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NIPPON STEEL

MARILOYTM S-400 Pipes,

1% Cr Steel for Cargo Oil and Water Ballast Pipes



TOHSHI KYOEI TANKER CO., LTD. IHI MARINE UNITED INC. 2007

NIPPON STEEL CORPORATION

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MARILOY[™] S-400 Pipes, 1% Cr Steel for Cargo Oil and Water Ballast Pipes P107en_02_202204f © 2019, 2022 NIPPON STEEL CORPORATION

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NIPPON STEEL's MARILOY[™] S-400 steel pipe is a steel product containing 1% chromium for enhanced corrosion resistance when used in or on the ocean. The origin of the word MARILOY comes from a combination of MARINE and ALLOY.

The addition of chromium produces an effect in which the rust layer on the surface prevents oxygen from infiltrating the base metal, thus inhibiting corrosion to half or less compared to ordinary steel.

MARILOY[™] S-400 steel pipes are mainly used for the cargo oil pipes in oil tankers, FPSO systems and water ballast pipes. Since its release about 25 years ago, more than 60,000 tons of MARILOY[™] S-400 has been used, reflecting highly-valued efficiency of this product.

Supply Records of MARILOY[™] S-400 Pipes



JAPAN MARINE UNITED CORPORATION SUMITOMO HEAVY INDUSTRIES, LTD.

KAWASAKI HEAVY INDUSTRIES, LTD., NAMURA SHIPBUILDING CO., LTD. BOHAI SHIPBUILDING HEAVY INDUSTRY CO., LTD. NANTONG COSCO KHI SHIP ENGINEERING CO., LTD. HYUNDAI HEAVY INDUSTRIES CO,. LTD. DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD JURONG SHIPYARD PTE LTD, KEPPEL SHIPYARD LIMITED ... etc.

2 Ship-owners

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NIPPON YUSEN KABUSHIKI KAISHA, MITSUI O.S.K. LINES, LTD. KAWASAKI KISEN KAISHA, LTD., KYOEI TANKER CO., LTD. IDEMITSU TANKER CO., LTD., NS UNITED KAIUN KAISHA, LTD JX OCEAN., LTD., BW VLCC, FORMOSA PLASTICS CORPORATION, U.S.A. PETROBRAS, DSD SHIPPING AS, TSAKOS SHIPPING (LONDON) LTD. PLEIADES SHIPPING AGENTS S.A., DALIAN OCEAN SHIPPING COMPANY MODEC. INC --- etc.

3 Type of ship, use

VLCC(Cargo Oil pipes, Water ballast pipes), Bulk Carrier(Water ballast pipes) FPSO

Standards for MARILOY[™] S-400 Pipes

Chemical composition

		С	Si	Mn	Р	S	Cr
	Specification	≦0.14	≦0.55	≦1.50	≦0.030	≦0.030	0.80 – 1.30

Mechanical properties

	ERW pip	oes	SML pipes		
	Specified value	Actual value	Specified value	Actual value	
Tensile strength (MPa)	≧400 461		≧400	437	
Yield strength (MPa)	≧245	362	≧245	300	
Elongation (%)	≥23 (L-direction)	47	\geq 23 (L-direction)	55	

Welding with MARILOY[™] S-400 Pipes

Welding materials

Time	Brand name	Diameter (mm)	Shield gas	Typical mechanical properties of weld metal			
Type				YS (MPa)	TS (MPa)	EL(%)	$_{V}E_{0}\left(J ight)$
Flux cored welding wire	SF-55RS	1.2, 1.4	CO ₂	580	640	26	54
Gas metal arc welding wire	YM-55RSA	1.2	Ar-CO ₂	560	630	23	114
Gas tungsten arc welding rod	YT-55RS	2.0, 2.4 3.2	Ar	540	620	26	265

There is no need of preheating and postheating. Weldability is the same as welding materials for carbon steels. Welding materials for MARILOY[™] are produced by NIPPON STEEL WELDING & ENGINEERING CO.,LTD.

Fittings and Sleeves for MARILOY[™] S-400 Pipes



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Please contact us on the availability of MARILOY™ pipes with nonstandard size.

U-groove weld cracking test (JIS Z 3157)









Fittings and sleeves for MARILOY™ are produced by BENKAN KIKOH Corporation.

Sleeve

Features

1 Chemical composition :1%Cr

- 2 Mechanical properties
- : TS=400MPa, on the same level as carbon steels
- 3 Weldability
- : Similar to carbon steels. No preheating is required.
- 4 Corrosion resistance
 - : Corrosion rate is half that of carbon steel in seawater (The diffusion rate of oxygen is slower in rust layers containing Cr compared to those that do not.)

Corrosion in Seawater-Gas Heat Exchanger Tubes



Corrosion loss of MARILOY[™] S-400 is half that of carbon steel (SS400).



Investigation of Secular Changes

Investigated Tanker and Operating Conditions

The data at the time of pipe installation

1) Tanker (VLCC)

Name of vessel: COSMO ASTREA Ship-owner: **KYOEI TANKER CO., LTD.** Builder: ISHIKAWAJIMA - HARIMA HEAVY INDUSTRIES CO., LTD. Structure: Single-hull Month and year of completion: November 1992 DWT: 230,000MT

② Investigated pipes Cargo oil pipe: 762.0mmOD, 19mmt

Inspection method

Water ballast pipe: 660.4mmOD, 17mmt **③ Investigation timing**

After 2.5, 7.5, 12.5 and 15 years

Wall thickness of pipes were continuously

measured by using ultrasonic testers.



Inside of pipes were visually inspected

using depth gauge.

and the depth of pitting was measured

Results of The Cargo Oil Pipe Inspection



Results of The Water Ballast Pipe Inspection

nside of water ballast pipe after 2.5 years





Inside of water ballast pipe after 15 years



nside of water ballast pipe after shot blasting

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MARILOY[™] Pipes Reduce Fabrication and Maintenance Costs



