IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 5, November 2025
Impact Factor: 7.67

Power Converters for Three Phase Electric Locomotives

Dr. H. Suresh, D. B. Abhishek, Rahul Chidanand Kumbar, Shivani, Devika. M. R
Associate Professor, EEE Department
Students, EEE Department
Bangalore Institute of Technology, Bengaluru, India.

Abstract: *Modern electric locomotives rely on robust and efficient power conversion stages to supply regulated energy to their auxiliary subsystems. These auxiliary loads—such as cooling pumps, compressors, blowers, and control equipment—demand a stable and high-quality three-phase supply, even when the locomotive operates under varying electrical and mechanical conditions. This paper presents a simulation based study of auxiliary converter design for a standard 6000 HP electric locomotive. The proposed model converts the single-phase high-voltage AC obtained from the overhead traction line into a regulated DC output using a closed-loop rectifier, followed by a DC–AC inverter stage that generates a balanced three-phase 50 Hz supply. The complete system is implemented and analyzed in MATLAB/Simulink, enabling detailed observation of converter behaviour, switching performance, and output waveform quality. Simulation results demonstrate effective voltage regulation, reduced harmonic distortion using SPWM control, and reliable operation suitable for traction auxiliary applications. The study high lights that simulation provides a powerful platform for validating converter performance prior to hardware integration, ultimately improving efficiency, reliability, and maintainability in electric locomotive systems.*

Keywords*:* Auxiliary converters, electric locomotives, AC–DCrectifier, DC–AC inverter, sinusoidal pulse width modulation (SPWM), voltage regulation, three-phase power con version, traction systems.