Instrument Transformer Division

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.
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

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.

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. Kuhlman 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.

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

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

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.

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.

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>
</tr>
</thead>
<tbody>
<tr>
<td>Std l mech</td>
<td>1.5kA</td>
<td>3.75kA</td>
<td>7.5kA</td>
<td>15.0kA</td>
</tr>
<tr>
<td>Hign l mech</td>
<td>6.0kA</td>
<td>15.0kA</td>
<td>31.0kA</td>
<td>63.0kA</td>
</tr>
</tbody>
</table>

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)