METHOD 2052.2

PARTICLE IMPACT NOISE DETECTION (PIND) TEST

1. Purpose. The purpose of this test is to detect loose particles inside a device cavity. The test provides a nondestructive means of identifying those devices containing particles of sufficient mass that, upon impact with the case, excite the transducer.

2. Apparatus. The equipment required for the PIND test shall consist of the following (or equivalent):

a. A threshold detector to detect particle noise voltage exceeding a preset threshold of the absolute value of 20 ±1 mV peak reference to system ground.

b. A vibration shaker and driver assembly capable of providing essentially sinusoidal motion to the DUT at:

(1) Condition A: 20 g's peak at 40 to 250 Hz.

(2) Condition B: 10 g's peak at 60 Hz minimum.

c. PIND transducer, calibrated to a peak sensitivity of -77.5 ±3 dB in regards to one volt per microbar at a point within the frequency of 150 to 160 kHz.

d. A sensitivity test unit (STU) (see figure 2052-1) for periodic assessment of the PIND system performance. The STU shall consist of a transducer with the same tolerances as the PIND transducer and a circuit to excite the transducer with a 250 microvolt ±20 percent pulse. The STU shall produce a pulse of about 20 mV peak on the oscilloscope when the transducer is coupled to the PIND transducer with attachment medium.

e. PIND electronics, consisting of an amplifier with a gain of 60 ±2 dB centered at the frequency of peak sensitivity of the PIND transducer. The noise at the output of the amplifier shall not exceed 10 mV peak.

f. Attachment medium. The attachment medium used to attach the DUT to the PIND transducer shall be the same attachment medium as used for the STU test.

g. Shock mechanism or tool capable of imparting shock pulses of 1,000 ±200 g's peak to the DUT. The duration of the main shock shall not exceed 100 μs. If an integral co-test shock system is used the shaker vibration may be interrupted or perturbed for period of time not to exceed 250 ms from initiation of the last shock pulse in the sequence. The co-test duration shall be measured at the 50 ±5 percent point.

3. Procedures.

3.1 Test equipment setup. Shaker drive frequency and amplitude shall be adjusted to the specified conditions. The shock pulse shall be adjusted to provide 1,000 ±200 g's peak to the DUT.

3.2 Test equipment checkout. The test equipment checkout shall be performed a minimum of one time per operation shift. Failure of the system to meet checkout requirements shall require retest of all devices tested subsequent to the last successful system checkout.

3.2.1 Shaker drive system checkout. The drive system shall achieve the shaker frequency and the shaker amplitude specified. The drive system shall be calibrated so that the frequency settings are within ±8 percent and the amplitude vibration setting are within ±10 percent of the nominal values. If a visual displacement monitor is affixed to the transducer, it may be used for amplitudes between .04 and .12 inch (1.02 and 3.05 mm). An accelerometer may be used over the entire range of amplitudes and shall be used below amplitudes of .040 inch (1.02 mm).

3.2.2 Detection system checkout. With the shaker deenergized, the STU transducer shall be mounted face-to-face and coaxial with the PIND transducer using the attachment medium used for testing the devices, prior to attaching any special fixtures. The STU shall be activated several times to verify low level signal pulse visual and threshold detection on the oscilloscope. Not every application of the STU will produce the required amplitude. All pulses which are greater than 20 mV shall activate the detector.

3.2.3 System noise verification. System noise will appear as a fairly constant band and must not exceed 20 mV peak to peak when observed for a period of 30 to 60 seconds.

3.3 Test sequence. The following sequence of operations (a. through i.) constitute one test cycle or run.

a. Three pre-test shocks.

b. Vibration 3±1 seconds.

c. Three co-test shocks.

d. Vibration 3±1 seconds.

e. Three co-test shocks.

f. Vibration 3±1 seconds.

g. Three co-test shocks.

h. Vibration 3±1 seconds.

i. Accept or reject.

3.3.1 Mounting requirements. Special precautions (e.g., in mounting, grounding of DUT leads, or grounding of test operator) shall be taken as necessary to prevent electrostatic damage to the DUT.

Most part types will mount directly to the transducer via the attachment medium. Parts shall be mounted with the largest flat surface against the transducer at the center or axis of the transducer for maximum sensitivity. Where more than one large surface exists, the one that is the thinnest in section or has the most uniform thickness shall be mounted toward the transducer, e.g., flat packs are mounted top down against the transducer. Small axial-lead, right circular cylindrical parts are mounted with their axis horizontal and the side of the cylinder against the transducer. Parts with unusual shapes may require special fixtures. Stud packages shall utilize a cylindrical fixture with a non-thru hole such that the bottom of the fixture is solid. The inner hole diameter shall be minimized and the fixture diameter shall be greater than the hex flat dimension. Such fixtures shall have the following properties:

(1) Low mass.

(2) High acoustic transmission (aluminum alloy 7075 works well).

(3) Full transducer surface contact, especially at the center.

(4) Maximum practical surface contact with test part.

(5) No moving parts.

(6) Suitable for attachment medium mounting.

3.3.2 Test monitoring. Each test cycle (see 3.3) shall be continuously monitored, except for the period during co-test shocks and 250 ms maximum after the shocks. Particle indications can occur in one or any combination of the three detection systems as follows:

a. Visual indication of high frequency spikes which exceed the normal constant background white noise level.

b. Audio indication of clicks, pops, or rattling which is different from the constant background noise present with no DUT on the transducer.

c. Threshold detection shall be indicated by the lighting of a lamp or by deflection of the secondary oscilloscope trace.

3.4 Failure criteria. Any noise bursts as detected by any of the three detection systems exclusive of background noise, except those caused by the shock blows, during the monitoring periods shall be cause for rejection of the device. Rejects shall not be retested except for retest of all devices in the event of test system failure. If additional cycles of testing on a lot are specified, the entire test procedure (equipment setup and checkout mounting, vibration, and co-shocking) shall be repeated for each retest cycle. Reject devices from each test cycle shall be removed from the lot and shall not be retested in subsequent lot testing.

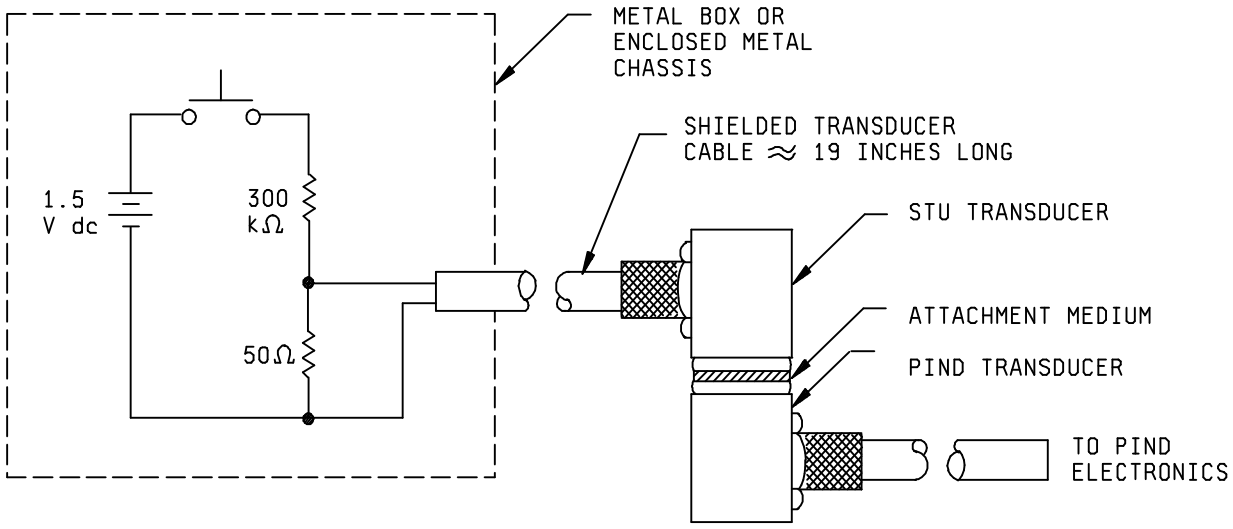
4. Summary. The following details shall be specified in the applicable detail specification:

a. Test condition letter A or B.

b. Lot acceptance/rejection criteria (if applicable).

c. The number of test cycles, if other than one.

d. Pre-test shock level and co-test shock level, if other than specified.



NOTES:
1. Pushbutton switch: Mechanically quiet, fast make, gold contacts. E.G. T2 SM4 microswitch.
2. Resistance tolerance five percent noninductive.
3. Voltage source can be a standard dry cell.
4. The coupled transducers must be coaxial during test.
5. Voltage output to STU transducer 250 microvolts, ±20 percent.

FIGURE 2052-1. Typical STU.

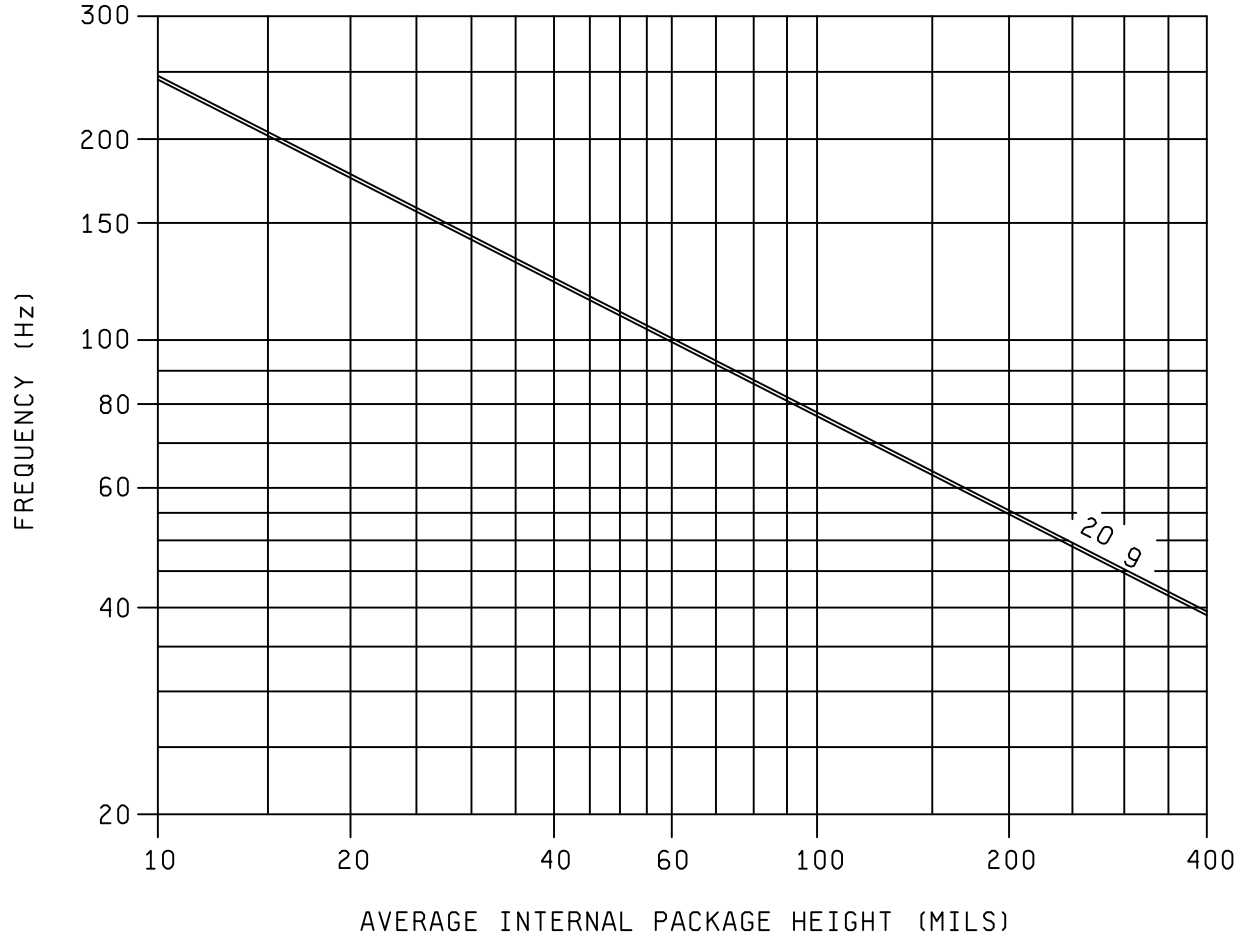


FIGURE 2052-2. Package height versus test frequency for 20 g's acceleration.