

ENGINEERING PRACTICE STUDY

TITLE: MIL-PRF-6106 addressing seal leak inspection
evaluating hermeticity for relays designed with a welded evacuation port.

28 January 2025

STUDY PROJECT (SEE ATTACHMENT 1)

FINAL REPORT

Study Conducted By DLA Land and Maritime

Project Number: 5945-2025-007

Prepared by:

Erika Baker

ATTACH 1

I. **OBJECTIVES:** Determine the acceptability of practiced seal leak inspection for hermetically sealed relays designed with a welded evacuation port.

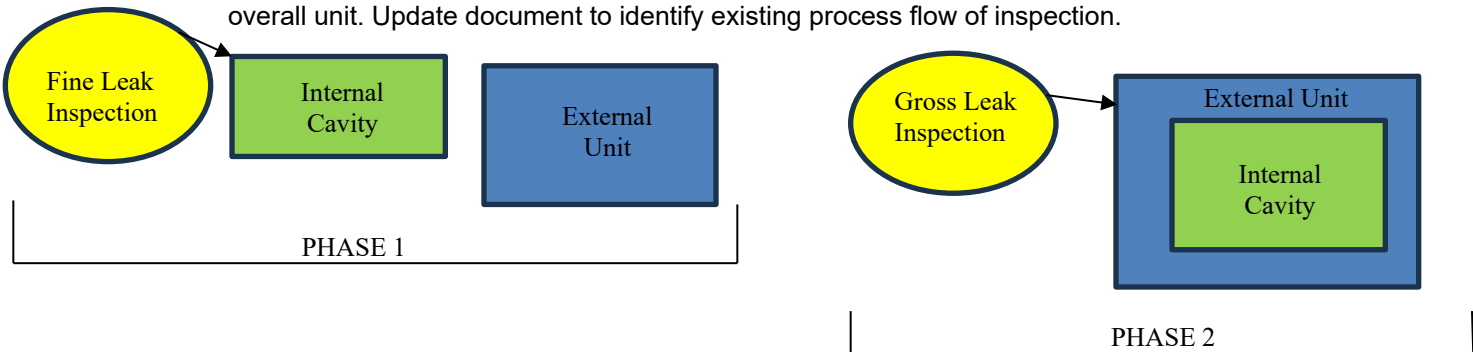
II. **BACKGROUND:** Based on ongoing communication, QPL Manufacturers are interpreting MIL-PRF-6106 TABLE VIII. Group A Inspection, A4, Footnote 5/ “For relays designed with evacuation ports, the seal test may be performed as a final assembly operation prior to performing Group A inspection on type I and type III, provided this test is performed on all of the relays.” to permit seal inspection occurring as part of the final assembly, and not the last process of the final assembly. To detail, the manufacturer is performing the seal inspection prior to sealing, painting or applying powder coating to the unit. In addition, the relays are larger, leading to increased internal volumes that may be a variable in some Seal test methodologies. Furthermore, 4.7.5 limits the seal leak for relays sealed by welding and rated below 25 amperes to condition B MIL-STD-883 (method 1014) – Test Condition B2/B1. However, the QPL Manufactures are augmenting requirements of MIL-STD-202 to evaluative gross and fine leak rate.

III. **RESULTS:**

1. Is the intent of Footnote 5 to allow Seal inspection to be performed after the final assembly and prior to Group A Inspection A1, or to be performed as a process step of the final assembly to include prior to the relay receiving a final seal?

The intent of Footnote 5 is to allow Seal inspection to be performed as a process step during final assembly, after process steps which may impact integrity of seal and material. Proposal to identify approved process steps that may occur after Seal inspection.

2. Can a relay be evaluated as hermetically sealed prior to the final assembly?
Given the constraints, the current process was deemed acceptable to perform the fine leak inspection on internal cavity, and then insert the internal cavity into the external unit and perform a gross leak inspection. Justification is excessive time and cost to perform a fine leak inspection on overall unit. Update document to identify existing process flow of inspection.



3. Can a relay be tested as hermetically sealed at a leak rate of 1×10^{-6} atm cm³/s of air exclusively using the gross leak method?
No, the fine leak and gross leak inspections are required to verify seal.
4. Should Footnote 5/ be reworded FROM “For relays designed with evacuation ports, the seal test may be performed as a final assembly operation prior to performing group A inspection on type I and type III, provided this test is performed on all of the relays.” TO “For relays designed with evacuation ports, the seal test may be performed after the completion of final assembly operation (defined as how customer receives product) and prior to performing group A inspection on type I and type III, provided this test is performed on all of the relays.”?
Note should be revised to identify permissible assembly steps after the leak inspection (i.e. paint).
5. Can a relay be rated as hermetically sealed if the final assembly (as customer received product) does not undergo gross and fine leak testing?
Given the size and associated costs to perform fine leak inspection on the final assembly, it was deemed acceptable to perform fine leak on the cavity, and gross leak on final unit. See illustration of Question 2.

6. Per 4.7.5, the inspection is restricted to MIL-STD-883 (method 1014) – Test Condition B₂/B₁ for relays sealed by welding and rated below 25 amperes. What is the technical justification to eliminate the option of MIL-STD-202, and require use of MIL-STD-883 fine leak and gross leak combination?

There was no technical justification given for an exclusive inspection method of MIL-STD-883- Test Condition B₂/B₁ for relays sealed by welding and rated below 25 amperes. As such, the inspection can be supported by alternate MIL-STD-202 and MIL-STD-883 methods.

7. For MIL-STD-883 (method 1014) – Test Condition A₂, B₁, B₂, C, and MIL-STD-202 (method 112) -Test Condition D, what is the technical justification for the fine leak to be performed prior to gross leak?

The fine leak should be performed prior to the gross leak. Technical justification is internal gas can escape during gross leak by plugging a hole that would otherwise be identified during a fine leak test.

8. Are there additional fine leak and gross leak inspection methods that can be used to verify hermeticity on 6106 products with an evacuation port, sealed by welding, applying paint or powder, and rated over 25 amps?

There is no existing method of MIL-STD-202 or MIL-STD-883 used by QPL-6106 manufacturers to inspect seal. As such, DLA will work with QPL-6106 manufacturers to document their existing inspection methods.

9. Given the seal inspection allowance for relays designed with an evacuation port, should the identification of an evacuation port be included in the Part or Identifying Number (PIN) to communicate inspection requirements?

It is beneficial to identify which relays are inspected by alternate sequence and seal inspection method. There was a strong opinion to not alter existing part numbers. There is an option to list an identifier on QPL-6106 Test Report Numbers. Example: TestNumber -EP where EP is an acronym for evacuation port.

IV. CONCLUSIONS: MIL-PRF-6106 was reviewed, and a DoD position determined the document shall be modified to reflect product inspection.

V. RECOMMENDATIONS: Update MIL-PRF-6106 Seal inspection method and process steps to evaluate relays with an evacuation port to clarify test sequence, and inspection method.