“One Source – One Commitment”

VIRGINIA TRANSFORMER (VTC) and GEORGIA TRANSFORMER (GTC) offers a total package to the Utility, Industrial, Oil and Gas, and Renewable Energy markets for power generation and transmissions up to 1400 MVA 500 kV class.
The 50-year Journey

The 1970's were our formative years, where our product offering was primarily specialty harmonic load transformers. In the 80's we invested in Industrial solutions for mills, transit, rail, etc. In the 90's we invested in solutions for utility – generation, transmission and distribution.

In this 21st century we have added large power transformer capability to our portfolio – to support the Renewable Energy Generation sector (holding largest market share in this sector today). We take pride as a US-based power transformer OEM to single-handedly reduce US power transformer imports - bringing power transformer manufacturing jobs back to US. This was accomplished through building American manufacturing capability by adding 4 additional plants – in 1995, 2003, 2013 and 2014 and adding management and technical resources in US, Mexico and India. We have established strategic sourcing partnerships with vendors in US, India and China to ensure a robust supply chain.

Our Place in History of Power Transformers in US

In the early part of 20th century US OEM's such as General Electric (GE), Westinghouse and McGraw Edison built the transmission grid. However, many of these large electrical OEM's could not evolve to sustain the business, and with no long-term vision, closed down. VTC took the lead domestically in expanding power transformer technology/processes, leading in physical sciences application – thermal, electromagnetic, materials, drying and improving productivity and accuracy through Automation. To put things in perspective, in 2014 more than 80% of US power transformer requirements were imported. Today, VTC has reduced the imports by 10%, we are moving forward to keep more business at home as overseas-based competitors continue to close and cut-back their US transformer operations (as an example ABB closed St. Louis operations and reduced South Boston work force), while we continue to offer our customers a superior option of great value, and “built at home”.

Vision for the Future

VTC will continue to build on, and share with employees, customers and vendors - our Legacy of Excellence, with references. We are leading the industry in producing 60-year service life transformers. With our monitoring technology of VCM we can keep our transformers working longer than 60 years! This will mean uninterrupted power to homes, industries and infrastructure. We are offering the VCM technology free - to have the industrial and utility markets experience the benefits. This is part of our offering of Digitization of Power Transformers for reliability and cyber security.

Our production/ process improvements are assuring no defect in the product and hence zero interruption for operation of Steel Mills and Renewable Power production. We have a program to have 5-year equivalent trained technicians producing transformers through New Employee Trainings, Team Engagement, Box Training of each Critical to Quality (CTQ) element of production – for each and every technician.

Our on-line customer support for engineering-starved utilities and 24 X 7 live technical support to customers (and non-customers) enables robust power to the grid and infrastructure.

VTC will continue to build our organizational capability by promoting from within to build legacy knowledge among technicians, engineers and managers.
The secret to making the most resilient power transformer...

Robust Design
It’s more than just a “good design”. We have years of experience and creativity to provide the best design, optimized for the most reliable performance for durability. It’s skill backed by a library of more than 15,000 case studies along with premium design tools and the latest software to create an optimum design for each custom specification.

Flawless Execution
It is no easy task, but it is standard operation here at Virginia-Georgia Transformer. Through meticulous processes, benchmark standards, advanced automation and experienced team members we achieve just that. Every unit is custom built to the individual specification and requirement and everyone is subject to the same rigorous production expectations. Our process guarantees flawless execution.

Continuous Monitoring
Striving for perfection doesn’t end with robust design and flawless execution, we’ve taken it a step further by implementing continuous monitoring. Using our patented module, we have seen where we can extend the life span of a transformer through this monitoring process. Whether it’s on-site or being analyzed remotely we can diagnose the condition of the transformer thus eliminating potential risk factors before they become a problem.

OUR QUALITY STATEMENT
TO BE AN INTERNATIONALLY RECOGNIZED MANUFACTURER AND SUPPLIER OF HIGH QUALITY, SPECIALIZED POWER TRANSFORMERS, ASSOCIATED EQUIPMENT AND SERVICES BY FULFILLING OUR COMMITMENTS TO THE CUSTOMER AND OUR EMPLOYEES THROUGH CONTINUED GROWTH AND IMPROVEMENT.

KEY FIGURES

<table>
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<th>MVA/Yr.</th>
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<tr>
<td>GEORGIA</td>
<td>24,000</td>
<td>500</td>
<td>1675</td>
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<td>POCATELLO</td>
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<td>ROANOKE</td>
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<tr>
<td>CHIHUAHUA</td>
<td>6,000</td>
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<td>350</td>
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OUR FACILITIES

**VTCR - Roanoke, Virginia**  
Our corporate headquarters was designed and constructed specifically to produce power transformers. This 145,000 sq. ft. manufacturing facility is absolutely state-of-the-art.  
*ISO 9001:2015*

**VTC - Troutville, Virginia**  
Tank fabrication, sand blasting and paint process for the Roanoke plant were relocated to this 125,000 sq. ft. building in December 2013. The tank fab plant is equipped with a welding robot that delivers leak free welds.  
*ISO 9001:2015*

**VTCU - Pocatello, Idaho**  
We acquired this 180,000 sq. ft. plant in 2003 from UST West when it was a repair facility. After investing in upgrades at the plant it is the best equipped medium power transformer plant in America.  
*ISO 9001:2015*

**VTCW - Chihuahua, Mexico**  
The 82,000 sq. ft. plant is a modern facility equipped to produce small power and liquid filled transformers. They have achieved 100% First Pass Yield and 100% on time Ready to Ship transformers.  
*ISO 9001:2015*

**Georgia Transformer Corp. - Rincon, Georgia**  
Acquired in 2015, this 250,000 sq. ft. is a state-of-the-art temperature controlled environment. World-class practices and technology allows the plant to produce our largest transformers with a 60-year service life.  
*ISO 9001:2008*
The headquarters for our corporation is located a few miles away from the picturesque Blue Ridge Parkway. Designed and constructed specifically to produce power transformers, this 145,000 sq. ft. manufacturing facility is absolutely state-of-the-art.

- A vapor phase drying (VPD) system executes optimum insulation dryness to achieve a 60-yr life. The automated VPD system is computer controlled, technicians can download the process parameters to their cell phones and (2) transformers can be processed simultaneously. The chamber maintains a vacuum level of .25 torr.

- A 2nd core cutting machine was also installed to increase capacity and eliminate a critical single point of failure. The machine cuts a 26 inches wide core. The edge burr level on this Soenen Core Cutting machine is measured with a laser typically less than 20 microns. The burr free edges deliver the lowest losses and the transformer sound level is reduced by 2dB.

- Our instrumented, fully equipped test room with complete diagnostic capabilities has the ability to produce test reports automatically.

- All floors of the plant were sealed to eliminate floor dust.

- Four winding machines were added to increase the capacity to build larger coils. The plant is equipped to manufacture 50MVA, 138kV, 650kV BIL as well as manufacturing dry type to 10MVA, 35kV, 150kV BIL.

- The flow of data to our Sonen Core Cutting machine is seamless, reduces human intervention and works virtually error-free. Using software that generates a file that includes cutting data, when transferred, this file loads the data in a server. The operator is ready to cut a particular job, he simply pull up a file with the particular job number using the machine interface, no modifications needed.
VTC MILESTONES

1970
VTC established to provide power transformers to the mining industry in the Appalachian mountains

1971
Current CEO assumes management

1976
Open 2nd manufacturing facility in Chihuahua, Mexico

1980
Achieved ISO Certification

1982
Current CEO assumes management

1986
VTCR Moved to new, larger facility

1989
Opened 2nd manufacturing facility in Pocatello, ID

1990
Acquired power transformer facility in Pocatello, ID

1995
Manufactured first 300 MVA Transformer

1997
Achieved ISO Certification

1999
Acquired power transformer facility in Pocatello, ID

2000
Expand Product Range thru alliance with GTC

2003
Opened separate Metal Fab facility in Troutville, VA

2010
Anoop Nanda hired as President

2013
Opened separate Metal Fab facility in Troutville, VA

2014
Manufactured first 345 kV Transformer

2015
Entered Renewable segment starting with Pad Mount units

2017
Manufactured first 345 kV Transformer

2018
Pocatello Plant expansion for 2nd core cutting line, E-bay, insulation shop

2019
Manufactured first 300 MVA Transformer

2020
Manufactured first 300 MVA Transformer

2021
Expand Product Range thru alliance with GTC

1971–2021

Roanoke VA Shop floor

Worker in the Finish dept. in Roanoke

Roanoke Test Area

UniClad transformer in Roanoke

Soenen Core Cutting machine in VTCR
In December 2013, an extension of the Roanoke facility was developed 11 miles from the main plant; tank fabrication, sand blasting and the paint process was relocated there. We strive for the highest quality and efficiency in production through increased computer-aided automation, through improvements such as our Automatic Paint System, our Robotic Welder, and the bar coding of materials.

- The tank fab facility is equipped with a welding robot that delivers leak free welds, a down draft sand blast booth for personnel safety and a SP-10 finish per SSPC standard for premium paint adhesion.

- The paint system is an epoxy primer on an activated surface and a top coat of polyurethane baked to a hard finish. Good bye rusting!

- The plasma table has been fitted with an etching gun to mark the location of all accessories thus eliminating missed parts needing welding after painting!

- Machines and work stations are laid out in close proximity to material storage that feeds particular machines and workstations. This process influenced layout reduces material movement, forklift traffic and utilizes overhead cranes efficiently.
VTCU is located 150 miles from Salt Lake City in Southeastern Idaho. Acquired in 2003, it is strategically located to serve customers throughout the USA and Canada. VT-GT has invested heavily in the plant over the years, making it the best equipped 230kV, 150MVA plant in North America.

The plant features 5 bays, each 35,000 sq. ft. One bay is dedicated for winding and insulation. Assembly floors are sealed to ensure a dust free environment.

The Soenen Core Cutting machine is capable of cutting up to 37 inches wide step lap core and produce a burr level of <20 microns. Exceeding the industry standard in meeting the lowest sound level of 55 dB and losses of less than 1/4% of the MVA.

The plant has its own tank shop, completely isolated from the assembly shop, which limits contamination. Our paint system is Polyurethane over an Epoxy making it suitable for the most aggressive environments in our country. Coal tar coated bottom tanks offers protection against rust for years and even decades.

The plant routinely achieves less than 100 pc partial discharge compared to the 500 allowed by IEEE. A lower partial discharge can mean extending the life of a transformer by 2X compared to a transformer offering 500 pc.

The winding shop is under positive pressure to eliminate dust, which is key to achieving a higher life. Coils are dried in a Vapor Phase oven under vacuum pressure. This assures optimum dryness of the insulation for maximum life. Too dry insulation can become brittle...too wet and it becomes very loose causing it to fail prematurely. Proper drying is an art that we have been able to master.

The plant has its own rail spur allowing it to ship over 100 ton transformers securely anywhere in the country.
Located 250 miles South of the US border, the 82,000 sq. ft. plant in Chihuahua, Mexico is a modern facility. Here we custom design and manufacture small power transformers: dry type transformers, VPI, UNIDIP and UNICLAD from 300kVA up to 7.5MVA 35kV class, liquid filled transformers, 500kVA up to 15MVA, 115kV class. We ship 3 product lines: dry type, renewable pad mount and substation transformers to Utilities and Industrial markets in North and Central America.

Providing reliable, on-time, ready to ship small power transformers is part of our DNA at our Chihuahua, Mexico facility. It is a state-of-the-art transformer manufacturing facility that satisfies the most rigorous requirements in the industry. The entire facility includes three buildings designed and laid out for the best material and production flow.

The first building is where we manufacture the transformers using a time tested optimized processes and quality checks in all manufacturing areas. These checks at each stage, together with virtually nonexistent rework, make for higher product reliability and keep our manufacturing time to a minimum.

The second building is a completely segregated custom metal fabrication - a seamless bridge from engineering design to manufacturing.

The third building is our receiving, incoming inspection and storing of necessary components used in manufacturing. By inspecting all incoming material and storing key components, we can produce reliable small power transformers while ensuring on time or quick shipments.

This combination of innovative technology, manufacturing process improvements, experienced employees and the addition of key leadership coming from various hi-tech industries have enabled us to achieve 100% First Pass Yield and 100% on time Ready to Ship transformers.
Virginia-Georgia Transformer got its start in the mining industry of Virginia and West Virginia, providing units for coal mines that needed low profile and rugged construction for the underground coal mines.

The next challenge came in supporting rectifier transformer requirements for a drive system manufacturer in Virginia. These started from a 6 pulse SCR VFD and grew over the years to VFD and then up to 36 pulse units. Today we lead this technology. We have successfully produced designs to 30,000 HP and 36 pulse power conversion for large compressors used in LNG liquefaction.

In recent years VT-GT has integrated the use of computer aided design programs such as; Maxwell, Volna, Seitlinger, and Ansys. They are used for mechanical stress and temperature analysis creating a fail safe and durable design. The design and analysis process is bridged with software to provide speed and accuracy for all of our designs.

With these programs and technical talent, we have developed a design to offer a – 20 dB noise level which is virtually no increase over sound. Perfecting the insulation systems and shop processes combined with our patented life monitoring system offer a 60-year life for your transformer versus our competitors.

Virginia-Georgia Transformer can design high impedance units to provide lower stray losses and lower short circuit current limitation up to 20%. Use of nonferrous material and hardware is practiced with the knowledge of material properties to achieve lower eddy and stray losses when needed. Winding can be designed by choosing the proper conductor geometry cross section to yield a stray factor of 10%. Using proven experience we can provide extremely efficient designs with very low no-load and load-losses.

VT-GT uses automation such as 3D cad designs and tank welding to manufacture our tanks. This automated process also drives plasma cutters and robotic welding machines used in tank manufacturing. Thus creating a tank that is free of leaks and with the highest quality welds available.

Virginia-Georgia Transformer prides itself on the large number of very experienced engineers and senior engineers with extensive experience with transformers up to 500kV 1,400MVA range. We currently have more than 150 engineers and designers with mechanical, electrical and industrial, BS, MS and PHD degrees. Many of our engineers have over 30 years of experience in their related fields. Last year alone we applied for 5 patents ranging from monitoring the life of transformers to liquid tight submerged transformers.

All four plants have dedicated design teams of electrical, mechanical and controls engineers. All plants are supported by a corporate design team that harmonizes the engineering practices and technical continuity throughout the company. The engineering analytical team members are a vital part of the plant design team to provide integrated solutions for production issues and to provide a quick resolution of any issues to ensure maximum efficiency.

All of the plants are connected through modern audio, video, data links. Regular inter-plant discussions and meetings are held for disseminating knowledge among each facility.
Professional overseeing and receiving tools and materials in a timely manner allow our trained and certified technicians to perform at their best. Our technicians are essential and their training must be continuous and up-to-date. Experienced supervisors are continuously “overseeing” and analyzing the finished work as well as the process from all angles to make sure everything makes sense and fits together. Without tools and materials nothing is going to move forward, therefore a team within VT-GT is dedicated to ensure that the process doesn’t stop as a result of tools and materials not showing up on time.

Many steps in the assembly have checks and balances built into to ensure minimization of errors. We have narrowed them down to 11 major hold points (HP) where production will not move forward without approvals. There are 2 major control points where the team leader will analyze and review the finished work from different angles. A traveling binder will document all the inspection work for any kind of root cause to be analyzed for later use.

We use a 3-prong approach for flawless shipping. Our shipping expert visualizes the journey of the unit through various highways and bridges. The shipping preparation and packing is very secure with the unit monitored through GPS throughout the journey. Our shipping team greets the transformer upon arrival, making sure all the parts are accounted for and instructions are in place. VT-GT has its own service and installation crew with oil rigs and other test equipment. This attention to every detail during the shipping and installation process is an example of how we put our value proposition to work.

MANUFACTURING

Our value proposition is to provide the most reliable transformer that’s shipped and installed in a timely and flawless manner to the site and monitored and serviced to last for more than 60 years.

A reliable transformer requires a robust design and a flawless execution based on our manufacturing pyramid: At the core, are people, supported by modern equipment and factory, a proven process and flawless shipping and installation.
PROJECT ADMINISTRATION OFFICE (PAO)

The Project Management Office (PMO) is a major component of our world class support. They are the single point of contact and their integrated management approach provides for the customer and they are the “customer voice” within the company. PMO have their fingers on the pulse of every project/job that is built; they know the status of each job at every stage of production from start to finish and they are the point of contact once an order is entered until it is shipped. Throughout the project execution the Project Management team is responsible for the scope of job execution in any given time frame, ensuring customer satisfaction, and managing the risk to an acceptable level for the customer and for the company.

CONTINUOUS IMPROVEMENT IS OUR CULTURE

The culture at Virginia-Georgia Transformer is one of continuous development.

Engineering Quality Assurance
- Customer order reviews and design control plan for each order
- Design validation plan with failure mode effect analysis (FMEA) for new designs, new components and new technology
- Engineering Process Audit (EPA) and inspection plan for engineering process assurance

Vendor Quality Assurance
- AQL quality control plan for incoming material inspection
- New component evaluation and testing plan
- New vendor evaluation and vendor performance score card
- Vendor quality surveillance audits and vendor rating system

Process Assurance in Manufacturing
- Training and skill certification programs for operators
- Statistical Process Controls (SPC) for critical processes of transformer manufacturing
- Three tier quality control plan for process adherence to assure product quality

Final Quality Assurance
- Transformer tests per IEEE standards/customer specification requirements
- “Fit, form, function” verification and customer specification compliance
- Shipment tracking and delivery coordination with customer
- Installation, oil processing and field testing
- Customer feedback surveys to assure service quality

Employee Training
We stay current with industry standards requirements and strive to improve further with comprehensive training programs across the entire organization.

The drive and commitment to excellence at Virginia-Georgia Transformer is unmatched anywhere else -- which explains why our company has grown substantially faster over the past decade than any other power transformer manufacturer in North America. We have made countless innovations and improvements in every aspect of our corporate operations, and we will continue to do so. Our commitment to both growth and improvement is unshakable.
THE MOST MODERN FACILITY IN NORTH AMERICA

The Rincon operation formally an Efacec facility, has always relied on technological development to ensure the competitiveness and high quality of its transformers. To support design and manufacturing, the operation focuses on:

- Sharing best general design practices with VTC and Efacec’s proven experience in Large Power
- Integration and automation of Efacec’s design programs and validation software tools
- Integrated management systems in technical design with manufacturing
- Electrical and electro-magnetic field analysis (2D & 3D)
- Overload and short circuit analysis with validation
- RLC model analysis for high frequency voltage variations (impulse)

This state-of-the-art transformer manufacturing facility was built in 2009 by Efacec Energia using the best engineering and design concepts available. Specializing in Core and Shell form transformers; Core form up to 500 MVA & 525 kV with a total capacity of 24,000 MVA. Shell form up to 1,400 MVA & 500 kV. The facility also has the capability to perform shell transformer repairs.

Since acquiring the Rincon facility in January 2015, Georgia Transformer has been focused on strengthening the business and operations while keeping the foundations established by Efacec intact (Engineering designs, manufacturing processes / procedures, etc.)

The 250,000 sq. ft. facility is state-of-the-art with a controlled environment throughout in order to assure optimal pressure, humidity and temperature for insulation materials and other critical parts used in the transformer manufacturing process.

The plant is ISO 9001:2008 certified.
The most modern facility (226,000 sq. ft. of manufacturing) in North America with all manufacturing areas environmentally controlled (temperature, humidity and particles) features:

- Astronics core cutting machine with fully automated E-stacking system.
- Comprehensive insulation / support structure fabrication area.
- Vertical and horizontal winding machines to enhance winding efficiencies and winding reliability
- Modern winding calibration stations to hydraulically press windings to the required design heights
- Phase assembly calibration stations to control design height
- Phase assembly drying utilizing fully automated Vapor Phase Drying process
- Hydraulic assembly platforms utilized to assemble the core and coils.
- Adjustable mounting systems utilized to support major components simulating the completed internal unit for testing prior to vapor phase.
- Handling of transformer and transformer parts by means of sophisticated air-cushion system
- Semi-automatic oil drying and transformer filling
- Welding and painting operations segregated from main assembly area
- Computer-assisted testing facility up to 1675 kV BIL, segregated from the main assembly area
- Shipping area for truck and rail equipped with special gantry crane
- Rail spur in shipping are accessible by air-cushion system
The ability to design power transformers that have a life-span of 60-years directly depends on the expertise of our design engineers. At Georgia Transformer, we have the expertise and have significantly invested in human engineering capital allowing us to further increase our design experience. The recent investment in our engineering department has brought us to an experience level that is by far exceeding Efacec’s previous level.

Our engineering design process is a methodical series of steps used in creating functional products and processes. The process is highly iterative - parts often need to be repeated many times before the production phase can be entered - though the part(s) that get iterated and the number of such cycles in any given project can be highly variable.

Electrical and mechanical design processes are being improved significantly by incorporating design automation, which will not only reduce design cycle time but reduce human errors. In addition to the traditional design tools typical for transformer design, validation tools are Seitlinger, Coulomb, Anderson and Volna.

Engineering analysis of transformer design in general requires a certain skill set that is based on years of experience within the industry. And we have that experience! Georgia Transformer’s engineering organization, which consists of a group of twenty three (23) full-time professionals, many of whom were trained in Portugal by Efacec.

Here are some highlights of our Electrical and a Mechanical design team:

**Electrical design team** – a team of seven (7) professionals (engineers and designers). Key members are active at the IEEE organization. The electrical design team’s core competencies are detailed high voltage design analysis and failure rate analysis, which are contributors to the reliability of our electrical designs in general; hence our transformers.

**Mechanical design team** – a team of fifteen (15) professionals (engineers and designers). Key members are active at the IEEE organization.
Core form Power Transformers, up to 500 MVA & 345 kV and shell form Power Transformers up to 1,400 MVA & 500 kV. Georgia Transformer’s (Efacec) CORE form technology was developed in-house and have evolved over the last 59+ years with the first transformer manufactured in 1957. Efacec has manufactured approximately 2,700 transformers worldwide while developing 20,000 MVA over the last 300 transformers manufactured in Portugal. The Rincon plant has delivered over 180 power transformers in excess of 22,000 MVA (not included in the output figures above for Portugal), mostly for customers in the U.S.

Main Characteristics:

- Cylindrical coils insulated with pressboard cylinders and spacers allowing free flowing cooling with mineral oil
- Circular cross section magnetic circuit construction formed indexed widths of magnetic steel laminations
- Clamping structure for the windings & “E” core is optimized for the required short circuit forces and to provide for active part tanking along with the lifting of the complete transformer
- Concentrically arranged winding are composed of multiple cylindrical coil sections. All coil sections are interleaved with pressboard cylinders and spacers to assure optimal coil cooling

Technological development is a main factor to ensuring competitiveness which has always been paramount with the ultimate goal of manufacturing the highest quality of transformers.

The design and manufacturability of power transformers is ensured through emphasis on the following:

- Integrated management systems in technical design with manufacturing
- Electrical and electro-magnetic field analysis (2D & 3D)
- Overload and Short-circuit analysis with validation
- RLC model analysis for high frequency voltage variations (Impulse)
DESIGN AND DEVELOPMENT

The Rincon facility, located near Savannah, GA has always relied on technological development to ensure the competitiveness and high quality of its transformers.

To support design and manufacturing of power transformers, the operation focuses on:

• Sharing best general design practices with VTC and Efacec’s proven experience in large power

• Integration and Automation of Efacec’s design programs and validation software tools

• Integrated management systems in technical design with manufacturing

• Electrical and electro-magnetic field analysis (2D and 3D)

• Overload and short circuit analysis and validation

• RLC model analysis for high frequency voltage variations (impulse)

PRODUCTION FACILITIES

State-of-the-art equipment

• CNC centers for insulation components

• Vertical and horizontal computer controlled winding machines

• Astronics core cutting machine with fully automated & integrated E-stacker

• Coil Phase drying with vapor phase technology

• Air cushion transportation to move all heavy components

• Multi-point bridge cranes with varying capacities up to 150 Metric Ton

• Computer controlled oil processing and filling system

• HV Test Lab with capabilities to 1675 KV BIL & 765 kV (computer integrated)

• All manufacturing areas with climate control (Pressure, Temperature, Humidity and Particles)
Generators:

- **2.4 MV Impulse Generator**
  - G1: 30 MVA / 10 kV / 3000 kW / 50-60 Hz
  - G2: 6 MVA / 5 - 10 kV / 1000 kW / 100 - 200 Hz

1 Capacitors bank: 144 MVAR / 145 kV

500 kV AC Resonant Test System (Applied)

Step-up transformer: 40 MVA / 10 - 20 kV

Reactors (3-phase or 1-phase): 9.6 MVAR - 200 Hz

Voltage: current and power integrated Measurement System:
- 4,000A / 200 kV (<1% losses with measurement uncertainty @ 0.005pf)

Partial discharges measurement:

Capability to perform all power transformer tests according to the Standards (IEC 60076, ANSI C57...) except Short-Circuit test at full power

Maximum BIL 1675 kV:

- Capacitance & Power Factor @ 10 kV
- SFRA
- Insulation Resistance
- Winding Resistance
- Turns Ratio
- CT amplitude and phase error
- CT excitation curves
- No-Load losses and Impedance Voltage
- Zero sequence impedance
- Temperature-Rise
- Noise level
- Switching Impulse
- Lightning Impulse
- Separate-Source
- Induced Voltage with Partial Discharges
## PRODUCT SCOPE

### LIQUID TYPE TRANSFORMERS

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<th>DRY TYPE TRANSFORMERS</th>
<th>SPECIALTY TRANSFORMERS</th>
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<td>VPI (Vacuum Pressure Impregnated)</td>
<td>- Neutral Deriving Transformers</td>
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<tr>
<td>- Up to 500kV Class</td>
<td>- 300kVA to 20MVA</td>
<td>- Drive Isolation Transformers</td>
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<td></td>
<td>- Up to 35kV Class</td>
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<td></td>
<td>- 220º Class Insulation</td>
<td>- Rectifier Duty Transformers</td>
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<tr>
<td>Cooling Fluids</td>
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<td>- Mineral Oil, Envirotemp (FR3), Beta, Silicone</td>
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<tr>
<td>Fluid Preservation</td>
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<td>- Three Phase Voltage Regulators (Up to 69 kV, 50,000 kVA Throughput)</td>
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<td>- Sealed Tank (Standard)</td>
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<td>LTC</td>
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<td>- Up to 500MVA</td>
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<td>- Auto Transformers</td>
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<td>- Inter-Phase Transformers</td>
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<td>- Dual Voltage Transformers</td>
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<td></td>
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<td>- Reconnectable Transformers</td>
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<tr>
<td></td>
<td></td>
<td>- Other applications available</td>
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</table>

### DRY TYPE TRANSFORMERS

<table>
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<tr>
<th>UN/Clad® Encapsulated Coils</th>
<th>Totally Enclosed Non-Ventilated (TENV)</th>
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<tbody>
<tr>
<td>- 300kVA to 15MVA</td>
<td>- Up to 5,000kVA</td>
</tr>
<tr>
<td>- Up to 35kV Class</td>
<td>- Up to 35kV Class</td>
</tr>
<tr>
<td>- 220º Class Insulation</td>
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### SPECIALTY TRANSFORMERS

- Neutral Deriving Transformers
- Drive Isolation Transformers
- Rectifier Duty Transformers
- Furnace Transformers
- Zig Zag Transformers
- Three Phase Voltage Regulators
- Air Core Reactors
- Scott T Transformers
- Single Phase Transformers
- Phase Changers
- Auto Transformers
- Inter-Phase Transformers
- Dual Voltage Transformers
- Reconnectable Transformers
- Other applications available

### MARKETS / APPLICATIONS

#### INDUSTRIAL
- Rectifier Duty
- Paper & Cement Mills
- Steel Mills
- Motor Start
- Fan, Pump & Compressor Operation
- Hoists
- Mining
- Drive Isolation - AC, DC
- Chemical Plants/ Ethanol
- Oil & Gas; Refineries, Pipelines, Storage, etc.
- Grounding Transformer
- Cycloconverter Application
- Dynamic Voltage Regulator
- Unit Substation
- Special Fluid Transformers - Silicone, Envirotemp (FR3), Beta Fluid
- Chemical/Hazardous Environment - Class I, Division II, Group C &D
- Coastal Environment/Offshore

#### UTILITY
- Substation
- Voltage Regulator
- Auto Transformer
- Grounding Transformer
- Transmission

#### POWER GENERATION
- Generator Step Up (GSU)
- Unit Auxiliary Transformer (UAT)
- Station Service Transformer (SST)
- Excitation
- Generator Start Up
- Reverse Auxiliary Transformer
- Wind Power
- Geo Thermal
- Solar

#### SWITCHGEAR MATCH-UP
- General Electric
- Cutler Hammer
- Siemens
- Square D
- Others

#### COMMERCIAL/INSTITUTIONAL
- Hospitals
- Offices
- Universities
- Airports
- Hotels
- Unit Substations

#### TRANSIT & LARGE DRIVE
- Extra Heavy Duty Traction (RI9)
- ANSI Circuit 25, 26, 25 & 26, 31, 41
- Up to 5,000KW Rectifier
- Up to 20,000 HP AC, DC
- Liquid Filled - 55 or 65º C rise
- Dry Type - 80/115/150º C rise

#### FIELD SERVICE OPTIONS
- Field Installation
- Crane Service/ Offloading
- Assembly On Site
- Field Testing
- Hot Oil Vacuum Processing
- On Site Training

### QUALIFICATIONS
- Four ISO Certified Manufacturing Plants
- UL Listed Dry Type up to 500kVA, 35kV Class 220º Insulation System, NEMA 1 or 3R
- UL Listed Liquid Filled up to 100MVA, 69kV Class
- NC, IEEE Standards CSA, IEC, UL, CUL, CE, ABS

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International Organization for Standardization
Our field service division offers a full range of aftermarket services for our transformers as well as competitor's transformers. These services include:

- Installation Services (including);
- Assembly, Oil filling, Pre-Commissioning Testing
- Repair Services
- Replacement Parts
- Oil Handling and Oil Testing Services
- Transformer Testing Services
- Technical support

We also provide lifetime extension programs of new and existing transformer assets to keep your transformer running at peak efficiency. **Our Field Service is rated the best in the industry by our customers.**

**Available services and capabilities:**

**Installation Services**
- Unit assembly to enable electrical operation
- Vacuum Processing, oil handling, oil filling
- Pre-commissioning testing, standard de-energized electrical acceptance testing and special customer request testing

**Repair and Maintenance Services**
- Physical external servicing of the transformer and associated components
- Internal inspection and troubleshooting
- Preventative maintenance to ensure long life

**Oil Handling and Oil Testing**
- Transformer vacuum processing and oil filling
- Hot oil processing (dehydration, filtering, de-gasification)
- Oil integrity testing (dielectric strength, dissolved gas analysis, moisture content, physical properties)

**Replacement Parts**
- Complete parts and component support for equipment manufactured by Virginia-Georgia Transformer
- Next day shipment for common parts

**Transformer Testing Services**
- Ratio
- Insulation Resistance
- Core Meggar
- Power Factor
- Resistance
- Oil Dielectric
- DGA Sampling
- DC Resistance
- Thermal Imaging
- Bushing Test (Hot Collar, Bushing Power Factor)
- Control Wiring Verification
- Doble Power Factor
- Doble SFRA
- Infrared Imaging
- Leakage Reactance
- Excitation
- TTR
- Arrestor Testing
- CT Testing

**Inspection Services**
- Pre commissioning
- Operational conditioning and status

**Technical Support**
- Full Engineering support
- Advisory capacity at any level before and during electrical operation
- Operational problem and trouble resolution
- Test data analysis and recommendation

**Virginia-Georgia Transformer also offers repair and refurbishment.**
VT-GT incorporates redesigns utilizing our latest developments in electrical standards and design technologies, materials and manufacturing processes. Your transformer can be refurbished to like-new condition.
Transformer Accessories

- Radiator Mounted Fans
- Potential Transformer
- Load Tap Changer
- Liquid Level Gauge
- Side Mounted LV Bushings
- HV Bushings & Arrestors (Shipped demounted)
- Control Cabinet
- LTC Controls
- Electronic Temperature Monitor
- Throat for Non-Segregated Bus
- CT’s (Bushing mounted internally)
- Dual Voltage Switch
- Nitrogen Preservation System
- Lightning Arrestors
Virginia Transformer - Georgia Transformer is a leader in custom power transformers engineered precisely for each customer application and optimized for performance and lifecycle.
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