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Test Series FFL-3

FLOW RATE AND PRESSURE DROP CHARACTERISTICS
OF AN INCONEL X-750 NOZZLE INTERFACE SEAL

(Title Unclassified)

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ABSTRACT

A component test has been performed to determine the hydrogen leakage rate past a nozzle interface seal. The test was run under isothermal ambient temperature conditions and at pressure levels ranging from 100 to 700 psia, and pressure differentials ranging from 0 to 220 psid.

The seal tested was a reactor seal constructed of Inconel-X-750 designated for component testing.

The leakage was recorded with the seal compressed to reactor specifications, first with aluminum interfaces on the reflector and nozzle side, and second with impregnated H4LM graphite on the reflector side and aluminum on the nozzle side. In both cases the conditions of pressure and pressure differential were the same; flow rate was materially higher in the second case.

The test piece, test equipment, and test procedure are described. Measurement accuracies are specified. The data is presented as recorded on the log sheet, as processed and printed out on the IBM 7090 digital computer and as plotted in parametric curve form.

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INTRODUCTION

This test is the first of a series of flow experiments to determine the hydrogen leakage rate past a reactor standard nozzle interface seal.

The first Inconel X-750 seal released for component testing failed on the test stand at a pressure differential of approximately 300 psid. A rigorous account of the events prior to the seal failure is presented in the text of this report. Details of the mechanism of the failure are not within the scope of this report; however, the failure was due to a defect in the seal rather than an over-pressure condition.

The second seal released for component testing was successfully tested with inner reflector simulators made of aluminum and impregnated H4LM graphite.

The leakage across the seal takes place through the interfaces between the seal and the reflector and the seal and the nozzle end flange. This interface initially tends toward a line-to-line contact but the seal is a pressure actuated seal and, when the pressure differential is increased, the interface is driven from line-to-line toward a surface-to-surface type condition.

The pressure loss is a total pressure loss as read and density is a total density as calculated from total pressure and total temperature as read. In this report the leakage flow is plotted against the product of density times pressure drop. It is also possible to relate these changes in flow to changes in area caused by movement of the seal due to changes in pressure differential.

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CONCLUSIONS

The hydrogen flow experiment performed and reported indicates that the hydrogen leakage flow rates across an Inconel X-750 nozzle interface seal at reactor inlet pressure and various conditions of pressure differential are within design limits.

RECOMMENDATIONS

It is recommended that the nozzle interface seal be tested to investigate (a) leakage at various conditions of seal compression from a maximum to a minimum condition, (b) leakage flow at various conditions of distortion which might take place in the reactor, (c) leakage flow at cryogenic temperature (140°R) to determine what effect low temperature has on flow rate and interface fits, and (d) leakage flow at higher pressure differentials.

DESCRIPTION OF TEST PIECE AND FLOW LOOP

A. Test Piece

Standard reactor fits are effectively simulated in the nozzle interface seal test rig. The rig body is made of aluminum tool plate in the form of a circular cylinder 2 inches high and 43 inches in diameter. A circular rectangular channel 1 inch deep and 2 inches wide, having an O.D. of 39.894 inches and an I.D. of 36 Inches, was cut in the face of the test fixture body, Figure 1. This channel accepts the interface seal, and the inner reflector simulator, Figure 2. The lid of the rig is an aluminum plate cut in the shape of a ring 43 inches O.D., 31.5 inches I.D., and 1 inch thick, Figure 3. Figure 4 shows a close-up of the impregnated H4LM

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inner reflector simulator with the seal in position. Figure 5 shows a close-up of the lid with impregnated H4LM inner reflector simulator and seal in position. The lid is fastened to a rig body by 120 three-quarter-inch bolts. The chamber is sealed by two continuous flat teflon gaskets in gasket grooves, one inside the outer bolt circle and one outside the inner bolt circle, Figure 6.

The inner reflector simulator is a copy of the lower portion of the inner reflector. The simulator is made to reactor specifications of dimension, surface finishes, and relief holes. It is 1-inch thick and properly compresses the interface seal when it is bottomed on the floor of the test rig body by the lid of the test rig.

The gasket grooves are cut in the top surface of reflector simulator, Figure 7. These grooves accept flat teflon gaskets which, aided by epoxy cement, prevent hydrogen from leaking through this area. The small space between these two gaskets is left open and connected to a pressure gauge. If a pressure is read on this gauge, it is an indication that extraneous leakage is taking place in this area, Figure 8.

The gas inlet to the rig comes from a manifold fed by a 1-inch flex hose. The flow from the manifold is split in four directions 90° to each other by four 1/4-inch tubes, and enters the high pressure side of the seal which is on the outer periphery of the test rig. Flow on the high pressure side of the seal leaks through the seal interfaces to the low pressure side of the seal and vents through twenty-four 0.100-inch dia. vent holes bored through the inner reflector simulator. The flow is then

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collected in an exhaust manifold through four 1/4-inch exhaust lines and vented to the stack by a 1-inch flex hose, Figures 8 and 9. Pressure taps measuring pressure on each side of the seal are bored through the floor of the test rig body into the inlet plenum and the outlet plenum. These taps are considered to be total pressure taps because the velocities in these areas are negligible, Figure 10. These two pressure taps are connected by a relief valve which is set at 230 psi to protect the seal against large pressure differences. A Hastings mass flow meter is connected to the outlet of the relief valve. The meter is capable of reading flows down to 1×10^{-8} lb/sec of hydrogen at standard conditions and demonstrates that the relief valve is closed while the data is being taken.

B. Flow Loop

The test piece is coupled into a flow loop consisting of a system of valves, calibrated orifices, and pipe, fed by a common gaseous hydrogen supply line and vented by a common exhaust.

Automatically controlled valving is used to set the inlet and outlet pressures in the seal region. A wide range of pressure levels up to 700 psia and pressure differences in excess of 200 psid can be accomplished. Flow entering and leaving the test piece is measured, thus demonstrating flow continuity. Figure 11 shows schematically the flow diagram of this loop. Pressure drop across sharp-edged orifices indicates the hydrogen flow at the locations mentioned above. The valves are diaphragm operated and are remotely controlled by automatic control stations in the control room. Copper-constantan thermocouples are employed; pressure levels and

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pressure differences are shown on dial indicators which are read by telescope from the control room. Figure 12 is a photograph of the flow loop with attached instrument panel.

TEST PROCEDURE

Total pressure upstream of the seal is maintained at a constant value of 700 psia. The pressure drop across the seal is varied from 0 to 220 psid. In one case the pressure differential was held constant at 40 psid and 120 psid with the inlet pressure varying from 100 to 700 psig.

The flow is measured entering and leaving the seal area by calibrated sharp-edged orifice sections. By choice of orifice size and by use of various ranges of dial indicator DP gauges in parallel, an attempt is made to use the pressure and flow measuring instruments toward the top of their measuring range.

When the system stabilizes, as indicated by a constant differential pressure across the seal, a check is made to insure no flow through the relief valve circuit. When these operations are complete, the readings are entered in the log sheet on the test stand, Appendix B. The data are processed by IBM 7090 computer. The results are printed out along with the original input on the computer output sheets, Appendix A.

Estimated expected errors in measurements both on a relative and absolute basis take into consideration inherent accuracy of the instrument and the closeness to which it can be read under test stand conditions. Accuracies on a relative basis involve the reproducibility of data without reference to a standard; accuracies on an absolute basis involve comparison to a laboratory standard or to data from other test facilities.

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On a relative basis at the lowest level at which the readings are taken, estimated expected errors of pressure level are 0.5%, pressure difference 5%, and weight flow measurements 1.5%.

Still on a relative basis at the highest level at which the readings are taken, the estimated expected errors of pressure level are 0.5%; pressure difference, 2%; weight flow measurements, 0.5%. On an absolute basis these estimated expected errors are approximately twice those quoted above.

Before and after each series of tests the seal was sent to Inspection to have 12 critical dimensions checked. This check clearly defined the shape and size of the seal before and after the test and also showed no significant change in the seal due to the test, Appendix C.

RESULTS AND DISCUSSION

Appendix B contains the log sheet used during the test in which the nozzle interface seal failed. The log sheet is accompanied by statements which were helpful in determining why the seal failed and is supported by inspection reports, Appendix C. On the log sheet there is an accurate account of the events which took place on the test stand prior to the seal failure.

A detailed examination of the seal was performed by the Materials Department. The results of this study showed that the seal, Serial No. PC-3, was greatly weakened by severe intergranular attack which occurred during fabrication of the part.

A replacement seal was instrumented with strain gauges to measure stress levels as the seal deflects during pressure and flow testing. These tests were run with an aluminum inner reflector simulator made to reactor

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specifications. At the conclusion of this test series it was found that only two of the gauges installed on the rig were reading properly and could be correlated with current stress values available. In addition, seal mechanical compression tests were conducted to demonstrate repeatability of the strain gauge data. Four (4) of the gauges repeated consistently and recorded stress levels that were in good agreement with current theoretical values. Comparison can be found in WANL-TME-881. Figure 13 shows density times pressure loss plotted against weight flow through the seal region using an aluminum reflector simulator.

Figures 14 and 15 show density times pressure loss plotted against weight flow through the seal region using an impregnated H4LM graphite reflector simulator. In the first case the pressure differential was set at 40 psid and the inlet pressure increased. In the second case the technique was the same but the pressure differential was increased to 120 psid.

Figure 16 shows density times pressure loss plotted against weight flow through the seal region using an impregnated H4LM graphite reflector simulator. During this series of tests a small amount of seepage to PLD was noticed. The source of this small flow is not entirely certain, that is, past the teflon seals or through the permeable graphite.

Comparison of the Aluminum Data to the Graphite Data, Figure 17, shows a substantial increase in flow with the H4LM reflector ring. What part of this increased flow is attributed to the graphite permeability and graphite interface characteristics will be determined in future testing.

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Figures 13, 16, and 17 show that as the values of $\rho \Delta P$ increase, the slope of the plot tends toward a horizontal line. This characteristic can be attributed to the fact that the seal is pressure actuated and as the pressure differential is increased, the seal contact changes from a line to a surface contact. This in turn increases the sealing ability of the seal.

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Figure 1 - Body of Test Rig Showing Circular Rectangular Channel

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Figure 2 - Sketch of Test Rig Showing Relative Positions
of Lid, Seal, Reflector Simulator, and Seal Shape

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Figure 3 - Lid of Test Rig with Impregnated
H₄LM Graphite Reflector Simulator in Position

Figure 4 - Close Up of Impregnated H₄LM Inner
Reflector Simulator with Seal in Position

Figure 5 - Close Up of Lid with Seal and Reflector Simulator in Position

Figure 6 - Body of Test Rig Showing Flat Teflon Gaskets

Figure 7 - Close Up of Graphite Reflector Simulator
Showing Gasket Grooves on the Top

NOZZLE INTERFACE SEAL MODEL

Figure 8 - Sketch of Test Rig Configuration Showing Pressure Taps

Figure 9 - Complete Assembly of Test Rig Showing Inlet and Exit Manifolds Plus the Relief Valve Circuit

Figure 10 - Close-up of Seal Chamber in Test Rig Body with Seal in Position Showing Upstream and Downstream Pressure Taps

NOZZLE INTERFACE SEAL SCHEMATIC TEST LOOP

LEGEND

- REMOTELY OPERATED PRESSURE CONTROL VALVE
- THERMOCOUPLE TC
- PRESSURE INDICATING GAUGE

Figure 11

Figure 12 - Flow Loop with Attached Instrument Panel

Figure 13 - Hydrogen Weight Flow Vs Density Times Pressure Drop
 Using Aluminum Reflector Simulator

Figure 14 - Hydrogen Weight Flow Vs Density Times Pressure Drop
 Using Impregnated H4IM Graphite Inner Reflection Shield

Figure 15 - Hydrogen Weight Flow Vs Density Times Pressure Drop
Using Impregnated H4LM Graphite Inner Reflector Simulator

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Figure 16 - Hydrogen Weight Flow Vs Density Times Pressure Drop
 Using Impregnated H4IM Graphite Inner Reflector Simulator

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Figure 17 - Hydrogen Weight Flow Vs Density Times Pressure Drop

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APPENDIX A

Computer Printout of Test Results

Definition of Computer Terms

INPUT DATA

POINT	- Point number
P1	- Pressure at inlet of seal region
DP 1-2	- Pressure drop across seal
DP 3-1	- Does not apply
T3	- Does not apply
P01	- Pressure upstream at orifice Number One
T01	- Temperature upstream at orifice Number One
DP01	- Pressure drop across orifice Number One
P02	- Does not apply
T02	- Does not apply
DP02	- Does not apply
P04	- Pressure upstream of orifice Number Four
T04	- Temperature upstream of orifice Number Four
DP04	- Pressure drop across orifice Number Four

OUTPUT DATA

W01	- Flow entering test rig
RH01*DP12	- Product of inlet density times pressure differential across seal
W04	- Flow leaving test rig
W01+W02	- Does not apply
W02	- Does not apply
RH03*DP31	- Does not apply
W02(SQ)	- Does not apply
W04(SQ)	- Flow leaving rig squared
(W01+W02) (SQ)	- Flow entering rig squared

APPENDIX A TEST RESULTS

MASS FLOW AND RHO DELTAP PRODUCTS FOR NOZZLE SEAL TEST DATA

ORIFICE	RUN NUMBER 3	BAR. PRESS. = 29.52 IN. HG = 14.50 PSIA	
01	K(BETA)SQ.	CSC.	FSLBA
02	5.3060E-02	2.981CE-01	1.0000E 00
04	6.2230E-02	9.158CE-01	1.0000E 00

INPUT DATA

POINT	P1 PSIG	DP12 PSIC	DP31 PSID	T3 MV	P01 PSIG	TC1 MV	DP01 IN. H2O	P02 PSIG	T02 MV	DP02 IN. H2O	P04 PSIG	T04 MV	DP04 IN. H2O
1.0	682.0	181.0C	C.	0.	680.0	0.840	47.4C	0.	C.	0.	500.0	0.740	8.00
2.0	678.0	170.0C	C.	0.	675.0	0.840	56.2C	0.	C.	0.	505.0	0.740	9.30
3.0	677.0	154.0C	C.	0.	675.0	0.830	57.0C	0.	C.	0.	515.0	0.750	9.30
4.0	678.0	146.0C	0.	0.	675.0	0.840	56.5C	0.	C.	0.	530.0	0.760	8.80
5.0	680.0	123.5C	0.	0.	675.0	0.860	54.0C	0.	C.	0.	558.0	0.770	8.20
6.0	681.0	108.0C	C.	0.	677.0	0.870	52.5C	0.	C.	0.	577.0	0.780	7.70
7.0	688.0	96.0C	C.	0.	682.0	0.890	43.5C	0.	C.	0.	590.0	0.790	6.40
8.0	689.0	77.5C	0.	0.	682.0	0.900	40.7C	0.	C.	0.	615.0	0.800	5.80
9.0	691.0	64.0C	C.	0.	685.0	0.910	38.8C	0.	C.	0.	632.0	0.800	5.30
10.0	695.0	45.5C	C.	0.	687.0	0.900	34.5C	0.	C.	0.	653.0	0.800	4.60
11.0	700.0	28.0C	C.	0.	689.0	0.910	26.3C	0.	C.	0.	673.0	0.810	3.40
12.0	703.0	17.0C	C.	0.	690.0	0.920	16.8C	0.	C.	0.	692.0	0.830	2.20
13.0	711.0	8.0C	C.	0.	699.0	0.920	5.8C	0.	C.	0.	710.0	0.830	0.70
14.0	720.0	4.0C	C.	0.	708.0	0.920	0.1C	0.	0.	0.	723.0	0.830	0.20
15.0	745.0	13.5C	C.	0.	735.0	0.910	9.6C	0.	C.	0.	738.0	0.830	1.20
16.0	735.0	40.0C	C.	0.	730.0	0.930	27.5C	0.	C.	0.	700.0	0.830	3.70
17.0	730.0	84.0C	C.	0.	728.0	0.930	36.5C	0.	C.	0.	650.0	0.840	6.10
18.0	730.0	56.0C	C.	0.	728.0	0.930	32.4C	0.	C.	0.	680.0	0.840	4.50
19.0	725.0	110.0C	C.	0.	723.0	0.910	42.9C	0.	C.	0.	618.0	0.840	6.40
20.0	720.0	132.0C	C.	0.	720.0	0.890	5.45	0.	C.	0.	585.0	0.840	8.30
21.0	718.0	166.5C	C.	0.	717.0	0.880	63.0C	0.	C.	0.	550.0	0.840	10.20
22.0	709.0	185.5C	C.	0.	709.0	0.880	86.0C	0.	C.	0.	520.0	0.850	14.40

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APPENDIX A
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OUTPUT DATA
RUN NUMBER 3

FLOW RATES IN LB/SEC RHU*DP IN LB.S./FT**5

W01	RHC1*DP12	W04	W01+W02	W02	RHU3*DP31	W02(SQ)	W04(SQ)	(W01+W02)SW
5.3149E-03	6.2608E-03	6.8248E-03	5.3149E-03	0.	0.	0.	4.6578E-05	2.8248E-05
5.7670E-03	5.8475E-03	7.3934E-03	5.7670E-03	0.	0.	0.	3.4662E-05	3.3259E-05
5.8103E-03	5.2941E-03	7.4596E-03	5.8103E-03	0.	0.	0.	5.5645E-05	3.3760E-05
5.7824E-03	5.0220E-03	7.3530E-03	5.7824E-03	0.	0.	0.	5.4067E-05	3.3436E-05
5.6484E-03	4.2529E-03	7.2709E-03	5.6484E-03	0.	0.	0.	5.2866E-05	3.1904E-05
5.5749E-03	3.7213E-03	7.1560E-03	5.5749E-03	0.	0.	0.	5.1208E-05	3.1080E-05
5.0883E-03	3.3347E-03	6.5908E-03	5.0883E-03	0.	0.	0.	4.3438E-05	2.5890E-05
4.9198E-03	2.6936E-03	6.3967E-03	4.9198E-03	0.	0.	0.	4.0918E-05	2.4204E-05
4.8116E-03	2.2287E-03	6.1946E-03	4.8116E-03	0.	0.	0.	3.9373E-05	2.3152E-05
4.5453E-03	1.5945E-03	5.3615E-03	4.5453E-03	0.	0.	0.	3.4357E-05	2.0660E-05
3.9724E-03	9.8713E-02	5.1100E-03	3.9724E-03	0.	0.	0.	2.6112E-05	1.5780E-05
3.1758E-03	6.0123E-02	4.1618E-03	3.1758E-03	0.	0.	0.	1.7320E-05	1.0086E-05
1.8775E-03	2.8602E-02	2.3764E-03	1.8775E-03	0.	0.	0.	5.6472E-06	3.5252E-06
2.4804E-04	1.4473E-02	1.2812E-03	2.4804E-04	0.	0.	0.	1.6415E-06	6.1522E-04
2.4749E-03	5.0496E-02	3.1691E-03	2.4749E-03	0.	0.	0.	1.0043E-05	6.1249E-06
4.1718E-03	1.4747E-03	5.4268E-03	4.1718E-03	0.	0.	0.	2.9450E-05	1.7404E-05
4.7999E-03	3.0769E-03	6.7240E-03	4.7999E-03	0.	0.	0.	4.5212E-05	2.3039E-05
4.5223E-03	2.0513E-03	5.9004E-03	4.5223E-03	0.	0.	0.	3.4815E-05	2.0451E-05
5.1910E-03	4.0095E-03	6.7239E-03	5.1910E-03	0.	0.	0.	4.5211E-05	2.6946E-05
1.8480E-03	4.7877E-03	7.4538E-03	1.8480E-03	0.	0.	0.	5.5640E-05	3.4153E-06
6.2734E-03	6.0230E-03	8.0304E-03	6.2734E-03	0.	0.	0.	6.4488E-05	3.9355E-05
7.2857E-03	6.6359E-03	5.2864E-03	7.2857E-03	0.	0.	0.	8.6237E-05	5.3082E-05

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APPENDIX A
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MASS FLOW AND RHO DELTAP PRODUCTS FOR NOZZLE SEAL TEST DATA

ORIFICE	RUN NUMBER	BAR. PRESS. =	IN.Hg =	PSIA
01	K(BETA)SQ.	DSQ.	FSQ3A	Y
02	5.3060E-02	2.9810E-01	1.0000E 00	1.0000E 00
04	0.	0.	0.	0.
	6.2230E-02	9.1580E-01	1.0000E 00	1.0000E 00

INPUT DATA

POINT	P1	DP12	DP31	T3	P01	T01	DP01	P02	T02	DP02	P04	T04	DP04
	PSIG	PSID	PSID	MV	PSIG	MV	IN.H2O	PSIG	MV	IN.H2O	PSIG	MV	IN.H2O
1.0	199.0	36.00	0.	0.	199.0	0.700	112.00	0.	0.	0.	163.0	0.720	16.80
2.0	300.0	37.00	0.	0.	300.0	0.680	117.00	0.	0.	0.	260.0	0.710	16.60
3.0	402.0	36.00	0.	0.	400.0	0.670	121.00	0.	0.	0.	363.0	0.710	16.50
4.0	500.0	37.00	0.	0.	499.0	0.650	137.00	0.	0.	0.	462.0	0.720	18.40
5.0	599.0	39.00	0.	0.	500.0	0.670	148.00	0.	0.	0.	563.0	0.670	19.50
6.0	599.0	121.00	0.	0.	600.0	0.670	219.00	0.	0.	0.	473.0	0.650	33.50
7.0	503.0	121.00	0.	0.	504.0	0.660	203.00	0.	0.	0.	380.0	0.650	32.80
8.0	400.0	122.50	0.	0.	400.0	0.660	188.00	0.	0.	0.	273.0	0.640	33.30

OUTPUT DATA

RUN NUMBER 4

FLOW RATES IN LB/SEC RHO*DP IN LB.SQ/FT**5

W01	RHO1*DP12	W04	W01+W02	W02	RHO3*DP31	W02(SQ)	W04(SQ)	(W01+W02)SQ
4.5988E-03	3.9346E 02	5.8501E-03	4.5988E-03	0.	0.	0.	3.4223E-05	2.1149E-03
5.6992E-03	5.9451E 02	7.2223E-03	5.6992E-03	0.	0.	0.	5.2161E-05	3.2480E-03
6.6438E-03	7.6370E 02	8.4277E-03	6.6438E-03	0.	0.	0.	7.1026E-05	4.4140E-03
7.8597E-03	9.6748E 02	9.9752E-03	7.8597E-03	0.	0.	0.	9.9505E-05	6.1775E-03
8.1700E-03	1.2091E 03	1.1306E-02	8.1700E-03	0.	0.	0.	1.2781E-04	6.6749E-03
1.0839E-02	3.7512E 03	1.3652E-02	1.0839E-02	0.	0.	0.	1.6636E-04	1.1749E-04
9.6088E-03	3.1793E 03	1.2174E-02	9.6088E-03	0.	0.	0.	1.4820E-04	3.2329E-03
8.2848E-03	2.5886E 03	1.0477E-02	8.2848E-03	0.	0.	0.	1.1019E-04	6.8639E-03

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APPENDIX A
(Continued)

MASS FLOW AND RHO DELTAP PRODUCTS FOR NOZZLE SEAL TEST DATA

ORIFICE	RUN NUMBER 4	BAR. PRESS. = 29.40 IN. HG = 14.44 PSIA	
01	K(ETA)SQ.	OSQ.	FSUBA
02	5.3060E-02	2.9810E-01	1.0000E 00
04	6.2230E-02	9.1580E-01	1.0000E 00

INPUT DATA

POINT	P1 PSIG	DP12 PSIC	DP31 PSIC	T3 MV	P01 PSIG	TC1 MV	DP01 IN.H2O	P02 PSIG	T02 MV	DPC2 IN.H2O	P04 PSIG	T04 MV	DP04 IN.H2O
1.0	710.0	18.0C	0.	0.	705.0	1.290	45.50	0.	0.	0.	690.0	1.210	5.80
2.0	678.0	38.0C	0.	0.	675.0	1.290	106.00	0.	0.	0.	640.0	1.210	14.00
3.0	642.0	62.0C	0.	0.	645.0	1.310	168.00	0.	0.	0.	580.0	1.230	22.80
4.0	622.0	80.0C	0.	0.	630.0	1.320	210.00	0.	0.	0.	540.0	1.230	29.30
5.0	600.0	101.0C	0.	0.	608.0	1.320	247.00	0.	0.	0.	500.0	1.240	35.80

OUTPUT DATA

RUN NUMBER 4

FLOW RATES IN LB/SEC RHO*DP IN LB.SQ/FT**5

W01	RHO1*DP12	W04	W01+W02	W02	RHO3*DP31	W02(SQ)	W04(SQ)	(W01+W02)SQ
5.2030E-03	6.2404E 02	6.6458E-03	5.2030E-03	0.	0.	0.	4.4166E-05	2.7071E-05
7.7789E-03	1.2609E 03	9.9621E-03	7.7789E-03	0.	0.	0.	9.9244E-05	6.0512E-05
9.5761E-03	1.9501E 03	1.2122E-02	9.5761E-03	0.	0.	0.	1.4693E-04	9.1701E-05
1.0583E-02	2.4397E 03	1.3282E-02	1.0583E-02	0.	0.	0.	1.7640E-04	1.1200E-04
1.1285E-02	2.9762E 03	1.4147E-02	1.1285E-02	0.	0.	0.	2.0014E-04	1.2735E-04

APPENDIX A
 (Continued)

MASS FLOW AND RHO DELTAP PRODUCTS FOR NOZZLE SEAL TEST DATA

ORIFICE	RUN NUMBER 4		BAR. PRESS. = 29.40IN.HG = 14.44PSIA		
01	K(BETA)SQ.	USQ.	FSLBA		Y
02	2.3427E-01	2.9810E-01	1.0000E 00		1.0000E 00
04	0.	0.	0.		0.
	6.2230E-02	9.1580E-01	1.0000E 00		1.0000E 00

INPUT DATA													
POINT	P1	DP12	DP31	T3	PC1	TC1	DP01	P02	TC2	DP02	P04	T04	DP04
	PSIG	PSID	PSID	MV	PSIG	MV	IN.H2O	PSIG	MV	IN.H2O	PSIG	MV	IN.H2O
1.0	588.0	123.00	0.	0.	588.0	1.140	23.40	0.	0.	0.	460.0	1.180	44.00
2.0	583.0	150.00	0.	0.	580.0	1.150	24.50	0.	0.	0.	425.0	1.170	49.00
3.0	588.0	175.50	0.	0.	588.0	1.160	24.50	0.	0.	0.	405.0	1.170	53.00
4.0	583.0	201.00	0.	0.	580.0	1.160	22.50	0.	0.	0.	375.0	1.170	51.50
5.0	593.0	173.00	0.	0.	590.0	1.200	21.30	0.	0.	0.	415.0	1.160	44.00
6.0	600.0	149.00	0.	0.	599.0	1.210	20.00	0.	0.	0.	440.0	1.170	39.30
7.0	610.0	126.00	0.	0.	603.0	1.220	18.40	0.	0.	0.	475.0	1.170	34.00

OUTPUT DATA

RUN NUMBER 4

FLOW RATES IN LB/SEC RHO*DP IN LB.SQ/FT**5

W01	RHC1*DP12	W04	W01+W02	W02	RHO3*DP31	W02(SQ)	W04(SQ)	(W01+W02)SQ
1.5200E-02	3.6059E 03	1.5109E-02	1.5200E-02	0.	0.	0.	2.2830E-04	2.3105E-04
1.5446E-02	4.3584E 03	1.5362E-02	1.5446E-02	0.	0.	0.	2.3599E-04	2.3859E-04
1.5541E-02	5.1369E 03	1.5615E-02	1.5541E-02	0.	0.	0.	2.4383E-04	2.4153E-04
1.4796E-02	5.8356E 03	1.4841E-02	1.4796E-02	0.	0.	0.	2.2024E-04	2.1894E-04
1.4491E-02	5.0886E 03	1.4399E-02	1.4491E-02	0.	0.	0.	2.0734E-04	2.1000E-04
1.4138E-02	4.4285E 03	1.3986E-02	1.4138E-02	0.	0.	0.	1.9562E-04	1.9989E-04
1.3599E-02	3.8013E 03	1.3492E-02	1.3599E-02	0.	0.	0.	1.8202E-04	1.8492E-04

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APPENDIX A
(Continued)

MASS FLOW AND RHO DELTAP PRODUCTS FOR NOZZLE SEAL TEST DATA

ORIFICE	RUN NUMBER 4	BAR. PRESS. = 29.40 IN. HG = 14.44 PSIA	
	K(BETA)SQ.	CSQ.	FSLBA
01	5.3060E-02	2.981CF-01	1.00C0E 00
02	0.	0.	0.
04	6.2230E-02	9.1580E-01	1.00C0L 00

INPUT DATA

POINT	P1	DP12	DP31	T3	P01	TC1	DP01	P02	T02	DP02	P04	T04	DP04
	PSIG	PSIG	PSID	MV	PSIG	MV	IN.H2O	PSIG	MV	IN.H2O	PSIG	MV	IN.H2O
1.0	705.0	20.0C	0.	0.	705.0	1.23C	73.0C	0.	0.	0.	690.0	1.180	5.60
2.0	687.0	39.0C	0.	0.	681.0	1.280	153.00	0.	0.	0.	645.0	1.190	12.30
3.0	658.0	61.0C	0.	0.	660.0	1.310	220.00	0.	0.	0.	590.0	1.200	18.00
4.0	650.0	71.0C	0.	0.	653.0	1.330	240.00	0.	0.	0.	575.0	1.200	19.80
5.0	680.0	41.0C	0.	0.	678.0	1.320	138.00	0.	0.	0.	635.0	1.210	11.20
6.0	655.0	62.0C	0.	0.	659.0	1.330	226.00	0.	0.	0.	591.0	1.220	18.50
7.0	705.0	22.0C	0.	0.	693.0	1.30C	64.00	0.	0.	0.	680.0	1.210	6.00

OUTPUT DATA

RUN NUMBER 4

FLOW RATES IN LB/SEC RHO*DP IN LB.SQ/FT**5

W01	RHO1*DP12	W04	W01+W02	W02	RHO3*DP31	W02(SQ)	W04(SQ)	(W01+W02)SQ
6.6058E-03	6.9196F 02	6.5379E-03	6.6058E-03	0.	0.	0.	4.2744E-05	4.3636E-05
9.3888E-03	1.3023F 03	9.3797E-03	9.3888E-03	0.	0.	0.	8.7979E-05	8.8149E-05
1.1079E-02	1.9641E 03	1.0871E-02	1.1079E-02	0.	0.	0.	1.1818E-04	1.2274E-04
1.1504E-02	2.2562F 03	1.1263E-02	1.1504E-02	0.	0.	0.	1.2685E-04	1.3234E-04
8.8842E-03	1.3611E 03	8.8772E-03	8.8842E-03	0.	0.	0.	7.8805E-05	7.8929E-05
1.1204E-02	1.9846E 03	1.1021E-02	1.1204E-02	0.	0.	0.	1.2147E-04	1.2553E-04
6.1182E-03	7.5702E 02	6.7126E-03	6.1182E-03	0.	0.	0.	4.5059E-05	3.7433E-05

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T P	P ₁ PSIG	T MV	DPL ₁ PSIG	P _{O1} PSIG	T _{O1} MV	DFO ₁ INH ₂ O	P _{O4} PSIG	T _{O4} MV	DPO ₄ INH ₂ O	PLD PSIG	REMARKS	T P	P ₁ PSIG	T MV	DPL ₁ PSIG	P _{O1} PSIG	T _{O1} MV	DFO ₁ INH ₂ O	P _{O4} PSIG	T _{O4} MV	DPO ₄ INH ₂ O	PLD PSIG	REMARKS	
1	200	12	20	770	04	60	190	24	231	0		33	200	12	20	770	04	60	190	24	231	0		App 300 psig High DPL reading
2	100	24	14	770	04	15	100	24	120	0		34	100	24	14	770	04	15	100	24	120	0		Pressure was
3	Shut down to allow for good impact seal											35	During purge with He under pressure											High upstream
4	Inspection of the seal ring has revealed a 2 1/2" long											36	conditions of P ₁ at app 400 psig and DPL at											increased to
5	rupture on the reflector side of the ring.											37	high as 300 psid. A second attempt was made to											770 psi then
6	The surface is depicted by the arrow on the											38	lower DPL by lowering P ₁ . DPL was reduced											200 psi
7	log sheet configuration figure											39	to app 200 psid by lowering P ₁ to app 200 psig.											head and effort
8												40	with the 4.5 inch orifice installed. DFO											the DPL could be
9												41	read no higher than 1/2 inch of H ₂ O. The 1/2											maintained on
10	Inspection of the surfaces that mate											42	was shut down and the 4.5 inch orifice was											APPE
11	with the seal ring show two marks in the											43	registered with the 306 inch orifice. A seal											
12	At which correspond to the lines of contact											44	purge operation was begun. During the second											
13	between the seal and the parts comprising it											45	purge with He under pressure conditions											
14	The marks can be seen but are not evident											46	of P ₁ at app 400 psig and DPL at high											
15	to the touch.											47	as 300 psig. A second attempt was made											
16	There is one scratch in the lower											48	to lower DPL by lowering P ₁ . DPL was											
17	surface of the fixture which was produced											49	by a chip under the reflector simulator											
18	by a chip under the reflector simulator											50	P ₁ to 200 psig. With 306 inch orifice											
19	where the rig was in transit from Bldg #1 to											51	installed. DFO read app 8 inches of H ₂ O											
20	Bldg #5. The location of this scratch is											52	where He was turned on and P ₁ was adjusted											
21	away from the area where sealing is											53	to 600 psig. DPL read app 400 psid. P ₁											
22	accomplished											54	was reduced to app 300 psig which required											
23												55	DPL to 250 psid. As P ₁ was increased via											
24												56	valve being closed to increase back pressure.											
25												57	During this attempt to increase P ₁ without											
26												58	increasing DPL a metal piece was found on the											
27												59	interior. Subsequently the highest DPL that											
28												60	could be set was 20 psid at P ₁ of 200 psig											
29												61	under the conditions of P ₁ from 200 psig to 600 psig											
30												62	DFO was constantly of scale. The P ₁ level was											
31												63	reduced to 200 psig and the above readings											
32												64	were taken											

WESTINGHOUSE ELECTRIC CORPORATION
Astronuclear Laboratory
PITTSBURGH PA

FLUID FLOW LAB
LOG SHEET
B-3 NOZZLE INTERFACE SEAL TEST

TEST RECORD BOOK NO. 11-5731 RUN NO. 1 SHEET 1 OF 1
TIME OF DAY 0700 hr DATE 27 Feb 64
ENG NEER R. J. St. H. OPERATOR C. W. J. J. J.
REF JUNCT ON 32°F TEST GAS Hydrogen
SUPPLY PRESSURE BEFORE 2200 SUPPLY PRESSURE AFTER 2020
SUPPLY TEMP BEFORE 57°F SUPPLY TEMP AFTER 35°F
BAR PRESS JPE 2743 @ 69 °F SEAL A PC-3

Orifice
01 306
04 306
CONFIGURATION
DIM A .350 DIM B .504

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APPENDIX B

It has been established that during initial static pressure checking of the A1 housing, before a manifold was made for this purpose, a ΔP of approximately 300 psid was put across the seal once.

Statement Supporting Log Sheet

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~~Atomic Energy Act 1954~~

POINT	P ₁	T ₁	DP _{L-E}	P _{O₂}	T _{O₂}	DP _{O₂}	DP _{O₄}	T _{O₄}	P _{O₄}	PLD	REMARKS	POINT	P ₁	T ₁	DP _{L-E}	P _{O₂}	T _{O₂}	DP _{O₂}	DP _{O₄}	T _{O₄}	P _{O₄}	PLD	REMARKS
1	715	92	120	710	92	233	7.7	88	600	0		33	709	88	185.5	705	81	86	144	85	520	0	
2	715	91	93	710	91	244	7.5	88	630	0	Open to	34											
3	713	89	61	710	90	240	7.0	89	640	0	high for regulator	35											
4	720	89	55	710	90	214	6.4	89	670	0	accuracy better	36											
5	730	89	33	728	90	156	4.5	88	700	0	not valid	37											
6	735	89	18	728	89	90	2.5	88	723	0		38											
7	748	89	7	740	89	21	6	88	745	0		39											
8	16 April 64	Test continued P Rec 2752 @ 725 F										40											
9	01	changed to 161										41											
10	682	83	181	680	84	47.4	8.0	74	500	0		42											
11	678		160	675							NG	43											
12	678	85	170	675	84	56.2	7.3	14	505	0		44											
13	677	83	154	675	83	57	7.3	75	515	0		45											
14	676	83	145	675	84	56	8.8	75	530	0		46											
15	680	84	123.5	675	86	54	8.2	77	527	0		47											
16	681	86	103	611	87	52.5	7.7	78	511	0		48											
17	688	81	96	652	87	43.5	6.4	79	590	0		49											
18	687	89	71.5	652	90	40.7	5.8	80	65	0		50											
19	671	87	64	685	71	38.3	2.3	80	632	0		51											
20	675	83	45.5	687	70	34.5	4.5	80	653	0		52											
21	700	87	28	677	71	25.3	3.4	81	673	0		53											
22	703	70	17	690	72	16.8	2.2	82	672	0		54											
23	711	70	8	697	72	5.8	1.7	83	110	0		55											
24	720	90	4	708	72	1	1.2	83	723	0		56											
25	745	88	13.5	735	71	7.6	1.2	81	718	0		57											
26	715	70	40	730	73	21.5	3.7	83	720	0		58											
27	732	72	56	730	73	27.4	4.5	83	690	0	NG	59											
28	730	92	34	728	73	36.5	6.1	84	650	0		60											
29	730	91	56	728	73	32.4	4.5	84	630	0		61											
30	725	89	110	725	71	42.7	6.4	84	618	0		62											
31	720	88	134	720	87	54.5	8.3	84	585	0		63											
32	718	88	166.5	711	88	63	10.2	84	550	0		64											

WESTINGHOUSE ELECTRIC
CORPORATION

Astronuclear Laboratory
PITTSBURGH, PA.

FLUID FLOW LAB
LOG SHEET
B-3 NOZZLE INTERFACE SEAL TEST

TEST RECORD BOOK NO. 1735-733 RUN NO. 3 SHEET 1 OF 1
TIME OF DAY 0900 hrs DATE 14 April 64
ENGINEER R.J. Stefan OPERATOR E. Solis
REF JUNCTION 32°F TEST GAS H₂
SUPPLY PRESSURE BEFORE 2200 SUPPLY PRESSURE AFTER 2000
SUPPLY TEMP BEFORE 61°F SUPPLY TEMP AFTER 62°F
BAR PRESSURE 29.7 @ 76°F SEAL Pc-10

O₂ .124
O₂ .306

CONFIGURATION

DIM A .300 DIM B .470

POINT	P ₁	T ₁	DP _{LE}	P ₀₂	T ₀₂	DP ₀₂	DP ₀₄	T ₀₄	P ₀₄	PLD	REMARKS	POINT	P ₁	T ₁	DP _{LE}	P ₀₂	T ₀₂	DP ₀₂	DP ₀₄	T ₀₄	P ₀₄	PLD	REMARKS	
PSIG	MV	PSID	PSIG	MV	IN H ₂ O	IN H ₂ O	MV	PSIG	PSIG			PSIG	MV	PSID	PSIG	MV	IN H ₂ O	IN H ₂ O	MV	PSIG	PSIG			
1	199	.72	36	199	.7	112	16.8	.72	163	75		33	622	1.31	80	630	1.32	210	29.3	1.23	540	578		
2	300	.68	37	300	.68	117	16.6	.71	260	130		34	600	1.30	101	608	1.32	247	35.8	1.24	500	571		
3	402	.67	36	400	.67	121	16.5	.71	363	199		35												
4	500	.65	37	499	.65	137	12.4	.72	462	264		36												
5	609										N.G.	37	588	1.14	123	588	1.14	23.4	44	1.18	460	580	Test continued	
6	599	.65	39	600	.67	148	19.5	.67	563	340		38	583	1.15	150	580	1.15	24.5	49	1.17	425	575	After	
7	690		122	640		224					N.G.	39	583	1.16	201	580	1.16	22.5	51.5	1.17	405	580	Internal leak	
8	599	.66	121	600	.67	219	33.5	.65	473	287		40	593	1.18	173	590	1.2	21.3	44	1.16	415	588	was sealed.	
9	503	.66	121	504	.66	203	32.8	.65	380	230		41	600	1.20	149	599	1.21	20.0	39.3	1.17	440	595		
10	400	.66	122.5	400	.66	188	33.3	.64	273	160		42	610	1.21	126	603	1.22	18.4	34.0	1.17	475	602		
11	Test continued 3 June 64 P Bar 29.20 H ₂ @ 65°F											43												Orifice plate changed from .325 to .161
12	711	.77	24	701	.78	45.5	5.8	.78	695	431		44	705	1.21	20	705	1.23	73.0	5.6	1.18	690	688		
13	690	.77	44.5	688	.78	100.5	13.3	.77	645	403		45	682	1.25	39	681	1.28	15.3	12.3	1.19	645	648		
14	688	.78	64.0	682	.78	137	18.8	.78	625	388		46	658	1.29	61	660	1.31	22.0	18.0	1.20	590	623		
15	678	.48	78.0	680	.48	159.5	22.3	.48	600	380	Test section	47	650	1.30	71	653	1.33	24.0	19.8	1.20	575	623		
16	668	.48	102	670	.48	179	26.0	.47	565	360	disassembled	48	680	1.31	41	678	1.32	138	11.2	1.21	635	655		
17	660	.49	122	662	.48	198	30.0	.48	533	343	end on internal	49	655	1.31	62	658	1.33	22.6	18.5	1.22	591	625		
18	648	.48	144	652	.48	217.5	34.4	.48	500	322	leak found	50	705	1.29	22	693	1.30	64	6.0	1.21	680	690		
19	645	.48	167	650	.48	224	37.2	.49	472	310	done N.G.	51												
20	643	.48	184	648	.48	232	39.9	.48	453	299		52												
21	640	.48	201	645	.47	234.5	42	.48	430	287		53												
22	640	.48	221	645	.47	237	44	.48	410	277		54												
23	640	.48	201	645	.47	231	41.3	.48	433	282		55												
24	648	.47	165.5	648	.47	216	35.5	.48	478	305		56												
25	673	.47	102	670	.47	162	23.3	.49	572	358		57												
26	700	.47	66	690	.46	117	16.3	.48	635	400		58												
27	707	.47	20	702	.47	44.4	5.7	.48	688	430		59												
28	705	.48	14	703	.47	15.0	2.0	.48	692	430		60												
29	Test continued 15 June 64 P Bar 29.40 @ 84°F											61												
30	710	1.27	18	705	1.29	45.5	5.8	1.21	690	692		62												
31	678	1.28	38	675	1.29	106	14	1.21	640	645		63												
32	642	1.30	62	645	1.31	168	22.8	1.23	580	599		64												

WESTINGHOUSE ELECTRIC
CORPORATION

Astronuclear Laboratory
PITTSBURGH, PA.

FLUID FLOW LAB

LOG SHEET

B-3 NOZZLE INTERFACE SEAL TEST

TEST RECORD BOOK NO. 173-73-4 RUN NO. 4 SHEET 1 OF 1
TIME OF DAY 1800 hrs DATE 27 MAY 64
ENGINEER R.J. Steffen OPERATOR E. Soles
REF JUNCTION 32°F TEST GAS Hydrogen
SUPPLY PRESSURE BEFORE 2000 SUPPLY PRESSURE AFTER 1700
SUPPLY TEMP BEFORE 160°F SUPPLY TEMP AFTER 60°F
BAR PRESSURE 29.21 @ 75 °F SEAL P₀-10

O₂ .161
O₄ .306

CONFIGURATION

DIM A .300

DIM B .480

APPENDIX B
(Continued)

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APPENDIX C
(Continued)

INSPECTION DATA SHEET						Sheet <u>1</u> of <u>1</u>
(W) P.O./S.O. <u>WO-53083</u>		Part Name <u>INTERFACE SEAL</u>		Date <u>2-28-64</u>		
Insp. Inst. Issue No. <u>NONE</u>		Drawing No. <u>909E935</u>		Rev. <u>E</u>		
Quantity <u> </u>		Serial No. <u>PC-3</u>				
Insp. Location ☐ Receiving		☐ In-Process		☐ Assembly Area		
No.	Characteristic	AQL	ACC	REJ	STAMP	DEFECTS/REMARKS
1	Drawing & Sub to P.O.					
2	Applicable Specs.					
3	Certs. Verification					
4	Shipping Release #					
5	Applicable V.R.'s					
6	Change Notices					
7	<u>37.540 ±.020</u>	<u>0</u>	<u>1</u>	<u>0</u>		<u>37.525 / 37.521</u>
8	<u>38.640 +.010 -.030</u>	<u>0</u>	<u>0</u>	<u>1</u>		<u>NOT VISIBLE</u> <u>38.679 / 38.695</u> (LARGE SIDE)
9	<u>38.700 +.000 -.015</u>	<u>0</u>	<u>0</u>	<u>1</u>		<u>38.676 / 38.687</u>
10	<u>39.794 +.000 -.015</u>	<u>0</u>	<u>0</u>	<u>1</u>		<u>39.751 / 39.752</u>
11	<u>.340 ±.000</u>	<u>0</u>	<u>1</u>	<u>0</u>		<u>334 / 336</u>
12	<u>.300 MAX</u>	<u>0</u>	<u>0</u>	<u>1</u>		<u>330 / 334</u> <u>.161 TO .165 - BOT (LARGE SIDE)</u>
13	<u>.187 ±.010</u>	<u>0</u>	<u>0</u>	<u>1</u>		<u>.192 TO .197 - TOP</u>
14	<u>STOCK THICKNESS 2-PLACES. .022 ±.002</u>	<u>0</u>	<u>0</u>	<u>1</u>		<u>.025 - AT WELD</u> <u>.0243 - SEAL EDGE</u>
15	<u>NO THINNING IN THIS AREA</u>					
16	<u>.396 ±.020</u>	<u>0</u>	<u>1</u>	<u>0</u>		<u>.389 / .392</u>

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Inspection Report on Seal PC-3 after Test 1

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APPENDIX C
 (Continued)

Sheet 1 of 2

W INSPECTION DATA SHEET

P.O./S.O. WC-54149 Part Name INTER. PLATE - Seal Date 7-29-64

Insp. Inst. Issue No. NONE Drawing No. 4477-1/25 Rev. 5

Quantity 1 Serial No. PC-10

Insp. Location ☐ Receiving ☐ In-Process ☐ Assembly Area

No.	Characteristic	AQL	ACC	REJ	STAMP	DEFECTS/REMARKS
1	Drawing & Sub to P.O.					909E435-E
2	Applicable Specs.					N/A
3	Certs. Verification					N/A
4	Shipping Release #					N/A
5	Applicable V.R.'s					N/A
6	Change Notices					N/A
7	51.111 ± .015	0	0	1	WANL 17	MEASURES 39.725-39.796
8	52.700 ± .005		0	1	WANL 17	FLANGE SIDE - 38.636-38.648 MEASURES OPP. SIDE - 38.595-38.675
9	39.125 ± .010		0	1	WANL 17	AREA NOT VISIBLE ON PC
10	37.540 ± .020		0	1	WANL 17	MEASURES 37.492-37.523
11	15° ± 5° 2 PLACES		0	1	WANL 17	14°
12	.027 ± .002		0	1	WANL 17	.024 TO .029
13	.340 ± .010		0	1	WANL 17	RANGES TO .365 IN FREE STATE, MEASURED ON SURFACE PLATE WITH INDICATOR. CAN BE BROUGHT INTO TOL. WITH LITE HAND PRESSURE
14	.320 ± .010 2 PLACES		0	1	WANL 17	RANGES TO .317
15	.181 ± .010		0	1	WANL 17	RANGE .167 TO .184 - TOP RANGE .188 TO .197 - BOT.
16	.396 ± .010		1	0	WANL 17	

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Inspection Report on Seal PC-10 before Test 3

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INSPECTION 2 MA. SALES

Sheet 2 of 2

C. I. O. W/O 54149

2. Name INTERFACE SEAL Date 2/28/64

File No. NONE

Drawing No. 909E435 Rev E

✓ /

Serial No. PC-10

✓ Receiving

In-Process ☐ Assembly Area

[illegible]

$\rho_{\text{air}} = .070$

Inspection Report on Seal PC-10 before Test 3 continued

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APPENDIX C
(Continued)

INSPECTION DATA SHEET						Sheet <u>1</u> of <u>1</u>
No.	Characteristic	AQL	ACC	REJ	STAMP	DEFECTS/REMARKS
1	$\pm .002$ OD	0			WNL 36	THICK .026 / .027
2	$\pm .010$ 340				WNL 36	DIST .344 / .362
3	$\pm .002$ OD				WNL 50	THICK .0225
4	$15^\circ \pm 15^\circ$				WNL 36	ANGL $12^\circ 30'$ TO 14°
5	$\pm .010$ 300 MAX				WNL 36	WIDTH .301 / .3134
6	$\pm .010$ 187				WNL 50	DIST .1945 / .1948
7	$\pm .020$ 396				WNL 36	WIDTH .379 / .3895
8	$\pm .000$ $-.015$ 39.794				WNL 36	ODIA 39.736 / 39.196
9	$\pm .020$ 37.540				WNL 36	ODIA 37.460 / 37.558
10	$\pm .000$ $-.015$ 38.640				WNL 36	ODIA NOT OBTAINABLE
11	$\pm .000$ $-.015$ 38.710				WNL 36	ODIA 38.616 / 38.696
12	N/O THINNING IN THIS AREA	Y			WNL 50	OK

WNL Form 1070

Inspection Report on Seal PC-10 after Test 3

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APPENDIX C
(Continued)

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INSPECTION DATA SHEET						Sheet <u>1</u> of <u>1</u>
No.	Characteristic	AQL	ACC	REJ	STAMP	DEFECTS/REMARKS
1	$\pm .002$ 0.022	0			WANL 36	THICK .026 / .027
2	$\pm .010$ 0.340				WANL 36	DIST. .344 / .362
3	$\pm .002$ 0.022				WANL 50	THICK .0225
4	15° $15^\circ - 0$				WAI 36	ANGL $12^\circ 30'$ TO 14°
5	$\pm .010$ 0.300 MAX				WANL 36	WIDTH .301 / .313
6	$\pm .010$ 0.187				WANL 50	DIST. .1945 / .1948
7	$\pm .020$ 0.396				WAI 36	WIDTH .379 / .3895
8	$\pm .000$ $\pm .015$ 39.794				WANL 36	ODIA 39.736 / 39.796
9	$\pm .020$ 37.540				WANL 36	IDIA 37.460 / 37.558
10	$\pm .000$ $\pm .015$ 38.640				WAI 36	ODIA NOT OBTAINABLE
11	$\pm .000$ $\pm .015$ 38.710				WANL 36	ODIA 38.616 / 38.696
12	NO THINNING IN THIS AREA	Y			WANL 50	OK

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Inspection Report on Seal PC-10 before Test 4

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APPENDIX C
(Continued)

WANL-TME-865

INSPECTION DATA SHEET						Sheet <u>1</u> of <u>2</u>	
P.O./S.O. <u>WO 53087</u>						Part Name <u>Nozzle Inner Face Seal</u> <u>909E435</u> Date <u>6-26-64</u>	
Insp. Inst. Issue No. <u>WO 53087</u>						Drawing No. <u>909E435</u> Rev. <u>—</u>	
Quantity <u>1</u>						Serial No. <u>10</u>	
Insp. Location ☒ Receiving ☐ In-Process ☐ Assembly Area							
No.	Characteristic	AQL	ACC	REJ	STAMP	DEFECTS/REMARKS	
1	$\pm .002$.022					1. .027	5. .026
						2. .026	6. .0265
						3. .026	7. .0265
						4. .026	8. .027
2	$\pm .010$.340					1. .348	5. .350
						2. .350	6. .3415
						3. .362	7. .3435
						4. .351	8. .354
3	$\pm .002$.022					1. .027	5. .026
						2. .026	6. .0265
						3. .026	7. .0265
						4. .026	8. .027
4	$\pm .5^\circ$ $- .0^\circ$ 15°					15°	
5	.300 MAX					1. .288	5. .299
						2. .281	6. .300
						3. .314	7. .313
						4. .295	8. .300
6	$\pm .02$.09					.09 $\pm .02$ outside Radius	
7	$\pm .010$.187						
8	$\pm .020$.396					1. .405	5. .396
						2. .398	6. .390
						3. .390	7. .397
						4. .391	8. .382
9	$\pm .000$ $- .015$ 38.700					Flange Side opp Flange Side 1 38.650 1 38.609 2 38.635 2 38.650 3 38.657 3 38.684 4 38.674 4 38.660	
10							

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Inspection Report on Seal PC-10 after Test 4

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APPENDIX C
(Continued)

WANL-TME-865

INSPECTION DATA SHEET						Sheet <u>2</u> of <u>2</u>
<div style="border: 1px solid black; border-radius: 50%; width: 20px; height: 20px; display: flex; align-items: center; justify-content: center; margin: 0 auto;">W</div>	P.O./S.O. <u>WO 53087</u>		Part Name <u>Nozzle Interface Seal</u> Date <u>6-26-69</u>			
Insp. Inst. Issue No. <u>WO 53087</u>		Drawing No. <u>909E435</u>		Rev. <u>—</u>		
Quantity <u>1</u>		Serial No. <u>10</u>				
Insp. Location ☒ Receiving		☐ In-Process		☐ Assembly Area		
No.	Characteristic	AQL	ACC	REJ	STAMP	DEFECTS/REMARKS
11.	37.540 <div style="font-size: small; margin-top: -10px;">$\pm .020$</div>					OP FLANGE 1 37.457 5 37.492
						2 37.508 6 37.495
						3 37.570 7 37.558
						4 37.536 8 37.533
12.	39.794 <div style="font-size: small; margin-top: -10px;">$\begin{matrix} +.000 \\ -.015 \end{matrix}$</div>					1. 37.733 3. 37.794
						2. 37.780 4 37.777
<p style="margin: 0;">All dimensions taken clockwise as per view of drawing.</p>						

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Inspection Report on Seal PC-10 after Test 4 continued

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~~GROUP 1 EXCLUDED FROM AUTOMATIC DOWNGRADING AND DECLASSIFICATION~~