

**Ferritic Heat Resisting Steel**

**Material Data Sheet**

Steel Designation:

Name

Material No.

**X10CrAlSi13**

**1.4724**

**Scope**

This data sheet applies for hot and cold rolled sheet and strip, semi-finished products, bars, rods and sections.

**Application**

For constructions parts which should be resistant to scaling up to about 850 °C and extensively inured to the effects of sulfurous gases. The inclination to carburization in reduced gases is very low.

**Chemical composition** (heat analysis in %)

| Product form | C      | Si        | Mn     | P       | S       | Cr            | Al        |
|--------------|--------|-----------|--------|---------|---------|---------------|-----------|
| C, H, P, L   | ≤ 0,12 | 0,70-1,40 | ≤ 1,00 | ≤ 0,040 | ≤ 0,015 | 12,00 - 14,00 | 0,70-1,20 |

C = cold rolled strip; H = hot rolled strip; P = hot rolled sheet; L = semi-finished products, bars, rods and sections

**Mechanical properties at room temperature in the annealed condition**

| Product form | Thickness <i>a</i> or diameter <i>d</i> mm | HB max. <sup>1)2)3)</sup> | Proof strength <sup>3)</sup>                   |                         | Tensile strength <sup>1)</sup><br><i>R<sub>m</sub></i> N/mm <sup>2</sup> | Elongation A % min.         |                    |                         |                  |
|--------------|--|---------------------------|--|-------------------------|--|-----------------------------|--------------------|-------------------------|------------------|
|              |  |                           | <i>R<sub>0,1.0</sub></i> N/mm <sup>2</sup> min | <i>R<sub>p0,2</sub></i> |  | Long products <sup>3)</sup> | Flat products      |                         |                  |
|              |  |                           |  |                         | <i>R<sub>p0,2</sub></i>  |                             |                    | <i>0,5 ≤ a/d &lt; 3</i> | <i>3 ≤ a/d</i>   |
| C,H,P        | <i>a</i> ≤ 12                              | 192                       | 250  | -                       | 450 - 650  | 15                          | 13 <sup>4)5)</sup> | 15 <sup>4)</sup>        | 15 <sup>5)</sup> |
| L            | <i>d</i> ≤ 25                              |                           |  |                         |  |                             |                    |                         |                  |

<sup>1)</sup> The maximum HB values may be raised by 100 units or the maximum tensile strength value may be raised by 200 N/mm<sup>2</sup> and the minimum elongation value be lowered to 20 % for cold worked sections and bars of ≤ 35 mm thickness.

<sup>2)</sup> For guidance only.

<sup>3)</sup> For rod, only the tensile values apply.

<sup>4)</sup> Longitudinal test piece

<sup>5)</sup> Transverse test piece

**Estimated average values about the long-term behavior at elevated temperatures (for guidance only)**

| Temperature<br>°C | 1 %-Elongation <sup>1)</sup> for |          | Rupture <sup>2)</sup> for |          |           |
|-------------------|----------------------------------|----------|---------------------------|----------|-----------|
|                   | 1000 h                           | 10 000 h | 1000 h                    | 10 000 h | 100 000 h |
|                   | N/mm <sup>2</sup>                |          | N/mm <sup>2</sup>         |          |           |
| 500               | 80                               | 50       | 160                       | 100      | 55        |
| 600               | 27,5                             | 17,5     | 55                        | 35       | 20        |
| 700               | 8,5                              | 4,7      | 17                        | 9,5      | 5         |
| 800               | 3,7                              | 2,1      | 7,5                       | 4,3      | 2,3       |
| 900               | 1,8                              | 1,0      | 3,6                       | 1,9      | 1,0       |

<sup>1)</sup> Stress related to the out put cross-section, which leads after 1000 or 10 000 h to a permanent elongation of 1 %.

<sup>2)</sup> Stress related to the out put cross-section, which leads after 1000, 10 000 or 100 000 h to breakage.

**Reference data on some physical properties** (for guidance only)

| Density at 20 °C<br>kg/dm <sup>3</sup> | Thermal conductivity W/m K<br>at |        | Specific heat capacity<br>at 20 °C<br>J/kg K | Electrical resistivity<br>at 20 °C<br>Ω mm <sup>2</sup> /m |
|--|----------------------------------|--------|--|--|
|  | 20 °C                            | 500 °C |  |  |
| 7,7                                    | 21                               | 23     | 500  | 0,75   |

Coefficient of linear thermal expansion 10<sup>-6</sup> K<sup>-1</sup> between 20 °C and

| 200 °C | 400 °C | 600 °C | 800 °C | 1000 °C |
|--------|--------|--------|--------|---------|
| 10,5   | 11,5   | 12,0   | 12,5   | -       |

**Guidelines on the temperatures for hot forming and heat treatment** (for guidance only)

| Hot forming*   |                 | Heat treatment +A (annealed), Microstructure |                          |                |
|----------------|-----------------|--|--------------------------|----------------|
| Temperature °C | Type of cooling | Temperature °C                               | Type of cooling          | Microstructure |
| 1100-750       | Air             | 780 - 840 <sup>1)</sup>                      | Air, Water <sup>2)</sup> | Ferrite        |

<sup>1)</sup> If heat treatment is carried out in a continuous furnace, the upper part of the range specified is usually preferred or even exceeded.

<sup>2)</sup> In special cases, furnace cooling is also permitted.

\* according to SEW 470

**Processing / Welding**

Standard welding processes for this steel are:

TIG-welding

MAG-welding solid wire

Arc welding (E)

Submerged arc welding (SAW)

| Process         | Filler metal |              |                                  |              |
|-----------------|--------------|--------------|----------------------------------|--------------|
|                 | similar      |              | higher alloyed                   |              |
| TIG             | -            |              | Thermanit D / 1.4829             |              |
| MAG solid wire  | Thermanit 17 |              | Thermanit D / 1.4829; L / 1.4820 |              |
| Arc welding (E) | Thermanit 17 |              | Thermanit D / 1.4829; L / 1.4820 |              |
| SAW             | Wire         | Powder       | Wire                             | Powder       |
|                 | Thermanit 17 | Marathon 213 | Thermanit D / 1.4820             | Marathon 213 |

Ferritic chrome steels are heat sensitive. Therefore the steel 1.4724 should be welded with lowest possible heat input by using thin electrode diameter, low current intensity and stringer bead welding.

For wall thicknesses under 3 mm, it is not necessary to preheat 1.4724. For thicker construction parts (> 3 mm) the preheating and interpass temperatures 200 – 300 °C should not be under respectively over run.

1.4724 can be processed with similar or higher alloyed filler metals. With sulfurous atmospheres a ferritic top layer should be layed on the media side (Thermanit L 1.4820).

**Cold forming**

When cold forming 1.4724, certain preventive measures should be observed. Sheets up to 3 mm thickness can be cold bended if necessary preheating with 200 - 300 °C should be done.

Products with thicknesses > 3 mm must be preheated up to 600 - 800 °C; concerning machinability 1.4724 can be compared to a low carbon steel.

### Embrittlement

While heating 1.4724 over about 950 °C, embrittlement by grain growth occurs which can be removed any more.

### Note

The material is magnetizable.

### Editor

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### References

|   |   |
|---|---|
| DIN EN 10095:1999-05                          | Beuth Verlag GmbH, Postfach, D-10772 Berlin                                     |
| Stahl-Eisen-material bulletin 470:1976-02     | Verlag Stahleisen GmbH, Postfach 10 51 64, D-40042 Düsseldorf                   |
| MB 821 "Properties"                           | Informationsstelle Edelstahl Rostfrei, Postfach 10 22 05,<br>D-40013 Düsseldorf |
| MB 822 "The converting of stainless steel"    |   |
| Böhler Schweisstechnik Deutschland GmbH, Hamm |   |

### Important note

Information given in this data sheet about property or applicability of materials respective products are no assurance of characteristics but serve for description.

Information, with which we like to advise you, relate to the experience of the producers and our own. Warranty for the results of the treatment and application of the products cannot be granted.

