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Project: LHC I.R.Feedboxes

Title: Verification Test of Pre-Production DFBX Chimney Bellows

Summary

Three pre-production DFBX Chimney Bellows purchased under PO 6705767 according to LBNL Specification M20003 were tested according to attached procedure/data sheet.

Except for the overall length all three bellows are in compliance with Specification M20003 and exhibit no degradation upon a rapid warmup to room temperature after being submersed in LHe for one hour.

Regarding the overall length, the bellows manufacturer, American BOA, notified us in advance that the overall length was incorrect because the weld cuffs were attached too close to the convolutions. The production bellows will be made to the correct overall length, and the convolutions in the pre-production bellows were fabricated exactly as they will be in production.

The bellows can be considered suitable for use in the DFBX, provided they are made per Specifcation M20003 and the approved BOA drawing.

15 July 2003
J. Zbasnik

Examination and Test of Chimney bellows for DFBX LHe Vessel

1. Objects to be tested

Bellows are Type I multi-ply bellows as specified in LBNL Specification M20003. They are produced by American BOA under LBNL PO 6705767. Three bellows will be provided for this evaluation. Label them as "1", "2", and "3" for identification.

2. Testing Details

2.1 Inspection (in B77)

Verify that the bellows assembly dimensions conform to BOA drawing 100875 Rev A. Not necessary to use the CMM. Enter the data in the Table below. Weld cuff measurements are taken at each end.

Dimension	Drawing Value	Bellows 1		Bellows 2		Bellows 3	
Bellows I.D.	5.84 ± .05 inch	5.875 / 5.890		5.885 / 5.895		5.887 / 5.893	
Bellows O.D.	6.63 ± .05 inch	6.633 / 6.647		6.635 / 6.647		6.635 / 6.643	
Overall Length	4.00 ± .06 inch	3.370 / 3.400		3.370 / 3.390		3.340 / 3.410	
Bellows Length	2.5 ± .12 inch	2.50 / 2.550		2.495 / 2.550		2.50 / 2.555	
Weld Cuff O.D.	6.00 ± .05 inch	6.0/6.025	6.0/6.025	6.0/6.018	5.995/6.02	6.005/6.012	6.0/6.025
Cuff Thickness	.08 ± .01 inch	.08	.08	.08	.08	.08	.08
Cuff Length	.32 ± .05 inch	.32	.32	.32	.32	.32	.32

2.2 Incoming Leak Check (in B77)

Leak check the bellows using a helium mass spectrometer leak detector in the conventional tracer probe method. Use bag sealant on each of the cuffs to seal to a flat plate. Since the bellows are very flexible, use an internal holder to prevent them from collapsing. Leak rate shall be less than 1 x 10^{-9} atm cc/sec (helium). 8/4/03 SRD

Bellows 1 Leak Rate: 4.8 X 10^{-10} atm cc/sec helium background / no helium response

Bellows 2 Leak Rate: SRD 4.8 x 10^{-10} atm cc/sec helium background — no helium response

Bellows 3 Leak Rate: SRD 4.8 x 10^{-10} atm cc/sec helium background — no helium response

2.3 LHe Immersion Test (in B52)

The outer two plies are perforated to allow any trapped helium fluid to be vented as it is warmed without destroying the bellows. This test verifies that there is sufficient perforation to allow venting. The test will be performed in B52 using Supercon Technicians and an existing superconducting magnet dewar.

Need 100 liters of LHe for the test.

1. Remove magnet from dewar. Store in a safe place.
2. Lower the 3 bellows into the dewar using Kevlar string
3. Install a top plate with access for LHe transfer line and another for venting.
4. Evacuate and backfill with GHe four times 4X < 100μ
5. Transfer in about 40 liters of LHe (16 inch deep in the Dewar). Measure the level with a thermoacoustic thumper through the vent hole.
6. Allow the bellows to be submerged for 1 hour, transferring LHe as necessary.
7. Quickly remove the bellows from the dewar and place them in a chamber where a protective atmosphere of N_2 can be provided.
8. Allow the bellows to warm to room temperature.
9. Examine the convolutions for signs of gross distortion. Take photographs of any damage. (If there is evidence of distortion, the degree of perforation may have to be increased.)

Photos of procedure emailed to J.Z.

10. Fill out the table with observations.

Bellows	Observations
1	No change H. Higley 8/5/03
2	No Change H.H
3	No Change H.H

2.4 Leak Check after Immersion Test (in B77)
If the bellows appear okay after the immersion test, perform a leak check as in 2.2 to verify they are okay. 8/5/03

Bellows 1 Leak Rate: 4.0×10^{-10} atm cc/sec helium background – no helium response JRD

Bellows 2 Leak Rate: 4.0×10^{-10} atm cc/sec helium background – no helium response JRD

Bellows 3 Leak Rate: 4.0×10^{-10} atm cc/sec helium background – no helium response. JRD

2.5 Pressure Test (in B77)
If the bellows pass the leak test in 2.4, perform a pressure test to 100 psig to verify they are okay. Pressure test with dry nitrogen gas, using the safety manifold setup for pressure testing the bus ducts. Design and fabricate suitable test caps; either using a radially-sealed O-ring or a welded on cap. Use at least 4 each 1/2-13 threaded rods (steel) to restrain the 4000 lbf exerted by the expanding bellows. Hold for 10 minutes with no pressure drop. Fill out the lines below.

Bellows 1 Pressure Drop after 10 min.: No change JRD 8/6/03

Bellows 2 Pressure Drop after 10 min.: No change JRD 8/6/03

Bellows 3 Pressure Drop after 10 min.: No change JRD 8/6/03

2.6 Final Leak Check (in B77)
If the bellows pass the pressure test, perform a leak check as in 2.2 to verify they are okay.

Bellows 1 Leak Rate: 4.4×10^{-10} atm cc/sec helium background – no helium response JRD

Bellows 2 Leak Rate: 4.4×10^{-10} atm cc/sec Helium background – no helium response JRD

Bellows 3 Leak Rate: 4.4×10^{-10} atm cc/sec Helium background – no helium response JRD
8/6/03