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APOLLO 10

RECOVERY FLASHING BEACON FAILURE

ANOMALY REPORT NO. 2

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

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APOLLO 10 MISSION

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STATEMENT

During the Apollo 10 recovery sequence, the recovery flashing light was not flashing after landing. The light had been operating in the high flash rate mode during descent on the main parachutes. Loss of the flashing light did not hinder subsequent recovery operations.

DISCUSSION

The glass flash tube was found cracked (fig. 1) during the postflight inspection of the flashing light, although there was no evidence of any impact to the lamp or deployment mechanism. Lamp tests indicated that the trigger coil and connector functioned properly, but the xenon flash tube was not operating. Broken xenon flash tubes were also found on the Apollo 11 spacecraft during the postflight inspection and on command and service modules 111 during preflight testing.

The high intensity recovery flashing light consists of a power supply and trigger circuit to provide a high-voltage discharge in a xenon gas flash tube. The lamp was originally designed to flash at a rate of 8 to 24 flashes per minute; however, for the manned Apollo spacecraft the unit was modified to operate in both a high and low flash rate mode of 120 and 20 flashes per minute, respectively. The light was not requalified for operation at the higher flash rate.

The flash tube consists of a xenon filled "U" shaped Vycor glass tube encapsulated in transparent epoxy for protection. The temperature coefficients of expansion for the glass and epoxy are 8×10^{-7} and 3.8×10^{-5} per degree centigrade. Tests have shown that the differential thermal expansion between the lamp glass and epoxy potting causes the glass flash tube to crack when the lamp is operated for extended periods of time at the higher flash rate. The cracked glass allows the xenon gas to escape and the lamp thus becomes inoperative.

CONCLUSION

Extended periods of lamp operation in the high flash-rate mode increase the temperature of the lamp such that thermally induced stresses due to differential expansion between the flash tube and its epoxy encapsulant crack the flash tube.

CORRECTIVE ACTION

Volume II of the Apollo Operations Handbook specifies using the high flash-rate mode during descent on the main parachutes. For Apollo 12 and subsequent, the Apollo Operations Handbook was changed to specify use of the low flash-rate mode only.

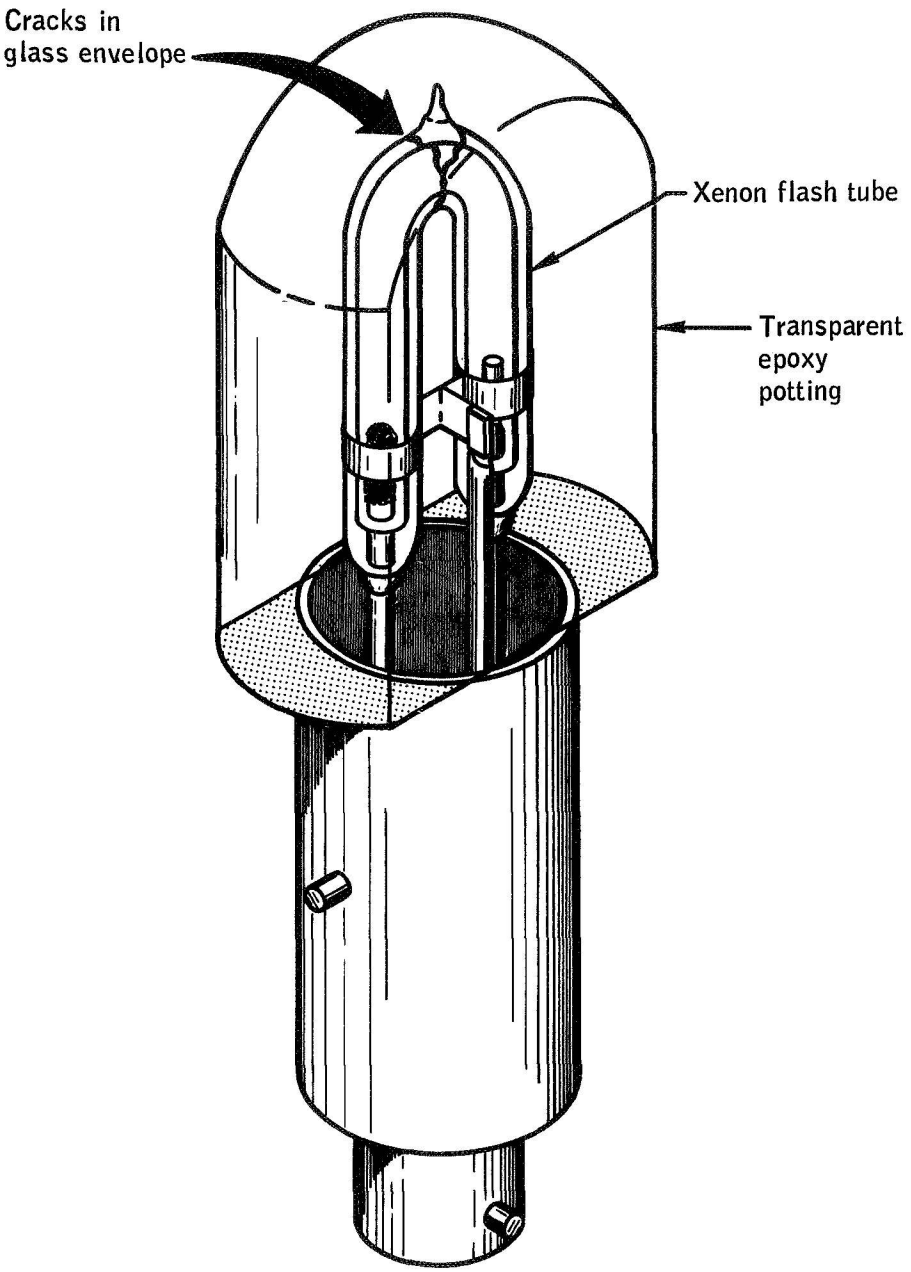

Figure 1.- Lamp assembly showing area of failure.