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ENGINEERING NOTE		D32221	M5131	1 OF 3
AUTHOR	DEPARTMENT	LOCATION	DATE	
RON HINTZ	DOUBLET III	T77G	FEB 10, 1978	

ON DOUBLET III FOR GENERAL ATOMIC CO.
WE ARE DESIGNING A LARGE ALUMINUM
CYLINDRICAL VACUUM TANK WITH THE
USUAL NUMBER OF WELDS, PORTS, AND
O-RINGS.

WE PLAN ON SPECIFYING A MAXIMUM
LEAK RATE OF 1×10^{-8} STD. CC/SEC
AIR EQUIVALENT FOR OUTSIDE FABRICATION.

I ASKED GEORGE BARBERO OF THE
ASSY. SHOP TO TEST SOME STOCK
BUNA-N O-RINGS TO DETERMINE THE
HELIUM PERMEATION RATE.

WE WANTED TO KNOW IF THIS PERMEATION
IS APT TO CAUSE DIFFICULTY WITH THE
LEAK RATE SPECIFICATION FOR THE WELDS.

FROM GEORGE'S DATA IT APPEARS THAT
WE SHOULDN'T HAVE DIFFICULTY AS
LONG AS THE O-RINGS ARE NOT
SUBJECTED TO HELIUM FOR AN EXTENDED
PERIOD OF TIME.

THE O-RINGS WERE LIGHTLY GREASED
WITH DOW-CORNING SILICONE LUBRICANT 970V

1×10^{-8}

D32221

M5131

2 OF 3

STANDARD CC/SEC AIR EQUIV.

(FOR HELIUM FLOW RATE
MULTIPLY BY 2.7)

(NEW VEECO
IN ASSY SHOP)

3RD O-RING

2ND O-RING

HELIUM PERMEATION
RATE THROUGH

$\frac{1}{4}$ INCH DIA. O-RING

X .5 METER LONG

1×10^{-9}

4TH O-RING

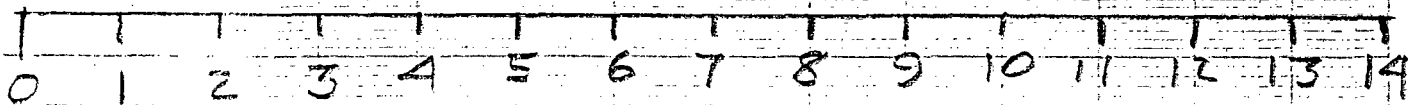
FIRST O-RING

NO RESPONSE ON OLD VEECO

IN ASSY SHOP AFTER 5 HRS

(FOR CRITICAL WORK YOU MAY
WANT TO USE THE NEW VEECO)

1×10^{-10}



HOURS →

APPROX 1 ATM OF HELIUM
ACROSS O-RING

RON HINTZ
FEB 10, 1978

4 SEPARATE O-RINGS
WERE TESTED

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The high sensitivity of tracer-gas detectors poses one particular problem. That is, there may be false leakage indications due to permeation through materials. Helium is a particularly difficult gas in this regard. The permeation of helium through a 1-inch-diameter O-ring is sufficient to produce a readily detectable helium pressure in the test volume. When probing with helium gas, care should be exercised to keep the helium from all O-rings in the system. After all other portions of the system have been leak checked, the individual O-ring seals may be checked. A permeation signal may be separated from a true leak by the rate of the signal response. The response of a true leak is related only to the system time constant if double-leak problems are ignored. Permeation signal response time is related to the time required for the establishment of a diffusion gradient through the material. A typical value of permeation response time for O-ring materials is about 1 hour. Therefore, if helium is applied to an O-ring, a quick response indicates a true leak, while a long-term buildup signifies permeation. The process of permeation is particularly obnoxious due to the fact that it possesses a long cleanup time. Once helium has penetrated through an O-ring, many hours of pumping will be required before the signal cleans up. The presence of only a few O-rings is enough to produce a signal which will completely saturate the leak detector. When large systems are bagged or hooded, it is advisable to isolate the O-rings from the helium atmosphere with a protective gas blanket or by some mechanical means of isolation.

FROM:

N66-36129

VACUM TECHNOLOGY AND SPACE SIMULATION

Donald J. Santeler, et al

NASA SP-105

Aero Vac Corporation

1966

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