Since 1901, NIPPON STEEL has been manufacturing rails of every description for more than 110 years, using cutting edge equipment and accumulated technology. NIPPON STEEL rails are highly rated at home and abroad. Not only that they meet most of the domestic demand, but also exported in large quantities to many countries around the globe.

NIPPON STEEL rails are available in various sizes and materials, so that they can be used for diverse applications, such as ordinary passenger railways, high speed railways, and heavy haul railways.

In addition to standard rails, NIPPON STEEL manufactures various rails such as Head hardened rail, rail for Heavy haul, Tongue rail, and crane rails.

As one of the world’s leading rail maker with superior quality, NIPPON STEEL are greatly contributing to Economical and Green railway transportations all over the world.
Features

1. Production by the Universal Rolling Process, with newest technology
   - Rail head with superior forging effect.
   - Highly symmetrical cross sections.
   - Smooth surface without defect

2. World top class technology and facility for producing uniform rails; Steel making, Rolling, Straightening
   - Highly uniform steel by continuous casting method.
   - Superior quality with high purity.
   - Uniform dimensions and shape for all length of the rail

3. Inspection by in-line automatic testing machines
   - Non-destructive testing by Ultra-Sonic Testers
   - Surface defect testing by Eddy Current testers
   - Automatic dimension measurement by Laser

4. Research and Development organized advancing toward easy to use, superior quality rails.
   - Integrated Research and Development organization, with basic theory to product characteristics, welding technology and evaluation of rail performance

5. Setting Up the system to manufacture and ship the world longest as rolled rails for railroads – 150-meter (480ft) long rails –
   - Worlds longest Ex-mill, not welded, long rails for railways
   - Reducing rail maintenance of railway companies by reducing the number of weld
   - Serve to help stabilize the rail
Manufacturing Process

1. Blast furnace → Pig iron → Charging molten iron → Oxygen-blowing → Basic-oxygen furnace → Secondary refining → Continuous casting → Bloom

2. Reheating Furnace → Bloom → Continuous casting → V1 Mill → V2 Mill → E1 Mill → E2 Mill → F Mill → V3 Mill

3. Hot saw → Hot Stamper → Cooling


5. Sawing & Drilling line → 50M 150M rail shipment → Chamfering

6. Final Inspection Assortment
NIPPON STEEL has varieties of standard rails.
NIPPON STEEL rails are produced to the specifications listed in the table below.

### Chemical Composition and Mechanical Properties

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Chemical Composition</th>
<th>Mechanical Properties</th>
<th>Falling Weight Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td><strong>150m rail</strong></td>
<td>0.74−0.86</td>
<td>0.10−0.60</td>
<td>0.75−1.25</td>
</tr>
<tr>
<td><strong>N.U.S. 35H</strong></td>
<td>0.72−0.82</td>
<td>0.10−1.00</td>
<td>0.70−1.25</td>
</tr>
<tr>
<td><strong>N.U.S. 40H</strong></td>
<td>0.74−0.86</td>
<td>0.10−1.00</td>
<td>0.75−1.25</td>
</tr>
<tr>
<td><strong>N.U.S. 50H</strong></td>
<td>0.62−0.80</td>
<td>0.15−0.58</td>
<td>0.70−1.20</td>
</tr>
<tr>
<td><strong>N.U.S. 50H</strong></td>
<td>0.72−0.80</td>
<td>0.15−0.58</td>
<td>0.70−1.20</td>
</tr>
<tr>
<td><strong>N.U.S. 34H</strong></td>
<td>0.60−0.80</td>
<td>0.10−0.50</td>
<td>0.80−1.30</td>
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<tr>
<td><strong>N.U.S. 37H</strong></td>
<td>0.80−0.90</td>
<td>0.10−0.50</td>
<td>0.80−1.30</td>
</tr>
<tr>
<td><strong>N.U.S. 40H</strong></td>
<td>0.60−0.80</td>
<td>0.10−0.50</td>
<td>0.80−1.30</td>
</tr>
<tr>
<td><strong>N.U.S. 40H</strong></td>
<td>0.60−0.80</td>
<td>0.15−0.58</td>
<td>0.70−1.20</td>
</tr>
<tr>
<td><strong>N.U.S. 50H</strong></td>
<td>0.72−0.80</td>
<td>0.10−0.50</td>
<td>0.80−1.30</td>
</tr>
<tr>
<td><strong>N.U.S. 50H</strong></td>
<td>0.72−0.80</td>
<td>0.15−0.58</td>
<td>0.70−1.20</td>
</tr>
</tbody>
</table>

### Dimensions and Weights

The dimensions and weights of rails being manufactured at NIPPON STEEL are tabulated below. Manufacture of sections other than those tabulated below will be considered depending on your quantities ordered. The standard length for rails is 25m under JIS, but longer or shorter length can be delivered if required. 150m rail is also available.

### Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>EN</th>
<th>UIC</th>
<th>ARS</th>
<th>AS</th>
<th>TH</th>
<th>JIS</th>
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<tbody>
<tr>
<td></td>
<td>54kg</td>
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<td>65kg</td>
<td>65kg</td>
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<tr>
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<td>16.00</td>
<td>16.00</td>
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<td>14.00</td>
<td>14.00</td>
<td>14.00</td>
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<td>14.00</td>
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<td>G</td>
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<td>12.00</td>
<td>12.00</td>
<td>12.00</td>
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<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
<td>8.00</td>
</tr>
<tr>
<td>W</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Yb</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>lx</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ly</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Xz</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Base</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Head</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

### Notes

- Neutral Axis
- GL=50mm
- GL=50.8mm
- 1 Height of falling for falling weight testing is as per JIS E1101-2001

* denotes values not stipulated in specifications but calculated by NIPPON STEEL
Recently, railroad companies desire to improve their rail life. Therefore, rails of various hardness and much deeper hardened layer are required depending on the conditions under which the tracks will be used.

NIPPON STEEL has developed DHH (Deep Head Hardened) rails in order to satisfy these demands.

**Features of DHH rails**

1) **Good wear resistance**
   DHH rails enjoy long rail life coming from higher hardness produced by In-Line heat treatment process. This leads to high economical performance by reducing maintenance cost and purchasing cost.

2) **Deep and Uniformly hardened layer in rail head**
   DHH rails show a fine pearlitic structure over the whole rail head. Consequently, DHH rails retain high hardness and strength deep into the rail head.

3) **High weldability**
   DHH rails permit flash-butt welding under the same condition as plain carbon rails. Also, the softened area of HAZ (Heat affected zone) is very narrow.

**Kinds of DHH rails**

We produce following grades of DHH rails:

- JIS E 1120: DHH340 DHH370
- EN 13674: R350HT
- IRST12: GR1080
**Specifications**

JIS E 1120 (for reference)

1. **Chemical Composition(%)**

<table>
<thead>
<tr>
<th>Type</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>Cr</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHH340</td>
<td>0.72—0.82</td>
<td>0.10—0.55</td>
<td>0.70—1.10</td>
<td>0.030 and under</td>
<td>0.20 and under</td>
<td>0.20 and under</td>
<td>0.03 and under*</td>
</tr>
<tr>
<td>DHH370</td>
<td>0.72—0.82</td>
<td>0.10—0.65</td>
<td>0.80—1.20</td>
<td>0.030 and under</td>
<td>0.20 and under</td>
<td>0.25 and under</td>
<td>0.03 and under*</td>
</tr>
</tbody>
</table>

2. **Mechanical Properties**

<table>
<thead>
<tr>
<th>Type</th>
<th>Tensile Strength N/mm² (kgf/mm²)</th>
<th>Elongation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHH340</td>
<td>1,080 (110) and over</td>
<td>8 and over</td>
</tr>
<tr>
<td>DHH370</td>
<td>1,130 (115) and over</td>
<td>8 and over</td>
</tr>
</tbody>
</table>

3. **Hardness**

<table>
<thead>
<tr>
<th>Type</th>
<th>Surface hardness at head (HBW)</th>
<th>Vickers hardness (HV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHH340</td>
<td>321—375</td>
<td>A point: gauge corner</td>
</tr>
<tr>
<td>DHH370</td>
<td>331—388</td>
<td>B point: center of the head</td>
</tr>
</tbody>
</table>

4. **Quality**

1. **Chemical Composition(%) and Electric Resistance (for reference)**

<table>
<thead>
<tr>
<th>Type</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>Cr</th>
<th>electrical resistivity (μΩ•cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHH340</td>
<td>0.78</td>
<td>0.24</td>
<td>0.87</td>
<td>0.012</td>
<td>0.011</td>
<td>0.13</td>
<td>22.80</td>
</tr>
<tr>
<td>DHH370</td>
<td>0.77</td>
<td>0.23</td>
<td>0.88</td>
<td>0.013</td>
<td>0.008</td>
<td>0.20</td>
<td>23.44</td>
</tr>
</tbody>
</table>

2. **Tensile properties (for reference)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Tensile Strength N/mm² (kgf/mm²)</th>
<th>Elongation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHH340</td>
<td>1,164 (118.7)</td>
<td>14</td>
</tr>
<tr>
<td>DHH370</td>
<td>1,291 (131.7)</td>
<td>13</td>
</tr>
</tbody>
</table>

3. **Brinell Hardness in rail section (for reference)**

Compared with conventional heat treated rails. The DHH rail has more uniform hardness over the entire rail head section.

![Brinell Hardness in rail section](image_url)

- Vickers (HV)
- Brinell (HB)

<table>
<thead>
<tr>
<th>Hardness level</th>
<th>Vickers (HV)</th>
<th>Brinell (HB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>415 up</td>
<td>(395 up)</td>
<td></td>
</tr>
<tr>
<td>400 up</td>
<td>(385 up)</td>
<td></td>
</tr>
<tr>
<td>385 up</td>
<td>(365 up)</td>
<td></td>
</tr>
<tr>
<td>370 up</td>
<td>(350 up)</td>
<td></td>
</tr>
<tr>
<td>355 up</td>
<td>(325 up)</td>
<td></td>
</tr>
<tr>
<td>340 up</td>
<td>(320 up)</td>
<td></td>
</tr>
<tr>
<td>325 up</td>
<td>(305 up)</td>
<td></td>
</tr>
<tr>
<td>310 up</td>
<td>(290 up)</td>
<td></td>
</tr>
<tr>
<td>300 up</td>
<td>(280 up)</td>
<td></td>
</tr>
<tr>
<td>290 up</td>
<td>(275 up)</td>
<td></td>
</tr>
<tr>
<td>280 up</td>
<td>(260 up)</td>
<td></td>
</tr>
<tr>
<td>270 up</td>
<td>(250 up)</td>
<td></td>
</tr>
<tr>
<td>260 up</td>
<td>(245 up)</td>
<td></td>
</tr>
<tr>
<td>250 up</td>
<td>(230 up)</td>
<td></td>
</tr>
</tbody>
</table>

* Vanadium are added if needed (JIS No4 testpiece)
Macro and Micro structure of DHH rail (for reference)

Macro structure of DHH rail

DHH rail

Point A

Point B

conventional HH rail

Micro structure (+x,000)

Macro structure of vertical cross section

DHH370 rail

Micro structure of vertical cross section

DHH340 rail

Residual Stress
The DHH rail shows stable residual stress distribution over the entire cross-section.

Residual Stress

DHH

NHH

Hardness distribution of top rail head and vertical cross section

Hardness distribution of top rail head and vertical cross section
( ii ) Thermite Welding
Thermite welding is also available for DHH340 & DHH370.

**DHH370 rail**
Macro structure of welded joint (JIS 50N rail)

**DHH340 rail**
Macro structure of welded joint (JIS 50N rail)

**Hardness distribution of welded joint (DHH370/TW)**

**Hardness distribution of welded joint (DHH340/TW)**

**Rail for Heavy Haul (HE Rail™)**
Recently, operating environment of track material, especially rail, are getting harsher and harsher, due to the increasing axle load. Under this circumstance, production for the higher wear resistance and higher economical performance rail are demanded. Therefore, in order to respond to such demand, We NIPPON STEEL have developed HE rail™ which has higher wear resistance and higher anti-surface defect performance than conventional HH rails.

### Comparison of DHH rail and HE rail™

- **Rail for Heavy haul**
  - DHH rail: 0.8% carbon
  - HE rail: 0.9% and higher carbon

### Relation between hardness, wear and carbon content (Reference)

- **DHH (0.8%C)**
- **HE (0.9%C)**
- **HE (1.0%C)**
- Contact pressure: 640MPa
- Slip factor: 20%

### Quality

Characteristic of DHH rail and HE rail are shown below:

#### Chemical composition (Reference)

<table>
<thead>
<tr>
<th>Rails</th>
<th>Type</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHH-370</td>
<td>eutectoid</td>
<td>0.8</td>
<td>0.3</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>DHH-370S</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.5</td>
</tr>
<tr>
<td>HE-400</td>
<td>Hyper</td>
<td>0.9</td>
<td>0.3</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>HE-400</td>
<td>Hyper</td>
<td>0.9</td>
<td>0.3</td>
<td>0.9</td>
<td>0.2</td>
</tr>
<tr>
<td>HE-X</td>
<td>Hyper</td>
<td>1.0</td>
<td>0.5</td>
<td>0.7</td>
<td>0.2</td>
</tr>
</tbody>
</table>

#### Tensile test result (Reference)

<table>
<thead>
<tr>
<th>Rails</th>
<th>Type</th>
<th>Yield Strength (MPa)</th>
<th>Tensile Strength (MPa)</th>
<th>Elongation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHH</td>
<td>eutectoid</td>
<td>830</td>
<td>1290</td>
<td>14</td>
</tr>
<tr>
<td>HE-370</td>
<td>Hyper</td>
<td>865</td>
<td>1353</td>
<td>12</td>
</tr>
<tr>
<td>HE-400</td>
<td>Hyper</td>
<td>910</td>
<td>1385</td>
<td>12</td>
</tr>
<tr>
<td>HE-X</td>
<td>Hyper</td>
<td>951</td>
<td>1438</td>
<td>11</td>
</tr>
</tbody>
</table>

### Rail life comparison test in the actual track (Reference)

- **DHH-370 (0.8%C)**
- **HE-370 (0.9%C)**
- **HE-400 (0.9%C)**

- Rail Life improvement: 38%

### Welding test result (Reference)

- (i) Full-butt welding
  - **HE370 rail**
Special Rails
(Tongue Rails/Crane Rails)

**Tongue Rails**

**Specification**

<table>
<thead>
<tr>
<th>Type</th>
<th>Standard</th>
<th>Chemical composition (%)</th>
<th>Mechanical Properties</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>80S</td>
<td>JS E 1101</td>
<td>C 0.63, Si 0.15, Mn 0.70</td>
<td>Tensile Strength (N/mm²)</td>
<td>800 and over</td>
</tr>
<tr>
<td>70S</td>
<td>JS E 1101</td>
<td>P 0.030, S 0.025</td>
<td>Elongation (%)</td>
<td>10 and over</td>
</tr>
<tr>
<td>50S</td>
<td>JS E 1101</td>
<td>Cr 0.70, Ni 1.10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Characteristic and Usage**

- **Characteristic**: Most suitable for machining into various tongue rails
- **Typical standard**: JIS
- **Usage**: Points and crossings

**Dimensions and Weights**

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions (mm)</th>
<th>Sectional Area (cm²)</th>
<th>Weight (kg/m)</th>
<th>Center of Gravity (cm)</th>
<th>Moment of Inertia (cm⁴)</th>
<th>Radius of Gyration (cm)</th>
<th>Section Modulus Z (cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80S</td>
<td>159.0</td>
<td>145.0</td>
<td>65.6</td>
<td>98.9</td>
<td>2.704</td>
<td>101.8</td>
<td>203.0</td>
</tr>
<tr>
<td>70S</td>
<td>148.0</td>
<td>140.0</td>
<td>63.0</td>
<td>98.9</td>
<td>2.120</td>
<td>101.8</td>
<td>254.0</td>
</tr>
<tr>
<td>50S</td>
<td>135.0</td>
<td>127.0</td>
<td>64.0</td>
<td>98.9</td>
<td>1.430</td>
<td>101.8</td>
<td>247.0</td>
</tr>
</tbody>
</table>

For Center of Gravity, c is distance from bottom, ε is distance from the top of the head
( ) denotes values not stipulated in specifications but calculated by NIPPON STEEL
*1) under 14.3mm from the top of rail head surface
**Chemical composition (%)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Standard</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>Cu Tensile Strength (N/mm²)</th>
<th>Elongation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR100K</td>
<td>NIPPON STEEL Standard</td>
<td>0.60</td>
<td>0.10</td>
<td>0.70</td>
<td>0.035 and under</td>
<td>0.040 and under</td>
<td>780 and over</td>
<td>8 and over</td>
</tr>
<tr>
<td>CR73K</td>
<td>NIPPON STEEL Standard</td>
<td>0.70</td>
<td>0.30</td>
<td>1.10</td>
<td>0.035 and under</td>
<td>0.040 and under</td>
<td>800 and over</td>
<td>8 and over</td>
</tr>
</tbody>
</table>

All tensile test uses JIS No4 test piece.

**Characteristics and Usage**

- Can bear a huge load weight with its stable shape.

**Usage**

- NIPPON STEEL Standard
- Cranes

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**Dimensions and Weights**

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions (mm)</th>
<th>Sectional Area (cm²)</th>
<th>Weight (kg/m)</th>
<th>Center of Gravity (cm)</th>
<th>Moment of Inertia (cm)</th>
<th>Radius of Gyration (cm)</th>
<th>Section Modulus Z (cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR100K</td>
<td>A:150.0, B:155.0</td>
<td>120.0, C:53.0, D:65.5, F:39.0</td>
<td>177.68</td>
<td>102.2</td>
<td>7.57</td>
<td>2.170</td>
<td>6.19</td>
</tr>
<tr>
<td>CR73K</td>
<td>A:135.0, B:140.0</td>
<td>120.0, C:43.0, D:65.5, F:32.0</td>
<td>183.78</td>
<td>113.3</td>
<td>7.43</td>
<td>2.200</td>
<td>6.81</td>
</tr>
</tbody>
</table>

For Center of Gravity, c is distance from bottom, e is distance from the top of the head

( ) denotes values not specified in specifications but calculated by NIPPON STEEL.

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**Section**

- **CR 100K**
- **CR 73K**
Marking (JIS E 1101) JIS Standard are shown for reference, please consult us anytime for original marking.

**Standard Rail**
- Arrow mark to indicate direction of top of ingot or billet
- Mark to indicate rail type
- Mark to indicate steel furnace type
- Trade Mark
- Year of manufacture
- Month of manufacture or its abbreviation
- Serial number of rail
- Number of strand
- Mark to indicate order of pouring melt into mould
- Heat number
- Work gang identification
- Carbon content
- Manganese content

**60**
- Branding: 60 LD T2345 A 3020 5
- Stamping: 12 B T2345 A 70 90

**50N, 40N 37A**
- Branding: 50N LD T2345 A 3020 5
- Stamping: 12 B T2345 A 70

**HH Rail**
- Arrow mark to indicate direction of top of ingot or billet
- Mark to indicate rail type
- Mark to indicate steel furnace type
- Trade Mark
- Year of manufacture
- Month of manufacture or its abbreviation
- Serial number of rail
- Number of strand
- Mark to indicate order of pouring melt into mould
- Heat number
- Work gang identification
- Carbon content
- Manganese content

**60**
- HH340, HH370
- Branding: 60 LD T2345 A 3020 5
- Stamping: 12 B T2345 A 75 105 HH37

**50N**
- HH340, HH370
- Branding: 50N LD T2345 A 3020 5
- Stamping: 12 B T2345 A 78 HH34

**Tongue Rails**
- Arrow mark to indicate direction of top of ingot or billet
- Mark to indicate rail type
- Mark to indicate steel furnace type
- Trade Mark
- Year of manufacture
- Month of manufacture or its abbreviation
- Serial number of rail
- Number of strand
- Mark to indicate order of pouring melt into mould
- Heat number
- Work gang identification
- Carbon content
- Manganese content

**80S**
- Branding: 80S LD T2345 A 2020 5
- Stamping: 12 B T2345 A 68 90

**70S**
- Branding: 70S LD T2345 A 2020 5
- Stamping: 12 B T2345 A 68 90

**50S**
- Branding: 50S LD T2345 A 2020 5
- Stamping: 12 B T2345 A 68

**Crane Rails**
- Arrow mark to indicate direction of top of ingot or billet
- Mark to indicate rail type
- Mark to indicate steel furnace type
- Trade Mark
- Year of manufacture
- Month of manufacture or its abbreviation
- Serial number of rail
- Number of strand
- Mark to indicate order of pouring melt into mould
- Heat number
- Work gang identification
- Carbon content
- Manganese content

**CR 100K**
- Branding: CR 100K T12345
- Stamping: T12345

**CR 73K**
- Branding: CR 73K T12345
- Stamping: T12345

Production record will be shown on the rails.

*JIS Standard are shown for reference, please consult us anytime for original marking.*
Research on Rails

At NIPPON STEEL, world-class research and development personnel provided with sophisticated laboratory facilities constantly make strenuous R & D efforts to offer better rails and new application technology, including new welding techniques. To meet the demand of faster high speed trains and heavier heavy haul railway.

Machines for rail performance testing.

- High speed rail tester (*)
- Rail wear and damage producing tester (*)
- Heat treatment tester
- Type Nishihara wear tester
- Rail damage simulator (*)
- Rail bend and fatigue tester
- Flash-butt welder
- Rail bend tester
- Falling weight tester

(*) NIPPON STEEL original machines