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| NMRA STANDARDS | |
| ELECTRICAL | |
| Sheet No. | S-9 |
| | Revised: Aug. 1984 |

NMRA STANDARDS S-9 Electrical

This STANDARD establishes ELECTRICAL requirements for interchange and safe and satisfactory performance of two rail equipment on model railroad layouts.

For Overhead Wire or Third Rail applications see STANDARD S-5.

I. POWER

- A. Full throttle voltage available at railhead shall not be less than 12 volts direct current at maximum anticipated load. (1)
- B. High frequency current superimposed upon the rails shall not interfere with the normal operation of Powered Equipment. (2)

II. CONTROL

- A. Direction control by polarity reversing shall be provided. Positive potential applied to the right hand rail shall produce forward motion. (3)
- B. Speed control means by voltage/current reduction shall be provided.

III. POWERED EQUIPMENT

- A. Shall be responsive to the Direction and Speed Controls of II. above.
- B. Metallic couplers shall be insulated from the rails. (4)

IV. NON-POWERED EQUIPMENT

- A. Wheelsets shall be insulated to prevent undue conductance between rails. (5)
- B. Metallic couplers shall be insulated from the rails.

V. COMMAND SYSTEMS

- A. It is recognized that command systems are inherently non-conforming to standards intended to set forth interchange requirements. Interchange may be facilitated by doing either or both of the following:
 1. Power and control means shall include a method of fully conforming to I. and II. above.
 2. Powered equipment shall include a means of fully conforming to III. above.

NOTES:

- (1) When using a power source delivering a wave with greater harmonic content than full wave rectified sine wave, exercise care not to operate in such a manner to exceed the rated current or otherwise overheat the motor.
- (2) The least restrictive wiring requirements of the U.S. National Electrical Code call for no combination of voltages in layout wiring to exceed 49 volts. Modelers in other countries are encouraged to check with local authorities.
- (3) The term "right hand rail" as used herein means the rail to the right of the observer standing between the rails with their back to the front of the locomotive.
- (4) Steam type locomotives may use uninsulated front couplers with due care not to couple two such locomotives head-to-head.
- (5) Where a high resistance path for lighting, detection or other purposes is required, such resistance shall be high enough to prevent significant drop in propulsion power.

For further information, see TRACTION STANDARDS S-5 and appropriate RECOMMENDED PRACTICES.