Introduction
This catalog is designed to provide basic information on the various transformers manufactured by Kuhlman Electric Corporation. For more detailed information on products listed, please use the self-addressed post card found in the back of this catalog.

Kuhlman Electric Corporation
a premier manufacturer of electrical products, earning supplier of choice status through operational excellence in service, quality, value and innovative customer solutions

Kuhlman has been a designer and manufacturer of distribution and power transformers for utilities and other users of electric energy since 1894. Kuhlman has expanded its product and manufacturing base to include a broad line of power, instrument, and distribution transformers. Transformers are supplied to utility and industrial customers throughout the United States and in many foreign countries.

Manufacturing facilities are located in Crystal Springs, MS and Versailles, KY. The company has a well-deserved reputation of outstanding customer service, engineering support, short lead times, guaranteed on-time deliveries, and excellent quality.

The company’s commitment to the customer and industry is stated as follows:

ALL DONE IN THE SPIRIT OF CONTINUOUS IMPROVEMENT

.... generating increasing value for our shareholders and employees.
Our Company

Kuhlman Electric is recognized as a leading designer and manufacturer of quality transformers and Field Engineering Services. Product and manufacturing base includes a broad line of power, instrument, and distribution transformers. Company headquarters, customer service, and marketing are located in Versailles, Kentucky. Manufacturing facilities are situated in Versailles, Kentucky and Crystal Springs, Mississippi.

Our Strategy

Kuhlman Electric insures that 100% of customers’ transformer needs are met in a superbly serviced, cost effective and environmentally compliant fashion. Kuhlman understands the need to show quantifiable bottom-line impact, while at the same time demonstrating the ability to measure the ongoing success of cost saving initiatives. Kuhlman provides customers with value-added services and solutions that reduce the total supply chain costs.

Our Commitment

Kuhlman Electric delivers measurable total cost savings in product, process, and inventory control. Competitive initial pricing, combined with significant internal cost reductions provide lower total cost and reduced risks for the purchaser. Kuhlman delivers superior service to all stakeholders, 24 hours a day!

The Kuhlman Advantage

Kuhlman provides services that address specific customer needs, and differentiates itself from the competitors by:

- Unparalleled Engineering and Application Support
- Short Lead Times
- High Product Quality
- High On-Time Delivery

Substantial savings can be realized by working with Kuhlman Electric to identify cost reductions in each area of the cradle-to-grave transformer life cycle.
“We put our quality on the line—your line”™

Year-in and year-out, under all kinds of operating conditions, Kuhlman puts quality on the line by doing everything possible to provide the highest quality and the latest in transformer technology. Believing the best can always be better, Kuhlman is dedicated to continuous improvement.

Continuous Improvement

As an early industry pioneer, Kuhlman has always played a major role in the continuous improvement of the transformers and technology. Down through the years, Kuhlman engineers and designers have contributed to the development of strip windings, low-loss cores, low stress core forming, connectors, coated insulating papers and countless other innovations.

Quality Manufacturing

Kuhlman is committed to assuring the highest quality of every distribution, power, and instrument transformer leaving the factory. It begins with selecting superior materials and follows through every step of production. The goal is: Do it right the first time.

Kuhlman practices stringent defect prevention and trains manufacturing personnel in clearly defined quality assurance procedures. Management-level quality assurance committees meet regularly to discuss ways to improve overall quality.

Suppliers are evaluated continuously and inspections are made on incoming materials. Quality controls are integrated into core and tank manufacturing processes. Coil winding operations are repeatedly monitored during manufacturing for conformance to specifications and standards of workmanship and quality.

Kuhlman manufacturing meets or exceeds specifications and tests in accordance with the latest ANSI, IEEE and NEMA standards. Careful attention to detail insures that transformers are manufactured in accordance with the highest industry and customer standards.
## Power Transformers
- Three phase conventional and LTC designs through 42/50/62.5 MVA, 161 kV.
- Three phase small power designs from 5MVA to 10MVA and up to 69kV HV.
- Three phase large power designs from 50MVA to 500MVA and up to 500kV HV.
- Mobile Substations are used to bypass a complete substation, following failure of any major equipment in the substation, minimizing the duration of power outages.

## Instrument Transformers
- Cast resin and dry type current and voltage transformers through 69 kV.
- Single phase oil-filled current and voltage transformers through 765 kV, 1800 kV BIL and three phase through 46 kV, 250 kV BIL.
- Station Service Voltage transformers through 230 kV, and 100 kVA single phase.
- Indoor CTs and VTs for 5kV and 15kV ratings.

## Distribution Transformers
- Pole-mounted single phase: conventional, protected and rural ratings through 500 kVA, 34.5 kV class, 200 kV BIL.
- Pole-mounted three phase: 30 through 300 kVA, 25kV class, 125kV BIL.
- Pad-mounted single phase: ANSI types 1&2, ratings through 19920 volts, 150 kV BIL, 25-167 kVA.
- Submersible single phase: vertical and horizontal 25-167 kVA and duplex 25/10 kVA to 100/50 for 25 kV systems.
- Station service single phase: Up to 46kV, 250kV BIL 2 bushing to 100kVA.

## Facilities Serving You...

### Distribution Transformer Division and Molded Instrument Transformers
Versailles, Kentucky
Factory and Headquarters

### Power Transformer Division and Oil-filled Instrument Transformers
Crystal Springs, Mississippi
Factory
Power Transformer Division

Kuhlman power transformers are designed in accordance with the highest engineering standards to provide reliable and economical service for a wide variety of utility and industrial applications. Designs take full advantage of improved core, coil and insulation materials, new manufacturing techniques and processes, and the latest advances in power transformer technology.

Transformers 5000 through 10,000 kVA, three phase are self-cooled with additional single stage forced-air cooling available. Three phase transformers larger than 10,000 kVA are available self-cooled, with up to 2 stages of forced air cooling.

Primary voltages through 161 kV are offered, as well as a full range of options in all ratings. All designs feature high short circuit strength to withstand repeated through fault conditions encountered in modern power systems. Kuhlman power transformers have a sturdy construction, are compact, economical, and simple to operate and maintain. They have exceptionally good service records under all types of applications and loading conditions.

Designs have been optimized to incorporate the best materials, processing and design concepts for any given transformer rating and service requirement.

Mobile Substations

Kuhlman/IEM mobile substations consist of a single or three phase transformer, high voltage disconnected switch, high and low voltage lighting arresters, high voltage fuses, low voltage circuit breakers with control and metering equipment, grounding reactors or resistors, auxiliary transformer for control equipment; all mounted on a trailer to facilitate rapid and easy movement.

Kuhlman/IEM mobile substations are typically shipped complete, including oil in the transformer, tested and ready for immediate use. The power transformer included on mobile substations has the same manufacturing, technical and economical advantages of IEM power transformers on both configurations: Shell form and Core form transformers.
Power Transformers

Power transformers with or without load tap changing through 37.5/50/62.5 MVA, 161 kV

Cores

Kuhlman power transformers are designed with mitered, step-lapped joints providing high mechanical strength and optimum magnetic performance. Individual laminations are accurately cut to size and mitered for each core design. The combination of premium steel and optimum construction provides Kuhlman power transformers with low core losses and quiet operation.

Windings

All Kuhlman power transformer windings are cylindrical construction for maximum short-circuit strength. High voltage windings are continuous wound disk type. Low voltage windings are generally multi-strand, disk or helical type. All windings are designed to withstand repeated through fault conditions.

Core and Coil Assembly

The assembled core and coils are locked together in a unified structure. Heavy insulated steel or laminated pressure rings at the top of the coils are held in place by heavy steel jack bolts on the underside of the top core clamp. The locking system for the complete core and coil assembly provides symmetrical coil clamping force at the center line of each core leg ensuring full axial compression under all conditions.

Tanks

Transformer tanks are all-welded steel construction and provide a compact, rugged enclosure for the core and coils. All tanks are designed for full vacuum processing and filling. Lifting lugs near the top corners permit lifting of completely assembled transformers. Horizontal tank braces have sloped tops to shed water, dirt, and help minimize corrosion.
De-energized Tap Changer

Kuhlman self-aligning no load tap changers assure good electrical connections at all times. The de-energized tap changer handle is mounted at a convenient operating height, normally on the end of the tank. The operating handle is simple to operate, snaps into position, and has provisions for padlocking.

Load Tap Changer

Kuhlman three phase power transformers with load tap changing (LTC) use vacuum, reactive, or resistive mechanisms. The LTC operates with a total of 33 positions. There are sixteen (16) 5/8% steps above and below normal voltage for a total tap range of 20% of rated secondary voltage. Automatic voltage controls are provided with additional manual override.

Load Tap Changing Equipment and Options:

• Local tap position indicator, optional remote indicator

• Operations counter

• Raise and lower switches for alternate manual control

• Motor and control circuits protected by breakers

• Optional parallel operation with new or existing LTC transformer

All load tap changing mechanisms are in separately sealed oil compartments and can be serviced independently of the main transformer tank.
Control Cabinet

The control cabinet is a separate weather-tight enclosure mounted on the side of the transformer tank. The control cabinet houses all terminal blocks for customer connections, controls for cooling, and load tap changing equipment. Control cabinets are heavy gauge steel with gasketed doors and three point stainless steel latches. Cabinet interiors have a high gloss white finish and are equipped with a door activated light and accessory outlet with ground fault protection.

Self-Cooled, Class OA

All Kuhlman power transformers have a self-cooled rating. Flat panel radiators are used as the cooling surface in addition to the main tank surfaces. Radiators are either bolted on with individual shut-off valves or welded directly to the tank. Radiator configuration is orderly, compact and designed to provide the best cooling efficiency in the least amount of space.

Forced Air Cooled, Class OA/FA and OA/FA/FA

Forced air cooling may be added to the radiators to increase the transformer capacity. Weatherproof motor driven fans are mounted on the radiator to provide increased air flow. Each fan is connected with a weatherproof cable and a separable connector for ease of maintenance.

Fan operation is controlled either manually or by automatic controls that are activated by the winding temperature indicator and/or top oil thermometer.
Sealed Tank Oil Preservation

Sealed tank oil preservation system is standard on all Kuhlman power transformers. The gas space over the oil is sufficient to allow for oil expansion over the entire range of operating temperatures. A pressure vacuum gauge is provided to monitor the pressure inside the tank. A self-sealing pressure relief device is provided on the transformer cover to vent excessive pressures that may develop during abnormal or fault conditions.

Inert Gas Oil Preservation System (option)

This system maintains a positive pressure of nitrogen gas on the transformer at all times. A regulating valve on the high pressure nitrogen cylinder controls the nitrogen supply and a pressure relief device is provided for relieving pressure outside the normal operating range.

Air Bladder Conservator Oil Preservation System (option)

The air bladder conservator oil preservation system provides a reservoir of oil above the main tank, along with expansion space. This system keeps the main tank completely full of oil under all operating conditions.
Power Transformers

Standard Accessories
- De-energized tap changer for operation at ground level with padlocking provisions
- Lifting lugs for lifting complete transformer
- Magnetic liquid level gauge with minimum, maximum, and 25°C markings
- Dial type liquid temperature gauge with maximum temperature drag hand
- Nameplate mounted at eye level
- Tank ground pads, two mounted on opposite diagonal bottom corners
- Skid base for moving in all directions with corner jack pads
- Bottom drain and top fill valves
- Pressure relief device
- Sealed tank oil preservation system with pressure/vacuum gauge
- Winding temperature indicator for forced cooled transformers at 10 MVA and above

Optional Accessories
(Partial List)
- Bushing current transformers
- Surge arresters and mounting brackets
- High voltage or low voltage terminal compartments
- Wye-delta and series-multiple terminal connections
- Forced air cooling or provisions for forced air cooling
- Inert gas or air bladder conservator oil preservation
- Winding temperature indicator (below 10 MVA)
- Electronic temperature indicator
- Fiber optic winding temperature indicator
- Microprocessor LTC controls

Electrical Test
Testing and quality checks throughout the manufacturing process assure total quality in the final product. Testing of the completed transformer is conducted in accordance with industry standards.

ANSI, IEEE and NEMA Standard Tests:
- Resistance measurements
- Ratio
- Load loss and impedance
- Core loss and excitation current
- Polarity or phase displacement
- Applied potential
- Induced potential
- RIV or partial discharge for class II power transformers
- Impulse for class II power transformers
- Insulation power factor

Special or Design Test:
- Audible sound level
- Temperature rise
- Impulse
- Switching surge
- Partial discharge measurement
- Frequency Response Analysis (Framit)
- Steep Front Impulse
Field Engineering Services (FES)

Turnkey Installations
Kuhlman Electric offers the option of complete field installation service for all your transformer needs, regardless of the manufacturer of the transformer.

Transportation to site, unloading, inspection, installation and testing are all provided under the direction and supervision of field service technicians. This means that Kuhlman takes full responsibility to insure that all of the details of the installation are performed. Service begins at the factory and follows the transformer through every step of packing, shipping, arrival at the job site, installation and final inspection. The transformer is inspected upon arrival, supervised during unloading, and Kuhlman ensures the installation is completed properly and on-time. Kuhlman’s Field Engineering Services can save days of installation time by using this closely coordinated work process.

The cost of the service is minimal compared to the value, assurance and protection that Kuhlman provides. To guarantee power transformers are installed properly and with the least amount of time and effort, have them installed by Kuhlman.... the people who know transformers the best.

Additional Services
Kuhlman has an exclusive sales agreement with GEA Renzmann & Gruenewald who is known as an acknowledged expert in forced transformer cooling for more than forty years and is a trusted partner of leading transformer manufacturers around the world. Kuhlman Electric/GEA Renzmann & Gruenewald’s combined product offering in North America ranges from a wide array of standardized air/water coolers and transformer oil pump products to much more complex, custom-designed cooling packages and complete unit installations. Kuhlman Electric Field Engineering Services Teams are at your company’s disposal for installation and service needs for these products when required.

Kuhlman FES is also the factory-authorized U.S. field service installer of the Dynamic Ratings’ line of transformer monitor and control systems. This unique relationship provides utility customers with application, design, hardware, and installation support for retrofit applications of these products, all from a single source Kuhlman Field Engineering Services.

FES performs other services in addition to power transformer turnkey installations. Kuhlman specializes in power factor testing, site inspection, transformer component replacement of retrofit of coolers and pumps and monitoring products. Kuhlman personnel are also trained to perform site measurement for slipover current transformer installations.
Transformer Protector
Kuhlman also sells, services and installs the TRANSFORMER PROTECTOR, a unique passive mechanical system designed and engineered to protect transformers against explosion and fire. Use of this Transformer Protector Corporation product can help minimize damage in the event of an internal fault on power transformers by suppression of oil fires and preventing tank rupture.

In-Service and On Site Instrument Transformer Accuracy Testing
On site testing services offered by Kuhlman Electric Corporation are done by industry experts. These services consist of the following tests:

*In-Service CT Excitation Testing (BCTs/GCTs)*
- Variable Resistance Type of Excitation Test
  - Existing BCT burden disconnected (2 min.)
  - CT voltage/current values at different burdens
  - Wiring is verified
- RCF and PA Data is Derived from Excitation Data
  - Core cross-section information is assumed
  - Data not traceable
- Access at shorting terminal block to replace burden

*On Site CT and VT Accuracy Certification*
- Off-Line Accuracy Test
  - Short outage for testing-no need to remove CTs
  - Simple access to secondary connections
  - VTs tested up to 34.5kV voltages
- RCF and PA Metering Certification
  - Each CT or VT is tested individually
  - Actual readings are used from tested CTs and VTs
  - CT report on 10% & 100% rated current performance
  - Tested at burden appropriate for the application
- NIST Trace-ability
  - Instrumentation traceable to NIST
  - Data taken from actual readings and identified by location

Each set of measured secondary voltage/current values are converted to an actual excitation curve for every unit tested.

Supervision and Testing
Kuhlman FES can provide field supervision and testing for power transformers at the job-site. Fully qualified technicians are available to oversee transformer installation and/or testing of your power transformers.

Decommissioning & Transfer Services
With reduction in resources, many of our customers require assistance in removing or transferring existing power transformers. Kuhlman FES provides expertise in field removal and preparation of the transformer for disposal or reinstallation elsewhere. Many years of transformer turnkey installations of not only our units but that of many of our competitors qualifies Kuhlman Field Engineering Services to provide fast, convenient service.
Kuhlman manufactures instrument transformers at the facilities in Versailles, KY and Crystal Springs, MS. Kuhlman offers the electric power market instrument transformer products from 600 volts to 765kV for applications ranging from generator protection to metering power flow. Current ratings are available from 5 amps through 50,000 amps on selected products. Electric utility metering, protection, transmission and distribution substation departments, and electrical OEM manufacturers utilize these products in a wide range of applications.

Kuhlman has the widest product offering of instrument transformers available in North America. Instrument transformers meet all metering and relaying needs for the transmission, distribution and generation customers. In addition, Kuhlman offers specialty high accuracy metering products to solve new metering applications required as a result of utility deregulation. Please contact Kuhlman with any requirements.
600 Volt Auxiliary Current and Voltage Transformers

Dry-type open construction auxiliary current transformers for summation and ratio correction applications are available in current ranging from 0.1 to 50 amps and up to T800 accuracy. Voltage transformers are also available in this same construction.

Type PS 600V Slip-over Large Window Current Transformers

Transformers are outdoor rated and are intended for retrofit application for relaying protection/control circuits. The product is applied upon high voltage insulators (bushings) to allow a 600V rated design to be used on high voltage systems.

Type PS CT’s are totally encapsulated in UV stabilized cast resin material, and equipped with a noncorrosive conduit box with (2) 1” NPT openings.

Product ratings:
- **Window sizes** 6” to 42”
- **Outside Diameter** 14” to 46”
- **Height** 2-1/2” to 8-3/4” (as needed)
- **Ratios** 100 to 10000:5 SR, DR, or MR
- **Accuracy** Up to C800 and metering to 0.3% B1.8

ACCUSlip™ Slip-over Current Transformers

For the first time since the introduction of the slip-over type current transformers, Kuhlman has developed a high accuracy revenue metering design. Proprietary ACCUSlip™ design can achieve excellent results down to ratios of 200:5 or lower.

**ACCUSlip CT**

This product provides accuracy of 0.15% at nominal current and up to rating factor levels, with 0.3% accuracy down to 10% of nominal current.

Higher rating factors of 4.0 can be supplied.

**ACCUSlip™ Accuracy Performance**

Window sizes from 6” to 42” for use over most bushing sizes. Units are inherently safe and do not introduce additional oil or SF6 gas into the substation. Insulation consists of UV stabilized black molded cast resin material.

This design provides overall lowest metering cost by:
- Reducing initial purchase price
- Low installation cost
- Short leadtime
- High accuracy performance
SCADA Recloser CT’s
SCADA-BEH, SCADA-DEH, SCADA-CEH

These CT’s are small slip-over designs specifically sized for use on reclosers. Units are outdoor rated and intended to power solid-state devices to indicate load level on distribution circuits.

Compact design to fit 15 and 25kV recloser bushings and even many 34.5kV applications. Aluminum conduit box with (2) 1” NPT outlets is supplied.

Outdoor rated insulation is UV stabilized solid cast resin molded in black color. Each CT is shipped with 3 aluminum mounting brackets.

Product information as follows:
Window sizes 4.75”, 5.5”, 5.75” and 8.12”
Height 1.75”, 2.25” and 3”
Ratios 50:5 to 1200:5 single or multi-ratio
Accuracy Going from 5% error at low ratios, and to 0.3% accuracy at 600:5 ratios and higher

Generator Current Transformers

High current rated generator current transformers (GCT’s) have specially designed shield windings to prevent phase interference on generator measurement. Designs available in both light-weight board-mounted configuration, and outdoor encapsulated unit to provide for all applications. Arrays are also available to save installation cost.

Electrical ratings of product:
Ratios up to 45,000:5 SR, DR, or MR
Window sizes up to 35” (890mm)
Operating Frequency 50/60 Hz
Insulation Class 130 and 155 °C designs
IEEE or IEC specifications
Accuracies of up to C800 and metering to 0.3%B1.8
High accuracy 0.15% designs available
Higher voltage designs available, contact factory
15-34.5kV Outdoor Molded Current and Voltage Transformers

These molded cycloaliphatic epoxy insulated current (type BB) and voltage (type PTT) transformers are intended for outdoor use on 15, 25, 34.5kV distribution systems. Kuhlen supplies a full line of current transformers and voltage transformers and offers a metering rack fully assembled and tested at the factory.

**Electrical ratings of product:**
- **Voltage/BIL ratings:**
  - 15kV/110kV BIL
  - 25kV/150kV BIL
  - 34.5kV/200kV BIL
- **CT Ratios** 10:5 to 1200:5: SR and DR
- **Accuracy** 0.3B1.8 (standard) and 0.3B0.5(extended)
- **Relay Accuracy** up to T200
- **VT Ratios** from 60:1 to 500:1
- **Accuracy** 0.3Y (0.3Z available at 15kV)

Units have RUS approval and many have Industry Canada metering approval. Combination CT/VT units also available.

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5-34.5kV Outdoor Window/Bar Current Transformers

Type TD, LG and RMB window/bar type molded current transformers are station post configuration for convenient mounting in substations. CT’s are designed to mount in any orientation, but cannot be used as bus supports. Inside diameter of insulator is provided with a semiconductive shield and pig-tail lead to insure positive voltage contact.

**Product ratings:**
- **Voltage/BIL ratings**
  - 5 kV/60kV BIL
  - 15kV/110 kV BIL
  - 25kV/150 kV BIL
  - 34.5kV/200 kV BIL
- **Ratios up to**
  - 4000:5 SR, DR, MR (Specials to 8000:5)
- **Window sizes** of 3.5”, 4.5”, 8.75”, and 11”
- **Accuracy** up to C800 and 0.3B1.8

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15-34.5kV Outdoor, Oil-filled Distribution Class Instrument Transformers

Type SCOF current transformer and Type SPOF voltage transformer are compact designs that provide the robust performance of an oil-filled product in a distribution transformer housing. With full accuracy/burden ratings and flexible options comparable to larger substation class products, the SCOF/SPOF are ideal when molded designs cannot meet the application requirements. Rugged, baked-on powdered polyester paint protects the mild steel housings of the transformers. Designs are hermetically sealed using a gas cushion above the oil in the main tank. Options include 0.15% accuracy, factory-installed lightning arresters, pedestal mounting as well as traditional pole-mounting.

**Type SPOF Voltage Transformer**
- 60:1 to 500:1 Ratios
- 0.3ZZ Accuracy

**Type SCOF Current Transformer**
- 10/20:5 to 600/1200:5
- Ratios 0.3B1.8/1.8 Accuracy

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*Through window fully insulated Type LG CT*
Oil-filled Instrument Transformers

Kuhlman Electric manufactures a very flexible line of substation class oil-filled current and voltage transformers in Crystal Springs, Mississippi. These products are typically constructed with high creepage insulators and corrosion-resistant housings with a rugged baked-on powdered polyester paint finish applied over a 5 stage metal pre-treatment. All designs have a gas cushion above the oil in the main transformer tank to provide a sealed design against moisture entry, while allowing oil expansion and contraction under all ambient and load conditions.

25-161kV Outdoor Substation Class Current Transformers
Type COF oil-filled head type current transformers can be provided with metering accuracy, relaying accuracy or a combination of both in a multiple core configuration. Housing can accommodate from 1 to 4 separate cores within the head of the unit. Metering accuracy supplied per IEEE as 0.3B1.8. Relay designs up to C800 available.

Expanded Metering Substation Class Current Transformers
Type CXM current transformers provide best accuracy of 0.15%B1.8 from 0.5% to 400% of current. This transformer ensures stable revenue accuracy over a broad current range for solid-state metering, and is best suited for power generation facilities.

Improved Short-time Current Rating Transformers
Type CMF current transformers have superior mechanical and thermal short-time ratings for current ratios below 800:5. By using enhanced bracing and secondary current limiting measures, this design provides an improved withstand of 4 times that of normal units. Enhanced short-time ratings allow this unit to be applied to circuits having relatively high available fault current but requiring low ratios for metering.

Typical CMF Performance at Low Ratios

<table>
<thead>
<tr>
<th>Ratio</th>
<th>10/20:5</th>
<th>25/50:5</th>
<th>50/100:5</th>
<th>100/200:5</th>
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<tr>
<td>Std I mech</td>
<td>1.5kA</td>
<td>3.75kA</td>
<td>7.5kA</td>
<td>15.0kA</td>
</tr>
<tr>
<td>High I mech</td>
<td>6.0kA</td>
<td>15.0kA</td>
<td>31.0kA</td>
<td>63.0kA</td>
</tr>
</tbody>
</table>

25-138kV Outdoor Substation Class Voltage Transformers
Type POF oil-filled inductive voltage transformers are supplied with two tapped secondary windings that can be used for revenue metering, or for relaying applications. Many units have withstand levels that comply with Canadian group 3c requirement of 190% over-voltage for 8 hours.

Standard designs provide accuracy 0.3% ZZ capability and high thermal burden ratings. High accuracy 0.15% designs available upon request.

46-230kV Outdoor Station Service Voltage Transformers
Type SSVT single phase transformers are intended to provide low voltage control power for substations, cell tower installations and switching stations by tapping directly from the high voltage line.

Power windings available in 120/240VAC and other voltages for power levels from 10kVA to 125kVA. In addition, the SSVT can be supplied with 1 or 2 metering windings with accuracy of 0.3%ZZ or better. Contact factory for higher kVA ratings availability.
High Voltage Oil-filled Instrument Transformers through 765kV

To offer domestic customers the benefit of a full product line through the highest voltage ratings, Kuhlman Electric developed a joint manufacturing relationship in 1996 with Arteche of Spain, with facilities in Bilbao, Spain; Mexico City, Mexico; and Barquisimeto, Venezuela. Arteche has been producing instrument transformers since 1946, and all manufacturing facilities have ISO-9000 certification. Units are built and tested to IEEE standards, and are warranted by Kuhlman and carry the Kuhlman label. *All 230kV and higher instrument transformers are for sale only to U.S. and Canadian customers and packagers.*

Units are built corrosion resistant using aluminum domes and galvanized steel bases. Designs are equipped with stainless steel bellows to provide for oil expansion and contraction in a sealed arrangement. This allows horizontal shipment and storage of the transformers, with the exception of the coupling capacitor voltage transformer, which is shipped vertically with the upper capacitor dis-assembled.

**230-765kV Outdoor Substation Class Current Transformers**

Type CA head-type design current transformers can be applied to high voltage circuits for metering, control and protective relaying. Standard metering designs are equipped with a single core having dual ratio arrangement, and relaying designs have multiple cores with multi-ratios specified to meet system requirements.

The type CA design is supplied with an aluminum dome to house the fully insulated and braced core/ coils.

These designs can accommodate up to 6 total cores within the single housing for relaying applications with up to C800 accuracy.

Variations available for metering include accuracies of 0.3B1.8 and better accuracies such as 0.15B1.8.

In addition, expanded metering range designs (designated type CXM) are available to provide 0.15% accuracy for B0.1-B1.8 burdens from 0.5% to 400% of current. The expanded metering range designs have been developed to accurately meter the full range of currents normally encountered in peaking generation facilities.

**138-500kV Outdoor Substation Class Voltage Transformers**

Type UTE/UTF oil-filled inductive voltage transformers are supplied with two tapped secondary windings that can be used for revenue metering or relaying applications. Three secondary winding designs are available.

Voltage ratings from 138kV to 230kV have a single stage insulation structure with the core located in the base housing. Type UTF-420 (345kV) design is a cascade design with the core positioned between two insulation structures at 50% voltage. Standard designs provide accuracy 0.3% ZZ capability.

**69-500kV Outdoor Oil-filled Coupling Capacitor Voltage Transformers**

Type D capacitive voltage transformers have two tapped secondary windings that can be used for metering, relaying or carrier communications in an outdoor substation. Design has an oil-filled base arrangement that is equipped with an external calibration terminal box. Carrier accessories and voltage tap ground switch available as options.

From 69kV to 500kV ratings, metering accuracy is 0.3% Z and relaying performance is 0.6% ZZ. Wave traps are also available as a separate item.
Single Phase and Three Phase Outdoor Metering Units

Kuhlman Electric’s oil-filled combination metering units incorporate both current and voltage transformers into a common housing. By packaging the separately insulated current and voltage transformer assemblies into a compact arrangement, benefits include smaller mounting space, lower purchase cost and installation expense, reduced structure needs and quicker installation time.

15-34.5kV Distribution Class Single Phase Metering Units
Type JS oil-filled metering unit has a distribution transformer type housing that readily adapts to overhead mounting using typical pole hanger brackets. Reliable self-healing oil insulation provides rugged performance in the voltage ranges available.

Design has current ratios up to 600:5 and voltage ratings for up to 34.5kV systems. Full burden and accuracy ratings of 0.3B1.8/1.8 for dual ratio current transformers, and 0.3% ZZ for the voltage transformer provides performance comparable to substation class equipment. Standard design meets the Canadian group 3c requirements of 190% over-voltage for 8 hours. Options include 0.15% high accuracy, mounting feet for pedestal mounting, stainless steel housing and factory-installed lightning arresters.

46-230kV Substation Class Single Phase Metering Units
Type KA oil-filled metering units are designed for pedestal mounting within a substation. This design consists of two tapped secondary winding voltage transformers and a dual ratio single core current transformer in one housing for metering applications. Separate insulated core/coils are contained within the aluminum dome and the galvanized steel base housing and hermetically sealed with stainless steel bellows. The bellows arrangement allows the units to be shipped in the horizontal position.

Design has current ratios up to 1500/3000:5 and voltage ratings for up to 230kV systems. Metering accuracy of 0.3B1.8/1.8 and 0.3% ZZ supplied in accordance with IEEE. 0.15% high accuracy designs available with wide range performance from 0.5% to 400% of rated current.

15-46kV Distribution Class Three Phase Metering Units
Type MVCT oil-filled metering units can be provided in 2, 2-1/2, and 3 element configurations. Unit is normally pedestal mounted, but can be fitted with hanger brackets for pole mounting. Reliable self-healing oil insulation provides rugged performance in the voltage ranges available.

Design has current ratios up to 1200:5 and voltage ratings for up to 46kV systems. Full burden and accuracy ratings of 0.3B1.8/1.8 for dual ratio current transformers, and 0.3% ZZ for the voltage transformer provides performance comparable to substation class equipment. Standard design meets the Canadian group 3c requirements of 190% over-voltage for 8 hours. Options include 0.15% high accuracy, hanger bracket for pole mounting, stainless steel housing and factory-installed lightning arresters.
Instrument Transformer
On-Site Testing

Kuhlman has developed a specialized procedure to verify excitation and accuracy performance on in-service current transformers while they are energized. This unique testing program allows customers to check proper CT operation without taking equipment off-line.

This can be used to verify:

- Bushing CT’s performance in the case of relay mis-operation.
- Generator CT’s performance for both relaying and metering.
- GSU BCT’s verification for revenue metering measurement.

A test technician can be sent to site to take measurements with proprietary equipment certified to National Institute of Standards and Testing (NIST) and provide a formal test report to define the results.

On-Site Training Program

Kuhlman Electric offers a comprehensive training program with seasoned instructors to cover all aspects of instrument transformer design, operation, testing, and application. Typical program is a 4 hour long course presented via Computer/Projector with support material. Also available for self-paced course is a CD/Training manual to cover the transformer basics to applications.

Field service slip-over CT installation

Kuhlman is the number one supplier of slip-over CT’s, and has experienced field service technicians available for installation. When company resources are strained or nonexistent, keep in mind that Kuhlman Electric can help perform at-site services to install and test slip-over current transformers.

By having Kuhlman perform the site measurements, proper sized products are guaranteed for critical installations.

(See also Kuhlman Field Engineering Services Section pages 12 & 13)
Kuhlman Electric manufactures a full array of pole type, padmount, and submersible distribution transformers. All transformers are built to order and comply with the latest industry standards.

Kuhlman differentiates itself with the fastest lead times and best on-time performance of any transformer manufacturer, and the quality is unsurpassed.

Kuhlman works with its customers to reduce overall costs through proven supply chain management and e-commerce solutions. The company mission is to reduce customer total costs while improving the overall quality of goods and services provided.

**Standard Shell-Type Design**

Kuhlman distribution transformers are of all shell-type construction consisting of one coil with two core loops. The windings may be wound as a low voltage, high voltage, low voltage, (low-high-low) arrangement, or as a low – high configuration, as the application dictates.

All windings use adhesive coated, thermally upgraded paper as the insulation between the layers. Secondary windings are usually wound with aluminum sheet conductor, while primary windings use either aluminum or copper film insulated magnet wire.

The cores are constructed of single turn laminations cut and formed so that each lamination completes a magnetic circuit. The laminations are assembled through and around the coil in a staggered joint pattern to keep core loss and exciting current to a minimum.
Pole Type, Single Phase

Kuhlman pole type distribution transformers are available in conventional and protected styles. They feature aluminum or copper primary windings and aluminum sheet secondary windings. They have exceptionally high short circuit strength, sturdy construction, low losses and inherently high thermal capacity.

Conventional

Ratings are available 5 though 500 kVA, 2400/4160 Y through 19920/34500 Y, 200 kV BIL and below, with typical secondary voltages of 120/240, 277 or 240/480. Additional secondary voltage ratings for all types are available on request.

Protected

Protection includes internal secondary breakers, primary protective links, and external lightning arresters.

These transformers are available with 120/240, 277 and 240/480 secondary voltages in ratings 5 through 100 kVA and primary voltages of 2400/4160Y through 19920/34500Y, 200 kV BIL and below. All Kuhlman transformers are RUS approved.

DSST-Station Service Applications

A station service transformer (DSST) provides a fully insulated product up to 48 kV (250kV BIL) with power performance up to 100 kVA. The design can withstand 115% over-voltage continuously and 130% over-voltage for one minute.

The station service transformer is mounted onto a pedestal or pole with primary tied to the transmission line. The secondary cables are connected to the station power panel.

Typical secondary ratings available: 120/240 VAC, 277 VAC, 240/480 VAC, 600 VAC. Contact us for other configurations.

Accessories

Kuhlman’s pole type distribution transformers are equipped with accessories in accordance with the latest ANSI standards. The following optional items are available upon request:

• Externally operated primary tap changer
• Externally operated dual volt switch
• Internal primary fusing
• Internal secondary breaker
• Externally mounted primary lightning arrester
Pole Type, Three Phase

Kuhlman three phase Triplex pole type transformers are designed to meet your three phase load requirements. One three phase transformer replaces three single phase units.

The triplex transformer consists of three standard single phase cores and coils arranged vertically in a common core clamp and round tank. The clean, slender profile of this construction makes Triplex ideal for pole mounting. No platform or extra cross arm structures are required.

Conventional ratings are available through 300 kVA. Protected transformers are available through 150 kVA.

Primary voltages are available 2400 delta through 24940 wye, 125 kV BIL and below. Secondary voltages are available in delta or wye configurations through 600 volts.
Padmounted - Single Phase

Kuhlman Lo-Pak single phase padmounted transformers are offered in two basic designs covering a full range of ratings and options.

Lo-Pak I (ANSI Type 1) features roomy compartments with terminations located for vertical cable termination. Ratings through 100 kVA are 32 inches high. Primary voltage ratings are available through 34.5 kV CLASS (150 kV BIL).

Lo-Pak II (ANSI Type 2) offers the same core and coil assembly as Lo-Pak I in a smaller more compact design. Ratings through 100 kVA are typically only 24-27-inches high. 167 kVA are 35 inches high. Primary voltage ratings are available through 34.5kV CLASS (150 kV BIL).

Lo-Pak transformers are engineered especially for underground residential systems, front or rear lot line installation. Transformer tank and compartments are contoured for neat appearance and safety. Locking provisions are recessed. The high and low voltage compartment is tamper-resistant as tested in accordance with the latest ANSI standards. All transformers are RUS approved.

Optional Features

- Insulated integral primary bushings or universal wells for either loadbreak or non-loadbreak inserts
- Externally replaceable weak link or current-limiting primary fuses
- Under oil MOV arresters
- Secondary breakers
- Primary loadbreak switch(es)
- Taps and a choice of single or multiple voltage ratings
Submersible - Single Phase

Kuhlman submersible underground transformers are offered in three configurations: Sub Pak I, Sub-Pak II and Sub-Pak Duplex.

Sub-Pak I features a round vertical tank that is hermetically sealed for repeated flooding and/or immersion. Terminals, ground pads, and nameplates are cover-mounted for easy access from ground level. Ratings: 25-167 kVA.

Sub-Pak II is a horizontal design which installs in a trench vault. Low and high voltage terminals are accessible through removable grates. Ratings: 25-167 kVA.

Sub-Pak Duplex also installs in a trench vault. Ideal for apartment buildings and light industry where load is basically single phase applications, Sub-Pak Duplex acts like a three phase subway transformer used in place of a three phase padmounted unit. Both single and three phase services are available. Ratings 25/10 kVA to 100/50 kVA.

Standard Accessories:

- Stainless steel tank, cover and hardware
- Bushing wells for deadfront elbow connectors
- Parking stand for primary connector
- Low voltage stud type bushings, screw on cable leads
- Liquid level indicator

In addition to standard accessories the following options are offered:

- Sub-Pak I has 1 or 2 primary 2-position loadbreak switches
- Externally replaceable current limiting fuse with interlock loadbreak switch in Sub-Pak I
- Bayonet type fuse with isolation link/ CLF for Sub-Pak I
- Secondary breaker and coordinated internal primary fuse
- Primary breaker & coordinated isolation link (Sub-Pak II)
- Grounded neutral
- Loadbreak or non-loadbreak primary inserts
- Spades on low voltage bushings
- Automatic pressure relief device
Submersible/Loadbreak, Oil Switch Modules

Kuhlman switch modules are designed to reduce the cost of providing control and flexible, easy-to-service system protection. Various switching combinations are available in both fused and non-fused designs. Non-fused designs provide load switching, sectionizing, and loop isolating. Fused designs add current limiting fusing in dry well canisters for the protection of a group of non-fused transformers or circuits.

Open-close, loadbreak oil switches are rated 200 amp, 15-25 kV, 12.5 kV BIL - 10,000 amps symmetrical make and latch. Switches are quick-make, quick-break type. Switch speed is independent of operating handle speed.

Features:
• Tanks are all-welded, hermetically sealed stainless steel construction
• Oil level gauge
• Externally replaceable current limiting fuses are equipped with interlocks to prevent removal of the fuse while the switch is in the closed position
• Accessories are made of stainless steel or other non-corrosive materials
• Universal bushings wells
• Parking stands accommodate all line accessories
• Non-corrosive ground connections are located near high voltage bushings
• Internal bussing is copper, all connections are double nutted
• Tanks are uncoated with 304L stainless steel and equipped with base channels for beam or clearance mounting in vaults or enclosures
• Lifting lugs are designed to provide a sufficient factor of safety
• Oil thief tube is accessible for oil sampling
• Nameplate and all identification plates are stainless steel and cover mounted

Common Switching Configurations:
Kuhlman Pad-mount Dead-front Oil-filled Switches

Kuhlman padmounted oil switches provide above grade, convenient line fusing and switching in padmount cabinets. They are constructed in accordance with current ANSI safety standards. Lockable flip-top hoods open upward for better access and are removable when needed.

Switches are available in fused or non-fused designs, for single or multiple line configurations.

**Electrical Ratings**

**Primary Ratings** of 8.3kV, 15kV, and 23 kV and up to 150kV BIL.

**Fuse Ratings** through 100 amperes. (Paralleled Operation)
Distribution Transformers

Distribution Transformer Services

Inventory Management

Kuhlman has an active inventory management group that can work for you! Kanban techniques, capacity planning, and material replenishment programs help customers control inventory costs. Users interact directly with our planning personnel to cut out any middle man. Production planning and marketing services are provided to track all requirements for valued customers, thereby saving the purchasing company’s time and resources.

Short Cycle Lead Times

The facility in Versailles, Kentucky offers the best delivery schedules and on-time performance in this industry.

Single Phase Pole Type and Padmount Transformers are available for short cycle deliveries to meet customer immediate needs.

Kuhlman’s typical on-time performance has been 100% on time to the day or earlier.

Emergency Response

Kuhlman is committed to supporting loyal customers at times of great need, by planning together before an emergency occurs. Kuhlman’s emergency response agreement dedicates production space completely to the customer. Kuhlman builds to order in as little as five working days.

Literally thousands of transformers have been placed in service since the initiation of these agreements, with an on time performance to the customer of nearly 100%.
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DISTRIBUTION
__Polemounted
__Padmounted
__Submersible
__Oil-Filled Switches
__Distribution Services

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