

JFE-SIPTM Series Corrosion-Resistant Steel for Ships

1. Introduction

Corrosion occurs in many parts of ship, including the outer surface, which is exposed to the effects of sea water, and also inner surfaces that are affected by the cargo or other factors, and increased operation and maintenance (O&M) costs and securing safety and security have become issues. In order to improve the corrosion resistance of the steel members used in ships, JFE Steel successively developed corrosion-resistant steels for shipbuilding which demonstrate corrosion resistance corresponding to these various corrosion environments as a product series called “JFE-SIPTM (JFE-Steel for Ship Inside Protection).”

This article introduces the features of the JFE-SIP Series.

2. Overview of JFE-SIP Series

At present, JFE Steel has commercialized corrosion-resistant steels corresponding to the four types of corrosion environments in ships shown in Table 1 as the JFE-SIP Series. Among these products, in response to the use of heavy-duty anticorrosion coatings in ballast tanks, which is mandatory under the Performance Standard for Protective Coatings (PSPC¹⁾ of the International Maritime Organization (IMO), JFE Steel developed JFE-SIP-BT for ballast tanks, which has the effect of suppressing deterioration of coating films after painting, and thus is contributing to reduction of O&M costs and longer ship life. JFE-SIP-CC for the

cargo holds of coal carriers is used in the side walls of cargo holds, and is also contributing to reduced O&M costs and longer ship life by reducing plate thickness loss due to corrosion, responding to requirements for a corrosion addition (additional plate thickness for predicted thickness loss due to corrosion) and side wall painting under Common Structural Rules (CSR)²⁾. Unpainted use of JFE-SIP-OT1 in the inner bottom plates of cargo oil tanks in oil tankers and JFE-SIP-OT2 for the upper deck of oil tankers was recognized as an exception to the painting requirement under PSPC³⁾. These products not only reduce O&M costs, but also substantially reduce the burden of painting work in shipyards during ship construction.

3. JFE-SIP Series

3.1 JFE-SIP-BT

Corrosion of ballast tanks, which are an indispensable part of ships, is mainly caused by the seawater used to fill the tanks. In particular, the underside of the upper deck plates is exposed to a severe corrosion environment characterized by repeated wetting and drying, and electrolytic corrosion protection is ineffective because this part is not immersed in seawater. Under film corrosion (corrosion under the protective paint film) is a typical corrosion mode, and interaction of rust and swelling/peeling of the paint film accelerate its spread. JFE-SIP-BT, which was developed by JFE Steel as the first steel of its type in the world, can be

15 years to 25 years or more⁴⁾, and the burden of repair painting can also be dramatically reduced by using this steel. At present, JFE-SIP-BT has a record of more than 10 years in maritime service since it was first introduced, and evaluation while ships are in dock is continuing.

Among approvals by ship classification societies, DH36, DH40 and EH40 grades have been approved, and JFE-SIP-BT has also received special approval from Nippon Kaiji Kyokai (ClassNK) for plate thicknesses up to a maximum of 42 mm.

3.2 JFE-SIP-BT -CC

Because the steel used in the cargo holds of coal carriers is subject to severe corrosion by dilute sulfuric acid, which is formed by the reaction between sulfur in the coal and dew condensation water, use of a protective coating (painting) or a corrosion addition (additional plate thickness) is mandatory. However, physical delamination of paint coatings used in cargo frequently occurs by contact with the cargo or cargo handling equipment. As a result, a long-term corrosion protection effect cannot be expected, and repainting and local replacement of the steel due to corrosion damage are necessary.

JFE-SIP-CC, also developed by JFE Steel as the

