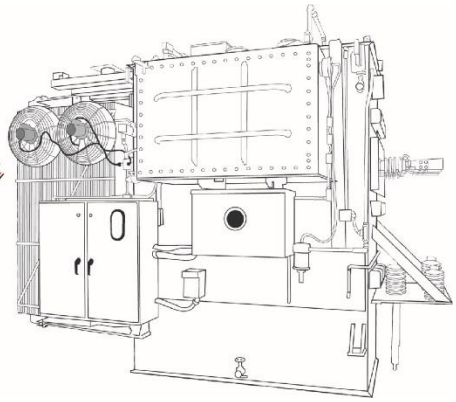
VIRGINIA - GEORGIA TRANSFORMER
ONE SOURCE–ONE COMMITMENT

Legacy of Excellence in Power Transformers



CEO, PRABHAT K. JAIN Communication #3, 10/19/2019

RELIABILITY – A 60 YEAR TRANSFORMER

I covered Robust Engineering & Flawless Execution in my previous communications. But you may ask what is the value of these to our customers? "The" value is Reliability! A transformer that will live for 60 years. Let me explain our vision, strategy, requirements & guiding principles towards achieving this goal.

Our Vision: *To build a perfect power transformer for reliable 60-year service, fulfilling our commitments to the customer, our employees, our communities and stockholders through process improvement and business growth, as a proud American Manufacturer "powering business growth".*

Our Strategy: *To create a culture of customer commitment; continuous training and employee development; expanding into growth adjacencies driven by INNOVATION; deploying our "Digital Strategy"; continuous process improvement; maintaining a safe and productive workplace for our employees*.

Our Requirements for Success: *robust engineering, process design, flawless execution; design optimization; lean approaches and production automation; meet Customer Expectation; technological advancements; strategic planning to serve changing market place; On-Time performance; employee selection and retention; employee training and development*.

Our Guiding Principles: *Pride in our legacy; passion for our mission; RCDE, WMJ /TDL; ownership of our team; rewards and recognition for retention; adapt to new generation; ownership of plan to meet objectives - plan and re-plan.*

Let me divulge some **secrets of achieving long life**:

Pristine insulation to preserve dielectric strength and safety factor.
Dry ness of insulation and oil to produce lower *Partial Discharge (PD), and lower the **moisture content in the oil and insulation
Tight and secure windings to withstand ***short circuits and achieve ****low sound levels.
Coil phase center line matching diameter and height to specs to minimize short circuit forces.
Burr free core, control gaps in corners, uniform clamping pressure to achieve low PD, ******gassing, *****lower core losses
No sharp points in and around the winding in the high voltage fields to achieve low PD and eliminate Hydrogen or other combustible gases
Control humidity during winding and assembly to achieve low moisture towards long life of insulation system
VPD for coil and full assembly to seal in low moisture to achieve long life of insulation

What reduces the life and KILLS a transformer?

***Partial Discharge**: By far the #1 killer of a transformer – these micro pockets of arcing reduce electrical clearance, 'eat' the cellulose insulation, enlarging with time to fail the transformer.
****Moisture:** Reduces the voltage withstand of oil and insulation, accelerating the rate of additional moisture generation, leading to premature failure. Lower moisture helps withstand voltage spikes.

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***Short circuit strength**: Higher short circuit strength will enable the transformer to withstand higher magnitude and number of short circuits that occur during normal & abnormal operations.
****Sound**: Higher sound level comes from: 1) lose coil, adjacent turns rubbing at 60 cycles, 2) loose core and large core cutting burrs vibrating at 120 Hz.
*****Losses**: Lower losses reduce the operating temperatures which in turn reduce the operating costs of transformer.
******Gassing**: Combustible gasses generation and accumulation will lead to catastrophic failure resulting in explosion.

The matrix below shows how the quality of transformer delivers long life

		Factors for 60 Year Life Transformer				
	Partial Discharge (PC)	Moisture (PPM)	Combustiblle gases (PPM)	short circuit strength	Sound (dBA)	losses (KW
burr on core edges	reduce		redcue		redcue	reduce core loss
tight windinsgs				higher withstand	lower sound	
coil sizing				higher withstand		lower load loss
moisture in oil	reduce	reduce , lower PF				
insulation moisture	reduce	reduce , lower PF	reduce			load loss,
Air conditioned plant	lower	lower				
cable insulation machine	Lower		reduce			
vertical winding				improve	reduce	lower load loss
metallized crimps	lower		reduce			
mushrooms				improve		
coil VPD		reduce moisture				
assembly VPD		reduce moisture				
core stacker (astronic)			reduce			lower core loss

Mantras to achieve this performance?

Rely on trained work force, tech leads supervising work, design engineer checking progress, quality engineer auditing.

Treat insulation with respect – no creasing, no moisture, no scratch!

Dryness of insulation - process control, labeling dry insulation with time stamp, A/C plant, VPD, limit the air exposure of assembly.

5-Axis Milling Machine

Computerized Winding Machines

Tight secure winding: tension control by size and copper tensile strength; vertical winding,

Hydrostatic pressing of coils assembly using mushrooms under vacuum to secure winding as it dries.

Isostatic Winding Pressing Mushrooms

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Astronic Core stacker to minimize the destruction factor of core and burrs.

Robotic Core Stacking

And, better control through persistent focus on:

Digital Testing

Chart of PD, Sound, core burr reduction, HI pot failure reduction, Impulse failure reduction, field defects over time indicate better control.

To sum it up, we can estimate Increase in life of VT-GT transformer over brand X Transformer with a normal life span of less than 40 years:

Reduced PD to less than equal to 100 pC - increase life by 30 %
Sound reduction of 10 dB: Increase life by 10%
Reduce moisture to .5% in insulation and < 10 PPM in oil - increase life by 15 %
Tight coils - increase life due to reduced short circuits damage by 10 %

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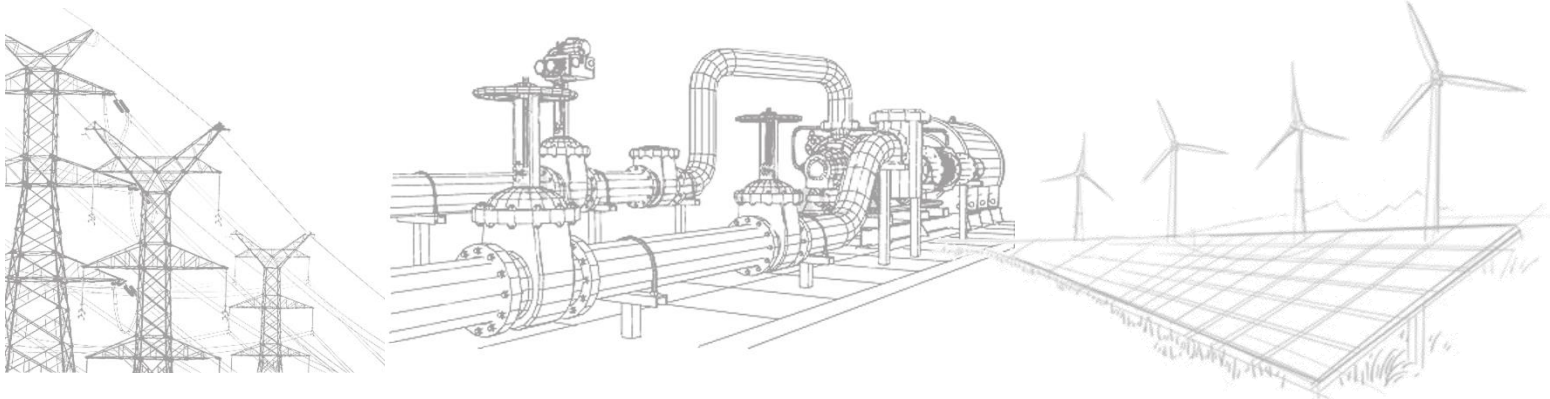

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