

KAWASAKI STEEL GIHO

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350 25kg/mm²
Steel Plate for Pressure Vessels Having Yield Strength over 25kg/mm² at 350

| | | |
|-------------------|--------------------|--------------------|
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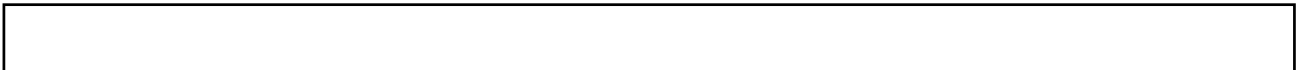
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| | | | |
|-------|-----|----------------------|-------|
| 75mm | 350 | 25kg/mm ² | KHY25 |
| KHY25 | | | |

Synopsis :

KHY25 steel having yield strength over 25kg/mm² at 350 has been developed for pressure vessels used at intermediate and moderate temperatures. Its mechanical properties, workability, weldability and others have been examined on a 75 mm thick sample, Test results show that KHY25 steel can be fabricated in the normalized condition and its strength, ductility and toughness are excellent after stress relieving heat treatment.

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中・常温圧力容器用350°C降伏強さ25kg/mm²保証鋼Steel Plate for Pressure Vessels Having Yield Strength over 25 kg/mm² at 350°C

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Synopsis:

KHY25 steel having yield strength over 25 kg/mm² at 350°C has been developed for pressure vessels used at

intermediate and moderate temperatures.

Its mechanical properties, workability, weldability and corrosion resistance are satisfactory.

DMC 系合金鋼の熱処理特性とその応用 (昭和53年10月)

| 鋼種 | 熱処理条件 | 機械的性質 | 特性 |
|-------|-------|-------------------------|-----|
| S45C | 油焼入れ | σ _b 800 MPa | 高強度 |
| | 水焼入れ | σ _b 750 MPa | 高靭性 |
| S50C | 油焼入れ | σ _b 850 MPa | 高強度 |
| | 水焼入れ | σ _b 800 MPa | 高靭性 |
| S55C | 油焼入れ | σ _b 900 MPa | 高強度 |
| | 水焼入れ | σ _b 850 MPa | 高靭性 |
| S60C | 油焼入れ | σ _b 950 MPa | 高強度 |
| | 水焼入れ | σ _b 900 MPa | 高靭性 |
| S65C | 油焼入れ | σ _b 1000 MPa | 高強度 |
| | 水焼入れ | σ _b 950 MPa | 高靭性 |
| S70C | 油焼入れ | σ _b 1050 MPa | 高強度 |
| | 水焼入れ | σ _b 1000 MPa | 高靭性 |
| S75C | 油焼入れ | σ _b 1100 MPa | 高強度 |
| | 水焼入れ | σ _b 1050 MPa | 高靭性 |
| S80C | 油焼入れ | σ _b 1150 MPa | 高強度 |
| | 水焼入れ | σ _b 1100 MPa | 高靭性 |
| S85C | 油焼入れ | σ _b 1200 MPa | 高強度 |
| | 水焼入れ | σ _b 1150 MPa | 高靭性 |
| S90C | 油焼入れ | σ _b 1250 MPa | 高強度 |
| | 水焼入れ | σ _b 1200 MPa | 高靭性 |
| S95C | 油焼入れ | σ _b 1300 MPa | 高強度 |
| | 水焼入れ | σ _b 1250 MPa | 高靭性 |
| S100C | 油焼入れ | σ _b 1350 MPa | 高強度 |
| | 水焼入れ | σ _b 1300 MPa | 高靭性 |

Table 1. 鋼種別機械的性質 (油焼入れ/水焼入れ)

Table 3 Chemical compositions of an industrial test heat (wt %)

| Sample | C | Si | Mn | P | S | Cu | Ni | Mo | V | Al | Ceq ¹⁾ |
|--------|------|------|------|-------|-------|------|------|-------|-------|-------|-------------------|
| Ladle | 0.16 | 0.39 | 1.42 | 0.020 | 0.008 | 0.18 | 0.18 | 0.153 | 0.069 | 0.024 | 0.47 |
| Check | 0.15 | 0.38 | 1.43 | 0.018 | 0.008 | 0.18 | 0.17 | 0.137 | 0.076 | 0.026 | 0.45 |

$$1) C_{eq} = C + \frac{Mn}{6} + \frac{Si}{24} + \frac{Ni}{40} + \frac{Cr}{5} + \frac{Mo}{4} + \frac{V}{14} (\%)$$

600°C×450min → 冷の S. R. を行った後、常温および高温引張試験、曲げ試験、衝撃試験、NRL 落重試験を行った。

(1) 常温および高温引張試験

良好な引張特性を示している。

(2) 曲げ試験

圧延方向に平行および直角方向試片について、表曲げ試験(R=1.5t, 180°)および側曲げ試験(t=

Table 5 Drop-weight test conditions

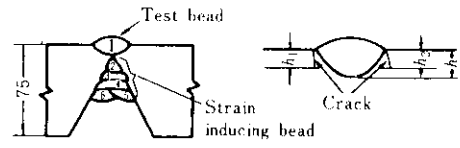
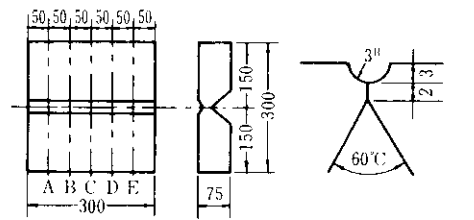
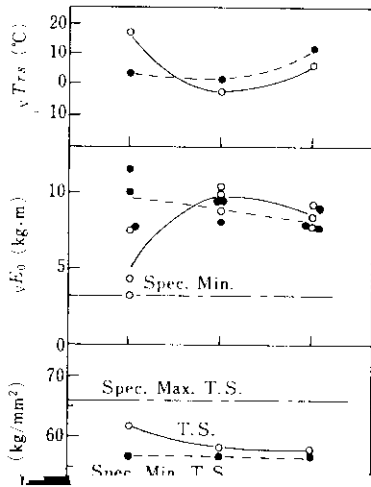
| 試料番号 | 試験温度 (°C) | 落下高さ (mm) | 落下重量 (g) | 試験結果 |
|------|-----------|-----------|----------|------|
| 1 | 20 | 100 | 10 | 破断 |
| 2 | 20 | 100 | 10 | 破断 |
| 3 | 20 | 100 | 10 | 破断 |
| 4 | 20 | 100 | 10 | 破断 |
| 5 | 20 | 100 | 10 | 破断 |
| 6 | 20 | 100 | 10 | 破断 |
| 7 | 20 | 100 | 10 | 破断 |
| 8 | 20 | 100 | 10 | 破断 |
| 9 | 20 | 100 | 10 | 破断 |
| 10 | 20 | 100 | 10 | 破断 |
| 11 | 20 | 100 | 10 | 破断 |
| 12 | 20 | 100 | 10 | 破断 |
| 13 | 20 | 100 | 10 | 破断 |
| 14 | 20 | 100 | 10 | 破断 |
| 15 | 20 | 100 | 10 | 破断 |
| 16 | 20 | 100 | 10 | 破断 |
| 17 | 20 | 100 | 10 | 破断 |
| 18 | 20 | 100 | 10 | 破断 |
| 19 | 20 | 100 | 10 | 破断 |
| 20 | 20 | 100 | 10 | 破断 |
| 21 | 20 | 100 | 10 | 破断 |
| 22 | 20 | 100 | 10 | 破断 |
| 23 | 20 | 100 | 10 | 破断 |
| 24 | 20 | 100 | 10 | 破断 |
| 25 | 20 | 100 | 10 | 破断 |
| 26 | 20 | 100 | 10 | 破断 |
| 27 | 20 | 100 | 10 | 破断 |
| 28 | 20 | 100 | 10 | 破断 |
| 29 | 20 | 100 | 10 | 破断 |
| 30 | 20 | 100 | 10 | 破断 |
| 31 | 20 | 100 | 10 | 破断 |
| 32 | 20 | 100 | 10 | 破断 |
| 33 | 20 | 100 | 10 | 破断 |
| 34 | 20 | 100 | 10 | 破断 |
| 35 | 20 | 100 | 10 | 破断 |
| 36 | 20 | 100 | 10 | 破断 |
| 37 | 20 | 100 | 10 | 破断 |
| 38 | 20 | 100 | 10 | 破断 |
| 39 | 20 | 100 | 10 | 破断 |
| 40 | 20 | 100 | 10 | 破断 |
| 41 | 20 | 100 | 10 | 破断 |
| 42 | 20 | 100 | 10 | 破断 |
| 43 | 20 | 100 | 10 | 破断 |
| 44 | 20 | 100 | 10 | 破断 |
| 45 | 20 | 100 | 10 | 破断 |
| 46 | 20 | 100 | 10 | 破断 |
| 47 | 20 | 100 | 10 | 破断 |
| 48 | 20 | 100 | 10 | 破断 |
| 49 | 20 | 100 | 10 | 破断 |
| 50 | 20 | 100 | 10 | 破断 |
| 51 | 20 | 100 | 10 | 破断 |
| 52 | 20 | 100 | 10 | 破断 |
| 53 | 20 | 100 | 10 | 破断 |
| 54 | 20 | 100 | 10 | 破断 |
| 55 | 20 | 100 | 10 | 破断 |
| 56 | 20 | 100 | 10 | 破断 |
| 57 | 20 | 100 | 10 | 破断 |
| 58 | 20 | 100 | 10 | 破断 |
| 59 | 20 | 100 | 10 | 破断 |
| 60 | 20 | 100 | 10 | 破断 |
| 61 | 20 | 100 | 10 | 破断 |
| 62 | 20 | 100 | 10 | 破断 |
| 63 | 20 | 100 | 10 | 破断 |
| 64 | 20 | 100 | 10 | 破断 |
| 65 | 20 | 100 | 10 | 破断 |
| 66 | 20 | 100 | 10 | 破断 |
| 67 | 20 | 100 | 10 | 破断 |
| 68 | 20 | 100 | 10 | 破断 |
| 69 | 20 | 100 | 10 | 破断 |
| 70 | 20 | 100 | 10 | 破断 |
| 71 | 20 | 100 | 10 | 破断 |
| 72 | 20 | 100 | 10 | 破断 |
| 73 | 20 | 100 | 10 | 破断 |
| 74 | 20 | 100 | 10 | 破断 |
| 75 | 20 | 100 | 10 | 破断 |
| 76 | 20 | 100 | 10 | 破断 |
| 77 | 20 | 100 | 10 | 破断 |
| 78 | 20 | 100 | 10 | 破断 |
| 79 | 20 | 100 | 10 | 破断 |
| 80 | 20 | 100 | 10 | 破断 |
| 81 | 20 | 100 | 10 | 破断 |
| 82 | 20 | 100 | 10 | 破断 |
| 83 | 20 | 100 | 10 | 破断 |
| 84 | 20 | 100 | 10 | 破断 |
| 85 | 20 | 100 | 10 | 破断 |
| 86 | 20 | 100 | 10 | 破断 |
| 87 | 20 | 100 | 10 | 破断 |
| 88 | 20 | 100 | 10 | 破断 |
| 89 | 20 | 100 | 10 | 破断 |
| 90 | 20 | 100 | 10 | 破断 |
| 91 | 20 | 100 | 10 | 破断 |
| 92 | 20 | 100 | 10 | 破断 |
| 93 | 20 | 100 | 10 | 破断 |
| 94 | 20 | 100 | 10 | 破断 |
| 95 | 20 | 100 | 10 | 破断 |
| 96 | 20 | 100 | 10 | 破断 |
| 97 | 20 | 100 | 10 | 破断 |
| 98 | 20 | 100 | 10 | 破断 |
| 99 | 20 | 100 | 10 | 破断 |
| 100 | 20 | 100 | 10 | 破断 |

100
80



20





Welding rod: KS86II (5φ)
 Preheating temperature: 200°C

Table 9 Welding conditions

| Welding conditions | |
|----------------------------|--------------------|
| Welding method | Welding conditions |
| Shielded metal arc welding | Electrode |
| | Current |
| | Shielding gas |
| Gas metal arc welding | Electrode |
| | Current |
| | Shielding gas |
| Submerged arc welding | Electrode |
| | Current |
| | Shielding gas |
| Electron beam welding | Beam current |
| | Beam voltage |
| | Beam diameter |
| Resistance spot welding | Electrode |
| | Current |
| | Time |
| Resistance seam welding | Electrode |
| | Current |
| | Time |

Table 13 Welding conditions for thick plate butt joint

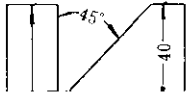
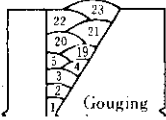
| Welding method | Welding wire and flux | Pass No. | Diameter of wire (mm) | Welding current (A) | Arc voltage (V) | Welding speed (cm/min) | Heat input (kJ/cm) | Preheating and interpass temp. (°C) | Groove design | Welding pass sequence |
|----------------|-----------------------|----------|-----------------------|---------------------|-----------------|------------------------|--------------------|-------------------------------------|--|---|
| Submerged | KW101B ✓ | 1 | 4.8 | 520 | 28 | 20 | 44 | 150 |  |  |

Table 14 Welding conditions for fatigue test specimens

| Groove design | Welding | Welding rod | Welding current | Arc voltage | Welding speed | Heat input | S.R. |
|---------------|---------|-------------|-----------------|-------------|---------------|------------|------|
|---------------|---------|-------------|-----------------|-------------|---------------|------------|------|

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