

**Annex A to Appendix A to Part 679
Influence Quantity and Disturbance Tests**

- A.1 General
- A.2 Test considerations
- A.3 Tests
 - A.3.1 Static Temperatures
 - A.3.2 Damp Heat, Steady State
 - A.3.3 Power Voltage Variation
 - A.3.4 Short Time Power Reduction
 - A.3.5 Bursts
 - A.3.6 Electrostatic Discharge
 - A.3.7 Electromagnetic Susceptibility
- A.4 Bibliography

A.1 General

Included in this annex are tests that are intended to ensure that electronic scales can perform and function as intended in the environment and under the conditions specified. Each test indicates, where appropriate, the reference condition under which the intrinsic error is determined.

A.2 Test Considerations

A.2.1 All electronic scales of the same category must be subjected to the same performance test program.

A.2.2 Tests must be carried out on fully operational equipment in its normal operational state. When equipment is connected in other than a normal configuration, the procedure must be mutually agreed to by NMFS and the applicant.

A.2.3 When the effect of one factor is being evaluated, all other factors must be held relatively constant, at a value close to normal. The temperature is deemed to be relatively constant when the difference between the extreme temperatures noted during the test does not exceed 5° C and the variation over time does not exceed 5° C per hour.

A.2.4 Before the start of a test, the equipment under test (EUT) must be energized for a period of time at least equal to the warm-up time specified by the manufacturer. The EUT must remain energized throughout the duration of the test.

A.3 Tests

Test	Characteristics under test	Conditions applied
A.3.1 Static temperatures	Influence factor	MPE
A.3.2 Damp heat, steady state	Influence factor	MPE
A.3.3 Power voltage variation	Influence factor	MPE
A.3.4 Short time power reduction	Disturbance	sf
A.3.5 Bursts	Disturbance	sf
A.3.6 Electrostatic discharge	Disturbance	sf
A.3.7 Electromagnetic susceptibility	Disturbance	sf

A.3.1 Static Temperatures

Test method: Dry heat (non condensing) and cold.

Object of the test: To verify compliance with the applicable MPE under conditions of high and low temperature.

Reference to standard: See section A.4 Bibliography paragraph 1.

Test procedure in brief: The test consists of exposure of the EUT to the high and low temperatures specified in section 2.2.4.1 for belt scales, section 3.2.4.1 for automatic hopper scales, and section 4.2.3.1 for platform scales and hanging scales, under "free air" condition for a 2-hour period after the EUT has reached temperature stability. The EUT must be tested during a weighing operation consisting of:

For belt scales - the totalization of the \sum_{\min} , 2 times each at approximately the minimum flow rate, an intermediate flow rate, and the maximum flow rate.

For platform, hanging, and automatic hopper scales - tested with at least five different test loads or simulated loads under the following conditions:

- a. At a reference temperature of 20° C following conditioning.
- b. At the specified high temperature, 2 hours after achieving temperature stabilization.
- c. At the specified low temperature, 2 hours after achieving temperature stabilization.
- d. At a temperature of 5° C, 2 hours after achieving temperature stabilization.
- e. After recovery of the EUT at the reference temperature of 20° C.

Test severities: Duration: 2 hours

Number of test cycles: At least one cycle.

Maximum allowable variations:

- a. All functions must operate as designed.
- b. All indications must be within the applicable MPEs.

Conduct of test: Refer to the International Electrotechnical Commission (IEC) Publications mentioned in section A.4 Bibliography paragraph a. for detailed test procedures.

Supplementary information to the IEC test procedures

Preconditioning: 16 hours.

Condition of EUT: Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test. Adjust the EUT as close to a zero indication as practicable prior to the test.

Test sequence:

- a. Stabilize the EUT in the chamber at a reference temperature of 20° C. Conduct the tests as specified in the test procedure in brief and record the following data:
 - i. Date and time,

- ii. Temperature,
- iii. Relative humidity,
- iv. Test load,
- v. Indication,
- vi. Errors, and
- vii. Functions performance.

b. Increase the temperature in the chamber to the high temperature specified. Check by measurement that the EUT has reached temperature stability and maintain the temperature for 2 hours. Following the 2 hours, repeat the tests and record the test data indicated in paragraph A.3.1 of this Test Sequence section.

c. Reduce the temperature in the chamber as per the IEC procedures to the specified low temperature. After temperature stabilization, allow the EUT to soak for 2 hours. Following the 2 hours, repeat the tests and record the test data as indicated in paragraph A.3.1 of this Test Sequence section.

d. Raise the temperature in the chamber as per the IEC procedures to 5° C. After temperature stabilization, allow the EUT to soak for 2 hours. Following the 2 hours, repeat the tests and record the test data as indicated in paragraph A.3.1 of this Test Sequence section. Note: This test relates to a -10° C to +40° C range. For special ranges, it may not be necessary.

e. Raise the temperature in the chamber as per the IEC procedures and to the 20° C reference temperature. After recovery, repeat the tests and record the test data as indicated in paragraph A.3.1 of this Test Sequence section.

A.3.2 Damp Heat, Steady State

Test method: Damp heat, steady state.

Object of the test: To verify compliance with the applicable MPE under conditions of high humidity and constant temperature.

Reference to standard: See section A.4 Bibliography paragraph b.

Test procedure in brief: The test consists of exposure of the EUT to a constant temperature at the

upper limit of the temperature range and of a constant relative humidity of 85 percent for a 2-day period. The EUT must be tested during a weighing operation consisting of the following:

For belt scales - the totalization of the \sum_{\min} , 2 times each at approximately the minimum flow rate, an intermediate flow rate, and the maximum flow rate.

For platform, hanging, and automatic hopper scales - tested with at least five different test loads or simulated loads at a reference temperature of 20° C and a relative humidity of 50 percent following conditioning, and at the upper limit temperature and a relative humidity of 85 percent 2 days following temperature and humidity stabilization.

Test severities:

Temperature: upper limit.

Humidity: 85 percent (non-condensing).

Duration: 2 days.

Number of test cycles: At least one test.

Maximum allowable variations:

a. All functions must operate as designed.

b. All indications must be within the applicable MPE.

Conduct of the test: Refer to the IEC Publications mentioned in section A.4 Bibliography paragraph b. for detailed test procedures.

Supplementary information to the IEC test procedures.

Preconditioning: None required.

Condition of EUT:

a. Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test.

b. The handling of the EUT must be such that no condensation of water occurs on the EUT.

c. Adjust the EUT as close to a zero indication as practicable prior to the test.

Test sequence:

a. Allow 3 hours for stabilization of the EUT at a reference temperature of 20° C and a relative humidity of 50 percent. Following stabilization, conduct the tests as specified in the test procedures in brief and record the following data:

- i. Date and time,
- ii. Temperature,
- iii. Relative humidity,
- iv. Test load,
- v. Indication,
- vi. Errors, and
- vii. Functions performance.

b. Increase the temperature in the chamber to the specified high temperature and a relative humidity of 85 percent. Maintain the EUT at no load for a period of 2 days. Following the 2 days, repeat the tests and record the test data as indicated in paragraph A.3.2 of this Test Sequence section.

c. Allow full recovery of the EUT before any other tests are performed.

A.3.3 Power Voltage Variation

A.3.3.1 AC Power Supply

Test method: Variation in AC mains power supply (single phase).

Object of the test: To verify compliance with the applicable MPEs under conditions of varying AC mains power supply.

Reference to standard: See section A.4 Bibliography paragraph c.

Test procedure in brief: The test consists of subjecting the EUT to AC mains power during a weighing operation consisting of the following:

For belt scales - while totalizing the \sum_{\min} at the maximum flow rate.

For platform, hanging, and automatic hopper scales - at no load and a test load between 50 percent and 100 percent of weighing capacity.

Test severities: Mains voltage:

Upper limit U (nom) +10 percent.

Lower limit U (nom) -15 percent.

Number of test cycles: At least one cycle.

Maximum allowable variations:

- a. All functions must operate correctly.
- b. All indications must be within MPEs specified in sections 2, 3, or 4 of this appendix to part 679.

Conduct of the test:

Preconditioning: None required.

Test equipment:

- a. Variable power source,
- b. Calibrated voltmeter, and
- c. Load cell simulator, if applicable.

Condition of EUT:

- a. Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer.
- b. Adjust the EUT as close to a zero indication as practicable prior to the test.

Test sequence:

- a. Stabilize the power supply at nominal voltage ± 2 percent.
- b. Conduct the tests specified in the test procedure in brief and record the following data:
 - i. Date and time,
 - ii. Temperature,
 - iii. Relative humidity,
 - iv. Power supply voltage,
 - v. Test load,
 - vi. Indications,
 - vii. Errors, and
 - viii. Functions performance.
- c. Reduce the power supply to -15 percent nominal.
- d. Repeat the test and record the test data as indicated in paragraph A.3.3 of this Test Sequence section.
- e. Increase the power supply to +10 percent nominal.

f. Repeat the test and record the test data as indicated in paragraph A.3.3 of this Test Sequence section.

g. Unload the EUT and decrease the power supply to nominal power ± 2 percent.

h. Repeat the test and record the test data as indicated in paragraph A.3.3 of this Test Sequence section.

Note: In case of three-phase power supply, the voltage variation must apply for each phase successively. Frequency variation applies to all phases simultaneously.

A.3.3.2 DC Power Supply

Under consideration.

A.3.4 Short Time Power Reduction

Test method: Short time interruptions and reductions in mains voltage.

Object of the test: To verify compliance with the applicable significant fault under conditions of short time mains voltage interruptions and reductions.

Reference to standard: See section A.4 Bibliography paragraph d. IEC Publication 1000-4-11 (1994).

Test procedure in brief: The test consists of subjecting the EUT to voltage interruptions from nominal voltage to zero voltage for a period equal to 8-10 ms, and from nominal voltage to 50 percent of nominal for a period equal to 16-20 ms. The mains voltage interruptions and reductions must be repeated ten times with a time interval of at least 10 seconds. This test is conducted during a weighing operation consisting of the following:

For belt scales - while totalizing at the maximum flow rate at least the \sum_{\min} (or a time sufficient to complete the test).

For platform, hanging, and automatic hopper scales - tested with one small test load or simulated load.

Test severities: One hundred percent voltage interruption for a period equal to 8-10 ms. Fifty percent voltage reduction for a period equal to 16-20 ms.

Number of test cycles: Ten tests with a minimum of 10 seconds between tests.

Maximum allowable variations: The difference between the weight indication due to the disturbance and the indication without the disturbance either must not exceed 1d or the EUT must detect and act upon a significant fault.

Conduct of the test:

Preconditioning: None required.

Test equipment:

a. A test generator suitable to reduce the amplitude of the AC voltage from the mains. The test generator must be adjusted before connecting the EUT.

b. Load cell simulator, if applicable.

Condition of EUT:

a. Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer.

b. Adjust the EUT as close to zero indication as practicable prior to the test.

Test sequence:

a. Stabilize all factors at nominal reference conditions.

b. Totalize as indicated in paragraph A.3.4 of this Test Sequence section and record the--

- i. Date and time,
- ii. Temperature,
- iii. Relative humidity,
- iv. Power supply voltage,
- v. Test load,
- vi. Indications,
- vii. Errors, and
- viii. Functions performance.

c. Interrupt the power supply to zero voltage for a period equal to 8 - 10 ms. During interruption observe the effect on the EUT and record, as appropriate.

d. Repeat the steps in paragraph A.3.4 of this Test Sequence section four times, making sure that there is a 10 second interval between repetitions. Observe the effect on the EUT.

e. Reduce the power supply to 50 percent of nominal voltage for a period equal to 16 - 20 ms. During reduction observe the effect on the EUT and record, as appropriate.

f. Repeat the steps in paragraph A.3.4 of this Test Sequence section four times, making sure that there is a 10 second interval between repetitions. Observe the effect on the EUT.

A.3.5 Bursts

Test method: Electrical bursts.

Object of the test: To verify compliance with the provisions in this manual under conditions where electrical bursts are superimposed on the mains voltage.

Reference to standard: See section A.4 Bibliography paragraph e.

Test procedure in brief:

The test consists of subjecting the EUT to bursts of double exponential wave-form transient voltages. Each spike must have a rise in time of 5 ns and a half amplitude duration of 50 ns. The burst length must be 15 ms, the burst period (repetition time interval) must be 300 ms. This test is conducted during a weighing operation consisting of the following:

For belt scales - while totalizing at the maximum flow rate at least the \sum_{\min} (or a time sufficient to complete the test).

For platform, hanging, and automatic hopper scales - tested with one small test load or simulated load.

Test severities: Amplitude (peak value) 1000 V.

Number of test cycles: At least 10 positive and 10 negative randomly phased bursts must be applied at 1000 V.

Maximum allowable variations: The difference between the indication due to the disturbance and the indication without the disturbance either must not exceed the values given in sections 2.2.1.1 b., 3.2.1.1 b., and 4.2.1.1 b. or the EUT must detect and act upon a significant fault.

Conduct of the test: Refer to the IEC Publication referenced in section A.4 Bibliography paragraph e. for detailed test procedures.

Supplementary information to the IEC test procedures:

Test equipment:

A burst generator having an output impedance of 50 ohms.

Test conditions:

The burst generator must be adjusted before connecting the EUT. The bursts must be coupled to the EUT both on common mode and differential mode interference.

Condition of EUT:

a. Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer.

b. Adjust the EUT as close to a zero indication as practicable prior to the test.

Test sequence:

a. Stabilize all factors at nominal reference conditions.

b. Conduct the test as indicated in paragraph A.3.5 of this Test Sequence section and record the--

- i. Date and time,
- ii. Temperature,
- iii. Relative humidity,
- iv. Test load,
- v. Indication,
- vi. Errors, and
- vii. Functions performance.

c. Subject the EUT to at least 10 positive and 10 negative randomly phased bursts at the 1000 V mode. Observe the effect on the EUT and record, as appropriate.

d. Stabilize all factors at nominal reference conditions.

e. Repeat the test and record the test data as indicated in paragraph A.3.5 of this Test Sequence section.

A.3.6 Electrostatic Discharge

Test method: Electrostatic discharge (ESD).

Object of the test: To verify compliance with the provisions of this manual under conditions of electrostatic discharges.

Reference to standard: See section A.4 Bibliography paragraph f.

Test procedure in brief:

A capacitor of 150 pF is charged by a suitable DC voltage source. The capacitor is then discharged through the EUT by connecting one terminal to ground (chassis) and the other via 150 ohms to surfaces which are normally accessible to the operator. This test is conducted during a weighing operation consisting of the following:

For belt scales - while totalizing at the maximum flow rate at least the \sum_{\min} (or a time sufficient to complete the test).

For platform, hanging, and automatic hopper scales - test with one small test load or simulated load.

Test severities:

Air Discharge: up to and including 8 kV.

Contact Discharge: up to and including 6 kV.

Number of test cycles: At least 10 discharges must be applied at intervals of at least 10 seconds between discharges.

Maximum allowable variations:

The difference between the indication due to the disturbance and the indication without the disturbance either must not exceed the values indicated in sections 2.2.1.1 b., 3.2.1.1 b., and 4.2.1.1 b. or the EUT must detect and act upon a significant fault.

Conduct of the test: Refer to the IEC Publication mentioned in section A.4 Bibliography paragraph d for detailed test procedures.

Supplementary information to the IEC test procedures.

Preconditioning: None required.

Condition of EUT:

a. The EUT without a ground terminal must be placed on a grounded plate which projects beyond the EUT by at least 0.1 m on all sides. The ground connection to the capacitor must be as short as possible.

b. Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test.

c. The EUT must be operating under standard atmospheric conditions for testing.

d. Adjust the EUT as close to a zero indication as practicable prior to the test.

Test sequence:

a. Stabilize all factors at nominal reference conditions.

b. Conduct test as indicated in paragraph A.3.6 of this Test Sequence section and record the--

- i. Date and time,
- ii. Temperature,
- iii. Relative humidity,
- iv. Power supply voltage,
- v. Test load,
- vi. Indication,
- vii. Errors, and
- viii. Functions performance.

c. Approach the EUT with the discharge electrode until discharge occurs and then remove it before the next discharge. Observe the effect of the discharge on the EUT and record, as appropriate.

d. Repeat the above step at least nine times, making sure to wait at least 10 seconds between successive discharges. Observe the effect on the EUT and record as appropriate.

e. Stabilize all factors at nominal reference conditions.

f. Repeat the test and record the test data as indicated above.

A.3.7 Electromagnetic Susceptibility

Test method: Electromagnetic fields (radiated).

Object of the test:

To verify compliance with the provisions in this manual under conditions of electromagnetic fields.

Reference to standard: See section A.4 Bibliography paragraph g.

Test procedure in brief:

a. The EUT is placed in an EMI chamber and tested under normal atmospheric conditions. This test is first conducted at one load in a static mode, and the frequencies at which susceptibility is evident are noted. Then tests are conducted at the problem frequencies, if any, during a weighing operation consisting of the following:

For belt scales - while totalizing at the maximum flow rate at least the \sum_{\min} (or a time sufficient to complete the test). It is then exposed to electromagnetic field strengths as specified in the Test severities in this section A.3.7 of this annex to appendix A of this part.

For platform, hanging, and automatic hopper scales - tested with one small test load.

b. The field strength can be generated in various ways:

i. The strip line is used at low frequencies (below 30 MHz or in some cases 150 MHz) for small EUT's;

ii. The long wire is used at low frequencies (below 30 MHz) for larger EUT's;

iii. Dipole antennas or antennas with circular polarization placed 1 m from the EUT are used at high frequencies.

c. Under exposure to electromagnetic fields the EUT is again tested as indicated above.

Test severities: Frequency range: 26 - 1000 MHz

Field strength: 3 V/m

Modulation: 80 percent AM, 1 kHz sine wave

Number of test cycles: Conduct test by continuously scanning the specified frequency range while maintaining the field strength.

Maximum allowable variations: The difference between the indication due to the disturbance and the indication without the disturbance either must not exceed the values given in this manual, or the EUT must detect and act upon a significant fault.

Conduct of the test: Refer to the IEC Publication referenced in section A.4 Bibliography paragraph g. for detailed information on test procedures.

Supplementary information to the IEC test procedures.

Test conditions:

a. The specified field strength must be established prior to the actual testing (without the EUT in the field). At least 1 m of all external cables must be included in the exposure by stretching them horizontally from the EUT.

b. The field strength must be generated in two orthogonal polarizations and the frequency range scanned slowly. If antennas with circular polarization, i.e., log-spiral or helical antennas, are used to generate the electromagnetic field, a change in the position of the antennas is not required. When the test is carried out in a shielded enclosure to comply with international laws prohibiting interference to radio communications, care needs to be taken to handle reflections from the walls. Anechoic shielding might be necessary.

Condition of EUT:

a. Normal power supplied and "on" for a time period equal to or greater than the warm-up time specified by the manufacturer. Power is to be "on" for the duration of the test. The EUT must be operating under standard atmospheric conditions for testing.

b. Adjust the EUT as close to a zero indication as practicable prior to the test.

Test sequence:

a. Stabilize all factors at nominal reference conditions.

b. Conduct the test as indicated in paragraph A.3.7 of this Test Sequence section and record the--

- i. Date and time,
- ii. Temperature,
- iii. Relative humidity,
- iv. Test load,
- v. Indication,
- vi. Errors, and
- vii. Functions performance.

c. Following the IEC test procedures, expose the EUT at zero load to the specified field strengths while slowly scanning the three indicated frequency ranges.

d. Observe and record the effect on the EUT.

e. Repeat the test and observe and record the effect.

f. Stabilize all factors at nominal reference conditions.

g. Repeat the test and record the test data.

A.4 Bibliography

Below are references to Publications of the International Electrotechnical Commission (IEC), where mention is made in the tests in annex A to appendix A of this part.

a. IEC Publication 68-2-1 (1974): Basic environmental testing procedures. Part 2: Tests, Test Ad: Cold, for heat dissipating equipment under test (EUT), with gradual change of temperature.

IEC Publication 68-2-2 (1974): Basic environmental testing procedures, Part 2: Tests, Test Bd: Dry heat, for heat dissipating equipment under test (EUT) with gradual change of temperature.

IEC Publication 68-3-1 (1974): Background information, Section 1: Cold and dry heat tests.

b. IEC Publication 68-2-56 (1988): Environmental testing, Part 2: Tests, Test Cb: Damp heat, steady state. Primarily for equipment.

IEC Publication 68-2-28 (1980): Guidance for damp heat tests.

c. IEC Publication 1000-4-11 (1994):

Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques, Section 11. Voltage dips, short interruptions and voltage variations immunity tests. Section 5.2 (Test levels - Voltage variation). Section 8.2.2 (Execution of the test-voltage variation).

d. IEC Publication 1000-4-11 (1994):

Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques, Section 11: Voltage dips, short interruptions and voltage variations immunity tests. Section 5.1 (Test levels - Voltage dips and short interruptions. Section 8.2.1 (Execution of the test-voltage dips and short interruptions) of the maximum transit speed and the range of operating speeds.

e. IEC Publication 1000-4-4 (1995):

Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test. Basic EMC publication.

f. IEC Publication 1000-4-2 (1995):

Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test. Basic EMC Publication.

g. IEC Publication 1000-4-3 (1995):

Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency electromagnetic field immunity test.