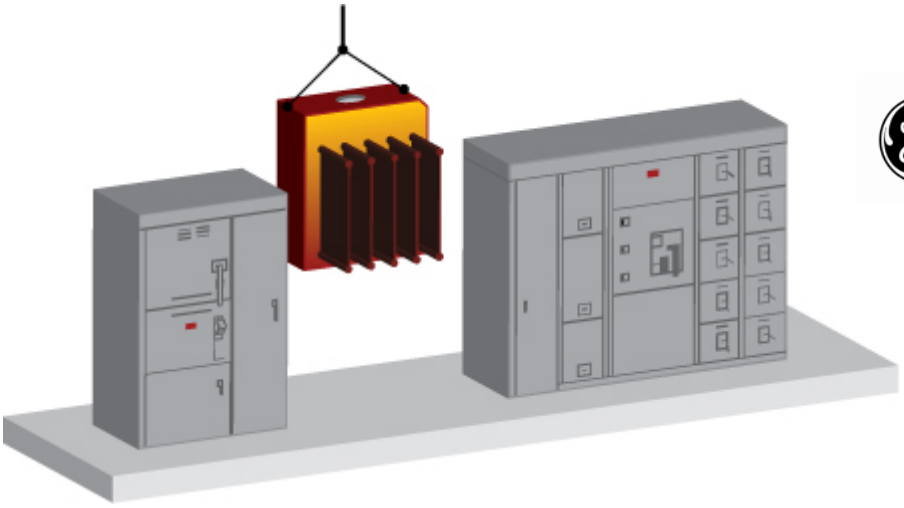
Replacing Secondary Electrical Substation Transformers

Exclusively Licensed Provider of Genuine GE Renewal Parts



Partner
Industrial

Why be concerned?

Electrical Engineers and Transformer Specialist within the industry agree that the base of electrical substation transformers installed in the 1950's, 1960's, 1970's and early 1980's are now at risk of failure due to reaching the later stages of the transformer's designed life. These type transformers include liquid filled, dry type and gas filled designs. The capacity ranges from 500kVA through 3000kVA having a primary side of 15KV and a load side of 480V or 208V. Normally, these transformers are part of a substation line-up that includes a primary interrupter switch and a load side breaker package.

The major transformer manufacturers during that era routinely performed accelerated life cycle tests to determine how the electrical design and the insulation material reacted over time. Included in these tests were periodic Gas-in-Oil samples, tests and analysis. This program was performed in harmony with ANSI and NEMA Standards to project acceptable levels of gases over time. As a result of the repeated testing and analysis of accumulated data, these transformer manufacturers concluded that the designed life expectancy would range from a 30-40 year period. At some point in this time frame the weakest area of the design, the paper insulation system would begin to lose its insulating integrity. The paper became hard and brittle due to continuous exposure to heat from transformer. Also, the smallest amount of moisture retained in the insulation contributed to the deterioration process of the paper. These two factors combined, disregarding overloading periods, became somewhat predictable as to life expectancy of these size transformers.

Of course, customers and manufacturers thought, as it was, this critical time period was long, long away. The industrial and commercial users now have transformers at high risk of failing. Reliable experts estimate that the Secondary Substation size transformer base that now powers U.S. industry and institutions ranges from 110,000 transformers to 160,000 transformers. One company, GE, provided over 70,000 of these size transformers prior to ceasing operations in the U.S. The bulk of these units were installed in 1950's, 1960's, 1970's and 1980's.

As alarming as this situation is, it is imperative that industries throughout the U.S. review their installed base to identify their transformers at risk. The cost for not doing this will result in lost production and service from the transformer. This cost will be much greater than cost of a replacement transformer. Normal cycle time from requesting a quotation, placing an order and shipment of a replacement transformer is approximately 20 weeks. Lost production and service of a transformer will be insignificant to the incurred financial losses for a 20-week period.

General Assessment of Installed Transformer Base

Liquid Filled Transformers - Routine Preventative Maintenance:

1. Routinely perform a Dissolved Gas-in-Oil test by collecting samples from each transformer and secure certified tests results of each sample.

2. Over time plot the results so a "tendency profile" can be developed for each.

3. The critical gases to watch are as follows:

    a. Rise of Hydrogen (H2) and Acetylene (C2H2). Elevation of these gases could provide early indication of "arcing" within the transformer. These are "combustible gases" and if they are rising, quick intervention must occur.

    b. Aging liquid filled transformers will, at some point, produce increased levels of Carbon Monoxide (CO) and Carbon Dioxide (CO2). As the insulation deteriorates due to heat and time in service, the insulation's integrity is decreased putting transformer at risk of failure. Owner should not delay replacing the transformer as levels get closer to the total limit, 33,000 ppm. Exceeding this limit will definitely put unit in position to fail.

    c. In concert with (a.) and (b.), above, routine maintenance should include recording "load" and "oil and/ or winding temperature" readings. If the "oil and/or winding temperature" begin to increase, immediate attention should be given to the possible cause.

    d. Less critical gases, important nonetheless, are Methane (CH4), Ethane (C2H6) and Ethylene (C2H4) that generally reflect elevated heat levels due to electrical "Hot Spots". Immediate attention must be given to the possible cause.

Dry Type / Cast Coil Transformers – Routine Preventative Maintenance:

1. These transformers are "open to air circulation for cooling" designs. They tend to collect dust and develop "cob webs" over time from a normal environment. These transformers must be routinely taken off-line and cleaned.

    Instruction Books for these type transformers include "cautions" with recommendations to perform this maintenance yearly.

2. As the contamination accumulates, "creep paths" develop from phase to phase and phase to ground. If these paths connect to each other, the unit will fail.

3. Another enemy includes moisture from the environment of location. The air should be controlled removing excess amounts of moisture. Dry Type transformers can, over time, absorb moisture into insulation thereby putting unit in harms way. This absorbed moisture deteriorates the insulation's integrity.

4. Routine maintenance should include record of "winding temperature" vs. load. This provides data so the owner can develop "tendency profiles".

5. Routine Maintenance and analysis of recorded data will clearly show when transformer should be replaced.

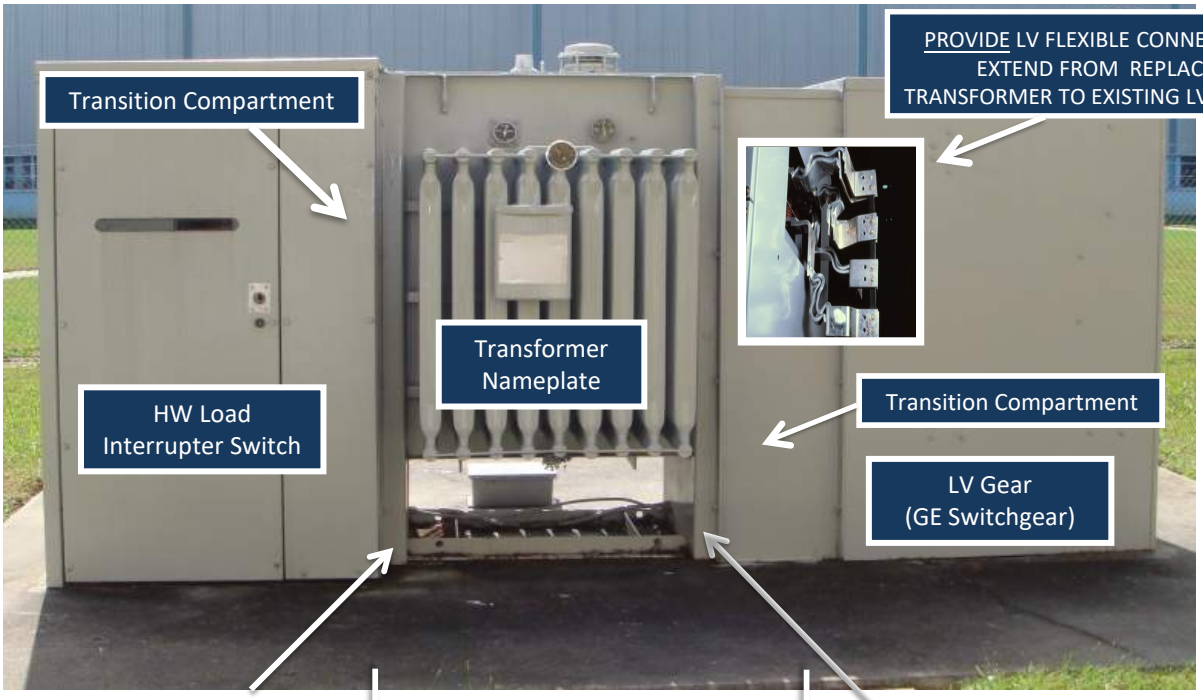
GE Rome, GA produced these Secondary Sub-station Transformers

Vaportran
Refrigerant – R113

Liquid Filled
Mineral Oil, *Silicone,*
Pyranol (PCB)

Dry Type (Air Cooled)
Traditional Dry Type Cast Coil
Dry Type – Sealed Gas

Outdoor Liquid Filled Sub-station Transformer

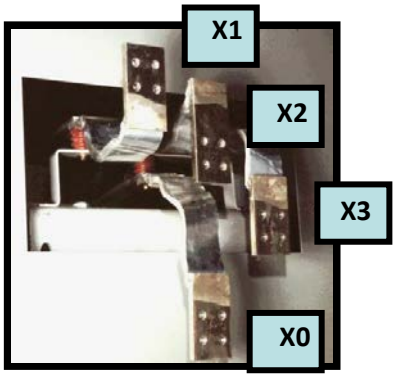


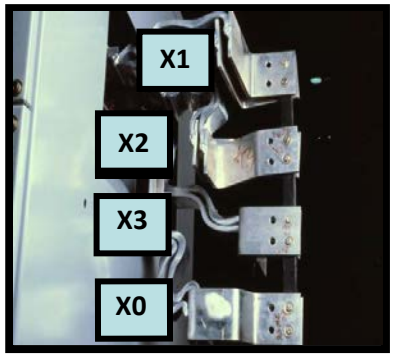
MATCH HV Flange Configuration & Interface Hole Pattern

MATCH the *Critical* Dimension HV Flange to LV Flange Interfaces

MATCH LV Flange Configuration & Interface Hole Pattern

Termination Points on Existing LV Equipment





The Critical and Costly LV Flexible Connectors should be included with any replacement transformer

The OEM Retrofit Solution

Without a comprehensive transformer replacement program by the owners, replacement needs become reactionary where the transformer develops problems requiring it to be replaced. Since time is of the essence, a compressed plan and change-out schedule must be developed for a replacement. If the transformer is located outdoor, the change-out is less complicated than if transformer is located inside a facility.

Regardless, the optimum situation for the owner is to acquire an electrical duplicate that meets their application as the original transformer did. Also, acquiring a "Retrofit" replacement design simplifies the installation process and significantly reduces overall project costs.

Purchasing just an electrical duplicate having similar dimensions, as the original transformer, is not the ideal solution having the least cost. Modifying this replacement transformer on site to fit requires additional sheet metal fabrication. More importantly, on site designing and making the electrical connections from the replacement to existing HV and LV termination points increases installation cost significantly. This is certainly the case where the replacement transformer does not include the LV Flexible Connectors that extend from LV Bushings or LV Bars to the existing LV equipment termination points. This hidden, additional, cost can add $20,000 to $30,000 more to project cost delaying installation.

As transformer replacement needs arise, we strongly suggest that owners contact the original manufacturer for a replacement rather than look to the used or surplus transformer suppliers. It is extremely critical to the operation and service of a replacement that the unit is an electrical duplicate with the physical design that matches and will mate with the existing HV and LV equipment.

NOT ALL TRANSFORMERS ARE THE SAME EVEN THOUGH THEY MAY HAVE THE SAME ELECTRICAL INFORMATION ON TRANSFORMER NAMEPLATES.*

**Rome Replacement Unit, RRU, business was established at the old GE Rome facility to address customer needs for a true GE Rome transformer "retrofit'/replacement transformer that physically fits and accurately connects to existing equipment on site.*

Why in Rome, GA? All original GE Rome transformer Intellectual Properties and documentation for each transformer's original design is maintained, in tact, at this facility. Access to this information and documentation allows a replacement to be pre-engineered from the original design including customer's original special requirements with consideration for the intended transformer application.

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