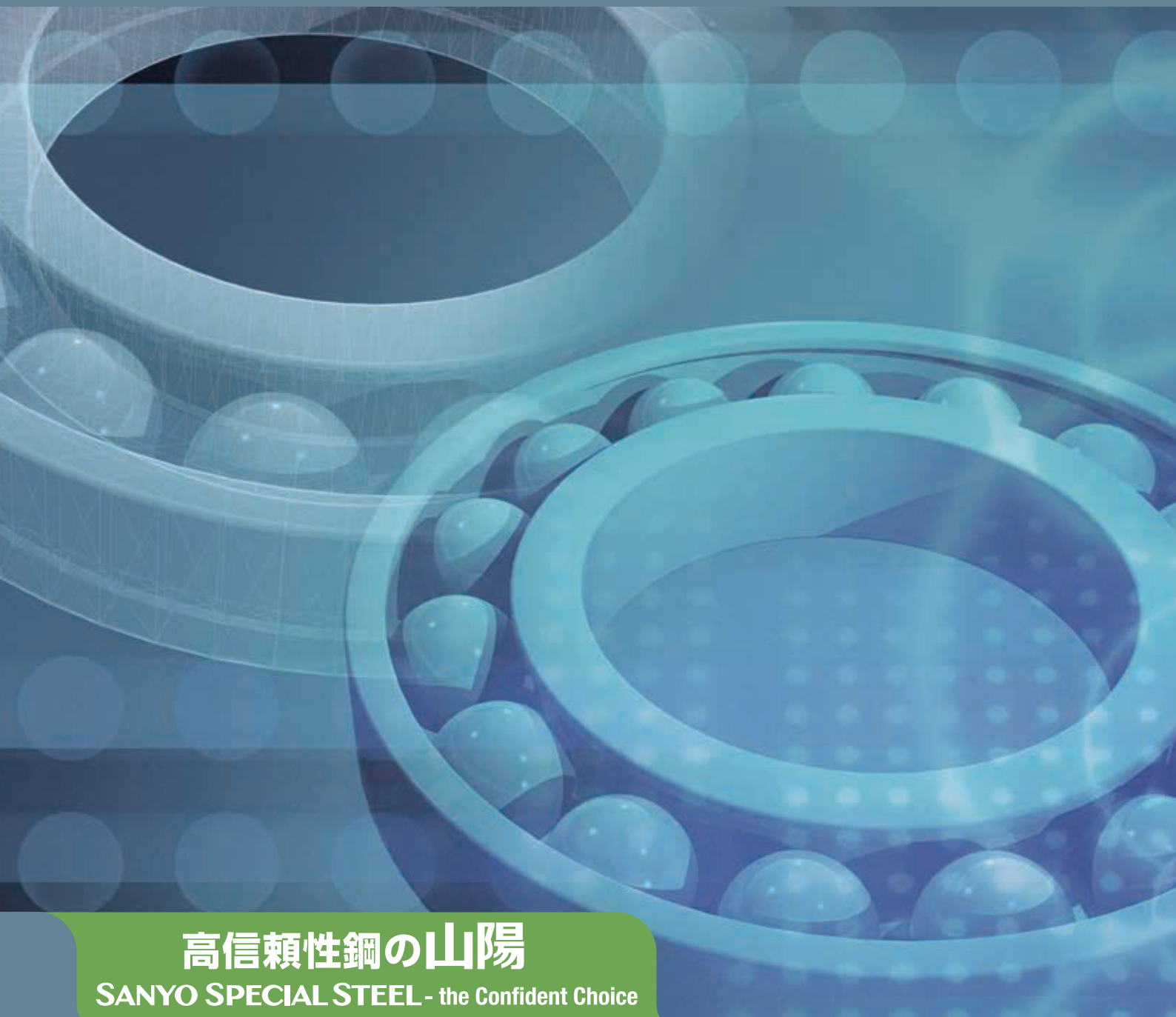


# 軸受用鋼

Bearing Steel



高信頼性鋼の山陽

SANYO SPECIAL STEEL - the Confident Choice



## 他の追随を許さない超高清浄度 ベアリングの寿命と信頼性のさらなる向上を目指して

Unsurpassed Premium Cleanliness Steel  
Aiming for Longer Service Life and Better Reliability

山陽特殊製鋼が長年にわたって培ってきた超高清浄度鋼製造技術。世界最高級の清浄度を実現する技術を駆使し、軸受用鋼の品質と信頼性の高さで業界をリードするとともに、棒鋼・線材・鋼管から素形材まで、お客様の加工工程に合わせた最適な形状で提供できる体制を構築しています。これからも、高品質の軸受用鋼の提供を通じて、ベアリングの寿命・信頼性と、お客様における生産性のさらなる向上に貢献します。

Sanyo Special Steel has built up a fund of advanced clean steel technology over many years.

Sanyo Special Steel leads the industry in the manufacture of high quality and reliable bearing steel using its technology to achieve the world's highest-class cleanliness. In so doing, the company has created a production system that has made it possible to supply products in a form that is optimal for customer's individual processing requirements, ranging from steel bars, wire rods, and tubes to formed and fabricated materials.

Through providing high-quality bearing steel, Sanyo Special Steel contributes to enhancing the service life and reliability of bearings and improving their customers productivity.

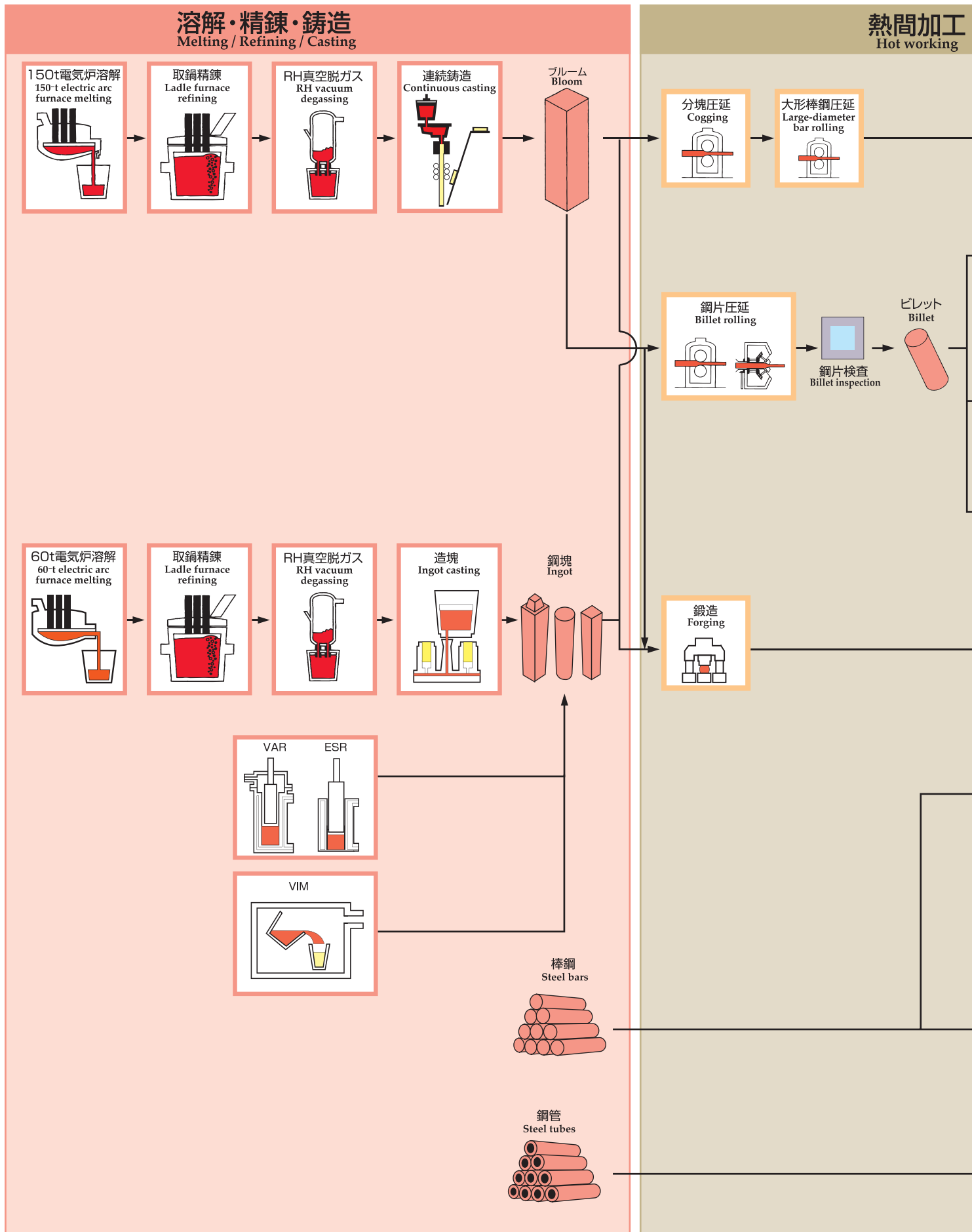




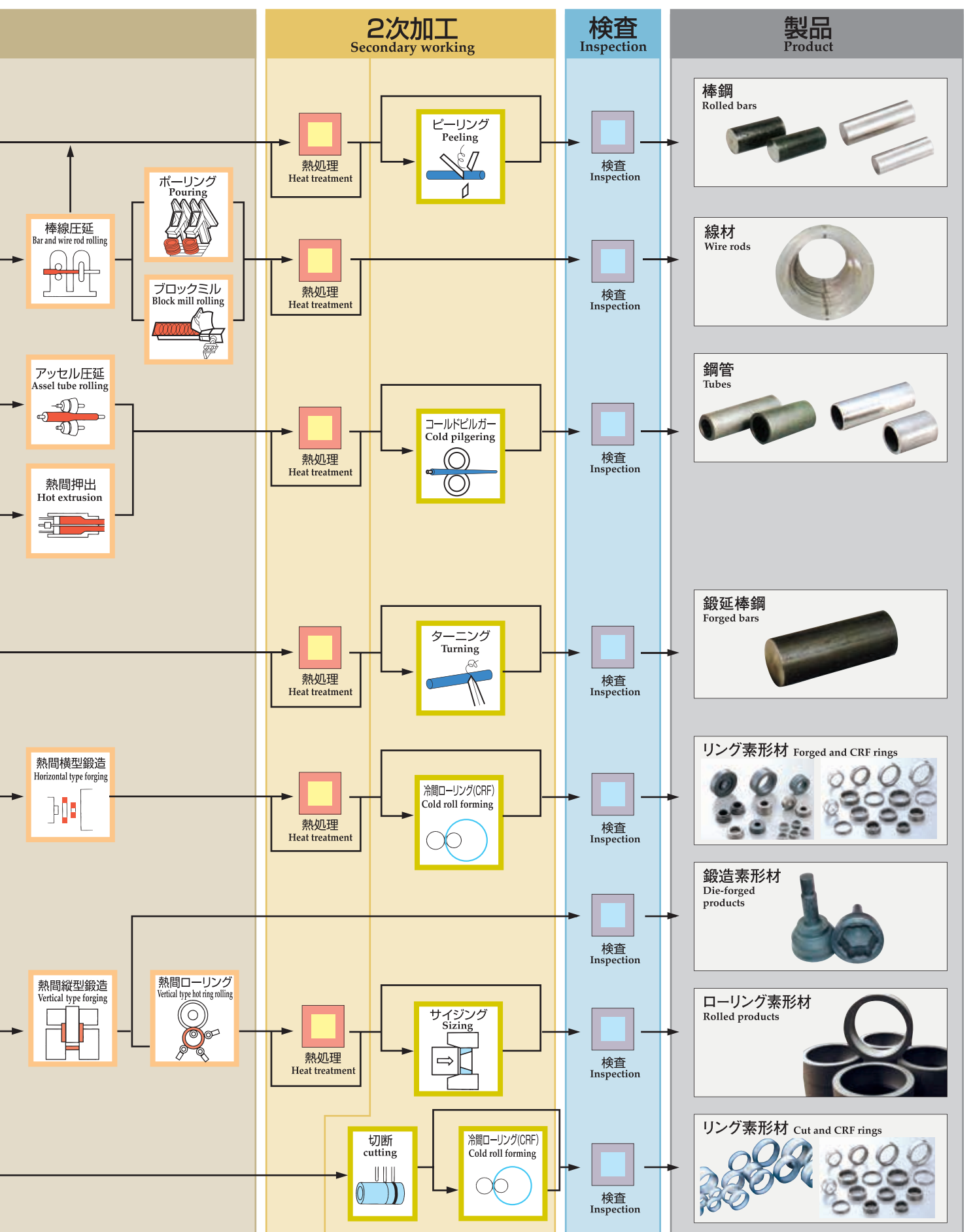


# 製造工程

## Manufacturing Processes







# 製造技術

## Manufacturing Technology

ベアリングは、高い圧縮・衝撃荷重が長時間繰り返して作用する過酷な条件で使用されるため、その材料となる軸受用鋼には、厳しい負荷に耐えうる高い硬度と強度に加え、優れた疲労強度を持つことが求められます。山陽特殊製鋼では、軸受用鋼に求められる品質特性と高い信頼性を実現する高度な製造プロセスを確立しています。

また、時代とともに変化するお客様のニーズに応えるために、さらなる品質と信頼性の向上に向けた研究開発にも積極的に取り組んでいます。

Since bearings are used under severe conditions where high compression and a large impact load are repeatedly applied over a long period, bearing steel requires superior fatigue strength, in addition to high hardness and strength that make the steel able to withstand a severe load. Sanyo Special Steel has established advanced production processes to manufacture bearing steel with the required quality characteristics and enhanced reliability.

Sanyo Special Steel is also committed to research and development that will achieve higher quality and more reliable steel products, so that it can meet the ever-changing needs of its customers.



150t UHP電気炉  
150-t UHP electric arc furnace

### 製鋼・鋼片圧延工程



取鍋精錬設備  
Ladle furnace



RH真空脱ガス設備  
RH vacuum degasser



連続铸造設備  
Completely vertical type bloom caster

- 大容量UHP電気炉による安定した生産
- 取鍋精錬とRH真空脱ガスによる清浄度の向上
- 軸受鋼の品質確保を最優先した大断面完全垂直型連続铸造設備
- 分塊圧延からPSW鋼片圧延機により、鋼片・管材を高効率に製造

#### Steelmaking and Billet Rolling

- Stable production using large-capacity UHP electric arc furnace
- Improved cleanliness with the use of ladle furnace refining and vacuum degassing
- Completely vertical type heavy section bloom caster, with the highest priority given to ensuring the production of the highest quality bearing steels
- Highly efficient production of billets and tube rounds using the cogging mill and PSW billet rolling mill

軸受用鋼に共通の要求特性  
Requirements common to all bearing steels

高清浄度  
High cleanliness

## 圧延・製管工程

- 棒鋼・線材は、最新鋭連続圧延機による高精度な仕上げ
- アッセルミルによるシームレスパイプの製造

### Rolling and Steel Tube Manufacturing

- High-precision finished steel bars and wire rods manufactured with the continuous rolling mill
- Manufacturing of seamless tubes using the Assel tube rolling mill



精密圧延機  
Precision rolling mill



アッセルミル  
Assel tube rolling mill

## 熱処理工程

- 連続焼鈍炉による安定した品質

### Heat Treatment

- Continuous annealing furnace for consistent quality



連続焼鈍炉  
Continuous annealing furnace

## 加工工程

- コールドピルガーミルは、熱間加工では製造困難な細径・薄肉の鋼管を精度よく冷間圧伸
- コールドピルガーミルにより長寿命かつ取り代削減の実現

### Cold Working

- Cold pilgering provides precise production of small-diameter and thin-wall steel tubes that is not feasible by hot working
- Cold pilgering provides longer fatigue life and reduces machining allowances



コールドピルガーミル  
Cold pilgering mill

## 検査工程

- 全領域超音波探傷機、漏洩磁束探傷機、自動寸法測定器など豊富な非破壊検査設備と、綿密な品質管理による高度な保証体制の確立

### Inspection

- Sophisticated total quality assurance, incorporating various non-destructive inspection facilities including the across-the-section ultrasonic inspection machine, magnetic leakage flux inspection machine and automatic dimensional control devices, and strict quality control



水浸超音波探傷機  
Water-immersion ultrasonic inspection machine



漏洩磁束探傷機  
Magnetic leakage flux inspection machine

酸化物系非金属介在物の減少  
Reduction of oxide nonmetallic inclusions

鋼中酸素量の低減

Reduced oxygen in steel

非金属介在物の微細化

Finer nonmetallic inclusions



確かな品質と高い信頼で、あらゆるニーズに応えます。

Assured quality and high reliability to meet your needs

長寿命

Long life



# 特性

## Characteristics

### 高炭素クロム軸受鋼 High-carbon chromium bearing steel

高炭素クロム軸受鋼は、調質が容易なため直接焼入れで高い硬さが得られるとともに、球状化焼きなましで被削性が向上するという特長があります。SUJ2<SUJ4<SUJ3<SUJ5の順に焼入性が高く、使用されるベアリングの寸法や肉厚に応じて使い分けられます。

High-carbon chromium bearing steel, which is easily thermally refined, provides higher hardness by direct quenching, as well as higher machinability through spheroidizing annealing. The hardenability of steel products increases in the following order: SUJ2 < SUJ4 < SUJ 3 < SUJ5. Which one of these types is used depends on the diameter and wall thickness of the bearing.

### 成分表 Chemical compositions [JIS G 4805:2008]

(%)

| 鋼種 Grade | C         | Si        | Mn        | P      | S      | Cr        | Mo        |
|----------|-----------|-----------|-----------|--------|--------|-----------|-----------|
| SUJ2     | 0.95~1.10 | 0.15~0.35 | ≤0.50     | ≤0.025 | ≤0.025 | 1.30~1.60 | —         |
| SUJ3     | 0.95~1.10 | 0.40~0.70 | 0.90~1.15 | ≤0.025 | ≤0.025 | 0.90~1.20 | —         |
| SUJ4     | 0.95~1.10 | 0.15~0.35 | ≤0.50     | ≤0.025 | ≤0.025 | 1.30~1.60 | 0.10~0.25 |
| SUJ5     | 0.95~1.10 | 0.40~0.70 | 0.90~1.15 | ≤0.025 | ≤0.025 | 0.90~1.20 | 0.10~0.25 |

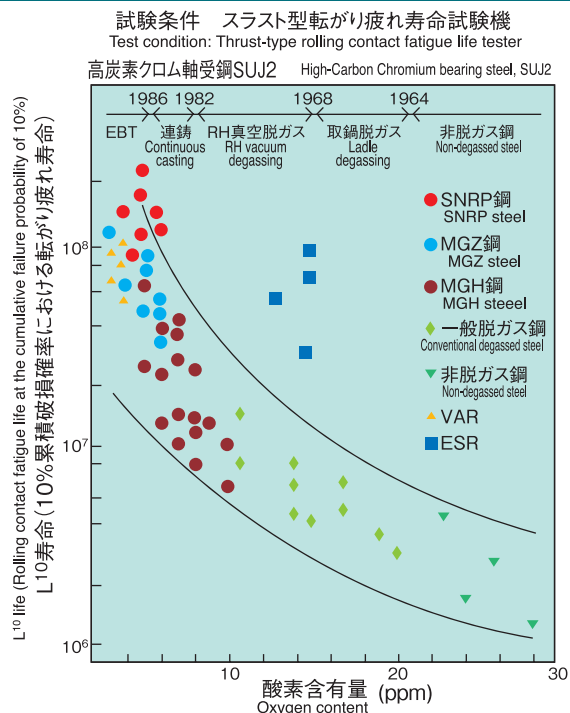
備考 1.不純物としてNi、Cuともそれぞれ0.25%をこえてはならない。ただし、線材のCuは0.20%以下とする。SUJ2およびSUJ3のMoは、0.08%をこえてはならない。  
2.受渡当事者間の協定によって、上表以外の元素を0.25%以下添加してもよい。

Notes: 1.Either Ni or Cu as impurity must not exceed 0.25%. Cu in wire rods must not exceed 0.20%. Mo in SUJ2 and SUJ3 must not exceed 0.08%.  
2.Upon agreement between the supplier and the consignee, elements other than those given in the above table may be added up to 0.25%.

### 特長と用途 Characteristics and Applications

| 鋼種 Grade | 特長 Characteristics   | 用途 Application  |
|----------|--|---|
| SUJ2     | 高炭素クロム鋼系の中でも90%以上使用されている代表鋼種<br>The representative grade of the high carbon chromium steels, 90% of which fall into this grade.    | 直径25mm以下のボールやローラー及び、肉厚25mm以下のレースにはほとんどの鋼種を使用<br>Used for almost all the balls and rollers having a diameter of 25 mm or less and races having a wall thickness of 25 mm or less.              |
| SUJ3     | SUJ2よりSiとMnを高めCrを減らした焼入性が良い鋼種<br>Provides better hardenability than SUJ2 because of higher Si and Mn content and lower Cr content. | 直径25mm以上のボールやローラー及び、厚肉のレース<br>Used for balls and rollers having a diameter of 25 mm or more and races having a thick wall.  |
| SUJ4     | SUJ2とSUJ3の中間の焼入性をもつ鋼種<br>Offers intermediate hardenability between those of SUJ2 and SUJ3.   | SUJ2とSUJ3の中間寸法のボールやローラー及びレース<br>Used for balls, roller and races with intermediate dimensions between those made of SUJ2 and SUJ3.  |
| SUJ5     | SUJ3にMoを加えて、さらに焼入性を向上させた鋼種<br>Offers better hardenability through the addition of Mo to SUJ3.                                      | SUJ3では熱処理後の心部硬さが不足する大径のボールやローラーあるいは厚肉のレース<br>Used for large diameter balls and rollers and heavy-wall races where use of SUJ3 will result in insufficient core hardness after heat treatment. |

### 酸素含有量と寿命の関係 Relationship between oxygen content and fatigue life



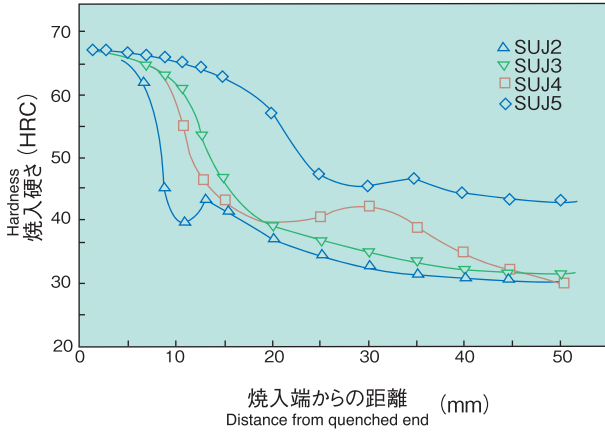
### SNRP(Sanyo New Refining Process)

SNRPとは、「鋼材がもつ本来の性能を最大限まで引き出すために、鋼中の最大介在物の大きさをコントロールする」という当社独自のコンセプトで開発された、超高清浄度鋼の製造プロセスです。

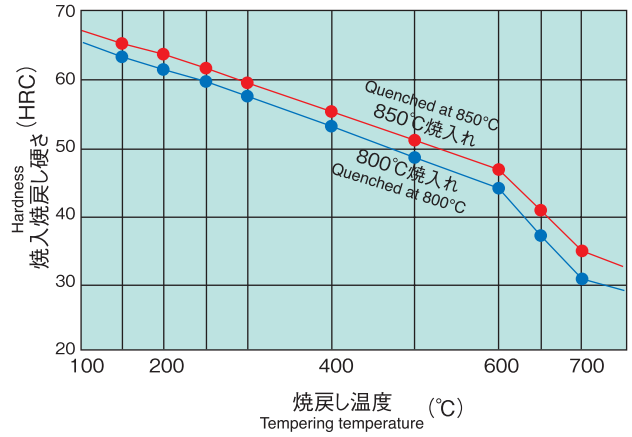
150t電気炉溶解から連続 castingまでの製造プロセスを最適化することで、材料の疲労強度と信頼性の飛躍的な向上を実現します。

SNRP is a steel refining process for premium cleanliness steel. This technology, unique to Sanyo, minimizes the largest inclusion size in steel to bring out the inherent performance of the steel. SNRP realizes improved fatigue strength and reliability of the steel by optimizing processes from melting by a 150-t electric arc furnace through continuous casting.

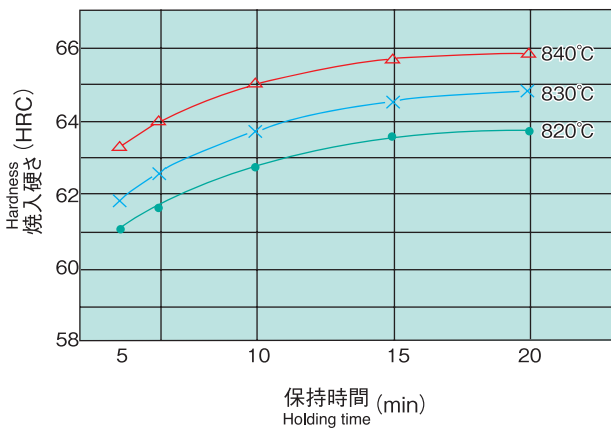
### 高炭素クロム軸受鋼の焼入性 Hardenability



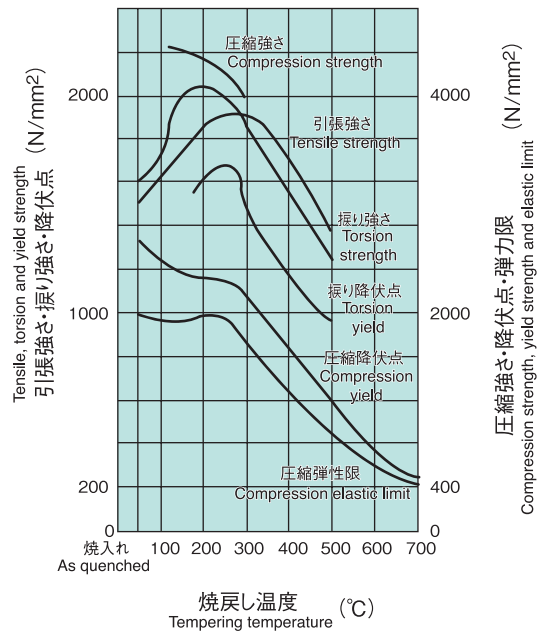
### 焼入焼戻し硬さ SUJ2 Quenched and tempered hardness of SUJ2



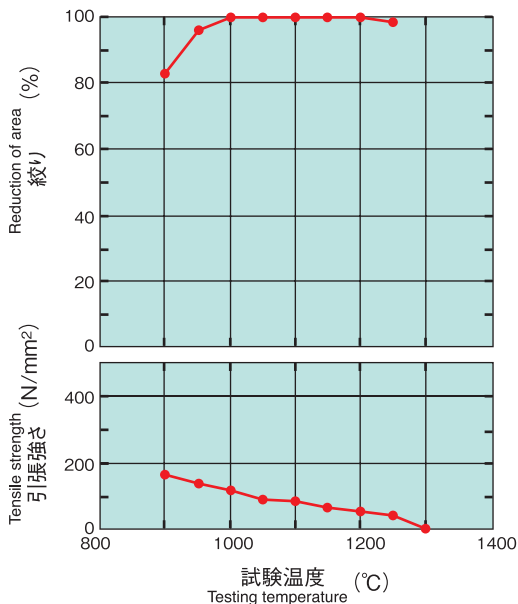
### 焼入保持時間と硬さ SUJ2 Quenching holding time and hardness of SUJ2



### 焼戻し性能曲線 SUJ2 Tempered properties of SUJ2



### 熱間加工性 SUJ2 Hot workability of SUJ2



### 熱処理条件と硬さ Heat treatment conditions and hardness

| 鋼種<br>Grade | 焼ならし(°C)<br>Normalizing | 焼なまし(°C)<br>Annealing | 焼入れ(°C)<br>Quenching                 | 焼戻し(°C)<br>Tempering | 焼入焼戻し硬さ<br>(HRC)<br>Quenched and tempered hardness |
|-------------|-------------------------|-----------------------|--------------------------------------|----------------------|--|
| SUJ2        | 840~900                 | 760~800               | 800~840 油冷<br>800~840, oil quenching | 150~180              | ≧62  |
| SUJ3        | 840~900                 | 760~800               | 790~830 油冷<br>790~830, oil quenching | 150~180              | ≧63  |
| SUJ4        | 840~900                 | 760~800               | 800~840 油冷<br>800~840, oil quenching | 150~180              | ≧63  |
| SUJ5        | 840~900                 | 760~800               | 790~830 油冷<br>790~830, oil quenching | 150~180              | ≧63  |

# 特性

## Characteristics

### 中炭素・肌焼合金鋼系軸受用鋼 Medium-carbon and casehardening bearing steel

中炭素鋼系軸受用鋼は、高い硬さが求められる部分に高周波焼入れを施され、自動車のハブユニット軸受や、直線運動軸受などに多く用いられています。

肌焼合金鋼系軸受用鋼は、浸炭を施されることによって表面に高炭素クロム軸受鋼並みの硬さと耐摩耗性を持ちながら、芯部に靱性を併せ持つことができます。圧延機用ベアリングなど大型・厚肉のベアリングにおいて、硬度(焼入れ性)と耐衝撃性の両方が求められる場合には、高Ni肌焼合金鋼に浸炭を施して使用します。

Medium-carbon bearing steel features induction hardening of those portions where high hardness is needed. This steel is often used for hub-unit bearings, linear motion bearings, etc.

Casehardening bearing steel provides a tough core as well as a hard and wear-resistant surface like high-carbon chromium steel created by carburization. For large-sized, thick-walled bearings for rolling mills that require both hardness (hardenability) and impact resistance, carburized, high-nickel casehardening alloy steel is used.

#### 化学成分 Chemical compositions

[JIS G 4051:2005、JIS G 4053:2008]

(%)

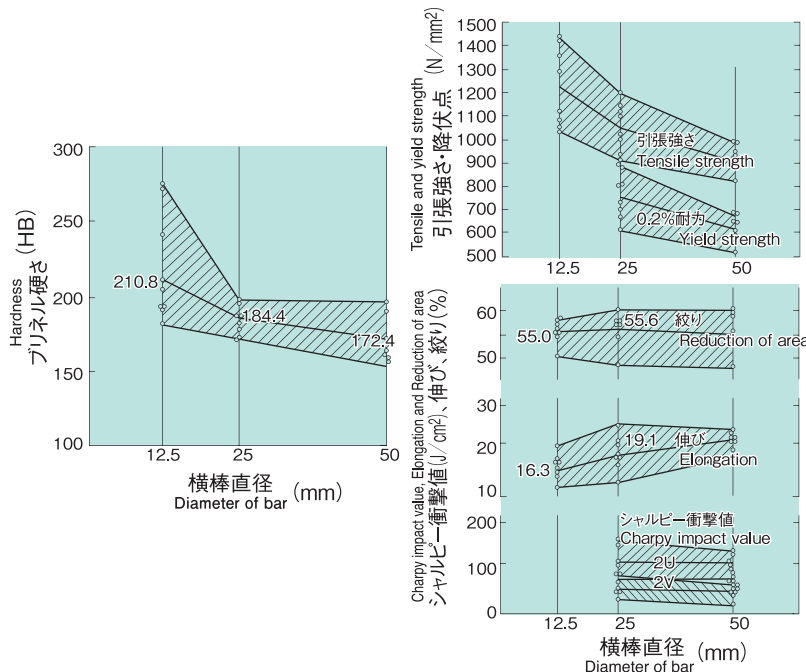
| 鋼種 Grade | C         | Si        | Mn        | P      | S      | Ni        | Cr        | Mo        | 備考  |
|----------|-----------|-----------|-----------|--------|--------|-----------|-----------|-----------|---|
| S53C     | 0.50~0.56 | 0.15~0.35 | 0.60~0.90 | ≤0.030 | ≤0.035 | —         | —         | —         | Crは0.20%を、Cuは0.30%を、Niは0.20%を、Ni+Crは0.35%を越えてはならない。<br>The contents of Cr, Cu, Ni and Ni+Cr must not exceed respectively 0.20%, 0.30%, 0.20% and 0.35%. |
| SCr420   | 0.18~0.23 | 0.15~0.35 | 0.60~0.90 | ≤0.030 | ≤0.030 | ≤0.25     | 0.90~1.20 | —         | 不純物としてCu 0.30%を越えてはならない。<br>The content of Cu as an impurity must not exceed 0.30%.   |
| SCM420   | 0.18~0.23 | 0.15~0.35 | 0.60~0.90 | ≤0.030 | ≤0.030 | ≤0.25     | 0.90~1.20 | 0.15~0.25 | 不純物としてCu 0.30%を越えてはならない。<br>The content of Cu as an impurity must not exceed 0.30%.   |
| SNCM220  | 0.17~0.23 | 0.15~0.35 | 0.60~0.90 | ≤0.030 | ≤0.030 | 0.40~0.70 | 0.40~0.60 | 0.15~0.25 | 不純物としてCu 0.30%を越えてはならない。<br>The content of Cu as an impurity must not exceed 0.30%.   |
| SNCM420  | 0.17~0.23 | 0.15~0.35 | 0.40~0.70 | ≤0.030 | ≤0.030 | 1.60~2.00 | 0.40~0.60 | 0.15~0.30 | 不純物としてCu 0.30%を越えてはならない。<br>The content of Cu as an impurity must not exceed 0.30%.   |
| SNCM815  | 0.12~0.18 | 0.15~0.35 | 0.30~0.60 | ≤0.030 | ≤0.030 | 4.00~4.50 | 0.70~1.00 | 0.15~0.30 | 不純物としてCu 0.30%を越えてはならない。<br>The content of Cu as an impurity must not exceed 0.30%.   |

#### 機械的性質 Mechanical properties

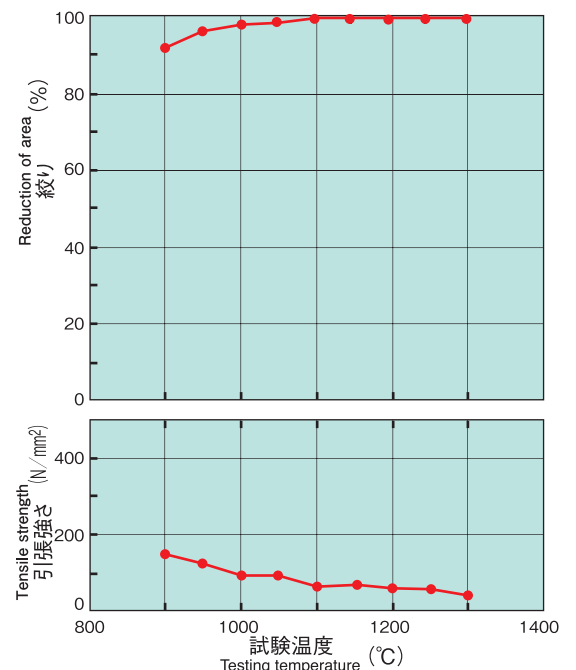
[JISハンドブック引用参考値]

| 鋼種 Grade | 熱処理 Heat treatment (°C)   |                                      | 機械的性質 Annealing                        |   |                  |                         |                              |                 |
|----------|---|--------------------------------------|--|---|------------------|-------------------------|------------------------------|-----------------|
|          | 焼入れ Quenching   | 焼戻し Tempering                        | 降伏点(N/mm <sup>2</sup> ) Yield strength | 引張強さ(N/mm <sup>2</sup> ) Tensile strength | 伸び(%) Elongation | 絞り(%) Reduction of area | シャルピー衝撃値 Charpy impact value | 硬さ(HB) Hardness |
| S53C     | 800~850 水冷<br>800~850, water cooling  | 550~650 急冷<br>550~650, rapid cooling | ≥590                                   | ≥780                                      | ≥14              | ≥35                     | ≥59                          | 229~285         |
| SCr420   | 1次850~900 油冷 / 2次800~850油冷 又は925保持後850~900油冷<br>Primary:850~900, oil quenching/Secondary:800~850, oil quenching or 925 holding, box cooling, and 850~900, oil quenching | 150~200 空冷<br>150~200, air cooling   | —                                      | ≥830                                      | ≥14              | ≥35                     | ≥49                          | 235~321         |
| SCM420   | 1次850~900 油冷 / 2次800~850油冷 又は925保持後850~900油冷<br>Primary:850~900, oil quenching/Secondary:800~850, oil quenching or 925 holding, box cooling, and 850~900, oil quenching | 150~200 空冷<br>150~200, air cooling   | —                                      | ≥930                                      | ≥14              | ≥40                     | ≥59                          | 262~352         |
| SNCM220  | 1次850~900 油冷 / 2次800~850 油冷<br>Primary:850~900, oil quenching/Secondary:800~850, oil quenching  | 150~200 空冷<br>150~200, air cooling   | —                                      | ≥830                                      | ≥17              | ≥40                     | ≥59                          | 248~341         |
| SNCM420  | 1次850~900 油冷 / 2次770~820 油冷<br>Primary:850~900, oil quenching/Secondary:770~820, oil quenching  | 150~200 空冷<br>150~200, air cooling   | —                                      | ≥980                                      | ≥15              | ≥40                     | ≥69                          | 293~375         |
| SNCM815  | 1次830~880 油冷 / 2次750~800 油冷<br>Primary:830~880, oil quenching/Secondary:750~800, oil quenching  | 150~200 空冷<br>150~200, air cooling   | —                                      | ≥1080                                     | ≥12              | ≥40                     | ≥69                          | 311~375         |

#### SCM420の中心部の機械的性質 Mechanical properties of center in SCM420



#### SCM420の熱間加工性 Hot workability





## 耐食・耐熱鋼系軸受用鋼 Stainless hardening and High temperature bearing steel

耐食(ステンレス)鋼系軸受用鋼は、耐食性に加えて耐摩耗性に優れた特性をもち、化学工業や食品工業など材料の腐食が進行しやすい環境はじめ、潤滑油を使用することができない強酸化性雰囲気や医療機器などで使用されるベアリングに用いられます。  
耐熱鋼系軸受用鋼は、長時間高温にさらされても硬さの低下が少なく、寸法安定性も良好で、転動疲労寿命にも優れた特性をもつことから、高温環境で使用される耐熱ベアリングに用いられます。

Stainless hardening bearing steel features superior wear resistance in addition to corrosion resistance, and is used for bearings in the chemical and food industries where materials are likely to corrode. It is also ideal for use in strong-oxidizing atmospheres and for medical equipment where lubricants cannot be used.

High temperature bearing steel, with enduring hardness, stable dimensions, and a longer rolling fatigue life, even when exposed to a high temperature environment over long periods, is used for heat-resistant bearings that are exposed to high temperatures.

### 化学成分 Chemical compositions

**[JIS G 4303:2005]**

(%)

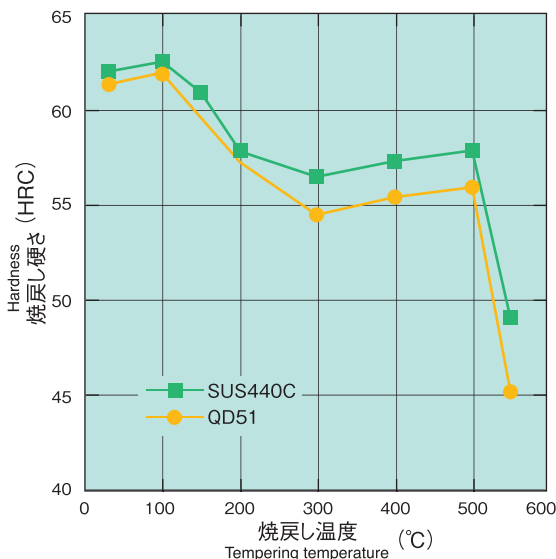
| 鋼種 Grade               | C         | Si    | Mn        | P      | S      | Ni    | Cr          | Mo    | 備考   |
|------------------------|-----------|-------|-----------|--------|--------|-------|-------------|-------|--|
| JIS SUS420J2           | 0.26~0.40 | ≤1.00 | ≤1.00     | ≤0.040 | ≤0.030 | *     | 12.00~14.00 | —     | Nilは、0.60%以下を含有してよい。<br>Ni content may be up to 0.60%.   |
| JIS SUS440C            | 0.95~1.20 | ≤1.00 | ≤1.00     | ≤0.040 | ≤0.030 | *     | 16.00~18.00 | *     | Nilは、0.60%以下を含有してよい。Moは、0.75%以下を含有してよい。<br>Ni content may be up to 0.60%. Mo content may be up to 0.75%. |
| 山陽記号 Sanyo Symbol QD51 | 0.65~0.75 | ≤0.35 | 0.45~0.75 | ≤0.030 | ≤0.030 | ≤0.60 | 12.00~14.00 | ≤0.75 |  |

### 機械的性質 Mechanical properties

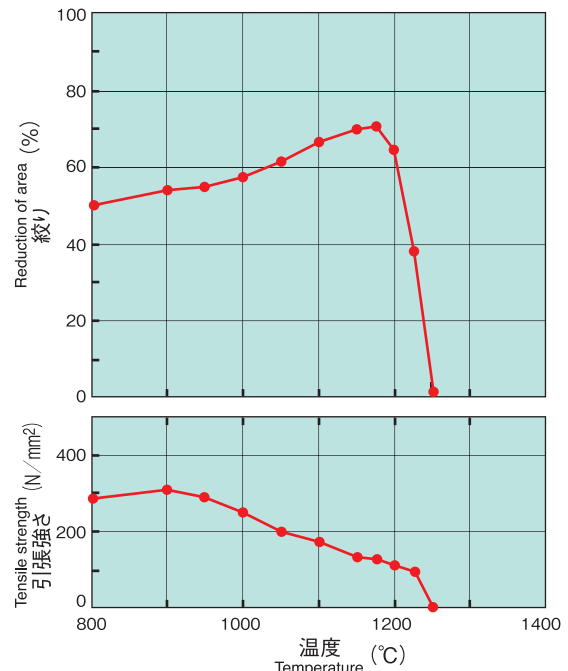
**[JIS G 4303:2005]**

| 鋼種 Grade               | 【参考】熱処理 Heat treatment (°C)                                    |                                      | 機械的性質 Mechanical properties            |   |                  |                         |                              |                       |
|------------------------|--|--------------------------------------|--|---|------------------|-------------------------|------------------------------|-----------------------|
|                        | 焼入れ Quenching  | 焼戻し Tempering                        | 降伏点(N/mm <sup>2</sup> ) Yield strength | 引張強さ(N/mm <sup>2</sup> ) Tensile strength | 伸び(%) Elongation | 絞り(%) Reduction of area | シャルピー衝撃値 Charpy impact value | 硬さ(HBW)(HRC) Hardness |
| JIS SUS420J2           | 920~980 油冷<br>920~980, oil quenching                           | 600~750 急冷<br>600~750, rapid cooling | ≥540                                   | ≥740                                      | ≥12              | ≥40                     | ≥29                          | ≥217(HBW)             |
| JIS SUS440C            | 1,010~1,070 油冷<br>1,010~1,070, oil quenching                   | 100~180 空冷<br>100~180, air cooling   | —                                      | —   | —                | —                       | —                            | ≥58(HRC)              |
| 山陽記号 Sanyo Symbol QD51 | 1,020~1,050 空冷、油冷<br>1,020~1,050, air cooling or oil quenching | 160~200 空冷<br>160~200, air cooling   | —                                      | —   | —                | —                       | —                            | 55~60(HRC)            |

### 焼入焼戻し硬さ(SUS440C、QD51) Quenched and tempered hardness



### SUS440Cの熱間加工性 Hot workability



# 外国規格

## Overseas Standards

### JIS対比表 Table of comparison with JIS

高炭素クロム軸受鋼鋼材  
High-carbon chromium bearing steels

| JIS  | AISI / SAE | ASTM        | ISO / EN     | GOST    | 材料No.<br>Material No. |
|------|------------|-------------|--------------|---------|-----------------------|
| SUJ2 | E52100     | A295 52100  | 100Cr6       | SchCh15 | 1.3505                |
| SUJ3 | —          | A485Grade I | 100CrMnSi4-4 | —       | 1.3518                |
| SUJ4 | —          | —           | —            | —       | —                     |
| SUJ5 | —          | —           | —            | —       | —                     |

### 化学成分 Chemical compositions

#### [AISI/SAE]

(%)

| 規格No.<br>Standard No. | 種類記号<br>Grade symbol | 材料No.<br>Material No. | C         | Si        | Mn        | P      | S      | Ni    | Cr        | Mo    | Cu    | Ni+Cu |
|-----------------------|----------------------|-----------------------|-----------|-----------|-----------|--------|--------|-------|-----------|-------|-------|-------|
| J404/2000             | E52100               | 1.3505                | 0.98~1.10 | 0.15~0.35 | 0.25~0.45 | ≤0.025 | ≤0.025 | ≤0.25 | 1.30~1.60 | ≤0.06 | ≤0.35 | —     |

#### [ASTM]

(%)

| 規格No.<br>Standard No. | 種類記号<br>Grade symbol | 材料No.<br>Material No. | C         | Si        | Mn        | P      | S      | Ni    | Cr        | Mo        | Cu    | Ni+Cu |
|-----------------------|----------------------|-----------------------|-----------|-----------|-----------|--------|--------|-------|-----------|-----------|-------|-------|
| A295/2005             | 52100                | 1.3505                | 0.93~1.05 | 0.15~0.35 | 0.25~0.45 | ≤0.025 | ≤0.015 | ≤0.25 | 1.35~1.60 | ≤0.10     | ≤0.30 | —     |
| A485/2003             | Grade1               | —                     | 0.90~1.05 | 0.45~0.75 | 0.90~1.20 | ≤0.025 | ≤0.015 | ≤0.25 | 0.90~1.20 | ≤0.10     | ≤0.30 | —     |
|                       | Grade2               | —                     | 0.85~1.00 | 0.50~0.80 | 1.40~1.70 | ≤0.025 | ≤0.015 | ≤0.25 | 1.40~1.80 | ≤0.10     | ≤0.30 | —     |
|                       | Grade3               | —                     | 0.95~1.10 | 0.15~0.35 | 0.65~0.90 | ≤0.025 | ≤0.015 | ≤0.25 | 1.10~1.50 | 0.20~0.30 | ≤0.30 | —     |
|                       | Grade4               | —                     | 0.95~1.10 | 0.15~0.35 | 1.05~1.35 | ≤0.025 | ≤0.015 | ≤0.25 | 1.10~1.50 | 0.45~0.60 | ≤0.30 | —     |

#### [ISO]

(%)

| 規格No.<br>Standard No. | 種類記号<br>Grade symbol | 材料No.<br>Material No. | C         | Si        | Mn        | P      | S      | Ni | Cr        | Mo        | Cu    | Ni+Cu |
|-----------------------|----------------------|-----------------------|-----------|-----------|-----------|--------|--------|----|-----------|-----------|-------|-------|
| 683-17<br>/1999       | 100Cr6               | 1.3505                | 0.93~1.05 | 0.15~0.35 | 0.25~0.45 | ≤0.025 | ≤0.015 | —  | 1.35~1.60 | ≤0.10     | ≤0.30 | —     |
|                       | 100CrMnSi4-4         | 1.3518                | 0.93~1.05 | 0.45~0.75 | 0.90~1.20 | ≤0.025 | ≤0.015 | —  | 0.90~1.20 | ≤0.10     | ≤0.30 | —     |
|                       | 100CrMnSi6-4         | 1.3520                | 0.93~1.05 | 0.45~0.75 | 1.00~1.20 | ≤0.025 | ≤0.015 | —  | 1.40~1.65 | ≤0.10     | ≤0.30 | —     |
|                       | 100CrMnSi6-6         | 1.3519                | 0.93~1.05 | 0.45~0.75 | 1.40~1.70 | ≤0.025 | ≤0.015 | —  | 1.40~1.65 | ≤0.10     | ≤0.30 | —     |
|                       | 100CrMo7             | 1.3537                | 0.93~1.05 | 0.15~0.35 | 0.25~0.45 | ≤0.025 | ≤0.015 | —  | 1.65~1.95 | 0.15~0.30 | ≤0.30 | —     |
|                       | 100CrMo7-3           | 1.3536                | 0.93~1.05 | 0.15~0.35 | 0.60~0.80 | ≤0.025 | ≤0.015 | —  | 1.65~1.95 | 0.20~0.35 | ≤0.30 | —     |
|                       | 100CrMnMoSi8-46      | 1.3539                | 0.93~1.05 | 0.40~0.60 | 0.80~1.10 | ≤0.025 | ≤0.015 | —  | 1.80~2.05 | 0.50~0.60 | ≤0.30 | —     |
|                       | 100CrMo7-4           | 1.3538                | 0.93~1.05 | 0.15~0.35 | 0.60~0.80 | ≤0.025 | ≤0.015 | —  | 1.65~1.95 | 0.40~0.50 | ≤0.30 | —     |

#### [GOST]

(%)

| 規格No.<br>Standard No. | 種類記号<br>Grade symbol | 材料No.<br>Material No. | C         | Si        | Mn        | P      | S      | Ni    | Cr        | Mo | Cu    | Ni+Cu |
|-----------------------|----------------------|-----------------------|-----------|-----------|-----------|--------|--------|-------|-----------|----|-------|-------|
| 801-78<br>/1978       | SchCh4               | 1.3501                | 0.95~1.05 | 0.15~0.30 | 0.15~0.30 | ≤0.027 | ≤0.020 | ≤0.30 | 0.35~0.50 | —  | ≤0.25 | ≤0.50 |
|                       | SchCh15              | 1.3505                | 0.95~1.05 | 0.17~0.37 | 0.20~0.40 | ≤0.027 | ≤0.020 | ≤0.30 | 1.30~1.65 | —  | ≤0.25 | ≤0.50 |
|                       | SchCh15SG            | 1.3520                | 0.95~1.05 | 0.40~0.65 | 0.90~1.20 | ≤0.027 | ≤0.020 | ≤0.30 | 1.30~1.65 | —  | ≤0.25 | ≤0.50 |
|                       | SchCh20SG            | —                     | 0.90~1.00 | 0.55~0.85 | 1.40~1.70 | ≤0.027 | ≤0.020 | ≤0.30 | 1.40~1.70 | —  | ≤0.25 | ≤0.50 |

# 製造範囲

## Production Range

### 圧延棒鋼 Hot rolled bar

| 直径 Diameter | 長さ Length |
|-------------|-----------|
| 14~210mm    | 3~7m      |

### 鍛造棒鋼 Forged bar

| 直径 Diameter | 長さ Length |
|-------------|-----------|
| 120~880mm   | 2~9m      |

### 冷間仕上棒鋼 Cold finished bar

|                            | 仕上直径(mm) Finished diameter (mm) | 長さ(m) Length (m) | 備考 Remarks                              |
|----------------------------|---------------------------------|------------------|---|
| ターニング品 Turned              | 70~850                          | 1.0~9.0          | 単重 $\leq$ 13t Bar weight $\leq$ 13t     |
| ピーリング品 Peeled product      | 10~205                          | 3.0~7.0          |   |
| 引抜品 Cold drawm             | 6~65                            | 3.0~6.0          |   |
| センタレス研磨品 Centerless ground | 6~75                            | 2.0~6.0          | 長さ:一部3.5m Length of some products: 3.5m |

### 線材 Wire rod

| 直径 Diameter     | 単重 Coil weight   |
|-----------------|------------------|
| $\phi$ 5.5~40mm | 2tまたは1t 2t or 1t |

### (線材仕様・荷姿) Specifications of wire rod and its packing

|                       |                       |                     |  |
|-----------------------|-----------------------|---------------------|--|
| 重量 weight             | 1000, 2000kg          |                     | <p>ラベル2枚(内・外) Two labels (inner and outer)</p> |
| 内径 Inner diameter     | $\geq$ 1000mm         |                     |  |
| 外径 Outer diameter     | $\geq$ 1400mm         |                     |  |
| 高さ Height             | $\leq$ 900mm          | 単重1t Coil weight 1t |  |
|                       | $\leq$ 1800mm         | 単重2t Coil weight 2t |  |
| 巻方向 Coiling direction | 左巻き Counter clockwise |                     |  |

梱包その他ご指定に応じます。  
Packaging and others may be subject to requirements.

### 切断リング素形材 Cut ring

| 製造工程 Production process | 外径 Outer diameter                      | 肉厚 Wall thickness | 幅 Width |           |
|-------------------------|--|-------------------|---------|-----------|
| 継目無鋼管<br>Seamless tube  | 切断 Cut                                 | 60~170            | 5~30    | $\geq$ 25 |
|                         | 切断 Cut → 外径サイジング Outer diameter sizing | 60~170            | 5~30    | $\geq$ 25 |
|                         | 切断 Cut → 冷間ロールフォーミング Cold roll forming | 75~250            | 5~25    | 20~100    |

### 鍛造リング素形材 Forged ring

|                           | 外径 Outer diameter | 内径 Inner diameter | 幅 Width |
|---------------------------|-------------------|-------------------|---------|
| 鍛造リング品 Forged ring        | 30~80             | $\geq$ 10         | 10~45   |
| 冷間ローリング品 Cold roll formed | 40~120            | $\geq$ 15         | 10~45   |

表以外の寸法についてはご相談ください。

For products with dimensions not listed in these tables, please contact us.



# 製造範囲

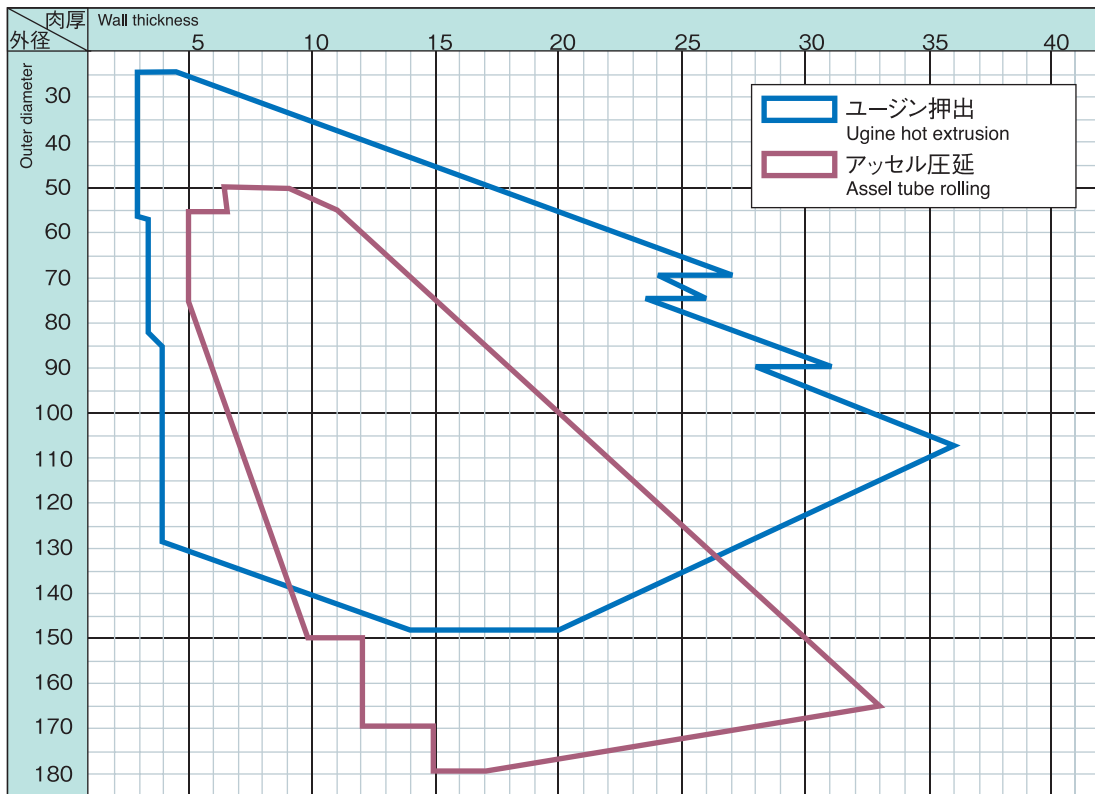
## Production Range

### 継目無鋼管 Seamless tube

(軸受鋼) Bearing steels

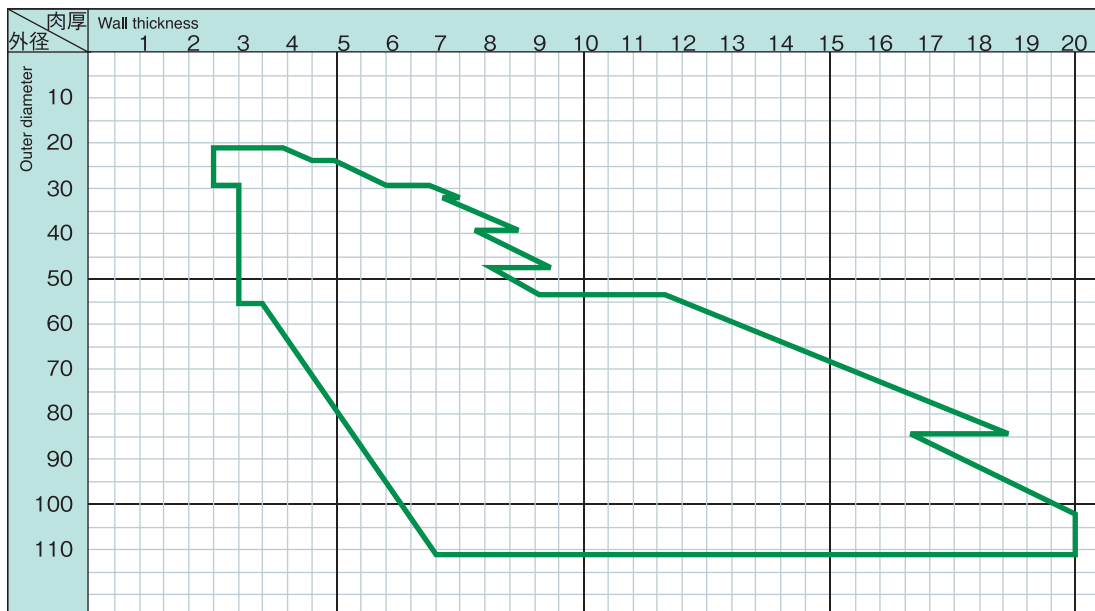
#### 1. 熱間仕上鋼管 Hot finished Tube

(mm)



#### 2. 冷間仕上鋼管 Cold finished Tube

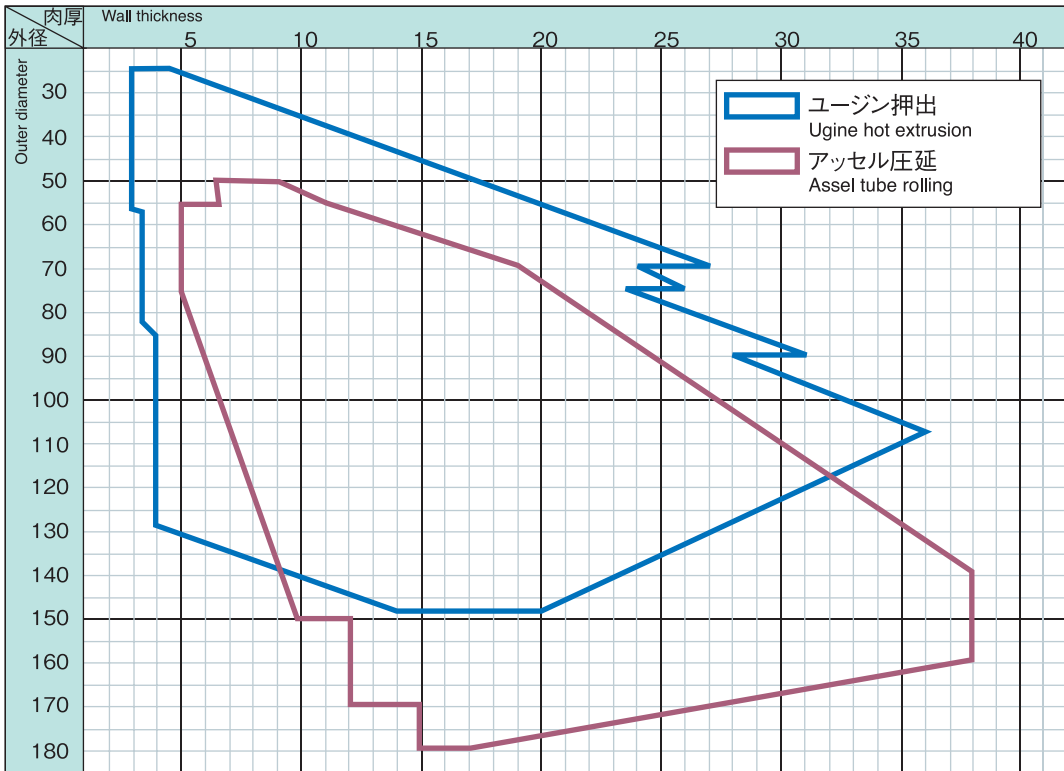
(mm)



(合金鋼) Alloy steels

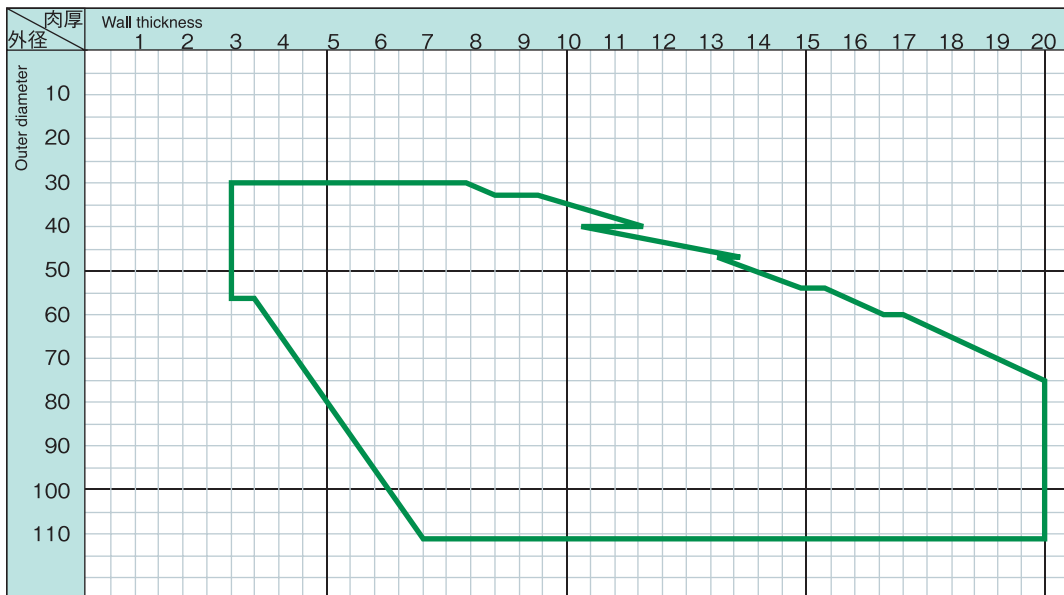
1. 熱間仕上鋼管  
Hot finished Tube

(mm)



2. 冷間仕上鋼管  
Cold finished Tube

(mm)



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