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Next Generation Direct Feed MV Power Supply for Large Steelmaking EAFs

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The expansion of EAF production, alongside with the large-scale deployment of renewable energy sources, has significant impact on network stability and local capacity. Steel producers will face growing pressure to minimize disruptions to the electrical grid and meet ever increasing utility requirements. To tackle these challenges a novel multilevel converter for the decoupling of EAF operation from the medium voltage grid supply was developed, installed and commissioned in a German steelmaking plant in Dec. 2024. This Direct Feed (DF) Power Supply enables steelmakers to increase both, power quality and EAF performances. Key benefits demonstrated during full heat cycle operation in the nominal power range (up to 130 MW) include flicker reduction up to the factor of ten for 10 min. values resp. eleven for 1 min. values, EAF operation with individually controlled electrode currents, and related EAF performance benefits that will be highlighted in the EEC 2026 conference paper with the title “Direct Feed to Enhance Power Quality and EAF Performances” .

The DF modular multilevel converter (MMC) design is based on robust press-pack IGBT technology that has been adapted to meet the special needs of electric arc furnace power supplies and can be scaled up to a power level of 260 MW, without generating reactive power in the medium voltage grid (power factor above 0.99 at the HV busbars without additional power compensation systems). The latest DF converter design has a redundant control architecture and can be operated at nominal power with n-1 submodules in each converter arm. This enables to restart the converter after a component failure in any of the 12 converter arms and continue EAF operation without a loss in performance, enabling to fulfill highest availability requirements for the power supply. Thanks to the variable output voltage and frequency of the DF power supply, the control tasks for the existing EAF transformer tap changer is significantly reduced. The DF converter control system has demonstrated that it can reliably control and limit the electrode currents to predefined values, which significantly reduces the stress on the entire power supply network. Thanks to these gains in controllability, power quality and EAF performance, five large steelmaking plants have decided to build on this new type of MV MMC DF power supply, the largest one is an EAF with a peak nom. power of 260 MW.

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