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# NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

# GB/T 47376-2026

## Full life cycle corrosion evaluation method for oil and gas well tubing strings

油气井管柱全生命周期腐蚀评价方法

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## 1 Scope

GB/T 47376-2026 is the Chinese national standard covering the corrosion a tubing string will suffer over the life of a well - the CO2, H2S, chlorides and water cut it will see as the well ages, the material selection that follows, and the monitoring and re-evaluation as the produced fluid changes. First edition, in force since 1 November 2026. It was issued on 30 April 2026 and takes effect on 1 November 2026, as a first edition. The document is under the responsibility of the Standardization Administration of China. This page is published from the official record of the 2026 edition; the clause text of a standard this recent is not yet in circulation, and the figures, limits and tables it contains are those of the document itself, delivered in full with the English translation.

6.2 Samples shall be taken from the tubing or casing using wire cutting or machining methods, with the sampling point 20 cm away from the male and female threaded ends of the tubing and casing. The sample surface should not have microstructure abnormalities, microcracks, or pits with a depth greater than 12% of the wall thickness.

6.3 Grind the sample surface with sandpaper until the final surface roughness is no greater than Ra0.8.After grinding, use acetone and alcohol to clean the sample. Perform degreasing for 3 to 5 minutes, dry with cold air, and place in a desiccator for later use.

6.4 Measure the geometric dimensions of the sample, and record the length, width,

thickness, and aperture size, accurate to

0.02 mm. When calculating the corrosion rate, the opening should be considered. The change in the total surface area of the sample after drilling was determined. The sample was then weighed three times consecutively, and the arithmetic mean was taken, accurate to

0.1 mg.

6.5 At least 3 parallel samples should be taken for each group of samples.

## 6 Samples

6.1 The sample size should preferably be 50mm x 10mm x 3mm. A circular hole with a diameter not exceeding 4mm is made at one end of the sample for use. The specimen is suspended or fixed, and a number is printed on the other end. A schematic diagram of the specimen shape and dimensions is shown in Figure 1. The unit is millimeters. Figure

### 7.1 Class I Environmental Corrosion Test

7.1.1 Test Procedure The tubing or casing samples were subjected to corrosion tests sequentially in three test media. fresh acid, residual acid, and formation water. The placement of the samples in each medium... The order of extraction is shown in Table 2, and the experimental procedure diagram is shown in Figure 2. Table

2.Sequence of placing and removing samples in three test media environments Serial Number Medium Test Specimen After Test, Remove Specimen and Add New Specimen

### 7.1.2 Fresh Acid Environment Corrosion Test

7.1.2.1 Inject fresh acid solution into the high-temperature and high-pressure reactor without deoxygenation, and test the acid concentration or pH value of the solution.

7.1.2.2 Fix the samples from groups A, B, and C (3 parallel samples per group) as specified in Table 2 onto the annular sample holder of the high-temperature autoclave. The length of the sample should be parallel to the autoclave wall, and there should be a minimum distance of

3.0 mm between samples. Confirm sample installation. After completion, seal the high-temperature and high-pressure autoclave.

7.1.2.3 The heating rate of the high-temperature and high-pressure reactor should be controlled at 3°C/min~6°C/min. After reaching the predetermined test temperature, N2 is injected, and the pressure is increased to the pre-pressurized level. The total pressure of the test should be determined, and the specific time should be determined based on the actual working conditions on site or through consultation. The test cycle should preferably

be 4 hours.

7.1.2.4 After the test, cool the high-temperature autoclave to room temperature, and take out the Group A samples in the order specified in Table 2 for use in tubing or casing. Analysis of the results of the fresh acid corrosion test.

7.1.2.5 Clean the samples from groups B and C with residual acid solution, blow them dry, and then place them in a drying oven under vacuum or inert gas protection. Store in a cool, dry place to prevent oxidation and contamination from contact with air.

7.1.2.6 Take a portion of the solution from the high-temperature autoclave and test the acid concentration or pH value of the solution.

7.1.2.7 Drain the residual liquid from the high-temperature and high-pressure reactor and thoroughly clean the reactor body.

### 7.1.3 Residual Acid Environmental Corrosion Test

7.1.3.1 Add the group D samples in the order shown in Table 2, and then fix them together with the group B and group C samples in the annular sample holder of the high-temperature and high-pressure reactor. Next, the residual acid environmental corrosion test was carried out. A pre-deoxygenated residual acid solution was injected into the high-temperature and high-pressure reactor, and the pH value of the solution was tested.

7.1.3.2 Introduce N2 into the high-temperature and high-pressure reactor at a flow rate of not less than 100 mL/min for deoxygenation, and the deoxygenation time shall not be less than 2 hours.

7.1.3.3 Heat to the predetermined temperature at the heating rate specified in 7.1.2.3, and inject CO2 and [other gases] according to the partial pressure of corrosive gases in the formation. H2S, N2 injected to the total test pressure, test cycle is the time of on-site residual acid backflow operation.

7.1.3.4 After the test, cool the high-temperature autoclave to room temperature, and take out the samples from groups B and D in the order shown in Table

2.The samples from group B are then used... Analysis of the results of the continuous corrosion test of oil tubing and casing with fresh acid and residual acid; Group D samples were used for oil tubing or casing after the residual acid corrosion test. Results analysis.

7.1.3.5 The C group samples were washed with formation aqueous solution, dried, and then stored in a drying oven under vacuum or inert gas protection. Avoid oxidation and contamination due to contact with air.

7.1.3.6 Test the pH value of the solution after the experiment.

### 7.1.4 Formation water environment corrosion test

7.1.4.1 Add the E group samples in the order shown in Table 2, and then fix them together with the C group samples on the annular sample holder of the high-temperature and high-pressure reactor. Further formation water environment corrosion tests were conducted by injecting pre-deoxygenated formation water solution into a high-temperature and high-pressure reactor and testing the pH value of the solution.

7.1.4.2 Introduce N2 into the high-temperature and high-pressure reactor to remove oxygen. The deoxygenation shall meet the requirements of 7.1.3.2.

7.1.4.3 Heat to the predetermined temperature at the heating rate specified in 7.1.2.3, and inject CO2 and [other gases] according to the partial pressure of corrosive gases in the formation. H2S, inject N2 to increase the pressure to the expected total test pressure, and the test time should be 7 days to 90 days.

7.1.4.4 After the test, cool the high-temperature autoclave to room temperature, and take out the oil pipe samples from groups C and E in the order shown in Table

2.Group C samples... Samples from group E are used for analyzing the results of continuous corrosion tests on tubing or casing subjected to fresh acid-residual acid-formation water. Analysis of the results of the corrosion test of the pipe through the formation water.

7.1.4.5 Test the pH value of the solution after the experiment.

### 7.2 Class II Environmental Corrosion Test

7.2.1 Inject pre-deoxygenated annular protective solution into the high-temperature and high-pressure reactor and test the pH value of the solution.

7.2.2 Introduce N2 into the high-temperature and high-pressure reactor to remove oxygen. The deoxygenation shall meet the requirements of 7.1.3.2.

7.2.3 Heat to the predetermined temperature at the heating rate specified in 7.1.2.3, inject N2, and pressurize to the expected total test pressure. The test time should be [time to be specified]. 7d~90d.

7.2.4 After the test, the high-temperature and high-pressure reactor was cooled to room temperature, and the samples were taken out for corrosion test result analysis.

7.2.5 Test the pH value of the solution after the experiment.

### 7.3 Class III Environmental Corrosion Test

7.3.1 Inject pre-deoxygenated formation simulation solution into the high-temperature and high-pressure reactor, test the pH value of the solution, and the sample installation shall