

American Railway Engineering and Maintenance of Way Association Letter Ballot

1. **Committee and Subcommittee:** Committee 4 - Rail, Subcommittee 5 – Physical Tests and Measurements
2. **Letter Ballot Number:** 04-22-02
3. **Assignment:**
4. **Ballot Item:** Revision of Section 2.1.3.1 – Chemical Composition
5. **Rationale:** It was determined that Ch.4 Section 2.1.3.1b – Chemical Composition, allowed for product testing of finished rail, but did not have directional verbiage for where the chemical samples could be taken.

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2.1.2 MANUFACTURE (2016)

- a. The steel shall be made by either of the following processes: basic oxygen or electric furnace.
- b. The steel shall be cast by a continuous process, or by other methods agreed by purchaser and manufacturer.
- c. Rails shall be furnished in the as-rolled (carbon and low alloy), or head hardened (in-line or off-line processes) conditions.

2.1.3 CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES (2016/2022)

2.1.3.1 Chemical Composition

- a. The chemical composition of a rail steel, determined as prescribed in Paragraph d, shall be within the limits found in the Product/Chemical Analysis Table. The specified compositions for Carbon Rail Steel and Low Alloy Rail Steel can be found in Table 4-2-1-3-1a. and Table 4-2-1-3-1b., respectively.
- b. Finished material representing the heat may be product tested. When the finished rail chemical composition is checked, it shall be taken anywhere in the head a sufficient distance below the external surface to avoid decarburization and surface contaminants. In case of dispute, the test shall be carried out at the clean steel location described in Figure 4-2-3 of Section 2.1.9.6.3. The product analysis shall be within the limits for product analyses specified in Paragraph a.
 - (1) If product chemistry testing is performed on fractured weld slow bend test specimens, the rail base of the parent rail may be tested. The testing shall not be performed on the external surface of the base due to the possibility of decarburization. In case of dispute, the test shall be carried out as described in Paragraph b.
- c. The chemical composition limits of alloy high-strength rail steel grades not shown in current Product/Chemical Analysis Tables are subject to agreement of the purchaser and manufacturer.
- d. Separate analyses shall be made from test samples representing the front, middle (optional), and back of the heat preferably taken during pouring of the heat. Determination may be made chemically or spectrographically. Any portion of the heat meeting the chemical analysis requirements of Paragraph a may be applied.
- e. Upon request by the purchaser, samples shall be furnished to verify the analysis as determined in Paragraph d.
- f. The analysis, most representative of the heat (clear of the transition zone for continuous cast steel), shall be recorded as the official heat analysis, but the purchaser shall have access to all chemical analysis determinations.
- g. Rail heats shall be tested for hydrogen content using a sampling/analytical method or a direct measurement method. The testing shall be performed during the continuous casting process. Hydrogen content¹ shall be recorded and available for review or reporting at the request of the purchaser. The producer shall define the method used to determine hydrogen content, which of the following methods are used for hydrogen removal, and present evidence of applicable procedures used to control the final rail hydrogen.
 - Vacuum Degassing.
 - Bloom Controlled Cooling.
 - Rail Controlled Cooling.

¹ As a result of the use of different methods and reporting procedures, the comparison of hydrogen levels between various rail producers may not be appropriate.

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