

A O AUTICAL MAT IAL SPECIFICATIONS

AMS 2259

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Revised

CHEMICAL CHECK ANALYSIS LIMITS Wrought Low Alloy and Carbon Steel

1. PURPOSE: To publish standard chemical check analysis limits as established by AISI or AMS usage and to correlate their application and use with material specifications.
2. APPLICATION: The chemical check analysis limits shown herein shall apply when referenced in the material specification, unless otherwise agreed upon by purchaser and vendor. Check limits not listed herein shall be as agreed upon by purchaser and vendor.
3. DEFINITIONS:
 - 3.1 Check Analysis: An analysis made by purchaser or vendor of the metal after it has been worked into semi-finished or finished forms or fabricated into parts, and is either for the purpose of verifying the composition of a heat or lot or to determine variations in the composition within a heat. Acceptance or rejection of a heat or lot of material or batch of parts may be made by the purchaser on the basis of this check analysis. In the analysis of finished parts these values do not apply to elements whose percentage can be varied by fabricating techniques employed (for example carbon in steel) unless the sample is taken in such a manner as to exclude such changes.
 - 3.2 Variation Limit, Under Min or Over Max: Given in Section 6 is the amount an individual determination for a specified element may vary under or over the specified composition limit. In no case shall the several determinations of any element in a heat, using the same analytical procedure, vary both above and below the specified range. These variations are not permitted for ladle or ingot analyses made by the producer. Dimensional sizes shown in column headings refer to cross sectional area of product being analyzed.
 - 3.3 Remainder: Shows the basis element from which the alloy is made and is assumed to be present in an amount approximately equal to the difference between 100% and the sum percentage of the alloying elements and listed impurities. It need not be analyzed nor need a percentage figure be reported.
 - 3.4 Other Impurities (Elements), Each, Max: The maximum amount of an individual element not mentioned specifically in the composition section that may be present. Producer normally will analyze only for impurities which are possible to be present because of raw materials or manufacturing processes and which may affect the product significantly. Others will analyze for impurities as they deem necessary.

Section 7C of the SAE Technical Board rules provides that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no obligation to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

3.5 Other Impurities (Elements), Total, Max: The sum percentage of the impurities (elements) (See 3.4) found. It is not inferred by this statement that an analysis need be made for each element of the periodic table not mentioned specifically in the composition section.

4. SAMPLING: For the purpose of determining conformance to the material specification composition requirement, each heat in the shipment shall be considered separately. All samples shall be taken from material in the condition in which it is received, except that all protective surface treatments shall be removed before sampling finished parts. Drillings or chips shall be taken without the application of water, oil, or other lubricants, and shall be free from scale, grease, dirt, and other foreign materials, and in such a manner as to prevent alteration of the chemical composition of the sample. If finished parts are too hard for machining, they may be tempered in a protective atmosphere prior to sampling. Sampling shall be in accordance with ASTM E59-57 insofar as practicable.

5. ANALYTICAL PROCEDURES: Referee methods of analysis shall be the latest edition of ASTM "Methods of Chemical Analyses of Metals" or methods approved by the National Bureau of Standards. Procedures for elements not covered shall be as agreed upon by purchaser and vendor.

6. CHECK LIMITS:

6.1 Carbon Steels: (See Note 1)

6.1.1 Bars, Forgings, and Forging Stock:

| Element | Limit or Maximum of Specified Element, % | Variation, Under Min or Over Max | |
|------------|--|----------------------------------|------------------------------|
| | | 100 sq in. and under | Over 100 to 200 sq in., incl |
| Carbon | 0.25 and under | 0.02 | 0.03 |
| | Over 0.25 to 0.55, incl | 0.03 | 0.04 |
| | Over 0.55 | 0.04 | 0.05 |
| Manganese | 0.90 and under | 0.03 | 0.04 |
| | Over 0.90 to 1.65, incl | 0.06 | 0.06 |
| Silicon | 0.35 and under | 0.02 | 0.02 |
| | Over 0.35 to 0.60, incl | 0.05 | -- |
| Phosphorus | 0.040 and under | 0.008 | 0.008 |
| | | | (See Notes 2, 3, & 4) |
| Sulfur | 0.060 and under | 0.008 | 0.010 |
| | | | (See Notes 2 & 4) |
| Copper | All | 0.02 | 0.03 |
| Lead | 0.15 to 0.35, incl | 0.03 | -- |

6.1.2 Sheet Strip, Plate, and Flat Wire:

| Element | Limit or Maximum of Specified Element, % | Variation | |
|------------|--|-----------|----------------------|
| | | Under Min | or Over Max |
| Carbon | 0.15 and under | 0.02 | 0.03 |
| | Over 0.15 to 0.40, incl | 0.03 | 0.04 |
| | Over 0.40 to 0.80, incl | 0.03 | 0.05 |
| | Over 0.80 | 0.03 | 0.06 |
| Manganese | 0.60 and under | 0.03 | 0.03 |
| | Over 0.60 to 1.15, incl | 0.04 | 0.04 |
| | Over 1.15 to 1.65, incl | 0.05 | 0.05 |
| Silicon | 0.30 and under | 0.02 | 0.03 |
| | Over 0.30 to 0.60, incl | 0.05 | 0.05 |
| Phosphorus | All | -- | 0.01 (See Note 4) |
| Sulfur | All | -- | 0.01 (See Note 4) |
| Copper | All | 0.02 | -- |

6.1.3 Wire, Other than Flat:

| Element | Limit or Maximum of Specified Element, % | Variation, Under | |
|------------|--|------------------|-----------------------|
| | | Min | or Over Max |
| Carbon | 0.75 and under | 0.01 | |
| | Over 0.75 | 0.02 | |
| Manganese | 0.90 and under | 0.02 | |
| | Over 0.90 to 1.65, incl | 0.03 | |
| Silicon | 0.35 and under | 0.02 | |
| | Over 0.35 to 0.60, incl | 0.05 | |
| Phosphorus | 0.050 and under | 0.005 | (See Notes 2, 3, & 4) |
| Sulfur | 0.060 and under | 0.005 | (See Notes 2 & 4) |
| Copper | All | 0.02 | (See Note 5) |
| Lead | 0.15 to 0.35, incl | 0.003 | |

6.1.4 Seamless Tubing:

| Element | Limit or Maximum of Specified Element, % | Variation | |
|------------|--|-----------|----------------------------|
| | | Under Min | or Over Max |
| Carbon | 0.25 and under | 0.02 | 0.02 |
| | Over 0.25 to 0.55 | 0.03 | 0.03 |
| | Over 0.55 | 0.04 | 0.04 |
| Manganese | 0.90 and under | 0.03 | 0.03 |
| | Over 0.90 to 1.65 | 0.06 | 0.06 |
| Silicon | 0.35 and under | 0.02 | 0.02 |
| | Over 0.35 to 0.60, incl | 0.05 | 0.05 |
| Phosphorus | 0.05 and under | -- | 0.008 (See Notes 3 & 4) |
| Sulfur | 0.060 and under | -- | 0.008 (See Note 4) |
| Copper | All | 0.02 | -- |
| Lead | 0.15 to 0.35 | 0.03 | 0.03 |

6.1.5 Welded Tubing:

| Element | Limit or Maximum of Specified Element, % | Variation | |
|------------|--|-----------|-----------------------|
| | | Under Min | or Over Max |
| Carbon | 0.25 and under | 0.02 | 0.03 |
| | Over 0.25 to 0.40, incl | 0.03 | 0.04 |
| | Over 0.40 to 0.55, incl | 0.03 | 0.05 |
| Manganese | 0.90 and under | 0.03 | 0.03 |
| | Over 0.90 | 0.06 | 0.06 |
| Phosphorus | All | -- | 0.010 (See Note 4) |
| Sulfur | All | -- | 0.010 (See Note 4) |
| Silicon | 0.30 and under | 0.02 | 0.02 |
| | Over 0.30 to 0.60 | 0.05 | 0.05 |
| Copper | All | 0.02 | -- |

- Notes:
1. Variations for carbon, phosphorus, and sulfur do not apply in rimmed or capped steels.
 2. Over max only.
 3. For basic steel only; for acid Bessemer steel, 0.010 over max is permitted for maximum phosphorus 0.12 and under.
 4. Values do not apply to rephosphorized or resulfurized steels.
 5. Under min only.