CU 16 - 00717

TEST ANALYSIS REPORT

PROJECT NAME :
Scale and Corrosion Removal Performance Evaluation of Indoor Pipe Scale Removal Device

KOREA CONFORMITY LABORATORIES

Plastic Reliability Center

시 험 분 석 보 고 서

CU 15 - 00717				
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과 제 명 : '옥내배관 스케일 제거 장치'의 스케일 및 부식 제거 성능평가				
용도 :				

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한국건설생활환경시험연구원장

비 고	

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Ⅰ. Purpose of the Test

In order to confirm the performance of 'Indoor Piping Scale Removal System' provided by IOREX and Corrosion-Reduced Performance as the result of quantitative , we used a ‘Closed Loop Test System’ equipment proposed by IOREX .

Ⅱ. During in TEST

Aug. 22. 2016 ~ Nov. 6.2016

Ⅲ. Test Department and contact person

1. Department : Korea conformity Laboratories Plastic Reliability Center
2. Test contact person : Senior Researcher Lee KyeongJae 이 경재
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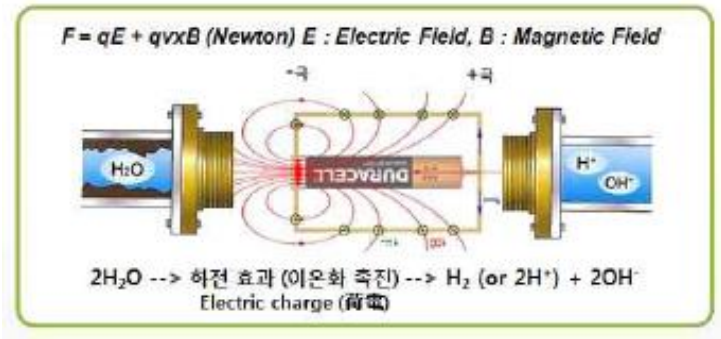
Ⅳ. Principles of Corrosion Suppression of Evaluation Products

The performance evaluation target is installed in the supply water pipe, and the fluid flow change to the piping system for the drainage and water supply of the water is strengthened to maximize (by Turbulence Jet) the friction phenomenon, thereby inducing the electrostatic field and inducing the generation of the electromotive force.
As shown in Figure 1, the water passing through the electrostatic field is momentarily ion-activated and donates electrons to the dissolved oxygen and dissolved substances in the water to induce the stabilized state, thereby suppressing the occurrence of rust and scale Effect.

Turbulence jet

Generation of electromotive force when water (conductive material) passes through a special carbon electrode (magnetic field) (Fleming's law)
: The ions dissolved due to the generated potential are ionized by the Lorentz electric field and ion collision reaction



Fi. 1. Principle of generating electromotive force of performance evaluation object

The remaining electrons in the water passing through the electrostatic field enter the piping system and combine with the pre-formed rust and scale existing in the inner wall of the pipe, thereby eliminating it from the inner wall of the pipe. As a result, the stability of the pipe and the effect Can be obtained.

Ⅴ. Selection of performance evaluation items and test methods

Subject to performance assessment proposed by the IOREX, as shown in Figure 2 below for an evaluation of its performance as a product, which leads to inhibition, such as water supply piping system and water supply are installed in the supply pipe for the future of the steel material pipe rust and scale after constructing the CLTS, the performance of the test object is verified by confirming the reduction of the rust generated by exposing the specimen of the steel material (see Fig.2)

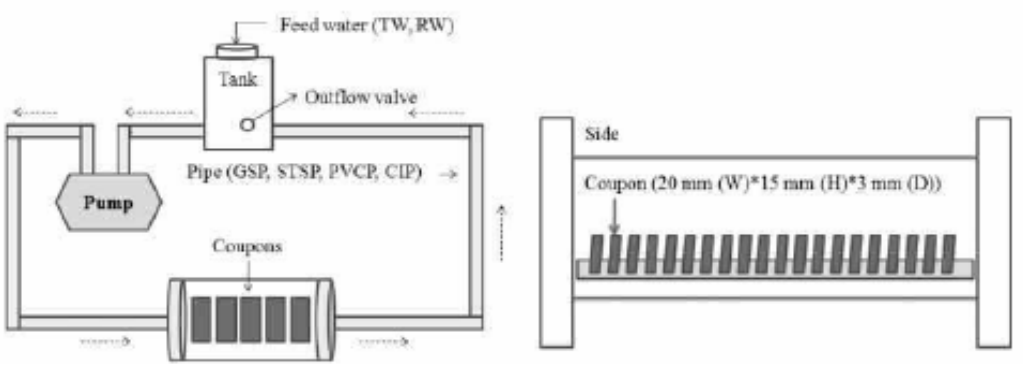


Fig. 2. CLTS structure for performance evaluation (Source: Kang Sungwon et al., 4, "Corrosion and Water Quality Effects of Sewage Reuse Water using Model Recycled Tube", Journal of Korean Society of Environmental Engineering, 37 (7), p473,2012

The equipment for the evaluation was designed to allow the water passing through the descaling unit provided by IOREX to flow through the specimen where corrosion occurred at a constant flow amount and flow rate. It was designed to check the flow rate and flow rate through a transparent tube with a corroded coupon and return to the tank through the pump. After the transparent tube where the coupon is located, there is a valve and a pipe that bypasses the test piece. This bypass pipe circulates the water without going through the coupon before the test, and carries out cleaning and pretreatment of the scale removal device to be evaluated.
The evaluation equipment is shown in Figure 3.

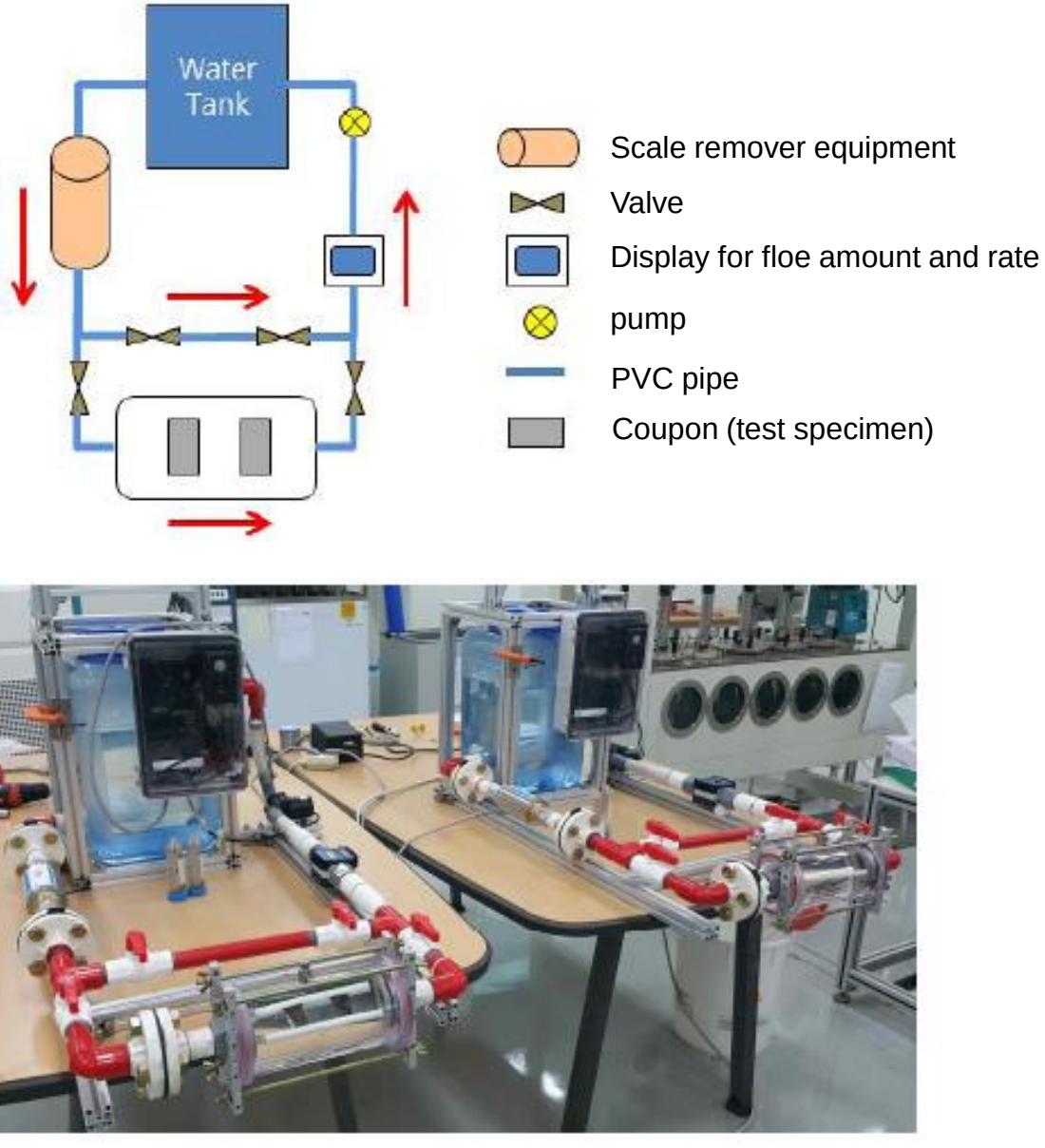


Fig. 3. Composition of Performance evaluation Test

Ⅵ. TEST Methods and Results

For this performance evaluation, a commercially available 0.6 mm thickness metal plate was purchased and cut size as 25 * 50 mm to prepare a test piece. The prepared metal specimens were left in acidic solution for one week at 80℃ for rapid corrosion (Figure 4).
The thickness of the corrosion generated on the specimen was measured using a tool microscope capable of measuring up to 0.001 mm in such a way that the corrosion layer was separated from the cross section of the corrosion-resistant metal specimen. The measured thickness of the corrosion layer is shown in Fig.6.

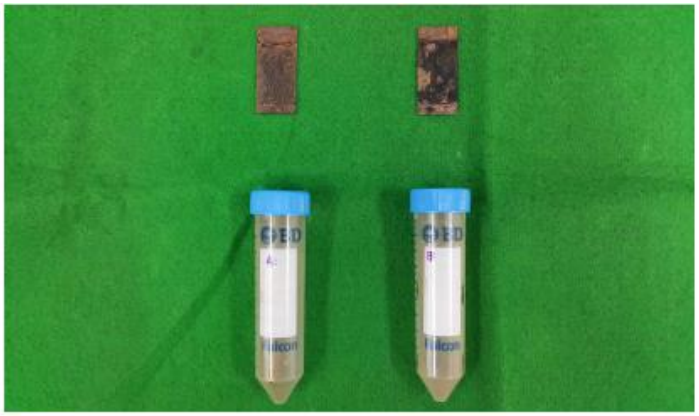


Fig. 4. generated corrosion metal specimen

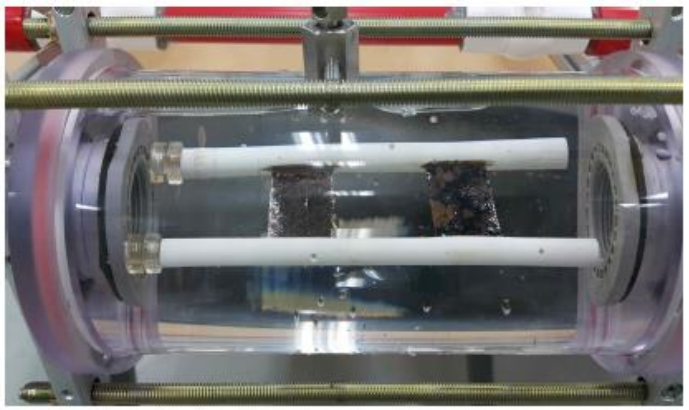


Fig. 5. Metal specimen installed on performance evaluation equipment

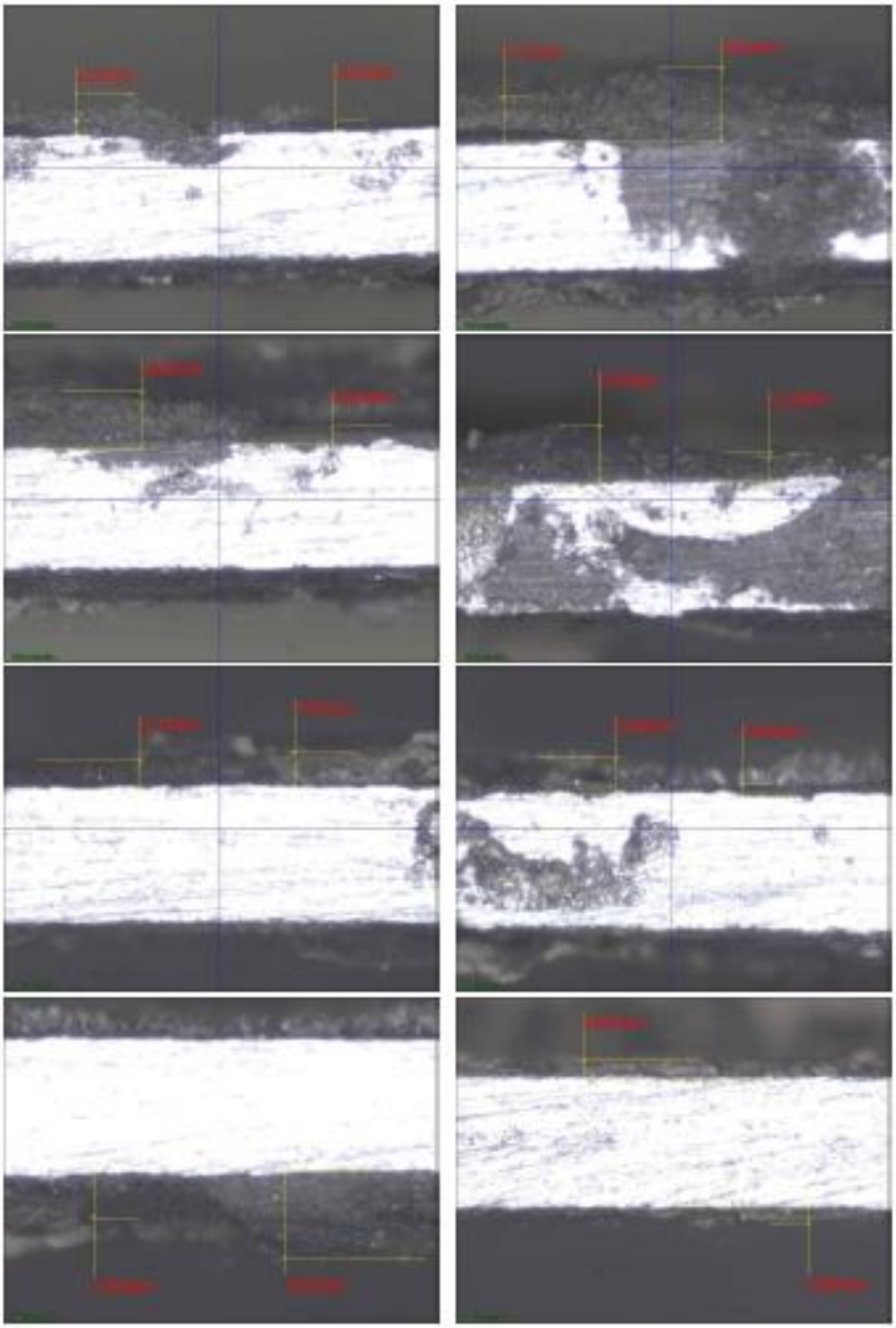


Fig. 6. Cross section of metal specimen after generated corrosion

Corrosion-generated coupons were installed on the test equipment manufactured for evaluation as shown in Fig.5. The water used in this evaluation was regular tap water so that the water used was the same as the actual conditions of use. The descaling device was cleaned and pretreated by circulating the water through the bypass pipe before and after the coupons installed and before the test. After that, the valve of the pipe was closed and the valve of the pipe with the coupon was opened to circulate the water at a rate of 24 L / min for 200 hours (Fig.7).

Fig. 7. Test flow amounts and rate

Coupons treated for 200 hours with the de-descaling device provided by IOREX were dried for 80℃ to 24 hours and then the remaining rust and scale was measured (Figure 8). The thickness of the corrosion layer before and after the evaluation is shown in Table 1and 2.

Table 1 corrosion thickness before evaluation

Corrosion thickness (mm)								avg
0.163	0.061	0.175	0.291	0.221	0.076	0.229	0.114	0.163
0.117	0.142	0.138	0.053	0.180	0.342	0.081	0.068	

Table 2 corrosion thickness after evaluation

Corrosion thickness (mm)								avg
0.035	0.033	0.019	0.046	0.035	0.054	0.033	0.110	0.061
0.042	0.039	0.072	0.077	0.056	0.105	0.100	0.114	

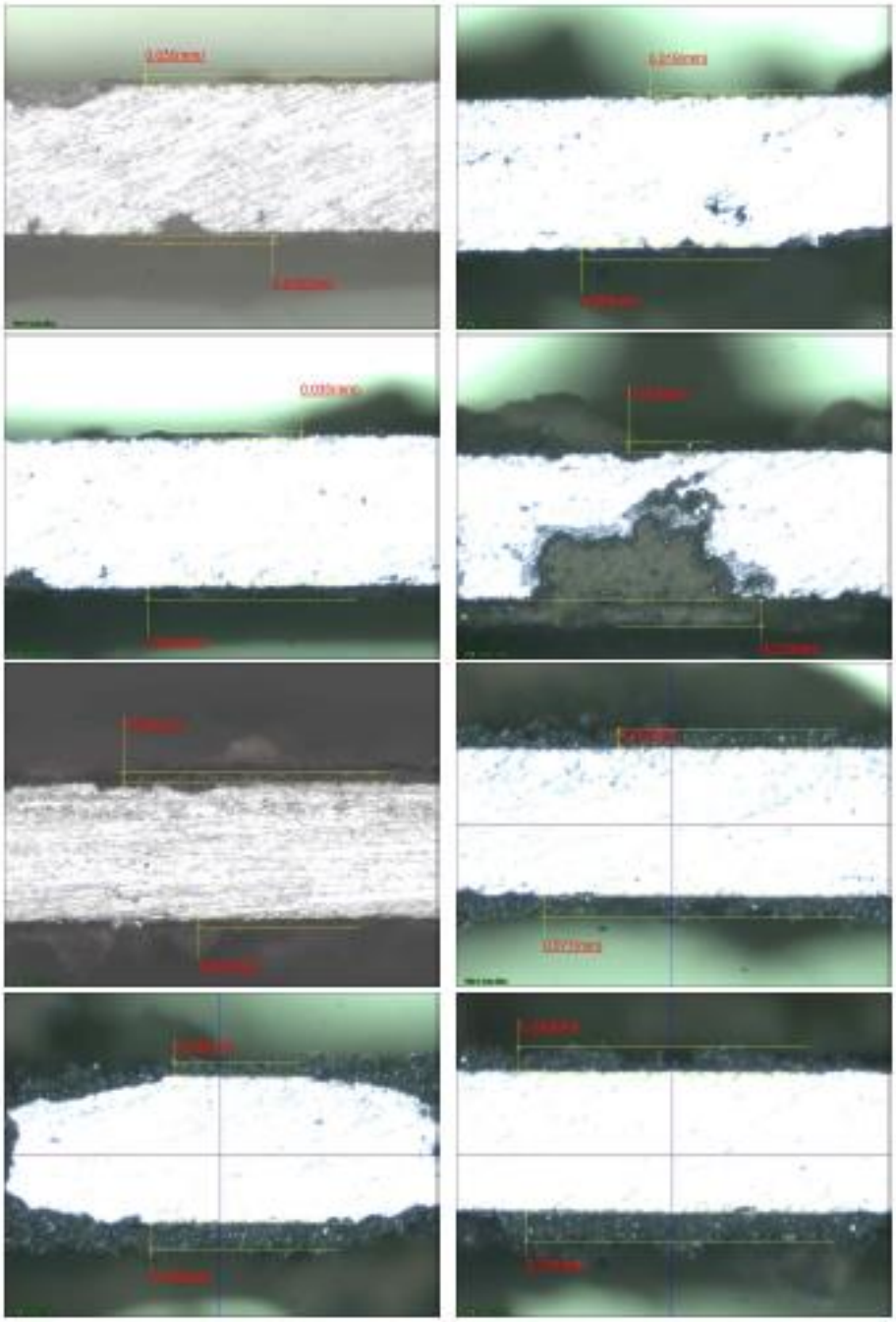


Fig. 8 cross section of metal specimen after 200 hrs in de-scaling device

Ⅶ. Comprehensive opinion

Corrosion means that when a metal is placed in an electrolyte such as water or soil, there is a local potential difference on its surface, resulting in a number of cathode and anode portions. At this time, a current flows between the cathode part and the anode part, so that the metal of the anode part dissolves into the electrolyte. Oxidation and reduction reactions occur at the anode portion having a low electric potential and the cathode portion having a high electric potential. At the anode portion, the metal loses electrons and becomes a cation. The cathode portion receives electrons and becomes an anion. The degree of corrosion is determined by the elution of metal ions and the ease of elution depends on how easily the metal is ionized in the aqueous solution.

In order for corrosion to occur, there must be an anode, a cathode, an electrical circuit, and an electrolyte. The object of this report is to maximize the friction phenomenon by inducing the electrostatic field and inducing the electromotive force to be generated by strengthening the fluid flow change to suppress and eliminate such corrosion. The water that has passed through the generated electrostatic field is activated by ion, and it plays a role of suppressing the cause of corrosion by inducing stabilization state by donating electrons to dissolved oxygen and dissolved substances in water.

This test was carried out to evaluate the rust suppression and removal performance of the test object.
This is a method of placing a sample on a pre-prepared CLTS test equipment in order to evaluate the ability of the test object to remove or inhibit rusting of the sample that has been pre-melted.
The difference in the local flow velocity due to the turbulence created on the rust-generated sample surface, including the fixed areas at both ends of the designed sample, creates Erosion Corrosion, a type of corrosion on the sample surface.
Erosion corrosion is the shock corrosion caused by the ejection of the liquid impinging on the metal surface, and the feeding of the corrosive medium and the movement of the corrosion products are carried out through the flow of the liquid.

In addition, there is a case where the corrosion product is separated from the metal surface by the pure mechanical factor, that is, the shear stress which increases the turbulence between the metal and the liquid.
In a particular case, these mechanical elements of erosion corrosion become stronger by floating solid particles such as bubbles and sand.
Although local erosion due to turbulent corrosion generally represents a bright surface free of corrosion products, the corrosion pits are shaved in the direction of the liquid flow and the cross-section represents the surface recessed to interfere with the flow of liquid.

This evaluation report was tested to evaluate the scale and corrosion removal performance of the indoor pipe descale system provided by IOREX. As a result, it was confirmed that the thickness of the corrosion layer decreased to 0.061 mm when the metal specimen having the corrosion layer having the average thickness of 0.153 mm was exposed to the object for 200 hours.