

Short circuit testing in HV Power Systems

Advanced power systems



— Skilled engineers from ABB with long experience from HV commissioning perform the test.

The ride through capability of the power system and the selectivity of the relay protection are tested when live short circuit testing is conducted. In modern power systems the most critical configurations regarding fault clearance can be when a minimum number of generators are online.

The goal of live short testing is not to test maximum fault currents, but to demonstrate compliance with class rules and ensure operational safety in failure modes to the vessel owner. For example DP vessels with closed bus operation or other vessels where the consequences of black out in real operation can be devastating such live testing should be considered. In recent years, both class societies and ship-owners have more frequently requested such testing to be performed.

Test planning and preparation

Careful planning is crucial to secure a successful outcome:

- Test description with plan is agreed between ABB, marine class, shipyard and shipowner. Configuration of the power system including number of on-line generators in addition to fault location and recording of data are critical.
- Safe Job Analysis (SJA) is performed by ABB in co-operation with shipyard and shipowner. The SJA includes a risk assessment of the testing including measures to prevent unwanted incidents. Of high-

Live testing including short circuit in HV Power Systems is an excellent way of proving the integrity of the power system. Such testing requires careful planning and implementation to ensure both personnel and equipment safety. ABB has long track record of short circuit testing in HV power systems.

est importance is personnel safety, only essential people needed to execute the test are allowed to be present.

Test execution

- Minimum two engineers from ABB to attend the test; one is responsible for the safety and one is responsible for the test connections with switching operations. Both engineers to have long experience with HV power systems and have passed all applicable safety courses.
- Test is controlled and performed from the engine control room. Personnel is kept away from the HV switchboard rooms.



— Example of voltage and current trends during a test. Sub-transient and transient condition are completed within 50ms, fault is cleared after 250ms.

Test recording

- Test is recorded by ABB protection relay disturbance data logger, RDS system and PMS/IAS system. No additional external measurement equipment is needed due to the built in logging capabilities in the ABB equipment. Disturbance files can be used to reproduce the test in later stage of the vessel life (e.g. re-classing, demonstrate to other maritime authorities)
- Disturbance recorder data can be analyzed with ABB engineering tools.

Example of test configuration

Test configuration needs to follow test procedure. One typical configuration can be:

- DP vessel with closed ring switchboard configuration.
- 2 out of 6 generators connected and running.
- All thruster, drilling and distribution transformers connected
- Short circuit test in one transformer feeder
- Short circuit test in 11kV busbar.

A bolted Cu link is used to shorten the 3 phases, the short circuit is activated by closing a circuit breaker to the Cu link.

Test result

- Fault clearance according to expected result, disconnection of faulty part of power system with all other feeders connected and running as in pre failure condition.
- Successful ride through of consumers.
- Verification of correct trip times and magnitude of failure currents
- Verification of voltage recovery after clearance of fault

Live testing can be performed during vessel new building stage or during re-classing of vessel. ABB's equipment is suitable for live fault testing; factory recommendation on equipment preparation and



No personnel is present in the HV SWBD room during testing.



Testing is controlled from Engine Control Room.

verification has to be followed (e.g. breaker resistance check, cool down time of generator due to thermal loading etc.)

For more information, please contact:

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Verification of circuit breaker after testing.

