

P2351177

## Report of Testing

Issued date : November 20, 2023

Objective : Testing Corrosion Resistance of Coated Steel Pipe  
by Salt Spray Technique

Customer : UI STEEL PIPE CO., LTD.  
5/8 Moo 5, Soi Klongmadua 17, Sethakit Rd.,  
T. Donkaidee, A. Kratumban,  
Samutsakorn 74110

Serviced by : Smart Manufacturing and Maintenance Technology Research Team  
Rail and Modern Transports Technology Research Center (RMT)  
National Science and Technology Development Agency

Received date : September 28, 2023

Tested date : October 2 – 3, 2023

Sample : Coated Steel Pipe

Samples Identification: - IMC CONDUIT ½" W/coupling, IMC CONDUIT ¼" W/coupling  
- IMC CONDUIT 1" W/coupling, IMC CONDUIT 1.¼" W/coupling  
- IMC CONDUIT 1.½" W/coupling, IMC CONDUIT 2" W/coupling  
- IMC CONDUIT 2.½" W/coupling, IMC CONDUIT 3" W/coupling  
- IMC CONDUIT 3.½" W/coupling, IMC CONDUIT 4" W/coupling  
- RSC CONDUIT 4" W/coupling, RSC CONDUIT 5" W/coupling  
- EMT CONDUIT ½", EMT CONDUIT ¼", EMT CONDUIT 1"  
- EMT CONDUIT 1.¼", EMT CONDUIT 1.½", EMT CONDUIT 2"

Tested method : Salt Spray (Fog) Test according to ISO 9227

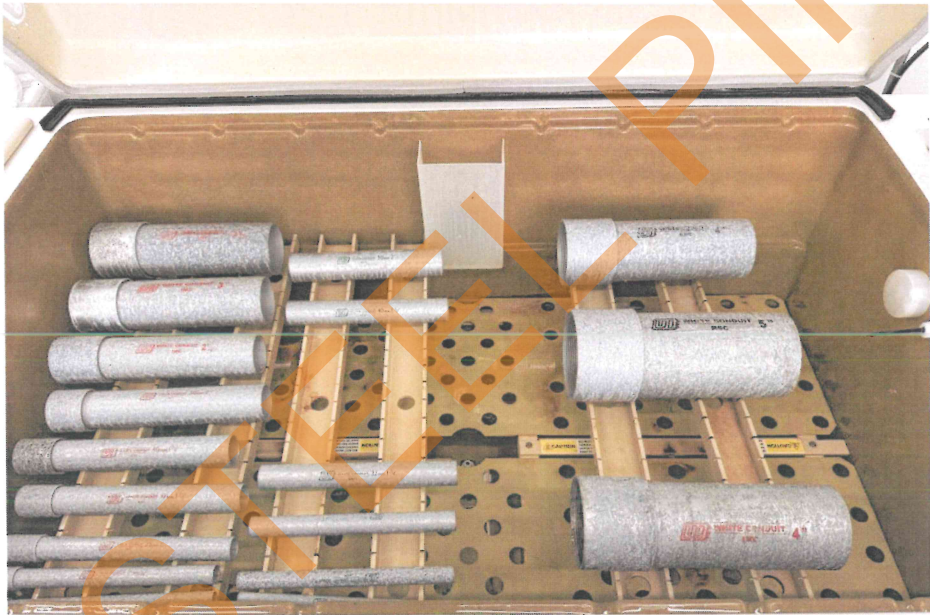
Tested instrument : - Salt Spray (Fog) Chamber (Q-FOG-CCT1100)  
- Digital Camera (Nikon D7500)

### 1. Background Information

UI Steel Pipe Company Limited is a manufacturer and distributor of coated steel pipe products, electrical conduit pipes, and electrical conduit joints under the UI trademark. In service, these products must be exposed to the general atmosphere. There may be different corrosion resistances in different areas. Therefore, it is often tested to evaluate its ability to resist corrosion.

The test that is commonly used is the salt fog test. This is an accelerated corrosion testing method. Its purpose is to evaluate the material's ability to resist corrosion by simulating actual use conditions in the field and testing them in the laboratory. It is a method that allows scientists and engineers to develop new products in a short period of time: for example, the development of coated steel sheet products, finding a new type of coating, etc.

Therefore, the company has sent these products, as shown in **Figure 1**, to the Smart Manufacturing and Maintenance Technology Research Team, the Rail and Modern Transport Technology Research Center (RMT), National Science and Technology Development Agency, which performed according to ISO 9227 standards for 24 hours to evaluate corrosion resistance using the salt spray technique in order to use the information to improve the design process and the production process for a longer lifespan.



**Figure 1:** Samples of part IMC CONDUIT coupling, RSC CONDUIT coupling, and EMT CONDUIT were used to test corrosion resistance by the salt spray technique.

## 2. Testing Methods

### 2.1 Salt Spray Test

#### 2.1.1 Testing apparatus and spraying system

- Q-FOG Model CCT-1100

#### 2.1.2 Sample preparation

- Samples were prepared according to the company's specification.

#### 2.1.3 Surface cleaning and preparation

##### 2.1.3.1 Surface cleaning before testing:

- None

##### 2.1.3.2 Surface cleaning after testing:

- Remove excessive salts with flowing tap water, but do not remove corrosion products, and then the surfaces were photographed.

#### 2.1.4 Testing conditions

##### 2.1.4.1 Testing standard: ISO 9227

-Type of testing: Neutral salt spray test -Grade of NaCl: AR grade 99.5%

-Type of solvent: Deionized water

-Concentration of solution:  $5 \pm 1$  wt. % of NaCl

-pH of solution: 6.85

-Conductivity:  $62 \text{ mS/cm}^2$

4.2 Temperature around the samples during testing:  $35 \pm 2 \text{ }^\circ\text{C}$

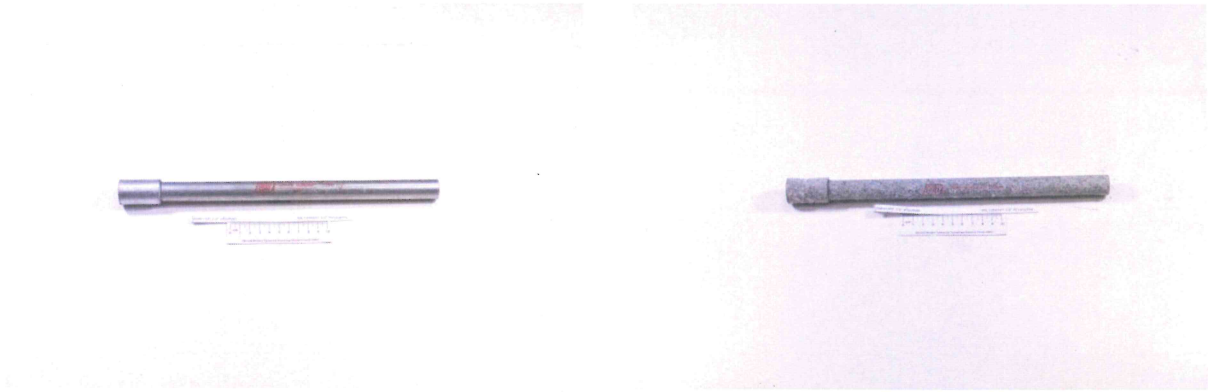
##### 2.1.4.2 Orientation of samples: Horizontal

##### 2.1.4.3 Testing period: 24 hours

##### 2.1.4.5 Interruption during testing: Non

## 3. Results

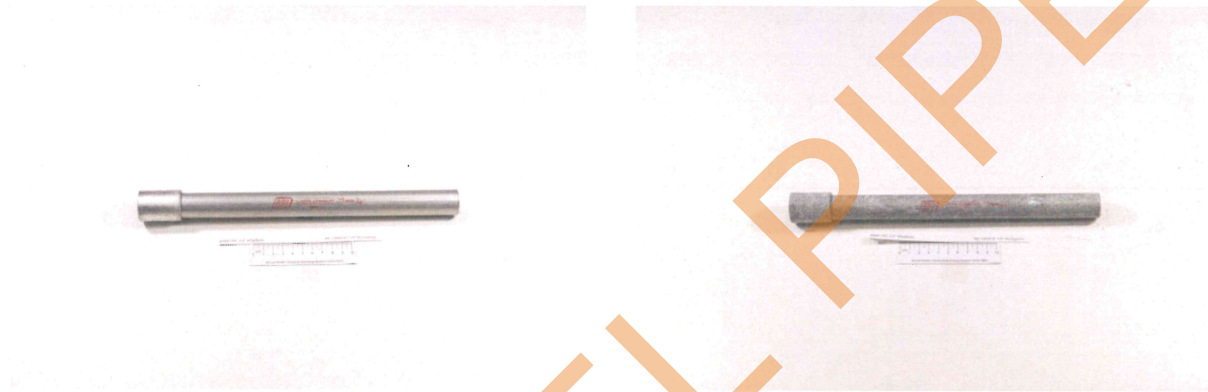
The physical appearances of the samples of IMC CONDUIT coupling, RSC CONDUIT coupling, and EMT CONDUIT before and after salt spray testing at 24 hours are shown in Figs. 2-19, respectively.



Sample before salt spray test

Sample after 24-hours salt spray test

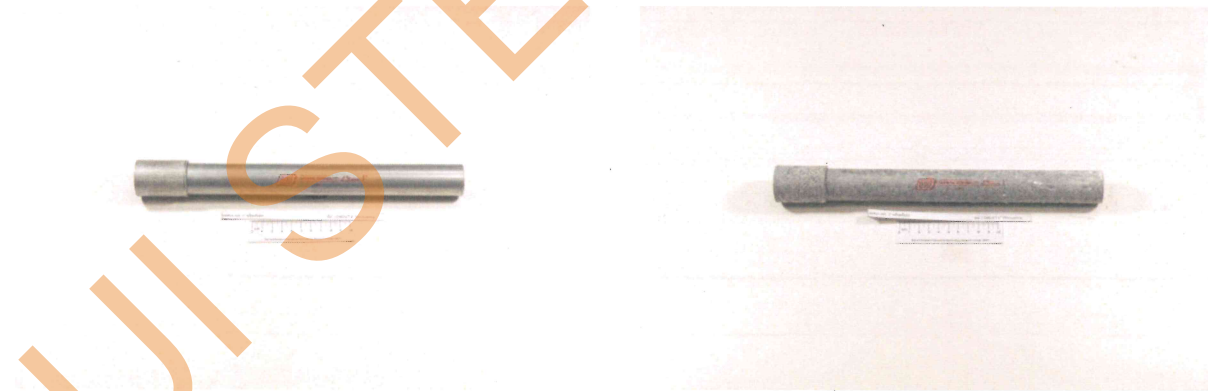
Fig. 2: IMC CONDUIT 1/2" W/coupling before-after salt spray test.



Sample before salt spray test

Sample after 24-hours salt spray test

Fig. 3: IMC CONDUIT 3/4" W/coupling before-after salt spray test.



Sample before salt spray test

Sample after 24-hours salt spray test

Fig. 4: IMC CONDUIT 1" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 5: IMC CONDUIT 1.1/4" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 6: IMC CONDUIT 1.1/2" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 7: IMC CONDUIT 2" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 8: IMC CONDUIT 2.½" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 9: IMC CONDUIT 3" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 10: IMC CONDUIT 3.½" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 11: IMC CONDUIT 4" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 12: RSC CONDUIT 4" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 13: RSC CONDUIT 5" W/coupling before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 14: EMT CONDUIT 1/2" before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 15: EMT CONDUIT 3/4" before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 16: EMT CONDUIT 1" before-after salt spray test.





Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 17: EMT CONDUIT 1.1/4" before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 18: EMT CONDUIT 1.1/2" before-after salt spray test.



Sample before salt spray test



Sample after 24-hours salt spray test

Fig. 19: EMT CONDUIT 2" before-after salt spray test.

#### 4. Conclusion

The results of salt fog corrosion resistance testing of all samples of IMC CONDUIT coupling, RSC CONDUIT coupling, and EMT CONDUIT samples after a 24-hour salt spray test are summarized in Table 1. It can be concluded that no rust spots can be detected (OK) in all samples.

Table 1: Summary of salt spray testing for 24 hours

Samples	24 hours	Samples	24 hours
IMC CONDUIT ½" W/coupling	OK	EMT CONDUIT ½"	OK
IMC CONDUIT ¾" W/coupling	OK	EMT CONDUIT ¾"	OK
IMC CONDUIT 1" W/coupling	OK	EMT CONDUIT 1"	OK
IMC CONDUIT 1.¼" W/coupling	OK	EMT CONDUIT 1.¼"	OK
IMC CONDUIT 1.½" W/coupling	OK	EMT CONDUIT 1.½"	OK
IMC CONDUIT 2" W/coupling	OK	EMT CONDUIT 2"	OK
IMC CONDUIT 2.½" W/coupling	OK		
IMC CONDUIT 3" W/coupling	OK		
IMC CONDUIT 3.½" W/coupling	OK		
IMC CONDUIT 4" W/coupling	OK		
RSC CONDUIT 4" W/coupling	OK		
RSC CONDUIT 5" W/coupling	OK		

#### 5. Reference

1. ISO 9227-2017, Corrosion tests in artificial atmospheres - Salt spray tests.
2. ASTM D610-01, Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces.
3. EN 12329:2000, Corrosion protection of metals Electrodeposited coatings of zinc with supplementary treatment on iron or steel.

Work Performed and Analyzed by:

(Mr. Witsanupong Khonraeng)

Senior Engineer

Approved by:

(Mr. Siam Kaewkumsai)

Project Manager

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