**Characteristics of the steel**

**Steel 25HGNMA**

5. Chemical composition of the steel 25HGNMA should conform to the requirements of the table 1.

Table 1

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Steel grade | Weight percentage of elements (ladle sample), % | | | | | | | | | | |
| С | Si | Mn | Cr | Mo | Ni | Al | P | S | Cu | N |
| Max | | | |
| 25HGNMA | 0,20  0,25 | 0,21  0,28 | 0,80  1,20 | 0,40  0,60 | 0,15  0,25 | 0,50  0,80 | Min  0,025 | 0,020 | 0,020 | 0,15 | 0,012 |
| Allowable variations in finished steel | ±0,01 | ±0,02 | ±0,05 | ±0,02 | ±0,02 | ±0,05 | -0,005 |  |  |  |  |

Table 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| For the finished steel of the diameter from 12 to 95 mm | | | | | | | |
| Heat treatment conditions of the samples | Impact energy KV, Joule,temp. --40 C | Yield stress, σт N/mm2 | Ultimate tensile strength σ B, N/mm2 | Percent elongation, δ, % | Contraction ratio , ψ % | | Impact resistance KCU,J/cm² |
| Quenching (880-900° С) chilled water  Drawback (360-440° C) chilled water | Min | | | | | | |
| 42 | 1275 | 1420 | 10 | 50 | | 78 |
| For the finished steel of the diameter from 95 to 120 mm | | | | | | | |
| Heat treatment conditions of the samples | | Yield stress, σт N/mm2 | Ultimate tensile strength σ B, N/mm2 | Percent elongation, δ, % | Contraction ratio , ψ % | Impact energy KV, Joule | |
| -40° C | |
| Quenching (880-900° С) chilled water  Drawback (550-650° C) chilled water or air | | Min | | | | | |
| 410 | 690 | 17 | 40 | 35 | |

**Steel 25G2А**

6. Chemical composition of the steel (ladle sample) should conform to the requirements of the table 1.

Table 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Steel grade | Weight percentage of elements in ladle sample, % | | | | | | | | |
| С | Mn | Si | P | S | Cu | Ni | Cr | Al |
| Max | | | | | 0,020  0,050 |
| 25G2A | 0,18  0,24 | 1,45  1,76 | 0,17  0,37 | 0,020 | 0,020 | 0,30 | 0,30 | 0,30 |
| Allowable variations in finished steel | ±0,01 | ±0,05 | ±0,03 | - | - | - | - | - | ±0,005 |

Notes:

1.It is recommended when lower weight percentage of the carbon to have the weight percentage of the Mangan higher than 1,5 %.

2. The processing aid of the titanium is added to the steel assuming (exclusive of burn-off loss) at 0,06%, residual weight percentage of the titanium is determined and indicated in the quality certificate.

Table 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operation | Recommended  heat treatment  conditions of the samples or  workpieces | Yield stress, σт, N/mm2 (kgf/mm2) | Ultimate  tensile  strength, σ B N/mm2  (kgf/mm2) | Percent elongation,  δ5,% | Contraction ratio,  Ψ, % | Impact resis-tance KCU  J/cm²  (kgf m/cm2) | Impact energy KV, Joule | | |
| 0°С | | -20° С |
| P1 | Quenching  880-900° С  water or oil  quenching  Drawback  400-°±50° C  water  quenching | Min | | | | | | | |
| 932(95) | 1030(105) | 12 | 50 | 78(8) | - | - | |

Сontinuation of the table 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P2 | Quenching (900°±10°)С  Hydrocooling (18-25°C)  Drawback (480-°-520° C)  Hydrocooling (18-25°C) | Min | | | | | | |
| 410  (41) | 690  (70) | 17 | 40 |  | 60 | 35 |
| Note: the sign «-« means, the rate is not defined and not controlled. | | | | | | | | |

**Steel 20H**

2. Chemical composition of the steel 25HGNMA should conform to the requirements of the table 1.

Table 1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Steel grade |  | Elements mass content,% | | | | | | | | | |  |  |
| С | Si | Mn | Cr | Al | S | P | Ni | Cu | W | | Mo | Ti |
| 20H-PV | 0,17-  0,23 | 0,17-  0,37 | 0,50  0,80 | 0,70  1,00 | 0,020  0,050  1 | Min. | | | | | | | |
| 0,012 | 0,00,015 | 0 00,10 | 00,0,10 | 0, ,0,10 | 0, 0,15 | | 0 0,03 |
| Allowable variations on elements mass content in finished steel | ±0,01 | ±0,02 | ±0,05 | ±0,02 | ±0,005 | - | - | - | - | - | - | | - | |

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**Table 2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operation | Heat treatment conditions of the samples | Yield stress  N/mm2 | Ultimate tensile strength,  σ B,N/mm2 | Percent elongation, δ5,% | Contraction ratio, Ψ, % | Impact resistance KCU at 0°С  J/cm² | Impact energy KV, Joule | |
| 0°С | -20° С |
| Min. | | | | | | |
| P1 | Quenching (880-900° С) chilled water.  Drawback (360-°440° C) chilled water | 635 | 780 | 11 | 40 | 59 | - | - |
| P2 | Normalization 900° C,сhilling air | 295 | 490-690 | 22 | - | - | 27 | 27 |
| P3 | Quenching 910 +/- 10° С chilled water.  Drawback 450-480° C chilled water | 410 | 690 | 17 | 40 | - | 60 | 35 |
| The operation is indicated when placing the order | | | | | | | | |

**St3PS**

**Сhemical composition of the material St3PS in %**

GOST 380-2005

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| C | Si | Mn | Ni | S | P | Cr | N | Cu | As |
| 0,14-0,22 | 0,05-0,15 | 0,4-0,65 | Before 0,3 | Before  0,05 | Before  0,04 | Before 0,3 | Before 0,008 | Before 0,3 | Before 0,08 |

Shop characteristics of the St3PS

|  |  |
| --- | --- |
| Overall weldability | No limits |
| Flake susceptibility | Not sensitive |
| Temper brittleness | Indisposed |

Mechanical properties at T=20° C of the St3PS material.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Range | Size | Stress | σ B | σ T | δ5 | ψ | KCU | Heat treatment |
| - | mm |  | MPa | MPa | % | % | Kj/m2 | - |
| Pipes, GOST 8696-74 |  |  | 372 | 245 | 23 |  |  |  |
| Pipes, GOST 10705-80 |  |  | 372 | 225 | 22 |  |  |  |
| Rolled products, GOST 535-2005 |  |  | 370-480 | 205-245 | 23-26 |  |  |  |
| Thick sheet, GOST 14637-89 |  |  | 370-480 | 205-245 | 23-26 |  |  |  |
| Reinforcing steel, GOST 5781-82 |  |  | 373 | 235 | 25 |  |  |  |
| Rolled steel, GOST 30136-95 |  |  | 490-540 |  |  | 60 |  |  |

|  |  |
| --- | --- |
| Hardness St3ps | HB 10-1=131 MPa |

Physical characteristics of the St3ps material

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| T | E 10-5 | α106 | Λ | p | C | R 109 |
| Degree | MPa | 1/ Degree | W/  (m-Degree) | kg/ m3 | J(kg- Degree) | Om-m |
| 20 |  |  |  | 7850 |  |  |