

MATERIAL NUMBER 1.4006 · CLASS 1.4

# BS410S21

Material no. 1.4006

also listed as X10Cr13

Chemical composition, mechanical and physical property values, and 145 standard designations from 25 regions.

|                                         |                                                |                                      |
|-----------------------------------------|------------------------------------------------|--------------------------------------|
| DENSITY<br><b>7.7</b> g/cm <sup>3</sup> | OTHER DESIGNATIONS<br><b>145</b> in 25 regions | PROPERTY VALUES<br><b>14</b> on file |
|-----------------------------------------|------------------------------------------------|--------------------------------------|

## Chemical composition

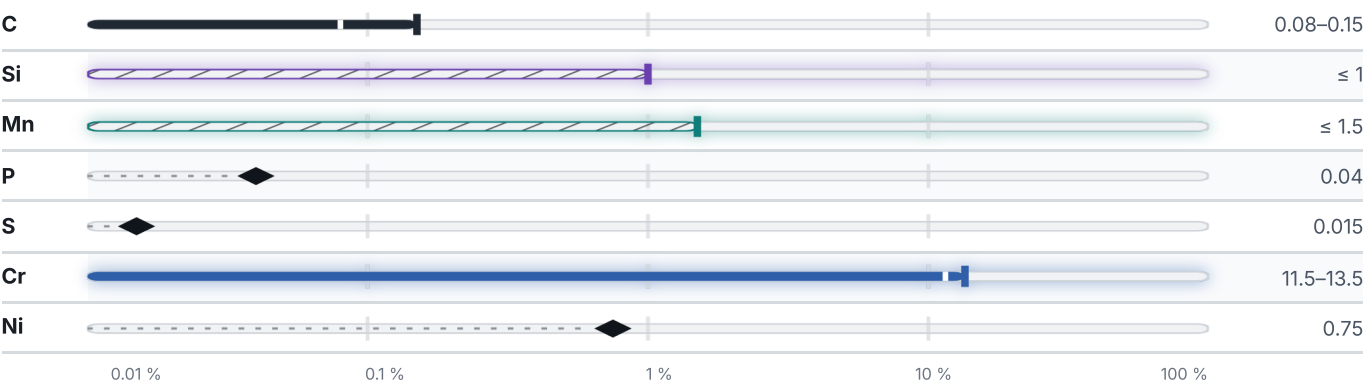
Mass fraction in %

What this alloy is



● Iron — the balance, never listed by a standard — 84.1 % ● Cr — 12.5 % ● Mn — 1.5 % ● Si — 1 % ● Traces & impurities · 0.9 %

Logarithmic scale, 0.01 % to 100 % — every value here compares directly, decade by decade.



The scale is logarithmic, not the element's raw share of the alloy — the only honest way to fit 0.01 % and 100 % in one picture, and it means every value here can be compared with every other.

## Predicted transformation temperatures

Not enough recorded composition to predict a transformation temperature for this grade — missing: Mo.

## Mechanical properties

47 values across 8 conditions

| CONDITION · DIMENSION                                       | RM<br>N/mm <sup>2</sup> | A5<br>% | HB      |
|-------------------------------------------------------------|-------------------------|---------|---------|
| Pipe hot strain, GOST 9940-81                               | 392                     | 21      | –       |
| Pipe cooling strain, GOST 9941-81                           | 392                     | 22      | –       |
| Bar, GOST 18907-73                                          | 490–780                 | 16      | –       |
| Wire, GOST 18143-72                                         | 490–740                 | 16–20   | –       |
| Sheet thin, GOST 5582-75                                    | 440                     | 21      | –       |
| 12KH13 ( 12X13 ) (quenching, tempering) , GOST 25054-81     | –                       | –       | 187–229 |
| 12KH13 ( 12X13 ) (annealing) , Bar GOST 5949-75             | –                       | –       | 121–197 |
| 12KH13 ( 12X13 ) (annealing) , Bar GOST 18907-73            | –                       | –       | 121–187 |
| 12KH13 ( 12X13 ) (normalize, tempering) , Bar GOST 18968-73 | –                       | –       | 192–229 |

| CONDITION · DIMENSION  | RM<br>N/mm <sup>2</sup> | RE<br>N/mm <sup>2</sup> | A<br>% | Z<br>% | AK<br>J/cm <sup>2</sup> | HB  | HRB | HV  |
|------------------------|-------------------------|-------------------------|--------|--------|-------------------------|-----|-----|-----|
| Plate/Sheet Hot-rolled | 440                     | 205                     | 20     | –      | –                       | –   | –   | –   |
| Bars/Rods              | 540                     | 345                     | 25     | 55     | 98                      | –   | –   | –   |
| Hot-rolled             | –                       | –                       | –      | –      | –                       | 201 | 93  | 210 |

| SOFT ANNEALED | HB  |
|---------------|-----|
| Soft annealed | 220 |

| CONDITION · DIMENSION | RM<br>N/mm <sup>2</sup> | RE<br>N/mm <sup>2</sup> | A5<br>% | Z<br>% | KCU<br>kJ/m <sup>2</sup> |
|-----------------------|-------------------------|-------------------------|---------|--------|--------------------------|
| Bar, GOST 5949-75     | 590                     | 410                     | 20      | 60     | 880                      |

| CONDITION · DIMENSION | RM<br>N/mm <sup>2</sup> | RE<br>N/mm <sup>2</sup> | A5<br>% | Z<br>% | KCU<br>kJ/m <sup>2</sup> |
|-----------------------|-------------------------|-------------------------|---------|--------|--------------------------|
| Bar, GOST 18968-73    | 620                     | 440–610                 | 20      | 60     | 780                      |

| QUENCHING AND DRAWING | RM<br>N/mm <sup>2</sup> | RE<br>N/mm <sup>2</sup> | A5<br>% | Z<br>% | KCU<br>kJ/m <sup>2</sup> |
|-----------------------|-------------------------|-------------------------|---------|--------|--------------------------|
| to 600                | 617                     | 392                     | 15–18   | 40–50  | 490–740                  |

| CONDITION · DIMENSION     | RM<br>N/mm <sup>2</sup> | RE<br>N/mm <sup>2</sup> | A5<br>% |
|---------------------------|-------------------------|-------------------------|---------|
| Sheet trick, GOST 7350-77 | 650                     | 250                     | 15      |

| CONDITION · DIMENSION     | RM<br>N/mm <sup>2</sup> | RE<br>N/mm <sup>2</sup> | A5<br>% |
|---------------------------|-------------------------|-------------------------|---------|
| Sheet trick, GOST 7350-77 | 490                     | 345                     | 21      |

## Physical properties

7 values

| CONDITION · DIMENSION | RHO<br>g/cm <sup>3</sup> | E<br>GPa | ALPHA<br>10 <sup>-6</sup> /K | LAMBDA<br>W/(m·K) | CP<br>J/(kg·K) | RHO_EL<br>nΩ·m |
|-----------------------|--------------------------|----------|------------------------------|-------------------|----------------|----------------|
| 20                    | 7.72                     | 217      | —                            | —                 | —              | 506            |
| 100                   | 7.7                      | 212      | 10.2                         | 28                | 473            | 584            |
| 200                   | 7.67                     | 206      | 11.2                         | 28                | 487            | 679            |
| 300                   | 7.64                     | 198      | 11.4                         | 28                | 506            | 769            |
| 400                   | 7.62                     | 189      | 11.8                         | 28                | 527            | 854            |
| 500                   | 7.58                     | 180      | 12.2                         | 27                | 554            | 938            |
| 600                   | 7.55                     | —        | 12.4                         | 26                | 586            | 1021           |
| 700                   | 7.52                     | —        | 12.7                         | 26                | 636            | 1103           |
| 800                   | 7.49                     | —        | 13                           | 25                | 657            | —              |
| 900                   | —                        | —        | 10.8                         | —                 | 666            | —              |
| 1000                  | —                        | —        | 11.7                         | —                 | —              | —              |

| PROPERTY                 | VALUE | UNIT              |
|--------------------------|-------|-------------------|
| Density                  | 7.7   | g/cm <sup>3</sup> |
| Transformation point Ac1 | 730   | °C                |
| Transformation point Ac3 | 850   | °C                |
| Transformation point Ar3 | 820   | °C                |
| Transformation point Ar1 | 700   | °C                |

## Technological properties

| PROPERTY           | VALUE                | UNIT |
|--------------------|----------------------|------|
| Weldability        | limited weldability. |      |
| Temper brittleness | predisposed          |      |

## Heat treatment

2 regimes

| STEP                                  | TEMPERATURE            | MEDIUM |
|---------------------------------------|------------------------|--------|
| source joins the operations with (or) |                        |        |
| Annealing                             | Temperature not stated | —      |

| STEP                                                  | TEMPERATURE            | MEDIUM |
|-------------------------------------------------------|------------------------|--------|
| Tempering                                             | Temperature not stated | —      |
| source joins the operations with + / procedural order |                        |        |
| Quenching                                             | Temperature not stated | —      |
| Solution annealing                                    | Temperature not stated | —      |
| Tempering                                             | Temperature not stated | —      |
| Ageing                                                | Temperature not stated | —      |

## Designations across standards

145 designations · 7 documented as identical

| United States |                       | 44       | United Kingdom            |                       | 14  |
|---------------|-----------------------|----------|---------------------------|-----------------------|-----|
| Grade 410     |                       | uns      | 3S61                      |                       | bs  |
| S41000        | This grade's own name | uns      | 403S17                    |                       | bs  |
| S41001        | This grade's own name | uns      | 410C21                    |                       | bs  |
| 403           |                       | aisi-sae | 410S2                     |                       | bs  |
| 410           | This grade's own name | aisi-sae | 410S21                    |                       | bs  |
| 410 CA 15     |                       | aisi-sae | 420S37                    |                       | bs  |
| 51410         |                       | aisi-sae | 56A                       |                       | bs  |
| 614           | This grade's own name | aisi-sae | AMI 4006                  |                       | bs  |
| CA-15         |                       | aisi-sae | ANC 1 grade A             |                       | bs  |
| Gr.CA40       |                       | aisi-sae | ANC1A                     |                       | bs  |
| J91150        |                       | aisi-sae | BS410S21                  | This grade's own name | bs  |
| J91171        |                       | aisi-sae | En 56 A                   |                       | bs  |
| J91201        |                       | aisi-sae | ENEN56A                   |                       | bs  |
| S41000        |                       | aisi-sae | X12Cr13                   |                       | bs  |
| S41001        |                       | aisi-sae |                           |                       |     |
| A1012         |                       | astm     | Japan                     |                       | 13  |
| A1021         |                       | astm     | SCS1                      |                       | jis |
| A1028         |                       | astm     | SUS 410FB                 |                       | jis |
| A1049         |                       | astm     | SUS 410TKA                |                       | jis |
| A176          |                       | astm     | SUS 410TKC                |                       | jis |
| A182          |                       | astm     | SUS F 410-A               |                       | jis |
| A193          |                       | astm     | SUS F 410-B               |                       | jis |
| A194          |                       | astm     | SUS F 410-C               |                       | jis |
| A240          |                       | astm     | SUS F 410-D               |                       | jis |
| A268          |                       | astm     | SUS410                    |                       | jis |
| A276          |                       | astm     | SUS410S                   |                       | jis |
| A314          |                       | astm     | SUS410TB                  |                       | jis |
| A336          |                       | astm     | SUS410TK                  |                       | jis |
| A473          |                       | astm     | SUS420J1                  |                       | jis |
| A479          |                       | astm     |                           |                       |     |
| A493          |                       | astm     | United States / Aerospace |                       | 12  |
| A511          |                       | astm     | 5350                      |                       | ams |
| A580          |                       | astm     | 5504                      |                       | ams |
| A815          |                       | astm     | 5505                      |                       | ams |
| A837          |                       | astm     | 5591                      |                       | ams |
| A988          |                       | astm     | 5609                      |                       | ams |
| F1613         |                       | astm     | 5611                      |                       | ams |
| F2215         |                       | astm     | 5612                      |                       | ams |
| F2281         |                       | astm     | 5613                      |                       | ams |
| F593          |                       | astm     | 5614                      |                       | ams |
| F594          |                       | astm     | 5776                      |                       | ams |
| F738          |                       | astm     | 5777                      |                       | ams |
| F899          |                       | astm     | 5876                      |                       | ams |
| Grade 410     |                       | astm     |                           |                       |     |

|                                            |        |                                |        |
|--------------------------------------------|--------|--------------------------------|--------|
| <b>Russia / CIS</b>                        | 9      | <b>Spain</b>                   | 3      |
| 12Ch13                                     | gost   | F.3401                         | une    |
| 12H13                                      | gost   | F.3401-X12Cr 13                | une    |
| 12KH13                                     | gost   | X10Cr13                        | une    |
| 12X13                                      | gost   |                                |        |
| 15Ch13L                                    | gost   | <b>Czechia</b>                 | 3      |
| 15KH13L                                    | gost   | 17021                          | csn    |
| 15X13Л                                     | gost   | 17022                          | csn    |
| 1X13                                       | gost   | 422905                         | csn    |
| Sv-12Kh13                                  | gost   |                                |        |
| <b>France</b>                              | 7      | <b>Poland</b>                  | 3      |
| 410F20                                     | afnor  | 1H13                           | pn     |
| Z10C13                                     | afnor  | 2H13                           | pn     |
| Z10C14                                     | afnor  | LOH13                          | pn     |
| Z12C13                                     | afnor  |                                |        |
| Z12C13-M                                   | afnor  | <b>Hungary</b>                 | 3      |
| Z12Cr13                                    | afnor  | AoX12Cr13                      | msz    |
| Z13C13                                     | afnor  | KO2                            | msz    |
|                                            |        | X12Cr13                        | msz    |
| <b>South Korea</b>                         | 6      | <b>Romania</b>                 | 3      |
| STS410                                     | ks     | 10Cr130                        | stas   |
| STS410TKA                                  | ks     | 12C130                         | stas   |
| STSF410-A                                  | ks     | T15Cr130                       | stas   |
| STSF410-B                                  | ks     |                                |        |
| STSF410-C                                  | ks     | <b>Bulgaria</b>                | 3      |
| STSF410-D                                  | ks     | 1Ch13                          | bds    |
|                                            |        | 1Ch13L                         | bds    |
| <b>China</b>                               | 5      | X12Cr13                        | bds    |
| 1Cr12                                      | gb     |                                |        |
| 1Cr13                                      | gb     | <b>International</b>           | 1      |
| 2Cr13                                      | gb     | X12Cr13E                       | iso    |
| ZG15Cr13                                   | gb     |                                |        |
| ZG1Cr13                                    | gb     | <b>Sweden</b>                  | 1      |
| <b>Italy</b>                               | 5      | 2302                           | ss     |
| GX12Cr13                                   | uni    | <b>Slovakia</b>                | 1      |
| X10Cr13                                    | uni    | 17 021                         | stn    |
| X12Cr13                                    | uni    |                                |        |
| X12Cr9KG                                   | uni    | <b>Brazil</b>                  | 1      |
| X20Cr13                                    | uni    | 410                            | abnt   |
| <b>Europe</b>                              | 3      | <b>Serbia</b>                  | 1      |
| 1.4006                                     | din-en | Č.4170.1                       | srps   |
| X10Cr13 <span>This grade's own name</span> | din-en | <b>former Yugoslavia</b>       | 1      |
| X12Cr13 <span>This grade's own name</span> | din-en | Č.41701                        | jus    |
|                                            |        | <b>Australia / New Zealand</b> | 1      |
|                                            |        | 410                            | as-nzs |

|            |       |           |     |
|------------|-------|-----------|-----|
| Austria    | 1     | Finland   | 1   |
| BOHLERN100 | onorm | G-X12Cr13 | sfs |

**Note on use.** The data is compiled to the best of our knowledge from publicly available standards and manufacturer documentation. It replaces neither material testing nor an inspection document to EN 10204. Please request a mill certificate to EN 10204 2.1, 3.1 or 3.2 together with your enquiry. The standard in its current valid edition always prevails.

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