**http://www.metaltrade.ru/steelinfo/12x18n9t.htm**

**Марка стали 12Х18Н9Т**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Общие сведения**   |  | | --- | | Заменитель | | стали: 10Х14Г14Н4Т, 12Х17Г9АН4, 12Х18Н10Т. | | Вид поставки | | сортовой прокат, в том числе фасонный: ГОСТ 5949-75, ГОСТ 2590-71, ГОСТ 2591-71, ГОСТ 2879-69. Калиброванный пруток ГОСТ 7417-75, ГОСТ 8559-75, ГОСТ 8560-78. Шлифованный пруток и серебрянка ГОСТ 5949-75, ГОСТ 14955-77, ГОСТ 18907-73. Лист толстый ГОСТ 7350-77. Полоса ГОСТ 4405-75, ГОСТ 103-76. Проволока ГОСТ 18143-72. Поковки и кованые заготовки ГОСТ 1133-71, ГОСТ 25054-81. | | Назначение | | сварная аппаратура, трубы, детали печной арматуры, теплообменники, муфели, детали выхлопных систем, листовые и сортовые детали. Аппараты и сосуды, работающие при температуре от -196 до 600 °С под давлением, а при наличии агрессивных сред до 350 °С. Сталь коррозионно-стойкая, жаростойкая аустенитного класса. |   **Химический состав**   |  |  | | --- | --- | | Химический элемент | % | | Кремний (Si), не более | 0.8 | | Медь (Cu), не более | 0.30 | | Марганец (Mn), не более | 2.0 | | Никель (Ni) | 8.0-9.5 | | Титан (Ti) | 0.6-0.8 | | Фосфор (P), не более | 0.035 | | Хром (Cr) | 17.0-19.0 | | Сера (S), не более | 0.020 |   **Механические свойства**  Механические свойства   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Термообработка, состояние поставки | Сечение, мм | s 0,2 , МПа | s B , МПа | d 5 , % | y , % | | Прутки. Закалка 1020-1100 °С, воздух, масло, вода. | 60 | 196 | 540 | 40 | 55 | | Прутки шлифованные, обработанные на заданную прочность. | 1-30 |  | 540-880 | 20 |  | | Прутки нагартованные | <5 |  | 935 |  |  | | Листы горячекатаные или холоднокатаные. Закалка 1030-1080 °С, вода или воздух. | >4 | 216 | 530 | 38 |  | | Поковки. Закалка 1050-1100 °С, воздух или вода. | <1000 | 216 | 510 | 35 | 40 | | Проволока термообработанная | 1-6 |  | 540-880 | 20 |  | | Проволока нагартованная | 1-6 |  | 1080 |  |  |   Механические свойства при повышенных температурах   |  |  |  |  |  | | --- | --- | --- | --- | --- | | t испытания, °C | s 0,2 , МПа | s B , МПа | d 5 , % | y , % | | *Прутки диаметром 18-25 мм. Закалка 1050 °С, вода [170]* | | | | | | | | | | | | | | | | 20 | 280 | 620 | 41 | 63 |  |  |  |  |  |  |  |  |  |  | | 300 | 200 | 460 | 31 | 65 |  |  |  |  |  |  |  |  |  |  | | 400 | 180 | 450 | 31 | 65 |  |  |  |  |  |  |  |  |  |  | | 500 | 180 | 450 | 29 | 65 |  |  |  |  |  |  |  |  |  |  | | 600 | 180 | 400 | 25 | 61 |  |  |  |  |  |  |  |  |  |  | | 700 | 160 | 280 | 26 | 59 |  |  |  |  |  |  |  |  |  |  | | 800 | 100 | 180 | 35 | 69 |  |  |  |  |  |  |  |  |  |  | | *Образец диаметром 10 мм, длиной 50 мм, прокатанный. Скорость деформирования 20 мм/мин. Скорость деформации 0,007 1/с. [81]* | | | | | | | | | | | | | | | | 800 | 155 | 200 | 27 | 57 |  |  |  |  |  |  |  |  |  |  | | 900 | 110 | 120 | 41 | 90 |  |  |  |  |  |  |  |  |  |  | | 1000 | 58 | 66 | 50 | 95 |  |  |  |  |  |  |  |  |  |  | | 1100 | 35 | 38 | 66 | 99 |  |  |  |  |  |  |  |  |  |  | | 1200 | 22 | 26 | 79 | 100 |  |  |  |  |  |  |  |  |  |  | | *Лист толщиной 2 мм. Нагартовка со степенью холодной пластической деформации 60 \% [170]* | | | | | | | | | | | | | | | | 20 | 1290 | 1330 | 10 |  |  |  |  |  |  |  |  |  |  |  | | 300 | 970 | 1080 | 6 |  |  |  |  |  |  |  |  |  |  |  | | 500 | 780 | 870 | 10 |  |  |  |  |  |  |  |  |  |  |  | | 700 | 360 | 420 | 29 |  |  |  |  |  |  |  |  |  |  |  |   Механические свойства в завис. от степени пластической деформации   |  |  |  |  | | --- | --- | --- | --- | | Термообработка, состояние поставки | s 0,2 , МПа | s B , МПа | d 5 , % | | *Лист. Закалка 1050 °С, вода.* | | | | | | | | | | | | | | | | Степень обжатия 0 \% | 280-400 | 550-650 | 40-50 |  |  |  |  |  |  |  |  |  |  |  | | Степень обжатия 30 \% | 900 | 950 | 12 |  |  |  |  |  |  |  |  |  |  |  | | Степень обжатия 70 \% | 1150 | 1250 | 3 |  |  |  |  |  |  |  |  |  |  |  |   **Технологические свойства**   |  | | --- | | Температура ковки | | Начала 1200, конца 850. Сечения до 350 мм охлаждаются на воздухе. | | Свариваемость | | сваривается без ограничений. Способы сварки: РДС электродами ЦЛ-11, ЦЛ-15 (обеспечивающие коррозионную стойкость), ЦТ-26 (используемый как жаропрочный без требований по МКК), ЭШС. Рекомендуется последующая термообработка. | | Обрабатываемость резанием | | В закаленном состоянии при НВ 169 и s B = 610 МПа K u тв.спл. = 0,85, K u б.ст. = 0,35. |   **Ударная вязкость**  Ударная вязкость, KCU, Дж/см 2   |  |  |  | | --- | --- | --- | | Состояние поставки, термообработка | +20 | -70 | | Пруток сечением 18-25 мм. Закалка 1050 С, вода. бв = 620 МПа, б0,2 = 280 МПа. | 250 | 250 |   **Предел выносливости**   |  |  |  | | --- | --- | --- | | s -1 , МПа | t -1 , МПа | n | | 279 |  | 1Е+7 | | 196-235 | 132 |  |   **Жаростойкость**   |  |  |  |  | | --- | --- | --- | --- | | Среда | Температура, °С | Глубина, мм/год | Группа стойкости или балл | | Перегретый пар | 600 | 0,0018 | 2 | | Воздух | 650 | 0,0022 | 2 | | Воздух | 750 | 0,013 | 4 |   **Физические свойства**   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Температура испытания, °С | 20 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | | Модуль нормальной упругости, Е, ГПа | 195 | 189 | 182 | 175 | 167 | 180 | 153 | 143 | 135 |  | | Плотность, pn, кг/см3 | 7900 | 7860 | 7820 | 7780 | 7740 | 7690 | 7650 | 7600 | 7560 | 7510 | | Коэффициент теплопроводности Вт/(м ·°С) |  | 16 | 18 | 20 | 21 | 23 | 25 | 26 | 28 | 29 | | Уд. электросопротивление (p, НОм · м) | 725 | 792 | 861 | 920 | 976 | 1028 | 1075 | 1117 | 1149 | 1176 | | Температура испытания, °С | 20- 100 | 20- 200 | 20- 300 | 20- 400 | 20- 500 | 20- 600 | 20- 700 | 20- 800 | 20- 900 | 20- 1000 | | Коэффициент линейного расширения (a, 10-6 1/°С) | 16.0 | 17.0 | 17.6 | 18.0 | 18.3 | 18.6 | 18.9 | 19.3 | 19.5 | 20.1 | | Удельная теплоемкость (С, Дж/(кг · °С)) | 469 | 486 | 498 | 511 | 519 | 528 | 532 | 544 | 548 |  |   **Чувствительность к охрупчиванию**   |  |  |  | | --- | --- | --- | | Температура, °С | Время, ч | KCU, Дж/см 2 | | - | Исходное состояние | 245 | | 500 | 10000 | 186 | | 550 | 20000 | 220 | | 600 | 10000 | 215 | |