**Groupe Logistique**

**Section Gestion Matériel**

***TECHNICAL SHEET***

***N° 551 - rév. 0 – 15.12.2002***

| CERN reference N° | **SCEM 44…** |
|---|---|
| Identification | ***CAST OR WROUGHT STAINLESS STEEL PARTS FOR VERY LOW TEMPERATURE APPLICATIONS*** |

| ***REQUIREMENTS*** | |
|---|---|
| Applicable documents | EN 10204, ASTM E45-97e1, EN 10002-1, EN 10021.<br>Wrought: ASTM E112-96, EN 10088-3, EN 10228-4.<br>Cast: EN 10213-1&4, ASTM E446-98, NF A 04-160, EN 1371-1, EN 571-1 |
| Material | Wrought: X2CrNi19-11 (1.4306, AISI 304L) or X2CrNiMoN17-13-3 (1.4429, AISI 316LN), according to EN 10088-3.<br>Cast: GX2CrNi19-11 (1.4309, AISI 304L) or GX2CrNiMo19-11-2 (1.4409, AISI 316L), according to EN 10213-4.<br>Special requirement for Co (0.20 % max) |
| State | Solution annealed. Rough machined in order to allow US (wrought only) or XR (cast only) testing, die penetrant testing (cast only) then machined to the final dimensions and cleaned. The supplier shall warrant the raw material soundness, i.e. its compactness and its homogeneity, and its weldability by minimising the impurity content (S+P+B).<br><br>Any repair of surface defects by welding is forbidden. |
| NDT | US testing (wrought only): 100% scanning on each part according to EN 10228-4, quality class 3. Reject if ultrasonic indications are greater than the acceptance level for the mentioned quality class and/or the loss in back wall echo is greater than 20% of the screen height.<br><br>XR (cast only), to be quoted apart: 2 pre-series parts will be 100% XR and delivered to CERN with complete certificates for further inspection and approval before starting production. On the following parts a statistic XR control shall be applied (frequency to be defined). Acceptance criteria as specified in the standard NF A 04-160[1]: smaller than level 1 for defects of category A, B, C; defects of category D, E, F, G are forbidden. The supplier shall warrant the reproducibility of casting parameters and final material quality all along manufacturing.<br><br>Visual inspection and die penetrant (cast only): 100% on each part. Acceptance criteria for die penetrant according to EN 1371-1: non-linear SP03 (CP03) for isolated (grouped) indications; linear (aligned): LP1 (AP1). |

[1] The radiographs shall be compared to the standard radiographs defined in the Annex A of the standard, which refers to ASTM E446-98. The classification of indications is established in Annex A, Section 1.2 of the reference standard.

<table>
<tr><td rowspan="11">Tensile properties[2]</td><td colspan="2">Testing according to EN 10002-1 or equivalent. Cast properties shall be measured on casting.</td><td colspan="2">Tensile properties shall be verified in the relevant directions according to the standards in force. Minimum two tests.</td></tr>
<tr><td rowspan="4">Tensile strength Rm</td><td rowspan="2">wrought</td><td>1.4306</td><td>460 – 680 MPa</td></tr>
<tr><td>1.4429</td><td>580 – 800 MPa</td></tr>
<tr><td rowspan="2">cast</td><td>1.4309</td><td>440 – 640 MPa</td></tr>
<tr><td>1.4409</td><td>440 – 640 MPa</td></tr>
<tr><td rowspan="4">Yield strength Rp 0.2% min.</td><td rowspan="2">wrought</td><td>1.4306</td><td>180 MPa</td></tr>
<tr><td>1.4429</td><td>280 MPa</td></tr>
<tr><td rowspan="2">cast</td><td>1.4309</td><td>185 MPa</td></tr>
<tr><td>1.4409</td><td>195 MPa</td></tr>
<tr><td rowspan="4">Elongation at break A min.</td><td rowspan="2">wrought</td><td>1.4306</td><td>40 %</td></tr>
<tr><td>1.4429</td><td>40 %</td></tr>
<tr><td rowspan="2">cast</td><td>1.4309</td><td>30 %</td></tr>
<tr><td>1.4409</td><td>30 %</td></tr>
<tr><td>Impact properties [2]</td><td colspan="2">Impact energy at 4.2 K[3] KV min</td><td colspan="2">40 J</td></tr>
<tr><td>Structure [2]</td><td colspan="4">The structure after solution annealing shall be fully austenitic.<br><br>Wrought: in accordance with the standard ASTM E112-96, the grain size shall be lower than 3.<br><br>Cast: gas porosities, cracks, hot tears, cold laps, internal chills and shrinkage holes are not acceptable.</td></tr>
<tr><td>Inclusions [2]</td><td colspan="4">Amount and definition shall meet standard ASTM E45-97e1, method A. The class of inclusions shall be at most 2.</td></tr>
<tr><td>Certification</td><td colspan="4">All certificates in accordance with EN 10204 3.1.B</td></tr>
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[2] Checked on each lot. A lot is defined according to EN 10088-3 (wrought) or EN 10213-1 (cast).

[3] The Charpy tests shall be performed according to the standard EN 10045-1 or equivalent. The tests shall be performed on three ISO V-notched samples cut from the parts (removal according to the relevant standards for the mentioned grades). Each individual value shall exceed 40 J. The tests shall be performed at liquid helium temperature (4.2 K). The test method shall assure that the temperature of the sample is truly 4.2 K at the time of rupture. The tests shall be carried out by qualified laboratories approved by CERN. CERN may provide their list upon request.