# PRESENTATION TO AEDU March 2023
# SANS 780: Efficiency, and why is it important

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# SANS 780 DISTRIBUTION TRANSFORMERS

- SANS and SABS basically the same thing
- SANS working groups
- Worldwide move toward more efficient transformers
- European specifications are IEC
- SANS adopts the IEC and then modifies it for South African conditions
- A Utility can adopt SANS or IEC but needs to specify certain things like Ambient Temp, colour etc
- Need to make sure all manufacturers are meeting the correct specifications.

# SANS 780 GENERAL

- SANS 780-2009 was reviewed in 2019 and again in 2021 and is now SANS 780-2021
- SANS 780 is based on IEC  60076-1
- Efficiency guidelines based on UN U4e regulations

$$\eta = \frac{\text{output power}}{\text{input power}} = \frac{\text{output power}}{\text{output power} + \text{losses}}$$

U4E United for Efficiency

SABS South African Bureau of Standards

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# SANS 780 GENERAL (ctd)

- About 30% more expensive to manufacture SANS 780-2021 Tx
- Need to specify which spec you requires
- Need to check certification
- Need to check that manufacturer complies with tank stiffness, oil specs, paint thickness and type, impulse levels etc.

# TRANSFORMER TEST REPORTS

- Need to ask for manufacturers test reports because we do not have equipment locally to verify by testing
- It is easier to have all manufacturers manufacturing to the same SANS 780 Version than to capitalise the costs for comparison

**A.3.2** In general, the present value of the energy losses of the transformer over its expected lifetime should be added to the initial cost of the transformer in order to enable the purchaser to select the most cost-effective supplier.

# SANS 780 SPECIFIED LOSS RANGES

**Table 7 — Standard power ratings and standard component losses of dual-ratio transformers (other than auto-transformers)**

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| Rated no-load secondary voltage V | Rated power kVA | Component losses | | | |
| | | No-load loss W | | | Load loss W |
| | | Up to 12 | 24 | 36 | |
| 121 or 242, single phase | 5 | 40 | – | – | 160 |
| | 16 | 80 | 100 | – | 400 |
| | 25 | 110 | 140 | 160 | 530 |
| | 50 | 180 | 220 | 250 | 900 |

# SANS 780 SPECIFIED LOSSES (ctd)

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| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| Rated no-load secondary voltage V | Rated power kVA | Component losses | | | |
| | | No-load loss W | | | Load loss W |
| | | Up to 12 | 24 | 36 | |
| 420 or 550, three phase | 16 | 95 | 120 | – | 410 |
| | 25 | 120 | 150 | 170 | 570 |
| | 50 | 180 | 220 | 250 | 1 000 |
| | 100 | 300 | 360 | 400 | 1 700 |
| | 160 | 420 | 500 | 550 | 2 300 |
| | 200 | 520 | 600 | 650 | 2 700 |
| | 315 | 720 | 840 | 890 | 3 800 |
| | 500 | 1 100 | 1 180 | 1 230 | 5 400 |
| | 630 | 1 300 | 1 400 | 1 450 | 6 400 |
| | 800 | 1 600 | 1 650 | 1 700 | 8 000 |
| | 1 000 | 1 900 | 1 950 | 2 000 | 9 500 |
| | 1 250 | 2 250 | 2 300 | 2 350 | 11 000 |
| | 1 600 | 2 750 | 2 770 | 2 820 | 13 500 |
| | 2 000 | 3 250 | 3 250 | 3 300 | 16 000 |

# ARE LOWER LOSSES IMPORTANT?

| 50kVA Transformer | Losses (Kwh) | Losses (N$) | | |
|---|---|---|---|---|
| Old Spec Losses over 10 Yrs | 37 668 | 45 401,24 | | |
| Old Spec Losses over 20 Yrs | 75 336 | 90 802,48 | SAVING | |
| New Spec Losses over 10 Yrs | 28 908 | 34 842,81 | NAD 10 558,43 | over 10 years |
| New Spec Losses over 20 Yrs | 57 816 | 69 685,62 | NAD 21 116,86 | over 20 years |

| NAMPOWER TARIFF (N$/kWh) | 1,2053 |
|---|---|

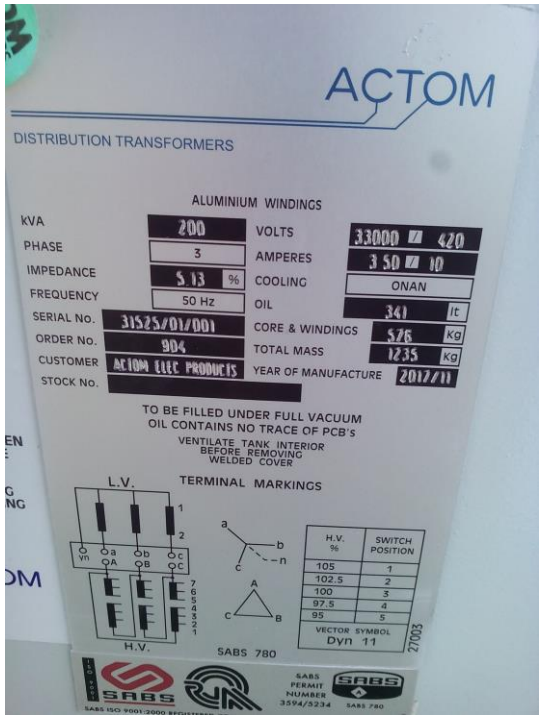
# 7: RATING PLATES:

## 7.1 Information to be given in all cases

The requirements of SANS 60076-1 apply with the following additions:

a) the month of manufacture; and

b) the applicable edition number of SANS 780.

# SCHEDULE A & B

**Part 1 — Preferred fittings**

| 1 | 2 | | 3 | 4 |
|---|---|---|---|---|
| **Subclause of SANS 780** | **Description** | | **Schedule A** | **Schedule B** |
| | Number of units required<br>a) firm<br>b) optional | | <br>.....<br>..... | <br>xxxxxxxxxx<br>xxxxxxxxxx |
| 4 | Nominal rating | | ..... | xxxxxxxxxx |
| | Rating of low-voltage neutral terminal, if other than as specified | kVA | ..... | xxxxxxxxxx |
| 4.5 | Primary voltage | V | ..... | xxxxxxxxxx |
| | Secondary voltage | V | ..... | xxxxxxxxxx |
| | Number of phases | | Single-phase<br>Three-phase | xxxxxxxxxx |
| 4.6 | Insulation level | | | |
| | a) medium-voltage<br>b) low-voltage | kV<br>kV | xxxxxxxxxx<br>xxxxxxxxxx | .....<br>..... |
| 5.2 | Tappings | | YES/NO | xxxxxxxxxx |
| 4.8 | Losses, if other than as specified<br>a) no-load losses<br>b) load losses | <br>W<br>W | <br>.....<br>..... | <br>.....<br>..... |

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# POLE MOUNTED TRANSFORMERS: CORRECT EARTHING PRACTICE

# ESKOM TRANSFORMER EARTHING PRACTICE

**pole-mounted units:**

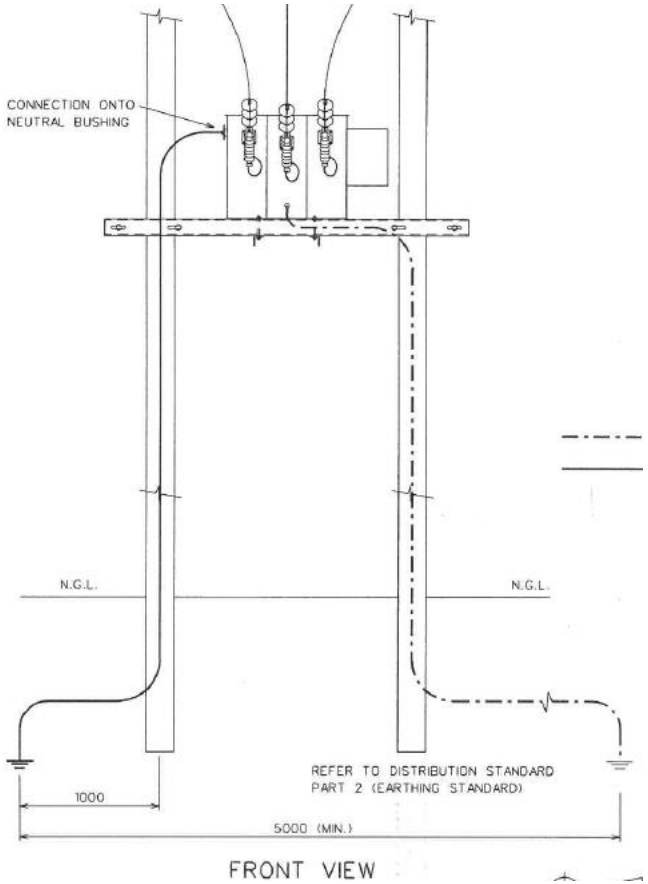
One earth terminal shall be located on the primary side of the tank. It shall be in the center of the tank, close to the bottom. One earth terminal shall be located on the secondary side of the transformer, between 250 mm and 300 mm below the neutral bushing. The design shall take into account that Eskom will mount a neutral surge arrester, on the secondary earth terminal, see Figure 15 (not applicable to SWER isolation transformers).

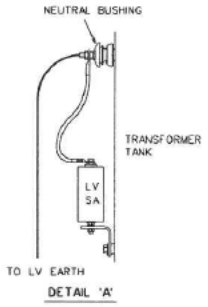
**Note:** According to the Eskom earthing philosophy, if the MV and LV earth electrodes are to be separated on site, the electrical bridge between the earthing terminal and the LV neutral bushing would then be removed as required, and the neutral surge-arrester would become effective.

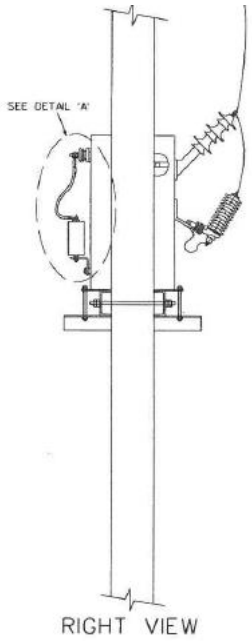
# SANS 780 Pole Mounted Transformer Earthing

- The transformer MV surge diverter earth shall be connected to the transformer tank earthing stud.
- The transformer tank earthing stud shall be connected to the MV three-point-star earth electrode arrangement with insulated copper earth lead (size dependent on short circuit ratings – 70mm² minimum)
- The transformer LV neutral shall be bonded to the transformer tank earthing stud (MV earth) via a metal oxide valve (MOV) surge diverter to protect the transformer.
- The transformer LV phase surge diverter earths shall be connected to the transformer neutral bushing.
- The transformer neutral bushing shall be connected to the LV three-point-star earth electrode arrangement with 70mm² insulated copper earth lead. This may be directly from the transformer, or via the distribution kiosk/board earthing bar.
- Bare portions of transformer MV and LV earth electrode arrangements shall be separated by at least 5000mm, so that the LV earth is outside the resistance area of the MV earth.
- The transformer MV earth electrode arrangement and bare parts of consumer's ECC shall be separated by at least 5000mm, so that the ECC is outside the resistance area of the MV earth.

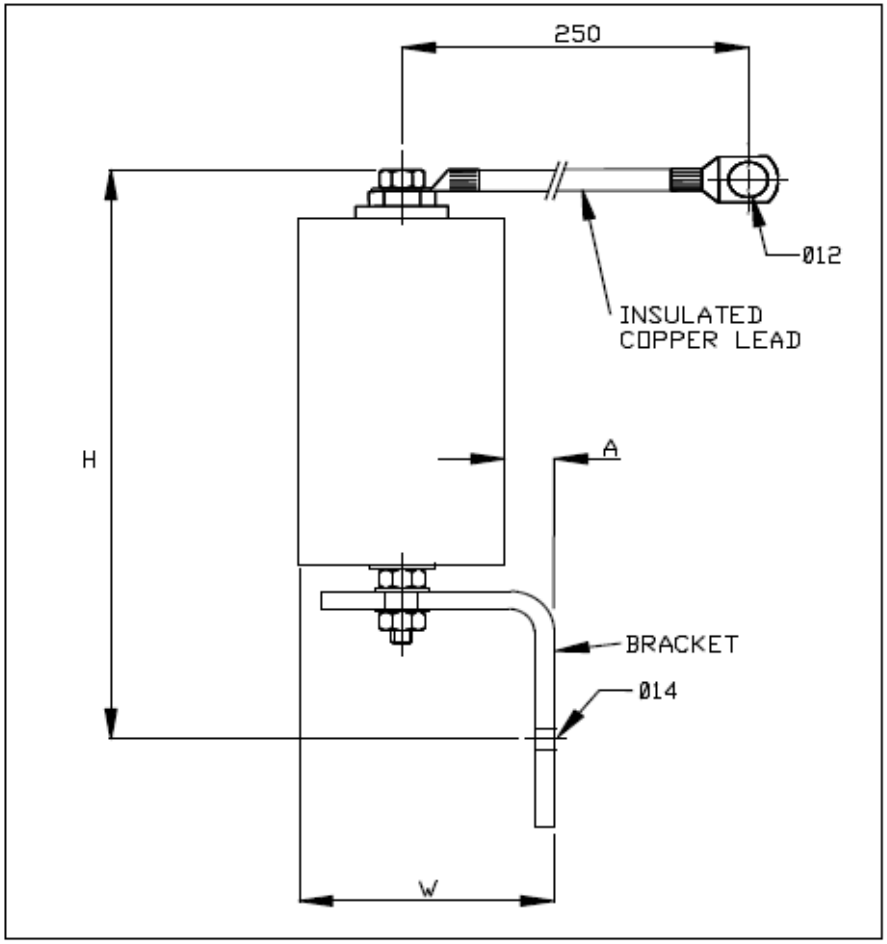
# ESKOM TRANSFORMER EARTHING PRACTICE



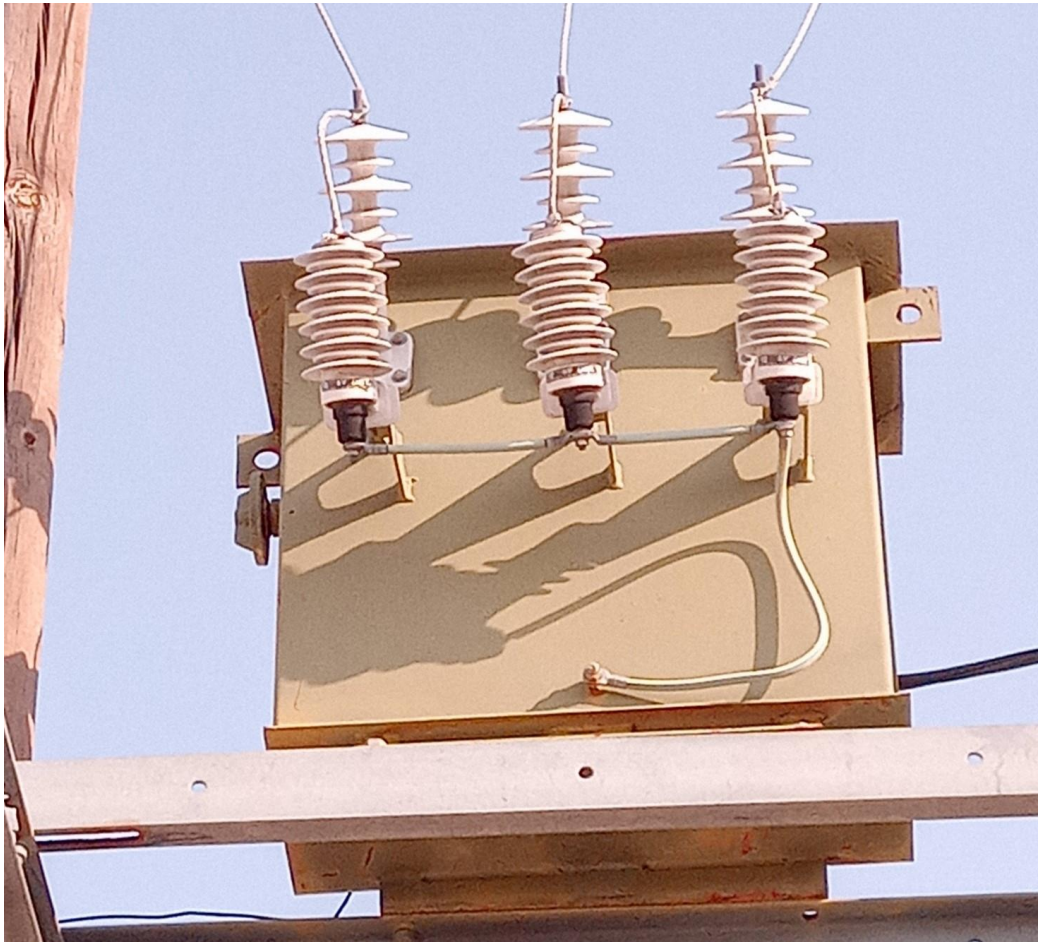



# SANS 780 LV SURGE DIVERTER



# HOW IT LOOKS IN PRACTICE (HV Side)



# HOW IT LOOKS IN PRACTICE (LV Side)

# ESKOM TRANFORMER SURGE PROTECTION

- ESKOM INSTALLS TWO SURGE ARRESTERS PER PHASE ON EACH TRANSFORMER
- SHORTLY ACTOM WILL HAVE A SOLUTION WITH A BRACKET TO TAKE TWO SURGE ARRESTERS PER PHASE
- THERE IS AN EVEN BETTER OPTION AVAILABLE

  A STATION CLASS (CLASS 2) SURGE ARRESTER

# PROPOSAL

ACTOM COULD POSSIBLY SUPPLY YOU WITH STATION CLASS SURGE ARRESTERS AT A PRICE SIMILAR TO WHAT YOU ARE PAYING FOR CLASS 1 SURGE ARRESTERS AT PRESENT.

OR

PROVIDE YOU WITH A DOUBLE BRACKET FOR TWO SURGE ARRESTERS PER PHASE

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