Introduction of Products

6,000 kVA OIL-IMMERSED SELF-COOLED LOW NOISE LEVEL SEALED TRANSFORMERS WITH LOAD RATIO CONTROL

There is a rapidly increasing demand for transformers with load ratio control in connection with service improvement of power distribution system of late. Such popularity for this type of transformers may be explained by their low costs of both installation and operation and their high reliability. The Company has been in this field for many years producing a large number of transformers and winning a high reputation for their unique features. Herein a 6,000 kVA Oil-immersed, self-cooled, low noise level, sealed transformer is introduced. It has been lately delivered to the Tokyo Electric Power Company. Intended for installation at unit substations, Kamikitazawa, Ikegami, and Fukuromachi in Tokyo, this type is particularly designed fitting for transportation as completely assembled. Fig. 1 shows one now operating at Ikegami Substation.

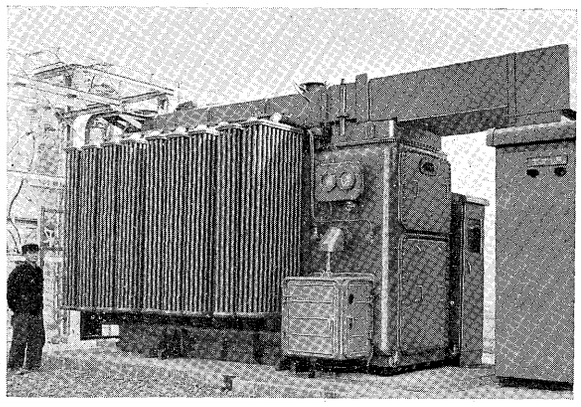

Fig. 1. 6,000 kVA oil-immersed self-cooled sealed transformer with load ratio control

Specifications are as follows:

Three phase; 6,000 kVA 50∿
Oil-Immersed Self-Cooled Nitrogen Sealed Type for Outdoor use, Core Type
Primary; 23.3–23.0–22.6–22.2–21.8–21.4–210–20.6–R20.2–19.8–19.4–19.0–18.6–18.2–17.8–17.4–17.1 kV
Delta connection 171.5 A

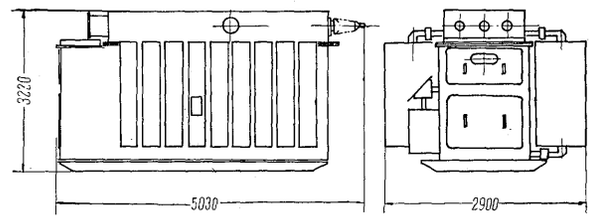

Fig. 2. Dimension of the transformer in Fig. 1.

Secondary; 3.45 kV Delta connection 1,005 A
Over-all weight; 33,000 kg Oil capacity; 9,300 *l*
Noise level; 53.5 phon (by sound level meter owned by Tokyo Electric Power)
Specified level; 58 phon

As seen from these specifications, primary voltage 20,200 V is stepped down to secondary voltage 3,450 V; at the same time it is so arranged that secondary voltage is maintained constant at 3,450 V even when primary voltage varies ±15% of rated one and the load changes 0∼100% (power factor 80%). Since the voltage between taps is 400 V on the primary side, voltage fluctuation at the time of tap-changing is practically negligible and continuous adjustment is thus available.

This transformer, originally intended for installation in the residential quarters within city limits, is required to have a specified noise level of 58 phon and a target value of 55 phon. On the basis of testing and study results made over a long period, it has been built with a special sound-insulating construction, that is, double-walled tank and resilient pads inserted between tank aud inner body to provide perfectly elastic contact. As a result, the noise level as registered by the sound-level meter of Tokyo Electric Power Co. proved to be 53.5 phon, an expectedly low value; this is far below the NEMA standard value of 68 phon and well satisfies the specified level,

One of the major drawbacks to the transformers in general is that the oil deteriorates in contact with air, and its life is shortened thereby. The conven-

tional preventive means adopted by the Company has been the use of the Inert Air Type Conservator, OC– or FT–Type. A far more effective method will be to use a construction with sealed-in nitrogen; in that case, however, meticulous care should be taken not to allow nitrogen leakage at gasket joints. So, in the nitrogen sealed type transformer, use of packings is limited to unavoidable places only and joints are made mostly by welding, followed by a strict air-tightness test on them to prove the perfectness of weld.

A second point calling for special attention with this type of transformer is that the oil expands or contracts with temperature variation and the dielectric strength of the insulating oil depends in a large measure upon the pressure distribution of the nitrogen in solution and above the oil, the pressure of which fluctuates with the change of oil volume mentioned. Accordingly, the range of pressure variation of the sealed nitrogen must be selected with extreme caution. It is assured that the transformer of the Company's production is given due consideration in this respect. On the other hand, the tank is subjected to repeated load application on account of this kind of pressure change. Therefore, the tank should have a construction mechanically sturdy enough to withstand this load; the transformer is then built with due consideration on this point.

Main windings are cylindrical layer ones and tap layer windings are divided into two parts, i.e., rough and fine; the fine one is cylindrical tap layer winding, whose axial mechanical force becomes infinitesimal in time of short-circuit at the lowest tap and whose abnormal voltage between taps on the arrival of impulse voltage wave is also extremely small.

For tap changing, a Jansen type under-load tap-changing switch unique product of the Company is employed, assuring rapid and reliable operation; the change-over time is 0.04 sec, which is made possible by using a strong spring and taking advantage of the dead point of its link motion. Also by this, any possibility of the movable contacts coming to a neutral state in the middle of changing is avoided. This switch is normally electrically operated by an apparatus attached to the transformer, but it can be converted to manual operation by the change-over. No matter which system of operation is resorted to, electrical or manual, the mentioned feature of the change-over switch, dependent on the spring, is fully ensured. Moreover, as this switch is placed in a separate room entirely isolated from the main body, there is no fear of the pure oil in the main body being mixed with the contaminated oil by the arc generated at tap changing; this room is provided with a window through which the contamination of oil can be watched all the time.

The mechanism of the nitrogen sealed type transformer does not permit effective use of a Buchholz Protecting Device against internal accidents, so that in this transformer the bursting tube is fitted with trip contacts against emergencies. When the buffer plate is broken by some internal accident, the contacts attached to the plate quickly work tripping the power source and cutting off the transformer; thus the accident can be prevented from spreading.

(Transformer Dev. Eng'g. Dept. by S. Kunieda)

CORELATION BETWEEN GASES GENERATED IN BUCHHOLZ RELAYS AND TRANSFORMER FAILURE

By

Michihiko Yamaoka

(2nd Div., Material Reserch Laboratory)

I. INTRODUCTION

Seeing that various kinds of gases always generate by the decomposition of insulation oil or other insulating materials whenever oil immersed transformers fail by short-circuit or discharge occurred in them. Max Buchholz conceived an idea that if the generated gases were detected at the very beginning of troubles and alarms were given automatically, necessary steps would be taken before it became too late. The device thus invented is termed a Buchholz relay which is extensively applied to transformers for detection of troubles.

However, constant watch of the Buchholz relay often reveals that it will not operate only by a simple electrical action. It is considered necessary to make study of the cause of gas generation as well as the analysis of gases accumulated in the relay by building a model transformer. Brief account of this study with respect to oil immersed given herein.