REQUIREMENT 23

DETAILED REQUIREMENTS FOR FUSES

23. General. This section describes detailed requirements for a DPA of commonly used fuses. These requirements supplement the general requirements in section 4. Examples of typical configuration sketches are included. When applicable, specification numbers or type numbers are referenced to assist in identification. Pre-DPA tests, such as functional tests and solderability tests, are assumed to have been satisfied by normal inspection and testing and are therefore not addressed.

23.1 Fuses, instrument, power, and telephone (MIL-PRF-15160).

23.1.1 Method.

23.1.1.1 External visual. Perform an external visual examination of the devices and record any obvious defects in marking or workmanship of the devices.

23.1.1.2 Disassembly. Disassemble 50 percent of the device (round up) by scribing circumferentially around the center of the cylindrical body with a sharp diamond or carbide scribe. Snap the device(s) in two by applying a three-point bend force to each end of the device. Examine the interior of each end of the device(s) in accordance with the criteria of 23.1.3.

23.1.1.3 Cross-sectioning. Encapsulate the remaining devices in a clear epoxy and begin sectioning in a plane parallel to the longitudinal axis of the device. Upon opening the internal cavity, inspect the devices in accordance with 23.1.3. Then backfill the cavity with epoxy to ensure adequate mechanical support for the internal member. Continue sectioning to the midpoint of the end caps and leads. Inspect the sectioned devices in accordance with 23.1.3.

23.1.2 Data records. DPA findings that deviate from the specified configuration or other requirements shall be documented.

23.1.3 Visual inspection criteria. The following defects will be considered unacceptable.

a. Evidence of corrosion of the fuse element or end caps.

b. Fuse element not adequately soldered to the end cap.

c. End caps not adequately attached to body of device.

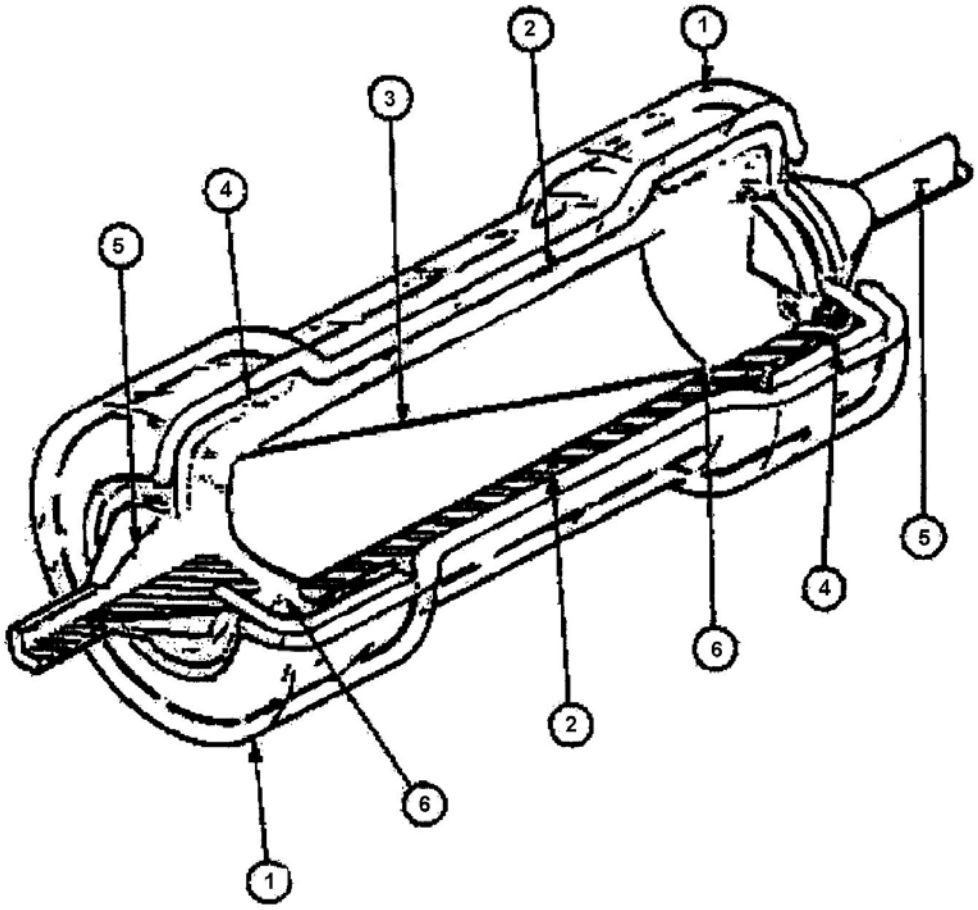
d. Loose or potentially loose foreign particles or solder balls greater than 0.12 mm (.005 inch) in length inside the cavity of the device(s).

23.2 Fuses, glass and ceramic substrate style.

23.2.1 Method.

23.2.1.1 External visual. Perform an external visual examination of the devices and record any obvious defects in marking or workmanship of the devices.

23.2.1.2 Radiography. Perform radiographic inspection in two perpendicular planes to determine the orientation of the substrate in the case and to detect voids in the case (potting) material. See figures 23-2 and 23-3 for acceptance and rejection criteria.



1 Outer Plastic Sleeve
2 Ceramic/Glass Body
3 Fuse element
4 End Cap
5 Lead (Terminals)
6. Solder

(See Table 17-1)

FIGURE 23-1. Example of typical instrument, power, and telephone fuse.

23.2.2 Fuses with glass substrates.

23.2.2.1 Disassembly. Lap the fuse material to the surface of the glass substrate opposite the lead attachments.

a. Using a magnification of 10X minimum, inspect the deposited resistance element for adhesion to the glass substrate. Cracks in the resistance element or lifting of the element shall be considered unacceptable.

b. Using a magnification of 10X minimum, inspect metallization-bonding areas for alignment with the adhesion of the resistance element.

c. Using a magnification of 10X minimum, inspect for conchoidal fractures. A conchoidal fracture starts on one surface, intrudes into the interior of the substrate and if carried to its conclusion, returns to the same surface. Conchoidal fractures in the substrate (glass) between the lead and the fuse element that extend more than 50 percent of the lead are unsatisfactory.

d. Remove the remaining case material with a suitable solvent and using 10X minimum, inspect lead solder connections for smoothness and proper wetting. Evidence of cold solder joints or cracks in the solder shall be unacceptable.

23.2.2.2 Data records. DPA findings that deviate from the specified configuration or other requirements shall be documented.

23.2.3 Fuses with ceramic substrates and epoxy encapsulant.

23.2.3.1 Method.

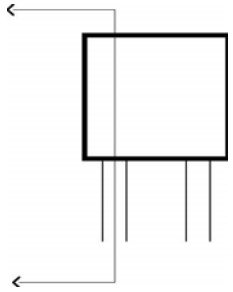
23.2.3.1.1 Cross-sectioning (group 1). Encapsulate one third of the samples (round up) in epoxy and section longitudinally through the center of one lead and inspect for the following:

a. Adequate attachment at the lead to substrate.

b. Evidence of fractures within the solder joint or substrate. Ceramic substrate scribe marks shall not be cause for rejection.

c. Evidence of contamination.

d. Solder voids shall not exceed 25 percent of the solder cross-sectional area.



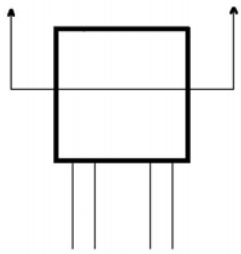
Group 1 plane of section.

23.2.3.1.2 Cross-sectioning (group 2). Encapsulate one third of the samples (round down) in epoxy and section transversely through the center of the fuse package perpendicular to the lead axis and inspect for the following:

a. Pinholes > 0.25 mm (.010 inch) in length in the arc suppressant material.

b. Evidence of contamination.

c. Evidence of fractures within the solder joint or substrate. Ceramic substrate scribe marks shall not be cause for rejection.



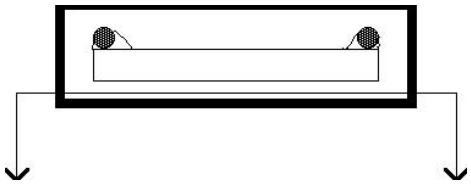
Group 2 plane of section.

23.2.3.1.3 Cross-sectioning (group 3) Encapsulate the remaining samples in epoxy and section/lap into the face of the fuse package into the back of the fuse substrate. Stop sectioning when the substrate is thin enough to inspect the fuse element through the thin remaining ceramic. Inspect for the following:

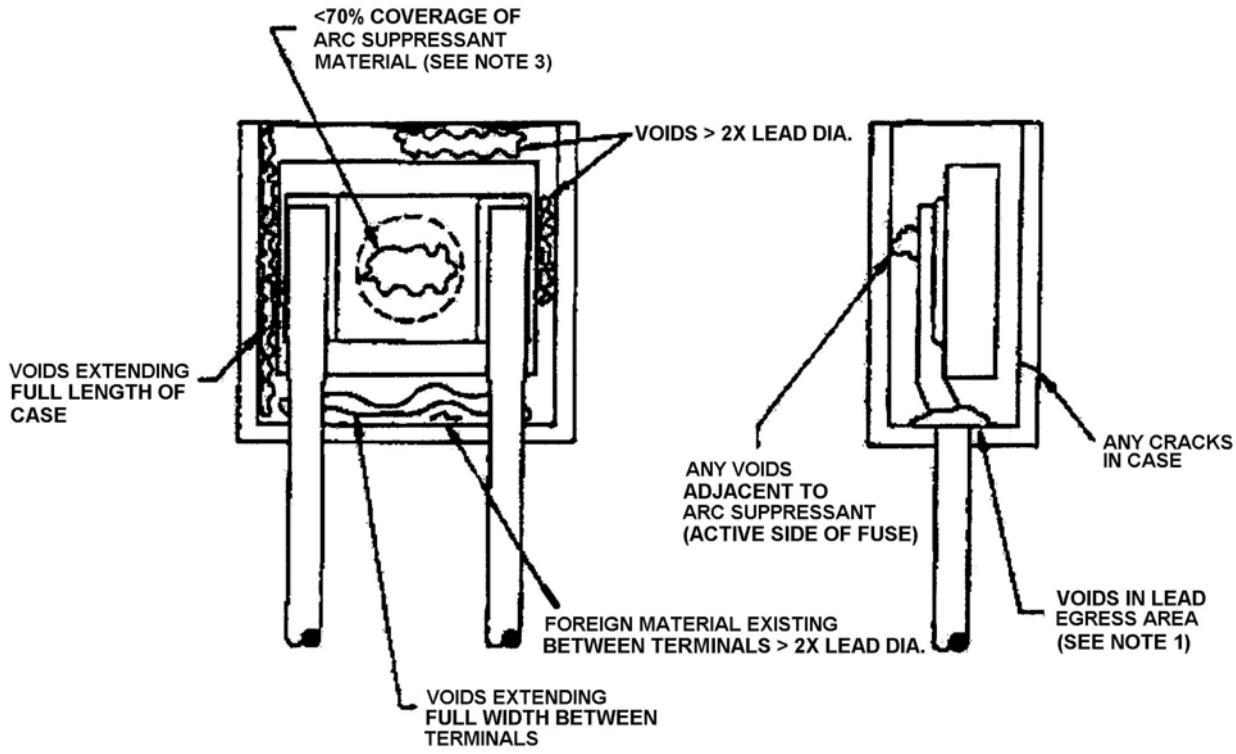
a. Voids in the epoxy.

b. Examine the substrate for conchoidal or other type cracks.

c. Examine the fuse element for pinholes or other anomalies.



Group 3 plane of section.



NOTES:

1. VOIDS IN LEAD EGRESS AREA SHALL NOT EXCEED 50% OF THE DISTANCE BETWEEN THE CASE BOTTOM AND THE SUBSTRATE.

2. VOIDS EXISTING BETWEEN TERMINALS THAT ARE > 2X LEAD DIA. ARE REJECTABLE.

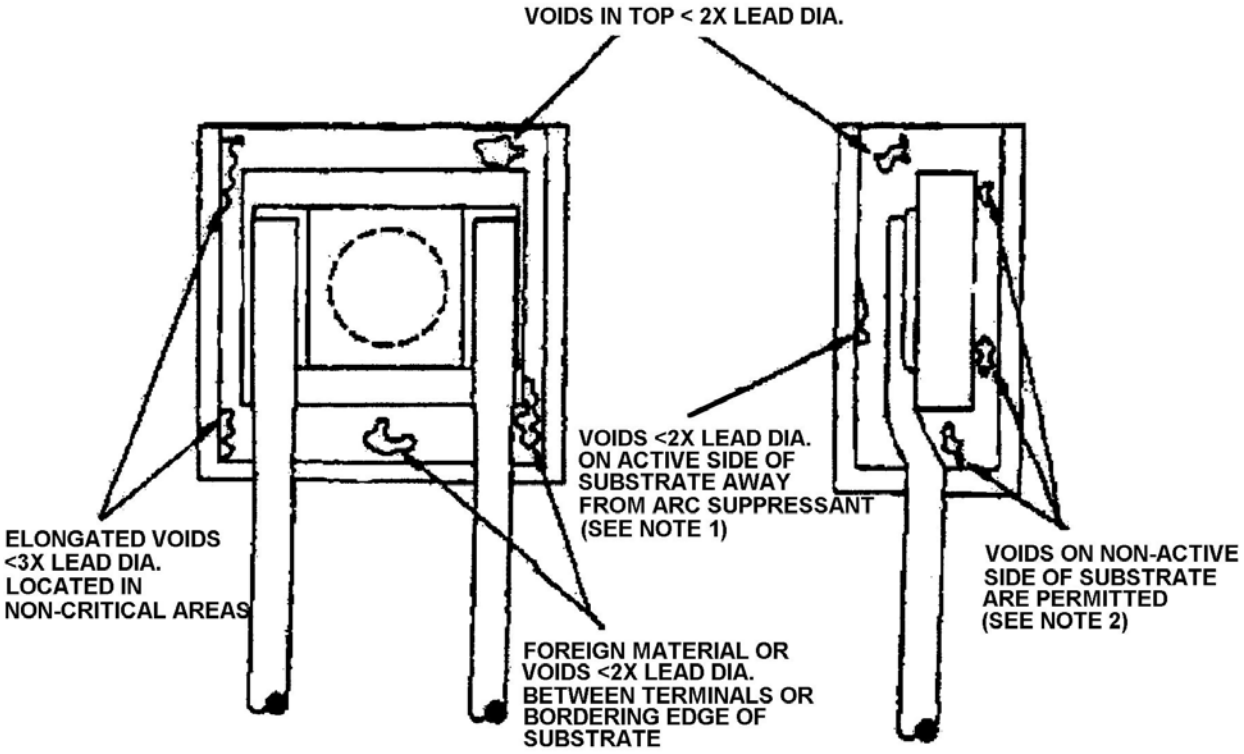
3. PIN HOLES < 0.010” IN THE ARC SUPPRESSANT MATERIAL ARE REJECTABLE.

4. ELONGATED VOIDS THAT RUN FULL LENGTH OF THE CASE OR ANY ELONGATED VOID RUNNING PARALLEL TO AND WITHIN 0.005” OF THE LEAD FROM BOTTOM OR SUBSTRATE TO BOTTOM OF CASE IS REJECTABLE.

5. VOIDS > 3X LEAD DIAMETER ARE REJECTABLE.

6. ORIENTATION OF SUBSTRATE IS NOT CRITICAL UNLESS SUBSTRATE PROTRUDES OUTSIDE OF CASE OR RESTS ON BOTTOM OF CASE.

FIGURE 23-2. Rejection criteria.



NOTES:

1. VOIDS OR FOREIGN MATERIAL EXISTING BETWEEN THE CASE AND THE ACTIVE SIDE OF SUBSTRATE ARE ACCEPTABLE PROVIDED THEY ARE LESS THAN 2X LEAD DIA. IN SIZE AND A DEFINITE SEPARATION BETWEEN THE VOID AND TERMINAL CAN BE DETECTED ON THE EDGE VIEW OF THE RADIOGRAPH.

2. VOIDS OR FOREIGN MATERIAL ARE PERMISSIBLE TO THE EXTENT THAT THEY ARE LOCATED IN NON-CRITICAL AREAS AND THE TOTAL AREA OF VOIDS DOES NOT EXCEED 30% VOLUME OF THE CASE.

3. EPOXY FILL LINES ARE ACCEPTABLE.

4. CRITICAL AREAS SHALL BE DEFINED AS THE AREA BEHIND THE ACTIVE SIDE OF SUBSTRATE (AREA WITHIN DASHED CIRCLE ABOVE), AREA BETWEEN TERMINALS, AND THE LED EGRESS AREA.

FIGURE 23-3. Rejection criteria.