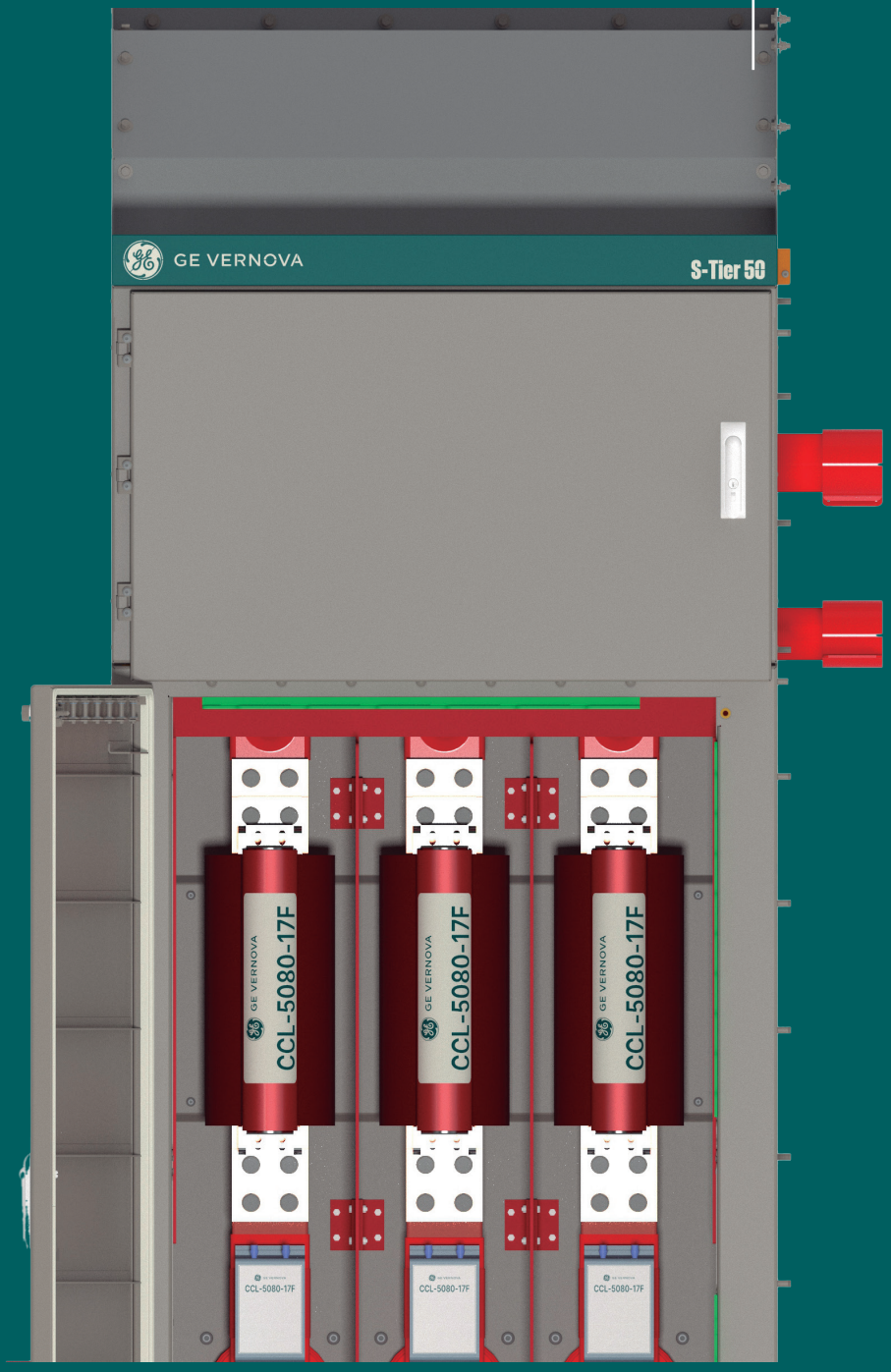
GE VERNOVA

Power Conversion & Storage

CCL

COMMUTATING CURRENT LIMITER



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GE VERNOVA

THE ENERGY TO CHANGE THE WORLD

GE Vernova Power Conversion & Storage
As innovators in advanced energy conversion and storage systems, we empower our utility and industrial customers by solving their most challenging electrification problems and accelerating their transition to a sustainable, decarbonized future.

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WHAT WE DO

Innovation is our DNA. More than 2,000 engineers and R&D associates collaborate with GE Vernova's Global Research Business to advance fundamental energy conversion technologies.

Our expertise includes pioneering developments in superconductivity, energy storage, power systems, high-speed motors, permanent magnet generators and high-voltage direct current systems.

Our mission is to transform energy to improve customer processes. We solve recurring problems such as turning electrical energy into mechanical energy by a motor, turning mechanical energy into electrical energy by a generator or adjusting the frequency and current by means of a converter or inverter

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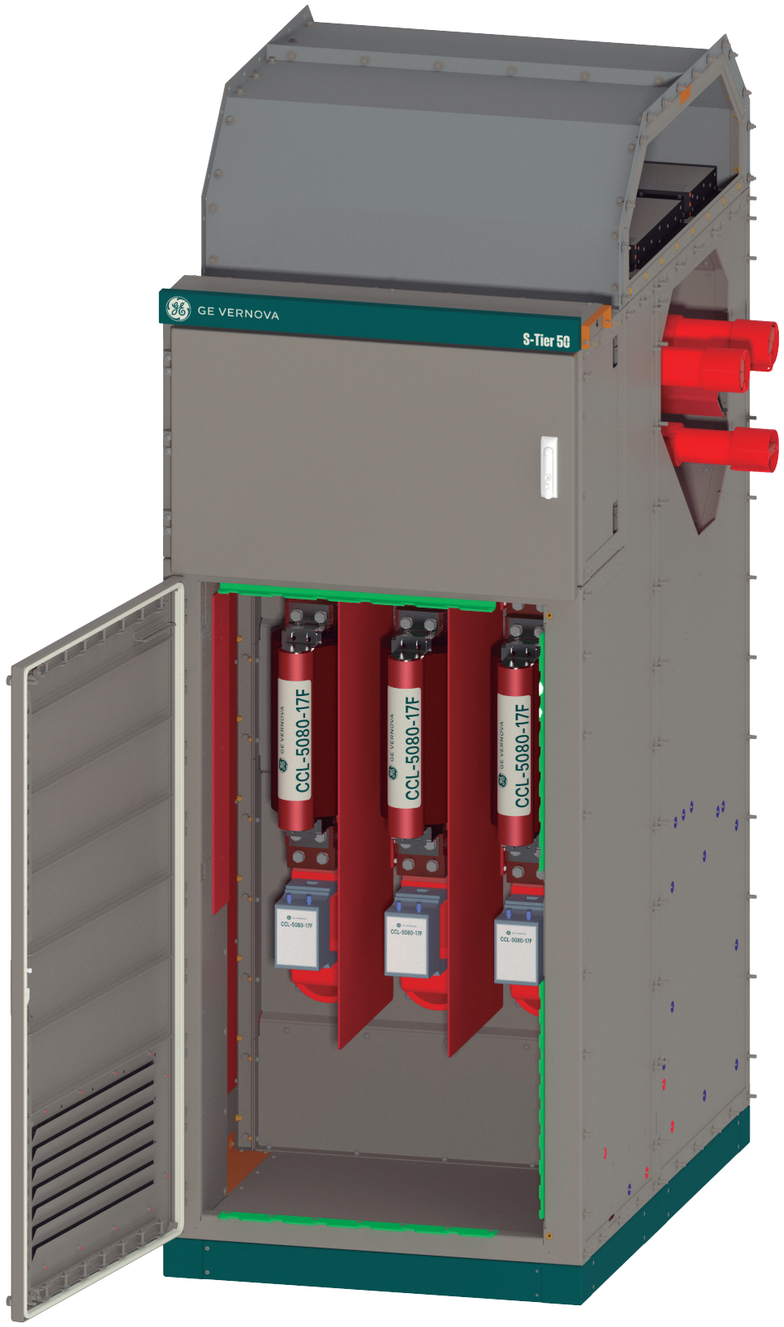


CONTENT

GE VERNOVA

ALIGNING GE VERNOVA'S BUSINESS SUCCESS WITH SUSTAINABILITY SUCCESS

OUR SUSTAINABILITY FRAMEWORK

ELECTRIFY

Catalyze access to more secure, sustainable, reliable, and affordable electricity, and help drive global economic development

LEADING GOALS

Be a leading provider of new power generating capacity and grid capacity for the world

Be a leading provider of

Address electrification in regions underserved by reliable, affordable, and sustainable electricity

Support workforce development, with a focus on underserved populations globally

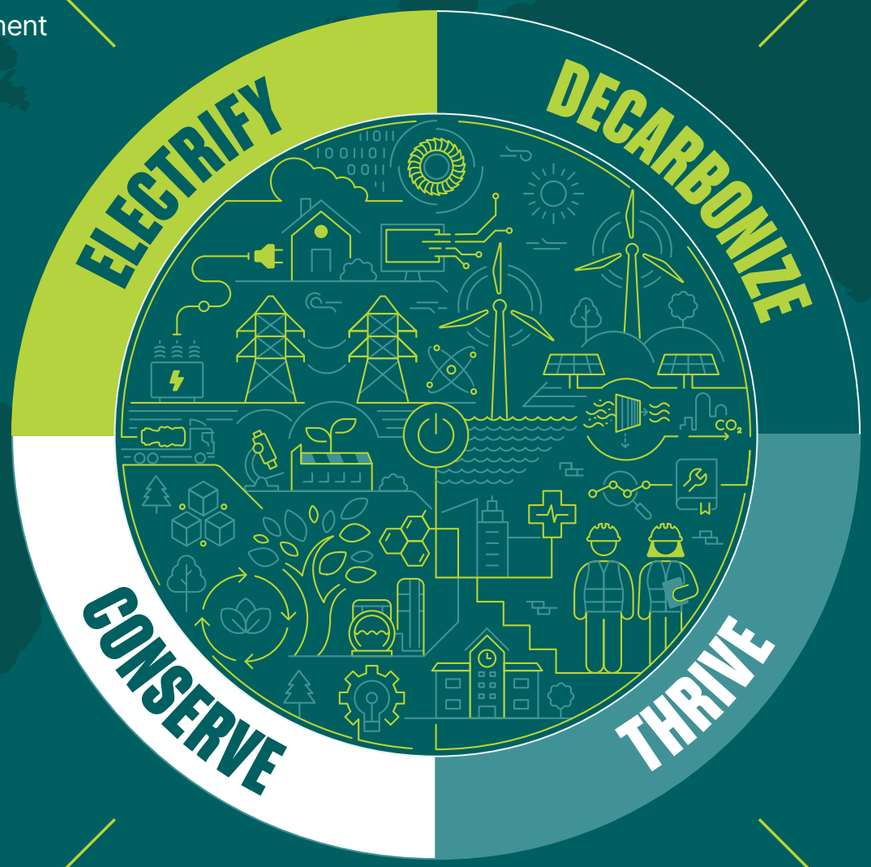
DECARBONIZE

Invent, deploy, and service the technology to help decarbonize and electrify the world

LEADING GOALS

Improve the trajectory on carbon intensity for near-term impact

Innovate toward our 2050 Scope 3 net zero ambition for use of sold products



CONSERVE

Innovate more while using less, safeguarding natural resources

LEADING GOALS

Carbon neutrality for Scope 1 and 2 GHG emissions by 2030

90% of our top products covered by our 4R circularity framework by 2030

THRIVE

Advance safe, responsible, and fair working conditions in our operations and across our value chain

LEADING GOALS

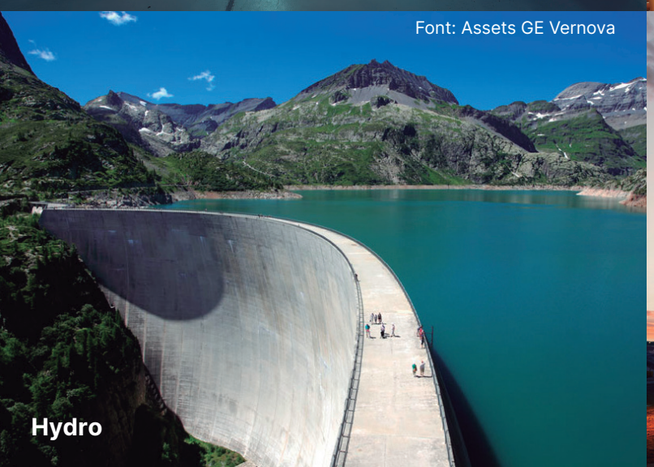
Fatality-free operations

Demonstrate progress on inclusive culture and equal employment opportunity for all employees

Embed and implement ethical decision-making into business decisions

Partner with suppliers to promote and uphold human rights in our value chain

SAFETY AND EFFICIENT OPERATION FOR EVERY APPLICATIONS



GE VERNOVA

Commutating Current Limiter (CCL) was designed by GE Vernova to ensure the safe and efficient operation of electrical systems in scenarios where thermal and dynamic effects may exceed the tolerable limits of equipment, potentially causing damage and posing safety risks.

The CCL operates by immediately responding to the first rise of short-circuit current, reducing it to levels below the substation equipment's short time withstand capability and breaking capacity, within less than 0.7 milliseconds.

BENEFITS

Easy Maintenance: Designed for minimal maintenance requirements, ensuring long-term reliability and reduced downtime.

Material Selection: Manufactured with carefully chosen materials to enhance durability and efficiency.

Compact Design: Engineered with reduced dimensions to improve space utilization without compromising performance.

Standardization: Incorporates standardized components to simplify integration and reduce complexity.

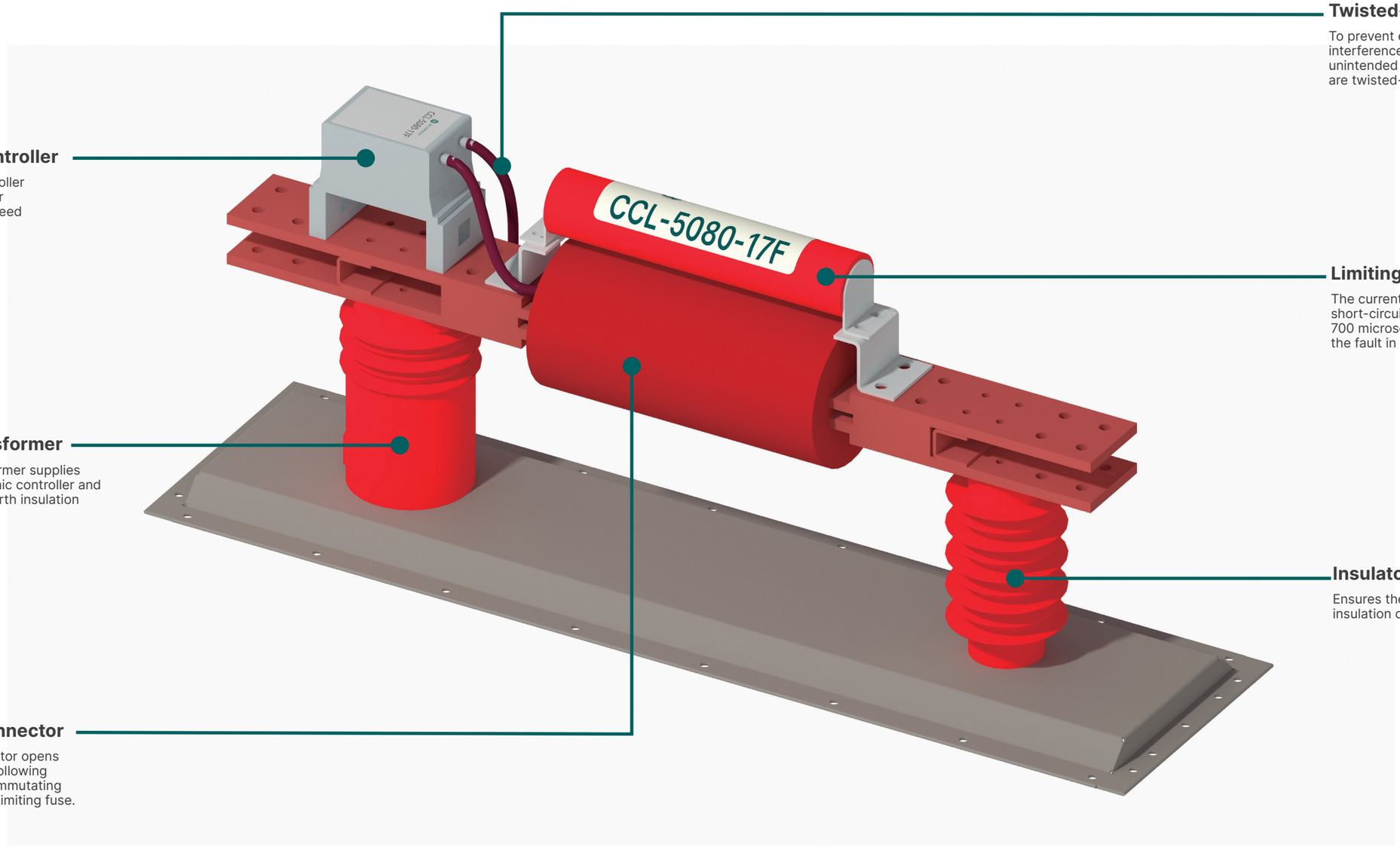
Personnel Safety: Prioritizes personnel safety with robust features and compliance measures.

Simplified Inspection: Facilitates straightforward inspection processes to ensure consistent performance checks.

Easy Installation: Features easy mounting and connection capabilities for quick and efficient setup.

Compliance: Compliant with the applicable standards.

CCL
DESIGN



Twisted-Pair Cable

To prevent electromagnetic interference issues and consequently unintended operations, the CCL cables are twisted-pair and shielded.

Electronic Controller

The electronic controller triggers the pulse for opening the high-speed disconnect switch

Limiting Fuse

The current-limiting fuse limits the short-circuit current within less than 700 microseconds, extinguishing the fault in 4 to 6 milliseconds.

Insulator Transformer

The insulator transformer supplies power to the electronic controller and ensures phase-to-earth insulation

Insulator

Ensures the phase-to-earth insulation on the CCL.

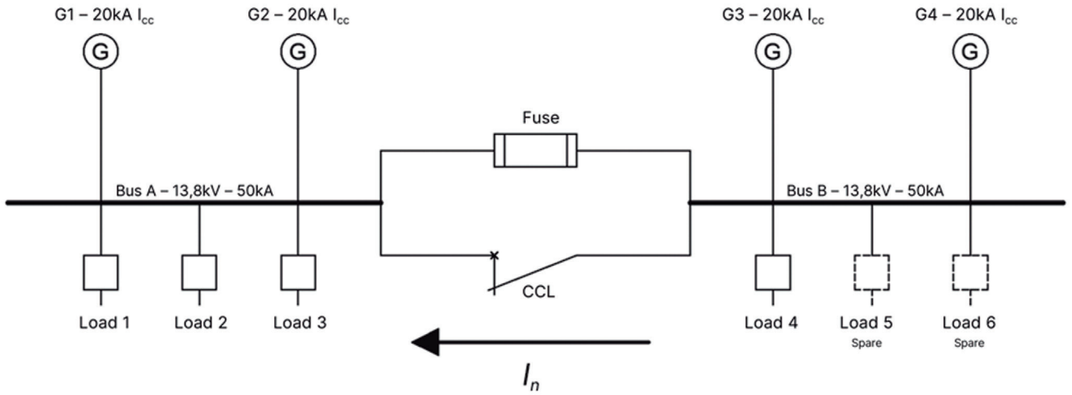
High-speed Disconnector

The high-speed disconnector opens within 100 microseconds following short-circuit detection, commutating the current to the current-limiting fuse.

OPERATING PRINCIPLE

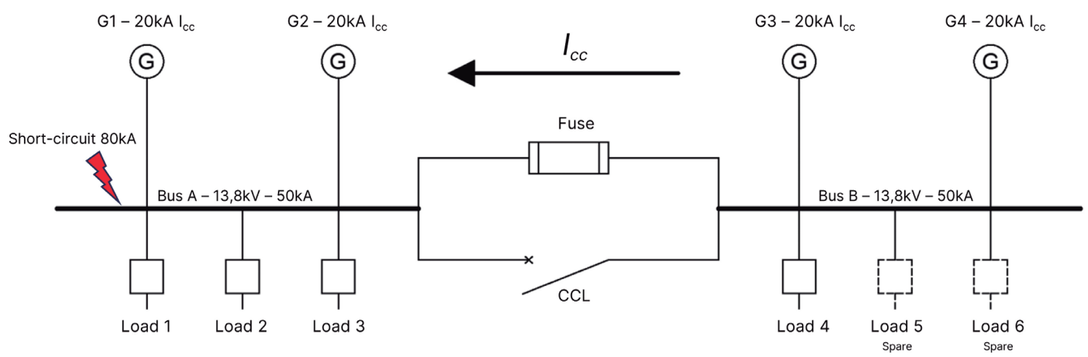
CCL is a protective device designed to limit short-circuit current before reaching the midpoint of the first cycle of the event in less than 700 microseconds, thereby preventing it from reaching its peak value.
To determine when it needs to act, CCL monitors both the instantaneous value and the rate of rise of the current. If these values exceed the pre-set thresholds defined for the CCL, the process of limiting/extinguishing the short-circuit current begins immediately.

Normal Operating Conditions

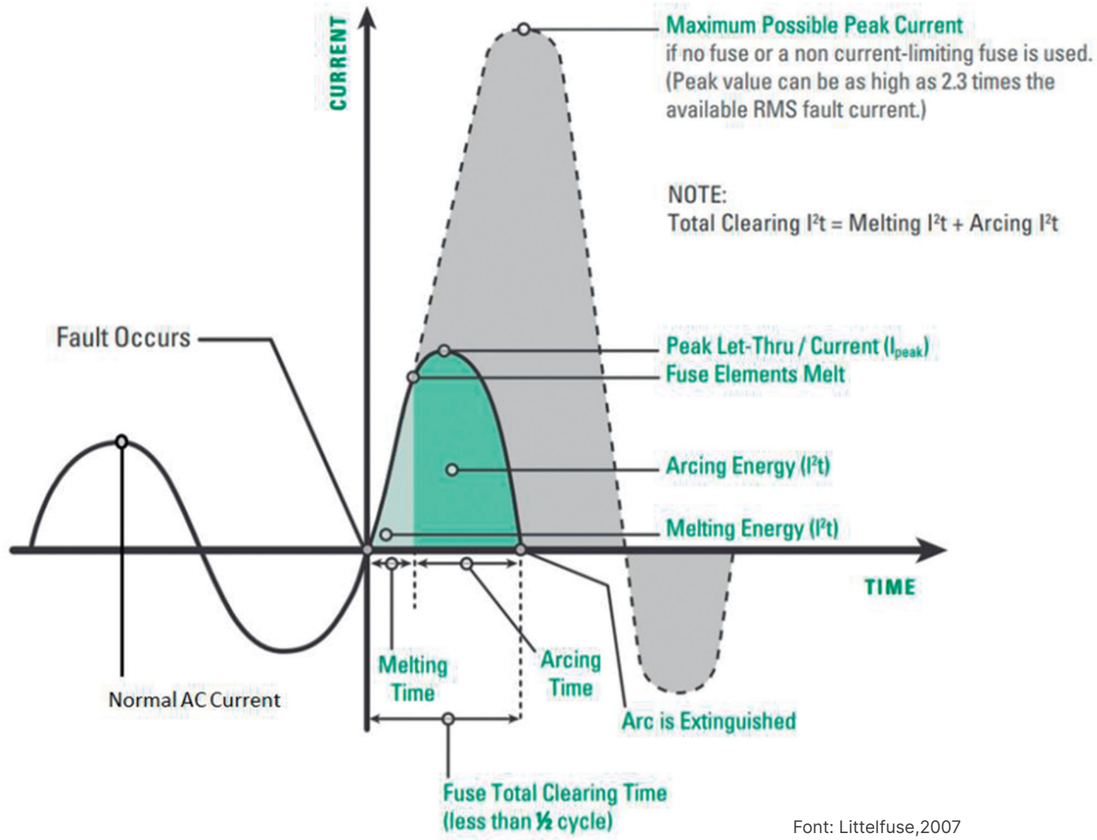


Under normal operating conditions, the current predominantly flows through the high-speed disconnector.

Switching Process



Upon detection of a short circuit, a pulse is sent to open the high-speed disconnector. Subsequently, the short-circuit current will flow through the fuse.



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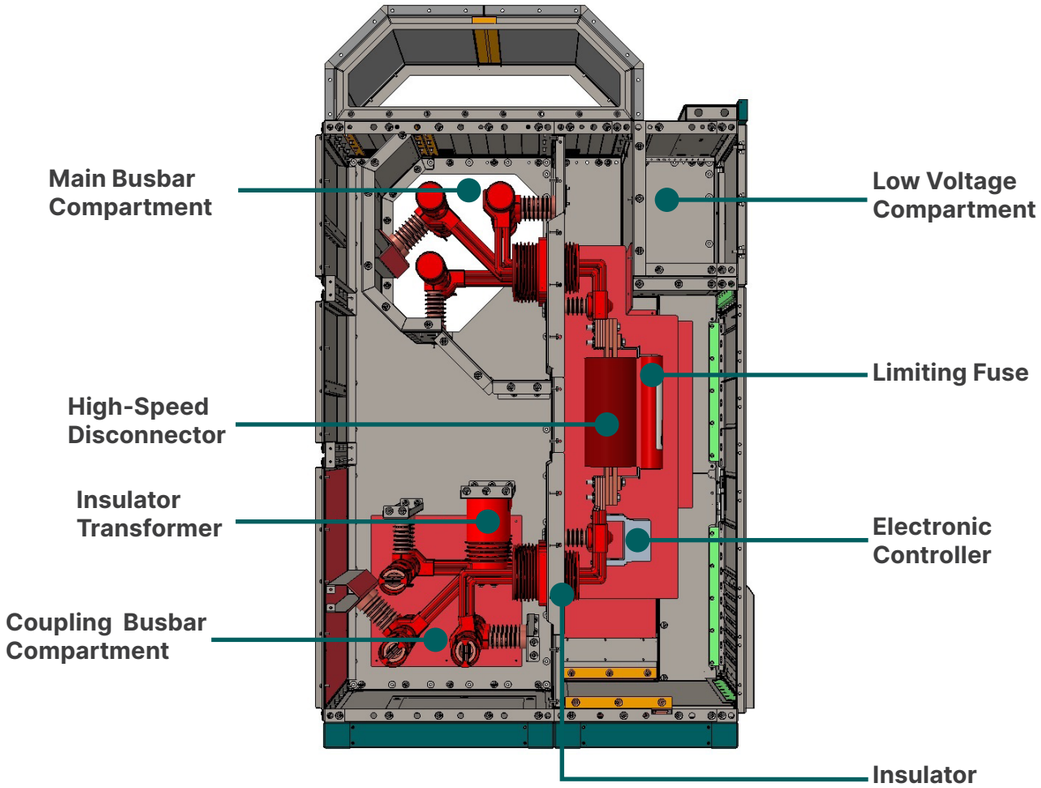
Limitation and Extinguishing of Short-Circuit Current

Once the short-circuit current is conducted through the fuse, the process known as the pre-arcing time or melting time begins. For the Current Limiting Circuit (CCL), this period lasts approximately 500 microseconds.
In less than 700 microseconds after the melting of the fuse element, the limitation of the short-circuit current occurs. From this point, the extinction of the fault begins, which will last approximately 5ms. This entire process is referred to as the arcing time.
Therefore, considering the moment of short-circuit detection to the point of its limitation, the CCL operates in less than 700 microseconds

TECHNICAL DATA

Description	Units	Ratings				
Rated Voltage	kV	7.2	12	17.5	24	36/40.5
Power-Frequency Withstand Voltage	kV	20	28	38	50	80
Lightning Impulse Withstand Voltage	kV	60	75	95	125	185
Rated Current	A	1250 - 6300		1250 - 5000	1250 - 4000	1250 - 3150
Short-Circuit Breaking Capacity	kArms	Up to 200				
Rated Short-time Withstand Current	kA	50				
Rated Duration of Short-circuit	s	1				
Time to Limit	ms	≤ 0.70				
Total Operating Time	ms	≤ 6				
Peak Current Limiting Ratio	%	Up to 80%				
Control Voltage	V	110 - 220 (AC/DC)				
Frequency	Hz	50/60				

CCL
PANEL DESIGN



Busbar Compartment

The main busbar compartment is located at the rear top of the panel enclosure.
It is completely isolated from other compartments.

Low Voltage Compartment

The control compartment is located at the front top of the panel enclosure.
The control wiring goes through an internal duct located at the left side.

Coupling Busbar Compartment

Insulator transformer, busbar and insulators are placed in the coupling busbar compartment.

CCL Compartment

GE Vernova commutating current limiter is located in the CCL compartment with the electronic controller,insulators, limiting fuse and high speed disconnector.

ORDER CODE

CCL - 50 - 80 - 17 - F

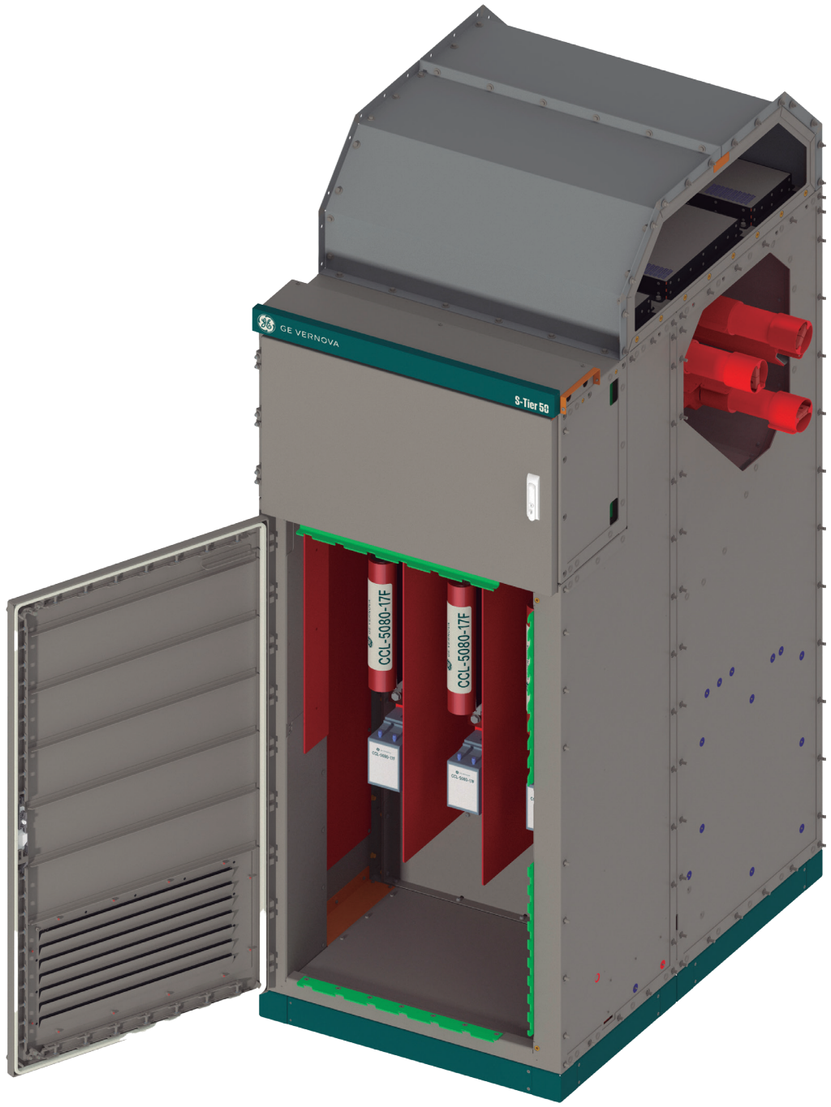
Model
Fixed digits that cannot be changed

Versions	
F	Fixed
W	Withdrawable

Rated Current	
1250A	12
1600A	16
2000A	20
2500A	25
3150A	31
4000A	40
5000A	50
6300A	63

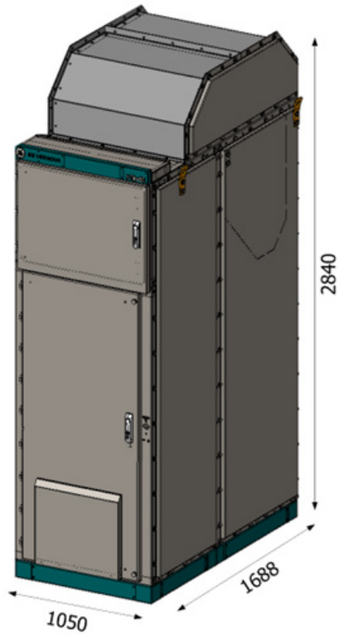
Rated Voltage	
3.6kV	03
7.2kV	07
12kV	12
17.5kV	17
24kV	24
36kV	36
40.5kV	40

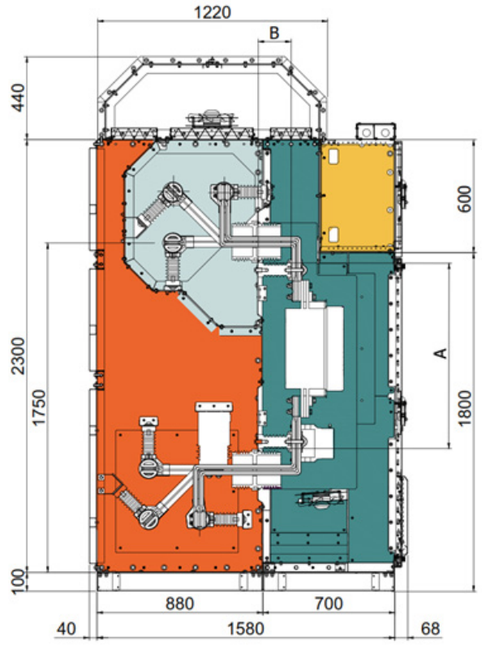
Breaking Capacity	
50kA	50
63kA	63
80kA	80
100kA	100
200kA	200



Standard Code: CCL-50-80-17-F – Commutating current limiter in a fixed version, with a rated current of 5000 A, a breaking capacity of 80 kA and a rated voltage of 17.5 kV.

DIMENSIONS





Rated Voltage (kV)	Rated Current (A)	Dimensions (mm)	
		A	B
7.2	12500 - 5000	784	180
	6300	880	180
12	1250 - 4000	804	280
	5000 - 6300	900	280
17.5	1250 - 4000	964	280
	5000	1020	280
24	1250 - 3150	1141	280
	4000	1197	380
36/40.5	1250 - 3150	1612	475

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APPLICABLE STANDARDS AND TECHNICAL REPORTS

CCL was designed to meet the normative and technical criteria applicable to switchable current limiters, ensuring compliance with:

- IEC 60282-1:2020 – High-Voltage Fuses – Part 1: Current-Limiting Fuses
- IEC 62271-1:2021 – High-Voltage Switchgear and Controlgear – Part 1: Common Specifications for Alternating Current Switchgear and Controlgear
- IEC 62271-200 - High Voltage SwitchGear and Controlgear Part 200 - AC Metal Enclosed Switchgear and Controlgear for Rated Voltages Above 1kV - 52kV – 2021
- IEC 61000-4-18:2019 - Electromagnetic Compatibility (EMC) - Part 4-18: Testing And Measurement Techniques - Damped Oscillatory Wave Immunity Test
- IEC 61000-4-4:2012 - Electromagnetic Compatibility (EMC) - Part 4-4: Testing And Measurement Techniques - Electrical Fast Transient/Burst Immunity Test
- IEC 61000-4-5 - Electromagnetic Compatibility (EMC) - Part 4-5: Testing And Measurement Techniques - Surge Immunity Test
- CIGRE Technical Report 239 - Fault Current Limiters In Electrical Medium And High Voltage Systems
- CIGRE Technical Report 497 - Application and Feasibility of Fault Current Limiters in Power Systems

TYPE TEST CERTIFICATES

Thus, the type tests were conducted in specialized laboratories to ensure compliance with the applicable standards.

Test	Standard	Parameter	Laboratory
Temperature Rise Test	IEC 62271-200	4000A	CEPEL
Temperature Rise Test	IEC 62271-200	5000A	CEPEL
Short-Circuit Withstand Capability	IEC 62271-200	50kA – 1s	CEPEL
Damped Oscillatory Wave Immunity Test	IEC 61000-4-18	1MHz – 2kV – 2s	XIHARI
Electrical Fast Transient/Burst Immunity Test	IEC 61000-4-4	2.50kHz – 4kV – 15ms	XIHARI
Electrical Fast Transient/Burst Immunity Test	IEC 61000-4-4	5kHz – 2kV – 15ms	XIHARI
Surge Immunity Test	IEC 61000-4-5	2kV – 1kA	XIHARI
Test Duty 1	IEC 60282-1	12kV (Single-phase) – 80kA	KEMA B.V.
IP (Ingress Protection for Switchgear Assembly)	IEC 62271-200	IP42	USP
Mechanical Impact Test (Switchgear Assembly)	IEC 62271-200	IK10	USP

SPECIAL TEST CERTIFICATES

To assess the performance of the CCL near its operational limits and under conditions of external command blocking, GE Vernova conducted specialized testing on the product. Based on the parameters defined in the test prototype, the minimum condition required for the CCL to activate was the occurrence of a short circuit of 9.5 kArms.

Test	Parameter	Asymmetry	CCL Status	Laboratory	Criterion	Result
Two-Phase Short-Circuit Test – R and S	11kA - 13.8kV	2.6	Blocked	CEPEL	Blocked	Approved
Two-Phase Short-Circuit Test – S and T	11kA - 13.8kV	2.6	Blocked	CEPEL	Blocked	Approved
Two-Phase Short-Circuit Test – R and S	11kA - 13.8kV	No control	In Operation	CEPEL	In Operation	Approved
Two-Phase Short-Circuit Test – S and T	11kA - 13.8kV	2.6	In Operation	CEPEL	In Operation	Approved
Two-Phase Short-Circuit Test – R and S	5kA - 13.8kV	2.6	In Operation	CEPEL	In Operation	Approved
Two-Phase Short-Circuit Test – S and T	5kA - 13.8kV	2.6	In Operation	CEPEL	In Operation	Approved
Two-Phase Short-Circuit Test – R and S	5kA - 13.8kV	No control	In Operation	CEPEL	In Operation	Approved
Two-Phase Short-Circuit Test – S and T	5kA - 13.8kV	No control	In Operation	CEPEL	In Operation	Approved

The results demonstrate the operational robustness of the CCL under the simulated conditions, confirming its application reliability.

Contact US
Use phone or mail to log your case. Use contact details listed/complete form and return via email.

Case Details
Provide accurate the issue details and include company name, site, location, and best contact information.

Communication
Our agents will confirm a unique case reference number and explain next steps to resolve the issue.

Site Intervention
If our remote support and related instructions are not suitable enough, then our team will appoint time for our Field Service Engineers to come locally.

gevernova.com/power-conversion
CONTACT US: salesgepclatam@gevernova.com

GEA35555_CCL Commutating Current Limiter_EN_20250705

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