SPECIFICATION FOR SEAMLESS FERRITIC ALLOY-STEEL PIPE FOR HIGH-TEMPERATURE SERVICE

1. Scope

1.1 This specification covers nominal wall and minimum wall seamless ferritic alloy-steel pipe intended for high-temperature service. Pipe ordered to this specification shall be suitable for bending, flanging (vanstoning), and similar forming operations, and for fusion welding. Selection will depend upon design, service conditions, mechanical properties, and high-temperature characteristics.

1.2 Several grades of ferritic steels (see Note 1) are covered. Their compositions are given in Table 1.

NOTE 1 — Ferritic steels in this specification are defined as low- and intermediate-alloy steels containing up to and including 10% chromium.

1.3 Supplementary requirements (S1 to S7) of an optional nature are provided. These supplementary requirements call for additional tests to be made, and when desired, shall be so stated in the order together with the number of such tests required.

1.4 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification. The inch-pound units shall apply unless the "M" designation of this specification is specified in the order.

NOTE 2 — The dimensionless designator NPS (nominal pipe size) has been substituted in this standard for such traditional terms as "nominal diameter," "size," and "nominal size."

2. Referenced Documents

2.1 ASTM Standards:
A 999/A 999M Specification for General Requirements for Alloy and Stainless Steel Pipe
E 213 Practice for Ultrasonic Examination of Metal Pipe and Tubing
E 309 Practice for Eddy-Current Examination of Steel Tubular Products Using Magnetic Saturation
E 381 Method of Macroetch Testing Steel Bars, Billets, Blooms, and Forgings
E 527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
E 570 Practice for Flux Leakage Examination of Ferromagnetic Steel Tubular Products

2.2 ASME Standard:
B36.10M Welded and Seamless Wrought Steel Pipe

2.3 Other Documents:
SNT-TC-1A Recommended Practice for Nondestructive Personnel Qualification and Certification
SAE J 1086 Practice for Numbering Metals and Alloys (UNS)

3. Ordering Information

3.1 Orders for material under this specification should include the following, as required, to describe the desired material adequately:

3.1.1 Quantity (feet, metres, or number of lengths),
3.1.2 Name of material (seamless alloy steel pipe),
3.1.3 Grade (Table 1),
3.1.4 Manufacture (hot-finished or cold-drawn),
3.1.5 Size using one of the following:

3.1.5.1 NPS and schedule number,
3.1.5.2 Outside diameter and nominal wall thickness,
3.1.5.3 Outside diameter and minimum wall thickness,
<table>
<thead>
<tr>
<th>Grade</th>
<th>Designation</th>
<th>UNS</th>
<th>Carbon</th>
<th>Manganese, Max.</th>
<th>Phosphorus, Max.</th>
<th>Sulfur, Max.</th>
<th>Silicon</th>
<th>Chromium</th>
<th>Molybdenum</th>
<th>Others</th>
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</thead>
<tbody>
<tr>
<td>P1</td>
<td>K11527</td>
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<td>0.10–0.20</td>
<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>0.10–0.30</td>
<td>0.40–0.60</td>
<td>0.45–0.65</td>
<td>0.44–0.65</td>
</tr>
<tr>
<td>P2</td>
<td>K11547</td>
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<td>0.10–0.20</td>
<td>0.30–0.61</td>
<td>0.025</td>
<td>0.025</td>
<td>0.10–0.30</td>
<td>0.50–0.81</td>
<td>0.44–0.65</td>
<td>0.45–0.65</td>
</tr>
<tr>
<td>P3</td>
<td>K11545</td>
<td></td>
<td>0.15 max.</td>
<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>0.50 max.</td>
<td>4.00–6.00</td>
<td>0.45–0.65</td>
<td>0.45–0.65</td>
</tr>
<tr>
<td>P5b</td>
<td>K15145</td>
<td></td>
<td>0.15 max.</td>
<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>1.00–2.00</td>
<td>4.00–6.00</td>
<td>0.45–0.65</td>
<td>0.45–0.65</td>
</tr>
<tr>
<td>P5c</td>
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<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>0.50 max.</td>
<td>4.00–6.00</td>
<td>0.45–0.65</td>
<td>0.45–0.65</td>
</tr>
<tr>
<td>P9</td>
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<td>0.30–0.60</td>
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<td>0.025</td>
<td>0.25–1.00</td>
<td>8.00–10.00</td>
<td>0.90–1.10</td>
<td>0.45–0.65</td>
</tr>
<tr>
<td>P11</td>
<td>K13597</td>
<td></td>
<td>0.05–0.15</td>
<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>0.50–1.00</td>
<td>1.00–1.50</td>
<td>0.44–0.65</td>
<td>0.44–0.65</td>
</tr>
<tr>
<td>P12</td>
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<td>0.05–0.15</td>
<td>0.30–0.61</td>
<td>0.025</td>
<td>0.025</td>
<td>0.50 max.</td>
<td>0.80–1.25</td>
<td>0.44–0.65</td>
<td>0.44–0.65</td>
</tr>
<tr>
<td>P15</td>
<td>K13578</td>
<td></td>
<td>0.05–0.15</td>
<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>1.25–1.65</td>
<td>0.44–0.65</td>
<td>0.44–0.65</td>
<td>0.44–0.65</td>
</tr>
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<td>0.025</td>
<td>0.50 max.</td>
<td>2.65–3.35</td>
<td>0.80–1.06</td>
<td>0.45–0.65</td>
</tr>
<tr>
<td>P22</td>
<td>K21590</td>
<td></td>
<td>0.05–0.15</td>
<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>0.50 max.</td>
<td>1.90–2.60</td>
<td>0.87–1.13</td>
<td>0.45–0.65</td>
</tr>
<tr>
<td>P23</td>
<td>K41650</td>
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<td>0.04–0.10</td>
<td>0.10–0.60</td>
<td>0.030 max.</td>
<td>0.001 max.</td>
<td>0.50 max.</td>
<td>1.90–2.60</td>
<td>0.05–0.30</td>
<td>0.50–0.80</td>
</tr>
</tbody>
</table>

- **NOTES:**
  - New designation established in accordance with Practice E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).
  - Grade P5c shall have a titanium content of not less than 1 times the carbon content and not more than 0.70%, or a columbium content of 8 to 10 times the carbon content.
Designation: A 335/A 335M – 06

Standard Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service

This standard is issued under the fixed designation A 335/A 335M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

(Identical with ASTM Specification A 335/A 335M-06 except for the addition of hardness requirements for P23 and P911 in 9.3 and 14.2.1, and the correction of the UNS numbers for P9 and P91.)

1. Scope

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3.1.5 Size using one of the following:

3.1.5.1 NPS and schedule number,
3.1.5.2 Outside diameter and nominal wall thickness,
3.1.5.3 Outside diameter and minimum wall thickness,
3.1.5.4 Inside diameter and nominal wall thickness, and
3.1.5.5 Inside diameter and minimum wall thickness.
3.1.6 Length (specific or random),
3.1.7 End finish (Ends Section of Specification A 999/ A 999M),

*A Summary of Changes section appears at the end of this standard.

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3.1.8 Optional requirements (Section 8, 12 and 13 of this specification. See the Sections on Hydrostatic Test Requirements and Permissible Variation in Weight for Seamless Pipe in Specification A 999/A 999M),

3.1.9 Test report required (Certification Section of Specification A 999/A 999M),

3.1.10 Specification designation, and

3.1.11 Special requirements or any supplementary requirements selected, or both.

4. General Requirements

4.1 Material furnished to this specification shall conform to the applicable requirements of the current edition of Specification A 999/A 999M, unless otherwise provided herein.

### TABLE 1 Chemical Requirements

<table>
<thead>
<tr>
<th>Grade</th>
<th>UNS Designation</th>
<th>Carbon, max</th>
<th>Manganese, max</th>
<th>Phosphorus, max</th>
<th>Sulfur, max</th>
<th>Silicon, max</th>
<th>Chromium, max</th>
<th>Molybdenum, max</th>
<th>Others</th>
</tr>
</thead>
<tbody>
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<td>0.30–0.80</td>
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<td>0.025</td>
<td>0.10–0.50</td>
<td>. . .</td>
<td>0.44–0.65</td>
<td>. . .</td>
</tr>
<tr>
<td>P2</td>
<td>K11547</td>
<td>0.10–0.20</td>
<td>0.30–0.61</td>
<td>0.025</td>
<td>0.025</td>
<td>0.10–0.30</td>
<td>0.50–0.81</td>
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</tr>
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<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>0.50 max</td>
<td>4.00–6.00</td>
<td>0.45–0.65</td>
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<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>1.00–2.00</td>
<td>4.00–6.00</td>
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<td>0.30–0.60</td>
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<td>0.025</td>
<td>0.50 max</td>
<td>4.00–6.00</td>
<td>0.45–0.65</td>
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</tr>
<tr>
<td>P9</td>
<td>S50400</td>
<td>0.15 max</td>
<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>0.25–1.00</td>
<td>8.00–10.00</td>
<td>0.90–1.10</td>
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</tr>
<tr>
<td>P11</td>
<td>K11597</td>
<td>0.05–0.15</td>
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<td>0.025</td>
<td>0.025</td>
<td>0.50–1.00</td>
<td>1.00–1.50</td>
<td>0.44–0.65</td>
<td>. . .</td>
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<td>P12</td>
<td>K11562</td>
<td>0.05–0.15</td>
<td>0.30–0.61</td>
<td>0.025</td>
<td>0.025</td>
<td>0.50 max</td>
<td>0.80–1.25</td>
<td>0.44–0.65</td>
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<tr>
<td>P15</td>
<td>K11578</td>
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<td>0.30–0.60</td>
<td>0.025</td>
<td>0.025</td>
<td>1.15–1.65</td>
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<td>P21</td>
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<td>0.025</td>
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<td>0.025</td>
<td>0.50 max</td>
<td>1.90–2.60</td>
<td>0.87–1.13</td>
<td>. . .</td>
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<tr>
<td>P23</td>
<td>K41650</td>
<td>0.04–0.10</td>
<td>0.10–0.60</td>
<td>0.030 max</td>
<td>0.010 max</td>
<td>0.50 max</td>
<td>1.90–2.60</td>
<td>0.05–0.30</td>
<td>V 0.20–0.30</td>
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<table>
<thead>
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<th>Composition, %</th>
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<td>P91</td>
<td>K91560</td>
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<td>K92460</td>
<td>0.07–0.13</td>
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<td>P122</td>
<td>K92930</td>
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<tr>
<td>P911</td>
<td>K91061</td>
<td>0.09–0.13</td>
</tr>
</tbody>
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*a New designation established in accordance with Practice E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

*b Grade P 5c shall have a titanium content of not less than 4 times the carbon content and not more than 0.70 %; or a columbium content of 8 to 10 times the carbon content.