

Guide for the Application of Alternating Current High-voltage (Rated above 72.5 kV) Short-circuit-current-restricting Circuit Breakers

**Electric Power Research Institute of
Zhejiang Electric Power Co., Ltd.**

Recommended PES TC: 15. Switchgear

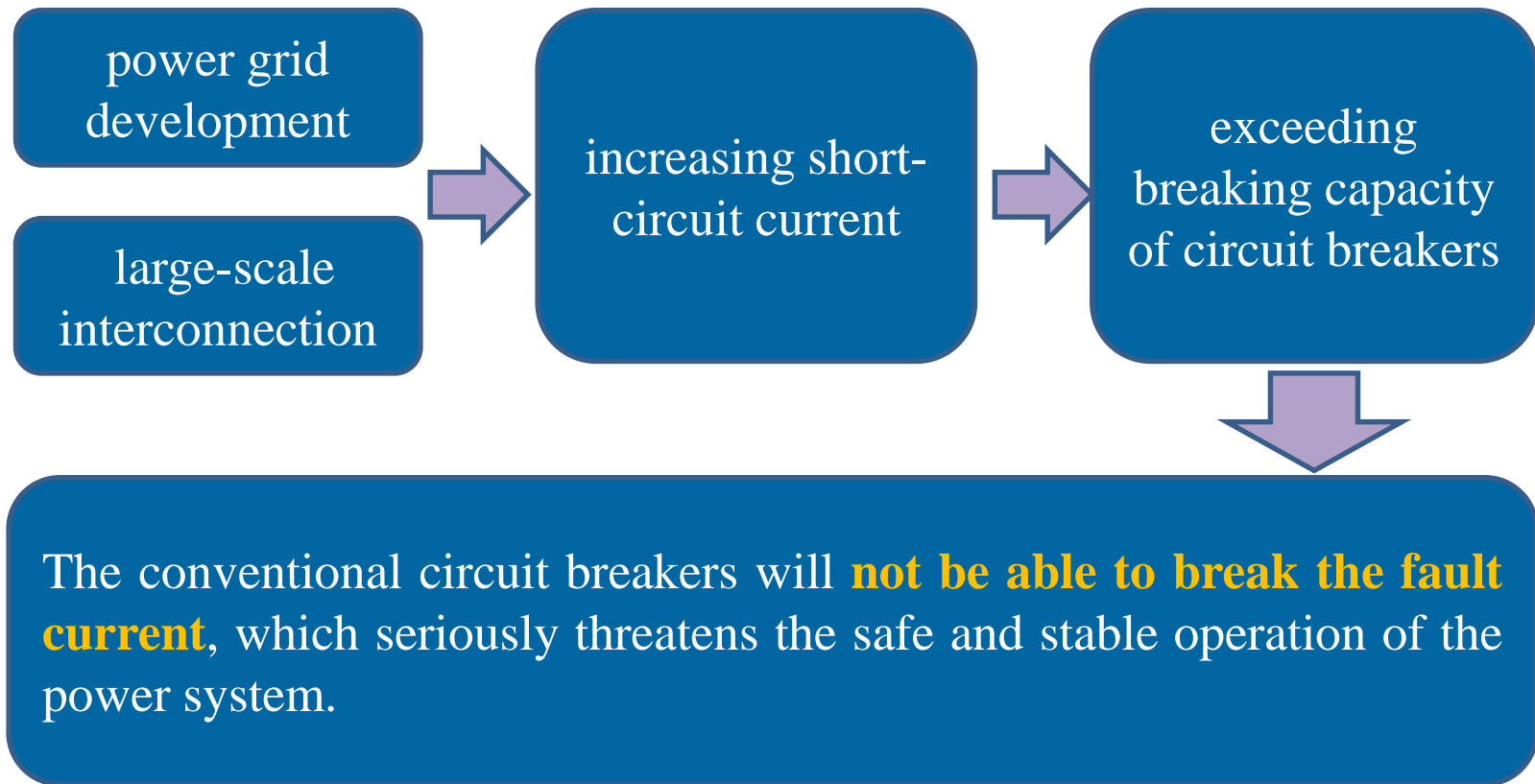
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AGENDA

- **Background**
- **Requirement Analysis**
- **Existing Standard Investigation**
- **Scope**
- **Working Group**
- **Framework**

Background

➤ Problems



Background

➤ Technical Solutions



AC High-voltage Short-circuit-current-restricting Circuit Breakers

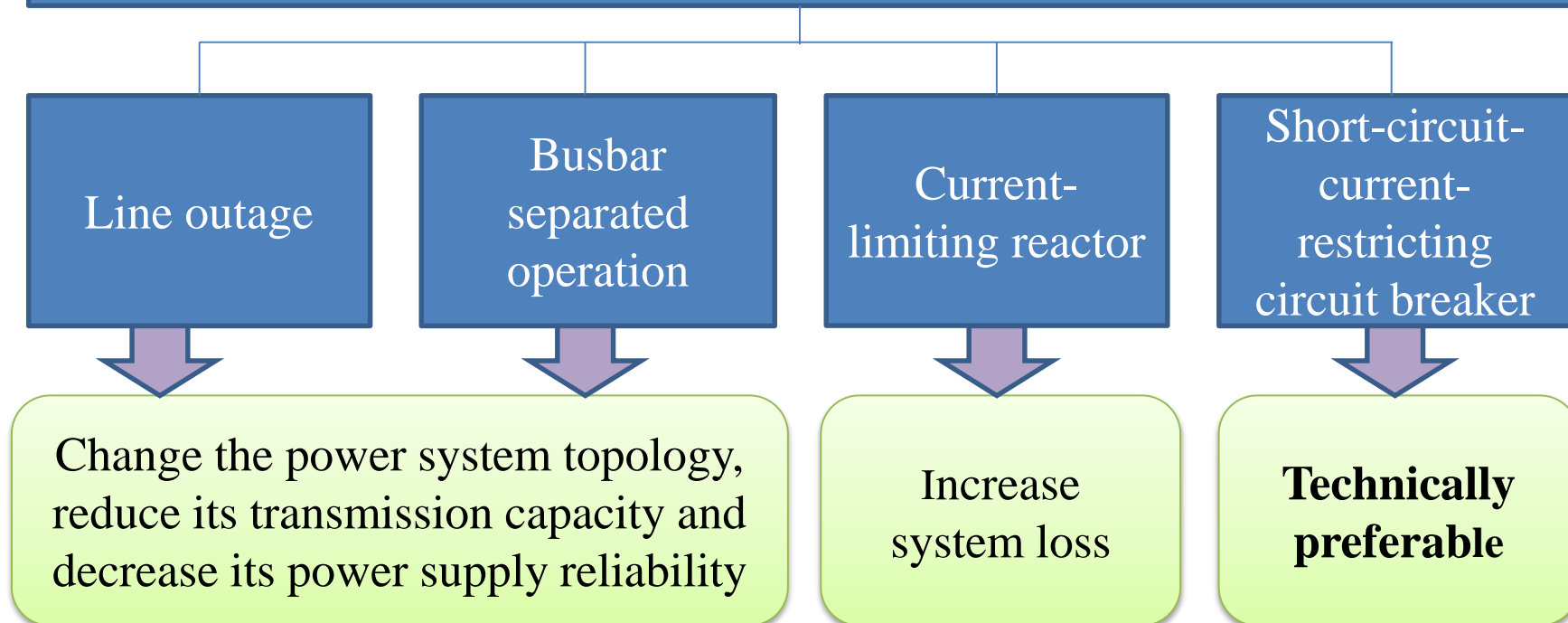
A kind of special circuit breaker that can **open rapidly to disconnect the power grids** after a power system failure occurs and before conventional circuit breakers intervene.

- ▶ Much faster breaking speed
- ▶ Reduce short-circuit current by more than 40%
- ▶ Return normal system topology after the failure is removed
- ▶ negligible impact on normal operations

Requirement Analysis

➤ Technical requirement

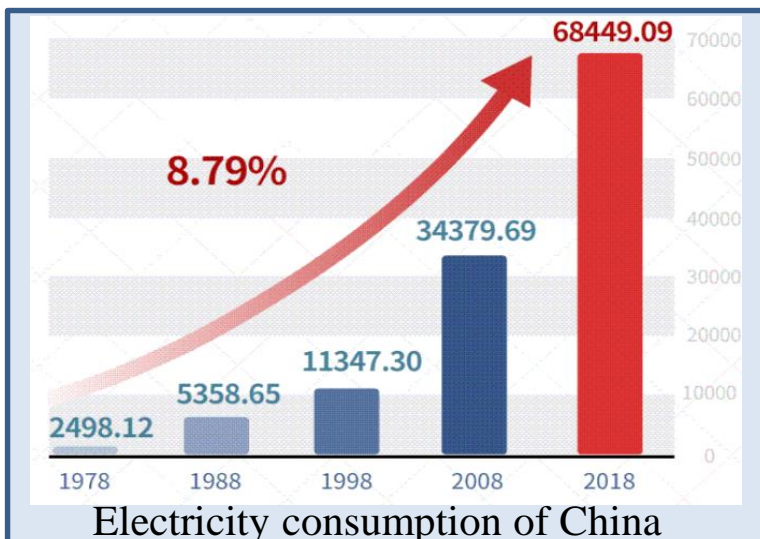
Technical schemes for solving the problem of excessive short-circuit current



Requirement Analysis

➤ Market requirement

- ▶ Increasing electricity consumption causes a growing problem of excessive short-circuit current. An effective solution is urgently needed by the market.
- ▶ Technologies of AC high-voltage short-circuit-current-restricting circuit breakers have become mature and been applied in some engineering projects.



Short-circuit grounding test verification on the 220 kV short-circuit-current-restricting circuit breaker in Zhejiang, China



Great application prospects and market demand can be anticipated.

Requirement Analysis

➤ Standardization

- ▶ Power grid enterprises, equipment manufacturers, equipment operation and maintenance companies, technology R&D institutes who are interested in short-circuit-current-restricting equipment and technology will benefit from this guide.
- ▶ Structural design, technical parameters, test requirements, selection guidelines of AC high-voltage short-circuit-current-restricting circuit breakers will be standardized.
- ▶ Conflicting product requirements, poor interchangeability, and unclear application methods in the promotion process will be avoided.

Existing Standard Investigation

➤ IEEE Standards

Title	Scope	Explain
IEEE C37.04-2018 - IEEE Standard for Ratings and Requirements for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V	Applies to ac high-voltage circuit breakers with rated nominal voltage above 1000 V, including rating structure, preferred ratings, construction and functional component requirements.	Does not cover AC high-voltage short-circuit-current-restricting circuit breakers.
IEEE C37.09-2018 IEEE Standard Test Procedures for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V	Applies to conventional AC high-voltage circuit breakers with rated maximum voltage above 1000 V. Defines various tests that are made on ac high-voltage circuit breakers.	Special tests for AC high-voltage short-circuit-current-restricting circuit breakers are not included.
IEEE C37.012-2014 - IEEE Guide for the Application of Capacitance Current Switching for AC High-Voltage Circuit Breakers Above 1000 V	For a special-purpose circuit breaker. Addresses the general theory of capacitance current switching; and the notions of restrike, re-ignition, non-sustained disruptive discharge.	Does not cover AC high-voltage short-circuit-current-restricting circuit breakers

Existing Standard Investigation

➤ IEC Standards

Title	Scope	Explain
<p>IEC 62271-1-2017 High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear</p>	<p>General guideline of the IEC 62271 series standards. Applies to AC switchgear and controlgear designed for indoor and/or outdoor installation and for operation at service frequencies up to and including 60 Hz and having rated voltages above 1 000 V.</p>	<p>Does not involve AC high-voltage short-circuit-current-restricting circuit breakers.</p>
<p>IEC 62271-100 High-voltage switchgear and controlgear - Part 100: Alternating current circuit-breakers</p>	<p>A part of IEC 62271 series. Applicable to AC circuit-breakers designed for indoor or outdoor installation and for operation at frequencies of 50 Hz and 60 Hz on systems having voltages above 1 000 V.</p>	<p>Does not involve AC high-voltage short-circuit-current-restricting circuit breakers.</p>
<p>IEEE/IEC 62271-37-013-2015 IEEE/IEC International Standard for High-voltage switchgear and controlgear -- Part 37-013: Alternating-current generator circuit-breakers</p>	<p>For a special-purpose circuit breaker. Specifies the technical requirements for high voltage AC circuit breakers used in generator terminals.</p>	<p>Does not involve AC high-voltage short-circuit-current-restricting circuit breakers.</p>

Scope

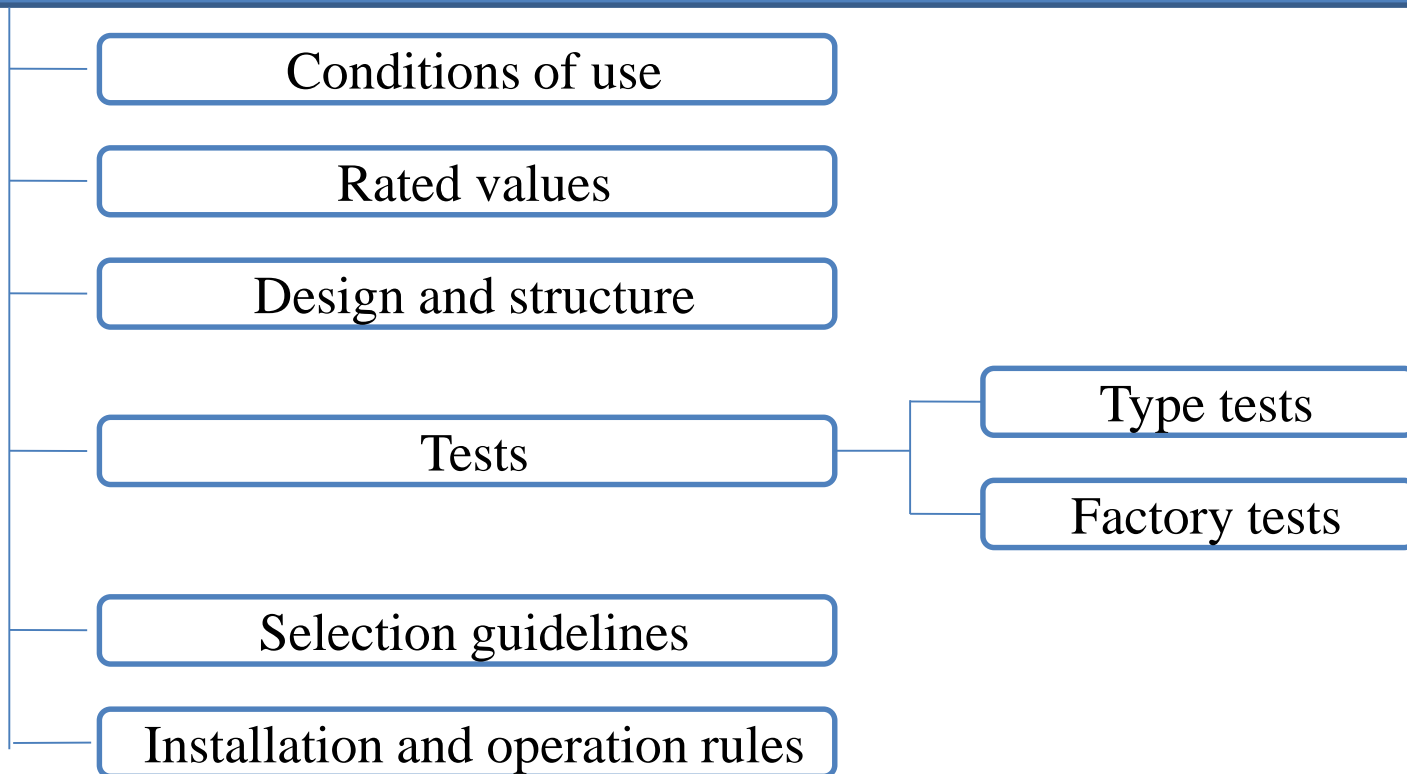
- This standard specifies the conditions of use, rated values, design and structure, type tests, factory tests, selection guidelines, installation and operation rules for AC high-voltage short-circuit-current-restricting circuit breakers.
- This standard is applicable to the AC high-voltage short-circuit-current-restricting circuit breakers which are designed for indoor or outdoor use in AC power systems with voltage level above 72.5 kV.

Working Group

1. State Grid Zhejiang Electric Power Co., Ltd. Research Institute
 2. China Electric Power Research Institute
 3. Pinggao Group Co., Ltd.
 4. China XD Group Co., Ltd.
 5. Shenyang University of Technology
 6. Shanghai JiaoTong University
 7. Zhejiang Energy Research Institute Co. Ltd.
- ... More companies will be invited to participate in the working group.

Framework

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Thank you!