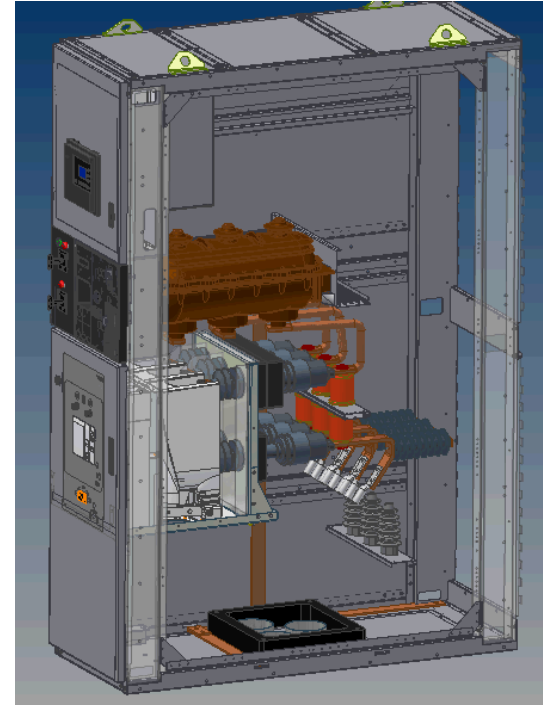


New Solutions with Medium Voltage SPS Metal-Enclosed Switchgear



Mike Bukovitz, P.E.
Vice-President, Power Systems Business

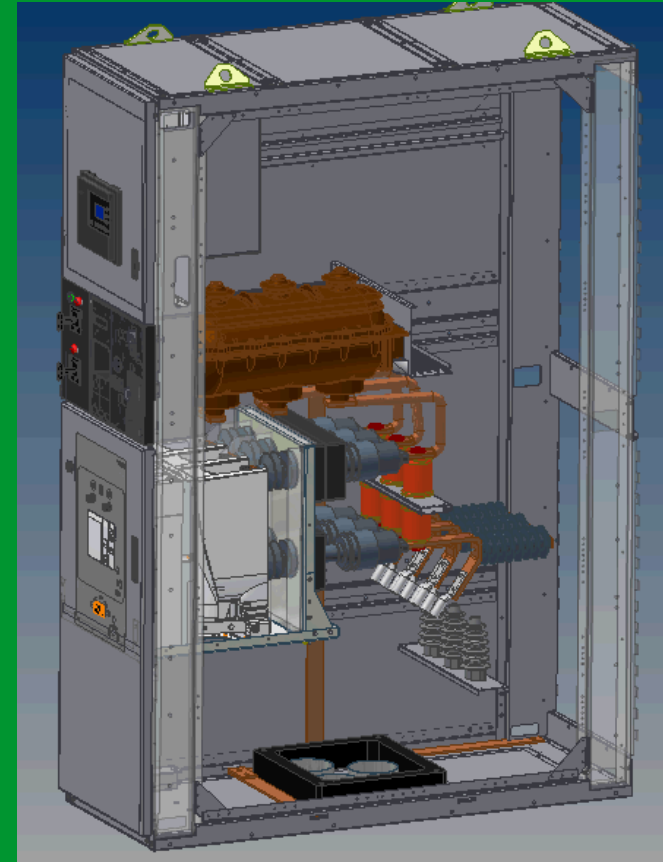
Why SPS Hybrid Metal-Enclosed Switchgear instead of Metal-Clad?

50% of applications only require up to 1200A, 25kA, 15kV

Advantages:

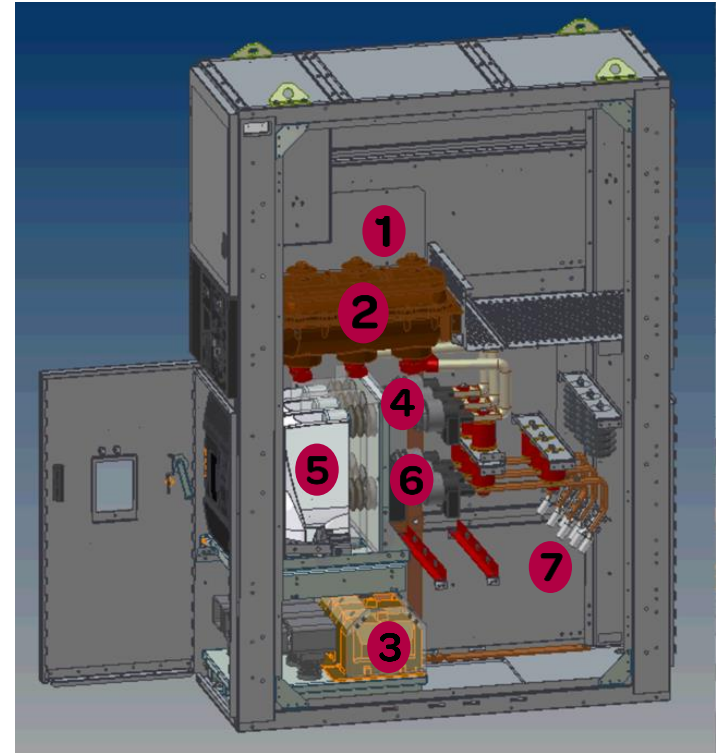
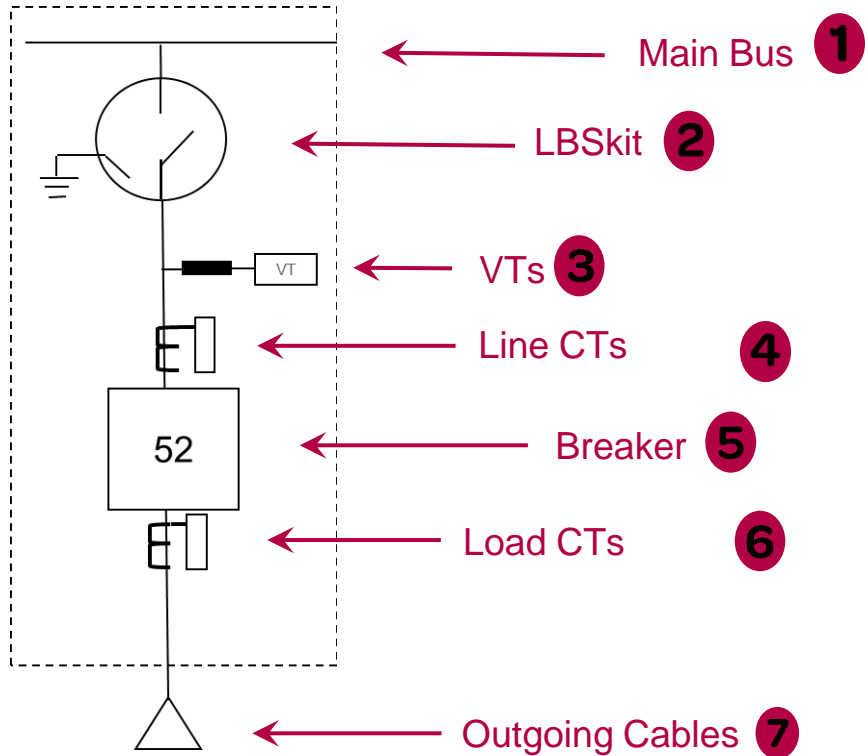
- VCB (Vacuum Circuit Breaker) vs. Fuses
- Space: Smaller Footprint
- Safety:
 - » Arc-Resistant construction
 - » No arc-rated PPE required for switching
 - » Integrated grounding
 - » Remote Operation
 - » Compartmentalized
- Cost Effective:
 - » Lower Price
 - » Lower Maintenance

Ratings:	600, 800 & 1200A, 25kA interrupting 4.76kV 60kV BIL 15.0kV, 95kV BIL
Enclosure:	NEMA Type 1 Enclosure (indoor) NEMA Type 3R (outdoor) Arc Resistant Isolation Switch 90" height x 26" width x 65" depth
Components:	Isolation Switch + Ground Switch Removable Vacuum Circuit Breaker Drawout Vacuum Circuit Breaker Arc Flash (12m) Circuit Breaker
Standards:	Switchgear – Metal Enclosed IEEE C37.20.3 Breaker – C37.04, C37.06, C37.09
Accessories:	Accessories: <ul style="list-style-type: none"> • Breaker & disconnect remote control • Arc Flash Relays • Arc Quenchers™



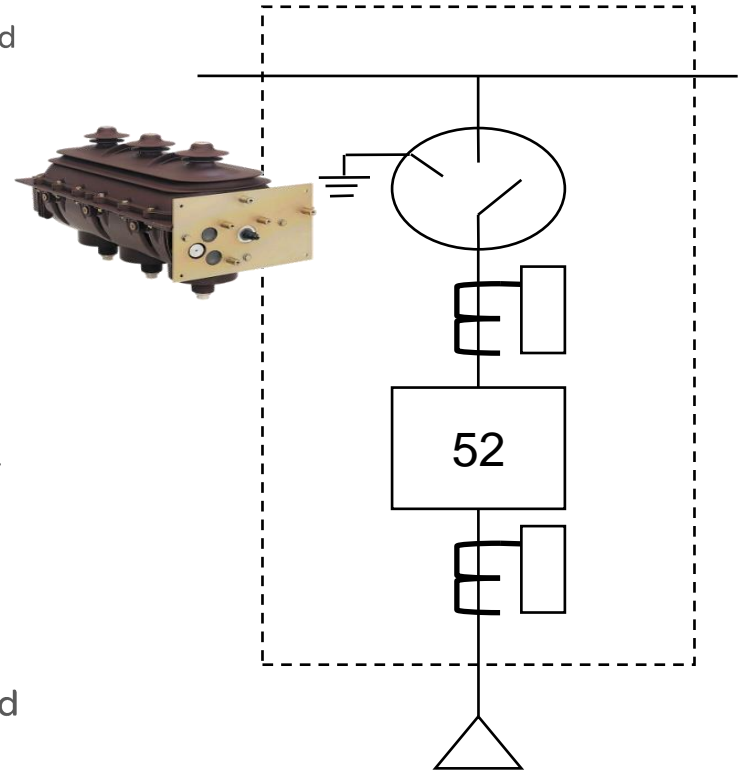
SPS Hybrid Metal-Enclosed Switchgear

Feeder Section – Side View



Why use the Schneider Electric LBSkit?

- Disconnect is used as isolation device, hence the SF6 (sulfur Hexafluoride) is an insulation medium only in this design (except for in duplex transformer primary – where it can be used as load break switch)
- Vacuum interrupter is used for nominal current & fault interruption.
- Disconnect is sealed for life - Over 1 million units of the disconnect installed world wide with SF6 leaks.
- Recover & Recycle - Since interruptions are not done in SF6 – the gas does not change state hence can be recovered & recycled at end of equipment life.
- Space Savings is Permanent - Use of SF6 disconnects allows for shrinking the footprint by 35% to comparable air insulated switchgear.



Space Savings

Front Accessibility

Allows for against the wall installation
Eliminates the requirement of NEC governed rear aisle space

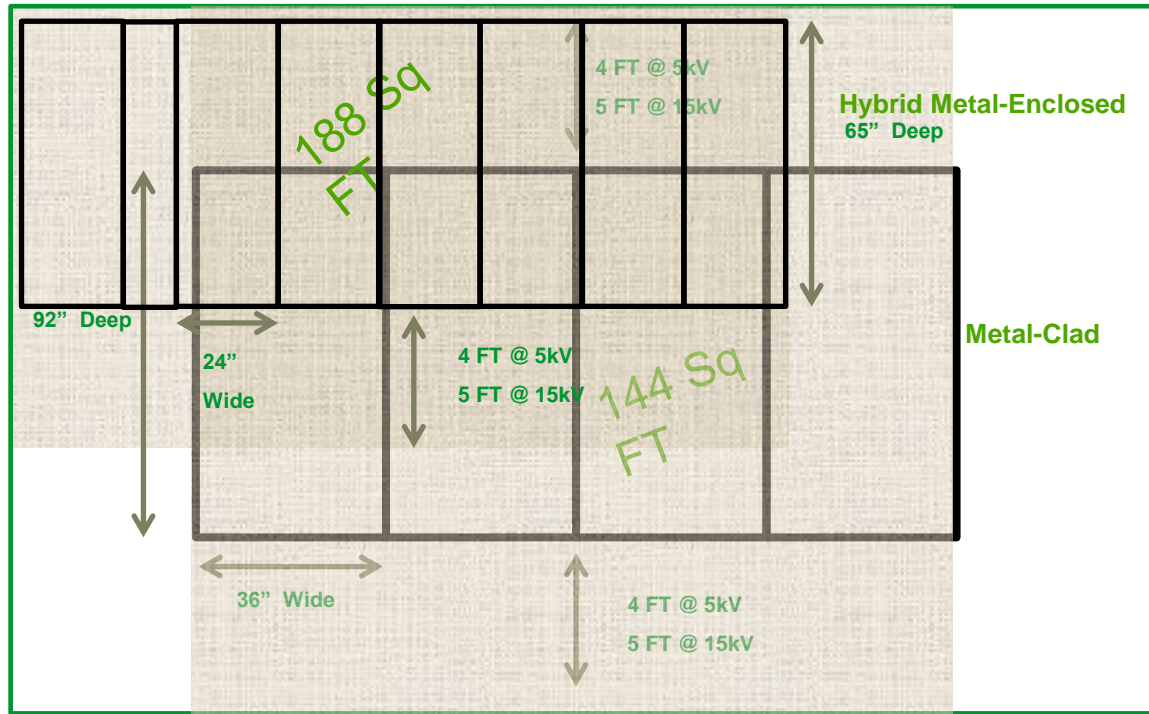
Small Footprint

Reduces square footage necessary for installation
Intergal Plenum helps reduce installation cost

Single High Breaker

Optimizes square footage use

Can be close-coupled



(Calculation with 1 main with VT & CPT, 6 Feeders at 5kV)

SPS Hybrid Metal-Enclosed Switchgear

Space Efficient

- Small footprint reduces 35% floor space
- Small enough to fit into compact locations

Safety

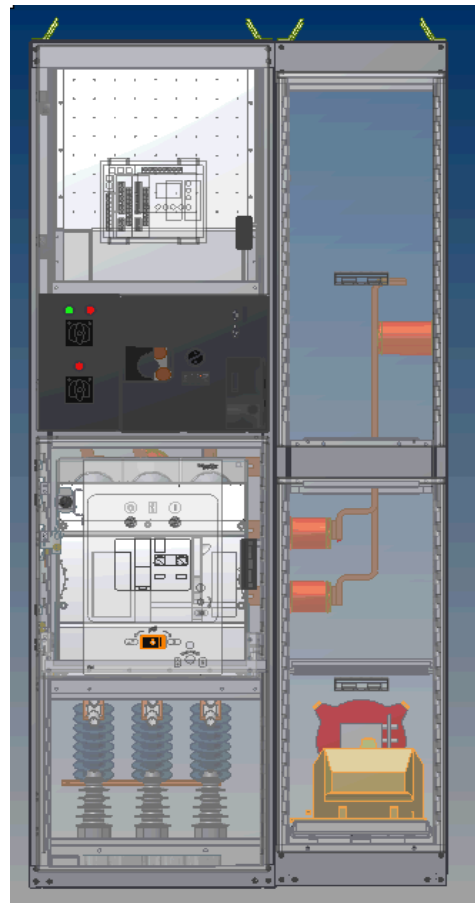
- Integrated safety features allow for increased protection of personnel
- Arc Resistant
- Integrated Grounding

Reduced Cost

- Lowest initial cost offer for a VCB
- Reduced maintenance intervals

Front and Rear Accessible Designs

- Front only or front/rear designs available



Maintainability

Breaker Swap: I have done it myself in < 15 minutes

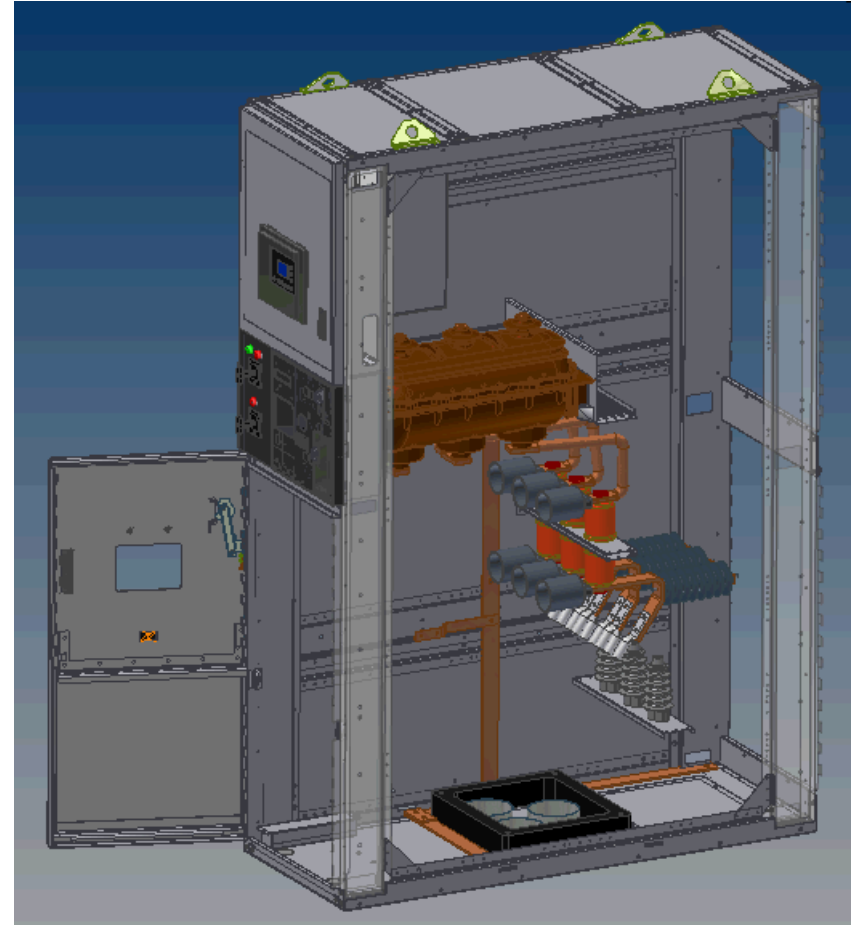
Breaker assembly along w/ CT's & CT bushings are removed from cubicle for easy cabling access



Tavrida



Evolis



Hybrid Metal-Enclosed Switchgear

Vacuum Circuit Breakers

Evolis
Tavrida
Others

Compartmentalized

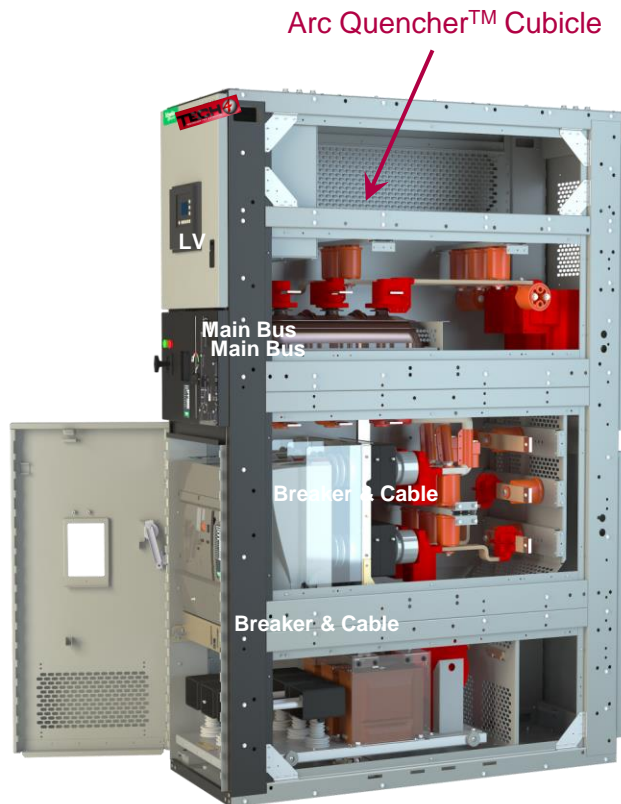
Prevents access to
unintended parts

Integral Grounding

Grounding of
compartment before
access

Targeted Maintenance

10 years...breaker mounting
helps achieve longer
maintenance interval



Interlocked Operation

Set sequence of operation

Only allows access to
compartments in de-energized &
ground state

Cable Connections

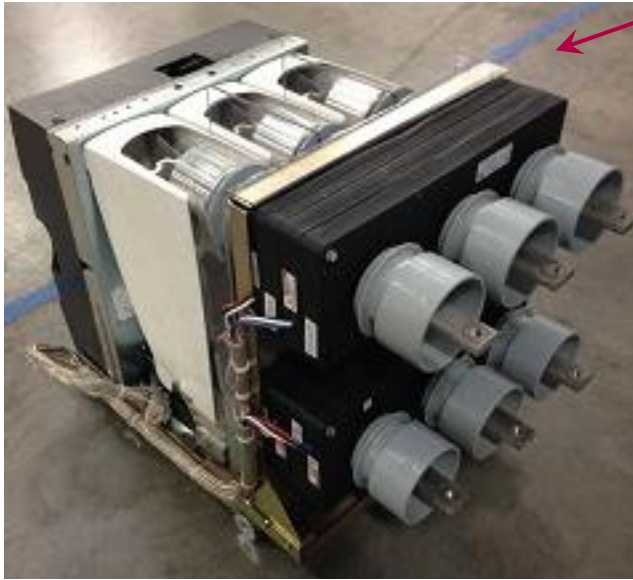
Optional top and bottom cable
connects allows for flexible entry

Evolis Vacuum Circuit Breaker

Mechanism common with
Masterpact LV Breaker; more
than 1 million units sold

10,000 mechanical operations
endurance

3 cycle interruption



Rear View

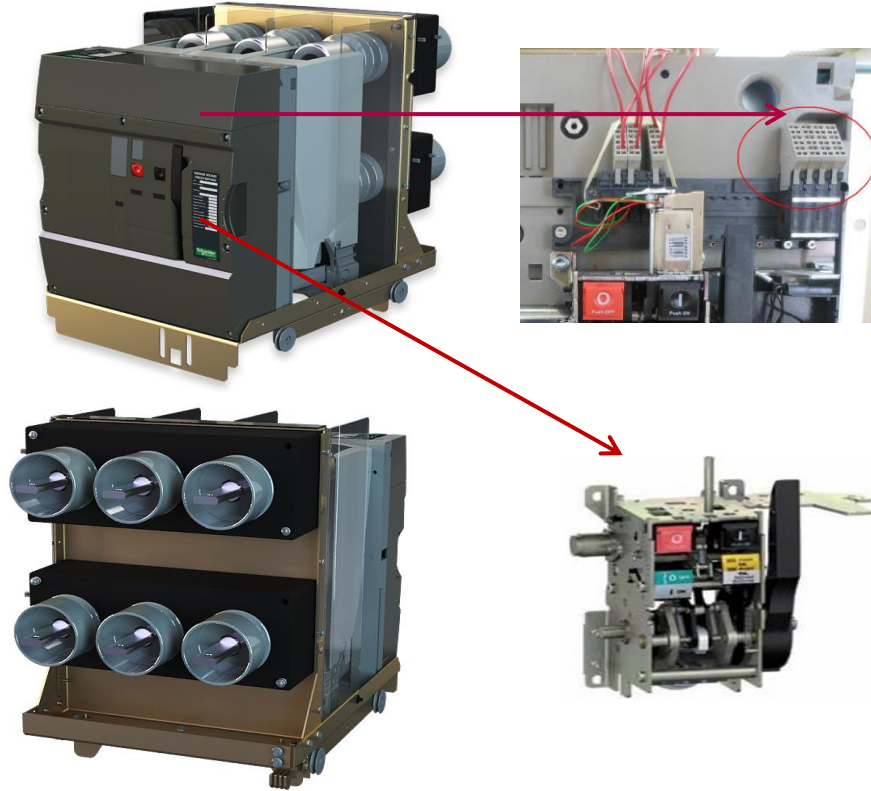


Front View



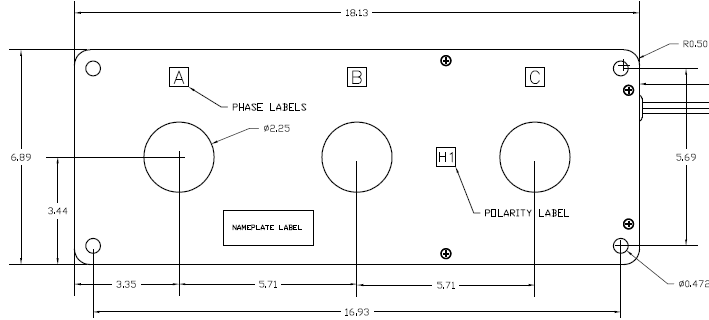
Mechanism

Evolis Breaker



- 3 poles integrated in a “sealed pressure system” type insulating enclosure.
- A P2 type, spring-operated stored energy control mechanism, electrifiable.
- A front panel housing the manual operating mechanism and status indicators
- Upstream and downstream terminals for the power circuit connection
- A terminal block for connection of external auxiliary circuits

Current Transformers



High Accuracy

CATALOG NUMBER	CURRENT RATIO	RELAY CLASS	ANSI METERING CLASS @ 60 HZ					THERMAL RATING	
			B0.1	B0.2	B0.5	B0.9	B1.8	30°C	55°C
CT481-500	50:5	-	4.8	-	-	-	-	1.5	1.33
CT481-750	75:5	C10	2.4	2.4	-	-	-	1.5	1.33
CT481-101	100:5	C10	1.2	1.2	2.4	-	-	1.5	1.33
CT481-151	150:5	C20	0.6	1.2	1.2	2.4	4.8	1.5	1.33
CT481-201	200:5	C20	0.6	0.6	1.2	2.4	4.8	1.5	1.33
CT481-251	250:5	C20	0.3	0.6	0.6	1.2	2.4	1.5	1.33
CT481-301	300:5	C20	0.3	0.3	0.6	1.2	2.4	1.5	1.33
CT481-401	400:5	C50	0.3	0.3	0.3	0.6	1.2	1.5	1.33
CT481-501	500:5	C50	0.3	0.3	0.3	0.3	0.6	1.5	1.33
CT481-601	600:5	C100	0.3	0.3	0.3	0.3	0.6	1.5	1.33
CT481-751	750:5	C100	0.3	0.3	0.3	0.3	0.3	1.5	1.33
CT481-801	800:5	C100	0.3	0.3	0.3	0.3	0.3	1.5	1.33
CT481-102	1000:5	C100	0.3	0.3	0.3	0.3	0.3	1.5	1.33
CT481-122	1200:5	C200	0.3	0.3	0.3	0.3	0.3	1.5	1.33

Standard Accuracy

CATALOG NUMBER	CURRENT RATIO	RELAY CLASS	ANSI METERING CLASS @ 60 HZ					THERMAL RATING	
			B0.1	B0.2	B0.5	B0.9	B1.8	30°C	55°C
CT480-500	50:5	-	4.8	-	-	-	-	1.5	1.33
CT480-750	75:5	-	4.8	4.8	-	-	-	1.5	1.33
CT480-101	100:5	-	2.4	2.4	-	-	-	1.5	1.33
CT480-151	150:5	C10	1.2	2.4	2.4	4.8	-	1.5	1.33
CT480-201	200:5	C10	0.6	1.2	2.4	2.4	4.8	1.5	1.33
CT480-251	250:5	C10	0.6	0.6	1.2	2.4	4.8	1.5	1.33
CT480-301	300:5	C20	0.3	0.6	0.6	1.2	2.4	1.5	1.33
CT480-401	400:5	C20	0.3	0.3	0.6	0.6	1.2	1.5	1.33
CT480-501	500:5	C50	0.3	0.3	0.3	0.6	0.6	1.5	1.33
CT480-601	600:5	C50	0.3	0.3	0.3	0.6	0.6	1.5	1.33
CT480-751	750:5	C50	0.3	0.3	0.3	0.6	0.6	1.5	1.33
CT480-801	800:5	C50	0.3	0.3	0.3	0.6	0.6	1.5	1.33
CT480-102	1000:5	C50	0.3	0.3	0.3	0.3	0.3	1.5	1.33
CT480-122	1200:5	C100	0.3	0.3	0.3	0.3	0.3	1.5	1.33

Tavrida Arc Flash Mitigation Circuit Breakers



5kV & 15kV



27kV & 34.5kV

5 year warranty

30,000 operations AT
FULL LOAD

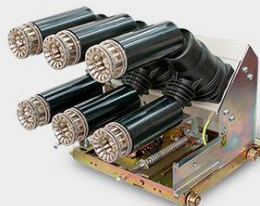
12ms opening time!

- Arc Flash Mitigation
- Reduce system stress

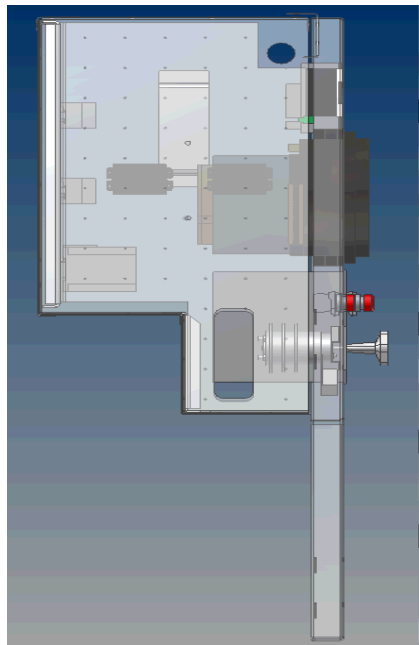
Tavrida Electric draw-out vacuum circuit breakers

Tavrida Electric develops and manufactures draw-out vacuum circuit breakers with lightest weight (only 72 kg) and the fastest opening time (only 12 ms*) VCBs on the market. The circuit breaker is maintenance free and guarantees long mechanical and electrical life. Draw out units are assembled to be easily integrated into existing switchgear designs. Complete with the rack-in cassette, guide-arms, tulip contacts and safety interlocks Tavrida Electric withdrawable vacuum circuit breakers are perfectly suited for draw-out panels manufacturing.

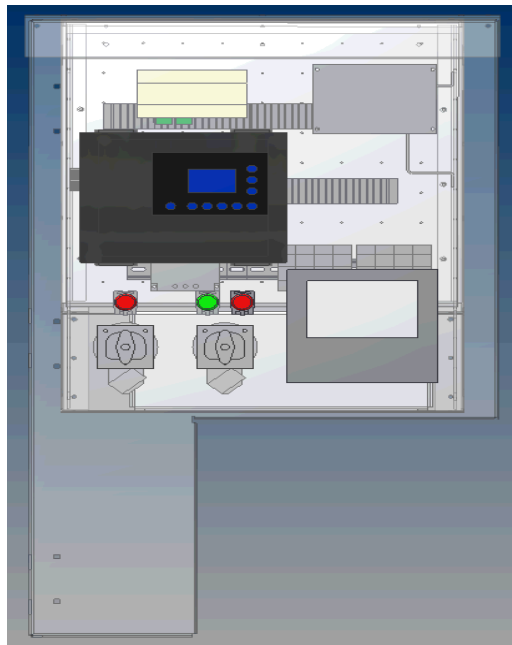
*Special configuration available with opening times of 12 ms and closing times of 24 ms.



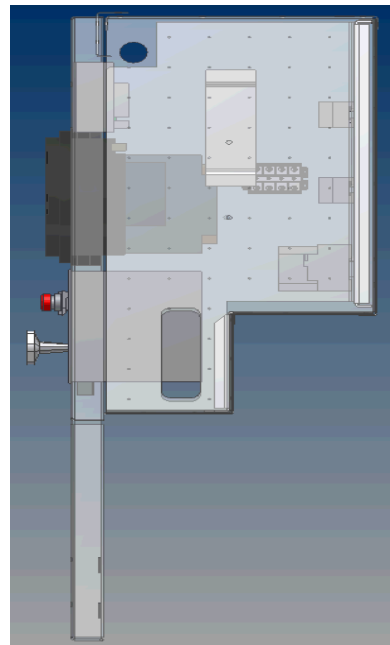
Low Voltage Compartment



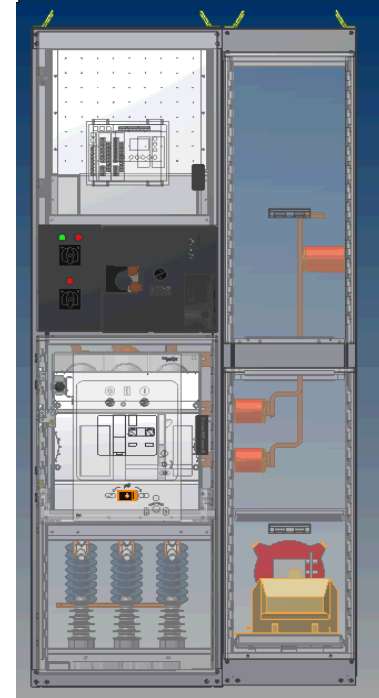
Left Side



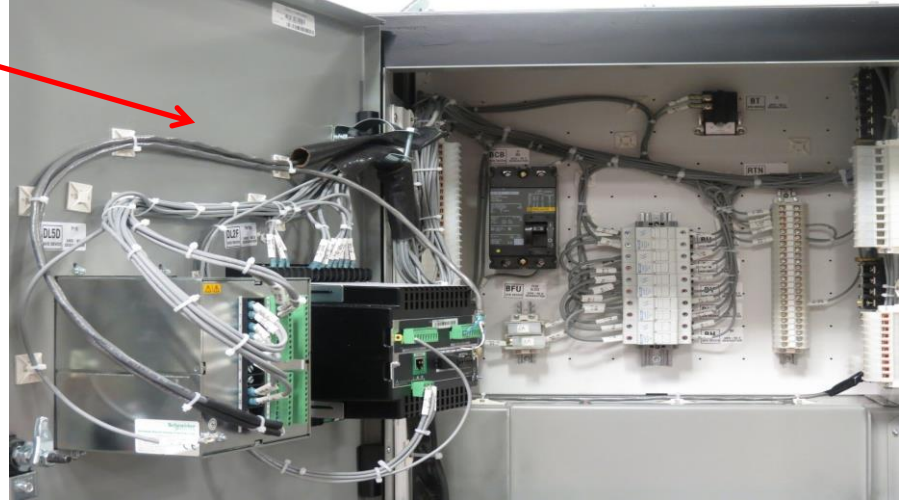
Front



Right Side



Low Voltage Compartment



Voltage and Control Power Transformer Compartment

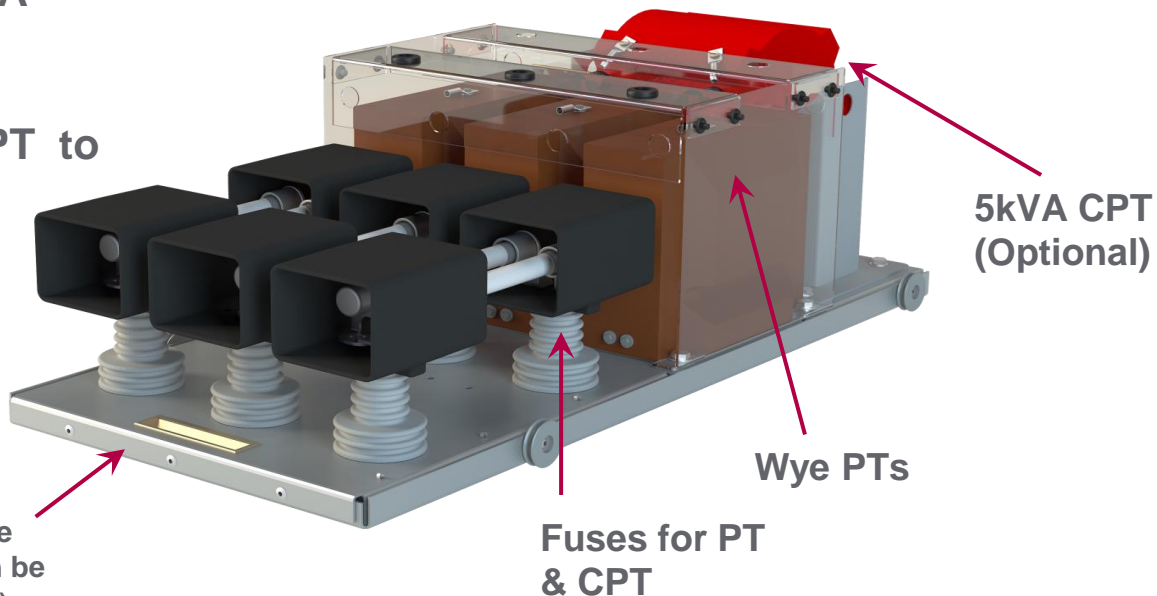
VTs:

Thermal Burden – 300VA

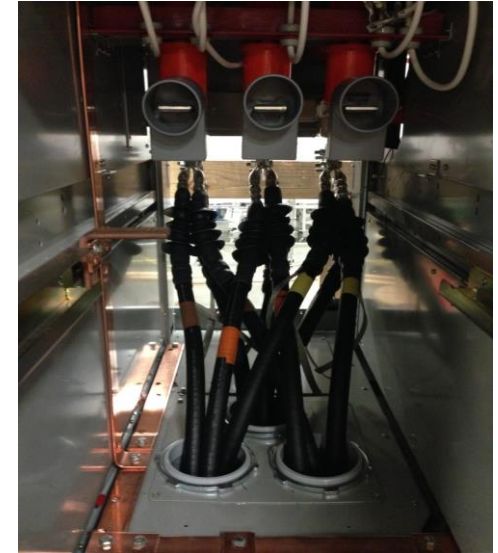
Accuracy – 0.3 WXY

Secondary – 120V

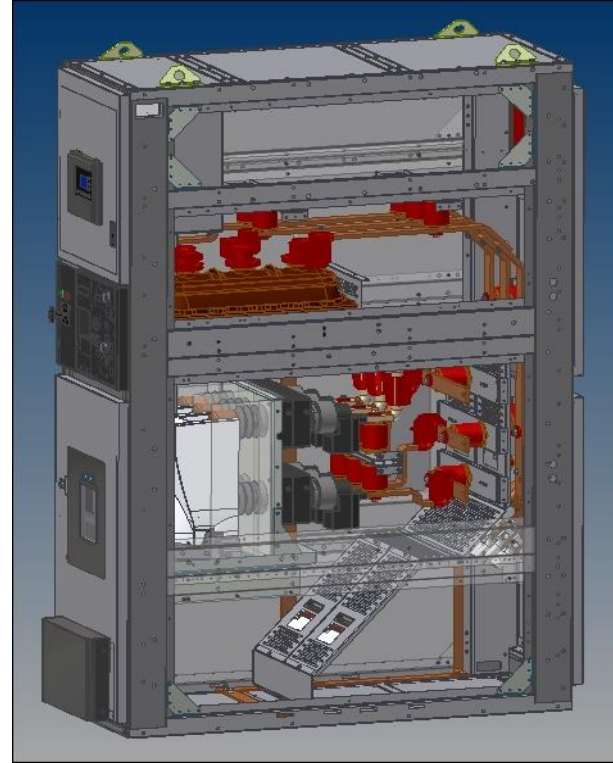
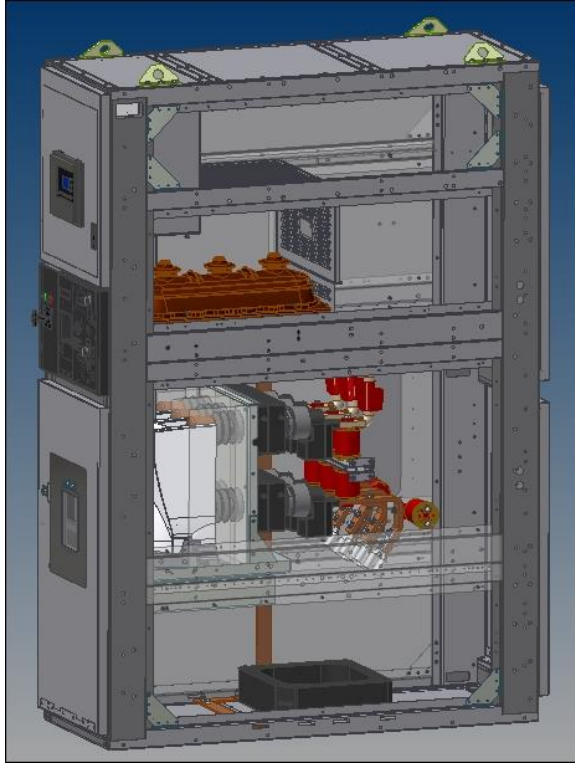
**Low Partial Discharge PT to
meet IEC 60044-2**



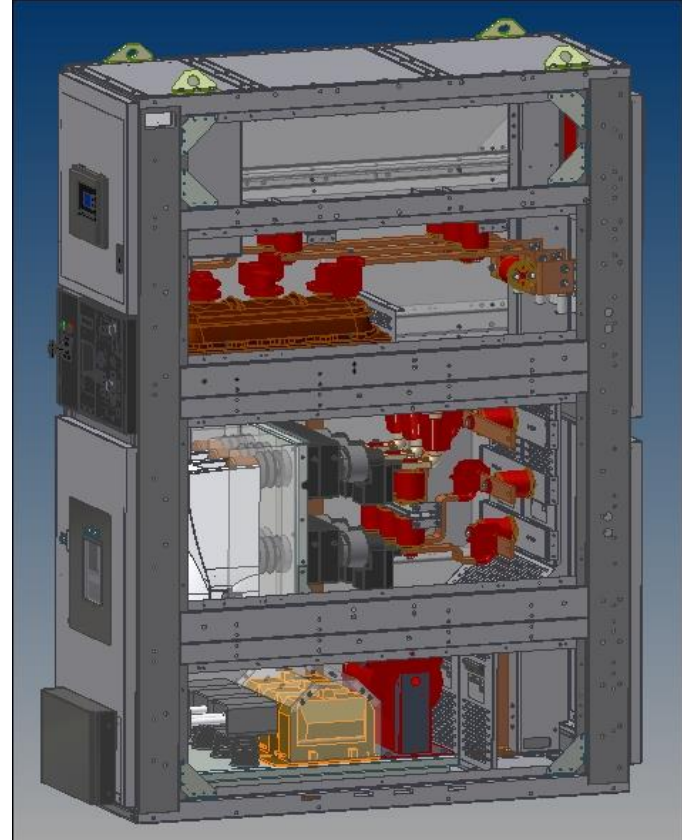
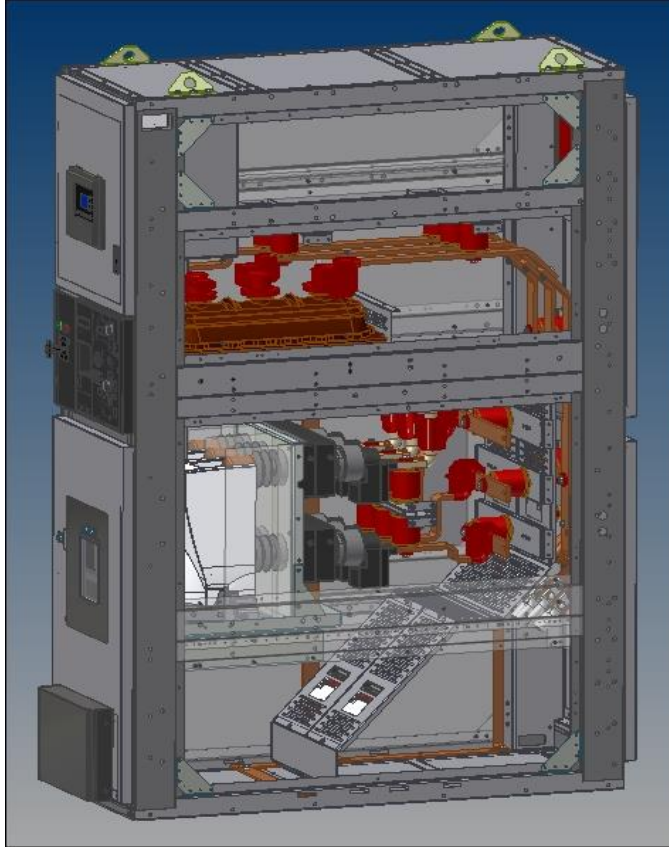
Cable Compartment



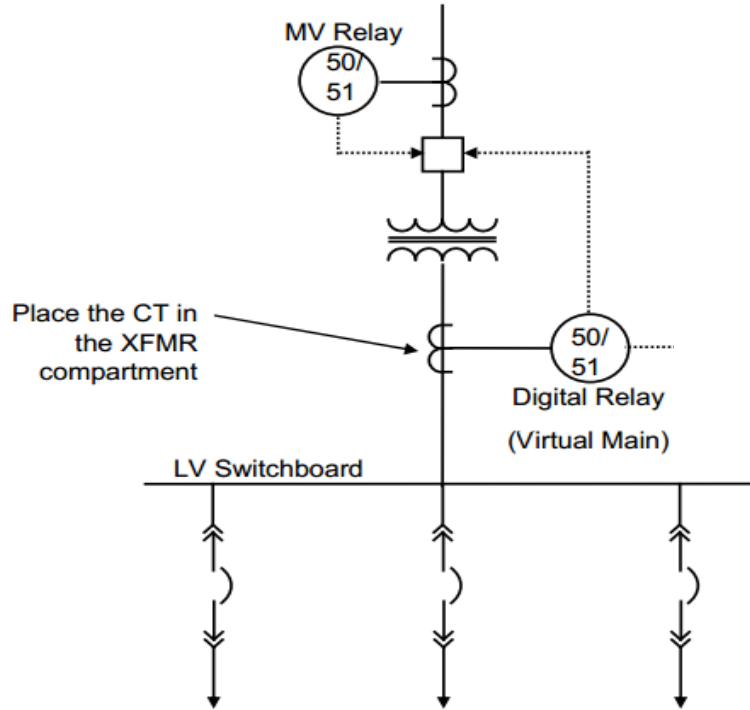
Front & Rear Accessible Design



Main Breaker



Use as a Virtual Main Transformer Primary



Improved Safety

- Incident energy reduction even with no secondary main breaker
- Arc Quenchers™ and Arc Flash Protective Relays

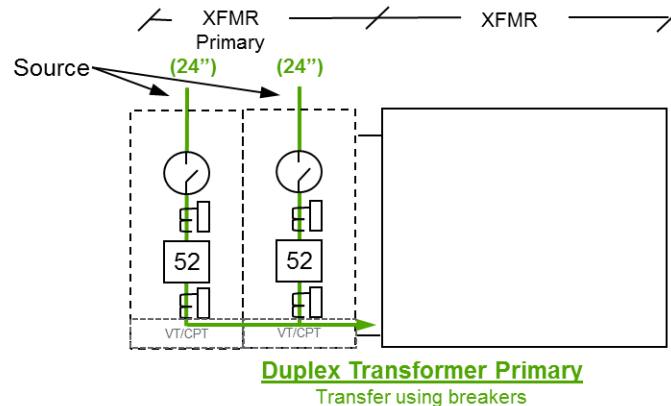
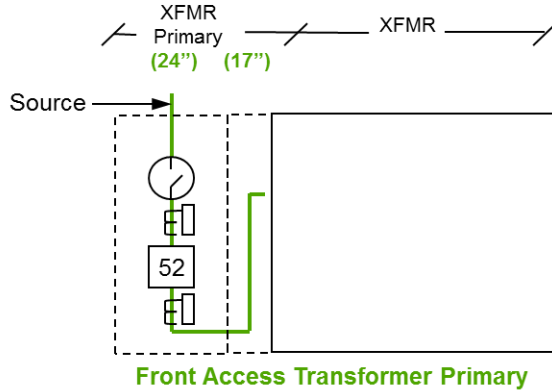
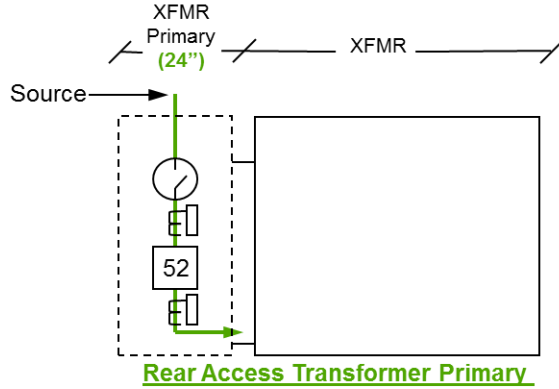
Improved Coordination

- Greater coordination vs. fuses

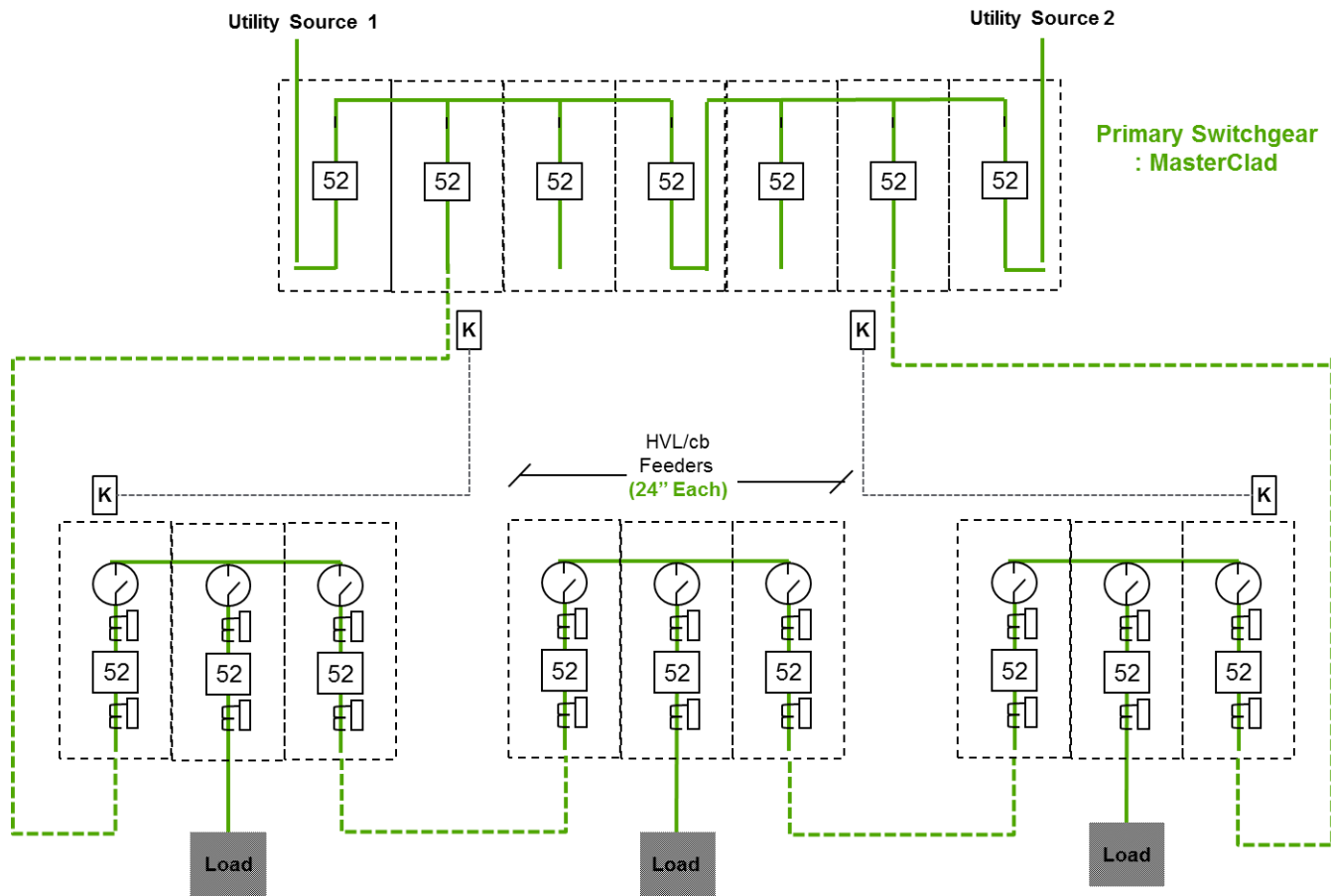
Compact Sizes

- Small size allows for easier retrofits

Applications - Transformer Primary



Applications - Ring Network



SPS Hybrid Metal-Enclosed Switchgear Benefits Summary

- Reliability – 30,000 Full Load Break (Tavrida)
- Maintainability – 10-year cycle
- Safety – IEEE C37.20.7 + Arc Quenchers™
- Cost savings – 30%-40% less than metal-clad

Support Available from L-3

- LBSkit Catalog
- SPS Brochures
- Arc Quencher Brochures
- Arc Quencher Manuals
- Arc Quencher System Sample Drawings
- Evolis Circuit Breaker Manual
- Tavrida Circuit Breaker Brochure & Manual
- SPS Sample Drawings
- Arc Flash Mitigation Toolbox (NEC 240.87 + NFPA 70E Annex O)

Thank you for your time!

- Mike Bukovitz, P.E.
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