

Fundamentals of Environmental Testing Standards

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Certification systems are a current hot topic within the field of quality control, and such systems are increasingly being discussed within the context of standards. To keep readers up-to-date in this area, we are presenting an overview of the fundamentals of standards for environmental testing, an area that is central to quality control activity in the field of electricity and electronics.

1. Standardization

We all practice standardization in our everyday activities. For example, the center line on the highway does not mean, “Drive on whichever side of the road you please!” In Japan, driving on the left is standard, making for a safe and smooth flow of traffic. It seems like an obvious convention, but it is also an extremely important one for an automotive society such as ours.

While standardization can also be seen as imposing restrictions, having everyone follow the same rules plays a crucial role in providing the ability to carry on trouble-free routines in our daily lives.

The original attempt to create an international standard was the “Metric Convention,” issued in 1875. This convention constituted an effort to define an international standard for the unit of measure, and the major contribution of that standard to the development of technology and industry is well known today.

That original initiative brought a keen awareness among the nations of the need for international standards, leading to the establishment of the International Electrotechnical Commission (IEC) in 1908 and the International Organization for Standardization (ISO) in 1947. At present, the IEC and ISO are central to a major trend of standardization for all kinds of industrial products.

2. Environmental testing standards

The standardization process referred to in section 1 yields common rules called “standards.” These standards range from the in-house variety imposed by a company all the way up to the international standards agreed upon throughout the world. The industrial standards commonly used in Japan are the Japanese Industrial Standards, better known as JIS.

In JIS, the term “standards” is defined as follows.

“In order to transmit benefits and convenience fairly between related individuals with a unified and simple purpose, [standards are] specified agreements on technical matters directly or indirectly related to goods and services for specified agreements in such matters as goods, performance, capacity, configuration, status, operation,

sequence, methods, procedures, responsibilities, duties, competence, methods of approach, and concepts.”

Standards play a vital role in the field of environmental testing as well. Investigating and setting all of the individual test conditions can be a daunting task for persons running the tests, and any inconsistencies in test methods and conditions from one tester or group of testers to the next could create real problems. For these reasons, unified standards are essential in such areas as test methods, test conditions, test equipment, and recording, measuring, and evaluating the tests. Standards covering these areas are collectively referred to as “environmental testing standards.”

3. Aims and role of environmental testing standards

3-1 Providing common yardsticks and assurances

By standardizing such matters as safety, quality, test methods, equipment compatibility, and properties of materials, we are able to provide common yardsticks for making judgments. As a result, we not only eliminate wasted effort in investigations and in stages of performance, we are also able to provide mutual assurances.

3-2 Providing yardsticks

On our first attempt to run a test, or when trying to modify a test method, we really need some sort of yardstick for determining such matters as test sequences and test conditions. Even slight variances in conditions during environmental tests can have a major impact on test results, and so one problem in a field such as environmental testing is the real difficulty in achieving theoretical correspondence in test results. Such difficulties place a premium on experience in the area of environmental testing. In today’s atmosphere of intense corporate competition, experience also helps in the arduous task of obtaining information concerning tests run by competitors. Due to the limited amount of details available, environmental testing standards can provide a valuable yardstick for discerning the true meaning behind the announced results of testing by competitors.

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3-3 Serving as a manual

The standards do not merely determine test conditions and the method and sequence of the test. Standards also offer reference data, present techniques for running the test skillfully, and provide valuable information on organizing and judging test results.

The atmospheric data recorded in the US military standard MIL-STD-810, for example, is generally very difficult to obtain. In such cases, standards can be used as manuals.

3-4 Providing a source of information on test trends

Given the dizzying pace of today’s technical progress, standards rarely endure over long periods of years, instead being frequently revised in accord with current conditions. As has been mentioned, information is relatively scarce in the arena of environmental testing, and investigating test trends in this secretive atmosphere can be very time-consuming. However, the effort to obtain information concerning transitions or revisions of standards is a means of obtaining valuable information on recent technological trends in testing, and should not be neglected.

4. Classification of standards

Various methods are used to classify standards. Classification can be made according to the organizations managing the standards, it can be made according to the items to which the standards are applied, or it can be made according to the purpose of the standards. More classification methods exist than can be enumerated. Let’s look at some examples of classification.

- (a) Classification according to the organization managing the standard — Refer to Table 1.
- (b) Classification according to the items to which the standards are applied

[Example of plastics]

- ISO 178 Plastics-Determination of flexural properties
- ISO 4892-1 Plastics-Methods of exposure to laboratory light sources-Part 1: General guidance
- JIS K 6900 Plastics-Vocabulary

- (c) Classification according to purpose

[Example of temperature tests]

- IEC 60068-2-2 Environmental testing. Part 2: Tests. Test B: Dry heat
- MIL-STD-810 Method 501 High temperature

Below are examples of classification based on the managing organizations (Table 1). These can be broadly divided into international standards, regional standards, national standards, and group standards.

5. Overview of major environmental testing standards

5-1 IEC (International Electrotechnical Commission)

The IEC sets standards in the field of electricity and electronics, and is headquartered in Geneva, Switzerland. Currently, as of November 2000, the group counts 61 member nations, including Japan. Since the IEC standards cannot issue standards without international agreement, the contents of the standards reflect concessions to the circumstances of various countries.

Table 1 Classification of standards (Classification by managing organizations)

Classification	Major standards
International standards Standards created through international cooperation for the mutual benefit of various countries and employed throughout the world.	ISO (International Organization for Standardization) Responsible for standardization in fields other than electricity and electronics. Examples include the ISO 9000 Series (quality management systems) and the ISO 14000 Series (environmental management systems).
	IEC (International Electrotechnical Commission) Responsible for standardization in the fields of electricity and electronics.
Regional Standards Standards established and applied within the limits of a specific region.	EN (European Unified Standards) Unified standards set by the CEN (The European Committee for Standardization) and CENELEC(European Committee For Electrotechnical Standardization)
National standards Domestic standards established by authorized agencies and created through mutual agreement of various interested parties of that country.	Japan JIS (Japan Industrial Standards) USA ANSI (American National Standards) Britain BS (British Standard) Germany DIN (Deutsche Institute für Normung) China GB (Guojia Biaozhun)
Organizational Standards Institutes and industrial organizations handle standardization as one of their activities. Standards are created by agreement among the members, and so as a rule are used within the organization, or to facilitate their dealings and transactions.	Japan JASO (Japan Automobile Standards Organization) EIAJ (Japan Electronics and Information Technology Industries Association) JTM (Testing Machinery Association of Japan) USA MIL (US Military Standards) and so on

5-1-1 How to read IEC standard ID numbers

IEC 60068-3-1 A
(1) (2) (3)

- (1) Number of the standard (not particularly classified, numbers are determined by the order in which the standards are enacted)
- (2) Section and sub-section (none, when there is no section or sub-section)
- (3) Supplement (alphabetic character)

5-1-2 Revisions

In principle, IEC standards are deliberated every five years, and can either be “confirmed” (deliberations find contents appropriate to current circumstances, and they are left unchanged), “amended” or “abolished.” When a section of text is amended, the details are issued as an

“amendment.” Such amendments are issued as No.1, No.2, etc. in the order in which each amendment was made. Therefore, when investigating a standard, one must also check for amendments.

[Example]

IEC60068-2-1 (issued in 1990)	43 pages
Amendment No.1 (issued in 1993)	3 pages
Amendment No.2 (issued in 1994)	7 pages

Accordingly, the most recent edition of IEC60068-2-1 consists of all three of these documents.

5-1-3 Environmental Tests

Series 60068 (environmental tests) is used most often. The 60068 series was deliberated and enacted by IEC Technical Committee TC104 (environmental conditions, classification and test methods). (Refer to Table 2.)

Table 2 The IEC60068 Series and corresponding JIS numbers

No. (Publication date)	Title	JIS
60068-1(1998)	General and guidance	C-0010*
60068-1-am1(1992)	Amendment No.1	
60068-2-1(1990)	Cold	C-0020
60068-2-1-am1(1993)	Amendment No.1	
60068-2-1-am2(1994)	Amendment No.2	
60068-2-2(1974)	Dry heat	C-0021
60068-2-2-am1(1993)	Amendment No.1	
60068-2-2-am2(1994)	Amendment No.2	
60068-2-3(1969)	Damp heat, steady state	
60068-2-5(1975)	Simulated solar radiation at ground level	
60068-2-6(1995)	Vibration (sinusoidal)	C-0040
60068-2-7(1983)	Acceleration, steady state	C-0045
60068-2-7-am1(1986)	Amendment No.1	
60068-2-9(1975)	Guidance for solar radiation testing	
60068-2-9-am1(1984)	Amendment No.1	
60068-2-10(1988)	Mould growth	
60068-2-11(1981)	Salt mist	C-0023
60068-2-13(1983)	Low air pressure	C-0029
60068-2-14(1984)	Change of temperature	C-0025
60068-2-14-am1(1986)	Amendment No.1	
60068-2-17(1994)	Sealing	C-0026*
60068-2-18(2000)	Water	C-0034
60068-2-20(1979)	Soldering	C-0050
60068-2-20-am2(1987)	Amendment No.2	
60068-2-21(1999)	Robustness of terminations and integral mounting devices	C-0051*
60068-2-27(1987)	Shock	C-0041*
60068-2-28(1990)	Guidance for damp heat tests	C-0033
60068-2-29(1987)	Bump	C-0042
60068-2-30(1980)	Damp heat, cyclic (12 +12-hour cycle)	C-0027
60068-2-30-am1(1985)	Amendment No.1	
60068-2-31(1969)	Drop and topple, primarily for equipment-type specimens	C-0043
60068-2-31-am1(1982)	Amendment No.1	
60068-2-32(1975)	Free fall (Procedure 1)	C-0044
60068-2-32-am2(1990)	Amendment No.2	
60068-2-33(1971)	Guidance on change of temperature tests	
60068-2-33-am1(1978)	Amendment No.1	

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60068-2-38(1974)	Composite temperature/humidity cyclic test	C-0028
60068-2-39(1976)	Combined sequential cold, low air pressure, and damp heat test	
60068-2-40(1976)	Combined cold/low air pressure tests	C-0030
60068-2-40-am1(1983)	Amendment No.1	
60068-2-41(1976)	Combined dry heat/low air pressure tests	C-0031
60068-2-41-am1(1983)	Amendment No.1	
60068-2-42(1982)	Sulphur dioxide test for contacts and connections	C-0090
60068-2-43(1976)	Hydrogen sulphide test for contacts and connections	C-0092
60068-2-44(1995)	Guidance on Test T: Soldering	
60068-2-45(1980)	Immersion in cleaning solvents	C-0052
60068-2-45-am1(1993)	Amendment No.1	
60068-2-46(1982)	Hydrogen sulphide test for contacts and connections	C-0093
60068-2-47(1999)	Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests	C-0047*
60068-2-48(1982)	Guidance on the application of the tests of IEC 68 to simulate the effects of storage	
60068-2-49(1983)	Guidance on Test Kc: Sulphur dioxide test for contacts and connections	C-0091
60068-2-50(1983)	Combined cold/vibration (sinusoidal) tests for both heat-dissipating and non-heat-dissipating specimens	C-0038
60068-2-51(1983)	Combined dry heat/vibration (sinusoidal) tests for both heat-dissipating and non-heat-dissipating specimens	C-0037
60068-2-52(1996)	Salt mist, cyclic (sodium, chloride solution)	C-0024
60068-2-53(1984)	Guidance to Tests Z/Afc and Z/BFc: Combined temperature(cold and dry heat) and vibration (sinusoidal) tests	C-0039
60068-2-54(1985)	Soldering-Solderability testing by the wetting balance method	C-0053
60068-2-55(1987)	Bounce	
60068-2-56(1988)	Damp heat, steady state, primarily for equipment	C-0032
60068-2-57(1999)	Vibration-Time-history method	
60068-2-58(1999)	Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)	C-0054*
60068-2-59(1990)	Vibration-Sine-beat method	
60068-2-60(1995)	Flowing mixed gas corrosion test	C-0048
60068-2-61(1991)	Climatic sequence	C-0035
60068-2-64(1993)	Vibration, broad-band random (digital control) and guidance	C-0036
60068-2-65(1993)	Vibration, acoustically induced	
60068-2-66(1994)	Damp heat, steady state (unsaturated pressurized vapour)	
60068-2-67(1995)	Damp heat, steady state, accelerated test primarily intended for components	
60068-2-68(1994)	Dust and sand	
60068-2-69(1995)	Solderability testing of electronic components for surface mount technology by the wetting balance method	
60068-2-70(1995)	Abrasion of marking and letterings caused by rubbing of fingers and hands	
60068-2-74(1999)	Fluid contamination	
60068-2-75(1997)	Hammer tests	
60068-2-77(1999)	Body strength and impact shock	
60068-3-1(1974)	Background information-Section One: Cold and dry heat tests	C-0095
60068-3-1A(1978)	First supplement	
60068-3-2(1976)	Background information-Combined temperature/low air pressure tests	
60068-3-3(1991)	Guidance-Seismic test methods for equipment	C-0055
60068-4(1987)	Informational for specification writers-Test summaries	
60068-4-am1(1992)	Amendment No.1	
60068-4-am2(1994)	Amendment No.2	
60068-5-1(1991)	Guide to drafting of test methods. General principles	
60068-5-2(1992)	Guide to drafting of test methods-Terms and definitions	

* These correspond to the IEC numbers, but correspondences are only shown for old editions.

5-2 JIS (Japan Industrial Standards)

JIS sets standards for industrial products through industrial standardization laws aimed at improving quality. The Ministry of Economy, Trade and Industry enacts the standards based on investigations by the Japanese Industrial Standards Committee. As of March 2000, 8,768 JIS standards have been enacted.

To promote international coordination of standards, many currently enacted JIS standards are direct translations of ISO and IEC standards. As a result, JIS standards now are issued using a system of section and sub-section numbers and supplements that were not used in earlier JIS standards.

5-2-1 How to read JIS standard ID numbers

The JIS number is composed of an alphabetic character used as a department symbol, and a classification number.

JIS C 0010- 1993
(1) (2) (3)

- (1) The number of the department (C stands for electronic equipment and electrical machinery.)
- (2) The number of the standard (The first two digits on the left represent the classification. For C, 00 through 09 represent general classification.)
- (3) The calendar year of the enactment or revision

5-2-2 Revision

In principle, JIS standards are deliberated every five years, and can either be “confirmed,” “revised” or “abolished.” To help you keep abreast of new developments in this area, the Japanese Standards Association publishes its official monthly magazine called The Standardization Journal, and you can also find information on the Japanese Standards Association homepage at <http://www.jsa.or.jp/>.

5-2-3 Environmental test standards

A number of environmental test methods are established in JIS, but the most common series for the electrical and electronics field is the C0010 series, almost all of which has been adopted from the aforementioned IEC60068 series. (However, the details of some standards have been modified to conform to the actual circumstances in Japan.) (Refer to Tables 3 and 4.)

Table 3 JIS C0010 Series (Environmental testing)

No.	Title
C0010:93	General and guidance
C0020:95	Cold
C0021:95	Dry heat
C0022:87	Damp heat, steady state
C0023:89	Salt mist
C0024:00	Salt mist, cyclic (sodium, chloride solution)
C0025:88	Change of temperature
C0026:94	Sealing
C0027:88	Damp heat, cyclic (12 +12-hour cycle)
C0028:88	Composite temperature/humidity cyclic test
C0029:89	Low air pressure
C0030:95	Combined cold/low air pressure tests
C0031:95	Combined dry heat/low air pressure tests
C0032:96	Damp heat, steady state, primarily for equipment
C0033:93	Guidance for damp heat tests
C0034:96	Water
C0035:96	Climatic sequence
C0036:97	Vibration, broad-band random (digital control) and guidance
C0037:97	Combined dry heat/vibration (sinusoidal) tests for both heat-dissipating and non-heat-dissipating specimens
C0038:97	Combined cold/vibration (sinusoidal) tests for both heat-dissipating and non-heat-dissipating specimens
C0039:97	Guidance to Tests Z/Afc and Z/BFc: Combined temperature(cold and dry heat) and vibration (sinusoidal) tests
C0040:99	Vibration (sinusoidal)
C0041:95	Shock
C0042:95	Bump
C0043:95	Drop and topple, primarily for equipment-type specimens
C0044:95	Free fall (Procedure 1)
C0045:93	Acceleration, steady state
C0046:93	Impact, spring hammer
C0047:95	Mounting of components, equipment and other articles for dynamic tests including shock (Ea), bump (Ed), vibration (Fc and Fd) and steady-state acceleration (Ga) and guidance
C0048:99	Flowing mixed gas corrosion test
C0050:96	Soldering
C0051:94	Robustness of terminations and integral mounting devices
C0052:95	Immersion in cleaning solvents
C0053:96	Solderability testing by the wetting balance method
C0054:94	Solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)
C0055:00	Guidance. Seismic test method for equipments
C0061:00	Fire hazard testing - Needle-flame test
C0062:87	Fire hazard testing - bad-connection test with heaters

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C0063:00	Fire hazard testing - Guidance for assessing fire hazard of electrotechnical products—General guidance
C0064:93	Fire hazard testing. Part 1: Guidance for the preparation of requirements and test specifications for assessing fire hazard of electrotechnical products: guidance for electronic components
C0065:93	Fire hazard testing. Part 1: Guidance for the preparation of requirements and test specifications for assessing fire hazard of electrotechnical products: Guidance for use preselection procedures
C0066:93	Methods of test for the determination of the flammability of solid electrical insulating materials when exposed to an igniting source
C0067:99	Terminology concerning fire test
C0068:95	Fire hazard testing - Diffusion type and premixed type flame test methods
C0069:95	Fire hazard testing - 1 kW nominal pre-mixed test flame and guidance
C0070:96	Fire hazard testing. Assessment of potential corrosion damage by fire effluent—General guidance
C0071:97	Fire hazard testing - 500 W nominal test flames and guidance
C0072:97	Fire hazard testing - Glow-wire test methods—General
C0073:97	Fire hazard testing - Glow-wire end-product test and guidance
C0074:97	Fire hazard testing - Glow-wire flammability test on materials
C0075:97	Fire hazard testing - Glow-wire ignitability test on materials
C0076:97	Fire hazard testing. Guidance on the minimization of toxic hazards due to fires involving electrotechnical products—General
C0077:99	Fire hazard testing - Assessment of potential corrosion damage by fire effluent—Guidance on the selection and use of test methods
C0078:00	Fire hazard testing. Guidance and test methods for the minimization of the effects of abnormal heat on electrotechnical products involved in fires-Method for testing products made from non-metallic materials for resistance to heat using the ball pressure test
C0090:93	Sulphur dioxide test for contacts and connections
C0091:93	Guidance on Test Kc: Sulphur dioxide test for contacts and connections
C0092:93	Hydrogen sulphide test for contacts and connections
C0093:93	Guidance on Test Kd: Hydrogen sulphide test for contacts and connections
C0094:93	An appraisal of the problems of accelerated testing for atmospheric corrosion
C0095:95	Background information—Cold and dry heat tests

Table 4 JIS C0010 Series (Classification of environmental conditions)

No.	Title
C0110:95	Classification of environmental parameters and their severities
C0111:95	Environmental conditions appearing in nature. Temperature and humidity
C0112:95	Classification of groups of environmental parameters and their severities introduction
C0113:96	Environmental conditions appearing in nature. Precipitation and wind
C0114:97	Classification of groups of environmental parameters and their severities—Storage
C0115:97	Environmental conditions appearing in nature. Air pressure
C0116:97	Classification of groups of environmental parameters and their severities—Stationary use at weatherprotected locations
C0117:97	Classification of groups of environmental parameters and their severities—Stationary use at non-weatherprotected locations
C0118:99	Environmental conditions appearing in nature. Solar radiation and temperature
C0119:99	Classification of groups of environmental parameters and their severities. Portable and non-stationary use
C0120:00	Classification of groups of environmental parameters and their severities. Microclimates inside products

5-3 MIL (US military standards)

MIL (Military Specifications and Military Standards) is a document used by the US Department of Defense. This document was drafted exclusively with regard to materials, products, and labor used by the federal government or military agencies.

Features include: (1) revisions are made promptly when something is found to be amiss; (2) equipment and manufacturers are specified; and, (3) constant supervision is required due to frequent revisions.

Since environmental tests were historically developed within the framework of military use, military standards have exerted a major influence on all types of environmental testing standards. Furthermore, it has become extremely common for these standards to be applied in fields outside the military.

5-3-1 Organization

The organization of the military standards is as follows.

- Military Specifications
Drafted for individual items
- Military Standards
Drafted to prescribe technical methods for standard items, and to explain such methods
- Military Handbook
Drafted to explain and provide a commentary on technological data for military specifications and military standards

5-3-2 How to read MIL standard ID numbers

MIL-STD-883 E 1010.7
 (1) (2) (3) (4) (5)

- (1) Classification — The following abbreviations are used.
- SPEC: military specification
 - STD: military standard
 - HDBK: military handbook
- (2) Number of the standard
- (3) Alphabetic character indicating the revision
- (4) Number of the individual test method
- (5) Character indicating the individual test method revision. Depending on the standard number, this can be either an alphabetic character or a numeral.

5-3-3 Revisions

A standard generally does not have binding force on its own, and so merely abolishing an old standard does not prevent its use. In fact, care must be taken with MIL standards because old versions are often used. The following three types of revisions are used.

- (1) Amendment
- (2) Change Notice
- Small-scale revisions are merely issued on an alteration page. One must realize that details from previous Change Notices are not included. In this case, only the test number is revised. (Previous item (5))
- [Example] MIL-STD-883D 1010.6
 →MIL-STD-883D 1010.7
- (3) Complete revision
- Large-scale revisions result in the entire standard being re-issued. In such cases, the alphabetic character at the end of the standard number is changed.
- [Example] MIL-STD-883D → MIL-STD-883E

The three instances above are not decoded in the same way as the JIS standards. The only way to tell the new versions from the old ones is to compare the texts. Also, the test method may be revised as in (2) even when the entire standard is not re-issued as in (3), and so when investigating MIL standard test methods, you must confirm the test method number.

5-3-4 Environmental test standards

The following are some typical environmental testing standards.

- MIL-STD-202 Test Methods for Electronic and Electrical Component
- MIL-STD-750 Semiconductor Devices
- MIL-STD-810 Environmental Engineering Considerations and Laboratory Tests
- MIL-STD-883 Microcircuit

Tables 5 through 8 show environmental test methods from within each of the standards.

Table 5 MIL-STD-202F Test Methods for Electronic and Electrical Component Parts Class 100 (Environmental Tests)

No.	Title
101	Salt spray (corrosion)
102	Temperature cycling
103	Humidity (steady state)
104	Immersion
105	Barometric pressure (reduced)
106	Moisture resistance
107	Thermal shock
108	Life (At elevated ambient temperature)
109	Explosion
110	Sand and dust
111	Flammability (external flame)
112	Seal

Table 6 MIL-STD-750D Semiconductor Devices 1000 Class Environmental Tests

Method	Title
1001	Barometric pressure (reduced)
1011	Immersion
1015	Steady-state primary photocurrent irradiation procedure (electron beam)
1016	Insulation resistance
1017	Neutron irradiation
1018	Internal water-vapor content
1019	Steady-state total dose irradiation procedure
1020	Electrostatic discharge sensitivity (ESDS) classification
1021	Moisture resistance
1022	Resistance to solvents
1026	Steady-state-operation life
1027	Steady-state operation life (sample plan)
1031	High-temperature life (nonoperating)
1032	High-temperature (nonoperating) life (sample plan)
1033	Reverse voltage leakage stability
1036	Intermittent operation life
1037	Intermittent operation life (sample plan)
1038	Burn-in (for diodes, rectifiers, and zeners)
1039	Burn-in (for transistors)
1040	Burn-in (for thyristors (controlled rectifiers))
1041	Salt atmosphere (corrosion)
1042	Burn-in and life test for power MOSFET's or insulated gate bipolar transistors (IGBT)
1046	Salt spray (corrosion)
1048	Blocking life
1049	Blocking life (sample plan)
1051	Temperature cycling (air to air)
1054	Potted environment stress test
1055	Monitored mission temperature cycle
1056	Thermal shock (liquid to liquid)
1061	Temperature measurement, case and stud
1066	Dew point
1071	Hermetic seal
1080	Single event gate rupture and drain burnout test

Table 7 MIL-STD-810F Environmental Engineering Considerations and Laboratory Tests Laboratory Test Methods

No.	Title
500	Low Pressure (Altitude)
501	High Temperature
502	Low Temperature
503	Temperature Shock
504	Contamination by Fluids
505	Solar Radiation (Sunshine)
506	Rain
507	Humidity
508	Fungus
509	Salt Fog
510	Sand and Dust
511	Explosive Atmosphere
512	Immersion
513	Acceleration
514	Vibration
515	Acoustic Noise
516	Shock
517	Pyroshock
518	Acidic Atmosphere
519	Gunfire Vibration
520	Temperature, Humidity, Vibration, and Altitude
521	Icing/Freezing Rain
522	Ballistic Shock
523	Vibro—Acoustic/Temperature

Table 8 MIL-STD-883E Microcircuit Environmental Tests

Method	Title
1001	Barometric pressure, reduced (altitude operation)
1002	Immersion
1003	Insulation resistance
1004	Moisture resistance
1005	Steady state life
1006	Intermittent life
1007	Agree life
1008	Stabilization bake
1009	Salt atmosphere (corrosion)
1010	Temperature cycling
1011	Thermal shock
1012	Thermal characteristics
1013	Dew point
1014	Seal
1015	Burn-in test
1016	Life/reliability characterization tests
1017	Neutron irradiation
1018	Internal water-vapor content
1019	Ionizing radiation (total dose) test procedure
1020	Dose rate induced latchup test procedure
1021	Dose rate upset testing of digital microcircuits
1022	Mosfet threshold voltage
1023	Dose rate response of linear microcircuits

(Cont.)

(Cont. from the previous column)

1030	Preseal burn-in
1031	Thin film corrosion test
1032	Package induced soft error test procedure (due to alpha particles)
1033	Endurance life test
1034	Die penetrant test (for plastic devices)

5-4 Standards of Japanese organizations

5-4-1 JASO (Japanese Automobile Standards Organization)

Automobile standards issued by the Japanese Automobile Standards Organization are generally referred to as “JASO standards.” The most commonly used standard for environmental tests is the “General Rules of Environmental Testing Methods for Automobile Electronic Equipment D001.” This standard sets 26 test methods for such environmental tests as the temperature and humidity cycle test, the low-temperature shelf test, and the dew cycle test. Table 9 shows test items from this standard.

Table 9 JASO D001 General rules of environmental testing methods for automotive electronic equipments

Method No.	Title
5.1	Normal power supply voltage test
5.2	Test for power supply voltage upon engine starting
5.3	Power source micro interruption test
5.4	Power supply inverse polarity connection test
5.5	Overvoltage test (A method)
5.6	Overvoltage test (B method)
5.7	Transient voltage characteristics test
5.8	Electrostatic test
5.9	Conducted electromagnetic test
5.10	Radiated electromagnetic test
5.11	Temperature characteristic test
5.12	Low temperature maintain test
5.13	Low temperature operation test
5.14	High temperature maintain test
5.15	High temperature operation test
5.16	Heat cycle test
5.17	Thermal shock test
5.18	Temperature and humidity cycle test
5.19	Constant high humidity test
5.20	Dew formation test
5.21	Water resistance test
5.22	Salt water spray test
5.23	Vibration test
5.24	Shock resistance test
5.25	Dust resistance test
5.26	Oil resistance test

* An English version of JASO D001 has been issued.

5-4-2 EIAJ (Electronic Industries Association of Japan, currently Japan Electronics and Information Technology Industries Association)

The creation of the Japan Electronics and Information Technology Industries Association (JEITA) in November 2000 resulted from a merger of the Japan Electronic Industry Development Association and the Electronic Industries Association of Japan. Existing standards from the old organizations were transferred unchanged to the new organization. In other words, standards from the Electronic Industries Association of Japan, known as “EIAJ standards,” continue to exist and are still called “EIAJ standards.” Standards are issued for each individual environmental test. Table 10 presents some examples of EIAJ environmental testing standards.

Table 10 EIAJ standards for environmental test methods

No.	Title
CP-5102	Methods of measurement on receiving antennas for SHF satellite broadcast transmission (mechanical and environmental characteristics)
ED-2531	Environmental test methods for Liquid Crystal Display devices
ED-4701*	Environmental and endurance test methods for semiconductor devices
ED-8403	Environmental and endurance test methods for semiconductor pressure sensors (diffused piezoresistance type)
ED-8503	Environmental and endurance test methods for mini-mold type hall sensors
ET-7407*	Environmental and endurance test methods for CSP/BGA package on mounting condition
RC-8325	Testing methods for environmental test of audio magnetic heads

* English versions have been issued for standards marked with an asterisk.

5-4-3 JTM (Testing Machinery Association of Japan)

The standards issued by the Testing Machinery Association of Japan differ from those we have been discussing up to this point. Rather than addressing environmental test methods, these standards are set for the test equipment. Tabai is a member of this association, and participates in issuing the standards. Table 11 presents some examples of JTM standards.

Table 11 JTM standard

No.	Title
JTM K-01:1998	Humidity chambers—Test and indication method for performance
JTM K-02:1999	Standard for safety of humidity chambers
JTM K-03:1992	Standard for performance of environmental temperature and humidity rooms
JTM K-04:1992	Standard for safety of environmental temperature and humidity rooms
JTM K-05:2000	High temperature chambers—Test and indication method for performance
JTM K-06: 2001	Standard for safety of high temperature chambers

6. Supplement

This report has presented a brief overview of environmental testing standards to provide an aid to understanding the basics of those standards. While the examples given are typical, they cannot provide a thorough treatment of the subject. Please realize also that the test methods presented in the tables cannot cover every aspect.

As has been noted, obtaining information about standards requires knowledge of trends in test technology, and so one must be vigilant in keeping up with the latest trends.