Designation: B 516 – 98

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Specification for
Welded Nickel-Chromium-Iron Alloy (UNS N06600, UNS N06603, UNS N06025, and UNS N06045) Tubes

This standard is issued under the fixed designation B 516; 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.

1. Scope

1.1 This specification covers welded UNS N06600*, N06603, N06025, and N06045 alloy boiler, heat exchanger,
and condenser tubes for general corrosion resisting and low or
high-temperature service.

1.2 This specification covers tubes ¼ to 5 in. (3.18 to 127
mm), inclusive, in outside diameter and 0.015 to 0.500 in. (0.38
to 12.70 mm), inclusive, in wall thickness. Table 2 of Speci-
fication B 751 lists the dimensional requirements of these sizes.
Tubes having other dimensions may be furnished provided
such tubing complies with all other requirements of this
specification.

1.3 The values stated in inch-pound units are to be regarded
as the standard. The values given in parentheses are for
information only.

2. Referenced Documents

2.1 ASTM Standards:
B 751 Specification for General Requirements for Nickel
and Nickel Alloy Welded Tube

3. Ordering Information

3.1 It is the responsibility of the purchaser to specify all
requirements that are necessary for the safe and satisfactory
performance of material ordered under this specification.
Examples of such requirements include, but are not limited to,
the following:

3.1.1 Quantity (feet or number of lengths),
3.1.2 UNS number,
3.1.3 Size (outside diameter minimum or average wall
thickness),
3.1.4 Length (random or specific),
3.1.5 Class,
3.1.6 ASTM designation,
3.1.7 Product Analysis—State if required,
3.1.8 Certification—State if a certification or a report of test
results is required, and
3.1.9 Purchaser Inspection—State which tests or inspec-
tions are to be witnessed, if any.

4. Material and Manufacture

4.1 Tube shall be made from flat-rolled alloy by an auto-
matic welding process with no addition or filler metal. Subse-
quent to welding and prior to final annealing, the material
shall be cold-worked in either the weld metal only or both weld
and base metal.

4.2 Tube shall be furnished with oxide removed. When
bright annealing is used, descaling is not necessary.

5. Chemical Composition

5.1 The material shall conform to the composition limits
specified in Table 1. One test is required for each lot as defined
in Specification B 751.

5.2 If a product analysis is performed, it shall meet the
chemistry limits prescribed in Table 1, subject to the analysis
tolerances specified in Table 2 of Specification B 751.

6. Mechanical Properties and Other Requirements

6.1 Mechanical Properties—The material shall conform to
the mechanical property requirements specified in Table 2. One
test is required for each lot as defined in Specification B 751.

6.2 Flattening Test—A flattening test shall be made on each
end of one tube per lot. Superficial ruptures resulting from
surface imperfections shall not be cause for rejection.

6.3 Flange Test—A flange test shall be made on each end of
one tube per lot.

6.4 Nondestructive Test Requirements:

6.4.1 Class 1—Each piece in each lot shall be subject to one
of the following four tests: hydrostatic, pneumatic (air under-
water), eddy current, or ultrasonic.

6.4.2 Class 2—Each piece in each lot shall be subjected to
a leak test and an electric test as follows:

6.4.2.1 Leak Test—Hydrostatic or pneumatic (air under-
water).

6.4.2.2 Electric Test—Eddy current or ultrasonic.

6.5 The manufacturer shall have the option to test to Class
1 or Class 2 and select the nondestructive test methods, if not
specified by the purchaser.

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1 This specification is under the jurisdiction of ASTM Committee B-2 on
Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee
B02.07 on Reinforced Nickel and Cobalt and Their Alloys.

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* New designation established in accordance with ASTM B 527 and SAE J1086.

Practice for Numbering Metals and Alloys (UNS).

TABLE 1 Chemical Requirements

<table>
<thead>
<tr>
<th>Element</th>
<th>N06600 Limits, %</th>
<th>N06603 Limits, %</th>
<th>N06625 Limits, %</th>
<th>N06645 Limits, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel</td>
<td>72.0 min</td>
<td>Bal</td>
<td>Bal</td>
<td>45.0 min</td>
</tr>
<tr>
<td>Chromium</td>
<td>14.0 min</td>
<td>24.0–26.0</td>
<td>24.0–26.0</td>
<td>26.0–29.0</td>
</tr>
<tr>
<td>Iron</td>
<td>17.0 max</td>
<td>8.0–11.0</td>
<td>8.0–11.0</td>
<td>21.0–25.0</td>
</tr>
<tr>
<td>Manganese</td>
<td>10.0 max</td>
<td>1.0</td>
<td>0.15 max</td>
<td>1.0 max</td>
</tr>
<tr>
<td>Carbon</td>
<td>0.15 max</td>
<td>0.15–0.40</td>
<td>0.15–0.25</td>
<td>0.05–0.12</td>
</tr>
<tr>
<td>Copper</td>
<td>0.5 max</td>
<td>0.50 max</td>
<td>0.10 max</td>
<td>0.3 max</td>
</tr>
<tr>
<td>Silicon</td>
<td>0.5 max</td>
<td>0.50 max</td>
<td>0.5 max</td>
<td>2.5–3.0</td>
</tr>
<tr>
<td>Sulfur</td>
<td>0.015 max</td>
<td>0.010 max</td>
<td>0.010 max</td>
<td>0.010 max</td>
</tr>
<tr>
<td>Aluminum</td>
<td>2.4–3.0</td>
<td>1.8–2.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titanium</td>
<td>0.01–0.25</td>
<td>0.1–0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.020 max</td>
<td>0.02 max</td>
<td>0.02 max</td>
<td></td>
</tr>
<tr>
<td>Zirconium</td>
<td>0.01–0.40</td>
<td>0.01–0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yttrium</td>
<td>0.01–0.15</td>
<td>0.05–0.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerium</td>
<td></td>
<td></td>
<td></td>
<td>0.03–0.09</td>
</tr>
</tbody>
</table>

*Nickel shall be determined arithmetically by difference.

8. Keywords
8.1 welded tube; N06600; N06603; N06625; N06645

7. General Requirements

7.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification B 751 unless otherwise provided herein.

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