# INTERNAL VISUAL INSPECTION OF ELECTROMAGNETIC RELAYS

## ESCC Basic Specification No. 2043600

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| Issue 2 | October 2013 |

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| DCR No. | CHANGE DESCRIPTION |
|---|---|
| 799 | Specification upissued to incorporate editorial changes per DCR. |

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## 1 SCOPE

This specification, to be read in conjunction with ESCC Basic Specification No. 20400, "Internal Visual Inspection", contains additional requirements for electromagnetic relays. They shall apply, where relevant, to each device inspected.

## 2 GENERAL REQUIREMENTS

### 2.1 APPLICABILITY

The following criteria may not be varied or modified after commencing any inspection stage. Any ambiguity or proposed minor deviation shall be referred to the ESCC Executive for resolution and approval.

### 2.2 PROCEDURE

Before encapsulation, the relays shall be inspected on a laminar flow bench. The workbench shall fulfil adequate cleanliness conditions. All items shall be examined in such a manner that a minimum of handling and movement of the component is involved. Apart from the clothing normally prescribed for wear in clean rooms, inspectors shall wear gloves or finger-cots when manipulating relays.

## 3 EQUIPMENT REQUIRED

### 3.1 MAGNIFICATION

The optical equipment necessary for the inspection should be a stereozoom with a magnification of X10.

### 3.2 MOUNTING FIXTURES

Suitable fixtures may be used to assist in the inspection process provided they do not of themselves cause damage to the device. Care shall be taken that adequate provision is made to avoid accidental damage.

### 3.3 ELECTRICAL EQUIPMENT

The appropriate electrical equipment shall be provided for energising relay coils and visualising contact opening and closing.

## 4 DETAILED REQUIREMENTS

### 4.1 REJECT CRITERIA

A component shall be rejected if it exhibits any of the defects listed in any of the following paragraphs. Where applicable, drawings have been included to provide additional explanatory material.

4.2 GENERAL

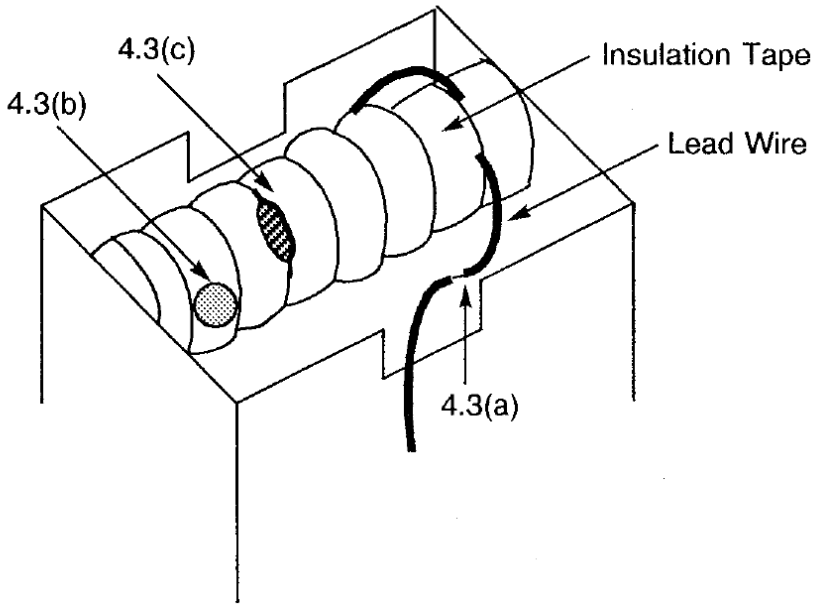
(a) Loose particles (in particular, free particles of insulating material or detachable metal particles shall not be accepted).
(b) Chemical contamination (grease, varnish, ink, etc.).
(c) Blistering or flaking of plating on any metal part.

**N.B.** If cleanliness requirements for relay and housings are not met, further cleaning operations shall be allowed, followed by another inspection.

4.3 COILS

(a) Tool or fixture nicks on coil insulation and lead wire insulation.
(b) Evidence of cracks, holes or marks in coil insulation exposing copper wires of the coil winding.
(c) Incomplete coverage of coil winding by an insulation tape.
(d) Finishing end of wrapping not adhering to coil.
(e) Loose particles of insulating material.
(f) Embedded metal particles in coil insulation.

**FIGURE I - COIL DEFECTS**

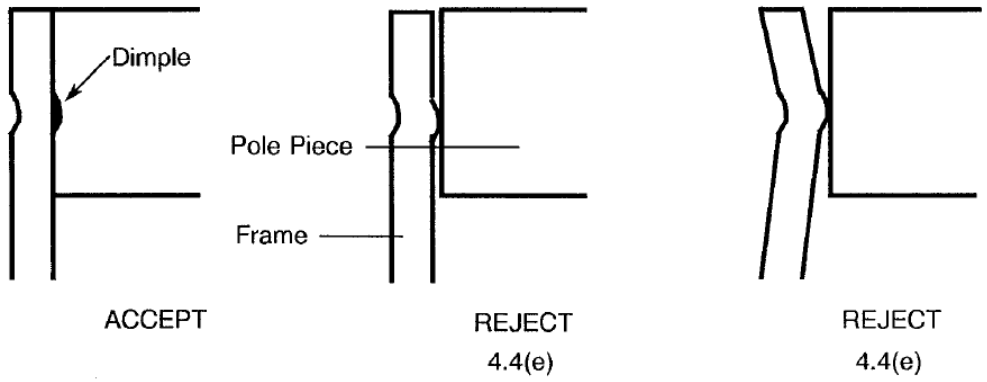



(g) Incorrect position of lead wires, so that they are in the way of moving parts or within 0.2mm of their furthest travel.
(h) Dirty coil insulation (recleaning permitted).

4.4 ELECTRICAL WELDS

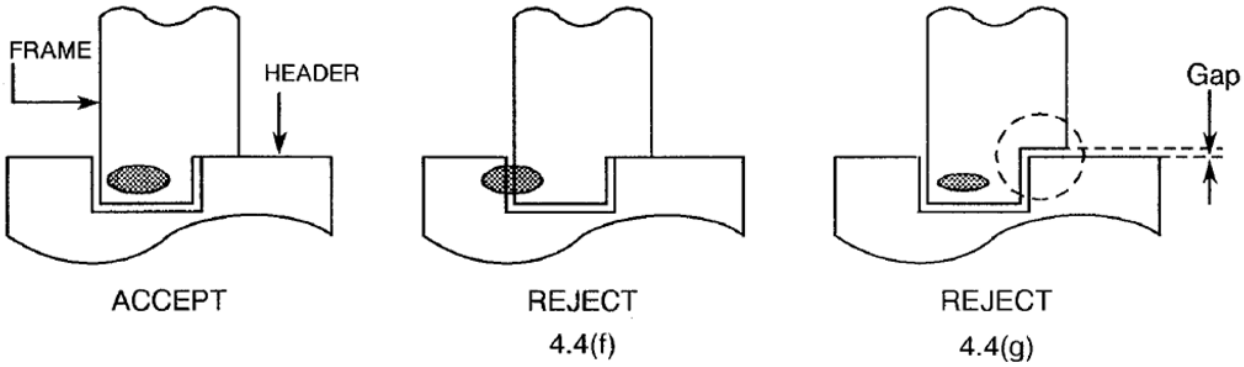
(a) Weld point missing.
(b) Burnt welds.
(c) Weld flashes. (They can be accepted if they are firmly attached).
(d) Welds with cracks.
(e) Weld projection (dimple) not flattened.

**FIGURE II - FLATTENING OF WELD PROJECTION**



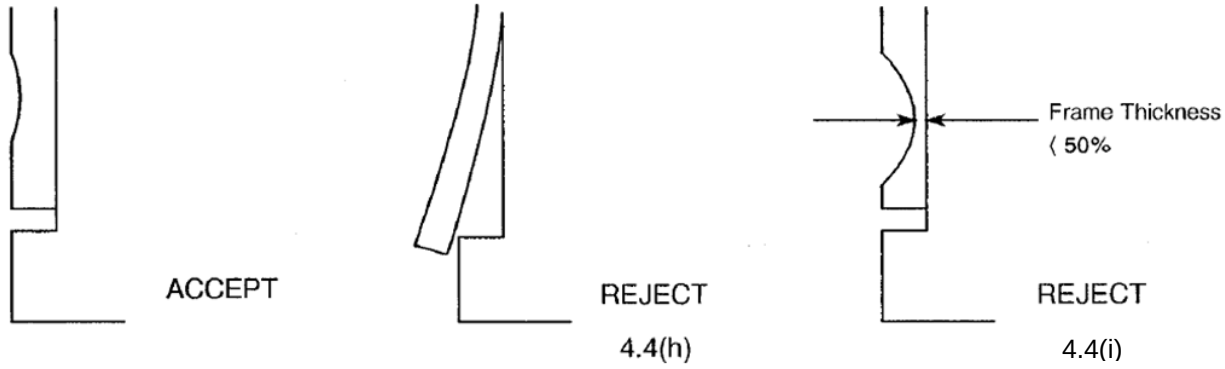

(f) Weld point overlapping frame and header.
(g) Any gap (except by design) between frame and header, where indicated.

**FIGURE III - FRAME TO HEADER WELD**




(h) Bent frame leg.
(i) Welding pressure too high, leg deformed by more than 50% of its thickness.

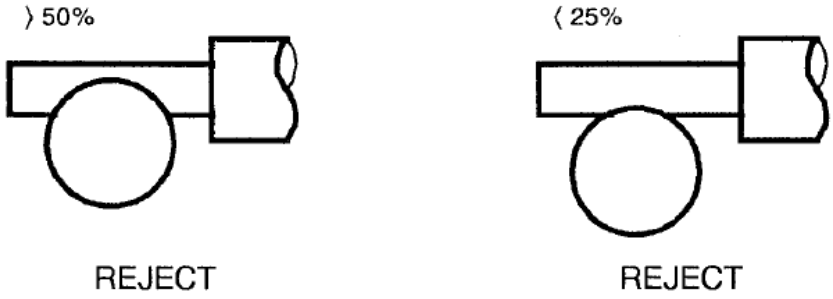
**FIGURE IV - FRAME TO HEADER WELD (CROSS SECTION)**




4.4(h) 4.4(i)

(j) Lead wire deformed by more than 50% or less than 25% of its initial thickness.

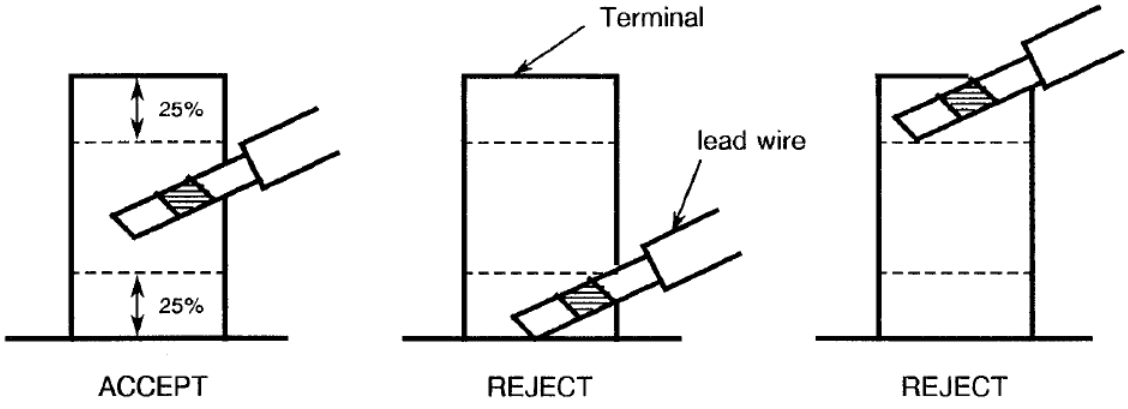
**FIGURE V - LEAD WIRE TO TERMINAL WELD (CROSS SECTION)**




4.4(j)

(k) Incorrect position of lead wire on terminal relative to header.

**FIGURE VI - LEAD WIRE TO TERMINAL WELD**

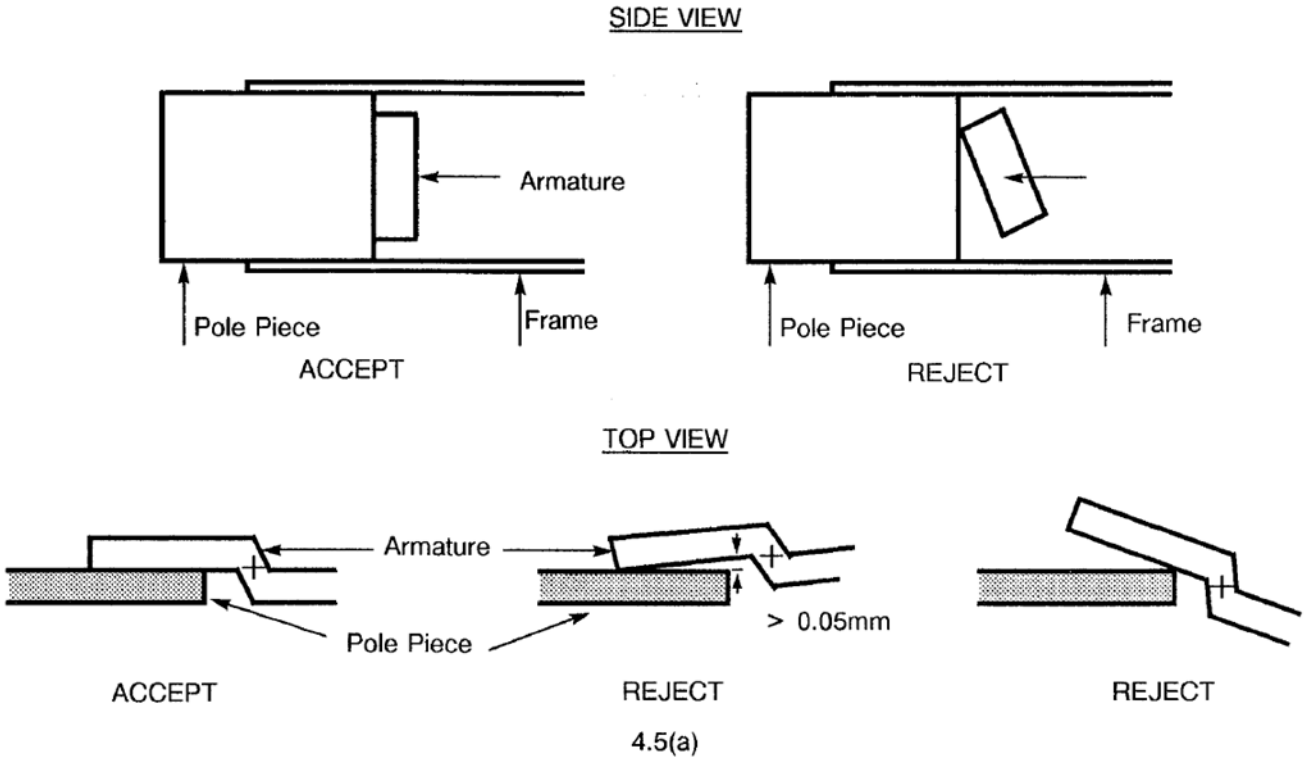



4.4(k) 4.4(k)

4.5 MAGNETIC CIRCUITS, ARMATURE, ACTUATOR

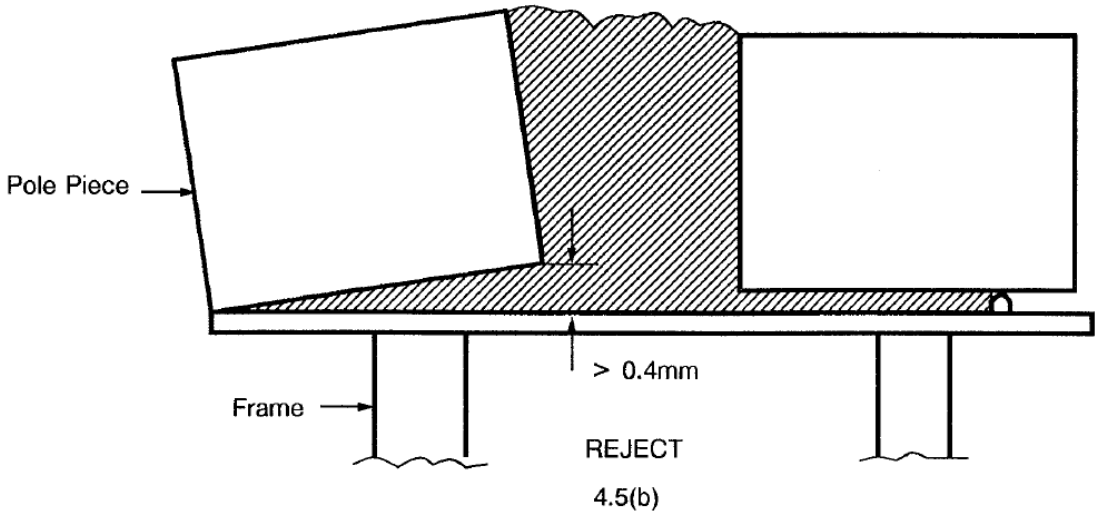
(a) The physical contact area between pole piece and armature is less than two thirds of the design contact area or > 0.05mm where indicated in Figure VII.

**FIGURE VII - ARMATURE/POLE PIECE CONTACT AREA AND GAP**



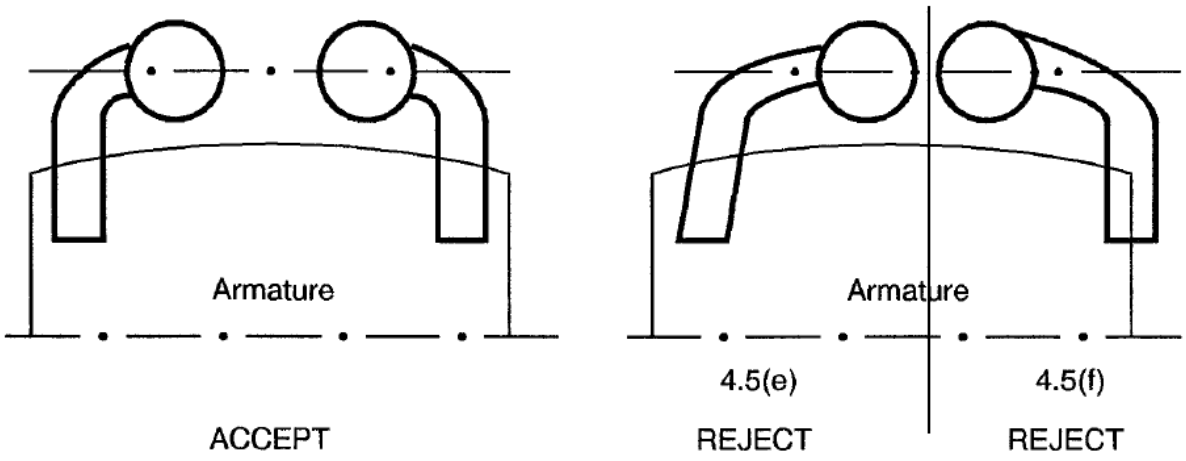

(b) Gap greater than 0.4mm between pole piece and frame.

**FIGURE VIII - POLE PIECE / FRAME GAP**



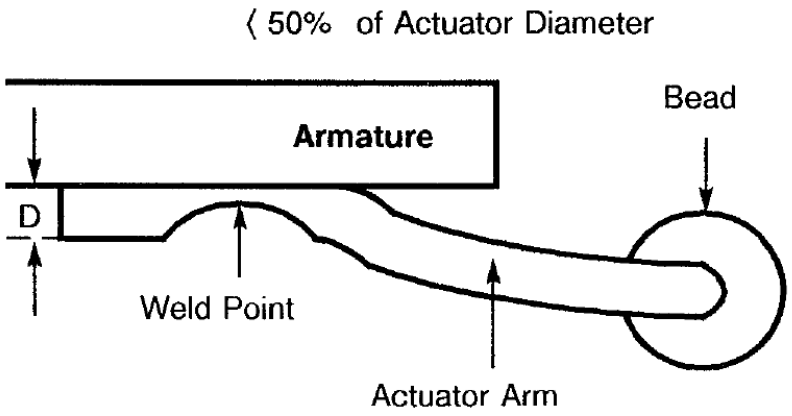

(c) Armature is not moving freely.
(d) End or side play in excess of design.
(e) Lack of parallelism between armature and actuator arm (unless by design).
(f) The actuator arm stands proud of the armature, unless by design.

**FIGURE IX - ACTUATOR POSITION**




(g) Excessive deformation of actuator at weld point (> 50%) of its initial thickness.

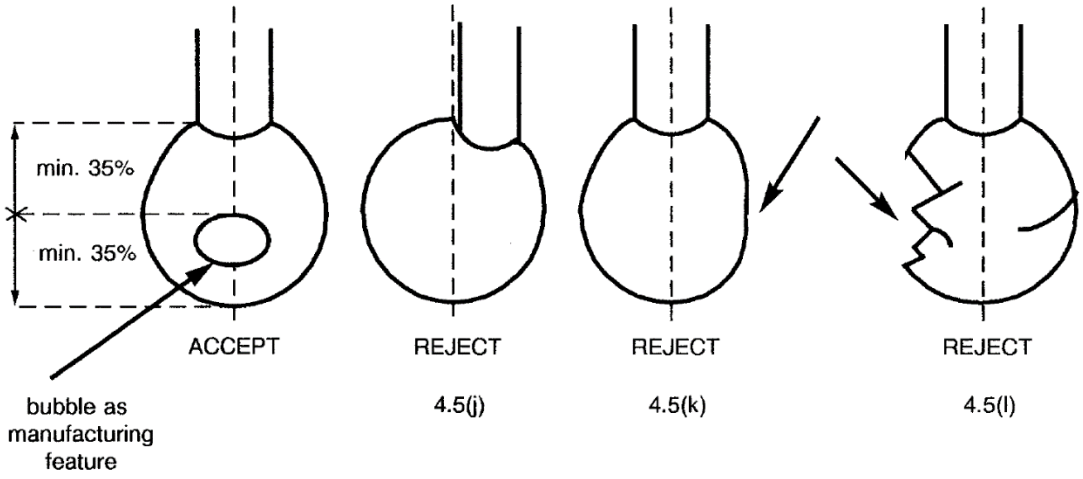
**FIGURE X – ACTUATOR / ARMATURE WELD**




4.5(g)

(h) Deformation of armature.
(i) Actuator bead asymmetrically located.
(j) Irregular shape of actuator bead.
(k) Cracks or chip-outs in bead.

**FIGURE XI - ACTUATOR GLASS BEAD**

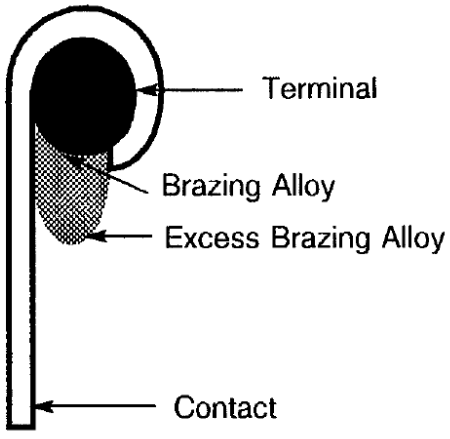



(l) Bubbles of dimension and location weakening the bead. (See Figure XVIII).
(m) Foreign materials (black dots).

4.6 CONTACTS

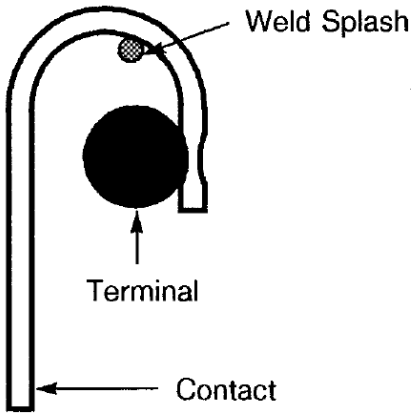
(a) Tool marks.
(b) Scratches or visible damage.
(c) Any corrosion, unsmooth surface.
(d) Deformation of contacts in excess of design.
(e) Deformation of terminals in excess of design.
(f) Bad adherence of plating around brazing area.
(g) Brazing alloy (braze construction) in excess of design.
(h) Weld splash (weld construction).

**FIGURE XII - CONTACT / TERMINAL BRAZE**




4.6(g)
REJECT

**FIGURE XIII - CONTACT / TERMINAL WELD**



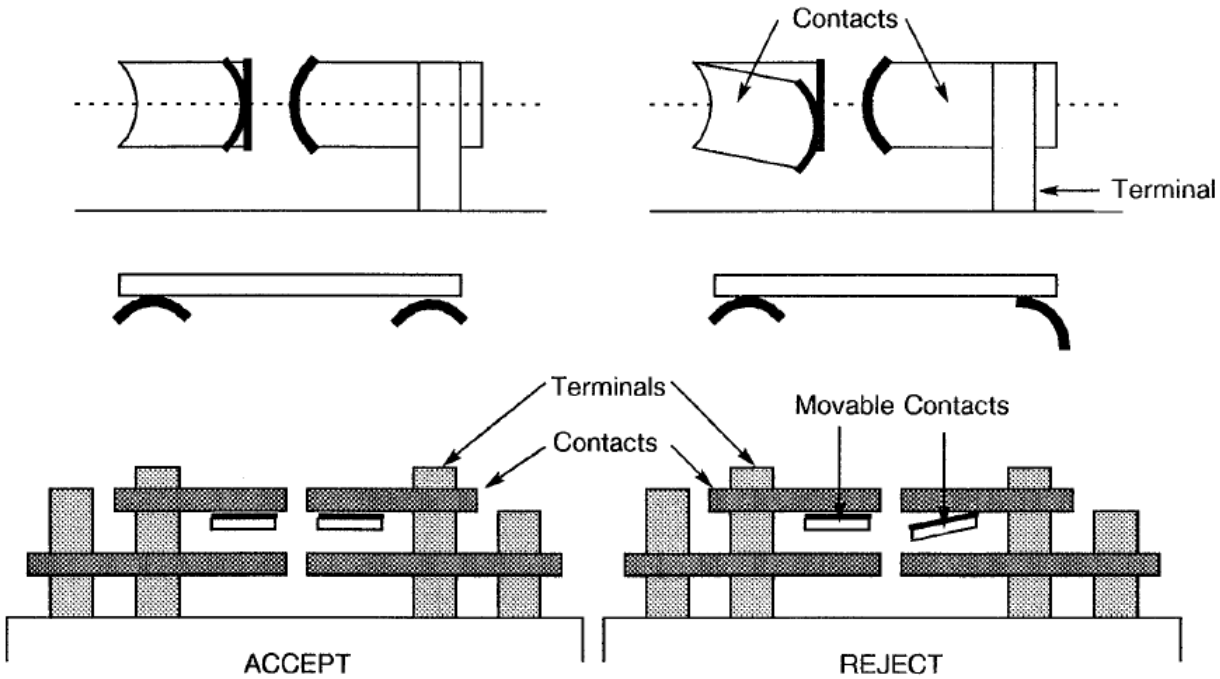

4.6(h)
REJECT

(i) Incorrect contact alignment:
   1. The plane containing the surfaces of the contacts are misaligned by more than one third of the design contact area.
   2. The physical contact area is less than two thirds of the design contact area.

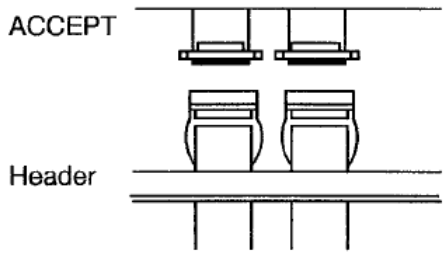
(j) Incorrect parallelism between header and contacts.

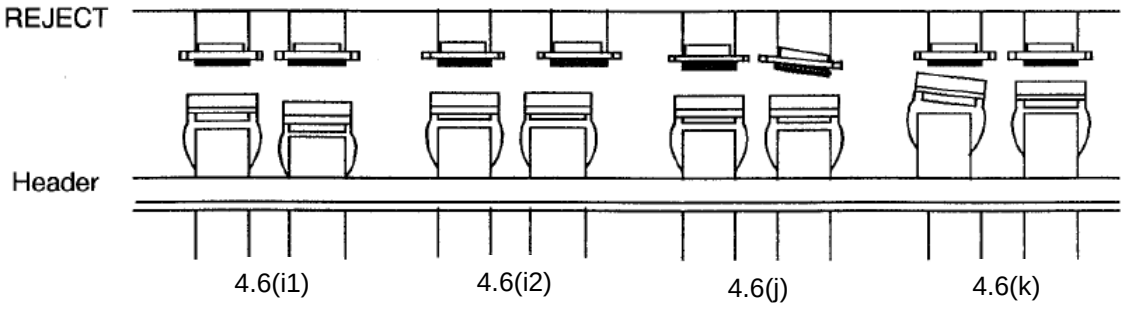
(k) Incorrect parallelism between contacts.

**FIGURE XIV - EXAMPLE OF CONTACT ALIGNMENTS**




4.6(i)

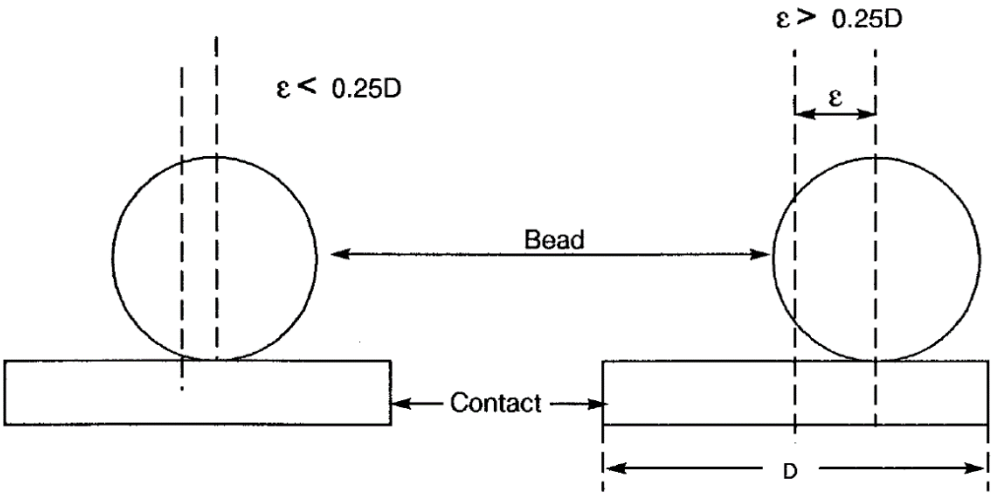



4.6(i1) 4.6(i2) 4.6(j) 4.6(k)

(l) Clearance between actuator and contacts less than design.
(m) Incorrect position of actuator bead relative to contacts.

**FIGURE XV - ACTUATOR / CONTACT POSITION**



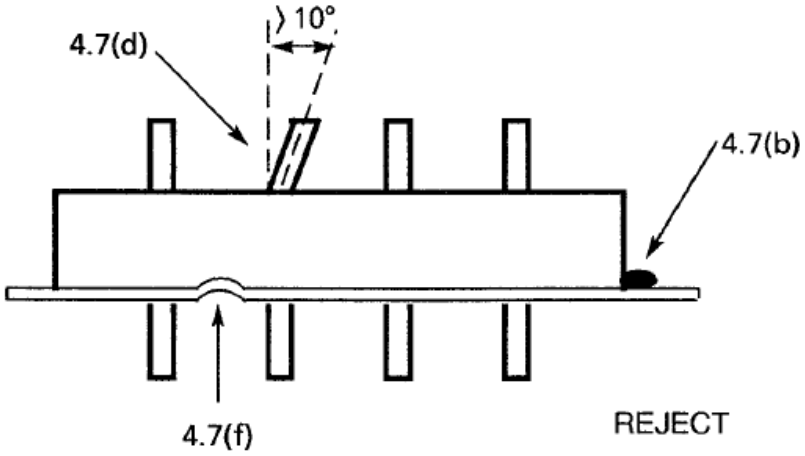

4.6(m)

D: contact width

4.7 HEADERS

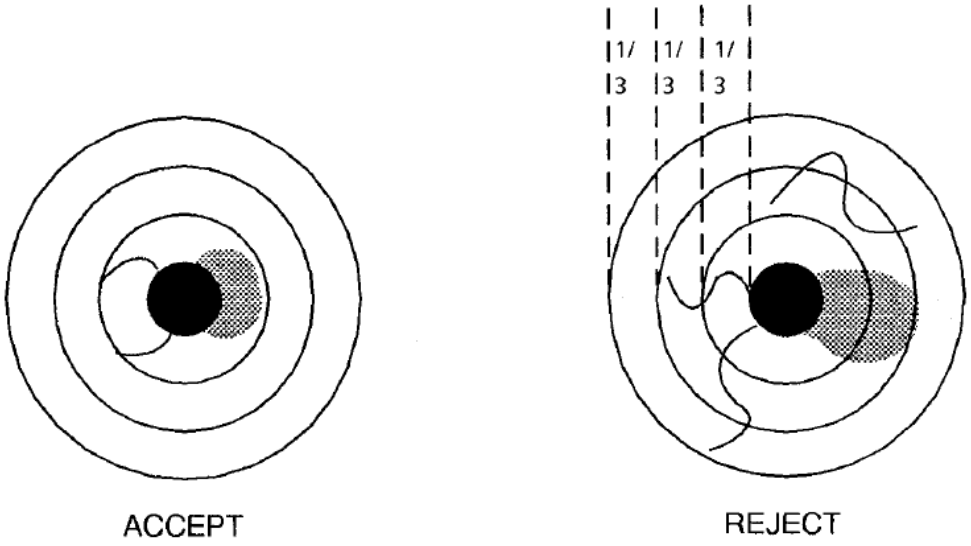
(a) Nicks, dents on periphery of header, where the can is Tungsten-Inert Gas, Electron Beam, Laser Beam, welded.
(b) Glass on the flange or the side of the header.
(c) Blistering or flaking of gold or nickel plating.
(d) Header post bent more than 10°.
(e) Metal shavings on the flange or side of the header longer than the width of the flange.
(f) Bent or deformed flanges.

**FIGURE XVI - HEADER DEFECTS**




(g) Grease, varnish, ink or similar stain on the flange or side of the header.
(h) Any conductive material overlapping the glass seal.
(i) Cracked or chipped glass seal.

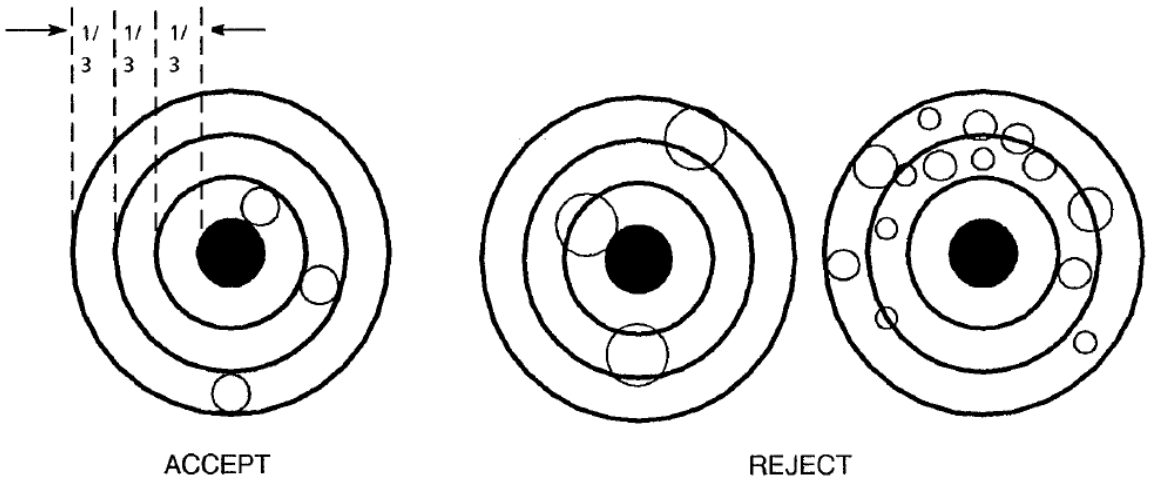
**FIGURE XVII - GLASS-TO-METAL SEAL CRACKS AND CHIP-OUTS**




4.7(i)

(j) Non-uniformity of finish of lead or pillar, particularly at the glass seal.
(k) Nicks or bulges in the wire diameter outside stated lead tolerance.
(l) Individual bubbles diameter more than a third of the minimum distance between the terminal and the header, or an area of adjacent bubbles in the seal area bigger than 12.5% of the seal area.

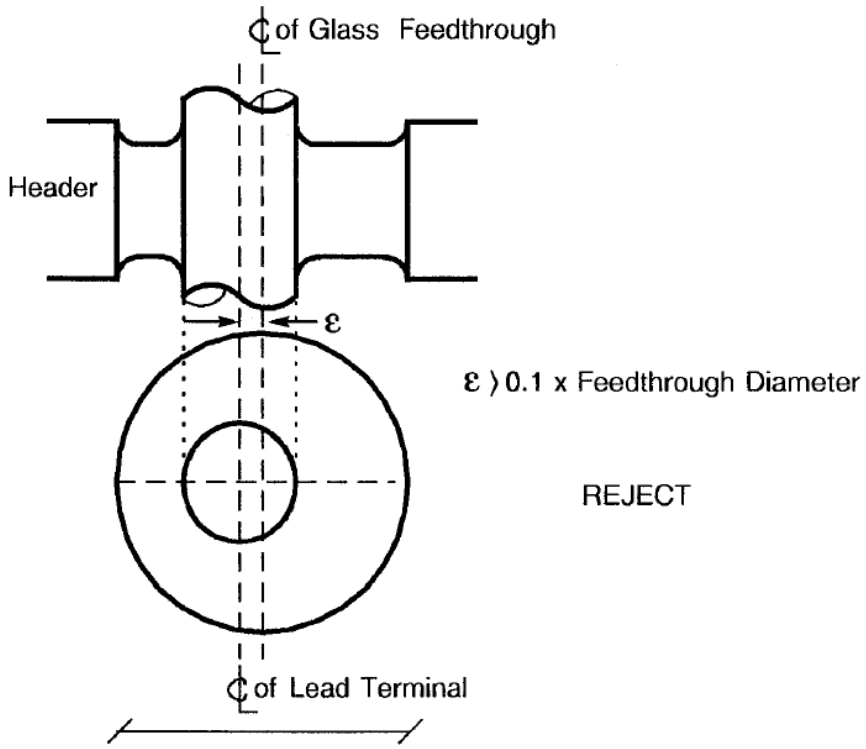
**FIGURE XVIII - BUBBLES IN GLASS-TO-METAL SEAL**




4.7(m)

(m) Foreign particles embedded in the glass seal.
(n) Eccentricity of lead passing through the centre of the glass-to-seal greater than 10% of the glass feedthrough diameter.

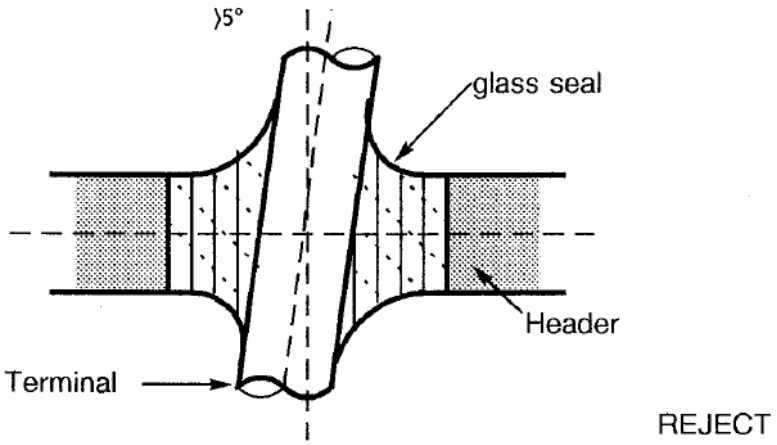
**FIGURE XIX - LEAD POSITION WITHIN GLASS-TO-METAL SEAL**




4.7(n)

(o) Lead tilted more than 5°.

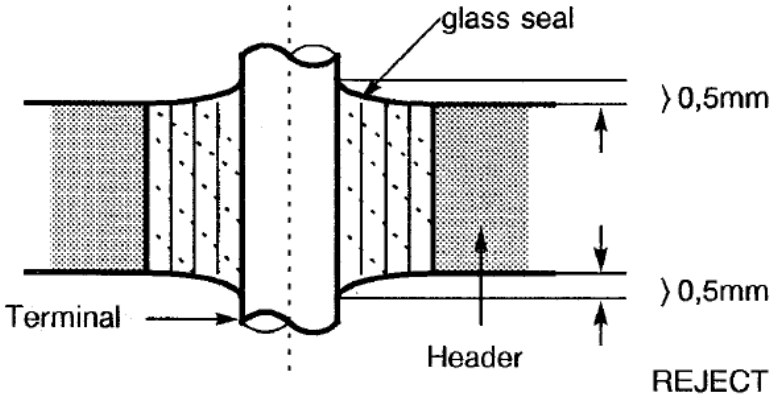
**FIGURE XX - TILT OF TERMINAL IN GLASS-TO-METAL SEAL**




4.7(o)

(p) Incorrect position of solder hooks (see Detail Specification).
(q) Glass seal protruding above or below header along terminal by more than 0.5mm.

**FIGURE XXI - GLASS MENISCUS**




4.7(q)

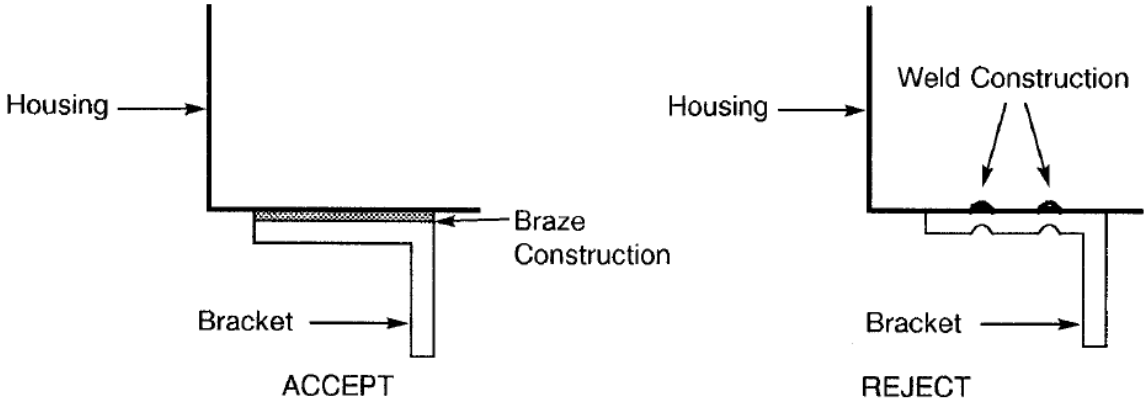
4.8 HOUSINGS

(a) Tool marks.
(b) Scratches or visible damage.
(c) Corrosion.
(d) Dents.
(e) Deformation by shocks.

If applicable:

(f) Electrically welded brackets.

**FIGURE XXII - BRACKET TO HOUSING WELD**




4.8(f)

(g) Incorrect position of mounting brackets (see PID).
(h) Excess brazing alloy on bracket, causing change of dimensions.
(i) Granular brazing alloy.
(j) Microholes in brazing alloy.
(k) General lack of alloy around bracket/housing.