

NOV 10 1959

XW-49, 3-2
Project No. T-16430
Case No. 784.00
Ref. Syn: 1613(110)

TO: DISTRIBUTION

Re: Leak Rate Tests on the XW-49 Warhead

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW	
1 st Review Date: <u>5/20/98</u>	2. Classification Retained
Authority: <input checked="" type="checkbox"/> ADD	3. Classification Changed to: <u>uncl</u>
Name: <u>W.C. Payne</u>	4. Contains No DOE Classified Information
2 nd Review Date: <u>5/26/98</u>	5. Contains WFO
Authority: <u>ADD</u>	6. Contains UCAF
Name: <u>W.C. Payne</u>	Comments: <u>Did not</u>

Object of Test

The object of this test was to determine leak rates of the XW-49-0, XW-49-XI and a leak test cylinder mockup of the XW-49-XI. It was requested in a Work Order from Organization 1245. Mr. B. E. Martinez, 1245, was the consultant.

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SEP 14 1965

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Summary of Results

Leak rates and location of leaks were determined for the three units. A relation between leak rate and differential pressure was also determined.

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AUG 6 1964

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Procedure and Results

Two tests were probed at Site Able on the XW-49-0 utilizing a Consolidated 24-210 helium leak detector. Helium leakage rate tests were performed in the large vacuum chamber in Area II on one XW-49-XI. Helium leakage rate tests were also performed in Area II on a mockup of the XW-49-XI with seals as used in the weapon. The helium leak detector used on the large vacuum chamber in Area II was a Consolidated 24-210. The accuracy of the large vacuum chamber system in detecting helium leakage is known to be poor because of the method of calibrating the standard leak. The leakage rate of the units checked could be in error by 100%. A method of obtaining better accuracy on standard tests is being investigated. The allowable leak rate on these units is 5.6×10^{-4} cc/sec.

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Tests at Site Able

Probe tests on a XW-49-0 weapon at site Able on 6-18-59 revealed leakage through the squash relief valve.

Similar tests on 7-15-59 revealed leakage through the squash relief valve of the weapon.

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Tests in Area II on XW-49-1

An XW-49-1 was pressurized with 10.0 psig of nitrogen and 7.6 psig of helium (the unit was pressurized with this mixture so as to obtain a 25% mixture of helium at approximately 2 atmos. absolute pressure). A helium leakage rate

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SANDIA SYSTEMATIC DECLASSIFICATION REVIEW DOWNGRADING OR DECLASSIFICATION STAMP	
CLASSIFICATION CHANGED TO: <u>U</u>	AUTHORITY: <u>W.C. Payne</u>
PERSON CHANGING MARKING & DATE: <u>Emelda Selph 5/27/98</u>	RECORD ID: <u>98SN2117</u>
PERSON VERIFYING MARKING & DATE: <u>W.C. Payne 5/28/98</u>	DATED: <u>5/26/98</u>

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check was then performed on the unit. The indicated leakage rate was 2.3×10^{-3} cc/sec. (This is the total leakage rate considering the nitrogen helium mixture at a pressure differential of 1 atmos.). It was reported by the personnel in Area II that six runs were performed on this unit and all runs were approximately equal. A helium probe test revealed leakage through plug J3 in the nose of the weapon. The consultant repaired plug J3. A recheck of the unit revealed a total leakage of 9.2×10^{-4} cc/sec. with a one atmos. pressure differential. Probe tests revealed leakage through the rear cover seal.

Further tests were performed on an XW-49-X1. The unit was once again pressurized with 10.0 psig of nitrogen and 7.6 psig of helium. The total leakage rate was 1.8×10^{-2} cc/sec with a one atmos. pressure differential. A probe test revealed leakage through the front main seal. The pressure was reduced in the weapon to 4 psig. The leakage rate was 4.6×10^{-3} cc/sec with a one atmos. pressure differential. (This leakage rate is based on the assumption that when the pressure was reduced to 4 psig the helium concentration was still 25% of the total mixture). Probe tests were performed on the unit in Area I utilizing a Veeco MS9AB helium leak detector. Leakage was detected through the pressurizing valve and through the front and back main "O" ring seals.

Mockup of XW-49-X1

The unit was pressurized with 10 psig of nitrogen and 7.6 psig of helium. The leakage rate detected was 1.3×10^{-3} cc/sec with a one atmos. pressure differential.

Leakage tests on the mockup XW-49-X1 were then performed at different weapon pressures ranging from 0 psig to 20 psig. Table I is a tabulation of the results of this test. The pressures mentioned are gage pressures in the unit. Since the unit was checked in a vacuum, the differential pressures were the gage readings listed, plus one Albuquerque atmos. (approx. 12.2 psi). The leakage readings obtained are helium leakage only. No factors for the pressure differential was calculated into the leak rate. (Differential pressure does affect leak rate). And no factor for the % concentration of helium was calculated into the final leak rate. (If we assume that the percent helium in the unit remained at 25% while the pressure was being reduced, the leakage rate recorded should be multiplied by 4. This number 4 is also assuming that helium and nitrogen escape from a hole at the same rate).

Table II shows the leakage rate of the unit with corrections made for the percent helium and for the pressure differential. All readings were corrected for a one atmos. pressure differential. Two assumptions were made in making these calculations. The first assumption was that helium and

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nitrogen go through a small hole at the same rate. The second assumption was that the leaks in the unit were of the molecular type. In this type of leakage the leakage rate doubles as you move from 1 atmos. to 2 atmos. pressure differential. According to this procedure, all of the reading below should be equal since they are all related to a one atmos. pressure differential. The readings do vary slightly but they are fairly consistent considering the calibrated leak could be off by 100% on any given reading.

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TABLE II -- LEAKAGE RATES FOR VARIOUS INTERNAL
LEAPON PRESSURES WITH CONNECTIONS
MADE FOR % HELIUM AND FOR
DIFFERENTIAL PRESSURE

<u>PSIG SUPPLIED TO UNIT</u>	<u>LEAKAGE RATE IN ATMOS. CC/SEC</u>
20	2.1×10^{-3}
19	2.9×10^{-3}
18	3.1×10^{-3}
17	2.8×10^{-3}
16	3.5×10^{-3}
15	3.2×10^{-3}
14	3.4×10^{-3}
13	3.1×10^{-3}
12	3.2×10^{-3}
11	2.9×10^{-3}
10	2.6×10^{-3}
9	3.2×10^{-3}
8	3.4×10^{-3}
7	4.4×10^{-3}
6	4.4×10^{-3}
5	3.1×10^{-3}
4	3.6×10^{-3}
3	2.9×10^{-3}
2	3.1×10^{-3}
1	3.1×10^{-3}
0	2.8×10^{-3}

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TABLE 1 - LEAKAGE RATES FOR VARIOUS
INTERNAL WEAPON PRESSURES

<u>PSIG SUPPLIED TO UNIT</u>	<u>LEAKAGE RATES IN CC/SEC</u>
20	1.4×10^{-3}
19	1.9×10^{-3}
18	1.9×10^{-3}
17	1.7×10^{-3}
16	2.0×10^{-3}
15	1.8×10^{-3}
14	1.8×10^{-3}
13	1.5×10^{-3}
12	1.6×10^{-3}
11	1.4×10^{-3}
10	1.2×10^{-3}
9	1.4×10^{-3}
8	1.4×10^{-3}
7	1.7×10^{-3}
6	1.6×10^{-3}
5	1.1×10^{-3}
4	1.2×10^{-3}
3	9.2×10^{-4}
2	8.9×10^{-4}
1	9.5×10^{-4}
0	7.1×10^{-4}

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