CIGRE Study committe B5
PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG B5/C4.93

NAME OF THE CONVENOR
KASZTENNY Bogdan (CANADA)

TITLE
Protection Requirements for Specifying Source Fault-Response

THE WG APPLIES TO DISTRIBUTION NETWORKS: YES

ENERGY TRANSITION
1 / Storage
2 / Hydrogen
5 / Grids and Flexibility
6 / Solar PV and Wind

POTENTIAL BENEFIT OF WG WORK
2 / potential interest from a wide range of stakeholders
3 / likely to contribute to new or revised industry standards
4 / state-of-the-art or innovative solutions or directions

STRATEGIC DIRECTION
1 / The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-ofthe-art technological advances

SUSTAINABLE DEVELOPMENT GOAL
7 / Affordable and clean energy

BACKGROUND :

Today’s power systems experience substantial additions of unconventional sources, typically involving or based on power electronics, commonly referred to as IBR (Inverter Based Resources). These source terminals include not only sources per se (such as wind or solar farms) but also industry-scale energy storage systems, FACTS and high-voltage dc (HVDC) transmission links. Their response to fault conditions is characterized by low currents that follow patterns fundamentally different from those observed historically in systems with synchronous generators. Moreover, although constrained by physical limits such as semiconductor ratings or dc-bus capabilities, these sources can respond to faults in a wide variety of ways depending on design choices, selected control methods, and user-adjustable control parameters.

For a long time, the protection community refrained from specifying the desired source response during faults, assuming that existing protection principles and methods could be easily adapted to accommodate these new sources. This assumption was eventually abandoned, and the industry began issuing source-response specifications, such as prescribing the negative-sequence current injection.

However, standardization efforts around source fault-response specifications continue to underdeliver for a variety of reasons. One key issue is the lack of clear requirements for source fault behaviour that are explicitly, carefully, and completely derived from protection principles. Before designing or mandating specific source-response specifications (the negative-sequence current injection, for example), the industry must first define the underlying protection requirements. In other words: when making the transition from not requiring anything from the sources to mandating specific source-response specifications, the industry skipped a key technical step: outlining the protection requirements from the protection community’s point of view. These requirements must be exact and complete.

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

It is necessary to maintain a clear distinction between:

1. Protection requirements derived from protection principles, and
2. The eventual specification of fault-response behaviour that must balance protection, stability, control, operational, and implementation considerations

The proposed WG focuses exclusively on the first item. It will review the practical protection principles used today in networks near unconventional sources and state the voltage and current relationships required for these principles to work correctly. The focus will be on transmission level protection.

The Working Group output is intended as an input for future source fault-response specifications in industry standards and utility grid codes (second item above).

One can also view the output of this Working Group as a scorecard for past and future industry standards and grid codes, since those standards can be measured against the requirements outlined by the Working Group.

SCOPE :

The Working Group will consider at a minimum the following protection principles: bus, line, and transformer differential protection elements; all practical forms of directional elements; both mho and quadrilateral distance elements; faulted-loop selection logic; and current polarizing for fault locating. Only the most fundamental versions of these principles will be considered, with the objective of representing practical implementations across a wide range of manufacturers and relay technologies.

Using these principles, the Working Group will develop the voltage and current relationships required by these protection principles. These relationships will be defined in both the frequency and time domains. Moreover, they will be expressed through desired equivalent networks for the sources. The WG should give indications about equivalent source behaviour, which is higher level than a detailed source model. The Working Group will not develop any IBR models.

Finally, the Working Group will investigate, compare and finally recommend a method for assessing any specific unconventional source (existing or future) against the stated protection requirements. This assessment will include test cases as well as permissible deviations from the ideal response. These permissible deviations are derived by comparing the fault response of a typical synchronous generator (the fault-current level notwithstanding) against the requirements developed by the Working Group. The WG will reference any known work that supports feasibility of the required fault response.

Out of Scope:

1. The Working Group will not consider any proprietary or not commonly used protection principles, only the tried-and-true principles in common use.
2. The Working group will not consider implementation issues.
3. The Working Group will not specify any system configurations or parameters for the suggested test cases but only describe the cases at a high level.

References:

- The potential link with other active working groups dealing with unconventional sources (such as B5.78) will have to be evaluated

DELIVERABLES AND EVENTS

Deliverables Types

Annual progress and activity report to Study Committee
CSE
Technical Brochure and Executive Summary in Electra
Tutorial
Webinar

Time schedule

Q4	2026	Recruit members (National Committees)
Q1	2027	Develop final work plan
Q2	2028	Draft TB for Study Committee Review
Q4	2028	Final TB & other deliverables

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:

Rannveig S. J. Loken
November 22nd, 2026