Cosmetic corrosion test method for automotive parts

1. Scope

This standard specifies a method to examine cosmetic corrosion of metalic material and surface treatment for automotive parts by cyclic corrosion test.

Remark: Applicable standards of this standard are shown as follows.

JIS C 2388	Pressure-sensitive polyester adhesive tapes for electrical insulation
JIS G 4401	Carbon tool steels
JIS K 1503	Aceton
JIS K 5400	Testing methods for organic coatings
JIS K 5538	Lucquer thinner
JIS Z 1524	Pressure sensitive adhesive polyvinyl chloride tapes for packaging
JIS Z 2371	Method of salt spray testing
JASO M 609	Corrosion test method for automotive materials

2. Definitions

Definitions of major terms used in this standard shall be as follows.

(1) Cosmetic corrosion
A corrosion phenomenon to damage parts appearance such as pitting and entire corrosion which is caused by such outside environmental factors as rainwater, sunshine, and salt for melting snow.

(2) Surface treatment
Such treatments as painting, plating, chemical treatment and anodization which are processed for decoration and anticorrosion.

(3) Cyclic corrosion test
A test in which a cyclic atmosphere consisting of salt water spraying, drying and wetting is repeated in order to approximate and activate a natural environment.

3. Type of test

The type of test shall be classified as Cyclic corrosion test.

4. Testing method

The testing method is such that a test piece prepared by a specified method shall be repeatedly exposed in a cyclic atmosphere consisting of salt spraying, drying and wetting maintained under a specified condition so as to evaluate cosmetic corrosions on a base metal and a surface treatment.

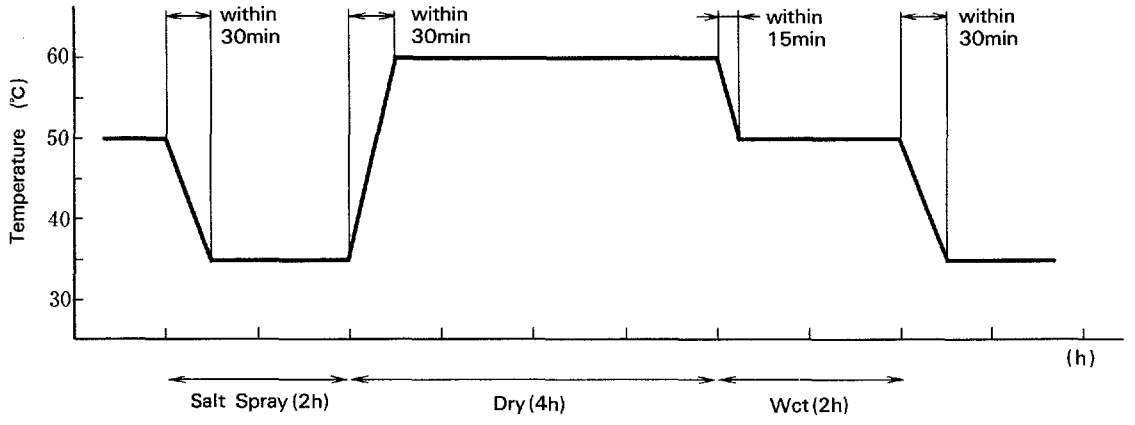
5. Test conditions

The preparation conditions and the test conditions shall be as shown in **Table 1** and **Table 2** respectively.
As to the heating conditions in preparation, taking account of environmental conditions where the parts are used, they shall be determined as agreed upon between the purchaser and the manufacturer.

Table 1 Preparation conditions

Type of test piece	Preparation	Conditions
Painted	Cutting	2 parallel cuts to the base
Surface treated other than paint, Not treated	Heating	(80 ± 5)°C or (120 ± 10)°C x 30 min.

Table 2 Test conditions

Item	Condition
1. Salt water spraying (1) Temperature (2) Density of salt	 35 ± 1°C 5 ± 0.5% Others shall conform to **JIS Z 2371**
2. Drying (1) Temperature (2) Relative humidity	 60 ± 1°C 20~ 30% RH
3. Wetting (1) Temperature (2) Relative humidity	 50 ± 1°C 95% RH and over
4. Duration and content per cycle	8 hours Salt spraying: 2 hours Drying: 4 hours Wetting: 2 hours (including time for each change respectively)
5. Time required in changing condition (Times required to reach the temperature and relative humidity specified for that condition after changing to the condition.)	From spraying to drying: within 30 minutes From drying to wetting: within 15 minutes From wetting to spraying: within 30 minutes (Spraying shall be, in principle, momentary)
6. Test pattern	
7. Test piece holding angle	Evaluation face of test piece shall be held at an angle of 15 ~ 20° to the vertical line

6. Test apparatus and instrument

(1) Test apparatus

The test apparatus to be required for this test shall consist of the salt spraying tower, tank of salt water for test, test piece holder, collecting container for sprayed solution, testing bath equipped with a temperature regulator, salt water supply tank, compressed air supplier, humidifier, dry air supplier, exhauster, and other necessary devices. The test apparatus shall satisfy to set up the specified test conditions as well as the conditions required as follows.

(a) The testing bath shall have capacity of 0.4 m^3 and over. However, the shape and dimensions have no restriction.

(b) The ceiling or top cover of the testing bath shall be so designed that the solution deposited on that place does not drop off onto the test piece.

(c) Corrosion resistive materials shall be used for the apparatus.

(d) The construction of the apparatus shall be so designed that the temperature and sprayed salt water in the testing bath shall not be influenced from the outside air, and the solution dropped from the test piece shall not be reused for further tests.

(e) The test piece holder shall hold the test piece at the specified angle.

(f) The collecting container for sprayed solution shall be a clean container having a horizontal collecting area of of 80 cm^2 and located at least two positions where the uniformity of salt water spraying may be confirmed.
For example, one is located at a place near the test piece, another is located at a place near the salt water spraying tower, and the other is located at a place far away.

(g) The humidifier shall have a capability to set up to the specified wetting condition.

(h) The dry air supplier shall have a capability to set up to the specified drying condition.

(i) The exhauster shall be so designed that the salt water spraying is not influenced from the outside wind pressure.

(j) The maintenance control of the test apparatus shall be properly achieved so as to always obtain the specified conditions.

A typical example of the test apparatus shall be as shown in **Fig. 1.**

(2) Point micrometer
This is an instrument to measure the position at which the plate thickness is decreased by corrosions, and it shall have capability to measure a range of 1/1000 mm. However, an alternative instrument may be used if it has capability to measure the equivalent range.

(3) Tapes for masking
The tapes shall be used for masking a portion on a test piece where shall not be subjected to a test, thus it shall protect the masked portion from salt water and moisture, and shall be free from peeling off during a test. The polyester adhesive tapes conforming to the requirements specified in **JIS C 2338** are suitable for this purpose.

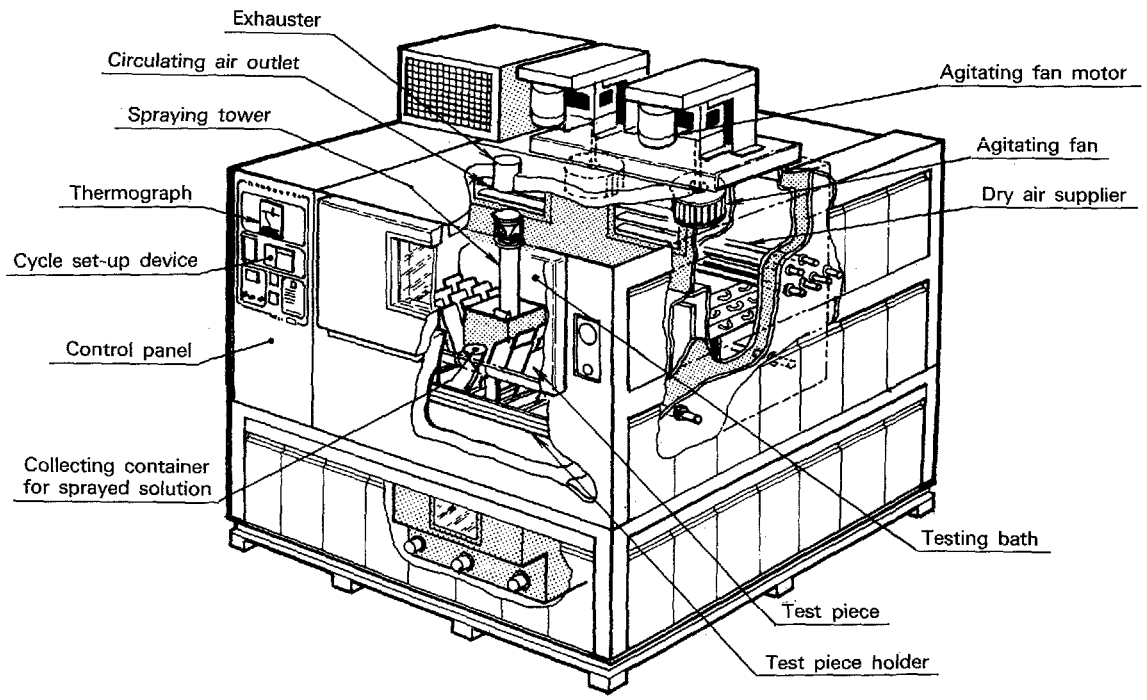
(4) Tapes for peeling-off
Cloth adhesive tapes specified in **JIS Z 1524** having width of 25 mm or equivalent shall be used.

(5) Cutter knife
A half side cutter made from SK2 specified in **JIS G 4401** having width of approximately 18 mm shall be used.

7. Reagent

The salt solution shall be a neutral sodium chloride solution and shall conform to the requirement specified in **6** of **JIS Z 2371** (Salt solution for salt spray testing).

Fig. 1 An example for cyclic corrosion test apparatus



8. Test piece

The test piece shall be a part itself or cut from a part. The numbers of test pieces shall be 3 per type.
However, when they are not suitable for the test pieces because of their shapes or masses, test pieces of flat sheet may be used upon agreement between the purchaser and the manufacturer.

9. Commencement of test

9.1 Preparation

(1) Parts painted

60 mm long two lines parallel and 30 mm apart to each other shall be cut with a cutter knife with a depth of cut reaching the base metal surface. In this case, 15 mm of minimum space is necessary from the edge of the evaluated face to the cuts. Length and numbers of the cuts may be reduced, when the area of the evaluated face is small.

(2) Parts surface-treated other than painting and Parts not treated

Constat-temperature oven shall be used and the test piece shall be held in the oven for specified hours after reaching specified temperature.

9.2 Cycle test

After checking a condition of salt spraying previously, a test piece is placed in the testing bath, stopping spraying a moment and then the test starts. As to painted parts, the cuts shall be placed vertically.

10. Continuation of test

The test shall be, in principle, continued during the period of the test. When the test is to be temporarily stopped for an intermediate inspection or putting in and out of the specimens, an effort shall be taken to minimize the time of period to be stopped. When a stoppage is to be continued for a long time, the test pieces shall be washed with water to remove the deposited salt, placed in an oven of 50°C for one hour for drying, and stored in a desiccator until resumption of the test.

11. Duration of tests

Duration of the test shall be determined as agreed upon between the purchaser and the manufacturer.

Informative reference:
It should preferably be set up the duration of tests as follows.

10 cycles (80 hours)
30 cycles (240 hours)
60 cycles (480 hours)
120 cycles (960 hours)

12. Handling and disposition of test pieces after testing

After testing, the test pieces shall be taken out with care to eliminate to damage the surface. In order to remove salt deposited on the surface of test pieces, the test pieces shall be washed up with water of ordinary temperature and immediately dried off in a room temperature.

13. Method of evaluation for test results

The methods of evaluation for test results shall conform to **Table 3** in which the methods are classified into "parts not treated" and "parts surface-treated"

Table 3 Evaluation item and evaluation method

Material or sort of treatment			Evaluation item	Evaluation method
Parts not treated	Stainless steel		Corrosion depth	Maximum corrosion depth method
			Cosmetic corrosion	Corrosion rating number method
	Aluminum alloy expanded material		Corrosion depth	Maximum corrosion depth method
	Aluminum alloy die-casting material Zinc ally die-casting material		Cosmetic corrosion	Corrosion crade method
Parts treated	Painted		Cosmetic corrosion	Peeling width method of coating film Blistering width method of coating film
	Plated	Zinc plated	Cosmetic corrosion	Corrosion grade method
		Nickel plated Chromium plated	Cosmetic corrosion	Corrosion rating number method
	Chemical treatment		Cosmetic corrosion	Corrosion grade method
	Anodization		Cosmetic corrosion	Corrosion rating number method

13.1 Corrosion depth

Corrosion product shall be removed by the method shown in **Attached table 1**. A little remainder may be removed by using nylon brush and others. In addition, corrosion depthes shall be obtained on three test pieces by the following method and maximum value of them shall be shown as the test result.

(1) Maximum corrosion depth method
Remaining plate thickness of all pitted portions originated on an evaluation face shall be measured as fine as $\frac{1}{1000}$ mm with a point micrometer, being rounded off to $\frac{1}{100}$ mm as an effective figure Difference in thickness from initial one is obtained at each pitted portion and a maximum value of them is defined as "corrosion depth".

13.2 Cosmetic corrosion

(1) Corrosion rating number method
The results are evaluated by the method specified in **JIS Z 2371, 13.** (Evaluation method) **(1)** (Area method) and the obtained rating number is shown as the test result.

(2) Blistering width method of coating film
Maximum blistering width at one side of a cut is measured as fine as $\frac{1}{10}$ mm with a slide caliper and the value is defined as "blistering width".

(3) Peeling width method of coating film
Leaving the test pieces as they are approximately for 24 hours after taking them out, taping the cuts lines for peeling off the coating-film, rubbing the tape thoroughly with a fingertip to have a good adhesion, the tapes shall be quickly peeled off in such manner that the test pieces are placed in horizontal level, and the tapes are pulled up obliquely at an angle of a range from 30° to 40° to the horizontal surface by holding the tape end. This operation shall be applied three times, then the maximum width of the coating-film peeled off at one side shall be measured down the order of $\frac{1}{10}$ mm with a slide caliper, etc. and the value is defined as "width of coating-film peeled off".

(4) Corrosion grade method
Cosmetic corrosion after testing shall be evaluated by type of corrosion and corrosion area using **Table 4** Evaluation criteria of corrosion grade. However, when more than two types of corrosion are included, a larger numerical fig. of cosmetic corrosion grade shall be selected for the evaluation.

Table 4 Evaluation criteria of corrosion grade

Type of corrosion	Corrosion area	Cosmetic corrosion grade
No corrosion	0%	0
Spotting corrosion (Incl. filiform corrosion)	5% max.	1
White corrosion	25% max.	2 ~ 1
	25 ~ 50%	2 ~ 2
	50% min.	2 ~ 3
Rust	25% max.	3 ~ 1
	25 ~ 50%	3 ~ 2
	50% min.	3 ~ 3
Erosion	100%	4

Remark: When test piece is stored, after completing a series of measurement, it is preferable to coat clear paint and store it in a desiccator.

14. Records

The following items shall be recorded.

(1) Name and type of test apparatus
(2) Names, material and sort of surface-treatment of test piece
(3) Preparation of test piece
(4) Preparation method or conditions of test
(5) Temperature and relative humidity during the test
(6) The following numerical values derived from the containers to collect each spraying solution
  (a) Extracted quantity per one hour
  (b) Density of salt, specific gravity and pH
(7) When discontinued a test, the reason and duration of the stoppage
(8) Number of cycles (or duration of tests)
(9) Removing method for corrosion product
(10) Test results
(11) Photographs of test pieces, if necessary

Attached table 1 Chemical method for removal of corrosion products

Material	Chemicals	Time	Temperature	Remark
Aluminium and Aluminium alloy	Join 50 ml of phosphoric acid (H_3PO_4, 1.69 in specific gravity), 20 g of chromium oxide (VI) (CrO_3) and distilled water to make 1000 ml.	5 to 10 minutes	90°C boiling	When the coating of corrosive product remains, the following nitric acid treatment is successively carried out.
	Nitric acid (HNO_3, 1.42 in specific gravity)	1 to 5 minutes	20 to 25°C	In order to prevent a reaction inducing excess removal of underlying metal, peripheral extraneous matters and bulky corrosion products are removed.
Stainless steel	Join 100 ml of nitric acid (HNO_3, 1.42 in specific gravity) and distilled water to make 1000 ml.	20 minutes	60°C	–
	Join 150 g of diammonium citrate [$(NH_4)_2HC_6H_5O_7$] and distilled water to make 1000 ml.	10 to 60 minutes	70°C	–
	Join 100 g of citric acid ($C_6H_8O_7$), 50 ml of sulfuric acid (H_2SO_4, 1.84 in specific gravity), 2 g of inhibitor (diorthotolylthiourea, quinoline ethyliodide, or β-naphtholquinoline), and distilled water to make 1000 ml.	5 minutes	60°C	–
	Join 200 g of sodium hydroxide (NaOH), 30 g of potassium permanganate ($KMnO_4$), 100 g of diammonium citrate [$(NH_4)_2HC_6H_5O_7$] and distilled water to make 1000 ml.	5 minutes	Boiling	–
	Join 100 ml of nitric acid (HNO_3, 1.42 in specific gravity), 20 ml of hydrofluoric acid (HF, 0.987 in specific gravity) and distilled water to make 1000 ml.	5 to 20 minutes	20 to 25°C	–
	Join 200 g of sodium hydroxide (NaOH), 50 g of powdery zinc and distilled water to make 1000 ml.	20 minutes	Boiling	Since powdery zinc naturally ignites by contact with air, care shall be taken therefor.

Explanatory note on JASO M 610-92 Cosmetic corrosion test method for automotive parts

This **Explanatory notes** are only for explaining articles specified in the **Standard** and their relatings, thus the stated do not form any part of the **Standard.**

Introduction

Recently, corrosion of automobiles has been increasing due to the deterioration of driving circumstance such as spattering of salt for melting snow at a cold district in North America and such anticorrosion technology as surface treated plate plus cathodic electrodeposition coating has become practical.

However, there is no evaluation method of this anticorrosion technology being commonly used other than salt spray testing, therefore at present stage automobile manufacturers are now fumbling after several testing methods prepared by themselves.

Under this background, as to the steel plate for automotive body, "Sub-committee of corrosion test method for automotive materials" was organized in Material committee of society of automotive engineers of Japan in 1987. The standardization was studied, conducting Round robin test for several surface treatments and "**JASO M 609** Corrosion test method for automotive materials" was established in 1991.

One year later than the start up of this subcommittee, in 1988 "Sub-committee of cosmetic corrosion test method for automotive parts" was organized for automotive parts in the Material committee.

Under such circumstances as mentioned above, this sub-committee undertook to study the items peculiar to the parts, taking over the results of "Sub-committee of corrosion test method for automotive materials", and several tests were conducted under the basic requirements deseribed as follows.

(1) Basic requirements of cyclic corrosion shall be same as those for Corrosion test method for automotive materials, so as to obtain reproductivility of origination and acceleration of corrosion as experienced in actual service in market.

(2) Since the functions which the parts have are various and their corrosion mechanisms are different with each other, in consideration of difficulty in standardization, the object to study shall be defined only to cosmetic corrosion.

(3) As the problems peculiar to the parts, cracks and heat are taken into consideration and the test method shall be so constructed as to evaluate their effects.

(4) International application shall be possible.

(5) Engineering level shall be practically operable for each firm. Since automotive parts consist of so wide range of materials including not only steel but also aluminium and stainless steel, Round robin tests of various materials shown in **Explanatory table 1** have been newly conducted for 3 years from 1988 through 1990, being repeatedly tested concentratedly on those items which

Explanatory table 1

Test piece	Material	Surface treatment	Damage
Flat plate	SPCC	Not treated, Zinc plating (yellow), Zinc plating (green), Chromats-zinc coating (Dacrotized coating), Cathodic electrodeposition coating, Fe-Zn alloy plating, Zn plating plus fluorine resin coating	Heat, Cracks
	SUS 304	Not treated	
	ADC 10	Not treated, Acrylic resin coating	
	FC 250	Not treated, Alkyd resin coating	
Bolt, Nut	SWCH	Not treated, Zinc plating (yellow), Zinc plating (green), Chromats-zinc coating, Anodic electrodeposition coating, Fe-Zn alloy plating	Heat
	SUS 304	Not treated	Heat

JASO M 609 can not cover. The cycle corrosion test requirements which are proper to the corrosion test method for automotive parts were obtained resulting in establishing this test method.

Purpose

The purpose of establishing this standard is to standardize a cosmetic corrosion testing method for automotive parts so as to ensure the proper quality and to minimize overlapped tests. The supplemental explanations shall be given as necessary in the following part (item numbers in the following are the same as those in the **Standard**).

1. Scope

The reason for selecting only cosmetic corrosion for the standardization is that this is the most essential corrosion, and other so called functional corrosions are not uniform in their mechanism, thus it is difficult to evaluate all of these functional corrosions by a type of test method, and this subject is most requested from each company. Further, subject materials and surface treatments are considered for those parts commonly being used as automotive parts listed in **Explanatory table 1.**

2. Definitions

In the technical field to evaluate corrosion resistibility of automotive materials, there are usually more terms customarily used than those specified in **JIS** standards.
In this standard the terms commonly being used are adopted considering the actual situation, but all of them are not always used as the uniform meanings. Therefore, in order to clarify these meanings, the definitions of the terms are provided herewith.

(1) Cosmetic corrosion
Among the various corrosions originated during using automobiles, a limited condition which defines the corrosion as those caused by outside environmental factor was clarified.

(2) Surface treatment
There are very many sorts and various usages in surface-treatments. This standard clarifies to define the usages as these being processed for anticorrosion of automotive parts and lists those sorts most commonly being used.

(3) Cyclic corrosion test
Another terms such as combined test or combined corrosion test is used, however, this term has possibility to be interpreted that several conditions may be simultaneously set with several factors for corrosion. The test specified in this standard is such that a composite test combining corrosion factors is repeatedly proceeded with, therefore the word of cyclic corrosion test is adopted in order to eliminate a confusion.

3. Type of test

The type of test shall basically conform to those methods specified in "Corrosion test method for automotive materials". For comparison purpose, experiments were conducted upon setting three conditions as shown in **Explanatory table 2.**

As the result, some difference was found between CCT-1 and CCT-2 but it was not so decisive, thus the conditions of CCT-2 was adopted, thinking basically much of identicalness with the test method for automotive materials.

4. Test method

As the factors having an effect on cosmetic corrosion of parts, there are heat generated from an engine and chipping cracks caused by sand dust being rolled up by wheels. Therefore, in order to evaluate their effects, providing previously heat or cuts is specified as a preparation.

Explanatory table 2

Test name	Condition of cycle	Wet ratio	Remark
SST	—	100%	—
CCT-1	SST (4h) + DRY (2h) + WET (2h)	75%	Acceleration priority mode
CCT-2	SST (2h) + DRY (4h) + WET (2h)	50%	**JASO M 609** mode

5. Test conditions

The conditions of cyclic testing shall be quite same as that of corrosion test method for automotive materials.
As for the preparation, the effects of heat and cuts were determined to be experimented, and the test pieces with cuts heated previously were prepared and provided for the cyclic testing.
As the results, it was found that cuts have significant effects on painted parts and heat has a big effect on both surface treated parts other than the painted and not treated parts, thus the preparation is specified as shown in the **Standard.**
Further, as to the cutting method, cross-cutting is more popular, but it was determined to adopt parallel cutting considering the difficulty and a large error in measuring a peeling width and a blistering width at a crossing point of two lines.
As to the test piece holding angle, the angle most commonly being used was selected in accordance with that of the corrosion test method for automotive materials. However, as to Bolt and Nut, round robin test was proceeded holding an evaluated top face at an angle of 70° to 75° to the vertical line.
As the results, effects on the corner was too significant due to small area of the head, and it was determined to unify to use those angles commonly used, considering that an effect brought by an angle of evaluated face is small.

6. Test apparatus and instrument

(1) Test apparatus
The construction of the test apparatus was determined to be same as that specified in the corrosion test method for automotive materials, considering that the apparatus should be basically set up the conditions listed in **Table 2** of the standard.

(2) Point micrometer
A point micrometer is adopted considering that it is commonly used for measurement of corrosion depth and is also specified in the corrosion test method of automotive materials.

(3) Tapes for masking
The same tapes for masking as those specified in the corrosion test method for automotive materials are adopted, since there are some cases requiring masking depending on the shapes of the parts used for the test.

(4) Tapes for peeling
For commonly used tapes for adherence test for painted-films, adhesive tapes of cellophane specified in **JIS K 5400** are mostly being used.
However, cloth adhesive tapes were adopted, since it is preferable to use the tapes having stronger adhesion in order to find surely the portion where adherence of painted-films is reduced and the same tapes are specified in the corrosion test method for automotive materials.

(5) Cutter knife
This is to be used to prepare cut lines on painted parts. It was determined to use same one as that for the corrosion test method for automotive materials.

7. Reagent

A salt solution used for salt water spraying shall to conform to **JIS Z 2371.**

8. Test pieces

In the round robin test, test pieces in shape of flat plate was used. However, it is natural to use the transaction part itself for the test piece in the corrosion test.
Therefore, it was concluded in this standard that test piece shall be the part itself as much as possible and if it is impossible due to the size and others, it shall be cut off depending on the necessity.

9. Commencement of test

9.1 Preparation

How to provide cut lines and heat is specified in detail.

9.2 Cyclic test

In the past standardization of such test, definition of the start of test has not been satisfactorily clarified. Therefore, in this standard, an intention to clarify this problem was incorporated. Since it is difficult to accurately measure the collected amount of spraying because the salt water spraying condition shall be moved to the following drying condition after 2 hours in one cycle. Therefore, a practical test shall be entered after confirming the amount of spraying and pH which are collected from an operation for 24 hours after starting under a predetermined salt water spraying condition.

10. Continuation of test

Unnecessary break of a test shall be prohibited in order to minimize influences to the test results. However, considering unavoidable break of a test for a long period of time due to a long vacation such as the year end and new year time, the method for handling of test pieces during such break time is involved.

11. Duration of tests

Determined duration of tests or numbers of cycles shall be different according to the type of parts and required performance. In this standard, duration of tests is not determined based on an idea to exclude a specification for performances. It shall be necessary to determine the product specification as agreed upon between the purchaser and manufacturer. However, the appropriate time durations from the test results which obtained from the round robin test, are to be presented as an informative reference.

12. Handling and disposition of test pieces after testing

The stated shall be matters of common sense, and described to call the concerned attention.

13. Evaluation method of test result

Type of corrosion is determined depending on the test piece material. In this standard, it is determined that pitting corrosions are evaluated as to stainless steels and aluminium alloy extended material and cosmetic corrosions are evaluated as to other materials and surface treated parts.

13.1 Corrosion depth

There are many methods of measuring corrosion depth. Here, even though it lacks a little accuracy, a micrometer in which measurement is simple was adopted.
The reason is that for example, even though the method of section inspection by microscopic structure is accurate, it takes too much time, therefore, it is impractical if it is required to measure many corrosion points as ordinary work.
Further, **JIS Z 2371** was quoted as to **Attached table 1** Chemical method for removal of corrosion products.

13.2 Cosmetic corrosion

As evaluation methods of cosmetic corrosion, there are many methods. These are determined by materials and a sort of surface treatments. In this standard, 4 types of methods were specified. They are corrosion rating number method, blistering width method of coating film, peeling width method of coating film and corrosion grade method.

(1) Corrosion rating number method
This method is adopted to those cases when the surfaces are passivated and spottedly corroded, which can be seen in case of stainless steel, nickel plating, chromium plating and anodization. The method conforms to the specification of **JIS Z 2371.**

(2) Blistering width method of coating film
This method is adopted for painted parts. The commonly used method of measuring maximum blistering width on one side was adopted.

(3) Peeling width method of coating film
In peeling off the tapes, individual differences are not avoidable as to peeling off speed and peeling angle.
Therefore, in order to minimize this individual differences, the peeling off shall be repeated 3 times.

(4) Corrosion grade method
Many materials and surface treatments such as aluminium alloy die casting, zinc plating and chemical treatments which are corroded from the surface on the whole area are usually evaluated by corroded area.
However, the evaluation by the corroded area will lack accuracy and a little difference is apt to be evaluated meaninglessly. Accordingly, the corroded area is divided and classified into 6 stages and is evaluated by the rank. Further, in order to avoid dispersion of evaluation error, it is preferable to exchange a grade sample of cosmetic corrosion on each object part between the parties concerned.

14. Records

In order to properly understand the test results, the items for the minimum requirements are listed.
The photographs of test pieces referred in **(11)** shall be such data for better understanding as supplemental informations for the numerical data. Therefore, the photographs should preferably be respectively prepared before and after testing (before and

after peeling-off paint-films for painted parts). In addition, for a close-up photography, it should be preferable to photograph the test pieces with a gray paper for a background and a scale graduated in 1 mm positioning near the test pieces for convenience of observation on the corroded surfaces.

In the event of any doubt, the original
standards in Japanese should be referred.

SI THIRD PHASED STANDARD

(The standard where SI units and newly values are given and do not using customary units, but it is excepted that the standards are represented in only accustomed metric units as m, A, Hz etc.)

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