NIPPON STEEL & SUMITOMO METAL

Pipes & tubes of Nippon Steel & Sumitomo Metal

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Pipes & tubes of Nippon Steel & Sumitomo Metal

Nippon Steel & Sumitomo Metal 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 & Sumitomo Metal 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 & Sumitomo Metal.

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## Pipe-making facilities and product types

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<tr>
<th>Classification</th>
<th>Pipe-making facilities</th>
<th>Location of mills</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>Mannesmann-plug mill process (Hot finish)</td>
<td>Tokyo pipe &amp; tube Division</td>
<td>156,000</td>
<td>25.4 168.3</td>
<td>3.0—50.0</td>
<td>Carbon steel, alloy steel, and stainless pipes &amp; tubes</td>
</tr>
<tr>
<td></td>
<td>(Cold finish)</td>
<td></td>
<td></td>
<td>6.0 152.4</td>
<td>1.0—17.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UGINE-Sajourn Hot extrusion process (Hot finish)</td>
<td>Hikari Pipe &amp; tube Division</td>
<td>48,000</td>
<td>34.0 175.0</td>
<td>2.0—25.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Cold finish)</td>
<td></td>
<td></td>
<td>6.0 168.3</td>
<td>0.9—16.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Amagasaki Works</td>
<td>Mannesmann-plug mill process (Hot finish)</td>
<td>60,000</td>
<td>36.0 219.1</td>
<td>3.0—35.0</td>
<td>Casing &amp; Tubing</td>
</tr>
<tr>
<td></td>
<td>Hot hollow forging process (Cold finish)</td>
<td></td>
<td></td>
<td>6.0 219.1</td>
<td>1.0—30.0</td>
<td>Green tube for drill pipes</td>
</tr>
<tr>
<td></td>
<td>Ehrhardt Push Bench High frequency induction welding process (Hot finish)</td>
<td>Amagasaki Works</td>
<td>14,400</td>
<td>165.2 962.5</td>
<td>15.0—160</td>
<td>Pipes &amp; tubes for mechanical structures</td>
</tr>
<tr>
<td></td>
<td>Hot hollow forging process (Cold finish)</td>
<td></td>
<td></td>
<td>219.1 508</td>
<td>12.7—40.0</td>
<td>Mechanical tube</td>
</tr>
<tr>
<td></td>
<td>Hot hollow forging mandrel mill process (Hot finish)</td>
<td></td>
<td></td>
<td>168.3 426</td>
<td>4.5—50.0</td>
<td>Pipes &amp; tubes for pressure vessels</td>
</tr>
<tr>
<td></td>
<td>Mannesmann Hot hollow forging process (Kainan West)</td>
<td></td>
<td></td>
<td>73.0 182</td>
<td>4.5—46.0</td>
<td>Pipes &amp; tubes for the chemical industry</td>
</tr>
<tr>
<td></td>
<td>Hot hollow forging process (Kainan East)</td>
<td>Wakayama Works</td>
<td>350,000</td>
<td>31.8 141.3</td>
<td>2.5—40.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Cold finish / Kainan)</td>
<td></td>
<td></td>
<td>15.0 127.0</td>
<td>1.7—23.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arc-welded pipes &amp; tubes</td>
<td>Spiral process (SAWH)</td>
<td>Yawata Works</td>
<td>102,000</td>
<td>400 1625.6</td>
<td>4.5—19.0</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Kimitsu Works</td>
<td>168,000</td>
<td>400 2500</td>
<td>4.5—19.0</td>
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<tr>
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<td></td>
<td>UOE process (SAWL)</td>
<td>Kimitsu Works</td>
<td>500,000</td>
<td>457.2 1422</td>
<td>6.0—25.4</td>
</tr>
<tr>
<td></td>
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<td>Kashima Works</td>
<td>500,000</td>
<td>508.0 1524.0</td>
<td>6.4—40.0</td>
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<tr>
<td></td>
<td></td>
<td>Press Bend process</td>
<td>OEM by related companies</td>
<td>120,000</td>
<td>400 8000</td>
<td>6.0—40.0</td>
</tr>
<tr>
<td></td>
<td>Electric resistance-welded pipes &amp; tubes</td>
<td>High-frequency induction welding process (2&quot;)</td>
<td>Nagoya Works, Wakayama Works (OEM by NSPC*)</td>
<td>36,000</td>
<td>21.7 65.0</td>
<td>0.8—8.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-frequency induction welding process (4&quot;)</td>
<td>Hikari Pipe &amp; tube Division</td>
<td>60,000</td>
<td>13.8 40.5</td>
<td>1.4—9.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Kimitsu Works</td>
<td>66,000</td>
<td>19.0 114.3</td>
<td>1.8—10.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-frequency induction welding process (4&quot;)</td>
<td>Nagoya Works, Wakayama Works (OEM by NSPC*)</td>
<td>72,000</td>
<td>38.1 114.3</td>
<td>1.4—10.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High frequency induction welding process (8&quot;)</td>
<td>Wakayama Works (OEM by NSPC*)</td>
<td>–</td>
<td>114.3 216.3</td>
<td>2.0—14.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High frequency resistance welding process (16&quot;)</td>
<td>Nagoya Works</td>
<td>360,000</td>
<td>114.3 406.4</td>
<td>2.1—19.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High frequency resistance welding process (24&quot;)</td>
<td>Hikari Pipe &amp; tube Division</td>
<td>480,000</td>
<td>318.5 600.6</td>
<td>3.0—22.0</td>
</tr>
<tr>
<td></td>
<td>Hot-finish electric resistance-welded pipe (5W)</td>
<td>High-frequency induction welding process (3W)</td>
<td>Kashima Works</td>
<td>276,000</td>
<td>21.7 114.3</td>
<td>2.0—10.0</td>
</tr>
</tbody>
</table>

* NIPPON STEEL & SUMIKIN PIPE CO., LTD
# Nippon Steel & Sumitomo Metal 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</th>
<th>Main characteristics/applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Piping</strong></td>
<td>Electric resistance-welded carbon steel pipes for piping</td>
<td>STPY400-E</td>
<td>Electric resistance welding</td>
<td>216.3—609.6mm</td>
<td>Electric resistance-welded carbon steel pipes &amp; tubes used for relatively low-pressure steam, water, gas, air, etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Stainless pipes &amp; tubes for boilers and heat exchangers</strong></td>
<td>Stress corrosion crack-resistant stainless pipes &amp; tubes</td>
<td>YUS®990</td>
<td>Seamless</td>
<td>15.9—57.1mm</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>
<td></td>
</tr>
<tr>
<td><strong>Low-alloy pipes &amp; tubes</strong></td>
<td>High-corrosion-resistant stainless pipes &amp; tubes</td>
<td>YUS 170, YUS 270</td>
<td>Seamless</td>
<td>15.9—139.8mm</td>
<td>Stainless pipes &amp; tubes with excellent corrosion resistance against a chloride environment and against sulfurous acid/organic acid environments; these are suitable for refuse incineration boilers, seawater desalination plants, etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Pipe &amp; tubes for boilers</strong></td>
<td>Sulfuric acid-resistant pipes &amp; tubes</td>
<td>S-TEN®, CR1A</td>
<td>Seamless, arc welding, electric resistance welding</td>
<td>21.7—4,000mm</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 sulfurous acid gas.</td>
<td></td>
</tr>
<tr>
<td><strong>Pipe &amp; tubes for boilers</strong></td>
<td>Superheater tubes</td>
<td>HCM2S®, NF116</td>
<td>Seamless</td>
<td>6—950A</td>
<td>Pipe &amp; tubes with excellent steam oxidation resistance, high-temperature strength, and weldability; these contribute to the improved efficiency of thermal power generation boilers.</td>
<td></td>
</tr>
<tr>
<td><strong>Outside coated pipes &amp; tubes</strong></td>
<td>Heavy-duty anti-corrosion pipe sheet pipes</td>
<td>NS-PAC®</td>
<td>Arc welding, electric resistance welding</td>
<td>Max. 1524.0mm</td>
<td>Polyethylene is coated on the outside surface of the pipe &amp; tube by extrusion forming. This is effective for potential corrosion areas such as the splash zones of pier pipes. It has a better price and a longer life compared to conventional coating. It also has an advantage in eliminating electrolytic protection.</td>
<td></td>
</tr>
<tr>
<td><strong>Pipes &amp; tubes for construction structures</strong></td>
<td>Heavy-duty anti-corrosion pipe sheet pipes</td>
<td>NS-PAC®</td>
<td>Arc welding</td>
<td>406.4—2,250mm</td>
<td>A urethane elastomer is spray-coated on the outside surface of the pipe &amp; tube. This is effective for potential corrosion areas such as the splash zones of pipe 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>
<td></td>
</tr>
<tr>
<td><strong>Shaped steel for construction structures</strong></td>
<td>Hot extrusion shaped steel for construction structures</td>
<td>NSNO-SM</td>
<td>Hot extrusion</td>
<td>Max. 0.215mm</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>
<td></td>
</tr>
<tr>
<td><strong>Pipes &amp; tubes for civic work projects</strong></td>
<td>Stepped pipes &amp; tubes</td>
<td>SGP-MD, NSDP009</td>
<td>Hot electric resistance-welding, electric resistance welding</td>
<td>48.6—165.2mm</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>
<td></td>
</tr>
<tr>
<td><strong>Low-alloy pipes &amp; tubes</strong></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—4,000mm</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>
<td></td>
</tr>
<tr>
<td><strong>Seawater-resistant pipes &amp; tubes</strong></td>
<td>Weldable high-tensile pipes &amp; tubes</td>
<td>WEL-TEN® SUMSTRING</td>
<td>Seamless</td>
<td>17.3—426mm</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>
<td></td>
</tr>
<tr>
<td><strong>Aluminum-plated pipes</strong></td>
<td>Aluminum-plated pipes</td>
<td>AI sheet steel pipes for automobiles</td>
<td>—</td>
<td>Electric resistance welding</td>
<td>25.4—114.3mm</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>Original pipes for drawing points</strong></td>
<td>Material pipes</td>
<td>KSS, KSS, KSSGE, KSSKE, KSSKE</td>
<td>Seamless, electric resistance welding</td>
<td>21.7—609.6mm</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>
<td></td>
</tr>
<tr>
<td><strong>Composite pipes</strong></td>
<td>Composite pipes for automobile noise prevention</td>
<td>NSD</td>
<td>Electric resistance welding</td>
<td>42.7—101.6mm</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>
<td></td>
</tr>
<tr>
<td><strong>ZNOKOTE steel pipes</strong></td>
<td>Exhaust pipes for automobiles</td>
<td>—</td>
<td>Electric resistance welding</td>
<td>21.7—114.3mm</td>
<td>This is suitable for low-pressure exhaust tubes in automobile exhaust gas systems.</td>
<td></td>
</tr>
<tr>
<td><strong>Stainless pipes &amp; tubes for mechanical structures</strong></td>
<td>Heat-resistant stainless pipes &amp; tubes for automobile exhaust gas</td>
<td>YUS®731</td>
<td>Seamless, electric resistance welding</td>
<td>27.2—139.8mm</td>
<td>Pipes &amp; tubes developed for automobile exhaust gas treatment; austenite type (YUS 731) with excellent heat resistance and oxidation resistance at a high-temperature zone and ferritic type (YUS 490D, 180, 436S) are available. Also, stainless AI sheet steel pipes that have aluminum plating for salt damage protection are available (YUS 490D Al sheet, etc.).</td>
<td></td>
</tr>
<tr>
<td><strong>Oil &amp; Gas pipes &amp; tubes for drilling</strong></td>
<td>Pipes &amp; tubes for drilling</td>
<td>STMR-M</td>
<td>Seamless</td>
<td>17.3—130mm</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>
<td></td>
</tr>
<tr>
<td><strong>Pipes &amp; tubes for oil wells</strong></td>
<td>Tubing &amp; casing</td>
<td>SM® series NT</td>
<td>Seamless, electric resistance welding</td>
<td>60.3—406.4mm</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>
<td></td>
</tr>
</tbody>
</table>
Applications

Pipes & tubes for piping

- Fire-extinguishing pipe
- 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

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

Pipe & tube columns for high-rise buildings

Transmission tower

Offshore platform

Dimple pipe for solar panel stand

Stadium roof

Torii

Lighting pole (tapered pipes & tubes)

Offshore platform

Dimple pipe for solar panel stand

Lighting pole (tapered pipes & tubes)

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

Pipes & tubes for plants
- Geothermal steam pipe
- In-plant gas piping
- LNG pipe
- Petrochemical plant pipe

Pipes & tubes for shipbuilding
- Marine steel pipes
- Ship’s piping
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
- Heat exchanger tubes for steam generators (SG)
- Hollow piston
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.

- **Plug mill process**
  After heating the round steel billet, hollow pipes are made with a piercer. Then, elongating rolling is performed through a plug mill. Pipes are reeled and finished to a specified diameter for final products. For a pipe & tube with a small diameter, original pipes with a specified diameter are reheated and then finished to the specified outside diameter and thickness through a reducing mill 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 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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**Flowchart of Hot extrusion process**
(Ugine-Sejournet process)

- Ingot
- Horizontal extrusion press
- Heat treatment
- Cutting
- Vertical expanding press
- Heating
- Pipe material
- Pilger rolling
- Cutting

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

- Ingot
- Vertical piercing press
- Cutting
- Heat treatment
- Inner/outer surface cutting
- Non-destructive inspection
- Identification marking/painting
- Straightener
- Heat treatment
- Cold forging
- Non-destructive inspection
- Identification marking/painting
- Hot-rolled products
- Straightener
- Heat treatment
- Cold forging
- Non-destructive inspection
- Identification marking/painting
- Hot-rolled products
- Cutting

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, NSSMC 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.

![Forming and welding machine for hot electric resistance welding](image1)

![Stretch reducer](image2)

![Cooling floor](image3)
**Arc-welded pipes & tubes**

**SAWL pipe (by UOE process)**
UOE pipes are produced by forming the both ends of the plate into a groove, forming the groove-shaped steel into a cylindrical shape with a U press and O press, and then arc welding the linear joints from the inside and outside (SAW Submerged Arc Welding).

**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 process)**
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

NSSMC 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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**External polyethylene coating: NS-PEL**

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**Head Office, regional offices and branch offices**

1. Head Office (Pipe & tube Division)
2. Osaka Office
3. Hokkaido Marketing Branch
4. Tohoku Marketing Branch
5. Niigata Marketing Branch
6. Hokuriku Marketing Branch
7. Ibaraki Marketing Branch
8. Nagoya Marketing Branch
9. Chugoku Marketing Branch
10. Shikoku Marketing Branch
11. Kyushu Marketing Branch

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**Steel mills and works**

1. Kashima Works — Hot electric resistance-welded pipes & tubes
2. Tokyo Pipe & tube Division — Seamless pipes & tubes (Mannesmann process)
3. Kimitsu Works — Electric resistance-welded pipes & tubes, SAWH pipe (by Spiral process), SAWH pipe (by UO process)
4. Nagoya Works — Electric resistance-welded pipes & tubes
5. Amagasaki Works — Seamless pipes & tubes (hot extrusion process, hot hollow forging process)
6. Wakayama Works — Seamless pipes & tubes (Mannesmann process)
7. Hikari Pipe & tube Division — Electric resistance-welded pipes & tubes, seamless pipes & tubes (hot extrusion process)
8. Yawata Works — SAWH pipe (by Spiral process)