Pipes & tubes of NIPPON STEEL

NIPPON STEEL has produced and sold a complete range of steel products and has served every need in Japan and overseas for over a long period of time as a comprehensive steel manufacturer.

In the pipe & tube unit, we have the latest production facilities that can cover all products, such as those involving seamless rolling, electric resistance welding, butt welding, and arc welding, as well as a product control system based on non-destructive inspection using computers.

In addition, the comprehensive unique capabilities of NIPPON STEEL include application technologies and construction technologies varying from high-grade pipes for lines, oil wells, and power generation, etc., to general pipes & tubes such as those for piping and structures. We believe that such technologies will serve you and your needs.

We would like to gain your interest in the pipe & tube products of NIPPON STEEL.

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### Pipe-making facilities and product types

<table>
<thead>
<tr>
<th>Classification</th>
<th>Pipe-making facilities</th>
<th>Location of mills</th>
<th>Production method</th>
<th>Production capacity (tons/year)</th>
<th>Available production size (outer diameter: mm)</th>
<th>Thickness (mm)</th>
<th>Product type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seamless pipes &amp; tubes</td>
<td>Kyushu Works Oita area (Hikari Pipe &amp; Tube Div.)</td>
<td>(Hot finish)</td>
<td>Hot extrusion process</td>
<td>48,000</td>
<td>40: 21.4, 65.0, 127.0</td>
<td>2.0–25.0</td>
<td>Carbon steel, alloy steel, and stainless pipes &amp; tubes</td>
</tr>
<tr>
<td></td>
<td>Kansai Works Amagasaki area</td>
<td>(Cold finish)</td>
<td>High-frequency induction welding process (2&quot;)</td>
<td>60,000</td>
<td>80: 21.4, 65.0, 127.0</td>
<td>0.9–16.0</td>
<td>Hot-extruded shape steel</td>
</tr>
<tr>
<td></td>
<td>East Nippon Works Kimitsu area</td>
<td>(Hot finish)</td>
<td>High-frequency induction welding process (SR)</td>
<td>168,000</td>
<td>120: 21.4, 65.0</td>
<td>4.5–19.0</td>
<td>Line pipes</td>
</tr>
<tr>
<td></td>
<td>East Nippon Works Kimitsu area</td>
<td>(Cold finish)</td>
<td>High-frequency induction welding process (4&quot;)</td>
<td>480,000</td>
<td>300: 114.3</td>
<td>4.5–50.0</td>
<td>Pipes &amp; tubes for water supply (coated pipes &amp; tubes)</td>
</tr>
<tr>
<td></td>
<td>Kansai Works Amagasaki area</td>
<td>(Hot finish)</td>
<td>High-frequency induction welding process (8&quot;)</td>
<td>66,000</td>
<td>400: 114.3</td>
<td>6.0–25.4</td>
<td>Pipes &amp; tubes for oil wells</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Cold finish)</td>
<td>High-frequency induction welding process (16&quot;)</td>
<td>360,000</td>
<td>600: 114.3</td>
<td>6.2–40.0</td>
<td>Pipes &amp; tubes for boilers and heat exchangers</td>
</tr>
<tr>
<td></td>
<td>Kyushu Works Oita area (Hikari Pipe &amp; Tube Div.)</td>
<td>(OEM by related company&quot;)</td>
<td>High-frequency induction welding process (24&quot;)</td>
<td>480,000</td>
<td>1000: 114.3</td>
<td>6.2–50.0</td>
<td>Pipe piles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(OEM by related company&quot;)</td>
<td>Hot-extrusion process</td>
<td>276,000</td>
<td>2000: 114.3</td>
<td>6.2–50.0</td>
<td>Pipe sheet piles</td>
</tr>
</tbody>
</table>

1. Related company: NIPPON STEEL PIPE CO., LTD.
## NIPPON STEEL product standards

<table>
<thead>
<tr>
<th>Classification of application</th>
<th>Product for application</th>
<th>Main product name</th>
<th>Grade</th>
<th>Applicable production process</th>
<th>Available outside diameter (mm)</th>
<th>Main characteristics/applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Piping</strong></td>
<td>Pipelines &amp; tubes</td>
<td>Electric resistance-welded carbon steel tubes for piping</td>
<td>STPY400-E</td>
<td>Electric resistance welding</td>
<td>216.3—609.6</td>
<td>Electric resistance-welded carbon steel pipes &amp; tubes used for relatively low-pressure steam, water, gas, air, etc.</td>
</tr>
<tr>
<td><strong>Stainless pipes &amp; tubes</strong></td>
<td>for boilers and heat exchangers</td>
<td>Stress corrosion crack-resistant stainless pipes &amp; tubes</td>
<td>YUS® 990</td>
<td>Seamless</td>
<td>15.0—57.1</td>
<td>Ferritic stainless steel pipes with excellent stress corrosion crack resistance and grain boundary corrosion resistance; these are used for water heaters, etc.</td>
</tr>
<tr>
<td><strong>Low-alloy pipes &amp; tubes</strong></td>
<td></td>
<td>High-corrosion-resistant stainless pipes &amp; tubes</td>
<td>YUS 170, YUS 270</td>
<td>Seamless</td>
<td>15.0—139.8</td>
<td>Stainless pipes &amp; tubes with excellent corrosion resistance against a chloride environment and against sulfuric acid/organic acid environments; these are suitable for refuse incineration boilers, seawater desalination plants, etc.</td>
</tr>
<tr>
<td><strong>Heat transfer</strong></td>
<td></td>
<td>Sulfuric acid-resistant pipes &amp; tubes</td>
<td>S-TEN®, ORA</td>
<td>Seam welded, electric resistance welding</td>
<td>21.7—4,000.0</td>
<td>This exhibits excellent sulfuric acid resistance for boilers, heat exchangers, air preheaters, and various exhaust gas pipes, etc., which may cause sulfuric acid dew-point corrosion due to sulfuric acid gas.</td>
</tr>
<tr>
<td><strong>Heat transfer</strong></td>
<td></td>
<td>Superheater tubes</td>
<td>HCM25®, NFI16, SUPER304HY</td>
<td>Seamless</td>
<td>6—950</td>
<td>Pipes &amp; tubes with excellent steam oxidation resistance, high-temperature strength, and weldability; these contribute to the improved efficiency of thermal power generation boilers.</td>
</tr>
<tr>
<td><strong>Outside coated pipes &amp; tubes</strong></td>
<td></td>
<td>Heavy-duty anti-corrosion pipe</td>
<td>NS-PAC®</td>
<td>Arc welding, electric resistance welding</td>
<td>Max. 1524.0</td>
<td>Polyethylene is coated on the outside surface of the pipe &amp; tube by extrusion forming. This is effective for problematic potential corroded areas such as the splash zones of pier piles. It has a better price and a longer life compared to conventional coating. It also has an advantage in eliminating electrolytic protection.</td>
</tr>
<tr>
<td><strong>Pipes &amp; tubes for construction structures</strong></td>
<td></td>
<td>Heavy-duty anti-corrosion pipe sheet pipe</td>
<td>NS-PAC®</td>
<td>Arc welding</td>
<td>406.4—2.250</td>
<td>A urethane elastomer is spray-coated on the outside surface of the pipe &amp; tube. This is effective for problematic potential corroded areas such as the splash zones of pier piles or embankments. It has a better price and a longer life compared to conventional coating, as well as an advantage in eliminating electrolytic protection.</td>
</tr>
<tr>
<td><strong>Shape for construction structures</strong></td>
<td></td>
<td>Tapered pipes &amp; tubes for construction structures</td>
<td>NS-TPP</td>
<td>Electric resistance welding</td>
<td>Max. 0.318</td>
<td>Tapered pipes &amp; tubes with excellent freedom of shape; these are used for lighting poles, sign poles, etc.</td>
</tr>
<tr>
<td><strong>Pipes &amp; tubes for civic work projects</strong></td>
<td></td>
<td>Hot extrusion shaped steel for construction structures</td>
<td>NSINO-SM, NSINO-COR-TENNO, NSINO-SUS</td>
<td>Hot extrusion</td>
<td>Max. 0.215</td>
<td>Hot extrusion shaped steel supported by a small lot with free design; this is suitable for achieving an architectural space with originality by using these pipes &amp; tubes as a construction material with design capability.</td>
</tr>
<tr>
<td><strong>Low-alloy pipes &amp; tubes</strong></td>
<td></td>
<td>Stopped pipes &amp; tubes</td>
<td>SGP-MD, NSD400N, STK400-MD</td>
<td>Hot electric resistance-welding, seamless</td>
<td>48.6—165.2</td>
<td>Steel pipes with a large stepped area that increases friction force with the ground and that features large supporting power; these are the most suitable for the application of house foundations or tunnel reinforcements.</td>
</tr>
<tr>
<td><strong>Weather-resistant pipes &amp; tubes</strong></td>
<td></td>
<td>Weather-resistant pipes &amp; tubes</td>
<td>COR-TEN®, SMA-W</td>
<td>Seamless, arc welding, electric resistance welding</td>
<td>21.7—4.000</td>
<td>With the function of alloy elements, a fine and hard oxide layer is formed on the surface. This prevents the further progress of corrosion. The maintenance of the coating is not required. This is suitable for iron towers or buildings.</td>
</tr>
<tr>
<td><strong>Seawater-resistant pipes &amp; tubes</strong></td>
<td></td>
<td>Sea water-resistant pipes &amp; tubes</td>
<td>MARLOY®S-400</td>
<td>Arc welding, electric resistance welding</td>
<td>25—900</td>
<td>Pipes &amp; tubes with excellent weldability and seawater corrosion resistance by adding alloy elements; these are suitable for seawater piping, gas coolers using seawater, cooling piping, and marine structures.</td>
</tr>
<tr>
<td><strong>Weldable high-tensile pipes &amp; tubes</strong></td>
<td></td>
<td>Weldable high-tensile pipes &amp; tubes</td>
<td>WEL-TEN®, SUPERSTRONG</td>
<td>Seamless</td>
<td>17.3—426</td>
<td>Pipes &amp; tubes with high tensile force, excellent weldability, corrosion resistance, wear resistance, and notch toughness; these are suitable for strong construction members or industrial machines such as crane booms.</td>
</tr>
<tr>
<td><strong>Aluminum-plated pipes</strong></td>
<td></td>
<td>Aluminum-plated pipes</td>
<td>Al sheet steel pipes for automobiles</td>
<td>Electric resistance welding</td>
<td>25.4—114.3</td>
<td>Pipes &amp; tubes developed for automobile exhaust gas treatment; these are excellent in machine processing and heat resistance at high-temperature zones.</td>
</tr>
<tr>
<td><strong>Material pipes</strong></td>
<td></td>
<td>Material pipes</td>
<td>KSKM, KSHT, KSB, KS, KED, KEH</td>
<td>Seamless, electric resistance welding</td>
<td>21.7—609.6</td>
<td>Pipes used for automobiles or industrial machines through the cold processing of a drawing tube or joint (elbow); various production methods and steel types for each application are available.</td>
</tr>
<tr>
<td><strong>Composite pipes</strong></td>
<td></td>
<td>Composite pipes for automobile noise prevention</td>
<td>NSD</td>
<td>Electric resistance welding</td>
<td>42.7—101.6</td>
<td>A glass cloth is inserted in between the double pipes. This is used for exhaust tubes to reduce noise from the automobile exhaust system.</td>
</tr>
<tr>
<td><strong>SENMOTO steel pipes</strong></td>
<td></td>
<td>Exhaust pipes for automobiles</td>
<td>—</td>
<td>Electric resistance welding</td>
<td>21.7—114.3</td>
<td>This is suitable for low-temperature exhaust tubes in automobile exhaust gas systems.</td>
</tr>
<tr>
<td><strong>Stainless pipes &amp; tubes for mechanical structures</strong></td>
<td></td>
<td>Heat-resistant stainless pipes &amp; tubes for automobile exhaust gas</td>
<td>YUS® 773I, YUS 490D, 180, 180S, YUS 409W, 436S</td>
<td>Seamless, electric resistance welding</td>
<td>27.2—159.8</td>
<td>Pipes &amp; tubes developed for automobile exhaust gas treatment; austenite type (YUS 773I) with excellent heat resistance and oxidation resistance at a high-temperature zone and ferrite type (YUS 490D, 180, 436S) are available. Also, stainless Al sheet steel pipes that have aluminum plating for salt damage protection are available (YUS-4900 Al sheet, etc.).</td>
</tr>
<tr>
<td><strong>Oil &amp; Gas</strong></td>
<td></td>
<td>Pipes &amp; tubes for drilling</td>
<td>STKR-M</td>
<td>Seamless</td>
<td>17.3—130</td>
<td>Pipes &amp; tubes with the strength and ductility of JIS and ASTM R80 or more to meet increasing drilling depth; these are suitable for very deep drilling.</td>
</tr>
<tr>
<td><strong>Pipes &amp; tubes for oil wells</strong></td>
<td></td>
<td>Tubing, casing</td>
<td>SM® series</td>
<td>Seamless, electric resistance welding</td>
<td>60.3—406.4, 114.3—508</td>
<td>Oil well pipes for the development of oil, natural gas, and geothermal heat with excellent characteristics regarding strength, crush resistance, and low-temperature toughness.</td>
</tr>
</tbody>
</table>

* CORTEN® is the registered trademark of United States Steel Corporation in the United States, Japan, etc. We are allowed to use the trademark.
Applications

Pipes & tubes for piping

- Inter city pipeline
- Various pipes in condominiums: ELP*-NTA (gas, water supply, water drain, hot water supply, etc.)
- Regional cooling conduit
- Offshore pipeline: NS-PEL* (green)
- Flare joints of equipment pipes in buildings
- Fire-extinguishing pipe

Pipes & tubes for mechanical structures

- Pipes & tubes for automobiles
- Printing roll
- Vibration-absorbing cylinder
- Pipes & tubes for construction machines (crane booms, lattices)
- Pipes & tubes for construction machines (cylinders, bushings)
Pipes & tubes for marine structures and general structures

- Torii
- Transmission tower
- Dimple pipe for solar panel stand
- Lighting pole (tapered pipes & tubes)
- Stadium roof
- Truss roof
- Road bridge post

Pipe & tube columns for offshore platform
Pipe & tube columns for high-rise buildings
Pipe & tube columns for high-rise buildings
Pipe piles/pipe sheet piles

Pipe piles for large offshore platforms
Pipe sheet piles for earth-retaining structures
Heavy-duty coating pipe pile

Pipes & tubes for shipbuilding

Marine steel pipes
Ship’s piping

Pipes & tubes for plants

In-plant gas piping
Geo thermal steam pipe
LNG pipe
Petrochemical plant pipe
Pipes & tubes for boilers/heat exchangers

- Appearance of thermal power generation boilers
- Boiler tubes
- Superheater tubes and main steam pipes
- Inside view of a thermal power generation boiler under construction

Pipes & tubes for high pressure hydrogen

- Product sample
- Hydrogen station piping

Pipes & tubes for the chemical industry/nuclear power plant

- Nuclear power plant
- Stick elbow
- Hollow piston
- Heat exchanger tubes for steam generators (SG)
Oil & Gas Casing & Tubing/Line pipe (offshore)

- Offshore line pipes for receiving crude oil
- Seabed oil/gas production equipment
- Offshore production well
- Installation of a pipeline
- Offshore platform
- Casing
### Production process
Seamless pipes & tubes (Mannesmann process)

#### Hot process

**Mandrel mill process**
After heating the round steel billet, hollow pipes are made with a piercer with toe angle. Then, elongating rolling is performed by a mandrel mill, which consists of a multi-step continuous rolling machine, to thereby produce the mother pipe. This mother pipe is reheated and is then finished by stretch reducing mill to a specified outside diameter and thickness for the final product.

**Cold-rolling process**
When higher dimensional accuracy and mechanical properties are required compared to pipes produced by the hot-rolling process, cold drawing subsequent to hot rolling is performed for the final product.
Seamless pipe pipes & tubes (hot extrusion - hot hollow forged)

**Hot extrusion process (Ugine-Sejournet process)**

Hot extrusion is a process in which heated billets are inserted into the cylinder, known as a “container,” and extruded with a hydraulic press. The specified outside diameter and thickness can be obtained with a die and mandrel. For pipes requiring higher dimensional accuracy and a surface finish, they are finished through cold rolling for the final product. With this process, fin pipes & tubes or various shaped steel other than steel pipes & tubes can be produced.

**Hot hollow forging process (Ehrhardt Push Bench process)**

Hot forging is a process for producing large-diameter thick pipes that are used in severe environments, such as main steam pipes at power plants.

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### Diagram

[Diagram showing the process flow of hot extrusion and hot hollow forging, including steps such as heating, cutting, piercing, rolling, and inspection.]
Electric resistance-welded pipes & tubes

Electric resistance-welded pipes & tubes are produced by forming the coil into a cylindrical form with top/bottom and left/right forming rolls while continuously rewinding the coil to be electric resistance welded. For a hot-finish electric resistance-welded pipe & tube (SR pipe), a long-size electric resistance welded pipe & tube is heated in a continuous heating furnace and drawn and finished by a stretch reducer. It is used to produce small-diameter pipes. Furthermore, NIPPON STEEL produces PIC (Pipe in Coil) in which the pipe is formed into a coil as a long-size pipe, in particular. Heat exchanger tubes by cold drawing are also produced.
Hot electric resistance-welded pipes & tubes

Hot electric resistance-welded (SW) pipes & tubes are produced by electric resistant welding the heated coil and finishing it to a specified size with a reducing mill.
Arc-welded pipes & tubes

**SAWL pipe (by UOE process)**
Manufacturing process of UOE pipe starts from edge milling of its substrate (steel plate) and forming it into cylindrical shape through U-ing and O-ing press. Then, inside/outside welding will be applied to linear joints with SAW/Submerged Arc Welding method, followed by mechanical expansion process.

**SAWL pipe (by Bending roll process)**
Bending rolled pipes have two processes: A press bend process for finishing pipes & tubes into a cylindrical shape with a forming press and a bending roll process to firstly make a circular shape at both edges of the steel sheet with a bend press, and then to make a perfect cylinder shape by rolling. The linear joints of a formed shape are arc welded (submerged arc welding) from the inside and outside.

**SAWH pipe (by Spiral Welded Pipe)**
Spiral welded pipes are produced by bending and forming a coil into a spiral with a forming roll while continuously rewinding the coil, and by welding the joints from the inside and outside.
Secondary machining

NIPPON STEEL performs various secondary machining on the produced pipes & tubes according to the order specifications or applications.

### Pipes & tubes for piping
- Internal/External coatings
  - Internal coatings with epoxy paints, powdered polyethylene, unplasticized polyvinyl chloride, etc.
  - External coatings with 3-layer polyethylene, 3-layer polypropylene, fusion bonded epoxy, polyurethane, various paints, etc.
- Threading
- Bevel machining
- Joint machining
- Production of irregular shape pipes

### Pipe piles and pipe sheet piles
- Various piles, sheet piles, and rust prevention

### Pipes & tubes for boilers and heat exchangers
- U bending, aluminum plating, rifle machining, drawing

Remarks: We will introduce companies for swaging, expanding, bending, cutting to length, etc.

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Pipe & tube plant of NIPPON STEEL

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Steel mills and works

1. East Nippon Works Kashima area  - Hot electric resistance-welded pipes & tubes
2. East Nippon Works Kimita area  - Electric resistance-welded pipes & tubes, SAWH pipe (by Spiral Welded Pipe), SAWL pipe (by UO process)
3. Nagoya Works  - Electric resistance-welded pipes & tubes
4. Kansai Works Amagasaki area  - Seamless pipes & tubes (hot extrusion process, hot hollow forging process)
5. Kansai Works Wakayama area  - Seamless pipes & tubes (Mannesmann process)
6. Kyushu Works Oita area  - Electric resistance-welded pipes & tubes, seamless pipes & tubes (hot extrusion process)
7. Kyushu Works Yawata area  - SAWH pipe (by Spiral Welded Pipe)