Gerapid High Speed DC Circuit Breakers
Guide Form Specification

1. General

This specification establishes the functional, environmental, and material requirements and conformance levels for high speed, high energy DC circuit breakers. The specification covers both feeder type and rectifier type breakers suitable for use in DC switchgear. The breakers can be used as main circuit breakers (MCBs), feeder circuit breakers (FCBs) and rectifier circuit breakers (RCBs) to protect semiconductors (converters/rectifiers). The specified high speed, high-energy DC circuit breakers shall be suitable for service in, but not limited to, the following applications:

- Traction Power (light rail transit, trolley, tram, subway, maglev, etc.)
- Industrial plant protection (electrolysis plants, iron and steel mills, etc.,)
- Mining, Chemical, and Petrochemical processes
- Electric Power Generation (solar panel, wind, field breakers)
- Research/experimental (e.g., physics, particle accelerator protection)

MCBs, FCBs and RCBs shall be furnished by the same manufacturer. MCBs, FCBs and RCBs shall be based on similar or identical designs to ensure commonality in spare parts, commonality in control power circuits and a common operator knowledge base.

- FCBs shall be available with rated operating currents up to 8,000A (6000A ANSI) and operating voltages up to 3600VDC.
- RCBs shall be available with rated operating currents up to 8,000A and operating voltages up to 1200VDC.

Breakers shall have very high interrupting capacities combined with current limiting characteristics. Gerapid circuit breakers Models 2607 through 10007R, manufactured by the General Electric Company (GE), are acceptable. No equals or substitutions shall be acceptable.

2. Scope and Applications

The breakers covered under this specification must meet the minimum ratings defined herein.

- FCBs shall be available with rated operating currents up to 8,000A (6000A ANSI) and operating voltages up to 3600VDC.
- RCBs shall be available with rated operating currents up to 8,000A and operating voltages up to 1200VDC.

The breakers shall be of a compact, modular design suitable for both new equipment applications and as replacement breakers for existing equipment.

3. Environment, Standards, Testing

Indoor/enclosed	IP 00 or NEMA 1
Ambient Temperature:	-5 to +40°C (55°C @ 0.8 I_n)
Humidity:	90% relative humidity (ANSI C37.14)
Pollution:	PD3A per EN50124-1
Vibration:	0.5g, 30s
Altitude:	-120m to 2000m above sea level

All breaker types shall be type tested in accordance with ANSI/IEEE, EN and IEC standards regulating electric power systems/supply to public transportation systems. Gerapid breakers comply with the Standards listed below:

ANSI/IEEE C37.14
ANSI/IEEE C37.16
ANSI/IEEE C37.17
ANSI/IEEE C37.20
EN 50123-1
EN 50123-2
EN 50124-1
EN 50121
IEC 947-1
IEC 947-2

4. Operation and Control

Breakers shall be Gerapid Type 2607, 4207, 6007, 8007, 8007R and 10007R manufactured by the General Electric Company (GE). Breakers shall be equipped with a 2-stage contact system and mechanically latched operating mechanisms. Latching shall not require external energy. Breakers shall be furnished with solenoid type closing mechanism and integrated control units. Solenoid shall be front-mounted and enclosed in a grounded casing. Solenoid mechanism shall include a self-interrupt control module (SU) with anti-pumping and signal blocking, to protect the unit from repeated activation due to a short circuit condition.

- The FCB mechanism shall close the breaker in 150ms or less, and the power consumption shall not exceed 2 kW.
- The RCB mechanism drive shall close the breaker in less than 350ms, and the power consumption shall not exceed 5kW.

The mechanism shall be capable of operating on all standard control voltages as defined by the applicable standards.

FCBs shall have the option for an internally mounted, fixed or adjustable, over-current trip (OCT) device. Opening time shall not exceed 5ms. Electronic type trip units are not acceptable.
RCBs shall be equipped with an internally mounted, adjustable, polarized over-current trip (POCT) device. The internal over-current trip devices shall operate without imported energy (self-powered). The energy to operate the OCT or POCT and open the breaker, shall be derived from short circuit current. The POCT device shall have design characteristics specific to forward and reverse current flow. Only reverse current flow exceeding the over-current trip setting shall trip the circuit breaker. The trip units shall be integral to the circuit breaker. Bolt-on or remotely mounted OCT or POCT units are not acceptable. Trip units shall have provisions for optional trip indication. RBC's equipped with a POCT device shall be fitted with a high-speed auxiliary trip unit. The trip unit shall be electro-dynamic type, powered by internal or external capacitors and operated by an external over-current (OC) relay. The external OC relay must be specified and supplied by others.

Breakers shall be capable of being equipped with either shunt trip (ST), or zero voltage trip (UVR) devices.

a) Shunt Trip operating voltage: 24V +/-5%
b) Zero Voltage Trip operating voltage: 24V +/-5%

Breakers shall have provisions for up to ten isolated form C auxiliary contacts (1 NO/NC each) activated by the movable main contact. Contact ratings shall be 5A/230vac, 0.1A/220VDC.

5. Ratings and Protection

RCBs shall be rated 6000A and 8000A with operating voltages either 800VDC or 1200VDC. Breakers shall comply with the relevant US and IEC standards (ANSI/IEEE C37.14, ANSI C37.16, ANSI C37.17, C37.20, IEC947). RCBs shall be fully rated and able to withstand rectifier short circuit conditions and reverse over-current conditions due to line side short circuits. RCBs shall be selective with FCBs, and have a very high transient over current withstand rating as listed below:

- 200kA short-circuit current @ 800VDC (per ANSI/IEEE C37.14)
- 134kA short-circuit current @ 1200VDC (per ANSI/IEEE C37.14)
- 8kA rated continuous current (per ANSI/IEEE C37.14)

FCBs shall be rated 2600-8000A (6000A max ANSI) with operating voltages up to 3600VDC (800VDC ANSI). Rated short circuit breaking capacity shall be in accordance with ANSI/IEEE C37.14, EN 50123-2 and IEC 942-2.

6. Materials and Construction

Rectifier and feeder breakers shall have a compact and enclosed construction. They shall be IP 00 (NEMA 1) protected. All parts shall be mounted on thick-walled, non-breakable and fireproof insulation panels with large covers protecting the breaker mechanism from damage. Optional transparent plastic side covers are available on types 2607, 4207 &, 6007 to further protect connection points.

RCBs shall use similar, proven technology as that used by the FCBs. Spare parts between the RCBs and FCBs shall be identical or very similar in design, construction and material.

RCB dimensions shall not exceed 425mm W x 960mm L x 900mm H.
FCB dimensions shall not exceed 270mm W x 825mm L x 900mm H.

7. Service

The suggested breaker maintenance is based on normal use in an indoor switchgear-type enclosure. Recommended maintenance includes visual inspection, observation of open/close operations, cleaning, lubrication and replacement of arcing parts. Visual inspection may reveal conditions that require additional service.

For standard environmental conditions, with recommended or reduced maintenance, the life of the breaker shall be no less than 10 years. The breaker shall be designed for a minimum number of 10,000 mechanical operations (C-O) prior to major service and repair. Inspection intervals shall be a minimum of once per year.

For heavy use (high short circuit currents or a high number (>50) of over current operations (<16kA), earlier maintenance is recommended. Breaker design shall permit complete maintenance by one (1) person.

Technical and commercial support shall be available throughout North America.