SINGLE PHASE POLE MOUNTED DISTRIBUTION TRANSFORMERS 11KV

Prepared by: **ARY SAIDAHMED SHEKSAEED**
Electrical Engineer
KEU ID#: 4252
Email: ary.sayd@hotmail.com

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Introduction:

The Single phase, 11kV pole-mounted distribution transformers are specifically designed for servicing residential overhead distribution loads. They are also suitable for light commercial loads, industrial lighting and diversified power applications. These transformers are oil-filled and designed for the application conditions normally encountered on electric utility power distribution systems. The Single phase, pole-mounted distribution transformers are designed and manufactured in compliance with all applicable (**RUS**), **(IEEE)**, **(ANSI)** and **(NESC)** standards.

RUS: The Rural Utilities Service .
IEEE: Institute of Electrical and Electronics Engineers.
ANSI: American National Standards Institute.
NESC: National Electrical Safety Code.

STANDARD RATINGS:

- **11 kV DT:** The standard ratings shall be 10, 16, 25, 63, 100, 160, 200, 250, 315, 400, 500, 630, 1000,1250, 1600, 2000 and 2500 kVA transformers.
- **33kV DT:** The ratings shall be 100, 160, 200, 315, 400, 500, 630, 1000, 1250, 1600, 2000, 2500 kVA.
- **Temp:** up to 70° C temperature rise
- **Frquency:** 50 hertz or 60 hertz
- **Low voltages-LV**: 120/240, 240/480 and 277 volts
- **High voltages-HV**: 2.4kV through 34.4kV

Type and Class of single phase pole mounted Distribution Transformers

The single phase pole mounted transformers are categorized by ***type*** and ***class***.

A) Transformer Type; This identifies the protection of the transformer. The four basic transformer types are

1. ***Conventional "S".***
2. ***Surge-Protecting "SP".***
3. ***Current-Protecting "CP".***
4. ***Self-Protected "CSP"*** *Transformers.*

All above together they represent a wide range of protective capabilities to meet nearly every application. For transformers supplied with overcurrent protection, the user must assure coordination with system protective devices. Failure to do so will defeat the purpose of such protection.

1. Conventional "S"; In this type, Both the current limiting fuse and the protective link are fuses working together to give full range transformer protection against fault-current. The protective link interrupts any low fault current while the current limiting fuse protects against fault currents which exceed the interrupting rating of the protective link. See **(Fig. 1)**

2. Surge-Protecting “SP”;

The “SP” transformers include transformer-mounted lightning arresters and internally-mounted high voltage protective links, but omit the internally-mounted low voltage circuit breaker. These transformers are used in locations where lightning is a problem. However, because the protective link protects the system only from outages due to internal transformer failure, overload protection, if desired, must be provided by external fuses.

3. Current-Protecting “CP” Transformers

The “CP” transformers are equipped with the internally mounted low-voltage circuit breaker and high voltage protective links, but *omit the lightning arresters. These* transformers are used in locations where lightning is not a problem. The arrester may be crossarm-mounted if surge protection is desired. The breaker and protective link are coordinated such that any fault or short circuit on the secondary side of the transformer will trip the breaker before the protective link operates, taking the load off the transformer before the core/coil is damaged.

4. Self-Protected “CSP” Transformers;

The CSP coordinated protection package is available as an option on overhead distribution transformers for increased protection against surge currents, short circuits, and overloads. See **(Fig. 2)**

Fig. 1
Transformer Type S

Fig. 2
Transformer Type CSP

B)Transformer Class: The transformer class identifies the number of high voltage bushings, mounting positions, and lightning arresters when required.

Transformer Class Designations

1. Type CSP, above 5 kV, 10-100 kVA.

Class A: Has two fully-insulated high voltage bushings, two arresters, two protective links and external breaker handle. Suitable for application on either wye or delta distribution systems. Single position pole mounting in accordance with latest ANSI standards. See **(Fig. 3)**

Class B-1: Has two fully-insulated high voltage bushings, one arrester, two protective links and external breaker handle. Normally applied on solidly grounded systems.

Class B-2: Has one fully-insulated high voltage bushing, one arrester, one protective link and external breaker handle. Suitable only for application on solidly grounded distribution systems. Single-position pole mounting in accordance with latest ANSI standards.

Class B-3: Its same as class B-2 except with two-position mounting.

2. Type CSP, 5 kV and below, 10-100 kVA. Similar to Type CSP above 5 KV except:

- Sidewall-mounted primary bushings.
- Class B-2 and B-3 not available.

Transformer Type CSP, above 5 kV, 10-100 kVA Class A, B-2 and B-3,

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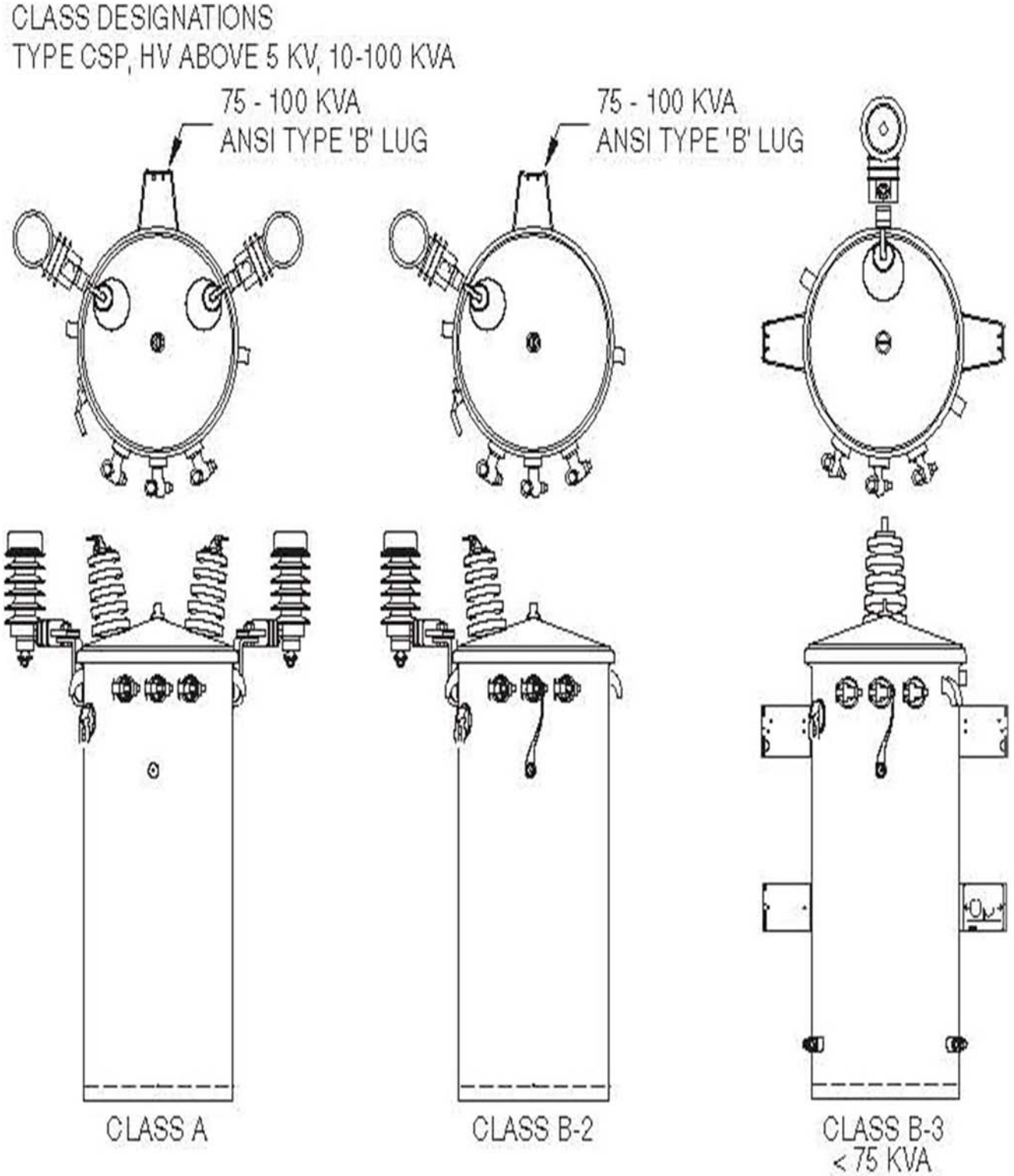

Fig. 3

Transformer Class Designations

1. Type S, above 5 kV, 10-500 kVA. **(Fig.4)**

Class A: Has two fully-insulated high voltage bushings, suitable for application on either wye or delta distribution systems. Single-position pole mounting in accordance with the latest ANSI standards.

Class B-2: Has one fully-insulated high voltage bushing, suitable only for application on solidly grounded distribution systems. Single-position pole mounting in accordance with the latest ANSI standards.

Class B-3: Its Same as class B-2 except with two-position mounting.

2. Type S, 5 kV and below, 10-500 kVA. Similar to Type S, above 5 kV, except:
- Sidewall-mounted primary bushings.
- Only Class A is available.

Transformer Type S, above 5 kV, 10-500 kVA. Class A, B-2 and B-3,

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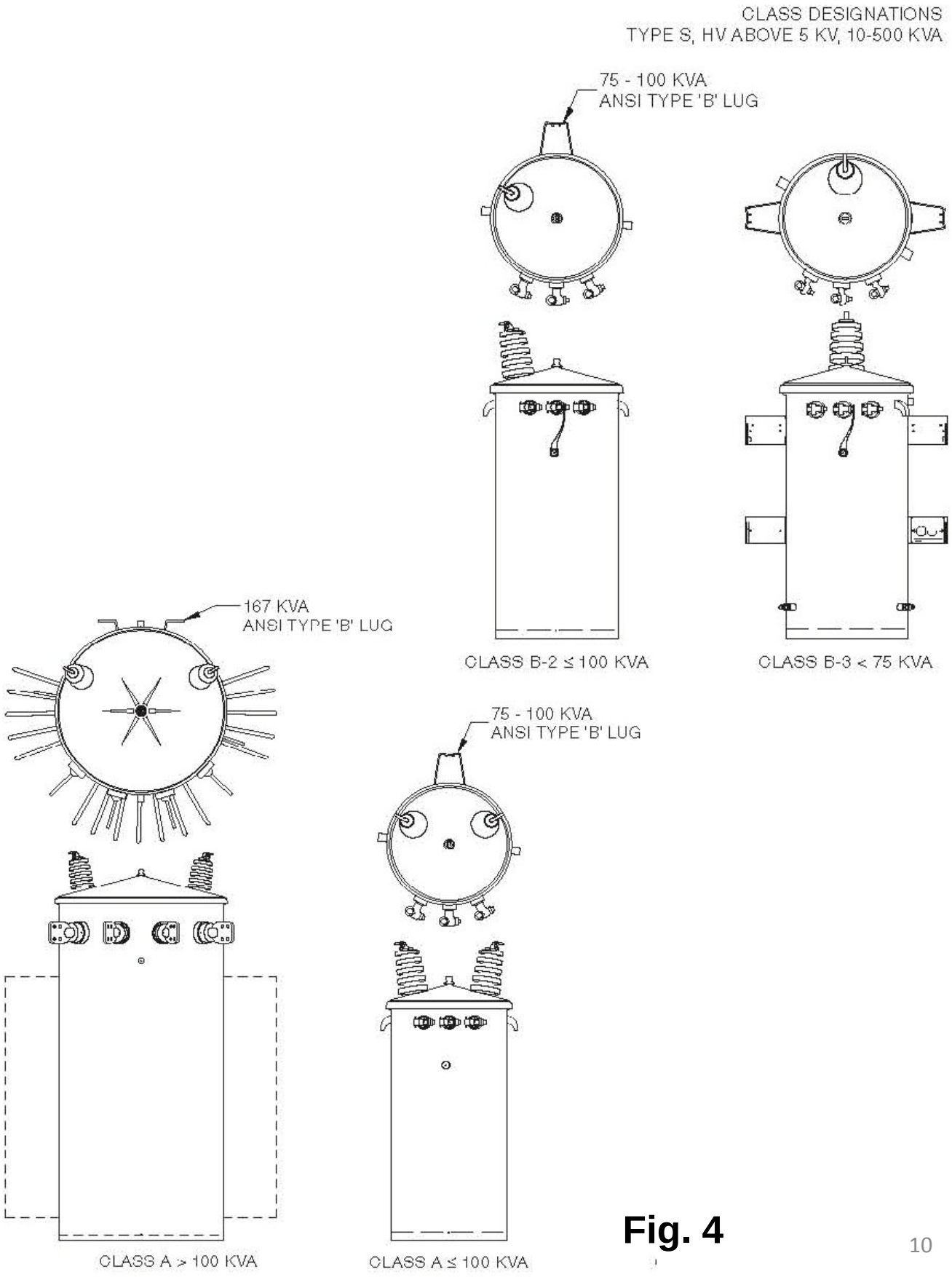


Fig. 4

Transformer accessories

Type	Class	# of Lightning Arresters	# of Link Fuse	# of LV Breaker	# of HV bushings	# of hanger brackets
S	A	0	0	0	2	1
S	B1	0	0	0	2	1
S	B2	0	0	0	1	1
S	B3	0	0	0	1	2
SP	A	2	0	0	2	1
SP	B1	1	0	0	2	1
SP	B2	1	0	0	1	1
SP	B3	1	0	0	1	2
CP	A	0	2	1	2	1
CP	B1	0	2	1	2	1
CP	B2	0	1	1	1	1
CP	B3	0	1	1	1	2
CSP	A	2	2	1	2	1
CSP	B1	1	2	1	2	1
CSP	B2	1	1	1	1	1
CSP	B3	1	1	1	1	2

Table 1

Standard Features for single phase transformers:

1. Lifting lugs-bracket.
2. Arrester mounting pads.
3. Cover-mounted high voltage porcelain bushing(s)
with eyebolt terminal (10-100 kVA) or spade terminal.
4. Low voltage insulators are available in fiberglass reinforced polyester material or porcelain (both eyebolt
and spade terminals).
5. Low voltage neutral grounding strap (furnished on
10-50 kVA single HV bushing units).
6. ANSI support lugs (hanger brackets).
7. Cover has 13 mils minimum of polyester coating providing15 kV dielectric insulation of tank ground parts from live parts and increased resistance to corrosion.
8. Self-venting and resealing cover assembly.
9. The core/coil bolt-in pads are 180° apart.
10. Embossed low voltage leads.
11. Oil filled plug with cover ground strap.
12. Tank ground pad.

Single phase Distribution Transformers, Type ‘S’

Design Dimensions and Weights

(All weights and dimensions are approximate.
Dimensions may change to meet the customer spec.)
Single Phase, 50 or 60 HZ.
Low Voltage 120/240 or 240/480 or 277
Standard Performance level. See **(Fig.5)** below

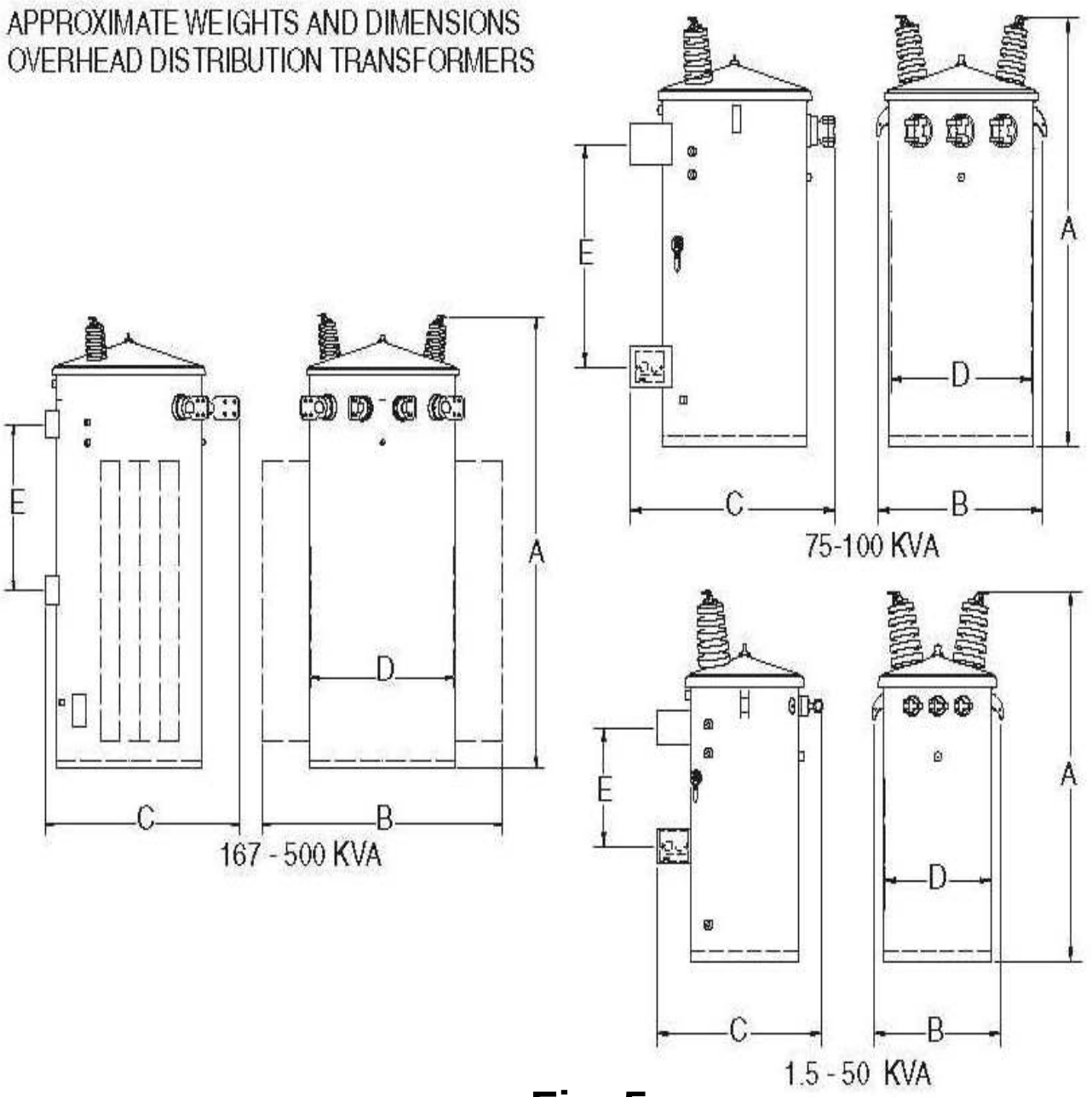
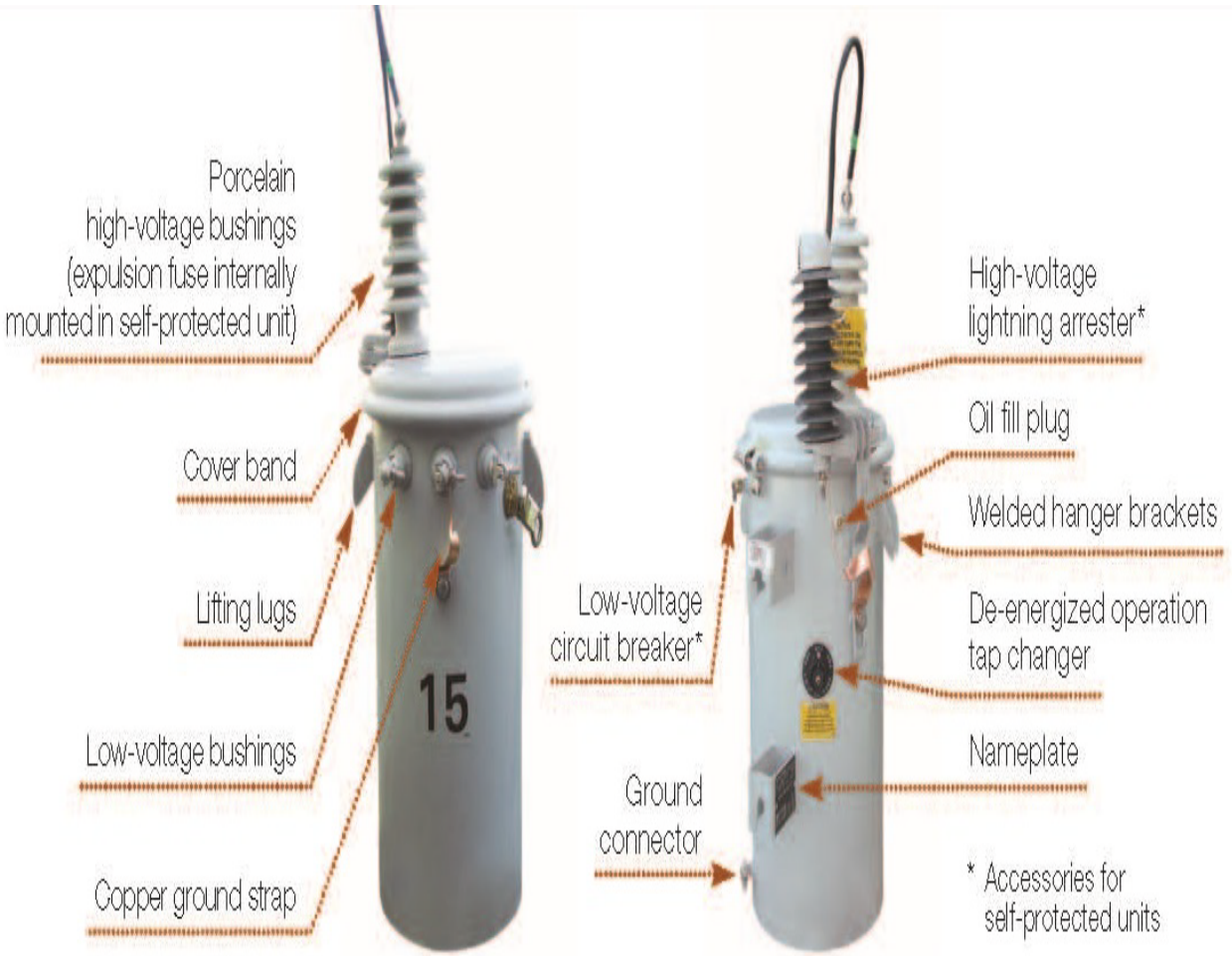


Fig. 5

Overall weights and dimensions are given in pounds, inches or gallons and are approximates
A = Overall Height, B = Overall Width, C = Overall Depth, D = Tank Diameter, E = Hanger Spacing

kVA	A	B	C	D	E	Wieght	Oil Qty
10	38	17	20	13.25	11.25	205	11
15	38	17	20	13.25	11.25	245	11
25	46	22	24	17.5	11.25	455	29
37.5	46	22	24	17.5	11.25	505	28
50	51	25	27	20	11.25	730	41
75	52	25	28	20	23.25	910	38
100	56	27	28	20	23.25	985	46
167	56	38	33	24	23.25	1,430	70
250	68	38	33	24	24	1,865	91
333	61	42	35	24	24	1,970	75
500	72	45	39	27	36	2,960	121

Table 2



Popular Configurations

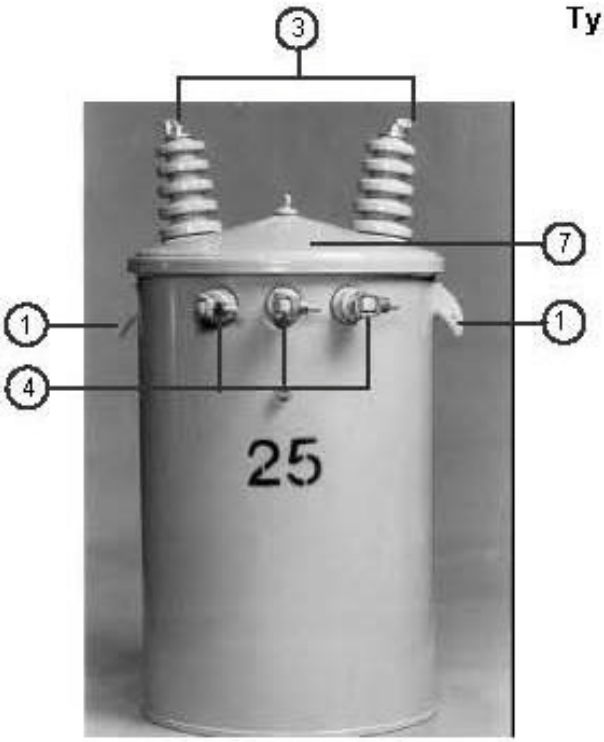
Double hanger bracket one high-voltage bushing conventional unit.

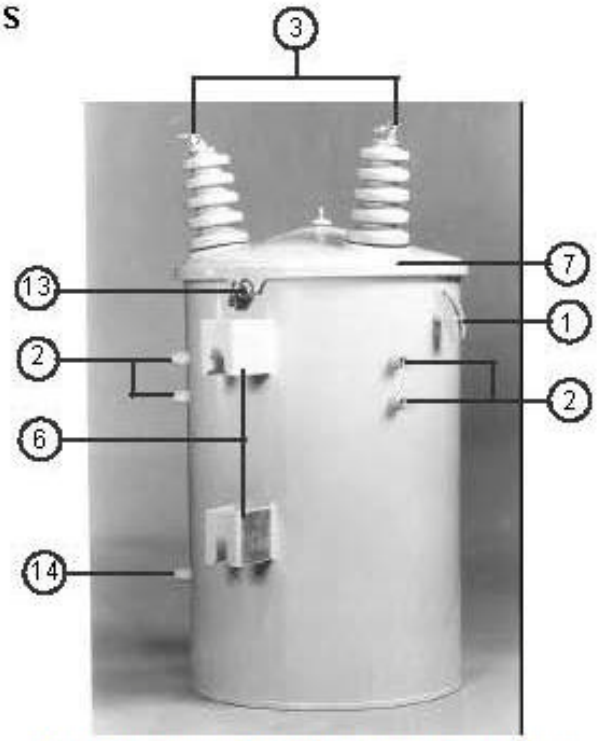
Single hanger bracket two high-voltage bushings conventional unit.

Single hanger bracket one high-voltage bushing self protected unit.

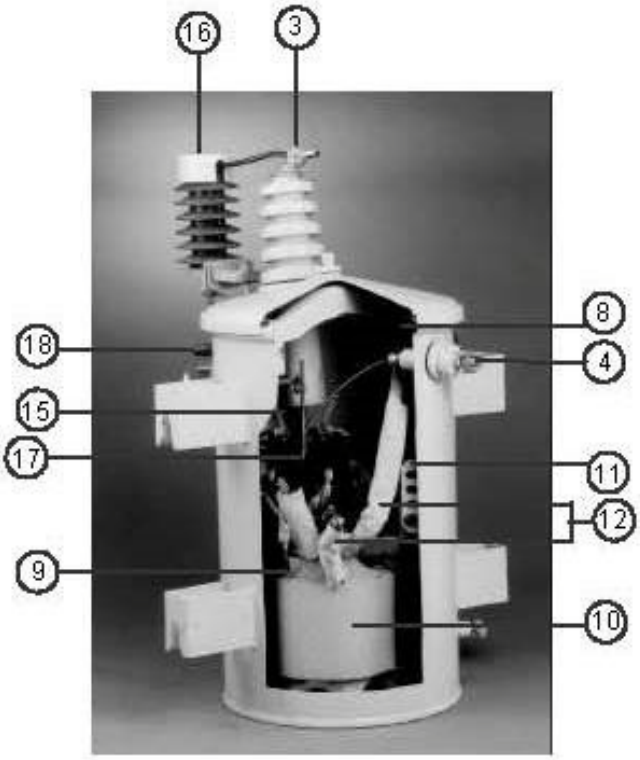
Single Phase pole mounted Distribution Transformers Standard features

Type S





Type CSP®



Single phase DT Standard Features

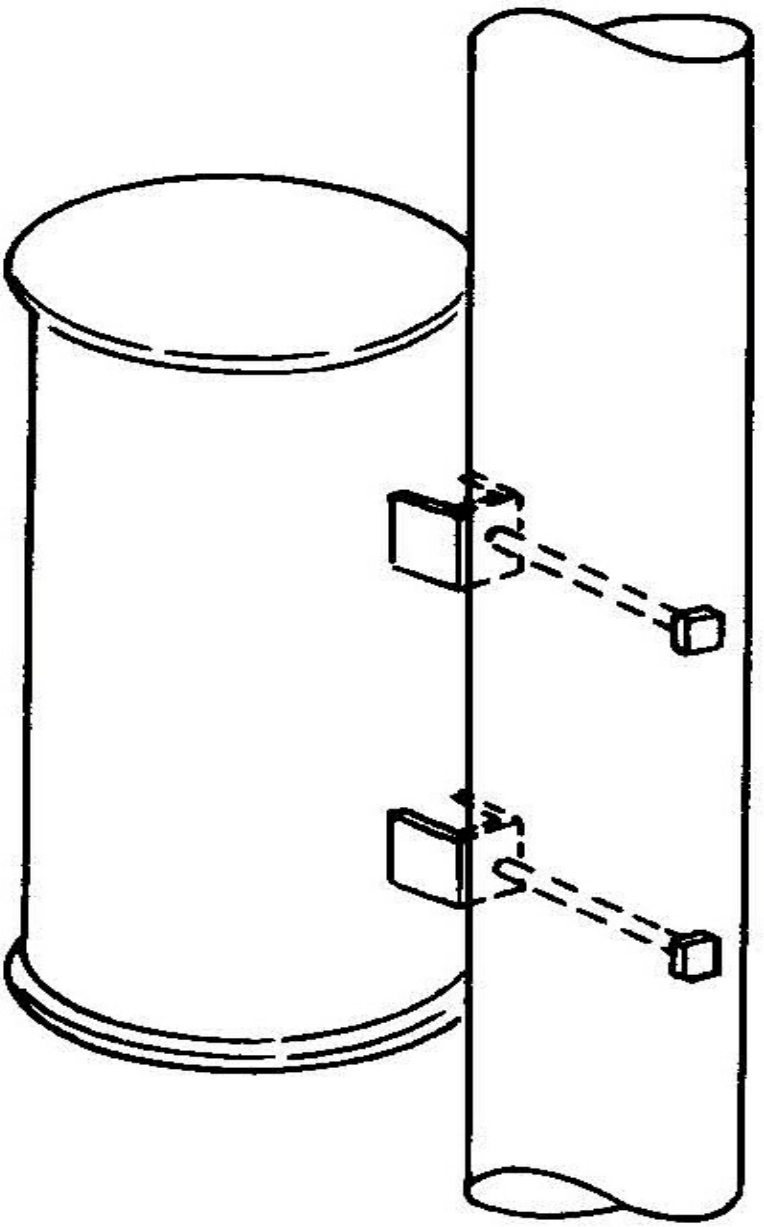
1. Lifting lugs
2. Arrester mounting pads
3. Cover-mounted high voltage porcelain bushing(s) with eyebolt terminal
4. Low voltage bushings with eyebolt terminals
5. Low voltage neutral grounding strap (Not Shown) (10-50 kVA Class B-2 and B-3 Only)
6. ANSI support lugs (hanger brackets) with laser inscribed nameplate on lower bracket
7. Polyester insulated cover
8. Self-venting and resealing cover assembly
9. Core
10. Coil
11. Centerline core/coil assembly support brackets
12. Low voltage leads
13. Oil fill plug with cover ground strap
14. Tank ground pad

The following additional features are all standard on self-protected Type CSP units only:

15. Primary protective link (mounted in high voltage bushing)
16. Surge arrester
17. Secondary circuit breaker
18. Secondary breaker operating handle with emergency overload reset and overload signal light

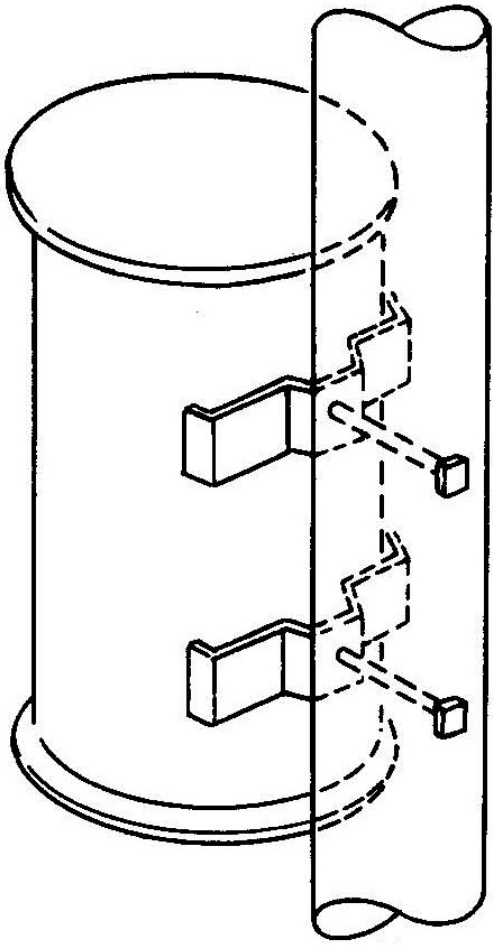
mounting brackets (hanger lugs)

Single phase pole mounted type transformers are provided with three different kinds of mounting brackets (hanger lugs), type A, B and C as required by ANSI Standard C57.12.20 for different kVA ratings. See **(Fig. 6, 7 & 8)**



Bracket type A

Fig. 6



Bracket type B

Fig. 7

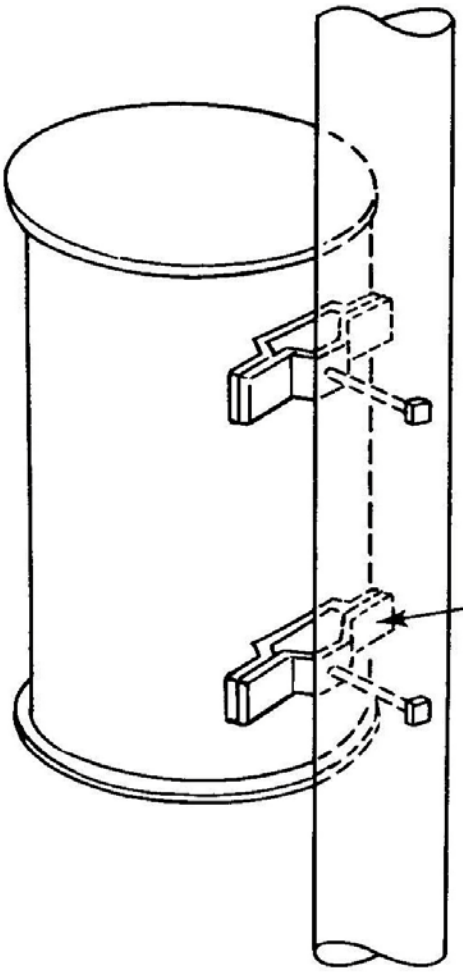


Fig. 8

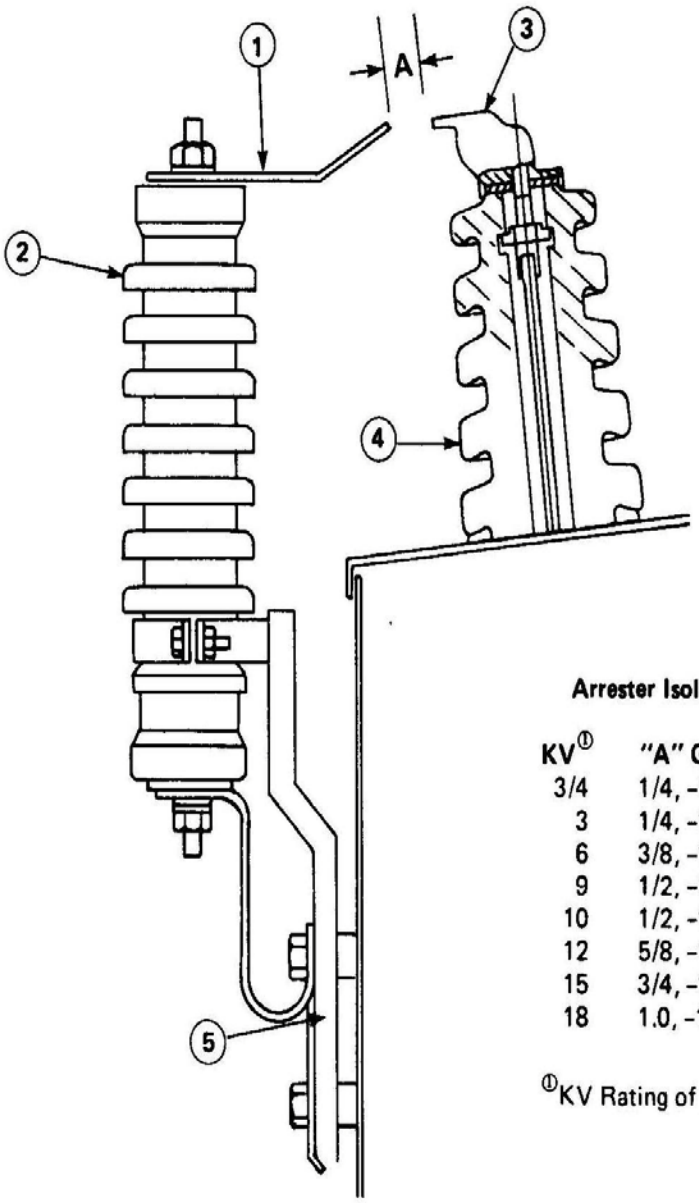
Bracket type C

Lightning Arresters

All transformers should be protected by surge arresters. Arresters should be as close to the transformer as practical. Some transformers are supplied with arresters mounted on them. Some arresters have their top directly connected to a high voltage bushing terminal and others have a gap between the arrester and bushing terminals. For proper gap spacing's **see (Fig. 9)**

The sum of the lengths of the line lead to the arrester and the ground lead from the arrester to the transformer ground should be less than 5 feet. The further an arrester is away from the transformer, the less protection it can give. Transformers with arresters mounted on them have the arresters grounded to the transformer tank. These connections must be tight when the transformer is installed. Ground connections from the tank or from separately mounted arresters should be completed before any connections from the high voltage line to the transformer is made. Transformers with low voltage ratings above 600 volts should have arresters installed on both the high voltage and low voltage side of the transformer. Whenever high potential or induced potential tests are made on transformers with arresters, the arrester must be disconnected during the tests. It there is a series gap between the arrester and the bushing, increase the gap setting considerably, remove one electrode of the series gap, or remove the arrester for testing. After the tests, the arresters must be replaced to their proper operating condition with a gap of the correct length.

Lightning Arresters and Gap Adjustments

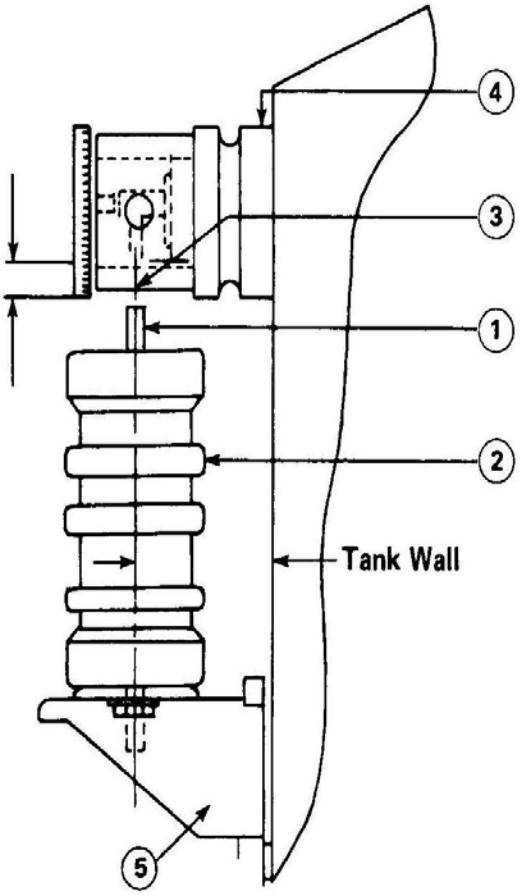


Cover Mounted Bushing and Arrester

Arrester Isolating Gap

KV①	"A" Gap Setting
3/4	1/4, -1/32 + 1/16
3	1/4, -1/32 + 1/16
6	3/8, -1/32 + 1/16
9	1/2, -1/16 + 1/16
10	1/2, -1/16 + 1/16
12	5/8, -1/16 + 1/16
15	3/4, -1/16 + 1/16
18	1.0, -1/16 + 1/16

①KV Rating of Arrester



Wall Mounted Bushing and Arrester

① Movable electrode
② Arrester
③ Fixed electrode
④ H.V bushing
⑤ Bracket with vertical adjustment

Fig. 9

Transformer Tap Changers (Fig. 10)

Tap changers are connected into the high voltage coil. The transformer output voltage can be increased or decreased by changing the tap changer setting.
The internal tap changer is operated by removing the transformer handhole cover, or transformer cover, and turning the tap changer handle to the position desired on the tap position indicator. The tap changer numbers on the position indicator are the same as ones on the transformer name plate. To change taps with the externally operated tap changer, loosen the locking screw in the handle, turn the handle to the tap position needed and tighten the locking screw.

Fig. 10

Transformer Dual Voltage Switch (Fig. 11)

Dual voltage switches permit the use of transformers on different primary voltage systems. They are externally operated with a handle on the outside of the tank. Voltage ratings are given at the switch handle and on the transformer nameplate. The switch handle is held in place by a locking screw. Back out the locking screw until it is clear from the locking hole, then rotate the handle. The locking screw should then be put into the locking hole for the new position and tightened.

Fig. 11

Construction of Single-Phase Core and Coil;

Single-phase transformers have one core and coil assembly fastened together in an end frame and housed in a round tank filled with oil. The coil usually has one high voltage coil in between two low voltage coils — the low-high-low design.
However, some coils have one high voltage and only one low voltage coil. **Fig. 12**.

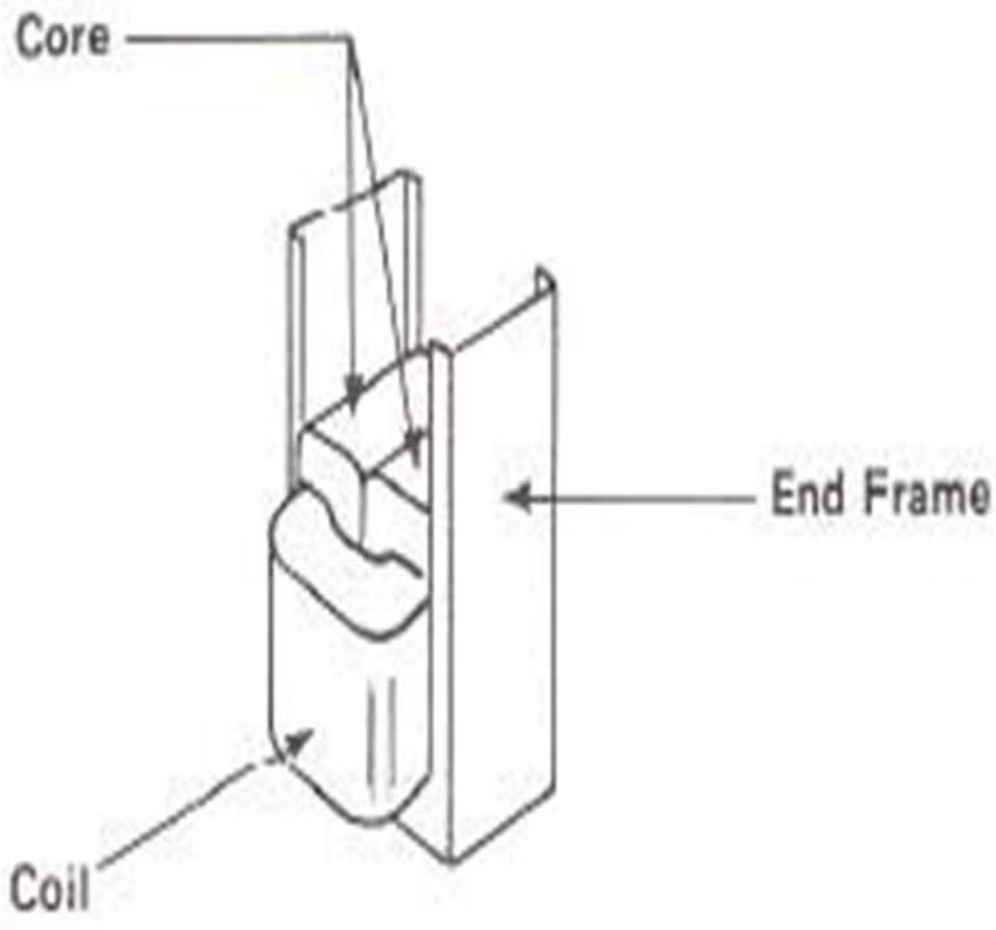


Fig. 12.

Current-Limiting Fuses for single phase transformers

High voltage current-limiting fuses are designed to limit the flow of current (and energy) to a low impedance fault. When properly applied, they prevent almost all violent failure of transformers. Like protective links, their purpose is to isolate the transformer from the distribution system in the event of an internal transformer fault. Current-limited fuses usually are applied when the system available fault current exceeds the interrupting capability of the protective link. Because partial range type current-limiting fuses are normally applied on overhead distribution transformers, a series protective link is applied with each current-limiting fuse. **(Fig. 13)** below

High Voltage Block Mounted Current Limiting Fuse in Series With Protective Link.

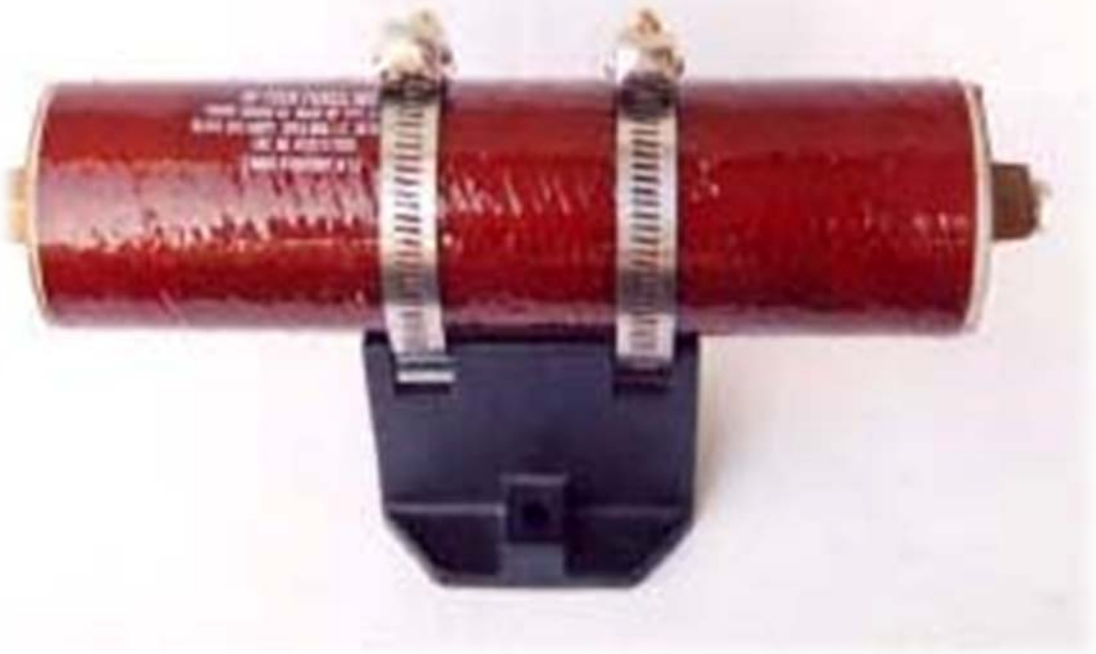


Fig. 13

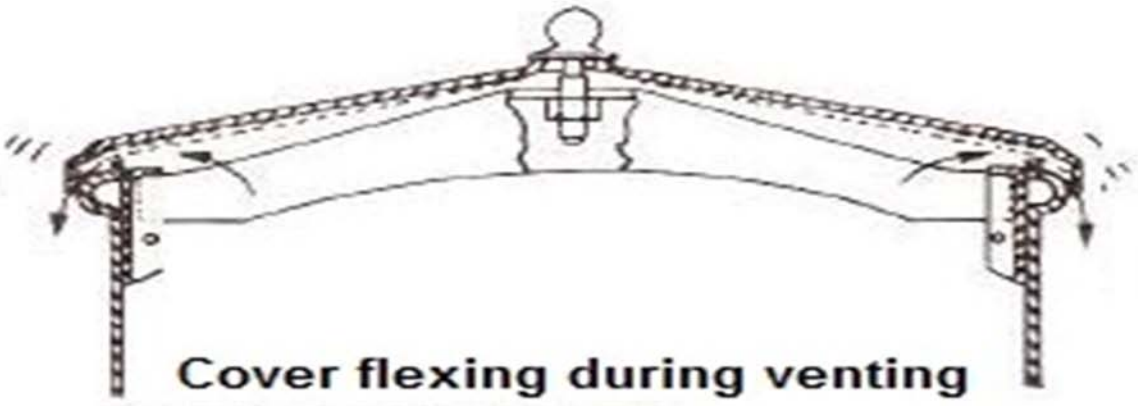
Overload signal light for single phase DT

Type CSP and CP transformers can be supplied with an overload signal light. When the signal light comes on it gives a warning that the transformer has experienced a heavy overload. The signal light remains lighted until reset by means of the breaker operating handle. It can be reset by operating the breaker handle to the maximum upward position and then back down to the closed position. If the breaker handle is operated to the reset position and then to the close position and the signal light remains on, the temperature of the transformer oil is still too hot to allow the signal light to turn off.

Tank Pressure Relief

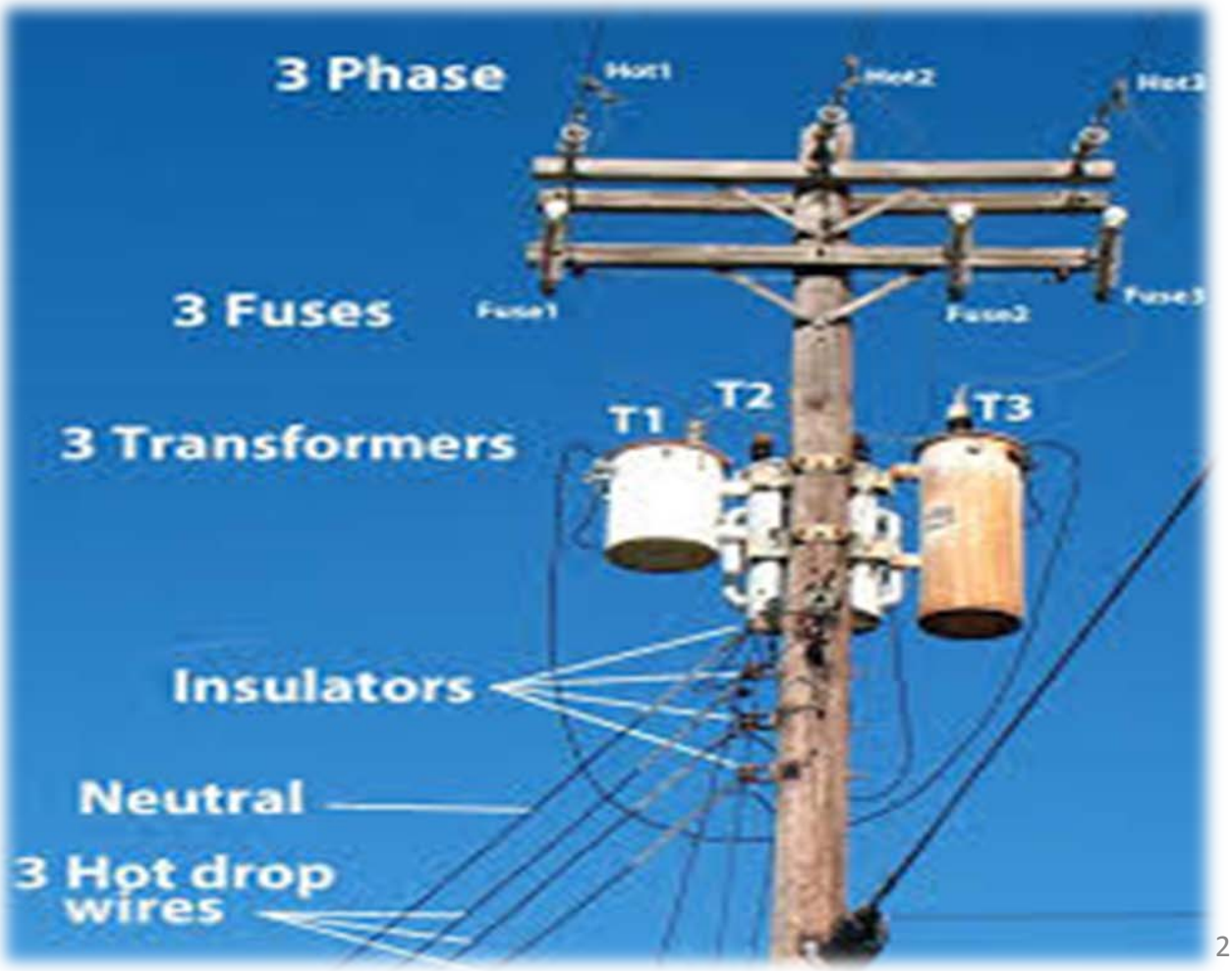
A unique feature of the transformer cover is its ability to flex and relieve pressure which can build up from some internal faults. Except in cases of extreme dynamic pressure build up, the cover automatically reseals itself. Whenever the cover needs to be removed, any internal static pressure is relieved automatically as the cover bolt is loosened. When the bolt is being loosened, the cover can vent but the bolt is still held by a nut in the cover beam. The cover bolt should be tightened to 350 in. lbs. (27 ft. lbs .)+10% to insure that the cover vents properly. If there is a handhole cover on the transformer cover, the handhole cover bolt should be tightened to 150 in. lbs. (13 ft. lbs.) + 10%. **(See Fig. 14)**

Normal cover position



Cover flexing during venting

Fig. 14 Self-Venting Cover


3 Phase
Hot1
Hot2
Hot3
3 Fuses
Fuse1
Fuse2
Fuse3
3 Transformers
T1
T2
T3
Insulators
Neutral
3 Hot drop wires


X3
X2
25


50
15


Distribution Transformers
Service lines

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Thank You.