ENERGO GROUP CANADA INC.

AND

ENERGO GROUP SARAJEVO D.O.O.

SMART, DRY TYPE TERMINALS, ELECTRICAL EQUIPMENT & TRANSFORMERS

www.egcanada.ca

Canada, 2018

ENERGO GROUP CANADA INC.

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For more details please contact us or visit our website www.egcanada.ca

OUR FACTORY FACILITY – EUROPE

PRODUCTION AREA

ENERGO GROUP CANADA INC. (EGC) & ENERGO GROUP SARAJEVO D.O.O. (EGSA)

About us

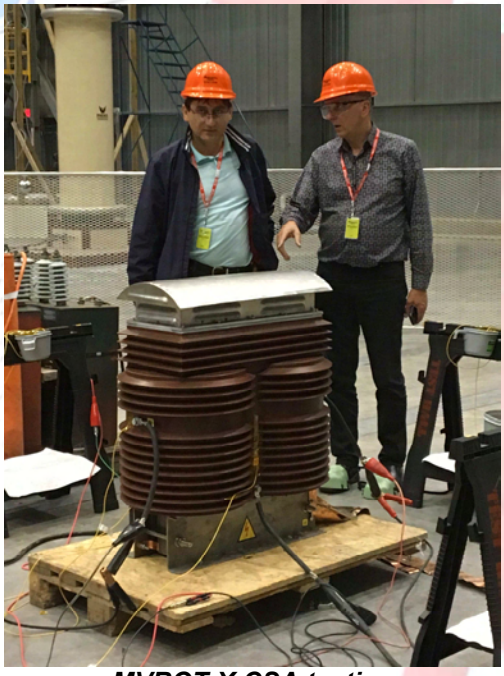
*Energo Group Canada Inc. (**EGC**) together with Energo Group Sarajevo D.O.O. (**EGSA**), is an Engineering, IP Research and Development, Manufacturer, and Distributor of specialized **SMART** electrical equipment.*

***EGC** was incorporated in 2014 to better serve the North, Central and South America marketplaces with products not currently available in the Americas.*

*We developed an integrated approach of theory and practice combined with an innovative Method and System which led to the development of the Medium Voltage Regulating and Optimizing Terminal ("**MVROT**") and the Smart Substation Grid Optimizer ("**SSGO**").*

Both products use an adaptive infrastructure within existing or new distribution grids, that balance loads, reduce losses, improve power quality and increase safety and reliability.

Winnipeg, CIGRE 2017 Expo, MVROT-X



MVROT-X CSA testing

*With offices in Toronto, Ontario, Calgary, Alberta and distribution centres in High River, Alberta and Burlington, Ontario; **EGC** is well positioned to attend all industries in American markets.*

*By **EGSA** positioned in central Europe we can serve all markets around the world as well. **EGSA** products are already well known in Europe, Asia, Africa and Australia - see maps on next page where our products are already successfully installed.*

***EGSA** was formed in Europe as a consortium of three major, well-established, companies from 1959 and 1969. Together they bring over 150 years of business experience in the electrical products industry.*

*Our manufacturing centre is **CSA, ISO 9001**, **ISO 14001,** and **OHSAS 18001** certified. Our VTOP and MVROT line of products are **CSA** certified with VROT scheduled next.*

Our mission statement:

Today's Solution for Today's and Tomorrow's Problems

We bring complete solution, together with the unique equipment

Countries Our Products Are Installed In

Europe

Africa, Asia and Australia

Also in Canada

CERTIFICATES


CERTIFICATE

The Certification Body of TÜV SÜD Management Service GmbH certifies that

Fabrika mernih transformatora Zaječar d.o.o.
Stražilovska 57
19000 Zaječar
Serbia

has established and applies a Quality Management System for

Design, production and sale of transformers, voltage transformers, insulators of epoxy resins, Earthing resistors and reactors.

An audit was performed, Report No. 707015930.
Proof has been furnished that the requirements according to

ISO 9001:2015

are fulfilled.
The certificate is valid from 2016-12-13 until 2019-12-12.
Certificate Registration No.: 12 100 46865 TMS.

ISO 9001


TMS

CERTIFICATE

The Certification Body
TMS CEE doo
certifies that

Fabrika mernih transformatora
Zaječar d.o.o.
Stražilovska 57
19000 Zaječar
Serbia

has established and applies an Occupational Health and Safety Management System for

Design, production and sale of transformers, voltage transformers, insulators of epoxy resins, Earthing resistors and reactors.

An audit was performed, Report No. 00107
Proof has been furnished that the requirements according to

SRPS OHSAS 18001:2008

are fulfilled. The certificate is valid from 2017-01-01 until 2019-12-31
Certificate Registration No. 5 116 00107

Belgrade, 2016-11-29

ZERTIFIKAT • CERTIFICATE • 证书 • CERTIFICADO • CERTIFICA

OHSS 18001


CERTIFICATE

The Certification Body of TÜV SÜD Management Service GmbH certifies that

Fabrika mernih transformatora Zaječar d.o.o.
Stražilovska 57
19000 Zaječar
Serbia

has established and applies an Environmental Management System for

Design, production and sale of transformers, voltage transformers, insulators of epoxy resins, Earthing resistors and reactors.

An audit was performed, Report No. 707015930.
Proof has been furnished that the requirements according to

ISO 14001:2015

are fulfilled.
The certificate is valid from 2017-01-13 until 2020-01-12.
Certificate Registration No.: 12 104 46865 TMS.

ISO 14001


CSA Group

Certificate of Compliance

Certificate: 70089255 Master Contract: 264700
Project: 70089255 Date Issued: 2016-09-01

Issued to: Energo Group Canada Inc.
2530 Hochwald Avenue SW
Calgary, Alberta T3E 7H5
CANADA
Attention: Dragan Lemer

The products listed below are eligible to bear the CSA Mark shown

Issued by: Douglas Brunswell
Douglas Brunswell

PRODUCTS

CLASS 5411 04 – TRANSFORMERS – MISCELLANEOUS

High voltage instrument transformers, potential type, Series VTOP followed by suffixes, primary rated up to 27.6 kV, secondary rated 120 Vac, 250 VA @ Class 3%, Insulation Class F.

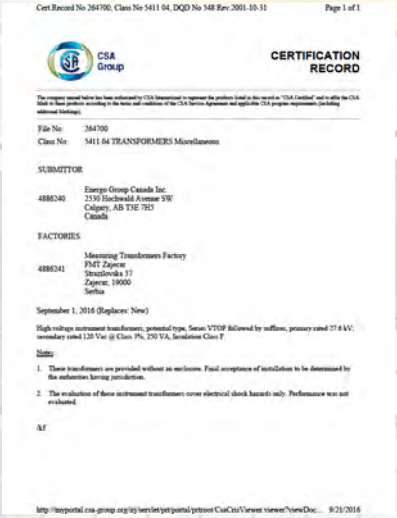
Notes:

1. These transformers are provided without an enclosure. Final acceptance of installation to be determined by the authorities having jurisdiction.
2. The evaluation of these instrument transformers cover electrical shock hazards only. Performance was not evaluated.

APPLICABLE REQUIREMENTS

C22.2 No. 47-13 – Air Cooled Transformers (Dry Type)

CSA - VTOP


Cert Record No 264700, Class No 5411 04, DQD No 548 Rev 2001-10-31 Page 1 of 1

CSA Group

CERTIFICATION RECORD

File No: 264700
Class No: 5411 04 TRANSFORMERS Miscellaneous

SUBMITTOR

4886240 Energo Group Canada Inc.
2530 Hochwald Avenue SW
Calgary, AB T3E 7H5
Canada

FACTORIES

4886241 Measuring Transformers Factory
FMT Zajecar
Stražilovska 57
Zajecar, 19000
Serbia

September 1, 2016 (Replaces: New)

High voltage instrument transformers, potential type, Series VTOP followed by suffixes, primary rated 27.6 kV, secondary rated 120 Vac @ Class 3%, 250 VA, Insulation Class F

Notes:

1. These transformers are provided without an enclosure. Final acceptance of installation to be determined by the authorities having jurisdiction.
2. The evaluation of these instrument transformers cover electrical shock hazards only. Performance was not evaluated.

Af

http://mysportal.csa-group.org/irj/servlet/prt/portal/prtroot/CsaCrisViewer.viewerViewDoc... 9/21/2016

CSA - FACTORY


CSA Group

Certificate of Compliance

Certificate: 70103418 Master Contract: 264700 (264700)
Project: 70103418 Date Issued: 2017-10-03

Issued to: Energo Group Canada Inc.
1110 - 1 Street SW
Calgary, Alberta T2R 0V1
CANADA
Attention: Dragan Lemer

The products listed below are eligible to bear the CSA Mark shown

Issued by: Douglas Brunswell
Douglas Brunswell

PRODUCTS

CLASS 5411 04 – TRANSFORMERS – Power

High voltage power transformer, Model MVROT-250, primary rated 4160 Vac; secondary rated 2500 Vac, 185 kVA, 30 kV BIL, Insulation Class H. Additional secondary windings: Measuring (voltage), rated 120 V, 50 VA; Control, rated 120 V, 3%, 300 VA; Current, rated 10 VA, 60:1.

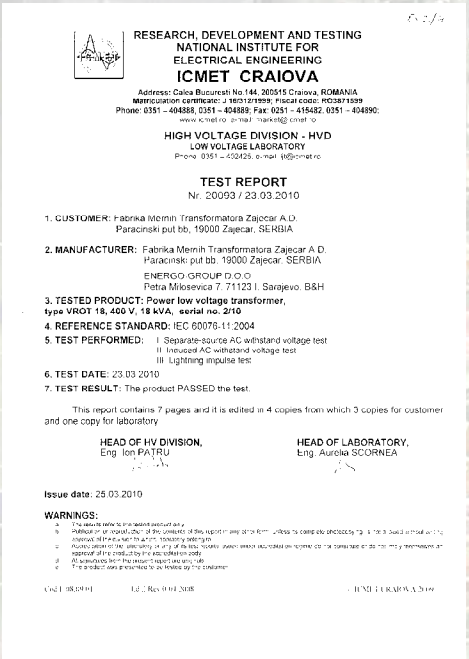
Notes:

1. These transformers are provided without an enclosure. Final acceptance of installation to be determined by the authorities having jurisdiction.
2. The evaluation of the instrument transformers windings cover electrical shock hazards only. Performance was not evaluated.

APPLICABLE REQUIREMENTS

C22.2 No. 47-13 – Air Cooled Transformers (Dry Type)

CSA - MVROT


RESEARCH, DEVELOPMENT AND TESTING
NATIONAL INSTITUTE FOR
ELECTRICAL ENGINEERING
ICMET CRAIOVA
Address: Calea Bucuresti No.144, 200515 Craiova, ROMANIA
Matriculation certificate: J 16/31/1999, Fiscal code: RO3671039
Phone: 0351 – 404888, 0351 – 404889; Fax: 0251 – 415482, 0351 – 404890;
www.icmet.ro e-mail: market@icmet.ro

HIGH VOLTAGE DIVISION - HVD
LOW VOLTAGE LABORATORY
Phone: 0351 – 432425, e-mail: lvl@icmet.ro

TEST REPORT
Nr. 20093 / 23.03.2010

1. CUSTOMER: Fabrika Mernih Transformatora Zajecar A.D.
Paracinski put bb, 19000 Zajecar, SERBIA

2. MANUFACTURER: Fabrika Mernih Transformatora Zajecar A.D.
Paracinski put bb, 19000 Zajecar, SERBIA
ENERGO GROUP D.O.O
Petra Mrlosevica 7, 71123 I. Sarajevo, B&H

3. TESTED PRODUCT: Power low voltage transformer,
type VROT 18, 400 V, 18 kVA, serial no. 2/10

4. REFERENCE STANDARD: IEC 60076-11:2004

5. TEST PERFORMED: I Separate-source AC withstand voltage test
II Induced AC withstand voltage test
III Lightning impulse test

6. TEST DATE: 23.03.2010

7. TEST RESULT: The product PASSED the test.

This report contains 7 pages and it is edited in 4 copies from which 3 copies for customer and one copy for laboratory

HEAD OF HV DIVISION, Eng. Ion PATRU
HEAD OF LABORATORY, Eng. Aurelia SCORNEA

Issue date: 25.03.2010

WARNINGS:

TYPE TEST - VROT


Eskom
ERTD DEPARTMENT

ESKOM RESEARCH, TESTING AND DEVELOPMENT

TEST CERTIFICATE

TEST CERTIFICATE AS SUPPLIED BY THE KOEBERG INSULATOR POLLUTION TEST STATION (KIPTS) FOR THE EVALUATION OF AN INSULATOR PRODUCT

ISSUED BY: DI WL VOELOO (CORPORATE CONSULTANT : ENVIRONMENTAL ENGINEERING)
SUPPORTED BY: O STRELEC (CHAIRMAN D STRIBUTION REGIONAL CHEMICAL GROUP)

To whom it may concern

Product Code: VTOP 2-24, Drawing: ES 400140H, Rev: 0 Date: 01-06-2011
Product Type: MV Voltage Transformer

This is to certify that the above insulation product, as manufactured by CPS Consultants & Energo Group Engineering Division and tested by CPS Consultants & Energo Group Engineering Division, has passed the light-to-medium pollution test (winter cycle) and has passed the heavy-to-very-heavy pollution test (summer cycle). The unit has been energised for the period May 2011 to April 2012 at the Koeberg Insulator Pollution Test Station (KIPTS), South Africa.

Tests have been performed in accordance to the Eskom specification DISSCAB rev 2 and Eskom test procedure 34-224 Rev 0 & 34-717 Rev 0. This test certificate renders the 22 kV (U_m) insulation product fit for use in an inland non-coastal environment and fit for use in a coastal environment.

Acceptance criteria	Result		Comment
	L-M	N-VH	
No more than three over-current trip-outs (750 mA Mace fuse blown)	Pass	Pass	None
No signs of material erosion deeper than 2 mm	Pass	Pass	Fine on beginning around pin during the heavy to very heavy pollution test cycle
No signs of tracking in the material	Pass	Pass	None
No signs of punctures or cracks in the material	Pass	Pass	None
No signs of corrosion that has exposed the base metal or can lead to failure of hardware	Pass	Pass	None
Material analysis completed			No

Note: The test data and results are available on CD: TEST_DATA_CPS-VT-2011

ESKOM - VTOP


ICMET CRAIOVA
ROMANIA

"Ovidiu Rarinca" HIGH POWER LABORATORY- LMP

INCERCARE
RENAR

TEST REPORT
No. 9812 / January 30, 2007

Tested product: 22000/100V Outdoor Voltage transformer
Test: Temperature rise test
Test method: According to IEC 60044-2 / 2003, clause 8.1
Test date: January 30th, 2007
Test result: Passed the tests

Head of LMP: Dr. Eng. Ovidiu Ciorcaru
Responsible for quality assurance: Eng. Constantin Ilioca
Responsible for test group: Eng. Constantin Ilioca
Responsible for test: Eng. Ilie Slovu
Eng. Nicu Dorobu

Test witnesses:

Test Report has 6 pages and it is edited in 4 copies from which 3 copies for customer.

Note
1. Publication or reproduction of the contents of this report in any other form unless its complete photocopying is not allowed without laboratory and RENAR writing approval.
2. Results refer to test product only.
3. Accreditation of the laboratory or any of its Test Reports issued under accreditation regime do not constitute or do not imply themselves an approval of the product by RENAR which gave the accreditation or any other body

TEMPERATURE RISE TEST

PRODUCT DESCRIPTION - VTOP

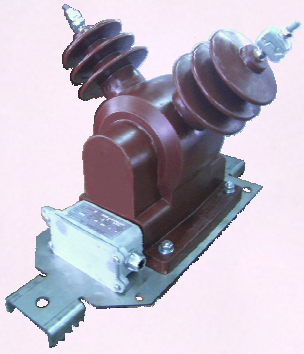
Dry Insulated Voltage Instrument Transformer

There are two designs of this voltage transformers:

- VTOP 1-X single – phase, dry insulated
- VTOP 2-X two – phase, dry insulated

Transformers are monolithically casted within cured epoxy resin and are designed for outdoor installation for voltage levels between 4.16 kV and 27.6 kV.

They are ideally paired with reclosers, powering remote wireless communication and transfer signal equipment, monitoring cameras and other small demand power equipment installed far from low voltage power supply lines.



The magnetic core is a classic type with its copper windings in layers. This provides convenient distribution of radial and axial stresses as well as good resistance to industrial frequency shocks and transients.
The voltage transformer is completely vacuum impregnated and sealed within cured epoxy resin, resulting in a one-piece compact body with smooth surfaces providing high dielectric strength and mechanical durability.

Single – phase voltage transformers can also have a residual voltage winding intended for broken delta connection. Single phase units can be supplied with one or two bushings.

Double bushing VTOPs are intended for connecting line to line (two phases), line to ground or line to neutral.

KEY PRODUCT BENEFITS

- Supply power to the equipment (up to 1000 VA) directly from medium voltage grids
- Act as a step-down transformer for the smaller load equipment
- **Built in safety technology to limit overvoltage surges (VTOP's unique design)**
- Can work as a small load, power, potential or instrument transformer
- Works as independent power supply directly from medium voltage lines
- Transformer is fire retardant
- 100% copper windings
- Insulation cannot drain out – fully cured in cast epoxy resin
- Excellent in ambient temperatures from -50°C to +65°C
- Transformer can be installed in any position and anywhere
- Easy installation and maintenance free
- No enclosure needed for outdoor installation
- Environmentally clean and friendly
- No risk for environmental and no special needs for disposal
- Operate silently
- Highly reliable
- Indoor and outdoor models are available
- Recloser operates independently from any other low voltage lines that might supply power to the other users
- Eliminates possible power losses to reclosers due to other users faulting low voltage lines
- Power to wireless protocols for controlling sectioning distribution networks from control centers
- Part of package for Metering units controlling power quality, **u [%],** (see pages 17, 18)

- ***Customizable for any voltage levels up to 44 kV***

VTOP 2(1)-X

264700

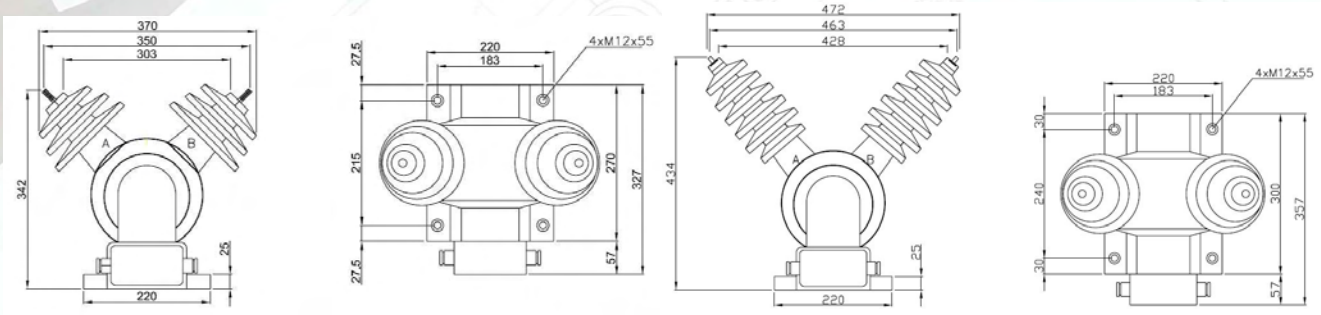
CSA Certified

Technical Characteristics

Type	VTOP 2(1)-**X**
Highest Voltage for Equipment [kV]	4.16 to 27.6
Rated Primary Voltage [kV]	**X** = 2.4 to 27.6
Rated Secondary Voltage [kV]	0.12 to 220
Winding Ratio Ranges:	20:1 to 230:1
Power Frequency Test Voltage [kV/1min]	7.2 to 55
Lightning Impulse Test Voltage (BIL) [kV]	60 to 150
Weight [kg]	25 to 32 (60 for larger VA units)
Burden / Accuracy class, 50/60Hz [VA / %]	(25 / 02), (65 / 0.5), (100 / 1), (200 / 3), (250 / 3),(=> 600 / 5) / (0.3WXY1.2Z)
Protection	3P, 6P / 1PWXY2PZ
Rated Frequency (for all types) [Hz]	50 & 60
Rated Voltage Factor/rated duration	1.2Un/ permanent for two phase, 1.9Un/8h – for single phase
Mounted	In any position
Ambient temperature range [^{0}C]	-50 to +65
Mechanical Protection	IP 54 / NEMA 3R
Standards / Certified	IEC 60044-2/2003, IEC 60529/2013, C22.2 No. 47-13, IEEE C57.13

For additional Technical Characteristics for other VTOP specification please refer to our website or contact us.

Overall Dimensions



VTOP 2-27 PICTURE & EXAMPLE OF OUTDOOR INSTALLATION

LOW VOLTAGE UNIQUE SMART TERMINAL - VROT

PRODUCT DESCRIPTION

Voltage Regulating Output Terminal (VROT) form the industry standard for the SMART innovative design and impeccable performance efficiency. This unique design works to control under voltage performance of low voltage (LV) electrical networks, balancing loads in them, increase safety protection, selectivity, and effectiveness. VROT terminals are monolithically casted within cured epoxy resin and designed for outdoor or indoor installation on low voltage lines.

Fully cured epoxy resin is a moisture resistant material providing VROT with a type of body that is non-combustible with smooth surfaces for high dielectric strength and mechanical durability. The magnetic core is a classical type with its copper windings wrapped in layers to provide convenient distribution of radial and axial stresses as well as good resistance to industrial frequency shocks and transients.

They are typically designed for an insulation voltage of 0.72kV to 3kV. VROT is constructed so that its energy losses in the iron are very small (500W), and all parts which are under the voltage are casted in epoxy resin or covered with insulating tiles.

VROT family of products are intended for a connection between low voltage lines and earth or between lines. VROT has built in unique Smart Technology components enabling it to regulate voltage, current and power in heavily loaded very long LV lines, guarantying quality of power and voltage.

BASIC VROT ELEMENTS:

- Breaker box
- Electronic control box
- Dry type energy power terminal

FUNCTIONING PRINCIPLE

This innovative system monitors the voltage stability/situation of the electrical network and by using internal SMART technology regulates the voltage or if there is a voltage drop, the system gives a signal to start the regulation process to sustain the voltage. The appropriate protection fuse for selected power of the unit is in a waterproof insulating box

KEY PRODUCT BENEFITS

- Guaranty quality of energy supply through the entire long low voltage line
- Delivers maximum demanded power to longer distances within the same conductor size
- Act as an alternative solution for the additional stepdown substation
- Reduces intermittence, demanded energy delivered faster
- VROT does not generate harmonics
- Designed to withstand extreme outdoor weather conditions
- Fast installation and operation
- Maintenance free
- Economically superior in comparison to traditional methods
- Automatically determine voltage deficiencies and regulates voltage needs

VROT technology brings complete fast and SMART solution to the existing or new low voltage lines. In use from 2009, it is already proven to be the superior invention in today's market. Please contact us and we can demonstrate you how.

VROT-X-1

Types:

There are two main types based on power:

VROT-15-Y (for 60Hz grids)
&
VROT-18-Y (for 50Hz grids)

Primary and secondary voltages can be adjusted per specific needs. Maximum primary voltage is 600 [V].

Combining and connecting two or more of these units as modules can achieve different voltages and power requirements.

Example of increasing power and various voltage:

- VROT-18-1, single phase (420 (438) // 243 (253) [V], 60Hz, 18kVA) (one unit)
- VROT-18-3, three phases (420 (438) // 243 (253) [V], 60Hz, 54kVA) (three units) …

Application:

- *Efficient maximum load transmission along entire length of low voltage line.*
- ***Alternative solution for stepdown SS:***
  SS 7.2 (15) (25) (27.6)/ / 0.120/0.208 kV, 45kVA
  SS 7.2 (15) (25) (27.6)/ / 0.120/0.240 kV, 45kVA
- *Automated regulation of power quality.*
- *Control the loss of electricity and unauthorised use.*
- *Residential blocks, sport halls, shopping malls, high-rise & office buildings, street lights…*
- *Control and protection of power lines*
- *To minimize or eliminate power interruptions.*

Advantages:

(in comparison with classic low voltage power transmission method and within the same parameters of low voltage lines)

- *Primary current is 36% lower than traditional, for the same power, as a result voltage drop is lower.*
- *Ability to transfer 9 times more power from step down transformer to the end of the power line.*
- *Possible transmission of nominal power up to 9 times longer distance.*
- *Power losses in distribution are ~64% lower.*
- *Huge savings in use of electrical energy.*
- *There are no harmonics.*
- *Power downtime ~ 15min to install VROT.*

VROT–X-Y:

- *Insulation voltage 0.72 kV to 3 kV*
- *Protection fuse included in waterproof insulating box.*
- *indoor or outdoor installation*
- *Installed in any position, pad or pole*
- *No ventilation needed*
- *Weight 95 kg*

Certified to:

- *IEC 60076-11:2004*

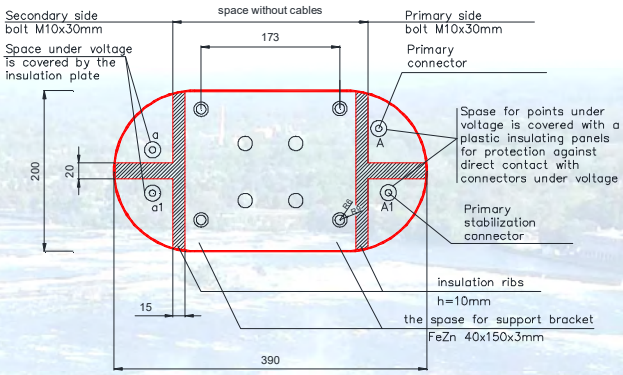
CSA #C22.2 No. 47-13, No. 92.2-07 and
UL 1561 certifications are underway

VROT-18-3 INSTALLED

Metric Dimensions and cable connections

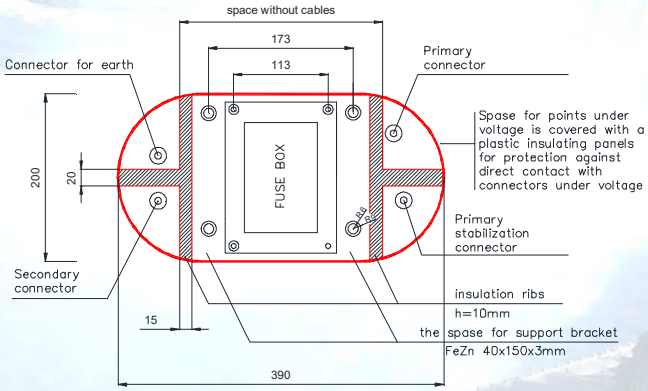
VROT-18-1 installed in Europe

Bottom view



VROT-18-3R connected to RS232 port reads:
I [A], U[V], W[kWh], [kVA]

Top view



Technical Characteristics

Type	**VROT-18-1**
Highest Voltage for Equipment [kV]	1
Test Voltage 60Hz, 1 min [kV]	3
Lightning Impulse Voltage 1.2/50μs [kV]	5
Rated Primary Voltage [V]	420(438)/243(253)
Rated Secondary Voltage [V]	230 ±10%
Nominal Power [W]	17460
Rated Power [kVA]	18
Current Output [A]	80
Rated Frequency [Hz]	50
Guaranteed no-load losses “Pcun [W] / Pfe [W]” [W]	500 / 80
Power Factor “cos φ”	0.97
Harmonics	N/A (does not generate / pass through)
Mechanical Protection	IP 54 / NEMA 3R
Ambient Temperature Range [^{0}C]	-50 to +65
Operating Temperature [^{0}C]	Up to 135
Ventilated	No
Installation (in any position)	On pole or pad mount
Standards / Certified	IEC 60076-11 / 2004, EN 50160

Technical Characteristics

Type	VROT-15-1
Highest Voltage for Equipment [kV]	1
Test Voltage 60Hz, 1 min [kV]	3
Lightning Impulse Voltage 1.2/50µs [kV]	6
Rated Primary Voltage [V]	600, 480, 420, 240, 208
Rated Secondary Voltage [V]	(480, 370, 277, 230) ±10%
Nominal Power [W]	14550
Rated Power [kVA]	15
Current Output [A]	125
Rated Frequency [Hz]	60
Guaranteed no-load losses "Pcun [W] / Pfe [W]" [W]	150 / 60
Power Factor "cos φ"	0.97
Harmonics	N/A (does not generate / pass through)
Mechanical Protection	IP 54 / NEMA 3R
Ambient Temperature Range [^{0}C]	-50 to +65
Operating Temperature [^{0}C]	Up to 135
Ventilated	No
Installation (in any position)	On pole or pad mount
Standards / Certified	IEC 60076-11 / 2004, EN 50160

Increasing power:

Combining and connecting two or more of these units as modules can achieve different voltages and power requirements such as:

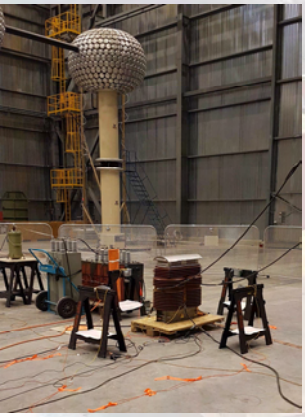
VROT-15-X (208) CONECTION COMBINATIONS

	VROT-15-2R	VROT-15-3	VROT-15-3R
Phase	2R	3	3R
Connection	ΔY	ΔY	ΔY
U1 [V]	208	208	208
U2 [V]	120/240 ± 10%	120/208 ± 10%	120/240/208 ± 10%
Sn [kVA]	30	45	90
Current [I]	125	125	125
BIL [kV]	1 / 3 / 6	1 / 3 / 6	1 / 3 / 6
Protection	IP / NEMA	IP / NEMA	IP / NEMA
Frequency	*60Hz*	*60Hz*	*60Hz*
Power Factor cos φ	0.97	0.97	0.97
Op Temp *°C*	Up to 135	Up to 135	Up to 135
Weight [kg]	2 x 95	3 x 95	6 x 95

Medium Voltage Terminal MVROT

264700

CSA Certified



PRODUCT DESCRIPTION

Energo Group's ***Regulating*** *and* ***Optimizing Terminal*** for Medium Voltage network adaptation, commonly known as the ***MVROT***, is an energy loss reduction device that combines instrumentation and power transformer coils in a novel (patent pending) manner.

MVROTs are consequently poised to set a new standard of efficiency in the electrical power distribution industry, by enabling distribution network operators to collect payment for a greater portion of the valuable energy that distributors purchase from generators and transmit for delivery from its substations to their customers.

MVROTs, in both laboratory and field trials, typically reduce energy losses by 60%!

MVROTs are installed at an optimal location (determined by our engineering team based on distribution grid's specific's) in your distribution network, using Energo Group's proprietary method of adapting two of the grid's 3 phase pairs to close the circuit of each branch supplying the energy to distributors customers.

MVROTs, when installed in accordance with Energo Group's engineering and method, typically pay for themselves within very short period.

MVROTs have the unusual advantage of being designed with a replaceable core that permits rapid repair to reduce branch downtime and are easily retrofit directly into distributors existing network infrastructure to extend its life-cycle, typically by over 10 years.

MVROTs however also have the advantage of being forward compatible with SCADA and other modern SMART systems for monitoring & controlling your existing network.

MVROTs are available in different models all of which: reduce energy loss, improve voltage quality, and decrease "intermittence" in distributors network … while also permitting you to monitor current, voltage, energy flow, and maximum loading conditions – without needing to connect expensive external metering devices to your network.

Advanced models of our MVROT are available with additional modules customized to distributors specific network data & operational needs both current and future. These units have the ability to rapidly identify downstream faults, locate those faults with GPS coordinates, and then report the detected condition and location requiring service to distribution control center. These units can also automatically control voltage regulators in the main substation.

SUMMARY OF KEY ATTRIBUTES

- reduce energy loss, to deliver more billable power to distributors customers
- reduce intermittence, to supply required energy more quickly to all loads
- reduce / eliminate network harmonics, to supply cleaner power for electronics
- solving ferroresonance issues
- better balance asymmetrical loads
- an ideal enhancement to existing SCADA controlled networks
- withstand extreme outdoor weather (snow or sun) conditions
- simple, rapid installation and reliable operation
- less expensive means to upgrade distributors grid to deliver more energy using existing infrastructure = typically 1/3rd the cost of traditional methods

MVROT technology brings complete fast and SMART solution to the existing or new medium voltage lines. Please contact us for more information.

Medium Voltage Terminal
MVROT

CSA Certified
264700

Technical Characteristics

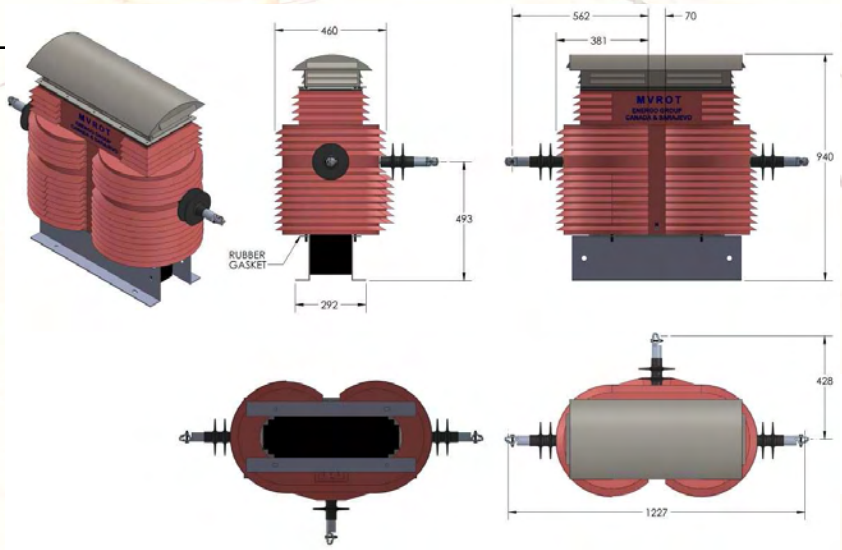
Application

Reduce energy losses (by 60%) across power distribution grids. By adapting 3 phase power supply lines to more efficiently deliver energy to single phase loads this device (combining instrumentation and power transformer coils in a novel manner) reduces both the line loss (voltage drop) and heating inherent in transmitting electrical energy using metal transmission lines. Coincidentally, the sinusoidal wave carrying the energy is more stable with no harmonics being generated by device, such that "cleaner" energy is available for modern electronic loads. The key result is that a greater portion of generated electrical energy is actually delivered to paying customers over long distances using existing distribution grid infrastructure.

Height [mm]	940
Depth [mm]	460
Weight [kg]	870
Mechanical Protection	IP56/NEMA 3R
Ambient Temperature	-50 to +65
Primary Voltage [kV]	0.6 to 4.16 (13.8)
Secondary Voltage [kV]	0.11 to 2.5 (8.0)
Power: Sn [kVA]	up to 215
Power Factor: "COS"	0.97
Harmonics	N/A (Does not generate / pass through)
Nominal Power [kVA]	185
Frequency [Hz]	50 / 60
BIL [kV]	30
Insulation Degree [kV]	7.2/20 (13.8/38/95)
Power Losses [kW]	Total 1% of Pnom
Standards / Certified	IEC 60076-11 / 2004, EN 50160, NETA, C22.2 No. 47-13, IEEE C57.12.01 / 2015

	Metering PT	Control PT	Metering CT
Primary Voltage [kV]	4.16 (13.8)	4.16 (13.8)	4.16 (13.8)
Secondary Voltage [V]	120	120	-
Primary Current [A]	-	-	60
Secondary Current [A]	-	-	1 / 5
Class [%]	0.5%	3%	0.5%
Protection	3P	3P	-
Burden [VA]	100	300	10
BIL [kV]	30	30	30
Insulation Degree [kV]	7.2/20 (13.8/38/95)	7.2/20 (13.8/38/95)	7.2/20 (13.8/38/95)

Overall Dimensions



Medium Voltage Terminal MVROT_R

CSA Certified
264700

INDOOR INSTALLATION

OUTDOOR INSTALLATION

Energo Group Canada's, patent pending, Medium Voltage Regulating and Optimizing Terminal ("**MVROT_r**") is dry casted, single phase, power (energy) unit, with internally built-in, current and voltage windings in a novel (patent pending) manner. Secondary windings are built as dual connection, and as such can provide power to the group of single phase consumers within low voltage distribution. This way, MVROT provides equalization of electrical current, per phase, and can easily achieve high level of symmetricity loads within three phase distribution systems. The advantage here is that current in neutral conductor is eliminated or very small and with **smaller current²**, we are drastically reducing technical losses in distribution.

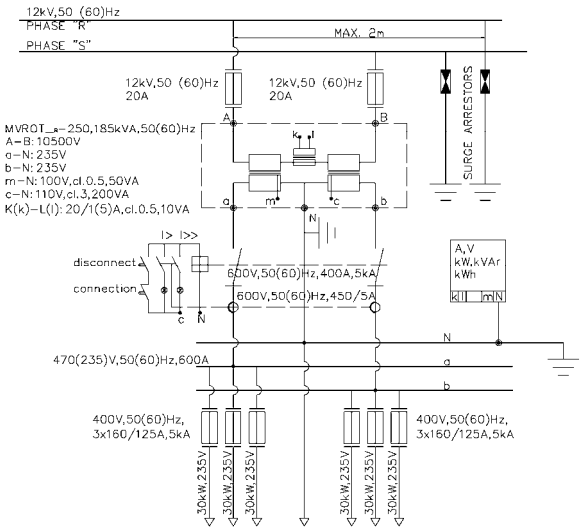
SOME OF THE ADVANTAGES AND BENEFITS OF MVROT_R IN COMPARISONS WITH CLASSIC SOLUTIONS:

- Optimum relationship between nominal power and characteristics of the user groups.
  - *(i.e. if all consumers are single phase but using three phase distribution, that will generate un-symmetricity within low voltage conduits. MVROT will optimize that)*
- Eliminates unnecessary Capital/investment for large reconstructions
- Low cost installation
- Fast installation with minimal disruption
- Dry unit – minimum maintenance
- Small unit footprint, requiring small installation area
- Possible to be installed on the pole
- Integral measurements at high voltage side
- Resistant to ferroresonance state, and stops harmonics
- This unit can supply group of single phase users who generate frequent similar loads within the same time as:
  - *Weekend homes, development areas*
  - *Business / office buildings*
  - *Street and public lights*
  - *Traffic lights and tunnel lights*
  - *Industrial centers with many single phase users*
  - *Telecommunication centers and towers for the signal transmissions*

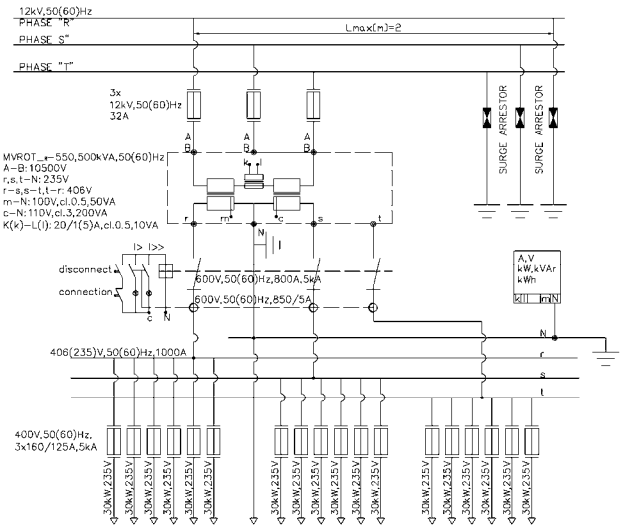
TECHNICAL CHARACTERISTICS (for this unit size up to):

- **Nominal voltage grid level: 15000V**
- **Nominal primary voltage: 13800V**
- **Nominal secondary voltage: 120/240V**
- **Nominal power: 185kVA**
- **Losses, normal load: 480W**
- **Losses, short circuit: 1030W**
- **Current transformer: 20A/5(1)A, cl. 0.5%,10VA**
- **Voltage transformer: 13800V/100V, cl 0.5%, 50VA**
- **Control windings and its consumption: 120V, cl. 3%, 200VA**
  (dedicated mainly for transmitting signals)
- **Insulation windings: 12/28/75kV**
- **Frequency [Hz]: 50 / 60**

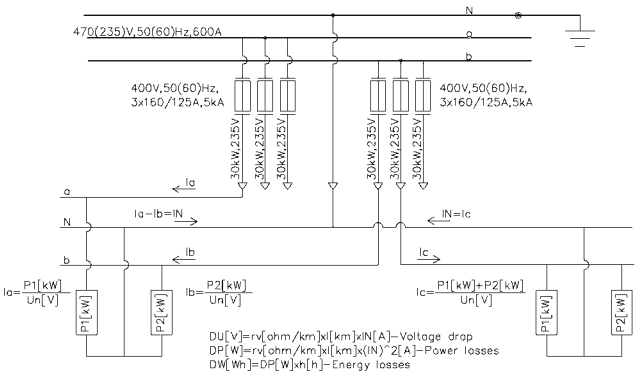
SINGLE LINE DIAGRAM – SINGLE PHASE CONSUMERS:



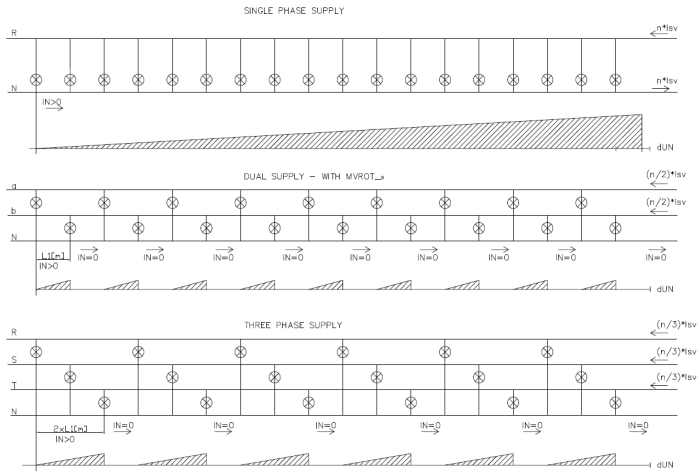
SINGLE LINE DIAGRAM – THREE PHASE CONSUMERS:



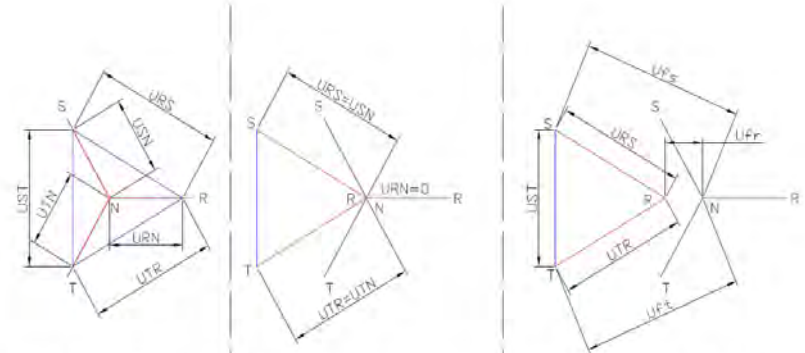
DISTRIBUTION SYSTEM WITH SINGLE PHASE CONSUMERS AND WORKING PRINCIPLE:



SUPPLY PUBLIC AREA LIGHTS:



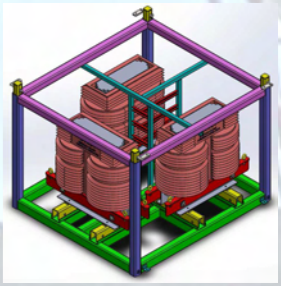
SHORT CIRCUIT AND FERRORESONANCE STAGE IN GRIDS:

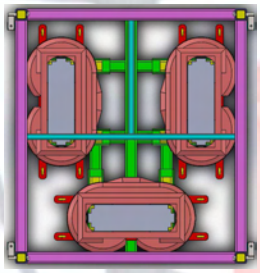


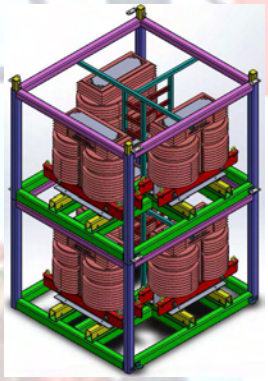
WITH MVROT_R-250 SYSTEM ALL CONNECTED POWER EQUIPMENT, CURRENT AND VOLTAGE SINGLE PHASE SENSORS, ARE IN VOLTAGE TRIANGLE, SO INFLUENCE OF ELEVATED PHASE VOLTAGES ON THAT EQUIPMENT IS ELIMINATED.!

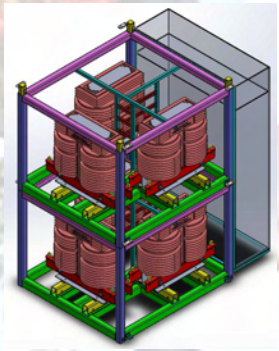
Smart Substation Grid Optimizer – "SSGO"

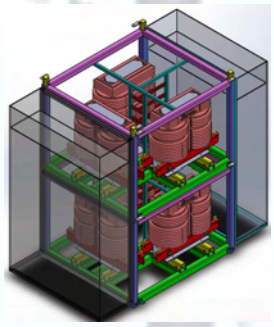
NEW Product











We developed an integrated approach of theory and practice combined with an innovative Method and System which led to the development of MVROT and subsequently SSGO. Both products use an adaptive infrastructure within existing or new distribution grids, that balance loads, reduce losses, improve power quality and increase safety and reliability.

SSGO is fully automated and controllable power delivery, 1.2MVA unit, based on modularizing MVROT technology. It has unique ability to recognize power demands, automatically reduce or increase power delivery, to control power per phase, in three phase systems, and that way will reduce losses even more.

Installing it at strategic location within the distribution grids or industry complexes will bring complete automation, controls and measurements on Medium Voltage and Low Voltage sides as that is integral part of this compact Smart unit.

SSGO is based on our innovative technology for which we received two patent pending statuses from Patent Cooperation Treaty "PCT" who confirmed them to be Novelty, Innovative and Industry Applicable:

Method and System for Reducing Losses During Electrical Power Distribution
&
Apparatus for Losses Reduction During Electrical Power Distribution

Additional benefits to Utilities and Industries due to the inherent design include:

- Improved ability to isolate sections of the feeder providing enhanced fault detection
- Independent from low voltage supply lines and providing isolation from faults down the line
- Increased safety and protection by reducing / eliminating the currents in the neutral line
- Eliminates circuit currents in ground
- Built-in wireless communication and additional line condition measuring capabilities
- Utilities gain smart grid visibility and optimization
- Automation and control over their network
- SSGO create perfect "hardware" addition for SCADA system
- Monitor network conditions in real time, locate faults and identify energy losses – SMART GRIDS
- Extend the load carrying capacity and the useful life of existing facilities
- Improved operating efficiency and system performance / reliability
- Reduced energy capital expenses
- Utility can lower rates and increase customer satisfaction
- Extend the life of the installed assets by reduced currents and symmetrical loads per each phase
- Deliver energy, per demand only, will reduce use and with that will reduce GHG emissions

SSGO Solution addresses power system flexibility and will reduce energy use and losses through deployment of EGC technology that is based upon systems already been tested and deployed in Europe on low voltage distribution lines. SSGO will stabilize voltage and significantly reduce voltage drops on feeders where installed which enables utilities to take measures toward a self-healing and self-correcting grids.

SSGOs are requiring smaller primary current to provide the same power resulting in an efficient and a balanced energy infrastructure.

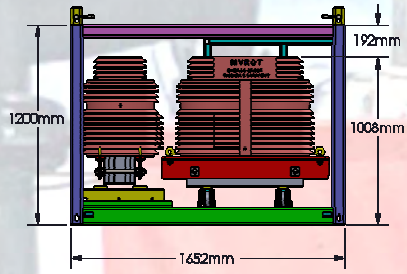
The final results are improved voltage levels and quality of power to the end users.

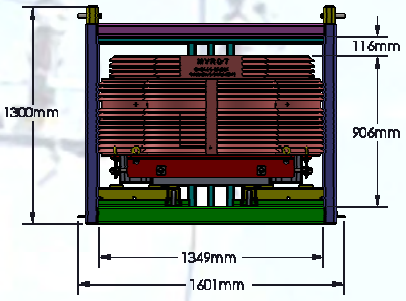
Smart Substation Grid Optimizer – "SSGO"

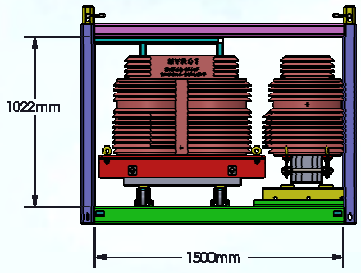
NEW Product

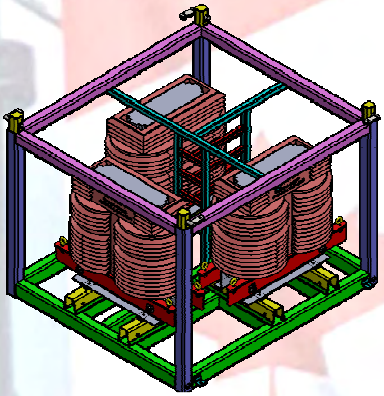
Some Technical Characteristics and dimensions (for more details see MVROT data sheets)

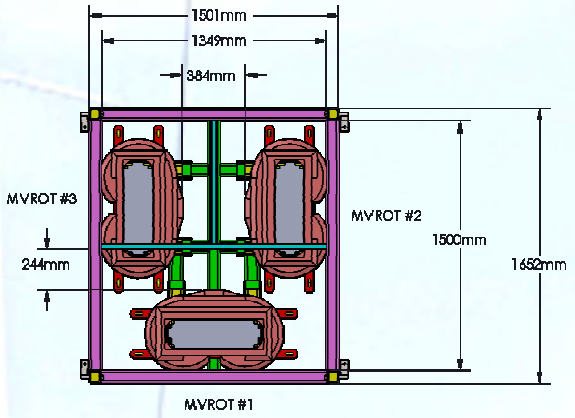
Application	*Reduce energy losses.* control power delivery per phase, energy delivered per demand…
Mechanical Protection	IP56 / NEMA 3R or per customer requirements
Ambient Temperature	-50 to +65, indoor or outdoor application
Nominal Power [kVA]	One module 555, two modules 1200,…
Standards / Certified	IEC 60076-11 / 2004, EN 50160, NETA, C22.2 No. 47-13, IEEE C57.12.01 / 2015



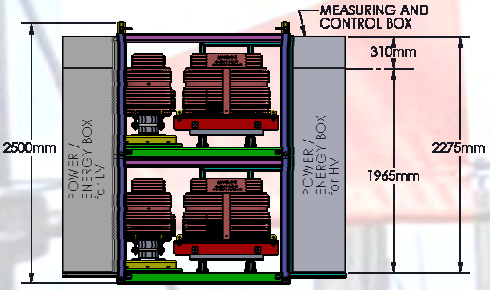


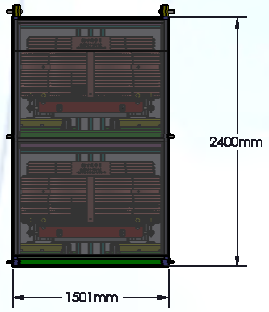


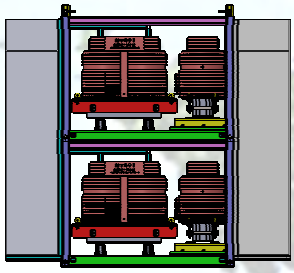


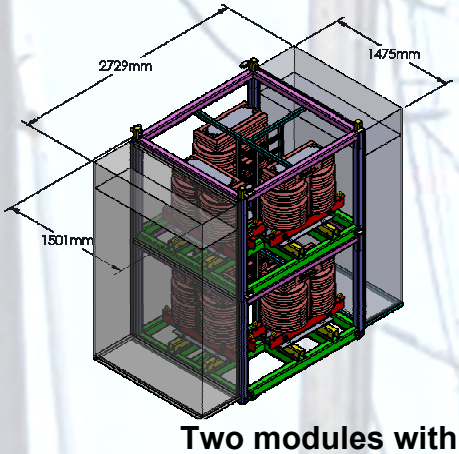


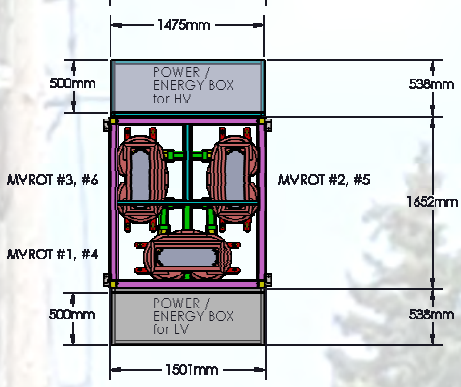
One module 555 kVA











Two modules with automatization and controls 1.2 MVA

POWER TRANSFORMERS - TES

TES-X-Y (shown w/o enclosure box)

Base Electrical Characteristics:
(North American Markets)

Primary voltage X, [kV]	**5.0 to 25**
Secondary voltage [kV]	**0.6, 0.4, 0.24, 0.12**
Power rated Y, [kVA]	**20 to 630**
Phase	**3**
Primary winding regulation	**+/- 2 x 2.5%**
Frequency [Hz]	**50 or 60**
Ambient Temperature [^{0}C]	**-40 to +40**
Insulation Temperature [^{0}C]	**220, 150 rise**
Multiple taps available on primary and secondary sides per specific requests	

Certified to:

- IEC 60076-1	**- IEC 60076-2**
- DIN 42540 (Noise Level Test)	**- IEC 270, VDE 0533 (Partial Discharge Test)**

CSA and UL 1561 certifications are underway

Key Features:

- *Fire retardant*
- *High efficiency: meets NEMA Premium*
- *Copper windings casted in epoxy resin*
- *Wall or floor installation*
- *Highly reliable and Maintenance free*
- *Sound: meets NEMA ST-20, DIN 42540 and VDE 0532 standards*
- *Outdoor or indoor enclosures (IP/NEMA)*
- *No carbon monoxide emissions, environmentally friendly*

Advantages:

- *Long performance history, first built in 1960's*
- *Compact footprint*
- *No harmful or dangerous material in construction*
- *Resistant to insulation cracking*
- *Resistant to short circuit faults*
- *Resistant to impulse voltage*
- *Resistant to ingress of moisture and chemicals*
- *Handles higher short-time overloads*
- *Low noise, easy installation, no maintenance*
- *Resistance to fire – self-extinguishes*

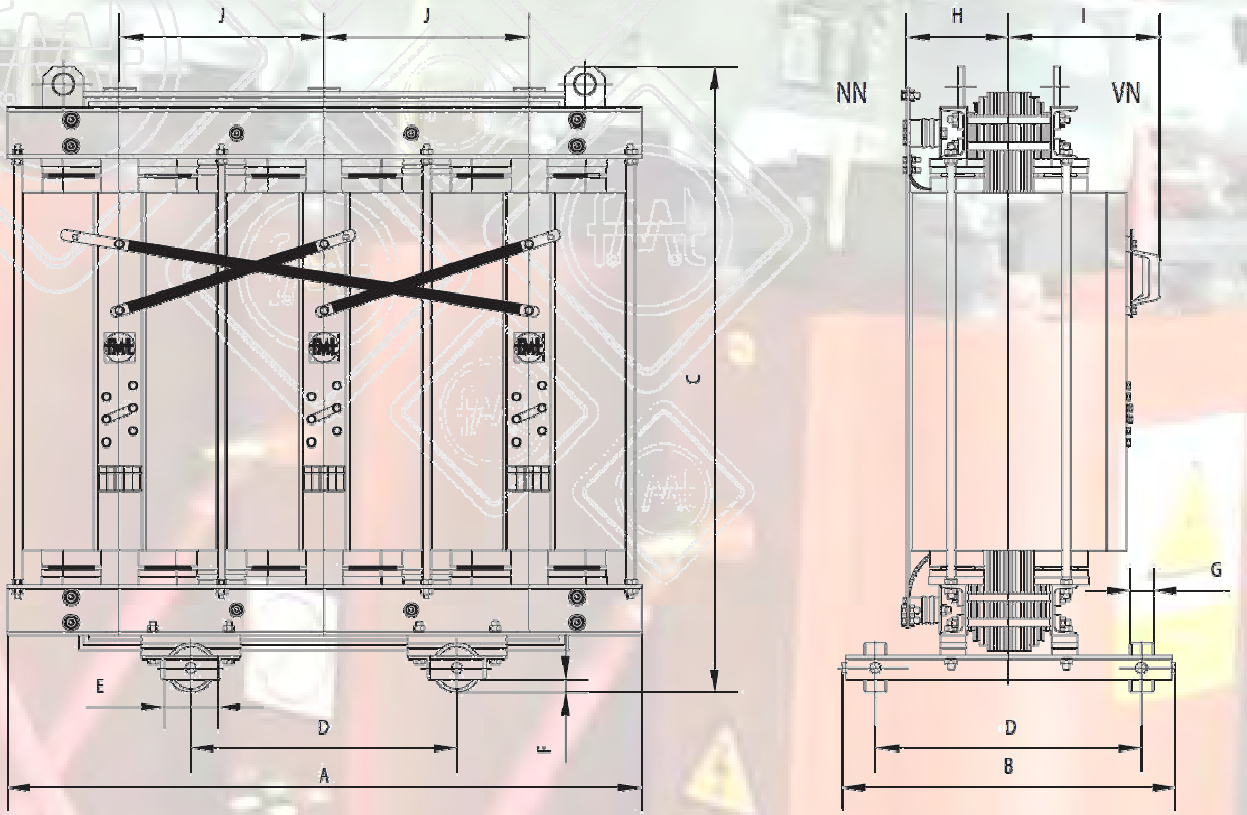
Technical data for 10 kV are given in table below:

Transformer type	Rated power	Vector group	No-load losses	Short – circuit losses at 120°C	Resistance voltage	Short – circuit voltage	Weigh t
	kVA		W	W	%	%	kg
TES -10-20	20	Yz5,Dy5	250	500	2.5	4	260
TES -10-31.5	31.5	Yz5,Dy5	270	900	2.85	4	290
TES -10-50	50	Yz5,Dy5	300	1200	2.4	4	500
TES -10-63	63	Yz5,Dy5	360	1300	2.06	4	600
TES -10-100	100	Yz5,Dy5	440	1800	1.8	4	660
TES -10-160	160	Yz5,Dy5	610	2400	1.5	4	850
TES -10-250	250	Dy5	800	3400	1.36	4	1100
TES -10-400	400	Dy5	1200	4800	1.2	4	1700
TES -10-500	500	Dy5	1250	5600	1.12	4	2000
TES -10-630	630	Dy5	1500	6800	1.08	4	2300

Other technical data for different voltages and larger sizes available on request.

DRY TYPE POWER TRANSFORMERS - TES

TES-10-Y - DIMENSIONS



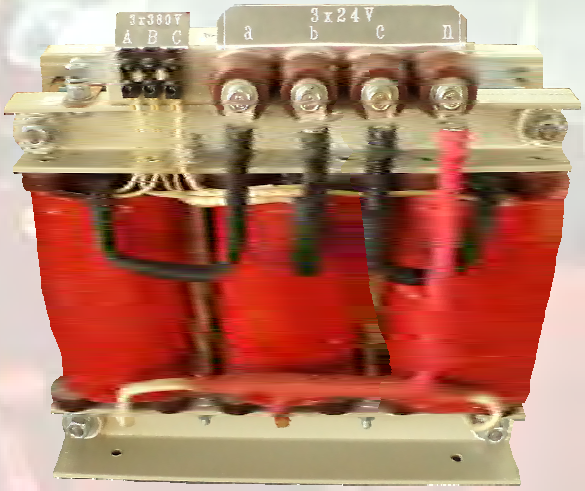
Type	D I M E N S I O N S [mm]									
	A	B	C	D	E	F	G	H	I	J
TES -10-20	790	420	720	420	65	42	------	146	156	250
TES -10-31.5	790	420	770	420	65	42	------	146	156	250
TES -10-50	900	600	805	520	105	25	50	225	240	300
TES -10-63	965	550	865	520	105	25	50	235	240	300
TES -10-100	965	550	865	520	105	25	50	235	240	300
TES -10-160	1210	650	1095	520	105	25	50	256	261	397
TES -10-250	1300	650	1200	520	105	25	50	200	275	400
TES -10-400	1520	790	1370	620	140	35	60	280	316	500
TES -10-500	1520	790	1370	620	140	35	60	280	316	500
TES -10-630	1610	790	1510	620	140	35	60	283	346	525

Industries / Application:

Oil and gas, Mining, Power distribution, …
Hospitals, airports, market centers, sport and congress halls, theatres and cinemas …

- *Office / Residential buildings*
- *Manufacturing facilities*
- *Substations…*

DRY TYPE LOW VOLTAGE POWER TRANSFORMERS - TTES



TTES-X, High Efficiency
(shown without enclosure box)

Base Electrical Characteristics:
(North American Markets)

Primary voltage X, [V]	**600, 480, 277**
Secondary voltage [V]	**480, 277, 208, 120**
Power rated Y, [kVA]	**3 to 250**
Phase	**3**
Ambient Temperature [^{0}C]	**-5 to +40**
Insulation Temperature [^{0}C]	**220, 150 rise, 115, 80 rise option**
Multiple taps available on primary and secondary sides per specific requests	

Certified to:

- IEC 60076-11: 2004	

CSA #C22.2 No. 47-13, No. 92.2-07 and UL 1561 certifications are underway

Key Features:

- *Harmonic mitigating transformers (HMT)*
- *Fire retardant*
- *High efficiency: meets NEMA Premium*
- *Copper windings*
- *Wall or floor installation*
- *Highly reliable and Maintenance free*
- *Sound: meets NEMA ST-20, DIN 42540 and VDE 0532 standards*
- *Indoor enclosures (IP/NEMA)*
- *No carbon monoxide emissions, environmentally friendly*

Advantages:

- *Long performance history, first built in 1960's*
- *Compact footprint*
- *No harmful or dangerous material in construction*
- *Resistant to insulation cracking*
- *Resistant to short circuit faults*
- *Resistant to impulse voltage*
- *Resistant to ingress of moisture and chemicals*
- *Handles higher short-time overloads*
- *Low noise, easy installation, no maintenance*
- *Resistance to fire – self-extinguishes*

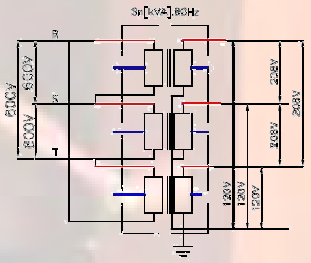
	TTES-75	TTES-45	TTES-35
U1 [V]	600/480/277	600/480/277	600/480/277
U2 [V]	480/277/208 /120	480/277/208 /120	480/277/208 /120
Sn [kVA]	75	45	35
Efficiency	98.6%	98.4%	98.3%
BIL [kV]	1 / 3 / 6	1 / 3 / 6	1 / 3 / 6
Protection	IP / NEMA	IP / NEMA	IP / NEMA
Frequency	*60Hz*	*60Hz*	*60Hz*
Impendance	2.5 to 6.5%	2.5 to 6.5%	2.5 to 6.5%
W/D/H [mm]	889/584/780	775/508/635	775/508/635
Weight [kg]	345	241	207

Any IP / NEMA enclosure types available.
K-Factor: per ANSI / IEEE C57.110 and specified request to mitigate harmonic / heating effects

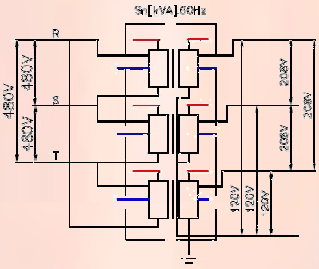
Made for indoor / temperature control environment.

TAP CONNECTIONS

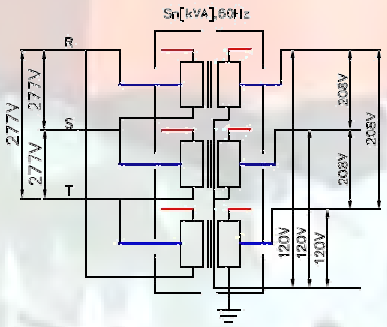
Other tap / ratio connections available per specific orders



Red Taps: Ratio – 600//208/120



Black Taps: Ratio – 480//208/120



Blue Taps: Ratio – 277//208/120

POWER TRANSFORMERS - TTES

POWER TRANSFORMERS - PRODUCTION LINE

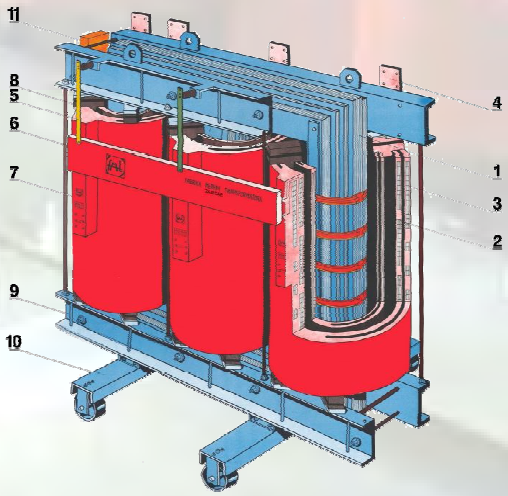
Application (power to):

- EHT (Electric Heat Tracing)
- Low voltage Motors
- Lightings, instrumentation...

Industries:

Oil and Gas, Mining, Ships …
Hospitals, airports, market centers, sport and congress halls, theatres and cinemas …

TTES-X 3D view (without enclosure)



Main parts:

1. *Magnetic core - impregnated hipersil sheet;*
2. *Secondary-voltage winding with copper foil;*
3. *Primary-voltage winding casted in epoxy resin, coil with rectangular wire;*
4. *Secondary-voltage connection;*
5. *Primary-voltage connection;*
6. *Connecting clamp;*
7. *Voltage regulation (Taps);*
8. *Elastic bolster;*
9. *Bracket arms for core compression and carrying;*
10. *Traveling base;*
11. *Electronic thermal protection.*

METERING UNITS TYPE - SMST-X-Y

SMST 52-2

Base Electrical Characteristics (Two phase systems):

Type:	**SMST-52-2**
Metering platform	**46 [kV]**
Outdoor Current Transformers	**SMT-SM-52**

50/95/250kV, 60HZ, CSA C60044-1,
150-5A, ACC. 0.15B09, CCRF-3.0,

Outdoor Voltage Transformers **DNT-SM-52**
50/95/250kV, 60HZ, CSA C60044-2,
46000-115V, ACC 0.3WXY, 1000VA, 1.1 UN PERM,

EQUIPMENT COMES MOUNTED, ASSEMBLED AND WIRED ON THE SKID - SEE EXAMPLE PICTURE ON THE LEFT

MEASUREMENT CANADA APPROVAL IN PROCESS

METERING PLATFORM CAN BE FABRICATED AND ASSEMBLED PER SPECIFIC CLIENT SPECIFICATIONS.

Two Phase System Assembly:

- *Galvanized structural frame*
- *3 single phase HV breakers*
- *2 two phase metering transformers VT's*
- *2 Current metering transformers CT's*
- *Indirect two phase system metering groups in separate enclosure on same unit*

Application and Advantages:

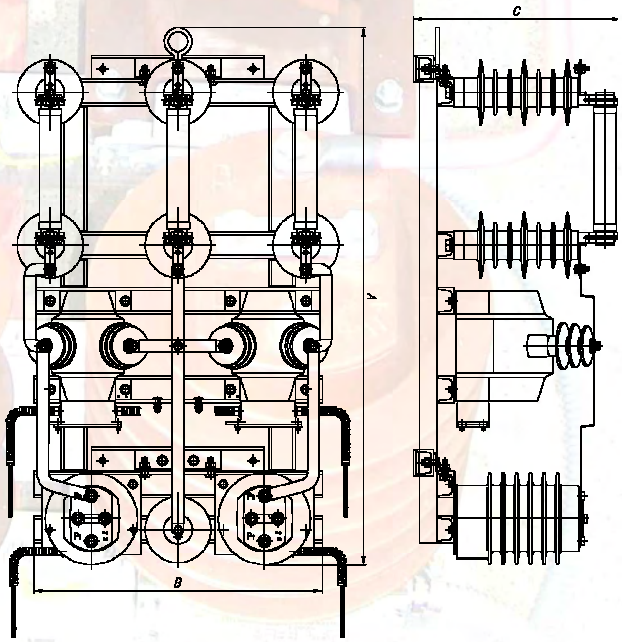
- *Revenue Metering, indoor or outdoor*
- *Outdoor installation on Substation Poles*
- *Easily installed on any shape of poles*
- *High Voltage or Low Voltage metering*
- *Can be mounted vertically or horizontally*
- *Required Isolators for HV*

Dimensions for some of the units

Type [SMST-]	A x B x C [mm]	CT [ATMS-]	VT [VTOP-]	Mass [kg]
2-2/1	1305x700x500	2411	2-20	182
24-2/1	1455x860x500	2411	2-20	192
12-3/2	1305x780x500	2411	JNT SM-12	221
24-3/2	1535x860x600	3811	JNT SM-24	266

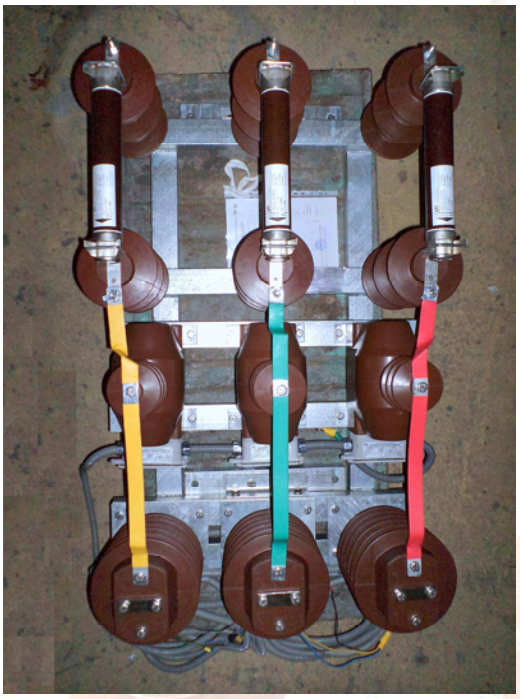
Listed units are assembled for revenue metering on 10 kV and 20 kV sides.

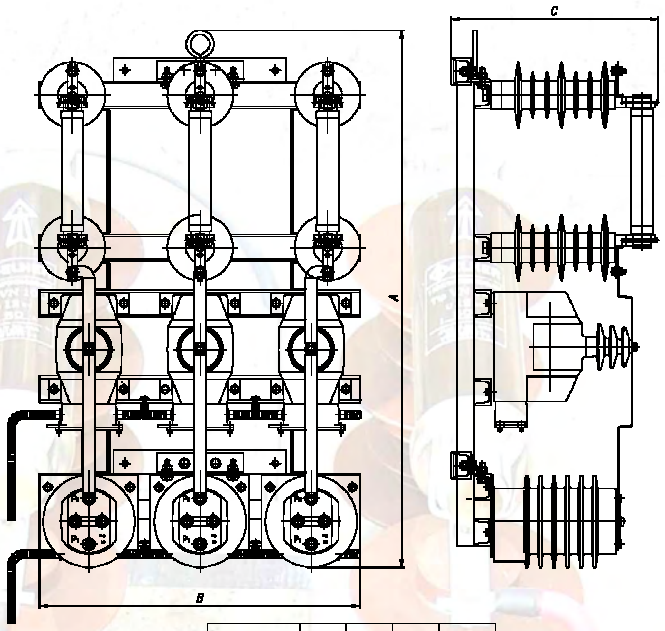
12-2/1 - assembly for two phase system at 10 kV side
24-2/1 - assembly for two phase system at 20 kV side
12-3/2 - assembly for three phase system at 10 kV side
24-3/2 - assembly for three phase system at 20 kV side



Assembly for Three Phase Systems

METERING UNITS TYPE - SMST-X-Y





ASSEMBLY TYPE	A	B	C	Mass (kg)
SMST-12-3/2	1302.5	780	503.5	221
SMST-24-3/2	1532.5	860	503.5	260

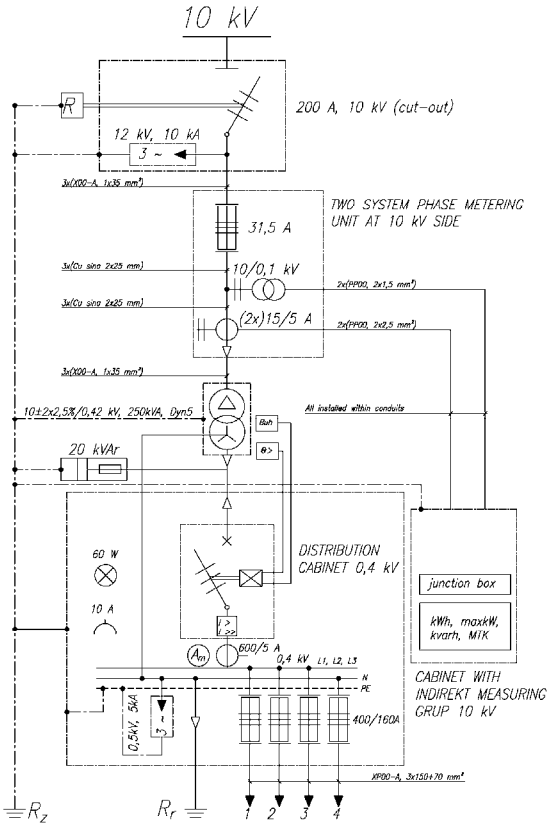
Three Phase System Assembly:

- *Galvanized structural frame*
- *3 single phase HV breakers*
- *3 single phase metering transformers VT's*
- *3 Current metering transformers CT's*
- *Indirect three phase system metering groups in separate enclosure on same unit*

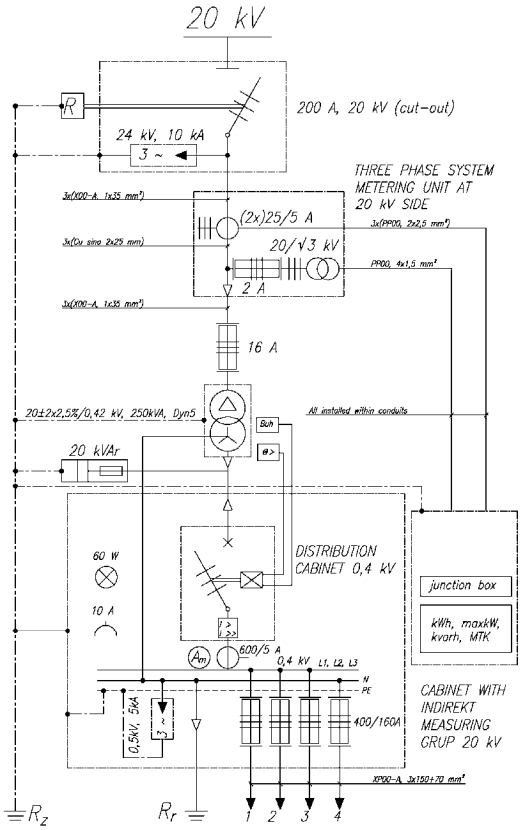
Application and Advantages:

- *Revenue Metering, indoor or outdoor*
- *Outdoor installation on Substation Poles*
- *Easily installed on any shape of poles*
- *High Voltage or Low Voltage metering*
- *Can be mounted vertically or horizontally*
- *Required Isolators for HV*

Two system phase metering system installation



Three phase system metering system installation

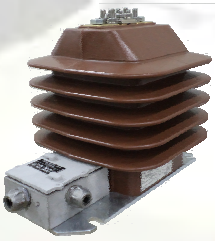


OTHER AVAILABLE EQUIPMENT

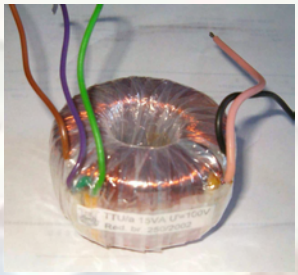
We carry variety of dry type electrical equipment for the medium and low voltage. Please contact us for the technical data, or send us your specific requirements.

Current Instrument low voltage transformers:

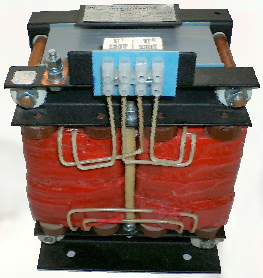
Current instrument medium voltage transformers:

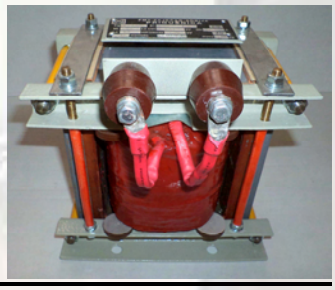


Special small transformers

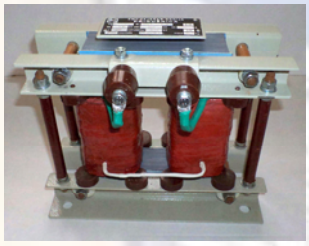


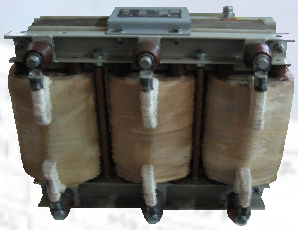
Special power transformers





Specialty custom products, dampeners

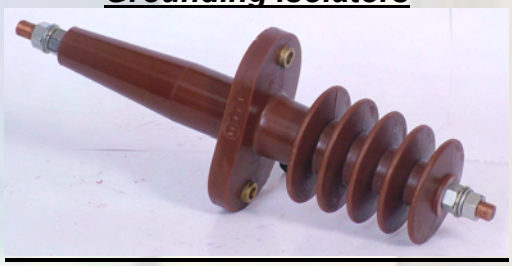




Enclosures, NEMA boxes

Isolators

Grounding isolators



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