

**American Railway Engineering and Maintenance of Way Association  
Letter Ballot**

**1. Committee and Subcommittee:**

- Committee 16 – Economics of Railway Engineering and Operations
  - Subcommittee 2 - Part 3: Power

**2. Letter Ballot Number:** 16-22-01

**3. Assignment:**

- Review, modify and update material in MRE Part 16.3 Power

**4. Ballot Item:**

- Proposed text to insert as new article 16.3.2.8 Locomotive Gear Ratios
- Approved on February 24<sup>th</sup>, 2022

**5. Rationale:**

- Ballot to approve the newly developed material for Chapter 16, Part 3, Section 2, Article 8: Locomotive Gear Ratios, and insert the new material into the existing articles of Chapter 16, Part 3, Section 2: Locomotive Characteristics.
- This change is part of the ongoing effort to update existing material in Part 16.3 Power (dating to 1970 and 1983) to reflect modern locomotive designs and utilization practices, and better explain fundamental motive power concepts and characteristics.

**AREMA Chapter 16, Part 3, Section 2, Article 8**  
**Locomotive Gear Ratios**  
**FINAL (post Letter Ballot) – 24 Feb 2022**

The gear ratio of a locomotive defines the speed range through which the locomotive can be operated continuously at maximum horsepower output without damage to the traction motors. As indicated in Article 3.2.6.1 this is especially critical with DC traction motors.

The numerical presentation of a gear ratio provides the ratio of the teeth in the gear on the axle to that of teeth on the pinion connected to the traction motor. As the value of the ratio increases, the minimum and maximum speed of the locomotive is decreased. Some sample traction motor gear ratios are presented in Table 16-3-1. Note that minimum and maximum speeds and continuous tractive effort values may vary dependent on specifications dictated by railroad's service and purchasing requirements.

**Table 16-3-1. Sample Gear Ratios and Speed Ranges for Diesel-electric Locomotives**

<b>Gear Ratio</b>	<b>Minimum Continuous Locomotive Speed (mph)</b>	<b>Maximum Continuous Locomotive Speed (mph)</b>	<b>Continuous Tractive Effort (lbf)</b>	<b>Service</b>	<b>Locomotive Type</b>
62 : 15	11	65	47,000	Freight	1,800 hp 4-axle DC motors
62 : 15	9	65	56,000	Freight	2,000 hp 4-axle DC motors
62 : 15	11	65	58,000	Freight	3,000 hp 4-axle DC motors
62 : 15	11	65	83,000	Freight	3,000 hp 6-axle DC motors
60 : 17	16	76	48,000	Passenger	3,000 hp 4-axle DC motors
57 : 20	16	103	40,000	Passenger	3,000 hp 4-axle DC motors
82 : 19	12	70	93,600	Freight	3,800 hp 6-axle DC motors
74 : 29	12	110	38,000	Passenger	4,250 hp 4-axle DC motors
83 : 20	11	70	100,000	Freight	4,400 hp 6-axle DC motors
74 : 29	0	90	78,000	Passenger	4,400 hp 4-axle AC motors
87 : 16	0	75	166,000	Freight	4,400 hp 6-axle AC motors

Note that for AC traction motor locomotives the gear ratio design allows for operation at a virtual standstill in both power and dynamic brake since the AC motor design does not result in damaging heat conditions at very low speeds. High speed limitations on AC locomotives are governed by a combination of the motor design and gearing capability.