

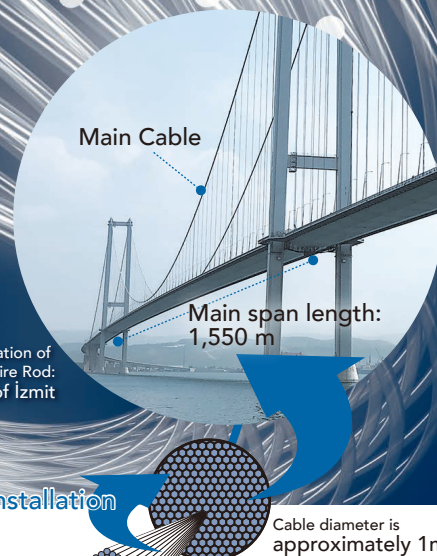
Environmentally-Friendly Super-High-Strength Wire Rod

In the infrastructure and construction industry, along with safety assurance and cost reduction, there is always a demand for higher strength and improvement of production efficiency. To meet this demand, Nippon Steel Corporation developed and commercialized the world's highest strength wire rod utilizing our unique and environmentally-friendly production process (DLP, Direct in-Line Patenting).



This development was awarded Main Prize of Ichimura Award, Keidanren Chairman's Prize of National Commendation for Invention, and the Okochi Production Award.

Examples of the application of our Super-High-Strength Wire Rod: Osman Gazi Bridge spanning the Gulf of Izmit



5-6mm ϕ wire (for cable length 3-4km)

Stranding (putting wire together)

Strand

Cable diameter is approximately 1m

General Production Process of Main Cable of Bridge

Main Cable of Bridge are made by stranded high strength steel wire.

What is DLP (Direct in-Line Patenting)?

In-line heat treatment enables omission of the heat treatment (LP, lead patenting) process on the customer's side. In addition, this enables manufacturing of a highly-balanced wire rod with strength, toughness and ductility using the method excellent in productivity and environmental response.

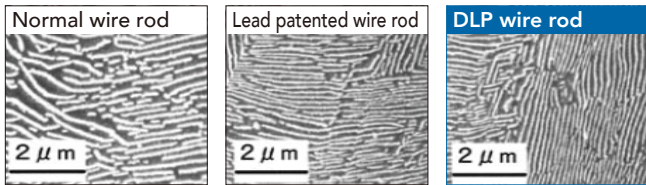
Wire rod manufacturing process (NIPPON STEEL CORPORATION)		Wire manufacturing process (customer)		
Hot rolling	Cooling and heat treatment	Around 3,000 to 20,000 tons of Wires are used per bridge.		
		Heat treatment	Wire drawing	Hot dipping
Conventional method	<p>800~900°C</p>	<p>Hot coiling Wind furnace</p>	LP Low Productivity Not environmentally-friendly <p>Heating Lead bath Cool coiling</p>	
	CO ₂ 100kg/t-steel	Lead	1,000t/month/factory	Impossible
	CO ₂ Emissions	Lead free	Productivity	Production of high strength wire in lead restricted areas
Current development	CO ₂ 30kg/t-steel	Nitrate	30,000t/month/factory	Possible
	<p>800~900°C Lead free patenting process (first in the world)</p>	Unnecessary		
				Restriction of wire size
				Enables larger diameter of wire
				Enables flexibility in designing bridge
			<p>12mmϕ Dies</p>	<p>5mmϕ Zinc bath Wire</p>

About our DLP wire rod

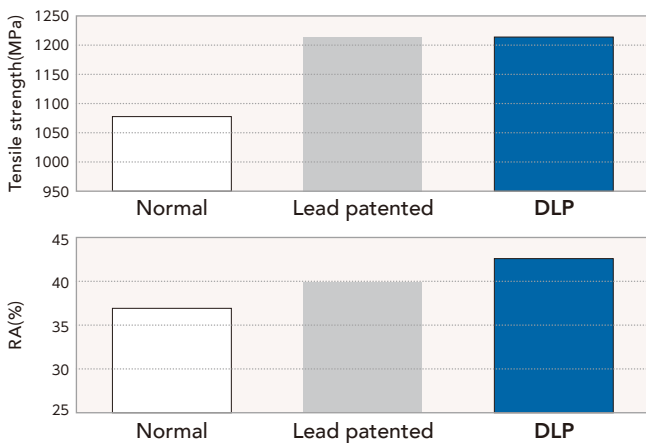
DLP wire rod can omit the lead patenting process done at our customers, which results to lower carbon emission. DLP wire rod is best fit to applications which needs both high strength and high ductility.

■ DLP wire rod has good balance of tensile strength and ductility, because of its fine and homogeneous microstructure achieved in the cooling and heat treatment process.

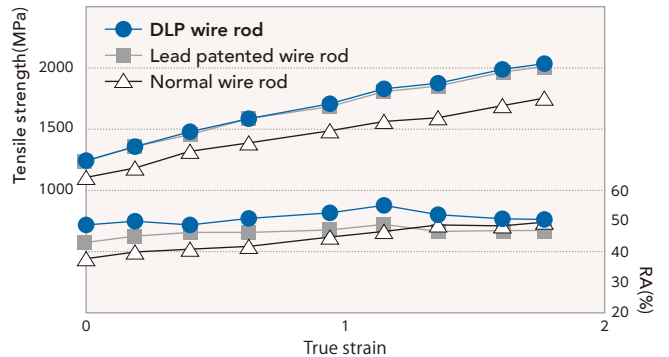
(1) Microstructure



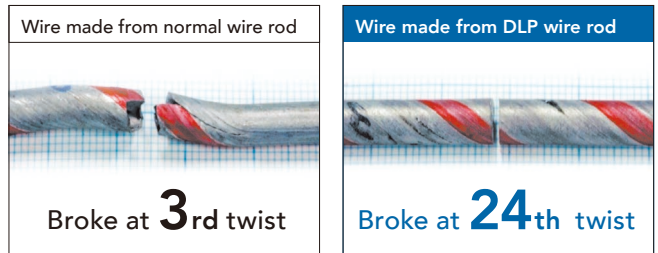
(2) Mechanical properties of wire rod (SWRS82B 11mm)



(3) Mechanical Properties of processed wire

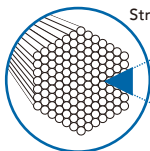


(4) Torsion test of drawn wire



Major Applications

Bridge cable



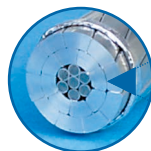
Strand cross section image

Made by putting together super-high-strength wire rod

Many business record

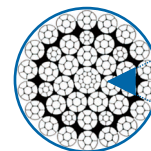
- Domestic: Toyoshima Bridge
- Turkey: Osman Gazi Bridge
- China: Dongting Lake Bridge
- Norway: Halogaland bridge

Overhead conductor




Stronger and smaller diameter core steel wire enables to expand the dimension of aluminum, which leads to lower power loss by 10-30%.

Crane wire rope



Used in wire rope such as mobile crane, which requires high strength due to safety.

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NIPPON STEEL CORPORATION

2-6-1 Marunouchi, Chiyoda-ku, Tokyo 100-8071 Japan
Tel: 03-6867-4111
www.nipponsteel.com

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