



ADVANCED POWER
TECHNOLOGIES

208V-480V UL Listed Switchboard & Control Switchgear



SBU-Series Low Voltage Switchboard & Switchgear Solutions Brochure

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



ALN: 531 Rev. 01

General Features

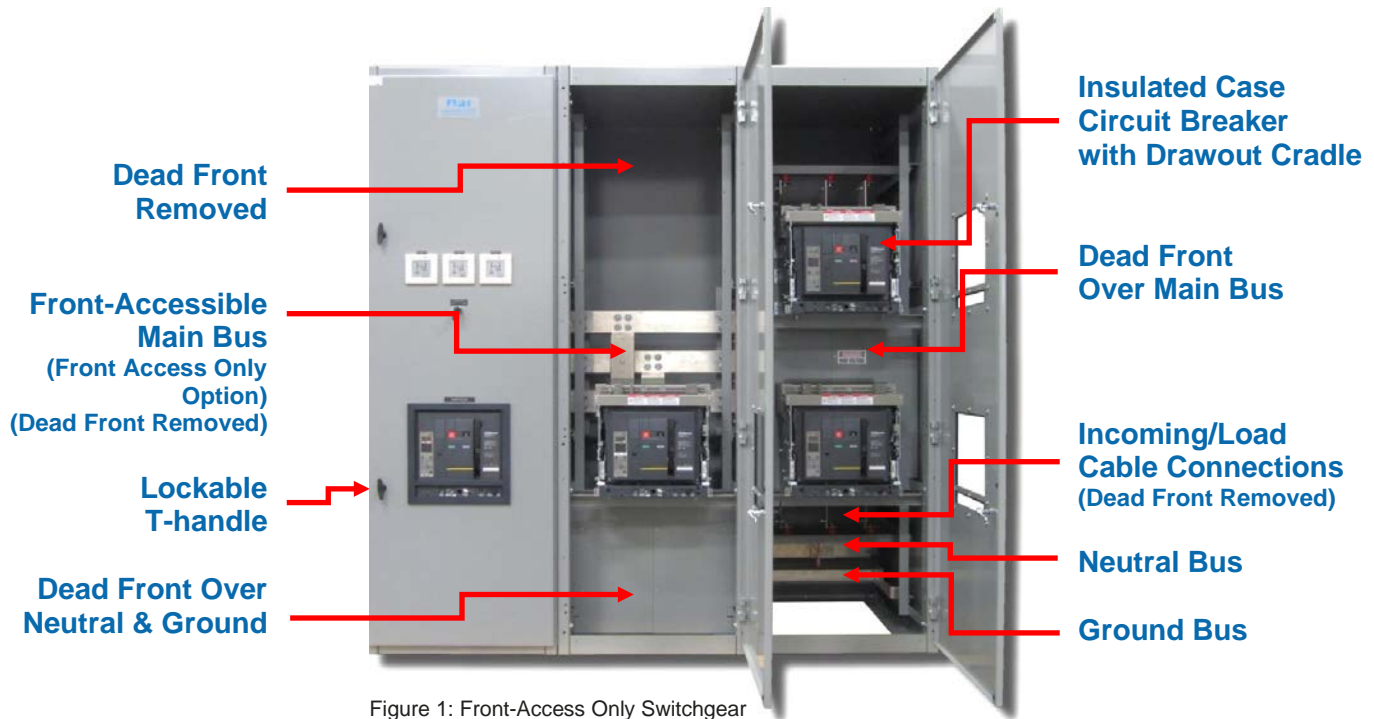


Figure 1: Front-Access Only Switchgear

Designed to Meet UL® 891 Requirements

- ⊙ UL 891 Listed & Labeled
- ⊙ Voltage:
 - 208V – 690V, 3Ø
- ⊙ Frequency:
 - 60Hz or 50Hz
- ⊙ Silver plated copper bus
- ⊙ Standard bus ampacity up to 4000A
- ⊙ Busbar connections with NEMA standard hole pattern
- ⊙ Bus Access & Cable Entry
 - Front or Rear Access for either top or bottom cable entry
- ⊙ Insulated Case Circuit Breakers
 - See page 5 (Feeder Sections) for more information
- ⊙ Molded Case Circuit Breakers
 - See page 5 (Feeder Sections) for more information
- ⊙ Intelligent close prevents simultaneous connection of multiple generators to dead bus
- ⊙ Installation Location & Enclosure
 - NEMA 1 for Indoor Installation
 - NEMA 3R for outdoor installation
 - Manufactured from Carbon Steel
 - Powder coated ANSI 61 Gray
 - Lockable T-handles
 - Internal Climate Control (requires 120VAC)
 - Anti-condensation Heater w/Thermostat
 - Stainless steel hardware
 - Optional Power System Mimic Bus
- ⊙ Standard Section Cabinet Sizes
 - 80"H x 26"W x 22.5"D
 - 80"H x 26"W x 30.5"D
 - 80"H x 36"W x 22.5"D
 - 80"H x 36"W x 30.5"D
 - 80"H x 36"W x 36"D
- ⊙ Custom Sizes Available Upon Request

Master Control Panel (MCP)

Compartments are configurable for incoming/ outgoing utilities, generator sources, and motor drives/starters for the ultimate in flexibility



Figure 2: APT Master Control Panels with 20" Touchscreen Operator Interface & APTView SCADA System

Advanced Logic Master Control Section

- ⊙ Human Machine Interface (HMI)
 - Advanced Industrial Personal Computer (AiPC)
 - 20" Full Color Touchscreen
 - Windows 10
 - Provides power system monitoring & control via graphical interface
- ⊙ Local SCADA:
 - Graphical displays:
 - System One Line
 - Detailed genset electrical information
 - Genset loading controls
 - Alarm annunciation
 - Storage of all the monitored data every minute with date and time stamp
 - Remote monitoring and remote-control software
 - Capability of remote system troubleshooting
- ⊙ Uninterruptable Power Supply keeps unit powered during unplanned outages
- ⊙ Each generator electrical data:
 - Line to line voltages: Vab, Vbc, Vca
 - Generator frequency, Hz
 - Phase currents: Ia, Ib, Ic
 - 3Ø power: kW, PF, kVAR, kVA
 - 3Ø energy: kWh import, kWh export, kVARh import, kVARh export
- ⊙ Generator bus electrical data:
 - Line to line voltages; Vab, Vbc, Vca
 - Bus Frequency, Hz
- ⊙ System Status Information (alarm and events log):
 - Generator and Feeder circuit breakers position
 - Circuit breaker control switch in Trip position

Generator Protection & Control



Figure 3: Front Access Section Generator Protection & Control Door Open



Figure 4: Generator Protection Circuit Breaker behind door & Door Mounted Generator Paralleling Control



Figure 5: Close-Up of APT GP Advanced Control Module Powered Up

Advanced Generator Protection & Control Sections

- ⦿ Behind door mounted generator protection circuit breaker provides an added layer of operator protection
- ⦿ Provide ability to automatically parallel multiple generators in the same or multiple sections:
- ⦿ Complete Manual Paralleling Facilities
 - Synch Check Relay
 - Synch Lights
- ⦿ Complete 3Ø Generator Protection
 - Under/overvoltage, under/over frequency
 - Reverse Power (two setpoints)
 - Reverse VARs (two setpoints)
 - Current balance (two setpoints)
- ⦿ Optional 3Ø Bus Protection
 - Under/overvoltage and under/over frequency
- ⦿ Remote Start/Stop Interface
- ⦿ Prevention of Closing of Multiple Generators to a Dead Bus Simultaneously
- ⦿ First Up – First On logic Connects First Available genset to a Dead Bus
- ⦿ Uninterruptable Power Supply to trip the generator circuit breaker when main control power battery source fails
- ⦿ Insulated Case Circuit Breaker
- ⦿ Backlit 3.5" Color HMI:
 - Provides control & viewing of all the switchgear protective, process control, and configuration setpoints
 - Displays generator set operating parameters, real time system status, and historical list of events/alarms
- ⦿ Complete 3Ø Generator & Bus Metering:
 - True RMS Digital metering with accuracy within 0.3% for voltage & current 0.6% for power & energy
 - Direct 3Ø voltage sensing
 - 0-5 Amp sensing from generator or switchgear CTs
 - Generator metering includes:
 - A, V, Hz, kW, PF, kVAR, kWh, kVARh
 - Bus metering:
 - V, Hz

Protection for Facility Main/Feeders

**Circuit Breaker
Position
Indicating Lights
& Control Switch**

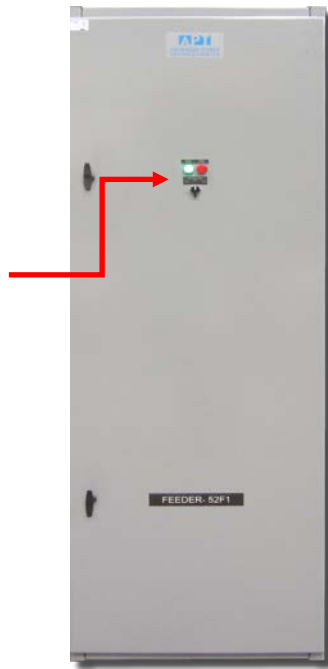


Figure 6: Door Mounted Circuit Breaker Position Indication & Control Switch

**Insulated Case
Circuit Breaker**



Figure 7: Inside Feeder Section

Large & Small Branch Circuit Protection Sections

- ⊙ High visibility, LED type indicating lights with lenses of 1" outside diameter and a service life of 100,000 hours at 77°F
- ⊙ See page 9 for available circuit breaker ratings
- ⊙ Your Choice of Circuit Breakers:
 - Molded Case Circuit Breakers:
 - UL® 489 Listed
 - Available up to 3000A
 - Manually Operated
 - Electrically Operated with Motor Operator Add-on
 - 80% or 100% Rated
 - Fixed Mounted
 - Interrupting Rating:
 - 18kA – 200kA @ 480V_{AC}
 - Circuit breaker position Aux Contacts ("a" and "b")
 - Insulated Case Circuit Breakers:
 - UL® 489 Listed
 - Available from 800A up to 4000A
 - Electrically or Manually Operated
 - 100% Rated
 - Fixed Mounted or Drawout
 - Interrupting Rating:
 - 65kAIC (800 – 2000A)
 - 100kAIC (over 2000A)
 - Circuit breaker position Aux Contacts ("a" and "b")
 - Circuit Breaker Trip Units:
 - LI – Adjustable long time, instantaneous trip settings
 - LSI – Adjustable long & short time, instantaneous trip settings
 - LSIG – Adjustable long & short time, instantaneous trip settings, with ground fault trip settings

Automatic Source Transfer



Figure 8: Automatic Transfer Controls



Figure 9: Automatic Transfer Controls & Protection NEMA 3R



Figure 10: Inside Automatic Transfer Sections

Automatic Transfer Transition Options

- ⊙ Automatic standby with Open Transition return operation:
 - Time delayed control sensor detects if a utility outage has occurred
 - When timer expires, the generator set is automatically started and brought up to speed and voltage
 - Utility circuit breaker opens and generator circuit breaker closes (after adjustable time delay) so that generator supplies power to the site load
 - When a healthy utility is connected for a set time delay, the generator breaker opens and the utility breaker closes and Normal power is restored
- ⊙ Call APT for Automatic standby with (Soft loading/Unloading) operation or Sustained Utility Paralleling operation
- ⊙ Automatic standby with Closed Transition return operation:
 - Time delayed control sensor detects if a utility outage has occurred
 - When timer expires, the generator set is automatically started and brought up to speed and voltage
 - Utility circuit breaker opens and generator circuit breaker closes (after adjustable time delay) so that generator supplies power to the site load
 - When a healthy utility is connected for a set time delay and the generator is synchronized with the utility, the generator circuit breaker shall open within 100ms and Normal power is restored

Motor Starting, Protection, & Control

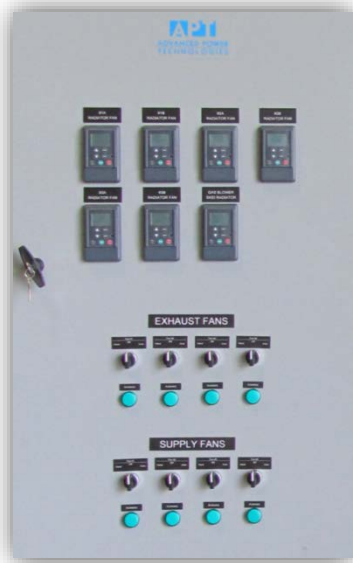


Figure 11: Thru Door Motor Controls



Figure 12: Motor Control Section with Ventilation



Figure 13: Motor Drives & Protection

Motor VFDs, Soft Starts, Contactors Sections

- ⊙ Single Phase and Three Phase (115V – 575V) motor controls
- ⊙ 0.5HP – 400HP drives in a single standard section
- ⊙ Over 400HP through 800HP drives can be housed in larger custom sized sections
- ⊙ Hand-Off-Auto control switches and activity indicating lights gives users the ability to control motors from the control panel
- ⊙ Terminal blocks as needed for customer field connections
- ⊙ Able to house:
 - Variable Frequency Drives
 - Motor Soft Starters
 - Manual Starters
 - Motor Controller Contactors
 - Overload Relays
 - Full Voltage Non-Reversing Starters
 - Full Voltage Reversing Starters
- ⊙ Air Flow cutouts ensure proper cooling for the number of devices

Temporary Generator / Load Bank

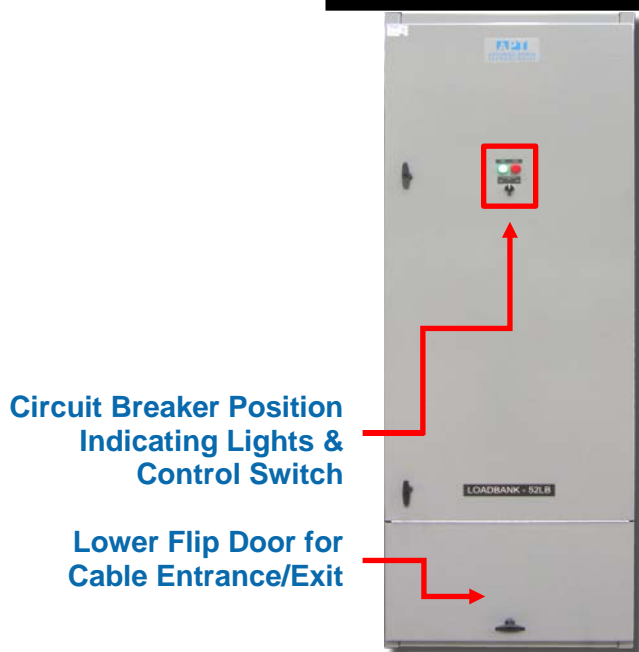


Figure 14: Quick Connect Section

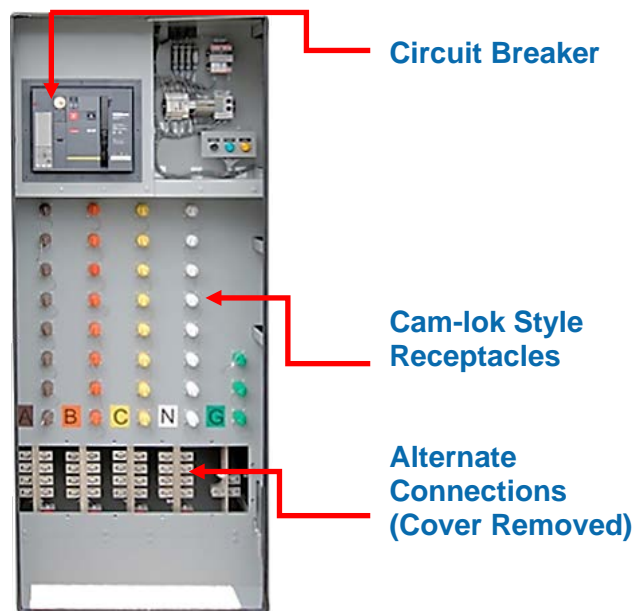


Figure 15: Inside GQC Section

Integrated Generator / Load Bank Quick Connection

- ⊙ Per NEC 700.3, temporary generator connection applications require either mechanical or electrical interlocking of the power sources to safely prevent the inadvertent paralleling of the normal & emergency power sources:
 - Service Entrance Rated Manual Transfer Switchboard (two integrated keys)
 - Utility service entrance circuit breaker with mechanical key interlock
 - Temporary generator circuit breaker with mechanical key interlock
 - Temporary Generator Connection Only
 - External service main no temporary generator circuit breaker protection
 - One integrated mechanical key interlock, one ship loose with mechanical key interlock for installation on facility service main
 - Multiple generators or feeders circuit breaker sections (multiple mechanical key interlocks, transfer block)

- ⊙ Operation sequence without the interlocking of sources is available for systems that achieve NEC 700.3 source interlocking externally
- ⊙ Loadbank connection only applications
 - Easily connects a temporary loadbank to a facility's permanent generator(s)
 - Utilizes female cam-lok type receptacles
 - Does not require the use of interlocking
 - Circuit breaker and monitoring options available
- ⊙ Integrated Generator & Loadbank Quick Connection
 - Integrates male & female cam-loks into one unit for all your temporary connection needs in one location
 - Dual-purpose termination cabinet allows for safe and clean connection of a portable temporary generator or loadbank
- ⊙ Alternatively, cam-lok gender changeover adapters are available to convert Generator Quick Connection into Loadbank Quick Connection*

*Subject to implemented options

Circuit Breaker Ratings

Table 1: Available Circuit Breaker Ratings

Breaker Type	Frame Rating (A)	Interrupting Rating (kA)			Sensor Plug (A)
		240V	480V	600V	
Drawout	800	65	65	50	100, 250, 400, 600, 800
		100	100	85	
		200	150	100	
		200	150	100	
	1200	65	65	50	600, 800, 1000, 1200
		100	100	85	
		200	150	100	
		200	150	100	
	1600	65	65	50	800, 1000, 1200, 1600
		100	100	85	
		200	150	100	
		200	150	100	
	2000	65	65	50	1000, 1200, 1600, 2000
		100	100	85	
		200	150	100	
		200	150	100	
	2500	100	100	85	1200, 1600, 2000, 2500
		200	150	100	
	3000	100	100	85	1600, 2000, 2500, 3000
		200	150	100	
	4000	100	100	85	2000, 2500, 3000, 4000
		200	150	100	
	5000	100	100	85	2500, 3000, 4000, 5000
		200	150	100	
	6000	100	100	85	3000, 4000, 5000, 6000
		200	150	100	
Fixed	800	65	65	50	100, 250, 400, 600, 800
		100	100	85	
	1200	65	65	50	600, 800, 1000, 1200
		100	100	85	
	1600	65	65	50	800, 1000, 1200, 1600
		100	100	85	
	2000	65	65	50	1000, 1200, 1600, 2000
		100	100	85	
	2500	100	100	85	1200, 1600, 2000, 2500
	3000	100	100	85	1600, 2000, 2500, 3000
	4000	100	100	85	2000, 2500, 3000, 4000
	5000	100	100	85	2500, 3000, 4000, 5000
	6000	100	100	85	3000, 4000, 5000, 6000

Typical GG Applications

Generator Only Configurations

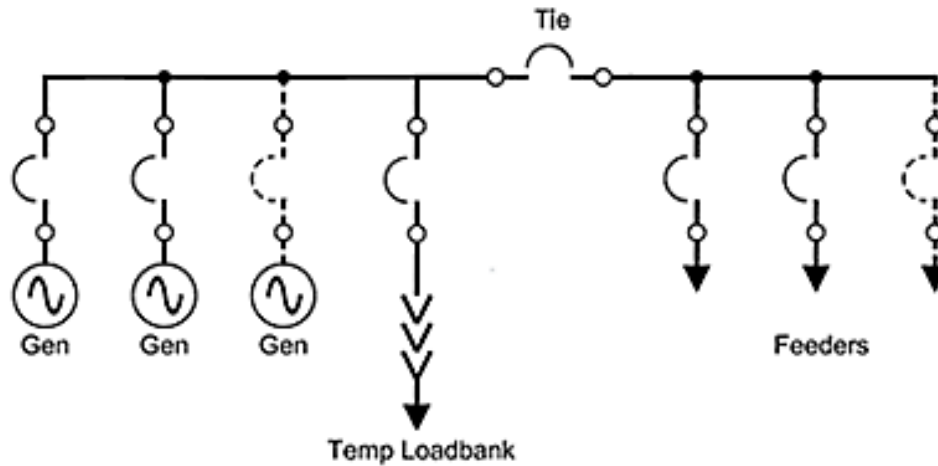


Figure 16: Generator Paralleling with Temporary Loadbank Quick Connection, Gen Bus Tie & Distribution Feeders

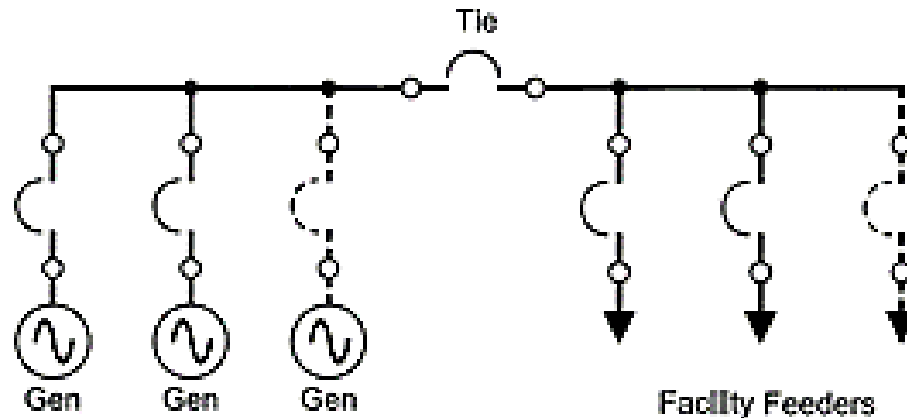


Figure 17: Generator Paralleling with Gen Bus Tie & Distribution Feeders

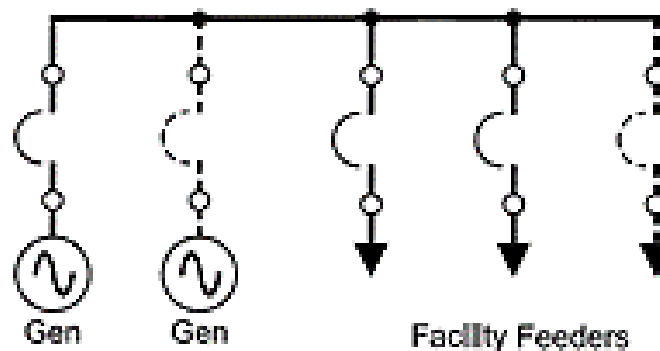


Figure 18: Single Generator or Generator Paralleling with Distribution Feeders

Typical UU Applications

Utility Source Only Configurations

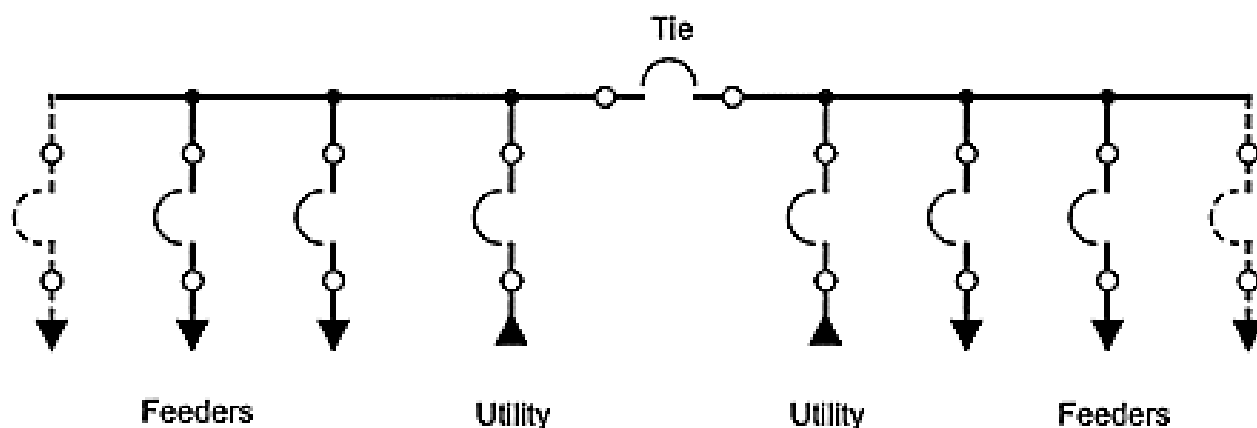


Figure 19: Two Utility Sources Main-Tie-Main with Feeders on Both Ends of the Tie

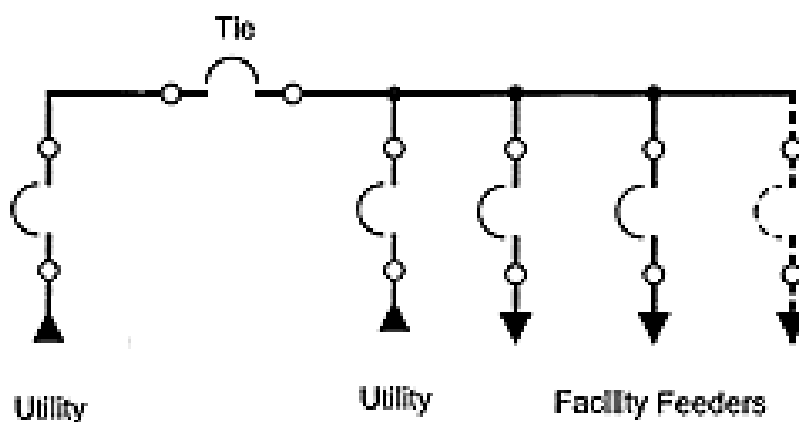


Figure 20: Backup Utility Source Main-Tie-Main with Feeders on One End of the Tie

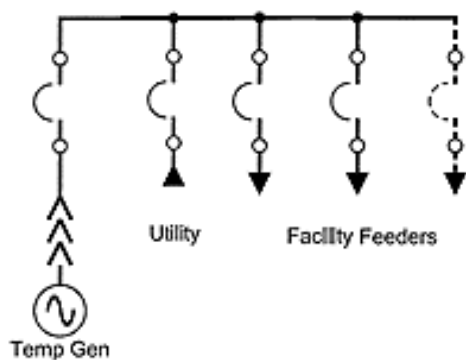


Figure 21: Utility with Temporary Generator Back Up

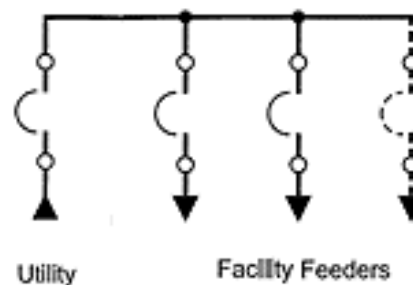


Figure 22: Single Utility with Distribution Feeders

Typical UG Applications

Utility & Generator Configurations

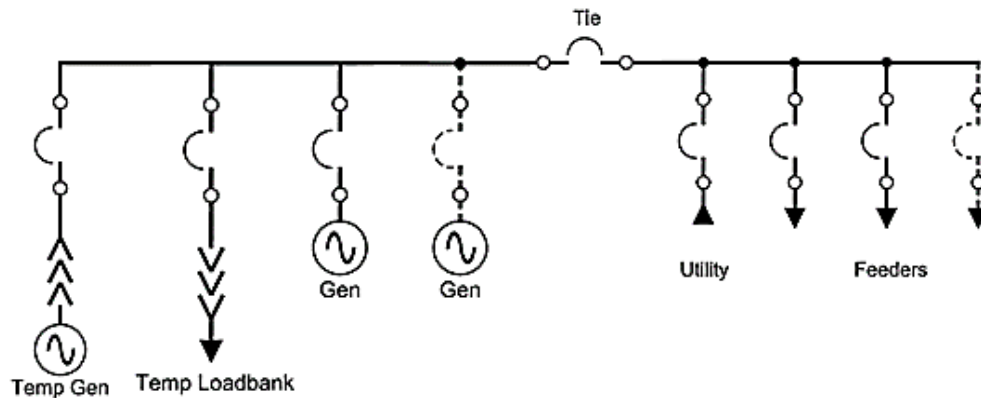


Figure 23: Generator Paralleling with Temporary Generator & Load Bank Quick Connection, Gen Bus Tie, Normal Utility & Distribution Feeders

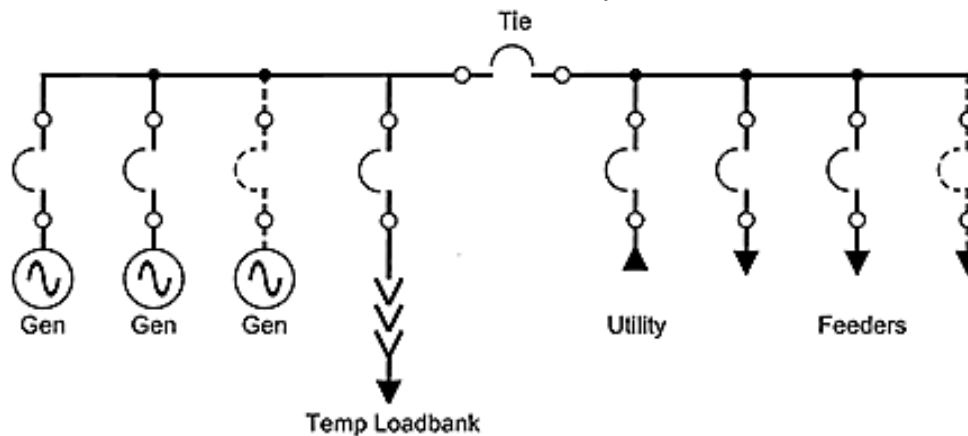


Figure 24: Generator Paralleling with Temporary Generator & Load Bank Quick Connection, Gen Bus Tie, Normal Utility & Distribution Feeders

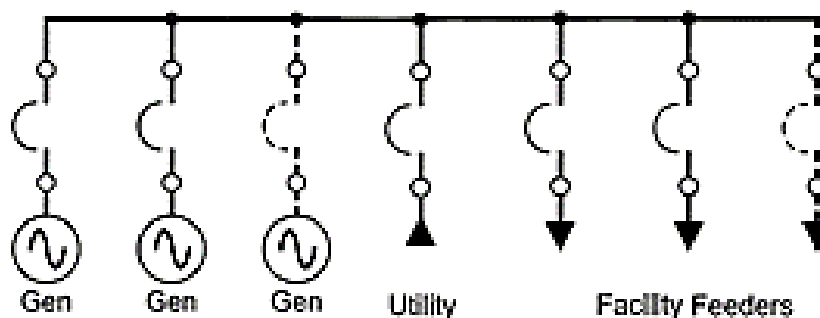


Figure 25: Generator Paralleling Peak Shaving with Normal Utility & Distribution Feeders

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 industry. 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 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 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.