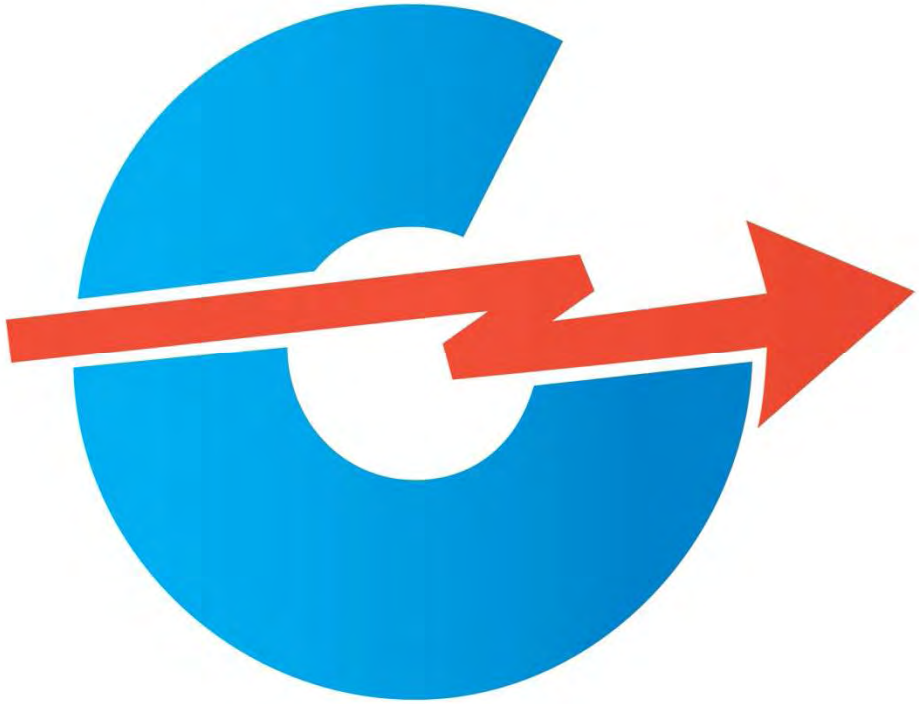
ENERGO GROUP CANADA Inc.



Medium Voltage Regulating & Optimization Terminal

[MVROT]

Installation Manual

EGC-MVROT-MNL-01

www.egcanada.ca

18 July 2019 **Rev 3**

This product must be installed in accordance with the National Electric Code (NEC), or the Canadian Electric Code (CSA 22.1) and all applicable Federal, State, Provincial and Local Electric codes including construction codes by qualified personnel familiar with the construction and operation of the product and hazards involved.

Read and understand the contents of this installation manual before attempting to assemble, handle, install, use or service the product. Failure to comply may result in death or serious injury or property damage.

Installation and Operation

Do not lift or move this product without proper equipment, tools, and precautions. Lifting instructions shall be strictly adhered to.

Terminals are for electrical loading only, use flexible connectors to avoid mechanical strain.

Do not make or attempt any connections that are not authorized by the nameplate or connection diagram.

Do not energize the product without proper ground connection.

Important Notice

Failure to observe the requirements of OSHA Standard 1910.269 can cause death or severe burns and disfigurement. This Standard specifically prohibits the wearing of polyester, acetate, nylon or rayon clothing by personnel working with exposure to electric arcs or flames.

The product(s) covered by these instructions have been inspected and tested to meet all applicable standards of the highest quality product.

The instructions should familiarize qualified personnel with the proper procedures to install and keep all new units in proper operating condition.

These instructions does not propose to cover all details, not to provide for every contingency to be met with respect to installation, operation or maintenance. Should further information be required or particular problems arise which are not covered, please contact **Energo Group Canada Inc**.

TABLE OF CONTENTS

1. CERTIFICATE

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 Lemez

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

Issued by: *Douglas Bramwell*
Douglas Bramwell

PRODUCTS

CLASS 5411 06 – 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)

DQD 507 Rev. 2016-02-18 Page 1

CSA Group

Supplement to Certificate of Compliance

Certificate: 70103418 **Master Contract:** 264700 (264700)

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

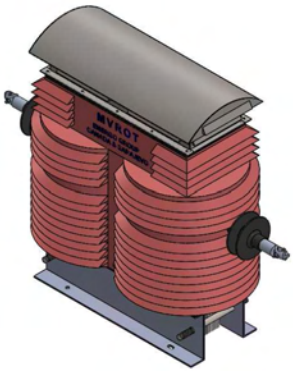
Product Certification History

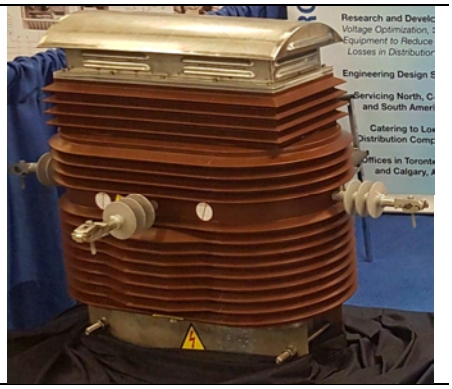
Project	Date	Description
70103418	2017-10-03	High Voltage Power Transformer, Model MVROT-250.

DQD 507 Rev. 2016-02-18 Page 1

2. MAIN PARTS LIST

- **MVROT-X-Y**
  - X = POWER [kVA]
  - Y = LINE VOLTAGE [kV]





- **MVROT CONNECTOR INSULATOR (MVROT-KL-001)**
  - BY K-LINE INSULATORS LIMITED
  - DWG: SK-0442-1 (REV 6)

- **MVROT SUPPORT CONSOLE (MVROT-SP-001)**
  - DWG: EGC-2016-001

- **MVROT LIFTING BEAMS (MVROT-LFT-001)**
  - DWG: EGC-2016-005

- **AUXILIARY EQUIPMENT**
  - ELECTRIC SMART METER
  - VOLTAGE REGULATOR
  - SCADA READERS
  - GPS….

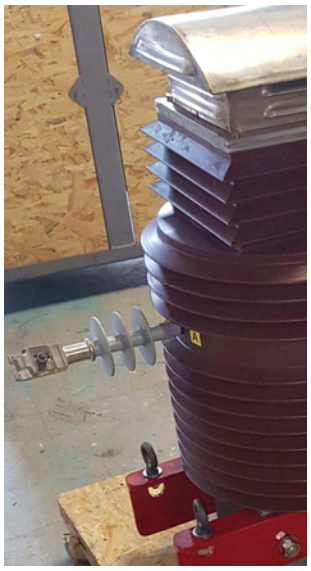
Electric meter as example

3. ACCESSORIES

3.1 MVROT-X-Y is a compact dry type epoxy casted unit that comes from the factory preassembled with connections built into its body.

a) Two primary connections (**A**) and (**B**) [both M12 x 1.75 – female treaded connection],

A=H1



B=H2

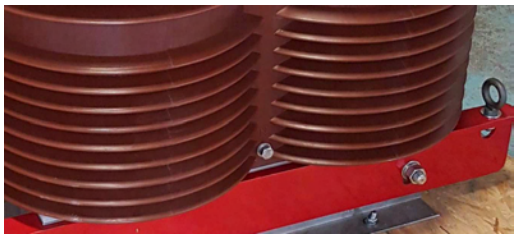
b) One secondary connection (**a**) [M12 x 1.75 - female treaded connection],

a=X1

d) Secondary terminal box
(see next page)

c) One neutral / grounding connection [M12 x 1.75 - female treaded connection],

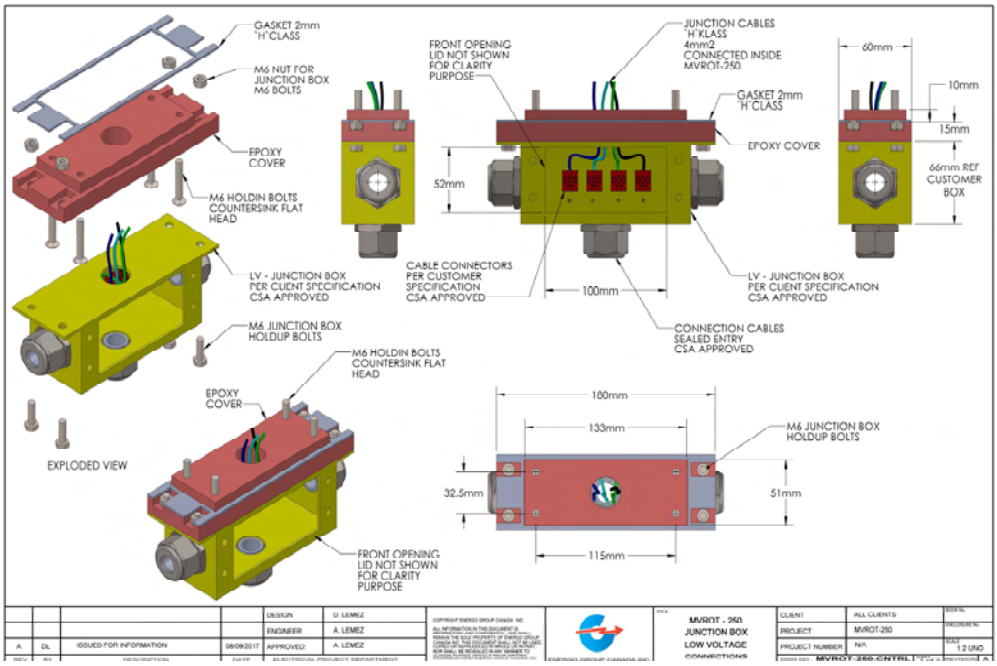
N=X0



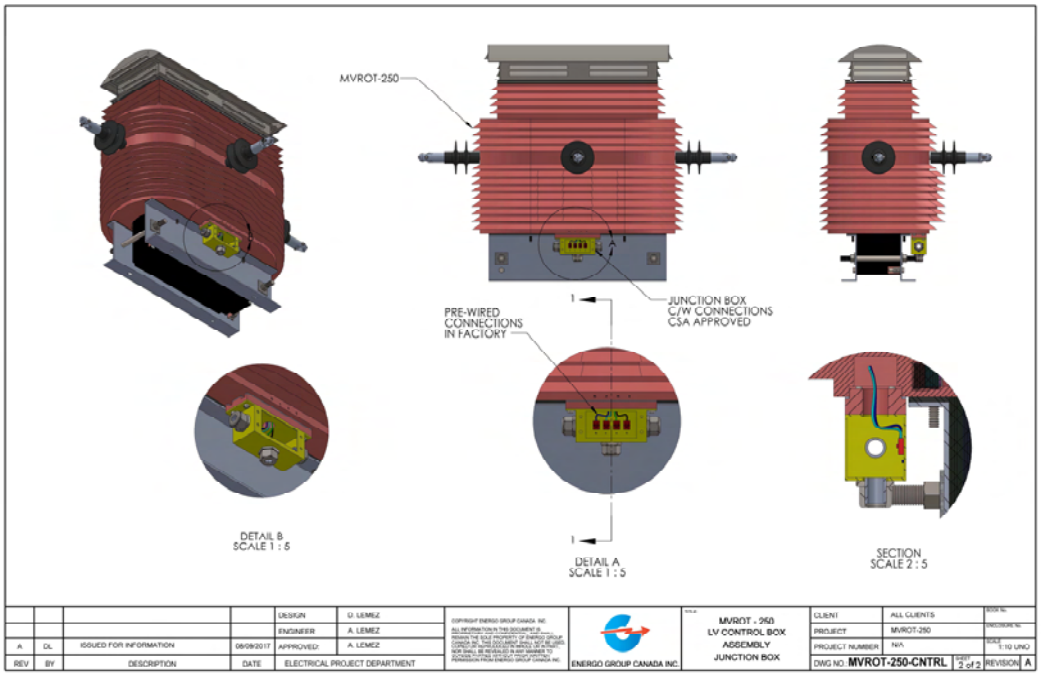
Grounding connection

d) secondary terminal box for connecting auxiliary equipment,
   a. [b] connection [M6 - female] (measuring voltage output 120V)
   b. [c] connection [M6 - female] (control voltage output 120V)
   c. [k] connection [M6 - female] (measuring current output 1A)
   d. [n] connection [M6 - female] (measuring current output 1A)
   e. All bolts and washers for these connections are supplied with the unit.
   f. Weather proofed lid for secondary box is supplied with the unit.

Discretionary secondary terminal box details (closing lid not shown)



Secondary terminal box location on MVROT



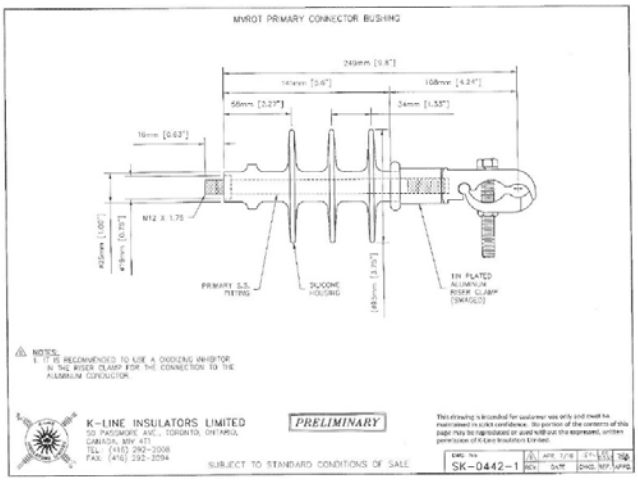
3.2 MVROT CONNECTOR INSULATOR
(Part number: MVROT-KL-001)

This is the main connection between **MVROT** and power supply cables, that is screwed into connections "**A=H1**", "**B=H2**" and "**a=X1**" of **MVROT**. It is fabricated in Toronto, Ontario by K-Line Insulators Limited. It comes preassembled with universal clamp for different cable size connections.

Manufacturer contacts:

K-Line Insulators Limited
50 Passmore Ave, Toronto, Ontario
Canada, M1V 4T1
Tel: 416-292-2008

Part detail drawing for ordering:



3.3 MVROT POLE SUPPORT CONSOLE
(Part Number: MVROT-SP-001)

The main **MVROT** support console is designed to be installed on poles. Designed and Certified by Energo Group Canada Inc. and Fabricated in Calgary, Alberta, MVROT comes with all fastening and lifting eye bolt accessories listed on the first sheet of the **EGC-2016-001** drawing.

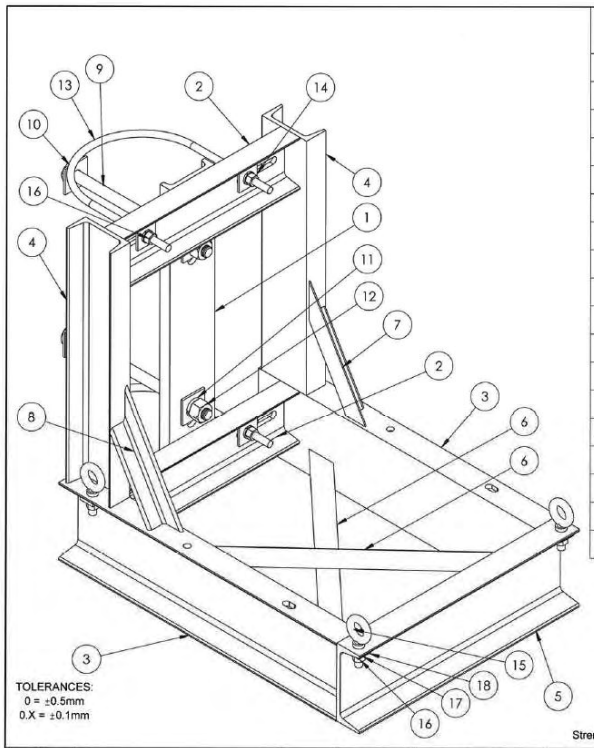
Designed to be lifted and installed with or without **MVROT** mounted on. Recommended installation is with preassembled **MVROT** on the console in the shop.

Engineered to hold 1,000 kg (2200 lbs) of weight in the most severe weather conditions in Canada.

To order this part contact Energo Group Canada Inc.

Pole mounting clearances and minimum space restrictions are shown on the drawing: **EGC-2016-002** (see attachments).

Certified drawings **EGC-2016-001**:



ITEM	QTY.	PART NUMBER	DESCRIPTION	MATERIAL	DWG	Weight [grams]
1	1	MVROT-SUP-01	C4x7.25 (C100x11)	CSA G40.21 300 W (44W)	EGC-2016-001	5139
2	2	MVROT-SUP-02	C4x7.25 (C100x11)	CSA G40.21 300 W (44W)	EGC-2016-001	4175
3	2	MVROT-SUP-03	C6x10.5 (C152x16) 630mm LNG	CSA G40.21 300 W (44W)	-	9871
4	2	MVROT-SUP-04	C4x7.25 (C100x11) 500mm LNG	CSA G40.21 300 W (44W)	-	5412
5	1	MVROT-SUP-05	C6x10.5 (C152x16) 500mm LNG	CSA G40.21 300 W (44W)	-	7834
6	2	MVROT-SUP-06	L1.5 x 1.5 x 3/16	CSA G40.21 300 W (44W)	EGC-2016-001	1548
7	1	MVROT-SUP-07	L1.5 x 1.5 x 3/16	CSA G40.21 300 W (44W)	EGC-2016-001	513
8	1	MVROT-SUP-08	L1.5 x 1.5 x 3/16	CSA G40.21 300 W (44W)	EGC-2016-001	513
9	2	BOLT-02	HHBOLT 0.75-10 - SEE DETAILS	ASTM A325 TYPE 1	EGC-2016-001	766
10	4	WASHER-02	WASHER FOR 0.75 - SEE DETAIL	CSA G40.21 300 W (44W)	EGC-2016-001	68
11	2	HLW 0.75	HEAVY LW 0.75	A325, GALV.		0.053
12	2	HHNUT 0.75	HHNUT 0.7500-10-B-N	ASTM A563 GRADE DH	-	0.220
13	2	U-BOLT-01	U-BOLT 0.50-13 - SEE DETAILS	ASTM A325 TYPE 1 GALV.	EGC-2016-001	633
14	4	WASHER-01	WASHER FOR 0.50 - SEE DETAIL	CSA G40.21 300 W (44W)	EGC-2016-001	46
15	4	S-279 UNC	CROSBY - EYE BOLT 1/2 x 1-1/2	FORGED STEEL	-	172
16	8	HHNUT-0.5 SS	SS HNUT 0.500 x 13-D-N	AISI 304 SS	-	17
17	8	LW 0.5 SS	REGULAR LOCK WASHER 0.5 SS	AISI 304 SS	-	6
18	4	TWSH-02	TAPERED WASHER 1/2 SS	AISI 304 SS		22

NOTES:

1. MINIMUM POWER POLE SIZE "CLASS 5" IS ASSUMED TO BE ADEQUETE TO SUPPORT THE UNIT.
2. MVROT CONSOLE SUPPORT WAS ENGINEERED TO CARRY: 1000 kg (2200 lbs).
3. ALL STRUCTURAL STEEL MATERIAL, WASHERS, NUTS AND BOLTS: TO BE GALVANIZED.
4. WHEN INSTALLED ON POLE TORQUE 1/2" ∅ U-BOLTS TO 57 ft-lb AND 3/4" ∅ BOLTS TO 100 ft-lb.
5. BOLT-02 TO BE SELECTED PER SPECIFIC POLE SIZE AT INSTALLATION SITE.

Strength analysis calculation for MVROT console support completed by CES Calgary and P.Eng certified report CESR1605001, Rev A Issued.

PROFESSIONAL ENGINEER GEORGE AMIN ALBERTA 23 May 2016 REV.1 SEGEN ENGINEERING APEGA PERMIT # 12023

REV	BY	DESCRIPTION	DATE
1	DL	MAIN BOLTS UPSIZED TO 3/4" DIA	23/05/2016
0	DL	ISSUED FOR FABRICATION	09/05/2016

DESIGN: D. LEMEZ | ENGINEER: A. GEORGE | APPROVED: J. LEE | ELECTRICAL PROJECT DEPARTMENT

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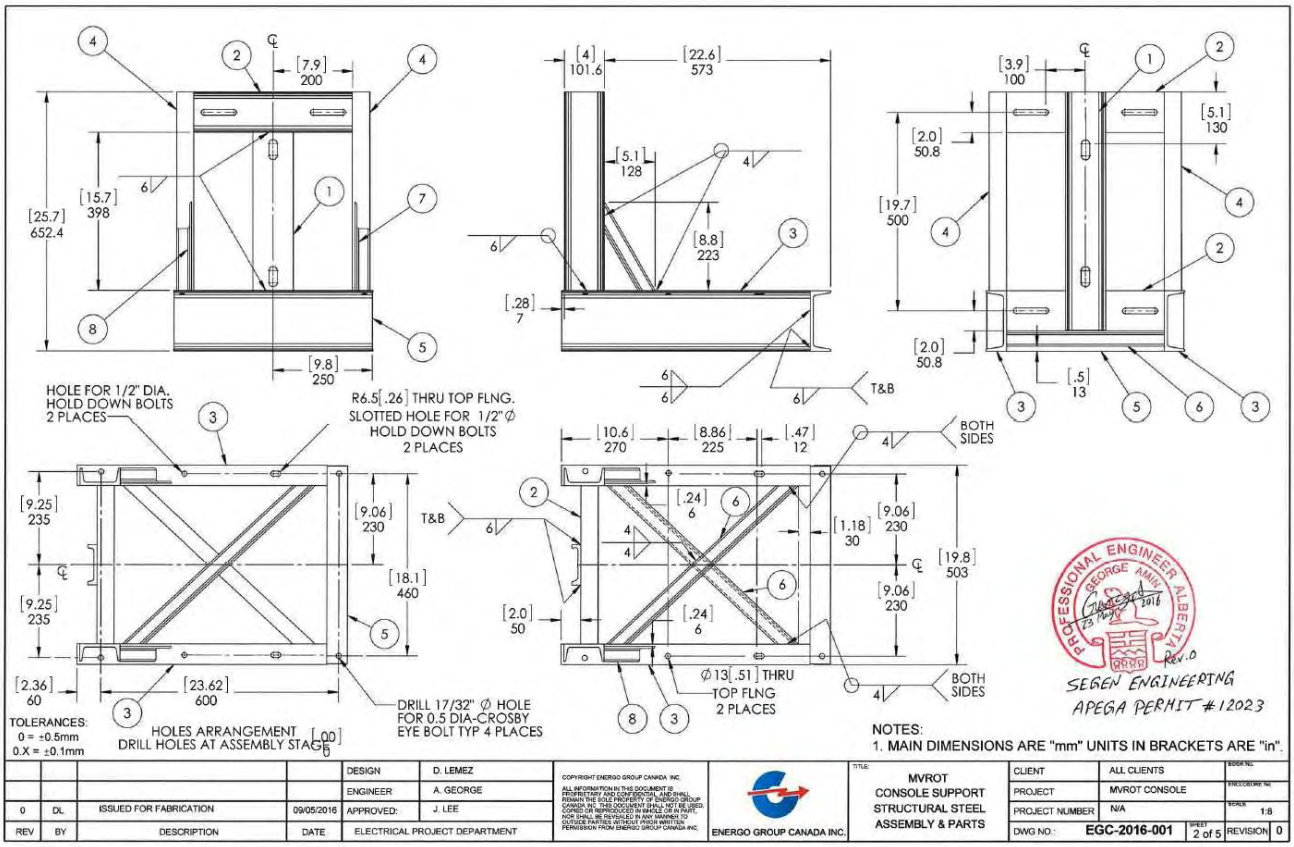
ENERGO GROUP CANADA INC.

TITLE: MVROT CONSOLE SUPPORT STRUCTURAL STEEL ASSEMBLY & MTO

CLIENT	ALL CLIENTS
PROJECT	MVROT CONSOLE
PROJECT NUMBER	N/A
DWG NO.:	EGC-2016-001
SHEET	1 of 5
REVISION	1
SCALE	1:5



NOTES:
1. MAIN DIMENSIONS ARE "mm" UNITS IN BRACKETS ARE "in".

PROFESSIONAL ENGINEER GEORGE AMIN ALBERTA 23 May 2016 REV.0 SEGEN ENGINEERING APEGA PERMIT # 12023

REV	BY	DESCRIPTION	DATE
0	DL	ISSUED FOR FABRICATION	09/05/2016

DESIGN: D. LEMEZ | ENGINEER: A. GEORGE | APPROVED: J. LEE | ELECTRICAL PROJECT DEPARTMENT

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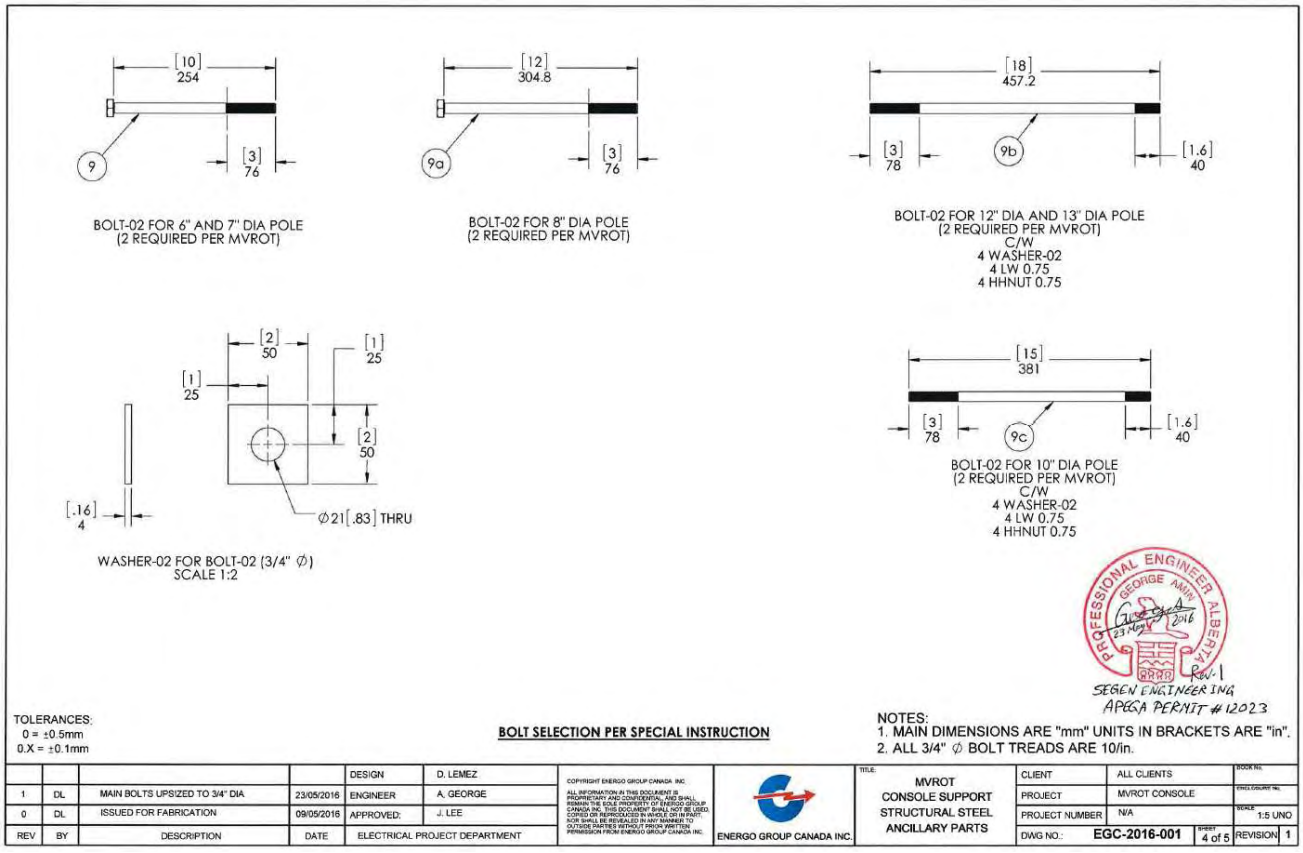
ENERGO GROUP CANADA INC.

TITLE: MVROT CONSOLE SUPPORT STRUCTURAL STEEL ASSEMBLY & PARTS

CLIENT	ALL CLIENTS
PROJECT	MVROT CONSOLE
PROJECT NUMBER	N/A
DWG NO.:	EGC-2016-001
SHEET	2 of 5
REVISION	0
SCALE	1:8


[10] 254
9
[3] 76
BOLT-02 FOR 6" AND 7" DIA POLE
(2 REQUIRED PER MVROT)
[12] 304.8
9a
[3] 76
BOLT-02 FOR 8" DIA POLE
(2 REQUIRED PER MVROT)
[18] 457.2
[3] 78
9b
[1.6] 40
BOLT-02 FOR 12" DIA AND 13" DIA POLE
(2 REQUIRED PER MVROT)
C/W
4 WASHER-02
4 LW 0.75
4 HHNUT 0.75
[2] 50
[1] 25
[1] 25
[2] 50
[.16] 4
Ø21[.83] THRU
WASHER-02 FOR BOLT-02 (3/4" Ø)
SCALE 1:2
[15] 381
[3] 78
9c
[1.6] 40
BOLT-02 FOR 10" DIA POLE
(2 REQUIRED PER MVROT)
C/W
4 WASHER-02
4 LW 0.75
4 HHNUT 0.75
PROFESSIONAL ENGINEER ALBERTA
GEORGE AMIN
23 May 2016
Rev. 1
SEGEN ENGINEERING
APEGA PERMIT # 12023
TOLERANCES:
0 = ±0.5mm
0.X = ±0.1mm
BOLT SELECTION PER SPECIAL INSTRUCTION
NOTES:
1. MAIN DIMENSIONS ARE "mm" UNITS IN BRACKETS ARE "in".
2. ALL 3/4" Ø BOLT TREADS ARE 10/in.
1 DL MAIN BOLTS UPSIZED TO 3/4" DIA 23/05/2016
0 DL ISSUED FOR FABRICATION 09/05/2016
REV BY DESCRIPTION DATE
DESIGN D. LEMEZ
ENGINEER A. GEORGE
APPROVED: J. LEE
ELECTRICAL PROJECT DEPARTMENT
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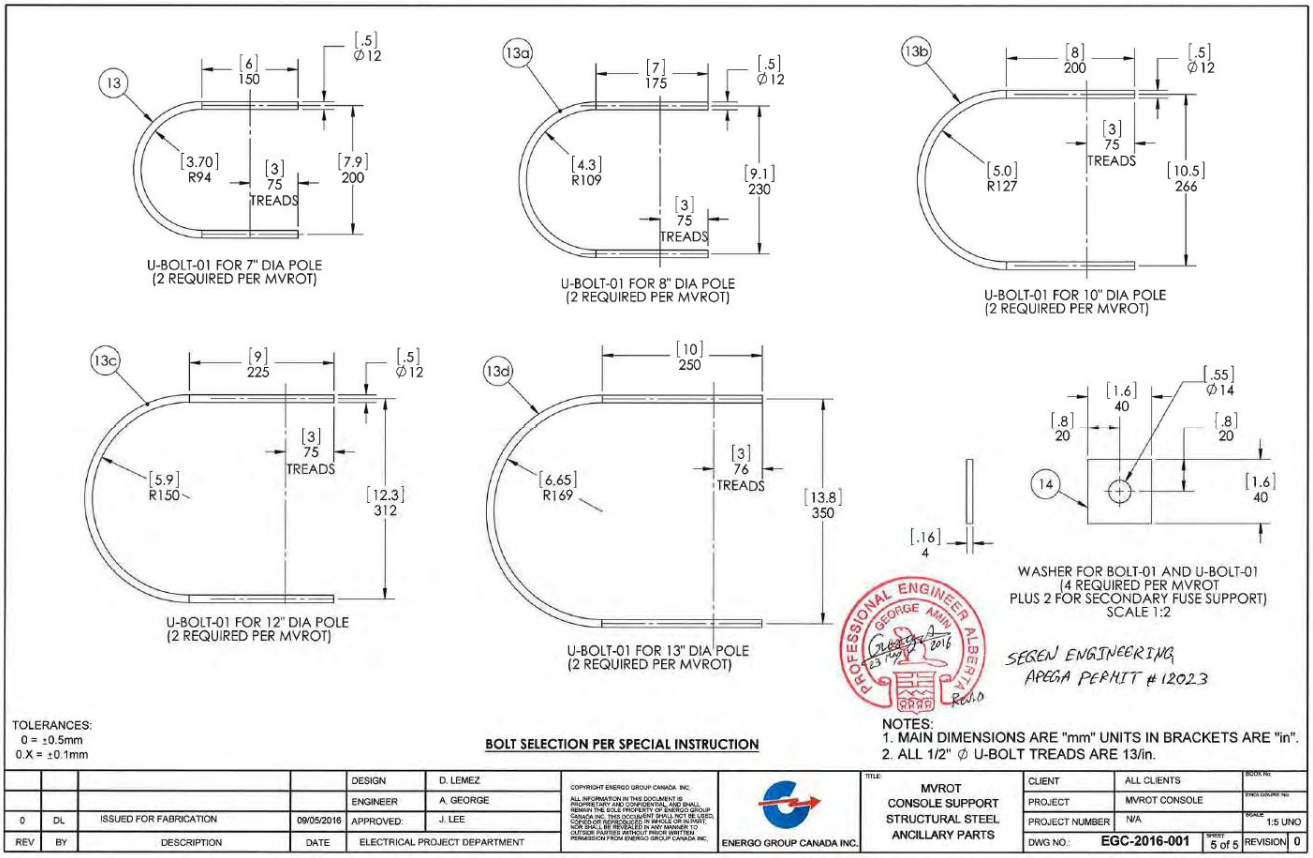
ENERGO GROUP CANADA INC.
TITLE:
MVROT
CONSOLE SUPPORT
STRUCTURAL STEEL
ANCILLARY PARTS
CLIENT ALL CLIENTS
PROJECT MVROT CONSOLE
PROJECT NUMBER N/A
DWG NO.: EGC-2016-001
SHEET 4 of 5
BOOK NO.
ENCLOSURE NO.
SCALE 1:5 UNO
REVISION 1


13
[6] 150
[.5] Ø12
[3.70] R94
[3] 75 TREADS
[7.9] 200
U-BOLT-01 FOR 7" DIA POLE
(2 REQUIRED PER MVROT)
13a
[7] 175
[.5] Ø12
[4.3] R109
[9.1] 230
[3] 75 TREADS
U-BOLT-01 FOR 8" DIA POLE
(2 REQUIRED PER MVROT)
13b
[8] 200
[.5] Ø12
[3] 75 TREADS
[5.0] R127
[10.5] 266
U-BOLT-01 FOR 10" DIA POLE
(2 REQUIRED PER MVROT)
13c
[9] 225
[.5] Ø12
[3] 75 TREADS
[5.9] R150
[12.3] 312
U-BOLT-01 FOR 12" DIA POLE
(2 REQUIRED PER MVROT)
13d
[10] 250
[3] 76 TREADS
[6.65] R169
[13.8] 350
U-BOLT-01 FOR 13" DIA POLE
(2 REQUIRED PER MVROT)
[.16] 4
[1.6] 40
[.55] Ø14
[.8] 20
[.8] 20
14
[1.6] 40
WASHER FOR BOLT-01 AND U-BOLT-01
(4 REQUIRED PER MVROT
PLUS 2 FOR SECONDARY FUSE SUPPORT)
SCALE 1:2
PROFESSIONAL ENGINEER ALBERTA
GEORGE AMIN
23 May 2016
Rev. 0
SEGEN ENGINEERING
APEGA PERMIT # 12023
TOLERANCES:
0 = ±0.5mm
0.X = ±0.1mm
BOLT SELECTION PER SPECIAL INSTRUCTION
NOTES:
1. MAIN DIMENSIONS ARE "mm" UNITS IN BRACKETS ARE "in".
2. ALL 1/2" Ø U-BOLT TREADS ARE 13/in.
0 DL ISSUED FOR FABRICATION 09/05/2016
REV BY DESCRIPTION DATE
DESIGN D. LEMEZ
ENGINEER A. GEORGE
APPROVED: J. LEE
ELECTRICAL PROJECT DEPARTMENT
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ENERGO GROUP CANADA INC.
TITLE:
MVROT
CONSOLE SUPPORT
STRUCTURAL STEEL
ANCILLARY PARTS
CLIENT ALL CLIENTS
PROJECT MVROT CONSOLE
PROJECT NUMBER N/A
DWG NO.: EGC-2016-001
SHEET 5 of 5
BOOK NO.
ENCLOSURE NO.
SCALE 1:5 UNO
REVISION 0

Notes:

1. The “U” bolts shown on the drawing “**EGC-2016-001** sheet **5 of 5**” are difficult to fabricate to a tight fit since the pole diameter varies at console installation.

   Instead of these bolts we have a better solution with stainless steel “1/2” diameter wire rope bolts” that can wrap tightly around different pole diameters.

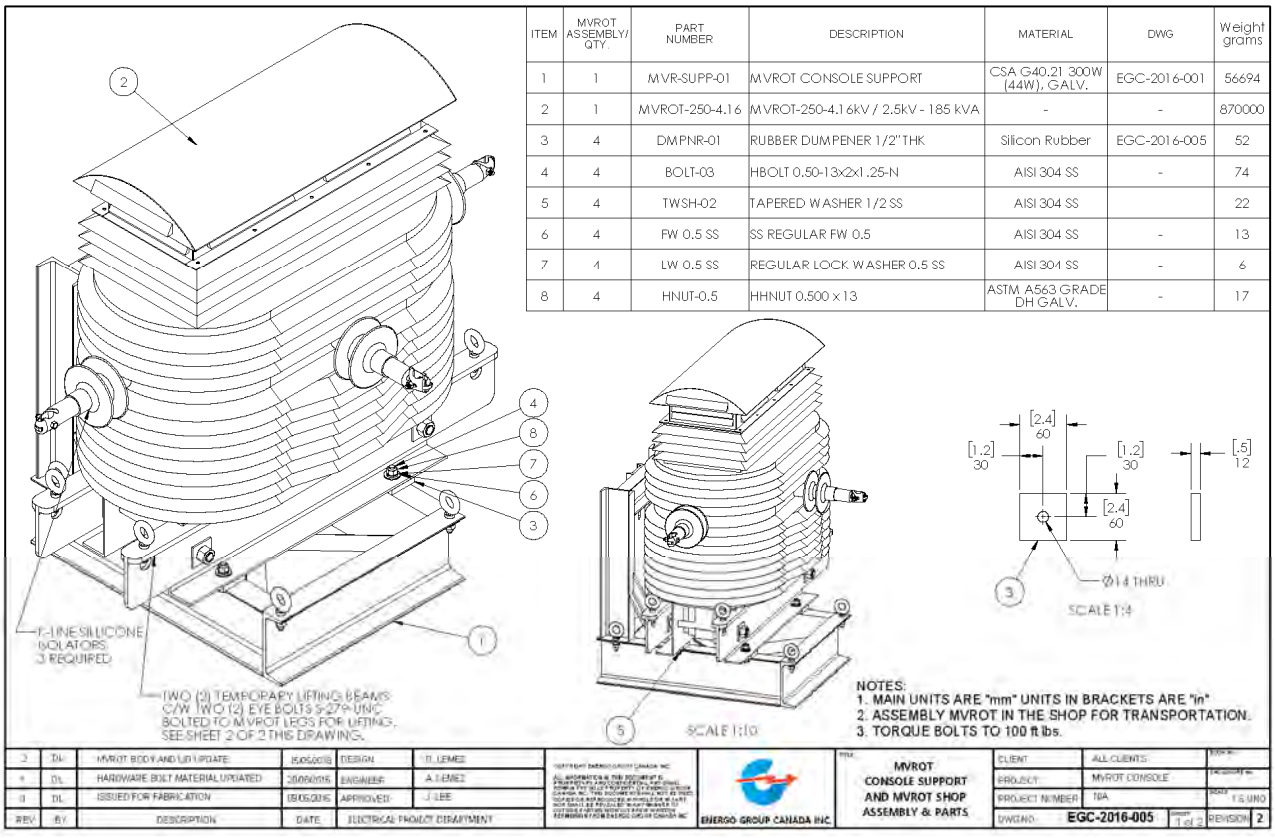
2. Main bolts through the pole are ¾” diameter and come in various lengths to account for various pole diameters.

3.4 LIFTING BEAMS
(Part Number: MVROT-LFT-001)

Lifting beams are designed to handle **MVROT** in the shop or in the field if the console is being installed prior to mounting **MVROT** onto it. These beams are removable and to be dismounted after the use. They can be used for multiple installations of **MVROT’s**.

Designed and Certified by Energo Group Canada Inc. Fabricated in Calgary, Alberta they come with all fastening and lifting eyes accessories as listed on drawing **EGC-2016-005**.

Fasteners needed to secure **MVROT** on the console are shown on sheet 1 of 2 on the drawing **EGC-2016-005**.



ITEM	MVROT ASSEMBLY/ QTY	PART NUMBER	DESCRIPTION	MATERIAL	DWG	Weight grams
1	1	MVR-SUPP-01	MVROT CONSOLE SUPPORT	CSA G40.21 300W (44W), GALV.	EGC-2016-001	56694
2	1	MVROT-250-4.16	MVROT-250-4.16kV / 2.5kV - 185 kVA	-	-	870000
3	4	DMPNR-01	RUBBER DUMPENER 1/2"THK	Silicon Rubber	EGC-2016-005	52
4	4	BOLT-03	HBOLT 0.50-13x2x1.25-N	AISI 304 SS	-	74
5	4	TWSH-02	TAPERED WASHER 1/2 SS	AISI 304 SS		22
6	4	FW 0.5 SS	SS REGULAR FW 0.5	AISI 304 SS	-	13
7	4	LW 0.5 SS	REGULAR LOCK WASHER 0.5 SS	AISI 304 SS	-	6
8	4	HNUT-0.5	HHNUT 0.500 x 13	ASTM A563 GRADE DH GALV.	-	17

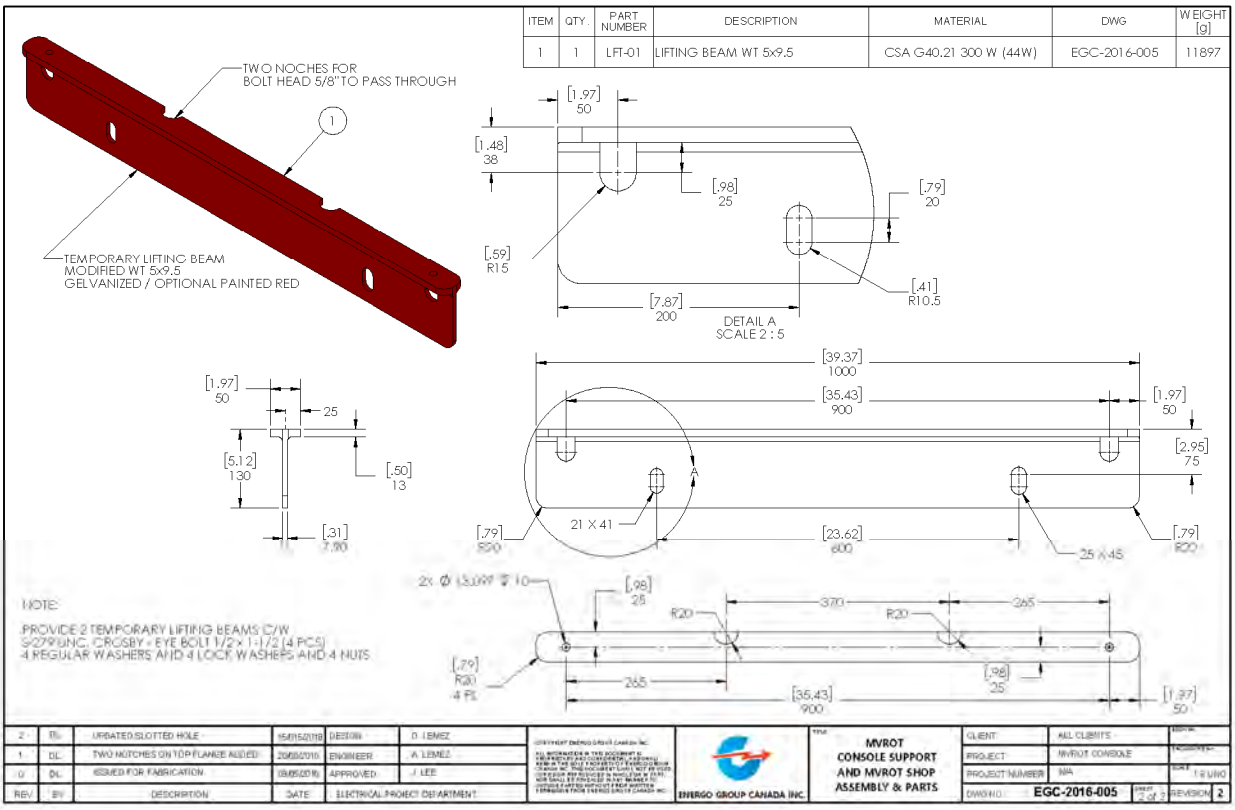
REV	BY	DESCRIPTION	DATE	ELECTRICAL PROJECT DEPARTMENT
3	DL	MVROT BODY AND LIFT UPDATE	15/05/2016	DESIGN: D. LEMIEZ
2	DL	HARDWARE BOLT MATERIAL UPDATED	20/04/2016	ENGINEER: A. LEMIEZ
1	DL	ISSUED FOR FABRICATION	15/05/2016	APPROVED: J. LEE

ENERGO GROUP CANADA INC

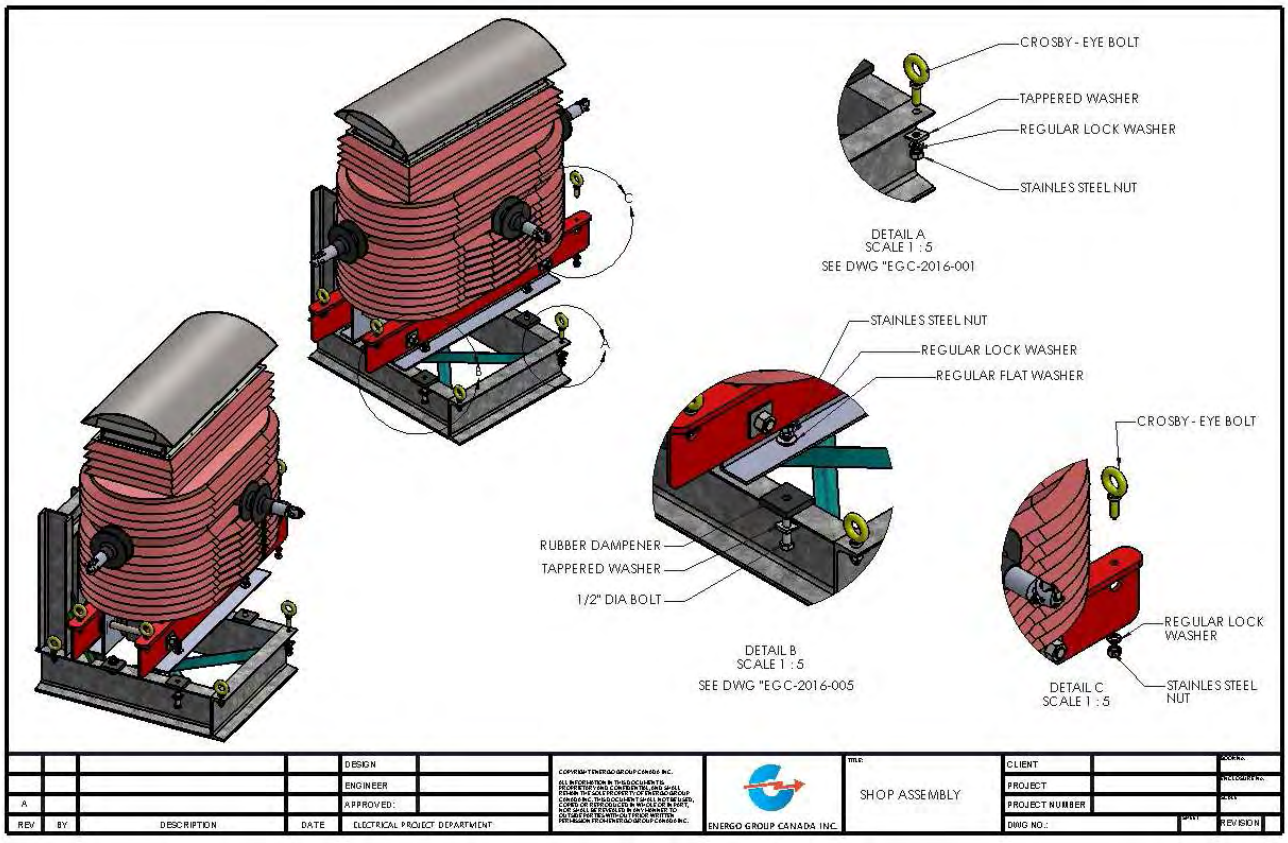
MVROT CONSOLE SUPPORT AND MVROT SHOP ASSEMBLY & PARTS

CLIENT	ALL CLIENTS
PROJECT	MVROT CONSOLE
PROJECT NUMBER	TBA
DWG NO.	EGC-2016-005
SHEET	1 of 2
REVISION	2

Lifting beam details are shown on sheet 2 of 2 on drawing **EGC-2016-005**.



MVROT assembly onto support console



3.5 AUXILIARY EQUIPMENT

This equipment is optional and it is available per client needs and specifications. MVROT has power supply connections built in a secondary box for any type of electronics that can run on 120V or 240V with small power. The proposed regular equipment that can come with the basic MVROT unit is the “Smart Energy Meter”.

With this available power we are able to connect many types of electronics. It can be paired well with ***SCADA*** system to give accurate readings on load side.

Basic Model can perform:

- *Measuring Current*
- *Measuring Voltage*
- *Measuring Energy*
- *Measuring maximum load/power (15min intervals)*
- *Reading load profiles - weekly*

Advance Model (Add on electronic modules):

- *Identifying faults in downstream system*
- *Locating faults with GPS coordinates*
- *Automatically controlling voltage regulators in main substation*
- *Any other "wish to have" readings, controls can be added per Client’s request*

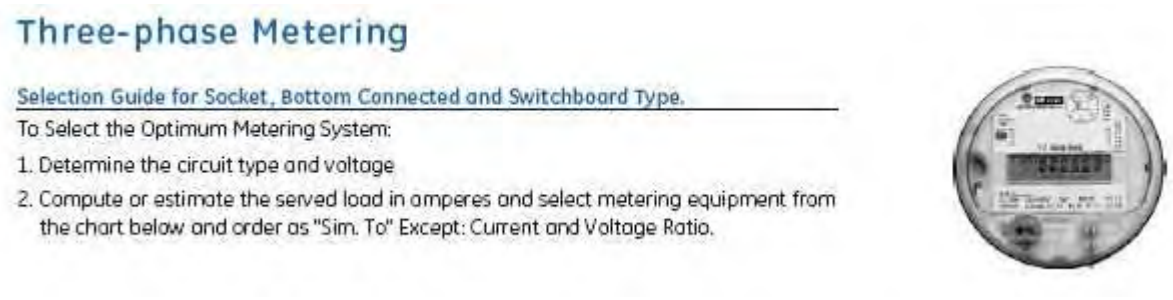
  Main advantage here is that we are able to measure electrical perimeters from 0 to 1A accuracy and, paired with the same capabilities of smart electronic energy meters we can have superior accurate readings of energy passing through MVROT onto SDT behind.

  SCADA systems will benefit on accuracy demand for the power and voltage so the voltage regulators controlled by *SCADA* can be even more efficient.

  All of these electronics can be paired with distribution network data protocols for transmitting data to the distribution centers. Wireless, Radio, Cell technology etc. can be implemented into these devices.

  We can suggest several suppliers for the electronics as listed here but Clients might have their own supplier and that will be discussed with them:

  General Electric: GE meters: www.geindustrial.com


Three-phase Metering

Selection Guide for Socket, Bottom Connected and Switchboard Type.

To Select the Optimum Metering System:

1. Determine the circuit type and voltage
2. Compute or estimate the served load in amperes and select metering equipment from the chart below and order as "Sim. To" Except: Current and Voltage Ratio.

Sensus / Elster meters: www.elster.com

sensus

elster
Vital Connections

Elster A3 ALPHA® meter with
Sensus® FlexNet™ SmartPoint® module

Lovato electric

LOVATO ELECTRIC S.P.A.
24020 GORLE (BERGAMO) ITALIA
VIA DON E. MAZZA, 12
TEL. 035 4282111
TELEFAX (Nazionale): 035 4282200
TELEFAX (International): +39 035 4282400
E-mail info@LovatoElectric.com
Web www.LovatoElectric.com

8390 GB I 01 15 311001194

GB Single-phase direct connection energy meter with RS-485 interface
Instructions manual

I Contatore di energia monofase a inserzione diretta con interfaccia RS-485
Manuale operativo

DME D121

CE

WESCHLER INSTRUMENTS

800-903-9870 | fax 800-903-9590 | weschler.com | info@weschler.com

Electro Industries Utility Billing Meter

NEXUS 1270

- 0.6% W/Hr Revenue Meter
- 20 Year Time of Use
- Loss Compensation
- Power Quality
- Data Logging & Event Recording
- Multiple Communication Paths
- Modbus, DNP3, Ethernet, Web
- Graphical LCD Display
- Normal Mode, Time of Use Mode, Diagnostic Mode
- Two Historic Logs, Multiple Demand Windows
- CBEMA/ITIC Log (Model 1270)
- Setup Parameters Stored in Non-Volatile Memory
- Dial Out on Alarm or Event

SPECIFICATIONS

Accuracy:	
Voltage	0.02%
Current	0.05%
Frequency	0.001Hz
kWh @1.0PF	0.06%
kWh @0.5PF	0.1%
kVAR	0.1%
kVA	0.1%
PF	0.1%
Sensing:	16 bit A/D inputs True RMS measurements 8 channel sample & hold
Digital Inputs:	8 channels, self excited, dry contact
Solid State Outputs (KYZ):	4 channels, form C, 350VDC/ 120mA
Timing:	Internal clock accurate to 1 min/month IRIG-B input for sync to external GPS signal
Standard Communications:	IR port Two RS-485 serial ports Modbus RTU, Modus ASCII, DNP3.0 protocols Data Speeds to 115kbps Eight high speed input channels
Optional Communications:	Internal modems with data buffering Internal Ethernet with multiple socket support & Modbus TCP/IP
Operating Temperature:	-40°C to 85°C
Security:	Hardware & Password Locks
Standard Power (S):	96-550VAC 50/60Hz auto-ranging meter power from any of the 3 phases.
External Power (SE):	96-275VAC 50/60Hz or 125VDC ±20%
Dimensions:	S case 6.96" dia x 6.0" deep SWB case 6.813"W x 9.188"H x 9.30"D

Memory:

Model	Log1	Log2	CBEMA	Event	Waveform	Output	Input
1260S	80 days	32 days		1024		512	512
1260A	601 days	132 days		1024		512	512
1270S	97 days	132 days	1024	1024	64	512	512
1270A	602 days	132 days	1024	1024	96	512	512

ORDERING INFORMATION

To Order–Insert Number Code for Each Letter to Select Catalog Number.

[A] - [B] - [C] - [D] - [E] - [F] - [G]

A	Model	
	1260	Nexus Utility Billing Meter
	1270	Nexus Utility Billing Meter with Advanced Power Quality
B	Memory	
	S	Standard
	A	Advanced
C	Form	
	9S	120-277V L-N; 3E, 4W, Wye
	35S	120-480V L-N; 2E, 3W, Delta
	36S	120-277V L-N; 2½E, 4W, Wye
	SWB	120-277V L-N; programmable
D	Class	(Amps)
	02	Class 2 (0 to 2 A)
	020	Class 20 (0 to 20 A)
E	Frequency	
	60HZ	
	50HZ	
F	Power Supply	
	S	Standard
	SE	Std External
	DE	18-60V DC
	D	69V AC ±20%
G	Internal I/O	
	X	None
	INP2	Dial out Modem
	INP10	10Mb Ethernet
	INP100	10/100 Base T
	4IP0	4 Pulse Output Relays

EXTERNAL OPTIONAL MODULES

External Modules	
EI/1MA0N4	4 Channel Analog Outputs, 0-1mA
EI/20MA0N4	4 Channel Analog Outputs, 4-20mA
EI/1MA0N8	8 Channel Analog Outputs, 0-1mA
EI20MA0N8	8 Channel Anaolgo Output, 4-20mA
EI/8AI1	8 Channel Analog Input, 0-1mA
EI/8AI2	8 Channel Analog Input, 4-20mA
EI/8AI3	8 Channel Analog Input, 0-5VDC
EI/8AI4	8 Channel Analog Input, 0-1VDC
4RO1	4 Relay Outputs
4PO1	4 Solid State Pulse Outputs
8DI1	8 Digital Status Inputs
MBIO	I/O Module Mounting Brackets
PSIO	Additional I/O Power Supply
Software	
NXDS1.0C	Single User Dial-in Server License
AIREPORTS1	AIREPORTS Single User License

29b

ISKRAMECO:

Iskraemeco d.o.o, Mjerenje i upravljanje energijom
10000 Zagreb, Žitnjak b.b., R. Hrvatska
Telefon +385 (0)1 240 62 34, Faks: +385 (0)1 240 62 37
http://www.iskraemeco.hr, E-pošta: prodaja@iskraemeco.hr
Izdavač: Iskraemeco. Pridržano pravo na promjene.

Iskraemeco, d. d.
4000 Kranj, Savska loka 4, Slovenija
Telefon: (+386 4) 206 40 00, telefaks: (+386 4) 206 43 76,
http://www.iskraemeco.si, e-pošta: info@iskraemeco.si
Izdavač: Iskraemeco. Pridržano pravo na promjene.

ISKRAEMECO

Metering is our Business

ICG

MT860

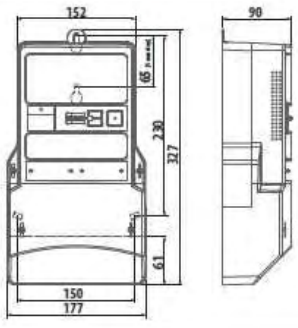
High precision modular meter

- Active, Reactive and Apparent Energy
- 4 Quadrant measurement
- Accuracy class
- Multiple connection types
- Transformer connection
- Power quality according to EN 50160
- Maximum demand
- Load profile
- Load control
- Event log
- Real-time clock
- Multi-rate registration
- IEC 62056-21 compliance
- SCADA, Modbus communications protocol
- Communication
- RS232 Interface
  RS485 Interface
- CS (20 mA current loop) Interface
  IR (optical port) Interface
- Photovoltaic ready

Proven technology, highest precision and communication modularity make the **MT860** the best solution for production and transmission applications. This multi-functional device meets modern market demands with extended functionalities:

- »No power reading« option via optical port
- Anti-tampering features
- Voltage cut, sag and swell detection
- Power quality monitoring
- Photovoltaic friendly design
- Recyclable casing material
- Exchangeable communication modules
- Exchangeable input/output modules

Meter dimensions



ICG MT860 High precision modular meter

Type overview

			MT860S-T1 CT connected	MT860S-T1 CT & VT connected
Network		High voltage		●
		Medium voltage	●	●
		Low voltage	●	●
Connection type		3P4W	●	●
		3P3W	●	●
Communication type	on board	optical probe + no power reading	●	●
		RS-485	●	●
	modules	CS – RS485	●	●
		RS485-RS485	●	●
		RS232-RS485	●	●
		MODBUS TCP/IP & RTU	●	●
		Ethernet – RS485	●	●
		GSM/GPRS-RS485	●	●
Outputs – on board		External power supply	●	●
		Two impulse outputs	●	●
		RS485	●	●
Input – output modules		4 OPTOMOS outputs + 5A bistable relay + 1 input	●	●
		5 OPTOMOS outputs + 1 input	●	●
		8 OPTOMOS outputs + 4 inputs	●	●

Technical specifications

			MT860S-T1 CT connected	MT860S-T1 CT & VT connected
Nominal voltage		Un	3 x 57.7/100 V ... 3 x 240/415 V	3 x 57.7/100 V ... 3 x 240/415 V
Voltage range			0.8 – 1.15 Un	
Reference frequency			50 Hz ±2 % or 60 Hz ±2 %	
Current		Nominal current In	1 A, 2 A, 5 A, 5//1 A	1 A, 2 A, 5 A, 5//1 A
		Base current Ib	–	–
		Maximal current Imax	6 A, 10 A	
Accuracy class		Active energy	Class 0.2S (IEC 62053-22)	
		Reactive energy	Class 2, 3 (IEC 62053-23), calibrated up to 0.5%	
		Apparent energy	According to the IEC 62053-22 standard	
Real-time clock		Accuracy	Crystal: < 5 ppm = ≤ ± 3 min./year (T = +25 °C)	
		Back-up power supply	Li battery : 10 years	
External power supply		Value	100 – 240 V AC/DC	
		Tolerance	0.8 – 1.15 Un	
		Frequency (only for AC)	50 Hz or 60 Hz	
Temperature ranges (IEC 62052-11)		Operation	-40 °C ... +70 °C	
		Storage	-40 °C ... +80 °C	
Ingress protection IEC 60529			IP 53	
Liquid Crystal Display (matrix-dot display with 4 x 20 characters)				

Basic functionality

Measurement features

- Active (import/export) and Reactive energy (import/export), 4Q Reactive, Apparent energy & demand
- Phase and three phase energy/demand measurements
- Current average, maximum and cumulative demand measurement
- Maximum demand can be calculated for all energies measured as tariff rated or cumulative

Tariff functions

- Complex time-of-use (TOU)
- Tariff control via RTC or external inputs

Load profiles

- Two independent Load profiles
- Programmable and independent Load profiles period
- Event log

Communication

- Independent communication channels
- MODBUS RTU and MODBUS TCP/IP

Power quality

- Measurement of RMS phase current
- RMS phase voltage
- Power factor
- Network frequency
- Phase angles
- Voltage interruptions
- Short power outages

Specifics

- Backlit LCD display
- Detection of opening main and terminal cover
- Secured communication channels
- Network anomalies detection
- Communication modules, Input/output modules

Optional

- Enhanced Power quality measurement features (Harmonic components, Total harmonic distortion factor, Voltage sags and swells)
- Load control
- RTC (Li battery)

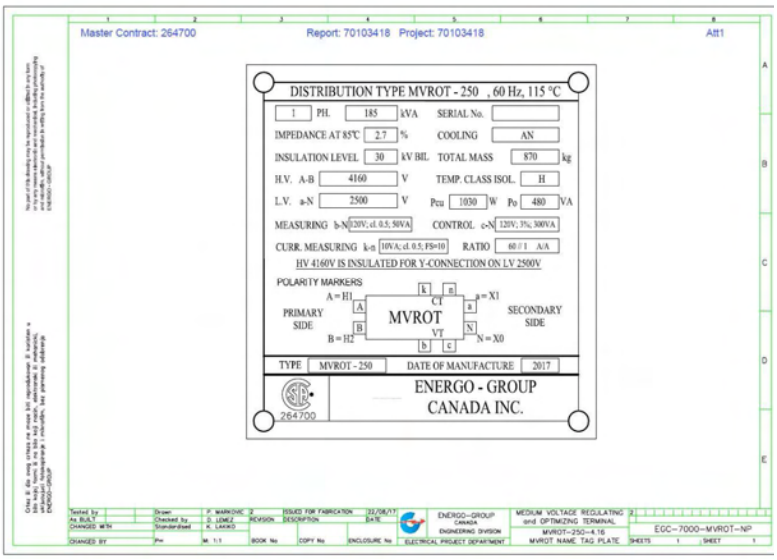
ISKRAEMECO

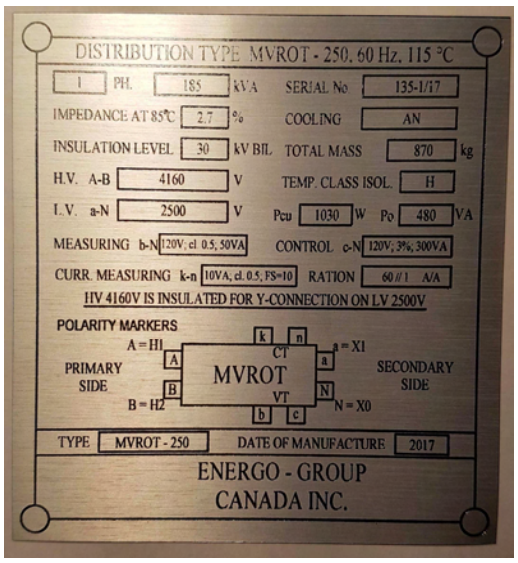
Iskraemeco, Energy Measurement and Management
4000 Kranj, Savska loka 4, Slovenia
Telephone: +386 4 206 40 00
http://www.iskraemeco.si, e-mail: info@iskraemeco.si

1 307 701 – 1

4. NAME PLATE AND PACKAGING

Example of Name Plate:





Packaging of MVROT is in heat treated wooden boxes and pallets (HT stamped) suitable for road, sea or air transport.

Shipping dimensions of package per one MVROT:

1200mm x 800mm x 1200mm
or
48” x 32” x 48”

MVROT weight depends of its rated voltages and power and it can be:

Between 700kg to 900kg or 1540lbs to 2000lbs

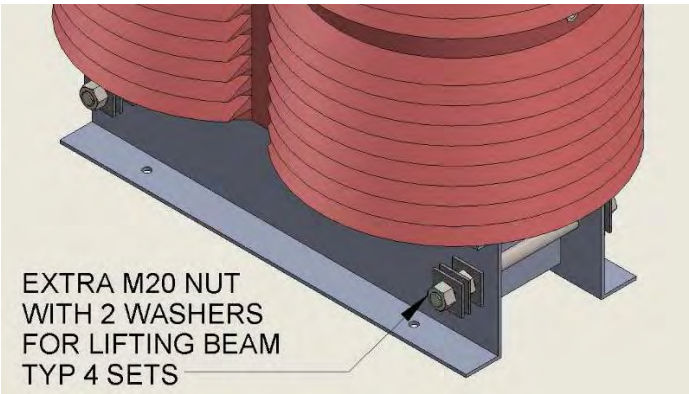
Shipping weight with package per one MVROT can be:

From 940 kg to 1150 kg or 2100 lbs to 2550 lbs

5. DRESSING and HANDLING MVROT IN THE SHOP

After receiving and unpacking MVROT in the testing laboratory shop these are the procedures for dressing and handling MVROT in while in the shop:

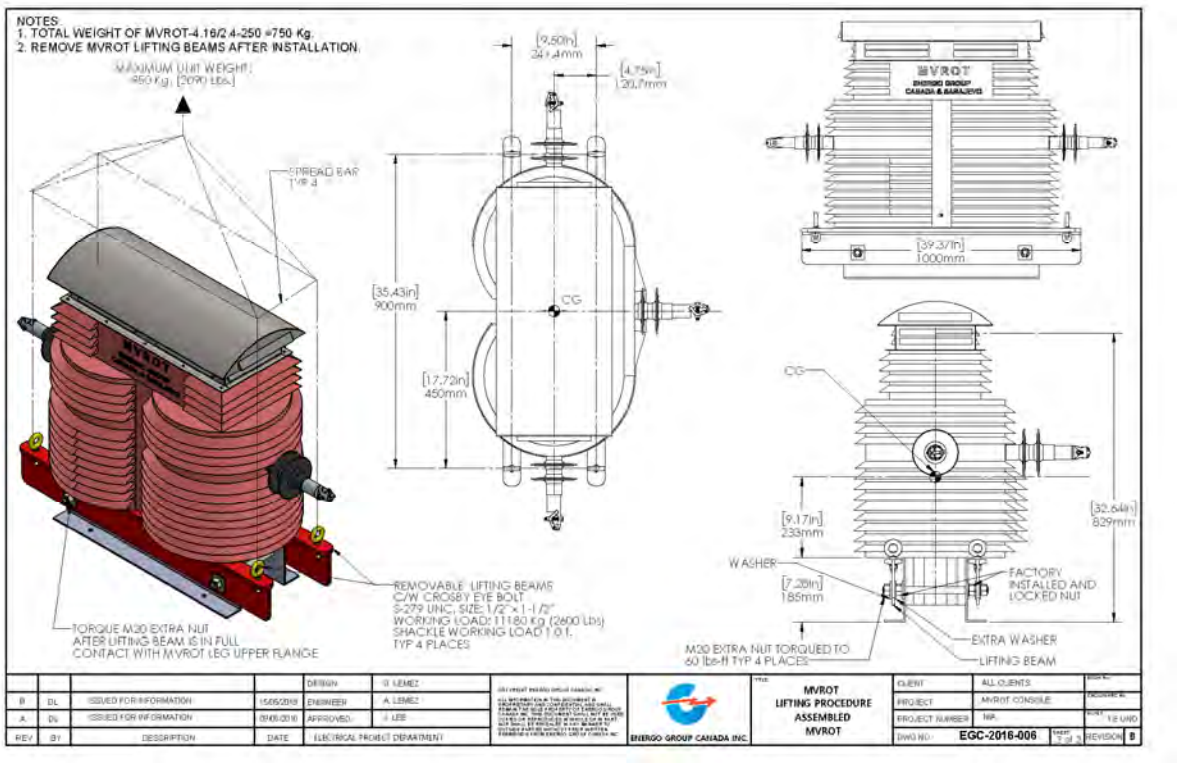
MVROT comes with an extra set of bolts at its legs (on main bolt fasteners) to mount lifting beams:



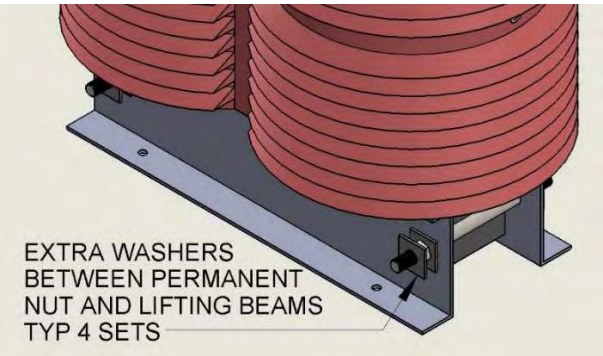
1. Unscrew extra nuts and remove one extra washer from the bolts (at 4 points)
    a. Make sure not to untighten main permanent nuts holding core of MVROT.

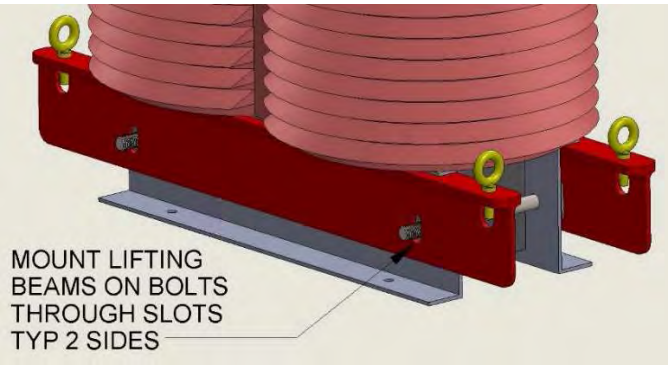
2. Dress lifting beams (MVROT-LFT-001) with supplied crane hooks. Crosby Eye Bolt S-279 UNC, size 1/2" x 1-1/2". Working load: 11180 Kg (2600 lbs).

   See drawing EGC-2016-006 sheet 2 of 2:

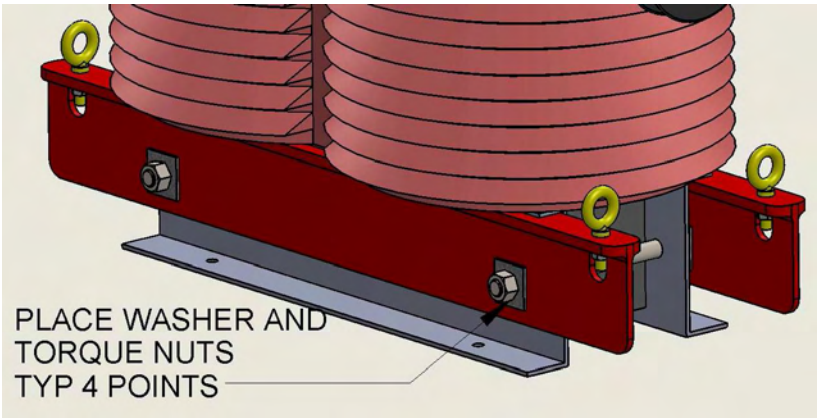


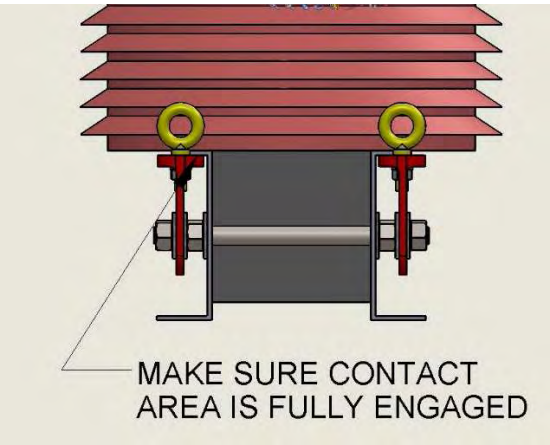
3. Place lifting beams (MVROT-LFT-001) on the bolts through lifting beam slotted holes.
    a. Make sure one extra washer stays in the place (between lifting beam and permanent nut)
    b. Notches in the lifting beams are oriented inside to allow clearance for vertical bolts and nuts in MVROT legs.





4. Place another washer and torque extra nut per the drawing EGC-2016-006
    a. Make sure top flange of the lifting beam is tight against MVROT leg top flange since that is the contact area to lift the MVROT. There will be enough space in the slotted holes to ensure this.
    b. Check clearance of vertical bolts and nuts passing through notch out in lifting beams.

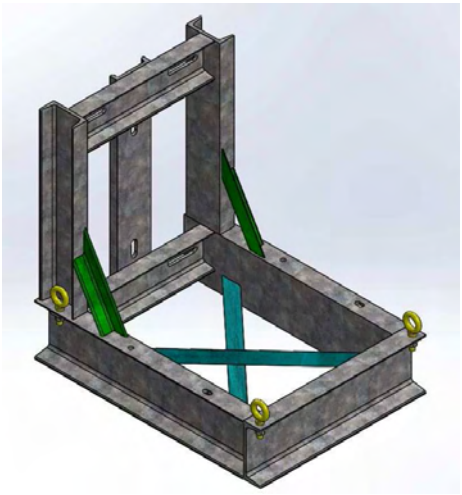




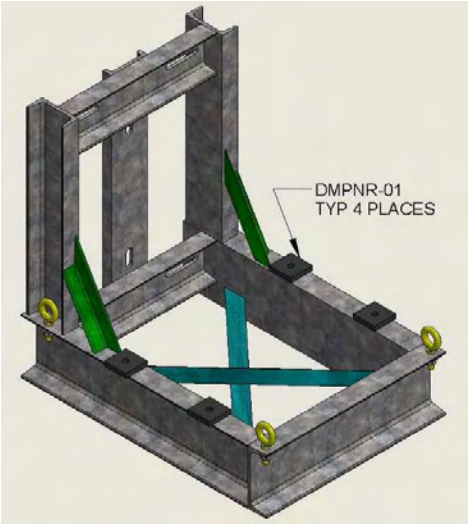
5. MVROT is ready to be lifted using crane or fork lift with a set of lifting ropes / wires and ***spread bars*** to ensure that those ropes do not come in contact with the MVROT as shown on drawing EGC-2016-006 sheet 2 of 2. ***See point 2 of this section.***
    a. Use appropriate shackle (not supplied) for the working loads and Crosby eye bolt.
    b. Spread bar lengths: 900mm (35.4”) x 2, plus 240mm (9.5”) x 2.
    c. Minimum length of the lifting ropes (sling wires) from eye bolt to spread bars are 650mm (25.75”).

6. Prepare support console (MVROT-SP-001) by placing it securely on the flat surface that can withstand the total weight of ~ 1,000kg (22,000lbs).

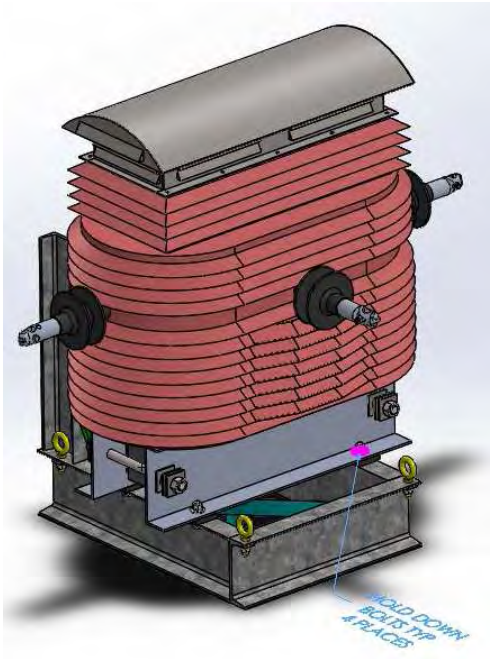
7. Mount supplied four (4) Crosby Eye Bolt S-279 UNC, size ½” x 1-1/2”. Working load: 11180 Kg (2600 lbs) as shown on drawing EGC-2016-001 (see section 2.3).



8. Place four (4) DMPNR-01 (1/2” thk.) over the holes on the console where MVROT will be placed, aligning the holes as closely as possible.

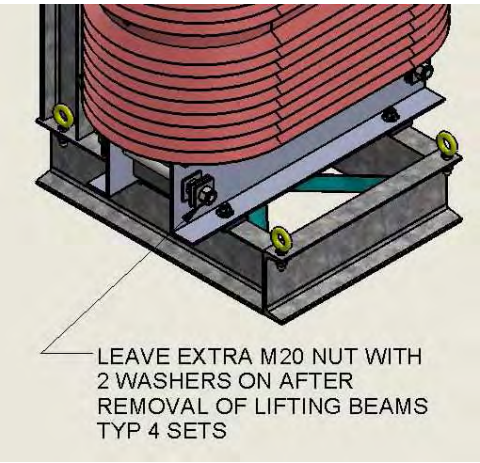


9. Place MVROT on top of dampener plates making sure holes are aligned by inserting pilot bolts through before entire MVROT weight is placed down.

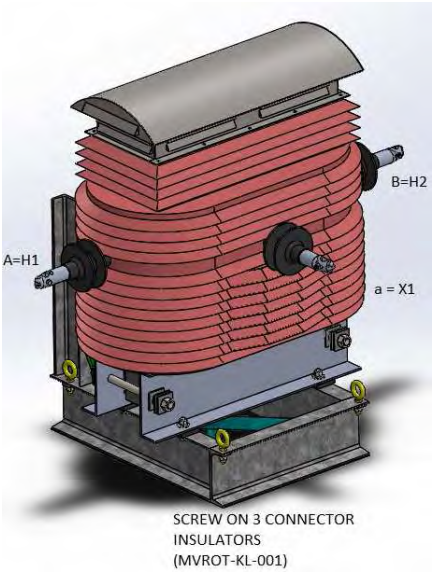


10. Insert and tighten all four (4) bolts (BOLT-03) and nuts (DWG: EGC-2016-005 – Section 2.4).
    a. Make sure tapered washer (TWSH-02) is inserted underneath of console top flange to take flange angle.
    b. Place bolt from bottom up.
    c. Flat washer (FW 0.5 SS) and lock washer (LW 0.5 SS) are on top of MVROT legs.
    d. Tighten nut from top.

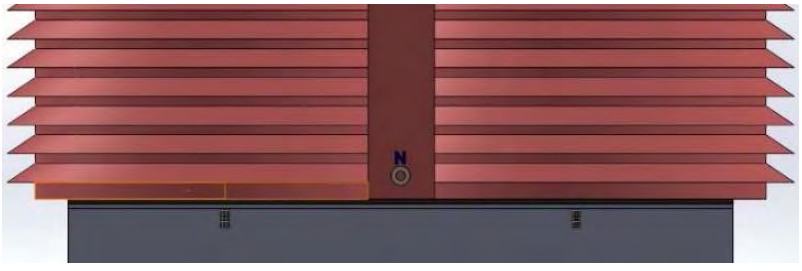
11. Remove temporary lifting beams (MVROT-LFT-001).
    a. Replace extra washers and tighten extra nuts that were holding lifting beams.



12. Attach 3 insulator connectors on MVROT prepared female connections.
    a. "A" and "B" are primary side connectors and "a" is secondary side connector.
    b. Tighten connectors to maximum torque of 35 ft-lbs, for flat surfaces to be fully in contact with brass flat surface on MVROT, and use ***"Loctite Blue"*** bonding to prevent it from unwinding due to wind swinging wires connected to it in the field. ***Loctite Blue*** allows connection to be disconnected (Loctite *Red does not*). (*Insulators can be shipped loose to the site and bonding can be applied in the field prior MVROT installation*)

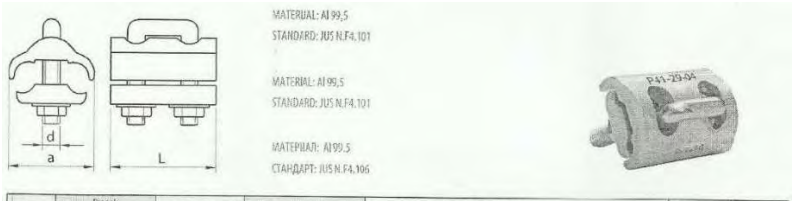


13. Connect neutral cable receivers (not supplied) to neutral connection on MVROT.

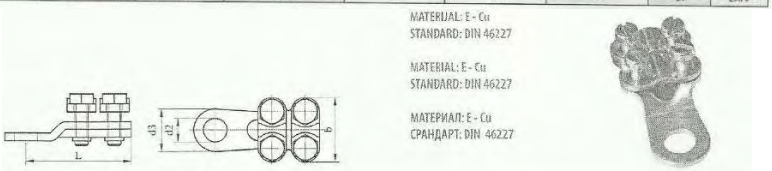


14. Use off the shelf products available for the grounding and neutral connections.

    See examples:



R.broj Nr. n/nj	Presek provodnika Cable interesction Сечение провода	Kodni broj CODE Код(номер)	Tip Type Тип	Dimenzije (mm) Dimenson (mm) Размеры (мм)			Pakovanje Packing Упаковка	Težina Weight Вес
				d	a	L		
1	4-25	P41-29-02	Al 4 - 25	M6	25.5	39	50	4.50
2	6-35	P41-29-03	Al 6 - 35	M6	31	40	50	5.00
3	6-50	P41-29-04	Al 6 - 50	M8	33.5	43	50	9.10
4	10-95	P41-29-05	Al 10 - 95	M8	40	53	25	11.90
5	25-150	P41-29-06	Al25 - 150	M8	50	64	20	23.70



R.broj Nr. n/nj	Presek provodnika Cable interesction Сечение провода	Kodni broj CODE Код(номер)	Tip Type Тип	Dimenzije (mm) Dimension (mm) Размеры (мм)				Vijak Screw Винта	Pakovanje Packing Упаковка	Težina Weight Вес
				b	d2	d3	L			
4	25 - 35	D40-11-05	VKP 35	27.0	10.5	19.0	37.0	M5x12	100	3.33
5	35 - 50	D40-11-06	VKP 50	28.0	10.5	19.0	45.0	M5x12	100	4.7
6	50 - 70	D40-11-07	VKP 70	30.0	13.0	24.0	52.0	M5x15	50	5.85
7	70 - 95	D40-11-08	VKP 95	32.0	13.0	24.0	57.0	M6x20	50	8.57
8	95 - 120	D40-11-09	VKP 120	40.0	13.0	24.0	69.0	M8x20	25	12.55
9	120 - 150	D40-11-10	VKP 150	42.0	17.0	30.0	65.0	M8x20	25	18.95

15. MVROT is now ready for Shop testing and certification to be verified for Energizing it in the live electrical distribution networks.

6. MANUFACTURING TESTING AND CERTIFCATION IN THE SHOP

After dressing MVROT and assembling it on the console, certification of the equipment will take place in the shop to be sure there was no damage done in transport, and that MVROT is ready to be energized in distribution networks.

Handling will now be done by connecting crane shackles to the Crosby eyes on the console. For that procedures see section 7.

1. MVROT comes with factory testing completed and its certificate. See attached factory certificate for MVROT-250:

FMT

MEASURING TRANSFORMERS FACTORY
ZAJECAR - Serbia

FACTORY CERTIFICATE
FOR THE ROUTINE TESTING OF THE TRANSFORMER

TECHNICAL DATA

	185	kVA	TYPE	MVROT-250		No.	135-1/17	USER :
1			Freq.	60	Hz	Year	2017	
2			Connection			No.of phases	1	SPECIAL TESTING :
3	4160	2500	V Insul.deg.	7.2/20/60		Sort	PT	
4			Z_K	2,7	%	Insul.cl.	H	
5			I_{kz}	40	x/n	Cooling	AN	DIMENSIONS (mm) :
	44.5	74	A	t_k	3	Sec.	Mass	870kg	A=850 B=480
				Standard		IEC 60076-11			C=950 D=460

TESTING RESULTS
TRANSFORMATION RATIO AND ACCURACY CLASS WINDINGS CHECKED

DIELECTRICAL TESTING	**A.** SEPARATE SOURCE AC WITHSTAND VOLTAGE TEST			
	(Prim.) – (Sec. + ⊥)	WITH	20 kV, 60Hz	60 sec.
	(Sec.) – (⊥)	WITH	4 kV, 60Hz	60 sec.
	(Sec.) – (CURR.Scc.)	WITH	4 kV, 60Hz	60 sec.
	B. INDUCED AC WITHSTAND VOLTAGE TEST			
	2 x Un; 150 Hz CONNECTED TO		8,32 kV	48 sec.

		WINDING	
MEASURMENT OF WINDING RESISTANCE AT 20 °C (mΩ)	CONNECTED	PRIMARY	SECONDARY
	A - B	215,9	/
	a - N	/	55,7

No-load current		2%
No-load losses	Po	480W
Load losses at 85°C	Pk	1029,8W
Total losses	Pt	1509,8W
Impedance voltage at rated current	Uzr	2,7 %

Note :
POLARITY MARKERS
PRIMARY SIDE: A=H1; B=H2
SECONDARY SIDE: a=X1; N=X0

CONTROLLED BY

ZAJECAR
10th 07.20

CHIEF OF CONTROL DEPARTMENT

2. Tests required to allow energizing MVROT into North America electrical distribution:
   a. Visual Inspection of any physical damage
   b. Insulation resistance test
   c. Dielectric withstand test
   d. Transformer turns ratio
3. Listed test will be done in accordance to CSA-C22.2 No. 47-13 and equivalent IEEE standards.
4. After testing is completed MVROT will be packaged for transportation to the installation site.

7. MVROT INSTALLATION AT SITE - PREPARATION

1. Example of Methods of Procedures (MOP) form is shown in Section 10.

2. Unpack MVROT on the truck and verify no damage occurred during transportation from the shop.

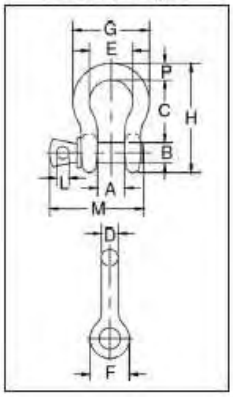
3. Re-test electric connectivity and re-verify MVROT readiness to be energized. (optionally add insulators if they were not permanently secured in the shop prior shipping.)

4. Prepare lifting crane / truck (RDB – Radial Boom Derrick) or similar to take MVROT from the truck and lift it onto the pole for the installation. Only qualified personnel trained and certified are allowed to operate this lifting equipment and execute this work.

Truck crane example

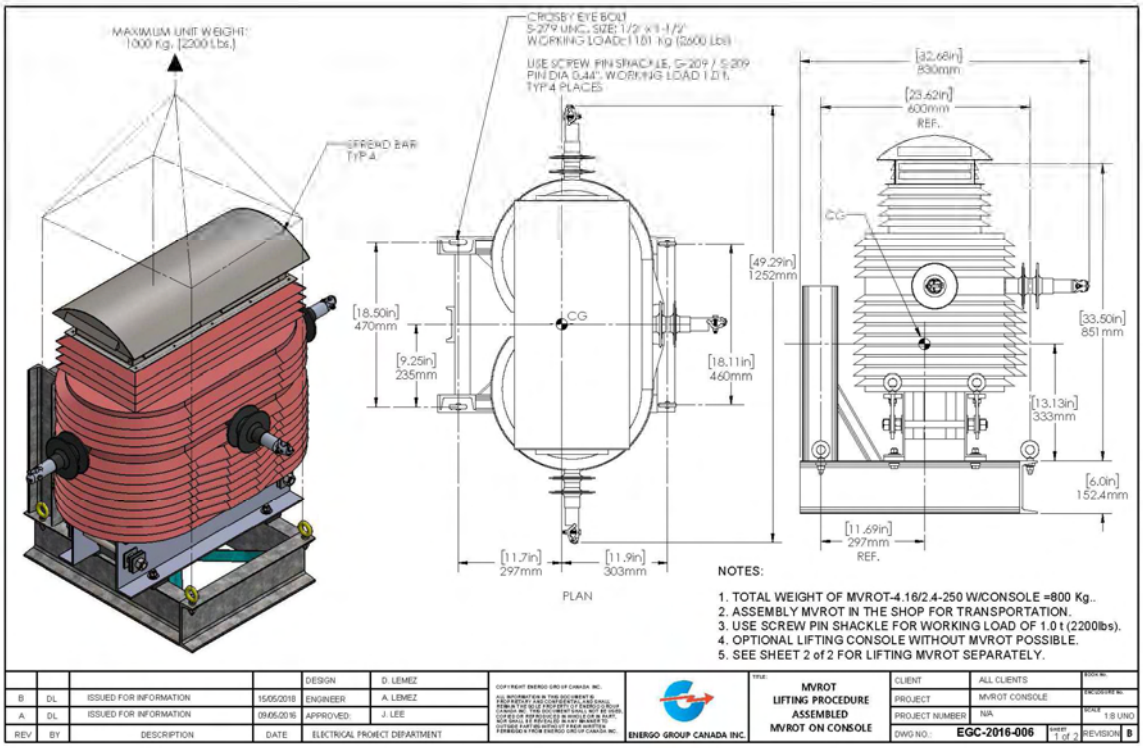
5. Lifting procedure with MVROT already mounted on the support console.
   a. Make sure lifting company has appropriate shackle for the size and loads indicated on the drawing EGC-2016-006 sheet 1 of 2.
      i. Use Screw Pin Shackle G-209 / S-209, Nominal size 3/8", working load 1.0 t.

G-209 / S-209



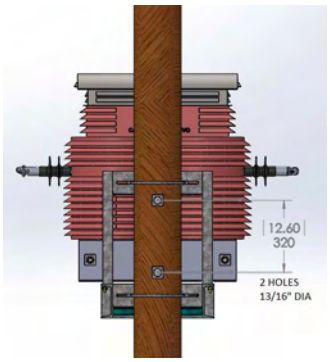
Nominal Size (in.)	Working Load Limit (t)*	Stock No.		Weight Each (lbs.)	Dimensions (in.)											Tolerance +/-	
		G-209	S-209		A	B	C	D	E	F	G	H	L	M	P	C	A
3/16	1/3	1018357	–	.06	.38	.25	.88	.19	.60	.56	.98	1.47	.16	1.14	.19	.06	.06
1/4	1/2	1018375	1018384	.10	.47	.31	1.13	.25	.78	.61	1.28	1.84	.19	1.43	.25	.06	.06
5/16	3/4	1018393	1018400	.18	.53	.38	1.22	.31	.84	.75	1.47	2.09	.22	1.71	.31	.06	.06
3/8	1	1018419	1018428	.31	.66	.44	1.44	.38	1.03	.91	1.78	2.49	.25	2.02	.38	.13	.06
7/16	1-1/2	1018437	1018446	.38	.75	.50	1.69	.44	1.16	1.06	2.03	2.91	.31	2.37	.44	.13	.06
1/2	2	1018455	1018464	.72	.81	.63	1.88	.50	1.31	1.19	2.31	3.28	.38	2.69	.50	.13	.06
5/8	3-1/4	1018473	1018482	1.37	1.06	.75	2.38	.63	1.69	1.50	2.94	4.19	.44	3.34	.69	.13	.06
3/4	4-3/4	1018491	1018507	2.35	1.25	.88	2.81	.75	2.00	1.81	3.50	4.97	.50	3.97	.81	.25	.06
7/8	6-1/2	1018516	1018525	3.62	1.44	1.00	3.31	.88	2.28	2.09	4.03	5.83	.50	4.50	.97	.25	.06
1	8-1/2	1018534	1018543	5.03	1.69	1.13	3.75	1.00	2.69	2.38	4.69	6.56	.56	5.13	1.06	.25	.06
1-1/8	9-1/2	1018552	1018561	7.41	1.81	1.25	4.25	1.16	2.91	2.69	5.16	7.47	.63	5.71	1.25	.25	.06
1-1/4	12	1018570	1018589	9.50	2.03	1.38	4.69	1.29	3.25	3.00	5.75	8.25	.69	6.25	1.38	.25	.06
1-3/8	13-1/2	1018598	1018605	13.53	2.25	1.50	5.25	1.42	3.63	3.31	6.38	9.16	.75	6.83	1.50	.25	.13
1-1/2	17	1018614	1018623	17.20	2.38	1.63	5.75	1.54	3.88	3.63	6.88	10.00	.81	7.33	1.62	.25	.13
1-3/4	25	1018632	1018641	27.78	2.88	2.00	7.00	1.84	5.00	4.19	8.86	12.34	1.00	9.06	2.25	.25	.13
2	35	1018650	1018669	45.00	3.25	2.25	7.75	2.08	5.75	4.81	9.97	13.68	1.22	10.35	2.40	.25	.13
2-1/2	55	1018678	1018687	85.75	4.13	2.75	10.50	2.71	7.25	5.69	12.87	17.84	1.38	13.00	3.13	.25	.25

b. Prepare lifting ropes (slings) and appropriate spread bars as per drawing EGC-2016-006.
   i. Spread bar lengths: 460mm (18”) x 2, plus 600mm (23.6”) x 2
c. Minimum length of the lifting ropes (sling wires) from eye bolt to spread bars are 900mm (35.5”)



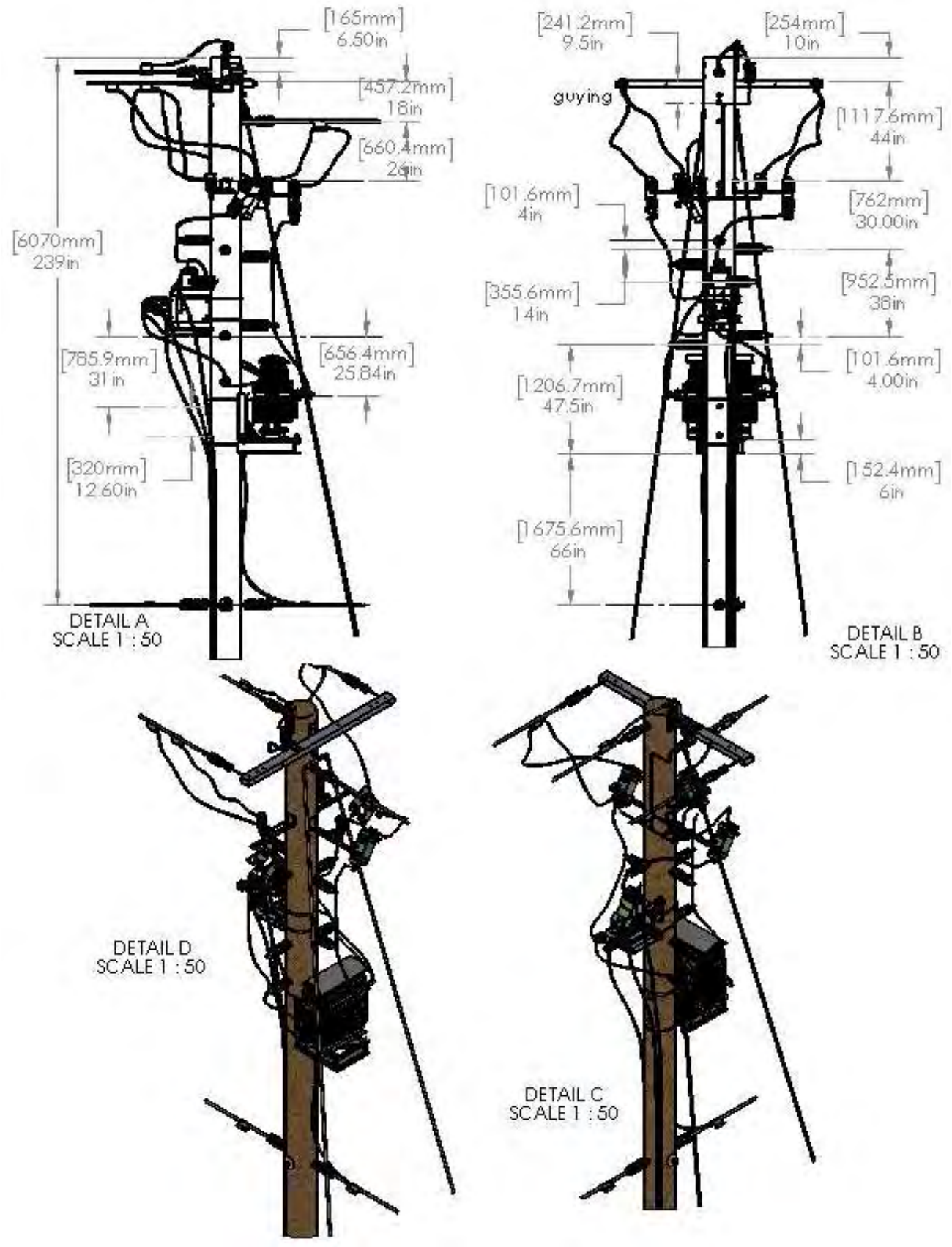
d. Lifting should be smooth and the crane hook positioned in line with the center of gravity to ensure vertical lift without tipping the equipment. Crane will need to be rated for the load over distance where pole is located.

6. Prior to lifting, ensure that the pole is ready to receive the support console together with MVROT by drilling two (2) holes for ¾” dia bolts through.
   a. Vertical space between two bolts has to be 320mm (12.6”) in vertical plane



7. Position of MVROT on the pole should be predetermined so those holes can be drilled ahead of time.

Example of the positioning MVROT on the pole:



For optional fuse (cut-outs and surge arrestors) supports see drawing EGC-2016-003, and for mounting and installation details see drawing EGC-2016-004 (see attachments)

8. Ensure that there are no obstacles on the pole preventing the installation of MVROT by overhead crane lift.
    a. No guywires are interfering with the space above MVROT on the pole during lifting.
    b. Temporarily remove guywires if they are in the way. Consult Engineer of record to check if that is allowed.
    c. MVROT is installed on the side of the single phase line. Make sure that there is enough space to safely lift MVROT into position below that wire.
    d. Make sure that the Neutral wire is below the MVROT.
    e. Make sure that power in the lines (feeder) are cut out prior lifting MVROT.

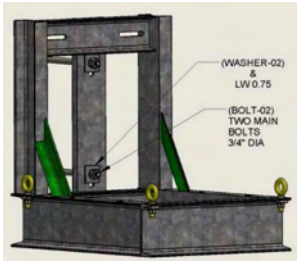
8. MVROT INSTALLATION AT SITE – LIFTING PROCEDURES

1. The lifting and securing of MVROT requires two (2) man high-line qualified crew members in the lift basket, to receive MVROT and fasten it onto the pole.

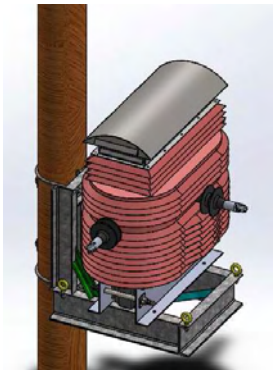
2. There are two possible procedures to lift and secure MVROT with console on the pole. Both procedures are safe and practical, so it is up to qualified installation crew to choose one or another.
   See drawing EGC-2016-001 for part list supplied with console.

    a. First procedure (MVROT and console together):

        i. Insert two (2) main ¾" dia bolts through the console holes (in vertical channel) at the back.
            - If bolts have a head: the bolt head needs to be in the space between MVROT and the console vertical channel. Make sure that the regular washer is placed between the head and console channel.
            - If bolts have both ends treaded: place one regular washer, lock washer and tighten one nut on shorter tread end of bolts. That will form head of the bolt and can be placed in the same way as a regular bolt with a head.



ii. Lift MVROT and console together with these two bolts inserted into the holes.
iii. The two-man crew in the basket will need to align bolts with the holes in the pole and hold them in place, not allowing them to be pushed out of the console, and direct the crane operator to move MVROT closer to the pole so the other ends of the bolts stick out of the pole.
iv. Place other regular washer and lock washer on the ends of the bolts sticking out of the other side of the pole and tighten nuts.
v. Make sure to tighten bolts to torque specified on the drawings (100 ft-lb) or until full vertical channel flange legs of the console are engaged onto the face of the pole.
vi. Insert two ½" dia. stainless steel wire roped bolts forming "U – bolts", add washers and lock washers onto the treaded ends and tighten nuts.
vii. After all bolts and U-bolts are secured in place slowly release crane hook to transfer loads onto the bolts.
viii. Make sure both main bolts through the pole are equally engaged on the top of the slotted hole in supporting console
ix. Disconnect shackles and move crane arm from this space.
x. Crew can start connecting MVROT into the distribution lines as per single line diagrams and electrical drawings (see next section).



b. <u>Second procedure (MVROT and console together):</u>
<u>(*applicable for the main bolts without heads*)</u>

i. Insert bolts through the pole
ii. Lift MVROT together with the console
iii. The two-man crew in the basket will need to align the bolts with holes in the console and hold them, not allowing them to be pushed out of the pole while directing the crane operator to move MVROT closer to the pole so that the other ends of the bolts can go through the holes in console.
iv. Add washers, lock washer and tighten nuts the same way as in first procedure.
v. The rest of the steps are the same as in first procedure.

c. Procedure for lifting console before MVROT:

i. Insert two (2) main ¾" dia bolts through the console holes (in vertical channel) at the back.
ii. Make sure regular washer is placed between the head and console channel.
iii. Lift console together with these two bolts inserted into the holes.
iv. The two-man crew in basket will need to align bolts with holes in pole, hold them in place not allowing them to be pushed out of console and direct crane operator to move console closer to the pole so the other ends of the bolts stick out of the pole.
v. Place other regular washer and lock washer on the ends of the bolts sticking out of the other side of the pole and tighten nuts.
vi. Make sure to tighten bolts to torque specified on the drawings (100 ft-lb) or until full vertical channel flange legs of the console are engaged onto the face of the pole.
vii. Insert two ½" dia. stainless steel wire roped bolts forming "U – bolts", add washers and lock washers on the treaded ends and tighten nuts.
viii. After all bolts and U-bolts are secured in place slowly release crane hook to release console.
ix. Make sure both main bolts through the pole are equally engaged on the top of the slotted hole in supporting console
x. Disconnect shackles and move crane arm to take MVROT up.
xi. Look at Section 4 (handling MVROT in the shop) for assembling temporary lifting beams on MVROT and getting it ready for the lift.
xii. Lift MVROT using a different set of sling wires and spread bars as described in Section 4.
xiii. Connect the MVROT onto the console secured on the pole in the same way as described in Section 4.
xiv. Remove temporary lifting beams and lower them to the truck for the future use.
xv. Crew can start connecting MVROT into the distribution lines as per single line diagrams and electrical drawings (see next section).

9. MVROT INSTALLATION AT SITE – CONNECTING ELECTRICITY

1. Only qualified personnel trained and certified are allowed to connect MVROT into the electrical distribution grid.
2. MVROT installation will be done under strict supervision of Energo Group Personnel or a certified representative.
3. Energo Group's Certified installation or supervision of installation is done by AC Tesla. Address and contacts are:

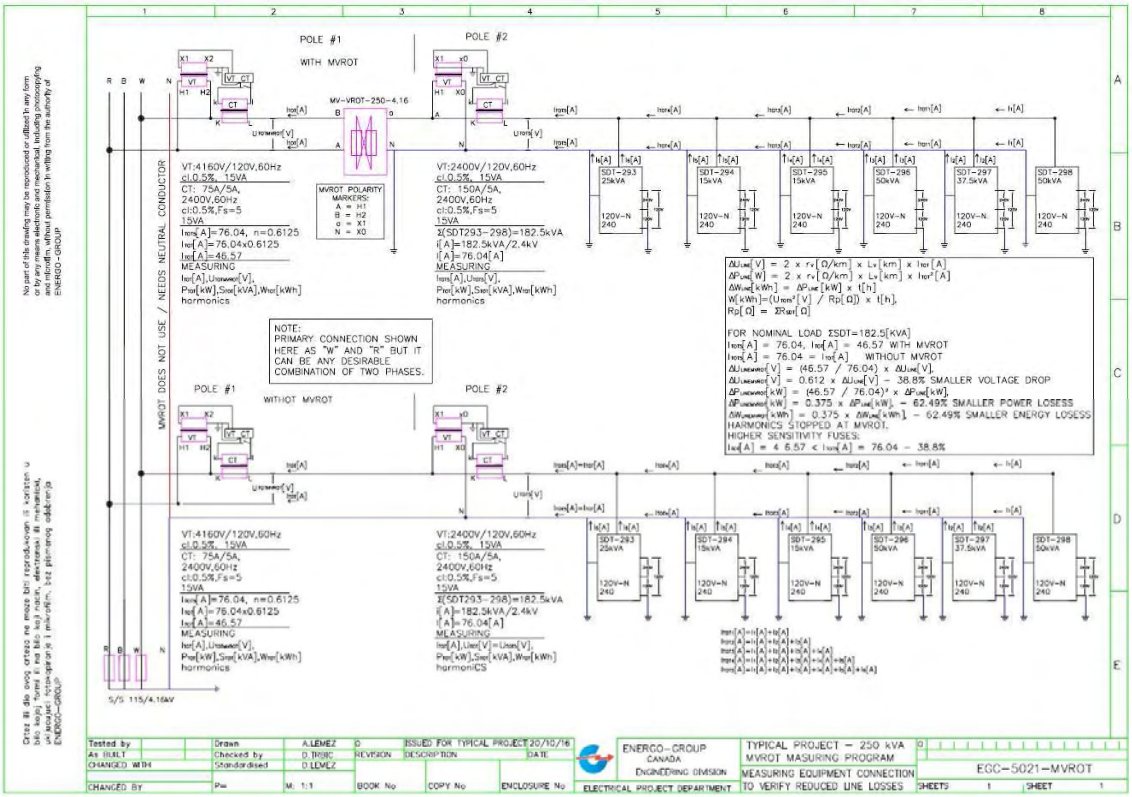
AC TESLA
Aleksandar Stojanovic, President,
3348 Harvester Rd, Burlington, ON L7N 3M8

4. The electrical installation company takes on full liability for the proper installation and following all safety procedures and instructions during execution of the work.

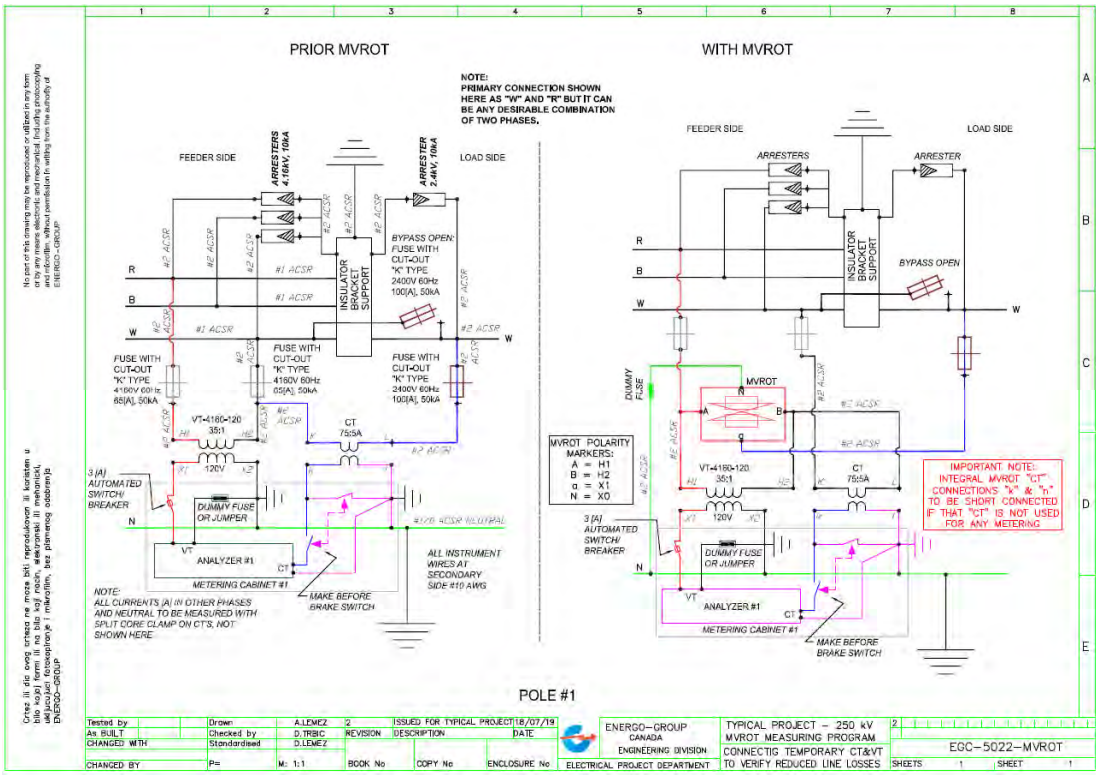
5. Any other project specific electrical equipment, wiring and requirements to be installed will be shown on single line diagrams for the specific site installation

6. All electrical connections of MVROT are shown on the drawings:

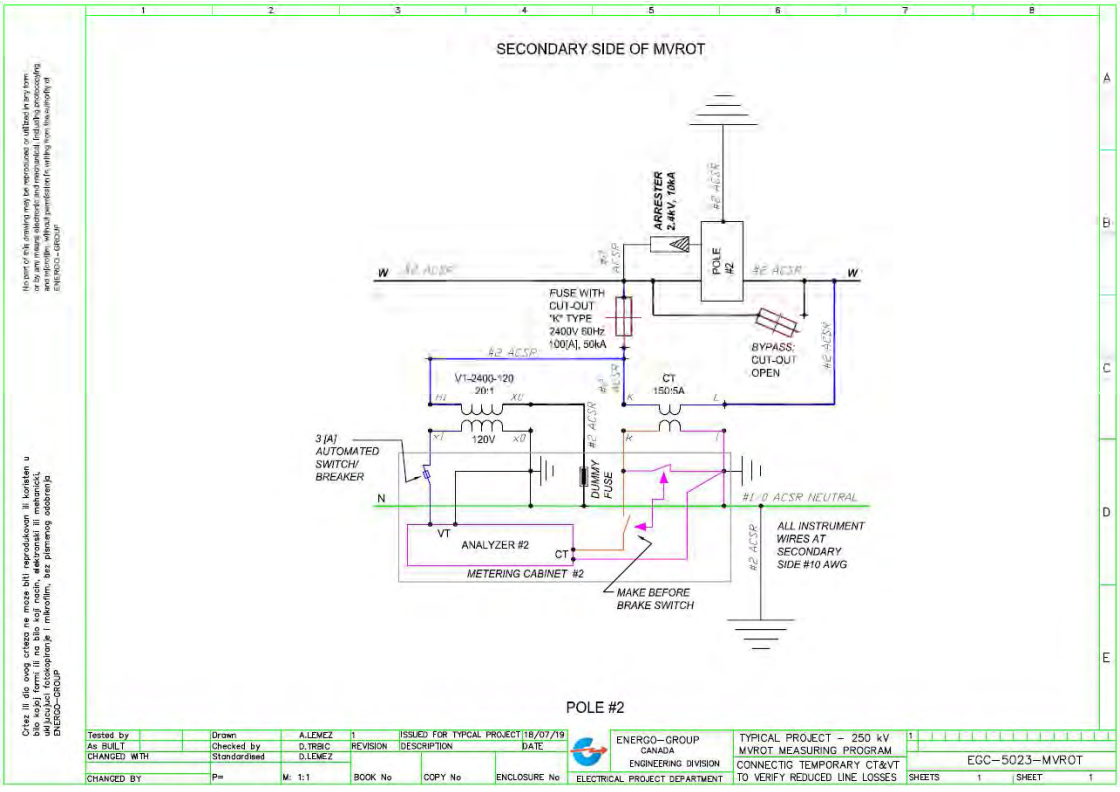
    a. Temporary measuring electrical parameters and equipment needed at MVROT installation site for 4.16 kV distribution line is shown on: EGC-5021-MVROT.



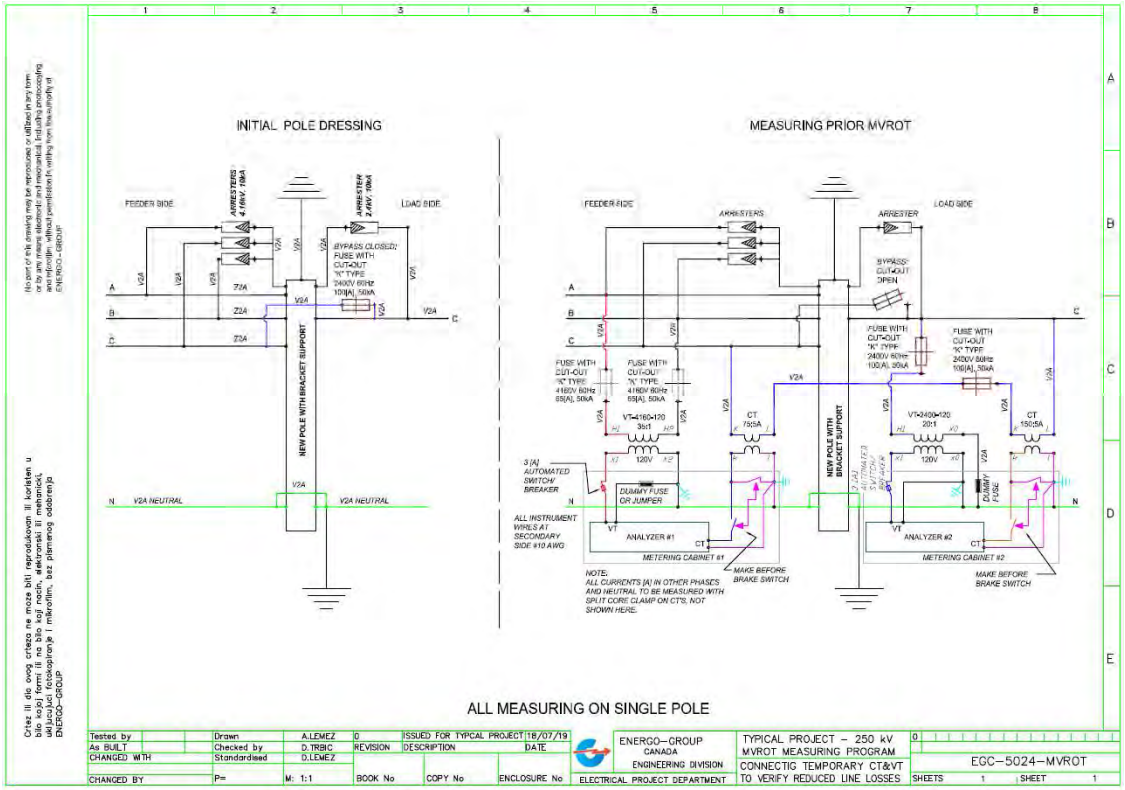
b. Connection drawing for temporary measuring CT's and VT's EGC-5022-MVROT



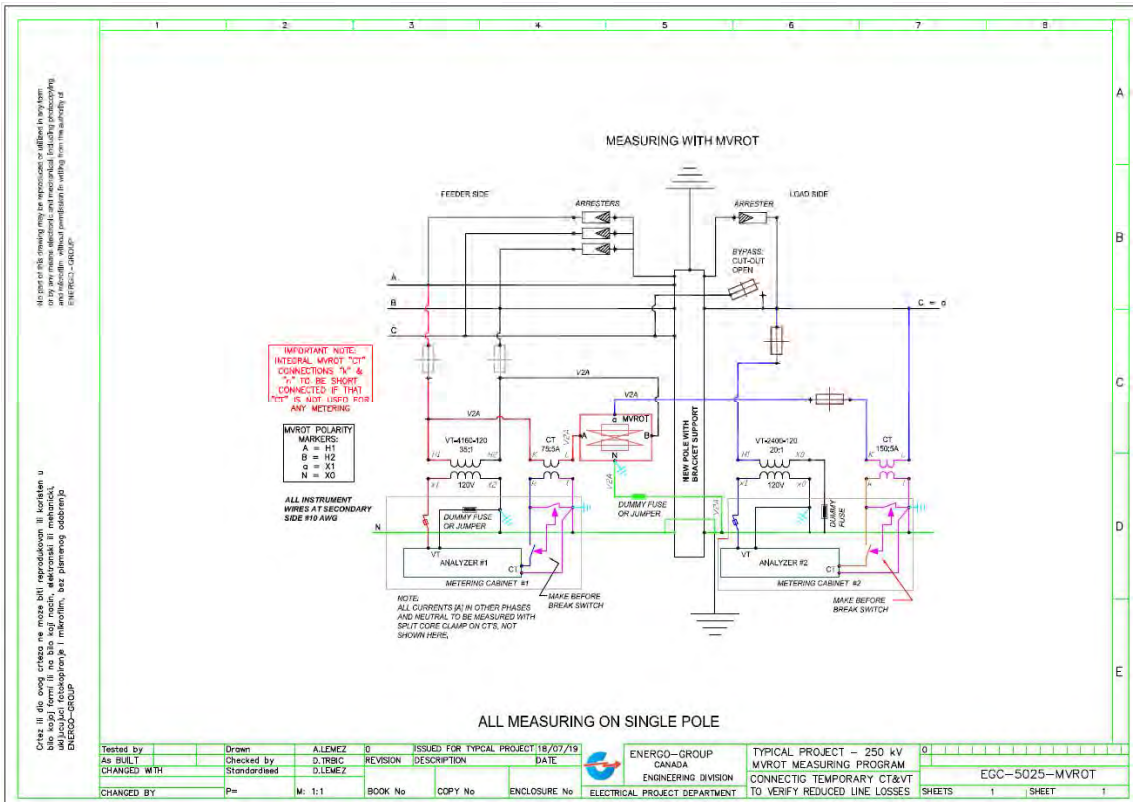
c. Measuring equipment connection on **MVROT** secondary side EGC-5023-MVROT:



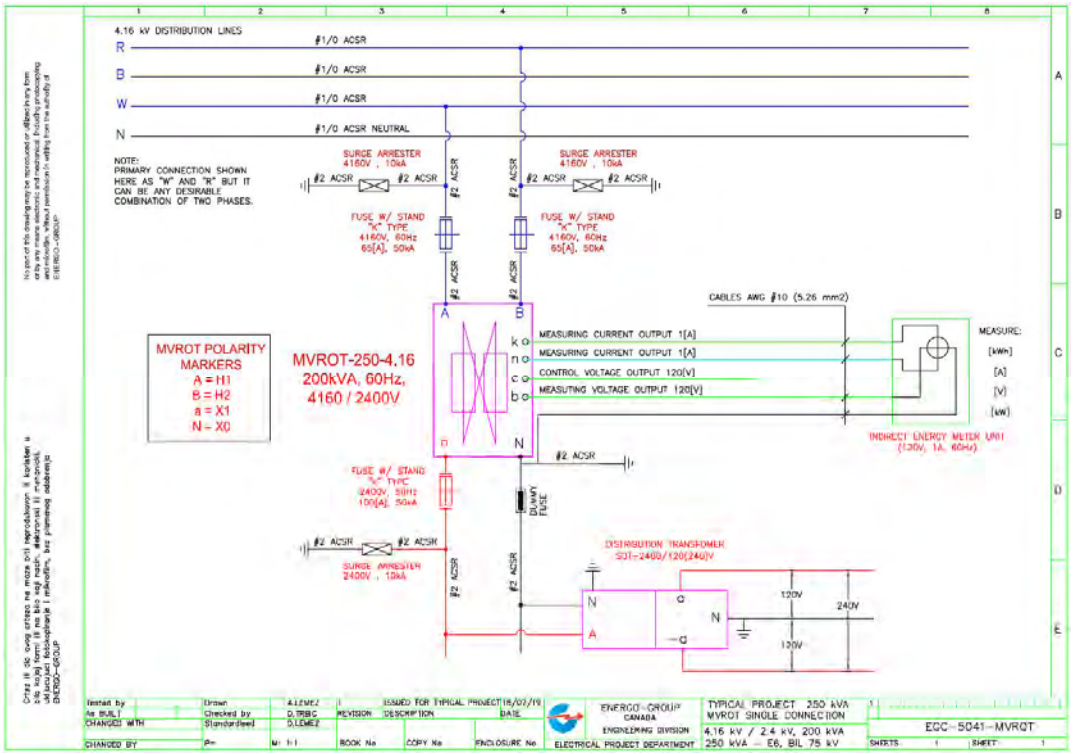
d. All measuring equipment connection on single pole EGC-5024-MVROT:



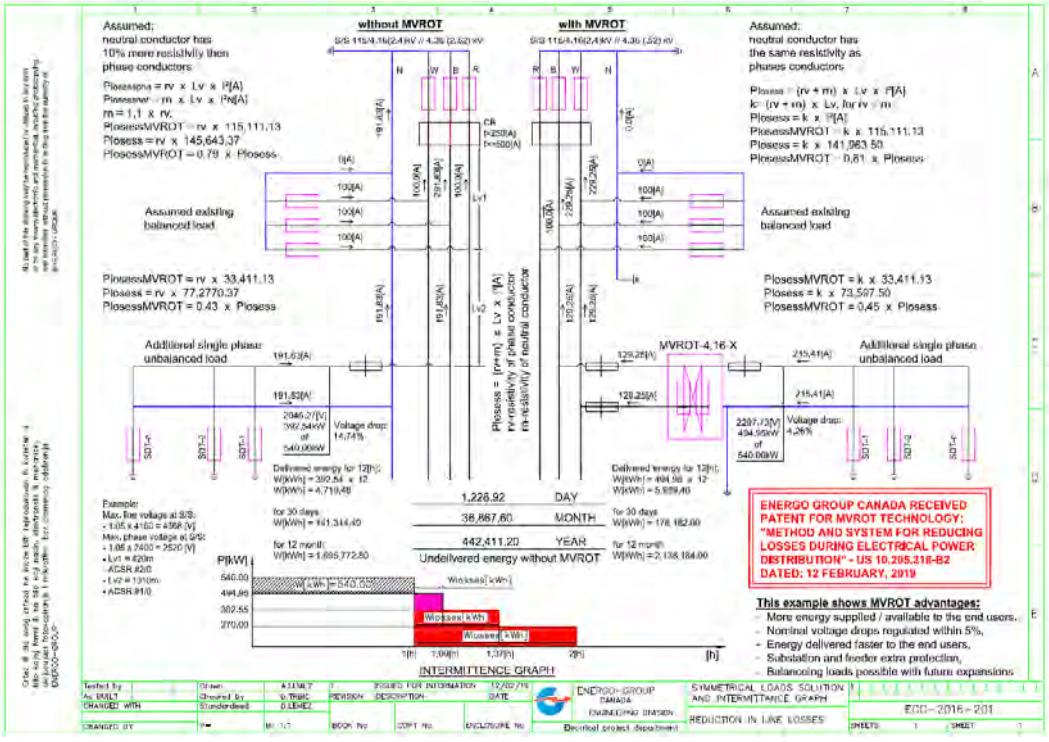
e. All measuring equipment connection on single pole EGC-5025-MVROT:



f. Single **MVROT** connection EGC-5041-MVROT



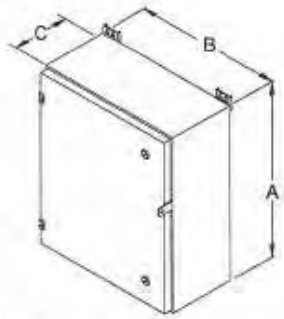
g. Results of the reading before **MVROT** and after **MVROT** will need to be analyzed per procedure establish for each site. Example drawing EGC-2016-201 is showing reduction in line losses

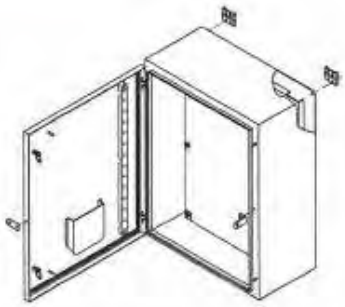


h. Metering cabinet data sheet for storing analyzers:

BEL **R Series**

EEMAC / NEMA 4-4x-12 / IP-65
Single Door Enclosures





TECHNICAL READOUT

Catalog No.	Dimensions A	B	C	Panel E x F	Weight lbs
R122406	12	24	6	9 x 21	36
R161206	16	12	6	13 x 9	26
R161606	16	16	6	13 x 13	32
R162006	16	20	6	13 x 17	38
R201206	20	12	6	17 x 9	31
R201606	20	16	6	17 x 13	38
R202006	20	20	6	17 x 17	43
R202406	20	24	6	17 x 21	55
R241206	24	12	6	21 x 9	36
R241606	24	16	6	21 x 13	46
R242006	24	20	6	21 x 17	55
R242406	24	24	6	21 x 21	60
R301606	30	16	6	27 x 13	53
R302006	30	20	6	27 x 17	65
R302406	30	24	6	27 x 21	75
R362406	36	24	6	33 x 21	88
R363006	36	30	6	33 x 27	114
R122408	12	24	8	9 x 21	40
R161208	16	12	8	13 x 9	30
R161608	16	16	8	13 x 13	34
R162008	16	20	8	13 x 17	43
R201208	20	12	8	17 x 9	33
R201608	20	16	8	17 x 13	43
R202008	20	20	8	17 x 17	47
R202408	20	24	8	17 x 21	59
R241208	24	12	8	21 x 9	40
R241608	24	16	8	21 x 13	49
R242008	24	20	8	21 x 17	59
R242408	24	24	8	21 x 21	68
R243008	24	30	8	21 x 27	85
R301208	30	12	8	27 x 9	42
R301608	30	16	8	27 x 13	54
R302008	30	20	8	27 x 17	70
R302408	30	24	8	27 x 21	82
R303008	30	30	8	27 x 27	102
R303608	30	36	8	27 x 33	121
R362408	36	24	8	33 x 21	94
R363008	36	30	8	33 x 27	121
R363608	36	36	8	33 x 33	139
R422408	42	24	8	39 x 21	107
R423008	42	30	8	39 x 27	132
R423608	42	36	8	39 x 33	162
R482408	48	24	8	45 x 21	117
R483008	48	30	8	45 x 27	153
R483608	48	36	8	45 x 33	182
R603608	60	36	8	57 x 33	208

Catalog No.	Dimensions A	B	C	Panel E x F	Weight lbs
R161210	16	12	10	13 x 9	34
R201610	20	16	10	17 x 13	48
R202010	20	20	10	17 x 17	52
R241210	24	12	10	21 x 9	43
R242010	24	20	10	21 x 17	63
R242410	24	24	10	21 x 21	73
R302010	30	20	10	27 x 17	76
R302410	30	24	10	27 x 21	87
R362410	36	24	10	33 x 21	102
R363010	36	30	10	33 x 27	127
R423010	42	30	10	39 x 27	137
R423610	42	36	10	39 x 33	184
R483010	48	30	10	45 x 27	159
R483610	48	36	10	45 x 33	190
R603610	60	36	10	57 x 33	230
R201612	20	16	12	17 x 13	54
R242012	24	20	12	21 x 17	67
R242412	24	24	12	21 x 21	78
R302412	30	24	12	27 x 21	90
R303012	30	30	12	27 x 27	113
R362412	36	24	12	33 x 21	106
R363012	36	30	12	33 x 27	130
R363612	36	36	12	33 x 33	137
R423012	42	30	12	39 x 27	150
R423612	42	36	12	39 x 33	175
R483612	42	36	12	45 x 33	197
R603612	60	36	12	57 x 33	239
R723012	72	30	12	69 x 27	260
R723612	72	36	12	69 x 33	320
R242016	24	20	16	21 x 17	81
R242416	24	24	16	21 x 21	86
R302416	30	24	16	27 x 21	100
R363016	36	30	16	33 x 27	137
R423616	42	36	16	39 x 33	147
R483616	48	36	16	45 x 33	213
R603616	60	36	16	57 x 33	256
R723016	72	30	16	69 x 27	260
R723616	72	36	16	69 x 33	272
R302420	30	24	20	27 x 21	111
R363020	36	30	20	33 x 27	155
R483620	48	36	20	45 x 33	227
R603620	60	36	20	57 x 33	272
R723020	72	30	20	69 x 27	287
R302424	30	24	24	27 x 21	129
R723024	72	30	24	69 x 27	300

Application:
Type 4-4x-12 / IP-65 enclosure designed for INDOOR/OUTDOOR housing of electrical, pneumatic or hydraulic instruments.

Construction:
- 16 or 14 gauge steel
- Removable cover
- Continuously welded and ground smooth seams
- Padlock hasp supplied
- Interchangeable left/right side cover opening
- Cover stabilizing bumpers
- 1/4 turn latches
- Grounding studs welded on inner cover surface
- Galvanized mounting rail
- Galvanized steel mounting panel (unpainted)
- Four (4) wall mounting brackets offering multiple installation positionning
- Self-adhesive polymer BEL data pocket
- ANSI/ASA61 grey polyester textured powder coating inside out

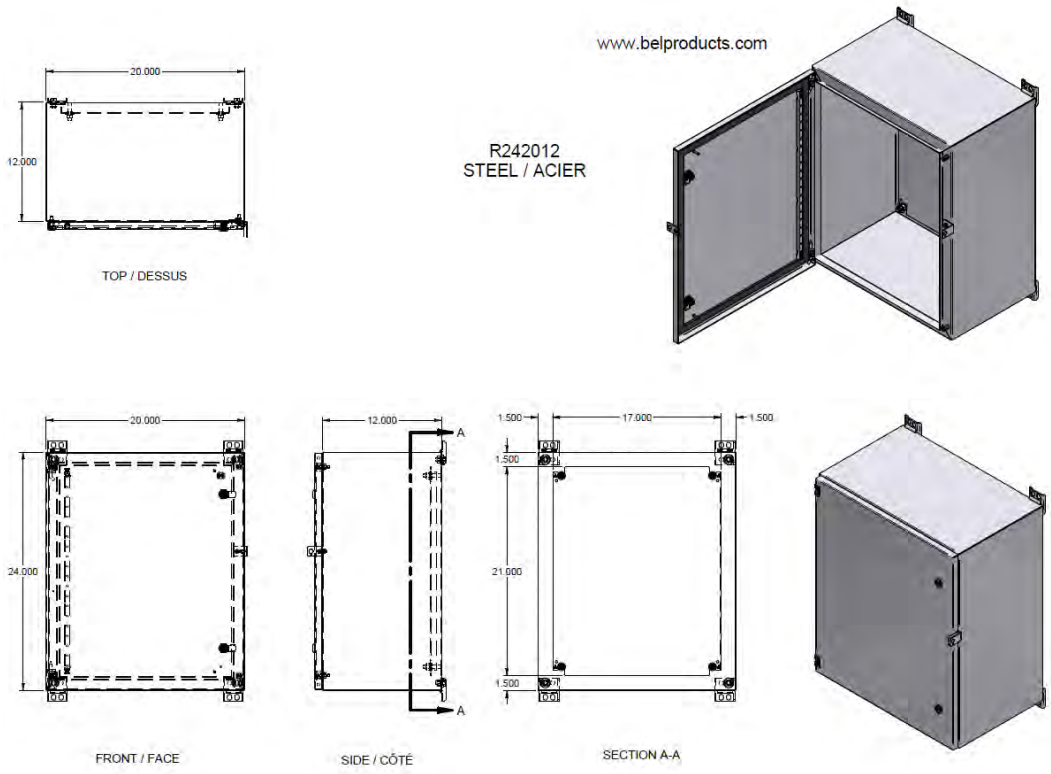
Also Available:
- Galvanized steel
- Cutouts, hubs, windows
- Special finishes & sizes
- Flush handle

Standards:
- CSA certified 150359
- UL listed E109310
- CE

C US

BEL Products Inc. 44
Technical specifications subject to change whitout notice. 10/2013

i. Metering cabinet drawing for storing analyzers:



10. DISCONNECTING MVROT FROM THE GRID

This procedure describes removing MVROT from the distribution lines for the repairs, replacement or decommissioning. All work will be done by qualified personnel and under strict supervision of foreman, directing the work per MOP's.

1. Prior disconnecting and removal make sure power in the lines are cut off.
2. Two-man crew in the basket will need to disconnect wires from the MVROT insulators.
3. MVROT will need to be disconnected from the console support.
4. Prior to disconnecting MVROT crane to lift temporary lifting beams (MVROT-LFT-001) for the two-man crew in the basket to attach them on the MVROT.
5. Follow section 4 how to attach these two lifting beams.
6. Use the same lifting ropes / wires / slings and spread bars as described in Section 4.5.
7. Position crane hook head over the MVROT and tighten lifting wires.
8. disconnect MVROT from the support console.
9. carry MVROT to the truck bed.
10. Two-man crew in the basket to reconnect power line as originally connected and shown on the engineered drawings.
11. If bypass is present connect fuse into cut-out

- See below example drawings prior MVROT and after MVROT with temporary measuring equipment:

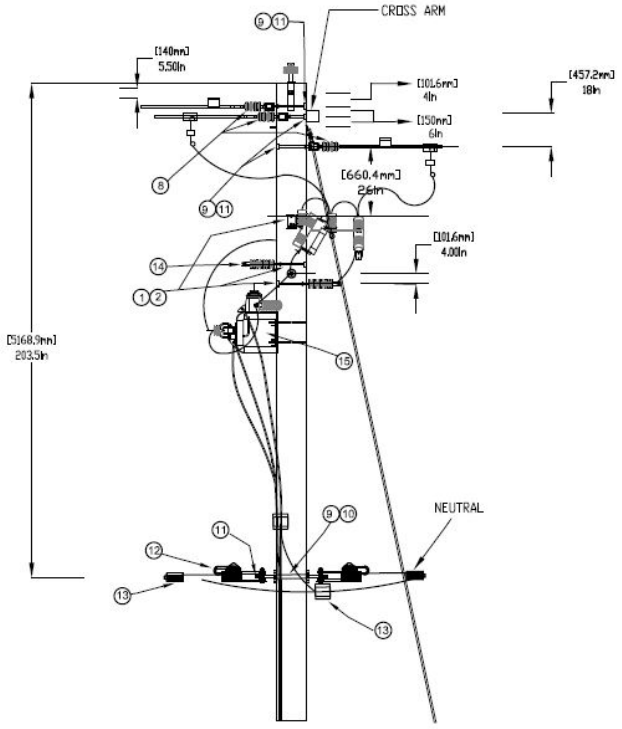


FIG 2

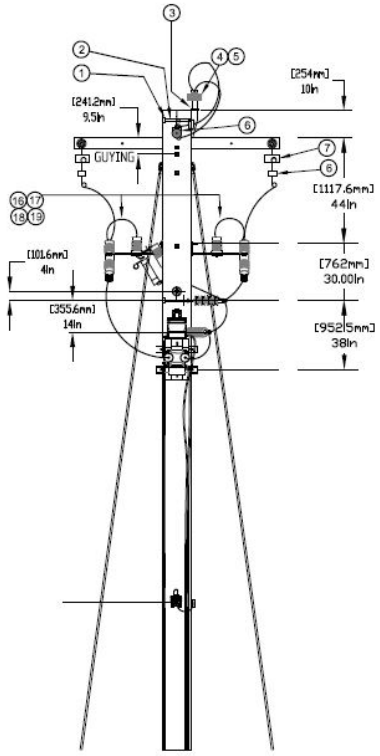


FIG 3

GROUNDING NOTE:
FOR GROUNDING DEATILS
REFER TO USF SECTION 9.

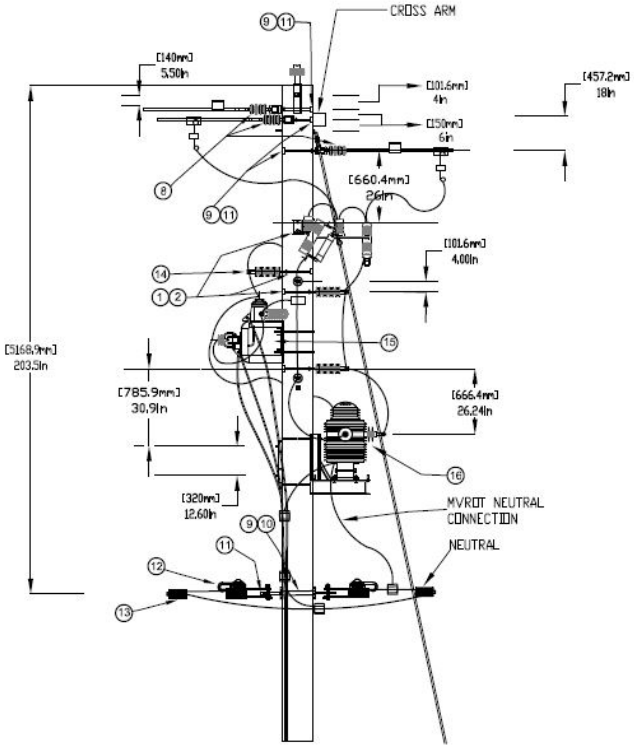


FIG 2

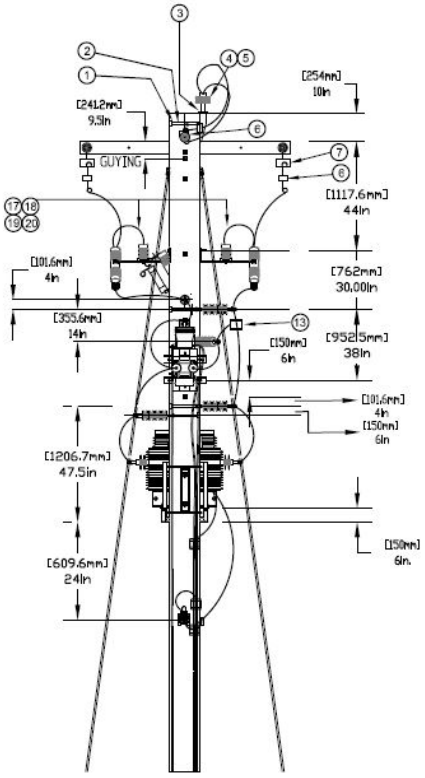


FIG 3

GROUNDING NOTE:
FOR GROUNDING DEATILS
REFER TO USF SECTION 9.

12. Check all connections and lower the basket to the ground.
13. Restore power and take MVROT away to the shop where it can be inspected, potentially core replaced and get it ready for the energizing it again into the distribution grids.

For procedure of replacing winding part and regular maintenance see document:

EGC-MVROT-MNT-01

11. METHOD OF PROCEDURES (MOP)

Example MOP form to be filled for all field installations of MVROT:

AC Tesla

Method of Procedure (MOP)

Project Supervisor:	Project Title: MVROT Project at xxxxxx distribution grid
Site Address:	ACTJ #:

A - Low Risk	☑	SMOP #:		Revision #: 000
B - Low-Medium Risk	☐	Date:		
C - Medium-High Risk	☐	Technicians:		
D - High Risk	☐	Description:		

General Information	
Requested By:	TBA
Company:	TBA
Start Date of Work:	TBA
Completion Date:	TBA
Time of Day:	TBA
Intrusive Work:	No
Local / Floor:	TBA
Purpose of Work:	

Procedure Sequence:	Time:	Shutdown Requirement:	Shutdown Time:	Notes:

3348 Harvester Rd., Unit #2 Burlington, Ontario L7N 3M8
Tel. (905) 637-0637 Fax. (905) 637-0655

12. ATTACHMENTS

List of referenced drawings within this MVROT manual:

1. EGC-2016-001
2. EGC-2016-002
3. EGC-2016-003
4. EGC-2016-004
5. EGC-2016-005
6. EGC-2016-006
7. EGC-5021-MVROT
8. EGC-5022-MVROT
9. EGC-5023-MVROT
10. EGC-5024-MVROT
11. EGC-5025-MVROT
12. EGC-5041-MVROT
13. EGC-2016-201
14. SK-0442-1 (K-Line Insulators Ltd)

For more information and typical MVROT project contact Energo Group Canada Inc.