

Title: **New Enhanced Safety Power Plant Solution for DP Vessels Operated in Closed Ring Configuration**

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Abstract

The new enhanced CLEAN power system has been introduced the last few years for all types of vessels. This power system is particularly suitable for DP operated vessels and closed bus-tie operation (even with only one engine on-line in combination with energy storage) which will be discussed in this paper.

The main electrical bus of the Siemens CLEAN systems is based on a nominal voltage of 930VDC. The incomers to the main switchboard can be synchronous generators or other power sources like energy storages or similar that is connected to the main bus through passive in-feed rectifiers. All loads to the distribution are connected to the main bus through inverters.

Generally in AC distribution systems medium voltage levels like 6 – 11kV is necessary when the installed power on a plant is above 10-12 MW due to high short circuit levels on the main AC switchgear.

This type of power plant does not need high short circuit power to blow fuses and breakers as this is a all drives distribution system of the main power system and as such the generators are of special design with high X_d and low max short circuit current. The rectifiers is designed to handle the max short circuit current the generator can provide in any failure and Siemens are introducing a new protection system for the power generation in addition to new method of engine speed control. Diesel engines are operated with variable frequency in the range of 40 – 90Hz to optimize the fuel consumption and CO₂ and NO_x emissions of the power plant. Approximate values of CO₂ reduction and NO_x reduction are up to 15% and 85% respectively.

A new type of bus-tie (Intelligent Load Controller “ILC”) has been developed for the system. This bus-tie enables segregation of the power sections and ensures that the short circuit rating on one section is not transferred to other adjacent sections. A severe failure like a short circuit will only impact the affected section since the ILC’s disconnects the connection to the other sections in the range of 10-50 microseconds to avoid propagation of faults to the adjacent switchboard sections. This functionality makes it possible to build low voltage system without considering the limitations in switchgear short circuit strength. To utilize this potential, several DC switchboards can be connected together, separated by ILC’s to form a line or a closed ring configuration which in sum will give room for considerably more installed power in this DC power system compared with a conventional AC low voltage system.

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