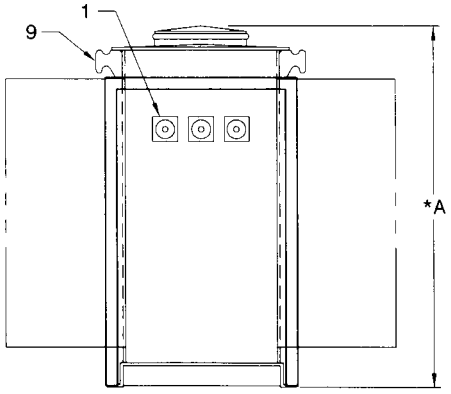
Secondary Unit Sub-Station
Distribution Transformer

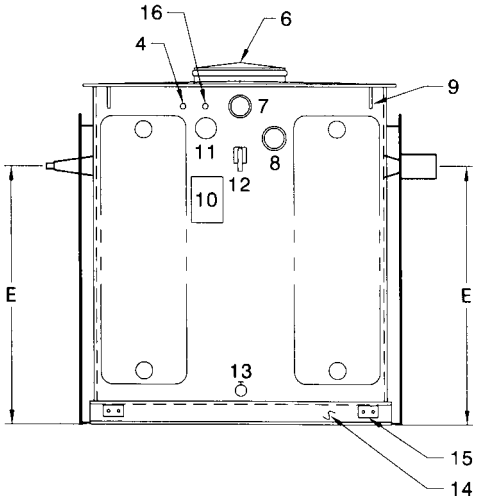
LEFT HAND UNIT
FULL LENGTH FLANGE / FLANGE CONNECTED



STANDARD FEATURES

1. H.V. bushings – 5/8" eyebolt
2. L.V. bushings – spade
3. Tank with welded-on cover
4. 1" fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Dial-type thermometer
9. Lifting lugs
10. Corrosion resistant nameplate and connection diagram
11. Liquid level gauge
12. De-energized tapchanger
13. 1" drain valve and sampling device
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad
16. Gas sample valve





NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION.**

KVA	*BASE DIMS. WD	LG	65° RISE A	B	C	D	E	GAL. LIQUID	TOTAL WEIGHT	55/65° RISE A	B	C	D	E	GAL. OIL	TOTAL WEIGHT OIL
112.5	25 1/2	42	45	45 3/8	38	21	29	86	2000	45	45 3/8	44	26	29	89	2100
150	25 1/2	44	45	47 3/8	40	23	29	89	2100	45	47 3/8	40	23	29	92	2200
225	27 1/2	46	45	49 3/8	45	28	29	105	2710	45	49 3/8	48	31	29	106	2750
300	27 1/2	46	45	49 3/8	48	31	29	103	3000	45	49 3/8	62	31	29	109	3100
500	27 1/2	52	55	55 3/8	48	31	39	161	3800	55	55 3/8	48	31	39	168	3970
750	32 1/2	53	55	56 1/2	51	34	39	201	5950	55	56 1/2	73	34	39	210	6170
1000	32 1/2	55	61	58 1/2	57	40	45	253	6950	61	58 1/2	78	39	45	264	7530
1500	32 1/2	59	73	62 1/2	57	40	55	320	8800	73	62 1/2	78	39	55	350	9550
2000	35 1/2	59	73	62 1/2	76	41	55	375	10250	75	62 1/2	100	50	55	407	10650
2500	35 1/2	59	73	62 1/2	82	41	55	355	13730	75	62 1/2	108	54	55	379	14250

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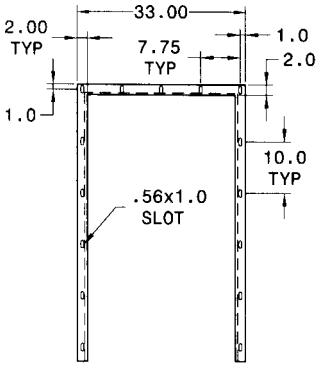
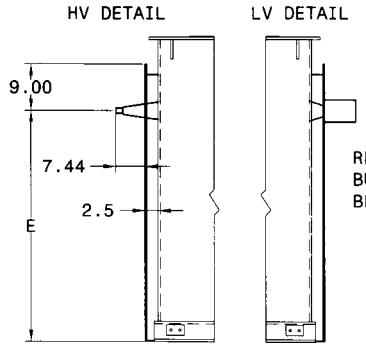
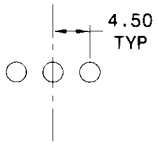




Detailed Information

KVA	208Y/120	240	480Y/277	480
112	FIG. 3-5	FIG. 1-5	FIG. 3-5	FIG. 1-5*
150	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
225	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
300	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
500	FIG. 3-7	FIG. 1-7	FIG. 3-5*	FIG. 1-5*
750	FIG. 2-6	FIG. 4-7	FIG. 2-5	FIG. 4-5
1000	FIG. 2-6	FIG. 4-6	FIG. 2-7	FIG. 4-7
1500	– –	– –	FIG. 3-7	FIG. 4-7
2000	– –	– –	FIG. 3-6	FIG. 4-6
2500	– –	– –	FIG. 3-6	FIG. 4-6

FIG. #1 TANK CL



LV ARRANGEMENTS

FIG. #2 TANK CL

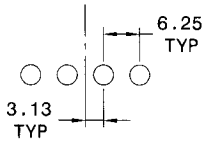


FIG. #3 TANK CL

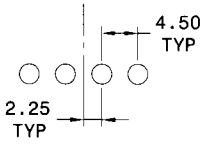
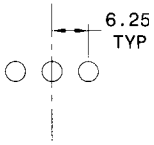


FIG. #4 TANK CL



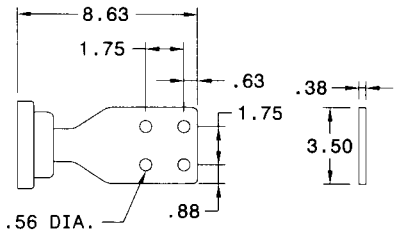


FIG. #5
BUSHING No.
48-111-0014-46

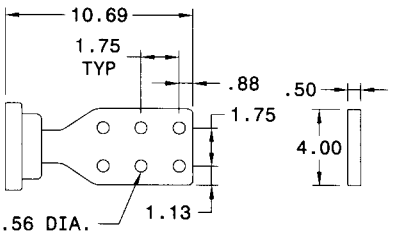


FIG. #6
BUSHING No.
48-111-0003-27

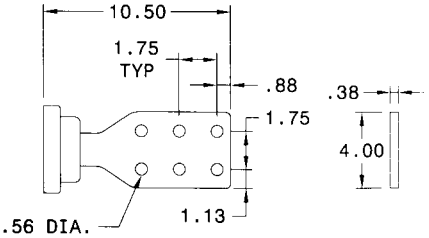


FIG. #7
BUSHING No.
48-111-0003-26

STANDARD TESTS

Resistance
No load losses
Load losses
Impedence
Exciting current
Polarity
Phase rotation
Applied potential
Induced potential
Impulse test

OPTIONAL TESTS

Temperature Test
Sound level test
Corona level test
Sudden pressure relay

OPTIONAL FEATURES

55/65° C rise
Pressure relief device
High fire point fluid
Forced air cooling

REQUIRED ORDERING INFORMATION

CUSTOMER:						P.O. NO.:		AGENT		
QUAN.	KVA RATING	COOLING	TEMP. RISE	PHASE	FREQ.	INSULATING LIQUID	%IMP.	SOUND LEVEL	BIL	DESTINATION

PRIMARY:	TAPS:	SECONDARY:	PAINT:

APPROVAL DWGS.	RECORD DWGS.	CERTIFIED TEST REPORTS	FACTORY INSP. REQD.	REQD. DELIVERY:

SPECIAL FEATURES OR CONDITIONS:

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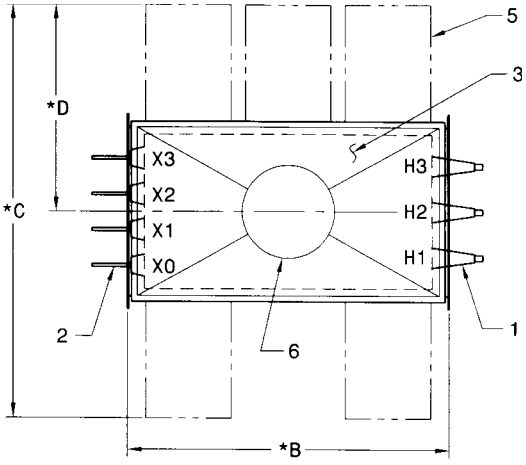
Secondary Unit Sub-Station
Distribution Transformer

RIGHT HAND UNIT
FULL LENGTH FLANGE / FLANGE CONNECTED



STANDARD FEATURES

1. H.V. bushings –5/8" eyebolt
2. L.V. bushings – spade
3. Tank with welded-on cover
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5. Cooling panels
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9. Lifting lugs
10. Corrosion resistant nameplate and connection diagram
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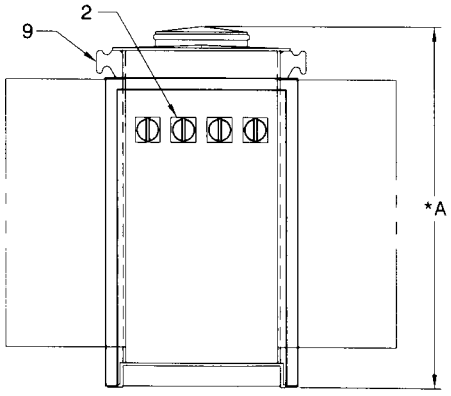
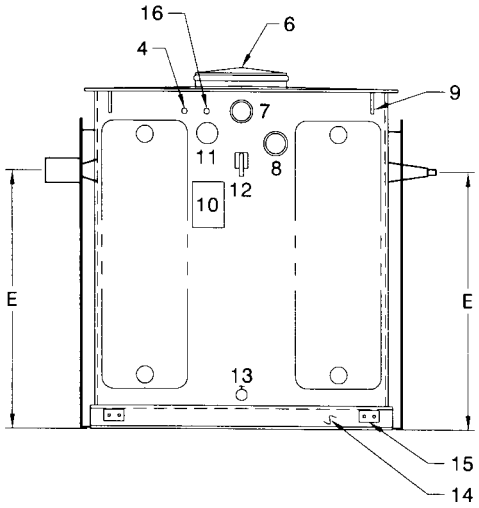
13. 1" drain valve and sampling device
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad
16. Gas sample valve





NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION.**

	*BASE DIMS.			65° RISE				GAL.	TOTAL	55/65° RISE					GAL.	TOTAL
KVA	WD	LG	A	B	C	D	E	LIQUID	WEIGHT	A	B	C	D	E	OIL	WEIGHT OIL
112.5	25 1/2	42	45	45 3/8	38	21	29	86	2000	45	45 3/8	44	26	29	89	2100
150	25 1/2	44	45	47 3/8	40	23	29	89	2100	45	47 3/8	40	23	29	92	2200
225	27 1/2	46	45	49 3/8	45	28	29	105	2710	45	49 3/8	48	31	29	106	2750
300	27 1/2	46	45	49 3/8	48	31	29	103	3000	45	49 3/8	62	31	29	109	3100
500	27 1/2	52	55	55 3/8	48	31	39	161	3800	55	55 3/8	48	31	39	168	3970
750	32 1/2	53	55	56 1/2	51	34	39	201	5950	55	56 1/2	73	34	39	210	6170
1000	32 1/2	55	61	58 1/2	57	40	45	253	6950	61	58 1/2	78	39	45	264	7530
1500	32 1/2	59	73	62 1/2	57	40	55	320	8800	73	62 1/2	78	39	55	350	9550
2000	35 1/2	59	73	62 1/2	76	41	55	375	10250	75	62 1/2	100	50	55	407	10650
2500	35 1/2	59	73	62 1/2	82	41	55	355	13730	75	62 1/2	108	54	55	379	14250

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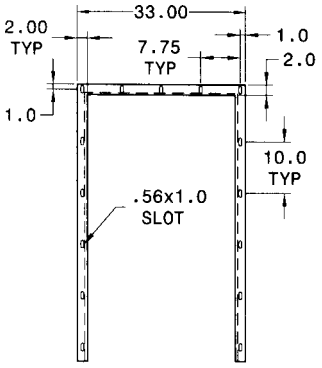
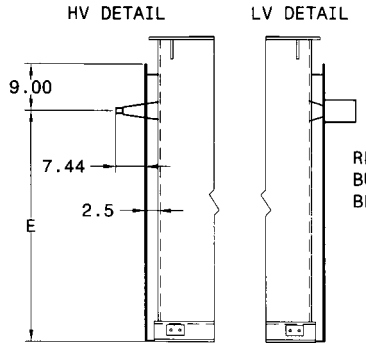
ALSTOM

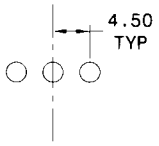




Detailed Information

KVA	208Y/120	240	480Y/277	480
112	FIG. 3-5	FIG. 1-5	FIG. 3-5	FIG. 1-5*
150	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
225	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
300	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
500	FIG. 3-7	FIG. 1-7	FIG. 3-5*	FIG. 1-5*
750	FIG. 2-6	FIG. 4-7	FIG. 2-5	FIG. 4-5
1000	FIG. 2-6	FIG. 4-6	FIG. 2-7	FIG. 4-7
1500	– –	– –	FIG. 3-7	FIG. 4-7
2000	– –	– –	FIG. 3-6	FIG. 4-6
2500	– –	– –	FIG. 3-6	FIG. 4-6

FIG. #1 TANK CL



LV ARRANGEMENTS

FIG. #2 TANK CL

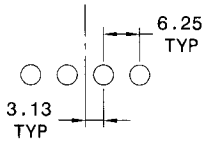


FIG. #3 TANK CL

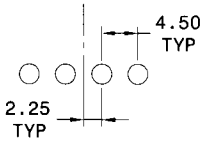
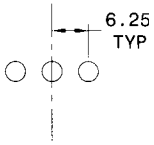


FIG. #4 TANK CL



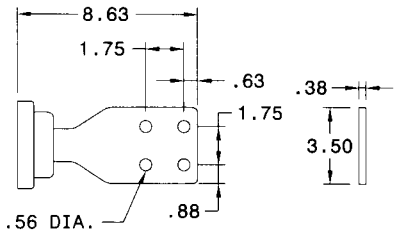


FIG. #5
BUSHING No.
48-111-0014-46

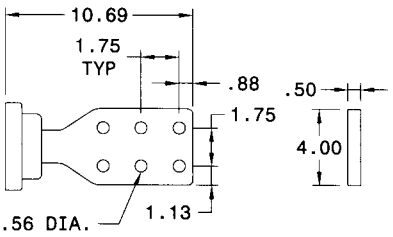


FIG. #6
BUSHING No.
48-111-0003-27

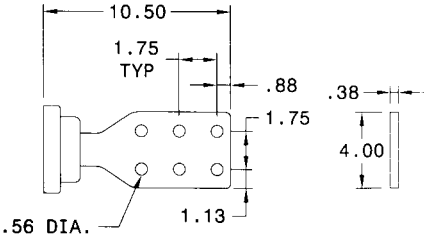


FIG. #7
BUSHING No.
48-111-0003-26

STANDARD TESTS

Resistance
No load losses
Load losses
Impedence
Exciting current
Polarity
Phase rotation
Applied potential
Induced potential
Impulse test

OPTIONAL TESTS

Temperature Test
Sound level test
Corona level test
Sudden pressure relay

OPTIONAL FEATURES

55/65° C rise
Pressure relief device
High fire point fluid
Forced air cooling

REQUIRED ORDERING INFORMATION

CUSTOMER:						P.O. NO.:		AGENT		
QUAN.	KVA RATING	COOLING	TEMP. RISE	PHASE	FREQ.	INSULATING LIQUID	%IMP.	SOUND LEVEL	BIL	DESTINATION

PRIMARY:	TAPS:	SECONDARY:	PAINT:

APPROVAL DWGS.	RECORD DWGS.	CERTIFIED TEST REPORTS	FACTORY INSP. REQD.	REQD. DELIVERY:

SPECIAL FEATURES OR CONDITIONS:

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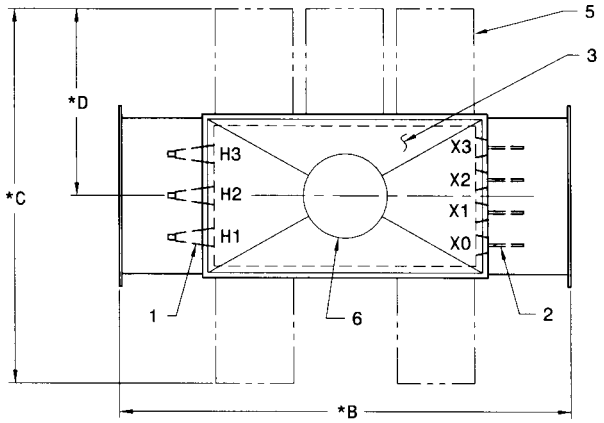
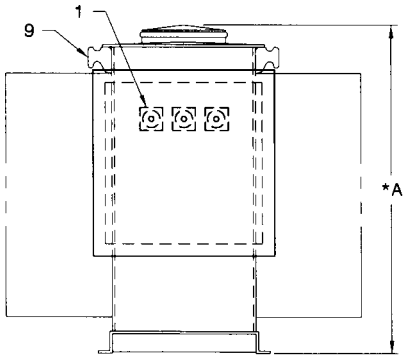
ALSTOM USA INC.
Transformers
300 West Antelope Road, Medford, Oregon U.S.A 97503-1089
Tel.: (541) 826-2113 • Fax: (541) 826-8847

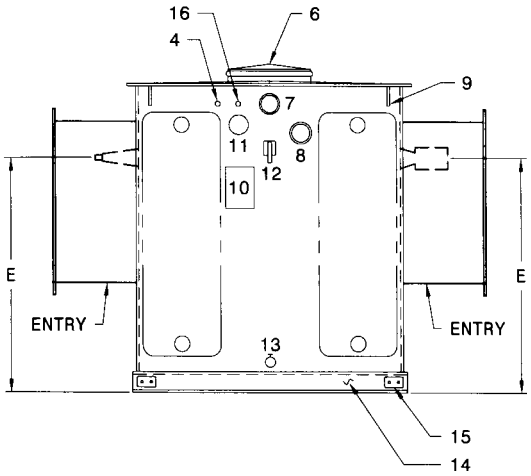
LEFT HAND UNIT
AIR TERMINAL CHAMBER / AIR TERMINAL CHAMBER

STANDARD FEATURES

1. H.V. bushings – 5/8" eyebolt
2. L.V. bushings – spade
3. Tank with welded-on cover
4. 1" fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Dial-type thermometer
9. Lifting lugs
10. Corrosion resistant nameplate and connection diagram
11. Liquid level gauge
12. De-energized tapchanger
13. 1" drain valve and sampling device
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad
16. Gas sample valve







NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION.**

KVA	*BASE DIMS. WD	LG	65° RISE A	B	C	D	E	GAL. LIQUID	TOTAL WEIGHT	55/65° RISE A	B	C	D	E	GAL. OIL	TOTAL WEIGHT OIL
112.5	25½	42	45	81	38	21	29	86	2200	45	73	44	26	29	89	2250
150	25½	44	45	83	40	23	29	89	2360	45	75	40	23	29	92	2425
225	27½	46	45	85	45	28	29	105	2970	45	77	48	31	29	106	3086
300	27½	46	45	85	48	31	29	103	3180	45	77	62	31	29	109	3300
500	27½	52	55	91	48	31	39	161	4060	55	83	48	31	39	168	4223
750	32½	53	55	92	51	34	39	201	6210	55	84	73	34	39	210	6425
1000	32½	55	61	95	57	40	45	253	7230	61	87	78	39	45	264	7810
1500	32½	59	73	98	57	40	55	320	8860	73	90	78	39	55	350	9820
2000	35½	59	73	98	76	41	55	375	10510	75	90	100	50	55	407	10910
2500	35½	59	73	98	82	41	55	355	13986	75	90	108	54	55	379	14487

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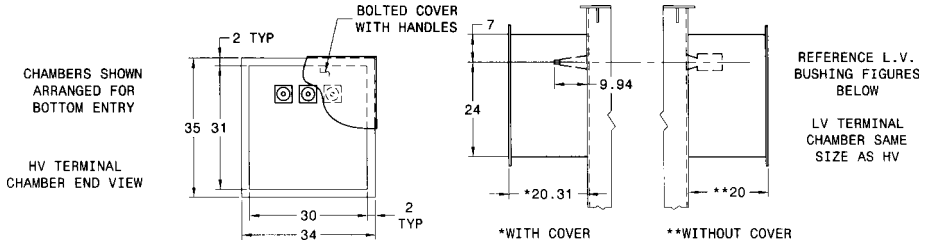


KVA	208Y/120	240	480Y/277	480
112	FIG. 3-5	FIG. 1-5	FIG. 3-5	FIG. 1-5*
150	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
225	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
300	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
500	FIG. 3-7	FIG. 1-7	FIG. 3-5*	FIG. 1-5*
750	FIG. 2-6	FIG. 4-7	FIG. 2-5	FIG. 4-5
1000	FIG. 2-6	FIG. 4-6	FIG. 2-7	FIG. 4-7
1500	– –	– –	FIG. 3-7	FIG. 4-7
2000	– –	– –	FIG. 3-6	FIG. 4-6
2500	– –	– –	FIG. 3-6	FIG. 4-6

FIG. #1 TANK CL

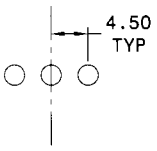


FIG. #2 TANK CL

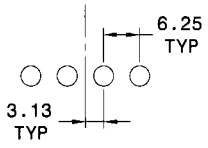


FIG. #3 TANK CL

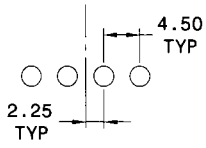
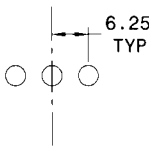


FIG. #4 TANK CL



LV ARRANGEMENTS

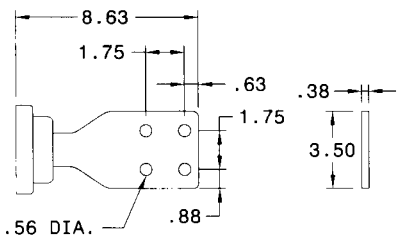


FIG. #5
BUSHING No.
48-111-0014-46

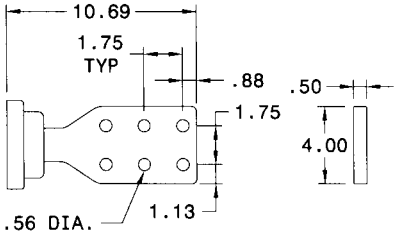


FIG. #6
BUSHING No.
48-111-0003-27

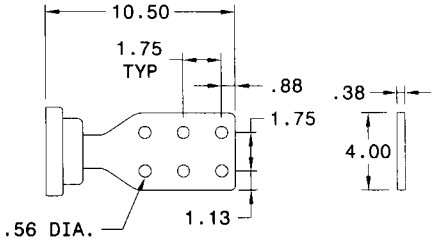


FIG. #7
BUSHING No.
48-111-0003-26

STANDARD TESTS

Resistance	Polarity
No load losses	Phase rotation
Load losses	Applied potential
Impedence	Induced potential
Exciting current	Impulse test

OPTIONAL TESTS

Temperature Test
Sound level test
Corona level test
Sudden pressure relay

OPTIONAL FEATURES

55/65° C rise
Pressure relief device
High fire point fluid
Forced air cooling

REQUIRED ORDERING INFORMATION

CUSTOMER:	P.O. NO.:	AGENT

QUAN.	KVA RATING	COOLING	TEMP. RISE	PHASE	FREQ.	INSULATING LIQUID	%IMP.	SOUND LEVEL	BIL	DESTINATION

PRIMARY:	TAPS:	SECONDARY:	PAINT:

APPROVAL DWGS.	RECORD DWGS.	CERTIFIED TEST REPORTS	FACTORY INSP. REQD.	REQD. DELIVERY:

SPECIAL FEATURES OR CONDITIONS:

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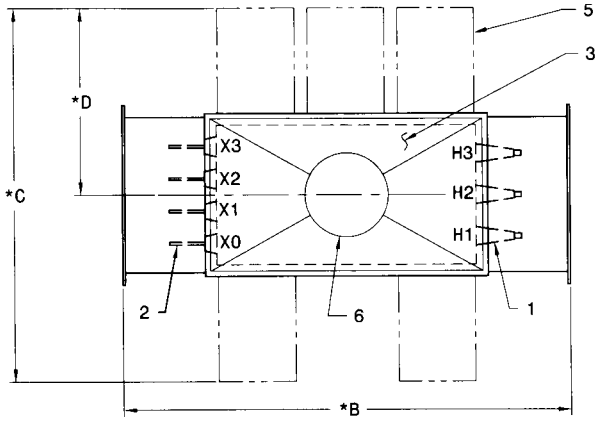
ALSTOM USA INC.
Transformers
300 West Antelope Road, Medford, Oregon U.S.A 97503-1089

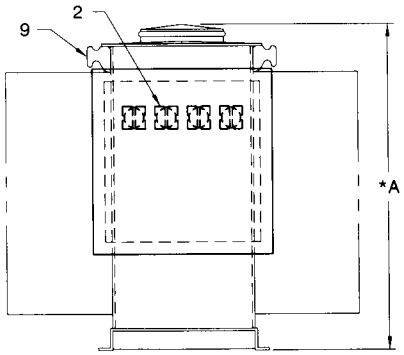
Secondary Unit Sub-Station
Distribution Transformer

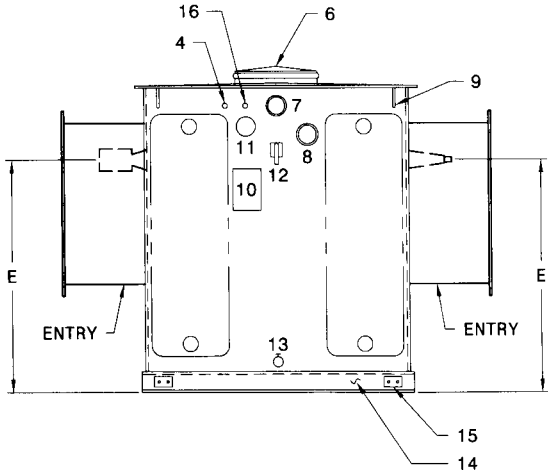
RIGHT HAND UNIT
AIR TERMINAL CHAMBER / AIR TERMINAL CHAMBER

STANDARD FEATURES

1. H.V. bushings – 5/8" eyebolt
2. L.V. bushings – spade
3. Tank with welded-on cover
4. 1" fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Dial-type thermometer
9. Lifting lugs
10. Corrosion resistant nameplate and connection diagram
11. Liquid level gauge
12. De-energized tapchanger
13. 1" drain valve and sampling device
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad
16. Gas sample valve







NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION.**

	*BASE DIMS.			65° RISE				GAL.	TOTAL	55/65° RISE					GAL.	TOTAL
KVA	WD	LG	A	B	C	D	E	LIQUID	WEIGHT	A	B	C	D	E	OIL	WEIGHT OIL
112.5	25½	42	45	81	38	21	29	86	2200	45	73	44	26	29	89	2250
150	25½	44	45	83	40	23	29	89	2360	45	75	40	23	29	92	2425
225	27½	46	45	85	45	28	29	105	2970	45	77	48	31	29	106	3086
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1000	32½	55	61	95	57	40	45	253	7230	61	87	78	39	45	264	7810
1500	32½	59	73	98	57	40	55	320	8860	73	90	78	39	55	350	9820
2000	35½	59	73	98	76	41	55	375	10510	75	90	100	50	55	407	10910
2500	35½	59	73	98	82	41	55	355	13986	75	90	108	54	55	379	14487

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ALSTOM

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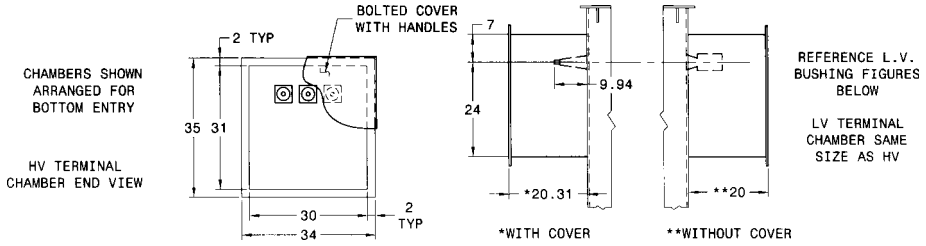


KVA	208Y/120	240	480Y/277	480
112	FIG. 3-5	FIG. 1-5	FIG. 3-5	FIG. 1-5*
150	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
225	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
300	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
500	FIG. 3-7	FIG. 1-7	FIG. 3-5*	FIG. 1-5*
750	FIG. 2-6	FIG. 4-7	FIG. 2-5	FIG. 4-5
1000	FIG. 2-6	FIG. 4-6	FIG. 2-7	FIG. 4-7
1500	– –	– –	FIG. 3-7	FIG. 4-7
2000	– –	– –	FIG. 3-6	FIG. 4-6
2500	– –	– –	FIG. 3-6	FIG. 4-6

FIG. #1 TANK CL

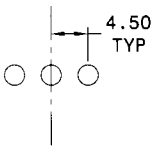


FIG. #2 TANK CL

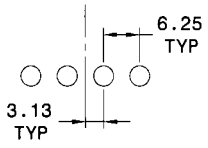


FIG. #3 TANK CL

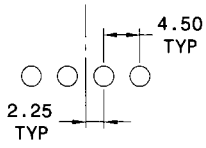
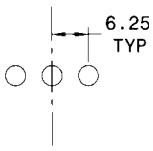


FIG. #4 TANK CL



LV ARRANGEMENTS

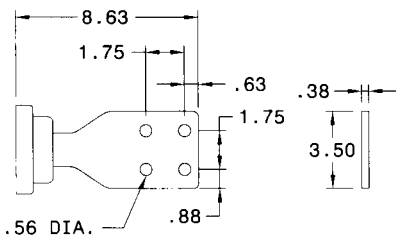


FIG. #5
BUSHING No.
48-111-0014-46

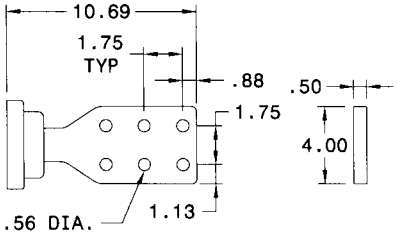


FIG. #6
BUSHING No.
48-111-0003-27

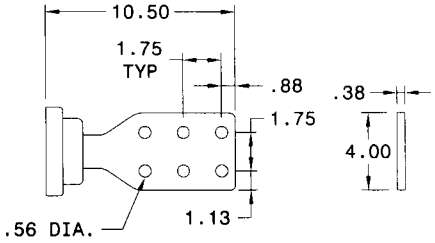


FIG. #7
BUSHING No.
48-111-0003-26

STANDARD TESTS

Resistance	Polarity
No load losses	Phase rotation
Load losses	Applied potential
Impedence	Induced potential
Exciting current	Impulse test

OPTIONAL TESTS

Temperature Test
Sound level test
Corona level test
Sudden pressure relay

OPTIONAL FEATURES

55/65° C rise
Pressure relief device
High fire point fluid
Forced air cooling

REQUIRED ORDERING INFORMATION

CUSTOMER:	P.O. NO.:	AGENT

QUAN.	KVA RATING	COOLING	TEMP. RISE	PHASE	FREQ.	INSULATING LIQUID	%IMP.	SOUND LEVEL	BIL	DESTINATION

PRIMARY:	TAPS:	SECONDARY:	PAINT:

APPROVAL DWGS.	RECORD DWGS.	CERTIFIED TEST REPORTS	FACTORY INSP. REQD.	REQD. DELIVERY:

SPECIAL FEATURES OR CONDITIONS:

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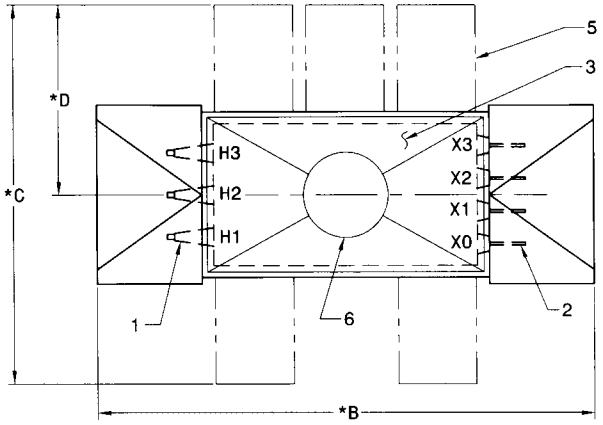
ALSTOM USA INC.
Transformers
300 West Antelope Road, Medford, Oregon U.S.A 97503-1089

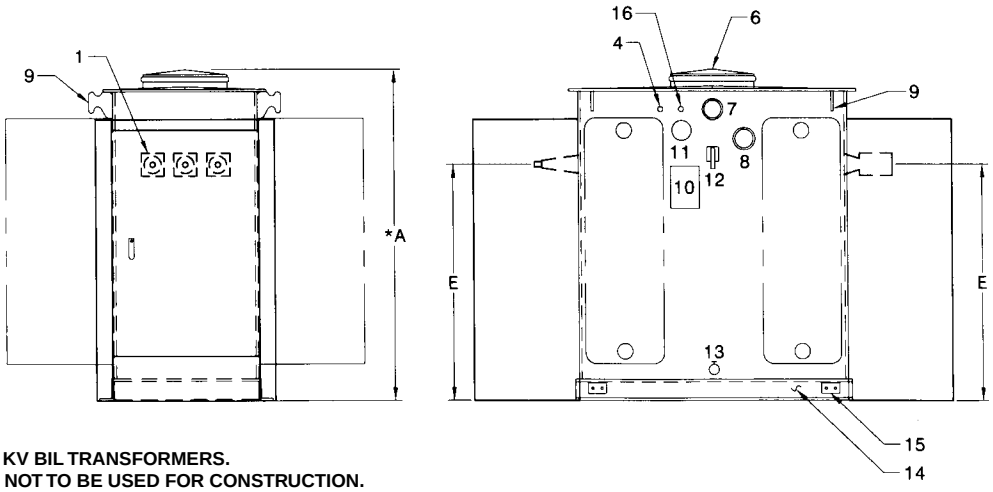
Secondary Unit Sub-Station
Distribution Transformer

LEFT HAND UNIT
FULL LENGTH CHAMBER / FULL LENGTH CHAMBER

STANDARD FEATURES

1. H.V. bushings – 5/8" eyebolt
2. L.V. bushings – spade
3. Tank with welded-on cover
4. 1" fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Dial-type thermometer
9. Lifting lugs
10. Corrosion resistant nameplate and connection diagram
11. Liquid level gauge
12. De-energized tapchanger
13. 1" drain valve and sampling device
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad
16. Gas sample valve





NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION.**

	*BASE DIMS.			65° RISE						55/65° RISE						
KVA	WD	LG	A	B	C	D	E	GAL. LIQUID	TOTAL WEIGHT	A	B	C	D	E	GAL. OIL	TOTAL WEIGHT OIL
112.5	25½	42	45	80.38	38	21	29	86	2500	45	80.38	44	26	29	89	2555
150	25½	44	45	82.38	40	23	29	89	2600	45	82.38	40	23	29	92	2675
225	27½	46	45	84.38	45	28	29	105	3210	45	84.38	48	31	29	106	3326
300	27½	46	45	84.38	48	31	29	103	3500	45	84.38	62	31	29	109	3620
500	27½	52	55	84.38	48	31	39	161	4300	55	84.38	48	31	39	168	4463
750	32½	53	55	91.50	51	34	39	201	6450	55	91.50	73	34	39	210	6665
1000	32½	56	61	94.50	57	40	45	253	7470	61	94.50	78	39	45	264	8049
1500	32½	59	73	97.50	57	40	55	320	9100	73	97.50	78	39	55	350	10060
2000	35½	59	73	97.50	76	41	55	375	10750	75	97.50	100	50	55	407	11150
2500	35½	59	73	97.50	82	41	55	355	14226	75	97.50	108	54	55	379	14727

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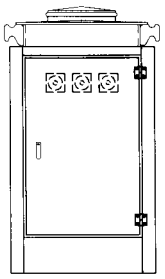
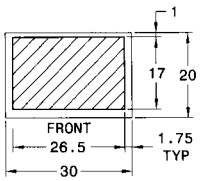
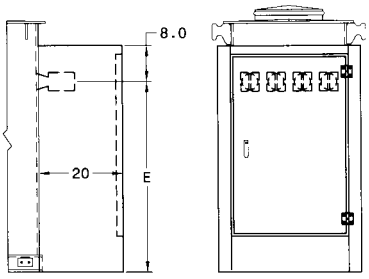


HV FULL HEIGHT TERMINAL CHAMBER



TYPICAL HV & LV
CONDUIT ENTRY
26.50 X 17.00



LV FULL HEIGHT TERMINAL CHAMBER

FIG. #1 TANK CL

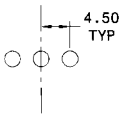


FIG. #2 TANK CL

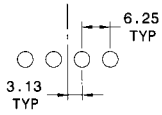


FIG. #3 TANK CL

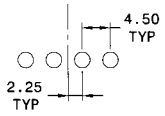
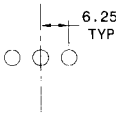


FIG. #4 TANK CL



LV ARRANGEMENTS

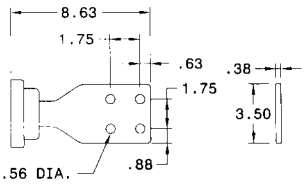


FIG. #1
BUSHING No.
48-111-0014-46

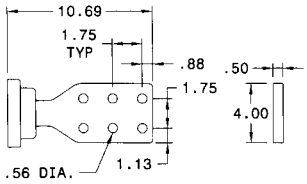


FIG. #6
BUSHING No.
48-111-0003-27

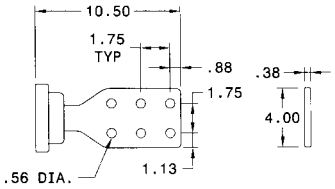


FIG. #7
BUSHING No.
48-111-0003-26

KVA	208Y/120	240	480Y/277	480
112	FIG. 3-5	FIG. 1-5	FIG. 3-5	FIG. 1-5*
150	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
225	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
300	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
500	FIG. 3-7	FIG. 1-7	FIG. 3-5*	FIG. 1-5*
750	FIG. 2-6	FIG. 4-7	FIG. 2-5	FIG. 4-5
1000	FIG. 2-6	FIG. 4-6	FIG. 2-7	FIG. 4-7
1500	– –	– –	FIG. 3-7	FIG. 4-7
2000	– –	– –	FIG. 3-6	FIG. 4-6
2500	– –	– –	FIG. 3-6	FIG. 4-6

STANDARD TESTS

Resistance
No load losses
Load losses
Impedence
Exciting current
Polarity
Phase rotation
Applied potential
Induced potential
Impulse test

OPTIONAL TESTS

Temperature Test
Sound level test
Corona level test
Sudden pressure relay

OPTIONAL FEATURES

55/65° C rise
Pressure relief device
High fire point fluid
Forced air cooling

REQUIRED ORDERING INFORMATION

CUSTOMER:				P.O. NO.:			AGENT				
QUAN.	KVA RATING	COOLING	TEMP. RISE	PHASE	FREQ.	INSULATING LIQUID	%IMP.	SOUND LEVEL		BIL	DESTINATION
PRIMARY:			TAPS:			SECONDARY:			PAINT:		
APPROVAL DWGS.	RECORD DWGS.		CERTIFIED TEST REPORTS			FACTORY INSP. REQD.			REQD. DELIVERY:		

SPECIAL FEATURES OR CONDITIONS:

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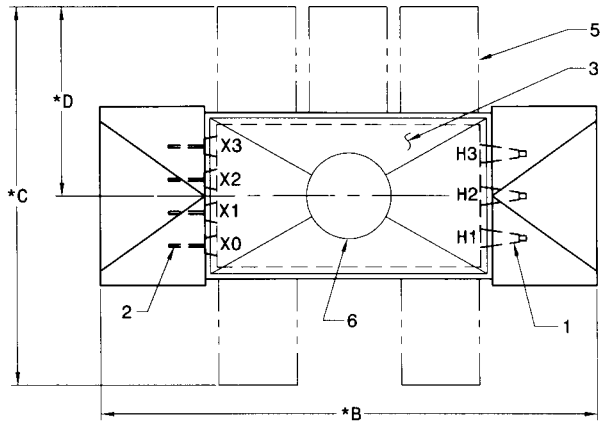
ALSTOM USA INC.
Transformers
300 West Antelope Road, Medford, Oregon U.S.A 97503-1089
Tel.: (541) 826-2113 • Fax: (541) 826-8847

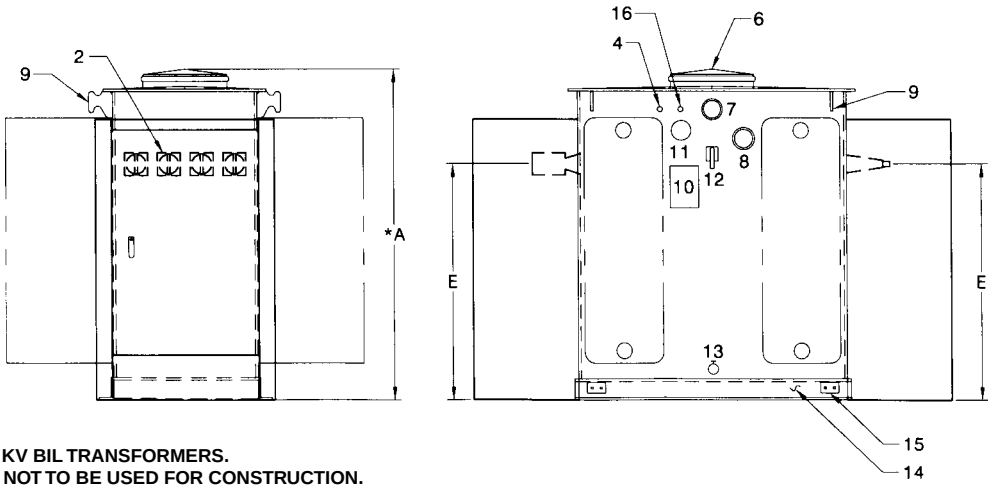
Secondary Unit Sub-Station
Distribution Transformer

RIGHT HAND UNIT
FULL LENGTH CHAMBER / FULL LENGTH CHAMBER

STANDARD FEATURES

1. H.V. bushings – 5/8" eyebolt
2. L.V. bushings – spade
3. Tank with welded-on cover
4. 1" fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Dial-type thermometer
9. Lifting lugs
10. Corrosion resistant nameplate and connection diagram
11. Liquid level gauge
12. De-energized tapchanger
13. 1" drain valve and sampling device
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad
16. Gas sample valve





NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION.**

	*BASE DIMS.			65° RISE				GAL.	TOTAL	55/65° RISE					GAL.	TOTAL
KVA	WD	LG	A	B	C	D	E	LIQUID	WEIGHT	A	B	C	D	E	OIL	WEIGHT OIL
112.5	25½	42	45	80.38	38	21	29	86	2500	45	80.38	44	26	29	89	2555
150	25½	44	45	82.38	40	23	29	89	2600	45	82.38	40	23	29	92	2675
225	27½	46	45	84.38	45	28	29	105	3210	45	84.38	48	31	29	106	3326
300	27½	46	45	84.38	48	31	29	103	3500	45	84.38	62	31	29	109	3620
500	27½	52	55	84.38	48	31	39	161	4300	55	84.38	48	31	39	168	4463
750	32½	53	55	91.50	51	34	39	201	6450	55	91.50	73	34	39	210	6665
1000	32½	56	61	94.50	57	40	45	253	7470	61	94.50	78	39	45	264	8049
1500	32½	59	73	97.50	57	40	55	320	9100	73	97.50	78	39	55	350	10060
2000	35½	59	73	97.50	76	41	55	375	10750	75	97.50	100	50	55	407	11150
2500	35½	59	73	97.50	82	41	55	355	14226	75	97.50	108	54	55	379	14727

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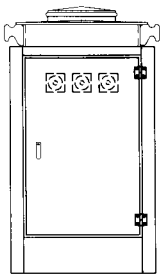
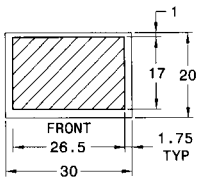
ALSTOM

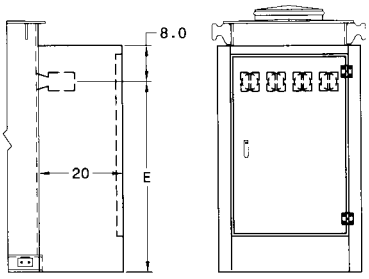
Detailed Information



HV FULL HEIGHT TERMINAL CHAMBER



TYPICAL HV & LV
CONDUIT ENTRY
26.50 X 17.00



LV FULL HEIGHT TERMINAL CHAMBER

FIG. #1 TANK CL

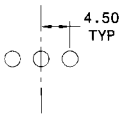


FIG. #2 TANK CL

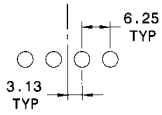


FIG. #3 TANK CL

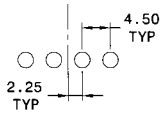
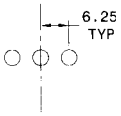


FIG. #4 TANK CL



LV ARRANGEMENTS

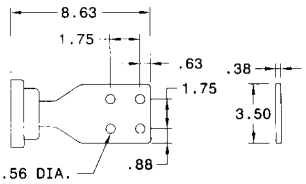


FIG. #1
BUSHING No.
48-111-0014-46

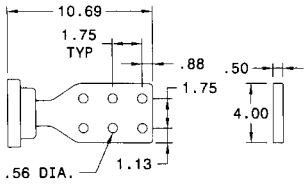


FIG. #6
BUSHING No.
48-111-0003-27

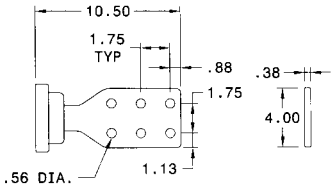


FIG. #7
BUSHING No.
48-111-0003-26

KVA	208Y/120	240	480Y/277	480
112	FIG. 3-5	FIG. 1-5	FIG. 3-5	FIG. 1-5*
150	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
225	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
300	FIG. 3-5	FIG. 1-5	FIG. 3-5*	FIG. 1-5*
500	FIG. 3-7	FIG. 1-7	FIG. 3-5*	FIG. 1-5*
750	FIG. 2-6	FIG. 4-7	FIG. 2-5	FIG. 4-5
1000	FIG. 2-6	FIG. 4-6	FIG. 2-7	FIG. 4-7
1500	– –	– –	FIG. 3-7	FIG. 4-7
2000	– –	– –	FIG. 3-6	FIG. 4-6
2500	– –	– –	FIG. 3-6	FIG. 4-6

STANDARD TESTS

Resistance
No load losses
Load losses
Impedence
Exciting current
Polarity
Phase rotation
Applied potential
Induced potential
Impulse test

OPTIONAL TESTS

Temperature Test
Sound level test
Corona level test
Sudden pressure relay

OPTIONAL FEATURES

55/65° C rise
Pressure relief device
High fire point fluid
Forced air cooling

REQUIRED ORDERING INFORMATION

CUSTOMER:				P.O. NO.:			AGENT				
QUAN.	KVA RATING	COOLING	TEMP. RISE	PHASE	FREQ.	INSULATING LIQUID	%IMP.	SOUND LEVEL		BIL	DESTINATION
PRIMARY:			TAPS:			SECONDARY:			PAINT:		
APPROVAL DWGS.	RECORD DWGS.		CERTIFIED TEST REPORTS			FACTORY INSP. REQD.			REQD. DELIVERY:		

SPECIAL FEATURES OR CONDITIONS:

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ALSTOM USA INC.
Transformers
300 West Antelope Road, Medford, Oregon U.S.A 97503-1089
Tel.: (541) 826-2113 • Fax: (541) 826-8847

Distribution transformers

Station type

75 to 5000 kVA

ALSTOM

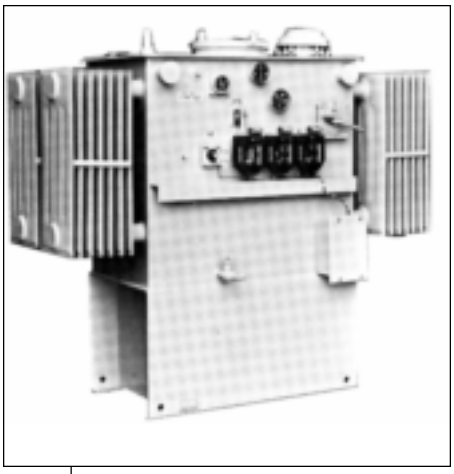
Standard Tests

Each unit is subjected to the following tests:

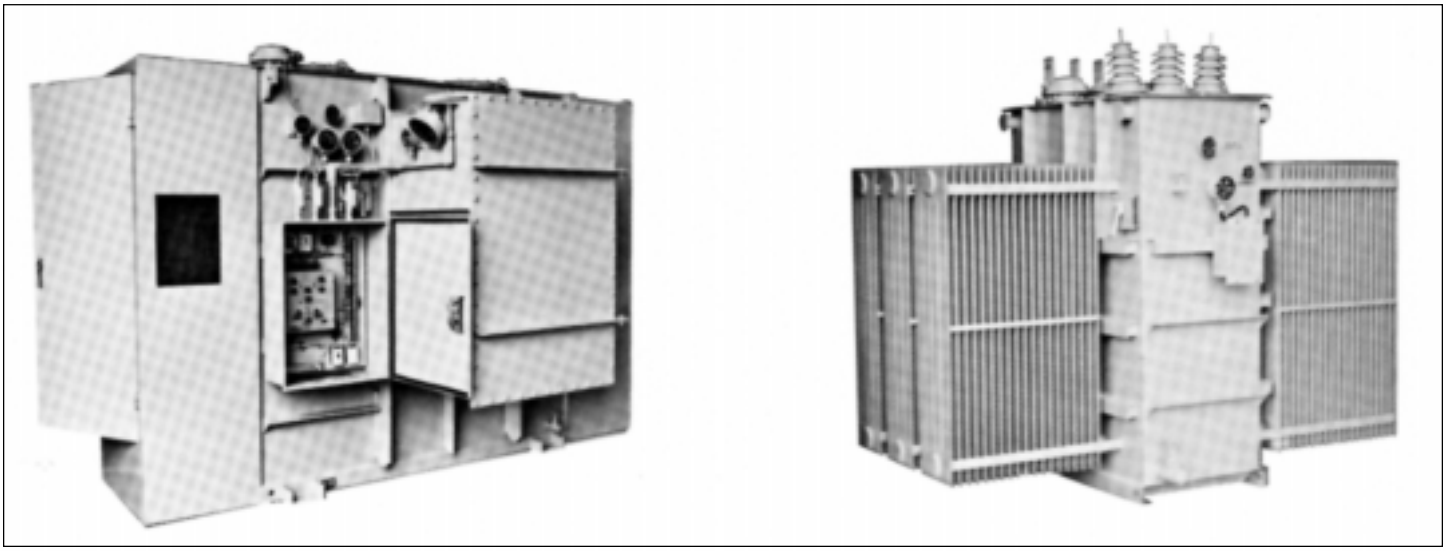
- Resistance
- Ratio
- Polarity
- Phase relation
- Core loss
- Exciting current
- Impedance
- Load loss
- Applied potential test
- Induced potential test
- Quality control impulse test
- Pressure leak test

Optional Features

- Five-legged core wye-wye connections
- 55/65° C temperature rise
- High fire point liquid
- Pressure relief device
- Winding temperature indicator
- Gauges and relief devices with alarm contacts
- Delta-wye switch
- Sudden pressure relay
- Primary or secondary throats
- Primary or secondary terminal chambers
- Station class or intermediate class lightning arrestors
- Current transformers
- Provision for forced air cooling
- Forced air cooling minus fans
- Forced air cooling



These photographs show typical configurations



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Application

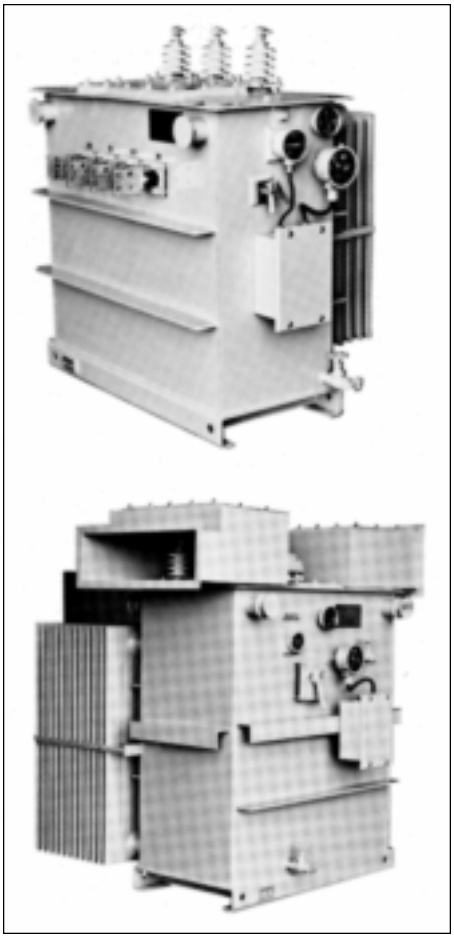
ALSTOM's distribution substation transformers are designed for use in distribution applications and are designed for ease of installation and first cost savings.
All ratings are designed in accordance with applicable ANSI, NEMA and IEEE standards.

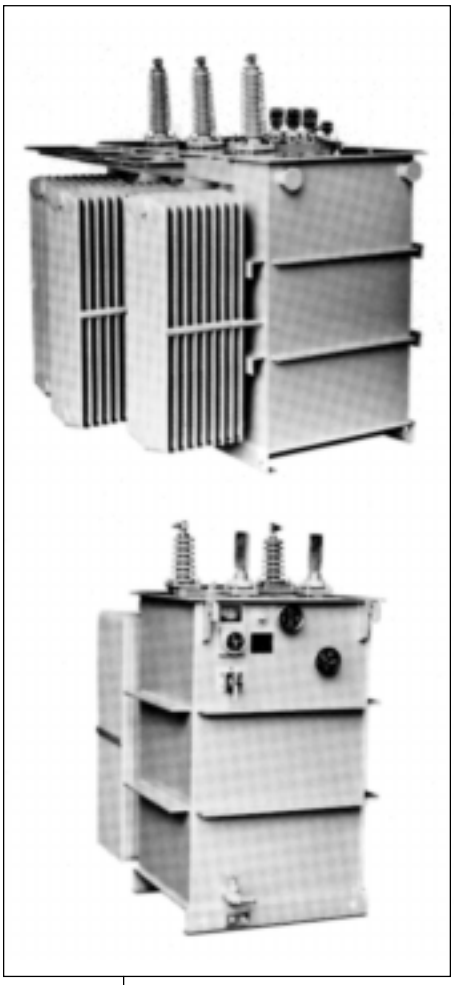
Standard Features

- Magnetic liquid gauge
- Pressure vacuum gauge
- Dial type thermometer with maximum indicating hand
- One inch drain plug - supplied with drain valve and sampling device 750 kVA and above.
- Pressure test and upper filter press connection - 1" pipe plug
- De-energized tap changer if required
- NEMA two hole ground pad
- Corrosion resistant nameplate
- Provisions for jacking and lifting
- Base suitable for rolling or skidding
- Welded cover with handhole
- Oil preservation - sealed tank
- High voltage cover mounted bushings
- Low voltage bushings
- Rugged steel plate tank reinforced with steel channel selections for strength and rigidity

Ratings

- kVA ratings - 75 kVA through 5000 kVA
- Primary voltage - all voltages through 34.5 kV - 200 BIL
- Secondary Voltage - all voltages through 5 kV
- Frequency - 60Hz or 50 Hz
- Temperature rise 65° C
- Consult factory for ratings not shown





These photographs show typical configurations

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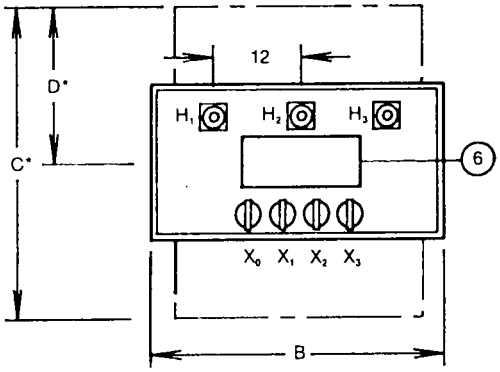
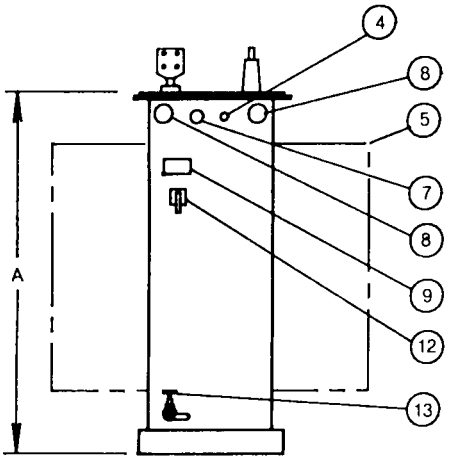
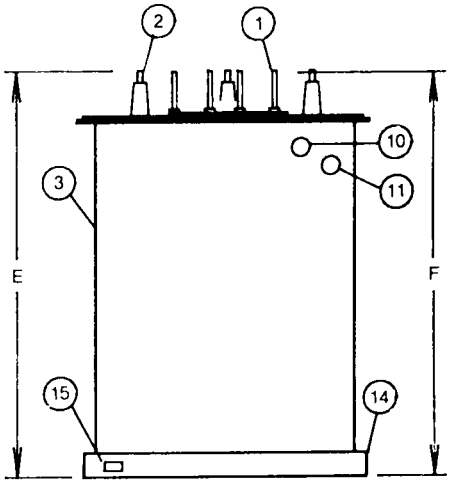
Three Phase Distribution Substation Transformers

STANDARD FEATURES

1. L.V. bushings–spade
2. H.V. bushings–eyebolt
3. Tank with welded-on cover
4. 1” fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Lifting lugs
9. Corrosion resistant nameplate and connection diagram
10. Liquid level gauge
11. Dial-type thermometer
12. De-energized tapchanger
13. 1” drain plug–supplied with drain valve and sampling device 750 KVA and above
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad







NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION**

	BASE DIMS.				65° RISE				GAL.	TOTAL	55/65° RISE						GAL.	TOTAL
KVA	WD	LG	A	B	C	D	E	F	LIQUID	WEIGHT	A	B	C	D	E	F	OIL	WEIGHT OIL
112.5	22	42	42	49½	33	21	52	49	86	2000	42	49½	38	26	52	49	89	2100
150	22	44	42	51½	35	23	52	49	89	2100	42	51½	35	23	52	49	92	2200
225	24	46	42	53½	41	28	52	49	105	2710	42	53½	45	31	52	49	106	2750
300	24	46	42	53½	45	31	52	49	103	3000	42	53½	45	31	52	49	109	3100
500	24	52	52	59½	45	31	62	59	161	3800	52	59½	45	31	62	59	168	3970
750	29	53	52	60½	50	34	62	59	201	5950	52	60½	73	34	62	59	210	6170
1000	29	56	58	63½	55	40	68	67	253	6950	58	63½	78	39	68	67	264	7200
1500	29	59	70	66½	55	40	81	79	320	8800	70	66½	78	39	81	79	350	9550
2000	32	59	70	66½	76	41	81	79	375	10250	72	66½	100	50	83	81	407	10650
2500	32	59	70	66½	82	41	81	79	355	13730	72	66½	108	54	83	82	379	14250

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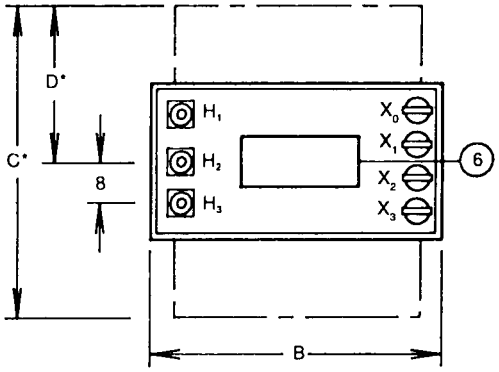
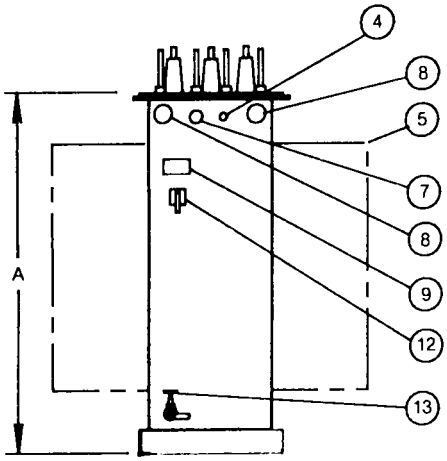
ALSTOM

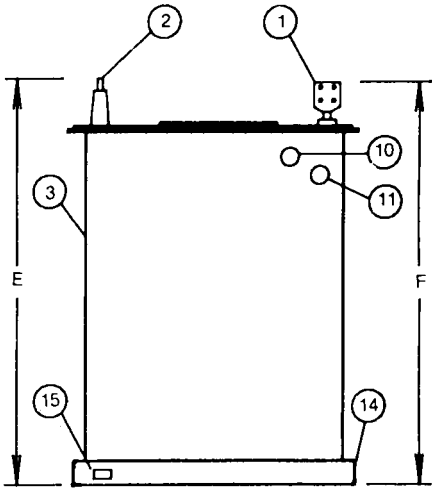
Three Phase Distribution Substation Transformers

STANDARD FEATURES

1. L.V. bushings–spade
2. H.V. bushings–eyebolt
3. Tank with welded-on cover
4. 1” fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Lifting lugs
9. Corrosion resistant nameplate and connection diagram
10. Liquid level gauge
11. Dial-type thermometer
12. De-energized tapchanger
13. 1” drain plug–supplied with drain valve and sampling device 750 KVA and above
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad







NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION**

	BASE DIMS.				65° RISE				GAL.	TOTAL	55/65° RISE						GAL.	TOTAL
KVA	WD	LG	A	B	C	D	E	F	LIQUID	WEIGHT	A	B	C	D	E	F	OIL	WEIGHT OIL
112.5	22	42	42	49½	33	21	52	49	86	2000	42	49½	38	26	52	49	89	2100
150	22	44	42	51½	35	23	52	49	89	2100	42	51½	35	23	52	49	92	2200
225	24	46	42	53½	41	28	52	49	105	2710	42	53½	45	31	52	49	106	2750
300	24	46	42	53½	45	31	52	49	103	3000	42	53½	45	31	52	49	109	3100
500	24	52	52	59½	45	31	62	59	161	3800	52	59½	45	31	62	59	168	3970
750	29	53	52	60½	50	34	62	59	201	5950	52	60½	73	34	62	59	210	6170
1000	29	56	58	63½	55	40	68	67	253	6950	58	63½	78	39	68	67	264	7200
1500	29	59	70	66½	55	40	81	79	320	8800	70	66½	78	39	81	79	350	9550
2000	32	59	70	66½	76	41	81	79	375	10250	72	66½	100	50	83	81	407	10650
2500	32	59	70	66½	82	41	81	79	355	13730	72	66½	108	54	83	82	379	14250

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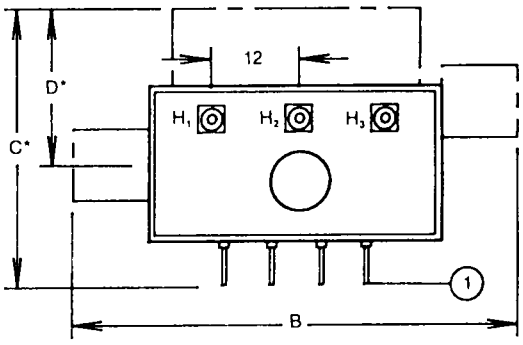
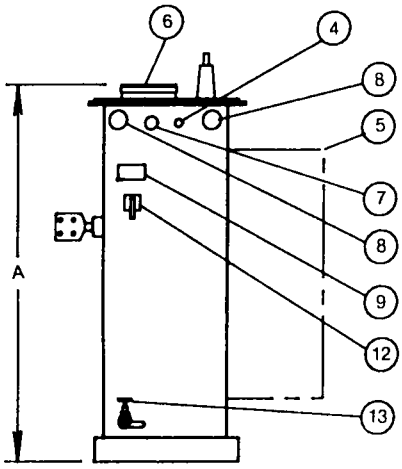
ALSTOM

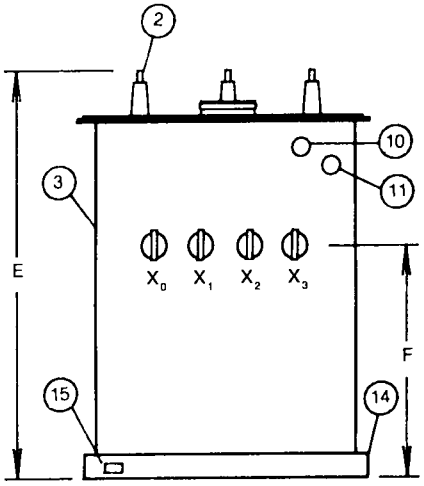
Three Phase Distribution Substation Transformers

STANDARD FEATURES

1. L.V. bushings–spade
2. H.V. bushings–eyebolt
3. Tank with welded-on cover
4. 1” fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Lifting lugs
9. Corrosion resistant nameplate and connection diagram
10. Liquid level gauge
11. Dial-type thermometer
12. De-energized tapchanger
13. 1” drain plug–supplied with drain valve and sampling device 750 KVA and above
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad







NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION**

	BASE DIMS.				65° RISE				GAL.	TOTAL	55/65° RISE						GAL.	TOTAL
KVA	WD	LG	A	B	C	D	E	F	LIQUID	WEIGHT	A	B	C	D	E	F	OIL	WEIGHT OIL
112.5	22	42	45	49½	40	21	52	29	86	2000	45	49½	45	26	52	29	89	2100
150	22	44	45	51½	42	23	52	29	89	2100	45	51½	42	23	52	29	92	2200
225	24	46	45	53½	47	28	52	29	105	2710	45	53½	51	31	52	29	106	2750
300	24	46	45	53½	51	31	52	29	103	3000	45	53½	51	31	52	29	109	3100
500	24	52	55	59½	51	31	62	39	161	3800	55	59½	51	31	62	39	168	3970
750	29	53	55	60½	55	34	62	39	201	5950	61	60½	61	39	62	45	249	6170
1000	29	56	61	63½	63	40	68	45	253	6950	61	63½	78	39	68	55	264	7200
1500	29	59	73	66½	63	40	81	55	320	8800	75	66½	76	52	83	55	358	9550
2000	32	61	75	70½	75	41	83	55	420	11000	75	70½	83	58	83	55	442	10650
2500	32	61	75	70½	79	41	83	55	398	12100	75	70½	92	66	83	55	432	14250

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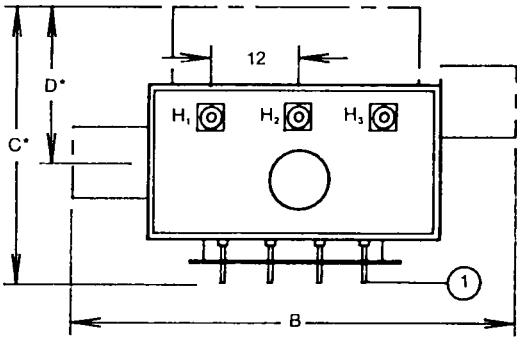
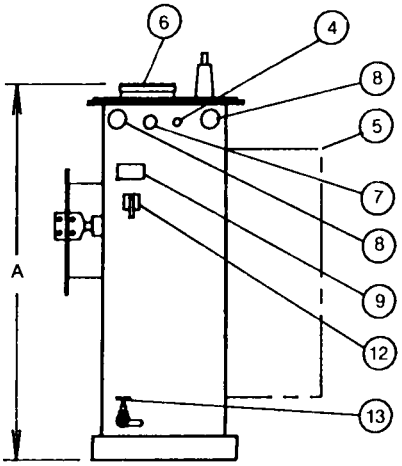
ALSTOM

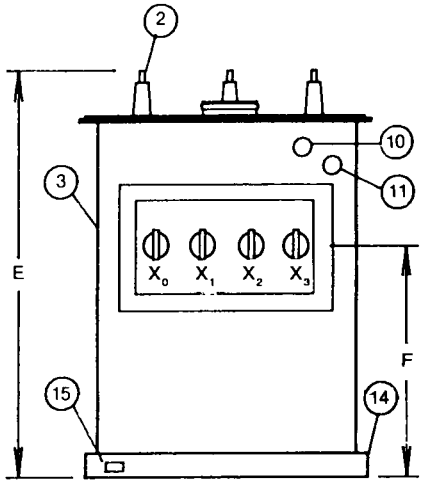
Three Phase Distribution Substation Transformers

STANDARD FEATURES

1. L.V. bushings–spade
2. H.V. bushings–eyebolt
3. Tank with welded-on cover
4. 1” fill plug and filter press connection
5. Cooling panels
6. Handhole
7. Pressure vacuum gauge
8. Lifting lugs
9. Corrosion resistant nameplate and connection diagram
10. Liquid level gauge
11. Dial-type thermometer
12. De-energized tapchanger
13. 1” drain plug–supplied with drain valve and sampling device 750 KVA and above
14. Base suitable for jacking, skidding, or rolling
15. NEMA ground pad







NOTE: ALL DIMENSIONS ARE FOR 95 KV BIL TRANSFORMERS.
*** DIMENSIONS ARE APPROXIMATE — NOT TO BE USED FOR CONSTRUCTION**

	BASE DIMS.				65° RISE				GAL.	TOTAL	55/65° RISE						GAL.	TOTAL
KVA	WD	LG	A	B	C	D	E	F	LIQUID	WEIGHT	A	B	C	D	E	F	OIL	WEIGHT OIL
112.5	22	42	45	49½	40	21	52	29	86	2000	45	49½	45	26	52	29	89	2100
150	22	44	45	51½	42	23	52	29	89	2100	45	51½	42	23	52	29	92	2200
225	24	46	45	53½	47	28	52	29	105	2710	45	53½	51	31	52	29	106	2750
300	24	46	45	53½	51	31	52	29	103	3000	45	53½	51	31	52	29	109	3100
500	24	52	55	59½	51	31	62	39	161	3800	55	59½	51	31	62	39	168	3970
750	29	53	55	60½	55	34	62	39	201	5950	61	60½	61	39	62	45	249	6170
1000	29	56	61	63½	63	40	68	45	253	6950	61	63½	78	39	68	55	264	7200
1500	29	59	73	66½	63	40	81	55	320	8800	75	66½	76	52	83	55	358	9550
2000	32	61	75	70½	75	41	83	55	420	11000	75	70½	83	58	83	55	442	10650
2500	32	61	75	70½	79	41	83	55	398	12100	75	70½	92	66	83	55	432	14250

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ALSTOM

Application

ALSTOM USA INC. distribution substation is specifically designed for use by industrial customers and for servicing commercial buildings. The design features ease of installation and first cost savings.

All ratings are designed in accordance with NEMA Standard TR-11.

Tank Construction

A rugged steel tank made from high quality steel plate and reinforced with external bracing to provide extra strength and rigidity during shipping and operation is furnished on all distribution transformers.

The latest welding techniques and equipment combined with special black light testing of welds reduces the possibility of oil leaks.

Insulation

Only the highest quality 100% Kraft paper is used throughout the coil. It is thermally upgraded for increased overload capability. Units rated at 55° C use the same insulation and assure a 12% increase in KVA when operated at 65° C.

The quantity and location of insulation is computer designed and carefully assembled to assure the highest possible dielectric strength.

Core

The ALSTOM USA INC. core is a Distributed Gap Type design which utilizes the highest quality electrical silicon steel. It is cut to assure maximum utilization of its properties of grain orientation. It is braced and secured to prevent shifting during shipment or normal operation

A five legged core is used to provide a path for third harmonic flux during unbalanced conditions. This type of core construction benefits the user by providing lower losses, exciting current and overall operating costs.

Coil Construction

ALSTOM USA INC. has been a leader in the use of aluminum in both the primary and secondary of its transformers. Our experience has led to a regular wound coil which features an aluminum sheet wound secondary winding and a layer-wound primary winding using aluminum rectangular or round conductor.

The advantages of a sheet-wound secondary combined with uniform winding tension is evidenced in the short circuit strength of the transformer. The low voltage sheet-winding allows the electrical centers of the high voltage and low voltage windings to be easily aligned, thus virtually eliminating the vertical component of short circuit.

Uniform winding tensions and the resulting tight, compact coil, minimizes the possibility of coil telescoping should the vertical component of short circuit be present.

Core Clamp

The core clamp is made from heavy gauge steel that is assembled to the core and coil while under pressure.

Processing

The prime areas of processing are moisture and air removal. At ALSTOM USA INC. the core and coil assembly is thoroughly dried in drying oven and tested for power factor to insure complete moisture removal. The entire assembly is retightened while hot to correct for shrinkage. The unit is immediately tanked then put into a specially designed vacuum chamber where near vacuum is applied until all the trapped air is removed. The unit is then filled with de-gassed oil. The next step is to subject the transformer to standard tests which will confirm dielectric integrity. The final stage of processing is the pressure leak test which consists of applying 7 PSI of dry nitrogen to the final unit to assure a sealed tank. We now have a quality transformer made from quality components.

STANDARD TESTS

Resistance	Polarity
No load losses	Phase rotation
Load losses	Applied potential
Impedence	Induced potential
Exciting current	Impulse test

OPTIONAL TESTS

Temperature Test
Sound level test
Corona level test

OPTIONAL FEATURES

55/66° C rise
Pressure reliev device
High fire point fluid
Forced air cooling
Dial thermometer (with contacts)
Liquid level gauge (with contacts)
Sudden pressure relay

REQUIRED ORDERING INFORMATION

CUSTOMER:	P.O. NO.:	AGENT

QUAN.	KVA RATING	COOLING	TEMP. RISE	PHASE	FREQ.	INSULATING LIQUID	%IMP.	SOUND LEVEL	BIL	DESTINATION

PRIMARY:	TAPS:	SECONDARY:	PAINT:

APPROVAL DWGS.	RECORD DWGS.	CERTIFIED TEST REPORTS	FACTORY INSP. REQD.	REQD. DELIVERY:

SPECIAL FEATURES OR CONDITIONS:

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ALSTOM USA INC.
Transformers
300 West Antelope Road, Medford, Oregon U.S.A 97503-1089
Tel.: (541) 826-2113 • Fax: (541) 826-8847

Material Safety Data Sheets

ALSTOM

MATERIAL SAFETY DATA SHEET
EQUILON MSDS: 1101E-09 01/04/99

DIALA(R) OIL A
TELEPHONE NUMBER:
24 HOUR EMERGENCY ASSISTANCE
EQUIVA SERVICES: 877-276-7283
CHEMTREC: 800-424-9300
GENERAL MSDS ASSISTANCE
877-276-7285

NAME AND ADDRESS
EQUILON ENTERPRISES LLC
PRODUCT STEWARDSHIP
P.O. BOX 674414
HOUSTON, TX 77267-4414

SECTION I NAME

PRODUCT: DIALA(R) OIL A
CHEM NAME: MIXTURE (SEE SECTION II-A)
CHEM FAMILY: PETROLEUM HYDROCARBON; INDUSTRIAL DIELECTRIC OIL
REACTIVITY: 0
SHELL CODE: 68701 69701 68744
HEALTH HAZARD: 1 FIRE HAZARD: 1 REACTIVITY:

SECTION II-A PRODUCT/INGREDIENT

NO.	COMPOSITION	CAS NO.	PERCENT
P	DIALA OIL A		
1	SEVERELY HYDROTREATED MIDDLE DISTILLATE	64742-46-7	50-100
2	HYDROTREATED LIGHT NAPHTHENIC DISTILLATE	64742-53-6	0-50

NOTE: DIALA OIL CONTAINS NO DETECTABLE LEVELS (<1 PPM) OF PCB AS MEASURED BY ASTM D4059.
NFPA HAZARD RATING: HEALTH 0 FIRE 1 REACTIVITY 0

SECTION II-B ACUTE TOXICITY DATA

NO.	ACUTE ORAL LD50	ACUTE DERMAL LD50	ACUTE INHALATION LC50
P	NOT AVAILABLE		
2	>5.0 G/KG, RAT*	>2 G/KG, RABBIT*	NOT AVAILABLE

* BASED ON API STUDIES

SECTION III HEALTH INFORMATION

THE HEALTH EFFECTS NOTED BELOW ARE CONSISTENT WITH REQUIREMENTS UNDER THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200).

EYE CONTACT: BASED ON ESSENTIALLY SIMILAR PRODUCT TESTING PRODUCT IS PRESUMED TO BE NONIRRITATING TO THE EYES.

SKIN CONTACT: BASED ON ESSENTIALLY SIMILAR PRODUCT TESTING PRODUCT IS PRESUMED TO BE SLIGHTLY IRRITATING TO THE SKIN. PROLONGED AND REPEATED CONTACT MAY RESULT IN VARIOUS SKIN DISORDERS SUCH AS DERMATITIS, FOLLICULITIS OR OIL ACNE. RELEASE DURING HIGH PRESSURE USAGE MAY RESULT IN INJECTION OF OIL INTO THE SKIN CAUSING LOCAL NECROSIS.

INHALATION: INHALATION OF VAPORS (GENERATED AT HIGH TEMPERATURES ONLY) OR OIL MIST MAY CAUSE A MILD IRRITATION OF THE UPPER RESPIRATORY TRACT.

INGESTION: INGESTION OF PRODUCT MAY RESULT IN VOMITING; ASPIRATION (BREATHING OF VOMITUS INTO THE LUNGS) MUST BE AVOIDED AS EVEN SMALL QUANTITIES MAY RESULT IN ASPIRATION PNEUMONITIS.

SIGNS AND SYMPTOMS: IRRITATION AS NOTED ABOVE. ASPIRATION PNEUMONITIS MAY BE EVIDENCED BY COUGHING; LABORED BREATHING AND CYANOSIS (BLUISH SKIN); IN SEVERE CASES DEATH MAY OCCUR. LOCAL NECROSIS IS EVIDENCED BY DELAYED ONSET OF PAIN AND TISSUE DAMAGE A FEW HOURS FOLLOWING INJECTION.

AGGRAVATED MEDICAL CONDITIONS:

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PREEXISTING SKIN AND RESPIRATORY DISORDERS MAY BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT.

OTHER HEALTH EFFECTS:

THIS PRODUCT AND ITS COMPONENTS ARE NOT CLASSIFIED AS CARCINOGENS BY INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC), NATIONAL TOXICOLOGY PROGRAM (NTP) OR OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).

SECTION IV — OCCUPATIONAL EXPOSURE LIMITS

COMP NO.	OSHA PEL/TWA	PEL/CEILING	ACGIH TLV/TWA	TLV/STEL	OTHER
P	*5 MG/M3	NONE	*5 MG/M3	*10 MG/M3	

* OIL MIST, MINERAL

SECTION V — EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: FLUSH EYES WITH WATER. IF IRRITATION OCCURS, GET MEDICAL ATTENTION.

SKIN CONTACT: REMOVE CONTAMINATED CLOTHING/SHOES AND WIPE EXCESS FROM SKIN. FLUSH SKIN WITH WATER. FOLLOW BY WASHING WITH SOAP AND WATER. IF IRRITATION OCCURS, GET MEDICAL ATTENTION. IF MATERIAL IS INJECTED UNDER THE SKIN, GET MEDICAL ATTENTION PROMPTLY TO PREVENT SERIOUS INJURY.

INHALATION: REMOVE VICTIM TO FRESH AIR AND PROVIDE OXYGEN IF BREATHING IS DIFFICULT. GET MEDICAL ATTENTION.

INGESTION: DO NOT INDUCE VOMITING. IF VOMITING OCCURS SPONTANEOUSLY, KEEP HEAD BELOW HIPS TO PREVENT ASPIRATION OF LIQUID INTO THE LUNGS. GET MEDICAL ATTENTION.

NOTE TO PHYSICIAN: IF MORE THAN 2.0 ML PER KG HAS BEEN INGESTED AND VOMITING HAS NOT OCCURRED, EMESIS SHOULD BE INDUCED WITH SUPERVISION. KEEP VICTIM'S HEAD BELOW HIPS TO PREVENT ASPIRATION. IF SYMPTOMS SUCH AS LOSS OF GAG REFLEX, CONVULSIONS OR UNCONCIOUSNESS OCCUR BEFORE EMESIS, GASTRIC LAVAGE USING A CUFFED ENDOTRACHEAL TUBE SHOULD BE CONSIDERED.

SECTION VI — SUPPLEMENTAL HEALTH INFORMATION

AMOCO HAS REPORTED TO THE U.S. EPA PURSUANT TO SECTION 8(E) OF TSCA THAT A SAMPLE OF HYDROTREATED MIDDLE DISTILLATE (CAS REGISTRY NUMBER 64742-46-7) APPLIED REPEATEDLY TO THE SKIN OF EXPERIMENTAL ANIMALS OVER THEIR LIFETIME PRODUCED A WEAK TUMORIGENIC RESPONSE IN THE SKIN. THE FULL REFINING/PROCESS HISTORY OF THIS SAMPLE WAS NOT PROVIDED IN AMOCO'S SUBMISSION.

SECTION VII — PHYSICAL DATA

BOILING POINT (DEG F):	SPECFIC GRAVITY (H2O = 1):	VAPOR PRESSURE (MM HG):
>400	0.8833	<0.1
MELTING POINT (DEG F):	**SOLUBILITY IN WATER:**	**VAPOR DENSITY (AIR = 1):**
-40 (POUR POINT)	NEGLIGIBLE	NOT AVAILABLE
		VISCOSITY: 12 (CST @ 104 DEG F)

EVAPORATION RATE (NORMAL BUTYL ACETATE = 1):NOT AVAILABLE

APPEARANCE AND ODOR:WHITE LIQUID. SLIGHT HYDROCARBON ODOR.

DIELECTRIC STRENGTH: 30 KV (MIN)

SECTION VIII — FIRE AND EXPLOSION HAZARDS

FLASH POINT AND METHOD: 295 DEG F. (COC)

FLAMMABLE LIMITS/PERCENT VOLUME IN AIR: LOWER: N. A. HIGHER: N. A.

EXTINGUISHING MEDIA:

USE WATER FOG, FOAM, DRY CHEMICAL OR CO2. DO NOT USE A DIRECT STREAM OF WATER. PRODUCT WILL FLOAT AND CAN BE REIGNITED ON SURFACE OF WATER.

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SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS:
MATERIAL WILL NOT BURN UNLESS PREHEATED. DO NOT ENTER CONFINED FIRE-SPACE WITHOUT FULL BUNKER GEAR (HELMET WITH FACE SHIELD, BUNKER COATS, GLOVES AND RUBBER BOOTS), INCLUDING A POSITIVE-PRESSURE NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS. COOL FIRE EXPOSED CONTAINERS WITH WATER.
UNUSUAL FIRE AND EXPLOSION HAZARDS:
NONE IDENTIFIED

SECTION IX REACTIVITY

STABLITY: STABLE HAZARDOUS POLYMERIZATION WILL NOT OCCUR
CONDITIONS AND MATERIALS TO AVOID:
AVOID HEAT, OPEN FLAMES AND OXIDIZING MATERIALS.
HAZARDOUS DECOMPOSITION PRODUCTS:
THERMAL DECOMPOSITION PRODUCTS ARE HIGHLY DEPENDENT ON THE COMBUSTION CONDITIONS. A COMPLEX MIXTURE OF AIRBORNE SOLID, LIQUID, PARTICULATES AND GASES WILL EVOLVE WHEN THIS MATERIAL UNDERGOES PYROLYSIS OR COMBUSTION. CARBON MONOXIDE AND OTHER UNIDENTIFIED ORGANIC COMPOUNDS MAY BE FOUND UPON COMBUSTION.

SECTION X EMPLOYEE PROTECTION

RESPIRATORY PROTECTION:
IF EXPOSURE MAY OR DOES EXCEED OCCUPATIONAL EXPOSURE LIMITS (SECTION IV) USE A NIOSH-APPROVED RESPIRATOR TO PREVENT OVEREXPOSURE. IN ACCORD WITH 29 CFR 1910.134 USE EITHER AN ATMOSPHERE-SUPPLYING RESPIRATOR OR AN AIR-PURIFYING RESPIRATOR FOR ORGANIC VAPORS AND PARTICULATES.
PROTECTIVE CLOTHING
WEAR CHEMICAL RESISTANT GLOVES AND OTHER PROTECTIVE CLOTHING AS REQUIRED TO MINIMIZE SKIN CONTACT. NO SPECIAL EYE PROTECTION IS ROUTINELY NECESSARY. TEST DATA FROM PUBLISHED LITERATURE AND/OR GLOVE AND CLOTHING MANUFACTURERS INDICATE THE BEST PROTECTION IS PROVIDED BY NITRITE GLOVES.
ADDITIONAL PROTECTIVE MEASURES:
NONE IDENTIFIED

SECTION XI ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES:
MAY BURN ALTHOUGH NOT READILY IGNITABLE. USE CAUTIOUS JUDGMENT WHEN CLEANING UP LARGE SPILLS. *** LARGE SPILLS *** WEAR RESPIRATOR AND PROTECTIVE CLOTHING AS APPROPRIATE. SHUT OFF SOURCE OF LEAK IF SAFE TO DO SO. DIKE AND CONTAIN. REMOVE WITH VACCUM TRUCKS OR PUMP TO STORAGE SALVAGE VESSELS. SOAK UP RESIDUE WITH AN ABSORBENT SUCH AS CLAY, SAND, OR OTHER SUITABLE MATERIALS; DISPOSE OF PROPERLY. FLUSH AREA WITH WATER TO REMOVE TRACE RESIDUE. *** SMALL SPILLS *** TAKE UP WITH AN ABSORBENT MATERIAL AND DISPOSE OF PROPERLY.

SECTION XII SPECIAL PRECAUTIONS

MINIMIZE SKIN CONTACT. WASH WITH SOAP AND WATER BEFORE EATING, DRINKING, SMOKING OR USING TOILET FACILITIES. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. PROPERLY DISPOSE OF CONTAMINATED LEATHER ARTICLES, INCLUDING SHOES, THAT CANNOT BE DECONTAMINATED.STORE IN A COOL, DRY PLACE WITH ADEQUATE VENTILATION. KEEP AWAY FROM OPEN FLAMES AND HIGH TEMPERATURES.

SECTION XIII TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION:
NOT HAZARDOUS BY D.O.T. REGULATIONS
OTHER REQUIREMENTS: NOT APPLICABLE
FOR BARGE SHIPMENTS; USE CARGO INFORMATION CARD SCM 68701, DIALA OIL.

SECTION XIV OTHER REGULATORY CONTROLS

THE COMPONENTS OF THIS PRODUCT ARE LISTED ON THE EPA/TSCA INVENTORY OF CHEMICAL

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SUBSTANCES.
PROTECTION OF STRATOSPHERIC OZONE (PURSUANT TO SECTION 611 OF THE CLEAN AIR ACT AMENDMENTS OF 1990): PER 40 CFR PART 82, THIS PRODUCT DOES NOT CONTAIN NOR WAS IT DIRECTLY MANUFACTURED WITH ANY CLASS I OR CLASS II OZONE DEPLETING SUBSTANCES.
IN ACCORDANCE WITH SARA TITLE III, SECTION 313, THE ATTACHED ENVIRONMENTAL DATA SHEET (EDS) SHOULD ALWAYS BE COPIED AND SENT WITH THE MSDS.

SECTION XV STATE REGULATORY INFORMATION

THE FOLLOWING CHEMICALS ARE SPECIFICALLY LISTED BY INDIVIDUAL STATES; OTHER PRODUCT SPECIFIC HEALTH AND SAFETY DATA IN OTHER SECTIONS OF THE MSDS MAY ALSO BE APPLICABLE FOR STATE REQUIREMENTS. FOR DETAILS ON YOUR REGULATORY REQUIREMENTS YOU SHOULD CONTACT THE APPROPRIATE AGENCY IN YOUR STATE.

STATE LISTED COMPONENT	CAS NO	PERCENT	STATE CODE
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE	64742-53-6	0-50	MA

CA = CALIFORNIA HAZ. SUBST. LIST; CA65C, CA65R, CA65C/R = CALIFORNIA SAFE DRINKING WATER AND TOXICS ENFORCEMENT ACT OF 1986 OR PROPOSITION 65 LIST; CT = CONNECTICUT TOXIC. SUBST. LIST; FL = FLORIDA SUBST. LIST; IL = ILLINOIS TOX. SUBST. LIST; LA = LOUISIANA HAZ. SUBST. LIST; MA = MASSACHUSETTS SUBST. LIST; ME = MAINE HAZ. SUBST. LIST; MN = MINNESOTA HAZ. SUBST. LIST; NJ = NEW JERSEY HAZ. SUBST. LIST; PA = PENNSYLVANIA HAZ. SUBST. LIST; RI = RHODE ISLAND HAZ. SUBST. LIST.
VOLATILE ORGANIC COMPOUNDS (VOC): THIS PRODUCT IS EXEMPT FROM VOC REPORTING UNDER THE CALIFORNIA CLEAN AIR ACT. SECTION 94510 EXEMPTS ORGANIC COMPOUNDS THAT EITHER HAVE A VAPOR PRESSURE OF <0.1 MM HG @ 20 DEG C OR HAVE MORE THAN 12 CARBON ATOMS.

SECTION XVI SPECIAL NOTES

MSDS REVISED IN SECTION II-A TO ADD PCB INFORMATION, SECTION VI, AND SECTION XV TO ADD VOC INFORMATION.

THE INFORMATION CONTAINED IN THIS DATA SHEET IS BASED ON THE DATA AVAILABLE TO US AT THIS TIME, AND IS BELIEVED TO BE ACCURATE BASED UPON THAT DATA. IT IS PROVIDED INDEPENDENTLY OF ANY SALE OF THE PRODUCT, FOR PURPOSE OF HAZARD COMMUNICATION. IT IS NOT INTENDED TO CONSTITUTE PRODUCT PERFORMANCE INFORMATION, AND NO EXPRESS OR IMPLIED WARRANTY OF ANY KIND IS MADE WITH RESPECT TO THE PRODUCT, UNDERLYING DATA OR THE INFORMATION CONTAINED HEREIN. YOU ARE URGED TO OBTAIN DATA SHEETS FOR ALL PRODUCTS YOU BUY, PROCESS, USE OR DISTRIBUTE, AND ARE ENCOURAGED TO ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

TO DETERMINE THE APPLICABILITY OR EFFECT OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, YOU SHOULD CONSULT WITH YOUR LEGAL ADVISOR OR THE APPROPRIATE GOVERNMENT AGENCY. WE WILL NOT PROVIDE ADVICE ON SUCH MATTERS, OR BE RESPONSIBLE FOR ANY INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN. THE UNDERLYING DATA, AND THE INFORMATION PROVIDED HEREIN AS A RESULT OF THAT DATA, IS THE PROPERTY OF EQUIVA SERVICES, LLC AND IS NOT TO BE THE SUBJECT OF SALE OR EXCHANGE WITHOUT THE EXPRESS WRITTEN CONSENT OF EQUIVA SERVICES, LLC.

ENVIRONMENTAL DATA SHEET
EQUILON EDS: 1101E

DIALA(R) OIL A
TELEPHONE NUMBER:
24 HOUR EMERGENCY ASSISTANCE
EQUIVA SERVICES: 877-276-7283
CHEMTREC: 800-424-9300
GENERAL MSDS ASSISTANCE
877-276-7285

NAME AND ADDRESS
EQUILON ENTERPRISES
PRODUCT STEWARDSHIP

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P.O. BOX 674414
HOUSTON, TX 77267-4414
PRODUCT CODE: 69701

SECTION I PRODUCT COMPOSITION

NO.	COMPOSITION	CAS	PERCENT
P	DIALA OIL A	MIXTURE	100
1	SEVERLY HYDROTREATED MIDDLE DISTILLATE	64742-46-7	50-100
2	HYDROTREATED LIGHT NAPHTHENIC DISTILLATE	64742-53-6	0-50

SECTION II SARA TITLE III INFORMATION

NO.	EHS RQ (*1)	EHS TPQ (*2)	SEC-313 (*3)	313 CATEGORY (*4)	311/312 CATEGORY (*5)

BASED ON THE DATA AVAILABLE THIS PRODUCT IS NOT REGULATED BY SARA, TITLE III.

*1 = REPORTABLE QUANTITY OF EXTREMELY HAZARDOUS SUBSTANCE, SEC 302
*2 = THRESHOLD PLANNING QUANTITY, EXTREMELY HAZARDOUS SUBSTANCE, SEC 302
*3 = TOXIC CHEMICAL, SEC 313
*4 = CATEGORY AS REQUIRED BY SEC 313 (40 CFR 372.65 C), MUST BE USED ON TOXIC RELEASE INVENTORY FORM
*5 = CATEGORY (FOR AGGREGATE REPORTING REQUIREMENTS UNDER SARA 311, 312)
HEALTH: H-1 = IMMEDIATE (ACUTE) HEALTH HAZARD
H-2 = DELAYED (CHRONIC) HEALTH HAZARD
PHYSICAL: P-3 = FIRE HAZARD
P-4 = SUDDEN RELEASE OF PRESSURE HAZARD
P-5 = REACTIVE HAZARD

SECTION III ENVIRONMENTAL RELEASE INFORMATION

THIS PRODUCT IS COVERED BY EPA'S COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA) PETROLEUM EXCLUSION. THEREFORE RELEASES TO AIR, LAND, OR WATER ARE NOT REPORTABLE UNDER CERCLA ("SUPERFUND"). HOWEVER UNDER SECTION 311 OF EPA'S CLEAN WATER ACT (CWA), THIS PRODUCT IS CONSIDERED AN OIL. AS SUCH , SPILLS INTO OR LEADING TO SURFACE WATERS THAT CAUSE A SHEEN MUST BE REPORTED TO THE NATIONAL RESPONSE CENTER, 800-424-8802.
THIS PRODUCT IS AN OIL UNDER 49 CFR (DOT) PART 130. IF SHIPPED BY RAIL OR HIGHWAY IN A TANK WITH A CAPACITY OF 3,500 GALLONS OR MORE, IT IS SUBJECT TO THE REQUIREMENTS OF PART 130. MIXTURE SOLUTIONS IN WHICH THIS PRODUCT IS PRESENT AT 10% OR MORE MAY ALSO BE SUBJECT TO THIS RULE.

SECTION IV RCRA INFORMATION

IF THIS PRODUCT BECOMES A WASTE, IT WOULD NOT BE A HAZARDOUS WASTE BY RCRA CRITERIA (40 CFR 261). PLACE IN AN APPROPRIATE DISPOSAL FACILITY IN COMPLIANCE WITH LOCAL REGULATIONS.

THE INFORMATION CONTAINED IN THIS DATA SHEET IS BASED ON THE DATA AVAILABLE TO US AT THIS TIME, AND IS BELIEVED TO BE ACCURATE BASED UPON THAT DATA. IT IS PROVIDED INDEPENDENTLY OF ANY SALE OF THE PRODUCT, FOR PURPOSE OF HAZARD COMMUNICATION. IT IS NOT INTENDED TO CONSTITUTE PRODUCT PERFORMANCE INFORMATION, AND NO EXPRESS OR IMPLIED WARRANTY OF ANY KIND IS MADE WITH RESPECT TO THE PRODUCT, UNDERLYING DATA OR THE INFORMATION CONTAINED HEREIN. YOU ARE URGED TO OBTAIN DATA SHEETS FOR ALL PRODUCTS YOU BUY, PROCESS, USE OR DISTRIBUTE, AND ARE ENCOURAGED TO ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

TO DETERMINE THE APPLICABILITY OR EFFECT OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, YOU SHOULD CONSULT WITH YOUR LEGAL ADVISOR OR THE

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APPROPRIATE GOVERNMENT AGENCY. WE WILL NOT PROVIDE ADVICE ON SUCH MATTERS, OR BE RESPONSIBLE FOR ANY INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN. THE UNDERLYING DATA, AND THE INFORMATION PROVIDED HEREIN AS A RESULT OF THAT DATA, IS THE PROPERTY OF EQUIVA SERVICES, LLC AND IS NOT TO BE THE SUBJECT OF SALE OR EXCHANGE WITHOUT THE EXPRESS WRITTEN CONSENT OF EQUIVA SERVICES, LLC.

KAREN G. HAYNES

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P.O. BOX 674414
HOUSTON, TX 77267-4414

FOR ADDITIONAL INFORMATION ON THIS ENVIRONMENTAL DATA PLEASE CALL
(877) 276-7285
FOR EMERGENCY ASSISTANCE PLEASE CALL
EQUIVA SERVICES LLC: (877) 276-7283
CHEMTREC: (800) 424-9300
}

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MATERIAL SAFETY DATA SHEET
EQUILON MSDS: 60030E-11 01/04/99

DIALA(R) OIL AX
TELEPHONE NUMBER:
24 HOUR EMERGENCY ASSISTANCE
EQUIVA SERVICES: 877-276-7283
CHEMTREC: 800-424-9300

GENERAL MSDS ASSISTANCE
877-276-7285

NAME AND ADDRESS
EQUILON ENTERPRISES LLC
PRODUCT STEWARDSHIP
P.O. BOX 674414
HOUSTON, TX 77267-4414

SECTION I NAME

PRODUCT: DIALA(R) OIL AX
CHEM NAME: MIXTURE (SEE SECTION II-A)
CHEM FAMILY: PETROLEUM HYDROCARBON; INDUSTRIAL DIELECTRIC OIL
SHELL CODE: 68702 68745 69702 69704
HEALTH HAZARD: 1 FIRE HAZARD: 1 REACTIVITY: 0

SECTION II-A PRODUCT/INGREDIENT

NO.	COMPOSITION	CAS NO.	PERCENT
P	DIALA OIL AX		
1	HIGHLY REFINED PETEROLEUM OILS	MIXTURE*	100
2	BUTYLATED HYDROXY TOLUENE	128-37-0	<0.2

NOTE: DIALA OIL CONTAINS NO DETECTABLE LEVELS (<1 PPM) OF PCB AS MEASURED BY ASTM D4059.
*MAY CONTAIN: 64742-46-7, 64742-53-6
NFPA HAZARD RATING: HEALTH 0 FIRE 1 REACTIVITY 0

SECTION II-B ACUTE TOXICITY DATA

NO.	ACUTE ORAL LD50	ACUTE DERMAL LD50	ACUTE INHALATION LC50
2	>5 G/KG, RAT	>2 G/KG, RABBIT	NOT AVAILABLE

SECTION III HEALTH INFORMATION

THE HEALTH EFFECTS NOTED BELOW ARE CONSISTENT WITH REQUIREMENTS UNDER THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200).

EYE CONTACT: BASED ON ESSENTIALLY SIMILAR PRODUCT TESTING PRODUCT IS PRESUMED TO BE NONIRRITATING TO THE EYES.

SKIN CONTACT: BASED ON ESSENTIALLY SIMILAR PRODUCT TESTING PRODUCT IS PRESUMED TO BE SLIGHTLY IRRITATING TO THE SKIN. PROLONGED AND REPEATED CONTACT MAY RESULT IN VARIOUS SKIN DISORDERS SUCH AS DERMATITIS, FOLLICULITIS OR OIL ACNE. RELEASE DURING HIGH PRESSURE USAGE MAY RESULT IN INJECTION OF OIL INTO THE SKIN CAUSING LOCAL NECROSIS.

INHALATION: INHALATION OF VAPORS (GENERATED AT HIGH TEMPERATURES ONLY) OR OIL MIST MAY CAUSE A MILD IRRITATION OF THE MUCOUS MEMBRANES OF THE UPPER RESPIRATORY TRACT.

INGESTION: INGESTION OF PRODUCT MAY RESULT IN VOMITING; ASPIRATION (BREATHING OF VOMITUS INTO THE LUNGS) MUST BE AVOIDED AS EVEN SMALL QUANTITIES MAY RESULT IN ASPIRATION PNEUMONITIS.

SIGNS AND SYMPTOMS: IRRITATION AS NOTED ABOVE. ASPIRATION PNEUMONITIS MAY BE EVIDENCED BY COUGHING, LABORED BREATHING AND CYANOSIS (BLUISH SKIN); IN SEVERE CASES DEATH MAY OCCUR. LOCAL NECROSIS IS EVIDENCED BY DELAYED ONSET OF PAIN AND TISSUE DAMAGE A FEW HOURS FOLLOWING INJECTION.

AGGRAVATED MEDICAL CONDITIONS:

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PREEXISTING SKIN AND RESPIRATORY DISORDERS MAY BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT.

OTHER HEALTH EFFECTS:

THIS PRODUCT AND ITS COMPONENTS ARE NOT CLASSIFIED AS CARCINOGENS BY INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC), NATIONAL TOXICOLOGY PROGRAM (NTP) OR OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).

FOR A SPANISH TRANSLATION OF THIS MSDS, CALL 1-800-240-MSDS.

SECTION IV — OCCUPATIONAL EXPOSURE LIMITS

COMP NO.	OSHA PEL/TWA	PEL/CEILING	TLV/TWA	ACGIH TLV/STEL	OTHER
P	5 MG/M3*	NONE	5 MG/M3*	10 MG/M3*	

*OIL MIST, MINERAL

SECTION V — EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: FLUSH EYES WITH WATER. IF IRRITATION OCCURS, GET MEDICAL ATTENTION.

SKIN CONTACT: REMOVE CONTAMINATED CLOTHING/SHOES AND WIPE EXCESS FROM SKIN. FLUSH SKIN WITH WATER. FOLLOW BY WASHING WITH SOAP AND WATER. IF IRRITATION OCCURS, GET MEDICAL ATTENTION. IF MATERIAL IS INJECTED UNDER THE SKIN, GET MEDICAL ATTENTION PROMPTLY TO PREVENT SERIOUS INJURY.

INHALATION: REMOVE VICTIM TO FRESH AIR AND PROVIDE OXYGEN IF BREATHING IS DIFFICULT. GET MEDICAL ATTENTION.

INGESTION: DO NOT INDUCE VOMITING. IF VOMITING OCCURS SPONTANEOUSLY, KEEP HEAD BELOW HIPS TO PREVENT ASPIRATION OF LIQUID INTO THE LUNGS. GET MEDICAL ATTENTION.

NOTE TO PHYSICIAN: IF MORE THAN 2.0 ML PER KG HAS BEEN INGESTED AND VOMITING HAS NOT OCCURRED, EMESIS SHOULD BE INDUCED WITH SUPERVISION. KEEP VICTIM'S HEAD BELOW HIPS TO PREVENT ASPIRATION. IF SYMPTOMS SUCH AS LOSS OF GAG REFLEX, CONVULSIONS OR UNCONSCIOUSNESS OCCUR BEFORE EMESIS, GASTRIC LAVAGE USING A CUFFED ENDOTRACHEAL TUBE SHOULD BE CONSIDERED.

SECTION VI — SUPPLEMENTAL HEALTH INFORMATION

AMOCO HAS REPORTED TO THE U.S. EPA PURSUANT TO SECTION 8(E) OF TSCA THAT A SAMPLE OF HYDROTREATED MIDDLE DISTILLATE (CAS REGISTRY NUMBER 64742-46-7) APPLIED REPEATEDLY TO THE SKIN OF EXPERIMENTAL ANIMALS OVER THEIR LIFETIME PRODUCED A WEAK TUMORIGENIC RESPONSE IN THE SKIN. THE FULL REFINING/PROCESS HISTORY OF THIS SAMPLE WAS NOT PROVIDED IN AMOCO'S SUBMISSION.

SECTION VII — PHYSICAL DATA

BOILING POINT (DEG F):	SPECFIC GRAVITY (H2O = 1):	VAPOR PRESSURE (MM HG):
>300	0.8833	<0.1
MELTING POINT (DEG F):	**SOLUBILITY IN WATER:**	**VAPOR DENSITY (AIR = 1):**
-40 (POUR POINT)	NEGLIGIBLE	NOT AVAILABLE
		VISCOSITY: 12 (CST @ 104 DEG F)

EVAPORATION RATE (NORMAL BUTYL ACETATE = 1):NOT AVAILABLE

APPEARANCE AND ODOR:WHITE LIQUID. SLIGHT HYDROCARBON ODOR.

PHYS/CHEM PROPERTIES:DIELECTRIC STRENGTH: 30 KV (MIN)

SECTION VIII — FIRE AND EXPLOSION HAZARDS

FLASH POINT AND METHOD: 295 DEG F (COC)

FLAMMABLE LIMITS/PERCENT VOLUME IN AIR: LOWER: N/AVA HIGHER: N/AVA

EXTINGUISHING MEDIA:

USE WATER FOG, FOAM, DRY CHEMICAL OR CO2. DO NOT USE A SIRECT STREAM OF

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WATER. PRODUCT WILL FLOAT AND CAN BE REIGNITED ON SURFACE OF WATER.
SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS:
MATERIAL WILL NOT BURN UNLESS PREHEATED. DO NOT ENTER CONFINED FIRE-SPACE WITHOUT FULL BUNKER GEAR (HELMET WITH FACE SHIELD, BUNKER COATS, GLOVES AND RUBBER BOOTS), INCLUDING A POSITIVE-PRESSURE NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS. COOL FIRE EXPOSED CONTAINERS WITH WATER.
UNUSUAL FIRE AND EXPLOSION HAZARDS:
NONE IDENTIFIED

SECTION IX REACTIVITY

STABLITY: STABLE HAZARDOUS POLYMERIZATION WILL NOT OCCUR
CONDITIONS AND MATERIALS TO AVOID:
AVOID HEAT, OPEN FLAMES, AND OXIDIZING MATERIALS.
HAZARDOUS DECOMPOSITION PRODUCTS:
THERMAL DECOMPOSITION PRODUCTS ARE HIGHLY DEPENDENT ON THE COMBUSTION CONDITIONS. A COMPLEX MIXTURE OF AIRBORNE SOLID, LIQUID, PARTICULATES AND GASES WILL EVOLVE WHEN THIS MATERIAL UNDERGOES PYROLYSIS OR COMBUSTION. CARBON MONOXIDE AND OTHER UNIDENTIFIED ORGANIC COMPOUNDS MAY BE FORMED UPON COMBUSTION.

SECTION X EMPLOYEE PROTECTION

RESPIRATORY PROTECTION:
IF EXPOSURE MAY OR DOES EXCEED OCCUPATIONAL EXPOSURE LIMITS (SECTION IV) USE A NIOSH-APPROVED RESPIRATOR TO PREVENT OVEREXPOSURE. IN ACCORD WITH 29 CFR 1910.134 USE EITHER AN ATMOSPHERE-SUPPLYING RESPIRATOR OR AN AIR-PURIFYING RESPIRATOR FOR ORGANIC VAPORS AND PARTICULATES.
PROTECTIVE CLOTHING
WEAR CHEMICAL-RESISTANT GLOVES AND OTHER PROTECTIVE CLOTHING AS REQUIRED TO MINIMIZE SKIN CONTACT. NO SPECIAL EYE PROTECTION IS ROUTINELY NECESSARY. TEST DATA FROM PUBLISHED LITERATURE AND/OR GLOVE AND CLOTHING MANUFACTURERS INDICATE THE BEST PROTECTION IS PROVIDED BY NITRILE GLOVES.
ADDITIONAL PROTECTIVE MEASURES:
NONE IDENTIFIED

SECTION XI ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES:
MAY BURN ALTHOUGH NOT READILY IGNITABLE. USE CAUTIOUS JUDGMENT WHEN CLEANING UP LARGE SPILLS. *** LARGE SPILLS *** WEAR RESPIRATOR AND PROTECTIVE CLOTHING AS APPROPRIATE. SHUT OFF SOURCE OF LEAK IF SAFE TO DO SO. DIKE AND CONTAIN. REMOVE WITH VACUUM TRUCKS OR PUMP TO STORAGE SALVAGE VESSELS. SOAK UP RESIDUE WITH AN ABSORBENT SUCH AS CLAY, SAND, OR OTHER SUITABLE MATERIALS; DISPOSE OF PROPERLY. FLUSH AREA WITH WATER TO REMOVE TRACE RESIDUE. *** SMALL SPILLS *** TAKE UP WITH AN ABSORBENT MATERIAL AND DISPOSE OF PROPERLY.

SECTION XII SPECIAL PRECAUTIONS

MINIMIZE SKIN CONTACT. WASH WITH SOAP AND WATER BEFORE EATING, DRINKING, SMOKING OR USING TOILET FACILITIES. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. PROPERLY DISPOSE OF CONTAMINATED LEATHER ARTICLES, INCLUDING SHOES, THAT CANNOT BE DECONTAMINATED.

SECTION XIII TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION:
NOT HAZARDOUS BY D.O.T. REGULATIONS
DOT PROPER SHIPPING NAME: NOT APPLICABLE
OTHER REQUIREMENTS: FOR BARGE SHIPMENTS; USE CARGO INFORMATION CARD SCM 68701, DIALA OIL.

SECTION XIV OTHER REGULATORY CONTROLS

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THE COMPONENTS OF THIS PRODUCT ARE LISTED ON THE EPA/TSCA INVENTORY OF CHEMICAL SUBSTANCES.
PROTECTION OF STRATOSPHERIC OZONE (PURSUANT TO SECTION 611 OF THE CLEAN AIR ACT AMENDMENTS OF 1990): PER 40 CFR PART 82, THIS PRODUCT DOES NOT CONTAIN NOR WAS IT DIRECTLY MANUFACTURED WITH ANY CLASS I OR CLASS II OZONE DEPLETING SUBSTANCES.
IN ACCORDANCE WITH SARA TITLE III, SECTION 313, THE ATTACHED ENVIRONMENTAL DATA SHEET (EDS) SHOULD ALWAYS BE COPIED AND SENT WITH THE MSDS.

SECTION XV STATE REGULATORY INFORMATION

THE FOLLOWING CHEMICALS ARE SPECIFICALLY LISTED BY INDIVIDUAL STATES; OTHER PRODUCT SPECIFIC HEALTH AND SAFETY DATA IN OTHER SECTIONS OF THE MSDS MAY ALSO BE APPLICABLE FOR STATE REQUIREMENTS. FOR DETAILS ON YOUR REGULATORY REQUIREMENTS YOU SHOULD CONTACT THE APPROPRIATE AGENCY IN YOUR STATE.

STATE LISTED COMPONENT	CAS NO	PERCENT	STATE CODE
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE	64742-53-6	0-50	MA

CA = CALIFORNIA HAZ. SUBST. LIST; CA65C, CA65R, CA65C/R = CALIFORNIA SAFE DRINKING WATER AND TOXICS ENFORCEMENT ACT OF 1986 OR PROPOSITION 65 LIST; CT = CONNECTICUT TOXIC. SUBST. LIST; FL = FLORIDA SUBST. LIST; IL = ILLINOIS TOX. SUBST. LIST; LA = LOUISIANA HAZ. SUBST. LIST; MA = MASSACHUSETTS SUBST. LIST; ME = MAINE HAZ. SUBST. LIST; MN = MINNESOTA HAZ. SUBST. LIST; NJ = NEW JERSEY HAZ. SUBST. LIST; PA = PENNSYLVANIA HAZ. SUBST. LIST; RI = RHODE ISLAND HAZ. SUBST. LIST.
VOLATILE ORGANIC COMPOUNDS (VOC): THIS PRODUCT IS EXEMPT FROM VOC REPORTING UNDER THE CALIFORNIA CLEAN AIR ACT. SECTION 94510 EXEMPTS ORGANIC COMPOUNDS THAT EITHER HAVE A VAPOR PRESSURE OF <0.1 MM HG @ 20 DEG C OR HAVE MORE THAN 12 CARBON ATOMS.

SECTION XVI SPECIAL NOTES

MSDS SECTION II-A, XV AND EDS SECTION I REVISED TO SHOW CHANGED PERCENTAGE OF INGREDIENTS. EDS SECTIONS III AND IV WERE UPDATED. THE OSHA HAZARD EVALUATION AND REGULATORY STATUS OF THE PRODUCT HAVE NOT CHANGED. A SPANISH TRANSLATION OF THIS MSDS MAY BE OBTAINED BY CALLING 1-800-240-MSDS.

ENVIRONMENTAL DATA SHEET
EQUILON EDS: 60030E

DIALA(R) OIL AX
TELEPHONE NUMBER:
24 HOUR EMERGENCY ASSISTANCE
EQUIVA SERVICES: 877-276-7283
CHEMTREC: 800-424-9300

GENERAL MSDS ASSISTANCE
877-276-7285

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NAME AND ADDRESS

EQUILON ENTERPRISES
PRODUCT STEWARDSHIP
P.O. BOX 674414
HOUSTON, TX 77267-4414

PRODUCT CODE: 69704

SECTION I PRODUCT COMPOSITION

NO.	COMPOSITION	CAS	PERCENT
P	DIALA OIL AX		
1	HIGHLY REFINED PETROLEUM OILS	MIXTURE*	100
2	BUTYLATED HYDROXY TOLUENE	128-37-0	<0.2
*MAY CONTAIN:		64742-46-7, 64742-53-6	

SECTION II SARA TITLE III INFORMATION

NO.	EHS RQ (*1)	EHS TPQ (*2)	SEC-313 (*3)	313 CATEGORY (*4)	311/312 CATEGORY (*5)

BASED ON THE DATA AVAILABLE THIS PRODUCT IS NOT REGULATED BY SARA, TITLE III

*1 = REPORTABLE QUANTITY OF EXTREMELY HAZARDOUS SUBSTANCE, SEC 302
*2 = THRESHOLD PLANNING QUANTITY, EXTREMELY HAZARDOUS SUBSTANCE, SEC 302
*3 = TOXIC CHEMICAL, SEC 313
*4 = CATEGORY AS REQUIRED BY SEC 313 (40 CFR 372.65 C), MUST BE USED ON TOXIC RELEASE INVENTORY FORM
*5 = CATEGORY (FOR AGGREGATE REPORTING REQUIREMENTS UNDER SARA 311, 312)
HEALTH: H-1 = IMMEDIATE (ACUTE) HEALTH HAZARD
H-2 = DELAYED (CHRONIC) HEALTH HAZARD
PHYSICAL: P-3 = FIRE HAZARD
P-4 = SUDDEN RELEASE OF PRESSURE HAZARD
P-5 = REACTIVE HAZARD

SECTION III ENVIRONMENTAL RELEASE INFORMATION

THIS PRODUCT IS COVERED BY EPA'S COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA) PETROLEUM EXCLUSION. THEREFORE, RELEASES TO AIR, LAND, OR WATER ARE NOT REPORTABLE UNDER CERCLA ("SUPERFUND"). HOWEVER, UNDER SECTION 311 OF EPA'S CLEAN WATER ACT (CWA), THIS PRODUCT IS CONSIDERED AN OIL. AS SUCH, SPILLS INTO OR LEADING TO SURFACE WATERS THAT CAUSE A SHEEN MUST BE REPORTED TO THE NATIONAL RESPONSE CENTER, 800-424-8802.

THIS PRODUCT IS AN OIL UNDER 49 CFR (DOT) PART 130. IF SHIPPED BY RAIL OR HIGHWAY IN A TANK WITH A CAPACITY OF 3,500 GALLONS OR MORE, IT IS SUBJECT TO THE REQUIREMENTS OF PART 130. MIXTURE SOLUTIONS IN WHICH THIS PRODUCT IS PRESENT AT 10% OR MORE MAY ALSO BE SUBJECT TO THIS RULE.

SECTION IV RCRA INFORMATION

IF THIS PRODUCT BECOMES A WASTE, IT WOULD NOT BE A HAZARDOUS WASTE BY RCRA CRITERIA (40 CFR 261). PLACE IN AN APPROPRIATE DISPOSAL FACILITY IN COMPLIANCE WITH LOCAL REGULATIONS.

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COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

TO DETERMINE THE APPLICABILITY OR EFFECT OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, YOU SHOULD CONSULT WITH YOUR LEGAL ADVISOR OR THE APPROPRIATE GOVERNMENT AGENCY. WE WILL NOT PROVIDE ADVICE ON SUCH MATTERS, OR BE RESPONSIBLE FOR ANY INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN. THE UNDERLYING DATA, AND THE INFORMATION PROVIDED HEREIN AS A RESULT OF THAT DATA, IS THE PROPERTY OF EQUIVA SERVICES, LLC AND IS NOT TO BE THE SUBJECT OF SALE OR EXCHANGE WITHOUT THE EXPRESS WRITTEN CONSENT OF EQUIVA SERVICES, LLC.

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FOR ADDITIONAL INFORMATION ON THIS ENVIRONMENTAL DATA PLEASE CALL
(877) 276-7285
FOR EMERGENCY ASSISTANCE PLEASE CALL
EQUIVA SERVICES LLC: (877) 276-7283
CHEMTREC: (800) 424-9300
}

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COOPER POWER SYSTEMS

Material Safety Data Sheet

MANUFACTURER:
Cooper Power Systems-RTE Fluids
1319 East Lincoln Avenue
Waukesha, Wisconsin 53186-5374

Emergency Number:
(414) 549-5000

PRODUCT IDENTIFICATION

Trade Name: R-Temp® Fluid
Synonyms: High Molecular Weight Hydrocarbon Dielectric Fluid, Fire-Resistant Hydrocarbon Fluid
Chemical Family: Deep solvent-extracted paraffinic hydrocarbon
Molecular Formula: Mixture of paraffinic hydrocarbons and additives

INGREDIENTS

CAS Registry No.	%W	%V	Identification	Carcinogen per NTP, IARC, OSHA
64741-88-4	>98	>98	Deep solvent refined paraffinic petroleum	not listed
128-37-0	<1	<1	Hindered Phenol	not listed
**	<1	<1	Flow modifier	not listed

**EPA confidential CAS accession number: 22130

PHYSICAL DATA

Boiling point: wide range
Vapor Pressure: <0.001 psi @ 20 C.
Vapor Density (air = 1): 18
Solubility in water: very low
Specific Gravity: 0.876
Percent Solid by wt: 0.0
pH: 7.0
Percent Volatile (v/v): nil
Appearance and odor: Viscous, odorless, translucent, straw-colored liquid

FIRE AND EXPLOSION DATA

ASTM D-92 Flash/Fire points 285/312 degrees Celsius (typical)
545/594 degrees Fahrenheit

Recommended fire extinguishing medium: Dry chemical or CO_2 foam. Use water spray to cool exposed containers, nearby structures and to protect personnel. Use water to flush spills away from sources of ignition.

FIREFIGHTING PRECAUTIONS: Exposed firefighters should wear MSHA/NIOSH approved self-contained breathing apparatus with full face mask and full protective equipment.

REACTIVITY DATA

Stability: R-Temp fluid is stable under normal conditions of use. Avoid contact with strong oxidizing agents.

DECOMPOSITION PRODUCTS: Products of complete combustion of R-Temp fluid are carbon dioxide and water. Products of incomplete combustion include these compounds plus volatile hydrocarbons, carbon monoxide, and small amounts of polynuclear aromatic hydrocarbons. Quantities and types of combustion products of R-Temp fluid have been shown to be less than those for equivalent amounts of conventional transformer oil.

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HEALTH HAZARD DATA

Routes of Exposure:
ORAL: ESSENTIALLY NON-TOXIC. Rat oral LD50 >5 grams/Kg. May cause gastrointestinal distress. Symptoms may include irritation, nausea, vomiting and diarrhea.

SKIN: ESSENTIALLY NON-TOXIC. Estimated rabbit dermal LD50 >5 grams/Kg. Repeated or prolonged contact may result in localized irritation of the skin. May cause allergic reactions in some individuals.

EYES: Slightly irritating. Avoid contact.

INHALATION: May cause respiratory tract irritation. Exposure to dense oil mist may lead to respiratory problems.

SPECIAL TOXIC EFFECTS: None

CARCINOGENIC/MUTAGENIC POTENTIAL: Essentially none.

FIRST AID

INGESTION: Do not induce vomiting. If spontaneous vomiting occurs, monitor the subject for breathing difficulty. Get immediate medical attention.

SKIN CONTACT: Remove contaminated clothing. Wash area of contact thoroughly with soap and water. If irritation is present, get medical attention. Thermal burns require immediate medical attention.

EYE CONTACT: Flush the eyes immediately with large amounts of water with the eyelids held away from the eye to ensure thorough rinsing. If irritation persists, get medical attention.

INHALATION: Remove affected person from source of exposure. Get medical attention if irritation persists.

PERSONAL PROTECTION INFORMATION

EYE PROTECTION: Wear safety glasses or goggles to prevent eye contact. Eye baths should be readily available in the area of handling R-Temp fluid.

SKIN PROTECTION: As with any petroleum product, oil-impervious clothing is recommended to prevent skin contact.

RESPIRATORY PROTECTION: Use MSHA/NIOSH approved equipment when working in areas of heavy oil mist. Ventilation can be used to control or reduce airborne concentrations of oil.

ENVIRONMENTAL AND DISPOSAL INFORMATION

SPILL OR RELEASE TO THE ENVIRONMENT:
Combine and recover any free liquid. There is no CERCLA reportable quantity of R-Temp fluid.

For technical advice, and assistance related to the spill, contact CHEMTREC (800-424-9300) and your local fire department.

With small spills, absorb the fluid with sand or clay absorbent, then flush the area with water. With large spills, dike the area ahead of the spill to contain its flow.

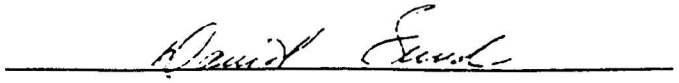
A spill or release of any petroleum fluid to navigable waters of a quantity sufficient to cause a sheen upon the water's surface must be reported immediately to the National Response Center (800-424-8802). Failure to report may result in civil or criminal penalties.

WASTE DISPOSAL: R-Temp fluid, when discarded or disposed of, is not listed as a hazardous waste per 40 CFR 261.33.

HANDLING AND STORAGE: Avoid extremes of temperature in storage. Store R-Temp fluid in tightly closed containers in cool, dry, isolated and well ventilated areas, away from sources of ignition or heat. Do not store in unlabeled containers.

This Material Safety Data Sheet has been prepared in order to help the users of R-Temp fluid. The data contained herein is accurate as of the date of preparation of this sheet.

Effective Date: May 15, 1989



Completed by David Sundin, Fluids Dept. Manager

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R-Temp Fluid Material Safety Data Sheet Supplement

The following is an explanation of the information contained on the R-Temp fluid Material Safety Data Sheet. This information is provided to enable you to identify and compare the risks associated with some other types of dielectric fluids.

Additional technical information concerning the handling, use, maintenance, reprocessing and disposal of R-Temp fluid can be found in the R-Temp Fluid Technical Manual, available from RTE Fluids.

An explanation of each section of the Material Safety Data Sheet follows:

Manufacturer:

The manufacturer of R-Temp fluid is RTE Fluids, which is part of Cooper Power Systems, Inc. The mailing address is listed, as is a phone number to call for technical information. This number is answered from 8:00 am to 5:00 pm CST, Monday through Friday, except on scheduled holidays.

Trade Name, Synonyms, and Formula:

This product is properly known as R-Temp fluid. R-Temp fluid is biodegradable, essentially nontoxic and easy to dispose of. It is generically referred to as a "High Molecular Weight Hydrocarbon Dielectric Fluid" or as a " Fire Resistant Hydrocarbon Fluid". It is classified as a less-flammable transformer insulating liquid for transformer installation by National Electrical Code Section 450-23, Less-Flammable Liquid-Insulated Transformers.

R-Temp fluid is manufactured from a natural, biodegradable paraffinic hydrocarbon. A special refining method is used to process a highly refined, natural petroleum oil into R-Temp fluid base oil. R-Temp fluid is a mixture of this base oil and additives giving it its excellent functional characteristics. The additives used are listed in the "Ingredients" table. A small amount of the fluid is a hindered phenolic type of antioxidant, the same as is used in nearly every brand of conventional transformer oil sold in the U.S. A trace of a flow modifier is added to improve the low-temperature flow characteristics of R-Temp fluid. Both additives are biodegradable and nonhazardous in the concentrations in which they are found in R-Temp fluid.

Physical Data:

This section contains information on R-Temp fluid's physical characteristics. Being derived from natural petroleum, R-Temp fluid displays a wide range of boiling points. At atmospheric pressure, the fluid begins to boil at about 450 °Celsius (842° Fahrenheit) and will continue to boil until about 800°C. (1472°F.) It has a very low vapor pressure, less than 0.001 psi at 20 °C, due to its high molecular weight. The vapor density is eighteen times that of air's density. R-Temp fluid is only slightly soluble in water. The specific gravity of R-Temp fluid is 0.876.

It contains no solid material. R-Temp fluid is a bland, essentially nonreactive, innocuous hydrocarbon. Its pH is 7.0. It contains no volatile matter.

R-Temp fluid appears as a translucent, light amber colored fluid. It has only a slight petroleum odor.

Fire and Explosion Data:

The typical flash and fire points of R-Temp fluid are 285 and 312 degrees Celsius (545 and 594 °F.) respectively, measured in accordance with ASTM D92. These high values give R-Temp fluid its fire-resistant properties.

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Even though R-Temp fluid has excellent fire resistant properties, it is not nonflammable. It is possible for any material to burn, when exposed to certain conditions, even those such as teflon or askarel fluids. A fire involving R-Temp fluid should be treated as any petroleum material would be; using dry chemical and foam extinguishers. Water should be used to cool exposed containers of R-Temp fluid or other material and to protect exposed personnel.

Although R-Temp fluid does not produce unusual toxic or hazardous fire decomposition products, firefighters should take the standard precaution of wearing a self-contained breathing apparatus that has been approved by the Mine Safety Health Administration (MSHA) and the National Institute of Occupational Safety and Health (NIOSH).

Reactivity Data:

R-Temp fluid is stable under normal conditions of use. Its properties will not change when stored. Its shelf life is indefinite.
The products of complete combustion of R-Temp fluid are the same as with any hydrocarbon fluid, carbon dioxide and water. Incomplete combustion will produce these compounds and small amounts of low molecular weight hydrocarbons, carbon monoxide and polynuclear aromatic hydrocarbons. Testing has shown that the quantity and types of combustion products from R-Temp fluid are less than those for equivalent amounts of conventional transformer oil.

Health Hazard Data:

R-Temp fluid is essentially innocuous and non-toxic. Tests have shown that is has very little or no effect on test animals, whether administered orally (as food) or dermally (applied to the animal's skin). The LD_{50} value for orally administered
R-Temp fluid is more than 5 grams of fluid per kg. of animal weight. The primary reaction expected to orally administered R-Temp fluid would be a laxative effect, plus possible stomach cramps and nausea.

Tests performed on R-Temp fluid have indicated that it is not mutagenic to laboratory animals. The International Agency for Research on Cancer (IARC) has studied fluids similar to R-Temp fluid and have found no evidence of carcinogenic activity or potential.

When applied to skin, there is virtually no reaction to R-Temp fluid. Some people, however, are allergic to petroleum oil and would exhibit an acne-like condition on their skin. Precautions to take would include removing all oil-soaked clothing and thorough washing with soap and water. Of course, hot R-Temp fluid could cause thermal burns, which should be treated as such.

If R-Temp fluid gets in the eyes, they should be thoroughly flushed with large amounts of water. The eyelids should be held away from the eye itself, to make sure that the rinsing is thorough. If irritation persists, consult a doctor.

If R-Temp fluid mist is inhaled, remove the person from the source of the exposure to an area of fresh air. If the person's lungs are irritated, consult a doctor, as a condition known as "oil pneumonia" may result.

Personal Protection Information:

Workers handling R-Temp fluid should wear safety goggles to prevent R-Temp fluid from accidentally splashing into their eyes. As with any petroleum or chemical product, eye baths should be available to quickly flush away any accidental fluid that contacts the eyes.

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Oil-impervious clothing (rubberized aprons, boots, and gloves) should be worn when working with any petroleum or chemical product.

When a heavy oil mist is present, workers should wear MSHA approved breathing apparatus. Rooms should be well-ventilated to prevent a heavy concentration of oil mist.

Environmental Information:

In case of an accidental spill of R-Temp fluid on the ground, combine and dispose of any free fluid. Superfund agencies (CERCLA) do not have to be reported, as there is no minimum CERCLA reportable amount of R-Temp fluid.
For technical assistance for any spill, a phone number for CHEMTREC (Washington, D.C.) has been listed on the MSDS. They will assist you in recovery and disposal of a chemical or petroleum spill by providing any information that you may need, free of charge.

Small fluid spills can be contained with earthen dikes or spill-absorbing pillows, etc.

By law, any spill that is of sufficient quantity to cause a sheen on a navigable waterway must be reported to the National Response Center (1-800-424-8802). Contacting this office will help ensure compliance with federal statutes that govern environmental spills of petroleum or chemicals.

Waste Disposal:

R-Temp fluid is not listed as a hazardous waste per 40 CFR 261.33. R-Temp fluid may be sold to a waste oil handler, to be reprocessed and used as a lubricant. R-Temp fluid may be burned in an industrial boiler without concern of a high concentration of residue such as silica ash.

Handling and Storage:

R-Temp fluid should be stored in tightly closed containers in cool, dry, isolated and well ventilated areas, away from sources of ignition or heat. Do not store R-Temp fluid in unlabeled containers. Bulk storage tanks that contain R-Temp fluid should be labeled as such.

Questions concerning the use, storage, handling, processing or disposal of R-Temp fluid should be directed to RTE Fluids at (414) 549-5000.

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R-TEMP® FLUID

DESCRIPTION

R-Temp fluid is a fire resistant dielectric coolant formulated for use in distribution transformers where its unique electrical, thermal and safety properties are advantageous. It is a High Molecular Weight Hydrocarbon (HMWH) based material. R-Temp fluid is non-toxic and readily biodegradable, making it eminently satisfactory to environmentalists. It is compatible with standard insulating materials, and processing equipment and procedures. R-Temp fluid is also referred to as a High Fire Point Fluid, a Fire Resistant Hydrocarbon or a Less-Flammable Dielectric Liquid.

Due to its excellent performance characteristics, applications for R-Temp fluid have expanded into a variety of other equipment, including sectionalizing switches, electromagnets, voltage regulators, rectifiers and high voltage substations. The fluid is also used for askarel and oil retrofill applications and as a make-up fluid for askarel-filled equipment.

TYPICAL R-TEMP FLUID PROPERTIES

Property	Value	Test Method
Electrical		
Dielectric Strength	56 kV @ 25° C (0.080 in. gap) 43 kV @ 25° C	ASTM D1816 ASTM D877
Relative Permittivity [Dielectric Constant]	2.2 @ 25° C	ASTM D924
Dissipation Factor [Power Factor]	0.16% @ 100° C	ASTM D924
Volume Resistivity	1×10^{14} W -cm @ 25° C	ASTM D1169
Physical and Chemical		
Specific Gravity	0.87 @ 25° C	ASTM D1298
Interfacial Tension	38 mN/m @ 25° C	ASTM D971
Neutralization Number	5×10^{-3} mg KOH/g	ASTM D664
Kinematic Viscosity	130 cSt @ 40° C 13 cSt @ 100° C	ASTM D445
Color	L 1.5	ASTM D1500
Thermal		
Flash Point	284° C	ASTM D92
Fire Point	312° C	ASTM D92
Pour Point	-24° C	ASTM D97
Thermal Conductivity	3.1×10^{-4} cal/(cm • sec • °C) @ 25° C	RTE Method
Specific Heat	0.46 (cal/gm/° C) @ 25° C	ASTM D2766
Coefficient of Expansion	7.3×10^{-4} cc/cc/° C @ 25° C	RTE Method

Typical properties subject to change without notice. Contact RTE Fluids for recommended acceptance values. Ask for R-Temp fluid Specification Guideline Bulletin 92009.

FIELD PERFORMANCE HISTORY

Since the energization of prototypes in 1975, over 30,000 R-Temp transformers have been installed, accumulating over a hundred thousand unit-years of reliable field service. **The safety record has been flawless.**[1]

The monitoring of operating R-Temp transformers, including the earliest prototypes, has demonstrated R-Temp fluid to be exceptionally stable.

APPLICATIONS

■ NEW TRANSFORMERS

Transformers filled with R-Temp fluid for indoor, submersible and outdoor applications are available from an extensive list of manufacturers in the United States and abroad.

For indoor applications, R-Temp transformers not only provide the proven performance of liquid-filled design, but at a lower total owning cost than other alternatives with equal ratings.

R-Temp transformers are also an excellent choice for outdoor, network or subsurface vault installations where an extra margin of safety against explosion and fire is desired as compared to conventional oil. Outdoor applications where enhanced safety is recommended include close proximity to buildings or valuable equipment, rooftop installations and close proximity to pedestrian areas. Types of transformers presently operating with R-Temp fluid include pole-mounted, pad-mounted, small and medium power substations (through 550 kV BIL), network and rectifier units.

R-Temp transformers have been widely accepted by industry and government. The fluid's favorable health and environmental properties make R-Temp transformers a frequent choice in food processing plants. Contact RTE Fluids or your equipment supplier for a copy of the User's List, Bulletin 90048.

Bulletin 92006
Product Information
February 1992
(supersedes Section 413-0 November, 1989)

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ENVIRONMENTAL & HEALTH

R-Temp fluid is carefully formulated to minimize health and environmental risk.

R-Temp fluid is not listed as hazardous by EPA, OSHA or DOT. Oral toxicity animal tests reported no signs of toxological reactions. It is not classified as bioaccummulating or mutagenic.[6] Unlike silicone, R-Temp fluid is biodegradable.[7]

The University of Dayton, under an Electrical Power Research Institute (EPRI) contract, tested for thermal decomposition by-products from typical utility materials. R-Temp fluid was placed in the least hazardous category.[8]

Thermal decomposition by-products from R-Temp fluid were also analyzed by the EPA as reported in the Federal Register. R-Temp fluid "did not produce PCDF's (Furans) or PCDD's (Dioxins) under the experimental conditions."[9]

Testing for acute toxicity of thermal degradation products also produced a favorable rating — superior to most materials tested, even more favorable than other natural materials such as wood and cotton.[10]

Additional product safety information is provided in the R-Temp fluid Material Safety Data Sheet (MSDS) available upon request.

GENERAL INFORMATION

■ SPECIFICATION GUIDELINE

The dielectric coolant shall be a listed less-flammable fluid meeting the requirements of National Electrical Code Section 450-23, including a minimum fire point of 300° C. The fluid shall be non-toxic, non-bioaccumulating and biodegradable. It shall be Factory Mutual Approved and UL Classified, R-Temp fluid or equal.

For recommended acceptance values, contact RTE Fluids or your equipment supplier for Bulletin 92009.

■ STORAGE AND HANDLING

The same basic procedures for storing and handling conventional mineral oil should be followed with R-Temp fluid. For additional storage and handling information, contact RTE Fluids or your equipment supplier.

■ FLUID MAINTENANCE

Periodic maintenance tests for R-Temp fluid-filled equipment should follow the same schedule used for conventional mineral oil-filled equipment. Recommended maintenance tests include:

1. Dielectric strength per ASTM D 877. The acceptable limit for continued use of service-aged R-Temp fluid is 24 kV minimum (69 kV equipment and below).
2. Flash Point and Fire Point. Relatively small amounts of conventional oil or other contaminants may reduce the flash point and fire point of R-Temp fluids. If it is suspected that the fluid may be contaminated, flash point and fire point should be measured in accordance with ASTM D 92.
3. Dissolved Gas Analysis. Recommended particularly for high value equipment or equipment servicing critical loads. ANSI/IEEE guide C57.104-1978 for detection and analysis of generated gases in conventional oil is also a suitable guideline for R-Temp fluids.
4. Testing one or more of the following properties provides a good indication of possible fluid contamination or unusual degradation. Acceptable limits for continued use of service-aged R-Temp fluids:[11]

Dissipation Factor	D924	1.0% at 25° C max.
Neutralization Number	D664	0.25% mg KOH/g max.
Interfacial Tension	D971	22 mN/m at 25° C min.

ORDERING INFORMATION

To order R-Temp fluid, specify:

	Catalog Number
Bulk	0425200A01
55 gallon drum	0425589A01
5 gallon container	0425589A02

For warranty, sales terms and conditions information contact RTE Fluids or your equipment supplier for Cooper Power Systems Terms and Conditions Sheet.

UL CLASSIFICATION MARKING

CLASSIFIED UL

Classified by Underwriters Laboratories Inc.® as to Fire Hazard Only:

R-Temp® Fluid. Classed 4 to 5 less hazardous than paraffin oil in respect to Fire Hazard. May evolve flammable gases when decomposed by an electric arc.

Classified by Underwriters Laboratories Inc. as to Section 450-23 of the 1990 National Electrical Code:

Classified as "less-flammable liquid" in compliance with the National Electrical Code, when used in 3-phase transformers, 45 through 10,000 kVA, with the following three "use restrictions":

A. For use only in 3-phase transformers having tanks capable of withstanding an internal pressure of 12 psig without rupture.

B. Required use of pressure relief devices in transformer tank in accordance with the following tabulation to limit internal pressure buildup and prevent tank rupture due to gas generation under low current arcing faults, and

C. Required use of current limiting fusing in transformer primary having I^2t characteristics not exceeding the values in the following tabulation to limit possible high current arcing faults.

3-Phase Transformer Rating, kVA	Required Current Limiting Fusing* Maximum I^2t (A^2s)	Minimum Required Pressure Relief Capacity** SCFM SCFM at 15 psi
45	500,000	35
75	500,000	35
112.5	550,000	35
150	600,000	50
225	650,000	100
300	750,000	100
500	900,000	350
750	1,100,000	350
1,000	1,250,000	350
1,500	1,500,000	700
2,000	1,750,000	700
2,500	2,000,000	5,000
3,000	2,250,000	5,000
3,750	2,500,000	5,000
5,000	3,000,000	5,000
7,500	3,000,000	5,000
10,000	3,000,000	5,000

* This is an additional requirement to the over current protection required in accordance with Section 450-3 of the 1990 National Electrical Code.

**Opening pressure, 10 psig, maximum.

35 H9

FACTORY MUTUAL APPROVAL:
Fire point greater than 300° C (ASTM D-92-72)
Convective heat release rate: 546 kW/m^2
Radiative heat release rate: 361 kW/m^2

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(Applications continued)

■ REFILLING CONVENTIONAL OIL-FILLED TRANSFORMERS

R-Temp fluid is well suited as a replacement fluid for upgrading the safety margin of conventional mineral oil-filled transformers. Contact RTE Fluids for application guidelines.

■ ASKAREL (PCB) RETROFILL

All major retrofilling companies list R-Temp fluid as a permanent fluid option. R-Temp fluid advantages for askarel retrofilling are high dielectric strength, excellent lubricity, material compatibility and a coefficient of expansion similar to askarel.

■ MAKE-UP FLUID

R-Temp fluid is fully miscible with askarel and oil. It may be used as a make-up fluid for topping off either type of transformer. Using R-Temp fluids as a make-up gluid eliminates the risk and expense of storing and handling askarel or other hazardous fluids such as chlorinated benzenes. For additional information, contact RTE Fluids or your equipment supplier.

■ LOADBREAK SWITCHING DEVICES

Excellent dielectric strength, lubricity and arc suppression make R-Temp fluid an excellent loadbreak switching medium. Unlike silicone, R-Temp fluid does not form a conductive gel under arcing conditions. Applications include new and retrofilled sectionalizing switches, voltage regulators and transformers with loadbreak accessories such as bayonet fusing, on-off switches, sectionalizing switches and load tap changers. Due to viscosity differences compared to conventional mineral oil, suitability of each application should be reviewed by the equipment manufacturer.

■ OTHER APPLICATIONS

The inherent safety and performance features of R-Temp fluid have led to its application in electrical equipment other than transformers, including industrial electromagnets, precipitator transformer/rectifier sets, power supplies for electrostatic painting equipment and electron beam furnaces. R-Temp fluid has excellent lubricity, an important characteristic for application in equipment with movable parts.

R-Temp fluid has been successfully used in each of the listed applications. However, suitability of each application of R-Temp fluid is the responsibility of the user.

FIRE SAFETY

The National Fire Protection Association has not had any report of fires caused by transformers filled with listed less-flammable liquids.[3] This attests to the fire resistance of R-Temp fluid and other listed less-flammable fluids.

R-Temp fluid meets the 1990 National Electrical Code™ Section 450-23 requirements as a listed less-flammable liquid and is covered by OSHA Article §1910.305, Section 5iii. For additional information, request the NEC™ Requirements Guideline, Catalog Section 418.

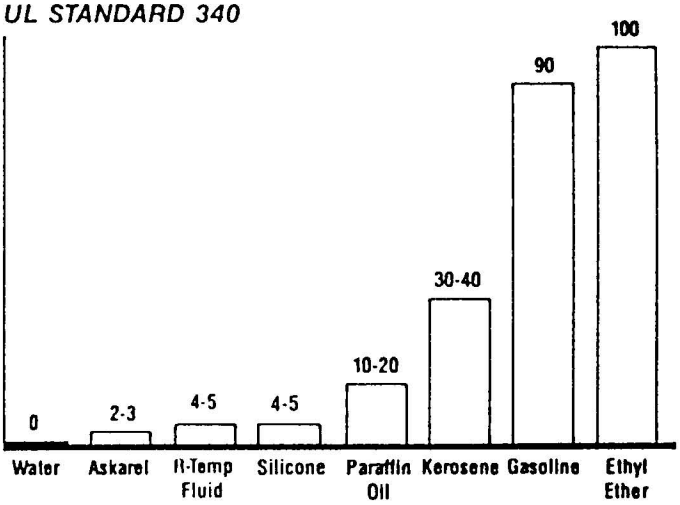
R-Temp fluid is Factory Mutual Approved, and is currently the only fluid UL Classified less-flammable per NEC Article 450-23.[4] R-Temp fluid is also recognized by Industrial Risk Insurers per application guide (I.R.I.-IM.5.4.5.)

In many large and small scale tests, fire resistant hydrocarbon fluids have demonstrated greater fire resistance than other askarel substitutes. Based on large scale testing, a study conducted by the National Electrical Manufacturers Association for the National Bureau of Standards concluded "silicone oil appeared slightly more flammable than high molecular weight hydrocarbons (e.g. R-Temp fluid) even though their flash and fire points are essentially the same."[5]

A fire hazard rating standard was developed by Underwriters Laboratories in 1972, UL Standard 340. The graph below demonstrates the favorable rating assigned to R-Temp fluid.

FIRE HAZARD RATING

UL STANDARD 340



Prior to shipment, R-Temp fluid undergoes extensive quality assurance testing.

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REFERENCES

[1] C. P. McShane, The Health, Environmental, Safety, Performance and Economic Analysis of R-Temp Fluid: The First Decade, EPRI Substitute Workshop, 12/17/86

[2] C. P. McShane, Analysis of Service Aged R-Temp Fluid, 10/8/87

[3] M. W. Earley, Minimizing the Hazards of Transformer Fires, *Fire Journal*, Jan/Feb 1988

[4] Gas and Oil Equipment Directory, 1991, Underwriters Laboratories, Inc.

[5] Development of Flammability Criteria for Transformer Dielectric Fluids, NB SIR 80-1992

[6] Laboratory Test Record 11/82, Bioassay Systems Corp. Project No. 10477

[7] Laboratory Test Record 12/77, Associated Analysts

[8] P. H. Taylor, et. al.; Evaluation and Potential Health Hazards from Fires Involving Liquid and Solid Utility Materials, University of Dayton Research Institute, EPRI PCB Seminar, 10/6-9/87

[9] Federal Register, Volume 50, No. 137, July 1985

[10] H. L. Kaplan, et. al.; Combustion Toxicology, Principles and Test Methods; Technomic Publishing Company, 1983

[11] IEEE Guide for Acceptance and Maintenance of Less Flammable Hydrocarbon Fluid in Transformers, IEEE C57.121 - 1988

COOPER

Cooper Power Systems

Cooper Industries
Cooper Power Systems Div.
RTE Fluids
1319 Lincoln Avenue, Dept. 6A
Waukesha, WI 53186-5386
414-459-5000 Fax 414-524-3205, 414-549-1488

To the best of our knowledge, the information and data in this brochure are accurate at the time of printing.

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R-TEMP FLUID
LESS-FLAMMABLE TRANSFORMER INSULATING FLUID

1. SCOPE

1.1 This specification covers fire resistant hydrocarbon-based fluid, intended for use in electrical equipment as a less-flammable, high fire point insulating and cooling medium, intended for use in electrical equipment.

2. REQUIREMENTS

2.1 Materials

The insulating fluid shall be UL Classified Less-Flammable, biodegradable, less-electrical insulating and cooling liquid. The fluid shall not be classified as a hazardous waste by any U.S. Government agency. The fluid shall be R-Temp fluid or equal.

2.2 Properties

Dielectric Strength, ASTM D-877	
kV, 25°C, as received in drums or bulk	30 min.
Dissipation Factor, ASTM D-924, % 25°C	0.01 max.
Interfacial Tension, ASTM D-971, mN/m, 25°C	38 min.
Neutralization Number, ASTM D-664, mgKOH/g	0.03 max.
Fire Point, ASTM D-92, °C	300 min.
Viscosity, ASTM D-445, centistokes, 100°C	15 max.
Pour Point, ASTM D-97, °C	-18 max.
Moisture Content, ASTM D-1533B, ppm	35 max.

3. QUALITY ASSURANCE

3.1 Inspection

Each lot received shall be visibly inspected for container leaks.

(continued on reverse side)

BULLETIN 92009
Specification Guideline
January 1992
(Replaces Section 416-0)

COOPER
Cooper Power Systems

COOPER INDUSTRIES
COOPER POWER SYSTEMS DIVISION
1900 East North Street
Waukesha, Wisconsin 53188-3899
414-547-1251; FAX: 414-524-4654

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3.2 Receiving Tests

Samples shall be taken from containers per ASTM D-923 Section 2.2, as follows:

Lot Size (gallons)	Number of Containers Sampled
600 or less	1
601 to 3000	2-6
3001 or more	6 minimum (10% of quantity of containers received recommended.)

When material is to be combined for production, samples may be mixed together in equal portions (creating a composite sample) before testing. Minimum tests required are dielectric strength and visual inspection. Dissipation factor test is recommended, although not essential.

4. PACKAGING

4.1 The electrical insulating fluid shall be furnished in sealed 55 gallon drums, or in bulk.

5. NOTES

5.1 Intended Use: The use of electrical insulating and cooling fluid is generally dictated by the engineering design of the electrical apparatus. The electrical insulating fluid covered by this specification is intended for use as an insulating and cooling medium in electrical equipment.

5.2 When transferring electrical insulating fluid from its original container, care should be taken to prevent contamination with moisture, dust, and foreign matter. These impurities can cause deterioration of the dielectric strength and performance.

5.3 Care must be taken to properly seal all partially filled containers so that they will not become contaminated.

5.4 Avoid storing drums outdoors, exposed to the elements. Extreme temperature variations can stress the integrity of the protective seals.

\cpm\specgd92.009

DOW CORNING CORPORATION
MATERIAL SAFETY DATA SHEET

561(TM) SILICONE TRANSFORMER LIQUID

SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Dow Corning Corporation
South Saginaw Road
Midland, Michigan 48686

24 Hour Emergency Telephone:	(517) 496-5900
Product Information:	(517) 496-6000
Product Disposal Information:	(517) 496-5813
Transportation Information:	(517) 496-8577
CHEMTREC:	(800) 424-9300

MSDS No: 02165619 Print Date: 05/13/94 Last Revised: 01/17/94

Generic Description: Silicone
Physical Form: Liquid
Color: Colorless
Odor: Odorless
NFPA Profile: Health NA Flammability 1 Reactivity 0

Note: NFPA = National Fire Protection Association

SECTION 2. HAZARDOUS COMPONENTS

CAS Number	Wt%	Component	Exposure Limits

None Known

Comments: None present. This is not a hazardous material as defined in the OSHA Hazard Communication Standard.

SECTION 3. EFFECTS OF OVEREXPOSURE

Acute Effects

Eye: Direct eye contact may cause temporary discomfort with mild redness and dryness similar to windburn.

Skin: A single prolonged exposure (24 to 48 hours) causes no known adverse effect.

Inhalation: No irritation to eyes and respiratory passages. No injury is likely from relatively short exposures of less than 8 hours.

Oral: Small amounts transferred to the mouth by fingers during use, etc., should not injure. Swallowing large amounts may cause digestive discomfort.

Repeated Exposure Effects

Skin: None Known.

Inhalation: None Known.

Oral: None Known.

Special Hazards

This material contains the following components with the special hazards listed below.

Carcinogens

None Known

Teratogens

None Known

Mutagens

None Known

Reproductive Toxins

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None Known

Sensitizers

None Known

Comments: Please read the additional information below.

The above listed potential effects of overexposure are based on actual data, results of studies performed upon similar compositions component data and/or expert review of the product.

SECTION 4. FIRST AID MEASURES

Eye: Immediately flush with water.

Skin: No first aid should be needed.

Inhalation: No first aid should be needed.

Oral: No first aid should be needed.

Comments: Treat symptomatically.

SECTION 5. FIRE FIGHTING MEASURES

Flash Point (Method):	> 213.80 DEGREE F / 101.00 DEGREE C
Autoignition Temperature:	Not Determined
Flammability Limits in Air:	Not Determined
Extingushing Media:	Carbon dioxide (CO2). Water. Water fog (or spray). Dry chemical. Foam.
Unsuitable Extinguishing Media:	None
Fire Fighting Procedures:	Self-contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals.
Unusual Fire Hazards:	None
Hazardous Decomposition Products:	Silicon dioxide. Carbon oxides and traces of incompletely burned carbon compounds. Formaldehyde.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Containment/Clean-up: Disposal of collected product, residues, and cleanup materials may be governmentally regulated. Observe all applicable local, state, and federal waste management regulations. Mop up, or wipe up, or soak up with absorbent and contain for salvage or disposal. For large spills, provide diking or other appropriate containment to keep material from spreading. Clean any remaining slippery surfaces by appropriate techniques, such as: several moppings or swabbings with appropriate solvents; washing with mild, caustic detergents or solutions; or high pressure steam for large areas. For nonsilicones, use typical industrial cleaning materials. Observe any safety precautions applicable to the cleaning material being used. Observe all personal protection equipment recommendations described in Sections 5 and 8. Local, state, and federal reporting requirements may apply to spills or releases of this material into the environment. See applicable regulatory compliance information in Section 15.

NOTE: See Section 8 for Personal Protective Equipment for Spills

SECTION 7. HANDLING AND STORAGE

Handling: No special precautions.

Storage: No special precautions. Use reasonable care.

561(TM) SILICONE TRANSFORMER LIQUID

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Local exhaust: None should be needed
General Ventilation: Recommended

Personal Protective Equipment For Routine Handling

Eyes: Use proper protection - safety glasses as a minimum.

Skin: Washing at mealtime and end of shift is adequate.

Suitable Gloves: No special protection needed.

Inhalation: No respiratory protection should be needed.

Suitable Respirator: None should be needed.

Personal Protective Equipment For Spills

Eye: Use proper protection - safety glasses as a minimum.

Skin: Washing at mealtime and end of shift is adequate.

Inhalation/
Suitable Respirator: No respiratory protection should be needed.

Precautionary Measures: Avoid eye contact. Use reasonable care.

Comments: None

Note: These precautions are for room temperature handling. Use at elevated temperature, or aerosol/spray applications, may require added precautions.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical form:	Liquid
Color:	Colorless
Odor:	Odorless
Specific Gravity @ 25C:	0.96
Viscosity:	50.00 CST
Freezing/Melting Point:	Not Applicable.
Boiling Point:	Not Determined.
Vapor Pressure @ 25C:	Not Determined.
Vapor Density:	Not Determined.
Solubility in Water:	None.
pH:	Not Applicable.
Volatile content (Wt%):	Not Determined.

Note: The above information is not intended for use in preparing product specifications. Contact Dow Corning before writing specifications.

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability: Stable.

Hazardous Polymerization: Hazardous polymerization will not occur.

Conditions to Avoid: None.

Materials to Avoid: Oxidizing material can cause a reaction.

561(TM) SILICONE TRANSFORMER LIQUID

Comments: None

SECTION 11. TOXICOLOGICAL INFORMATION

OPTIONAL SECTION - Complete information not yet available.

SECTION 12. ECOLOGICAL INFORMATION

OPTIONAL SECTION - Complete information not yet available.

SECTION 13. DISPOSAL CONSIDERATIONS

OPTIONAL SECTION - Complete information not yet available.

Call Dow Corning Environmental Mgmt. (517)496-6315, if more information is desired.

SECTION 14. TRANSPORT INFORMATION

DOT Information (49CFR 172.101)

Proper Shipping Name: Not Available

Hazard Technical Name: Not Available

Hazard Class: Not Available

UN/NA Number: Not Available

Packing Group: Not Available

Call Dow Corning Transportation, (517)496-8577, if additional information is required.

SECTION 15. REGULATORY INFORMATION

Contents of this MSDS comply with the OSHA Hazard Communication Standard 29CFR 1910.1200

TSCA Status: All chemical substances found in this product comply with the Toxic Substances Control Act inventory reporting requirements.

EPA SARA Title III Chemical Listings:

Section 302 Extremely Hazardous Substances:
None

Section 304 CERCLA Hazardous Substances:
None

Section 312 Hazard Class:

Acute:	N
Chronic:	N
Fire:	N
Pressure:	N
Reactive:	N

Y = Yes N = No

Section 313 Toxic Chemicals:
None present or none present in regulated quantities.

Supplemental State Compliance Information

CAS Number	Wt%	Component

California

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561(TM) SILICONE TRANSFORMER LIQUID

Warning: This product contains the following chemical(s) listed by the State of California under the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) as being known to cause cancer.

None Known.

Warning: This product contains the following chemical(s) listed by the State of California under the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) as being known to cause birth defects or other reproductive harm.

None Known.

Massachusetts

No ingredient regulated by MA Right-to-Know Law present.

New Jersey

063148629	100	Polydimethylsiloxane

Pennsylvania

063148629	100	Polydimethylsiloxane

SECTION 16. OTHER INFORMATION

Prepared by: Dow Corning Corporation

This information is offered in good faith as typical values and not as a product specification. No warranty, expressed or implied, is hereby made. The recommended industrial hygiene and safe handling procedures are believed to be generally applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate.

* * * * * This is the last page. * * * * *

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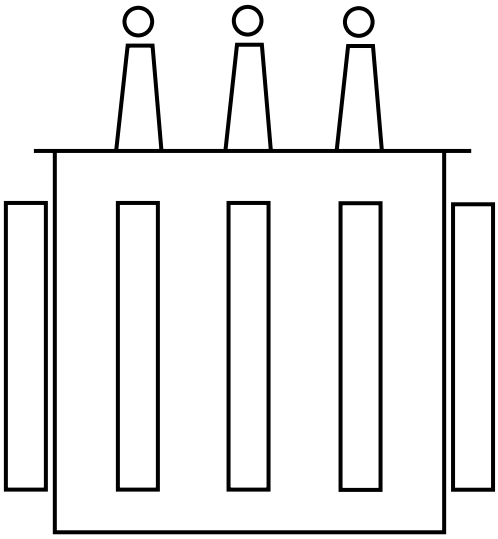
Distribution Transformer
Instruction Manual



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ALSTOM

INSTRUCTION BOOK

CARE AND MAINTENANCE OF OIL-IMMERSED
(R-TEMP-OR SILICONE IMMERSED) TRANSFORMERS

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SHIPPING

Distribution transformers are shipped completely sealed. Core and coils are assembled in a tank with the insulating liquid covering the coils.

This method of construction preserves the quality of insulation, the cooling and insulating liquid by preventing contamination from external sources.

INSPECTION ON RECEIPT

When a transformer is received, a thorough external inspection should be made before the unit is removed from the railroad car or truck. If there is evidence of damage and/or indication of rough handling in transit, an inspector representing the carrier should be requested and the manufacturer immediately notified.

NOTE: An internal inspection is necessary only if internal damage is suspected because of external indications of rough handling.

If the delivering carrier is willing to permit internal inspection of the transformer on the railroad car or truck prior to unloading, without requiring consignee's signature on the delivery slip, a representative of the manufacturer should be called and an internal inspection made as outlined in "Internal Inspection."

If the delivering carrier will not permit internal inspection of the transformer on the railroad car or truck, note on the acceptance slip for the shipment that there are "possible internal and/or hidden damages," and file a claim immediately for possible hidden damage. When the transformer has been removed to the installation site or some other convenient location to permit inspection of the internal assembly for damage in transit, proceed as outlined in "Internal Inspection." Request that a representative of the carrier be present during the inspection.

HANDLING

A. COMPLETE TRANSFORMER

The transformer should always be handled in the normal upright position unless information from the manufacturer indicates that it can be handled otherwise. Where a transformer cannot be handled by a crane, it may be skidded or moved on rollers into place, depending upon compatibility of transformer base design and the type of surface over which it is to be moved. During the handling operation, care must be taken to prevent overturning.

When a transformer is shipped it is usually ready to be set in place after the crating and shipping braces are removed. Bushings and accessories which are shipped separately should be thoroughly protected against moisture until they are installed. Proper precaution must be taken during installation of these parts to protect the transformer against the entrance of moisture.

B. LIFTING WITH SLINGS

Lifting lugs and eyes are designed to be lifted with a maximum sling angle of 30° from the vertical. For lift angles of greater than 30° from the vertical, spreader bars must be used to provide a vertical lift on the lugs.

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C. RAISING WITH JACKS

Jack bosses are provided on most transformers so that the transformer can be raised by means of jacks. On those transformers not equipped with bosses, the jacks may be placed under the transformer bottom plate at designated points. The manufacturer's drawings should be consulted.

Do not attempt to raise the transformer by placing the jacks under drain valves, pipe connections or other attachments. It is also recommended that these appendages not be subjected to a man's weight.

INTERNAL INSPECTION

WARNING: Avoid possible serious accident. Be sure to relieve tank pressure or vacuum before attempting to loosen and remove manhole cover.

A. INSULATING LIQUID

Before opening a transformer, take samples of the insulating liquid from the top and bottom of tank and test the dielectric strength. The dielectric strength should be 27.5 kv or higher. If it is lower, the transformer should not be placed in service until the dielectric strength has been restored by filtration.

B. CORE-AND-COIL ASSEMBLY

Lower the insulating liquid to the top of the core-and-coil assembly and inspect the interior to see if any damage has occurred. If possible, **DO NOT** permit the coils and insulation to be exposed to the air.

Examine the top of the core-and-coil assembly, all horizontal surfaces and the underside of the cover for signs of moisture. If there are no signs of moisture or damage, proceed with the reassembly of the transformer If there are signs of moisture inside the tanks steps should be taken to determine the extent of it and the manner in which the moisture entered the transformer. Reassembly should be carried through and the manufacturer of the equipment should be requested to make recommendations concerning further checks and steps for drying out the transformer.

If the transformer appears to have been damaged internally or if it is desirable to remove the core-and-coil assembly for inspection or drying, the transformer may be untanked as follows

1. Remove the handhole lid and disconnect high- and low voltage leads if the bushings are in position. Remove both primary and secondary bushings.
2. Small bushings may be left on the cover if they are protected and the cover is carefully handled. Remove cover. Remove thermometer, tapchanger and oil gauge and all other accessories and associated wells which project into the tank and which might interfere with untanking operations.
3. Use slings for removing the core-and-coil assembly.
4. Particular care must be taken in handling tools and other loose articles when working with a transformer. Metallic objects, if dropped in the windings and allowed to remain there, can cause a severe fault.

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STORAGE

It is advisable to locate a transformer, complete with liquids in its permanent location even if it will not be placed in service for some time. It is well to check the paint finish and to repair all damaged painted surfaces. If the transformer is shipped and stored in dry inert gas, the gas pressure should be maintained and periodically tested. If an oil-filled, indoor-type transformer is stored outdoors it should be thoroughly covered to keep out rain. A transformer should not be stored or operated in the presence of corrosive vapors or gases, such as chlorine.

Should it become necessary to store accessories for a long period of time, they should be stored in a clean, dry place or the manufacturer should be contacted for explicit instructions on the storage of individual pieces.

LOCATION

Accessibility, ventilation and ease of inspection should be given careful consideration in the location of transformers.

Self-cooled transformers depend entirely upon the surrounding air for carrylng away their heat. For this reason, care must be taken to provide adequate ventilation.

For indoor installation, the room in which the transformers are placed must be well ventilated so that heated air can escape readily and can be replaced by cool air. Inlet openings should be near the floor and distributed so as to be most effective. The outlet opening(s) should be as high above the apparatus as the construction of the building will permit. The number and size of air outlets required will depend on their distance above the transformer and on the efficiency and load cycle of the apparatus. In general, about 60 square feet of outlet opening or openings should be provided for each 1000 kva of transformer capacity. Air inlets should be provided with the same total area as the outlets.

Self-cooled transformers should always be separated from one another and from adjacent walls, partitions, etc., in order to permit free circulation of air about the tanks. This separation should not be less than 30 inches.

PREPARING FOR SERVICE

PRELIMINARY INSPECTION: Before any work is done on a transformer in preparation for service, a careful inspection of all external parts is needed to disclose any evidence of mistreatment or damage. This inspection should include a check of all parts required to complete the erection, making certain that all parts have arrived and are in first-class condition. Accessible bolted parts should be checked for tightness. Pressure tests should be taken and the liquid checked to determine both its physical level and dielectric strength. Any indication of leaks, which may have resulted in moisture entering the transformer, should be noted and appropriate action taken.

NOTE: Pressurized and sealed at ambient temperature at time of manufacture. It is common that a pressure vacuum gauge if supplied could read negative due to lower temperature at the site of installation. This is not an indication of an abnormality, but in fact an indication that the tank is properly sealed.

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PUTTING INTO SERVICE

Before applying voltage to transformer, check the following items:

1. Are feeder cables on bus connected to bushing terminals without stressing the porcelains?
2. Are winding neutral terminals properly grounded or ungrounded as required by system operation?
3. Is tank solidly grounded at grounding pads located near bottom of tank?
4. Are all current transformers connected to a load or short-circuited? **CAUTION:** Open secondaries can produce voltages dangerous to humans and connected equipment.
5. Is the tapchanger set in desired position to give desired voltage ratio?
6. Have all tools and foreign objects been removed from transformer?
7. Are all openings and joints sealed?
8. Is insulating liquid at proper level in tank? Also level in liquid-filled compartments (if supplied).
9. Are all fans and control circuits (if supplied) operational?
10. Is insulating dielectric strength of oil at least 27.5 kv? If tests are less, filter the liquid.
11. Are all personnel in the clear?

After energizing, watch transformer closely for the first three hours of operation for evidence of abnormal conditions.

LOADING

Transformers are suitable for full-load operation at rated temperature rise without loss of life, providing the following conditions are met:

1. Ambient temperature does not exceed 40°C; or average more than 30°C; in one 24-hour period.
2. Installed elevation does not exceed 3,300 feet (1,000 meters) above sea level. Refer to ANSI standard C57.19.00 for derating factors when installed at higher elevations.

PERIODIC INSPECTION

1. Sample and test insulating/cooling liquid for dielectric strength.

   CAUTION: If a vacuum is indicated on the pressure vacuum gauge, care must be used to eliminate it prior to oil sampling. Failure to do so may result in air being pulled into the tank through the drain valve which may lead to insulation failure if energized or upon re-energization. Contact factory for specific instructions.
2. Check level of liquid in main tank and liquid-filled compartments. Add clean liquid if necessary.
3. Check fan operation on Forced Air units.

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CAUTION: Before entering a transformer that has been in service, **BE SURE** to lock open the line switches on both the HV and LV side, then connect a grounded line to transformer terminals in order to discharge any stored energy in the windings.

DO NOT ENTER THE UNIT UNTIL THE GAS SPACE ABOVE LIQUID HAS BEEN PURGED WITH DRY AIR. BREATHING THE NITROGEN ABOVE THE TRANSFORMER LIQUID CAN CAUSE ASPHYXIATION.

MAINTENANCE DURING PERIODS OF SHUTDOWN

Clean any contamination from bushings.

Rotate the tapchanqer handle back and forth a few times. This will clean the contacts. Be sure to return the handle to its original position if no change in voltage ratio is desired.

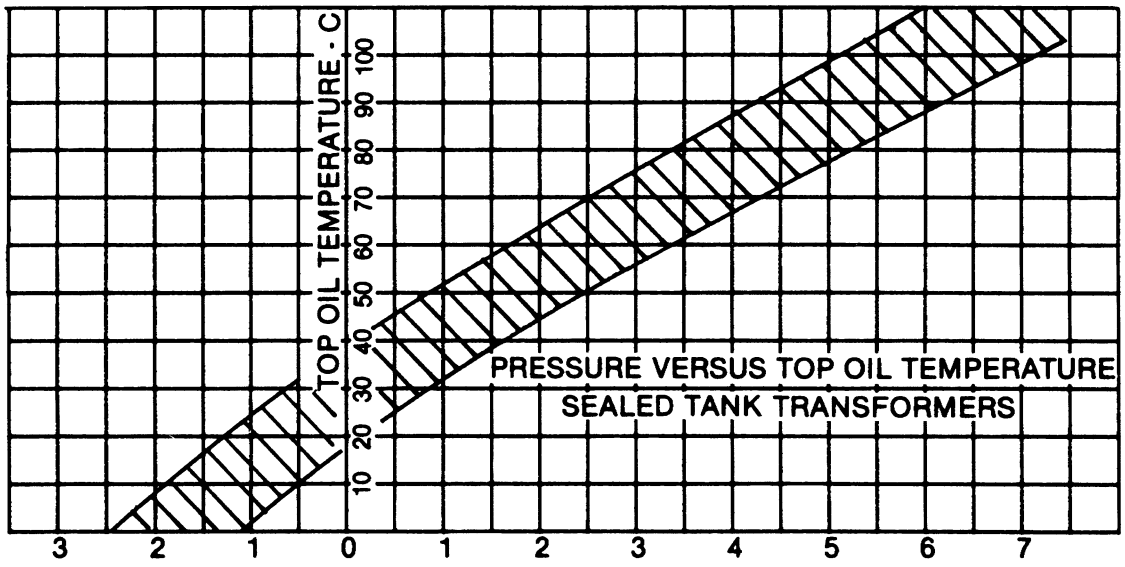
CHECKING FOR LEAKS:

Check pressure vacuum gauge daily the first week of transformer operation. If pressure-vacuum gauge stays at zero reading, it indicates a faulty seal. If transformer cannot be de-energized, be careful to not come into contact with live parts such as bushing terminals and leads.

Slowly add nitrogen or dry air AT LOW PRESSURE until gauge reads 5 PSI. Apply with a paint brush soapy water or detergent to all seals above liquid level. Small bubbles will indicate the location of the leak.

After leak is repaired, add sufficient dry air or nitrogen to provide 0.5 Psi gauge pressure at 256G (top liquid temperature). Refer to curve for normal pressure at other top liquid temperatures.

Pressure Curve:



VACUUM – PSI –GAGE PRESSURE – PSI – GAGE

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ACCESSORIES

PRESSURE RELIEF DEVICE

When required by the specifications, a mechanical automatic resealable type pressure relief device can be supplied. This device requires no adjustment after it operates. After relieving the pressure due to the gas build-up in the tank, it automatically recloses and reseals. Alarm contacts are available if specified.

PRESSURE-VACUUM BLEEDER DEVICE

When required by the specifications, a pressure-vacuum bleeder can be supplied. This device is designed to protect transformer from a slow build-up of pressure. It will either admit air or exhaust internal gases to maintain a safe level of pressure/vacuum.

SUDDEN PRESSURE RELAY

When required by specifications, a sudden pressure relay can be supplied. This relay can generate an electrical signal to either sound an alarm, or cause a breaker to operate when a transformer experiences sever arcing or transformer failure that generates a large quantity of gas that increases pressure in a short period of time. As an option, this device is available with or without a seal-in-relay.

DIAL TYPE THERMOMETER

When required by specifications, a dial type thermometer is mounted in a thermometer well located on the transformer's tank wall and can be easily removed. The thermometer reads the top oil temperature. As an option it is available with or without contacts which can be used to sound an alarm, control fans, and/or actuate circuit breakers when a preset temperature is reached.

The thermometer also has a drag pointer that indicates maximum temperature reached. The drag hand can be reset by turning the reset knob, located on the center face of the gauge counter clockwise until it reaches the temperature pointer.

LIQUID LEVEL INDICATOR

When required by specifications a liquid level gauge is mounted on the tank wall. This device is available with a gear driven float (common with Compartmental Padmount Transformers), and/or a magnetic device (common with Secondary & Unit Sub-Station Transformers). The magnetic gauge is a available with or without contacts that can be used for alarm circuits.

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METHOD OF DRYING TRANSFORMERS

The most common method is known as the "short-circuit" method. Before applying voltage, the transformer's cooling surfaces must be blanketed with heavy paper, cloth or builder's felt. The amount of surface to be blanketed can only be determined by trial.

The cover must be blanketed to prevent condensation on inside of cover.

Ventilate interior by raising manhole cover. If transformer is inside a buildings provide good ventilation to remove vapors from room. If outdoors, protect the opening from the weather.

Now short-circuit one winding of transformer and apply sufficient AC voltage to the other winding to give the value of current and temperature needed. The voltage required for this will be a small percent of the rated voltage.

In no case should value of current and temperature in the table be exceeded.

Maximum Allowable Short-Circuit Ampere in Percent of Full-Load Based on Self-Cooled Rating	Maximum Allowable Top-Liquid Temperature °C
50	100
75	90

DRYOUT CURRENTS AND TEMPERATURES

Drying should continue until seven consecutive tests of liquid samples show a dielectric strength of 27.5 kv. Take samples of oil from bottom of tank, since the water will accumulate there.

FILLING WITH OIL

A. CHECKING OIL

Check the dielectric strength of oil while it is still in containers. If free water is present, drain off the water before putting the oil through the filter press. Continue passing oil through the filter press until the prescribed dielectric strength is met.

B. NON-VACUUM FILLING

In cases where vacuum filling is not required, the tank should be filled through the main drain valve. A second opening at the top should be provided to relieve the air being displaced. Full voltage may not be applied to the transformer for a period of 24 hours.

C. VACUUM FILLING

Entrapped air is a potential source of trouble in all transformers. In general, therefore, it is desirable to fill transformers with oil under as high a vacuum as conditions permit. Particularly is it essential to vacuum-fill high voltage transformers shipped in nitrogen or dry gas in order to develop their full insulation strength before they are energized.

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