

CIL  
EMU CRITICAL ITEMS LIST

12/24/91 SUPERSEDES 08/31/90

ANALYST:

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NAME P/N QTY	CEI	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
PRESSURE GAGE, ITEM 213e SV7P042-3 (1)	1/1	<p>213E1MDA: Rupture of the bourdon tube assembly.</p> <p>CAUSE: Material heat treatment, weld defect or thin wall condition.</p>	<p>END ITEM: Rapid release of high pressure oxygen and resulting shock wave into the sensor reference cavity. Possible ignition of particles in the reference cavity. For a small leak, a vent hole is provided for pressure relief.</p> <p>GSE INTERFACE: Loss of BOP oxygen supply.</p> <p>MISSION: Abort EVA.</p> <p>CREW/VEHICLE: Possible loss of cresmen.</p>	<p>A. Design - The maximum expected number of operating pressure cycles during the life of this item is 175, and proof pressure cycles is 25. A fracture mechanics analysis predicts that the bourdon tube will leak before burst. The fracture mechanics analysis also predicts that a defect 93.4% or more through the bourdon tube wall is required to cause a leak during the 15 year life of the item. The bourdon tube is made of Inconel X-750 and is silver soldered into a 301 CREB tube on one end. The tube is in turn copper brazed into a 301 CREB socket. The other end of the tube is closed off and soldered to the pointer. Each bourdon tube assembly is stress tested to 15,000 psi which is higher than the SOP burst requirement of 14,000 psi. The bourdon tube sensing element has been designed with a factor of safety of 1.5 at operating conditions. The reference chamber vent hole prevents case overpressurization if the bourdon tube leaks. A ruptured bourdon tube however would flow in excess of the chamber vent hole capacity.</p> <p>B. Test - Component Acceptance Test - Tests are performed by the manufacturer, Kratos, which would detect a defective material heat treatment, thin wall or bad braze joint. The sensing tube is subjected to a 15,000 psi stress proof test, 11,200 psi proof test, 7,400 psi calibration test and an external leakage test. The gauge is subjected to a 11,200 psi proof test, a 7,400 psi calibration test and an internal leakage test.</p> <p>CEI PBR Test - The rupture of the bourdon tube at max operating pressure (7,400 psia) due to material heat treatment or braze defects would be detected by proof, leakage, and instrument accuracy testing. The item is proof pressure tested at 18,900 - 11,300 psia GN2 for 5 minutes minimum, and then visually inspected for evidence of distortion, cracks, or other defects. Sequentially, the item is externally leak tested with a 2% He and 98% N2 gas mixture at a pressure of 5000-6200 psig in a chamber vacuum. Leakage must not exceed 5.55 x 10<sup>-5</sup> scc/sec He (3.55 x 10<sup>-5</sup> scc/sec He max represents total end item (SDP) leakage). The accuracy of</p>

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NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
	1/1	213E#M06:		<p>the item is checked by pressurizing it to 7400 psig and then comparing with a known pressure. The two pressures must agree within 400 psi.</p> <p><b>Certification tests -</b> The item completed 100 proof and 1200 operating cycles during 4/79 to fulfill the cycle certification of 25 and 300 cycles respectively. The item completed a 14,800 psi test during 4/79 which fulfilled the burst requirement. No Class I engineering changes have been incorporated since this configuration was certified.</p> <p><b>C. Inspection -</b> There is 100% inspection, including proof pressure and leakage test of all the elements exposed to the high pressure medium during vendor acceptance testing per drawing 58778675. Particulates are minimized by cleaning those elements exposed to the oxygen to MS3150 EMS8A.</p> <p><b>D. Failure History -</b> NEMU-215-0001 (11-27-83) Bourdon tube fitting ruptured due to thin wall. Drawing changed to control minimum wall thickness by EC 42806-407.</p> <p><b>E. Ground Turnaround -</b> Fasted for rupture of the Bourdon tube Assembly per NEMU-8-001, SOP Servicing for Flight.</p> <p><b>F. Operational Use -</b> Crew Response - Pre/PostEVA: No response possible. EVA: No response possible. Training - No training specifically covers this failure mode. Operational Considerations - N/A.</p>

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