Comprehensive Technical Comparison in the Fault Current Limiter Industry

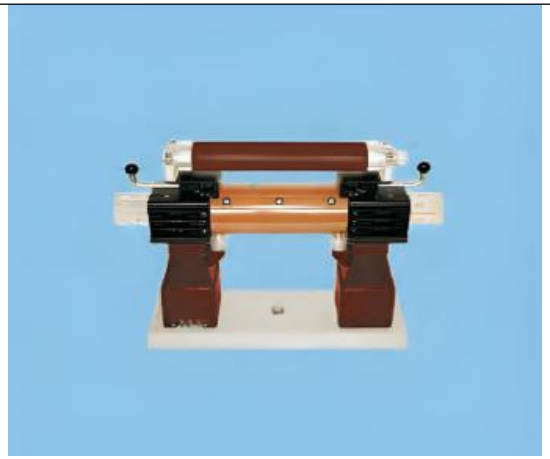
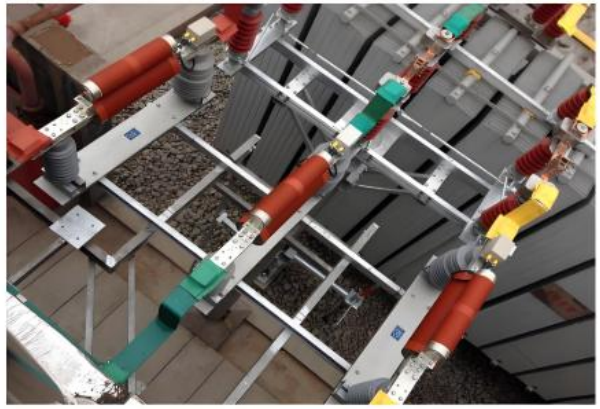
1.**Definition of Fault Current Limiter:** Also known as a fast current limiter, abbreviated as FCL (Fault Current Limiter), it is a device connected in series in an electrical circuit. It can increase impedance and effectively limit the peak value and/or effective value of the system's prospective short-circuit current (including the initial value of symmetrical short-circuit current IK") below the target value.

2.Definition of Pyrotechnic Blasting Fault Current Limiter (Fast Current Limiter): A device that uses the opening of a pyrotechnic blasting technology switch to transfer the fault current to a parallel high-voltage current-limiting fuse, thereby increasing impedance. This enables the conversion from the usual non-current-limiting mode to the current-limiting mode, limiting the prospective short-circuit current peak and/or effective value (including the initial value of symmetrical short-circuit current IK") in the AC system below the expected value, and interrupting before the short-circuit current reaches the expected peak.

3.Application Purpose of Fast Current Limiter: To limit the prospective peak value and/or initial symmetrical short-circuit current in AC power systems to or below the rated allowable value of the system, so that the switchgear in the fault circuit can withstand and interrupt short-circuit faults.

Serial Number	Category	Comparison Item	Is-limiter & FC-Protector	UFCL-Limiter
1	Definition of Fault Current Limiter	Whether It Conforms	Conforms	Conforms
2	Definition of Fast	Whether It Conforms	Conforms	Conforms

	Current Limiter			
3	Product Technology	Technical Principle	Based on Pyrotechnic Blasting Technology	Based on Pyrotechnic Blasting Technology
4	Current - limiting characteristics	Whether It Exists	Yes	Yes
		Cause Analysis	1) After the fault current (i.e., short - circuit current) occurs at 0s, due to the large DC component contributed by inductive coils such as those of generators, the asymmetry of the short - circuit current is caused, making the short - circuit current reach the peak value at about 10ms. 2) To limit the short - circuit current, the current limiter must limit and interrupt it within 10ms before the short - circuit current of the fault loop reaches the peak value. The short - circuit current of the fault loop is limited to below the rated peak value and rated making capacity of the switchgear, so as to avoid the damage to	1) After the fault current (i.e., short - circuit current) occurs at 0s, due to the large DC component contributed by inductive coils such as those of generators, the asymmetry of the short - circuit current is caused, making the short - circuit current reach the peak value at about 10ms. 2) To limit the short - circuit current, the current limiter must limit and interrupt it within 10ms before the short - circuit current of the fault loop reaches the peak value. The short - circuit current of the fault loop is limited to below the rated peak value and rated making capacity of the switchgear, so as to avoid the

			the dynamic stability of devices such as the switch in the fault loop caused by the electric force generated by the short - circuit current.	damage to the dynamic stability of devices such as the switch in the fault loop caused by the electric force generated by the short - circuit current.
5	Product appearance	Current Limiter		
		Switchgear Product		

6	Product Component Parts	Interruption Component		Tubular conductor single-break blasting structure, but still reliable	Row conductor multi-break blasting structure, but still can reliably open and break
				High-strength insulating tube fully sealed structure	High-strength insulating tube fully sealed structure
				For 7.2kV - 12kV products, above 3150A, two bridge arms need to be connected in parallel to form one item	For 3.6kV - 12kV products, even if the rated current is 6300A, a single bridge arm can meet the requirement
			Conductive bridge body	1) Sophisticated craftsmanship, reliable blasting; 2) The fully sealed structure avoids the risk of long-term damp failure of the sensing filler，and no pressure will be released to the outside during operation; 3) No action noise pollution, no smoke emission, avoiding the possibility of secondary short circuit	1) Sophisticated craftsmanship, reliable blasting; 2) The multi-break structure is designed to be redundant, with higher reliability, avoiding the possibility that the single-break structure cannot completely open and break the "fusing wire" during blasting and cutting, making it more secure; 3) The fully sealed structure avoids the risk of long-term damp failure of the sensing filler，and no pressure will be released to the outside during operation; 4) No action noise pollution, no smoke

					emission, avoiding the possibility of secondary short circuit
			Current-limiting fuse	For products above 3150A, two fuses need to be arranged in parallel to form one phase	Self-developed special current-limiting fuses, even for large-scale products, there is no need to arrange two fuses in parallel to form one phase
				No need to connect nonlinear zinc oxide "energy-absorbing resistors" in parallel	No need to connect nonlinear zinc oxide "energy-absorbing resistors" in parallel
		Measurement Unit	current transformer	Special electromagnetic current sensor installed in the switch cabinet	Special Rogowski coil-type large current sensor directly embedded in the conductive bridge arm
	Product Performance Parameters			Technical disadvantage: Although the measurement is fast and accurate, it cannot get rid of the dependence on the switch cabinet and must be installed inside the cabinet and indoors	Technical advantage: Embedded in the conductive bridge arm, no iron core, no saturation, high measurement accuracy, fast response speed
		Tripping Unit	Technical characteristics	Single-chip circuit, installed on the low-voltage side, easily affected by electromagnetic interference, special anti-electromagnetic	Military-grade pure analog circuit, installed on the high-voltage side, reducing electromagnetic interference, faster driving

				interference units are adopted to ensure reliability	speed
7	Product Performance Parameters	Technical Parameters	Rated Parameters	For 3.6kV - 24kV products, the maximum specification is 4000A	For 3.6kV - 12kV products, the maximum specification is 6300A
				No 40.5kV products	40.5kV products can reach 3150A
			Total Breaking Time	Total operating time (full opening time) : <10ms	Total operating time (full opening time) : <10ms
8	Product Technical Qualification	Test Report	Testing Institution	Affiliated to the KEMA Laboratory of the STL International Short - Circuit Test Alliance	Affiliated to the KEMA Laboratory of the STL International Short - Circuit Test Alliance
9	Product Reliability		Operation Criterion	Double criteria: Instantaneous current amplitude and rate of rise of short-circuit current di/dt	Double criteria: Instantaneous current amplitude and rate of rise of short-circuit current di/dt
			Setting Calculatio	Germany Ratingen has setting calculation capability	Has setting calculation capability

		n Capability		
		Reliability	High reliability	High reliability
10	Product Design	Switchgear Technology	Based on Unigar ZS1 switchgear cabinet, with international top-level performance, but cannot be customized	Based on IEC62271.200 standard, provides customers with customized switchgear cabinets of the highest domestic level, and offers international authoritative laboratory third-party factory inspection to ensure international quality
		Installation and Layout	Is-limiter is applied indoors in cabinet form, and FC-Protector can be split and applied outdoors, but the maximum rated current is 2500A	Both integrated installation and split installation are available. Advantages: More flexible and convenient for decentralized installation, with smaller required installation space, reduced consumption of connection materials, lower project investment, and easier maintenance

Note: 1) This comparison is made for fault current limiters that have already been commercialized. Fault current limiters that have not yet been commercialized, such as high - temperature superconducting fault current limiters, power electronic static switch - based fault current limiters, and series resonant - type fault current limiters, are not included.