ADVANCED POWER TECHNOLOGIES

2.4kV-38kV Metal Enclosed Vacuum Circuit Breaker Switchgear

APT VIEW ENABLED

MED-Series
Medium Voltage Switchgear
Solutions Brochure

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SAFE SMART SERVICEABLE SWITCHGEAR & ENGINEERED POWER SYSTEM SOLUTIONS

MADE IN THE USA

ALN: 540 Rev. 04

MED-Series Construction

Figure 1: APT MED-Series Compact Metal Enclosed Vacuum Circuit Breaker based Utility Switchgear Line-up External Construction NEMA 3R*

Figure 2: Up to 15kV Maximum Vacuum Circuit Breaker*

Figure 3: Optional 24VDC Control Power Batteries integrated to Keep the Controls On-line Even if the Power is out! *

The future of Switchgear for In/Outdoor Substations

- Compact Metal Enclosed Utility Switchgear for the High Demands of Tomorrow's Grid!
- Symmetrical Interrupting Capacity:
  - 2.4kV-38kV:
    - 25kA, 31.5kA, 40kA, 50kA*
- Main Bus:
  - 1200A, 2000A, 3000A
  - Optional: Insulated Main Bus
- APT Open or Closed Transition Automatic & Manual Transfer Modules Available for:
  - One Utility Source & One Generator Source
  - Two Utility Sources
  - Two Generator Sources
- Additional configurations:
  - 3-way transfer
  - Load Feeders
  - Tie circuit breakers

- Enclosure Environment Rating Options:
  - NEMA 1 (indoor)
  - NEMA 3R (outdoor) Non-Walk-In
  - Integrated onto APT PwrSkid Outdoor Non-Walk-In Switchgear Skid
  - Integrated into APT PwrHouse Outdoor Walk-In Switchgear Enclosure
  - NEMA 3R hardware is stainless steel
  - NEMA 3R Doors are Padlockable
  - Carbon Steel Powder coated ANSI 61 Gray
  - Ask About Aluminum & Stainless-Steel Options!
  - Infrared (IR) Viewing Windows
  - Durable Industrial Vinyl Mimic Bus

Protective Relaying & Switches

Figure 4: ANSI/IEEE 1547 Utility Intertie Protection with Redundant Relays, Test Switches, Pistol Grip CB Switch & (86) Knob Grip

Figure 5: Phase & Ground Fault Time-Overcurrent with Instantaneous Protection Protective Relay*

Utility Intertie, Generator Syncing, Feeder Protection

- Applications:
  - Utility Intertie & Paralleling Protection
  - Advanced Generator Protection
  - Tie Protection
  - Transformer Protection
  - Feeder Protection
  - Various Differential Protection Schemes
- Typical Relaying functions*:
  - 25 – Synch Check
  - 32 – Reverse Power
  - 50/51 – Inst./Time Overcurrent
  - 50N/51N – Inst./Time Ground Overcurrent
  - 27/59 – Under/Overvoltage
  - 59N – Ground Overvoltage
  - 81U/81O – Under/Overfrequency
  - 40 – Loss of Excitation
  - 60 – Current Balance
  - 67 – Directional Overcurrent
  - 86 – (LO) Lock-Out Relay (Knob Grip)
  - 87 – Differential Protective Relay
  - 87B – Bus Differential
  - 87G – Generator Differential
- (PG)* – Pistol Grip CB Control Switches
  - Red & Green Target to Indicate Circuit Breaker Position Status
- (TS)* – Test Switches
  - Provide a safe, simple, fast and reliable method to isolate, test, and service installed equipment without disturbing the power system
  - Permits convenient isolation of relays, meters, and instrument transformers (PTs & CTs)
  - Allows for quick and easy multi-circuit testing by conventional test methods
- (TP)* – Test Plugs
  - Enables easier measurement, calibration, verification and maintenance of relays, meters, PTs, & CTs
  - Conveniently connects devices measuring the currents and voltages being applied to the relays, meters, PTs, & CTs without interrupting or short-circuiting the circuit

Utility Grade Instrument Transformers – PTs, CTs

Figure 6: Fixed Mount Wye Configuration Voltage Transformers (PTs)*

Figure 7: Standard Duty Relaying and Metering Current Transformers (CTs)*

Figure 8: 15kV – Bottom Drawer Mounted Voltage Transformers (PTs) & Draw-out Access to Primary Fuses*

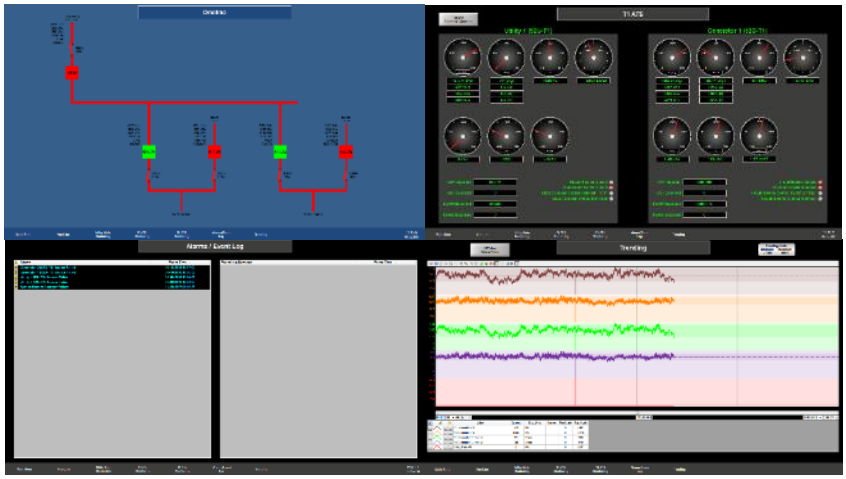
Voltage Transformers (PTs) & Current Transformers (CTs)

- Auxiliary Drawers
  - Accommodate Fuses, Control Power Transformers or Voltage Transformers
  - Secondary Self-aligning Contacts accommodate up to six independent circuits
  - For operator safety these devices are automatically grounded during movement to disconnected position
- PTs Available in Wye or Open Delta Voltage Sensing Configurations
- CTs for Relaying/Power Sensing, Differential, or Ground Fault sensing available in standard or Revenue Grade Metering Accuracy
  - Relay Accuracy Class Up to C400!

Figure 9: Very High Accuracy Line or Load Side Mounted Relaying Current Transformers (CTs) with Secondary Mounted for High Accuracy Revenue Grade Metering Applications*

*Due to continued product improvement, products delivered may differ from what is pictured.
*Optional Equipment Features Are Often Shown in Most Figures.
*Option Availability Subject to Product Series.

APT SCADA Control System Modules



In-House Designed & Built SCADA Controls with Electrical Interlocking Systems

Figure 10: APTView SCADA HMI with System One-line (top left), Source Metering Data (top right), Event Log (bottom left), Power Usage Time Adjustable Trend Chart (bottom left)*

Generators, Utilities, Renewables Source Control

- (UI) – APT Utility Intertie – requires one per utility source:
  - Stand-alone utility grade interconnection protection & control as required to meet ANSI/IEEE 1547 standard without paralleling or transfer controls.
- (BSI) – External BAS SCADA Interfacing:
  - The switchgear shall be appropriately instrumented to present utility and/or generator electrical data, system status information, adjustable setpoints, and SCADA DCS control.
  - The information extracted from the switchgear shall be converted to Modbus TCP/IP format and presented through an Ethernet port for ease of integration into the customers remote monitoring and control system.
- (AV) – APTView Remote SCADA System – maximum one per switchgear:
  - Utilizes Human Machine Interface (HMI) systems to monitor and control both APT and 3rd party equipment via personal computers or your favorite web or network-connected mobile device.
  - Emails can be sent in order to notify the user of any occurring alarm or event.
  - All system alarms and events are logged and date/time stamped.
  - Equipment operating parameters are periodically stored for future record/retrieval.

Main Bus

Figure 16: Power Source Cable Connection

Figure 18: Load Take-Off Connection*

1200A – 3000A Main Bus

- Main Bus Compartment:
  - Silver-plated copper
  - Optional insulation with bolted connections covered by insulating boots
  - Optional Glastic barriers mitigate the risk of fault propagation between major component compartments
- Symmetrical Bracing Capacity:
  - 2.4kV-15kV:
    25kA, 31.5kA, 40kA, 50kA, 100kA
- Optional Surge Arresters for main bus protection and individual incoming utilities/outgoing feeders
  - Distribution Class
  - Intermediate Class
  - Station Class

Figure 17: Optional Insulated Main Bus*

Figure 19: 15kV ATS With Panels Removed*

Figure 21: Surge Arrester*

Figure 20: Load Take-Off Cable Connections*

Vacuum Circuit Breakers (VCBs)

Figure 22: Compact Vacuum Circuit Breaker Compartment (Front)*

High Performance Robust Compact

- Drawout vacuum circuit breakers
- Fixed mounted vacuum circuit breakers
- Integral manual charging handle
- High-speed operation – complete fault clearing in less than 3 cycles
- Hermetically sealed vacuum interrupters protect contacts from corroding elements and contamination
- Vacuum interrupters with copper chrome contacts provide superior dielectric strength and very low
- Easy maintenance with contact wear indicator is provided on the vacuum interrupter moving stem
- Periodic visual inspection is recommended to verify that the contacts have not worn out

Available VCB Ratings

Figure 23: 5-15kV Max Vacuum Circuit Breakers*

Table 1: Standard Vacuum Circuit Breaker Ratings*												
			Voltage		Dielectric Ratings		Short Circuit Current					Mechanical Endurance
MVA Rating (reference only)	Actual MVA @ Maximum Rated Voltage	Rated Continuous Current	Max Rated Voltage	Range Factor	Power Frequency	Impulse 1.2 x 50µs	System Interrupting	Close and Latch Rating	Short-Time Current Rating	Short-Time Current Duration	Interrupting Time	No Load Mechanical Operations
		A RMS	kV RMS	K	kV RMS	kV peak	kA RMS	kA peak	kA RMS	s	Cycles	
250	330	1200	4.76	1.24	19	60	40	104	40	2	3	10,000
500	572	1200	8.25	1.24	36	95	40	104	40	2	3	10,000
750	1039	1200	15	1.24	36	95	40	104	40	2	3	10,000
200	207	1200	4.76		19	60	25	81.9	31.5	2	3	10,000
		1200	4.76		19	60	31.5	81.9	31.5	2	3	10,000
		2000	4.76		19	60	31.5	81.9	31.5	2	3	10,000
		1200	15		36	95	25	81.9	31.5	2	3	10,000
		1200	38				31.5		31.5			10,000
		2000	38				31.5		31.5			10,000

Optional PELT-FM CB Removal

Figure 24: Lift Truck with Vacuum Circuit Breaker*

PELT-FM Fixed Mounted on Rollers VCB Lift Truck

Figure 25

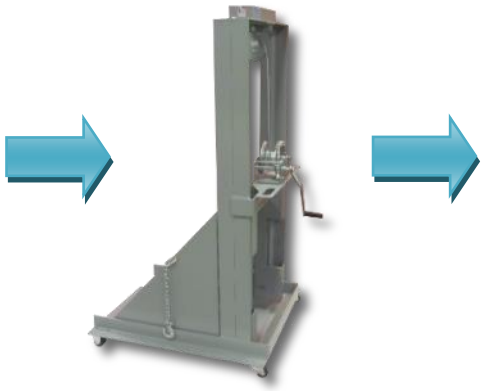


Figure 26

Figure 27

Figure 28

Figure 29

Customize Your Switchgear with These Premium Options

Table 2: Switchgear Accessories & Options*	
(LT) – Circuit Breaker Lift Truck	(GL) – Both Generator & Load Bank (Dual sets of Cam-loks)
(BM) – Equipment Mounted to X" Base	(HH) – Humidistat
(CC) – Harsh Environment Conformal Coating	(HR) – Generator Block Heater Receptacle
(GS) – Grounding Studs	(IR) – Infrared Windows
(GT) – Ground & Test Device (Manual or Electric)	(KK) – Kirk Key Interlocking
(LF) – PELT-FAC Circuit Breaker Lift Truck	(LK) – Cable Lead Kit
(LO) – Lock Out Relay (86)	(MB) – Industrial Vinyl Mimic Bus
(MC) – MOC	(PA) – Remote ATS Position Annunciation
(PG) – Pistol Grip CB Control Handles	(PB) – Top Mounted Cable Pull Box
(SL) – Specified Indication Lights (XXmm, XXVDC)	(PL) – Phase Loss Relay
(SS) – SafeStop Circuit Breaker Guard	(PM) – Phase Rotation Meter
(TO) – TOC	(PR) – Phase Rotation Monitoring
(UR) – Undervoltage Release	(RD) – Hinged Rear Doors
(WM) – PELT-WM Premium Winch Circuit Breaker Lift Truck	(RP) – Redundant PLC
(1G) – 100% Ground	(RR) – Remote Racking Device
(4G) – 40% Ground	(SC) – Specified Color:
(AC) – Alternate Portable Generator Lug Connections	(SE) – Service Entrance
(AM) – APT Power Metering	(SM) – Specified Power Metering
(AR) – 120VAC Battery Charger/Convenience Receptacle	(SP) – Spare Parts
(AV) – APTView SCADA System	(SR) – Seismic Rated (By Calculations)
(BT) – Bus Duct Throat	(TB) – Generator Remote Start/Stop Terminal Blocks
(CI) – SCADA Connection Interface Terminal Blocks	(TC) – CB Test Cabinet
(CL) – Convenience Light	(TG) – Temporary Generator Only
(CP) - Customer Provided XXXX	(TI) – Modbus TCP/IP Interface
(DR) – Load Dump Receptacle/Terminal	(TL) – Temporary Load Bank Only
(EI) – Ethernet Interface	(TP) – Test Plugs
(EN) – Engraved Nameplates	(TS) – Test Switches
(FA) – Only	(VB) – Glastic Vertical Barriers Between Sections (Full Height)
(FI) – Fiber Interface	(XL) – Extra Large Enclosure for Conduit Entry/Exit

*Due to continued product improvement, products delivered may differ from what is pictured.
*Optional Equipment Features Are Often Shown in Most Figures.
*Option Availability Subject to Product Series.

Shipping Splits & Lifting Provisions

Figure 30: NEMA 1 Switchgear Line-Up with Individual Section Shipping Splits*

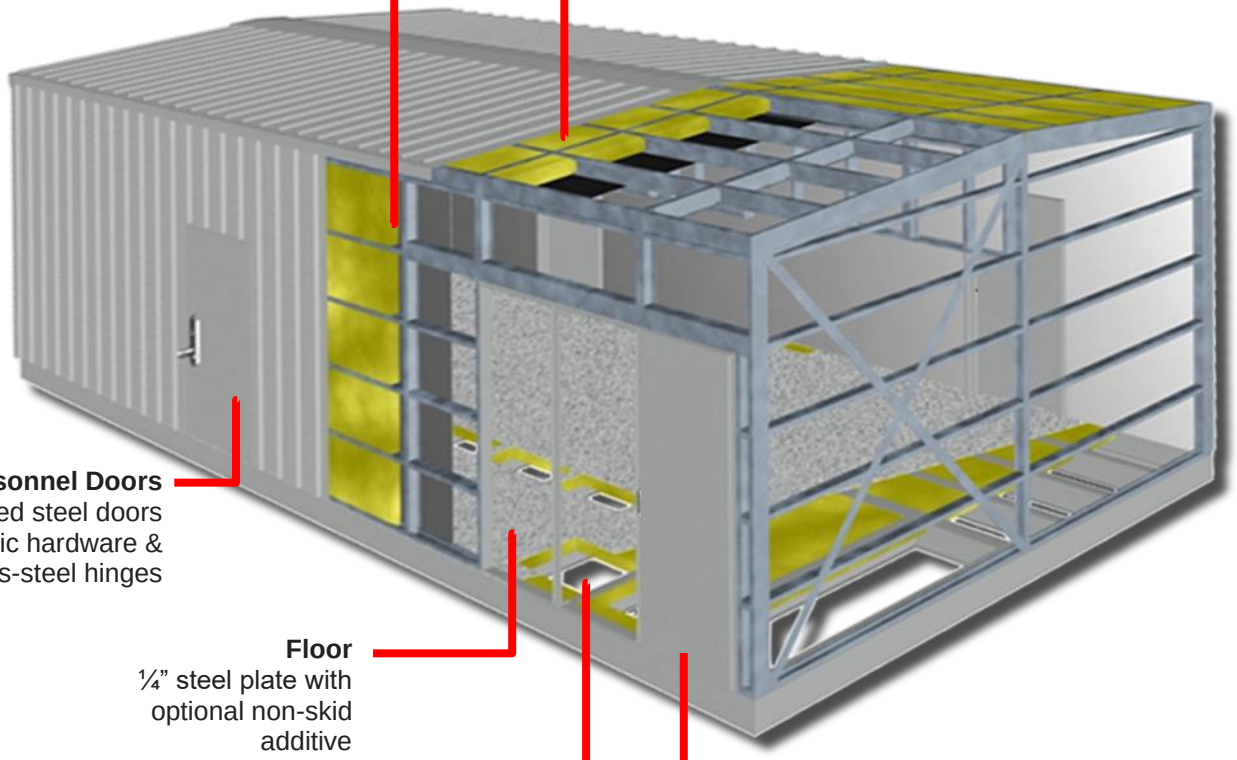
Figure 31: Ship Loose Switchgear Bus Splices for Contractor Installation During On-site Shipping Split Reassembly & Installation*

On-Site Installation Made Easy Is Standard!

- Ships as a completely assembled line-up for drop in place easy installation and little on-site assembly time
  - Connect your incoming/outgoing cables and field control wiring, test, and commission without all the additional labor of reassembling and interconnecting sections of switchgear
- Shipping Splits Available Upon Request
  - Gives the flexibility to bring switchgear through narrow hallways and doors
  - Bus Splice Pieces Shipped Loose for customer installation
- Maneuverability:
  - Option 1: Heavy Duty Lifting Angles allow for less time and errors in the field
  - Option 2: Fork Truck Pockets

Figure 32: Top Mounted, Removeable Heavy Duty Lifting Angles Allow for Crane Maneuvering*

PwrContainer E-House Construction



Optional Walls & Roof Insulation
Walls & Roof insulated to customer requirements

Personnel Doors
Insulated steel doors with panic hardware & stainless-steel hinges

Floor
¼" steel plate with optional non-skid additive

Optional Base Cutout
Cutouts in base plate for cable access

Optional Rear Access Plates
Exterior Rear Hinged Doors to access equipment/cable

HVAC (not pictured)
Optional heating and/or cooling as customer specified

Figure 37: PwrContainer Construction Features Diagram*

NEMA 3R Outdoor Non-Walk-In Switchgear

Base/Skid Mounted

Figure 38: PwrSkid Base/Skid Mounted Medium Voltage Metal-Clad Utility Intertie & Distribution Switchgear with Side Mounted 90° Turned Isolated Master Control Panel*

Outdoor Equipment Pad Mounted without Base

Figure 39: NEMA 3R Non-Walk-In Switchgear for Concrete Pad Mounting without Base/Skid*

Compact Fixed Mount NEMA 3R

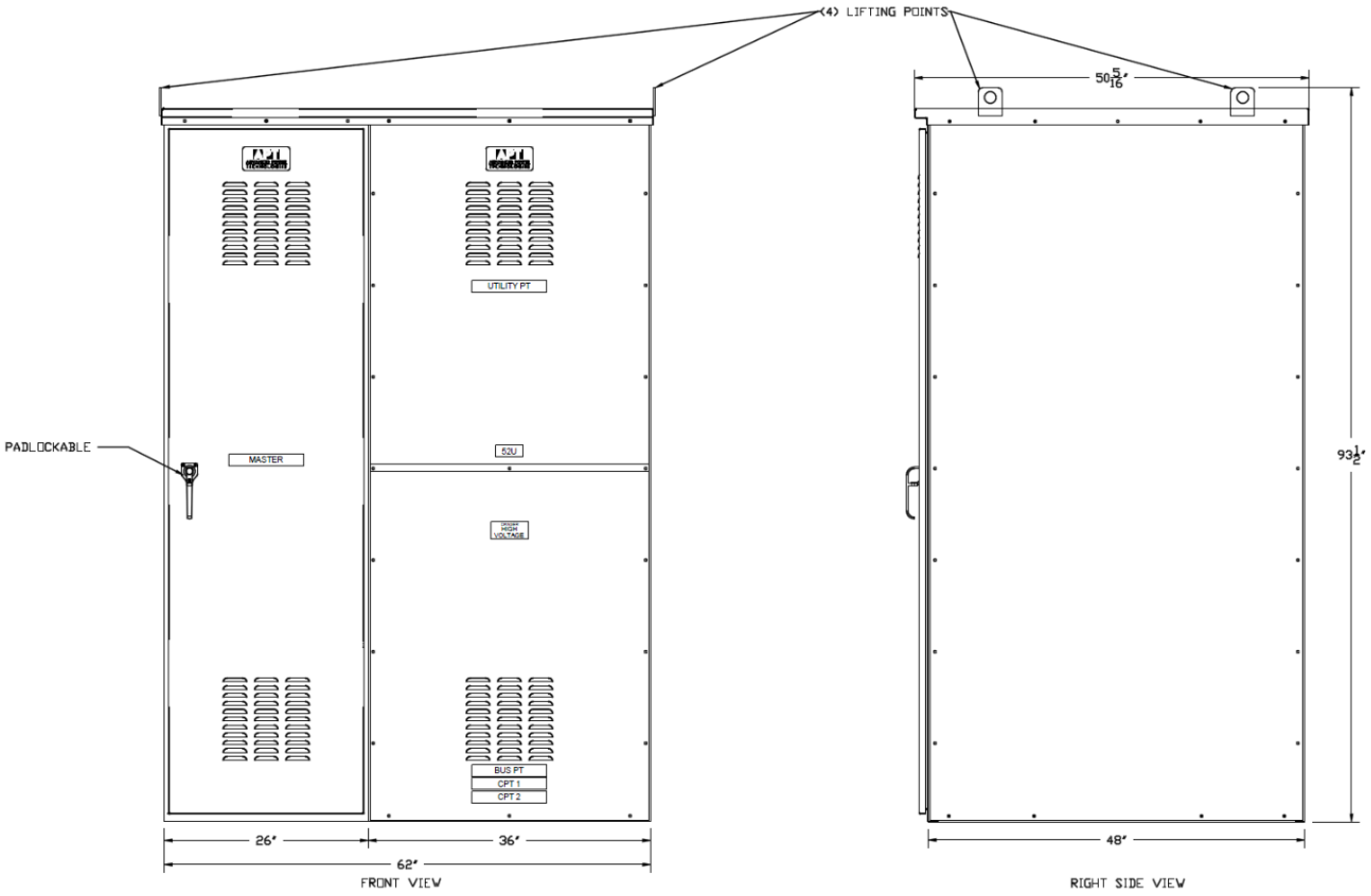


Figure 40: 15 kV Metal-Enclosed Switchgear Front, Side, & Top Views – Dimensions
Typical of NEMA 3R Section *

Table 3: Standard Section Weights*	
Component	Weight Per
NEMA 1 Section (Less Breakers)	2000 lbs.
NEMA 3R Section (Less Breakers)	3000 lbs.
1200A Circuit Breaker	360 lbs.
2000A Circuit Breaker	410 lbs.
3000A Circuit Breaker	480 lbs.

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Compact Fixed Mount NEMA 1/3R

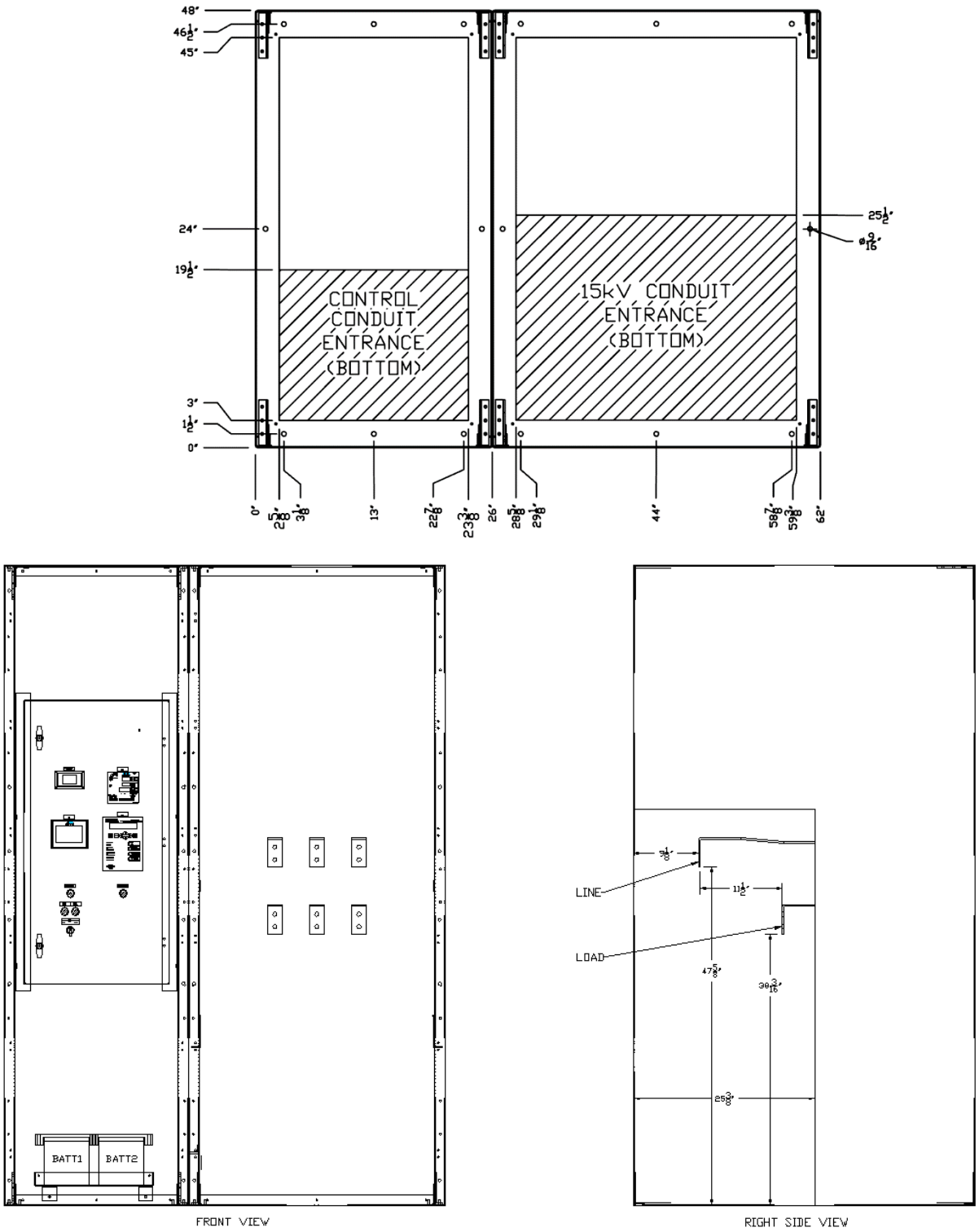

Figure 41: 5-15 kV Metal-Enclosed Switchgear Front, Side, & Top View
w/ Installation Dimensions NEMA 3R*

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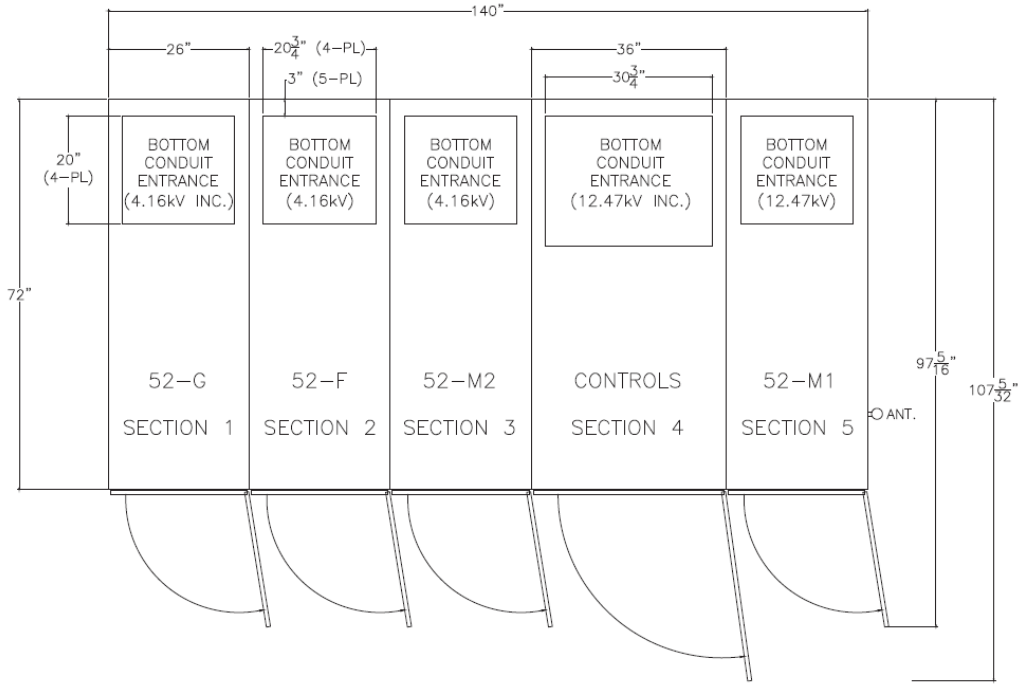
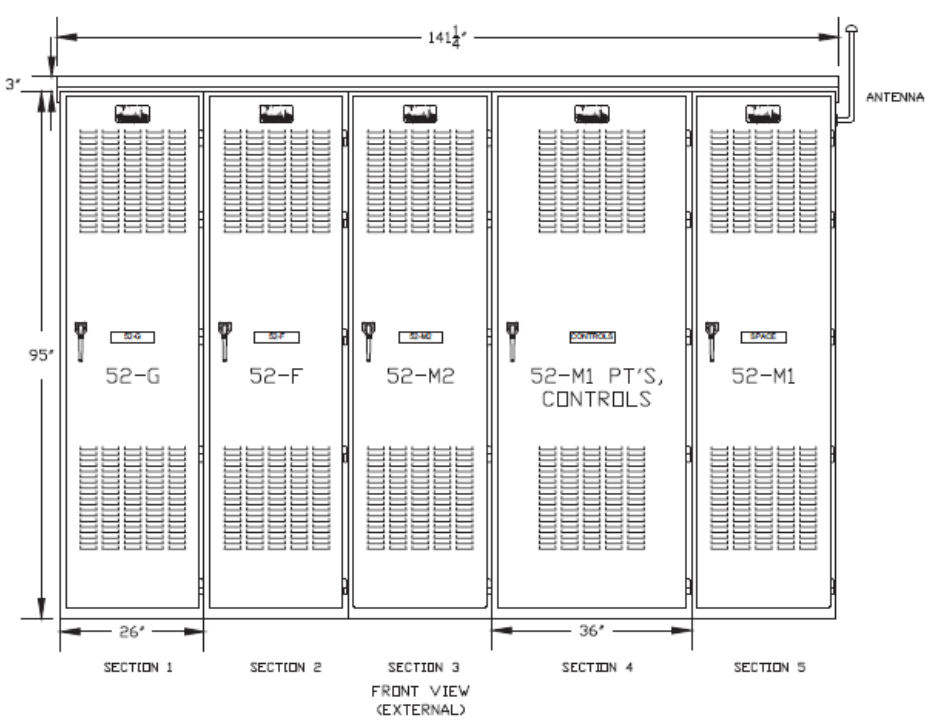
Compact Drawout NEMA 1/3R





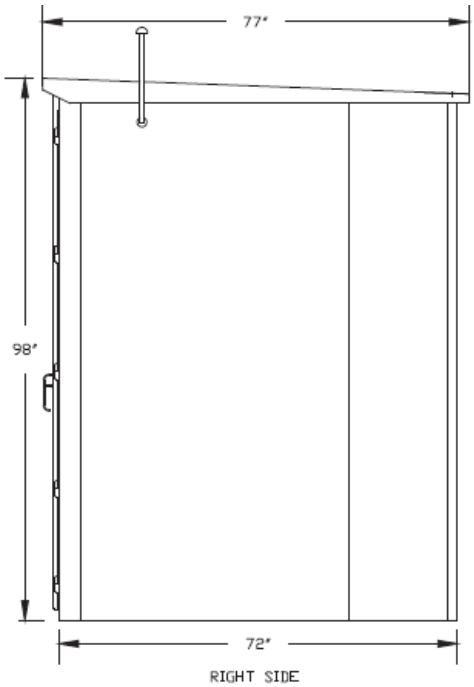


Figure 42: 5-15 kV Metal-Enclosed Switchgear Front, Side, & Top View
w/ Installation Dimensions NEMA 3R*

APT Application One-Line Diagrams

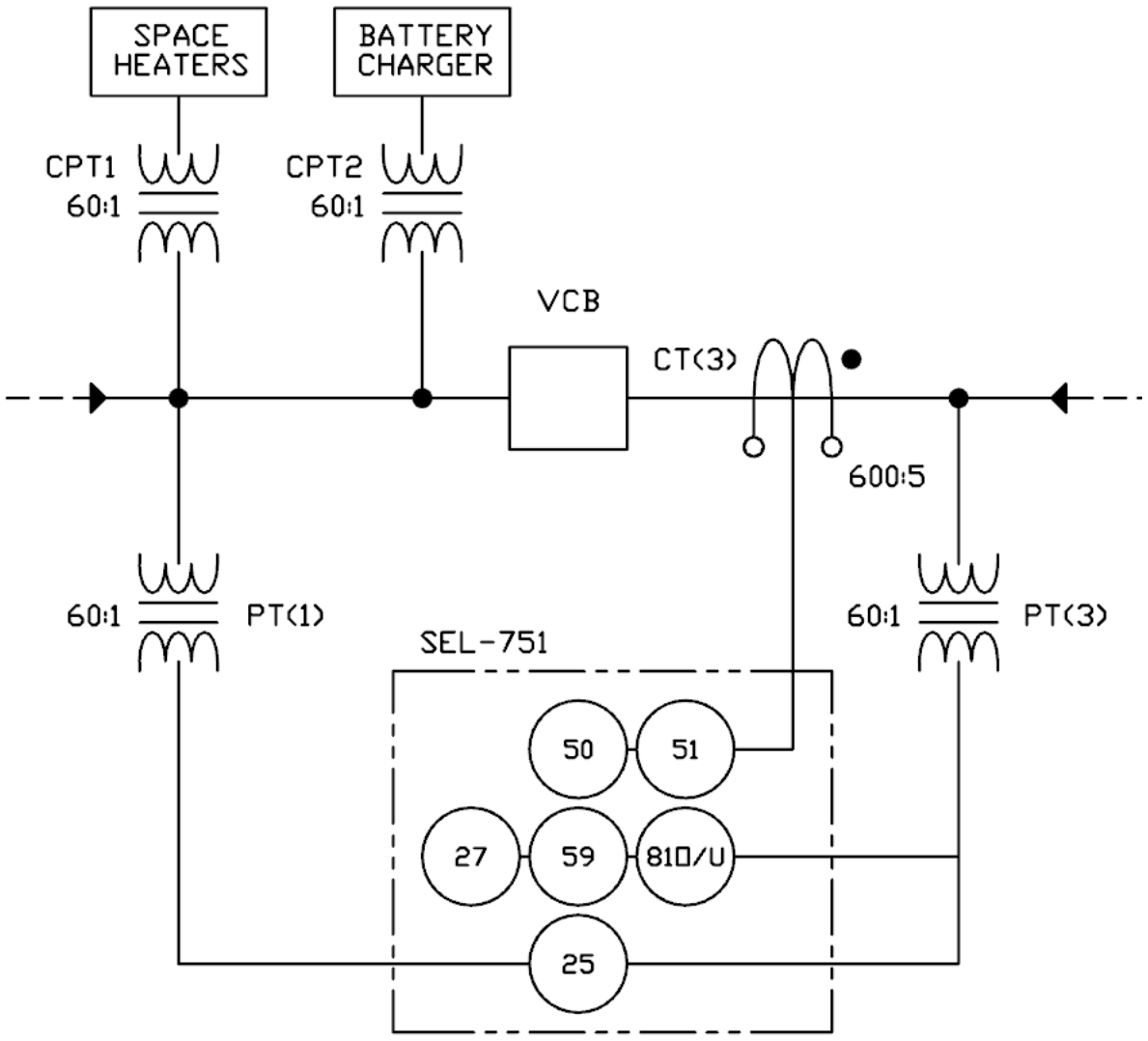
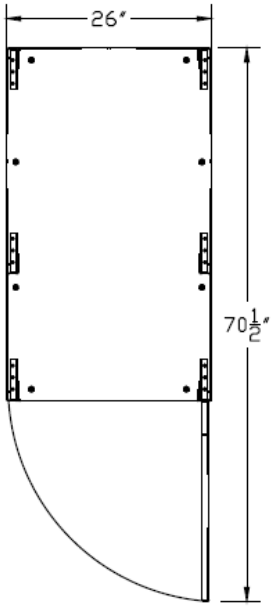
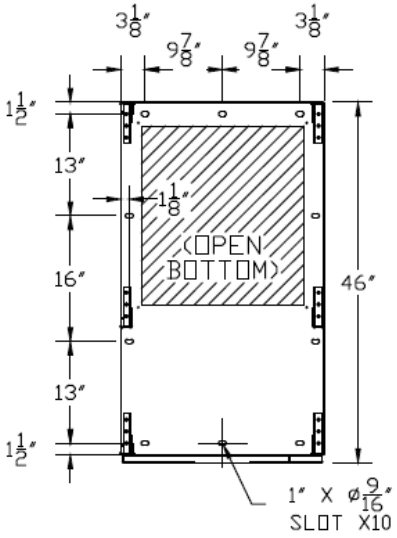


Figure 43: MED-Series Application One-Line of
Single Section Fixed Mount Utility Intertie Switchgear

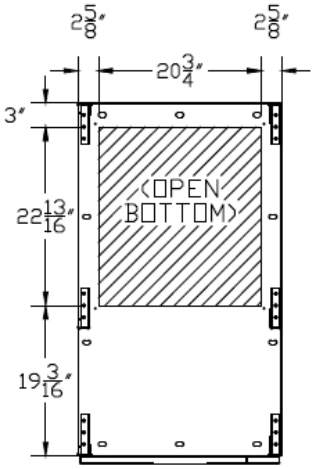
Breaker Over Breaker Bottom Entry/Exit



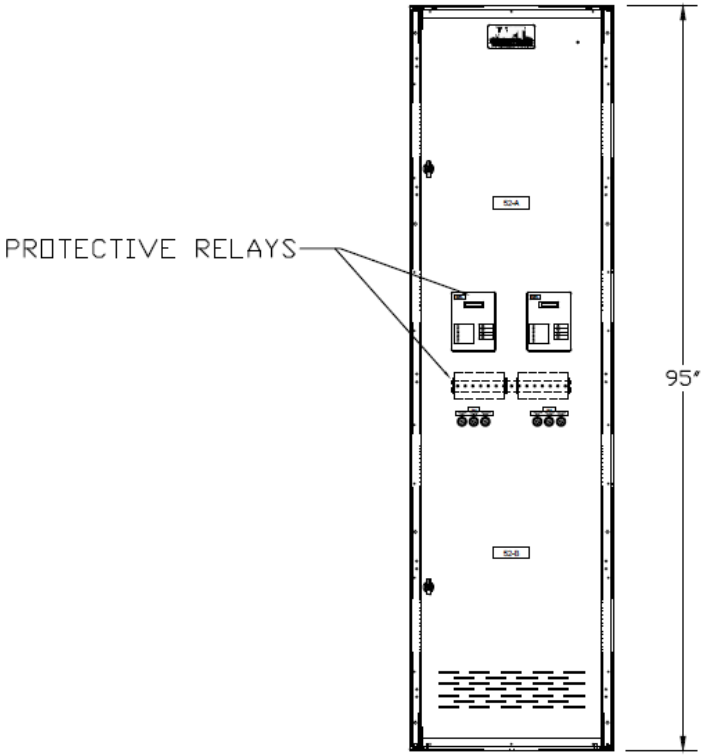
FEEDER
(TOP VIEW)



FEEDER
(PLAN VIEW)
(ANCHORING)



FEEDER
(PLAN VIEW)
(CABLE ENTRY)



About Advanced Power Technologies



Advanced Power Technologies (APT) is on the cutting edge of the latest engineered power system smart technologies, as it relates to microgrid & storage management, renewable & conventional energy source deployment, demand peak shaving, and facility back-up and co-generation power systems. Located in the central United States and headquartered in Lafayette, Indiana with solutions development engineers around the country, APT provides domestic and international products and services to industry leading companies from around the world. APT engineers have decades of power system experience from working with some of the largest companies in all industries. Over the last two decades, we have produced successful solutions for hundreds of large-scale electric power projects involving utility/generator paralleling, transfer, peak shaving, and distribution. We pride ourselves in providing electrical power systems that are engineered and custom built, utilizing state-of-the-art technologies to fit our customer's exact needs. The core of our business is low & medium voltage engineered power systems for a wide range of indoor & outdoor applications, such as:

- Utility(ies) and Generator(s) Paralleling/Transfer/Peak Shaving/Distribution Switchgear
- Microgrids, Microgrid Master Control Panels, SCADA systems
- Containerized Battery Energy Storage Systems (BESS)
- Photovoltaic (PV) Solar Power Collection/Distribution & Renewable Energy Storage Systems
- Low & High Resistance Grounding Systems, Grounding Systems for Photovoltaic Effective Grounding
- High Efficiency Combined Heat and Power Switchgear & Control Systems (CHP, Co-generation)
- Outdoor Walk-In Electrical Houses (E-Houses) & Skid-Mounted Switchgear
- Motor Control Centers & Motor Control Switchgear
- Automatic & Manual Load Transfer Switchgear
- Bypass/Isolation & Power Distribution Circuit Breaker Switchboards
- Generator/Loadbank Quick Connection Switchgear, Switchboards, & Tap Boxes
- Industrial Control Panels

Please see our product webpages on www.apt-power.com for product brochures and relevant information. Actual products may look different from images shown on the website and in brochures, based on actual specifications.
APT cares and understands that each power system is different. We will evaluate various solutions in order to develop the best solution for a site. APT focuses on our ability to a combine several traditional pieces of equipment/functionality into as little of a footprint possible. This saves on space, the cost of equipment, cost of installation, and accomplishes the most optimal/state-of-the-art design for your facilities. APT's desires to foster and grow a culture of continued open communication with each customer. Let APT be your source to provide fully engineered power system equipment solutions for the full customer facility on time, on or under budget, and in the smallest footprint possible. We are always available to assist customers and engineers representing customers in the development of complex power solutions for all facility types.