



-power in control

Delomatic 4 DM-4 Marine



Shore Connection Part 2, chapter 20



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20. Control, supervision and protection

There are 3 ways of handling a SC (Shore Connection breaker) in the DELOMATIC system:

- 1) Shore connection breaker supervision
- 2) Shore connection SEMI-AUTO breaker control
- 3) Shore connection AUTOMATIC breaker control

Shore connection breaker supervision

Once the SC DGU has detected an ON status at

- input **“SHORE CB POS. FEEDBACK ”** connected to SC DGU,

all automatic sequences for start of the auxiliary engines are blocked:

- SEMI-AUTO initiated GB ON
- Load-dependent start
- Blackout function



Blackout starts of any of the generator sets are not carried out as long as the shore connection circuit breaker is in ON position.

If the position ON is maintained for a period of time, at the same time as one or more DGs are connected to the busbar, the following alarm message is displayed on the DU (SC DGU):

- Alarm **“SCB POS. ON!”**

The supervision of available power on the busbar is disabled when the shore connection is ON. The shore connection is handled as being able to supply infinite power. Read-out of available power is null (zero).

Shore connection SEMI-AUTO breaker control

Shore connection SEMI-AUTO control is handled by the SC DGU according to a number of semi-automatic sequences. Altogether the semi-automatic sequences form a complete cycle of operation for the shore connection.

The shore connection can only be closed in SEMI-AUTO mode and only by request from the operator. Dependent on the situation on the busbar, the shore connection breaker will either close immediately (dead busbar) or be synchronised to the busbar (live busbar). If any DGs are connected to the busbar, the DGs must be disconnected manually.

An alarm is given, if a DG is running in parallel with the shore (mains) for too long time (programmable). If the shore connection is disconnected without any DGs being connected to the busbar, a blackout start of DGs is performed by the system.

When the plant mode is changed from SEMI-AUTO mode, the shore connection breaker cannot be operated from the DU, but will remain in the present position.

If e.g. the shore connection voltage or frequency is outside the acceptable limits, the DELOMATIC system will not complete the SCB ON sequence, but will display an alarm. In case the shore connection breaker is tripped by protective functions and a blackout situation occurs at the busbar, the system will perform an automatic blackout start of DGs (except in the presence of a short circuit alarm).

The DELOMATIC system will

- refuse to close the shore connection breaker, if the load of the busbar extends the size of the shore connection
- refuse to deload the shore connection breaker, if the nominal power of the connected DGs is too low to take over the entire load

The SC DGU is able to carry out the following semi-automatic sequences for control and supervision of the shore connection operation:

- Supervision of the load size for connecting/disconnecting the SCB
- SCB ON sequence - dynamical synchronisation incl. phase sequence supervision
- Frequency/load supervision during operation
- Shore connection breaker protection
- SCB OFF sequence - deloading of the shore connection

All the above-mentioned semi-automatic sequences are controlled according to a number of programmable setpoints and delays, which enable the operator to adjust the operation of the shore connection.

Shore connection AUTOMATIC breaker control

The SC DGU handles the shore connection control according to a number of automatic sequences. Altogether the automatic sequences form a complete cycle of operation for the shore connection.

The shore connection is activated by means of the SHORE mode. Selection and cancellation of the SHORE mode is able to initiate and complete respectively the cycle of operation for the shore connection.

Selected SHORE mode is automatically cancelled and AUTO plant mode selected, if

- a failure occurs during engagement of the shore connection, if e.g. the shore voltage or frequency is outside the acceptable limits
- the DELOMATIC system is unable to complete the SCB ON sequence successfully

Furthermore the SHORE mode is automatically cancelled during operation, if

- the shore connection breaker is tripped by a protective function
- a blackout occurs at the busbar

If the SHORE mode is automatically cancelled, the following alarm message is displayed at the DU (SC DGU):

- Alarm **“SC MODE CANCEL”**

The SC DGU is able to carry out the following automatic sequences for control and supervision of the shore operation:

- Selection of SHORE mode
- SCB ON sequence
 - dynamical synchronisation
 - incl. phase sequence supervision
 - load transfer from diesel generators to shore
- Frequency/load supervision during operation
- Shore connection breaker protection
- Selection of AUTO plant mode
 - automatic PMS start of the stand-by diesel generators
- SCB OFF sequence
 - deloading of the shore connection breaker/load transfer to the diesel generators

All the above-mentioned automatic sequences are controlled according to a number of programmable setpoints and delays, which enable the operator to adjust the operation of the shore connection.

Control, supervision and protection of shore connection breaker

The DELOMATIC system handles the shore connection breaker as a normal shaft generator breaker. The basic controlling and VTA structures are the same as described in the "COMMON GENERATOR SET PROTECTION".

Load transfer from DG to SCs

The load transfer from the running diesel generator sets to the shore connection is initiated when:

System 1: the operator presses the "CB OFF" push-button on the DU (DG DGU).



If a failure such as the "DG DELOAD FAIL" or the "DGB OFF FAILURE" occurs at one of the running DGs during the load transfer, no special action is taken by the system. The DGs must be disconnected manually to prevent parallel running with the mains for too long time.

System 2: the SHORE mode is selected, and the DGs are disconnected from the busbar.



If a failure such as the "DG DELOAD FAIL" or the "DGB OFF FAILURE" occurs at one of the running DGs during the load transfer, the AUTO mode will be selected again.

The load transfer is carried out by the diesel generator set deloading/ramp-down function. When running in parallel with the mains and not ramping either up or down, the DGs will run with a load of 40% of DG-P-Nom.



The system is not allowed for long time parallel running with the mains, and this should not be considered to be some kind of load test mode.

Load supervision during SC supply

The load-dependent start/stop function is *disabled*, when the shore connection is supplying the busbar.

Calculation of the predicted available power is carried out continuously. This allows the supervision of the predicted available power to be active (described in the paragraph POWER MANAGEMENT UNIT).

Connection of heavy consumers during shore connection supply

This also allows the conditional connection of heavy consumers, provided that sufficient available power is present at the busbar.

If, however, the predicted available power becomes too low when a heavy consumer requests start, the start is denied (described in the paragraph POWER MANAGEMENT UNIT).

Synchronisation of DGs to the shore connection

The DGs synchronise and connect to the busbar as described in the paragraph GENERATOR SET CONTROL when:

System 1: the operator presses the push-button marked "CB ON" on the DU (DG DGU).

System 2: the AUTO/SECURED plant mode gets selected.

Deloading of the shore connection

The SCB OFF sequence deloads the shore connection before allowing the breaker to be opened.

The breaker is deloaded by ramping up the power produced by the running DGs, until the measured power through the shore connection breaker is below the programmable limit. After this, the breaker is opened.

The operator is able to programme the VTA structure, by which the deloading of the shore connection is controlled.

- VTA structure "SCBPMinOff"
- VTA structure "SCBRampDown"



Please refer to technical manual part 1, paragraph 4 for a detailed description of the VTA structure.

If the shore connection is *not* below the limit within the VTA structure "SC DELOAD TIME", an alarm message is displayed at the DU(SC DGU).

If the "SC DELOAD FAIL" alarm is active:



**System 1: the operator must take care of the situation.
System 2: the SHORE mode will be selected again.**

System 1: If the nominal power of the connected DGs is below the load of the entire busbar, the SCB OFF command will be neglected, and the following alarm message is displayed at the DU(SC DGU):

- Alarm **"DG P-NOM TOO LOW"**

System 2: The automatic function will start the necessary DGs up and connect them to the busbar, until the situation is cleared. If this is not possible, the SHORE mode will be selected again.

DEIF A/S reserves the right to change any of the above.