



ShoreConnection

POWER FAULT CONTROL

Closed Bus Tie Breaker - DP2 & DP3

PFC



POWER FAULT CONTROL

- Production loss reduced to a minimum
- Better use of power plant capacity
- Unique logging and playback
- Simplifies fault finding
- Fuel reduction - less emission
- Less running hours – less maintenance
- Easy installation
- Add-on options

Enhanced safety & propulsion reliability

The PFC system detects possible common source power faults which can lead to loss of all electric power and/or loss of all thrusters when the bus tie breaker is closed.

PFC is a fast acting, monitoring and protection system, using advanced and multi-variable protection functions which are able to detect and isolate faults with a high degree of reliability and precision.

The PFC does not replace the traditional electric protection devices, but is an overlaying and complementary system to this. In principal, it will not alter the existing protection, even though it may be found necessary to change some of the protection settings in order to obtain the intended results.

The closed bus tie breaker challenge

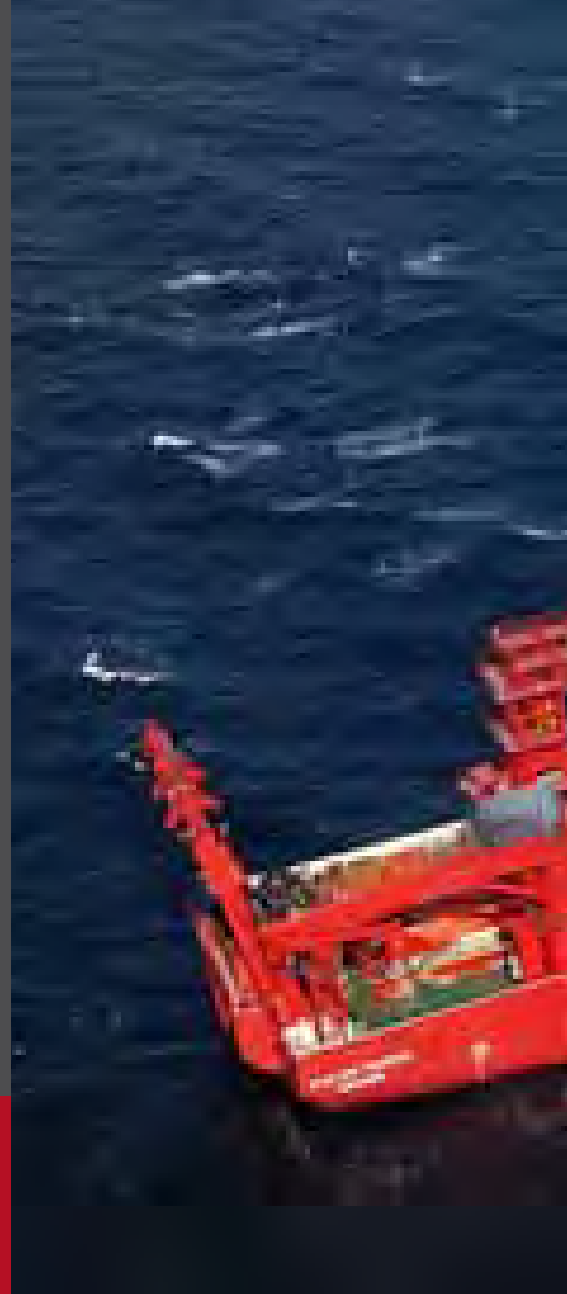
The majority of integrated power and propulsion vessels are depending on closed bus tie breaker operation for optimal use of their electric power plant.

Closed bus tie breaker operation is also the preferred mode to most system operators since this gives a better operational availability and less running hours of the main engines.

However, over the last decade, this same industry has become more aware of single point / common source failures which can lead to full black-out or loss of all thrusters when the bus tie breaker is closed.

Examples of common-source power faults that may occur:

- Over / under voltage
- Over / under frequency





- Unbalanced reactive power
- AVR/ Excitation fault
- Over load
- Short circuit - Earth circuit
- Unbalanced voltage
- Light Arc
- Voltage distortion/ EMC

Is an open bus tie breaker safer?

The recognition of the above mentioned common source failure modes when running with the bus tie breaker closed, has led to a prolonged discussion in the industry. The simple question above has been raised, which there unfortunately, isn't always a clear answer to.

Uncertainty factors

Depending on the design, there may be quite a few common source faults which can blackout a vessel / rig, even when the bus tie breaker is in open position. Open bus tie breaker cannot be regarded as 100% safe in all cases.

Lately, we have also seen quite a few inadequate attempts from various vendors to solve the closed bus tie breaker problem. Some of these half-done solutions are even class approved.

When the FMEA reveals lack of sufficient protection for closed bus tie breaker operation, or when in doubt, it is normal to implement a DP procedure stating;

"When operating in DP2/3 mode, the bus tie breaker must be opened"

This is the industry's most common reaction to the problem, and is the easiest way around a complicated topic. Unfortunately this simplified conclusion almost certainly results in an inadequate perception of the failure mode and power safety situation for the vessel.

The open / closed bus tie discussion is truly a headache for the industry, and leads to a uncertainty factor which will not just fade away.

Product range

The PFC is available in four versions and is customized to the individual customer's requirements and can be retrofit in to any electric power plant.

PFC-100 is a single system with recording and playback.
PFC-200 is a redundant system with recording and playback.
PFC-S1 is a simplified single version which only trips the Bus Tie Breaker.
PFC-S2 is a simplified redundant version which only trips the Bus Tie Breaker.

Investigation and analyzing

In the PFC 100 and 200, all signals are recorded and can be replayed and analyzed on board and even a shore. Data may be replicated to shore or manually exported through E-mail for analyzing and investigation of power fault situations. The unique playback tool makes investigation of power faults fast and precise.

Implementing a closed bus tie breaker solution

When a PFC is implemented as part of an overall closed bus tie breaker solution, we make sure to perform all required studies, adjustments and modifications to the existing switch boards, drives and control systems.

The PFC measures system variables that are easily available in normal design of electric power generation and distribution systems for vessels and rigs.

In retrofit applications, there may be a need to add certain sensors, and signal transducers for signal acquisition to the system. In some cases the bus tie breaker arrangement also needs to be modified.

Verification

During commissioning of a PFC, the built in playback tool is an absolute requirement in order to adjust the trip values and document that the required safety margins are obtained. Without this unique playback tool, it is impossible to verify and document the systems failure mode handling.

Equipment

All PFC equipment is type approved for marine applications. Documentation, testing, system FMEA and class approval is done case by case similar to a power management system.

Add-on option

The PFC is based on the comprehensive Høglund Marine Automation AS HC800 technology and ABB automation products. The PFC can be expanded with many optional modules like Power Management, Load Control and Energy Monitoring.



PFC-200 Node/ IO in a 3KV MSB

THE PFC DISPLAY

- Power mimic
- Alarm handling
- System Status
- Settings
- Playback
- Trend



Top left:
Layout PFC-100

Top right:
Layout PFC-200

Bottom left:
A 4,15kV MSB fitted with PFC200

Bottom right:
ShoreConnection Engineer during PFC commissioning

