

TWR-17591, Volume IV

QM-8 FINAL PERFORMANCE EVALUATION REPORT - SEALS

June 1989

Prepared for:

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QM-8 FINAL PERFORMANCE EVALUATION REPORT (SEALS)

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CONTENTS

1.0	INTRODUCTION	1
2.0	SUMMARY AND CONCLUSIONS	•
	2.1 Motor Performance Per Instrumentation	•
	2.2 Motor Performance Per Disassembly Inspection	7
	notes resident set bisableauty imprection vivilities.	•
3.0	DISCUSSION	8
	3.1 Test Objectives	12
	3.1.1 Structural	12
	3.1.2 Adjustable Vent Port Plug Installation Fixture	14
	3.1.3 Leak Check	18
	3.2 QM-8 Field Joint Assembly Procedure	22
	3.2.1 Grease Application	23
	3.2.2 V-2 Filler Installation	23
	3.2.3 0-ring Installation	24
	3.2.4 FJAF Installation and Mating	24
	3.3 Nozzle-to-Case Joint Assembly	24
	3.4 Leak Check Tests	25
	3.4.1 Leak Test Introduction	25
	3.4.2 Leak Check Conclusions and Recommendations	26
	3.4.3 Leak Check Results and Discussion	27
	3.5 Adjustable Vent Port Plugs	30
	3.6 Squeeze Calculations	31
	5.0 bqueeze Carcurations	JI
4.0	TEST RESULTS	31
	4.1 Instrumentation	32
	4.2 Field Joint Performance	33
	4.2.1 Field Joint Girth Gages	34
	4.2.2 QM-8 Field Joint Radial Growth Comparisons	35
	4.2.3 LVDT Gages	39
	4.3 Factory Joints	42
	4.3.1 Forward Segment Factory Joint Girth Gage Response	42
	4.4 Case Membrane Girth Gage Response	44
	4.4.1 QM-8 Case Membrane Radial Growth Comparison	45
	4.5 Case Biaxial Stresses	47
	4.5.1 Aft-to-Center Segment Case Line Load	47
	4.5.2 Aft Field/ET Attach Joint	51
	4.6 Nozzle-To-Case Joint Performance	55
	4.6.1 Nozzle-To-Case Joint	55
		56
		60
		62
		62
		63
		64
		65
		66

CONTENTS (Continued)

5.0	D:	[SASSEMB]	LY INSPECTION RESULTS	69
	5.1	Exter	nal Walk Around	71
	5.2	Field	Joint Disassemblies	71
		5.2.1	Forward Field Joint	72
		5.2.2	Center Field Joint	73
		5.2.3	Aft Field Joint	74
	5.3		e-to-Case Joint	75
	5.4		er Joints	76
		5.4.1	Safe and Arm Joint	79
		5.4.2	Outer Joint	79
		5.4.3	Inner Joint	80
	5.5		nal Nozzle	80
	J. J	5.5.1	Aft Exit Cone Field Joint (Joint 1)	86
		5.5.2	Forward End Ring-to-Nose Inlet Housing (Joint 2)	86
		5.5.3	Nose Inlet Housing-to-Throat Support Housing (Joint 3)	87
		5.5.4	Forward Exit Cone-to-Throat Support Housing (Joint 4)	87
		5.5.5	Fixed Housing-to-Aft End Ring (Joint 5)	88
	5 4		ry Joints	88
	J. 0	5.6.1	Disassembly of QM-8 Forward Dome and	oc
		3.0.1	Forward Segment Factory Joints	88
		5.6	.1.1 Forward Dome-to-Cylinder Factory Joint	88
			.1.2 Forward Segment Cylinder-to-Cylinder	OC
		٠٠٠.	Factory Joint	89
		5.6.2		90
		5.6.3	Disassembly of QM-8 Center Forward Factory Joint Disassembly of QM-8 Center Aft Factory Joint	90
		5.6.4	Disassembly of QM-8 Aft Factory Joints	91
			.4.1 Aft Segment Dome-to-Stiffener Joint	92
				92
				93
	5.7	_	.4.3 ET-to-Stiffener Factory Joint	94
	5.8		Plug Evaluation	94 95
	٥.٥	5.8.1		95
		5.8.2	Remains Observation	95
		5.8.3	Major Anomalies	96
	5.9	5.8.4	Critical Anomalies	96
	3.9	RPRD I	Position	96
6.0	DI	FERENCES	2	98
0.0	М	IL DECOMODE	······································	90
			TABLES	
Tabl	e 1	8-MQ	Case Field Joint Primary O-Ring Movement	20
Tabl	e 2	QM-8	Internal Nozzle Joint Leak Test Results	22

TABLES (Continued)

Table 3	QM-8 Seal Leak Testing	26
Table 4	QM-8 Case Field Joint Leak Test Results	27
Table 5	QM-8 Ignition System Leak Test Results	28
Table 6	QM-8 Nozzle-to-Case Joint Leak Test Results	29
Table 7	QM-8 Vent Port Plugs Leak Test Results	29
Table 8	QM-8 Forward Field Joint Girth Gage Response (Zero - 120 Seconds)	34
Table 9	QM-8 Center Field Joint Girth Gage Response (Zero to 120 Seconds)	35
Table 10	Forward Field Joint Radial Growth Comparisons to QM-8	36
Table 11	Center Field Joint Radial Growth Comparisons to QM-8	36
Table 12	O-Ring Sealing Gap Openings, QM-7, QM-6, JES, NJES, TPTA	40
Table 13	QM-8 Forward Segment Factory Joint Girth Gage Response (Zero to 100 Seconds)	43
Table 14	QM-8 Case Radial Deflection Case Girth Gage Response (Zero to 120 seconds)	44
Table 15	Case Membrane Radial Growth Comparisons to QM-8	45
Table 16	QM-8 Aft-to-Center Segment (Station 1196.48) Case Line Load Moment Biaxials (Zero to 120 seconds)	49
Table 17	QM-8 Aft-to-Center Segment (Station 1466.00) Case Line Load Moment Biaxials (Zero to 120 seconds)	49
Table 18	QM-8 Aft-to-Center Segment (Station 1196.48) Case Line Load Moment Biaxials, Maximum Hoop Stress (Zero to 120 seconds)	50
Table 19	QM-8 Aft-to-Center Segment (Station 1466.00) Case Line Load Moment Biaxials, Maximum Hoop Stress (Zero to 120 seconds)	50
Table 20	QM-8 Aft Field-to-ET Attach (Station 1498.00) Joint Biaxial Gages (Zero to 120 seconds)	52

TABLES (Continued)

Figure 2	QM-8 Assembled Field Joint	3
Figure 1	QM-8 Test Article	2
	FIGURES	
Table 34	Criteria for Classifying "Potential Anomalies"	97
Table 33	QM-8 Axial Growth Deflections (Zero to 120 seconds)	67
Table 32	QM-8 Forward, Center, Aft Field Joints and Nozzle-to-Case Joint and Heater Temperatures (-10.0 to Zero seconds)	66
Table 31	QM-8 Forward Dome Chamber Pressure (Zero to 120 seconds)	65
Table 30	QM-8 Aft Dome, Fixed Housing (Strainsert) Radial Station 1874.3, Axial Station 1875.2 (Zero to 120 seconds)	63
Table 29	QM-8 Aft Dome, Fixed Housing Nozzle-to-Case Joint Biaxial Gages (18 to 22 seconds)	62
Table 28	QM-8 Aft Dome, Fixed Housing Nozzle-to-Case Joint Biaxial Gages (Zero to 120 seconds)	61
Table 27	Nozzle-to-Case Joint Radial Growth Comparisons to QM-8	58
Table 26	QM-8 Aft Dome, Fixed Housing Nozzle-to-Case Joint Girth Gages (18 to 22 seconds)	57
Table 25	QM-8 Aft Field-to-ET Attach (Station 1511.00) Joint Biaxial Gages Maximum Hoop Stress (Zero to 120 seconds)	54
Table 24	QM-8 Aft Field-to-ET Attach (Station 1501.00) Joint Biaxial Gages Maximum Hoop Stress (Zero to 120 seconds)	54
Table 23	QM-8 Aft Field-to-ET Attach (Station 1498.00) Joint Biaxial Gages Maximum Hoop Stress (Zero to 120 seconds)	53
Table 22	QM-8 Aft Field-to-ET Attach (Station 1511.00) Joint Biaxial Gages (Zero to 120 seconds)	53
Table 21	QM-8 Aft Field-to-ET Attach (Station 1501.00). Joint Biaxial Gages (Zero to 120 seconds)	52

FIGURES (Continued)

Figure 3	QM-8 Assembled Nozzle-to-Case Joint	4
Figure 4	P-8 Strut Load Duty Cycle	9
Figure 5	P-9 Strut Load Duty Cycle	10
Figure 6	P-10 Strut Load Duty Cycle	11
Figure 7	Adjustable Vent Port Plug	16
Figure 8	Bottom Plug Installation Setup	17
Figure 9	QM-8 V2 Filler	23
Figure 10	Forward Field Joint Radial Growth Comparisons	37
Figure 11	Center Field Joint Radial Growth Comparisons	38
Figure 12	Forward Field Joint LVDT Measurement (Gap Opening)	41
Figure 13	Case Membrane Radial Growth Comparisons	46
Figure 14	Case-to-Nozzle Joint Radial Growth Comparisons	59
Figure 15	QM-8 Longwire Locations	68
Figure 16	Ignition Systems Seals	77
Figure 17	Igniter Cross Section	78
Figure 18	Forward Exit Cone-to-Aft Exit Cone Joint Interface	81
Figure 19	Nose Inlet Housing/Flex Bearing Joint	82
Figure 20	Nose Inlet/Throat Housing Joint	83
Figure 21	Throat/Forward Exit Cone Joint	84
Figure 22	Flex Bearing/Fixed-Housing Joint	85
	APPENDICES	
APPENDTY A	Inspection Forms	_i

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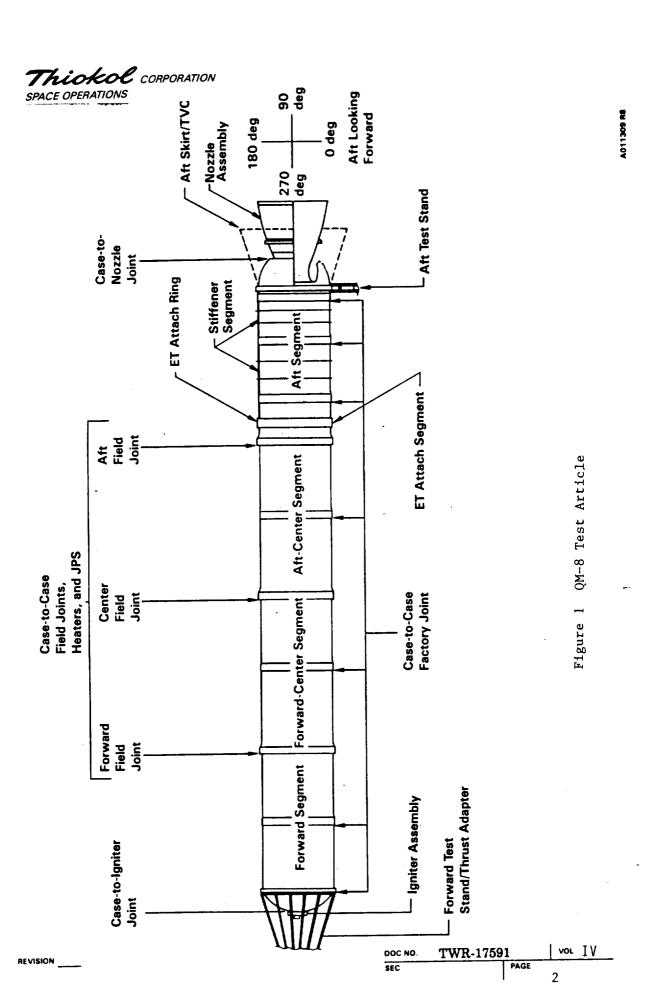
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1.0 INTRODUCTION

The Space Shuttle Redesigned Solid Rocket Motor (RSRM) static test of Qualification Motor-8 (QM-8) was conducted 20 January 1989 at Morton Thiokol, Inc., Space Operations. The QM-8 test article (see Figure 1) was the fifth full-scale, full-duration test, and the third qualification motor to incorporate the redesigned case field joint and nozzle-to-case joint as illustrated in Figures 2 and 3, respectively. This was the second static test conducted in the T-97 test facility, which is equipped with actuators for inducing external side loads to a 360 degree External Tank (ET) attach ring during test motor operation, and permits heating/cooling of an entire motor. The QM-8 motor was cooled to a temperature which ensured that the maximum propellant mean bulk temperature (PMBT) of 40° F was achieved at firing. QM-8 was tested per Morton Thiokol, Inc. Test Plan CTP-0060, Revision D (see Reference 1).

This final report does not include all test results, but rather, addresses the performance of the metal case, field joints, and nozzle-to-case joint. It focuses on the involvement of the Structural Applications and Structural Design Groups with the QM-8 test which includes: assembly procedures of the field and nozzle-to-case joints, joint leak check results, structural test results, and post-test inspection evaluations.

The final test report which addresses all objectives is TWR-17591, Volume I (see Reference 2).



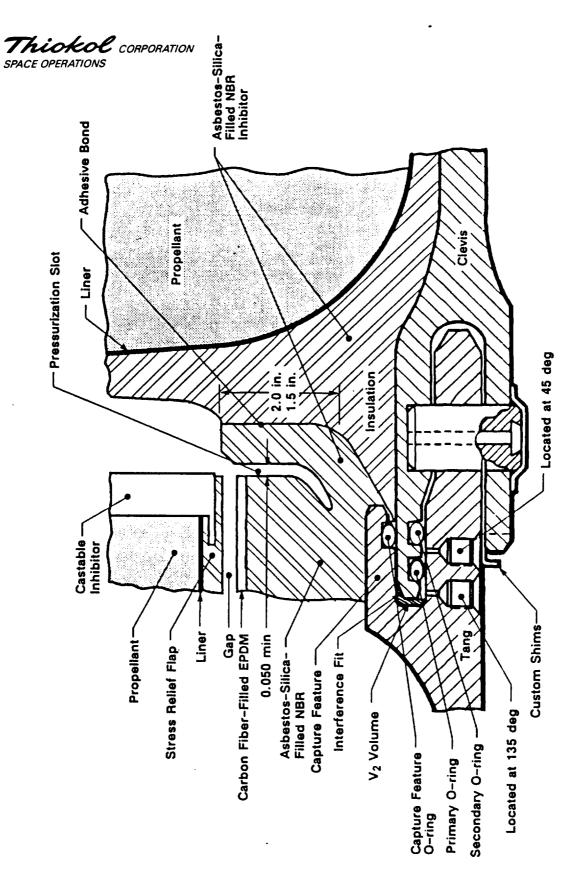
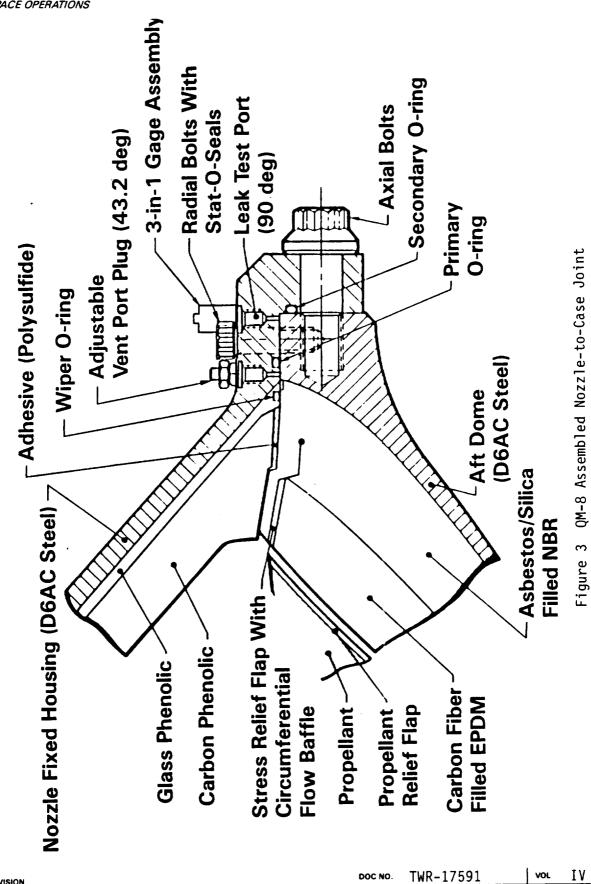


Figure 2 QM-8 Assembled Field Joint

DOC NO	TWR-17591			VOL	IV	
SEC		PAGE				
	'		3			



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SEC

PAGE

2.0 SUMMARY AND CONCLUSIONS

2.1 Motor Performance per Instrumentation

The girth gage measurements from QM-8 field, factory, case, and nozzle-to-case joints compare closely to pretest predictions. The highest percentage differences were 8.5 percent on the FWD field joint, 6.9 percent on the CTR field joint, 10.6 percent on the FWD cylinder to cylinder factory joint, 5.7 percent on case segment (station 1411.5), and 19.6 percent on the nozzle-to-case joint girth gages. The overall maximum radial growth occured in the case membrane at station 931.5, and had a value of 0.271 inch. Several of the gage readings are questionable, or produced no data.

The biaxial gage measurements were not consistently comparable with pretest predictions which are discussed in more detail in the test results sections. The included tables can more clearly depict similarities and differences. The maximum stress experienced by the case membrane (stations 1196 and 1466) occured in the hoop direction, 270 degrees, at station 1466, and had a value of 145.1 KSI. In the aft field joint/ET region, a comparison between biaxial gage test data and predicted values can be found in TWR-19506 (Reference 3).

The QM-8 maximum head end pressure of 872.6 psia occurred in the forward dome at 0.656 seconds following motor ignition (see Table 31). The joint and heater temperatures ranged between 84.9 °F to 106.7 °F prior to ignition (see Table 32), well above the 75 °F minimum required.

The gap opening aft of the primary 0-ring was measured with an LVDT via the 45 degree leak check port for the forward field joint. LVDTs were also used on the center and aft field joints, unfortunately the deflection data was not generated. The forward field joint Linear Variable Displacement Transformer (LVDT) measured a radial growth of 0.004 inch, which is the same as the pretest predictions.

The maximum axial growth was 1.06 inches between stations 527.0 to 1505.0 inches which is a typical value. (see Table 33) Negative values were experienced in the gages which spanned the joints. Evaluation of the placement of these gage locations which experienced negative values supports that these values are in error. In other words, the instrument measured a negative value but the joint did not go negative. The measurement was that of of instrument, and not the joint.

2.2 Motor Performance Per Disassembly Inspection

The detailed results of the post-test inspection of QM-8 can be found in Section 5.0. In summary, the most significant observations made from post-test inspection where:

- o White colored material, which ran circumferentially, was found on the aft edge of the forward field joint capture feature 0-ring at 169 degrees. More thin lines of the white colored material were found intermittently on the aft edge from 164 to 167 degrees. Also small thin lines of the white colored material were found on the capture feature metal-to-J-leg interface (aft of the capture feature groove on the tang J-leg) at intermittent degree locations. Lab analysis indicated the white material was Teflon tape adhesive. Teflon tape is used to mask the J-leg during grease application and 0-ring installation processes.
- o Inspection of the radial bolt Stat-O-Seals by the O-ring inspection team revealed that 35 of 100 had unacceptable flow line conditions which should have been rejected by Receiving Inspection. Drawing No. 1U75374 defines the Stat-O-Seals to be inspected per MIL-STD-413, which allows circumferential flow lines no greater than 0.180 inch in length. No radial flow marks are allowed.

At the present time there is a Stat-O-Seal inspection test designed to qualify each inspector. This test was not in force at the time the QM-8 Stat-O-Seal inspection occurred.

Inspection of the nose-to-forward end ring revealed one very small pressure path through the RTV of the joint interface at 355 degrees flowing circumferentially to 350 degrees before penetrating into the metal interface. The primary 0-ring experienced no damage as a result of the pressure path. The RTV backfill of this joint was much better than the current application of RTV to this joint ("buttering application"). No soot or evidence of blow by was present past the primary 0-ring.

Considering these case and seal observations were the most significant found, QM-8 represents the fifth successful assembly and firing of a full-scale capture feature RSRM in a horizontal configuration.

3.0 DISCUSSION

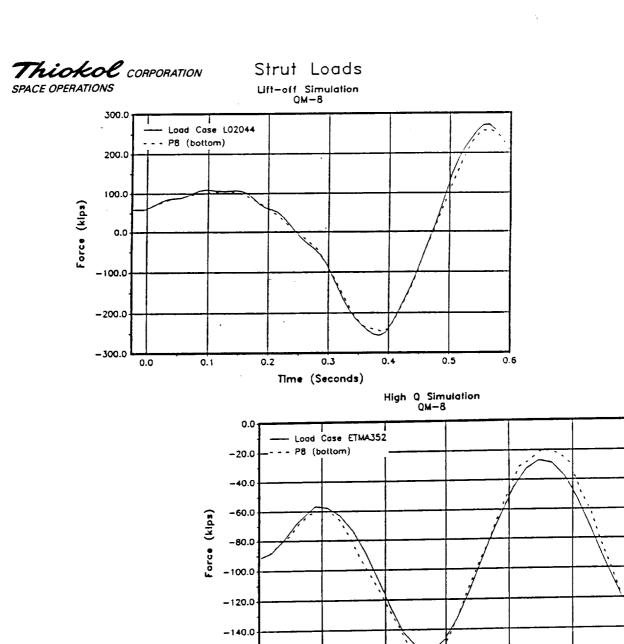
The following sections provide a discussion on the assembly of the field joints and nozzle-to-case joint. A summary of the QM-8 configuration follows:

O Field Joints

- RSRM design with fluorocarbon 0-rings
- o No intentional flavs
- o Joint protection system with heaters and weather seal installed
- o Adjustable vent port plugs and vent valves installed
- o LVDTs installed in leak check ports

O Case-To-Nozzle Joint

- Axial and radial bolt configuration with fluorocarbon 0-rings
- o No intentional flavs
- o Adjustable plug installed in vent port and a pressure transducer installed in the leak check port
- o Temperature sensors of 105 °F, + 5 °F
- O Side load actuators for inducing external side loads to the 360 degree external tank attach ring which follow the curves shown in Figures 4, 5, and 6.
- O Three stiffener rings installed on the aft segment
- O Weather seals installed on all factory joints



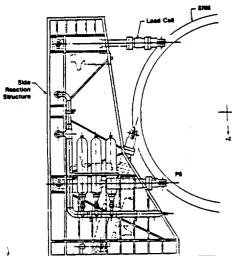


Figure 4 P-8 Strut Load Duty Cycle

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Time (Seconds)

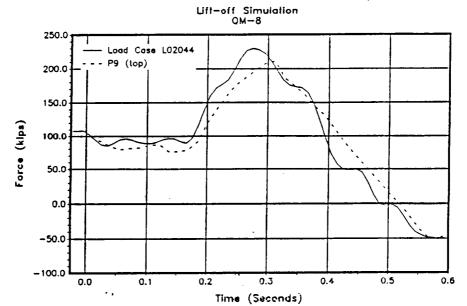
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Strut Loads



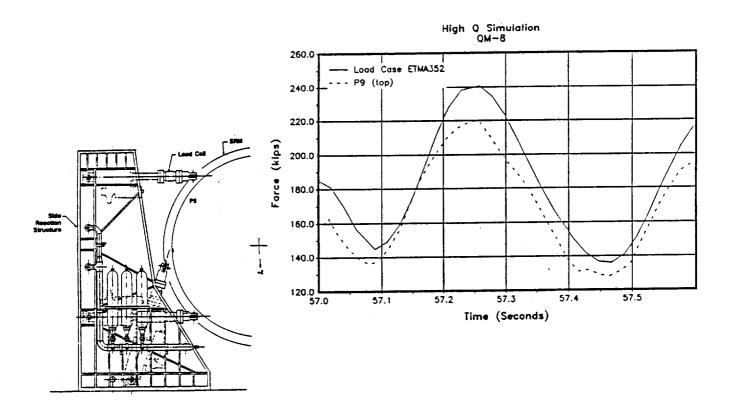


Figure 5 P-9 Strut Load Duty Cycle

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3.1 Test Objectives

Test objectives, as outlined in CTP-0060, Revision D (see Reference 1) which apply to any structural or seal issue, are addressed here. Explanation of how each objective was met is discussed.

3.1.1 Structural

The test objectives from CTP-0060, Revision D regarding structural performance and the corresponding results are as follows:

"H. Certify that all RSRM seals, including adjustable vent port plug seals in the field joints, experience no erosion or blow-by throughout the static test" (Section 3.2.1.2, CTP-0060, Revision D).

Post-test inspection showed that no motor gas pressurization went past any primary seal and no erosion or heat effects were found (see Section 5.0). Objective H was met.

"J. Certify that the case field joint and nozzle-to-case joint seals, if pressurized, accommodate static test motor and side load induced structural deflections" (Section 3.2.1.2.1.a, CTP-0060, Revision D).

Post-test inspection of the field and nozzle-to-case joints showed that no motor gas pressurization went past the J-Leg or polysulfide insulation respectively (see Section 5.1.2). Objective J was met.

"K. Certify that the case field joint and nozzle-to-case joint seals, if pressurized, operate when PMBT is at 40° F" (Section 3.2.1.2.1.b, CTP-0050, Revision D).

No pressure was seen to any field or nozzle-to-case joint seal (see Section 5.1.2). Objective K was met.

TWR-17591, Vol IV

"M. Certify that the nozzle-to-case joint 0-ring temperature is maintained prior to static firing" (Section 3.2.1.2.1.f, CTP-0060, Revision D).

Temperature gages located on the nozzle-to-case joint heater gave a temperature range of 87.4 °F to 106.7 °F (see Section 4.7). Objective M was met.

"W. Certify that the ignition system seals, if pressurized, accommodate static test motor structural deflections" (Section 3.2.1.2.4.a, CTP-0060, Revision D).

Post-test inspection of the igniter joints (see Section 5.3) showed there was no blow by past any primary gasket seal. Objective W was met.

"X. Certify that the ignition system seals, if pressurized, operate when PMBT is at 40 °F" (Section 3.2.1.2.4.b, CTP-0060, Revision D).

Post-test inspection of igniter joints (see Section 5.3) showed there was no blow by past any primary gasket seal. Objective X was met.

"Z. Certify that the nozzle internal seals and the aft exit cone field joint seals, if pressurized, accommodate static-test motor structural deflections" (Section 3.2.1.2.5.a, CTP-0060, Revision D).

Post-test inspection of all internal nozzle seals, which includes the aft exit cone-to-forward exit cone field joint seals, (Section 5.4) showed there was no blow by past any primary 0-ring. Objective Z was met.

"AA. Certify that the nozzle internal seals and the aft exit cone field joint seals, if pressurized, operate when PMBT is at 40 °F" (Section 3.2.1.2.5.b, CTP-0060, Revision D).

Post-test inspection of all internal nozzle seals, which includes the aft exit cone-to-forward exit cone field joint seals (see Section 5.4) showed there was no blow by past any primary 0-ring. Objective AA was met.

"AD. Certify that the case is capable of containing the static-test internal pressure" (Section 3.2.1.3.a, CTP-0060, Revision D)

Post-test inspection of the QM-8 hardware (see Section 5.0) and structural evaluation from strain gage instrumentation (see Section 4.0) indicated no anomalous conditions. Objective AD was met.

"A. (Development Objective) Acquire engineering data for model validation."

Comparisons of test data to predicted model data show a close correlation except in the nozzle-to-case biaxial strain gages. Discrepancies in this joint are explained in Section 4.2.2.4.

3.1.2 Adjustable Vent Port Plug Installation Fixture

Figure 7 illustrates the components which make up the adjustable vent port plug. Figure 8 shows how the installation fixture is used to install the bottom section of the plug into the vent port. The qualification test objectives regarding the vent port plug installation fixture and how the objectives were met are discussed in this section.

"CQ. Certify the performance of the Adjustable Vent Port Plug Installation Tool as a means of installing, rotating, and torquing the bottom section of the adjustable vent port plug" (Section 3.2.1.1, CTP-0060, Revision D).

All bottom sections of the plugs were installed correctly with the installation tool. However, three bottom sections had to be replaced when the tool slipped causing raised metal on the bottom section. This problem was a result of inadequate training in the use of the tool, not the tool design (see Section 3.5). Objective CQ was met.

"CR. Certify that the installation fixture is efficient and does not require special and additional tooling" (Section 3.2.1.1, CTP-0060, Revision D).

No addition tooling was required to install the Adjustable Vent Port Plugs (see Section 3.5). Objective CR was met.

"CS. Certify that the use of the adjustable vent port plug installation tool does not affect the safe and reliable use and reusability of the RSRM" (Section 3.2.1.1, CTP-0060, Revision D).

Post-test inspection of the QM-8 field and nozzle-to-case joint vent ports revealed no anomalous conditions (see Section 5.0). Objective CS was met.

"CT. Certify that the tool allows for a threaded installation to the bottom section of the adjustable vent port plug" (Section 3.2.1.2.1, CTP-0060, Revision D).

There were no problems associated with the threaded installation to the bottom section of the adjustable vent port plug (see Section 3.5). Objective CT was met.

"CU. Certify that the interlocking allows for rotation and torquing of the bottom section of the adjustable vent port plug" (Section 3.2.1.2.2, CTP-0060, Revision D).

All bottom sections of the plugs were torqued correctly with the interlocking feature of the installation tool (see Section 3.5). Objective CU was met.

"CV. Certify the capability of interlocking the installed installation tool with the bottom section of the adjustable vent port plug, and the utilization of the notch in the bottom section of the adjustable vent port plug" (Section 3.2.1.2.2, CTP-0060, Revision D).

All bottom sections of the plugs were installed correctly with the installation tool. However, three bottom sections had to be replaced when the tool slipped, causing raised metal on the bottom section. This problem was a result of inadequate training in the use of the interlocking feature, not the tool design (see Section 3.5). Objective CV was met.

"CW. Certify that the tool is capable of applying a minimum torquing force of 70 inch pounds to the bottom section of the adjustable vent port plug" (Section 3.2.1.2.4, CTP-0060, Revision D).

The tool was capable of applying the minimum required torque of 70 inch pounds (see Section 3.5). Objective CW was met.

"CX. Demonstrate that the tool is capable of being transported to the work site" (Section 3.2.8, CTP-0060, Revision D).

The tool size and weight are acceptable (see Figure 8).



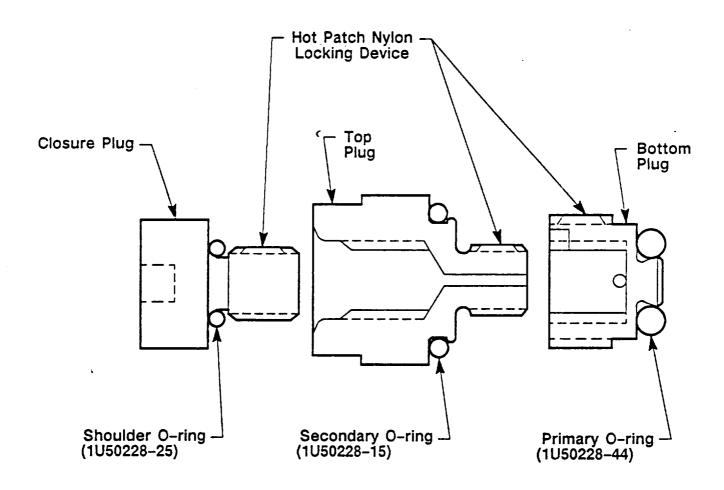


Figure 7 Adjustable Vent Port Plug

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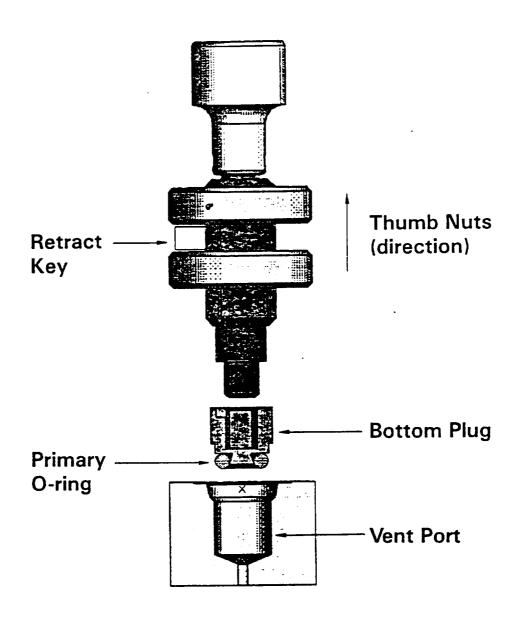


Figure 8 Bottom Plug Installation Setup

DOC NO. TWR-17591 VOL IV
SEC PAGE 17

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3.1.3 Leak Check

The qualification test objectives regarding leak test performance are as follows:

- "I. Certify the verifiability of the RSRM seals (except for the nozzle-to-case joint primary seal, the factory joint primary seal, the fixed housing to aft end ring primary seal, the igniter dual seal plugs (5 places) and the operational pressure transducer (OPT) primary and secondary seals)" (Section 3.2.1.2, CTP-0060, Revision D).
- "L. Certify that the case field joint and nozzle-to-case joint seal verification does not degrade the performance or integrity of the sealing system" (Section 3.2.1.2.1.c, CTP-0060, Revision D).
- "M. Certify that the bore seals for the center field joints are verifiable in the proper direction" (Section 3.2.1.2.1.d, CTP-0060 Revision D).
- "Y. Certify that the ignition system seal verification does not degrade the performance or integrity of the sealing system" (Section 3.2.1.2.4.c, CTP-0060, Revision D).
- "AB. Certify that the nozzle internal seals and the aft exit cone field joint seals verification does not degrade the performance or integrity of the sealing system" (Section 3.2.1.2.5.c, CTP-0060, Revision D).
- "AC. Certify that the bore seals for the nozzle are verifiable in the proper direction" (Section 3.2.1.2.5.e, CTP-0060, Revision D).
- "BD. Certify the field joint, nozzle-to-case joint, and igniter-to-case joint leak test compatibility" (Section 3.2.1.8.1.1.b, CTP-0060, Revision D).

The following is a discussion of the test objectives and test results relating to leak testing, and evidence that the current specifications meet the requirements of the CEI Specification.

Objective I requires that all RSRM seals be verifiable, which, by definition in the CEI Specification, means that a leak test must be performed. The seals not meeting this requirement have been previously identified in Deviations RDW0526 and RDW0541 (see Reference 4). These seals include the nozzle-to-case joint primary seal, the factory joint primary seal, the fixed housing-to-aft end ring primary seal, the igniter dual seal plugs (five places) and the OPT primary and secondary seals. All leak tests were completed successfully. The leak test results are provided and discussed in Section 3.4. Objective I was met.

Objective L requires the certification that the case field joint and nozzle-to-case joint seal verification (leak test) does not degrade the performance or integrity of the sealing system. This is verified by post-test inspection. The completed inspections show no damage or degradation to the system (see Section 5.0). This objective was met.

Objective M requires the certification that the bore seals in the field joints are verifiable in the proper direction. These data are gathered during the leak test. When the primary-to-secondary seal cavity (V4) is pressurized to 1000 psig, the secondary seal is seated in the proper direction. It is already in that configuration because of assembly, but that is assured with pressure. The primary seal is moved into the "wrong" position. When the primary seal-to-capture feature 0-ring cavity (V2) is

subsequently pressurized to 100 psig, the primary seal is moved and seated in the proper sealing direction. This seal movement is evidenced by a pressure rise in the V4 volume, which is monitored by a pressure transducer during the test. The pressure rise must be a minimum of 0.5 psi. Table 1 contains the results of the final leak tests, showing the pressure rises recorded.

Based on above data, all field joint bore seals were seated and verified in the proper direction. Objective M was met.

TABLE 1
QM-8 CASE FIELD JOINT PRIMARY O-RING MOVEMENT

FIELD JOINT	*INITIAL PRESSURE (psig)	*FINAL PRESSURE (psig)
FORWARD	0.036	3.573
CENTER	0.059	3.982
AFT	. 0.063	3.366

^{*} PRESSURE IN PRIMARY-TO-SECONDARY SEAL CAVITY DURING PRIMARY SEAL-TO-CAPTURE FEATURE O-RING CAVITY PRESSURIZATION TO 100 psig

Objective Y requires the certification that the ignition system seal verification does not degrade performance or integrity of the sealing system.

This is verified by post-test inspection of the seals, detailed in Section

5.4. No damage was seen because of leak testing. Objective Y was met.

Objective AB requires the certification that the nozzle internal seals and the aft exit cone field joint seal verification does not degrade the performance or integrity of the sealing system. This is verified by post-test inspection of the seals detailed in Section 5.5. Completed inspections show no damage caused by leak testing. This objective was met.

Objective AC requires the certification that the bore seals for the nozzle are verifiable in the proper direction. This is verified by the successful completion of a leak test. Nozzle joints 2 and 4 have the only bore seals. The bore seals are both secondary seals, so pressurization between the seals verifies them in the proper direction. The pressures used for leak testing are 920 psig and 144 psig for joints 2 and 4, respectively.

Full-scale testing on a field joint with a minimum 21 percent squeeze has shown that approximately 65 psig is sufficient to move and seat an 0-ring in the proper direction after it was seated in the opposite direction with 1000 psig. The internal nozzle joints are designed with minimum ten percent squeeze, resulting in easier movement. With the application of 144 psig and greater, it is assured the seal is seated in the proper direction. Results of the leak tests are given in Table 2. This objective was met.

Objective BD requires the certification of the field joint, nozzle-to-case joint and igniter-to-case joint leak test compatibility. This is accomplished by performing post-test inspections to determine that no damage to the insulation was caused by leak testing, and that the insulation performed acceptably. These inspections and analyses were performed with no anomalous conditions found. Detailed inspection reports are found in Section 5.0. This objective was satisfied.

TABLE 2
QM-8 INTERNAL NOZZLE JOINT LEAK TEST RESULTS

JOINT #	<u> </u>	*ALLOWABLE LEAK RATE, HI/LO(sccs)	ACTUAL LEAK RATE HI/LO (sccs)
#1	83	0.029/0.0082	0.0067/ 0.0011
#2	920	0.084/0.0082	0.0140/ 0.0053
#3	740	0.070/0.0082	0.0060/ 0.0000
#4	144	0.053/0.0082	0.0142/ 0.0004
# 5	920	0.084/0.0082	0.0065/ 0.0072

- * HI = MAX TEST PRESSURE, LO = 30 psig
- (#1) => FWD / AFT EXIT CONE
- (#2) => FWD END RING / NOSE INLET HOUSING
- (#3) => NOSE INLET HOUSING / THROAT SUPPORT HOUSING
- (#4) => THROAT SUPPORT HOUSING / FWD EXIT CONE
- (#5) => AFT END RING / FIXED HOUSING

3.2 QM-8 Field Joint Assembly Procedure

Assembly of the field joints proceeded in the following order:

- 1. Cleaning and greasing the joint
- 2. V-2 filler installation
- 3. 0-ring cleaning, greasing, and installation
- 4. Field Joint Assembly Fixture (FJAF) installation
- 5. Application of J-seal adhesive
- 6. Joint mating
- 7. Pin installation and FJAF removal
- 8. Installation of shims
- 9. Leak test procedure

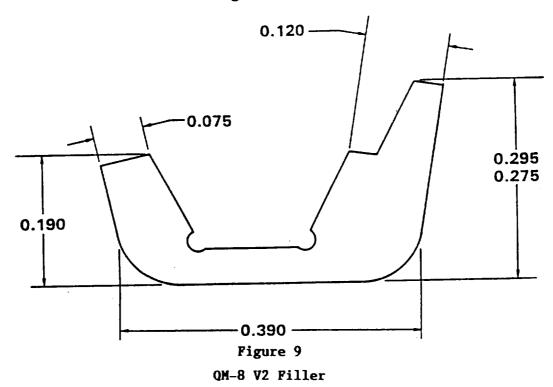
3.2.1 Grease Application

Grease application was accomplished per STW7-2999 (see Reference 5). Rational for the method of grease application can be found in TWR-18135, Revision A, Section 3.1.1 (see Reference 6).

3.2.2 V-2 Filler Installation

The V-2 filler installation is fully described in TWR-18135, Revision A, Section 3.1.2 (see Reference 6). However, the starting locations for the lengths at 91 and 136 degrees were changed to 90 and 137 degrees to allow a larger V-2 gap where the vent port is located. This was done to ensure the vent port was not obstructed.

For the purpose of convenience, a cross-section drawing showing some fundamental dimensions is shown in Figure 9.



3.2.3 O-Ring Installation

O-rings were installed per STW7-2999 (see Reference 5) which details the O-ring installation procedures.

3.2.4 FJAF Installation and Mating

Installation procedures for the FJAF are detailed in ETP-0228, Revision A (see Reference 6), which discusses how the FJAF is used to mate the joints to full pin installation.

3.3 Nozzle-to-Case Joint Assembly

Assembly of the nozzle-to-case joint proceeded in the following order:

- 1. Fixed housing metal parts were cleaned and regreased
- 2. The pregreased 0-rings were installed.
- 3. The fixed housing was covered to keep it clean
- 4. Aft dome metal parts were cleaned
- 5. Radial bolt hole plugs were installed in the aft dome
- 6. Teflon tape was applied to the aft dome metal surface from the insulation to approximately half way across the radial hole plugs

- 7. Polysulfide was mixed and applied to the aft dome.
- 8. Teflon tape was removed and aft dome metal surface was recleaned then greased. Radial bolt hole plugs were checked for proper alignment.
- 9. The joint was assembled vertically.

Details of the assembly procedure and radial bolt hole plug design can be found in TWR-18135, Section 3.2 (see Reference 7).

3.4 Leak Check Tests

3.4.1 Leak Test Introduction

After each RSRM joint is assembled, a leak test is performed to determine the integrity of the seals (excluding the factory joint seal and the flex bearing). The leak tests usually consist of a joint volume determination and a pressure decay test. The volume and pressure information is combined with temperature and time data, which is collected during the test, and used in the calculation of a leak rate, expressed in terms of standard cubic centimeters per second (SCCS). Each leak test has a maximum leak rate allowed. Some specifications require only a maximum pressure decay over time. This method has been determined as sufficient based on the small, constant volumes, and the equivalent leak rates, which are conservative when using all worst-case variables.

Table 3 contains a list of all joints, the Thiokol Corporation leak test specifications, and the equipment used to test the joints. The leak tests will be discussed in detail in Section 3.4.3

TABLE 3
QM-8 SEAL LEAK TESTING

	<u>Joint</u>	Specification	Equipment
1.	Case Field Joints	STW7-3447	8075902
2.	Forward-to-Aft Exit Cone Joint	STW7-3475	8076248
3.	Nozzle Internal		
	- Joint 2	STW7-3476	2U129718
	- Joint 3	STW7-3477	20129718
	- Joint 4	STW7-3478	20129718
	- Joint 5	STW7-3320	20129718
4.	Vent Port Plug	STW7-3661	7076357
5.	Nozzle/Case Joint	STW7-3448	20129718
6.	Case Factory Joints	STW7-2747	20129718
7.	Ignition System - Inner/Outer Gaskets and Special Bolt Installation	STW7-3632	20129718
	- S&A Joint	STW7-3633	8076500
	- X-ducer Assembly	STW7-2853	2065686
	- Barrier Booster	STW7-2913	2065848

3.4.2 Leak Check Conclusions and Recommendations

Based on the satisfaction of all QM-8 objectives as discussed in Section 3.1.3, it is concluded that all leak tests currently performed on the RSRM joints are certified for use on flight motors. These certification objectives were also satisfied during DM-9, QM-6, QM-7, and PV-1, except for the igniter inner gasket leak test, which was certified on QM-7 and PV-1. No further conclusions or recommendations are reached.

3.4.3 Leak Check Results and Discussion

The case field joint leak test results are shown in Table 4. All tests were performed with the 8U75902 leak test system. The "8U" system was used to test the flight motor field joints (360L001, 360L002, and 360L003), aft-to-forward exit cone joints, and the S&A-to-igniter joint. The results from the QM-8 field joint leak tests were nominal.

TABLE 4
QM-8 CASE FIELD JOINT LEAK TEST RESULTS

PRESSURE	CAVITY*	MAXIMUM LEAK	ACTUAL	LEAK RATES	(sccs)
(psig)		RATE (sccs)	FWD	CTR	AFT
1000	P-S	0.10	0.0002	0.0693	0.0081
30	P-S	0.0082	0.0005	0.0002	-0.0003
100	P-C	0.037	0.0102	0.0124	0.0163
**0	P-S	-0.037	-0.0005	-0.0006	-0.0006
30	P-C	0.0082	0.0006	0.0006	0.0001
**0	P-S	-0.0082	-0.0002	-0.0002	-0.0002

^{*} P-S PRIMARY-TO-SECONDARY SEAL

The QM-8 ignition system leak test results are shown in Table 5. The tests were performed with a variety of equipment as shown in Table 3. The equipment was identical to that used on the flight motors. All results were well within limits.

P-C PRIMARY SEAL-TO-CAPTURE FEATURE O-RING

^{**} MONITOR PRESSURE RISE IN P-S CAVITY

TABLE 5
QM-8 IGNITION SYSTEM LEAK TEST RESULTS

JOINT SEAL	ALLOWABLE LEAK RATE (secs), HI/LO*	ACTUAL LEAK RATE (sees), HI/LO	
IGNITER INNER	0.10 / 0.0082	0.0017 / 0.0055	
OUTER	0.10 / 0.0082	0.0123 /-0.0004	
TRANSDUCER INSTALLATION	0.10 / 0.0082	-0.0009 / 0.0000	
OPT **	10 psi IN 10 min/ 1 psi IN 10 min	3.0 / 0.0 3.0 / 0.0 3.0 / 0.0 3.0 / 0.0	
BARRIER* BOOSTER	1 psi IN 20 min	0.0 PSI	
S & A	0.10 / 0.0082	0.0303 /-0.0005	

^{*} HI = 1000 psig, L0 = 30 psig

Table 6 lists the results of the QM-8 nozzle-to-case joint leak test. The 2U129718 equipment was used. This equipment is identical to that used on the nozzle-to-case joints of the flight motors. All results were well within limits.

^{**} OPT'S TESTED AT 1024 psig AND 30 psig, ACTUAL LEAK RATE UNITS ARE psi/10 min

BARRIER BOOSTER TESTED AT 55-60 psig

TABLE 6
QM-8 NOZZLE-TO-CASE JOINT LEAK TEST RESULTS

PRESSURE (psig)	CAVITY*	MAXIMUM ALLOWABLE LEAK RATE (sccs)	Ŗ
920	P-S	0.084	0.0213
30	P-S	0.0082	-0.0002
25	P-V	**	0.140 psi/min
25	P-S^	-0.0082	-0.0002
STAT-O-SEAL	P-W	O BUBBLES/SEC	0

^{*} P-S = PRIMARY-TO-SECONDARY SEAL

Table 2 shows the results of the internal nozzle joint leak tests. Joint No. 1 was tested with the 8U75248, S/N 006 equipment, while Joints 2 through 5 were tested with the 2U129718 equipment. The "8U" was used on all flight motor No. 1 joints. The "2U" was used on the all flight motor nozzle internal joints. All data were well within limits.

Table 7 shows results of leak test performed on the vent port plugs used on QM-8. All results were will within limits.

TABLE 7
QM-8 VENT PORT PLUGS LEAK TEST RESULTS

PRESSURE	ALLOVABLE LEAK RATE	ACTUAL LEAK RATE (sccs)			
(psig)	(sccs)	AFT	CENTER	FORVARD	NOZZLE/CASE
1000	0.10	-0.0055	0.0051	0.0015	-0.0015

P-W = PRIMARY SEAL-TO-WIPER O-RING

^{** 5} psi DROP IN 5 MINUTES

MONITOR PRESSURE RISE RATE WITH P-W PRESSURIZED

3.5 Adjustable Vent Port Plugs

The adjustable vent port plug (AVPP), illustrated in Figure 7, was tested in QM-8. Four AVPPs were successfully installed in the case field joints and the nozzle-to-case joint vent ports at 135 and 43.2 degrees, respectively. A 2U132133 (8U76549) installation tool, shown in Figure 8, was used to install the bottom portion of the AVPPs in the vent ports. Each AVPP was installed per STW7-3499 (see Reference 8) and leak checked per STW7-3661 (see Reference 9).

No major problems occurred during the installation of the AVPPs. Three bottom portions were replaced when the AVVP tool slipped causing raised metal on the bottom plug. This anomaly was caused from the incorrect use of the installation tool. After training technicians in the use of the tool, no additional problems with the tool occurred. Training should be implemented to teach the correct use of the tool to prevent further problems with raised metal on the bottom plug. TWR-18838 (see Reference 10), documents the procedure for correct use of the AVPP installation tool.

The AVPP installation tool worked as designed to install the bottom portion of the AVPP into the port to the 70 in.lb maximum torque. The removal of the tool did not affect the installed plug. In addition, the installation process using the AVPP installation tool did not cause any damage to the tool. Two bottom portions were replaced because the installation torques exceeded the requirements (too much locking device). The installation

specification STW7-3499 (see Reference 8) has provisions to remove any plugs that exceed the initial installation torque.

Each AVPP successfully passed leak check. All were below the 0.1 sccs allowable leak rate. Actual leak rates are given in Table 7. Post-test inspection results indicate all AVPPs were nominal. No motor pressure reached the AVPPs, thus, no assessment of blow by or erosion can be made on the seals.

3.6 Squeeze Calculations

No DRs were generated on the QM-8 O-rings addressing the minimum squeeze. All O-rings were within the drawing tolerances, therefore, all QM-8 O-ring squeezes were within limits outlined in TWR-18811, Revision A (see Reference 11).

4.0 TEST RESULTS

The test results monitored by Structural Applications and Structural Design are described in this section. In most cases, actual test data are compared to predicted values for each location and are shown in the Data Summary Tables, Tables 8 through 33. Test data from each joint are summarized in these tables. Biaxial gages are presented in two tables — one to show the maximum strain and a comparison with predictions (where applicable), and another to show the maximum calculated hoop and axial stress.

The predictions included in these tables are ratioed to QM-8 pressure with respect to gage location. The ratios were determined by multiplying the original prediction by the ratio of the estimated QM-8 pressure to the prediction pressure. This is done because each set of predictions were calculated assuming a common pressure, which in most cases is somewhat larger than the actual pressure for the specific location. Therefore, by using the ratio of the predictions to QM-8 values, a comparison can be made. The calculation of the pressure ratio works as follows:

Maximum radial growth, e.g., girth strain, for a particular location is found from test data, and the time at which it occurred. The head end pressure at this time is determined, and a predicted pressure drop to the gage location at this time is found. For QM-8, the predicted pressure drops were given in TWR-18990 (see Reference 12). Therefore, the pressure ratio is:

The percent difference between analysis and measured strain data is given by:

4.1 Instrumentation

Instrumentation gages were placed on and close to the field and nozzle-to-case joints to characterize joint performance. Following is a list of gages used and their function.

Joint Girth Gages-

Measures the hoop strain for the entire 360 degree circumference. From the averaged hoop strain, radial deflections are determined from the product of measured (average) girth strain and the nominal hardware radii at the corresponding gage location.

Biaxial Gages-

Measures local, rather than average (girth gages) axial and hoop strains incurred in the case during pressurization. From the strains, stress can be calculated.

Strainserts-

Added to the hollowed out heads of the nozzle-to-case radial and axial bolts to measure initial and final loads on the bolts in pounds.

Linearly Variable-Differential Transducer (LVDT) Used to measure 0-ring gap opening for the field joints via the 45 degree leak check port.

Pressure Transducer- Installed in the igniter to measure head end pressure.

Thermocouple-

Instrumented on the field and nozzle-to-case joints to monitor temperature.

Axial Deflection-

Measures axial growth across the joint(s), gages and membrane.

4.2 Field Joint Performance

QM-8 instrumentation on the field joint consisted of four girth gages (except on the aft joint where there were none) and one LVDT per joint. Deflection gages were placed across each field joint to measure axial growth (see Section 4.8). Test results at these locations are compared to analytical results. To predict QM-8 field joint response, a three-dimensional finite element model was used for pretest predictions. The basic model represented a one degree cyclic-symmetric slice of the case and used friction interface elements to simulate the contact surfaces. A detailed

description of the model can be found in TVR-17118, Supplement B, Revision A (see Reference 13).

4.2.1 Field Joint Girth Gages

Tables 8 and 9 list the girth gage response (i.e., strain and radial growth) of the forward and center field joints, and compare it with the predictions. The results show a strong correlation between analysis and test data. Field joint predictions come within 8.5 percent of measured values.

Close study of the field joint growth behavior shows the joint is moving outward with the areas furthest from the pin centerline moving the most. This can be seen from the higher radial growth values at the forward and aft ends of each joint, and the lower values closer to the pin centerline.

TABLE 8

QM-8 FORWARD FIELD JOINT GIRTH GAGE RESPONSE (Zero to 120 seconds)

TEST NAME:

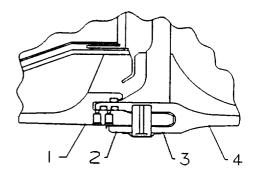
QM-8

JOINT:

FWD FIELD

DESCRIPTION: JOINT GIRTH GAGES

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



GIRTH GAGE LOCATION	GAGE NUMBER	STATION	RADIUS (IN)	RADIAL GROWTH (IN)	TEST STRAIN (UIN/IN)	ADJUSTED ANALYSIS STRAIN (UIN/IN)	ADJUSTED ANALYSIS RADIAL GROWTH (IN)	1	DIFF IN RADIAL GROWTH DIFF)
1	R303	848.5	73.1	NTO	ND	NID	ND		NID
2	s677	850.2	73.5	NTD	NID	NID	NID		NID
3	s965	852.6	73.5	0.157	2140	1959	0.144		-8.5
4	s621	855.0	73.1	0.175	2400	2441	0.178		1.7

TABLE 9
QM-8 CENTER FIELD JOINT GIRTH GAGE RESPONSE (zero to 120 Seconds)

TEST NAME:

8-MQ

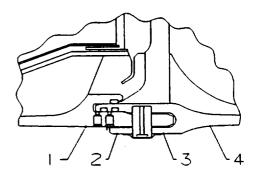
JOINT:

CTR FIELD

DESCRIPTION:

JOINT GIRTH GAGES

THE TIME RANGE IS 0.0 TO 120.0 SECONDS

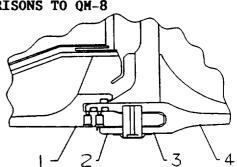


GIRTH GAGE LOCATION	GAGE NUMBER	STATION	RADIUS (IN)	RADIAL GROWIH (IN)	TEST STRAIN (UIN/IN)	ADJUSTED ANALYSIS STRAIN (UIN/IN)	ADJUSTED ANALYSIS RADIAL GROWTH (IN)	DIFF IN RADIAL GROWTH (% DIFF)
1	R304	1168.5	73.1	0.155	2118	1973	0.144	-6.9
2	S682	1170.2	73.5	0.136	1853	1880	0.138	1.4
3	s966	1172.6	73.5	0.151	2056	1915	0.141	-6.8
4	s635	1175.0	73.1	0.169	2316	2385	0.174	3.0

4.2.2 QM-8 Field Joint Radial Growth Comparisons

Tables 10 and 11, and Figures 10 and 11 compare QM-8 field joint radial growth to that on previous flights 360L001 and 360L002; and, full-scale static tests PV-1, QM-7, QM-6, DM-9, DM-8, and analysis. All values are pressure ratioed to the estimated QM-8 joint pressures. Radial growth values compare closely, considering the differences between each configuration. Actual radial growth at Location 3 on all three joints is much higher than the predictions, which is caused by the case thickness being smaller than the thickness used in the model. Figures 10 and 11 graphically illustrate data presented in Tables 10 and 11.

TABLE 10
FORWARD FIELD JOINT RADIAL GROWTH COMPARISONS TO QM-8



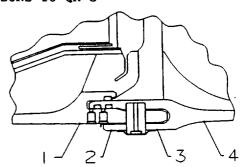
Fwd Field Girths

AVERAGE JOINT PRESSURE AT MAX STRAIN = 827

	STRAIN			_	TS-27	STS-26				RADIAL GROWIH (Inches)				
LCC.	GAGE	QM-8	QM-8	RIGHT	LEFT	RIGHT	LEFT	PV-1	QM-7	⊘ 1-6	DM-9	DM-8	PRED	
1	R303	ND	ND	ND	ND	ND	ND	ND	0.182	0.151	0.153	0.158	0.154	
2	s677	ND	ND	ND	0.146	ND	0.145	ND	0.140	0.132	0.146	0.142	0.141	
3*	S965	2150	0.157	ND	0.162	ND	0.164	ND	0.157	0.154	ND	0.155	0.144	
4	S621	2400	0.175	0.175	0.174	ND	0.180	ND	0.174	0.173	0.166	0.177	0.178	

* DM-8 is 1/3 Inch more Fwd than the other motors Note: All Test Radial Growths Are Ratios of QM-8 Test Pressure

TABLE 11
CENTER FIELD JOINT RADIAL GROWTH COMPARISONS TO QM-8

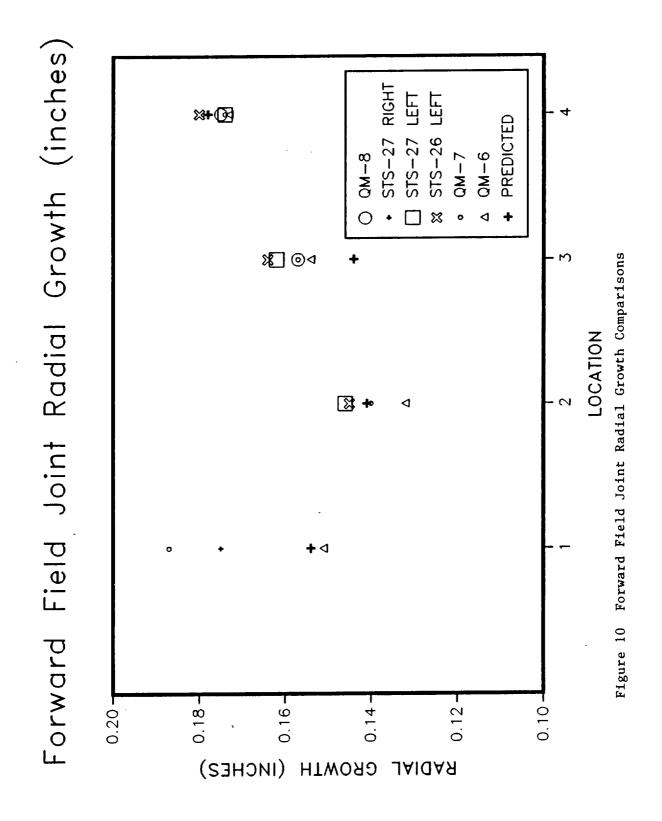


Ctr Field Girths

AVERAGE JOINT PRESSURE AT MAX STRAIN = 7

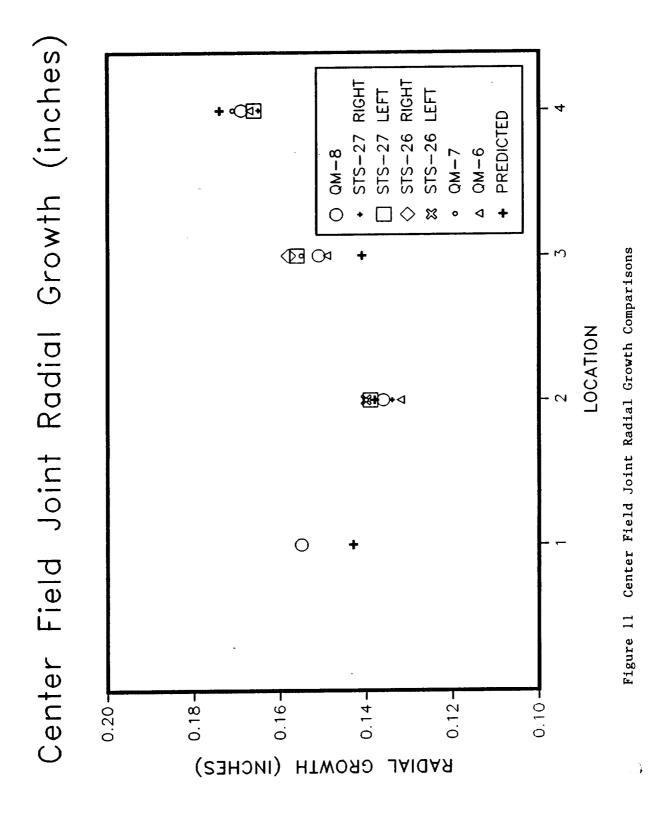
STRAIN			S	TS-27	STS-26				RADIAL CROWTH (Inches)				
LCC.	CACE	QM-8	QM-8	RICHT	LEFT	RIGHT	LEFT	PV-1	QM-7	QM-6	DM-9	DM-8	PRED
1	R304	2118	0.155	ND	ND	ND	ND	ND	ND	ND	0.146	0.151	0.143
2	S682	1853	0.136	0.134	0.139	ND	0.140	ND	0.140	0.132	0.150	0.141	0.138
3*	S966	2056	0.151	ND	0.156	0.158	ND	0.154	0.155	0.149	0.135	0.155	0.141
4	s635	2316	0.169	0.165	0.166	ND	ND	0.173	0.171	0.167	0.165	0.176	0.174

* DM-8 is 1/3 Inch more Fwd than the other motors Note: All Test Radial Growths Are Ratios of QM-8 Test Pressure



DOC NO. TWR-17591 VOL IV

REVISION ___



DOC NO. TWY-17591 VOL IV

REVISION

4.2.3 LVDT Gages

The 0-ring gap opening for QM-8 was measured directly for the forward, center and aft field joints via the 45 degree leak check ports. The LVDTs were lockwired, torque painted, and fitted tight into their respective ports. These measurements were also taken on the JES and TPTA tests. Figure 12 shows the actual test data for the forward field joint LVDT. The center, and aft field joint LVDT gages produced no data. Note that a negative value on the plot corresponds to gap opening and positive value to gap closing. Table 12 lists the maximum measured 0-ring gap openings; the flaw, if any, to the joint; and the test pressure for QM-8, QM-7, QM-6, TPTA-1.1, JES-3A, and JES-3B. For QM-8, the maximum field joint gage pressure was estimated to be 833 psig, which occurred at the forward field joint between 9 to 11 seconds.

For the JES and TPTA tests, 0-ring gap measurements were taken at more than one Location around the circumference, whereas QM-8 produced only one data point at 45 degrees on the forward field joint. Thus, it is probable the reading for QM-8 was not a maximum. On JES and TPTA, up to 12 LVDT readings were taken on a particular joint. The values used in Table 12 for the JES and TPTA tests are the measured maximums from these readings. The largest field joint 0-ring gap measured (flawed or unflawed) was 0.007 inch (QM-6). The 0.004 inch gap opening on the QM-8 forward field joint at the 45 degree Location was the same as predicted by analysis.

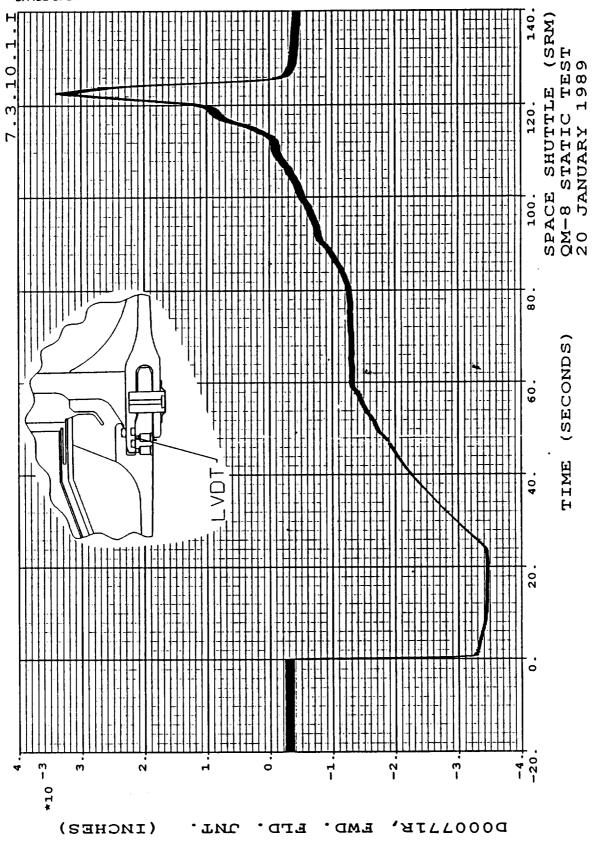
TWR-17591, Vol IV

TABLE 12
O-RING SEALING GAP OPENINGS, QM-7, QM-6, JES, NJES, TPTA

			Max.		Max.	
	Test	Joint	O-ring Gap (in.)	Test Defect	Pressure (psig)	ETA Ring
Field Joints	QM-8	Fvd	0.004	None	833	360
Joints	QM-7	Fwd	0.004	None	877	360
	QM-6	Fwd	0.007	None	854	360
	QM-6	Aft	0.002	None	816	360
	JES-3A	A	0.006	None	939	270
	JES-3A	В	0.005	J Seal Wave	939	
	JES-3B	A	0.004	Channel to Feature O-ring	907	None
	JES-3B	В	0.005	Pressure to Primary 0-ring	907 3	
	TPTA 1.1	A	0.001	None	901	360
	TPTA 1.1	В	0.006	None	901	
Nozzle to Case	NJES-2A	Primary 0-ring	0.007	Flaw to Wiper (saw no pres.)	1025	
Case	NJES-2A	Secondary 0-ring	No Data	n	1025	
	NJES-2B	Primary O-ring	0.005	Flaw to Wiper (saw pressure)	847	
	NJES-2B	Secondary 0-ring	0.002*	W	847	
	TPTA 1.1	Primary O-ring	0.006	W	901	
	TPTA 1.1	Secondary	0.004	*	901	

^{*} Maximum Gap Aft of Secondary

Thickol CORPORATION SPACE OPERATIONS



Forward Field Joint LVDT Measurement (Gap Opening)

Figure 12

REVISION ____ DOC NO. TWR-17591 VOL IV SEC PAGE 41

Therefore the value measured on QM-8 falls within the TPTA and JES data base which demonstrates that the O-rings would of remained sealed if motor pressure reached the primary O-ring. Also resiliency testing, which is an on-going study at this time, has shown that fluorocarbon will track 0.018 inch gap opening (see TWR-17991, Reference 14), given the following conditions:

- o Assembled with 16.5 percent squeeze for 180 days. 0-ring at 75 °F at the time of test.
- o Assembled with 18 percent squeeze for 365 days. 0-ring at 75 °F at the time of test.
- o 0-rings stored at ambient temperatures.

The lowest calculated percent squeeze for the QM-8 field joints was 21.0 percent (TWR-18811, Reference 11). Also the joint heater temperatures (see Table 32) were in the appropriate range to assure a minimum 0-ring temperature of 75 °F. None of the field joints or the nozzle-to-case joint were assembled beyond 365 days before the static test was conducted.

There was no evidence of gas reaching the forward and aft field joint O-rings because of the effectiveness of the J-Seal insulation. Therefore, the performance of these field joint O-rings cannot be fully evaluated.

4.3 Factory Joints

4.3.1 Forward Segment Factory Joint Girth Gage Response

QM-8 instrumentation on the forward segment factory joint consisted of four girth gages. Table 13 lists the girth gage response for the zero through

120 second range, and compares measured strain and corresponding radial growth with predicted values. Predictions were within 10.6 percent of measured test data. As expected, the pattern of joint rotation is the same as seen on the field joints. However, note the values of radial growth are generally higher than the field joints. This happens because this factory joint is nearer to the head end pressure, and the capture feature, which limits joint rotation, is not included in the factory joint design. Radial growth at Location 3 is higher than predicted, which was also the case in the field joints.

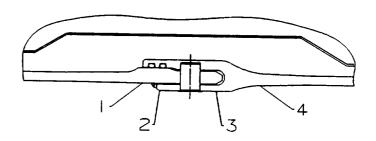
TABLE 13
QM-8 FORWARD SEGMENT FACTORY JOINT GIRTH
GAGE RESPONSE (Zero to 120 seconds)

TEST NAME: JOINT: QM-8

OINT: FWD SEGMENT FACTORY JOINT

DESCRIPTION: GIRTH GAGES

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



GIRTH GAGE LOCATION	GAGE NUMBER	STATION	RADIUS	RADIAL GROWTH (IN)	TEST STRAIN (UIN/IN)	ADJUSTED ANALYSIS STRAIN (UIN/IN)	ADJUSTED ANALYSIS RADIAL GROWTH (IN)	DIFF IN RADIAL GROWTH (% DIFF)
1	S1100	688.5	73.1	0.181	2472	2360	0.173	-4.5
2	S1101	690.2	73.5	0.168	2292	2179	0.160	-4.9
3	S1102	692.6	73.5	0.174	2369	2117	0.156	-10.6
4	S1103	695.0	73.1	0.181	2480	2354	0.172	-5.1

4.4 Case Membrane Girth Gage Response

QM-8 instrumentation on the case membrane consisted of eight girth gages. Table 14 lists the girth gage response and compares the measured strain and calculated radial growth with predicted values. Every prediction is within 5.7 percent of measured test data. The forward segment is made of standard weight cylinders, whereas the center and aft segments are made of thinner, lightweight cylinders, which affect radial growth. (The attach cylinder is standard weight, but there were no girth gages on this cylinder).

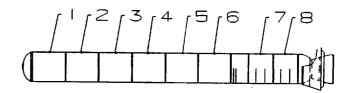
TABLE 14
QM-8 CASE RADIAL DEFLECTION, CASE GIRTH GAGE RESPONSE (Zero to 120 seconds)

TEST NAME: QM-8

JOINT: CASE RADIAL DEFLECTION

DESCRIPTION: CASE GIRTH GAGES

THE TIME RANGE IS 0.0 TO 120.0 SECONDS

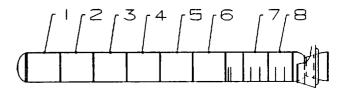


GIRTH CAGE LOCATION	GAGE NUMBER	STATION	RADIUS (IN)	RADIAL GROWTH (IN)	TEST STRAIN (UIN/IN)	ADJUSTED ANALYSIS STRAIN (UIN/IN)	ADJUSTED ANALYSIS RADIAL GROWIH (IN)	DIFF IN RADIAL GROWTH (% DIFF)
1	S584	611.5	73.0	0.270	3701	3699	0.270	-0.1
2	s585	771.5	73.0	0.258	3539	3637	0.266	2.8
3	s586	931.5	73.0	0.271	3712	3574	0.261	-3.7
4	S587	1091.5	73.0	0.268	3676	3533	0.258	-3.9
5	s588	1251.5	73.0	0.265	3628	3494	0.255	-3.7
6	5589	1411.5	73.0	0.268	3665	3456	0.252	-5.7
7	s591	1637.5	73.0	0.249	3407	3434	0.251	0.8
8	\$ 592	1757.5	73.0	0.251	3432	3445	0.252	0.4

4.4.1 QM-8 Case Membrane Radial Growth Comparison

Analysis and data from 360L001, 360L002, QM-7, QM-6, and DM-8 (see Table 15 and Figure 13) show that radial growth for the forward segment reduces from the value at Station 1 to the value at Station 2, illustrating the pressure drop down the bore of the motor. Also, a comparison with these motors show that the radial growth increases from Station 2 to Station 3. Factually, even though there is a pressure drop from Station 2 to 3, the transition from a standard weight segment to a lightweight segment overpowers the pressure drop, and a net increase in radial growth occurs. From Station 4 to 8 there is a drop of radial growth, which is illustrated in Figure 13.

TABLE 15
CASE MEMBRANE RADIAL GROWTH COMPARISONS TO QM-8

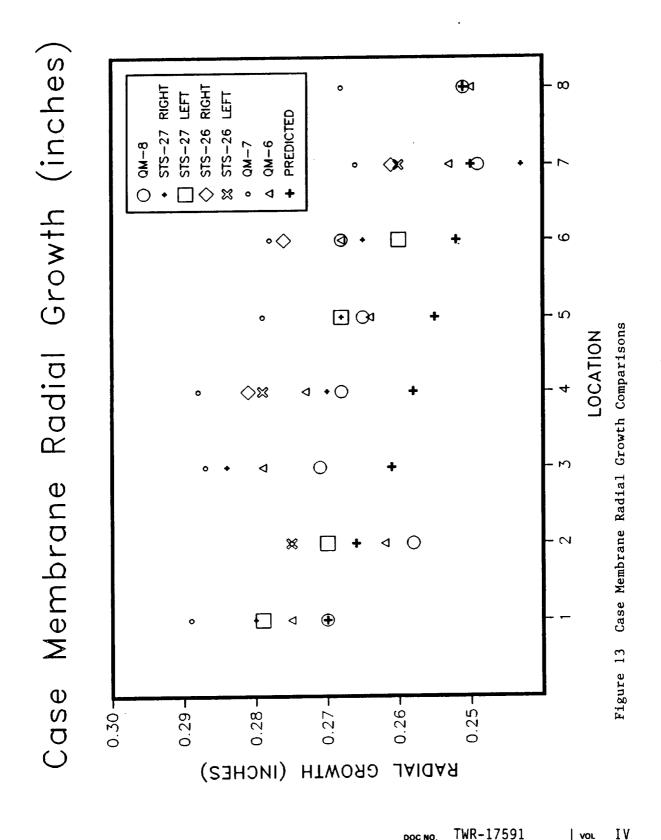


Caco	Membrane	Girths.
Lase	mentione	GLLUIS

												(= .	
LCC.	GAGE	STRAIN QM-8		RIGHT	TS-27 LEFT	SI RIGHT	S-26 LEFT	PV-1	QH-7	QM-6		(Inches) DM-8	PRED
1	S584	3701	0.270	0.280	0.279	ND	ND	ND	0.289	0.275	0.268	0.284	0.270
2	s585	3539	0.258	0.266	0.270	ND	0.275	ND	0.275	0.262	0.271	0.282	0.266
3	S586	3712	0.271	0.284	ND	ND	ND	ND	0.287	0.279	0.283	0.291	0.261
4	S587	3676	0.268	0.270	ND	0.281	0.279	ND	0.288	0.273	0.279	0.292	0.258
5	S588	3628	0.265	0.268	0.268	ND	ND	ND	0.279	0.264	ND	0.285	0.255
6	S589	3665	0.268	0.265	0.260	0.276	ND	ND	0.278	0.268	ND	ND	0.252
7	S591	3407	0.249	0.243	ND	0.261	0.260	ND	0.266	0.253	0.253	0.260	0.250
8	s592	3432	0.251	ND	ND	ERR	ND	ND	0.268	0.250	ND	ND	0.251

NOTE: Only the predictions are pressure ratioed to CM-8 Nozzle to Case Joint Radial Growth Comparisons to CM-8

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PAGE

4.5 Case Biaxial Stresses

4.5.1 Aft-to-Center Segment Case Line Load

QM-8 biaxial gage instrumentation consisted of two sets of gages on the center aft segment (one on Station 1196.48 and one on Station 1466.00). Tables 16 and 17 show the moment biaxial strains with the corresponding predictions for the 120 second burn time. Tables 18 and 19 show the maximum hoop with the corresponding axial stress, and maximum axial stress with the corresponding hoop stress for this same time frame.

Hoop predictions compared more closely with the measured values than the gages in the axial direction, especially at zero and 188 degrees. The majority of this discrepancy can be attributed to the attempt to predict the pretest sag effects of the motor in the test stand, and the subsequent lessening of the sag during motor pressurization. This sagging effect, known as column bending, would theoretically change motor stresses at the zero and 188 degree locations as described:

When the SRM chocks are removed, a sag in the motor results. This causes an induced tensile axial strain at zero degrees (bottom of the motor), and an induced compressive axial strain at 188 degrees (top of the motor). Then, just before the static-test, the biaxial gages in these areas are set to zero. Therefore, when the motor is fired, and the sag is lessened, an incorrect reading in both the zero and 188 degree area results.

The maximum measured stress occurred in the hoop direction at Location 2, 270 degrees. The measured value was 145.1 ksi. Using biaxial improvement, the ultimate case strength increases from 200 ksi to 214.2 ksi (i.e., 200 x 1.071 = 214.2), giving a safety factor of 1.48. No local yielding was measured.

There was relatively little difference in maximum hoop stress and the time it occurred between Locations 1 and 2. Maximum axial stress was affected by the induced strut loads (those occurring during the initial second of burn time), whereas maximum hoop stress was not.

A comparison of the QM-8 strain versus time plots with those of QM-6 (which did not have strut loads applied) shows the QM-8 strain was greatly affected by the induced strut loads. The QM-8 axial and hoop gage plots followed the same trend as in QM-6. Between about 51 and 60 seconds, the axial strain shows a definite down spike at zero and 90 degrees, and an up spike, of the same magnitude, at 188 and 270 degrees. Because gages were zeroed prior to ignition, the propellant induced strains were ignored, thus, the gages do not return to zero following burn time. Upon the completion of the test, negative (compression) strain results at 200 degrees, with positive (tension) strain at 180 degrees.

TABLE 16
QM-8 AFT-TO-CENTER SEGMENT (STATION 1196.48) CASE LINE LOAD
MOMENT BIAXIALS (Zero to 120 seconds)

TEST NAME:

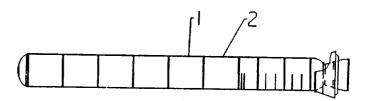
8-MQ

JOINT: AFT, DESCRIPTION: CASI

AFT/CTR SEGMENT (STATION 1196.48)

CASE LINE LOAD/ MOMENT BLAXIALS

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



LOCAT	ANGULAR LOCATION	AXIAL GAGE	HOOP GAGE	TEST I AXIAL STRAIN (UIN/IN)	ATA HOOP STRAIN (UIN/IN)	ADJUSTED AXIAL STRAIN (UIN/IN)	ANALYSIS HOOP STRAIN (UIN/IN)	%DIFF AXIAL	%DIFF HOOP
1	0.0	R680	R679	-845	3610	288	3103	-134.0	-14.0
	90.0	R740	R739	688	3506	740	3463	7.6	-1.2
	188.0	R720	R719	1148	3666	-142	3777	-112.4	3.0
	270.0	R686	R685	726	3550	747	3459	2.8	-2.6
			AVERAGE:	429	3583				

TABLE 17
QM-8 AFT-TO-CENTER SEGMENT (STATION 1466.00) CASE LINE LOAD
MOMENT BIAXIALS (Zero to 120 seconds)

TEST NAME:

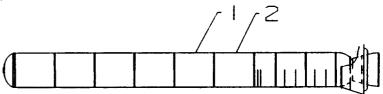
QM-8

JOINT: A

AFT/CTR SEGMENT (STATION 1466.00)

DESCRIPTION: CASE LINE LOAD/ MOMENT BIAXIALS

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



LOCAT	ANGULAR LOCATION	AXIAL GAGE	HOOP GAGE	TEST AXIAL STRAIN (UIN/IN)	DATA HOOP STRAIN (UIN/IN)	ADJUSTE AXIAL STRAIN (UIN/IN)	D ANALYSIS HOOP STRAIN (UIN/IN)	*DIFF AXIAL	*DIFF HOOP
2	0.0	R780	R779	-896	4193	298	3075	-133.3	-26.7
	90.0	R782	R781	682	4126	715	3404	4.8	-17.5
	188.0	R788	R7 87	983	3497	-145	3688	-114.8	5.5
	270.0	R786	R785	781	4197	712	3404	-8.9	-18.9
			AVERAGE:	387	4003				

TABLE 18

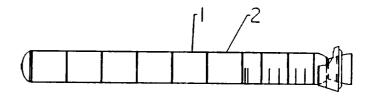
QM-8 AFT-TO-CENTER SEGMENT (STATION 1196.48) CASE LINE LOAD MOMENT BIAXIALS, MAXIMUM HOOP STRESS (Zero to 120 seconds)

TEST NAME:

8-MQ

JOINT: AFT/CTR SEGMENT (STATION 1196.48)
DESCRIPTION: CASE LINE LOAD/ MOMENT BLAXIALS

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



LOCAT	ANGULAR LOCATION	HOOP GAGE	AXIAL GAGE	MAX HOOP STRESS (KSI)	AXIAL STRESS (KSI)	TEST HOOP STRAIN (UIN/IN)	DATA AXIAL STRAIN (UIN/IN)	MAX AXIAL STRESS (KSI)	HOOP STRESS (KSI)	TEST AXIAL STRAIN (UIN/IN)	DATA HOOP STRAIN (UIN/IN)
1	0.0	R679	R680	122.7	49.4	3610	342	55.1	112.9	640	3220
	90.0	R739	R740	121.1	54.1	3506	520	55.6	110.0	688	3116
	188.0	R719	R720	127.8	60.8	3661	671	60.9	98.5	991	2671
	270.0	R685	R686	122.9	55.5	3550	548	57.8	113.4	726	3207
			AVERAGE:	123.6	54.9	3582	520	57.3	108.7	761	3053

TABLE 19

QM-8 AFT-TO-CENTER SEGMENT (STATION 1466.00) CASE LINE LOAD MOMENT BIAXIALS, MAXIMUM HOOP STRESS (Zero to 120 seconds)

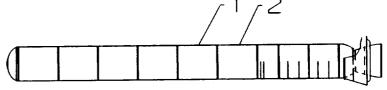
TEST NAME:

8-MQ

JOINT: AFT/CTR SEGMENT (STATION 1466.00)

DESCRIPTION: CASE LINE LOAD/ MOMENT BIAXIALS

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



LOCAT	ANGULAR LOCATION	HOOP GAGE	AXIAL GAGE	MAX HOOP STRESS (KSI)	AXIAL STRESS (KSI)	TEST HOOP STRAIN (UIN/IN)	DATA AXIAL STRAIN (UIN/IN)	MAX AXIAL STRESS (KSI)	HOOP STRESS (KSI)	TEST AXIAL STRAIN (UIN/IN)	DATA HOOP STRAIN (UIN/IN)
2	0.0	R779	R780	143.1	59.3	4193	456	61.1	139.9	554	4064
	90.0	R781	R782	142.2	62.7	4126	580	63.8	140.8	634	4067
	188.0	R787	R788	122.1	58.0	3497	641	58.2	122.0	647	3491
	270.0	R785	R786	145.1	65.2	4197	634	65.3	145.0	640	4192
			AVERAGE:	138.1	61.3	4003	578	62.1	136.9	618	3954

4.5.2 Aft Field-to-ET Attach Joint

QM-8 biaxial gage instrumentation on the aft field-to-ET attach joint consisted of 54 gages on the aft field joint and ET attach areas. Tables 20 through 22 list the maximum hoop and axial strains measured from biaxial gages for the zero to 120 second burn time. Tables 23 through 25 list the maximum hoop and axial stresses for this same time frame. The biaxial strain gages at Locations 1, 2, and 3 are at Stations 1498, 1501, and 1511, respectively.

The maximum measured stress occurred at Station 1498.0, Location 1 in the hoop direction at 188 degrees, measuring a local stress of 109.8 ksi. This maximum measured stress results in a 1.95 safety factor. The yield strength of D6AC is 180 ksi, therefore, no local yielding was measured in this area. A few select axial gages (R650, R714, R668, R674, R676, R716, R678, S1182, and S1188) indicate that maximum axial stress is highly affected by the induced strut loads.

Because of the complex nature of this area, no comparison to predictions is given in this report. A detailed comparison is given in TWR-19506 (see Reference 3).

TABLE 20 QM-8 AFT FIELD-TO-ET ATTACH (STATION 1498.00) JOINT BIAXIAL GAGES (Zero to 120 seconds)

TEST NAME:

QM-8

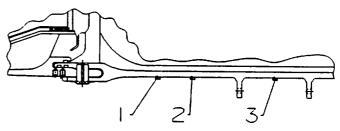
JOINT:

AFT FIELD / ET ATTACH (STATION 1498.00)

DESCRIPTION:

JOINT BIAXIAL GAGES

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



LOCAT	ANGULAR LOCATION	AXIAL GAGE	HOOP GAGE	TEST AXIAL STRAIN (UIN/IN)	DATA HOOP STRAIN (UIN/IN)
1	0.0	R644	R643	1634	2413
	90.0	R744	R743	1836	2432
	188.0	R726	R725	2420	2556
	220.0	R650	R649	2232	2460
	255.0	R656	R655	2068	2424
	270.0	R654	R653	1854	2460
	285.0	R658	R657	2021	2400
	300.0	R714	R713	1979	2389
	320.0	R660	R659	1896	2342
			AVERAGE:	1993	2431

TABLE 21 QM-8 AFT FIELD-TO-ET ATTACH (STATION 1501.00) JOINT BIAXIAL GAGES (Zero to 120 seconds)

TEST NAME:

8-MQ

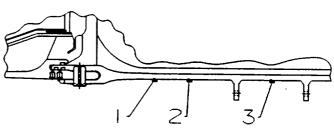
JOINT:

AFT FIELD / ET ATTACH (STATION 1501.00)

DESCRIPTION:

JOINT BIAXIAL GAGES

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



LOCAT	ANGULAR LOCATION	AXIAL GAGE	HOOP GAGE	TEST AXIAL STRAIN (UIN/IN)	DATA HOOP STRAIN (UIN/IN)
2	0.0	R662	R661	597	2108
	90.0	R746	R745	539	2281
	188.0	R728	R727	744	2262
	220.0	R668	R667	863	2193
	255.0	R674	R673	714	2170
	270.0	R672	R671	671	2248
	285.0	R676	R675	754	2138
	300.0	R716	R715	735	2192
	320.0	R678	R677	790	2101

AVERAGE:

712

2188

TWR-17591, Vol IV

TABLE 22 QM-8 AFT FIELD-TO-ET ATTACH (STATION 1511.00) JOINT BIAXIAL GAGES (Zero to 120 seconds)

TEST NAME:

8-MQ

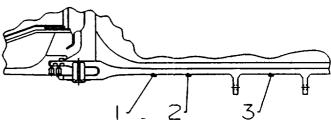
JOINT:

AFT FIELD / ET ATTACH (STATION 1511.00)

DESCRIPTION:

JOINT BIAXIAL GAGES

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



				TEST	DATA
LOCAT	ANGULAR LOCATION	AXIAL GAGE	HOOP GAGE	AXIAL STRAIN (UIN/IN)	HOOP STRAIN (UIN/IN)
3	0.0	S1176	S1175	997	2060
	90.0	S1178	S1177	940	2276
	188.0	S1180	S1179	1237	2062
	220.0	S1182	S1181	1327	2049
	255.0	S1188	S1187	1112	2095
	270.0	S1186	S1185	1019	2076
	285.0	S1190	S1189	1098	1981
	300.0	S1184	S1183	1127	2106
	320.0	51192	S11 91	1084	2083
			AVERAGE:	896	2087

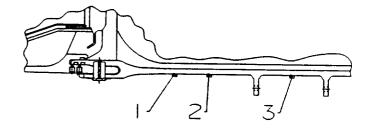
TABLE 23 QM-8 AFT FIELD-TO-ET ATTACH (STATION 1498.00) JOINT BIAXIAL GAGES MAXIMUM HOOP STRESS (Zero to 120 seconds)

TEST NAME: QM-8

JOINT: AFT

AFT FIELD / ET ATTACH (STATION 1498.00)

DESCRIPTION: JOINT BLAXIAL GAGES
THE TIME RANGE IS 0.0 TO 120.0 SECONDS



					MAX		TEST	DATA	MAX		TEST	DATA
LOCAT	ANGULAR LOCATION	HOOP GAGE	AXIAL GAGE	HOOP STRESS (KSI)	AXIAL STRESS (KSI)	HOOP STRAIN (UIN/IN)	AXIAL STRAIN (UIN/IN)	AXIAL STRESS (KSI)	HOOP STRESS (KSI)	AXIAL STRAIN (UIN/IN)	HOOP STRAIN (UIN/IN)	
1	0.0	R643	R644	96.3	77.5	2413	1579	78.8	95.2	1634	2364	
_	90.0	R743	R744	99.1	85.7	2421	1825	86.0	98.9	1836	2410	
	188.0	R725	R726	109.8	106.8	2556	2420	106.8	109.8	2420	2556	
	220.0	R649	R650	101.3	88.9	2460	1909	93.3	85.0	2232	1864	
	270.0	R653	R654	100.6	86.7	2460	1843	87.0	100.5	1854	2454	
	255.0	R655	R656	101.7	93.8	2424	2068	93.8	101.7	2068	2424	
	285.0	R657	R658	100.1	90.3	2400	1971	90.5	99.8	1977	2395	
	300.0	R713	R714	98.9	88.1	2389	1908	88.6	97.8	1935	2345	
	320.0	R659	R660	96.1	83.6	2342	1785	84.8	89.7	1896	2114	
			AVERAGE:	100.4	89.1	2429	1923	89.9	97.6	1983	2325	

TWR-17591, Vol IV

TABLE 24 QM-8 AFT FIELD-TO-ET ATTACH (STATION 1501.00) JOINT BIAXIAL GAGES MAXIMUM HOOP STRESS (Zero to 120 seconds)

TEST NAME:

8-MQ

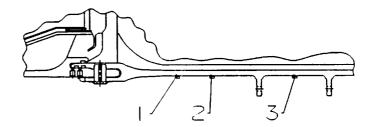
JOINT:

AFT FIELD / ET ATTACH (STATION 1501.00)

DESCRIPTION:

JOINT BLAXIAL GAGES

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



LOCAT	ANGULAR LOCATION	HOOP GAGE	AXIAL GAGE	MAX HOOP STRESS (KSI)	AXIAL STRESS (KSI)	TEST HOOP STRAIN (UIN/IN)	DATA AXIAL STRAIN (UIN/IN)	MAX AXIAL STRESS (KSI)	HOOP STRESS (KSI)	TEST AXIAL STRAIN (UIN/IN)	DATA HOOP STRAIN (UIN/IN)
2	0.0	R661	R662	75.1	39.8	2108	532	40.6	73.6	576	2049
	90.0	R745	R746	80.6	40.8	2281	506	41.5	79.9	539	2249
	188.0	R727	R728	81.8	46.4	2262	684	46.5	81.5	689	2252
	220.0	R667	R668	77.7	39.8	2193	507	45.6	62.7	863	1624
	270.0	R671	R672	80.8	44.4	2248	627	44.4	80.8	627	2248
	255.0	R673	R674	78.9	45.6	2170	689	45.6	78.9	689	2170
	285.0	R675	R676	77.7	45.1	2138	683	45.2	76.4	699	2095
	300.0	R715	R716	79.1	44.5	2192	648	45.0	72.8	735	1972
	320.0	R677	R678	76.1	43.4	2101	643	46.8	73.0	790	1961
			AVERAGE:	78.6	43.3	2188	613	44.6	75.5	690	2069

TABLE 25 QM-8 AFT FIELD-TO-ET ATTACH (STATION 1511.00) JOINT BIAXIAL GAGES MAXIMUM HOOP STRESS (Zero to 120 seconds)

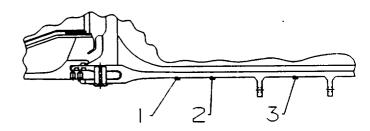
TEST NAME:

0M-8

JOINT: DESCRIPTION:

AFT FIELD / ET ATTACH (STATION 1511.00) JOINT BIAXIAL GAGES

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



						MAX		TEST	DATA	MAX		TEST	DATA
LOCAT	ANGULAR LOCATION	HOOP GAGE	AXIAL GAGE	HOOP STRESS (KSI)	AXIAL STRESS (KSI)	HOOP STRAIN (UIN/IN)	AXIAL STRAIN (UIN/IN)	AXIAL STRESS (KSI)	HOOP STRESS (KSI)	AXIAL STRAIN (UIN/IN)	HOOP STRAIN (UIN/IN)		
3	0.0	S1175	S1176	77.9	53.0	2060	948	53.8	76.9	986	2017		
•	90.0	S1177	S1178	65.6	-5.6	2276	-897	-9.0	57.3	-924	2034		
	188.0	S1179	S1180	81.0	62.4	2062	1232	62.4	81.0	1232	2062		
	220.0	S1181	S1182	78.7	56.5	2049	105 9	58.2	59.1	1327	1368		
	300.0	S1183	_	80.7	57.2	2106	1062	57.6	79.7	1083	2069		
	270.0	S1185		78.8	54.3	2076	981	54.3	78.8	981	2076		
	255.0	S1187		80.6	58.0	2095	1090	58.0	80.6	1090	2095		
	285.0	S1189		76.4	55.5	1981	1049	55.5	75.0	1066	1932		
	320.0	51191		79.2	54.9	2083	997	55.8	74.1	1084	1900		
			AVERAGE:	77.7	49.6	2087	836	49.6	73.6	881	1950		

TVR-17591, Vol IV

4.6 Nozzle-to-Case Joint Performance

4.6.1 Nozzle-to-Case Joint

QM-8 instrumentation on the nozzle-to-case joint consisted of seven girth gages, three biaxial gage locations, and eight strainserted axial and radial bolts. Test results at these locations are compared to analytical results acquired from a three dimensional finite element analysis (see Reference 15).

The analysis was performed with the finite element code ANSYS using a 1.8 degree model of the nozzle-to-case joint. Near the joint region, the model was three-dimensional, transitioning into two-dimensional away from the joint.

The following assumptions and parameters were included in the model:

- O Nominal values for material properties and hardware dimensions
- o Preload of 140 kips in the axial bolts and 47 kips in the radial bolts
- o Internal pressure of 909 psig applied to the backside of the primary 0-ring groove
- o Frictionless joint behavior
- o Zero vectoring nozzle condition
- o Propellant was not modeled

Because the model is cyclic-symmetric, any circumferential variation indicated by test data will not be taken into account. The analysis was performed at 909 psig, which was linearly scaled to the estimated 792 psig nozzle stagnation pressure that involves approximately five percent error caused by the nonlinear analysis. The estimated pressure corresponds to the maximum strain gage readings at the time interval of 20 seconds after ignition.

4.6.2 Nozzle-to-Case Girth Gages

Radial deflection is an important parameter to characterize, since it is proportional to joint hoop stress and bolt hole stress concentration. Table 26 shows the girth gage response from 18 to 22 seconds. This time frame was selected to minimize the effects of vectoring. The results compare closely to the analytical results, ranging from 10.5 to 19.6 percent. Also included in the table is the maximum radial growth for the full duration of the test (zero to 120 seconds).

As expected, calculated radial growths indicated a "prying open" action and outward rotation of the joint. The maximum measured hoop strain (1778 in./in.) and radial growth (0.097 in.) occurred at Location 3.

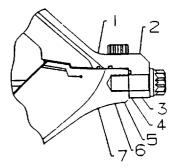
Comparing QM-8 strain versus time plots to QM-6, it can be concluded that the strut loads had little effect on strain at this location (also see Table 27).

TABLE 26

QM-8 AFT DOME, FIXED HOUSING NOZZLE-TO-CASE JOINT GIRTH GAGES (18 to 22 seconds)

TEST NAME: QM-8

JOINT: AFT DOME, FIXED HOUSING DESCRIPTION: NOZZLE CASE GIRTH GAGES THE TIME RANGE IS 18.0 TO 22.0 SECONDS



GIRTH GAGE LOCATION	CAGE NUMBER	STATION	RADIUS (IN)	RADIAL GROWTH (IN)	TEST STRAIN (UIN/IN)	ADJUSTED ANALYSIS STRAIN (UIN/IN)	ADJUSTED ANALYSIS RADIAL GROWTH (IN)	DIFF IN RADIAL GROWTH	MAXIMUM RADIAL GROWTH 0-120 SECONDS
1	S880	1873.0	50.4	0.081	1598	1431	0.072	-10.5	0.087
2	S878	1876.3	50.5	ND	NID	ND	NID	ND	ND
3	S877	1876.3	54.4	0.097	1778	2126	0.116	19.6	0.126
4	S884	1875.7	54.4	0.092	1689	1999	0.109	18.4	0.120
5	S887	1874.9	54.8	0.083	1520	1784	0.098	18.1	0.110
6	s875	1874.2	54.8	0.076	1394	1622	0.089	16.4	0.100
7	s874	1872.5	55.2	0.066	1193	1345	0.074	12.7	0.105

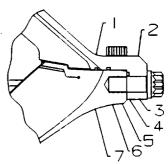
4.6.3 Nozzle-to-Case Joint Comparison

Table 27 and Figure 14 compare the radial growth of the QM-8 nozzle-to-case joint with the same joint configuration (radial bolt design) used in 360L001, 360L002, PV-1, QM-7, QM-6, DM-9, DM-8, and analysis. Data from QM-8 radial growth compares closely to the other motors which again confirm the minimal effect strut loads have on this joint as far as gap growth is concerned. Since the 0-ring sealing surface gap growth was not directly measured, it is assumed the growth is similar to that measured from NJES-2A, NJES-2B, and TPTA-1.1 testing, and predicted by analysis.

Table 12 above lists the maximum measured 0-ring gap openings, the flaw to the joint, and the test pressure for NJES-2A, NJES-2B, and TPTA-1.1. For QM-8, the maximum nozzle-to-case joint pressure did not exceed any maximum NJES and TPTA test pressures listed in Table 12 for the respective joints. The maximum measured gap opening for the nozzle-to-case joint was 0.007 inch (primary NJES-2A). Analysis predicts 0.006 inch for the primary 0-ring.

TABLE 27

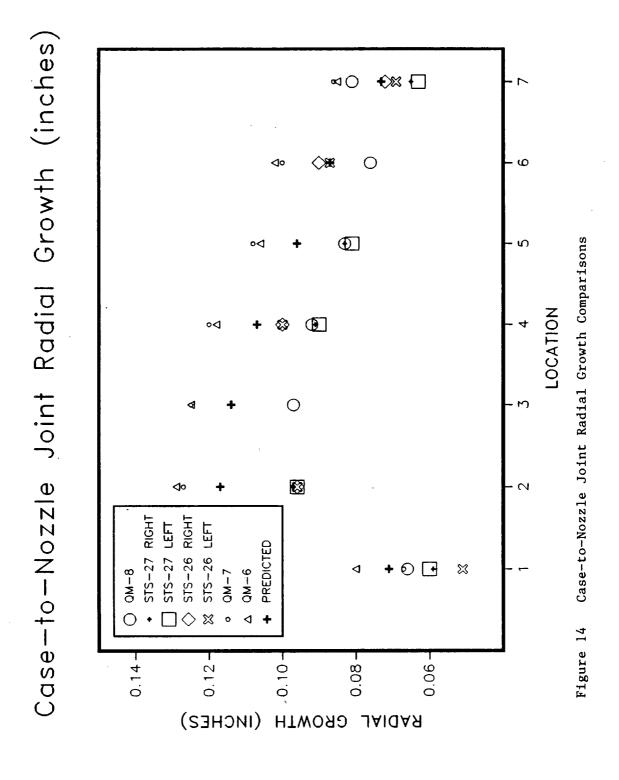
NOZZLE-TO-CASE JOINT RADIAL GROWTH COMPARISONS TO QM-8



STRAIN	STS-27	STS-26	RADIAL GROWTH (Inches)	
Nozzle to Case Girths		AVERAG	E JOINT PRESSURE AT MAX STRAIN =	793
				6

ισ.	GAGE	STRAIN QM-8		S RIGHT	TS-27 LEFT	ST RIGHT	S-26 LEFT	PV-1	QM-7	RADIAL QM-6		(Inches) DM-8	PRED
1	S880	1193	0.066	0.059	0.060	ND	0.051	0.086	0.067	0.080	0.072	ND	0.071
2	5878	ND	ND	0.097	0.096	0.096	0.096	0.127	0.127	0.129	0.115	ND	0.117
3	S877	1778	0.097	ND	ND	ND	ND	0.117	0.125	0.125	ND	0.124	0.114
4	S884	1689	0.092	0.091	0.090	0.100	0.100	0.124	0.120	0.118	0.114	ND	0.107
5	S887	1520	0.083	0.083	0.081	ND	ND	0.107	0.108	0.106	0.086	0.110	0.096
6	S875	1394	0.076	ND	ND	0.090	0.087	0.100	0.100	0.102	0.101	0.103	0.087
7	S874	1598	0.081	0.065	0.063	0.072	0.069	0.083	0.086	0.085	0.085	0.090	0.073

Note: All Test Radial Growths Are Ratios of QM-8 Test Pressure



DOC NO. TWR-17591 VOL IV

REVISION

4.6.4 Nozzle-to-Case Biaxial Strain Gages

Previous static tests have shown the nozzle-to-case joint biaxial gages do not compare as closely to analytical data as gages on other parts of the motor. The reason for the variation is:

- The girth gage at Location 1 is at the neck of the fixed housing; the 3-D model grid may not be fine enough to accurately predict circumferential strain.
- o Analytical data was linearly scaled to test data.
- Nozzle stagnation pressure was estimated to be 792 psig, but not measured.
- o Nominal materials were used for the finite element model.
- A slight variation in gage placement can greatly alter the expected results.

Two biaxial strain gages were placed on the fixed housing and one on the aft dome. Table 28 contains the test results for the burn time of zero to 120 seconds. Table 29 compares the test results between 18 and 22 seconds to analytical results to eliminate effects of nozzle vectoring. As previously mentioned, the analysis was cyclic-symmetric, which means analytical results will be identical at 90 degree increments about the circumference.

As shown in Table 29, hoop strain correlated better for the gage Locations 1 and 3 than gage Locations 2. Gage readings at Locations 1 and 3 ranged from 2.5 to 33.3 percent difference with the predictions. Gages readings at Location 2 ranged from 18.8 to 41.0 percent difference. Meridional strains at the three locations also varied, with the most favorable

correlation at Location 1 (range of 2.5 to 9.3 percent difference) and the least favorable at Location 2 (range of 18.8 to 41.0 percent difference).

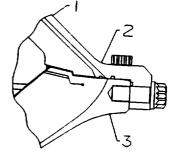
Stresses were calculated from the biaxial strains (see Table 28). The maximum calculated hoop stress was 41.2 ksi, and occurred at Location 3, 270 degrees. The maximum calculated meridional stress was -32.9 ksi, and occurred at Location 2, zero degrees. Based on the maximum calculated stress of 41.2 ksi and an ultimate material strength of 200 ksi, the safety factor is 4.85.

TABLE 28

QM-8 AFT DOME, FIXED HOUSING NOZZLE-TO-CASE JOINT
BIAXIAL GAGES (Zero to 120 seconds)

TEST NAME: QM-8

JOINT: FIXED HOUSING, AFT DOME
DESCRIPTION: NOZZLE / CASE BLAXIAL GAGES
THE TIME RANGE IS 0.0 TO 120.0 SECONDS



LOCAT	ANGULAR LOCATION	HOOP GAGE	MERID GAGE	MAX HOOP STRESS (KSI)	MERID STRESS (KSI)	TEST HOOP STRAIN (UIN/IN)	DATA MERID STRAIN (UIN/IN)	MAX MERID STRESS (KSI)	HOOP STRESS (KSI)	TEST MERID STRAIN (UIN/IN)	DATA HOOP STRAIN (UIN/IN)
	0.0	R528	R527	-11.9	13.6	-550	589	14.3	-10.8	600	520
1	0.0	R530	R529	-14.9	9.9	-611	495	14.6	-3.0	526	-259
	90.0		R531	-11.2	13.3	-521	572	14.5	-10.3	603	-505
	180.0 270.0	R532 R534	R533	-8.6	11.5	-416	481	13.9	-6.7	540	-376
			AVERAGE:	-11.7	12.1	-525	534	14.3	-7.7	567	-415
2	0.0	R520	R519	28.5	-30.3	1290	-1331	-32.9	26.9	-1404	1265
۷.		R522	R521	35.0	-17.0	1367	-952	-19.5	32.4	-1010	1306
	90.0	R524	R523	32.9	-20.0	1328	-1032	-22.4	31.5	-1098	1305
	180.0 270.0	R524	R525	29.2	-29.5	1306	-1312	-31.9	27.2	-1370	1263
			AVERAGE:	31.4	-24.2	1323	-1157	-26.7	29.5	-1220	1285
3	0.0	R602	R601	39.9	-16.5	1525	-989	-17.6	37.3	-999	1452
-	90.0	R604	R603	40.6	-15.7	1542	-968	-17.2	34.5	-955	1353
	180.0	R606	R605	40.3	-16.2	_636	-981	-18.2	35.9	-1002	1410
	270.0	R608	R607	41.2	-15.6	1560	-971	-17.2	37.1	-981	1440
			AVERAGE:	40.5	-16.0	1541	-97 7	-17.5	36.2	-984	1414

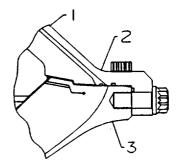
TWR-17591, Vol IV

TABLE 29
QM-8 AFT DOME, FIXED HOUSING NOZZLE-TO-CASE JOINT BIAXIAL GAGES (18 to 22 seconds)

TEST NAME:

2M-8

JOINT: FIXED HOUSING, AFT DOME
DESCRIPTION: NOZZLE / CASE BIAXIAL GAGES
THE TIME RANGE IS 18.0 TO 22.0 SECONDS



				TEST HOOP	DATA MERID	ADJUSTE			
LOCAT	ANGULAR LOCATION	HOOP GAGE	MERID GAGE	STRAIN (UIN/IN)	STRAIN (UIN/IN)	HOOP STRAIN (UIN/IN)	MERID STRAIN (UIN/IN)	*DIFF HOOP	%DIFF MERID
1	0.0	R528	R527	-513	551	-554	571	7.9	3.6
	90.0	R530	R529	-465	523	-554	571	19.1	9.3
	180.0	R532	R531	-482	558	-554	571	15.1	2.5
	270.0	R534	R533	-416	540	-555	570	33.3	5.5
			AVERAGE:	-469	543				
2	0.0	R520	R519	1276	-1404	1036	-829	-18.8	-41.0
	90.0	R522	R521	1356	-1021	1034	-828	-23.7	-18.9
	180.0	R524	R523	1309	-1098	1036	-829	-20.9	-24.5
	270.0	R526	R525	1288	-1370	1037	-829	-19.5	-39.5
			AVERAGE:	1307	-1223				
3	0.0	R602	R601	1525	-1006	1649	-848	8.1	-15.8
	90.0	R604	R603	1542	-989	1651	-848	7.1	-14.2
	180.0	R606	R605	1529	-1002	1650	-850	7.9	-15.2
	270.0	R608	R607	1540	-985	1653	-849	7.4	-13.8
			AVERAGE:	1534	-996				

4.6.5 Nozzle-to-Case Strainsert Gages

The Strainserts for QM-8 were added to eight radial and eight axial bolts. As Table 30 shows, the Strainserts at preload ranged from 40 to 54.9 kips for the radial bolts, and 122.6 to 139.2 kips for the axial bolts. The specification tolerances for QM-8 were 45.0, \pm 4.5 kips for the radial bolts and 140.0, \pm 14.0 kips for the axial bolts.

TABLE 30 QM-8 AFT DOME, FIXED HOUSING (STRAINSERT) RADIAL STATION 1874.3, AXIAL STATION 1875.2 (Zero to 120 seconds)

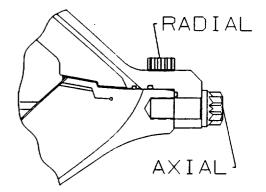
TEST NAME:

2M-8

JOINT: FIXED HODESCRIPTION: RADIAL -

FIXED HOUSING, AFT DOME (STRAINSERT)
RADIAL - STA 1874.3, AXIAL - STA 1875.2

THE TIME RANGE IS 0.0 TO 120.0 SECONDS



LOCAT	GAGE	ANGULAR LOCATION	PRELOAD STRESS (KSI)	PRELOAD LOAD (KIPS)	0-1 S MEAS. STRESS (KSI)	EC. MEAS. LOAD (KIPS)	12-22 MEAS. STRESS (KIPS)	SEC.' MEAS. LOAD (KIPS)	120-130 MEAS. STRESS (KIPS)	SEC. MEAS. LOAD (KIPS)	ANAL. PRELOAD (KIPS)	920 PSIG ANAL. LOAD (KIPS)
RADIAL	R150	358.2	78.6	40.0	75.2	38.3	75.6	38.5	77.0	39.2	46	44
RADIAL	R151	45.0	85.4	43.5	80.9	41.2	80.7	41.1	84.4	42.9	46	44
RADIAL	R152	88.2	81.2	41.3	75.3	38.4	75.9	38.6	80.3	40.9	46	44
RADIAL	R153	135.0	81.9	41.7	76.9	39.1	76.2	38.8	80.0	40.7	46	44
RADIAL	R154	178.2	80.9	41.2	72.8	37.0	75.2	38.3	82.0	41.7	46	44
RADIAL	R155	225.0	80.4	40.9	73.6	37.5	75.2	38.3	80.0	40.7	46	44
RADIAL	R156	268.2	81.0	41.2	72.7	37.0	73.6	37.4	80.8	41.1	46	44
RADIAL	R157	315.0	107.7	54.9	98.7	50.2	98.1	49.9	107.8	54.9	46	44
AXIAL	s397	0.0	98.7	129.7	90.7	119.2	91.1	119.8	100.1	131.7	140.0	130.9
AXIAL	S401	46.8	96.6	127.0	89.6	117.8	89.0	117.0	96.1	126.4	140.0	130.9
AXIAL	S398	90.0	94.6	124.4	88.2	115.9	87.4	114.9	94.1	123.8	140.0	130.9
AXIAL	s399	180.0	94.2	123.9	87.2	114.6	87.1	114.6	94.5	124.3	140.0	130.9
AXIAL	S400	270.0	94.6	124.4	87.5	115.1	87.1	114.6	94.4	124.1	140.0	130.9
AXIAL	S402	136.8	93.2	122.6	86.3	113.6	86.5	113.7	94.2	123.9	140.0	130.9
AXIAL	S403	226.8	98.1	129.1	91.7	120.6	91.5	120.3	97.2	127.8	140.0	130.9
AXIAL	S404	316.8	105.8	139.2	99.6	131.0	99.0	130.2	104.9	138.0	140.0	130.9

4.6.5.1 Axial Bolts

Bight axial bolts were replaced with Strainsert bolts (see Table 30) to measure a tension load in the bolts. Therefore, the change in bolt load resulting from motor pressurization was monitored during the firing. All showed a bolt load decrease in the range of 8.2 to 10.5 kips from zero to 1 second, 8.8 to 10.0 kips from 12 to 22 seconds, and -2.0 (positive load recovery) to 1.3 kips from 120 to 130 seconds.

An analysis was performed using a preload value of 140 kips in the axial bolts. The analysis predicts a load decrease of 9.1 kips at 920 psig. The bolt load drops off because of thinning of the fixed housing flange. The flange thinning is attributable to Poisson's effect resulting from the flange displacing radially outward. The results correlate closely with actual measured data.

4.6.5.2 Radial Bolts

The radial bolts were a primary concern of the QM-8 (see Table 30) nozzle-to-case joint because the amount of preload in these bolts governs the amount of delta gap opening of the joint. Delta gap controls the amount of dynamic 0-ring squeeze and consequently, the sealing of the joint.

Strainserts were added to eight radial bolts. Table 30 indicates the radial Strainsert bolts decreased in load during pressurization. The load decreased in a range between 1.7 to 4.7 kips from zero to one second, 1.5 to 5.0 kips from 12 to 22 seconds, and -0.5 (positive load recovery) to 0.8 kips from 120 to 130 seconds. The analysis, using a preload value of 46 kips, predicted the radial bolt loads would decrease by 2 kips at 920 psig. This correlates closely with actual measured data.

4.7 Head End Pressure and Joint Temperature

Table 31 lists the maximum measured head end pressures and the time at which they occurred. Table 32 gives the joint heater temperatures for the field and nozzle-to-case joints immediately prior to static test.

TABLE 31
QM-8 FORWARD DOME CHAMBER PRESSURE (ZERO TO 120 SECONDS)

GAGE NUMBER	CIRCUMFERENTIAL LOCATION (DEG)	MAXIMUM PRESSURE (PSIA)	TIME OF MAX PRES (SEC)	
P001	40.0	863.7	0.664	
P002	270.0	872.6	0.656	
P003	180.0	871.7	0.656	

TABLE 32
QM-8 FORWARD, CENTER, AFT FIELD JOINTS AND NOZZLE-TO-CASE
JOINT AND HEATER TEMPERATURES (-10.0 to Zero seconds)

TEMPERATURE LOCAT	GAGE NUMBER	CIRCUMFERENTIAL LOCATION (DEG)	MAXIMUM TEMPERATURE (DEG F)	TIME OF MAX TEMP (SEC)
FWD	T1001	15.0	90.4	-6.968
	T1002	.135.0	85.1	-4.984
	T1003	195.0	101.1	-9.784
	T1004	285.0	92.2	-7.576
CTR	T1005	15.0	86.2	-2.840
	T1006	135.0	84.9	-4.280
	T1007	195.0	97.7	-6.680
	T1008	285.0	105.7	-9.848
AFT	T1009	15.0	92.0	-4.248
	T1010	135.0	87.4	-3.736
	T1011	195.0	101.7	-8.984
	T1012	285.0	106.7	-9.768
NOZ	T0807	0.0	82.0	0.0
	T0808	120.0	78.5	0.0
	T0809	240.0	85.0	0.0

TWR-17591, Vol IV

4.8 Axial Growth Deflections

Several long wire gages were installed along the length of the motor (see Figure 15), and across joints to measure the axial growth experienced in different areas of the motor during pressurization. Table 33 shows the maximum deflection experienced by each gage for the duration of the test. Locations 5, 7, and 8 are all across joints, and all show a negative deflection. Evaluation of the placement of these gage locations which experienced negative values supports that these values are in error. In other words, the instrument measured a negative value but the joint did not go negative. The measurement was that of of instrument, and not the joint. The aft field joint does not show a negative value because it has a higher stiffness due to the stiffener rings and struts.

The largest measured axial growth was 1.002 inches and occurred between stations 527.0 and 1505.0 (270 degrees).

It is interesting to note that on the other side of the motor (90 degrees) between stations 527.0 and 1829.0, the measured axial growth was 0.406 inch. The maximums for both of these gages occurred during the ignition transient. Since the struts are located on the 270 degree side of the case, they had some influence in causing this difference between the two sides of the motor.

TABLE 33 QM-8 Axial Growth Deflections (Zero to 120 seconds)

TEST NAME: QM-8
DESCRIPTION: AXIAL GROWTH DEFLECTIONS
THE TIME RANGE IS 0.0 TO 120.0 SECONDS

LOCAT	FROM STATION	TO STATION	GAGE NUMBER	ANGULAR LOCATION	DEFLECTION (IN)	ANALYSIS	DEFLECTION DIFFERENCE
1	527.0	1505.0	D196	270.0	1.002	NID	ND
2	527.0	1829.0	D027	92.0	0.406	ND	ND
3	756.0	786.0	D169	80.0	0.021	0.017	0.004
4	756.0	786.0	D175	260.0	0.016	0.017	0.001
5	850.0	850.0	D321	86.0	-0.018	ND	ND
6	916.0	946.0	D168	80.0	0.028	0.014	0.014
7	1010.0		D386	86.0	-0.004	0.004	0.008
8	1170.0		D352	86.0	-0.012	0.023	0.035
9	1236.0	1266.0	D170	80.0	0.028	0.013	0.015
10	1490.0		D383	82.0	0.006	0.021	0.015

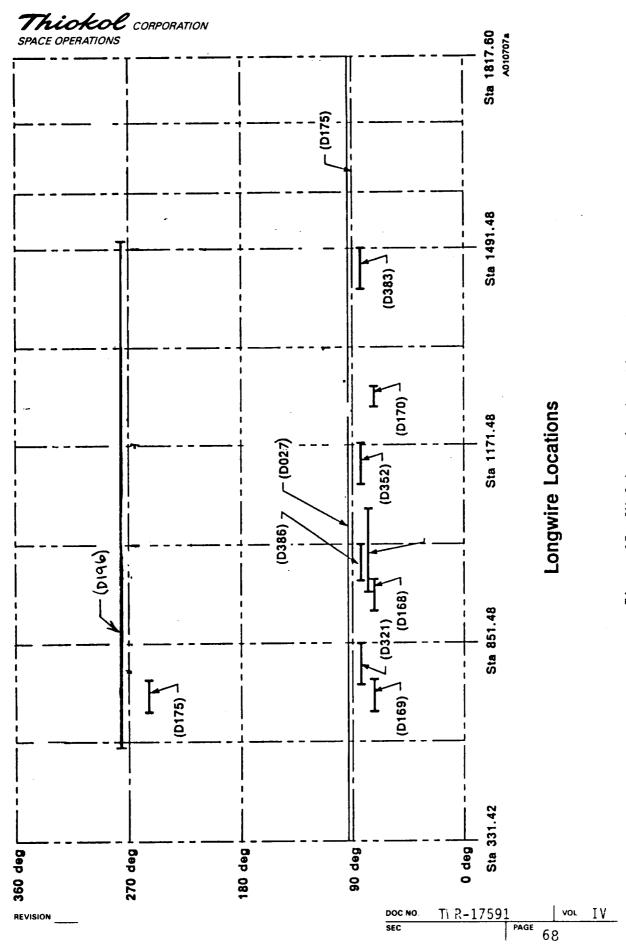


Figure 15 QM-8 Longwire Locations

5.0 DISASSEMBLY INSPECTION RESULTS

Structural Applications Design Engineering performed a post-fire evaluation of the QM-8 external case, field joints, internal nozzle joints, nozzle-to-case joint, the igniter and safe and arm joints, and the factory joints. The case and seals post-fire condition will be discussed with references made to the inspection forms found in the Evaluation Plan (see Reference 16), and the engineering evaluation limits plan (see Reference 17).

Pollowing the initial 0-ring inspection at time of disassembly, the 0-rings were inspected by a specifically organized team made up of personnel from Structural Applications, Liaison/Problem Reporting, and Quality Assurance. The team function was to inspect the 0-rings for damage which may have occurred during the static-test, assembly, or disassembly; and damage which may have gone undetected during disassembly inspection. Records are kept on each 0-ring and gasket so that the seals may be tracked for possible reuse.

The following guidelines have been established to classify 0-ring, Stat-O-Seal and corrosion damage found from post-flight test inspections. These guidelines were established so that each inspection database will be consistent and not be confusing or misleading. Some of these definitions are used in this document.

O-RINGS AND STAT-O-SEALS

<u>Cut</u>: Width, essentially zero (have to

open up to find the damage), and depth greater than 0.005 inch.

Scratch: Width less than 0.005 inch and

depth less than 0.005 inch.

Nick: Width less than 0.020 inch, but

greater than 0.005 inch; and depth less than 0.010 inch, but greater

than 0.005 inch.

Gouge: Width greater than 0.020 inch and

depth greater than 0.010 inch.

Circumferential

or Radial Flowline: Visible evidence of incomplete flow

or knit of the material.

(i) Closed: Tightly adhered, not separable,

does not open when lightly probed.

(ii) Separable: Visually appears closed. Separates

when lightly probed.

(iii) Open: Obvious separation or gap.

Hard Inclusion: Foreign material enclosed in the

seal material.

Porosity/Soft Inclusion: An air pocket enclosed in the seal

material.

Extrusion Damage: Seal material pinched and/or cut

due to an overfill condition.

Heat Effect: Glossy and/or hardened seal surface

due to hot gas impingement.

Brosion: Seal material missing due to hot

gas impingement or blow by.

CORROSION

Light Corrosion:

Can be wiped off by hand. Surface

discoloration.

Medium Corrosion:

Cannot be wiped off by hand without the use of a Scotch-Brite material.

methyl chloroform, or grease soaked

rag.

Heavy Corrosion:

Starting to penetrate into the

metal surface such that pitting

and/or metal material is significantly eroded.

The following sections contain the details of each joint at disassembly and subsequent seals examination by the Inspection Team.

5.1 External Walk Around

The external inspection of the fully assembled hardware at T-97 was performed on 21 January 1989 (see pages A-1 through A-5, Appendix A). The inspection included the case acreage, all field and factory joints, the igniter, and nozzle-to-case joint. The stiffeners and ETA ring bolts were also inspected. No anomalous conditions were encountered.

5.2 Field Joint Disassemblies

The QM-8 field joint configuration is shown in Figure 2. Joint conditions were as expected; there was no field joint 0-ring damage found by inspection at the time of disassembly. The V2 filler did not obstruct the

leak vent ports at 135 degrees. No corrosion was found on any field joint. Detailed inspection results are documented below.

5.2.1 Forward Field Joint

The QM-8 forward field joint was disassembled on 8 February 1989 (see pages A-6 through A-10, Appendix A). The overall condition of the joint was excellent. No hot gas or soot was observed past the J-leg. There was no evidence of damage to the 0-rings while in the grooves. Inspection of the 0-rings by the 0-ring Inspection Team revealed a 13.5 inch circumferential scratch running from 1.6 to 12.6 degrees (see page A-10, Appendix A). The depth of this scratch is indeterminable (very shallow). Scratches of this nature have been found on PV-1, Flight 360L001 and 360L002 0-rings. The cause is suspected to be from cleaning the 0-rings before final inspection. No damage was found by the 0-ring Inspection Team on the primary or secondary 0-rings.

There was no corrosion found on either the tang or clevis. The grease condition was per STW7-2999 on the sealing and non sealing surfaces. The V2 volume filler was in a nominal condition. Metal pinhole slivers were found in the bottom of the inner clevis leg pinholes in the following locations: 52, 54, 58, 60, 62, 232, 282, 286, 288, 290, and 292 degrees. This is a common occurrence. No other metal damage was found in the joint.

A long thin line of white colored material was found on the aft edge of the capture feature 0-ring at 169 degrees. More thin lines of the white colored material were found intermittently on the aft edge from 164 to 167 degrees. The long thin line at 169 degrees was approximately 0.400 inch long. All thin lines of the white colored material ran circumferential on the 0-ring. Lab analysis of a sample of the material indicated that it was Teflon tape adhesive. Teflon tape is used to mask the J-leg insulation during grease application and 0-ring installation processes.

Small thin lines of Teflon tape adhesive were also found on the capture feature metal-to-J-leg interface (aft of the capture feature groove on the tang J-leg) at 153, 178, 180, 227, 228, and from 230 to 233 degrees. All thin lines of Teflon tape adhesive ran circumferentially on the joint except for the lines at 178 degrees. On the clevis, Teflon tape adhesive was found on the top of the J-leg (near the inner clevis leg metal) at 138, 150, 152, 178, 180, and from 162 to 165, 167 to 170, 230 to 234, and 252 to 254 degrees. As on the tang, all Teflon tape adhesive ran circumferentially on the joint except for the lines at 178 degrees.

5.2.2 Center Field Joint

The QM-8 center field joint was disassembled on 7 February 1989 (see pages A-11 through A-14, Appendix A). The overall condition of the joint was excellent. No hot gas or soot was observed past the J-leg. There was no evidence of damage to the O-rings while in the grooves. Inspection of the

0-rings by the 0-ring Inspection Team revealed a similar 13.5 inch circumferential scratch as on the forward field joint capture feature 0-ring. This scratch is also located on the capture feature 0-ring and ranges from 4.7 to 15.7 degrees (see Page A-14, Appendix A). A series of radial scratches measuring 0.150 inch long was found on the capture feature 0-ring at 345.8 degrees. The depth of these scratches is approximately 0.001 inch. No damage was found by the 0-ring Inspection Team on the primary or secondary 0-rings.

There was no corrosion found on either the tang or clevis with the exception of what appeared to be a very light thin line of corrosion which crossed the landing between the 0-ring grooves at 134 degrees. The grease on the 0-rings was intermittently heavier than prescribed in STW7-2999. However, the grease was heavier on the aft side of the primary and secondary 0-rings. It was determined this grease was wiped from the inner tang (pin hole region) during disassembly. The grease condition was per STW7-2999 on the sealing and nonsealing surfaces. The V2 filler was nominal. There was no joint metal damage observed. A metal pin hole sliver was found in the 268 degree pin hole. This is a common occurrence.

5.2.3 Aft Field Joint

The QM-8 aft field joint was disassembled on 4 February 1989 (see pages A-15 through A-17, Appendix A). The condition of the joint was excellent.

No hot gas or soot was observed past the J-leg Insulation. There was no

evidence of damage to the 0-rings while in the grooves or found by the 0-ring Inspection Team. There was no corrosion found on either the tang or clevis. The pin hole at 136 degrees had a small metal pin hole sliver in it, which fell on the aft face of the secondary 0-ring during joint disassembly operations. Otherwise, no apparent metal damage was found during the inspection.

The grease on the 0-rings and sealing areas was as prescribed in STW7-2999, except not enough grease covered the clevis root from 232 to 282 degrees. There was a small amount of foreign material which had fallen onto the joint during or after disassembly.

5.3 Nozzle-to-Case Joint

The QM-8 nozzle-to-case joint (see Figure 3) was disassembled on 13 February 1989 (see pages A-18 through A-22, Appendix A). The overall condition of the joint was excellent. No hot gas or soot was observed past the polysulfide. There was no corrosion or metal damage found.

No 0-ring damage was found during the in-groove inspection. A heavy rub mark was found on the primary 0-ring at 354.6 degrees. This occurred on disassembly because the radial bolt hole plug at 354.6 degrees was in the bottom of the bolt hole. A heavy impact mark was found on the top of the plug. The plug appeared to be in this condition before disassembly. Inspection of the 0-rings by the 0-ring Inspection Team revealed one scratch

on the primary 0-ring and one scratch, one cut, and one nick on the wiper 0-ring (see pages A-20 and A-21, Appendix A). This damage was caused by disassembly; these are located within close proximity to radial bolt hole locations. Also, the charred surface of the nozzle was not covered with plastic prior to 0-ring removal. No damage was found on the secondary 0-ring by the 0-ring Inspection Team.

Polysulfide migrated past the wiper 0-ring through the vent slots around the entire circumference of the joint. The grease condition was per STW7-2999 on the 0-rings and sealing surfaces.

Inspection of the radial bolt Stat-O-Seals revealed that 35 of 100 had unacceptable flow line conditions which should have been rejected by Receiving Inspection. Drawing No. 1U75374 defines the Stat-O-Seals to be inspected per MIL-STD-413, which allows circumferential flow lines no greater than 0.180 inch in length. No radial flow marks are allowed. Presently there is a Stat-O-Seal TRACS class and inspection test each inspector must pass to qualify to perform an inspection. This class was not in force at the time of the QM-8 Stat-O-Seal inspection.

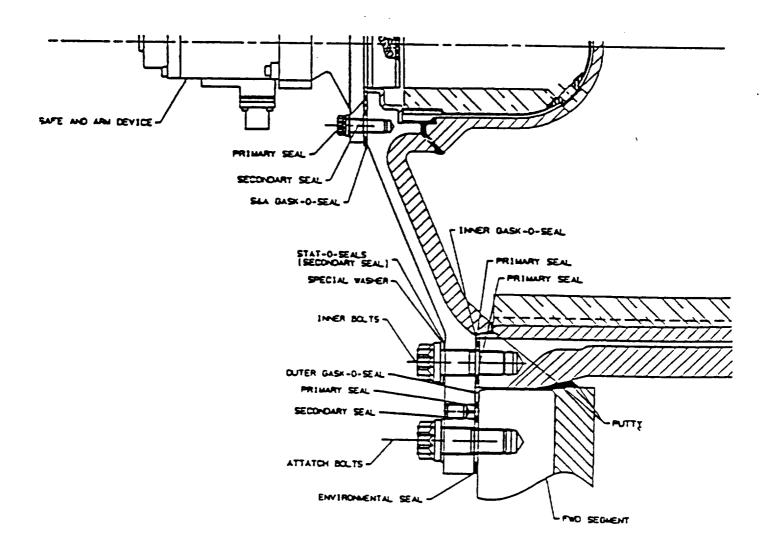
5.4 Igniter Joints

Figures 16 and 17 illustrate the Igniter and S & A seals and components, respectively. Post-test inspections were performed on the ignition system

1



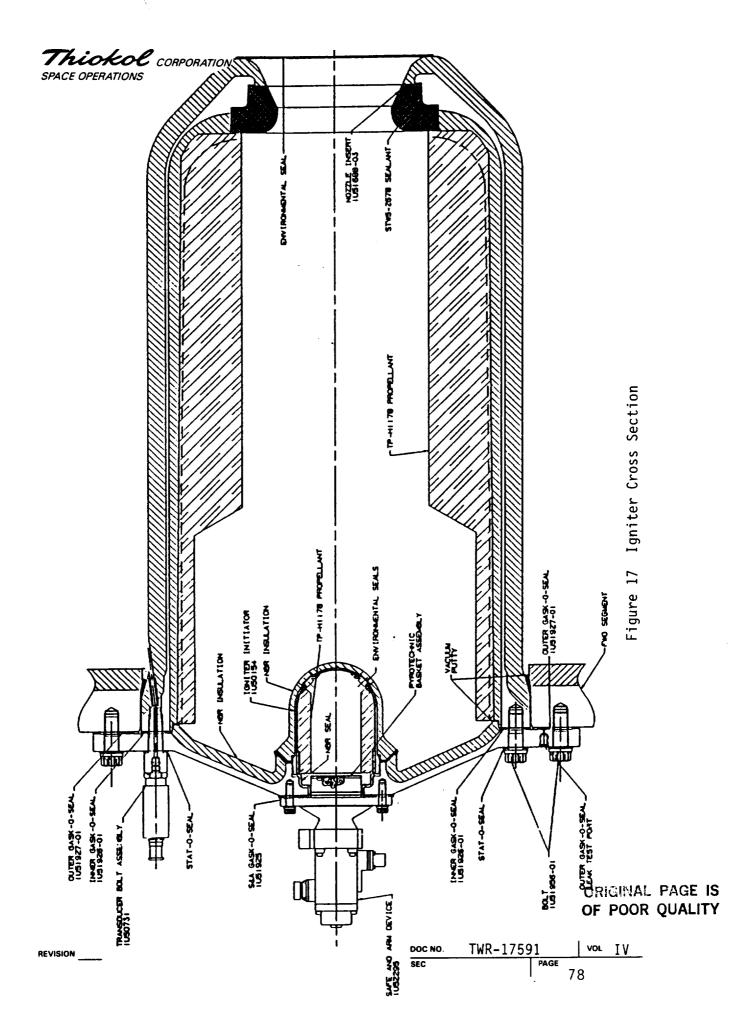
gaskets. All gaskets (Inner, Outer, and Safe & Arm) performed with no signs of heat effect or sooting past the primary seals, and all sealing surfaces were free of soot.



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Figure 16 Ignition System Seals

DOC NO.	TWR-17591	VOL IV
SEC	PA	7 7



5.4.1 Safe and Arm Joint

The post-fire evaluation of the QM-8 Safe and Arm-to-Igniter joint was conducted on 9 February 1989 (see pages A-23 through A-26, Appendix A). No evidence of hot gas or soot was observed past the primary seal. The S&A gasket and all sealing surfaces were visually inspected. No erosion or heat effects were observed. Soot was found around the circumference of the gasket retainer, inward of the primary seal, but not past. Detailed inspection at also showed the gasket to be in excellent condition with no seal damage observed. The sealing surfaces were in good condition with no evidence of contamination or corrosion. No corrosion or damage was found on the Barrier-Booster (S&A) or igniter adapter.

5.4.2 Outer Joint

The QM-8 igniter adapter-to-forward dome joint was disassembled on 1 March 1989 (see pages A-27 through A-29, Appendix A). A blowhole occurred through the igniter exterior putty at 15 degrees. No seal erosion or heat effects were observed. No soot was found to or past the primary seal. No soot was found on either side of the gasket retainer. Heavy soot deposits were found on the inside edge of the gasket, covering the entire circumference. No corrosion or joint contamination was found upon inspection of the sealing surfaces. Detailed inspection of the gasket by the 0-ring Inspection Team

revealed missing material in the outer void area and a nick on the inner bottom edge of the primary seal at 337 degrees (see page A-29, Appendix A). However, the nature of this damage suggested disassembly or handling after disassembly as the cause. Another nick was found on the crown of the secondary seal at 359 degrees (see page A-29, Appendix A). This nick is within the acceptable limits set forth by STW7-2790 (see Reference 18).

5.4.3 Inner Joint

The QM-8 adapter-to-chamber joint was disassembled on 5 May 1989 (see pages A-30 through A-32, Appendix A). No soot was found on either side (top and bottom) of the gasket retainer. Heavy sooting was present on the outside edge of the gasket because of the blowhole in the outer joint putty lay-up at 15 degrees. No blowhole was present in the inner putty lay-up, and no contamination was found on the sealing surfaces. Typical disassembly detorque damage was observed on the gasket seals.

5.5 Internal Nozzle

The internal nozzle joints are illustrated in Figures 18 through 22.

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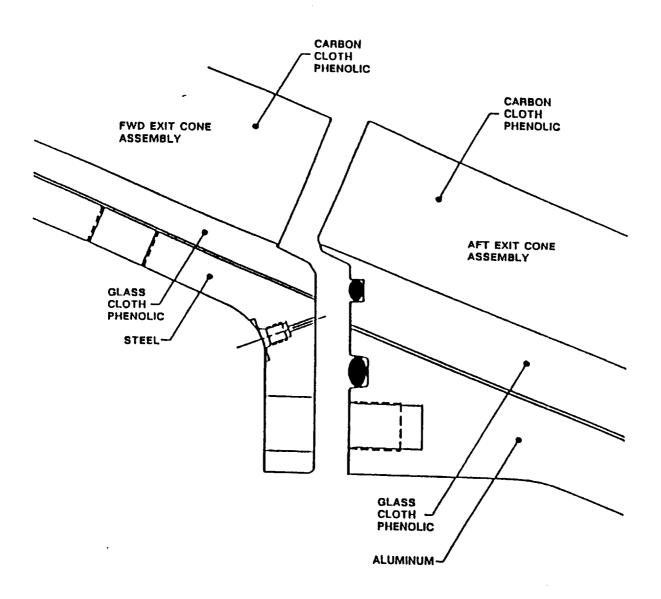


Figure 18 Forward Exit Cone-to-Aft Exit Cone Joint Interface

DOC NO. TWR-17591 VOL IV
SEC PAGE 81



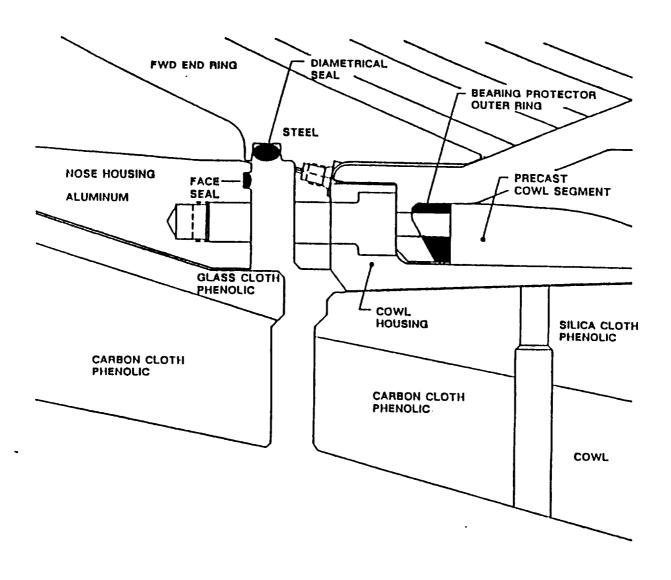


Figure 19 Nose Inlet Housing/Flex Bearing Joint

DOC NO. TWR-17591 | VOL IV

SEC | PAGE | 82



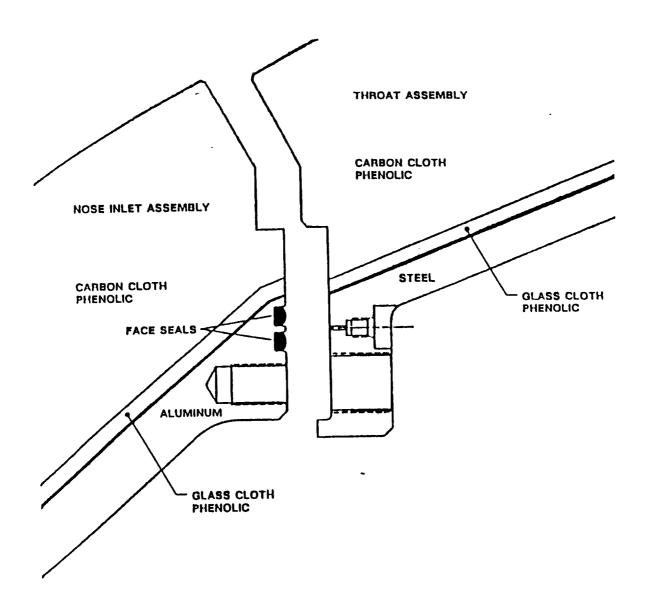


Figure 20 Nose Inlet/Throat Housing Joint

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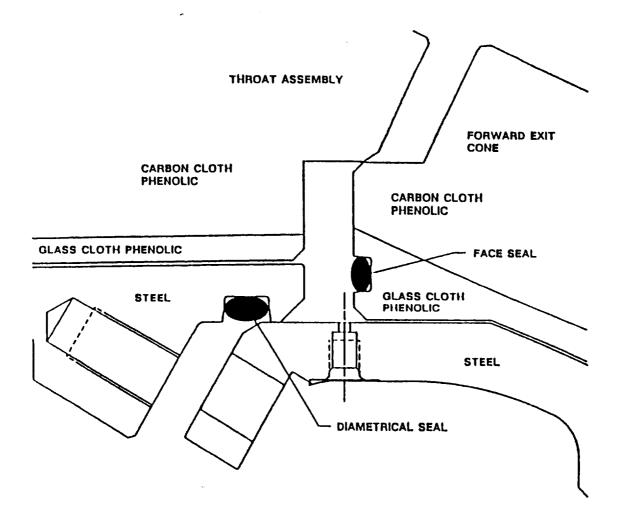


Figure 21 Throat/Forward Exit Cone Joint

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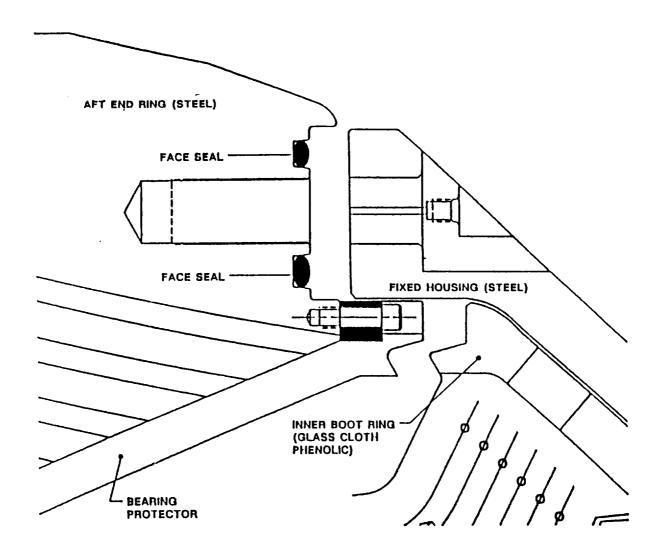


Figure 22 Flex Bearing/Fixed-Housing Joint

DOC NO. TWR-17591 VOL IV

5.5.1 Aft Exit Cone Field Joint (Joint 1)

The aft exit cone-to-forward exit cone of QM-8 was disassembled and inspected on 30 January 1989 (see pages A-33 through A-34, Appendix A). The seals and case inspection included the sealing surfaces, seals, and joint metal components. No anomalous conditions were encountered. There was no evidence of damage to the 0-rings while in the grooves, or found by the 0-ring Inspection Team. There were no voids in the RTV which would allow pressure to reach the primary 0-ring. The grease application was per design with no areas of corrosion found.

5.5.2 Forward End Ring-to-Nose Inlet Housing (Joint 2)

The nose-to-forward end ring was disassembled and inspected on 15 February 1989 (see pages A-35 through A-37, Appendix A). The primary 0-ring experienced pressure, but no apparent damage to the 0-ring was found. Inspection of the 0-rings by the 0-ring Inspection Team revealed a 2.67 inch indeterminable depth circumferential scratch on the primary 0-ring similar to the scratches found on the forward and center field joint capture feature 0-rings (see page A-37, Appendix A). No damage was found on the secondary 0-ring by the Inspection Team.

Inspection of the joint revealed one very small pressure path through the RTV of the joint interface. The pressure path started at 355 degrees and flowed circumferentially to 350 degrees before penetrating into the metal

interface of the joint. The RTV backfill of this joint was much better than the current application of RTV to this joint ("buttering application"). No soot or evidence of blow by was present past the primary 0-ring. The sealing surfaces suffered no assembly or disassembly damage.

5.5.3 Nose Inlet Housing-to-Throat Support Housing (Joint 3)

The nose-to-throat was disassembled and inspected on 15 February 1989 (see pages A-38 through A-41, Appendix A). There was no joint pressurization, and the 0-rings did not have any apparent damage at the time of disassembly. Inspection of the 0-rings by the 0-ring Inspection Team revealed two scratches on the primary 0-ring and one on the secondary 0-ring (see pages A-40 and A-41, Appendix A). This joint showed no signs of pressure past the RTV; i.e., heat-effected grease, soot, or an RTV void. The sealing surfaces showed no assembly or disassembly damage.

5.5.4 Forward Exit Cone-to-Throat Support Housing (Joint 4)

The forward exit cone-to-throat support housing was disassembled on 14 February 1989 (see pages A-42 through A-44, Appendix A). The primary 0-ring experienced pressure, but no damage to the 0-ring was found. No damage to the primary or secondary 0-rings was found during the in grooves inspection or by the 0-ring Inspection Team. Inspection of the joint revealed one pressure path through the RTV backfill at 205 degrees. The sealing surfaces suffered no assembly or disassembly damage.

5.5.5 Fixed Housing-to-Aft End Ring (Joint 5)

The aft end ring-to-fixed housing joint was disassembled on 14 February 1989 (see pages A-45 through A-47, Appendix A). There was no joint pressurization, and the in-groove 0-ring inspection revealed no damage. Inspection of the 0-rings by the 0-ring Inspection Team also revealed no damage. This joint showed no signs of pressure past the RTV; i.e., heat-effected grease, soot, or an RTV void. There was no sealing surface damage.

5.6 Factory Joints

Post test inspection findings of the QM-8 factory joint 0-rings and joint metal components are discussed in this section.

5.6.1 Disassembly of QM-8 Forward Dome and Forward Segment Factory Joints

The forward segment of QM-8 was disassembled on 24 April 1989 (see pages A-48 through A-53, Appendix A).

5.6.1.1 Forward Dome-to-Cylinder Factory Joint

No corrosion was observed on the outer clevis leg or in the joint areas including the tang. No scratches were observed in any joint area.

Very excessive insulation and Chemlok were on the land forward of the primary 0-ring groove intermittently throughout the circumference of the joint. The leak check port plug was removed in the previous log, therefore the break-away torque was not observed or a preliminary inspection completed. Inspection of the port threads revealed they were in nominal condition but had no grease on them. Preliminary inspection of the 0-rings showed nominal condition. The 0-ring Inspection Team reported no 0-ring damage.

5.6.1.2 Forward Segment Cylinder-to-Cylinder Factory Joint

No corrosion was observed on the outer clevis leg or in the joint areas including the tang. No scratches were observed in any joint area.

Very excessive insulation and Chemlok were on the land forward of the primary 0-ring groove intermittently throughout the circumference of the joint. The leak check port plug break-away torque was not recorded. The port plug head was partially covered with residual weather seal. Also, scratches were present on the port plug head, which is typical due to the weather seal removal. The port plug and port threads were in nominal condition with a light coat of grease on them. Preliminary inspection of the 0-rings showed nominal condition. The 0-ring Inspection Team reported no 0-ring damage.

5.6.2 Disassembly of QM-8 Center Forward Factory Joint

The QM-8 center forward factory joint was disassembled on 9 May 1989 (see pages A-54 through A-56, Appendix A). No corrosion was observed on the outer clevis leg or in the joint areas including the tang. No scratches were observed in any joint area.

Insulation and Chemlok were on the land forward of the primary 0-ring groove intermittently throughout the circumference of the joint.

The leak check port plug break away torque was not recorded because the port plug had been removed in the previous log. Inspection of the port hole was difficult because of the amount of grease in the port, but it showed a nominal condition. The excessive amount of grease was present in the port as a normal preservative operation during the disassembly effort. Preliminary inspection of the 0-rings showed nominal condition. The 0-ring Inspection Team reported no 0-ring damage.

5.6.3 Disassembly of QM-8 Center Aft Factory Joint

The QM-8 center aft factory joint was disassembled on 14 April 1989 (see pages A-57 through A-59, Appendix A). Inspection of the outer clevis leg showed no corrosion. Light corrosion was observed downstream of the secondary 0-ring groove through the clevis root and up the inside surface

of the outer clevis leg in the entire circumference of the joint. Light corrosion was observed on the tang downstream of the sealing surface on the entire circumference of the joint. No scratches were observed in any joint areas.

A particle of foreign material was observed between the forward wall of the primary 0-ring groove and the primary 0-ring at seven degrees. A laboratory analysis showed the particle to be aluminum oxide material with residual combustion by-products. It was determined that this particle fell into the joint during disassembly and remains an observation. A presentation was made to the EMT and RPRB for concurrence with this conclusion.

Insulation and Chemlok were on the land forward of the primary 0-ring groove intermittently throughout the circumference of the joint. The leak check port plug was removed in the previous log so the break-away torque was not observed or an inspection done. The port threads were in nominal condition but had no grease on them. Preliminary inspection of the 0-rings showed a nominal condition. The 0-ring Inspection Team also revealed no findings.

5.6.4 Disassembly of QM-8 Aft Segment Factory Joints

The QM-8 aft segment was disassembled on 2 and 3 March 1989 (see pages A-60 through A-68, Appendix A).

TWR-17591, Vol IV

5.6.4.1 Aft Segment Dome-to-Stiffener Joint

Intermittent spots of light to medium corrosion were observed on the outside of the outer clevis leg. No corrosion was observed in the joint. Scratches were observed on the land between the 0-ring grooves at 8, 22, 24, 26, 28, 30, 34, 36, 38, 40, 44, 304, 306, 308 to 316 and 346 degrees. Scratches and pits were observed on the inside of the tang downstream of the seal surface to the chamfer at 302 to 346 degrees. Insulation and Chemlok were on the land forward of the primary 0-ring groove and in contact with the forward edge of the primary 0-ring intermittently throughout the circumference of the joint.

The initial inspection of the port hole was difficult because of the amount of grease in the port but it showed a nominal condition. The excessive amount of grease was present because the port plug had been removed in the previous log. Thus the grease was put in the port as a normal preservative operation during the disassembly effort.

Preliminary inspection of the 0-rings showed a nominal condition. The A-2 0-ring Inspection Team also revealed no findings.

5.6.4.2 <u>Stiffener-to-Stiffener Factory Joint</u>

Intermittent spots of light to medium corrosion were observed on the outside of the outer clevis leg between 271 to 137 degrees. Light

corrosion was observed downstream of the secondary groove at 17 to 21, 32, 36 to 45, 84, and 147 to 175 degrees. Scratches were observed on the land between the 0-ring grooves at 358 degrees.

Insulation and Chemlok were on the land forward of the primary 0-ring groove and in contact with the forward edge of the primary 0-ring intermittently throughout the circumference of the joint.

The initial inspection of the port hole was difficult because of the amount of grease in the port but it showed a nominal condition. The excessive amount of grease was present because the port plug had been removed in the previous log. Thus, HD-2 grease was put in the port as a normal preservative operation during the disassembly effort.

Preliminary inspection of the 0-rings showed a nominal condition. The 0-ring Inspection Team also revealed no 0-ring damage.

5.6.4.3 ET-to-Stiffener Factory Joint

Intermittent spots of light to medium corrosion were observed on the outside of the outer clevis leg. Light corrosion was observed in the clevis bottom at 101 to 107 degrees. Scratches were observed on the land between the 0-ring groove at 18, 24, 38, and 316 degrees. Scratches were also observed on the land forward of the primary 0-ring groove at 38 and 316 degrees.

Insulation and Chemlok were on the land forward of the primary 0-ring groove and in contact with the forward edge of the primary 0-ring intermittently throughout the circumference of the joint.

The initial inspection of the port hole was difficult because of the amount of grease in the port, but it showed a nominal condition. The excessive amount of grease was present because the port plug had been removed in the previous log. Thus HD-2 grease was put in the port as a normal preservative operation during the disassembly effort.

Preliminary inspection of the O-rings showed a nominal condition. The O-ring Inspection Team also revealed no O-ring damage.

5.7 Port Plug Evaluation

Only recently, a detailed evaluation of all port plugs and port plug seals have been evaluated by the 0-ring Inspection Team (see pages A-69 through A-98, Appendix A). On past full-scale static tests (PV-1, QM-7, QM-6) the emphasis was focused mainly on the custom and adjustable plugs which were in the design and qualification phases. Inspection forms and engineering evaluation limits have since been added to the PEEP and PEEL documents, respectively (see References 17 and 18). Since there are so many port plugs in the RSRM, no attempt is made to discuss the post-test inspection findings of each plug. However, it can be stated that no gross unexpected conditions were encountered.

Copies of the completed PFORs (Post Fire Observation Records) are presented in Appendix A.

It should be noted that there were no port plugs installed in the 45 degree leak check ports of the field joints, and the 262.5 degree leak check port of the fixed housing-to-aft end ring (Nozzle Joint 5). There were pressure transducers installed in these ports. Also the leak check port plugs from the igniter inner and outer joints were not received.

5.8 Seals Component Program Team Recommendations

The Seals Component Program Team has reviewed all observations presented in this document and have determined that the following observations are potential anomalies, classified as critical, major, minor, or observation, as defined under Table 34 criteria.

5.8.1 Remains Observation

 The aluminum oxide, combustion by-product particle observed between the forward wall of the primary 0-ring groove and the primary 0-ring at seven degrees on the center aft factory joint. It was determined that this particle fell into the joint during disassembly and remains an observation.

5.8.2 Minor Anomalies

- 1. The white colored material, which ran circumferentially found on the aft edge of the forward field joint capture feature 0-ring at 169 degrees. More thin lines of the white colored material were found intermittently on the aft edge from 164 to 167 degrees. Also small thin lines of the white colored material were found on the capture feature metal to J-leg interface (aft of the capture feature groove on the tang J-leg) at intermittent degree locations. Lab analysis indicated the material was Teflon Tape adhesive.
- 2. Thirty five of 100 nozzle-to-case Stat-O-Seals had unacceptable flow line conditions.

5.8.3 Major Anomalies

There were no major anomalies.

5.8.4 Critical Anomalies

There were no critical anomalies.

5.9 RPRB Position

The RPRB has accepted as presented.

Table 34
Criteria for Classifying "Potential Anomalies"

Remains	Anomaly					
Observation	Minor Major		Critical			
Requires no Specific Action	Requires corrective action, but has no impact on: - Motor Performance - Program Schedule Does not reduce usability of part for its intended function Could cause damage preventing reuse of hardware in combination with other anomaly Significant departure from the historical database	Could cause failure in combination w/ other anomaly Could cause damage preventing reuse of hardware Program acceptance of cause, corrective action, and risk assessment required before subsequent static test or flight	Violates CEI Spec. requirements Could cause failure and possible loss of mission/life Mandatory resolution before subsequent static test/flight			

Note: These criteria to be applied to the specific observed "potential anomaly" as it relates to the observed article and as it relates to subsequent articles.

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APPLICABLE DRAWINGS

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- 2. Drawing 8U75902, "Leak Check System, Installation", Morton Thiokol, Inc., 11 December 1987.
- 3. Drawing 7U76357, "Vent Port Plug Leak Test Fixture", Morton Thiokol, Inc., 15 March 1988.
- 4. Drawing 2U65686, "Transducer Leak Test Fixture", Morton Thiokol, Inc., 17 January 1989.
- 5. Drawing 2U129718, "Auxiliary Leak Test Equipment", Morton Thiokol, Inc., 18 May 1988.

APPENDIX A INSPECTION FORMS

Morton Thiokol Inc. Space Operations

REV. ____

Joint External Walk Around - Evaluation Checkoff Worksheet

Motor No.: QM-8	Date: JAN 21 1	989	Time:	140	0
Inspector(s): DAVE ROWSE	LL, JEFF CL	RRY	LOW	ELL	NELSEN
Evidence of Combustion Product L	, , , , , , , , , , , , , , , , , , , ,	,			Comment Number
A. Forward Dome Factory Joint FDS, CLEVIS)	(Sta. 531.5,		yes .		no
B. Forward Segment Factory Jo FFS, CLEVIS)	int (Sta. 691.5,		yes .		no
C. Forward Field Joint (Sta. 851	.5, FWD, CLEVIS)		yes .	<u> </u>	no
D. Forward Center Segment Fac 1011.5, FCS, CLEVIS)	tory Joint (Sta.		yes		no
E. Center Field Joint (Sta. 1171	.5, CTR, CLEVIS)		yes .	<u> </u>	no
F. Aft Center Segment Factory ACS, CLEVIS)	Joint (Sta. 1331.5,		yes .	<u> </u>	no
G. Aft Field Joint (Sta. 1491.5,	AFT, CLEVIS)		yes .	<u> </u>	no
H. Aft Segment Factory Joint (S CLEVIS)	Sta. 1577.5, FSS,		yes .		no
I. Aft Segment Factory Joint (S	Sta. 1697.5, ASS,		yes .	<u> </u>	no
CLEVIS)				1/	
J. Aft Dome Factory Joint (Sta. CLEVIS)	1817.6, ADS,		yes		no
K. Nozzie to Case Joint (Sta. 18	75.2, NOZ, AFT)		yes		no
If yes, record the indicated data be	elow:				
					`
					İ
·					
		•			
•					

DOC NO.	TWR-17591			VOL	IV
SEC		PAGE	-	\-1	

External igniter interfaces - Evaluation Checkoff Worksheet

Motor No.: QM-8	Date: JAN 21	1989	Time: 140	٥٥
Inspector(8): DAVE ROWSE	ILL, JEFF C	URRY	LOWELL A	
Evidence of Combustion Product L		,		Comment Number
A. Adapter / Forward Dome In B. Adapter To Forward Dome C. Adapter / Chamber Interface D. Adapter To Chamber Bolts E. S&A / Adapter Interface (S. F. S&A To Adapter Bolts (S&A)	Bolts (IGN, FWD) ce (IGI, AFT) (IGI, FWD) &A, AFT) A, FWD)	yes yes yes yes yes	no no no no no	
If yes, record the indicated data b	elow:			
		•		
		-		

DOC NO.	TWR-17591		VOL	IV
SEC	·	PAGE	Δ_2	

External Walk Around - Evaluation Checkoff Worksheet

Inspector(s): DAVE ROU	USELL, JEF	FCURRY,	Lowell	NELSEN				
Motor No.: QM-B				Date: 21 77/1	F7			
Hotspots (Heat Affecte Aft Segment Aft Center Segment Forward Center Seg Forward Segment Loose or Cracked ETA	ment		yes yes yes yes yes	no no no no no				
III. Loose or Cracked Stiffe	ener Ring Bolts?		yes	X no				
IV. Additional Observations	3?		yes	no				
If yes, record the indicate	d data below:							
Segment (1 - 4) Condition	Axial Location (In.)	Degree Location (Deg.)	Axial Length (In.) If Applicable		Degree Arc If Applicable			
Notes / Comments		· · · · · · · · · · · · · · · · · · ·						

Note: Clarify any observations on an OCF if necessary

Rev. ____ <u>DOC</u> NO. TWR-17591 VOL IV SEC Page A-3

Stiffener Ring - Evaluation Checkoff Worksheet

Inspector(s): DAVE ROWSELL	TIELL , LOWELL	NECLEM 17	A.V			
				Date:	21 JAN 89	9
1. Cracked or Deformed Bolls (Removed)?	(Removed) ?) sek	no	
II. Cracked or Warped Stiffener	er Flange?			yes	0u	
III. Cracked or Warped Sliffener	er Web?			yes	ou	
IV. Cracked or Warped Stiffener	er Slubs?			yes ×	00	
V. Cracked or Deformed Stiffener Ring Bolt Holes?	iner Ring Bolt Hole	¿S;		yes	00	
VI. Cracked or Deformed Stiffener Stub Bolt Holes?	mer Stub Bolt Hole	¿s:	-	yes	no	
If yes, record the indicated data	a below:					
	Axial	Degree	Axial	Circumferential		Radial
Affected	Location	Location	Length	Width	Degree	Distance
Part	(In.)	(Deg.)	(In.)	(In.)	Arc .	(In.)
(IVI) Condition	(IV)	(IIV)	(Il Only)	(11, 111 & 1V)	(11, 111 & 1V)	(III & IV)
Holes I Comments SmALC ON 10 OF THE	SPOTS OF W	VEXY LIGHT BOLTS.	- SURFACE	CE CORRESIEN	LUHS LOREOSION	FOCAID 1 FOUND

DOC			
NO.	TWR-17591	VOL	I۷
SEC		Page	A-4

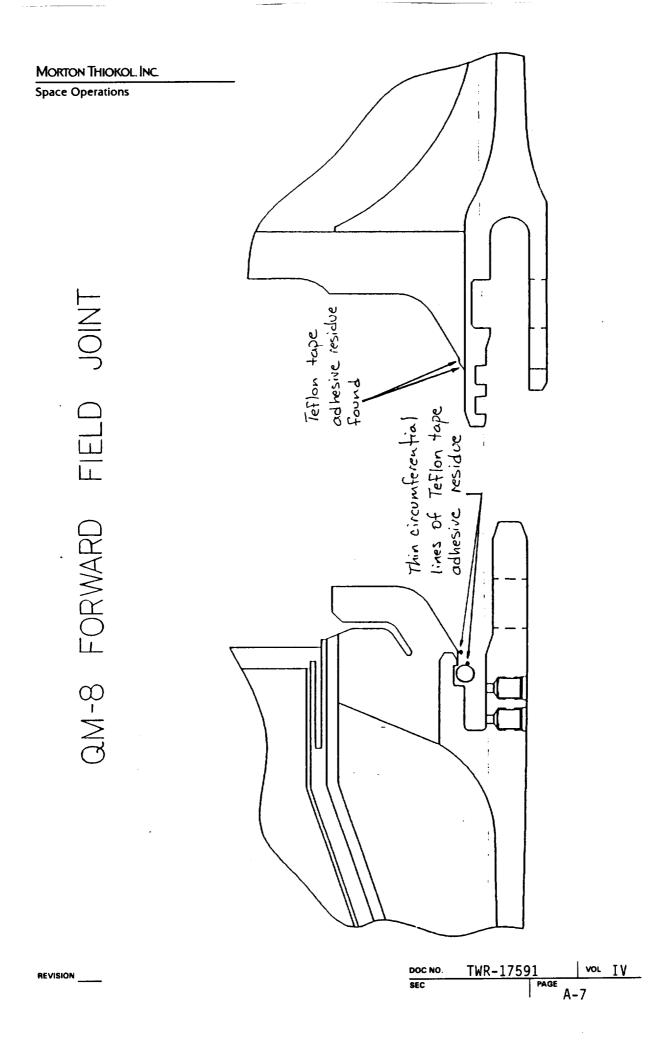
External Tank Attach (ETA) - Evaluation Checkoff Worksheet

Inspector(s): DAUE	DAVE ROWSELL	IC, KEWY	SAKER				
Motor No.: 6	QM-8				Date:	21 JAN 89	7
I. Cracked o	Cracked or Deformed Bolts ((Removed) ?			yes	00	
II. Cracked o	Cracked or Warped ETA Ring?	97			yes *	00	
III. Cracked o	Cracked or Warped ETA Segment Stubs?	ment Stubs?			yes X	00	
IV. Cracked o	Cracked or Deformed ETA Ring Bolt Holes?	ing Bolt Holes?			yes	9	
V. Cracked o	Cracked or Deformed ETA Segment Stub Bolt Holes?	egment Stub Bol	It Holes?		yes	92	
If yes, record	If yes, record the indicated data	below:					
٠		Axial	Degree	Axial	Circumferential		Radial
Affected		Location	Location	Length	Width	Degree	Distance
Part		(In.)	(Deg.)	(In.)	(In.)	Arc	(ln.)
(I-V)	Condition	(AII)	(All)	(Il Only)	(II & III Only)	(II & III Only)	(II & III Only)
Notes / Comments	nents		,				

DOC NO. TWR-17591 VOL IV SEC Page A-5

Case Field Joint Condition - Evaluation Checkoft	f Worksh	eet	
Motor No.: 9M-8	Date:	8 FEB	89
Joint: ☐ Forward (FWD) ☐ Center (CTR) ☐ Aft (AFT)			
Inspector(s): DAVE ROWSELL, JEFF CURRY			
Case Field Joint Observations:			Comment Number
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR	Yes		lo
SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?			
B. Sooted Grease (HAGRE)?	Yes		lo
C. Discolored Grease (DIGRE)?	Yes		lo
D. Volume 2 Filler Damage (V2FD)?	Yes		lo
E. Leak Check Port Obstructed (LPOBS)?	Yes		lo
F. Vent Port Obstructed (VPOBS)? ———————————————————————————————————	Yes		lo <u>/</u>
C. Totalgit material in the southing and daming the	165	•	
(FMIJ)? H. Rust on sealing surfaces (SSCOR)?	Yes		lo
I. Rust on metal parts (PITCO)?	Yes		lo
J. Heat affected metal (HTAFF)?	Yes	المسكل	٠
K. Damaged metal sealing surface (SSMET)?	Yes	1	No
I. A long thin line of white colored make the aft edge of the copture feature of Main lines of white colored material material lines of white colored material material was approximately on the aft edge of the control long. Set from letton tape. (FMIJ) NOTE: For YOUR INFORMATION (SEE ATTACHED FIRST June June) at 153, 178, 180, 227, 228, and from 2 of the thin lines of the white colored material were feature metal to J-leg interface (aft of the capture tang J-leg) at 153, 178, 180, 227, 228, and from 2 of the thin lines of the white colored material rethe joint except for the lines of white colored material rethe joint except for the lines of white colored material rethe inner clevis leg metal) at 138, 150, 152, to 165, 167 to 170, 230 to 234, and 252 to 254 deg	formal were specification the 178, 1	on the re groove 33 degrees umferentiat 178 de top of the 80, and f	capture on the s. All ally on egrees. e J-leg rom 162
all of the thin lines of the white colored materia on the joint except for the lines of white colored m	l ran c	ircumiere	ntially

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	۸ 6	



MORTON THIOKOL INC.

Space Operations

Field and Factory Joint - Evaluation Checkoff Worksheet

2.45 3 .55	Tr TC 0.1001	· · · · · · · · · · · · · · · · · · ·	
Inspector(s): DAUE ROWSECC,	JEFF CORK		
Motor No.: QM-8		Date: 8 FEB 89	
Joint:			l
☐ Forward Dome Factory Joint (531.5)	☐ Forward Segme	ent Factory Joint (691.5)	
X Forward Field Joint (851.5)	☐ Forward Center	r Segment Factory Joint (1011	.5)
Center Field Joint (1171.5)	☐ Aft Center Seg	ment Factory Joint (1331.5)	
☐ Aft Field Joint (1491.5)	Aft Segment F	actory Joint (1577.5)	ŀ
☐ Aft Segment Factory Joint (1697.5)	Aft Dome Fact	ory Joint (1817.6)	
I. Rust on Metal Parts (Corrosion)?		yes n	
II. Metal Damage?		yes Lyn	. I
Clarify below or on an OCF, if ne	ecessary		
III. Metal Slivers from pin holes?	•	yes n	
IV. Other?		yesn	.
Describe:			1.
			:
If yes, record the data below:		,	
Axial Degree			
Location (In.) Location D	Degree Arc	Length Width	1
If Applicable (Deg.) If	Applicable	If Applicable If Applicab	le l
251.5 SEE BELOW			_
			<u>:</u>
			<u>1</u> (4)
			_
			_
Notes / Comments:		Pinhole slivers were fou	nd
in the bottom of the inner cl 52, 54, 58, 60, 62, 232, 282, 28 material (D6AC) and are typical	66, 288, 290, and	es in the following hole	s:

NO. TWR-17591 VOL IV

REVISION ____

Detailed Case Fiel			Valuation Check		,	J. 7. 5 5.5.5/
Inspector(s): R	XKY Ash	Stott Ede:	D. GARY /	ELSON		
Motor No.:	(2M-8			Date: 2	10-8	9
Joint: YFon	ward 🔲 C	enter Af	t			,
PRIMARY O-RIN	G	Part No.: 1:175	150 -25	Serial No.:	000	331
	_	· · · · · · · · · · · · · · · · · · ·				
A. Erosion?					Yes	No No
B. Heat Affec	ł?				Yes	No No
C. Assembly/	Disassembly Dan	nage?			Yes	No No
D. Other? De	scribe:				Yes	No
If any of the above				low:		
Condition	Degree	Maximum	Circumferential			Distance
	-			CCVAR		
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
						
						
				-		
SECONDARY O-	RING	Part No.: 107	5150-25	Serial No :	000	アンクタフ
		10 /			Yes	No
A. Erosion?	_					
B. Heat Affec					Yes	No No
C. Assembly/I	Disassembly Dan	nage?			Yes	No
D. Other? De	scribe:				Yes	No
If any of the above				low:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	_	Depth	Width	CSVAP		(Length)
(A, B, C 01 D)	Location	Deptin	Width	CSTAP		(congin)
						
	··			···		

CAPTURE FEAT	JRE O-RING	Part No.: 1075	5150-11	Serial No.:	000	0024
A. Erosion?					Yes	V No
B. Heat Affect					Yes	✓ No
•	Disassembly Dan	~			Yes	No
D. Other? De	scribe:				Yes	No
If any of the above	conditions exis	t, record applicab	le dimensions be	olow:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
(, , , , , , , , , , , , , , , , , , ,	1.60	indeterminable	<u></u>			13.5
		MOSIE HIRMANIC				
						
						
Notes / Comments	:		-			
						• •
						

NO. TWR-17591 VOL IV

BEC PAGE A-9

_	O-RING OBSERVATION CLARIFICATION FORM
Date: 2-10-89	Inspector(s): South Eden Rocky Ash, D. Garna
//otor No.: <u> </u>	Joint: FWD FIELD JUNT
)-ring Location: Prima	
Part Number: 1075 15	50-11
erial Number:	1024
Pepth:	
Description: See	Be lour
ketch observation below o	or attach worksheets and list below. Indicate orientation and dimensions.
show as much detail as ne	cessary to explain the observation.
	· ·
	ce
	1.16 12.6
0. [1.1	L= 13.5" L= 13.5"
Circumferential	W = .001
Scratch	\
	D= indeterminable
	<u> </u>
	:
•	•
-	

DOC NO. TWR-17591 VOL IV

Case Field Joint Condition - Evaluation Chec	koff Worksheet		
Mater No: WM-8	Date: 🔾 -	7-89	
Joint: Forward (FWD) 🖾 Center (CTR) 🗆 Aft (AFT)			
Inspector(s): Lowell Nelsen			
mopositi (e). Viologiji i i i i i			Comment
Case Field Joint Observations:		. /	Number
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR	Yes	No	
SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?			ļ
	Yes	No No	
LOUISIA (DIGDE)?	Yes	No	
D. Volume 2 Filler Damage (V2FD)?	Yes	No	
E. Leak Check Port Obstructed (LPOBS)?	Yes	No	
F Vent Port Obstructed (VPOBS)?	Yes	No No	
G. Foreign material in the sealing area during motor operation	Yes	No	
(FMIJ)?	, Yes	✓ No	
H. Rust on sealing surfaces (SSCOR)?	Yes	No	エー
I. Rust on metal parts (PITCO)?	Yes	V No	
J. Heat affected metal (HTAFF)?	Yes	No	
K. Damaged metal sealing surface (SSMET)?			rund son-
if any of the above conditions exist, record applicable dimension	ns below. Desci	or a "C" if t	he condi-
fition using a comment number, a "T" if the condition is obser	la describe the	observation:	
dition using a comment number, a first comment number,	1 to describe		
1. Very light thin line of corros landing betweenthe o-ring clevis side.	No Nois	the	_
I wern the oring	grooves	at 13	4°,
landing between o	O		
clevis side.			
1			
	primary o	-ring	
Metal STITI	_ 1	a alam	
landing - VIIIIIIIII	Secondary	o-ring	
[[[] [] [] [] [] [] [] [] []			
l			
1 134° /			
Inner Clevis leg	†		
	•		
			<i>:</i>
•			
			• •

DOC NO. TWR-17591 | VOL 1V

SEC | PAGE | A-11

MORTON THIOKOL INC.

Space Operations

Field and Factory Joint - Evaluation Checkoff Worksheet

Inspector(s): Lowell Nelsen						
Motor No.: QM-8		Date: 2-7-	89			
Joint:						
☐ Forward Dome Factory Joint (531.5)	☐ Forward Segment Fa	ictory Joint (691	.5)			
☐ Forward Field Joint (851.5)	☐ Forward Center Segr	ment Factory Joi	int (1011.5)			
Center Field Joint (1171.5)	☐ Aft Center Segment	Factory Joint (1	331.5)			
☐ Aft Field Joint (1491.5)	☐ Aft Segment Factory	Joint (1577.5)				
Aft Segment Factory Joint (1697.5)	☐ Aft Dome Factory Jo	oint (1817.6)				
I. Rust on Metal Parts (Corrosion)?						
II. Metal Damage?		yes	no			
Clarify below or on an OCF, if ne	cessary	,				
III. Metal Silvers from pin holes?		yes	no			
IV. Other?		yes	no			
Describe:						
			:			
If yes, record the data below:						
Axial Degree			12			
	egree Arc Le	ngth	Width			
			Applicable			
1. 1171.5 <u>134°</u>		z landing _	- !			
3. 1171.5 268°	~ 0.	.60"	- <u>:</u> :			
		 -				
		-				
		·				
Notes / Comments: See Tuble B-III of TWR- Illustration. (PFOR Use		For Corr	05:02			
			**			

NO. TWR-17591 VOL IV

REVISION ____

TWR-17591 vol.

REVISION___

		(Post-Removal) -				
Motor No.: (1)	34 4 System + E	ely Al, Soft	Friend Dro	ARM NELSON	00	
		Center		Date: 2 - 9-	24	
PRIMARY O-RI				A		
		Part No.: 10.75	5150-25	Serial No.: O		
A. Erosion?					Yes	No
B. Heat Aff		_			Yes	No
	y/Disassembly Da	_			Yes	No
					Yes	No
		ist, record applica				
Condition	Degree	Maximum	Circumferentia			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
					-	
OFOONDARY 6	200					
SECONDARY C	-RING	Part No.: 10	15 i50-25	Serial No.:	∞	<u>^333</u>
A. Erosion?	_				Yes	No
B. Heat Affe		_			Yes	No
	//Disassembly Dai				Yes	No
D. Other?	Pescribe:				Yes	No
		st, record applical			•	
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
						· · · · · · · · · · · · · · · · · · ·
CARTIDE EEAT	TIPE O DING					
	ORE O-RING	Part No.:	75150-11	Serial No.:	∞	05)
A. Erosion?					Yes	No
B. Heat Affe		_			Yes	No
	/Disassembly Dar	nage?			Yes	No
D. Other? D					Yes	No
		et, record applicat				
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location リフ ^o	Depth	Width	CSVAP		(Length)
B	345,85	indeterminable				13.5 *
						.150
					-	
					• -	
Notes / Comment	<u> </u>					
						• -

	ME-O	NC CBSE	RVATION	CLARIFI	CATIO	OI: FORM	/I 14	145-	. < .
Date:	·	Inspecto	or(s):	SCCKH-	1:5h	$\frac{1}{2}$	TT -de	n Wen	6 74x
Motor No.:QM-8			<u></u>	J. WAR		TSON			
Left (A) Right (Joint: _		FIELD			☐ Wipe		
O-ring Location:		. ☐ Sec	ondary	LY Cap	ture i	Feature	☐ wibe	9 T	
Part Number:		<u> </u>							•
Serial Number:O	<u> </u>								
Depth:									
Description: <u>Se</u>	e Beloi	12							
							_,,		
	·····								
Sketch observation be	low or atta	ch work	sheets ar	nd list be	low.	Indicate	orientatio	n and dime	ensions.
Show as much detail	as necessa	ry to exp	lain the	observat	ion.				
								 	
		•							
									i
	c	,		• •		~^		`	
	4.7°				15.	<u>7°</u>			
							1 =	13.5"	
Circumferential	(-	— 13,5°		4		-		
Scratch	\ \ \					W	W =	,001	
Sualar	D:						6	indeterm	أمدامها
	W/A)	D=	Maciem	inabie
	<u> </u>								ļ
				•					Ī
	٠	•				. 0			
	270	,	345	5,8		O			
	-						1 =	: .150	
Radial	(,,,,	ĺ
Scratches			lai.			W	W:	1001	
36 LETTONE 2	(b)	•	150						
	/// -		· ·)	ρ.	= 1001	
	W					/			
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				•					
•									

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DOC NO. TWR-17591 | VOL IV

Case Field Joint Condition - Evaluation Checkoff	Works	heet	
	Date:		
☐ Forward (EWD) ☐ Center (CTR) ☒ Aft (AFT)		Ĭ,	

Motor No.: 9M-8	Date	e: 2	-6-89	
Joint: ☐ Forward (FWD) ☐ Center (CTR) ☒ Aft (AFT)			<u> </u>	
Inspector(s): K. Baker				
Case Field Joint Observations:				Comment Number
	Y	85	✓ No	Number
A. Soot In Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?		•		
	Y	es	₩ No	
B. Sooted Grease (HAGRE)?		es	No No	
C. Discolored Grease (DIGRE)? D. Volume 2 Filler Damage (V2FD)?		6 3	√ No	
		es	No	
		es	V No	
and the second s		es	V No	
G. Foreign material in the sealing area during motor operation (FMIJ)?				
H. Rust on sealing surfaces (SSCOR)?	Υ	es	∠ No	
I. Rust on metal parts (PITCO)?	Y	es	No	
J. Heat affected metal (HTAFF)?	Y	es	No	
K. Damaged metal sealing surface (SSMET)?	Y	es	No	
		_		
If any of the above conditions exist, record applicable dimension	ns below.	Descr	ibe the obse	rvea con-
tition using a comment number, a "T" if the condition is obser	vea on the	tang	or a C II I	ne condi-
tion is observed on the clevis and any other information needed	to descrit	Je ine	Observation	
• •				
				, , , , , , , , , , , , , , , , , , ,
·				
·			• •	

DOC NO.	TWR-17591	VOL	ΙV
SEC	PAG	Ε Λ 1 E	

MORTON THIOKOL INC.

Space Operations

Field and Factory Joint - Evaluation Checkoff Worksheet

Inspector(s): K. Baker			
Motor No.: QM-8		Date: 2-6	-89
Joint:			
☐ Forward Dome Factory Joint (531.	5)	gment Factory Joint	(691.5)
☐ Forward Field Joint (851.5)	☐ Forward Ce	inter Segment Factory	/ Joint (1011.5)
☐ Center Field Joint (1171.5)	☐ Aft Center	Segment Factory Joir	nt (1331.5)
☑ Aft Field Joint (1491.5)	☐ Aft Segmen	nt Factory Joint (1577	.5)
☐ Aft Segment Factory Joint (1697.5	5)	factory Joint (1817.6)	
I. Rust on Metal Parts (Corrosion)	7	yes	no
II. Metal Damage?		yes	no
Clarify below or on an OCF, i	If necessary		
III. Metal Slivers from pin holes?			no
IV. Other?		yes	no
Describe: Missing C	Arease in CI	evis Root	ŧ
Ů			
If yes, record the data below:		,	
Axial Degree			÷
Location (In.) Location	Degree Arc	Length	Width
If Applicable (Deg.)	If Applicable	if Applicable	If Applicable
136		-	
	50		
		· · · · · · · · · · · · · · · ·	
			<u> </u>
Notes 1 Comments: II Pinhole sliver found or 0-ring at 136 degrees disassembly,	n the aft ed . Pinhole sliv	lge of the S er fell there c	econdary

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NO. TWR-17591 VOL IV

REVISION ____

MORTON THIOKOL INC. Space Operations

Detailed Case Field Joil						ch A-2 Blag)	
Inspector(s): Wayne =	nem Scot	+ Elen	D. GARY	NEISON	/		
Motor No.: QYW-8	7 17			Date: Z/8	189		
Joint: Forward	☐ Center	⊠ Aft			T		
PRIMARY O-RING	***************************************		0-25	Serial No.:	<i>2003</i>	56	
A. Erosion?					Yes	ı/ No	
B. Heat Affect?					Yes	No	٠
C. Assembly/Disass	ambly Damaga	1					
					Yes	No	i
D. Other? Describe					Yes	<u>√</u> No	
If any of the above con-	ditions exist, rec	ord applicabl	e dimensions be	low:			
Condition De	gree N	laximum	Circumferential			Distance	
(A, B, C or D) Loc	cation	Depth	Width	CSVAP		(Length)	
SECONDARY O-RING	Dort 1	No. // arr	50-25	Social No	<u> </u>	301	\dashv
	Part	10: 10 /51	23	Serial No.:			, [
A. Erosion?					Yes	No No	
B. Heat Affect?					Yes	No No	
C. Assembly/Disass	•				Yes	No	
D. Other? Describe	D:				Yes	No	
If any of the above con-	ditions exist, rec	ord applicabl	e dimensions be	low:			
Condition De	agree M	laximum	Circumferential			Distance	
(A, B, C or D) Loc	cation	Depth	Width	CSVAP		(Length)	
						(2011)	
							•
							•
CAPTURE FEATURE	O PING 5						· •
•	J-HING Part	No.:/ <i>U75</i> /	150-11	_	-	,	
A. Erosion?				<u> </u>	_	No No	•
B. Heat Affect?					Yes	No	•
C. Assembly/Disass	embly Damage?	l			Yes	No	ĺ
D. Other? Describe):			٠	Yes	No	
If any of the above con-	ditions exist, rec	ord applicabl	e dimensions be	low:			
Condition De	ogree M	laximum	Circumferential			Distance	
	cation	Depth	Width	CSVAP		(Length)	
(7.1, 0, 0 0. 0)		oop		OUTAF		(Length)	
		 		· 	- -		•
							•
					- -		•
							• -
						· · · · · · · · · · · · · · · · · · ·	_
Notes / Comments:							
		. •	•				
	•	•					

NO. TWR-17591 VOL IV
SEC PAGE
A-17

Nozzie-to-Case Joint Condition - Eva	
Motor No.: GM-8	Date: 10 FEB 89
Joint: Nozzle-to-Case (NOZ)	
Inspector(s): DAVE ROWSELL	
Case Field Joint Observations: A. Soot in Proximity to / Past O-ring Groove (SPINS, SI SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? B. Sooted Grease (HAGRE)? C. Discolored Grease (DIGRE)? D. Polysulfide Past Wiper O-ring (PSEX)? E. Leak Check Port Obstructed (LPOBS)? F. Vent Port Obstructed (VPOBS)? G. Foreign material in the sealing area during motor of (FMIJ)? H. Rust on sealing surfaces (SSCOR)? I. Rust on metal parts (PITCO)? J. Heat affected metal (HTAFF)? K. Damaged metal sealing surface (SSMET)?	Yes No Yes No
If any of the above conditions exist, record applicable of dition using a comment number, an "F" if the condition condition is observed on the fixed housing and any other the observation and its location: 1. POLYSULFIDE GOT PHST THE WIP OVERITY SLOTS 360 DEGREES AROUNTE: RADIAL BOLT HOLE PLUG WESTOWN OF THE BOTTOWN OF THE 354.6 DEGREES IN THE PLUG APPEARED TO BE IN THE PRIMARY D-RING AT	I is observed on the art dome of all A little er information needed to completely describe ER O-RINK, THROUGH THE VIND THE JOINT. (PSEX) VAS SMASHED INTO THE . IZEE RADIAL BOLT HOLE. N THIS CONDITION BEFORE B MARK WAS FOUND ON

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE A	_18	

Unspector(s):					Wasatch A-2 Bldg
Motor No.: G	MAR	KUCKY ASA	, D. GARN	Date: 2-/4-	00
Joint: Nozzle-to-			· · · · · · · · · · · · · · · · · · ·	Date. 2-77-	8 7
PRIMARY O-RI		Post No. 1/1	75801-15 6	Parial Na	- 4 - 44
	10 -	Part No.:	75801-15 S		
A. Erosion?	-40			Y•	
B. Heat Affe				Y•	
	/Disassembly Da	-		Y•	
				Ye	No No
			able dimensions bei	ow:	
Condition	Degree	Maximum	Circumferential		Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)
c	_/31.7	0.003	0.002		0.050
					
					
SECONDARY O	-RING	Part No.:	75801-16 S	erial No.: <u>000</u>	00004
A. Erosion?				Ye	No No
B. Heat Affec	ct?			Ye	No No
C. Assembly	/Disassembly Da	mage?	•	Yes	No No
D. Other? D	escribe:	<u> </u>		Yes	Nò .
			ible dimensions belo	ow:	
Condition	Degree	Maximum	Circumferential		Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)
	-				
			·-···		

144000000000000000000000000000000000000					
WIPER O-RING		Part No.:	75801-14 S	erial No.: <u>000</u> 0	2004
A. Erosion?		•		Yes	✓ No
B. Heat Affec				Yes	No
	Disassembly Dar	_		V Yes	No
D. Other? De	escribe:			Yes	₩ No
			ble dimensions belo	w:	
Condition	Degree	Maximum	Circumferential		Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)
c	255.2"	0.003	0.003		0.040
c	314.4.	0.002	0.001		0.040
	354.3.	0.005	0.025		0.050
					
-					

00C NO.	TWR-1759	91	VOL	IV
SEC		PAGE	-	
	•	ļ	A-19	

	O-RING OBSERVA	TION CLARIFICA	TION FORM	١ .	~ .
ate: <u>2-/5-89</u>	Inspector(s)	Scor E	DEN, K	OCKY ASH	, D. Gara A
lotor No.: QM-8					
Left (A) Right (B		ZLE / CASE			
)-ring Location:		ry 🔲 Capture	e Feature	☐ Wiper	
art Number: 10738					
Serial Number: <u>0000</u>	209				
Depth:	55 0 5 1				
Description:(_58	E BELOW)				·
					
					
					· · · · · · · · · · · · · · · · · · ·
· · · · · · · · · · · · · · · · · · ·					-
Sketch observation belo	w or attach workshae	e and list halow	Indicate	orientation and	1 dimensions
Show as much detail as				Onemanon and	a differentialoris.
	1100000017 to explain				
*					
70°	/32.7°	7300			
	, , , , ,				
(CIRCO	MFERENTIAL	
\	rc.05 =1			ATCH	
	, Line of the second	× ×			
)		0.050	
		j		0.002	
			0 = 0	0.003	
		•	\$ = 8	0	
			7 - 8		
•		•			
				•	

DOC NO. TWR-17591 VOL IV
SEC PAGE A-20

Date: 2-14-	89 Ir		N CLARIFICATION F Scott EVEN	ORM ROCKY ASH	D.64
ierial Number: _ epth:	M-# light (B) J Primary [1/1/5801-14 0000004	loint: <u>A/O Z Z</u>			
Pescription:	(SEE BELOW)			
ketch observation how as much d	on below or attach	n worksheets as to explain the	nd list below. Indic observation.	cate orientation and d	imensions
/ 3 c ·	2.55.1 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	270		003 003	
270°	316.4	, c.n-y	$ \begin{array}{c} RABIAL \\ L \approx 0.0 \\ W \approx 0.00 \\ \rho \approx 0.00 \end{array} $	40 01	
270°	354.3	O - ()	$\begin{array}{c} RABIAL \\ L \approx 0.055 \\ U \approx 0.02. \\ D \approx 0.00. \end{array}$	0 5	
-	,				

Nozzle-To-Case Radial Bolt Stat-O-Seals - Evaluation Checkoff Worksheet

Motor No.: QM-8 Joint: Nozzie-To-Case Radial Boit (NOZ, STAT) PIN 1UT5374-02 Lot Number ECL 0003 Inspector(s): SCOTT EDEN, LON WER, GARY NELSON Boit Stat-O-Seal Observations: A. Eroded Stat-O-Seals (SORE)? B. Heat Affected Stat-O-Seals (HASOR)? C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? Ves No If any of the above conditions exist, describe below: C: Separation of circumferential flow mark \(Lalgo \) [2190° (SDMG) C: Circumferential tear in seal at retainer/rubber interface \(Lalgo \) [230° C: Radial Harroment appear when proted (SDMG) Note: 35 out of 100 stat-o-seals had unacceptable flow line conditions.
Inspector(s): SCOTT EDEN, LON HVER, GARY NELSON Bolt Stat-O-Seal Observations: A. Eroded Stat-O-Seals (SORE)? B. Heat Affected Stat-O-Seals (HASOR)? C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? Ves No If any of the above conditions exist, describe below: C: Separation of circumferential flow mark ~ L=190° (SDMG) C: Circumferential tear in seal at retainer/rubber interface ~ L=30° C: Circumferential flow mark open under way if ication (SDMG) C: Radial flow mark opens when probed (SDMG) (SDIS)
Inspector(s): SCOTT EDEN, LON HYER, GARY NELSON Bolt Stat-O-Seal Observations: A. Eroded Stat-O-Seals (SORE)? B. Heat Affected Stat-O-Seals (HASOR)? C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? Ves No If any of the above conditions exist, describe below: C: Separation of circumferential flow mark ~ L=190° (SDMG) C: Circumferential tear in seal at retainer/rubber interface ~ L=30° C: Circumferential flow mark open under uniqui (ication (SDMG) C: Radial flow mark opens when probed (SDMG)
Bolt Stat-O-Seal Observations: A. Eroded Stat-O-Seals (SORE)? B. Heat Affected Stat-O-Seals (HASOR)? C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? Ves No If any of the above conditions exist, describe below: C: Separation of circumferential flow mark ~ L=190° (SDMG) C: Circumferential tear in seal at retainer/rubber interface ~ L=30° C: Circumferential flow mark open under way if ication (SDMG) C: Radial flow mark open under probable (SDMG)
Bolt Stat-O-Seal Observations: A. Eroded Stat-O-Seals (SORE)? B. Heat Affected Stat-O-Seals (HASOR)? C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? Ves No If any of the above conditions exist, describe below: C: Separation of circumferential flow mark ~ L=190° (SDMG) C: Circumferential tear in seal at retainer/rubber interface ~ L=30° C: Circumferential flow mark open under uniquification (SDMG) C: Radial flow mark opens when probed (SDMG)
B. Heat Affected Stat-O-Seals (HASOR)? C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? Ves No If any of the above conditions exist, describe below: C: Separation of circumferential flow mark ~ L=190° (SDMG) C: Circumferential tear in seal at retainer/rubber interface ~ L=30° C: Circumferential flow mark open under jumpilication (SDMG) C: Radial flow mark open under jumpilication (SDMG) (SDIS)
B. Heat Affected Stat-O-Seals (HASOR)? C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? Ves No No If any of the above conditions exist, describe below: C: Separation of circumferential flow mark ~ La 190° (SDMG) C: Circumferential tear in seal at retainer/rubber interface ~ La 30° C: Circumferential flow mark open under waynification (SDMG) C: Radial flow mark opens when probable (SDMG)
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? Yes No
C: Separation of circumferential flow mark ~ L2190° (SDMG) C: Circumferential tear in seal at retainer/rubber interface ~ L230° C: Circumferential flow mark open under warynification (SDMG) C: Radial flow marks opens when probable (SDMG)
C: Separation of circumferential flow mark ~ L2190° (SDMG) C: Circumferential tear in seal at retainer/rubber interface ~ L230° C: Circumferential flow mark open under warynification (SDMG) C: Radial flow marks opens when probable (SDMG)
C: Crecumferential tear in seal at retainer/rubber interface ~ 1=30° C: Circumferential flow mark open under warynification (50mg) (5015) C: Radial flow marks opens when probad (50mg)
C: Radial flow ments opens when probed (SDMG)
C: Radial flow ments opens when probed (SDMG)
The make typis when probed (SDMG)
Note: 35 out of 100 stat-o-scals had unacceptable flow line conditions.
Note: 35 out of 100 stat-o-scals had unacceptable flow line conditions.
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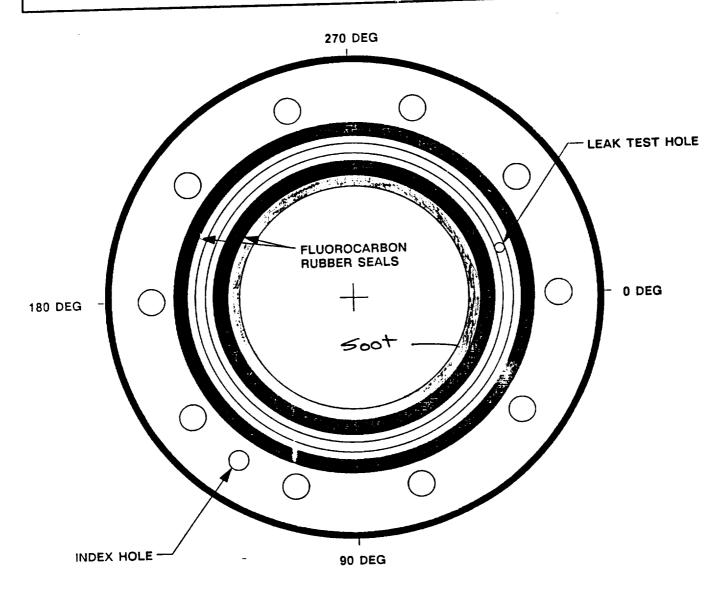
DOC NO.	TWR-17591		VOL	IV
SEC		PAGE		
		' /	A-22	

Ignition System	0 11	Surface	Condition	_	Evaluation	Checkoff	Worksheet
Janitian System	Sealing	Surface	Contantion				

Ignition System Sealing Surface Condition	Date: 2/9/89	
Motor No.: QM-8	Date: 2/9/89 Adapter to Chamber	(ICI)
Joint: S&A to Adapter (S&A) ☐ Adapter to Case (IGN)	Adapter to Chamber	(idi)
Inspector(s): G. Abawi, D. Rowsell		
inspector(c). G. Houwi J. C. Roses		
A. Soot in Proximity to / Past O-ring Groove (SPINS, SPPOR, SPSOR)? B. Sooted Grease (HAGRE)? C. Discolored Grease (DIGRE)? D. Leak Check Port Obstructed (LPOBS)? E. Foreign material in the sealing area during motor operation (FMIJ)? F. Rust on sealing surfaces (SSCOR)? G. Rust on metal parts (PITCO)? H. Heat affected metal (HTAFF)? I. Damaged metal sealing surface (SSMET)? J. Damaged metal other than sealing surface (DAMML)? If any of the above conditions exist, record applicable dimensions be condition using a comment number, a "FWD" if the condition is obsigoint or the adapter on the inner and outer joints or a "AFT" if the cadapter on the S&A joint, the chamber on the inner joint or the dominformation needed to describe the observation:	andition is observed on t	he

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE		
		t	A-23	

Motor No.: QM-8	Date: 2	2/9/	189	Time: 0900
Corresponding Comment Number			Inspector(s): G.	Abawi, D. Rowsell



Observation Drawing Worksheet - Igniter S&A Gasket (Forward Face)

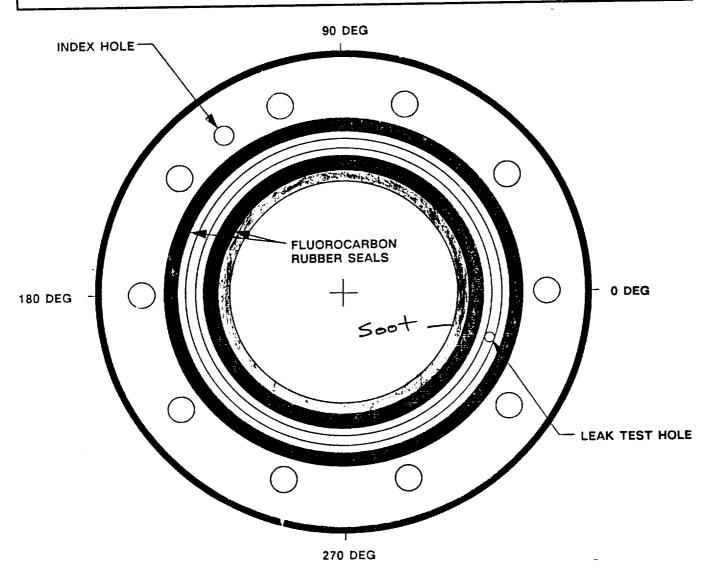
DOC NO. TWR-17591 VOL IV
SEC PAGE A-24

Motor No.: QM-8

Date: Z/9/89

Time: 0900

Corresponding Comment Number _____ Inspector(s): G. Abawi, D. Rowsell



Observation Drawing Worksheet - Igniter S&A Gasket (Aft Face)

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE A-	25	

Detailed Igniter Gasket - Evaluation Checkoff Worksheet

Motor No.: QM-8	Date: 2-9-89
Gasket: ☐ Inner (IGI) ☐ Outer (IGN) ☐ S&A ((S&A)
P/N: 1051925-01 S/N: 0000032	
Inspector(s): SCOTT EDEN, ROCKY ASH	
·	Comment
	Number
I. Soot Past Seals (SPINS, SPPOR, SPSOR)?	yes no
II. Foreign Material (FMIJ)?	yes no
III. Seal Damage (PCUT, PDIS, PDMG, SCUT,	yes no
SDIS, SDMG)?	ves / no
IV. Heat Affected Seals or Retainer (PORE, HAPOR	yes <u>V</u> no
SORE, HASOR, HTAFF)?	yes no
V. Rust (SSCOR, PITCO)? VI. Metal Damage (SSMET, DAMML)?	yes no
VI. Metal Damage (SSMET, DAMML)? If yes, describe below:	
in yes, describe below.	
	•
	· ·

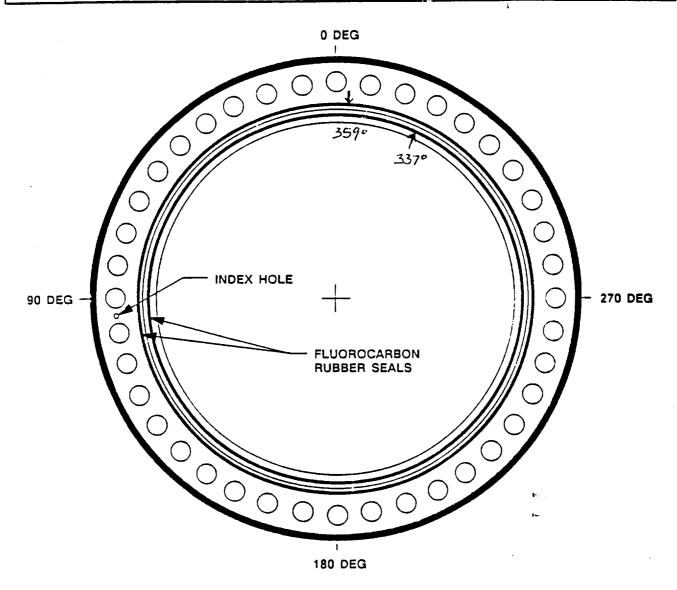
DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-26	

Ignition System Sealing Surface Condition - Evaluation Checkoff Worksheet MAR Date: 0M-8 Motor No.: Adapter to Chamber (IGI) Adapter to Case (IGN) S&A to Adapter (S&A) Joint: Inspector(s): ABAW Comment Number Soot in Proximity to ! Past O-ring Groove (SPINS, SPPOR, SPSOR)? Yes Sooted Grease (HAGRE)? В. Yes Discolored Grease (DIGRE)? C. Yes Leak Check Port Obstructed (LPOBS)? D. Foreign material in the sealing area during motor operation (FMIJ)? Rust on sealing surfaces (SSCOR)? F. Yes Rust on metal parts (PITCO)? G. Heat affected metal (HTAFF)? H. No Damaged metal sealing surface (SSMET)? Damaged metal other than sealing surface (DAMML)? If any of the above conditions exist, record applicable dimensions below. Describe the observed condition using a comment number, a "FWD" if the condition is observed on the S&A on the S&A joint or the adapter on the inner and outer joints or a "AFT" if the condition is observed on the adapter on the S&A joint, the chamber on the inner joint or the dome on the outer joint and any other information needed to describe the observation: A blowhole through the putty occurred at 15 degrees. No soot was found on either side of the gasket. Heavy soot deposits were found on the gasket inside edge.

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE A-	27	

REV ____

Motor No.: CM-8	ate:	20 April 1889 Time:
Corresponding Comment Number		Inspector(s): Wayne Spring Rock, Hist
		Dan Polleya



Observation Drawing Worksheet - Igniter Outer Gasket (Aft Face)

REV.		NO. TWR-17591		VOL	IV
	•	SEC		FAGE A-28	

Detailed Igniter Gasket - Evaluation Checkoff Worksheet

Motor No.: QM - 它	Date: 20 April 1989
Gasket: Inner (IGI) Quter (IGN) S&A (
PIN: 1451926-01 SIN: 0000040R1	
Inspector(s): Wayne Spein, Rocky Ash, Or	an Aller
	Comment
	Number
I. Soot Past Seals (SPINS, SPPOR, SPSOR)?	yes no
II. Foreign Material (FMIJ)?	yes no
III. Seal Damage (PCUT, PDIS, PDMG, SCUT,	
IV. Heat Affected Seals or Retainer (PORE, HAPOR	yes no
SORE, HASOR, HTAFF)?	/
V. Rust (SSCOR, PITCO)?	yes no
VI. Metal Damage (SSMET, DAMML)?	yes no
If yes, describe below:	1 . 6 6 2270
Primary Seal Aft side Missing material and	d a nick @ 35%
Secondary Sent Aft side nick @ 359°	
SECONDARY 359° Art Side	Nick L: ,01 D: ,02 W: .01 M:SSING MATERIAL L: ,07 W: ,01 D: ,005 W: .010

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	-29	

Ignition System Sealing Surface Condition - Evaluation Checkoff Worksheet

Ignition System Sealing Surface Condition - Evaluation	F 7 00	
Motor No.: QM-8	Date: 5 - 5 - 81	((C1)
Joint: S&A to Adapter (S&A) Adapter to Case (IGN)	Adapter to Chamber	(IGI)
Inspector(s): K. Baken		
A. Soot in Proximity to Past O-ring Groove (SPINS, SPPOR, SPSOR)? B. Sooted Grease (HAGRE)? C. Discolored Grease (DIGRE)? D. Leak Check Port Obstructed (LPOBS)? E. Foreign material in the sealing area during motor operation (FMIJ)? F. Rust on sealing surfaces (SSCOR)? G. Rust on metal parts (PITCO)? H. Heat affected metal (HTAFF)? I. Damaged metal sealing surface (SSMET)? J. Damaged metal other than sealing surface (DAMML)? If any of the above conditions exist, record applicable dimensions be condition using a comment number, a "FWD" if the condition is obtigint or the adapter on the inner and outer joints or a "AFT" if the cadapter on the S&A joint, the chamber on the inner joint or the dominformation needed to describe the observation: 1	condition is observed on the on the outer joint and	he any other

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-30	

Detailed Igniter Gasket - Evaluation Checkoff Worksheet

Motor No.: QM-8	Date: 5/22/89
Gasket: ☑ Inner (IGI) ☐ Outer (IGN) ☐ S&A ((S&A)
P/N: 1051926-01 S/N: 000054	
Inspector(s): Rocky Ash Wayne Spercy	
7	Comment
	Number
I. Soot Past Seals (SPINS, SPPOR, SPSOR)?	yes no
II. Foreign Material (FMIJ)?	yes _V no
III. Seal Damage (PCUT, PDIS, PDMG, SCUT, SDIS, SDMG)?	yes no
IV. Heat Affected Seals or Retainer (PORE, HAPOR SORE, HASOR, HTAFF)?	yes no
V. Rust (SSCOR, PITCO)?	yes no
VI. Metal Damage (SSMET, DAMML)?	yes no
If yes, describe below:	
•	

DOC NO.	TWR-17591			VOL	IV
SEC		PAGE	A	-31	

REV. _

Ignition System Stat-O-Seals - Evaluation Checkoff Worksheet

Motor No.: QM-8	Date: 5-5-89
Joint: Adapter/Chamber (IGI) Case End: STAT	
P/N 1475374-01 Lot Number <u>Ecc 2010</u>	
Inspector(s): K. Baken	
Bolt Stat-O-Seal Observations:	Comment
A. Eroded Stat-O-Seals (SORE)?	Number Yes ✓ No
B. Heat Affected Stat-O-Seals (HASOR)?	Yes No
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Yes No
If any of the above and time arise describe below	
If any of the above conditions exist, describe below:	
1. Typial disassemby damage was so	een on all stat-ousels
	•
•	

DOC NO.	TWR-17591	vo	L IV
SEC		PAGE A-32	

Nozzle Joint Condition - Evaluation Checkoff Worksheet

Inspector(s): K. Baker, J. Curry, L. Nelsen	20/20
Motor No.: QM-8	Date: 2-6-87
Joint: Throat/Fwd Exit Cone (4)	d End Ring/Nose Inlet (2)
☐ Fixed Housing/Aft End Ring (5) ☐ No	se inlet/Throat (3)
저 Fwit Exit Cone/Aft Exit Cone (1)	
a and the teachers and the same teachers	Comment
Case Field Joint Observations:	Number
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR	Yes No
SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	
· · · · · · · · · · · · · · · · · ·	Yes V No
(DIODE)	Yes No
	Yes No
D. Leak Check Port Obstructed (LPOBS)?	Yes No
E. Vent Port Obstructed (VPOBS)?	
F. Foreign material in the sealing area during motor operation	Yes No
(FMIJ)?	
G. Rust on sealing surfaces (SSCOR)?	Yes No
H. Rust on metal parts (PITCO)?	Yes No
I. Heat affected metal (HTAFF)?	YesNo
J. Damaged metal sealing surface (SSMET)?	Yes No
o. Daniaged moter coming contract (=====,	
If any of the above conditions exist, record applicable dimensions be dition using a comment letter, an "F" if the condition is observed on the aft end of the joint and a completely describe the observation and its location:	n the forward end of the joint or

DOC TWR-17591		VOL	IV
SEC	PAGE	A-33	

REVISION_

Detailed Nozzle Joint O-ring (Post-Removal) - Evaluation Checkoff Worksheet (Wasatch A-2 Bldg)

Inspector(s): Roc	Ky Ash, Sco	t Eden, Wa	ine Sperry	D. GA1-4 12	20,0
	<u>ገ- ሄ</u> ☑ Fwd Exit Cone	IAM Full Cons		Date: 2-3-3	
	☐ Throat/Fwd Ex			ind Ring/Nose Inle Housing/AFt End	
	☐ Nose Inlet/Thr		□ Fixed	nousing/Art End	ning
			-> 07 0		2
PRIMARY O-RING	Pan	No.: 107515	<u> </u>	ial No.: <u>COOC</u>	7
A. Erosion?				Yes	No
B. Heat Affect		_		Yes	No No
C. Assembly/D	•			Yes	No
	cribe:			Yes	No
			ble dimensions below	/:	
Condition	Degree	Maximum	Circumferential		Distance
(A, B, C or D)	Location	Depth	Wldth	CSVAP	(Length)
					
					
					
-					
SECONDARY O-F	ING Part	No : 11175	5150-04 Ser	del No : CCC	cr. 18
(If Applicable)			71 <u>-567 17</u> 500		<u>CL.,.ea.</u>
A. Erosion?				Yes	√ No
B. Heat Affect	,			Yes	No
	isassembly Dama	ae?		Yes	No
D. Other? Des	•	-		Yes	No
			ble dimensions belov		
Condition	Degree	Maximum	Circumferential	•	Distance
(A, B, C or D)	-	Depth	Width	CSVAP	(Length)
(,,, =, = =, =,				3017.1	(Longin)
			-		
					
					
					
					
					
Notes / Comments					
Notes / Comments					
Notes / Comments					
Notes / Comments					
Notes / Comments					

REV.

Nozzle Joint Condition - Evaluation Checkoff Worksheet

Inspector(s): LOWELL NELSEN, K. Baker	
Motor No.: QM-8	Date: 2/15/89
Joint:	Fwd End Ring/Nose Inlet (2)
Fixed Housing/Aft End Ring (5)	Nose inlet/Throat (3)
Fwd Exit Cone/Aft Exit Cone (1)	
	Comment
Case Field Joint Observations:	Number Yes No 4
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	
B. Sooted Grease (HAGRE)?	
C. Discolored Grease (DIGRE)?	Yes No
D. Leak Check Port Obstructed (LPOBS)?	Yes No
E. Vent Port Obstructed (VPOBS)?	Yes No
F. Foreign material in the sealing area during motor operation	Yes No
(FMIJ)? G. Rust on sealing surfaces (SSCOR)?	Yes /No
	V Yes No 2.
H. Rust on metal parts (PITCO)? I. Heat affected metal (HTAFF)?	Yes No
COMET\3	Yes No
J. Damaged metal sealing surface (SSIVIET)?	
dition using a comment letter, an "F" if the condition is observan "A" if the condition is observed on the aft end of the joint completely describe the observation and its location: 1. Very Small pressure path the at 355 degrees then flow primary orang groove. Very good	and any other information needed to frough RTV, Started owed Circumferentially pressure to reach RTV Backfill looked
2. metal discoloration of at 110 degrees to 150	bearing flange degrees And
from 240 degrees to 2	-80 degrees.

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-35	

REVISION___

Detailed Nozzie	Toomic O-Img (I		Valuation Checkon	WORKSHOOT (V	ABBEICI	n A-2 Blag)
Inspector(s): Wat	me Sperm	Rocky Ash	, D. GARY.	NELSON		
Motor No.: QM			<i>'</i>	Date: 2-1		
Joint:		ne/Aft Exit Cone	,	d End Ring/No		
	☐ Throat/Fwd		☐ Fixe	ed Housing/AF	t End I	Ring
	☐ Nose Inlet/1	hroat		· · · · · · · · · · · · · · · · · · ·		
PRIMARY O-RIN	IG P	art No.: 147515	9-07 S	Serial No.: <u>Oc</u>	2000	/4
A. Erosion?					Yes	No
B. Heat Affe	ct?				Yes	No
	Disassembly Dai				Yes	No
D. Other? D	escribe:		 ·		Yes	No
If any of the above	e conditions exi	st, record applical	ble dimensions bel	low:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
D	<u> 297° </u>	indeterminable	.001			2.67"
						i
						
-						
						
	et? Disassembly Dar	_	0-08 s	Serial No.:	Yes Yes Yes	No No No
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De	:t? Disassembly Dar escribe:	nage?			Yes Yes	No No
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do	et? Disassembly Dar escribe: e conditions exis	nage? st, record applicat	ole dimensions bel		Yes Yes Yes	No No No No
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition	ct? Disassembly Dar escribe: e conditions exis Degree	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do	et? Disassembly Dar escribe: e conditions exis	nage? st, record applicat	ole dimensions bel		Yes Yes Yes	No No No No
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition	ct? Disassembly Dar escribe: e conditions exis Degree	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition	ct? Disassembly Dar escribe: e conditions exis Degree	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition	ct? Disassembly Dar escribe: e conditions exis Degree	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition	ct? Disassembly Dar escribe: e conditions exis Degree	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition	ct? Disassembly Dar escribe: e conditions exis Degree	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition	ct? Disassembly Dar escribe: e conditions exis Degree	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition	ct? Disassembly Dar escribe: e conditions exis Degree	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition	Disassembly Dar escribe: e conditions exist Degree Location	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition (A, B, C or D)	Disassembly Dar escribe: e conditions exist Degree Location	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition (A, B, C or D)	Disassembly Dar escribe: e conditions exist Degree Location	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition (A, B, C or D)	Disassembly Dar escribe: e conditions exist Degree Location	mage? st, record applicat Maximum	ole dimensions bel Circumferential		Yes Yes Yes	No No No No Distance

 DOC NO.
 TWR-17591
 VOL IV

 SEC
 PAGE A-36

Morton	Thiokol Inc.	
Space	Operations	

Date: 2-17-89	Inspector(s): Wayne Spery, Rocky Ash, D. GARY NEW			
Motor No.:				
Left (A) Right (B)	Joint: Fund End Ring / Nose			
O-ring Location: ☑ Primary Part Number: 1475150 - 07	☐ Secondary ☐ Capture	Feature		
Serial Number: 0000014				
Depth:				
Description: <u>See Below</u>				
	4			
Sketch observation below or atta	ach worksheets and list below.	Indicate orientation and dimensions.		
Show as much detail as necessa	iry to explain the observation.			
O°	297°	270°		
		W= .001 D=indeterminable		
(D=indeterminable		
		L = 2.67"		
	1 2.67" 1) L= 2.61		
<u> </u>		/		
		-		
		·		
<u> </u>				

REV DOC TWR-17591 VOL IV		SEC		PAGEA-37	
		DOC NO.	TWR-17591	VOL	IV

Nozzle Joint Condition - Evaluation Checkoff Worksheet

Insp	pector(s): LOWELL NELSEN, Kelly	Bake-				
	tor No.: QM - 8				21:5/89	
Join	nt:				g/Nose inlet (2	2)
	☐ Fixed Housing/Aft End Ring (5)		Nose	Inlet/T	hroat (3)	
	Fwd Exit Cone/Aft Exit Cone (1)					
Cas	se Field Joint Observations:					Comment Number
A.	Soot in Proximity to / Past O-ring Groove (SPINS,	SICOR		_ Yes	No	
_	SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?			Yes	✓ No	ļ
В. С.	Sooted Grease (HAGRE)? Discolored Grease (DIGRE)?			_ Yes	No	
D.	Leak Check Port Obstructed (LPOBS)?			Yes	No No	
E.	Vent Port Obstructed (VPOBS)?			Yes	No No	
F.	Foreign material in the sealing area during motor	operation	·	- Yes	No	
• •	(FMIJ)?	- p	-	_		
G.	Rust on sealing surfaces (SSCOR)?			Yes	No	
н.	Rust on metal parts (PITCO)?			_ Yes	No	
1.	Heat affected metal (HTAFF)?			Yes	No	
J.	Damaged metal sealing surface (SSMET)?			_ Yes	No	
cor	mpletely describe the observation and its location:					
						_

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-38	

	IUNI		1110.
_	pace	 	

REVISION___

				AAOLYSUNGE (AABSEL			
Inspector(s): Rocky Ash, Wayne Sperry, Scott Eden, D. GARY NELSON							
Motor No.: OM				Date: 2-17-8			
Joint:		ne/Aft Exit Cone		d End Ring/Nose in			
	☐ Throat/Fwd I		∐ Fix	ed Housing/AFt End	Ring		
PRIMARY O-RIN	G Pa	irt No.:	0-10 5	Serial No.:	\sim 19		
A. Erosion?				Yes	No		
B. Heat Affec				Yes	No		
	Disassembly Dan			Yee	No		
D. Other? De	escribe:		-	Yes	No		
If any of the abov	e conditions exis	it, record applicab	le dimensions bel	low:			
Condition	Degree	Maximum	Circumferential		Distance		
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)		
<u> </u>	70.4	indeterminable			4.8		
<u>D</u>					$ \omega$		
							
							
							
							
							
SECONDARY O-	RING Pa	rt No.: <u>107515</u>	50-09 s	Serial No.:	20018		
(If Applicable)							
A. Erosion?				Yes	No		
B. Heat Affec				Yes	_✓ No		
	Disassembly Dam	-		Yes	No		
				Yes	No		
If any of the above	conditions exis	t, record applicabl	e dimensions bel	ow:			
Condition	Degree	Maximum	Circumferential		Distance		
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)		
	219.7°		001		386		
							
							
· .			· · · · · · · · · · · · · · · · · · ·				
							
							
Notes / Comments	1						
					ļ		
•					****		
					ļ		
	····						

Part Number:	1) Primary 15150~ 200019	Joint: Nose Secondary	Rocky Ash S. GALY 1 Inlet/TI	erson croat	e Sperry, Scott Eden
Sketch observation belo Show as much detail as				Indicate	orientation and dimensions.
Circumferential Scratch	8	70.4° 4.8		90°	L= 4.8 W= ·001 D= indeterminable
Diagonal scratches	o°	78.8°		_90°	$L = .100$ $W = .001$ $D = .001$ $Ø = 10^{\circ}$
			· .		

REV.

 DOC NO.
 TWR-17591
 VOL IV

 SEC
 PAGE A-40

otor No.: _M Left (A) Right (B) -ring Location: Pr int Number: 1) 75 orial Number:	Joint Joint Imary D'S 150-09	. Nose Inlet	/Throat	Wiper
epth:Scription:Sc	e Below	-		
etch observation below	v or ettech wo	rkeheate and list hal	ow Indicate orier	station and dimension
ow as much detail as				
		,		
	180°	219.7°	270°	
				L= .380 W= .001
		k -,380→		D= 1001
	<u> </u>			
	V			
	W			
	V			
	\			

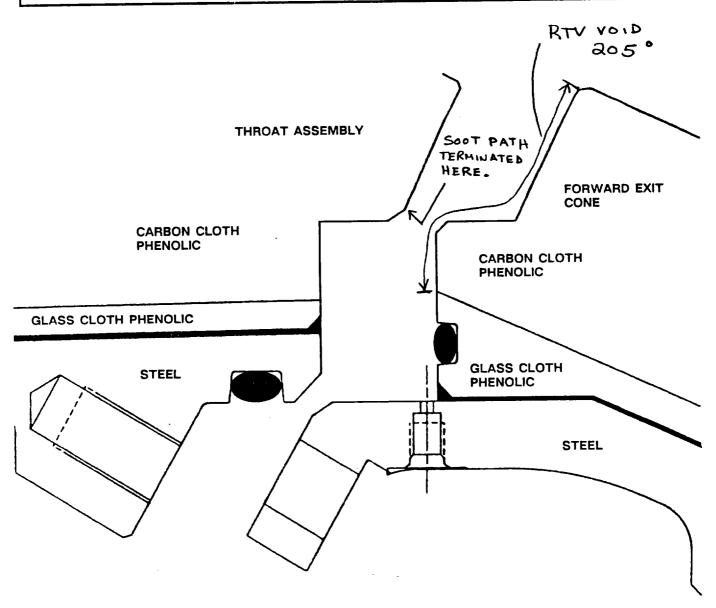
REV	NO. TWR-175	91	VOL	IV
	8EC	PAGE	A-41	

Nozzle Joint Condition - Evaluation Checkoff Worksheet

Inspector(s): KELLY BAKER, LOWELL NELSEN	
Motor No.: OM - 8	
Joint: Throat/Fwd Exit Cone (4) Fwd End Ring/Nose Inlet (3)	2)
Fixed Housing/Aft End Ring (5) Nose Inlet/Throat (3)	
Fwd Exit Cone/Aft Exit Cone (1)	
Case Field Joint Observations:	Comment Number
	Number
A. Soot in Proximity to 7 Past 5-11119 Crosts (5: Mar)	
SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	į
B. Sooled Grease (HAGRE)?	
C. Discolored Grease (DIGRE)?	
D. Leak Check Port Obstructed (LPOBS)? Yes V No	
E. Vent Port Obstructed (VPOBS)?	
F. Foreign material in the sealing area during motor operation Yes No	
(FMIJ)?	
G. Rust on sealing surfaces (SSCOR)?	
H. Rust on metal parts (PITCO)?	
L Yes I/ No	
Vec V No	
J. Damaged metal sealing surface (SSMET)?	
If any of the above conditions exist, record applicable dimensions below. Describe the observation using a comment letter, an "F" if the condition is observed on the forward end of the an "A" if the condition is observed on the aft end of the joint and any other information ne completely describe the observation and its location: 1. Grease penetrated the RTV bondline at 205° which created a RTV void to the Primary 0-ring. Soot did not reach the primary 0-ring. Soot did not reach drawing worksheet.	eded to

NO. TWR-17591 VOL IV

Motor No.: QM-8	Date: 211	4/89	Tim	e: //:0	٥
Corresponding Comment Number		Inspector(s):	KELLY	BAKER	LOWELL
					NELSEN



Observation Drawing Worksheet - Throat/Forward Exit Cone Joint

NO. TWR-17591 VOL IV

Detailed Nozzle Joint O-ring (Post-Removal) - Evaluation Checkoff Worksheet (Wasatch A-2 Bldg)

Inspector(s): Sc	OF EDEN,	WAYNE SP	ERRY D. GAL				
Motor No.: QA					15-8		
Joint:	☐ Fwd Exit Con	ne/Aft Exit Cone		End Ring/No			
	☐ Nose Injet/Ti		∐ Fixed	i Housing/AF	t Eng !	ring	
PRIMARY O-RING			150-01 50	rial No.: O			
A. Erosion?	a Pa	rt No.: <u>//75</u>	130-01 Se	riai No.: <u>U</u>			
B. Heat Affect	19				Yes	/_ No	
	r Disassembly Dan	2002			Yes		
					Yes	✓ No	
			ible dimensions belo		. •••		
Condition	Degree	Maximum	Circumferential	•••		Distance	
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)	
							
							
					- ·		
				* * *		·····	
					_ :		
SECONDARY O-RING Part No.: ///5/50-02 Serial No.: 0000020							
(If Applicable)							
	?				Yes	No	
A. Erosion? B. Heat Affect	.? Pisassembly Dam						
A. Erosion? B. Heat Affect C. Assembly/D	isassembly Dam				Yes Yes	√ No ✓ No	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De	Disassembly Dam scribe:	nage?			Yes Yes Yes	No No No	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De	Disassembly Dam scribe:	nage?			Yes Yes Yes	No No No	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Des	Disassembly Dam scribe: conditions exist	nage? t, record applica	ble dimensions below		Yes Yes Yes	No No No No No	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Det If any of the above Condition	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Det If any of the above Condition	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Det If any of the above Condition	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Det If any of the above Condition	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Det If any of the above Condition	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Det If any of the above Condition	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Det If any of the above Condition	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Det If any of the above Condition	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De: If any of the above Condition (A, B, C or D)	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De: If any of the above Condition (A, B, C or D)	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De: If any of the above Condition (A, B, C or D)	Disassembly Dam scribe: conditions exist	nage? t, record applica Maximum	ble dimensions below	 	Yes Yes Yes	No No No No No No Distance	

DOC NO. TWR-17591 VOL IV
SEC PAGE A-44

Nozzle Joint Condition - Evaluation Checkoff Worksheet

Insp	pector(s): KELLY BAKER, LOWELL NELSEN	
	or No.: QM - 8 Date: 2/14/89	
Join		
	Fixed Housing/Aft End Ring (5) Nose Inlet/Throat (3)	
	Fwd Exit Cone/Aft Exit Cone (1)	1
Cas	e Field Joint Observations:	Comment Number
Α.	Soot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes V No SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	
В.	Sooted Grease (HAGRE)? Yes V No	j
C.	Discolored Grease (DIGRE)? Yes V No	
D.	Leak Check Port Obstructed (LPOBS)? Yes No	
E.	Vent Port Obstructed (VPOBS)? Yes V No	
	Foreign material in the sealing area during motor operation Yes V No	
F.	(FMIJ)?	
G.	Rust on sealing surfaces (SSCOR)? Yes No	
Н.	Rust on metal parts (PITCO)? Yes No	
I.	Heat affected metal (HTAFF)? Yes No	
J.	Damaged metal sealing surface (SSMET)? Yes No	
	npletely describe the observation and its location:	

DOC NO.	TWR-17591	VOL	IV
SEC	PAGE	-45	

REVISION_

Detailed Nozzle Joint O-ring (Post-Removal) - Evaluation Checkoff Worksheet (Wasatch A-2 Bldg)

Inspector(s): W	AYNE SPERRY	, SCOTT	EDEN, D. GA	ay Nerson	
Motor No.: Q/	N-8		<u> </u>	Date: 2-15	-89
Join'	Fwd Exit Con			End Ring/Nose	
	☐ Throat/Fwd E		LM Fixed	Housing/AFt	End Ring
DRIMARY O RIN		-			
PRIMARY O-RIN	G Pa	rt No.: /// 75	150-05 Se	rial No.: <i>00</i>	00027
A. Erosion?	_			\	Yes No
B. Heat Affec	-			`	Yes No
	Disassembly Dam		·		Yes No
	escribe:				Yes No
		• •	ble dimensions belo	w:	
Condition	Degree	Maximum	Circumferential		Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)
					· · ·
	·- ········				
					
					
SECONDARY O-	-RING Par	rt No.: 1075	150-01 6-	-1-1-11	10
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/	it? Disassembly Dam	age?			/es No /es No
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De	it? Disassembly Dam escribe:	age?			/es No /es No /es No
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	et? Disassembly Dam escribe: conditions exist Degree	age? I, record applica Maximum			/es No /es No
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De	it? Disassembly Dam escribe: conditions exist	age?	ble dimensions below		/es No /es No /es No /es No
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	et? Disassembly Dam escribe: conditions exist Degree	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	et? Disassembly Dam escribe: conditions exist Degree	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	et? Disassembly Dam escribe: conditions exist Degree	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	et? Disassembly Dam escribe: conditions exist Degree	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	et? Disassembly Dam escribe: conditions exist Degree	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	et? Disassembly Dam escribe: conditions exist Degree	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	et? Disassembly Dam escribe: conditions exist Degree	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	Disassembly Damescribe: conditions exist Degree Location	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition (A, B, C or D)	Disassembly Damescribe: conditions exist Degree Location	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition (A, B, C or D)	Disassembly Damescribe: conditions exist Degree Location	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition (A, B, C or D)	Disassembly Damescribe: conditions exist Degree Location	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance
(If Applicable) A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition (A, B, C or D)	Disassembly Damescribe: conditions exist Degree Location	age? I, record applica Maximum	ble dimensions below		/es No /es No /es No /es No Distance

NO. TWR-17591 VOL IV

FIXEC HOUSING/AFT END RING Stat-O-Seals - Evaluation Checkoff Worksheet

Motor No.: QM-8	Date: 2-24-89	
Joint: FIXED HOUSING /AFT END RING (STAT)		
P/N 1075274-01 Lot Number _ ECL 0010		
Inspector(s): SCOTT EQEN, ROCKY ASH		6
Bolt Stat-O-Seal Observations:		Comment Number
A. Eroded Stat-O-Seals (SORE)?	Yes No	
B. HeLl Affected Stat-O-Seals (HASOR)?	Yes No	
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Yes No	
If any of the above conditions exist, describe below:		
All 72 stat-o-seals had extensive disassembly	seal damage	
7		

DOC NO.	TWR-17591		VOL	IV
SEC		PAGFA-4	17	_

Dase Factory Joint Condition - Evaluation Checkoff Worksheet

did distribute the second seco	
Inspector(s): Alan Carliste Motor No: OM-4 Date: 4/24/84	Time: 211)
motor non Sour	
Joint: ☐ Aft Dome Factory Joint (1817.6, ADS) ☐ StiffTo-Stiff. Fa ☐ ETA-To-Stiff. Factory Joint (1577.5, FSS) ☐ Aft Center Segme ☐ Fwd Segment Factory Joint (691.5, FFS) ☐ Forward Center So ☐ Fwd Dome Factory Joint (531.5, FDS)	ctory Joint (1697.5, ASS) ent Factory Joint (1331.5, ACS) egment Factory Joint (1011.5, FCS)
Case field joint observations:	Comment Number
 A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISCR, SPSOR)? B. Sooted Grease (HAGRE)? C. Discolored Grease (DIGRE)? D. Leak Check Port Obstructed (LPOBS)? E. Foreign material in the sealing area during motor operation (FMIJ)? F. Rust on sealing surfaces (SSCOR)? G. Rust on metal parts (PITCO)? I. Heat affected metal (HTAFF)? Damaged metal sealing surface (SSMET)? 	Yes No Yes X No
dition using a comment number, a "T" if the condition is obsertion is observed on the clevis and any other information needed	to describe the observation:
	e Willer
	·
-	

	Factory Joint	- Evaluation Check	off Worksheet	
Inspector(s):	Alan Cirlisk		, •	
Motor No.:	U-8	Unte	: 4/27/5°	Time: 2KD
Joint:			•	
☐ Aft Dome Fac	tory Joint (1817.5, A		Stiff, Factory Joint (16	
☐ ETA-to-Stiff.	Factory Joint (1577.5	i, FSS) Aft Cente	r Segment Factory Jo	int (1331.5, ACS)
			Center Segment Facto	ry Joint (1011.5, FCS)
⊠ Fwd Dome Fa	ctory Joint (531.5, Fl	OS)		
1. Carrosion O	n Metal Parts (PITCC))?	yes	no no
II. Sealing Sur	faca Corrosion (SSC	OR)?	yes	no no
III. Metal Dama	ge (DAMML)?		yes	
IV. Sealing Sur	face Metal Damage (SSMET)?	yes	no
V. Metal Sliver	s In Pin Holes (MSIP	H)?	yes	no
VI. Other?			yes	no
Describe	:			- 1200
If yes, record th	ne data below. Desci	ribe the observed c	ondition using the obs	servation code
of the correspon	nding condition from	above and the lette	er "C" if the condition	is observed
on the clevis or	"T" if the condition	is observed on the	tang (i.e. PITCO-T).	Field joint
	zones are mapped o			
tang and cityis				
Comment	Description	Degree	Degree	Zone
Number	(Use symbols	Start	Stop	(See zone
	from above)	Location	Location	description)
		(Deg.)	(Deg.)	
		, ,		
	- -			
Notes / Commer	nts:			
		·		
1				
	-1			

Inspector(s): 🔫						
		Wayne 5	perry Van	Pullern	<u></u>	
	M-8	 	<u>'</u>	Date: 4/2	75/89	9
Factory Joint:	.			,	,	
Forward Dome			Forward Seg			
_	Segment Factor			Segment Fact		•
Aft Segment F	-	•	Aft Segmen	it Factory Join	nt (169	7.5)
☐ Aft Dome Facto	ory Joint (1817.6)				
PRIMARY O-RIN	G Pa	irt No.: 1075	50-25 se	rial No.:	000	264
A. Erosion?		- -			Yes	√ No
B. Heat Affect	:t?				Yes	√ No
C. Assembly/	Disassembly Dan	nage?		400	Yes	No No
	escribe:				Yes	No No
			able dimensions belo			
Condition	Degrae	Maximum	Circumferential	•		Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		
		200	771 4 111	COVAP		(Length)

		. ———				· · · · · · · · · · · · · · · · · · ·
·	•					
					-	
		····				
SECONDARY O-	RING Pa	rt No.: 10751	50·25 se	erial No.:	2000	265
SECONDARY O- A. Erosion?	RING Pa	rt No.: 10751	50-25 se	erial No.:()()()()()()()()()()()()()()()()()()()(
		n No.: <u> 1.2751</u>	50-25 se	erial No.:(No
A. Erosion? B. Heat Affec C. Assembly/	t? Disassembly Dan	nage?		erial No.:(Yes	
A. Erosion? B. Heat Affec C. Assembly/	t? Disassembly Dan	nage?		erial No.:	Yes Yes	No No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De	t? Disassembly Dan escribe:	nage?			Yes Yes Yes	No No No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De	t? Disassembly Dan escribe:	nage?			Yes Yes Yes	No No No
A. Erosion? B. Heat Affect C. Assembly/ D. Other? De	t? Disassembly Dan escribe: conditions exis	nage? t, record applica	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	t? Disassembly Dan escribe: conditions exis	nage? t, record applica Maximum	ble dimensions belo		Yes Yes Yes	No No No
A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	t? Disassembly Dan escribe: conditions exis	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	t? Disassembly Dan escribe: conditions exis	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? Definition	t? Disassembly Dan escribe: conditions exis	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? Definition	t? Disassembly Dan escribe: conditions exis	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? Definition	t? Disassembly Dan escribe: conditions exis	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition	t? Disassembly Dan escribe: conditions exis	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? Definition	t? Disassembly Dan escribe: conditions exis	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? Definition	t? Disassembly Dan escribe: Conditions exis Degree Location	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: Conditions exis Degree Location	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: Conditions exis Degree Location	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: Conditions exis Degree Location	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affect C. Assembly/ D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: Conditions exis Degree Location	nage? t, record applica Maximum	ible dimensions belo Circumferential		Yes Yes Yes	No No No Distance

NO. TWR-17591 VOL IV

REVISION____

Case Factory Joint Condition - Evaluation Checkon	
Inspectoris): Alen Carliste	3.526
Motor No.: 0M-8 Date: 4/24/89	Time: 2330
Joint: Aft Dome Factory Joint (1817.6, ADS) StiffTo-Stiff. Factory of ETA-To-Stiff. Factory Joint (1577.5, FSS) Fwd Segment Factory Joint (691.5, FFS) Fwd Dome Factory Joint (531.5, FDS)	ctory Joint (1331.5, ACS)
Case field joint observations:	Comment Number
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? B. Sooted Grease (HAGRE)? C. Discolored Grease (DIGRE)? D. Leak Check Port Obstructed (LPOBS)? E. Foreign material in the sealing area during motor operation (FMIJ)? F. Rust on sealing surfaces (SSCOR)? G. Rust on metal parts (PITCO)? H. Heat affected metal (HTAFF)? Damaged metal sealing surface (SSMET)? If any of the above conditions exist, record applicable dimensions belodition using a comment number, a "T" if the condition is observed or	Yes No
tion is observed on the clevis and any other information needed to de	scribe the observation.
•	
	•
-	
	•
	•

	Factory Joint	- Evaluation Check	off Worksheet		
Inspector(s): A	Van Carliste		,		
Matar No.: QA	1-8	Date	4/24/89	Time: 2330	
Joint:					
	tory Joint (1817.6, A	•	Stiff, Factory Join		
1				ry Joint (1331.5, ACS)	
/	•		Center Segment F	factory Joint (1011.5, FC	S)
	ctory Joint (531.5, F		<u></u>		
	n Metal Parts (PITC)			yes no	
_	aca Corrosion (SSC	OR)7		yes no	
	ge (DAMML)?	001457\0		yes no	
_	ace Metal Damage (2/	
	s In Pin Holes (MSIP	н)?		yes X no	
VI. Other?					ĝ.
Describe:	e data below. Descr	ribe the observed co	andition using the	observation code	Ť.
	e data below. Descri				1
	"T" if the condition			· ·	
	cones are mapped o			Tyr Class James	
lang and clevis a	ones are mapped o	ut on the second pa	ge of this form	ومناهرة والمنافرة	£10.4
Comment	Description	Degree	Degree	Zone	\$ * ;
Number	(Use symbols	Start	Stop	(See zone	ļ
	from above)	Location	Location	description)	
		(Deg.)	(Deg.)		Ŧ
					,
				- · · · · · · · · · · · · · · · · · · ·	
					,

				-	
	· · · · · · · · · · · · · · · · · · ·			·	
Notes / Comment	s:		<u> </u>	· · · · · · · · · · · · · · · · · · ·	
		•			
See attached s	neet(s)				
		-			
			200		
REV			NO. TWR-	-17591 VCL IV	_
	•		SEC	PAGEA-52	

REVISION_

Detailed Case Factor	y Joint O-ring (Post-Removal) -	Evaluation Checkoff	Worksheet	(Wasate	ch A-2 Bldg)
Inspector(s): () ayı	e-500m	Rocky Hsh	ijan Pulleyn			
Motor No.: QM-5	8 7 7		<u> </u>	ite: 4-2	5-87	
Factory Joint:					1-:-4	.ea. e)
Forward Dome Fa	actory Joint (53	1.5)	Forward Segm			
 Forward Center S	Segment Factory	Joint (1011.5)	Aft Center Seg			
Aft Segment Fac	tory Joint (1577	.5)	Aft Segment F	actory Join	(1097	.3)
Aft Dome Factor				<u></u>		1
PRIMARY O-RING	Par	t No.: 14.75150	-25 Serie	i No.: <u>CX</u>		/
A. Erosion?					Yes	No
B. Heat Affect	?				Yes	No
	isassembly Dam	age?			Yes	No
D. Other? Det	scribe:				Yes	No
if any of the above	conditions exis	t, record applicat	ole dimensions below	:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	•	(Length)
(2, 5, 5 5, 5)						
		. —	•			·
	<u> </u>					
		•		•		
				,		
SECONDARY O-	RING Pa	rt No.: 147515	O-25 Se	rial No.: <u>00</u>	7002	/
A. Erosion?					Yes	No
B. Heat Affec	t?				Yes	No No
C. Assembly/	Disassembly Dar	mage?			Yes	No
	scribe:				Yes	No
			ible dimensions belov	v:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
(A, 5, 6 6, 5)						
						
Notes / Comment						
Notes / Comment						
Notes / Comment	•					
Notes / Comment	35					
Notes / Comment	•			DOC		E01 Với.

A-53

Case Factory Joint Condition - Evaluation Checkoff Worksheet Un Carliste Inspector(s): | Time: //00 Date: Motor No.: Joint: ☐ Stiff.-To-Stiff. Factory Joint (1697.5, ASS) Aft Dome Factory Joint (1817.6, ADS) ☐ ETA-To-Stiff, Factory Joint (1577.5, FSS)☐ Aft Center Segment Factory Joint (1331.5, ACS) Fwd Dome Factory Joint (531.5, FDS) Comment Number Case field joint observations: A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISCR, SPSOR)? Yes B. Sooted Grease (HAGRE)? Yes C. Discolored Grease (DIGRE)? Yes D. Leak Check Port Obstructed (LPOBS)? Foreign material in the sealing area during motor operation Yes (FMIJ)? Yes Rust on sealing surfaces (SSCOR)? Yes G. Rust on metal parts (PITCO)? Yes Heat affected metal (HTAFF)? Yes Damaged metal sealing surface (SSMET)? If any of the above conditions exist, record applicable dimensions below. Describe the observed condition using a comment number, a "T" if the condition is observed on the tang or a "C" if the condition is observed on the clevis and any other information needed to describe the observation:

	Factory Joint	 Evaluation Checko 	it Worksneet		
Inspector(s):	Van Carliste	· ·	· · · ·		
Motor No.: (2)	U-8	Date	5/9/89		
Joint:			,		
☐ Aft Dome Fac	tory Joint (1817.6, AD	os) 🔲 Stiffto-S	tiff. Factory Join	t (1697.5, ASS)	
T ETA-to-Stiff	Factory Joint (1577.5	. FSS) Aft Center	Segment Factor	y Joint (1331.5, ACS	5)
Fwd Segment	Factory Joint (691.5,	FFS) Forward C	enter Segment F	actory Joint (1011.5	. FCS)
	ctory Joint (531.5, FD				
I. Corrosion C	n Metal Parts (PITCO)?		yes no	
II. Sealing Sur	faca Corrosion (SSCC)R)?		yes no	
III. Metal Dama	ge (DAMML)?			yes no	
IV. Sealing Sur	face Metal Damage (SSMET)?		yes no	
V. Metal Sliver	s in Pin Holes (MSIPI	H)?		yes no	
VI. Other?				yes no	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Describe	: <u> </u>				· — 经基础
If yes, record th	ne data below. Descr	ibe the observed co	indition using the	observation code	。[2] 整語
of the correspo	nding condition from	above and the lette	r "C" if the cond	lition is observed	
on the clevis or	"T" if the condition	is observed on the	tang (i.e. PITCO-	-T). Field joint	
tang and clevis	zones are mapped or	ut on the second pa	ge of this form.		
Comment	Description	Degree	Degree	Zone Zone	\$5,83±0₹
		Start .	Stop	(See zone	
Number	(Use symbols	Location	Location	description)	. [
	from above)	•		and same of t	**
		(Deg.)	(Deg.)	्रवा विक्रिकीय विक्रमान्य । 	
				_	- '
				<u> </u>	_
					_
					_
				-	-
	 				-
1					
Notes / Comme	nts:				
		•			
					! .
					İ
☐ See attached	sheet(s)				
					7.1/
DE1/			NO. TV	VR-17591 vc.	IV
REV			SEC	PAGE A-55	

			-		
MORTON THIO					
Space Operati	ons				
etailed Case Fact	orv Joint O-rina	(Post-Removal)	- Evaluation Checko	ff Worksheet (W	asatch A-2 Bidg
		Wayne Spe			
	1-8	terry spe	THE TOWN THE	Date: 5/10/	89
actory Joint:	· · · · · · · · · · · · · · · · · · ·				ж.,
Forward Dome	Factory Joint (5:	31.5)	☐ Forward Seg	ment Factory Jo	oint (691.5)
Forward Center	Segment Factor	y Joint (1011.5)	Aft Center S	Segment Factory	Joint (1331.5)
Aft Segment Fa	actory Joint (157	7.5)	Aft Segmen	t Factory Joint (1697.5)
Aft Dome Facto	ory Joint (1817.6)			
RIMARY O-RIN	G Pa	int No.: 1075	150-25 Se	rial No.: _CCC	0293
A. Erosion?		<u> </u>		Y•	s √ No
B. Heat Affect	:t?			Y•	* No
C. Assembly/	Disassembly Dan	nage?		Y•	s No
D. Other? De	escribe:			Y•	* No
f any of the abov	e conditions exis	it, record applica	able dimensions beig	w:	
Condition	Degree	Maximum	Circumferential		Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)
					
			•		
		·		<u> </u>	
SECONDARY O-	-RING Pa	rt No.:	5150-25	erial No.: OC	00250
A. Erosion?		<u> </u>	<u> </u>	Ye	
B. Heat Affect	:17			Ye	
	Disassembly Dan	nage?		Ye	
D. Other? De	•			Ye	
		it, record applica	able dimensions belo		
Condition	Degree	Maximum	Circumferential		Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)
· · · · · · · · · · · · · · · · · · ·					
-					
•					

Notes / Comments

DOC NO.	TWR-1759	91		NOT IA
SEC		PAGE	Α-	·56

Rev. _

Case Factory Joint	Condition - Evaluation Ch	eckoff Worksheet	
Inspector(s): Alan (arliste.		Time: //30	
Motor No.: 0M-B	Date: 4/14/89	1 Time: 77,50	
Joint: Aft Dome Factory Joint (1817.6, AD ETA-To-Stiff, Factory Joint (1577.5) Fwd Segment Factory Joint (691.5, Fwd Dome Factory Joint (531.5, FD	, FSS)⊠Aft Center Segme FFS) □ Forward Center S	actory Joint (1697.5, ASS) ent Factory Joint (1331.5, AC egment Factory Joint (1011.	S) 5, FCS;
Case field joint observations: A. Soot in Proximity to / Past O-ring SOINT, SPINT, SIPOR, SPPOR SIS	Graove (SPINS, SICOR	Yes X No	Number
B. Sooted Grease (HAGRE)?C. Discolored Grease (DIGRE)?D. Leak Check Port Obstructed (LPC)E. Foreign material in the sealing are	BS)? ea during motor operation	Yes No Yes No Yes No	=
(FMIJ)? F. Rust on sealing surfaces (SSCOR G. Rust on metal parts (PITCO)? H. Heat affected metal (HTAFF)? Damaged metal sealing surface (Yes No Yes No Yes X No Yes X No	<u> </u>
If any of the above conditions exist, dition using a comment number, a "tion is observed on the clevis and are in the configuration of	ny other information needs	If of growt and Prinary	n:

DOC NO. TWR-17591 VOL IV SEC Page A-57

REV.

	Factory Joint	- Evaluation Check	off Worksheet	
Inspector(s): A	an Carlisle			
Motor No.: QN	14	Date	14/14/85	- Khe! 1/30
Joint:				
☐ Aft Dome Fac	tory Joint (1817.6, A	DS)	Stiff. Factory Joint (1697.5, ASS)
☐ ETA-to-Stiff.	Factory Joint (1577.	5, FSS) 🖂 Aft Cante	r Segment Factory	Joint (1331.5, ACS)
			Jenter Segment Fac	tory Joint (1011.5, FCS)
	ctory Joint (531.5, F		V	
	n Metal Parts (PITC)		X ye	
	face Corrosion (SSC	OR)?	ye	
	ige (DAMML)?	(0014FT) A	ye	
	face Metal Damage (ye	$\overline{\vee}$
	s in Pin Holes (MSIP	'Н)? .	ye	/ 🔾
VI. Other?			,	-/-
Describe		-th- shapped o	andition using the O	heervation code
	e data below. Desc			
	nding condition from			
	"T" if the condition			. Held John
tang and clevis	zones are mapped o	ut on the second pa	age of this form.	
Comment	Description	Degre e	Degree	Zone
Number	(Use symbols	Start	Stop	(See zone
	from above)	Location	Location	description)
		(Deg.)	(Deg.)	.,
	1-0	0	36D	<u> </u>
	1-T	D	360	\mathcal{B}
		•		
Notes / Commer				
Notes / Commen	n. 3.			
				}
			•	
See attached	sheet(s)			
C See attached	3110 0 1(3)			

DOC NO.

TWR-17591

A-58

Space Operations

REVISION_

Detailed Case Factor	ry Joint O-ring					1
Inspector(s): K	cky Ash L	Dayne Spe		w/2411		
Motor No.: (XY)		1'	<i>d</i> ']	Date: ` 4//	8/87	
Factory Joint:	•			,	•	
Forward Dome F	actory Joint (53	11.5)	☐ Forward Seg	ment Factor	y Joint	(691.5)
Forward Center	Segment Factor	y Joint (1011.5)	Aft Center S	egment Fact	tory Joi	nt (1331.5)
Aft Segment Fac	tory Joint (1577	7.5)	Aft Segment	t Factory Joi	nt (169	7.5)
Aft Dome Factor						
			CA) C	rial No.:	~~~	<u> </u>
PRIMARY O-RING	i Pa	n No.: 10751	3/43			
A. Erosion?			•		Yes	No
B. Heat Affect	7				Yes	→ No
C. Assembly/D	isassembly Dan	nage?			Yes	No
D. Other? Des	scribe:				Yes	No
If any of the above	conditions exis	t, record applica	able dimensions belo	w:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Wldth	CSVAP		(Length)
(A, B, O 0, D)	2002		_			
		•			_	
•						
				<u></u>		
					 .	· · · · · · · · · · · · · · · · · · ·
						
		11/75				2111
SECONDARY O-I	RING Pa	irt No.: <u>1075</u>	150-25 se	erial No.:		,
SECONDARY O-I	RING Pa	 irt No.: <u> U75</u>	150-25 se	erial No.:	Yes	No
A. Erosion? B. Heat Affect	?		<u> </u>	erial No.:	Yes Yes	No
A. Erosion? B. Heat Affect			150-25 se	erial No.:	Yes Yes Yes	No No No
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De	? Disassembly Dan scribe:	nage?			Yes Yes	No
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De	? Disassembly Dan scribe:	nage?	150-25 Se		Yes Yes Yes	No No No
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De	? Disassembly Dan scribe:	nage?			Yes Yes Yes	No No No
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Defended in the above Condition	? Disassembly Dan scribe: conditions exis	nage? et, record applica	able dimensions belo		Yes Yes Yes	No No No No
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Defended in the above Condition	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Defended in the above Condition	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Defended in the above Condition	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Defended in the above Condition	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Defended in the above Condition	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Defended in the above Condition	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Defended in the above Condition	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De If any of the above Condition (A, B, C or D)	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? Defended in the above Condition	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De If any of the above Condition (A, B, C or D)	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De If any of the above Condition (A, B, C or D)	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affect C. Assembly/D D. Other? De If any of the above Condition (A, B, C or D)	? Disassembly Dan scribe: conditions exis	nage? st, record applica Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance

Case Factory Joint Condition - Evaluation Checkoff Worksheet Motor No.: Time: /33/ Joint: Aft Dome Factory Joint (1817.5, ADS) ☐ Stiff.-To-Stiff. Factory Joint (1697.5, ASS) ☑ ETA-To-Stiff. Factory Joint (1577.5, FSS) ☐ Aft Center Segment Factory Joint (1331.5, ACS) ☐ Fwd Segment Factory Joint (691.5, FFS) ☐ Forward Center Segment Factory Joint (1011.5, FCS) ☐ Fwd Dome Factory Joint (531.5, FDS) Case field joint observations: Comment Number A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? Sooted Grease (HAGRE)? Yes C. Discolored Grease (DIGRE)? Yes Leak Check Port Obstructed (LPOBS)? Yes No Foreign material in the sealing area during motor operation Yes (FMIJ)? Rust on sealing surfaces (SSCOR)? Yes Rust on metal parts (PITCO)? Yes No Heat affected metal (HTAFF)? Yes No Damaged metal sealing surface (SSMET)? If any of the above conditions exist, record applicable dimensions below. Describe the observed condition using a comment number, a "T" if the condition is observed on the tang or a "C" if the condition is observed on the clevis and any other information needed to describe the observation: Intermittent and spothy light to medium corrosion on outer clevis les. LIGHT COrrosion in clevis bottom at 101-107.0

TWR-17591 | VOL 1V

REV.

	Factory Joint	- Evaluation Checkoff	Worksheet	
Inspector(s):	Van Carliste	Wave Kowsell		
Motor No.:	M-8	Unte:	3/2/89	
	tory Joint (1817.6, A Factory Joint (1577. Factory Joint (691.5 ctory Joint (531.5, A	5, FSS) \square Aft Center S 5, FFS) \square Forward Cer	f. Factory Joint (16 Segment Factory Jo Inter Segment Facto	int (1331.5, ACS) ry Joint (1011.5, FCS)
	on Metal Parts (PITC			no
	faca Corrosion (SSC		yes	1
	ge (DAMML)?		yes	
IV. Sealing Sur	face Metal Damage	(SSMET)?	yes	
V. Metal Slive	rs In Pin Holes (MSI	PH)?	yes	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
VI. Other?			yes	
Describe	e:	cribe the observed con	dition using the ch	servation code
on the clevis o	r "T" if the conditio	n above and the letter n is observed on the ta out on the second pag	ang (i.e. PITCO-1).	Field joint
Comment	Description	Degree	Degree	Zone
Number	(Use symbols	Start	Stop	(See zone
	from above)	Location	Location	description)
		(Deg.)	(Deg.)	11
)	PITO-C	Internitient and of	UK/	<u>///</u>
7	P110-C	/0/	107	_ <i>H</i>
3	OHMMI-C	18.24.38	316	F
3	DAMMI-C	38,3/6		<u>£</u>
	12 map			
		-		
Notes / Comme	HEAT AND SOUTHY, I	IGHT TO medium		
المرابع المرابع	Wasibu	•		
2) Light (0) 3) Scratches				
17) 5/10/10/03	•			
See attached	d sheet(s)			

TWR-17591 | VCL | PAGE A-61

DOC NO. SEC

			- Evaluation Checko			
Motor No.:	OM-8	i '		Date: 3/4	189	-
Factory Joint:				_		
_	Factory Joint (5			ment Factor		•
		ry Joint (1011.5)	<u>=</u>	Segment Fact	-	•
Aft Segment Fa			∐ Ait Segmen	t Factory Join	11 (109	7.5)
Aft Dome Facto	ory Joint (1817.6)				
PRIMARY O-RIN	G P	art No.: [475]	50 - 25 Se	rial No.: OC	2002	80
A. Erosion?			•		Yes	No No
B. Heat Affec	:t?				Yes	No
C. Assembly	Disassembly Da	mage?			Yes	No No
					Yes	No
-			able dimensions belo	w:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	•	(Length)
			atain · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·
					_ :	
		•	•			·
 .			·		-	
						·
SECONDARY O-	-RING P	art No.: 147519	50-25 s	erial No.:	<u> </u>	283
A. Erosion?					Yes	No
B. Heat Affect	t?				Yes	No
C. Assembly	Disassembly Dai	mage?			Yes	No
D. Other? D	escribe:				Yes	No
f any of the abov	e conditions exi	st, record applica	able dimensions belo	w:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
					- -	
						
					-	· · · · · · · · · · · · · · · · · · ·
					_ ·	
					_ :	

NO. TWR-	17591	<u>, </u>
SEC	PAGE	
	. A-62	

Specior(s): Ain Carliell, Lave Rousell	Time: 0600
otor No.: Q/4-8 Date: 7/2/87	
pint:	ory Joint (1697.5, ASS)
Aft Dome Factory Joint (1817.6, ADS)	t Factory Joint (1331.5, ACS)
Aft Dome Factory Joint (1817.6, ADS) Stift10-Stift. Factory Joint (1577.5, FSS) Aft Center Segment	ment Factory Joint (1011.5, FCS)
T Find Segment Factory Joint (691.5, 11.5)	
Fwd Dome Factory Joint (531.5, FDS)	Comme
Case field joint observations:	Number No
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR	Yes No
SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	Yes X No
- L Crass (HAGRE)?	Yes X No
n Discolared Grease (DIGRE)?	Yes X No
a constant of (1 POBS) (Yes No
 Leak Check Port Obstructed (2. 323) Foreign material in the sealing area during motor operation 	
(EMLI)?	Yes X No
F. Rust on sealing surfaces (SSCOR)?	Yes No Z
G. Rust on metal parts (PITCO)?	Yes X No
Heat affected metal (HTAFF)?	Yes No
Damaged metal sealing surface (SSMET)?	in the second column
of the above conditions exist, record applicable dimension	ns below. Describe the observed con
If any of the above conditions exist, record applicable dimension dition using a comment number, a "T" if the condition is obsertion is observed on the clevis and any other information needed 1) FMIJ-C: Fiber on land between Oring Groov (2) Light corrosion downstream of Secondary Groving 149-195	to describe the observation.
dition using a comment number, a tion is observed on the clevis and any other information needed tion is observed on the clevis and any other information needed 1) FM IJ-C: Fiber on land between O-ring grooved 1) FM IJ-C: Fiber on land between O-ring grooved 2) / 1'aht corrosien downstream of Secondary gro	to describe the observation.
dition using a comment number, a line of secondary growth of corrosium daynstream of secondary growth and light corrosium daynstream of secondary growth	to describe the observation.
dition using a comment number, a tion is observed on the clevis and any other information needed tion is observed on the clevis and any other information needed 1) FM IJ-C: Fiber on land between O-ring grooved 1) FM IJ-C: Fiber on land between O-ring grooved 2) / 1'aht corrosium dawnstream of Secondary gro	to describe the observation.
dition using a comment number, a tion is observed on the clevis and any other information needed 1) FM IJ-C: Fiber on land between Oring groovs 2) Light corrosian downstream of secondary groovs 147-175	to describe the observation.
dition using a comment number. In the distribution is observed on the clevis and any other information needed tion is observed on the clevis and any other information needed 1) FM IJ-C: Fiber on land between O-ring growth 1) FM IJ-C: Fiber on land between O-ring growth 2) Light corrosium dawnstream of Secondary growth 147-175	to describe the observation. Sove at 15-21, 32, 36-45, 84
dition using a comment number, a tion is observed on the clevis and any other information needed 1) FMIJ-C: Fiber on land between Oring Groove 2) Light corrosian downstream of Secondary Groove 147-175	to describe the observation. Sove at 15-21, 32, 36-45, 84
dition using a comment number. In the comment number, a tion is observed on the clevis and any other information needed 1) FMIJ-C: Fiber on land between Oring Groove 2) Light corrosion downstream of Secondary Groove 147-175	to describe the observation. Sove at 15-21, 32, 36-45, 84
dition using a comment number. In the comment number, a tion is observed on the clevis and any other information needed 1) FMIJ-C: Fiber on land between Oring Groove 2) Light corrosion downstream of Secondary Groove 147-175	to describe the observation. Sove at 15-21, 32, 36-45, 84
dition using a comment number, a tion is observed on the clevis and any other information needed 1) FMIJ-C: Fiber on land between Oring Groove 2) Light corrosian downstream of Secondary Groove 147-175	to describe the observation. Sove at 15-21, 32, 36-45, 84
dition using a comment number, a tion is observed on the clevis and any other information needed 1) FMIJ-C: Fiber on land between Oring Groove 2) Light corrosian downstream of Secondary Groove 147-175	to describe the observation. Sove at 15-21, 32, 36-45, 84

	Factory Joint	- Evaluation Checkof	f Worksneet	
spector(s):	Van Golisie	Dave Rowsel		
	1-8	Unte:	3/2/89	
ETA-to-Stiff. F	Factory Joint (691.5	, FSS) ☐ Aft Center , FFS) ☐ Forward C	liff. Factory Joint (16 Segment Factory Joi enter Segment Factor	nt (1331.5, ACS)
	tory Joint (531.5, Fi		X yes	no
	n Metal Parts (PITCC aca Corrosion (SSC		yes	no
		J , .	yes	no
II. Metal Damas	ge (DAMML)? ace Metal Damage (SSMET)?	yes	no
	s In Pin Holes (MSIF		yes	no
	2 111 111 110:00 (,	yes	no
VI. Other? Describe:			andition using the obs	
on the clevis or	"T" if the condition	is observed on the out on the second pa	er "C" if the condition tang (i.e. PITCO-T). age of this form.	Field joint
Comment	Description	Degree	Degree	Zone
	(Use symbols	Start	Stop	(See zone
Number	from above)	Location	Location	description)
	Hom above,	(Deg.)	(Deg.)	
,	Ριτιο- C	751	/37	<u> </u>
	Die	17-21.32.36-4	15,84,147-175	<u>6</u>
2	PITCO-C	2/5	348	<i>F</i>
3	DAMML-C			
Notes / Comme 1) Intermitte 2) Intermitter 3) Scrutch	ents: Timedium corres Hight corrosion o	jun on outer Lovis javnstleimof second	petween inted dear	er iocai, uns.

DOC TWK-17591

VCF IA

Detailed Case Fac		11 031 1101110 1017			. (a s.	aton A E bicg;
Inspector(s):	CCKy Ash	Wayne	Sperry , P. C	BANY NE	كره	
	M-8'	1	· 1		-6-	89
Factory Joint:						
Forward Dome	Factory Joint (5	31.5)	☐ Forward Seg	ment Factor	ry Joint	(691.5)
Forward Center	Segment Facto	ry Joint (1011.5)	Aft Center S	egment Fac	tory Jo	int (1331.5)
Aft Seament F	actory Joint (157	7.5)	Aft Segment	Factory Joi	int (169	7.5)
	ory Joint (1817.6	•	_ •	•	•	•
		·				
PRIMARY O-RIN	G Pa	art No.:	5150-25 Se	rial No.:	<u> </u>	0392
A. Erosion?					Yes	/_ No
B. Heat Affect	:t?				Yes	No
C. Assembly/	Disassembly Dar	nage?			Yes	No
D. Other? D	escribe:				Yes	No
If any of the abov	e conditions exis	st, record applica	able dimensions below	w:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	•	(Length)
(,,, _, _ ,			***************************************			(==::g)
						
					 .	
			-		- ,-	
 .	•		·			
SECONDARY O-	PING P	- No. 1137	E1EA 25 00			~ ~ 71
	TIII Pa	rt No.: 107	2130945 Se	rial No.:	_	
A. Erosion?					Yes	No
B. Heat Affec		_	•		Yes	No No
	Disassembly Dan	=			Yes	_✓ No
					Yes	No
If any of the above	e conditions exis	t, record applica	ible dimensions belov	v:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)

			 			···
	•		·			
						
Notes / Comments						
	•					
	i.					

NO TWR-17591 VOL IV

REVISION____

Rev. ____

Inspection(s): Alan Carliste Dave Rowsel Motor No: M-B Date: 3/2/87 Time: 0335 Joint: Aft Dame Factory Joint (1817.5, ADS) Stiff, -To-Stiff, Factory Joint (1831.5, ACS) ETA-To-Stiff, Factory Joint (1577.5, FSS) Aft Center Segment Factory Joint (1331.5, ACS) Fwd Segment Factory Joint (531.5, FFS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (1531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (1531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (1531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (1531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Case field joint observations Fest Vest Vest Vest Vest Vest Vest Vest V	Jase Factory Joint Condition - Evaluation Ch	heckoff Worksheet
Joint: Aft Dame Factory Joint (1817.5, ADS)	Inspector(s): Alan Carliste, Dave Rowsell	
Aft Dome Factory Joint (1817.6, ADS)	Motor No.: 01 -8 Date: 3/2/89	Time: 0336
A. Scot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes No SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? B. Scoted Grease (HAGRE)? Yes No Discolored Grease (DIGRE)? Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the sealing area during motor operation Yes No CE. Foreign material in the Sealing Area No CE. Foreign material in the Sealing Area No CE. Foreign material in the Sealing Area No CE. Foreign material in the Sealin	Aft Dome Factory Joint (1817.6, ADS) StiffTo-Stiff. Fa ETA-To-Stiff. Factory Joint (1577.5, FSS) Aft Center Segme Fwd Segment Factory Joint (691.5, FFS) Forward Center S	ent Factory Joint (1331.5, ACS)
A. Scot in Proximity to I Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? B. Scoted Grease (HAGRE)? C. Discolored Grease (DIGRE)? D. Leak Check Port Obstructed (LPOBS)? E. Foreign material in the sealing area during motor operation Yes No (FMIJ)? F. Rust on sealing surfaces (SSCOR)? G. Rust on metal parts (PITCO)? H. Heat affected metal (HTAFF)? Damaged metal sealing surface (SSMET)? If any of the above conditions exist, record applicable dimensions below. Describe the observed condition using a comment number, a "T" if the condition is observed on the tang or a "C" if the condition is observed on the clevis and any other information needed to describe the observation:	Case field joint observations:	
1	 A. Scot in Proximity to I Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? B. Sooted Grease (HAGRE)? C. Discolored Grease (DIGRE)? D. Leak Check Port Obstructed (LPOBS)? E. Foreign material in the sealing area during motor operation (FMIJ)? F. Rust on sealing surfaces (SSCOR)? G. Rust on metal parts (PITCO)? Heat affected metal (HTAFF)? Damaged metal sealing surface (SSMET)? If any of the above conditions exist, record applicable dimension dition using a comment number, a "T" if the condition is obsertion is observed on the clevis and any other information needed 	Yes No No Number Yes No No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes Yes No Yes Yes No Yes Yes No Yes Yes No Yes Yes No Yes Yes No Yes Yes No Yes Yes No Yes Yes No Yes Yes No Yes Yes No Yes Yes Yes No Yes Yes Yes No Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes

DOC NO. TWR-17591 VOL IV SEC Page A-66

REV.

	Factory Join	t - Evaluation Checkoff	Worksheet	
inspector(s): A	Van Carliste	Dave Rowsell		
Motor No.: OA	1-8	Date:	3/2/89	
Joint:				
Aft Dome Fac	tory Joint (1817.5,		f. Factory Joint (16	
☐ ETA-to-Stiff.	Factory Joint (1577	.5, FSS) 🗌 Aft Center S	egment Factory Joi	nt (1331.5, ACS)
		5, FFS) Forward Cen	iter Segment Factor	y Joint (1011.5, PCS)
	ctory Joint (531.5,			
	n Metal Parts (PITC		yes	no
	faca Corrosion (SSC	COR)?	yes	no
	ge (DAMML)?		yes	no
IV. Sealing Sur	face Metal Damage	(SSMET)?	yes	_X no
V. Metal Sliver	s In Pin Holes (MSI	PH)?	yes	_X no
VI. Other?			yes	_X_ no
Describe				
		cribe the observed cond		
of the correspo	nding condition from	m above and the letter	"C" if the condition	is observed
		n is observed on the ta		Field joint
tang and clevis	zones are mapped	out on the second page	e of this form.	
Comment	Description	Degree	Degree	Zone
Number	(Use symbols	Start	Stop	(See zone
	from above)	Location	Location	description)
		(Deg.)	(Deg.)	
,	PITCO-41/	Intermitten en ter	Ciramforence	M
	Odumb C	8,2204,26,28,36,34		F
2	DAMML-C		, <u>, , , , , , , , , , , , , , , , , , </u>	
		306 :08-3,6346		1/0
3	BAYNL-T	302	246	14/18
	•	•		
Notes / Common				
Notes / Commer		•		
11/2			_	
2) Kraiker	the land the at	sealing surface to cha	imper corner	
3) Scratches H), 15 (IOMIC) MARION			
See attached	sheet(s)	-		

TWR-17591

NO.

SEC

			- Evaluation Checks			1 X-2 010g/
Inspector(s): R	ocky Ash	Wayne Sp	erry, D-64	RY NELSON)	
Motor No.:	M-3			Date: 3	-6-89	· · · · · · · · · · · · · · · · · · ·
Factory Joint:			-	_		
Forward Dome			_	gment Factor		· ·
==		ry Joint (1011.5)		Segment Fac	-	
l — .	actory Joint (157		∐ Aft Segmen	t Factory Joi	nt (1697.5)
Aft Dome Facto	<u>.</u>	·				
PRIMARY O-RIN	G Pa	nt No.: 117	5150-25 se	erial No.:	000010	27
A. Erosion?			•		Yes _	·/ No
B. Heat Affec	:t?				_	✓ No
· ·	Disassembly Dan					√ No
					Yes _	_√ No
			ble dimensions belo	ow:	_	
Condition	Degree	Maximum	Circumferential			istance
(A, B, C or D)	Location	Depth	Width	CSVAP	. (Length)
						
 						
	· · · · · · · · · · · · · · · · · · ·	·	·			·
		· · · · · ·	·		- . 	
						
SECONDARY O-	RING Pa	irt No.: 1075	5150-25 se	erial No.:	9000 a	291
SECONDARY O- A. Erosion?	RING Pa	int No.: 1075	5150-25 se	erial No.:	<u>Como 2</u>	291 V No
		int No.: 1075	5150-25 s	erial No.:		
A. Erosion? B. Heat Affec			5150-25 se	erial No.:	Yes _	No
A. Erosion? B. Heat Affec C. Assembly/	t? Disassembly Dan			erial No.:	Yes _ Yes _	No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De	t? Disassembly Dan escribe:	nage?			Yes _ Yes _	NO NO NO NO NO NO NO NO NO NO NO NO NO N
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De	t? Disassembly Dan escribe: e conditions exis	nage? it, record applica			Yes _ Yes _ Yes _	NO NO NO NO NO NO NO NO NO NO NO NO NO N
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De	t? Disassembly Dan escribe: e conditions exis	nage? it, record applica	ble dimensions belo		Yes _ Yes _ Yes _	NO NO
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition	t? Disassembly Dan escribe: conditions exis	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition	t? Disassembly Dan escribe: conditions exis	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition	t? Disassembly Dan escribe: conditions exis	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: conditions exis	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: conditions exis	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: conditions exis	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: conditions exis	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: B conditions exis Degree Location	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: B conditions exis Degree Location	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: B conditions exis Degree Location	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No
A. Erosion? B. Heat Affec C. Assembly/I D. Other? De If any of the above Condition (A, B, C or D)	t? Disassembly Dan escribe: B conditions exis Degree Location	nage? et, record applica Maximum	ble dimensions belo Circumferential		Yes _ Yes _ Yes _	No No No No

NO. TWR-17591 VOL IV

Detailed Port Plug O-ring (Post-Removal) - Evaluatio				
Motor No.: QM - 8	Date:	3-13	<u>3-89</u>	
Joint: S&A to Adapter (S&A) Adapter to Case (IGN)	Ad	apter to	Chamber	(IGI)
Plug: Keak Check(LEAK) Degree /26				
	ARY	NEL	SON	
PRIMARY O-RING Part No.: A. Erosion (PORE)? B. Heat Affect (HAPOR)? C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)? If any of the above conditions exist, record below:	Y	es es es	No No No	Comment Number
SECONDARY O-RING (or Shoulder) Part No.: 1050228-25 Lot No.: ECLOOI3 A. Erosion (SORE)? B. Heat Affect (HASOR)? C. Cuts, Assembly/Disassembly Damaga (SCUT, SDMG, SDIS)? If any of the above conditions exist, record below: 1. O-ring had O.D. Circum ferent		es es es	No No No	Comment Number
CLOSURE SCREW O-RING Part No.: A. Erosion (CORE)? B. Heat Affect (HACOR)? C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)? If any of the above conditions exist, record below:		es es	No No No	Comment Number ———

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-69	

Detailed Port Plug O-ring (Post-Removal) - Evaluation	Checkoff Workshee	e t	
	Date: 3-13	-8°	
Motor No.: ♠M - 8 Joint: XS&A to Adapter (S&A)	Adapter to Ch	amber	(IGI)
Joint: Again to Happen 306			
Plug: Aced (AC)	Y NELSON		
			Comment
PRIMARY O-RING Part No.: Lot No.:		N.	Number
A. Erosion (PORE)?	Yes	_ No	
B Heat Affect (HAPOR)?	Yes	_ No No	
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?	Yes	_ 140	
If any of the above conditions exist, record below:			
			ļ
The SNO Control of the Man			Comment
SECONDARY O-RING (or Shoulder)		/	Number
Part No.: 10.50228-25 Lot No.: A. Erosion (SORE)?	Yes	No	
	Yes	_ No	
SCUT. SDMG, SDIS)?	Yes	No	
If any of the above conditions exist, record below:			
form.			
1. See o-ring observation form.			
·			
CLOSURE SCREW O-RING			Comment
Part No.: Lot No.:	· .,	Ma	Number
A. Erosion (CORE)?	Yes	_ No	
B Heat Affect (HACOR)?	Yes	No	
C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?	Yes	No	
If any of the above conditions exist, record below:			
	•		
	•		

DOC NO.	TWR-17591		VOL	١٧
SEC		PAGE	A-70	

O-RING OBSERVATION CLARIFICATION FORM

D-Hind Obolination
Inspector(s) Scott Eden, Rocky Ash, Motor No. QM-8 Joint (Or Plug) and Degree): 306° SEA O-Ring Location: Primary Secondary Capture Feature Wiper Closure Part Number: 1050208-25 Serial or Lot Number: Description: See below. Note: Very light coat of grease. Wrang Size O-ring was installed Wrang Size O-ring was installed Positioned on thread Side Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions.
Sketch observation below of account to explain the observation.
Sketch observation below of attachment of at
REFERENCE WILLIAM T.D. EXTRUSION

DOC NO. TWR-17591 | VOL IV

REV. ____

Detailed Port Plug O-ring (Post-Removal) - Evaluation	Checkoff Worksheet	
	Date: 3-13-89	
Can Adapter to Case (IGN)	Adapter to Chamber	(IGI)
50 mil STIC of 15	1° and 198°	
Plug: La Leak Check(LLAN)	SARY NELSON	
PRIMARY O-RING		Comment
Part No.: 1050228-18 Lot No.:	. /	Number
A. Erosion (PORE)?	Yes V No	
B. Heat Affect (HAPOR)?	Yes No	
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?	Yes V No	—
If any of the above conditions exist, record below:		_
NOTE: This observation is for bo	th SII PIU	8s,
primary scals.		
'		
SECONDARY O-RING (or Shoulder)		Comment Number
Part No.: 1050 228-38 Lot No.:	Yes V No	
A. Erosion (SORE)?	Yes No	
B. Heat Affect (HASOR)?C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Yes V No	
If any of the above conditions exist, record below:		İ
		_
NOTE: This observation is fo	r both SII	_
plugs, secondary scals	•	
, , , , , ,		
CONTRACTOR OF THE		Comment
CLOSURE SCREW O-RING Part No.: Lot No.:		Number
A. Erosion (CORE)?	Yes No	
B. Heat Affect (HACOR)?	Yes No	
C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?	Yes No	
If any of the above conditions exist, record below:		
		, .
-		-

Case Joint Plug and Plug Hole - Evaluation Checkoff Worksheet

0	Date: 2-6-89	
Motor No.: QM-8		
Inspector(s): K. Bak		
Joint:	r Fleid Joint (1171.5, CTR)	
	g-to-Case Joint (1875.2, NOZ)	
All tield down (trotte) the ty		
Flug: A vent for (valve)		
P/N: 1476425-03 Lot Number:	ECL 000 1	
Plug, plug hole observations:		mment mber
	Yes No	
I. Soot Past Seals (SPINS, SICOR, SOINT,		
SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)?	Yes No	
II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)?	Yes No	
IV. Rust on sealing surfaces (SSCOR)?	YesNo	
V. Rust on metal parts (PITCO)?	Yes No	
VI. Damaged metal sealing surface (SSMET)?	Yes No	
VII. Damaged metal other than sealing surface (DAMML)?	YesNo	
/III. Plug hole damage, deformed threads (DBHOL)?	Yes No	
if any of the above conditions exist, describe below:		
		1
·		
·		

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE A	-73	

REV. ____

	III OHOOKON THE
Detailed Port Plug O-ring (Post-Removal) - Evaluation	Date: 6 FEB 87
Motor No.: CILL-&	
Joint: M PVVD Total Check(I EAK) Degree	155
Blue. K Vent Folitivent)	Nelson
Inspector(s): Scott Edenz, Rocky Ash, Garry 1 PRIMARY O-RING Part No.: 1150228 - 44. Lot No.: ECL 0004 A. Erosion (PORE)? B. Hear Affect (HAPOR)? C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)? If any of the above conditions exist, record below: (. Extrusion Damage Expected See ATTACHED CLARIFICATION SHEET	Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes No Yes
SECONDARY O-RING (or Shoulder) Part No.: 1050228-15 Lot No.: 202053 A. Erosion (SORE)? Heat Affect (HASOR)? Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? If any of the above conditions exist, record below:	Comment Number Yes No Yes No Yes No No Yes No No Yes No Yes No Yes
CLOSURE SCREW O-RING Part No.: 1050228-25 Lot No.: ECL 0015 A. Erosion (CORE)? B. Heat Affect (HACOR)? C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)? If any of the above conditions exist, record below: NOTE: E-RING WAS POSITIONICO DIV PLUG GROCUE.	Commen Number Yes V No Ves V No THRCHD SIDE OF

DOC NO.

TWR-17591

O-RING OBSERVATION CLARIFICATION FORM

(40 09	Inspector(s) Scott Eden, Rocky Ash, Gary Helson
otor No. <u>(2111-8)</u>	inspector(s)
otol No. Tyri Correct	135° GUDFIELD
Ding Location: 177 Prime	ary Secondary Lapture Feature Wiper Lactoria
art Number: 1050228	7-44
art Number: 1030228 erial or Lot Number: 10	1 8009
escription:	C.D. & I.D. Extrusion damage (Acceptable
7001007	
	or attach worksheets and list below. Indicate orientation and dimensions.
cetch observation below	acessary to explain the observation.
low as much detail as it	scessary to explain the entering
	PRIMARY
	REFERENCE
1	
	O.O. EXTRUSION I.O. EXTRUSION
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	• .

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-75	

REV. ____

Case Joint	Plug and P	Plug Hole -	Evaluation	Checkoff	Worksheet
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Joint:	Case Joint Plug and Plug Hole - Evalu	······································
Joint: Forward Field Joint (851.5, FWD) Center Field Joint (1171.5, CTR) Att Field Joint (1491.5, AFT) Nozzie-to-Case Joint (1875.2, NOZ) Plug: Vent Port (VENT) Leak Check (LEAK) Degree Location: /35 PiN:	Motor No.: $Qm-Y$	Date: 2-6-89
□ Forward Field Joint (851.5, FWD) □ Center Field Joint (1171.5, CTR) □ Aft Field Joint (1491.5, AFT) □ Nozzle-to-Case Joint (1875.2, NOZ) Plug: □ Vent Port (VENT) □ Leak Check (LEAK) □ Degree Location: /35 PlN: 1176 425 -03 Lot Number: Eccopy Plug, plug hole observations: Comment Number 1. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? 11. Foreign Material (FMIJ)? Yes No □ No □ No □ No □ No □ No □ No □ No	Inspector(s): K. Baker	
□ Forward Field Joint (851.5, FWD) □ Center Field Joint (1171.5, CTR) □ Aft Field Joint (1491.5, AFT) □ Nozzle-to-Case Joint (1875.2, NOZ) Plug: □ Vent Port (VENT) □ Leak Check (LEAK) □ Degree Location: /35 PlN: 1176 425 -03 Lot Number: Eucocy Plug, plug hole observations: Comment Number 1. Soot Past Seals(SPINS, SICOR, SOINT, Yes No No No No No No No No No No No No No		
Att Field Joint (1491.5, AFT)	Joint:	
Plug: Vent Port (VENT) Leak Check (LEAK) Degree Location: /35 P/N: /// 425 - 03 Lot Number: Eucoxy Plug, plug hole observations: Comment Number I. Soot Past Seals(SPINS, SICOR, SOINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? Yes No SINT, SIPOR, SPPOR SISOR, HACOR)? Yes No No V. Rust on sealing surfaces (SSCOR)? Yes No No V. Rust on sealing surface (SSCOR)? Yes No No V. Damaged metal sealing surface (SSMET)? Yes No VII. Damaged metal other than sealing surface (DAMML)? Yes No VIII. Plug hole damage, deformed threads (DBHOL)? Yes No VIII. Plug hole damage, deformed threads (DBHOL)? Yes No VIII. Plug hole damage, describe below:		
PIN:	Aft Field Joint (1491.5, AFT)	Nozzle-to-Case Joint (1875.2, NOZ)
Plug, plug hole observations: I. Soot Past Seels (SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on seeling surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VIII. Damaged metal other than seeling surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? If any of the above conditions exist, describe below:		
I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? V. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? V. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? Ves No If any of the above conditions exist, describe below:	P/N: 1476 425 -03 Lot Numb	
SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? Ves Voo Voo Voo Voo Voo Voo Voo Voo Voo Vo	Plug, plug hole observations:	
III. Foreign Material (FMIJ)? III. Heat Affected Piug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VIII. Damaged metal other than sealing surface (DAMML)? VIIII. Plug hole damage, deformed threads (DBHOL)? If any of the above conditions exist, describe below:		Yes No
III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? If any of the above conditions exist, describe below:		Vee V No
/iii. Plug hole damage, deformed threads (DBHOL)? Yes No If any of the above conditions exist, describe below:		Yes V No
/iii. Plug hole damage, deformed threads (DBHOL)? Yes No If any of the above conditions exist, describe below:		Yes No
/iii. Plug hole damage, deformed threads (DBHOL)? Yes V No If any of the above conditions exist, describe below:		Yes No
/iii. Plug hole damage, deformed threads (DBHOL)? Yes No If any of the above conditions exist, describe below:		Yes No
If any of the above conditions exist, describe below:	VII. Damaged metal other than sealing surface (DAMI	
	/ili. Plug hole damage, deformed threads (DBHOL)?	Yes No
	If any of the above conditions exist, describe below:	
	•	

TWR-17591 VOL IV

REV.

Detailed Port Plug O-ring (Post-Removal) - Evaluation			-6
Motor No.: QIM-8	Date:	6 FEB 8	
Joint: FWD X CTR AFT NOZ	135°		
nspector(s): Scott Eden Rocky Ash, Gary H	lelson		
PRIMARY O-RING Part No.: 1150228-44 Lot No.: ECL COOY A. Erosion (PORE)? B. Heat Affect (HAPOR)? C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)? If any of the above conditions exist, record below: 1. 1.D. and 0.D. Circumferential impress.	Ye Ye	es N	Comment Number
SECONDARY O-RING (or Shoulder) Part No.: LUSOZZG-15 Lot No.: ECLOUS3 A. Erosion (SORE)? Heat Affect (HASOR)? Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? If any of the above conditions exist, record below:	Y	es	Comment Number No No
CLOSURE SCREW O-RING Part No.: 1050228-25 Lot No.: ECL CCO/5 A. Erosion (CORE)? B. Heat Affect (HACOR)? C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)? If any of the above conditions exist, record below:	Y	es	Comment Number No No No
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DOC NO.

REV. ____

Case Joint Plug and Plug Hole - Evaluation Checkoff Worksheet

Motor No.: QM-8	Date: 2-6-89
Inspector(s): K. Baken	
	r Field Joint (1171.5, CTR) e-to-Case Joint (1875.2, NOZ)
Plug: Vent Port (VENT) Leak Check (LEAK) Degre	se Location: _/35
P/N: 1476425-03 Lot Number:	ECLODO1
Plug, plug hole observations:	Comment
 I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? /iII. Plug hole damage, deformed threads (DBHOL)? 	Yes No No Yes No No Yes
If any of the above conditions exist, describe below:	
1. Damage to 1476425-01 during like installation tool slipped during torquing operations.	installation, looks out of groove

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-78	

REV.

Detailed Port Plug O-ring (Post-Removal) - Evaluation	Dets: /	CP 29	
Motor No.: Quil-8	Date: 6 A	-03 0/	
Joint: FWD CTR AFT NOZ	350		
Plug: W Vent Fort(VENT)			
Inspector(s): Scott Eden, Rocky Ash, Gary N	E15017		0
PRIMARY O-RING Part No.: (USO228-49 Lot No.: ECLOCO) A. Erosion (PORE)? B. Heai Affect (HAPOR)? C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)? If any of the above conditions exist, record below: I. Expected Extrusion Daimage SEE MITTICHED SHIET	Yes Yes Yes	No No No	Number
SECONDARY O-RING (or Shoulder) Part No.: 1050228-15 Lot No.: ECL 0047		V	Commen Number
A. Erosion (SORE)? Heat Affect (HASOR)? Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? If any of the above conditions exist, record below:	Yes Yes Yes	No No No	
Heat Affect (HASOR)? Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Yes Yes Yes Yes Yes Yes Yes	No No No No	

DOC NO.

REV.

O-RING OBSERVATION CLARIFICATION FORM

Date 67689 Motor No. 611-8	Inspector(s)	Scott Eden	, Rocky	Ash, Gary	, jyeisa
Motor No. OM-8			/	<u> </u>	-
Joint (Or Plug and Degree):	135° AF	T FIELD			
Joint (Or Plug and Degree): D-Ring Location: Primary Part Number: 1050228-	Secondary	/ Capture Fea	ture Wiper	Closure	
Part Number: 1050228-	44				
Serial or Lot Number: ECC	0009	_			
Description:		Extrusion	Danie	0	
/4pica/ 6	-xpected	CXTICITE	14.01.79		
,					
Sketch observation below or	attach workshe	ets and list below	. Indicate orie	intation and dim	ensions.
Show as much detail as nece	ssary to explain	n the observation.			
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DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-80	

Case Joint Plug and Plug Hole	 Evaluation 	Checkoff	Worksheet
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Motor No.: $\Omega M - \Theta$ Date: 13 FLB 89	
Inspector(s): DAUID ROWSELL	
Joint: Center Field Joint (851.5, FWD) Center Field Joint (1171.5, CTR)	l
Follward Field Count (County)	l
All Tield Collin (Treater)	
Plug: Vent Port (VENT) Leak Check (LEAK) Degree Location: 43. 2.	
P/N: 1076425-03 Lot Number: ECL 0001	
Plug, plug hole observations: Common Numl	
	l
I. Soot Past Seals (SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	
Yes V No	
III. Heat Affected Plug (HAPOR, HASOR, HACOR)? Yes No	
IV. Rust on sealing surfaces (SSCOR)?Yes	
V. Rust on metal parts (PITCO)? YesNo	
VI. Damaged metal sealing surface (SSMET)?	
VII. Damaged metal other than sealing surface (DAMML)?	
/III. Plug hole damage, deformed threads (DBHOL)? Yes Ves No	
If any of the above conditions exist, describe below:	
•	

DOC NO. TWR-17591 VOL IV
SEC PAGE A-81

REV.

Detailed Port Plug O-ring (Post-Removal) - Evalua	12 = 20 09	
Motor No.: Nu - 8	Date: 17 FEB 89	
Joint: FWD CTR AFT NOZ	//7 7 P	
Plug: Vent Port(VENT) Leak Check(LEAK) Degree	43.2	
Inspector(s): Scott Eden Rocky Ash Com	, Klelson	
PRIMARY O-RING Part No.: 1050778-44 Lot No.: ECL 0003 A. Erosion (PORE)? B. Heat Affect (HAPOR)?	Yes No	Comment Number ———
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?	? Yes No	1.
If any of the above conditions exist, record below:		
1. TYPICAL O.D. & I.D. CRCUMFERENTIA	AL EXTRUSION (EXPEC	7(6)
SECONDARY O-RING (or Shoulder) Part No.: 1050228-15 Lot No.: 100056 A. Erosion (SORE)? Heat Affect (HASOR)? Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Yes No Yes No Yes No	Comment Number
If any of the above conditions exist, record below:		
1. Note. Radial Flow MARK FOUND (MANUFACTURING PROD	3(Ein)
Radial Flow MARK NOT OPEN.		
SCE ATTACHED CLARIFICA	ATION SHEET	
CLOSURE SCREW O-RING Part No.: 1050728-25 Lot No.: 1050728-25 A. Erosion (CORE)? B. Heat Affect (HACOR)? C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS) If any of the above conditions exist, record below:	Yes No No Yes No No	Comment Number
	• .	

TWR-17591

O-RING OBSERVATION CLARIFICATION FORM

Date 17 FB 8-9 Inspector(s) Scott Eden, Rocky Ash, Gary Nelson
Motor No. 1/11-8 Inspector(s) 200 DESTITION OF THE PROPERTY OF
1/3 25 1/02/16 70 CASE
O-Ring Location: Primary A Secondary Capital Feature
m A November 11/1/07でダース
Serial or Lot Number: ECC 0056
Description:
RADIAL FLOW MARK ON SCIENDARY O'RING,
ANT VENT PORT PLUG
the second dimensions.
Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions.
Show as much detail as necessary to explain the observation.
ı
NOTE: SECONDARY RADIAL FLOW MARK
L≈ 0.100
REFERENCE W2 0.002
♦ (//\) n ≈ 0.001
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Figure B-3

	DOC NO.	TWR-17591		VOL	IV
REV	SEC		PAGE	A-83	

Nozzie Joint Plug and Plug Hole - Evaluation Checkoff Worksheet

Motor No.: GHI-8 Joint: □Throat/Fwd Exit Cone (4) □Fwd End Ring/Nose Inlet (2) □Fwd Exit Cone/Aft Exit Cone (1) Degree Location: 262.3° P/N: 1/25/25-02 B#M: ECLCO/ O-ring: P/N: 1/25/25-25 L/N: ECLCO/ Plug. plug hole observations: Comment Number	Inspector(s): KELLY BAKER, LOWCH NUSC	al,
Fixed Housing/Aft End Ring (5) Nose Inlet/Throat (3) Nose Inlet/Throat (4) Nose Inlet/Throat (Motor No.: GM-8	Date: 15 FEB 89
O-ring: P/N: 10502\$28-25 L/N: ECC 00/2 Plug, plug hole observations: Comment Number I. Soot Past Seals(SPINS, SICOR, SOINT, Yes No SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? Yes No SIMENTIAL SEALING	Fixed Housing/Aft End Ring (5)	☐ Nose Inlet/Throat (3)
Plug, plug hole observations: I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? Ves No		
I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)?	O-ring: P/N: 1050228-25	L/N: <u>ECC 00/2</u>
III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? Yes No No Ves No No	I. Soot Past Seals (SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	Yes No Number
IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? Yes No No		Yes No
VIII. Plug hole damage, deformed threads (DBHOL)? YesNo	IV. Rust on sealing surfaces (SSCOR)?	Yes No
VIII. Plug hole damage, deformed threads (DBHOL)? YesNo		Yes No
If any of the above conditions exist, describe below:	VII. Damaged metal other than sealing surface (DAMML)?	
	If any of the above conditions exist, describe below:	
		·
		i.
	·	

REV.	DOC NO.	TWR-17591		VOL	IV
NCV.	SEC		PAGE	A-84	1

Detailed Port Plug O-ring (Post-Removal) - Evaluation	1 50 012	
Motor No.: Wy-&	Date: 6 128 89	
Joint: ☐ Throat/Fwd Exit Cone (4) ☐ F	wd End Ring/Nose Inlet (2)	
	lose inlet/Throat (3)	
下wd Exit Cone/Aft Exit Cone (1)		
Plug: Leak Check(LEAK) Degree 262.3°		
	Nelson	
map of the test of		Comment
PRIMARY O-RING Lot No.:		Number
are 110	Yes No	
A. Erosion (PORE)?	Yes No	
B. Heat Affect (HAPOR)?	Yes No	
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?		
If any of the above conditions exist, record below:		
		1
SECONDARY O-RING (or Shoulder)		Comment
Part No.: 1050228-25 Lot No.: ECL CO12		Number
(0005)3	Yes No	
	Yes L No	
B. Heat Affect (HASOR)?	Yes No	1.
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?		
If any of the above conditions exist, record below:		
· 1> CUT DN (0 211/		
1. I.D. CUT ON O-RING (SDIS)		
SCE ATTACHED CLARIFICATION SHE	267	
•		
CLOSURE SCREW O-RING		Comment
Part No.: Lot No.:	_	Number
(0005)0	Yes No	
	Yes No	
B. Heat Affect (HACOR)?	Yes No	
C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?		
If any of the above conditions exist, record below:		

DOC NO.	TWR-17591			VOL	IV
SEC		PAGE	Δ.	-85	

REV.

O-RING OBSERVATION CLARIFICATION FORM

Date 6 FEB 87 Inspector(s) Scott Eden Rocky Ash, Gary Melson	1
Motor No. Qui-8	
$\frac{1}{2}$ (of Plug and Degree): $\frac{267}{5}$ (71)	
O-Ring Location: Primary Secondary Capture Feature Wiper Closure	
Part Number: 1050228-25	
Serial or Lot Number: ECL COIZ	
Description:	
1.D. CUT (SCE BELOW)	
NOTE: O-RING WAS POSITIONED ON THE THREAD SIDE	
OF THE PLUG GREEVE. ZASI THEELT	
WAS SHARP.	
the balance arientetion and dimension	ns.
Sketch observation below or attach worksheets and list below. Indicate orientation and dimension	
Show as much detail as necessary to explain the observation.	
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1.0. CUT L= 0-240	
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Nozzle Joint Plug and Plug Hole - Evaluation Checkoff Worksheet

Inspector(s): kell	y Baker, Lowell Nelson	
Motor No.:	,	Date: 2-/5-89
Joint:	☐ Throat/Fwd Exit Cone (4) ☐ Fixed Housing/Aft End Ring (5) ☐ Fwd Exit Cone/Aft Exit Cone (1)	⊠ Fwd End Ring/Nose Inlet (2) □ Nose Inlet/Throat (3)
Degree Location:	262.25 PIN: 1450159-02	S/N: ECL 0001
O-ring:	P/N: 1450228-25	L/N: <u>FCL 0006</u>
SPINT, SIPOR, II. Foreign Materi	Is(SPINS, SICOR, SOINT, SPPOR SISOR, SPSOR)?	Yes No Yes No No
IV. Rust on sealin V. Rust on metal VI. Damaged metal VII. Damaged metal VIII. Plug hole dam	ng surfaces (SSCOR)? parts (PITCO)? al sealing surface (SSMET)? al other than sealing surface (DAMML)? nage, deformed threads (DBHOL)?	Yes
·	e conditions exist, describe below:	
	-	

DOC TWR-17591	VOL	IV
SEC	PAGE A-87	

Detailed Port Plug	O-ring (Po	ost-Removal) -	Evaluation			
Motor No.: QM-8					EB 89	
Joint: Throat/Fw			,	vd End Ring/No		
Fixed Hou			☐ MG	ose Inlet/Throat	(3)	
Fwd Exit	Cone/Aft Exi	it Cone (1)				
Plug: Leak Check(LEAK)	Degree	265.3°				
Inspector(s): Scott Wen	Rocky	Ash, Ga	ry Nelso	017		
PRIMARY O-RING	, , ,		7			Comment
Part No.:	Lot No.:					Number
A. Erosion (PORE)?			_	Yes _	No	
B. Heat Affect (HAPOR)?			-	Yes _	No	
C. Cuts, Assembly/Disassembl	y Damage (PCUT, PDMG,	PDIS)?	Yes _	No	
If any of the above conditions						
•						
DECOMPARY OF BING (or Bh						Comment
SECONDARY O-RING (or Sh Part No.: 105022メー25	oulder)	ECLOOOL	دی		,	Number
	_ Lot No			Yes _	✓ No	
A. Erosion (SORE)?			•	Yes	No	
B. Heat Affect (HASOR)?	lu Damana (COUT SOMG	SDIS12	Yes	No	
C. Cuts, Assembly/Disassemble			301071			
If any of the above conditions	exist, record	below:	word?	SIDE ME	PIUG GI	ROOVE
HETE! O-RING WAS	PULLTION	ied on i	HECAD	Sisc O"	, e	
•						
1						
THE COREW OF PINC						Comment
CLOSURE SCREW O-RING	Lot No.:					Number
Part No.:	_ 1201 140			Yes	No	
A. Erosion (CORE)?			,	Yes	No	
B. Heat Affect (HACOR)?	. D	COUT COMO	CDIS12	Yes	No	
C. Cuts, Assembly/Disassemb			CDIST			
If any of the above conditions	exist, record	d below:				
•				•		
						 '.
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			DOC NO.	TWR-17591	lva	IV
REV			DOC NO.		VOL	IV

Nozzie Joint Plug and Plug Hole - Evaluation Checkoff Worksheet

Date: 2-/5-87 Joint:	Inspector(s):	Baker, L	. Nelsen			
Fixed Housing/Aft End Ring (5) Fwd Exit Cone/Aft Exit Cone (1) Degree Location: P/N: IUSDIST-D2 S/N: FCL 0001 O-ring: P/N: IUSDIST-D2 S/N: FCL 0001 Plug, plug hole observations: I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? V. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? If any of the above conditions exist, describe below:		/		Date: 2	-15-89	
O-ring: P/N: // I/SD228-25 L/N: ECL Dec 1 Plug, plug hole observations: Comment Number I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? Yes No III. Heat Affected Plug (HAPOR, HASOR, HACOR)? Yes No IV. Rust on sealing surfaces (SSCOR)? Yes No V. Rust on metal parts (PITCO)? Yes No IV. Damaged metal sealing surface (SSMET)? Yes No VII. Damaged metal other than sealing surface (DAMML)? Yes No III. Plug hole damage, deformed threads (DBHOL)? Yes No III. Plug hole damage, deformed threads (DBHOL)? Yes No III. Plug hole damage, describe below:	Joint:	☐ Fixed Housi	ing/Aft End Ring (5)			nlet (2)
Plug, plug hole observations: I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? If any of the above conditions exist, describe below:	Degree Location:	265		S/N:	E(L 0001	
I. Soot Past Seais(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? If any of the above conditions exist, describe below:	O-ring:	P/N:	1450558-52	L/N:	ECL 2001	
SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? If any of the above conditions exist, describe below:			D SOINT		Yes	Number
II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)? If any of the above conditions exist, describe below:				- ,		
VIII. Plug hole damage, deformed threads (DBHOL)? YesNo If any of the above conditions exist, describe below:	i e		•			No
VIII. Plug hole damage, deformed threads (DBHOL)? YesNo If any of the above conditions exist, describe below:						No
VIII. Plug hole damage, deformed threads (DBHOL)? YesNo If any of the above conditions exist, describe below:						No
VIII. Plug hole damage, deformed threads (DBHOL)? YesNo If any of the above conditions exist, describe below:						No
VIII. Plug hole damage, deformed threads (DBHOL)? YesNo If any of the above conditions exist, describe below:						No
					Yes	No
Brinkang torque was 17 in-165	If any of the abov	e conditions exi	ist, describe below:			
	Breakowa	torque w	17 in-16s			•
				-		
						ļ
			• .			
	ļ					
-						

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-89	

Detailed Port Plug O-ring (Post-Removal) - Eval		
Motor No.: 1711-8	Date: 17 FC/	
Joint: Throat/Fwd Exit Cone (4)	Fwd End Ring/Nose	
Fixed Housing/Aft End Ring (5)	Nose Inlet/Throat (3)
Fwd Exit Cone/Aft Exit Cone (1)	-	
Plug: A Leak Check(LEAK) Degree 265°		
	elson	
PRIMARY O-RING		Comment
Part No.: Lot No.:	<u> </u>	Number
A. Erosion (PORE)?	Yes	No
B. Heat Affect (HAPOR)?	Yes	No
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS))? Yes	No
If any of the above conditions exist, record below:		
in any or the above contained which receive contain		
		•
THE STATE OF THE S		
SECONDARY O-RING (or Shoulder)		Comment Number
Part No.: 1050228-25 Lot No.: ECL00/3	Yes	No
A. Erosion (SORE)?	Yes	No
B. Heat Affect (HASOR)?		No /,
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS	or <u>v</u> res	
If any of the above conditions exist, record below:		
1. I.D. CIRCUM FERCUTIAL SCR	ATCH 1-1	
l. I.D. CIRCUM PERENTIAC SCR	(SDIS)	
	•	
SEE ATTACHED CLARIFICATION	1 54667-	•
	- •	
OLOCUPE SCREW O PING		Comment
CLOSURE SCREW O-RING Part No.: 1-ot No.:		Number
	Yes	No
	Yes	No
COUT COMC COIS		No —
If any of the above conditions exist, record below:		
•	•	

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-90	

O-RING OBSERVATION CLARIFICATION FORM

Date 17 FCB 87 Inspector(s) Scall Ede	en Rocky Holi, Comy Nelson
Motor No. Com-8	
Joint (Or Plug and Degree): 265° JOINT #(3)	
O-Ring Location: Primary Secondary Capture	Feature
Part Number: 11:50228-25	
Serial or Lot Number: 1(LOO/3	
Description:	
1. D. CIRCUMFERENTIAL S	SCRATCH (SEC RELOVA)
MOTE: C-RING WAS POSITIONED O	N THREAD SIDE OF
PLUG GROOVE.	7///
Sketch observation below or attach worksheets and list be	elow. Indicate orientation and dimensions.
Show as much detail as necessary to explain the observa	
•	
·	
·]
0.250-	I.O. CIRCUMFERENTIAL
REFERENCE	SCRATCH
	10.410
	L = 0.150
	₩ ≈ 0.001
	4 < 0.001

 DOC NO.
 TWR-17591
 VOL IV

 SEC
 PAGE A-91

REV. ____

Nozzie Joint Plug and Plug Hole - Evaluation Checkoff Worksheet

Inspector(s): K.	BAKEn,	L. Nelsen		
Motor No.: $\hat{\mathcal{A}}\mathcal{M}$			Date: 2-/5-89	
Joint:		Exit Cone (4) ng/Aft End Ring (5) ne/Aft Exit Cone (1)	☐ Fwd End Ring/Nose Inlet (2) ☐ Nose Inlet/Throat (3)	
Degree Location:	268.75	PIN: 1450151-02		
O-ring:	P/N:	IN20558-52	LIN: ECLOOIS	
Plug, plug hole ob			Nu	mment mber
	is (SPINS, SICOF , SPPOR SISOR		Yes No	
II. Foreign Mater	rial (FMIJ)?		Yes No	
III. Heat Affected IV. Rust on sealing		HASOR, HACOR)? COR)?	Yes Vo	
V. Rust on meta	i parts (PITCO)?	?	Yes No	
VI. Damaged me	tal sealing surfa- tal other than se	ealing surface (DAMML)?	Yes No	
VIII. Plug hole dar	nage, deformed	threads (DBHOL)?	Yes Vo	
If any of the abov	e conditions exi	ist, describe below:		
Break Awry	torque	vas 35 12-165		
	•	· .		
		·		
·				

DEV	DOC NO.	TWR-17591	VOL	ΙV
REV.	SEC		PAGE 1-92	

Detailed Port Plug	O-ling (F	Jat-Herriovary - Evalue	1		m: 0 00	7
Motor No.: GM-8					FEB 89	
Joint: _ X Throat/Fw					Nose Inlet (2)	
☐ Fixed Hou	-		Nose in	nlet/Thro	ж (3)	
Fwd Exit (Cone/Aft Ex					
Plug: A Leak Check(LEAK)	Degree	268.75°				
Inspector(s): Scall Eden,	llayne	Sperry Ga	ry Ne	rson		
PRIMARY O-RING			/			Comment
Part No.:	Lot No.:			V.	A4 -	Number
A. Erosion (PORE)?				Yes	No	
B. Heat Affect (HAPOR)?				Yes	No	
C. Cuts, Assembly/Disassembly				Yes	No	
If any of the above conditions e	xist, record	below:				
				•		
SECONDARY O-RING (or She		FOLODIA				Comment
Part No.: 1050228-25	Lot No.:	ECICOIZ		Yes	No	Number
A. Erosion (SORE)?				Yes	No	
B. Heat Affect (HASOR)?	. D	COURT COME COIC/3		. Yes	No	
C. Cuts, Assembly/Disassembly				. 163		
If any of the above conditions e					DUY You	21/6-
MOIC: O. RING WAS	PESITION	CO ON THREA!	b SIDE	CV.	MUG GREE	DUE.
•						
				1		
CLOSURE SCREW O-RING	· · ·					Comment
Part No.:	Lot No.:			V	Ma	Number
A. Erosion (CORE)?				_ Yes	No	
B. Heat Affect (HACOR)?				- Yes	No	
C. Cuts, Assembly/Disassembl			·	Yes	No	
If any of the above conditions e	exist, record	d below:				
						•

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-93	•

Space Operations

REV. ____

Table D-II

Detailed Port Plug O-ring or Small O-ring (A-2) - Evaluation Checkoff Worksheet

Inspector(s): SCOTT EDEN, ROCKY ASK			
	Date: /4	June '8	?9
	facto		
Plug: Vent Port Leak Check Transducer		cial Bolt Plug	
Special Bolt Degree		•	
	267-01	ECL0011	
PRIMARY O-RING N/A: Lot No.:		,	Comment
A. Erosion (PORE)?	Yes	No	Number
B. Heat Affect (HAPOR)?	Yes		
		No	*****
	Yes	No	
If any of the above conditions exist, record below:			
·			
SECONDARY O-RING (or Shoulder) N/A:			Co
Part No.: 1050228-15 Lot No.: ECL0037		_	Comment Number
A. Erosion (SORE)?	Yes	No	***************************************
B. Heat Affect (HASOR)?	Yes	No	
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Yes	No	<u> </u>
If any of the above conditions exist, record below:			
1) I.O. circumferential cut			
	- 0-690	7 	
1≈ 0.490 b ≥ 0.030 REFERENCE	0.010		
b 2 0.030 REFERENCE	\	'	
NOTE: Orange resident to the first			\geq
NOTE: 0-ring positioned on thread side Chisel gouge on plug head O.O. Sharp last thread			
Chisel gouge on pluy head O.O.			
Sharp lest thread			
CLOSURE SCREW O-RING N/A: /			Comment
Part No.: Lot No.:			Comment Number
A. Erosion (SORE)?	Yes	No	
B. Heat Affect (HASOR)?	Yes	No	
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Yes	No	
If any of the above conditions exist, record below:			
, to mo above containons exist, record Delow;			
			- 1
			

DOC NO.	TWR-17591		VOL	·IV
SEC		PAGE	Δ – 9/	

O-RING OBSERVATION CLARIFICATION FORM

Date 4-25-89 Inspector(s) Scott Ed Motor No. QM-8	
Initial (Or filling and Degree): (C. FUID FACTORY	191N1
O-Ring Location: Primary X Secondary Capture re	ature Wiper Liciosure
Part Number: 1050228-15	
Serial or Lot Number: FCL0037	
Description: See below.	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -
NOTE: O-CINA Positioned	w thread side.
Chiseld gauge on plu	19 O.D.
	<u>u</u>
	d discoologo
Sketch observation below or attach worksheets and list below	w. Indicate orientation and dimensions.
Show as much detail as necessary to explain the observation	1.
•	
	i de la companya de la companya de la companya de la companya de la companya de la companya de la companya de
15-0.480 T	I.A. CIRCUMFERENTIAL
REFERENCE 1-0.480	I.A. CIRCUMFERENTIAL CUT
REFERENCE PO-1180	
REFERENCE P-0.480	
REFERENCE PO-1180	
REFERENCE P-0.480	CUT
REFERENCE PO. 1180	
REFERENCE PO-1180	
REFERENCE PO.1180	
	L≈ 0.480 D≈ 0.015

DOC NO. TWR-17591 VOL IV
SEC PAGE A-95

Space Operations

Table D-II

Detailed Port Plug O-ring or Small O-ring (A-2) - Evaluation Checkoff Worksheet

Inspector(s): Scott EDEN, ROCKY ASH			
Motor No.: QM-8	Date: 14	June 189	
Side: Lest (A) Right (B) Joint: Center - Forward	cyl/cyl s	seg fact	fory
Plug: Vent Port Leak Check Transducer	☐ Spec	lal Bolt Plug	
Special Bolt Degree	1100269-01	ECL002	2
PRIMARY O-RING Part No.: Lot No.:		•	Comment
A. Erosion (PORE)?	Yes	No	Number
B. Heat Affect (HAPOR)?	Yes	No	
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?	Yes	No No	_
If any of the above conditions exist, record below:			
,			
			}
			1
SECONDARY O-RING (or Shoulder) N/A:			
Part No.: 1050228-15 Lot No.: ECLO037			Comment Number
A. Erosion (SORE)?	Yes	√ No	
B. Heat Affect (HASOR)?	Yes	No	
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	√ Yes	No	7
If any of the above conditions exist, record below:			
1) I.O. circumferential out	₩-0.8 <i>i</i> 0-		
L 2 0.810 REFERENCE	1.0.010		
D ≈ 0.030		` ` >	
章 (//)		(//)	ا د
NOTE: Sharp last thread		\\\//	
Ding in last thread 0-ring positioned on last thread			
Chisel gauge on O.O. of also head			
CLOSURE SCREW O-RING N/A:			Comment
Part No.: Lot No.:			Number
A. Erosion (SORE)?	Yes	No	
B. Heat Affect (HASOR)?	Yes	No	
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Yes	No	
If any of the above conditions exist, record below:			
			1
			j
	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	

DOC NO.	TWR-17591		VOL	IV
SEC		PAGE	A-96	

O-RING OBSERVATION CLARIFICATION FORM

Date 4-20-89 Inspector(s) Scott Eden	, Rocky Ash				
Maran Na CAM - X					
Joint (Or Plug and Degree): O CTR AFT FACTORY JOINT					
O-Ring Location: Primary Secondary Capture Feature Wiper Closure					
Part Number: 10.50228-15					
Serial or Lot Number: ECL 0037					
Description: <u>See below</u> .					
Note: O-rina positioned on	last thread, cut				
Note: O-ring positioned on	thread.				
Dive and o-cine h	ad little to No				
arease. Chisel daous	or on top O.D.				
(lot plus	<u> </u>				
Sketch observation below or attach worksheets and list below.	Indicate orientation and dimensions.				
Show as much detail as necessary to explain the observation.					
· 1.300					
7.500	I.O. CIRCUMFERENTIAL				
REFERENCE	CUT				
幕 (///)	L≈ 1.300				
	Ω≈ 0.030				

 DOC NO.
 TWR-17591
 VOL IV

 SEC
 PAGE A-97

O-RING OBSERVATION CLARIFICATION FORM

Date 3-13-89 Inspector(s) S	cott Eden, Rocky Ash,			
MOTOR NO. SMI-O BAKY Nelson				
Joint (Or Rug) and Degree): Att Scancut factory joints				
O-Ring Location: Primary Secondary Part Number: See Description	☐ Capture Feature ☐ Wiper ☐ Closure			
Serial or Lot Number: Sec Description	υ			
Description:				
ET /STIF	(B) (C)			
PART # 1450,238-15	STIF/STIF STIF/AFT DOME			
1030880-15	1050228-15 1050228-15			
LOT. # ECLO041	ECL0041 FCL0031			
Sketch changetion below or attach workshoots	and the balance Authority			
Show as much detail as necessary to explain the	and list below. Indicate orientation and dimensions.			
one to made detail as decessary to explain th	e observation.			
Rolled last partial three A: (See Below) Orains was assistanced a	ad a last full thread still holding cut area aper			
0: (- 0/) 0 !! /	TEST THE STATE MOINTING ER I AVER GOEN			
B: (see Below) Rolled last partial +	hread			
C: (see Below) Rolled last thread.	to bring (very stight emount)			
	up to Orning (very slight emount)			
	4			
Note: All Mines plugs have chiral gouge a	plug head, all three O-rings were on			
thread side. Plug A had no apparen	+ grease. Alugs Bic had very light/some			
(((((((((((((_			
REFERENCE 0.920	I.O. CIRCUMFERENTIAL CUT			
幕 (///\	∠ ≈ 0.720			
	0 % 0.040			
@				
1 UGA				
REFERENCE	I.O. CIRCUMFERENTIAL CUT			
	/ 2 0 110			
	L= 0.490			
	0 ≈ 0.020			
©	-			
1 -1.130	T. A. a sacratification and			
REFERENCE	I.O. CIRCUMITERENTIAL CUT			
	<i>1</i> ≈1.130			
	//) b ≈ 0.020			
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REV.	NO. TWR-17591 VOL IV			
	SEC PAGE A-98			