



ADVANCED POWER
TECHNOLOGIES

2.4kV-15kV APT Front Access Compact Automatic Transfer Switchgear (ATS)



FAC-AT Load Transfer Switchgear Solutions Brochure

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**SAFE SMART SERVICEABLE SWITCHGEAR &
ENGINEERED POWER SYSTEM SOLUTIONS**



ALN: 541-AT Rev. 02

APT FAC ATS Construction



Figure 1: APT FAC-Series Ultra Compact Vacuum Circuit Breaker Based ATS External Construction NEMA 3R*



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



Figure 3: Optional 24VDC Control Power Batteries & Rack for Optional Remote Indoor Mounting for Convenience of Maintenance Keep the Controls On-line Even if the Power is out!*

2.4kV-15kV Ultra-compact ATS

- ⊙ Ultra-Compact Automated Switchgear for the High Demands of Tomorrow!
- ⊙ APT Open or Closed Transition Automatic Transfer Switchgear Applications:
 - One Utility Source & One Generator Source
 - Two Utility Sources
 - Two Generator Sources
- ⊙ Main Bus:
 - Steel Enclosed Compartmentalized
 - 1200A, 2000A, 3000A
 - Durable Industrial Vinyl Mimic Bus
- ⊙ Infrared (IR) Viewing Windows
- ⊙ Symmetrical Interrupting Capacity:
 - 2.4kV-15kV:
 - 12kA, 25kA, 31.5kA, 40kA, 50kA
- ⊙ 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 PwrContainer ISO Container Based Outdoor Walk-In Switchgear Enclosure Module
 - NEMA 3R hardware is stainless steel
 - NEMA 3R Doors are Padlockable
 - Carbon Steel Powder coated ANSI 61 Gray

Construction Details & Features



Figure 4: 5kV ATS Line-up*



Figure 7: Optional Bus PT Drawer*

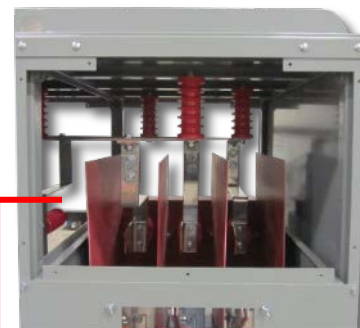


Figure 8: Close-up of Main Bus Compartment*

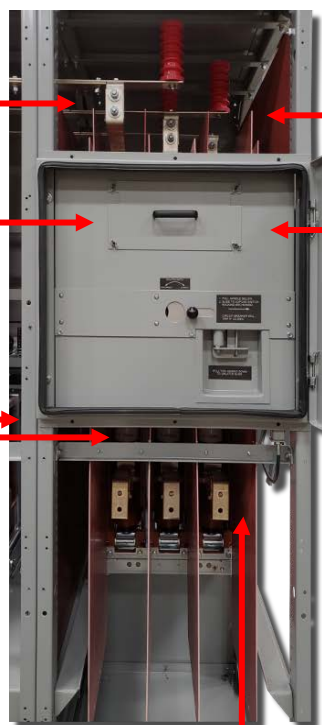


Figure 5: 5kV ATS Typical Generator Section Configuration*



Figure 9: 15kV Max Vacuum Circuit Breaker over Vacuum Circuit*



Figure 6: Rear Vacuum interrupters*



Figure 10: Close-up of Vacuum Interrupters from the front of the section*

APT Transfer Control System Modules



Figure 11: ATC & SL1 (selectable) Control System Local Operator Interface*



Figure 12: Control System Local Operator Interface with Premium Control Unit*

Multi-source Open & Closed Transition Transfer Control Modules

- ⊙ (ATO) – APT Automatic Standby Open Transfer Control Module – maximum one per switchgear:
 - Senses a source outage and disconnects the failed power source from the load. Once the failed source is disconnected from the load, the secondary source closes to supply power to the load.
- ⊙ (ATC) – APT Automatic Standby Closed Transfer Control Module – maximum one per switchgear:
 - Loss of primary source is executed as described in (ATO)
 - Upon sensing of a return of a primary source, the secondary source is synchronized with the primary source. Once synchronized, the primary source is connected, and the secondary sources is disconnected within 100 mS. Primary source immediately assumes the full load. The flow of power to the load is not interrupted upon this transition.
- ⊙ (SL1) – APT Automatic Soft Loading/Unloading – maximum one per switchgear:
 - Loss of primary source is executed as described in (ATO)
 - Upon sensing of a return of a primary source, the secondary source is actively synchronized with the primary source. Once in synchronism the primary source is connected, and the soft unloading of the secondary source begins. Primary source gradually assumes the site load. The secondary source is automatically disconnected when it's load is reduced to the unload trip setpoint level. The flow of power to the load is not interrupted upon this transition.
- ⊙ (AR) – APT Automatic Return to Normal – maximum one per switchgear:
 - Fully automated transfer back to the primary source, upon sensing a healthy primary source, without operator initiation.

APT Optional Control System Modules



Figure 13: ATC, SL1, IM, IE Control System Modules in Master Control Panel*



Figure 14: PS Control System Module in Master Control Panel*

- ⊙ (NA) – APT Non-Automatic Operator Supervised Return to Normal – maximum one per switchgear:
 - Operator initiated automatic transfer back to the primary source after an automatic transfer sequence has occurred.
- ⊙ (BI) – APT Maintenance Bypass/Isolation with Captive Key – maximum one per switchgear:
 - Manually bypass live power flow from source to load in the case that parts of the equipment are disabled/need to be isolated, de-energized for maintenance, testing, or repair.
- ⊙ (LS) – APT Load Shed Control – maximum one per switchgear:
 - Opens designated feeders during an outage and allows for only critical & life safety loads to be connected to the secondary source.
- ⊙ (IM) – APT Island Mode – maximum one per switchgear:
 - Allows soft loading closed transition of site load from utility to generator and safe system operation in isolation from the local electricity distribution network
- ⊙ (PS) – APT Peak Shaving (Base Load) – maximum one per switchgear:
 - Controls and adjusts the generator active and reactive load levels to allow operation in parallel with the utility.
- ⊙ (IE) – APT Import/Export Control (add-on to UP/PS) – maximum one per switchgear:
 - Maintains constant utility contribution to a site load by monitoring the utility contribution and trimming generator set load levels up and down as site loads change.
 - In Export Mode, the site is exporting the set KW to the utility grid.

APT SCADA Control System Modules

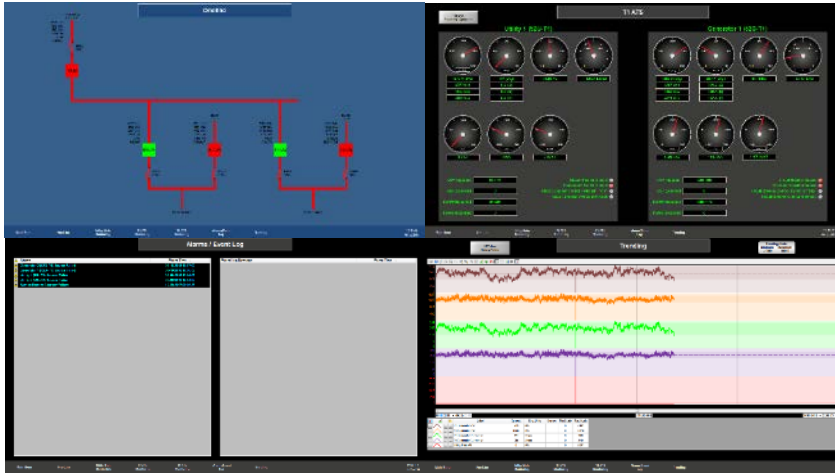


Figure 15: APTView SCADA HMI with System One-line (top left), Source Metering Data (top right), Event Log (bottom left), Power Usage Time Adjustable Trend Chart (bottom right)*

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

Generators, Utilities, Renewables Source Control

- ⦿ (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

Dead Break APT MV Isolation Switch

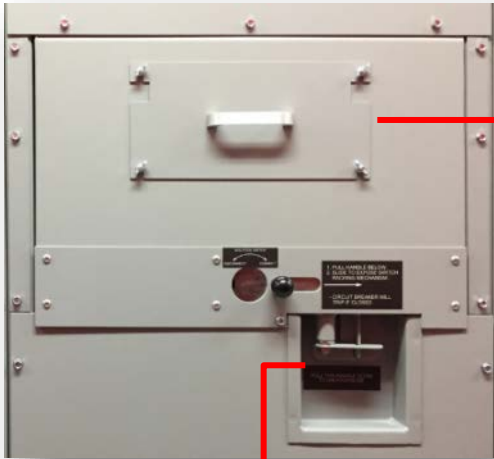


Figure 16: Dead Break Isolation Switch*

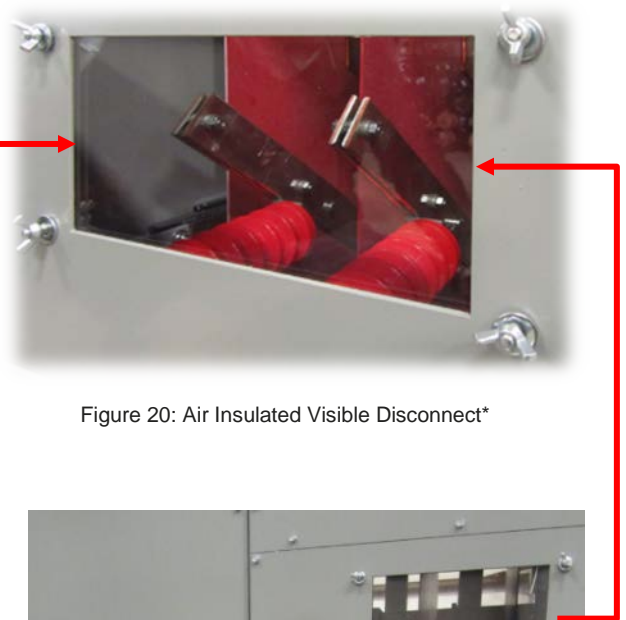


Figure 20: Air Insulated Visible Disconnect*

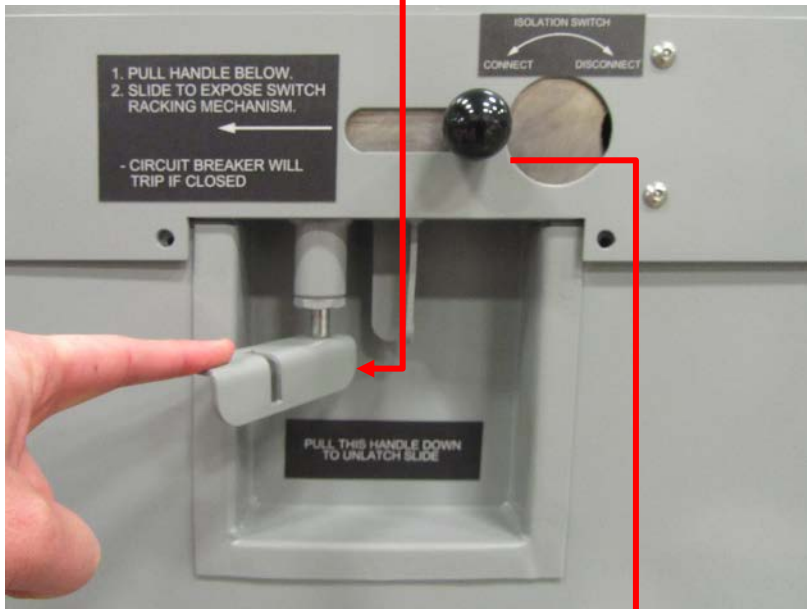


Figure 17: Mechanical Interlock & Padlocking Provision (In Open or Closed Position) *



Figure 19: Operation of Isolation Switch to Create Visible Disconnect *



Figure 18: Access to The Racking Mechanism*

Main Bus



Figure 21: Power Source Cable Connection*



Figure 22: Optional Insulated Main Bus*



Figure 23: Load Take-Off Connection*

500A – 2000A 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

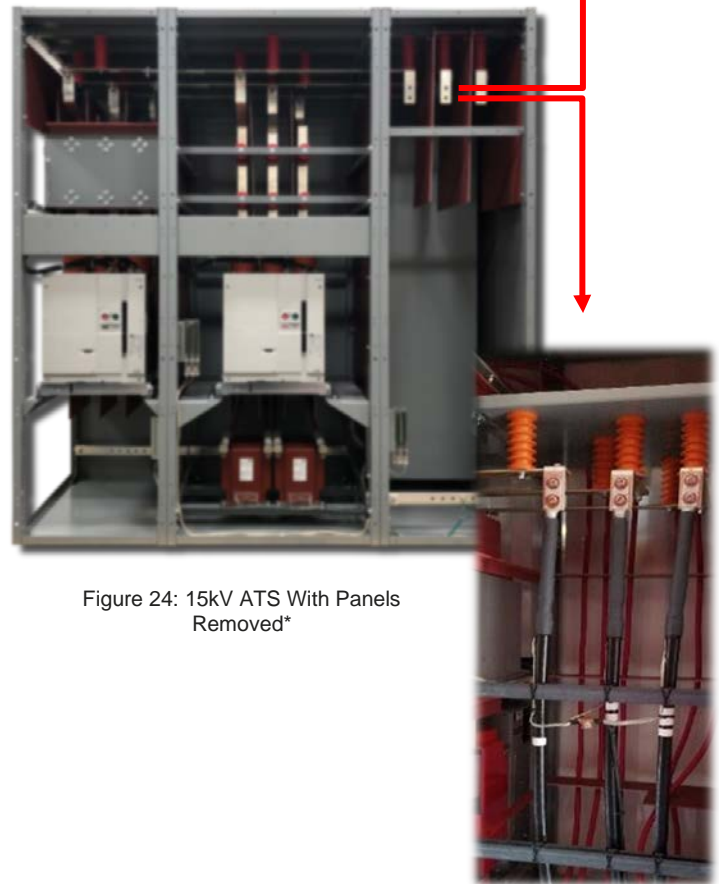


Figure 24: 15kV ATS With Panels Removed*



Figure 25: Load Take-Off Cable Connections*

Vacuum Circuit Breakers (VCBs)



Figure 26: Front Access Compact Vacuum Circuit Breaker Compartment (Front)*

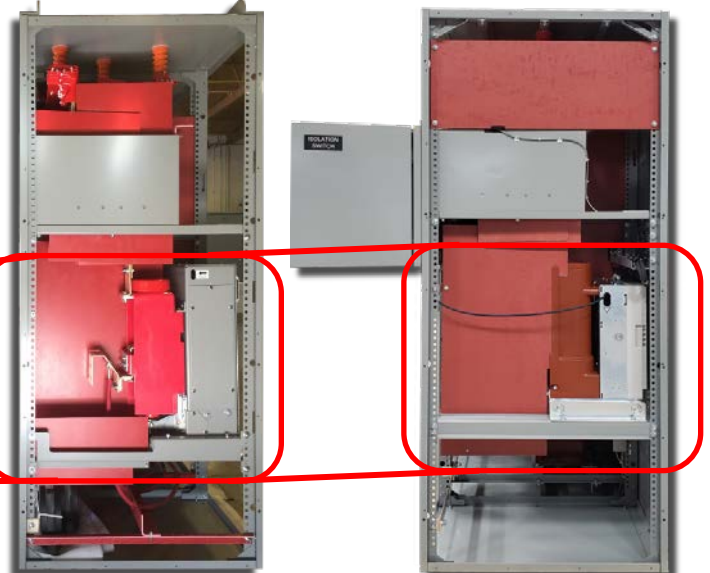


Figure 27: Side Views of Section NEMA 1 (Left) & NEMA 3R (Right)*

High Performance, Robust, Fixed Mount On-Rollers

- ⊙ Fixed mounted vacuum circuit breakers installed on rollers
 - Rollers provided to simplify the field removal of the circuit breakers
- ⊙ Integral manual charging handle
- ⊙ Where visible disconnect is required, mechanical & electrical interlocks will trip and prevent circuit breaker closing when the inline visible disconnect isolation switch is in the transitional position or when its mechanism is exposed to insertion of the racking handle.
 - Breaker cannot be electrically or mechanically closed under these conditions for operator safety
- ⊙ 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 28: 5-15kV Max Vacuum Circuit Breakers*

Table 1: Standard Vacuum Circuit Breaker Ratings*

MVA Rating (reference only)	Actual MVA @ Maximum Rated Voltage	Rated Continuous Current	Voltage		Dielectric Ratings		Short Circuit Current					Mechanical Endurance
			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 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	15		36	95	31.5	81.9	31.5	2	3	10,000
		2000	15		36	95	31.5	81.9	31.5	2	3	10,000

Optional PELT-FM CB Removal



Figure 29: Lift Truck with Vacuum Circuit Breaker*

PELT-FM Fixed Mounted on Rollers VCB Lift Truck



Figure 30

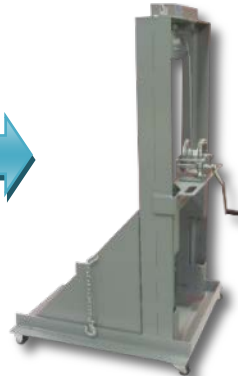


Figure 31



Figure 32



Figure 33



Figure 34

Protective Relaying & Switches



Figure 35: ANSI/IEEE 1547 Utility Intertie Protection Relays, Test Switches, Pistol Grip CB Switch & (86) Knob Grip Lockout Relay*



Figure 36: 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

Instrument Transformers – PTs, CTs

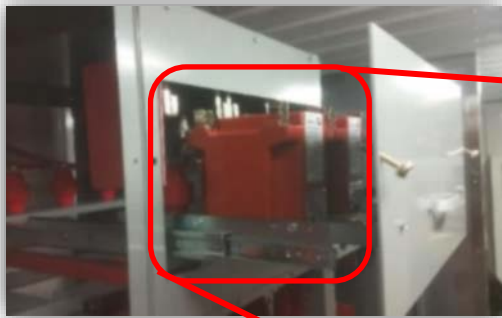


Figure 37: Access to Top Section Draw-out Voltage Transformers (PTs) Drawer*



Figure 38: 5kV - Top, 15kV - Bottom Drawer Mounted Voltage Transformers (PTs) & Access to Primary Fuses*



Figure 39: Auxiliary Drawer with Self-Aligning Contacts*

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



Figure 40: 5kV (Left) 15kV (Right) Fixed mounted Voltage Transformers (PTs)*

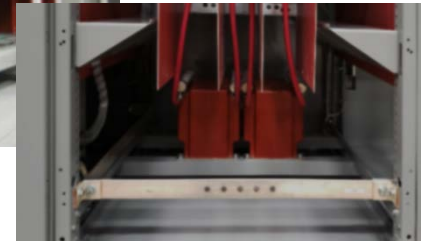


Figure 41: Relaying and metering Current Transformers (CTs)*

Switchgear Accessories & Options

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-locks)
(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) – Front Access Only	(VB) – Glastic Vertical Barriers Between Sections (Full Height)
(FI) – Fiber Interface	(XL) – Extra Large Enclosure for Conduit Entry/Exit

Shipping Splits & Lifting Provisions



Figure 42: NEMA 1 Switchgear Line-Up with Individual Section Shipping Splits*



Figure 43: 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 44: Top Mounted, Removeable Heavy Duty Lifting Angles Allow for Crane Maneuvering*

PwrContainer Walk-In Switchgear



Figure 45: PwrContainer Outdoor Walk-In Medium Voltage Metal Enclosed Utility & Generator Automatic Paralleling & Transfer Switchgear Enclosure*

**APT PwrContainer
walk-in switchgear
e-house offers a clean
and safe work
environment in an
optional climate-
controlled aisle**



Figure 46: PwrContainer Inside Aisle of 30' Medium Voltage Utility & Generator Paralleling & Automatic Transfer Switchgear E-House with Isolated Master Control Panel*



Figure 47: PwrContainer Relative Aisle Space (VCB withdrawn & in Aisleway) Includes Plenty of Space for Circuit Breaker Removal Devices*



Figure 48: PwrContainer Inside Temperature Controls with 24VDC Battery Rack* *

PwrContainer E-House Construction

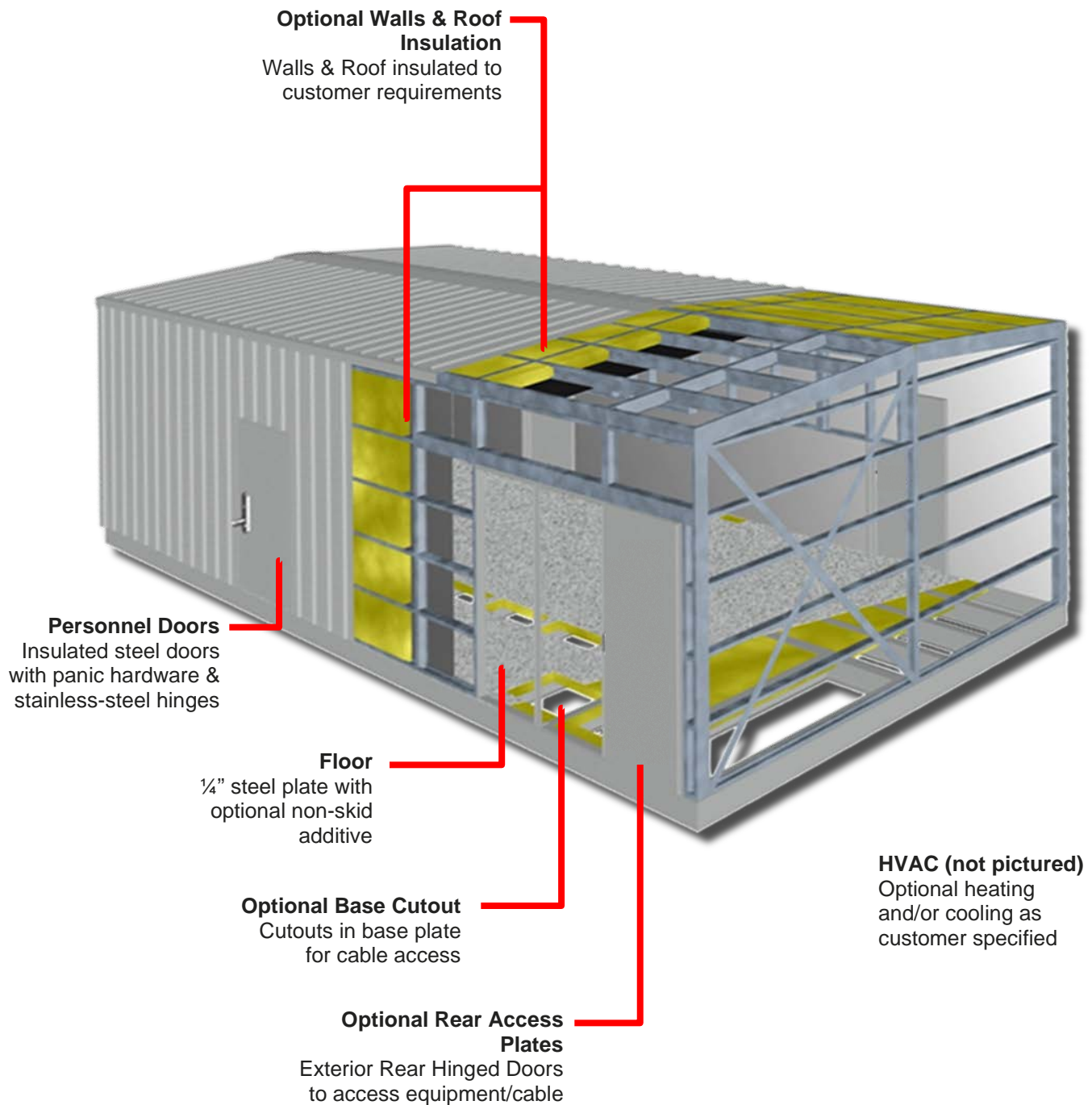


Figure 49: PwrContainer Construction Features Diagram*

NEMA 3R Outdoor Non-Walk-In Switchgear

Base/Skid Mounted



Figure 50: 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 51: NEMA 3R Non-Walk-In Switchgear for Concrete Pad Mounting without Base/Skid*

Front Access Compact NEMA 1

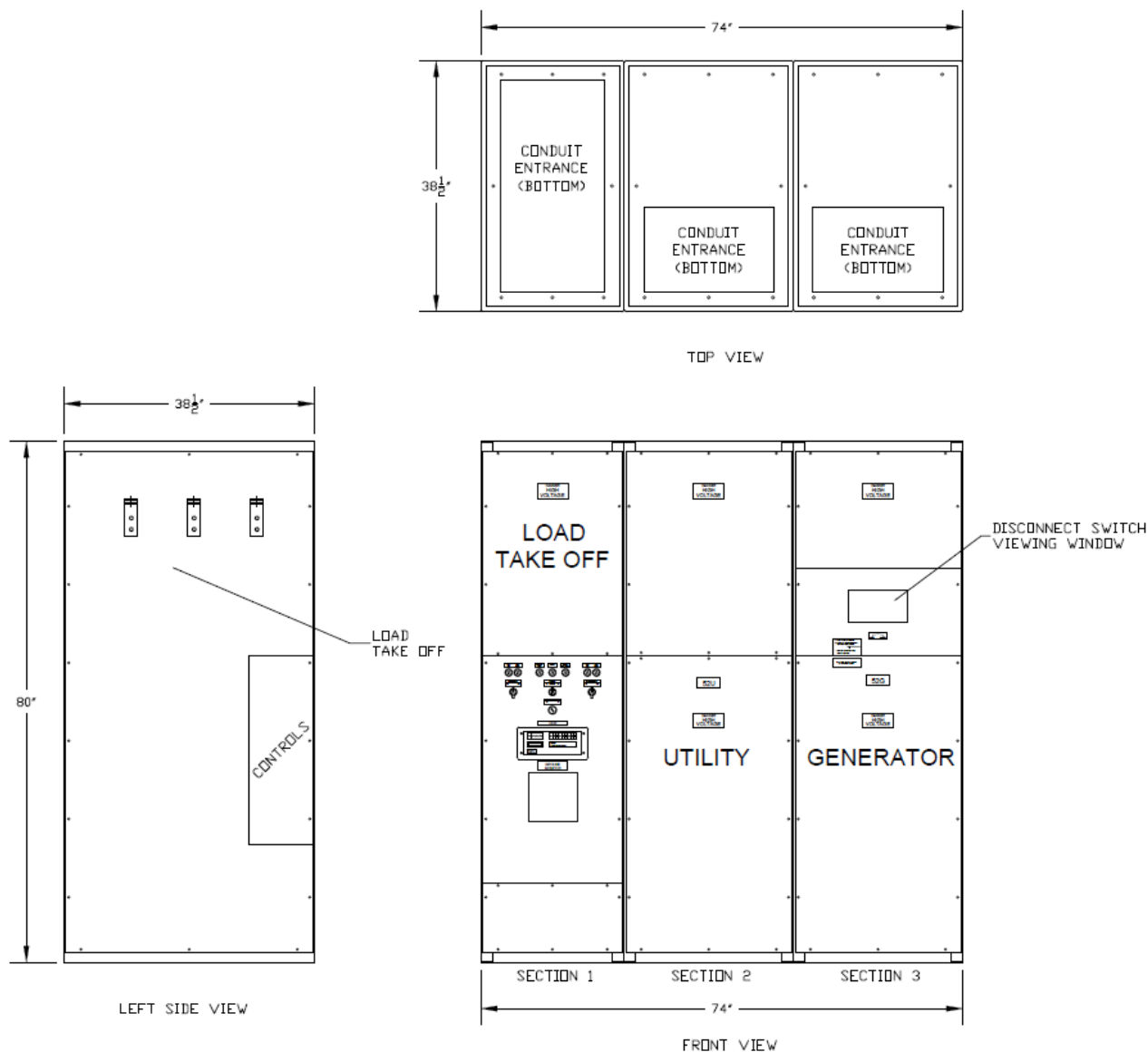


Figure 52: 5 kV Metal-Enclosed Switchgear Front, Side, & Top Views – Dimensions
Typical of NEMA 1 Section; NEMA 3R adds several inches to the Height & Depth*

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.

Ultra Compact NEMA 3R

Figure 53: 5-15 kV Metal-Enclosed Switchgear Front, Side, & Top Views – Dimensions
NEMA 3R*

Front Access Compact XL NEMA 1

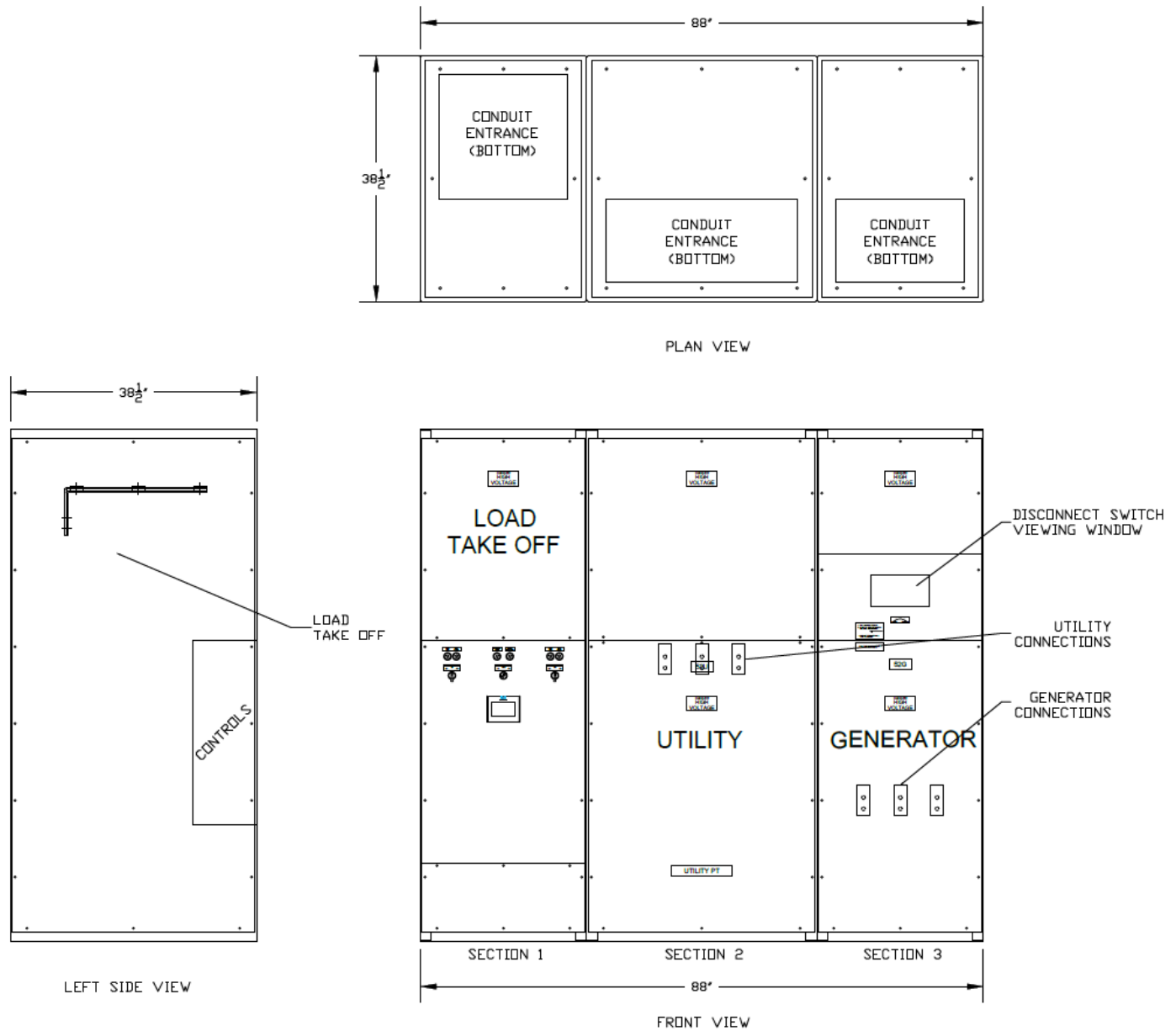


Figure 54: 5-15 kV Metal-enclosed Switchgear Front, Side, & Top Views – Dimensions
Typical of NEMA 1 Section; NEMA 3R adds several inches to the Height & Depth*

APT Application One-Line Diagrams

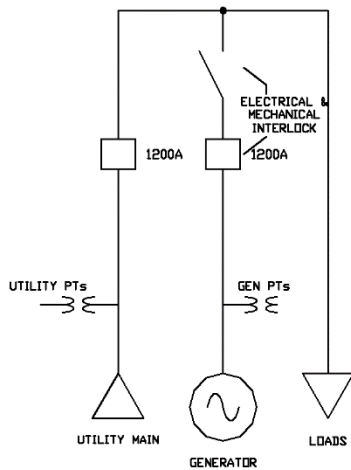


Figure 55: One Utility, One Generator Source Automatic Transfer Switchgear

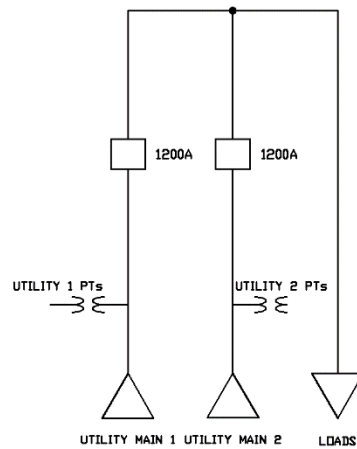


Figure 56: Two Utility Sources Automatic Transfer Switchgear

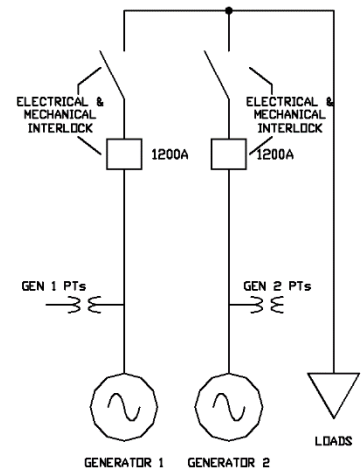


Figure 57: Two Generator Sources Automatic Transfer Switchgear

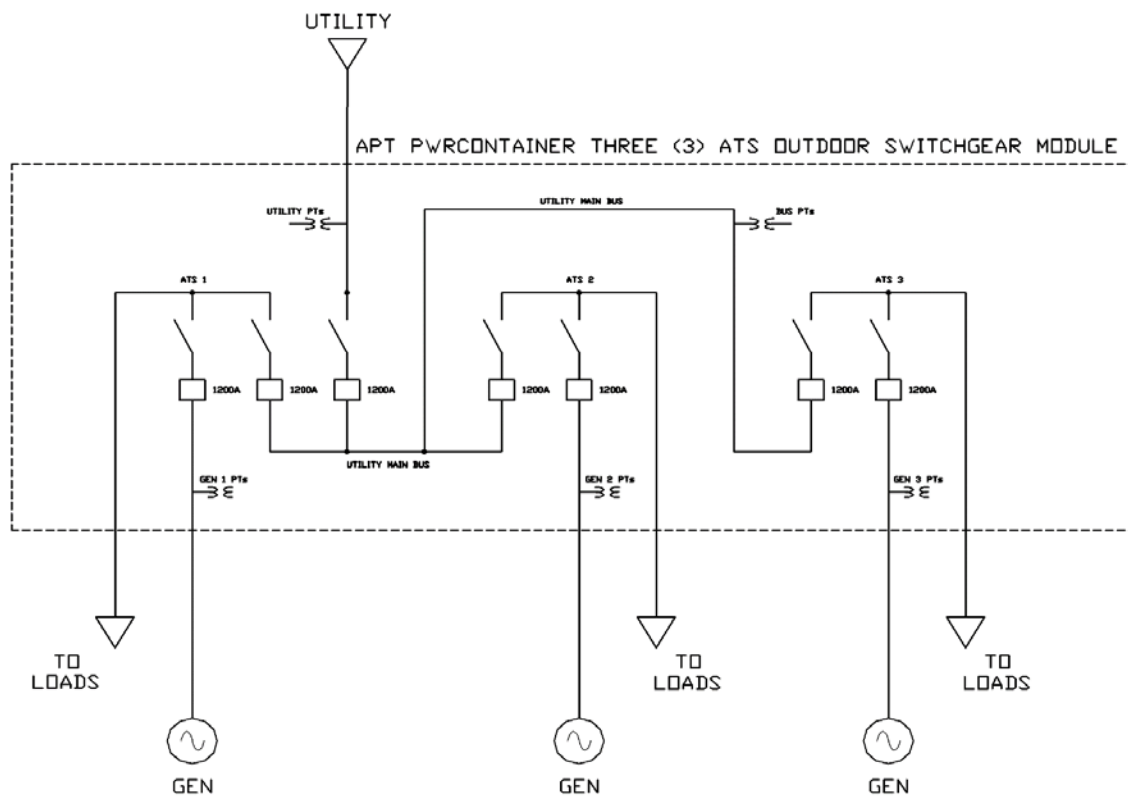


Figure 58: PwrContainer with Three (3) ATS Line-up

Part Number Builder – Coming Soon!

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.appt-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.