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EXAMINATION OF SHIPPING PACKAGES 9975-02274 AND 9975-04769

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DISCLAIMER

EXAMINATION OF SHIPPING PACKAGE S 9975-02274 AND 9975-04769

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Summary

Shipping packages 9975-02274 and 9975-04769 were examined in K-Area following the identification of a non-conforming condition; the axial gap between the drum flange and upper fiberboard assembly exceeded the maximum allowed value of 1 inch.

The fiberboard in package 9975-02274 had slightly elevated moisture content, up to 19 % wood moisture equivalent (WME). Other compliant packages have displayed similar moisture levels locally, but not as consistently throughout the entire fiberboard assembly. Evidence of mold was observed on the lower assembly, although it appeared relatively dormant. Relatively little compaction or physical degradation was observed in this package. Due to the mold, it is recommended that the fiberboard in this package not be re-used.

The fiberboard in package 9975-04769 was relatively dry (7-10 %WME) and showed no sign of compaction or physical degradation. Variations in the axial gap that have been measured on this package result from variations in the height of the upper and lower fiberboard assemblies, and their relative orientation to each other. The fiberboard in this package is physically sound and considered fit for continued use.

Background

Package 9975-02274 was received into KAMS in 2003 from RFETS. It remained loaded until it was opened as part of KAMS 9975 field surveillance activities in February 2011. This package was identified to have an axial gap between the drum flange and upper fiberboard assembly greater than the specified 1 inch maximum, and was placed under an NCR condition (2011-NCR-29-0006).

Package 9975-04769 was used to store material in KAMS from 7/28/08 until 5/23/11. It was re-certified by SRNL High Pressure Lab personnel in October 2011. This package was opened in K Area for pre-use checks on November 28, 2011. It was identified to have an axial gap between the drum flange and upper fiberboard assembly greater than the specified 1 inch maximum.

Both packages 9975-02274 and 9975-04769 were examined in K Area on November 29, 2011. Present at this examination were T. Grim, W. McEvoy, C. Zeigler, P. Stevens and W. Daugherty, with assistance from D. Holliday (SRNL High Pressure Lab).

Past experience [1 - 3] indicated the possibility that this axial gap condition might signal the presence of excess moisture within the fiberboard, and the examinations were conducted in a manner to identify whether excess moisture were present or if the fiberboard had experienced any significant degradation. This report documents the results of the examinations.

Examination Results

In examining each package, the lifting device typically used to remove the lead shield was not available. Therefore, each lower fiberboard assembly was slid out from its drum with the shield in place, and the inner surfaces of the lower fiberboard assemblies were

not examined. Given the condition of the outer surfaces of these assemblies, examination of the inner surfaces was not considered necessary.

The following observations were made during examination of package 9975-02274:
- The axial gap (average of 4 readings) at the top of the package was 1.077 inch.
- The relative humidity in the top air space was 47 %, with a temperature of 19.8C.
- Fiberboard moisture content was measured on the upper assembly and outer surfaces of the lower assembly. The upper assembly moisture was approximately 12 – 14 %WME on the inner surfaces, and 16 – 17 %WME on the outer surface. The lower assembly moisture was approximately 16 – 19 %WME on the outer surfaces.
- Dimensional measurements are summarized in Table 1.
- A strong musty odor was associated with the fiberboard. A slight fuzziness in the surface texture in regions of the lower assembly appeared consistent with the presence of mold, although the direct visual evidence of mold was minimal. A few small white spots observed along a glue line is consistent with the presence of mold.
- A heavy layer of lead carbonate corrosion product was present on the shield, with significant amounts flaking off during handling.
- The bottom of the lower fiberboard assembly was compressed slightly in a ring around the outside, from contact with the dished drum bottom. This ring was approximately 1.5 inches wide.

The following observations were made during examination of package 9975-04769:
- The axial gap (average of 4 readings) at the top of the package was 1.001 inch.
- Upon re-assembly of the package, the axial gap was 0.943 inch.
- The relative humidity in the top air space was 39 %, with a temperature of 19.6C.
- Fiberboard moisture content was measured on the upper assembly and outer surfaces of the lower assembly. The upper assembly moisture was approximately 7 - 9 %WME. The lower assembly moisture was approximately 8 - 10 %WME on the outer surfaces.
- Dimensional measurements are summarized in Table 2.
- Relatively little corrosion product was present on the shield.

Discussion

Drawing R-R2-F-0025 [4] recognizes that the axial gap dimension may vary over time due to variation in the fiberboard properties. An increase in the gap could result from axial shrinkage of the fiberboard (possibly as a result of moisture loss) or from compression of fiberboard layers (possibly as a result of local regions of elevated moisture).

The moisture content of the fiberboard in 9975-02274 is somewhat elevated relative to a typical package, but not excessively so. Compliant packages have been observed with fiberboard moisture content as high as 15 – 18 %WME, but generally the elevated moisture is limited to local regions of the fiberboard assembly. The small moisture gradient across the upper assembly indicates a relatively high moisture level throughout the entire assembly.

The strong musty odor from 9975-02274, combined with visual indications of mold, indicate that mold has been active in this package, although it appears relatively dormant at present. Significant time has elapsed since this package was unloaded in February 2011 to allow a stronger moisture gradient to diminish. This would tend to reduce the activity of mold growth as the local regions of elevated moisture content become dryer. It is likely that a stronger moisture gradient would return, and mold growth increase, if this package were returned to service as-is.

Aside from the mold, the fiberboard in 9975-02274 retains a high degree of integrity. The compression around the bottom of the lower assembly is minimal, and consistent with that typically seen after a period of service.

No specific degradation was observed in the fiberboard of 9975-04769. The material remains solid with no significant compaction. There was no indication of mold in this package. The source of the excessive axial gap appears to be variation in the height of the fiberboard assemblies. The height of the upper assembly (dimension UH1) varies by more than 0.2 inch, while the lower assembly varies in height by approximately 0.1 inch. Depending on the relative orientation between the upper and lower assembly, the total fiberboard height could vary. This would account for the varying measurements of axial gap, and the measurement of an axial gap less than 1 inch after reassembly of the package. The fiberboard in this package is relatively dry and physically sound, and appears acceptable for continued use.

References

1. SRNL-STI-2009-00240, “Examination of Fiberboard from Shipping Package 9975-01819”, W. L. Daugherty, April 2009

2. SRNL-STI-2009-00742, “Examination of Shipping Packages 9975-01818, 9975-01903 and 9975-02287”, W. L. Daugherty, November 2009

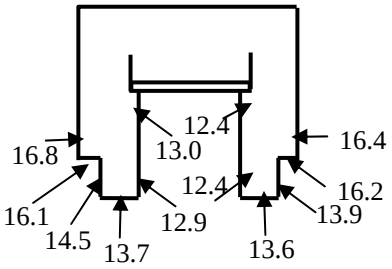
3. SRNL-STI-2010-00233, “Examination of Shipping Packages 9975-01968, 9975-04353 and 9975-06870”, W. L. Daugherty and J. L. Murphy, April 2010

4. Drawing R-R2-F-0025, Rev. 2, “9975 Drum with Flange Closure Subassembly and Details”, October 29, 2003

Table 1. Detailed data for package 9975-02274

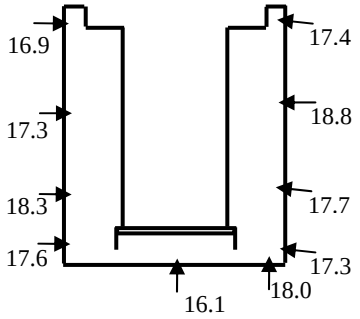
Upper air space RH	47% at 19.8 C		
Axial gap	1.077 inch		
Upper assembly			
Dimension UH1	7.12 inch	Dimension UH3	5.028 inch
Dimension UH2	2.168 inch		

Moisture content (%WME)

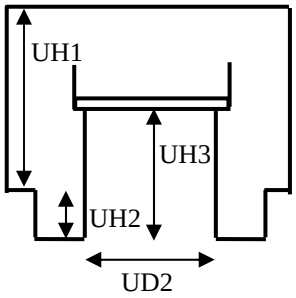


Lower assembly			
Dimension LH1	26.48 inch		

Moisture content (%WME)



Each recorded dimension is an average of 2 or 4 measurements, ~90 or 180 degrees apart. Larger dimensions were read to the nearest 1/32 inch with a tape measure. Smaller dimensions were read to the nearest 0.001 inch with calipers.
Dimension UH1 includes the air shield, which adds ~0.1 inch to the measurement.



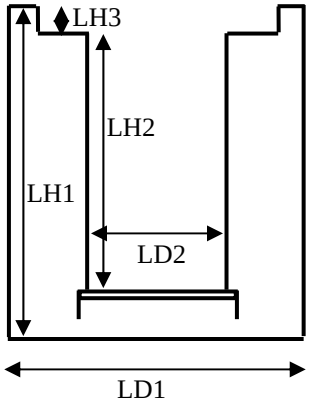
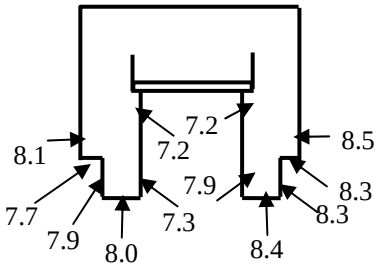


Table 2. Detailed data for package 9975-04769

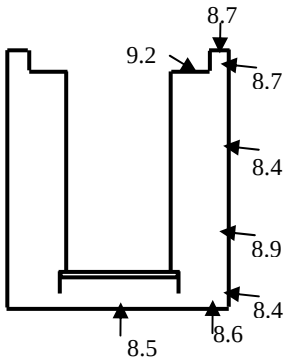
Upper air space RH	39% at 19.6 C		
Axial gap	1.001 inch before disassemble 0.943 inch after re-assemble		
Upper assembly			
Dimension UH1	7.066 inch	Dimension UH3	4.826 inch
Dimension UH2	1.948 inch		

Moisture content (%WME)

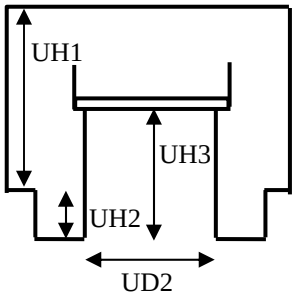


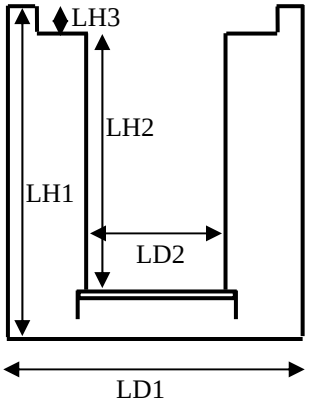
Lower assembly			
Dimension LH1	26.67 inch		

Moisture content (%WME)



Each recorded dimension is an average of 4 measurements, ~90 degrees apart. Larger dimensions were read to the nearest 1/32 inch with a tape measure. Smaller dimensions were read to the nearest 0.001 inch with calipers.
Dimension UH1 includes the air shield, which adds ~0.1 inch to the fiberboard height.





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