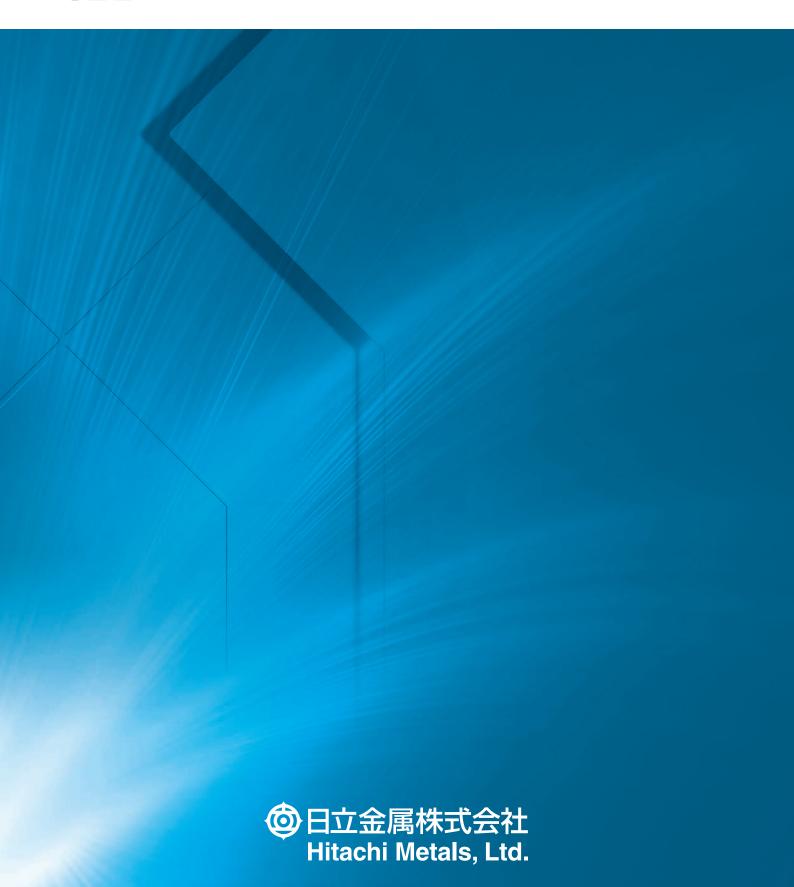




カタログ Catalog

YSS冷間加工用工具鋼 YSS COLD WORK TOOL STEELS



Y55冷間加工用工具鋼 **Y55** COLD WORK TOOL STEELS

Y55冷間加工用工具鋼の種類 Types of YSS cold work tool steels

| | 鋼種 Grade | | | | | 化学成分(%) Chemical composition | | | | | | | | | |
|---------------------------------|-----------|------------|----------------------------------|------|----------|------------------------------|------------|------------------|-------------|----------|-----------|------------|------|--|--|
| | | _ | 1 | | | | | 1C '7 | ·DX:75* (%) | Chemi | cai comp | OSILION | | | |
| | Y55 | 色 Color | JIS類似 JIS equivalent | AISI | DIN WNr. | С | Si | Mn | Cr | W | Мо | V | Co | その他 | |
| | SLD-MAGIC | | 開発鋼種 Original steel | | | ī | 。 高性能冷間 | ダイス鋼 | High-per | formance | cold work | tool steel | | 快削元素添加 Free-cutting elements added | |
| | SLD | | SKD11 | D2 | 1.2379 | 1.5 | 0.3 | 0. 4 | 12.0 | _ | 0.9 | 0.3 | _ | | |
| | SLD10 | | 8%Cr鋼 8% Cr steel | | | 1.0 | 1.0 | 0. 4 | 7. 5 | _ | 2.8 | 0.4 | _ | | |
| 点 Steels | ARK1 | | 開発鋼種 Original steel | | | 0.7 | 0.3 | 0. 4 | 7. 5 | _ | 1.0 | 0.3 | _ | S: 0.05 | |
| 冷間金型用鋼 Cold work tool steels | SGT | | SKS3 | 01 | 1.2510 | 1.0 | 0.3 | 1.0 | 0. 7 | 0.7 | _ | _ | _ | | |
| 用鋼 ow ploc | YCS3 | | SKS93 | W5 | | 1.0 | 0. 4 | 0. 9 | 0. 4 | _ | _ | _ | _ | | |
| | ACD37 | | 開発鋼種 Original steel | A4 | | 0.9 | 0.3 | 2. 0 | 1. 1 | _ | 1.3 | _ | _ | | |
| | HMD5 | | 開発鋼種 Original steel | | | 0.7 | 1.0 | 1.0 | 1.2 | _ | 0.2 | _ | _ | | |
| | HPM-MAGIC | | 開発鋼種 Original steel | | | 40 |)HRCプリ | ハードン金 | 型用鋼 | 40HRC | pre-hard | ened ste | el | | |
| | YXM1 | | SKH51 | M2 | 1.3343 | 0.9 | 0.3 | 0. 4 | 4. 2 | 6. 5 | 5. 0 | 2.0 | _ | | |
| 溶製高 | YXM4 | | SKH55 | | 1.3243 | 0. 9 | 0.3 | 0.3 | 4. 2 | 6. 5 | 5. 3 | 1.9 | 5. 0 | | |
| 溶製高速度工具鋼sleets loot peeds uith | YXR7 | | マトリックス | | | 0.8 | 0.8 | 0.3 | 4. 7 | 1.3 | 5. 5 | 1.3 | _ | | |
| 真鋼 ds ybjH | YXR3 | | ハイス Matrix high | | | 0.6 | 1.5 | 0. 4 | 4. 3 | _ | 2.9 | 1.8 | _ | | |
| | YXR33 | | speed steel | | | 0.5 | 0.2 | 0. 5 | 4. 2 | 1.6 | 2.0 | 1.2 | _ | | |
| 粉就eels | HAP5R | | 粉末ハイス | | | 0.9 | 0.8 | 0.3 | 4. 3 | 2.0 | 3. 0 | 3. 0 | _ | | |
| 末高速 s loot pa | HAP10 | | P/M high speed steel | M3:2 | | 1.4 | 0.6 | 0.3 | 5. 0 | 3. 0 | 6. 0 | 3.8 | _ | | |
| 粉末高速工具鋼sleets loot beeds High | HAP40 | | SKH40 | | 1.3244 | 1.3 | 0.3 | 0. 4 | 4. 2 | 6. 0 | 5. 0 | 3. 1 | 8. 0 | | |
| P/M His | | | 粉末ハイス P/M high speed steel | | | 2. 1 | 0. 4 | 0.3 | 4. 2 | 9. 5 | 8. 3 | 5. 0 | 9. 5 | | |

冷間加工用工具鋼の用途 Applications in cold work dies

| | | | | 標準硬さ | 適村 | 才鋼種名 Recommended YSS s | teel | |
|---------------------------|--------------------------|------------|------------------------------------|----------------------|----------------------|------------------------------|----------------------------|--|
| | 用 途 Application | | | HRC | | 多量用 For mass production use | | |
| | | | | Standard hardness | For general use | 耐摩耗用 For abrasion resistance | 耐衝擊用 For impact resistance | |
| _ n | 抜き型(小物、順送型) | | Blanking dies (small, progressive) | 58-62 | SLD, SLD-MAGIC, ARK1 | HAP10, HAP40 | YXM1, YXR7, HAP5R | |
| 冷間プレス型 Cold press die | 抜き型(板金) | 一般薄物用 | For general sheet use | 55-60 | HMD5 | SLD, SLD-MAGIC | ARK1 | |
| D a | Blanking dies 一般厚物用・ハイテン | | For general heavy plate use | 58-62 | SLD, SLD-MAGIC, ARK1 | HAP10, HAP40 | YXM1, YXR7, HAP5R | |
| ス 型 型 | 曲げ・絞り型 | 一般薄物用 | For general sheet use | 58-62 | SLD | SLD-MAGIC | ARK1 | |
| | Bending and Swaging dies | 一般厚物用・ハイテン | For general heavy plate use | 58-62 | SLD, SLD-MAGIC | HAP40 | YXM1 | |
| 冷間鍛造型 Cold toging dies | 鍛造型 | 雄 型 | Male die | 58-63 | SLD, SLD-MAGIC | YXM1, HAP40, YXM4 | YXR7, YXR3, HAP10 | |
| 間。 | Foging dies | 雌型 | Female die | 55-60 | SLD, SLD-MAGIC,ARK1 | YXM1, HAP10 | YXR7, YXR3, HAP5R | |
| 造品 | 造。 ヘッディングダイス 雄型 | | Male die | 58-62 | SLD, SLD-MAGIC | HAP40, YXM4 | YXM1, YXR7, YXR3 | |
| 모 등 | Heading dies | 雌型 | Female die | 55-60 | YSM | SLD, SLD-MAGIC | YXM1, YXR7, YXR3 | |
| ねじ | ねじ転造ダイス T | | Thread forming dies | 58-64 | SLD | YXR7, YXM1,SLD10 | | |
| 冷間 | 『ロール | | Cold working rolls | ≥80HS | SLD, SLD-MAGIC | YXM1, HAP40 | | |





| 特徴 | 主な用途 | Characteristics | Main Application |
|--|-----------------------------------|---|--|
| 金型寿命の向上とつくりやすさを 両立した高性能冷間ダイス鋼。 | ハイテン等高負荷成形用プレス金型、冷間金型全般 | High-performance cold work tool steel attaining both extended die life and easy die fabrication. | Cold work dies for high-tensile steels, SUS, mass production, and general use. |
| 耐摩耗性大の汎用冷間ダイス鋼。 焼入性が良好で、焼入歪小。 | 冷間金型全般、 フォーミングロール、シャー | Cold work die steel with high abrasion resistance for general use, excellent harden-ability and minimal quench stress. | Cold work dies for general use, forming roll, shear blade. |
| ダイス鋼で最高の硬さ62 ~ 64HRC、 靭性兼備。 | 高性能転造ダイス | Extreamly high hardness with excellent toughness in die steels, 62-64HRC. | Rolling dies. |
| 高靭性で被削性が良好な マトリックス冷間ダイス鋼。 | 板金用金型、プリント基板 用金型、ダイプレート他 | Cold work die steel with high toughness and improved machinability. | Dies for printed circuit board, die plates, stripper plates. |
| 優れた被削性の汎用冷間型鋼。大物 での焼入やワイヤ放電加工に注意。 | 板金用金型、ゲージ | Cold work die steel with superior machinability for general use; Special care is required for quenching large-size dies or wire electric discharge machining. | Dies for deep drawing, gauges. |
| 油焼入用の少量生産用炭素工具 鋼。SK105の焼入性を改善。 | プレス金型、治工具、ゲージ | Carbon tool steel for small production to be quenched in oil. Improved SK105 grade for its hardenability. | Press forming dies, jigs and tools, gauges. |
| 空冷・真空焼入鋼。SGTの焼入性、ワイヤ放電加工性を改善。 | 板金用金型、ゲージ | Vacuum quenched and air quenched steel. Improved SGT grade for its hardenability and wire electric discharge machinability. | Dies for deep drawing, gauges. |
| 火炎焼入用として、空冷で硬さが 高く、歪みも小さい。溶接性良好。 | 板金用金型 | Steel for flame hardening, resulting in high hardness and small strain even with air quenched; good weldability. | Dies for deep drawing. |
| 40HRCのプリハードン鋼。 | 少量生産用プレス型、 治工具 | 40HRC pre-hardened steel. | Press forming dies for small production, jigs and tools. |
| 耐摩耗性、靭性大の汎用ハイス。 | 冷間鍛造型、圧造工具、 スリッター | High speed steel with high abrasion resistance and toughness for general use. | Cold forging dies, cold heading dies, slitter. |
| 耐摩耗性、耐焼付性、耐圧性大の ハイス。 | 冷間鍛造型、絞り型 | High speed steel to prevent from abrasion, seizure and deformation under high pressure | Cold forging dies, drawing dies. |
| 62 ~ 65HRCで最高の靭性を示す マトリックスハイス。真空焼入可。 | 転造ダイス、冷間鍛造型、ロール、 冷間鍛造パンチ、抜打パンチ | Matrix high speed steel, extremely highest toughness in 62-65HRC. Available for vacuum quenching. | Rolling dies, cold forging dies, roll, cold forging panches, blanking panches. |
| 58~61HRCで最高の靭性を示す 汎用マトリックスハイス。 | 割れ、欠け対策用金型 | Matrix high speed steel for general use, extremely highest toughness in 58-61HRC. | Dies to be used for cracking or chipping resistance. |
| ハイス中で最高の靭性を示す マトリックスハイス。硬さ54 ~ 58HRC。 | 冷間鍛造型、温間鍛造型 | Matrix high speed steel highest toughness in high speed steels. Standard hardness 54-58HRC. | Cold forging dies, warm forging dies. |
| 高靭性粉末ハイス。 | 冷間鍛造型、 ファインブランキング型 | Extremely tough Powder Metallurgy process high speed steel. | Cold forging dies, fine blanking dies. |
| 高靭性粉末ハイス。 | 冷間鍛造型、 ファインブランキング型 | Extremely tough Powder Metallurgy process high speed steel. | Cold forging dies, fine blanking dies. |
| 耐摩耗性・靭性兼備の汎用粉末 ハイス。 | 多量生産用プレス型、ロール | P/M high speed steel with high abrasion resistance and toughness for general use. | Press forming dies for mass production, roll. |
| 高硬度で最高の耐摩耗性を 有した粉末ハイス。 | 長寿命冷間塑性加工用金型、 高性能ICモールド金型 | P/M high speed steel with high hardness and highest abrasion resistance. | Cold plastic working dies of long life, high performanced IC molds. |

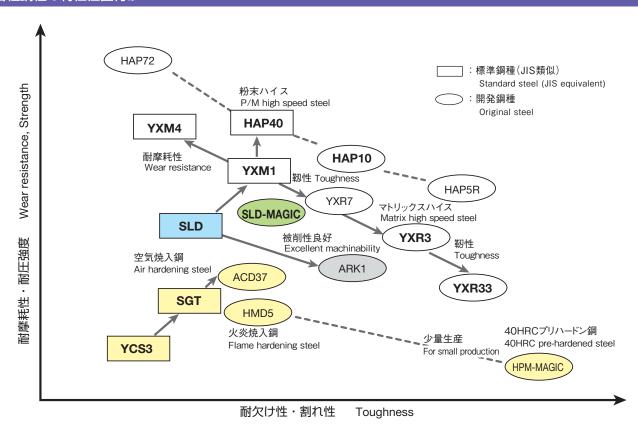
| | | | | 標準硬さ | | 適材鋼種名 Recommended YSS | Ssteel | |
|-----------|---|-------------|----------------------------|----------------------|----------------------------|------------------------------|----------------------------|--|
| | 用 途 Application | | | HRC | 一般用 | 多量用 For mass production use | | |
| | | | | Standard hardness | For general use | 耐摩耗用 For abrasion resistance | 耐衝擊用 For impact resistance | |
| 他 ig | 他 gu ku | | For sheet use | 55-60 | SLD, SLD-MAGIC, ARK1 | YXM1, HAP40 | YXR3, YXR7 | |
| 世野り | | | For heavy plate use | 50-55 | DAC, DM | | | |
| 神 is | | | Cold hobbing dies | 55-60 | SLD, SLD-MAGIC | YXM1 | | |
| 東 を | 引抜きダイス | | Drawing dies | 57-62 | SLD, YXM1 | HAP40 | | |
| | シャーブレード(直刃) | 薄板用 | For sheet service | 55-60 | SLD, SLD-MAGIC, ARK1 | YXM1, YXR7 | YXR3 | |
| Tele . jú | Shearing blade | 中板用 | For medium plate | 53-58 | SLD, SLD-MAGIC, ARK1, ACD8 | | YXR33 | |
| 横城 | (straight tooth) | 厚板用 | For heavy plate | 48-53 | DM, ACD8 | | | |
| 月 刃 点 | 機械 あり shearing blade (straight tooth) 厚板用 「厚板用 「ロータリーシャー・スリッタ」 ビレットシャー 細物用(50mm未満 | | Rotary shear slitters | 54-60 | SLD, SLD-MAGIC, ARK1 | YXM1, HAP40 | | |
| Mac | ビレットシャー | 細物用(50mm未満) | Thicknesses 50mm and under | 50-55 | DM, ACD8 | | | |
| | Billet shear | 太物用(50mm以上) | Thicknesses over 50mm | 48-53 | DAC, DM, ACD8 | | | |
| ゲー | ジ | | Gauges | 60-64 | SGT, ACD37, YCS3 | | | |



YSS 冷間加工用工具鋼の特徴

Characteristics of YSS cold work tool steels

各種鋼種の特性位置付け Characteristics of steels



諸特性の比較 Comparison of characteristics

| 鋼 種 Grade | 耐摩耗性 Wear resistance | 耐圧性 Pressure resistance | 靭 性 Toughness | 焼入性 Hardenability | 熱処理歪 Distortion by heat treatment | 被削性 Machinability | 溶接性 Weldability | 標準硬さ(HRC) Standard hardness |
|--------------|----------------------------|-------------------------------|------------------|----------------------|---|----------------------|-----------------|-----------------------------------|
| SLD-MAGIC | А | А | A ⁻ | A^+ | A ⁺ | A^- | В | 58~62 |
| SLD | А | А | В | A ⁺ | A ⁺ | В | С | 57~63 |
| SLD10 | A ⁻ | А | A ⁻ | A ⁺ | А | B ⁻ | С | 59~65 |
| ARK1 | B ⁺ | А | А | A^+ | А | A ⁻ | В | 58~60 |
| SGT | С | B ⁺ | В | С | D | А | В | 57~63 |
| YCS3 | D | С | С | D | D | A^+ | В | 57~63 |
| ACD37 | В | A^- | В | A^+ | А | А | В | 55~60 |
| HMD5 | С | В | В | _ | _ | А | А | 55~60 |
| HPM-MAGIC | D ⁻ | D | A ⁺⁺ | _ | _ | Α- | A ⁺ | 40 |
| YXM1 | А | A^+ | A ⁻ | В | В | В | С | 58~64 |
| YXM4 | A ⁺⁺ | A^+ | В | В | В | B ⁻ | С | 62~66 |
| YXR7 | А | A^+ | А | Α | В | В | С | 61~65 |
| YXR3 | A ⁻ | Α | A ⁺ | В | В | B ⁺ | C ⁺ | 58~61 |
| YXR33 | В | $B^{^{+}}$ | A ⁺⁺ | Α | В | B ⁺ | C ⁺ | 54~58 |
| HAP5R | А | А | A ⁺ | Α | А | В | С | 58~62 |
| HAP10 | A^+ | A^+ | А | Α | А | B ⁻ | С | 62~65 |
| HAP40 | A ⁺⁺ | A ⁺⁺ | A ⁻ | В | А | C ⁺ | С | 64~67 |
| HAP72 | A ⁺⁺⁺ | A ⁺⁺⁺ | С | A ⁻ | А | C ⁻ | D | 68~71 |

(Aが最も優れ、⁺はさらに良好) (A is the uppermost level and ⁺ indicates higher performance)



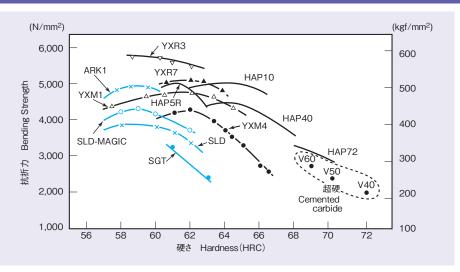


耐摩耗性 Wear resistance

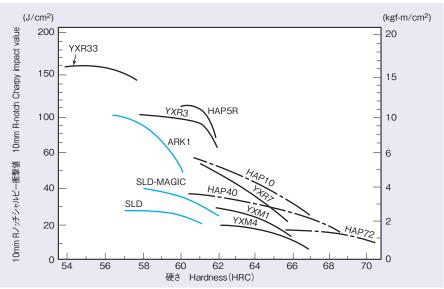
| 鋼 種 Grade | 硬さ(HRC) Hardness | 比摩耗量 Specific abrasion volume(mm³/mm²·mm)×10 ⁻⁷ 0.5 1.0 1.5 2.0 | |
|--------------|---------------------|--|---|
| SLD-MAGIC | 62.0 | | |
| SLD | 60.0 | | |
| ARK1 | 59.0 | | |
| SGT | 60.0 | | |
| YCS3 | 60.0 | | |
| ACD37 | 60.0 | | |
| YXM1 | 65.5 | | |
| YXM4 | 66.0 | | |
| YXR7 | 65.0 | |] . 大越式摩耗試験 |
| YXR3 | 59.0 | | 相 手 材:SCM415 |
| YXR33 | 58.0 | | 摩耗距離:400m 摩擦速度:0.76m/s |
| HAP5R | 60.0 | | 荷 重:67N |
| HAP10 | 64.0 | | Ohgoshi-method wear test Work material : SCM415 |
| HAP40 | 67.0 | | Friction distance : 400m |
| HAP72 | 70.0 | | Friction speed : 0.76m/s Load : 67N |

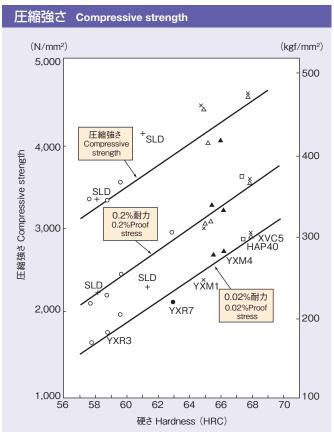
靱性 Toughness

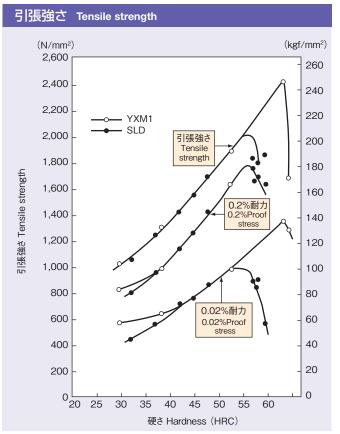
抗折力 Bending strength

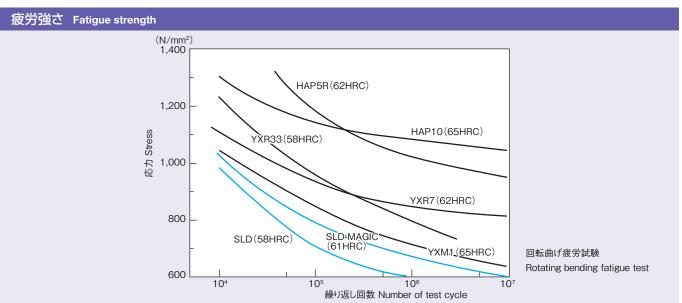


シャルピー衝撃値 Charpy impact value









物理特性 Physical properties

| 鋼種 Grade | 熱膨張係数 Thermal expansion coefficient ×10⁻⁵/℃ 20-200℃ | 熱伝導率 Thermal conductivity W/(m⋅K) 20℃ | ヤング率 Young's modulus GPa |
|-------------|---|---|--------------------------------|
| SLD-MAGIC | 12.2 | 16.5 | 201 |
| SLD | 11.2 | 20.6 | 211 |
| SGT | 13.6 | 23.3 | 201 |
| YCS3 | 14.3 | 25.9 | 207 |
| YXM1 | 11.2 | 21.0 | 216 |
| YXR3 | 11.3 | 18.7 | 212 |
| HAP40 | 10.3 | 19.3 | 227 |





YSS 冷間加工用工具鋼の熱処理

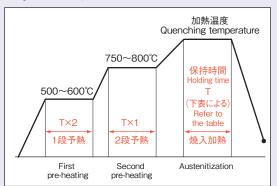
Heat treatment of YSS cold work tool steels

焼入れ Hardening

- *焼入加熱温度および冷却方法については各鋼種の標準熱処理条件をご参照ください。
- * Please refer to the standard heat-treatment condition of each grade for hardening and quenching condition.

●合金工具鋼、炭素工具鋼

Alloy tool steels, Carbon tool steels



焼入加熱保持時間 Holding time at austenitizing temperature

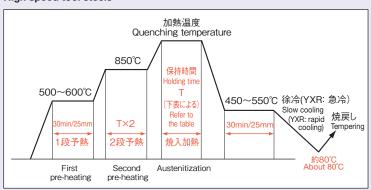
| 肉厚(mm) Thickness | ≦15 | 25 | 50 | 75 | 100 | 125 | 150 | 200 | 300 |
|--------------------------------------|-----|----|----|----|-----|-----|-----|-----|-----|
| 保持時間 (分) Holding time (min) | 15 | 25 | 40 | 50 | 60 | 65 | 70 | 80 | 100 |

注)ソルトバスは必ず予熱を行うことを前提とし、保持時間=浸漬時間とする。

Note: If you take preheating time, dipping time can be regarded as holding time.

●高速度工具鋼

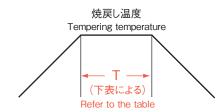
High speed tool steels



焼入加熱保持時間 Holding time at austenitizing temperature

| 加熱炉 Heating furnace | 肉厚(mm) Thickness 時間 Time | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|---------------------------|---|-----|----|-----|-----|-----|-----|------|-----|------|------|
| ソルトバス | 保持時間(秒) Holding time (sec) | 60 | 90 | 160 | 240 | 280 | 350 | 390 | 420 | 440 | 495 |
| Salt bath | 倍数 Magnification (Holding time/Thickness) | ×12 | ×9 | ×8 | ×8 | ×7 | ×7 | ×6.5 | ×6 | ×5.5 | ×5.5 |

焼戻し Tempering



- 注1: 本基準は500℃以上の焼戻しとし、250~500℃の焼戻しの場合T×1.5, 250℃以下の焼戻しはT×2とします。
- 注2: 高温焼戻しをする場合は最低2回、Co入り高速度鋼は少なくとも3回以上必要です。
- 注3: 高速度工具鋼の場合、一般的に600℃以上の焼戻しは靭性が低下するので避けてください。
- Note1: This standard is applicable to tempering at 500°C or more. When tempering at 250-500°C, holding time must be increased to 1.5 times longer and at lower than 250°C, 2 times longer than the standard.
- Note2: Tempering is required no less than two times for grades containing no cobalt and at least three times for grades containing cobalt to improve toughness when high temperature tempering is done.
- Note3: Because toughness deteriorates, tempering higher than 600°C must avoid for high-speed tool steels.

| 肉厚(mm) Thickness | ≦25 | 26 - 35 | 36 - 64 | 65 - 84 | 85 - 124 | 125 - 174 | 175 - 249 | 250 - 349 | 350 - 499 |
|--|-----|---------|---------|---------|----------|-----------|-----------|-----------|-----------|
| 焼戻し保持時間(h) Holding time for tempering | 1 | 1.5 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

焼なまし Annealing

- 1.素材は球状化焼なましが施されているので、球状化焼なましは 不要です。
- 2.再鍛造して使用する場合は、鍛造後球状化焼なましを実施してください。この際は標準熱処理条件をご参照ください。
- 3.応力除去焼なましは冷間加工(冷間引抜、冷間圧延、その他)ある いは切削加工の応力を取り除き、軟化もしくは後の熱処理変形の 軽減のために行います。
 - ●加熱温度 650~700℃
 - ●加熱時間 1h/25mm

- 1. All material is delivered as spheroidized annealed condition.
- 2. After reforging, spheroidizing is to be done before hardening. Please refer to the standard heat treatment conditions.
- Stress relief annealing is to be done to remove stress
 caused by cold working such as drawing and rolling and to
 soften or reduce distortion caused by subsequent hardening.
 - Heating temperature : 650-700 °C
 - Holding time: 1h/25mm thickness



標準熱処理条件 Standard heat treatment conditions

| | 鋼 種 | 納入硬さ(HBW) | 熱処理》 Heating te | 昷度(℃) emperature | 焼入焼戻し硬さ(HRC) | 焼なまし |
|---------------------------------------|-----------|------------------------|---|----------------------------------|-------------------|----------------------------|
| | Grade | Hardness as delivering | 焼入れ Hardening | 焼戻し Tempering | Tempered hardness | Annealing |
| | SLD-MAGIC | ≦255 | 1,010~1,040 空冷 Air cool 480~530または150~250 空冷 Air cool | | ≧60 | 830~880 徐冷 Slow cooling |
| | SLD | ≦248 | 1,000~1,050 空冷 Air cool | 480~530または150~200 空冷 Air cool | ≧58 | 830~880 徐冷 Slow cooling |
| 会 会 会 | SLD10 | ≦248 | 1,020~1,070 空冷 Air cool | 520~550 空冷 Air cool | ≧62 | 830~880 徐冷 Slow cooling |
| 間 金 s loo | ARK1 | ≦248 | 1,010~1,040 空冷 Air cool | 480~530または150~250 空冷 Air cool | ≧58 | 830~880 徐冷 Slow cooling |
| 一件間金型用鋼 Cold work tool steels | SGT | ≦217 | 800~850 油冷 Oil quench | 150~200 空冷 Air cool | ≧60 | 750~780 徐冷 Slow cooling |
| 鋼 \ploc | YCS3 | ≦212 | 790~850 油冷 Oil quench | 150~200 空冷 Air cool | ≧63 | 750~780 徐冷 Slow cooling |
| | ACD37 | ≦235 | 830~870 空冷 Air cool | 150~200 空冷 Air cool | ≧58 | 750~800 徐冷 Slow cooling |
| | HMD5 | ≦235 | フレームハードニング加熱 Flame hardening | 温度 940~1100℃ | _ | 825~875 徐冷 Slow cooling |
| 容 sels | YXM1 | ≦255 | (1)1,200~1,240 油冷 (2)1,160~1,200 Oil quench | 550~570 空冷 Air cool | ≧63 | 800~880 徐冷 Slow cooling |
| 溶製高速度工具鋼 Nigh speeds tool steels | YXM4 | ≦277 | (1)1,230~1,250 油冷 (2)1,210~1,230 Oil quench | 560~580 空冷 Air cool | ≧64 | 800~880 徐冷 Slow cooling |
| 速 度 sed to | YXR7 | ≦241 | (1)1,160~1,180 油冷 (2)1,120~1,160 Oil quench | 540~580 空冷 Air cool | ≧62 | 800~880 徐冷 Slow cooling |
| 上 具 yds yk | YXR3 | ≦241 | (1)1,150~1,170 油冷 (2)1,130~1,150 Oil quench | 560~590 空冷 Air cool | ≧57 | 800~880 徐冷 Slow cooling |
| 型点 | YXR33 | ≦241 | 1,080~1,140 油冷 Oil quench | 550~600 空冷 Air cool | ≧54 | 800~880 徐冷 Slow cooling |
| 粉士steels | HAP5R | ≦269 | 1,120~1,160 油冷 Oil quench | 530~580 空冷 Air cool | ≧58 | 820~870 徐冷 Slow cooling |
| 个高 ed tool | HAP10 | ≦269 | (1)1,170~1,190 油冷 (2)1,120~1,170 Oil quench | 550~580 空冷 Air cool | ≧63 | 820~870 徐冷 Slow cooling |
| 粉末高速工具鋼 M/M High speed tool steels | HAP40 | ≦277 | (1)1,190~1,210 油冷 (2)1,120~1,190 Oil quench | 560~580 空冷 Air cool | ≧66 | 820~870 徐冷 Slow cooling |
| 鋼H W/d | HAP72 | ≦352 | 1,180~1,210 油冷 Oil quench | 560~580 空冷 Air cool | ≧68 | 820~870 徐冷 Slow cooling |

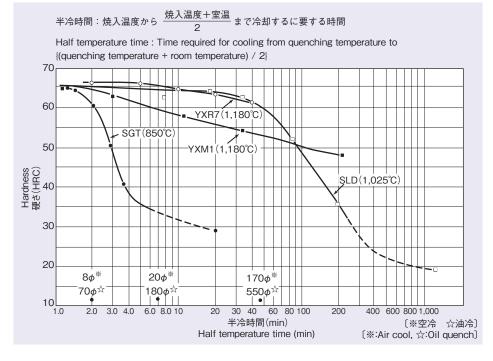
- (1) 簡単な形状の工具
- (2) 複雑な形状の工具、特に靭性を必要とする工具
- (1) Simple shape tools
- (2) Tools of complicated shape, requiring toughness in particular
- *JIS硬き試験の規定により供試材は約15mm角又は丸、長さ20mm * Specimen size is 15mm squire or round by 20 mm long in accordance with JIS standard hardness test.

焼入性 Hardenability

焼入れにより中心部硬さ60HRCが得られる最大丸棒直径

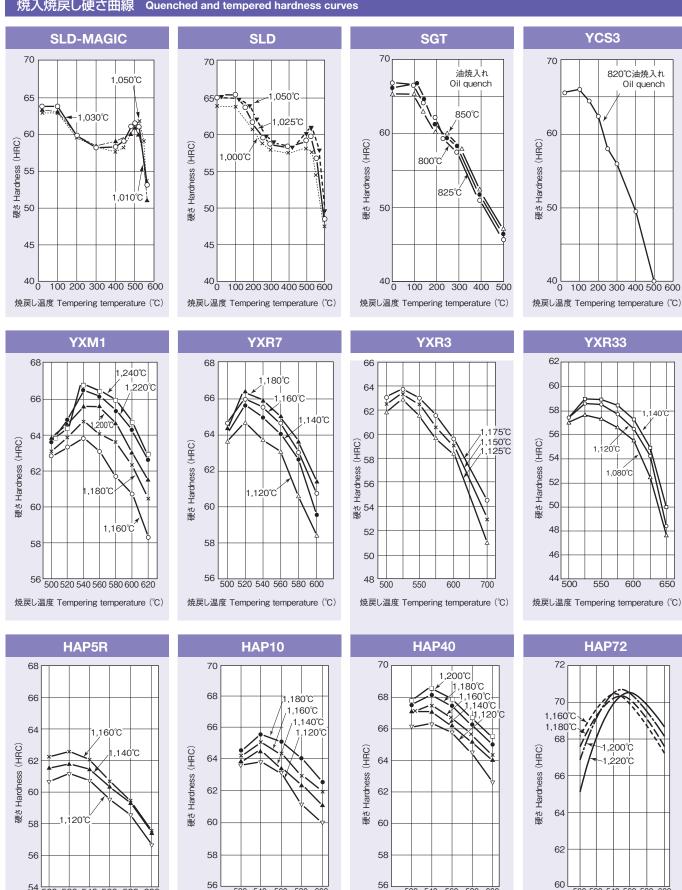
The maximum diameter of a round bar stock that obtains 60 HRC hardness at its center by quenching.

| 冷却 cooling 鋼種 Grade | 空冷 Air cool | 油冷 Oil quench |
|------------------------------|----------------|------------------|
| SLD-MAGIC | φ170 | φ550 |
| SLD | φ170 | φ550 |
| ACD37 | φ120 | _ |
| SGT | φ8 | φ70 |
| YXM1 | φ20 | φ180 |
| YXR7 | φ170 | φ550 |
| HAP10 | _ | φ180 |





焼入焼戻し硬さ曲線 Quenched and tempered hardness curves





54 500 520 540 560 580 600

焼戻し温度 Tempering temperature (℃)

520 540 560 580 600

焼戻し温度 Tempering temperature (℃)

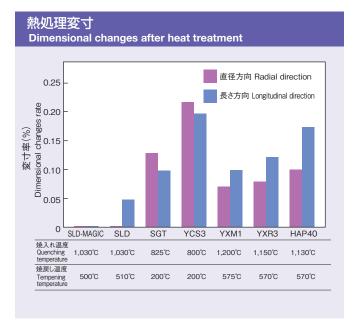
520 540 560 580 600

焼戻し温度 Tempering temperature (℃)

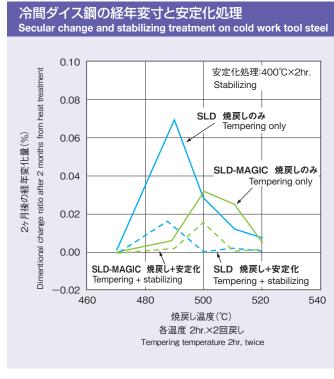
500 520 540 560 580 600

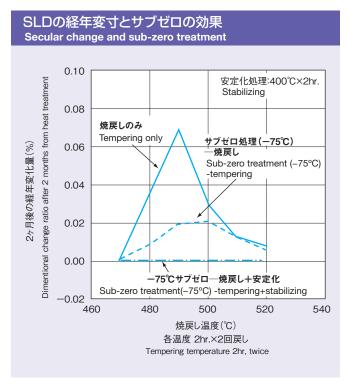
焼戻し温度 Tempering temperature (℃)

冷間ダイス鋼の熱処理変寸 Dimensional change after heat treatment of cold dies steel 0.10 SLD長さ方向 SLD longitudinal direction SI D-MAGIC長さ方向 0.05 SLD-MAGIC longitudinal Dimensional changes rate direction 変寸率(%) 0.00 SLD-MAGIC幅方向 SLD-MAGIC width direction -0.05SLD幅方向 SLD width direction -0.10 -0.15 100 200 300 400 500 600 焼戻し温度(℃) 2回実施 試験片 Specimen: 50T×100W×200L Tempering temperature (°C) 2hr, twice. Rolling direction 200L 焼入れ Quenching: 1030℃ 焼戻し Tempering: 2hr.×2回



残留オーステナイト The retained austenite 30 YXM1 1260℃焼入れ quenching ratio of retained austenite 25 SLD-MAGIC 1030°C焼入れ quenching 残留オーステナイト(%) 20 SLD 1030℃焼入れ quenching 15 10 SGT 825℃油焼入れ oil quenching Volume 5 0 0 100 200 300 400 500 600 焼戻し温度(℃)×2回 Tempering temperature, twice





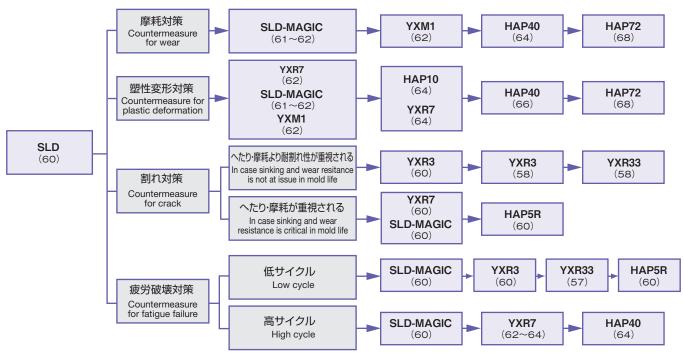




YSS 冷間工具鋼の型材・硬さによる改善手順

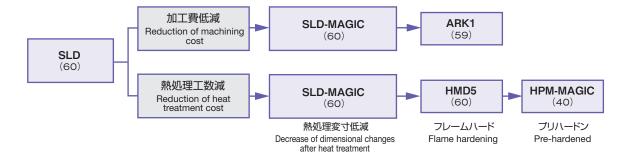
Improvement processes of YSS cold work tool steels in terms of hardness and dies for various applications

冷間工具鋼の寿命改善フロー Flowchart to improve die life of cold work tool steels



注:(HRC硬き目安) Remark:(HRC: rough standard hardness)

冷間工具鋼の原価低減改善フロー Flowchart to reduce die cost of cold work tool steels



Isotropy



アイソトロピィ工具鋼は、一般鋼材の欠点であるタテ(鍛伸方向)、 ヨコ方向の機械的性質の差異を低減し、等方性を持たせたものです。 工具鋼のお客様にも高い評価を受けているこの技術思想は全ての 鋼づくりに生かされ、鋼の特性の安定化や高寿命化に大きく貢献しています。

Isotropy tool steels are so named becase the difference in mechanical properties between its longitudinal (forging or rolling direction) and transverse directions is reduced, thus overcoming a weak point of ordinarily processed steels. This technological concept, which is highly evaluated by users of tool steels, is applied for the production of all our steels and contributes significantly to stabilizing their characteristics and enhance their service life.

YSS、ヤスキハガネ、SLD-MAGIC、SLD、ARK1、SGT、YCS、ACD、HMD、HPM-MAGIC、HPM、YXM、YXR、HAP、DACは日立金属の登録商標です。

YSS, SLD-MAGIC, SLD, ARK1, SGT, YCS, ACD, HMD, HPM-MAGIC, HPM, YXM, YXR, HAP and DAC are registered trademarks of Hitachi Metals, Ltd.

回日立金属株式会社

http://www.hitachi-metals.co.jp/

| 本社 | 〒105-8614 東京都港区芝浦一丁目 2番1号(シーバンスN館) 高級金属カンパニー | Tel. (03)5765-4410 Fax.(03)5765-8317 |
|--------|---|---|
| 支店 | | |
| 北日本支店 | 〒980-0021 宮城県仙台市青葉区 中央一丁目6番35号(東京建物仙台ビル) | Tel. (022)267-0216(代表) Fax.(022)266-7891 |
| 茨城支店 | 〒317-0851 茨城県日立市助川町 三丁目1番1号 | Tel. (0294)26-7660 Fax.(0294)22-5880 |
| 中部東海支店 | 〒460-0003 愛知県名古屋市中区 錦二丁目13番19号(瀧定ビル) | Tel. (052)220-7465 Fax.(052)220-7485 |
| 関西支店 | 〒541-0041 大阪府大阪市中央区 北浜三丁目5番29号(日生淀屋橋ビル) | Tel. (06)6203-9720 Fax.(06)6222-3417 |
| 中国支店 | 〒732-0827 広島県広島市南区 稲荷町2番16号(広島稲荷町第一生命ビル) | Tel. (082)535-1711(代表) Fax.(082)535-1713 |
| 九州支店 | 〒810-0001 福岡県福岡市中央区 天神二丁目14番13号(天神三井ビル) | Tel. (092)687-5261(代表) Fax.(092)687-5266 |
| 営業所 | | |
| 静岡営業所 | 〒422-8067 静岡県静岡市駿河区南町 18番1号(サウスポット静岡) | Tel. (054)202-1580(代表) Fax.(054)202-1588 |
| 浜松営業所 | 〒430-7725 静岡県浜松市中区板屋町 111番2(浜松アクトタワー) | Tel. (053)453-1191(代表) Fax.(053)456-7709 |
| 北陸営業所 | 〒939-8216 富山県富山市黒瀬北町 二丁目13番1号(イムズビル) | Tel. (076)420-2881(代表) Fax.(076)491-5201 |

| Head Office | SEAVANS North Building, 1-2-1, Shibaura, Minato-ku, Tokyo 105-8614, Japan High-Grade Metals Company | Tel. +81-3-5765-4410 Fax. +81-3-5765-8317 |
|-----------------|---|---|
| @ Hitach | i Metals America, Ltd. | |
| Head Office | 2 Manhattanville Road, Suite 301, Purchase, NY 10577, U.S.A. | Tel. +1-914-694-9200 Fax. +1-914-694-9279 |
| Other Office | Chicago, Detroit, Pittsburgh, San Jone, Novi Michigan | |
| O Hitach | i Metals Europe GmbH | |
| Head Office | Immermannstrasse 14-16,40210 Duesseldorf, Germany | Tel. +49-211-16009-0 Fax. +49-211-16009-29 |
| Other Office | London, Milano, Paris | |
| @ Hitach | i Metals Singapore Pte. Ltd. | |
| · | 12 Gul Avenue, Singapore 629656 | Tel. +65-6861-7711 Fax. +65-6861-1519 |

Allianti Matala (Dana Orran) Orranialia Otala Orrania

Head Office Cha Shan Town, Dong Guan City, 522380, China Tel. +86-769-8640-6726 Fax. +86-769-8640-6716 No.155 jiu yuan road, Qingpu industrial zone, Tel. +86-21-3929-2202 Shanghai Branch Qingpu District, Shanghai, 201712, China Fax +86-21-3929-2201 Tianjin Jinnan No.11, Jianshe 4th Branch Road, Balitai Town, Tel. +86-22-8699-3101/3102 Jinnan District, Tianjin, 300350, China Fax. +86-22-8699-3103 3#-2, Koushin Mould Industrial Park III B-1-1-1F. Tel. +86-411-8718-1011/1022 **Dalian Branch** Fax. +86-411-8718-1033 T. Z. Dalian, 116600, China

88 Xing lin Street, Suzhou Industrial Park, Tel. +86-512-6790-2106
Jiangsu Province, 215027, China Fax. +86-512-6790-2128



安全に関するご注意 Notes about safety

鋼材は重量物です。輸送や保管時に荷崩れや落下、挟まれなどを防止するための安全対策を実施してください。鋼材を鋸切断、切削、熱処理、研磨など各種加工される際や、金型、部品、治工具など製品として使用される際は、該当する法令・省令・条例・ガイドライン等に従い、保護具や治工具などを使用して作業者の安全を確保してください。

Steel is heavy. Please execute the safety measures to prevent falling or collapse of cargo or sandwiched during transportation or warehousing. Please ensure the safety of workers use the jigs and various protective equipment and follow the applicable laws and ministerial ordinance, ordinances, guidelines, etc. when sawing, cutting, heat treatment, polishing or when using as mould, machine parts, or tooling.

- 本カタログに記載の特性値は、代表的な値であり、保証値とは異なりますのでご注意願います。
- 本カタログに記載の事項は予告なく 変更することがございます。
- 本カタログ記載内容の無断転載を禁じます。
- ご不明な点は左記最寄の弊社特殊鋼 担当までご相談ください。
- The charactersitics and properties listed on this catalogue are representative and not quaranteed values.
- This catalog and its contents are subject to change without notice.
- Do not duplicate or reprint all or any part of this catalogue without prior permission from Hitachi Metals,Ltd.
- Please contact representatives of our Specialty Steel Division at the locations listed below for any inquiries.

本カタログ記載の住所、連絡先は2014年1月現在の ものです。

変更になる場合もありますので、電話やファクシミリがつながらない場合は、お手数ですが下記までご連絡をお願いいたします。

日立金属株式会社コミュニケーション室

Tel. (03) 5765-4076 (0800) 500-5055 Fax. (03) 5765-8312

Our address and contact indicated in this catalog are those as of January 2014.

If you cannot put a call through, please contact our Corporate Communications Office. in Tokyo below.

Hitachi Metals, Ltd. Corporate Communiations Office Tel: +81-3-5765-4076 Fax: +81-3-5765-8312