WORKING KNOWLEDGE BY TERRY MACKENZIE HOY

TRANSFORMERS ... NOT AS SIMPLE AS THEY SEEM

THIS MONTH, I thought I would share some knowledge about transformers as may be found in electrical installations (as against audio and electronic). There are three broad categories of transformers: power distribution transformers, voltage transformers and current transformers. We'll leave out large power system transformers since they fall under Eskom and municipalities.

Power transformers are made to SANS specification SANS 60076- 1:2011 Power transformers – Part 1: General.

The standard sizes are 200 kVA, 315 kVA, 500 kVA, 630 kVA, 800 kVA, 1 000 kVA, 1 250 kVA, 1 600 kVA, 2 000 kVA and 3 150 kVA. Naturally bigger sizes exist.

Most distribution transformers have a primary voltage rating of 6 600 V, 11 000 V, 22 000 V or 33 000 V, three-phase. In Cape Town, the most common rating is 11 500 V but not in the rest of the country. For years, the secondary voltage was 400 V three-phase, but more recently it's 420 V, which gives an unloaded single-phase voltage of 242 V. This is because municipalities and Eskom guarantee a terminal point voltage at the consumer of 220/240 V so the 420 V rating allows more volt drop in supply cables. There is a diversity of variations in power distribution construction.

Bushings: The bushings can be open or enclosed in a terminal box. If open, it is fairly simple to disconnect and replace the transformer but open bushings are a hazard and may be affected by debris and weather. Let me hasten to add that this occurs very occasionally and if you fence in the transformer, it is more or less safe from human contact. Enclosed bushings require specialised terminations, which make disconnection and replacement difficult, but the transformer need not be fenced in and can be in the same substation as the switchgear.

Skids or wheels: Transformers can be mounted on skids or wheels, depending on how portable you want them to be. Skids are most common.

Bolted or welded casing: The top plate of the transformer can be bolted with an intermediate gasket, or welded. The bolted version allows for removal of the transformer core, which is hardly ever required.

With or without conservator: Power transformers are generally oil-insulated, where the transformer windings are in a tank filled with transformer oil (you get 'dry' transformers, which have epoxy resin insulation). The tank can be kept topped up by an oil filled tank, called a conservator. If so, there is a special relay which detects if the tank is dry or if there is a short circuit in the transformer. This relay is a 'Bucholz' relay and is wired to give an alarm if the oil level is low and trip if there is a short circuit. Alternatively, the transformer can be sealed with no conservator or Bucholz. This is common in sizes of 630 kVA and below.

Generally, a winding temperature alarm and trip relay are incorporated to detect over-temperature.

Almost without exception, the primary winding (the high voltage winding) is connected in delta and the secondary winding in star. The resulting phase angle difference gives the transformer 'vector group'. Don't worry if you don't get this; all you have to know is that you can't run two transformers of different vector groups in parallel. A typical vector group is Dyn11. You shouldn't run transformers in parallel anyway.

Most transformers have an 'off load' tap changer, which means you can increase or decrease the secondary voltage by altering the high voltage tap. 'Off load' means do this with the transformer switch off., i.e no load current flowing at all. Otherwise, you will blow yourself up. Don't try!

The tapping is a bit confusing. Setting the tap to 105% will decrease the secondary voltage by 5%, not increase it. Check the name plate.

You will also see on the name plate a figure, '% impedance'. This is the secondary volt drop, no load to full load. So, if a transformer produces 420 V at no load, with a 6% impedance it will produce 420/1.06 V = 396 at full load.

There it is. Quite simple, but not as simple as it seems...

MARIO MAIO WINS STANDARD BANK SAPCC ENTREPRENEUR AWARD 2017

Owner and managing director of ACDC Dynamics, Mario Maio, has won the 2017 Standard Bank, SAPCC (South African Portuguese Chamber of Commerce) outstanding professional/entrepreneur award.

As a proud member of the South African Portuguese community, the award means a great deal to Mario, who always does his best to grow his own business and to advance the cause of the South African Portuguese community in any way he can. The award is a deserved reflection of his hard work and of just how much he has managed to achieve.