REQUIREMENT 17

DETAILED REQUIREMENTS FOR RELAYS

17. General. This section describes detailed requirements for a DPA of commonly used relays. These requirements supplement the general requirements in section 4. Examples of typical configuration sketches are included. When applicable, specification numbers or types 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.

17.1 Relays (MIL-PRF-6106, MIL-PRF-39016 and MIL-PRF-83536).

17.1.1 Method.

17.1.1.1 External examination. Examinations shall be performed using a microscope with 10X magnification, except when an abnormality is suspected and then 30X magnification (maximum) may be used to verify product integrity on the following:

a. Header glass seals. The glass seals of the header shall be in compliance with MIL-H-28719.

b. Protective finish and plating.

(1) There shall be no unplated areas or discontinuities of protective finishes.

(2) The finish shall be smooth and free from chips, blisters, or rough spots.

(3) There shall be no evidence of plating flaking off.

(4) There shall be no evidence of chipping, peeling, or blistering of the finish.

(5) There shall be no evidence of inadequate protection against corrosion.

(6) The case shall be free from distortion and dents.

(7) The case and terminal plating shall not be pure tin, cadmium, or zinc (<3 percent alloyed with other elements) as determined by SEM EDS.

c. Part marking. Part marking shall be in accordance with MIL-STD-1285.

d. Terminals, studs, and mounting.

(1) There shall be no bent or broken terminals.

(2) Relay terminals shall be in accordance with the detailed specification, and shall be free from burrs and malformations.

(3) Screw threads, tapped holes, and threaded inserts shall be of the size shown on the detailed specification, and shall be in accordance with FED-STD-H28, unless otherwise specified. No malformed threads shall be accepted. A minimum of three full threads of engagement shall be provided.

(4) Clearance holes and hardware such as nuts, washers, etc. shall be of the size shown on the detailed specification, and shall be free of burrs and malformations.

(5) Studs, flanges, brackets, etc. shall be securely fastened to the relay case.

17.1.1.2 Hermeticity testing. Perform testing on one sample in accordance with MIL-PRF-6106. The one sample is for reference only.

17.1.1.3 Internal water vapor testing/residual gas analysis (RGA). One relay shall be submitted for residual gas analysis (RGA) to a laboratory approved by the qualifying activity of the detail specification. The one sample is for reference only.

17.1.1.4 Radiographic examination. Suitable reference radiographs shall be taken to ensure proper device opening procedures will be utilized.

17.1.1.5 Suggested opening. CAUTION: The introduction of foreign particles during opening can result in unacceptable conditions during the inspection of 17.1.1.6. To avoid damage or deformation of the relay, the use of holding devices such as wire, clamps, or pliers is prohibited. Remove all adjunct sealants from relay headers prior to opening.

17.1.1.5.1 TO-5 type enclosures. Diagonal cutters may be used to minimize the possibility of the introduction of metal flakes inside the device. Alternatively, a can opener device designed specifically for the purpose of opening the TO-5 type enclosures can be used. The adjustment of pressure between the cutting wheel edge and the TO-5 enclosure should be set for the minimum required to allow cutting without deformation of TO-5 enclosure.

17.1.1.5.2 Rectangular type enclosure - method 1.

a. Securely mount the relay in a vice-like fixture. The fixture should not deform the relay nor disturb internal dimensions and settings, which may require measurement in latter parts of the DPA.

b. Orient the relay so that the header-to-can weld can be end-milled. This may be done as shown on figure 17-1.

c. Both the height and depth of the material to be end-milled away must be closely controlled. This may be done by using a drill press that has vernier calibration of the table's movement in three axes. When possible, the specific header dimensions and can-wall thickness should be obtained from the relay supplier or by examining a non-DPA test sample.

d. Gradually machine away the weld area. Typically, removal of 0.025 millimeters to 0.050 millimeters (.001 inch to .002 inch) of the relay wall thickness per pass with the end-mill is suggested.

   NOTE: If rotational speed of the end-mill is too fast, overheating and other problems can occur. If rotational speed is too slow, unacceptable vibration of the relay assembly may be induced.

e. During the machining, vacuum off the machined area continually or as often as possible so as to remove loose metallic particles that could disrupt later examinations.

f. Ideally, the weld is machined to a depth that reveals a seam around the relay in place of the weld. This should be a closed seam, i.e., the milling should not be so deep that any actual openings into the cavity exist.

   NOTE: Do not attempt to separate the relay assembly from the header in a shop area.

g. Take the relay to the clean area where the final inspection is to occur.

h. Using adhesive tape and a vacuum, remove all loose (or potentially loose) particles from around the machined surfaces. Examine the weld area at 30X magnification to verify that no loose particles are present.

   NOTE: If adjunct sealants were not completely removed, their presence on the header may be visible at this point, as evidenced by silicone particles around the periphery of the header.

i. Once it has been verified at 30X magnification that the relay exterior is free of particles, do not handle it without wearing finger cots or lint-free rubber gloves.

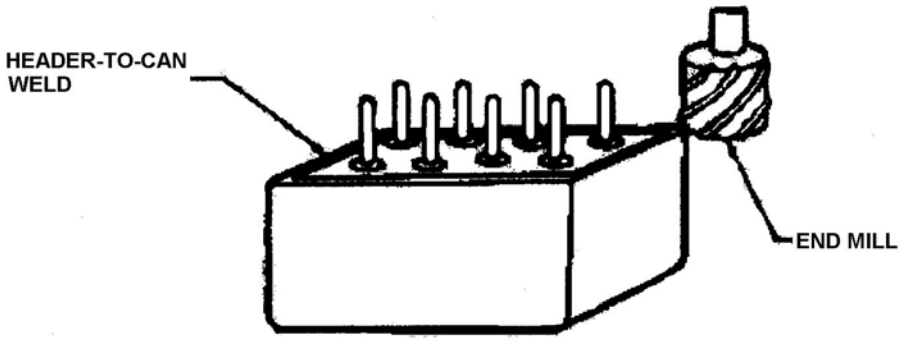

FIGURE 17-1. End-milling of header-to-can weld.

17.1.1.5.3 Rectangular type enclosure - method 2. NOTE: Method 1 is preferred and should be used whenever possible. Method 2 is an alternate approach to be used when the equipment of method 1 is not available or the procedures of method 1 are incompatible with the relay being dissected. A cut is made around the periphery of the enclosure approximately 2.5 millimeters (0.10 inch) above the base of the header. Depth of cut is not to exceed 90 percent of the thickness of the enclosure wall utilizing a cutting wheel (aluminum oxide) mounted in table saw fashion. After completion of the peripheral cut, the entire relay surface is vacuum cleaned. A sharp knife edge is then used to cut through the remainder of the wall enclosure.

17.1.1.6 Internal examination. Figure 17-2 shows a typical relay. All exposed inner surfaces of each relay shall be examined for the following characteristics at a minimum magnification of 20X.

a. Contamination. Loose particles of metallic or nonmetallic type or loose Teflon insulation or other fibrous material within the relay or cover is unacceptable.

b. Internal adjustment. Using appropriate gauges measure the gap between the N. O. contact and the movable gap by optical or mechanical means.

c. Contacts and terminals.

   (1) Burrs, cracking, or peeling of plating detectable at 20X magnification is unacceptable, if movable when probed with a force of 1.2 Newtons (125 grams) at 10X magnification.

   (2) Contacts not in alignment with their mating contact and parallel (equal contact gap) with each other are unacceptable.

   (3) Contact terminals with flash and ball type weld splatter or expulsion detectable at 20X magnification is unacceptable, if movable when probed with a force of 1.2 Newtons (125 grams) at 10X magnification.

d. Armature and pole piece.

(1) Armature and pole piece gaps for burrs, cracking, or peeling of plating detectable at 20X magnification is unacceptable, if movable when probed with a force of 1.2 Newtons (125 grams) at 10X magnification. (Reduction in magnification facilitates discernment of movement.)

(2) Rust detectable at 20X magnification between gaps or in armature or pole piece surfaces is unacceptable.

(3) Cracked or eroded glass on contact pusher bead detectable at 20X magnification is unacceptable.

e. Coil assembly.

(1) Ensure coil does not rotate nor exhibit looseness upon its core.

(2) Coil lead between coil and the coil terminal does not exhibit uninsulated portions where possibility of shorting exists, interference with moving parts, kinks, or tension (stretched tight).

f. Coil assembly frame: Must meet the following weld pull test:

(1) Grind or peel excess can material to provide frame tab clearance for pull test.

(2) Remove coil assembly (frame) from header by use of small hand grinder and cut-off diamond-impregnated wheel approximately 25 millimeters (1 inch) in diameter and 0.5 millimeters (.02 inches) thick.

(3) Each weld tab shall have a minimum of 1.5 millimeters (.06 inches) protruding above the header after cut-off operation.

(4) Grip protruding end of tab and peel away from header. Take note and measure force to separate weld. Examine weld remnants. If either observation arouses suspicion of weld integrity, investigate other welds more thoroughly as directed by the responsible relay parts engineer. A good weld should withstand a pull force of 85 Newtons (20 pounds) minimum.

(5) Relays are considered marginal when they exhibit coil assembly frame spot weld misalignment or spot weld area partially penetrating frame-to-header. (Pull force minimum requirement specified herein shall be adhered to).

g. Relays. If a leadless inverted device (LID) is used, it shall pass die shear and adhesive bond tests, and also bond strength of small interconnect wires in accordance with MIL-STD-883. Die shear requirements are based on area of adhesion. Wire bond strength is based on diameter of wire to chip on the LID.

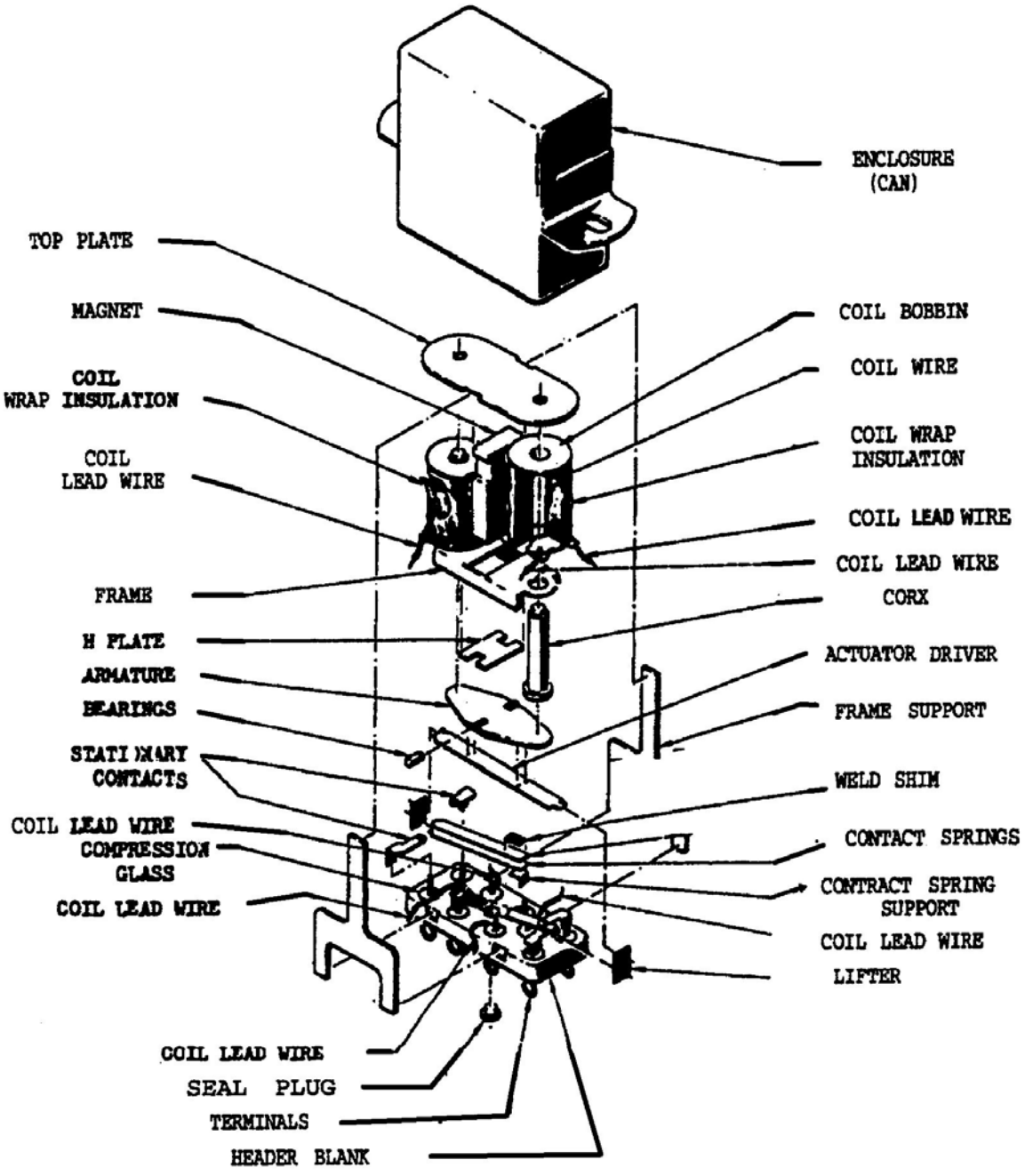

FIGURE 17-2. Typical latching relay.