Scope: The heat-seal tests as described in MIL-STD-2073-1D and 1E, Appendix G, Quality Assurance Provisions, are used to determine the effectiveness of the various Military Methods of Preservation that require heat-sealed seam barrier bag testing.
Purpose: To familiarize the DCMA Technical Specialist with MIL-STD-3010B, Test Method 2024 the heat-sealed seam test and Test Method 5009 for container leak testing.

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## Agenda

- Why test heat-seals?
- MIL-STD-2073, Appendix G requirements
- MIL-STD-3010B Test Methods 2024 & 5009
  - Test Method 2024 (Heat seal seam test)
  - Test Method 5009 (Leaks in Containers)
- Summary
- Quiz

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These agenda items cover the why, when and how of heat-seal testing, to include a brief Summary and Quiz.
Note when MIL-STD 2073 is referenced it refers to revision 1D and 1E.

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# Why Test Heat-Seals?

- **Extreme conditions warrant better protection of parts and supplies**
- **Heat, sand, rain, wind and infestation are just some of the conditions that our military supplies must be able to endure.**
- **The types of storage facilities are an unknown and therefore we must ensure our commodities are packaged and tested accordingly to protect our commodities .**

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Given today's Military environment, heat seal testing is more important than ever.

This photo illustrates the outside storage conditions observed at a Medical supply depot in Saudi Arabia, an indication that there are times when supplies are entirely exposed to the elements.

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## MIL-STD-2073 Requirements

- **Appendix G, Quality Assurance Provisions outlines the requirements for Heat-Seal tests.**
- **Table G.II is used to determine the Military Preservation Methods that require testing.**
- **Appendix G, cites testing I/A/W MIL-STD-3010B**
  - **Test Method 2024 (Heat-Seal seam testing)**
  - **Test Method 5009 (Leak testing)**

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FED-STD-101C has been superseded by MIL-STD-3010B. Table G.II of MIL-STD-2073 is a very good tool used to determine if the Military Preservation Method in a contract requires Heat-Seal testing.

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## Test Method 2024

- **A static load will be applied slowly and uniformly without impact and allowed to act for 5 minutes at normal room temperature.**
- **Static load shall be 36, 50 or 56 ounces ± 2 ounces depending on material specified (see MIL-STD-2073 -1E W/CH-1 paragraph G.4.3.2)**
- **A 5% reduction in static load weight is permitted when the room temperature area exceeds 90° F.**
- **Any separation or breakage for the duration of the 5 minute test shall be cause for failure.**

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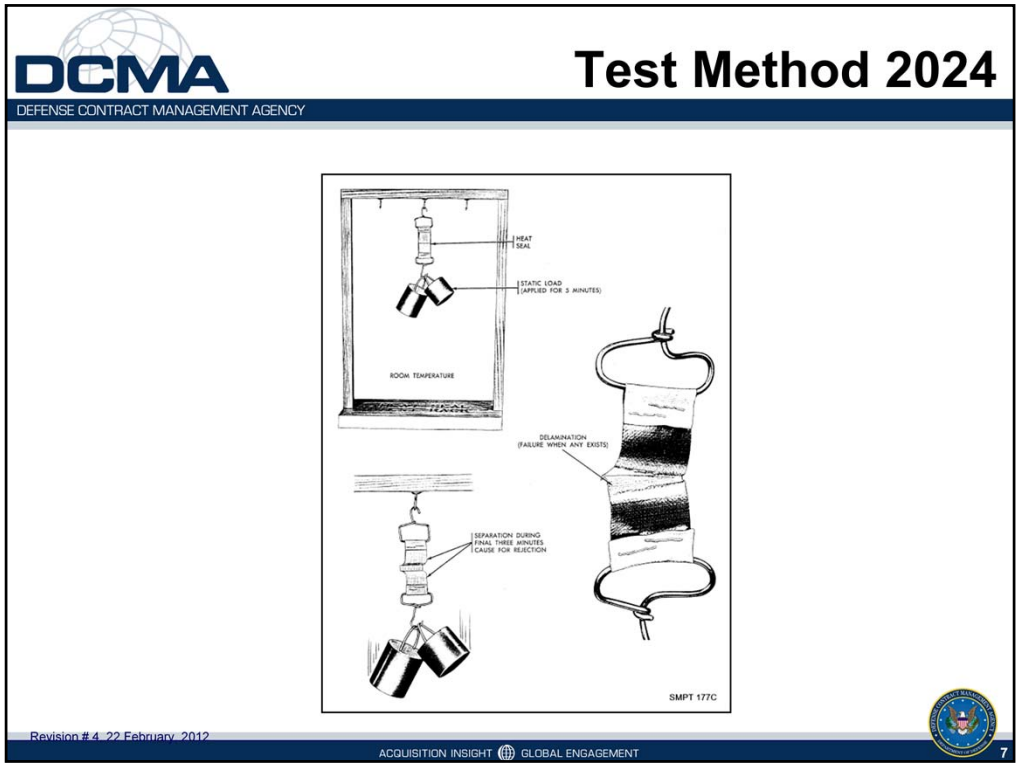
For contracts specifying MIL-STD-2073 prior to 1E W/CH-1, static load weights shall be determined using MIL-STD-2073-1D/E paragraph G.4.3.2 or Table IV of MIL-DTL-117H W/Amendment 2

Specific details of Test Method 2024 are found in MIL-STD-3010B paragraph 5.2.3.

An illustration of Test Method 2024 is shown on the next slide.




Double stapled attach ends with load on bottom.
A static load will be applied slowly and uniformly without impact and allowed to act for 5 minutes at normal room temperature (73 Degrees Fahrenheit, plus or minus 3.5 Degrees).
Picture is from an SMTP training workbook.

This illustration indicates how Test Method 2024 test A, is conducted using the applicable static load suspended from the test sample for 5 minutes at normal room temperature.

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# Test Method 5009

- **There are 5 Leak Test Techniques.**
  - **Vacuum Retention technique**
  - **Pneumatic Pressure technique**
  - **Squeeze technique**
  - **Hot Water technique**
  - **Submersion technique**

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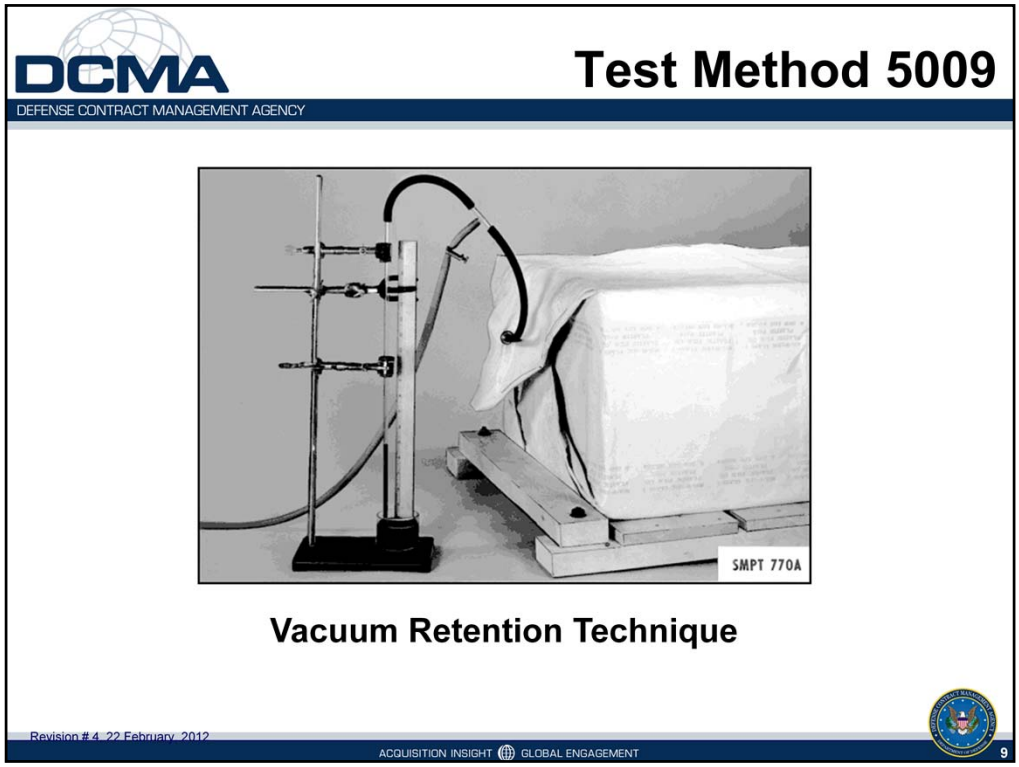
The selection of the appropriate Leak Test Technique depends on the container being tested. For example, there is a Vacuum Retention Test for Sealed Rigid Containers and a Vacuum Retention Test for Sealed Flexible Bags. (ref. MIL-STD-2073, G.4.2.2.1 & 2)



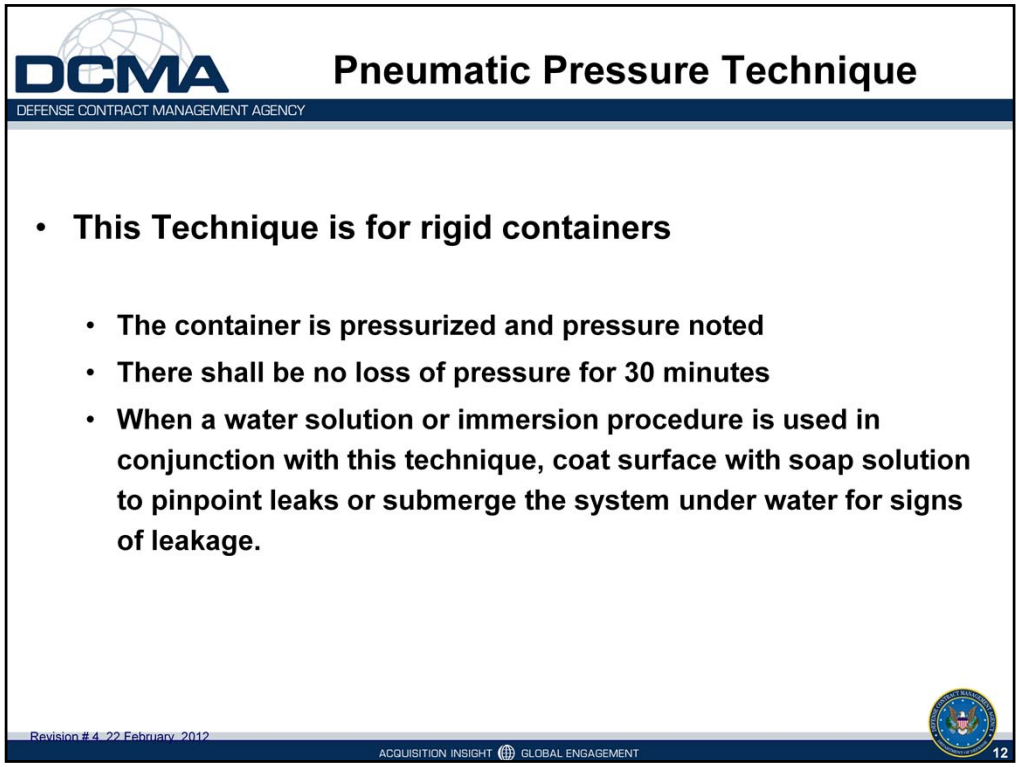

The Vacuum Retention Technique is generally used for sealed rigid containers or large sealed flexible bags. This technique does not specifically locate leaks and may not indicate the existence of tiny leaks in large unit packs.

# Test Method 5009

- **Vacuum Retention Techniques for Sealed Rigid Containers**
  - **Hook up a vacuum tube to evacuate air**
  - **Install a gage to determine loss of vacuum**
  - **After pressure is stabilized stop evacuating air**
  - **After 10 minutes check for static loss of vacuum pressure**
  - **Any loss of pressure is rejectable**

# Test method 5009

- **Vacuum Retention Technique for Sealed Flexible Bags**
  - **Draw air until bag clings snugly to enclosed item**
  - **Bag to remain undisturbed for two hours**
  - **Grasp bag and draw it away from item, then release**
  - **The bag shall remain taught**




When submerging the system it is like placing an inner tube in water and checking for leaks. The applied soap solution to the suspected leakage area will assist in pinpointing the leak as air bubbles will form at the spot of the leakage.

Over pressurization can cause an explosive failure, be sure to calculate specimen pressure in accordance with the formula detailed in Test Method 5009 of MIL-STD-3010B.

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## Squeeze Technique

- **During sealing, as much air as possible shall be entrapped within the flexible bag at ambient conditions.**
- **When the bag is squeezed to increase the internal air pressure of the container, there shall not be a steady stream or recurring succession of bubbles from any surface or seam**

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Conversely, if the bag is able to be inflated with air after sealing then this is also cause for rejection.

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# Hot Water Technique

- All samples shall be conditioned at ambient conditions at least four hours prior to performing this test.
- Observe evolution of air bubbles at each position of the sample.
- There shall not be a steady stream or recurring succession of bubbles from any surface or seam.
- Bubbles which appear on the surface of the unit pack but are not released or are released at a slowly decreasing rate are not to be construed as indication of failure.

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Place in water that is heated to 50°F over initial temperature of specimen, but not more than 110°F for wax dipped specimens. Observe for leaks. Test shall not last more than 8 minutes.

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# Submersion Technique

- After submersion and before opening the sealed system, carefully dry the outside.
- Open the sealed system and note whether leakage has occurred.
- There shall be no evidence of moisture within the bag.
- This technique is not as sensitive as the air leakage tests.

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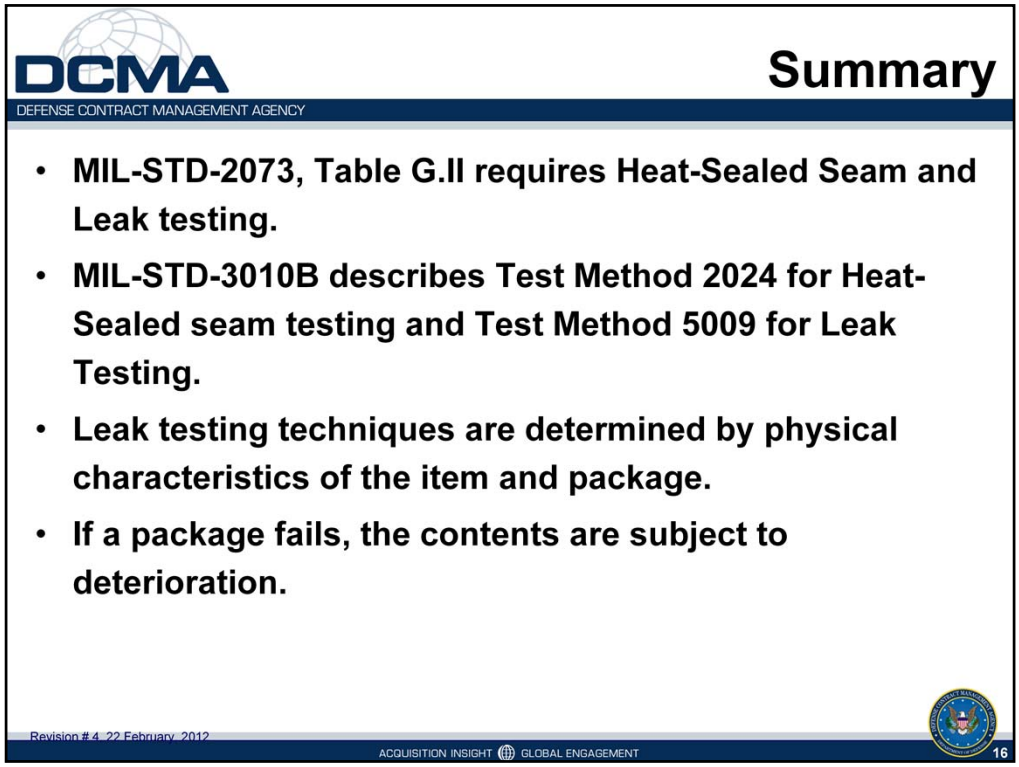
Submerge part in water for minimum 1 hour. Remove package and carefully and completely dry it off. Open package and look for moisture.




By using Table G.II of MIL-STD-2073 and Heat-Sealed Seam and Leak Test Methods of MIL-STD-3010B, the applicable testing can be determined and adequately performed. These tests will help to ensure that commodities are protected in the extreme conditions of a Military environment.

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# Quiz

1. **Where are the test requirements for each of the Military Methods of Preservation found?**

a) **MIL-STD-129P**
b) **MIL-STD-2073, Table G.II**
c) **ASTM-3951**
d) **MIL-Q-9858A**

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Answer: b) MIL-STD-2073, Table G.II

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# QUIZ

**2. What are the two Test Methods for testing Heat-Sealed seams for strength and leaks?**

a) MIL-STD-3010B and MIL-STD-2073
b) Test Methods 2420 and 9005
c) Test Methods 2024 and 5009
d) All of the above

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Answer: c) Test methods 2024 and 5009

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# Quiz

**3. Using Test Method 2024, Test A, the Heat-Sealed seam strength test, how many total minutes will a static load be applied.**

**a) 2 minutes**

**b) Until the specimen breaks**

**c) 36 or 50 ounces**

**d) 5 minutes**



Answer: d) 5 minutes

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# Quiz

**4. How many Heat-Sealed test Techniques are listed in the Test Method 5009 Leak Test?**

a) 2
b) 7
c) 5
d) 1

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Answer: c) 5 (Vacuum Retention, Pneumatic Pressure, Squeeze, Hot water and Submersion)

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# Quiz

**5. In the Heat-Sealed seam strength and leak tests, what are the factors that can cause failures and rejections?**

a) Test Method not properly conducted
b) Moisture on contents
c) Seam separation
d) Static load weight exceeds 2 ounce tolerance
e) All of the above

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Answer: e) All of the above