

TWR-17591, Volume IV

QM-8 FINAL PERFORMANCE EVALUATION REPORT - SEALS

June 1989

Prepared for:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION GEORGE C. MARSHALL SPACE FLIGHT CENTER MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812

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Thickol CORPORATION

SPACE OPERATIONS

P.O. Box 707, Brigham City, UT 84302-0707 (801) 863-3511

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QM-8 FINAL PERFORMANCE EVALUATION REPORT (SEALS)

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Prepared by:

Nelsen

Joints and Seals Design

Approved by:

Burn, Supervisor Ĵ.

Joints and Seals Design

Pulleyn

Systems Integration Engineering

3-2 System Safety

Daines, Manager ٧.

Metallic Component Design

10

R. B. Crosbie Program Management

Fek 40

Released by:

4-23-90

Data Management ECS No. 1004 4051

Thickol CORPORATION

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P.O. Box 707, Brigham City, UT 84302-0707 (801) 863-3511

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APPENDICES

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Contributions to this report were made by the following people:

Chris Rice Joints and Seals Design

Joe Hemen Joints and Seals Design

Dave Gurney Joints and Seals Design

Kelly Baker Joints and Seals Design

Alan Carlisle Joints and Seals Design

Jeff Curry Post Fired Hardware Engineering

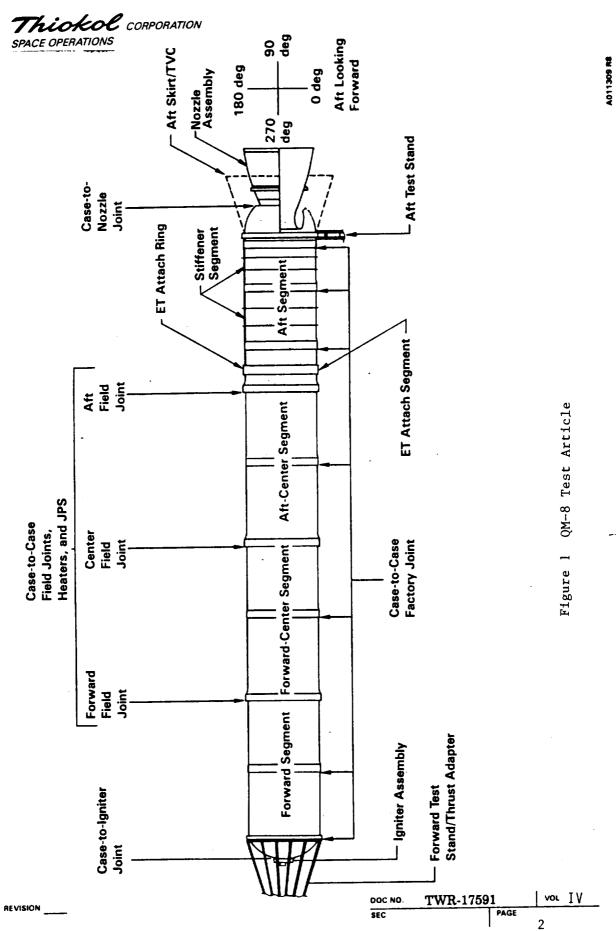
> Joe Lohrer Metal Component Design

1.0 INTRODUCTION

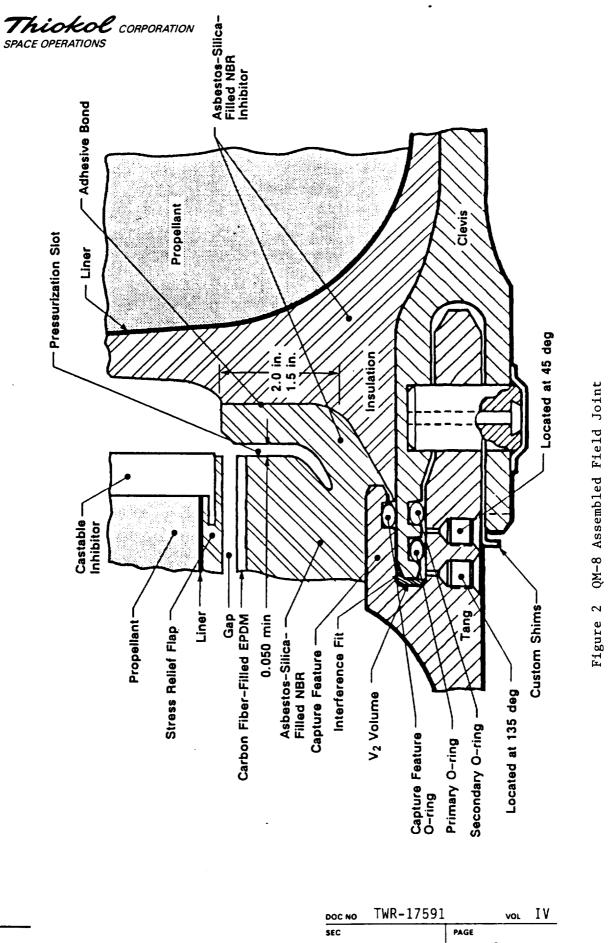
The Space Shuttle Redesigned Solid Rocket Motor (RSRM) static test of Qualification Motor-8 (QM-8) was conducted 20 January 1989 at Morton Thiokol, Inc., Space Operations. The QM-8 test article (see Figure 1) was the fifth full-scale, full-duration test, and the third qualification motor to incorporate 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).



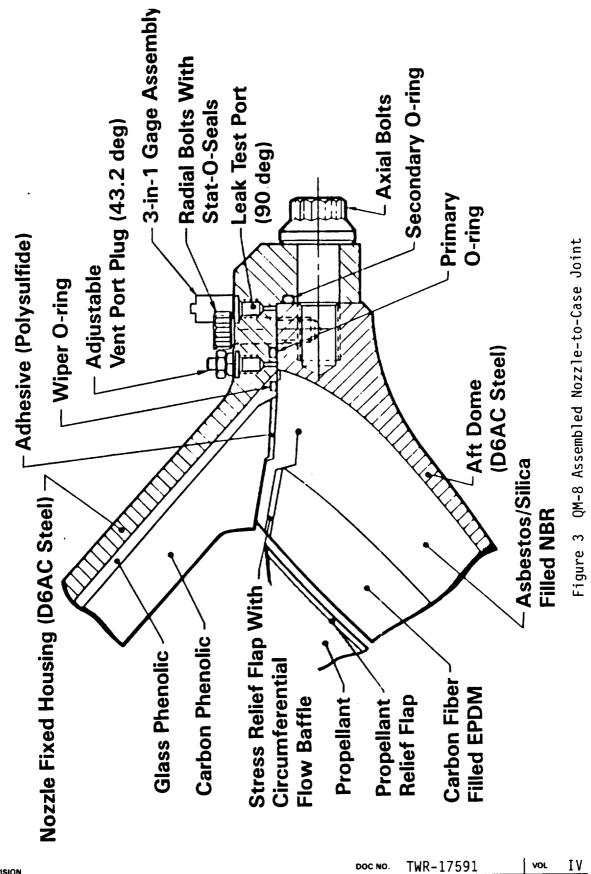
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2.0 SUMMARY AND CONCLUSIONS

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).

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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.

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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.

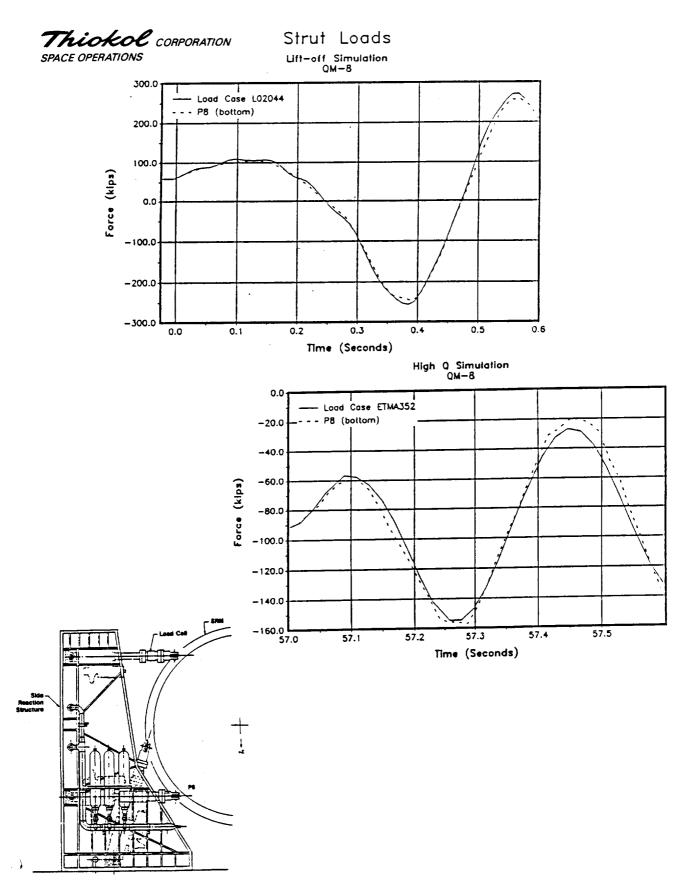
3.0 DISCUSSION

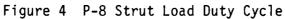
The following sections provide a discussion on the assembly of the field joints and nozzle-to-case joint. A summary of the QM-8 configuration follows:

0 Field Joints

- o RSRM design with fluorocarbon O-rings
- o No intentional flaws
- 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
- 0 Case-To-Nozzle Joint
 - Axial and radial bolt configuration with fluorocarbon 0-rings
 - o No intentional flaws
 - 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.

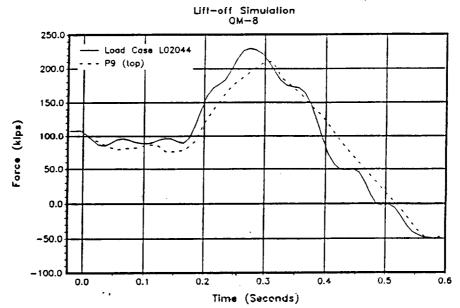
- O Three stiffener rings installed on the aft segment
- O Weather seals installed on all factory joints





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Strut Loads

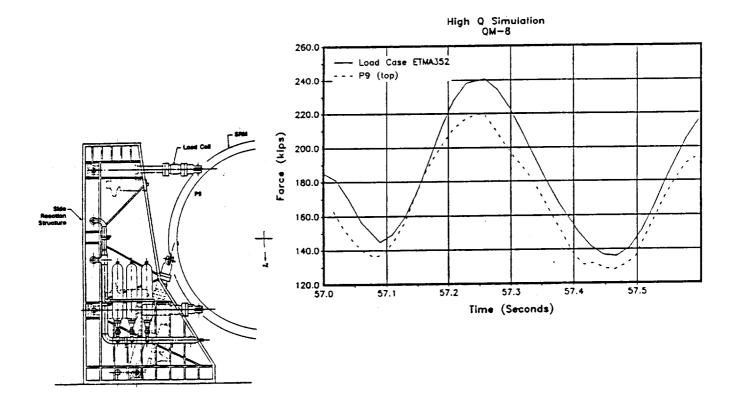


Figure 5 P-9 Strut Load Duty Cycle

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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.

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"M. Certify that the nozzle-to-case joint O-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 O-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 O-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).

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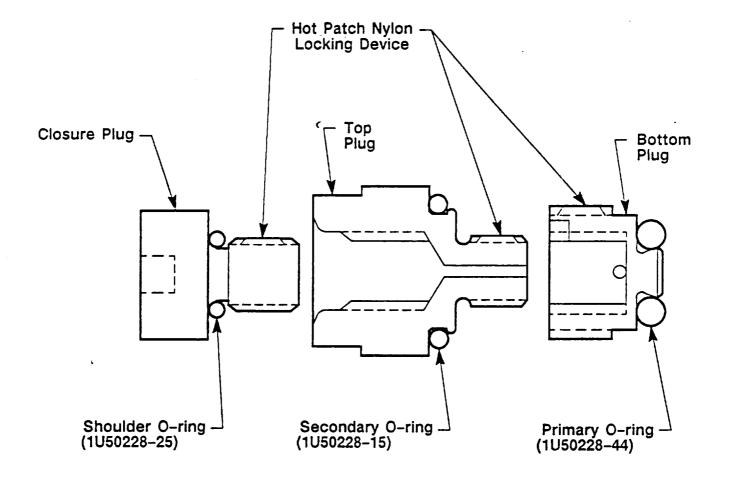


Figure 7 Adjustable Vent Port Plug

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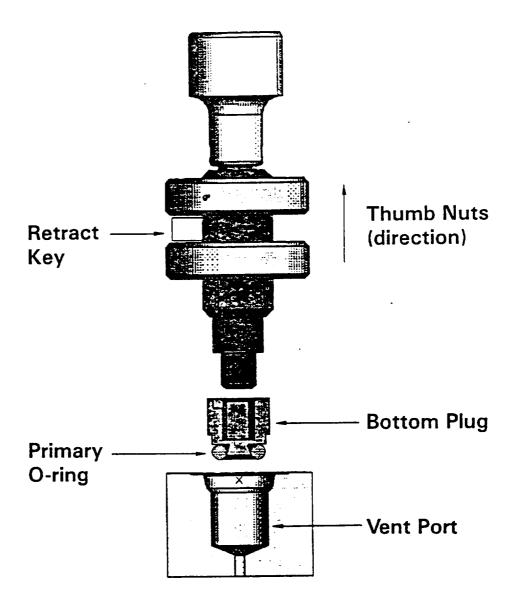


Figure 8 Bottom Plug Installation Setup

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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

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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.

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

 TABLE 1

 QM-8 CASE FIELD JOINT PRIMARY O-RING MOVEMENT

* 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 O-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.

JOINT #		*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

TABLE 2 QM-8 INTERNAL NOZZLE JOINT LEAK TEST RESULTS

* 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. O-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

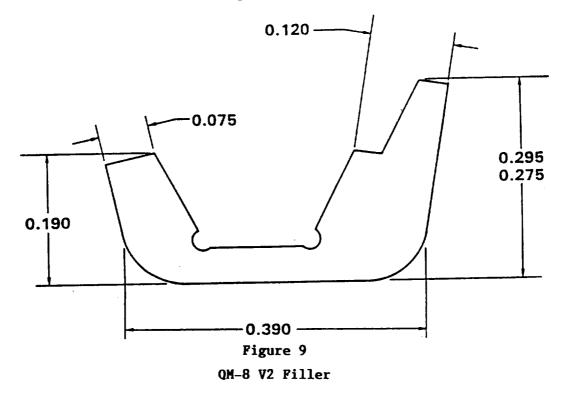
3.2.1 Grease Application

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.



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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 O-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

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	Joint	Specification	Equipment
1.	Case Field Joints	STW7-3447	8075902
2.	Forward-to-Aft Exit Cone Joint	STW7-3475	8U76248
3.	Nozzle Internal - Joint 2 - Joint 3 - Joint 4 - Joint 5	STW7-3476 STW7-3477 STW7-3478 STW7-3320	2U129718 2U129718 2U129718 2U129718 2U129718
4.	Vent Port Plug	STW7-3661	7076357
5.	Nozzle/Case Joint	STW7-3448	2U129718
6.	Case Factory Joints	STW7-2747	2U129718
7.	Ignition System - Inner/Outer Gaskets and Special Bolt Installation	STW7-3632	2U129718
	- S&A Joint - X-ducer Assembly - Barrier Booster	STW7-3633 STW7-2853 STW7-2913	8U76500 2U65686 2U65848

TABLE 3 QM-8 SEAL LEAK TESTING

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.

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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.

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

TABLE 4QM-8 CASE FIELD JOINT LEAK TEST RESULTS

* P-S PRIMARY-TO-SECONDARY SEAL P-C PRIMARY SEAL-TO-CAPTURE FEATURE O-RING ** MONITOR PRESSURE RISE IN P-S CAVITY

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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.

JOINT SEAL	ALLOWABLE LEAK RATE (sccs), HI/LO*	ACTUAL LEAK RATE (sccs), 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	

TABLE 5 QM-8 IGNITION SYSTEM LEAK TEST RESULTS

* HI = 1000 psig, L0 = 30 psig

** 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 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.

PRESSURE (psig)	CAVITY*	MAXIMUM ALLOWABLE LEAK RATE (sccs)	
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	₽-₩	0 BUBBLES/SEC	0

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

* P-S = PRIMARY-TO-SECONDARY SEAL P-W = PRIMARY SEAL-TO-WIPER O-RING ** 5 psi DROP IN 5 MINUTES

MONITOR PRESSURE RISE RATE WITH P-W PRESSURIZED

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 7QM-8 VENT PORT PLUGS LEAK TEST RESULTS

PRESSURE	ALLOWABLE LEAK RATE (sccs)				;)
(psig)		AFT	CENTER	FORWARD	NOZZLE/CASE
1000	0.10	-0.0055	0.0051	0.0015	-0.0015

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.

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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:

0 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-tocase 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-tocase radial and axial bolts to measure initial and final loads on the bolts in pounds.

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

- 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

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

4.2.1 Field Joint Girth Gages

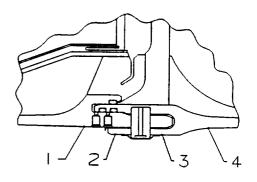
Tables 8 and 9 list the girth gage response (i.e., strain and radial growth) of the forward and center field joints, and compare it with the predictions. The results show a strong correlation between analysis and test data. Field joint predictions come within 8.5 percent of measured values.

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.

TABLE8

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

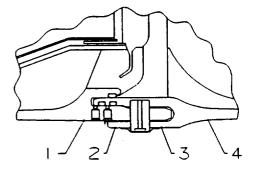
TEST NAME:	QM-8
JOINT:	FWD FIELD
DESCRIPTION:	JOINT GIRTH GAGES
THE TIME RANGE	IS 0.0 TO 120.0 SECONDS



GIRTH GAGE LOCATION	gage Number	STATION	RADIUS (IN)	RADIAL GROWTH (IN)	TEST STRAIN (UIN/IN)	ADJUSTED ANALYSIS STRAIN (UIN/IN)	ADJUSTED ANALYSIS RADIAL GROWIH (IN)	DIFF IN RADIAL GROWIH (% DIFF)
1	R303	848.5	73.1	ND	ND	ND	ND	ND
2	S677	850.2	73.5	ND	ND	ND	NID	ND
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:	QM-8
JOINT:	CTR FIELD
DESCRIPTION:	JOINT GIRTH GAGES
THE TIME RANGE	IS 0.0 TO 120.0 SECONDS

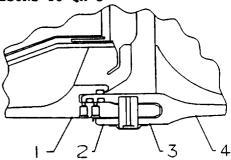


GIRTH GAGE LOCATION	gage Number	STATION	RADIUS (IN)	RADIAL GROWTH (IN)	TEST STRAIN (UIN/IN)	ADJUSTED ANALYSIS STRAIN (UIN/IN)	ADJUSTED ANALYSIS RADIAL GROWTH (IN)	DIFF IN RADIAL GROWTH (% DIFF)
1	R304	1168.5	73.1	0.155	2118	1973	0.144	-6.9
2	S682	1170.2	73.5	0.136	1853	1880	0.138	1.4
3	S966	1172.6	73.5	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



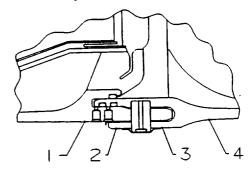
Fwd Field Girths

AVERAGE JOINT PRESSURE AT MAX STRAIN = 827

	•	STRAIN	1	S	TS-27	STS-26				RADIAL GROWIN		(Inches)		
١œ.	GAGE	QM-8	QM-8	RIGHT	LEFT	RIGHT	LEFT	PV-1	QH-7	QM-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

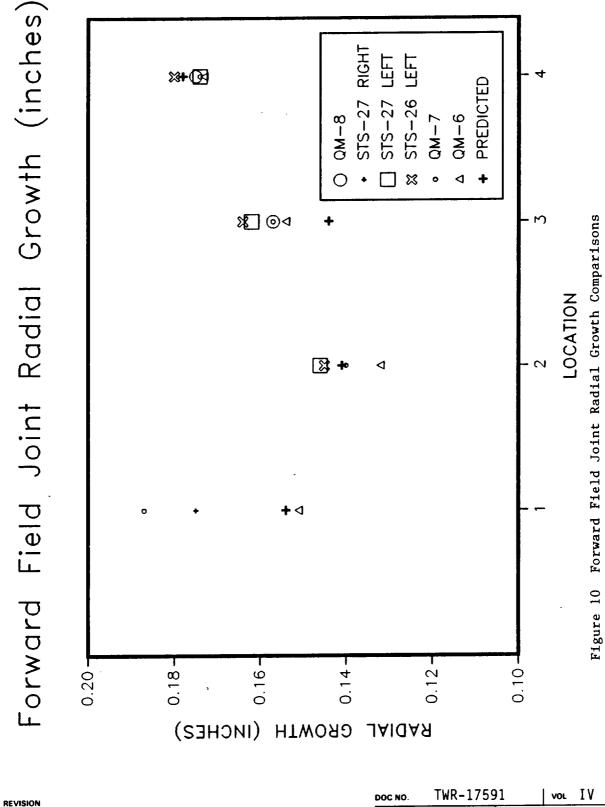
AVERAGE JOINT PRESSURE AT MAX SIRAIN = 799

		STRAIN	1	s	TS-27	STS-26				RADIAL	DIAL GROWIH (Inches)		
LOC.	GAGE	QM-8	QM-8	RIGHT	LEFT	RIGHT	LEFT	PV-1	QM7	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

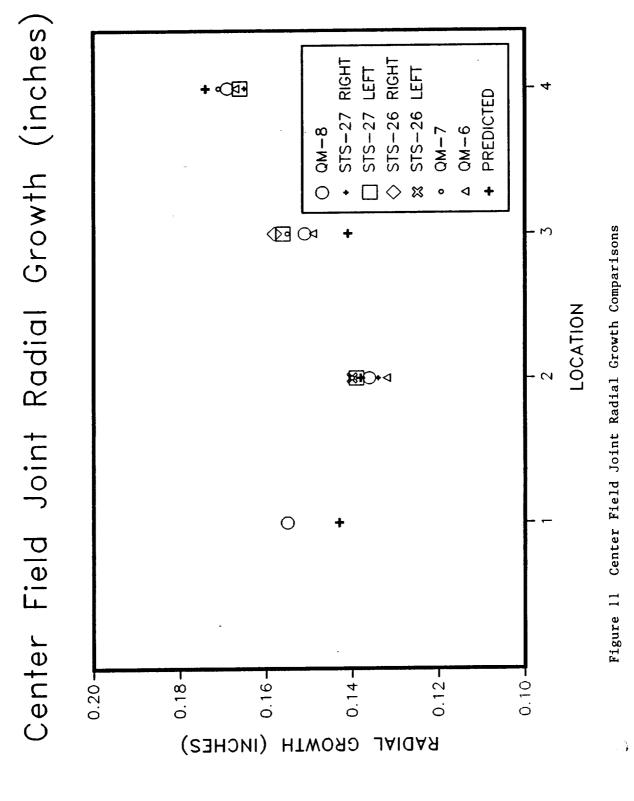
Note: All Test Radial Growths Are Ratios of QM-8 Test Pressure

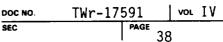
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4.2.3 LVDT Gages

The O-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 O-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, O-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 O-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.

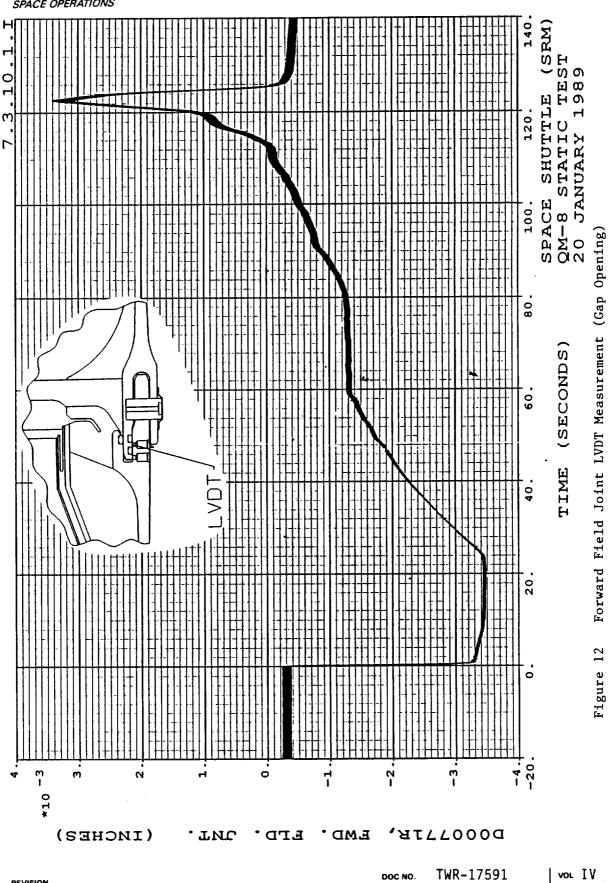
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			Max.	· · · · · · · · · · · · · · · · ·	Max.	
			0-ring Gap	Test	Pressure	ETA
	Test	Joint	(in.)	Defect	(psig)	Ring
Field	QM-8	Fvd	0.004	None	833	360
Joints	QM-7	Fvd	0.004	None	877	360
	QM-6	Fvd	0.007	None	854	360
	QM-6	Aft	0.002	None	816	360
	JES-3A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

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

* Maximum Gap Aft of Secondary



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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:

- Assembled with 16.5 percent squeeze for 180 days. 0-ring at 75
 °F at the time of test.
- 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

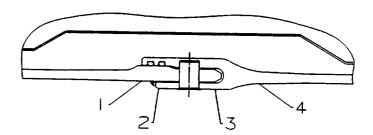
QM-8 instrumentation on the forward segment factory joint consisted of four girth gages. Table 13 lists the girth gage response for the zero through

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

TEST NAME: QM-8 JOINT: 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 GROWIH (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	22 92	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 14QM-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

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\square								

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)	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	S589	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	s592	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 Also, a comparison with these motors down the bore of the motor. drop that the radial growth increases from Station 2 to Station 3. Factushow ally, 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

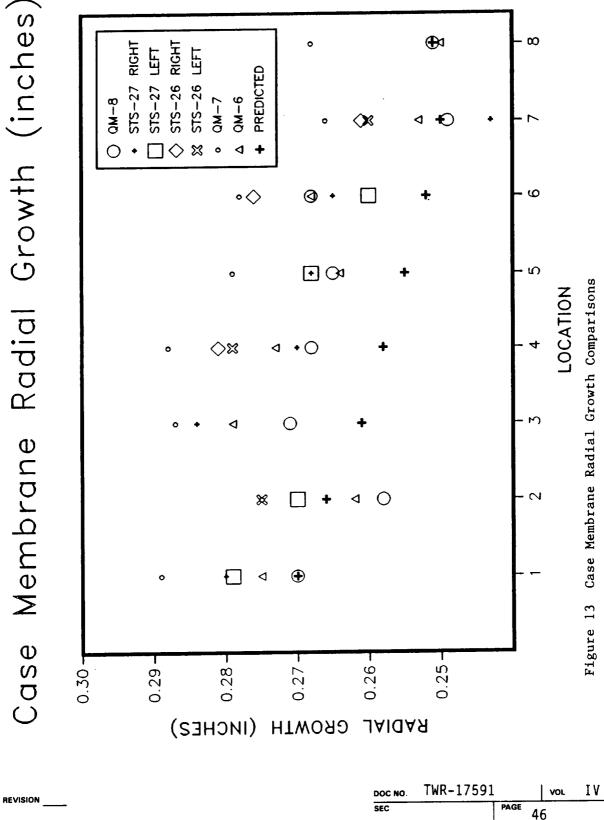
$\int $	∫ ²	3	ſ ⁴	5	6	78

۱œ.	GAGE	STRAIN QM-8	QM-8	S RIGHT	TS-27 LEFT	ST RIGHT	S-26 LEFT	PV-1	QH- 7	RADIAL 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 QM-8 Nozzle to Case Joint Radial Growth Comparisons to QM-8

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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.

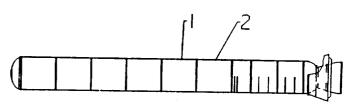
There was relatively little difference in maximum hoop stress and the time it occurred between Locations 1 and 2. Maximum axial stress was affected by the induced strut loads (those occurring during the initial second of burn time), whereas maximum hoop stress was not.

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.

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

TEST NAME:	QM-8
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	AXIAL GAGE	HOOP GAGE	TEST D AXIAL STRAIN (UIN/IN)	NATA 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)

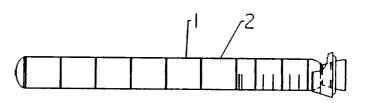
TEST NAME: JOINT: DESCRIPTION: THE TIME RANGE	QM-8 AFT/CTR SEGMENT (STATION 1466.00) CASE LINE LOAD/ MOMENT BIAXIALS IS 0.0 TO 120.0 SECONDS	2 _ا ا ر
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LOCAT	ANGULAR LOCATION	AXIAL GAGE	HOOP GAGE	TEST AXIAL STRAIN (UIN/IN)	DATA HOOP STRAIN (UIN/IN)	ADJUSTE AXIAL STRAIN (UIN/IN)	D ANALYSIS HOOP STRAIN (UIN/IN)	XDIFF AXLAL	&DIFF HOOP
2	0.0	R780	R779	-896	4193	298	3075	-133.3	-26.7
	90.0	R782	R7 81	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:	QM-8
JOINT:	AFT/CTR SEGMENT (STATION 1196.48)
DESCRIPTION:	CASE LINE LOAD/ MOMENT BLAXIALS
THE TIME RANGE	IS 0.0 TO 120.0 SECONDS

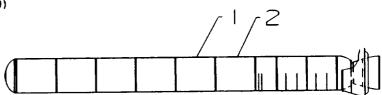


				MAX		TEST	DATA	MAX		TEST	DATA
LOCAT	ANGULAR LOCATION	HOOP GAGE	AXIAL GAGE	HOOP STRESS (KSI)	AXIAL STRESS (KSI)	HOOP STRAIN (UIN/IN)	AXIAL STRAIN (UIN/IN)	AXIAL STRESS (KSI)	HOOP STRESS (KSI)	AXIAL STRAIN (UIN/IN)	HOOP STRAIN (UIN/IN)
1	0.0	R679	R680	122.7	49.4	3610	342	55.1	112.9	640	3220
	90.0	R739	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:	QM8
JOINT:	AFT/CTR SEGMENT (STATION 1466.00)
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)
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.

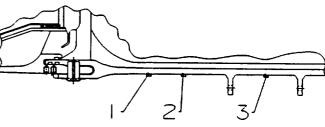
The maximum measured stress occurred at Station 1498.0, Location 1 in the hoop direction at 188 degrees, measuring a local stress of 109.8 ksi. This maximum measured stress results in a 1.95 safety factor. The yield strength of D6AC is 180 ksi, therefore, no local yielding was measured in this area. 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-8JOINT:AFT FIELD / ET ATTACH (STATION 1498.00)DESCRIPTION:JOINT BLAXIAL GAGESTHE TIME RANGE IS0.0 TO 120.0 SECONDS

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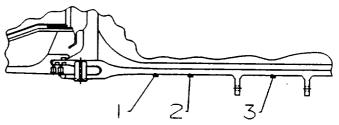


				TEST DATA			
LOCAT	ANGULAR LOCATION	AXIAL GAGE	HOOP GAGE	AXIAL STRAIN (UIN/IN)	HOOP STRAIN (UIN/IN)		
1	0.0	R644	R643	1634	2413		
	90.0	R744	R743	1836	2432		
	188.0	R726	R725	2420	2556		
	220.0	R650	R649	2232	2460		
	255.0	R656	R655	2068	2424		
	270.0	R654	R653	1854	2460		
	285.0	R658	R657	2021	2400		
	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)

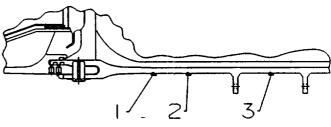
TEST NAME:	QM-8
JOINT:	AFT FIELD / ET ATTACH (STATION 1501.00)
DESCRIPTION:	JOINT BIAXIAL GAGES
THE TIME RANGE	IS 0.0 TO 120.0 SECONDS



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

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

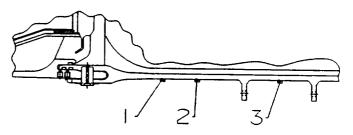
TEST NAME:	QM-8
JOINT:	AFT FIELD / ET ATTACH (STATION 1511.00)
DESCRIPTION:	JOINT BIAXIAL GAGES
THE TIME RANGE	IS 0.0 TO 120.0 SECONDS



				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	S1192	511 91	1084	2083			
			AVERAGE:	896	2087			

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

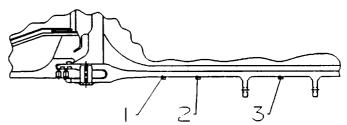
TEST NAME:	QM-8
JOINT:	AFT FIELD / ET ATTACH (STATION 1498.00)
DESCRIPTION:	JOINT BLAXIAL GAGES
THE TIME RANGE	IS 0.0 TO 120.0 SECONDS



				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
1	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

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

TEST NAME:	QM-8
JOINT:	AFT FIELD / ET ATTACH (STATION 1501.00)
DESCRIPTION:	JOINT BLAXIAL GAGES
THE TIME RANGE IS	S 0.0 TO 120.0 SECONDS



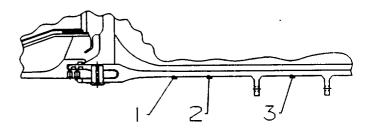
LOCAT	ANGULAR LOCATION	- Hoop Gage	AXIAL GAGE	MAX HOOP STRESS (KSI)	AXIAL STRESS (KSI)	TEST HOOP STRAIN (UIN/IN)	DATA AXIAL STRAIN (UIN/IN)	MAX AXIAL STRESS (KSI)	HOOP STRESS (KSI)	TEST AXIAL STRAIN (UIN/IN)	DATA HOOP STRAIN (UIN/IN)
2	0.0	R661	R662	75.1	39.8	2108	532	40.6	73.6	576	2049
	90.0	R745	R746	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:	QM8	
JOINT:	AFT FIELD / ET ATTACH	(STATION 1511.00)
DESCRIPTION:	JOINT BIAXIAL GAGES	
THE TIME RANGE	IS 0.0 TO 120.0 SECONDS	5



				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	1059	58.2	59.1	1327	1368
	300.0	S1183	S1184	80.7	57.2	2106	1062	57.6	79.7	1083	2069
	270.0	S1185	S1186	78.8	54.3	2076	981	54.3	78.8	981	2076
	255.0	S1187	S1188	80.6	58.0	2095	1090	58.0	80.6	1090	2095
	285.0	S1189	S1190	76.4	55.5	1981	1049	55.5	75.0	1066	1932
	320.0	\$1191		79.2	54.9	2083	997	55.8	74.1	1084	1900
			AVERAGE:	77.7	49.6	2087	836	49.5	73.6	881	1950

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:

- Nominal values for material properties and hardware dimensions
- Preload of 140 kips in the axial bolts and 47 kips in the radial bolts
- 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.

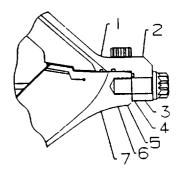
Comparing QM-8 strain versus time plots to QM-6, it can be concluded that the strut loads had little effect on strain at this location (also see Table 27).

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TABLE 26 QM-8 AFT DOME, FIXED HOUSING NOZZLE-TO-CASE JOINT GIRTH GAGES (18 to 22 seconds)

TEST NAME:QM-8JOINT:AFT DOME, FIXED HOUSINGDESCRIPTION:NOZZLE CASE GIRTH GAGESTHE TIME RANGE IS18.0 TO22.0 SECONDS

١



ADJUSTED

GIRTH GAGE LOCATION	GAGE NUMBER	STATION	RADIUS (IN)	RADIAL GROWTH (IN)	TEST STRAIN (UIN/IN)	ADJUSTED ANALYSIS STRAIN (UIN/IN)	ANALYSIS RADIAL GROWTH (IN)	DIFF IN RADIAL GROWTH (& DIFF)	MAXIMUM RADIAL GROWIH 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	ND	NID	ND	ND	ND
3	S877	1876.3	54.4	0.097	1778	212 6	0.116	19.6	0.126
4	S884	1875.7	54.4	0.092	1689	1999	0.109	18.4	0.120
5	S8 87	1874.9	54.8	0.083	1520	1784	0.098	18.1	0.110
6	S 875	1874.2	54.8	0.076	1394	1622	0.089	16.4	0.100
7	S 874	1872.5	55.2	0.066	1193	1345	0.074	12.7	0.105

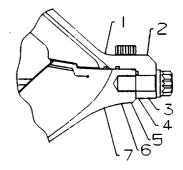
4.6.3 Nozzle-to-Case Joint Comparison

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 O-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 O-ring.

TABLE 27

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



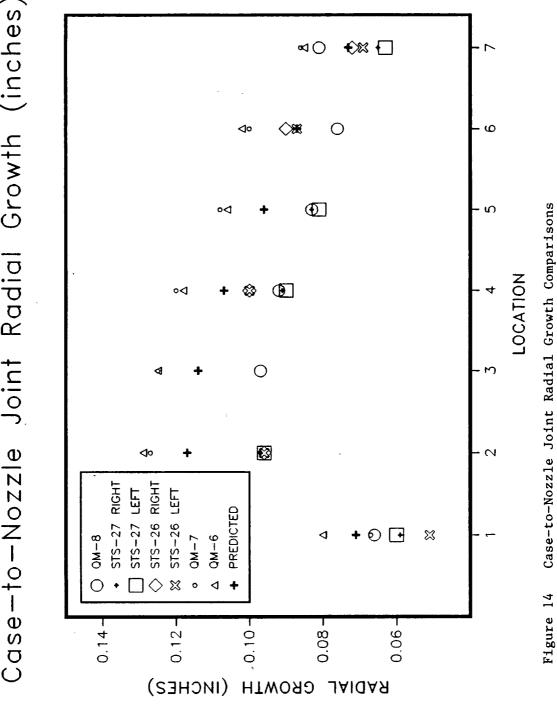
Nozzle to Case Girths

AVERAGE JOINT PRESSURE AT MAX STRAIN = 793

NOZZI	etota	se Girc	ns										
LOC.	GAGE	STRAIN QM-8	QM-8	-	TS-27 LEFT	ST RIGHT	S26 LEFT	PV-1	011- 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	S 878	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

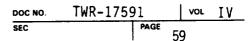
Note: All Test Radial Growths Are Ratios of QM-8 Test Pressure

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Case-to-Nozzle Joint Radial Growth (inches)

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:

- o 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.
- 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

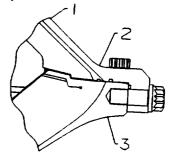
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correlation at Location 1 (range of 2.5 to 9.3 percent difference) and the least favorable at Location 2 (range of 18.8 to 41.0 percent difference).

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.

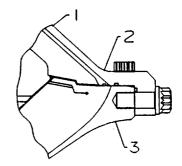
TABLE 28										
QM-8 AFT DOME,	FIXED HOUSING NOZZLE-TO-CA	SE JOINT								
BIAXIAL	GAGES (Zero to 120 seconds)								

TEST NAME:	QM-8
JOINT:	FIXED HOUSING, AFT DOME
DESCRIPTION: THE TIME RANGE	NOZZLE / CASE BLAXIAL GAGES 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)
<u> </u>	0.0	R528	R527	-11.9	13.6	-550	589	14.3	-10.8	600	-520
1	90.0	R530	R529	-14.9	9.9	-611	495	14.6	-3.0	526	-259
		R530	R531	-11.2	13.3	-521	572	14.5	-10.3	603	-505
	180.0 270.0	R532 R534	R531	-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
-		-520	5510	28.5	-30.3	1290	-1331	-32.9	26.9	-1404	1265
2	0.0	R520	R519	35.0	-17.0	1367	-952	-19.5	32.4	-1010	1306
	90.0	R522	R521		-20.0	1328	-1032	-22.4	31.5	-1098	1305
	180.0 270.0	R524 R526	R523 R525	32.9 29.2	-29.5	1306	-1312	-31.9	27.2	-1370	1263
	270.0	RJ20	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
2	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	-977	-17.5	36.2	-984	1414

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



 TEST NAME:
 QM-8

 JOINT:
 FIXED HOUSING, AFT DOME

 DESCRIPTION:
 NOZZLE / CASE BLAXIAL GAGES

 THE TIME RANGE IS
 18.0 TO
 22.0 SECONDS

				TEST HOOP	DATA MERID	ADJUSTE HOOP	D ANALYSIS MERID		
LOCAT	ANGULAR LOCATION	HOOP GAGE	MERID GAGE	STRAIN (UIN/IN)	STRAIN (UIN/IN)	STRAIN (UIN/IN)	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	
	180.0	R606	R605	1529	-1002	1650	-850	7.1	-14.2 -15.2
	270.0	R608	R607	1540	-985	1653	-849	7.4	-13.2
			AVERAGE :	1534	-996				

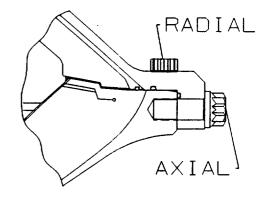
4.6.5 Nozzle-to-Case Strainsert Gages

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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:	QM-8
JOINT:	FIXED HOUSING, AFT DOME (STRAINSERT)
DESCRIPTION:	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) nozzleto-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 O-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.

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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 31QM-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 32QM-8 FORWARD, CENTER, AFT FIELD JOINTS AND NOZZLE-TO-CASEJOINT AND HEATER TEMPERATURES (-10.0 to Zero seconds)

TEMPERATURE LOCAT	GAGE NUMBER	CIRCUMPERENTIAL 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

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.

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

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

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LOCAT	FROM STATION	TO STATION	GAGE NUMBER	ANGULAR LOCATION	DEFLECTION (IN)	ANALYSIS	DEFLECTION DIFFERENCE
1	527.0	1505.0	D196	270.0	1.002	ND	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

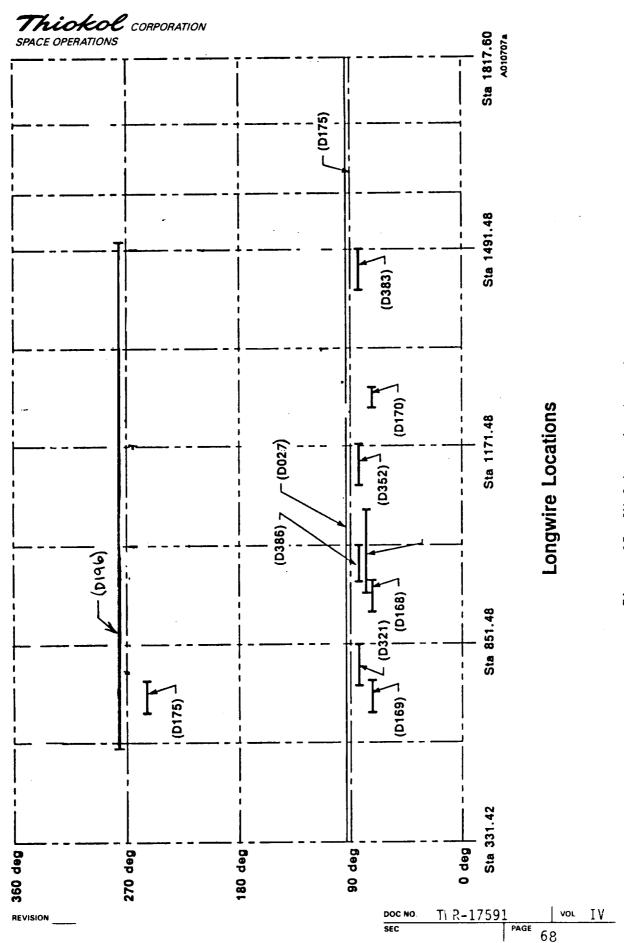


Figure 15 QM-8 Longwire Locations

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-tocase 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).

Following the initial O-ring inspection at time of disassembly, the O-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 O-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 O-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.

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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.
<u>Nick</u> :	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.
<u>Brosion</u> :	Seal material missing due to hot gas impingement or blow by.

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CORROSION

Light Corrosion:	Can be wiped off by hand. Surface discoloration.
<u>Medium Corrosion</u> :	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 O-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 O-rings while in the grooves. Inspection of the O-rings by the O-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 O-rings. The cause is suspected to be from cleaning the O-rings before final inspection. No damage was found by the O-ring Inspection Team on the primary or secondary O-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 O-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 O-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 O-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

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O-rings by the O-ring Inspection Team revealed a similar 13.5 inch circumferential scratch as on the forward field joint capture feature O-ring. This scratch is also located on the capture feature O-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 O-ring at 345.8 degrees. The depth of these scratches is approximately 0.001 inch. No damage was found by the O-ring Inspection Team on the primary or secondary O-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 O-ring grooves at 134 degrees. The grease on the O-rings was intermittently heavier than prescribed in STW7-2999. However, the grease was heavier on the aft side of the primary and secondary O-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

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evidence of damage to the O-rings while in the grooves or found by the O-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 O-ring during joint disassembly operations. Otherwise, no apparent metal damage was found during the inspection.

The grease on the O-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 O-ring damage was found during the in-groove inspection. A heavy rub mark was found on the primary O-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 O-rings by the O-ring Inspection Team revealed one scratch

on the primary O-ring and one scratch, one cut, and one nick on the wiper O-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 O-ring removal. No damage was found on the secondary O-ring by the O-ring Inspection Team.

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

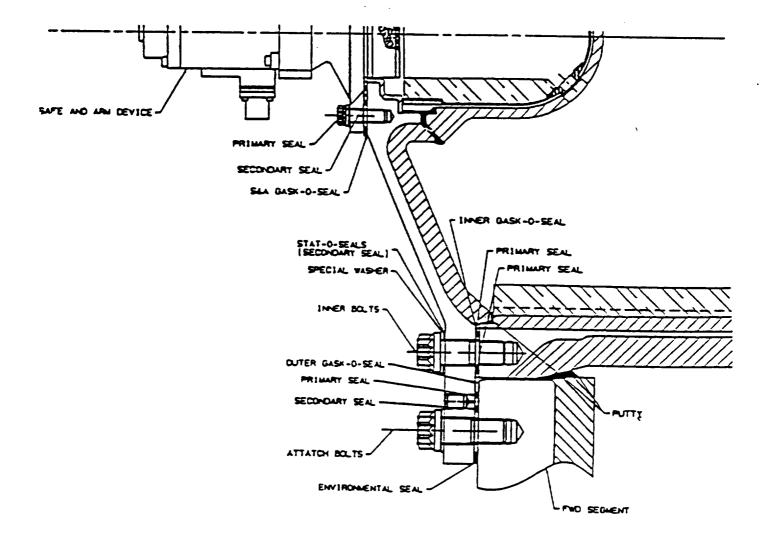
Inspection of the radial bolt Stat-O-Seals revealed that 35 of 100 had unacceptable flow line conditions which should have been rejected by Receiving Inspection. Drawing No. 1U75374 defines the Stat-O-Seals to be inspected per MIL-STD-413, which allows circumferential flow lines no greater than 0.180 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

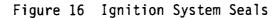
Figures 16 and 17 illustrate the Igniter and S & A seals and components, respectively. Post-test inspections were performed on the ignition system

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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.

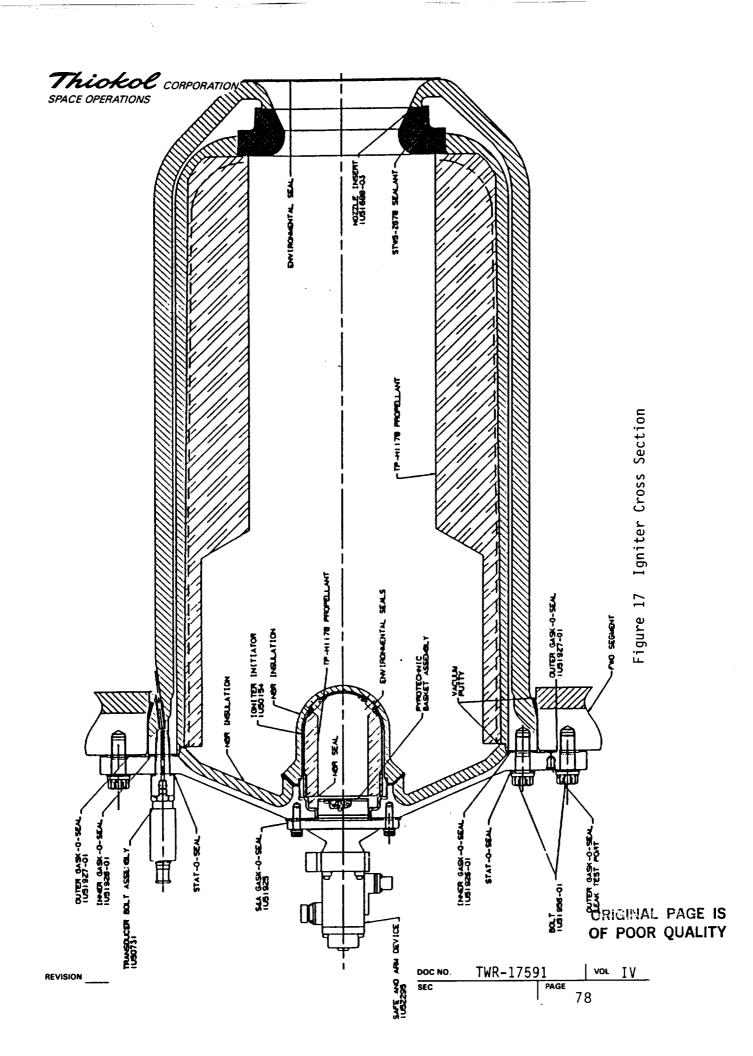


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5.4.1 Safe and Arm Joint

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 stat-o-seals. No 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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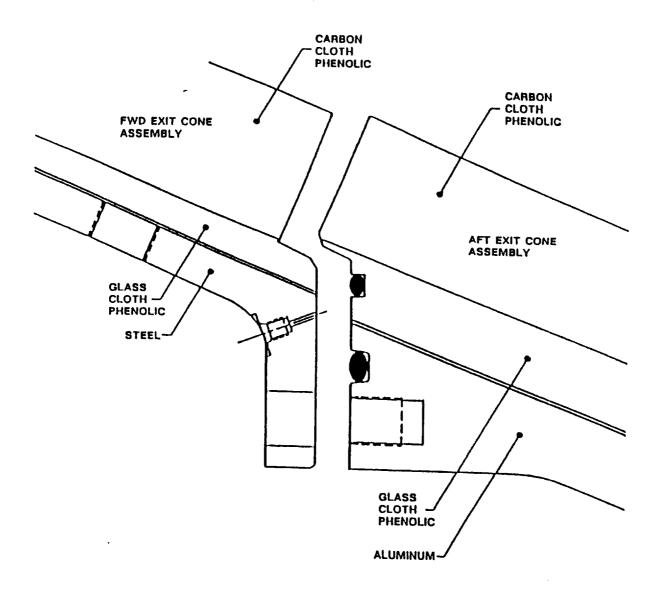


Figure 18 Forward Exit Cone-to-Aft Exit Cone Joint Interface

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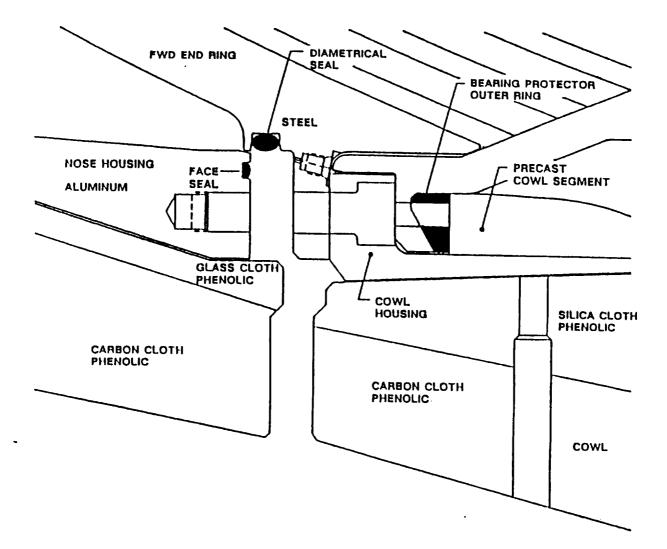


Figure ¹⁹ Nose Inlet Housing/Flex Bearing Joint

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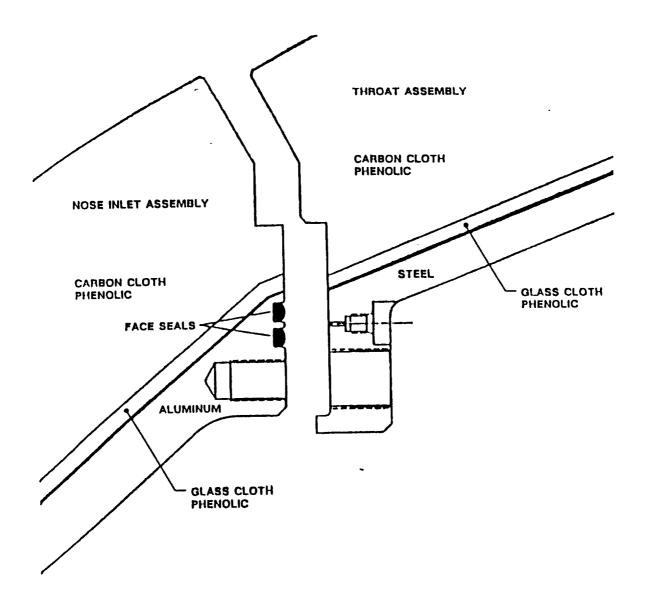


Figure 20 Nose Inlet/Throat Housing Joint

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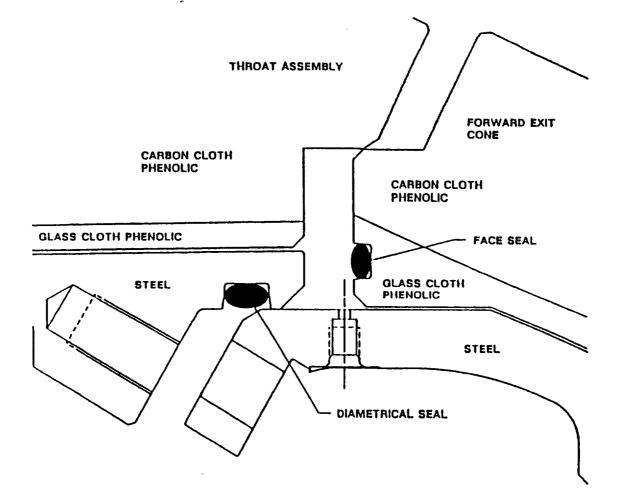


Figure 21 Throat/Forward Exit Cone Joint

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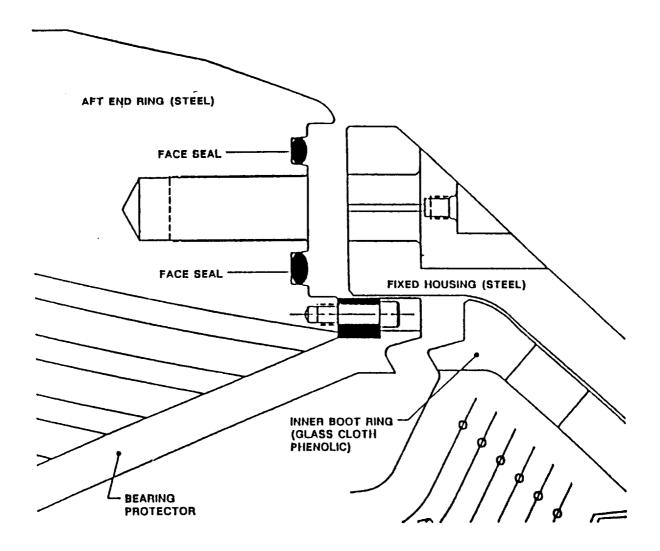


Figure 22 Flex Bearing/Fixed-Housing Joint

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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 O-rings while in the grooves, or found by the O-ring Inspection Team. There were no voids in the RTV which would allow pressure to reach the primary O-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 O-ring experienced pressure, but no apparent damage to the O-ring was found. Inspection of the O-rings by the O-ring Inspection Team revealed a 2.67 inch indeterminable depth circumferential scratch on the primary O-ring similar to the scratches found on the forward and center field joint capture feature O-rings (see page A-37, Appendix A). No damage was found on the secondary O-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

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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 O-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 O-rings did not have any apparent damage at the time of disassembly. Inspection of the O-rings by the O-ring Inspection Team revealed two scratches on the primary O-ring and one on the secondary O-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 O-ring inspection revealed no damage. Inspection of the O-rings by the O-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 O-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.

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Very excessive insulation and Chemlok were on the land forward of the primary O-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 O-rings showed nominal condition. The O-ring Inspection Team reported no O-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 O-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 O-rings showed nominal condition. The O-ring Inspection Team reported no O-ring damage.

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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 O-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 O-rings showed nominal condition. The O-ring Inspection Team reported no O-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 O-ring groove through the clevis root and up the inside surface

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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 O-ring groove and the primary O-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 O-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 O-rings showed a nominal condition. The O-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).

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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 O-rings showed a nominal condition. The A-2 O-ring Inspection Team also revealed no findings.

5.6.4.2 Stiffener-to-Stiffener Factory Joint

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 O-ring grooves at 358 degrees.

Insulation and Chemlok were on the land forward of the primary O-ring groove and in contact with the forward edge of the primary O-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.

5.6.4.3 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 O-ring groove and in contact with the forward edge of the primary O-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 O-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.

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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.

Remains		Anomaly			
Observation	Minor	Major	Critical		
Requires no Specific Action	Requires correc- tive 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 depar- ture from the his- torical database	Could cause failure in combination w/ other anomaly Could cause damage preventing reuse of hardware Program acceptance of cause, correct- ive action, and risk assessment re- quired before sub- sequent static test or flight	<pre>Violates CEI Spec. requirements Could cause failure and possible loss of mission/life Mandatory resolution before subsequent static test/flight</pre>		
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.					

Table 34Criteria for Classifying "Potential Anomalies"

6.0 REFERENCES

APPLICABLE DOCUMENTS

- Hugh P.J., CTP-0060 Revision D, "Space Shuttle Qualification Motor #8 (QM-8) Static Fire Test Plan", Morton Thiokol, Inc., 19 January 1989.
- Garecht D. M., TWR-17591 Vol. 1, "Space Shuttle Qualification Motor 8 (QM-8) Final Test Report", Morton Thiokol, Inc., March 1989.
- 3. TWR-19506 Has Not Been Released At This Time.
- Swopes, C., TWR-16459, Rev. E., "CPW1-3600 Specification Deviations", Morton Thiokol, Inc., 7 October 1988.
- Furgeson J. W., STW7-2999, "Calcium Grease, Field Joint, Factory Joint, Nozzle Joints Assembly, Application of, and Component Installation, Space Shuttle SRM", Morton Thiokol, Inc., March 1988.
- 6. Ferney D. G., ETP-0228, Revision A, "Horizontal Assembly Requirements for RSRM Segments with 7U75170 Field Joint Assembly Fixture", <u>Morton</u> Thiokol, Inc., January 1988.
- 7. Nelsen L. V., TWR-18135, Revision A, "DM-9 RSRM Structural Test Report", Morton Thiokol, Inc., 30 June 1988.
- 8. Tarbet G. F., STW7-3499, "Installation Procedure, Leak Check and Vent Port Plug, Space Shuttle Redesigned Solid Rocket Motor", <u>Morton</u> Thiokol, Inc., 25 July 1988.
- Tarbet G. F., STW7-3661, Revision B, "Leak Testing, Field Joint and Nozzle-to-Case Vent Port Plugs, Space Shuttle, Redesigned Solid Rocket Motor", Morton Thiokol, Inc., 7 September 1988.
- 10. TWR-18838, Installing' "The Adjustable Vent Port Plug", <u>Morton</u> Thiokol, Inc., (A Presentation, Publications No. 89268)
- Dean M. C., Ash R., TWR-18811, Revision A, "O-ring Squeeze Calculations and Temperature Requirements QM-8", <u>Morton Thiokol, Inc.</u>, 13 December 1988.
- Hutchison B. J., TWR-18990, "Predicted Ballistic Performance Characteristics for QM-8", Morton Thiokol, Inc., 15 December 1988.

- 13. Structural Design Section, TWR-17118, Supplement B, Revision A, "RSRM Case Structural Analysis Summary", Morton Thiokol Inc., April 1988.
- 14. St. Aubin, B. K., TWR-17991, "RSRM Seal Design Summary Report", <u>Morton</u> Thiokol, Inc., 1 September 1988.
- 15. Structural Design Section, TWR-17118, Supplement D, Revision A, "RSRM Case Structural Analysis Summary", <u>Morton Thiokol Inc.</u>, April 1988.
- 16. Performance and Advanced Design, et. al., TWR-16473, Revision B, Volume 4, "Qualification and Production Verification Motor Postfire Engineering Evaluation Plan", <u>Morton Thiokol, Inc.</u>, 13 January 1989
- 17. Performance and Advanced Design, et. al., TWR-17198, Revision A, Volume 4, "Postfire Engineering Evaluation Limits", <u>Morton Thiokol, Inc.</u>, 18 April 1988
- W. J. Straley, STW7-2790, Revision B, "Ignition System Gaskets, Reusable Acceptance Criteria For", <u>Morton Thiokol, Inc.</u>, 20 November 1987.

APPLICABLE DRAVINGS

- 1. Drawing 8U76500, "Leak Test System, Safe and Arm Device, Installation", <u>Morton Thiokol</u>, <u>Inc.</u>, 16 May 1988.
- 2. Drawing 8U75902, "Leak Check System, Installation", <u>Morton Thiokol</u>, Inc., 11 December 1987.
- 3. Drawing 7U76357, "Vent Port Plug Leak Test Fixture", <u>Morton Thiokol</u>, 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

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Morton Thiokol Inc. Space Operations

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Motor No.: QM-8	Date: JAN 21	1989	Time	»: 14a	00	
Inspector(s): DAVE ROWSE	ELL, JEFF C	JRRY	LOI	NELL	NE	LSEN
Evidence of Combustion Product L	_eakage (SOOT)?	,		,		Comment Number
A. Forward Dome Factory Joint FDS, CLEVIS)	(Sta. 531.5,		yes	<u> </u>	no	
B. Forward Segment Factory Jo FFS, CLEVIS)	pint (Sta. 691.5,	<u> </u>	yes	<u> </u>	no	
C. Forward Field Joint (Sta. 851	1.5, FWD, CLEVIS)		yes	<u> </u>	no	
D. Forward Center Segment Fac 1011.5, FCS, CLEVIS)	ctory Joint (Sta.		yes		no	
E. Center Field Joint (Sta. 1171 F. Aft Center Segment Factory ACS, CLEVIS)	-		yes yes		no no	
G. Aft Field Joint (Sta. 1491.5,	AFT, CLEVIS)		yes	\checkmark	no	
H. Aft Segment Factory Joint (CLEVIS)	Sta. 1577.5, FSS,		yes		no	
I. Aft Segment Factory Joint (CLEVIS)	Sta. 1697.5, ASS,		yes	<u> </u>	no	<u></u>
J. Aft Dome Factory Joint (Sta. CLEVIS)	. 1817.6, ADS,		yes	<u> </u>	no	
K. Nozzle to Case Joint (Sta. 18	875.2, NOZ, AFT)	·	yes		no	
If yes, record the indicated data b	elow:					
						•
		• • .				

Joint External Walk Around - Evaluation Checkoff Worksheet

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External Igniter Interfaces – Evaluation Checkoff Worksheet

Motor No.: QM-8	Date: JAN 21	1989	Time: 140	٥
Inspector(s): DAVE ROWSE	LL, JEFF C	URRY	LOWELL N	FLSEN
Evidence of Combustion Product Le		,		Comment
			V no	Number
A. Adapter / Forward Dome In		yes yes		
B. Adapter To Forward Dome		yes		
C. Adapter / Chamber Interfac D. Adapter To Chamber Bolts		yes	V, no	
E. S&A / Adapter Interface (S		yes		
F. S&A To Adapter Bolts (S&A		yes	по	
If yes, record the indicated data be	31044:			
				ļ
		-		

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Inspector(s):]	AVE ROWS	IL, JEFF	FCUERY.	LOWELL	NELSEN	<u> </u>
	QN1-B				Date: 21 JPM	F7
I. Hotspots (H 1. Aft Segm 2. Aft Cente	eat Affected F nent er Segment Center Segme			yes yes yes yes	Xno Xno Xno Xno	
II. Loose or Cri	acked ETA bo	lts?		yes	<u> </u>	
III. Loose or Cra	acked Stiffene	r Ring Bolts?		yes	<u> X </u>	
IV. Additional O	bservations?			yes	_ <u></u> no	
lf yes, record t	he indicated c	lata below:				
		Axial	Degree	Axial	Circumferential	
Segment		Location	Location	Length (in.)	Width (In.)	Degree Arc
(1 - 4) Co	ondition	(ln.)	(Deg.)	If Applicable	If Applicable	If Applicable
		<u> </u>	<u></u>	- <u></u>		
	<u> </u>	·			· · · · · · · · · · · · · · · · · · ·	
<u> </u>	<u> </u>				·	
	<u> </u>		,			
				. <u></u>	· · · · · · · · · · · · · · · · · · ·	
		<u></u>	<u> </u>			
						
	· •			<u> </u>	· · · · · · · · · · · · · · · · · · ·	·
Notes / Comme	ents					

External Walk Around - Evaluation Checkoff Worksheet

Note: Clarify any observations on an OCF if necessary

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	External Tank A	ttach (ETA) -	Evaluation Ch	External Tank Attach (ETA) - Evaluation Checkoff Worksheet		
Inspector(s): DAVE ROWSELL	IL REUT	SAKER				
Motor No.: QM-8				Date:	21 JAN 87	7
I. Cracked or Deformed Bolts (Removed)?	(Renioved) 7			yes X	ро	
II. Cracked or Warped ETA Ring?	1g ?			yes -	оп	
III. Cracked or Warped ETA Segment Stubs?	gment Stubs7			yes <u>X</u>	оц	
IV. Cracked or Deformed ETA Ring Bolt Holes?	Ring Bolt Holes?			yes X	OL	
V. Cracked or Deformed ETA Segment Stub Bolt Holes?	Segment Stub Bo	it Holes?		yes X	ОП	
If yes, record the indicated data	below:					
	Axial	Degree	Axial	Circumferential		Radial
Alfected	Location	Location	Length	Width	Degree	Distance
Part	(In.)	(Deg.)	(In.)	(In.)	Arc	(In.)
(I-V) Condition	(IIV)	(IIV)	(II Only)	(II & III Only)	(II & III Only)	(II & III Only)
Notes / Comments		1				

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Morton Thiokol, Inc. Space Operations

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	Case Field Joint Condition – Evaluation Che	ckoff Workshe	et	
Mol	tor No.: QM-8	Date: 5	B FEB 89	?
Joir				
Insp	Dector(8): DAVE ROWSELL, JEFF CURRY			
Cas	se Field Joint Observations:	<u> </u>		Comment Number
Α.	Soot In Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	Yes	No	
в.	Sooted Grease (HAGRE)?	Yes	No No	
C.	Discolored Grease (DIGRE)?	Yes	<u> </u>	
D.	Volume 2 Filler Damage (V2FD)?	Yes	No	
Ε.	Leak Check Port Obstructed (LPOBS)?	Yes	No	
F.	Vent Port Obstructed (VPOBS)?	Yes	No	
G.	Foreign material in the sealing area during motor operation (FMIJ)?	Yes	No	
н.	Rust on sealing surfaces (SSCOR)?	Yes	No	
1.	Rust on metal parts (PITCO)?	Yes	No	
J.	Heat affected metal (HTAFF)?	Yes	No	
к.	Damaged metal sealing surface (SSMET)?	Yes	No	<u></u>

If any of the above conditions exist, record applicable dimensions below. Describe the observed coniltion using a comment number, a "T" if the condition is observed on the tang or a "C" if the condiion is observed on the clevis and any other information needed to describe the observation:

1. A long this line of white colored material was found on the aff edge of the copture feature o-ring at 169 degrees. Marc this lines of white colored material were found intermittently on the aff edge of the capture feature orning from 164 to 167 degrees. The long this line at 169 degrees was approximately 0.400 inch long. Suspect adhesive from teston tape. (FMIIJ)

NOTE: FOR YOUR INFORMATION (SEE ATTACHED FIGURE) 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 153, 178, 180, 227, 228, and from 230 to 233 degrees. All of the thin lines of the white colored material ran circumferentially on the joint except for the lines of white colored material at 178 degrees. On the clevis, the white colored material 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 of the thin lines of the white colored material ran circumferentially on the joint except for the lines of white colored material at 178 degrees.

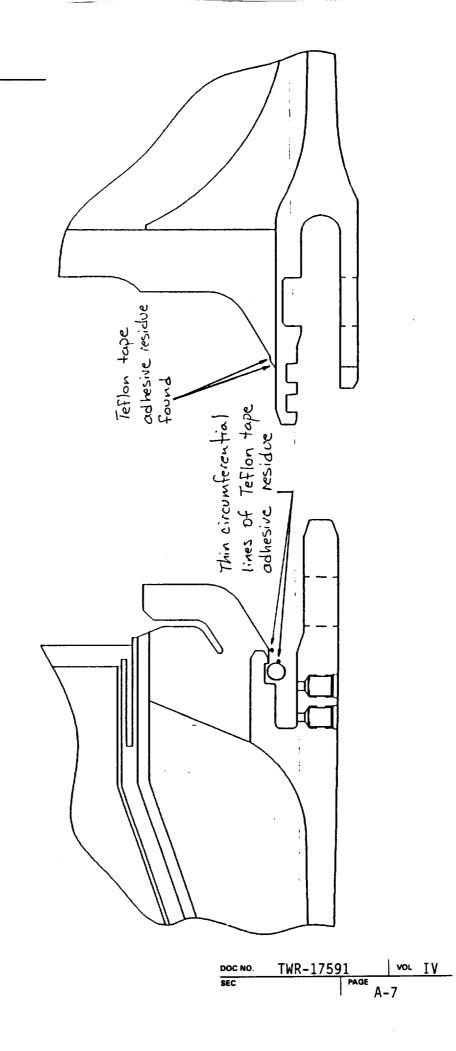
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Field and Factory Joint - Evaluation Checkoff Worksheet

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IV

Motor No.: QW	1-8		Date: 8	FEB 89
Joint:			<u>,</u>	
Forward Dome	Factory Joint (53	1.5) 🔲 Forward Se	egment Factory Joint	(691.5)
🕅 Forward Field	Joint (851.5)	Forward C	enter Segment Facto	ry Joint (1011.
Center Field J	oint (1171.5)	Aft Center	Segment Factory Jo	int (1331.5)
🔲 Aft Field Joint	(1491.5)	🔲 Aft Segme	Int Factory Joint (157	7.5)
Aft Segment F	Factory Joint (1697	7.5) 📋 Aft Dome	Factory Joint (1817.6)
I. Rust on Met	al Parts (Corrosion	n)?	ye	• <u> </u>
II. Metal Dama	ge?		ye	no <u> </u>
Clarify be	low or on an OCF	, if necessary	_	
III. Metal Sliver	from pin holes?		ye	s no
IV. Other?			ye	no
Describe:				I
Location (In.)	Degree Location	Degree Arc	Length	Width
If Applicable	(Deg.)	If Applicable	If Applicable	if Applicable
251.5	SEE BELOW	/		·
	<u>.</u>			
			·····	÷
· · · · · · · · · · · · · · · · · · · ·	<u></u>	· · · · · · · · · · · · · · · · · · ·	<u></u>	
				· · · · · · · · · · · · · · · · · · ·
52, 54, 58, 6	m of the inne	er clevis leg pin 2, 286, 288, 290, Dical. /	Pinhole slive sholes in the fol and 292. The slive ?	lowing holes
	,	C) : code :	
				·

MORTON THIOKOL INC.

Space Operations

Detailed Case Fie	id Joint O-rang	(Post-Removal) -	Evaluation Chec	koff Worksheet (Wasato	h A-2 Bidg)
Inspector(s): Re	XKY Ash	Soft Ede:	D. GARY	NELSON		
Motor Nc.:	QM-8	•		Date: 2-	10-8	9
Joint: For		Center A	it			1
PRIMARY O-RIN	G	Part No.: 1:174	150 -25	Serial No.:	000	331
A. Erosion?	_	يعاليها المحادية المحادية			Yes	V No
B. Heat Affec	*7				Yes	
					Yes	
•	Disassembly Da	-				
				<u> </u>	Yes	No
If any of the above	e conditions ex	ist, record applicat	le dimensions l	below:		
Condition	Degree	Maximum	Circumferentia			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
		· <u>····</u> ·······························	• 			
		<u></u>				
		·		•		
SECONDARY O-	RING	Part No.: _107	5150-25	Serial No.:	OOC	0287
A. Erosion?				, , , , , , , , , , , , , , , , , , , ,	Yes	No
B. Heat Affec	17				Yes	V No
	Disassembly Da	maga?			Yes	V No
•	•	•			Yes	
	escribe:			<u> </u>		
		ist, record applicat				D 1-0
Condition	Degree	Maximum	Circumferentia			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
						·
·						
			<u></u>	•		
CAPTURE FEAT	JRE O-RING	Part No.: 107	5150-11	Serial No.:	coo	2024
A. Erosion?					Yes	V No
B. Heat Affec	t?				Yes	V No
C. Assembly/	Disassembly Da	mage?			Yes	No
	•			$\overline{\mathbf{v}}$	Yes	No
		ist, record applicat				
•		•••				
Condition	Degree	Maximum	Circumferenti			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
D	1.60	indeterminable	<u></u>			13.5'
				• •		·····
		<u> </u>				
	·					
Notes / Comments	:					
			·····			
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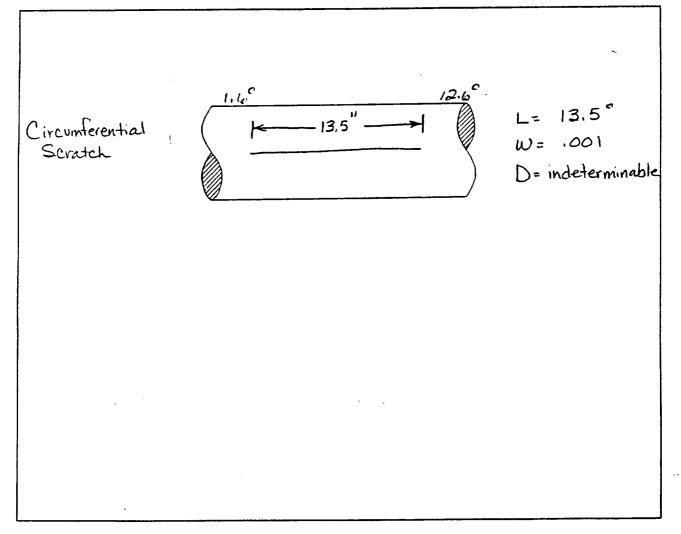
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Morton Thiokol Inc.

Space Operations

O-RING OBSERVATION CLARIFICATION FORM
o-RING OBSERVATION CLAHIFICATION FORM
lotor No.:QM-8
Left (A) Right (B) Joint: FWD FIELD JOINT
-ring Location: Primary Secondary Capture Feature Wiper
art Number: <u>1075150-11</u>
erial Number: 0000024
epth:
epth: escription:SceBelow

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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Case Field Joint Condition – Evaluation Chec	koff Workshee	t Bo	
Mater No: 61M-8	Date: X	-7-89	
Joint: Forward (FWD) 🕅 Center (CTR) 🗌 Aft (AFT)			
Inspector(s): Lowell Nelsen			
			Comment
Case Field Joint Observations:		. /	Number
	Yes	No	
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?			
	Yes	No No	
B. Sooted Grease (HAGRE)? C. Discolored Grease (DIGRE)?	Yes	No No	
	Yes	No	
D. Volume 2 Filler Damage (V2F0) 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)?	Mag	V No	
H. Rust on sealing surfaces (SSCOR)?	Yes Yes	No	
I. Rust on metal parts (PITCO)?	Yes	V No	
J. Heat affected metal (HTAFF)?	Yes	V No	
K. Damaged metal sealing surface (SSMET)? If any of the above conditions exist, record applicable dimension			
fillon using a comment number, a T while contained a comment number, a T while contained a close on the clevis and any other information needed 1. Very light thin line of corros landing between the O-ring clevis Side. Metal Metal Metal Million Metal Metal I and ing Metal I and ing Metal I I I I I I I I I I I I I I I I I I I	grooves primary c Secondary	at 13 at 13	Ϋ)

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1.2 m ¹ i

Notor No.: QM			Date: 2-	7-89
loint:				
Forward Dome	Factory Joint (53		egment Factory Joint (
Forward Field J	oint (851.5)	_	enter Segment Factory	
🖞 Center Field Jo	int (1171.5)		r Segment Factory Join	
] Aft Field Joint	(1491.5)		ent Factory Joint (1577	.5)
] Aft Segment Fa	ctory Joint (169	7.5) 🗌 Aft Dome	Factory Joint (1817.6)	
I. Rust on Meta	i Parts (Corrosio	n)?	yee	no
II. Metal Damag			yes	no
_	ow or on an OCF	, if necessary		
	from pin holes?		yee	no
IV. Other?			yes	no
Describe:_				-
If yes, record the	data below:			
A _1 _1	Derree			
	Degree Location	Degree Arc	Length	Width
Location (In.)	(Deg.)	If Applicable	If Applicable	If Applicable
	1340		Across Clevis 0-ring landing	
	268°		~ 0.60"	E
	<u> </u>	<u> </u>		
**************************************				•
````````````````````````````````				
Notes / Comments				
oce Tuble f	" 5-111 of -	rwR-16473, Vo	1.4 For co	rrosioN
· · · · · ·	J. (PFOR	used)		
1 llustration	-			- 許勝。
1 llustration				

;

Motor No.: 61118		· · ·	Eden, D.6	Date: 2-9-		
Joint: Form PRIMARY O-RING	The second s	Center A			<u> </u>	
A. Erosion?	1	Part No .: 1475	150-25	Serial No.: <u>OC</u>		,
B. Heat Affect	2				Yes	N
C. Assembly/D	•	maga?			Yes Yes	
	-				Yes	
		ist, record applicab		elow:		
Condition	Degree	Maximum	Circumferentia			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
		••••••		·		
	······		·			<u> </u>
SECONDARY O-F	RING	Part No.: 107	5150-25	Serial No.:	000	1333
A. Erosion?				·	Yes	N
B. Heat Affect	•				Yes	V No
C. Assembly/D		-			Yes	No
					Yes	No
		ist, record applicab				
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
				• <u>•••</u> ••••••••••••••••••••••••••••••••		
APTURE FEATU	RE O-RING	Part No.: 117	5150.11	Serial No.:		251
A. Erosion?					Yes	1
B. Heat Affect?	•				Yes	
	sassembly Da	mage?			Yes	
		• .		$\overline{}$	Yes	No
		st, record applicabl		elow:		
Condition	Degree	Maximum	Circumferential			Distance
A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
<u> </u>	<u>4.7°</u>	indeterminable	•		_	13.5
P	345,81					,150
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otes / Comments:						

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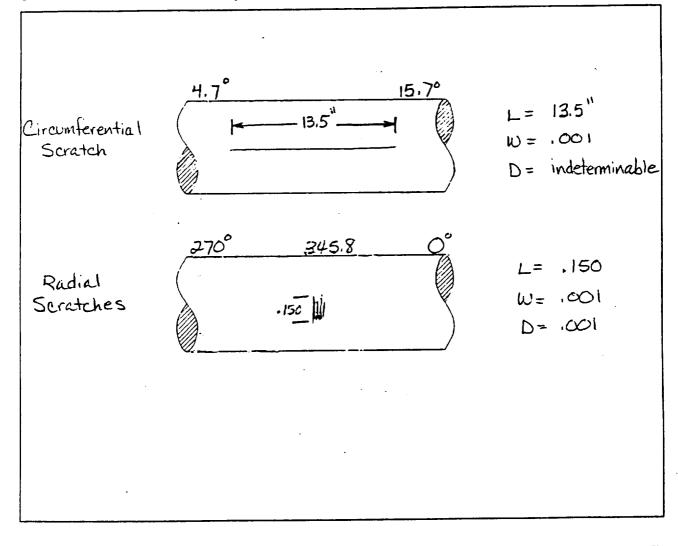
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Morton Thiokol Inc.				
Space Operations				<i></i> 28
Date: <u>1-9-89</u> Motor No.: QM-8	Inspector(s):	I CLARIFICATION FORM	M Ht Eden, Wic	the Sparry
Left (A) Right (B) D-ring Location: Primary Part Number: <u>1075150-</u>	Secondary	FIELO JOINT Capture Feature	□ Wiper	
Serial Number: 0000051				
Depth: Description: <u>SeeBelow</u>				<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.



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Case Field Joint Condition - Evaluation Check			
Motor No.: QM-8	Date:	2-6-89	
Joint: Forward (FWD) Center (CTR) Aft (AFT)		· · · · · · · · · · · · · · · · · · ·	
Inspector(s): K. Baker			
			Comment
Case Field Joint Observations:		/	Number
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR _ SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	Yes	No	
B. Sooted Grease (HAGRE)?	Yes		
C. Discolored Grease (DIGRE)?	Yes		
D. Volume 2 Filler Damage (V2FD)?	Yes	No No	
E. Leak Check Port Obstructed (LPOBS)?	Yes	No V No	<u> </u>
F. Vent Port Obstructed (VPOBS)?	Yes	V No	
G. Foreign material in the sealing area during motor operation _ (FMIJ)?	Yes		
H. Rust on sealing surfaces (SSCOR)?	Yes	No No	<u> </u>
I. Rust on metal parts (PITCO)?	Yes	No No	
J. Heat affected metal (HTAFF)?	Yes	No	·
K. Damaged metal sealing surface (SSMET)?	Yes	No	
tion is observed on the clevis and any other information needed to	describe 1	the observation	1

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MORTON THIOKOL INC. Space Operations

Field and Factory Joint - Evaluation Checkoff Worksheet

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MORTON THIOKOL INC. Space Operations

Inspector(I): Udague, Sparry Scalt Elen D. SALY NEISON Motor No.: G/N - 8 / 1 / Date: Z/8/29 Joint: Porveral Center Att PRIMARY O-RING Part No.: <u>IV75/50-25</u> Serial No.: <u>CCCC 35/2</u> No 8. Heat Affect? Ves / No 0. Other? Describe: Yes / No 1 any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length) SECONDARY O-RING Part No.: <u>IV75/50-25</u> Serial No.: <u>CCCC 35/1</u> A. Erosion? Yes / No C. Assembly/Dessessmbly Damage? Yes / No B. Heat Affect? Yes / No C. Assembly/Dessessmbly Damage? Yes / No If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential (A, B, C or D) Location Depth Width CSVAP (Length) If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential CAPTURE FEATURE O-RING Part No.: <u>JU75/1/0-//</u> Serial No.: <u>O000072</u> A. Erosion? Yes / No CAPTURE FEATURE O-RING Part No.: <u>JU75/1/0-//</u> Serial No.: <u>O000072</u> A. Erosion? Yes / No D. Other? Describe: Yes / No D. Other? Describe: Yes / No No It any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length) S. Heat Affect? Yes / No No Other? Describe: Yes / No No Describe: Yes / No No Describe: Yes /	Detailed Case Fi			- Evaluation Check			ch A-2 Bldg)
Motor No.: QTM-C I I Date: Z/G/G9 Joint: □ Forward □ Center ⊠ Aft Petr No.: L/TS/G0-25	Inspector(s): jua	the Sperm,	Scott Elen	D. GARY	· NELSON	/	
PRIMARY O-RING Part No.: 1///5/50-25 Serial No.: 000035/4 A. Erosion7	Motor No .: QY	4-8111					
A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disesembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Distance Condition Degree Maximum Circumfarential SECONDARY O-RING Part No.: (Length) Use SECONDARY O-RING Part No.: (Length) No Secondary Yes No No Secondary Ves No No If any of the above conditions exist, record applicable dimensions below: Condition Distance (A, B, C or D) Location Depth Width CSVAP (Length) Serial No.: Optication Depth	Joint: DFo	rward 🗌 🖸	enter 🔽	Aft		•	
B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum SECONDARY O-RING Part No.: (Location Depth Width CSVAP (Length) SECONDARY O-RING Part No.: (Location Yes No No SECONDARY O-RING Part No.: (Location Yes No If any of the above conditions exist, record applicable dimensions below: Condition Distance Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP No B. Heat Affect? Yes No <td< td=""><td>PRIMARY O-RIN</td><td>IG</td><td>Part No .: 1475</td><td>150-25</td><td>Serial No.: 00</td><td>$\infty 03$</td><td>356</td></td<>	PRIMARY O-RIN	IG	Part No .: 1475	150-25	Serial No.: 00	$\infty 03$	356
C. Assembly/Disassembly Damage?	A. Erosion?					Yes	No
C. Assembly/Disassembly Damage?	B. Heat Affe	ct?	•			Yes	
D. Other? Describe: Yes Yes No If any of the above conditions exist, record applicable dimensions below: Condition Distance Condition Degree Maximum Circumferential Distance SECONDARY O-RING Part No.: (Length) Ulargith CSVAP (Length) SECONDARY O-RING Part No.: (La 75/15/2 - 2.5) Serial No.: QQQQ 35/1 A. A. Erosion? Yes No No No No B. Heat Affect? Yes No No No C. Assembly/Dissesembly Damage? Yes No No D. Other? Describe: Yes No No No If any of the above conditions exist, record applicable dimensions below: Condition Distance No CAPTURE FEATURE O-RING Part No.: ////////////////////////////////////	C. Assembly	/Disassembly Dan	nage?			Yes	
If any of the above conditions exist, record applicable dimensions below: Distance Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length) SECONDARY O-RING Part No.: [(Langth)	-	-	-				
Candition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length) SECONDARY O-RING Part No.: (M 75/50-25) Serial No.: QOCO35/1 A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disessembly Damage? Yes No D. Other? Degree Maximum Circumferential Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length) CAPTURE FEATURE O-RING Part No.: _/U35/1/0-//					elow:		
(A, B, C or D) Location Depth Width CSVAP (Length) SECONDARY O-RING Part No.: (Lo 75(EQ - 25) Serial No.: QCCC 355(A. For an and an and an and an and an and an and and	•						Distance
SECONDARY O-RING Part No.: 14,75/50-25 Serial No.: 000035/ A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Condition Degree Condition Degree Maximum Circumfarential Distance (A. B, C or D) Location Depth Width CSVAP (Length) CAPTURE FEATURE O-RING Part No.: ///////// Serial No.: 0000052 No A. Erosion? Yes No No No No C. Assembly/Disassembly Damage? Yes No No D. Other? Describe: Yes No No If any of the above conditions exist, record applicable dimensions below: Yes No If any of the above conditions exist, record applicable dimensions below: Yes No If any of the above conditions exist, record applicable dimensions below: Yes No If any of the above conditions exist, record applicable dimensions below: No	-	-					
A. Erosion?		Location	Cepiii				(Longur)
A. Erosion?			<u></u>	······			
A. Erosion?							
A. Erosion?	CECONDARY O	DINC					
B. Heat Affect?		-RING	Part No.: 1475	5150-25	Serial No.:		
C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Distance Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)					·		, , .
D. Other? Describe: Yes Yes No If any of the above conditions exist, record applicable dimensions below: Distance (A, B, C or D) Location Depth Width CSVAP (Length) CAPTURE FEATURE O-RING Part No.: ////////////////////////////////////			_			+	
If any of the above conditione exist, record applicable dimensions below: Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)	•	•	-				
Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)						Yes	No No
(A, B, C or D) Location Depth Width CSVAP (Length)	If any of the above	ve conditions exis	it, record applica	able dimensions b	elow:		
CAPTURE FEATURE O-RING Part No.: _///75//5/0-// Serial No.: _/0000552 A. Erosion? Yes _/ No B. Heat Affect? Yes _/ No C. Assembly/Disassembly Damage? Yes _/ No D. Other? Describe: Yes _/ If any of the above conditions exist, record applicable dimensions below: Condition Distance (A, B, C or D) Location Depth Width CSVAP Motes / Comments:	Condition	Degree	Maximum	Circumferential			Distance
A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Yes No Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)	(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Yes No Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)	· · · · · · · · · · · · · · · · · · ·				······································		- ·
A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Yes No Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)			·····				
A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Yes No Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)							
A. Erosion?	CAPTURE FEAT	URE O-RING	Part No.: ///7	5150-11	Serial No.: /)	0000	52
B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Yes No Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)	A. Erosion?			<u></u>		÷	
C. Assembly/Disassembly Damage? D. Other? Describe:		ct?			·		
D. Other? Describe: Yes Yes No If any of the above conditions exist, record applicable dimensions below: Distance Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)			nage?				
If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)							
Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)					·		110
(A, B, C or D) Location Depth Width CSVAP (Length)							
		-					_
REVISION	(A, B, C or D)	Location	Depth	width	CSVAP		(Length)
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Nozzle-to-Case Joint Condition - Evaluation Checkoff Worksheet

Nozzle-to-Case Joint Condition - Evaluation encenter remember
Motor No.: 10 FEB 89
Joint: Nozzle-to-Case (NOZ)
Inspector(s): DAVE ROWSELL
Case Field Joint Observations: Commen Number
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes No SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?
B Socied Grease (HAGRE)?
C. Discolored Grease (DIGRE)?
E. Leak Check Port Obstructed (LPOBS)? Yes No
F. Vent Port Obstructed (VPOBS)? Yes No
(EMLI)?
H Bust on sealing surfaces (SSCOR)?
L Bust on metal parts (PITCO)?
J. Heat affected metal (HTAFF)?
K. Damaged metal sealing surface (SSMET)? Yes No
If any of the above conditions exist, record applicable dimensions below. Describe the observed con- dition using a comment number, an "F" if the condition is observed on the aff dome or an "A" if the condition is observed on the fixed housing and any other information needed to completely describe the observation and its location: 1. POLYSULFIDE GOT PHST THE WIPER O-RINK, THROUGH THE VENIT SLOIS 360 DEGREES AROWND THE JOINT. (PSEX) NOTE: RADIAL BOLT HOLE PLUG WAS SMASHED INTO THE BOTTOM OF THE 354.6 DEGREE RADIAL BOLT HOLE. THE PLUG APPENAKED TO BE IN THIS CONDITION BEFORE DISASSEMBLY, A HEAVY RUB MARK WAS FOUND ON THE PRIMARY D-RING AT 354.6 DEGREES.

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MORTON THIOKOL INC.

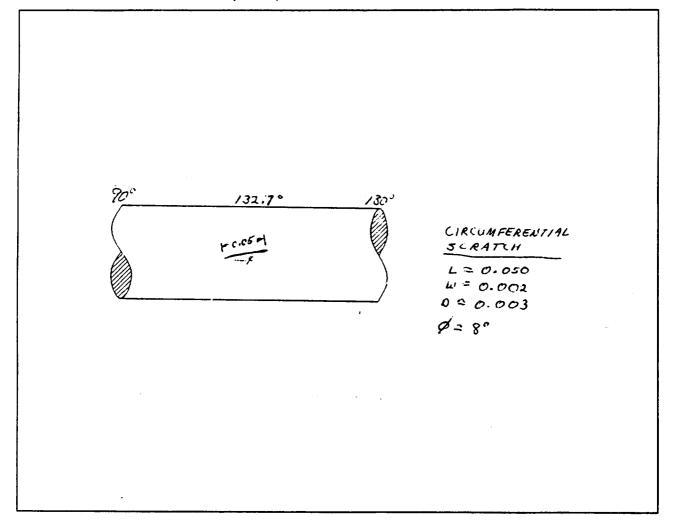
Space Operations

()	Facil			1		asatch A-2 B
Motor No.:	QME8	KOCKY ASK	, D. GARY NO			
Joint: Nozzle-to				Date: 2-	14-8	7
PRIMARY O-RI	يها المحمدين بالمحمد والمتباب المجال الفراط					
•••••		Part No.:	17 <u>5801-15</u> S	erial No.: <u>0</u>	0000	64,
A. Erosion?					Yes	
B. Heat Affe		-			Yes	
	/Disassembly Da			<u></u>	Yes	No
					Yes	No
f any of th <mark>e abo</mark>	ve conditions ex	ist, record applic	able dimensions beig	iw:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
<u> </u>		0.003	0.002			0.050
·	<u> </u>					······
		·······				
			<u>-</u>			
ECONDARY O	-RING	Part No.: 10	75801-16 Se	rial No.:	nar	204
A. Erosion?		- <u></u>			Yes	No No
B. Heat Affe	ct7				Yes	No No
C. Assembly	/Disassembly Da	mage?			Yes	
D. Other? D	escribe:	• • •	· _	····		
D. Other? D	/Disassembly Dai)escribe:	• • •	able dimensions hole		Yes	
any of the abov	ve conditions exi	st, record applic	able dimensions belo			Nò
any of the above Condition	ve conditions exi Degree	st, record applic Maximum	Circumferential			Distance
any of the above Condition	ve conditions exi	st, record applic		w: CSVAP		Nò
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any of the above Condition A, B, C or D) 	ve conditions exi Degree Location	st, record applic: Maximum Depth	Circumferential	CSVAP	Yes	Distance (Length)
A, B, C or D)	ve conditions exi Degree Location	st, record applic: Maximum Depth	Circumferential Width	CSVAP	Yee 	Distance (Length)
any of the above Condition A, B, C or D) IPER O-RING A. Erosion? B. Heat Affect	ve conditions exi Degree Location	st, record applic: Maximum Depth	Circumferential Width	CSVAP	Yes 	Distance (Length)
any of the above Condition A, B, C or D) IPER O-RING A. Erosion? B. Heat Affect C. Assembly/	ve conditions exi Degree Location	st, record applic: Maximum Depth Part No.: <u>///</u>	Circumferential Width	CSVAP	Yes 	Distance (Length)
any of the above Condition A, B, C or D) IPER O-RING A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do	ve conditions exi Degree Location 	st, record applic: Maximum Depth Part No.: _/U nage?	Circumferential Width	CSVAP	Yes 	Distance (Length)
any of the above Condition A, B, C or D) IPER O-RING A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do any of the above	ct? ct? ct? ct? ct? ct? ct? ct?	st, record applic: Maximum Depth Part No.: _/U mage?	Circumferential Width	CSVAP	Yes 	Distance (Length)
any of the above Condition A, B, C or D) IPER O-RING A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do any of the above Condition	ct? Degree Location 	st, record applic Maximum Depth Part No.: _/U mage?	Circumferential Width	CSVAP	Yes 	No Distance (Length) 209 No No No No No No No Distance
any of the abov Condition A, B, C or D)	ct? Degree Location 	st, record applica Maximum Depth Part No.: <u>///</u> mage? st, record applica Maximum Depth	Circumferential Width	CSVAP	Yes 	No Distance (Length) Distance V No
any of the abov Condition A, B, C or D) IPER O-RING A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do any of the abov Condition A, B, C or D) C	ct? Degree Location Location Ct? Disassembly Dar escribe: e conditions exis Degree Location 2 55.2'	st, record applic: Maximum Depth Part No.: _/U mage? st, record applica Maximum Depth Depth 	Circumferential Width	CSVAP	Yes 	Distance (Length)
any of the abov Condition A, B, C or D) IPER O-RING A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do any of the abov Condition A, B, C or D) C C	ct? Degree Location Location Location Ct? Disassembly Dar escribe: e conditions exis Degree Location 255.2' 214.9'	st, record applic Maximum Depth Part No.: _/U Part No.: _/U st, record applica Maximum Depth 0.003 	Circumferential Width 75801-14/ Se ble dimensions below Circumferential Width 	CSVAP	Yes Yes Yes Yes Yes	No Distance (Length) 209 No N
any of the abov Condition A, B, C or D) IPER O-RING A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do any of the abov Condition A, B, C or D) C	ct? Degree Location Location Ct? Disassembly Dar escribe: e conditions exis Degree Location 2 55.2'	st, record applic: Maximum Depth Part No.: _/U mage? st, record applica Maximum Depth Depth 	Circumferential Width	CSVAP	Yes Yes Yes Yes Yes	No Distance (Length) 204 No N
any of the abov Condition A, B, C or D) IPER O-RING A. Erosion? B. Heat Affect C. Assembly/ D. Other? Do any of the abov Condition A, B, C or D) C C	ct? Degree Location Location Location Ct? Disassembly Dar escribe: e conditions exis Degree Location 255.2' 214.9'	st, record applic Maximum Depth Part No.: _/U Part No.: _/U st, record applica Maximum Depth 0.003 	Circumferential Width 75801-14/ Se ble dimensions below Circumferential Width 	CSVAP	Yes Yes Yes Yes Yes	Distance (Length)

REVISION____

Morton Thiokol Inc.			Se
Space Operations			
	-RING OBSERVATION CL	ARIFICATION FORM	- /
Date: <u>2-15-89</u>	Inspector(s): Sc	OT EDEN, ROCKY A	154, D.Goar Nerso
Motor No.: QM-8			
Left (A) Right (B)			
O-ring Location: Prima] Capture Feature 🗌 Wiper	
Part Number: 1075801			
Serial Number: 000000			
Depth:			
Description: (SEE	BELOW)		
			_

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.

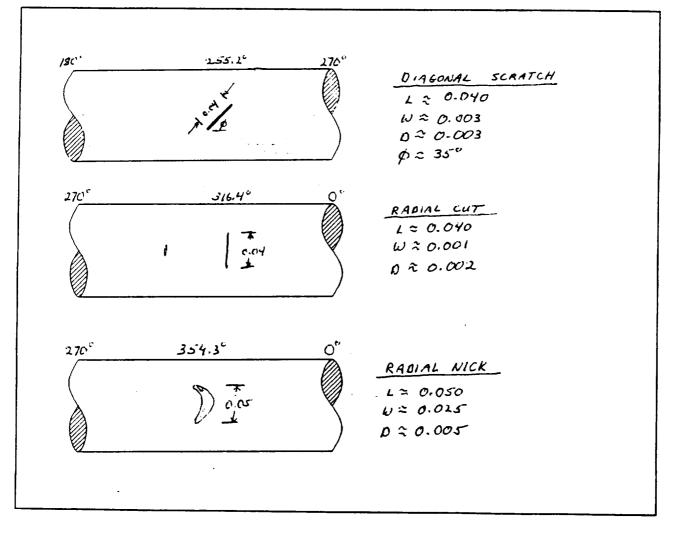


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Morton Thiokol Inc.		Sr
Space Operations		-6
O Date: <u>2 - / Y - 89</u> Motor No.: <u>Q M - 8</u> Left (A) Right (B)	-RING OBSERVATION CLARIFICATION FORM Inspector(s): <i>SCOTT_EQENROCKY_ASH</i>	D.GARY Norson
O-ring Location: Primar Part Number: <u>1075801-</u> Serial Number: <u>000000</u>	y 🗌 Secondary 📋 Capture Feature 🕒 Wiper	
Description: <u>(SEE AE</u>	LOW)	

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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Motor No.: QM-B	Date:	2-24-89	
Joint: Nozzie-To-Case Radial Bolt (NOZ, STAT)			
P/N /U75374-02 Lot Number _ECL 0003			
Inspector(s): SCOTT EDEN, LON HYER, GARY NELSON			
Bolt Stat-O-Seal Observations:			Comment Number
	Yes	No No	Number
A. Eroded Stat-O-Seals (SORE)? B. Heat Affected Stat-O-Seals (HASOR)?	Yes	No	
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 $\sim L_{2}$	1900	、 、	
C: Commeters la la la	SI SI	oms)	
C: creamferential tear in scal at retainer/rubbe	r intern	face ~ 1=	2 30 °
The mare open under under tire tire	n (Same	、	(5015)
C: Radial flow mente opens when probed (SDMG)	(200-10))	
Note: 35 out of 100 stat-o-scals had unacceptable	flow	line conditi	tions
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Nozzle-To-Case Radial Bolt Stat-O-Seals - Evaluation Checkoff Worksheet

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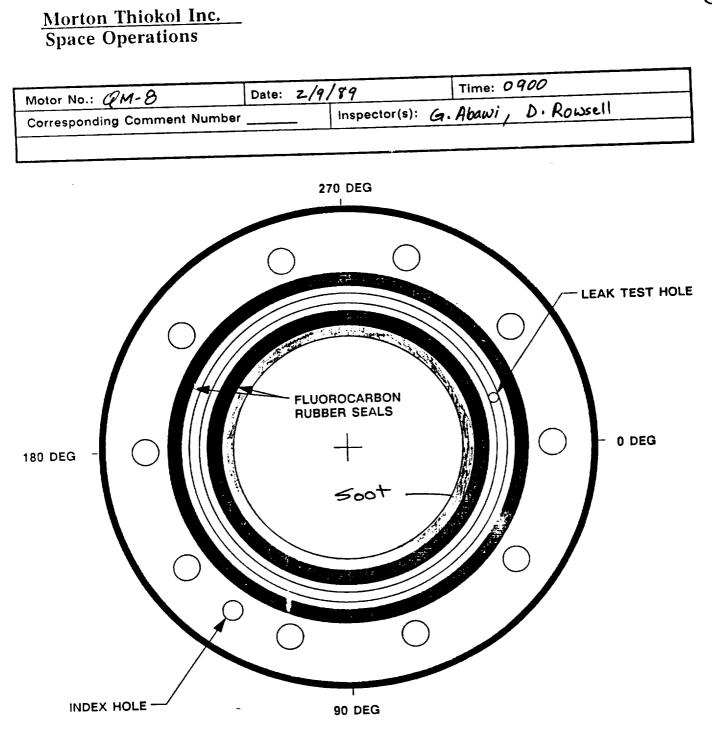
Motor No.: QM-B Date: 2/9/89 Joint: ☑ S&A to Adapter (S&A) □ Adapter to Case (IGN) □ Adapter to Chamber (IGI)	Ignition System Sealing Surface Condition – Evaluation	n Checkoff Worksheet
Joint: S&A to Adapter (S&A) Adapter to Case (IGN) Adapter to Chamber (IGI)	Que O	Date: 2/9/89
Joint: Jasa to Adapter (Sari)	Adepter to Case (IGN)	Adapter to Chamber (IGI)
	Joint: San to Adupter (San)	
Inspector(s): G. Abawi, D. Kowsell	Inspector(s): G. Abawi J. U. Kowsen	
A. Soot in Proximity to / Past O-ring Groove (SPINS, SPPOR,YesNo	 SPSOR)? B. Sooted Grease (HAGRE)? C. Discolored Grease (DIGRE)? C. Leak Check Port Obstructed (LPOBS)? F. 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 condition using a comment number, a "FWD" if the condition is o joint or the adapter on the Inner and outer joints or a "AFT" if the adapter on the S&A joint, the chamber on the inner joint or the doinformation needed to describe the observation: 	Yes No Yes No <td< td=""></td<>

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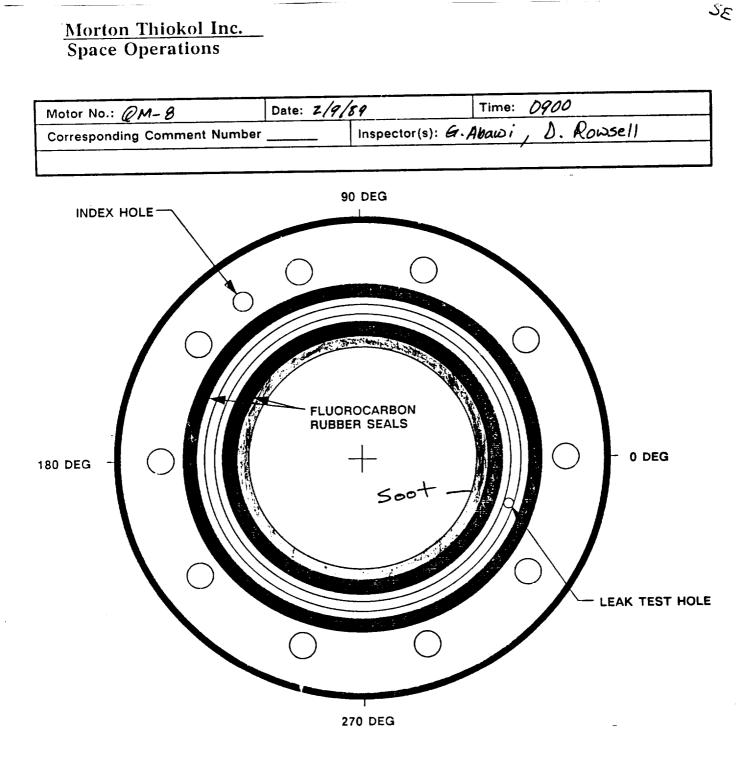


Observation Drawing Worksheet - Igniter S&A Gasket (Forward Face)

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

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Detailed Igniter Gasket - Evaluation Checkoff Worksheet

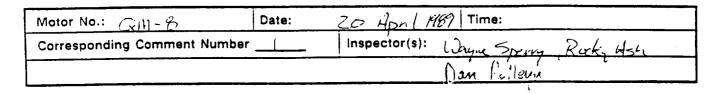
Motor No.: QM-8	Date: 2-9-89	
	U S&A (S&A)	
P/N: 1051925-01 S/N: 0000032		
Inspector(s): SLOTT EDEN, ROCKY ASH		
· ·		Comment
	/	Number
I. Soot Past Seals (SPINS, SPPOR, SPSOR)?	yes no	<u></u>
II. Foreign Material (FMIJ)?	yes no	
III. Seal Damage (PCUT, PDIS, PDMG, SCUT,	yes/ no	<u> </u>
SDIS, SDMG)? 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	. <u></u>
If yes, describe below:	•	
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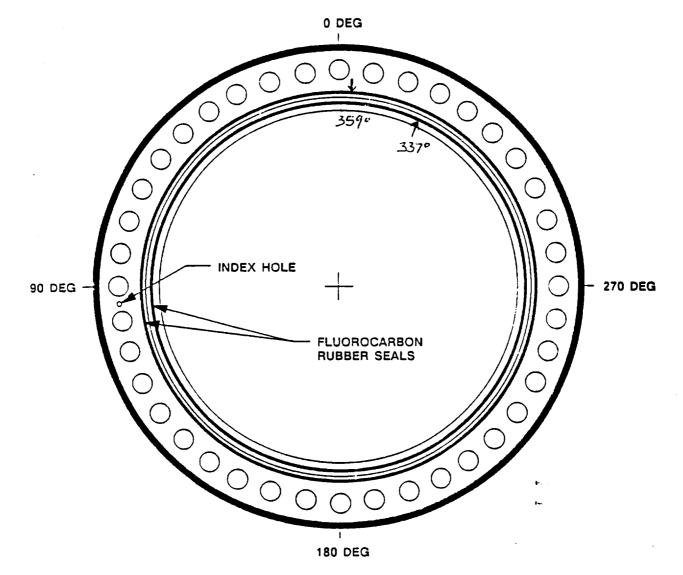
Ignition System Sealing Surface Condition - Evaluation	Checkoff Worksheet
Motor No.: QM-8	Date: 1 MAR 1989
Joint: S&A to Adapter (S&A) Adapter to Case (IGN)	Adapter to Chamber (IGI)
Inspector(s): (ABAW)	
 A. Soot in Proximity to ? Past O-ring Groove (SPINS, SPPOR, SPSOR)? B. Sooted Grease (HAGRE)? C. 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 commert number, a "FWD" if the condition is obs joint or the adapter on the inner and outer joints or a "AFT" if the condition needed to describe the observation: A blowhole through the putty occured at No soot was found on either side of Heavy Soot deposits were found on the institute of the adapter. 	erved on the S&A on the S&A ondition is observed on the e on the outer joint and any other

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Observation Drawing Worksheet - Igniter Outer Gasket (Aft Face)

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Date: ZU ADR/ 1989 QM-V Motor No.: S&A (S&A) 🛛 Outer (IGN) Inner (IGI) Gasket: PIN: 1451926-01 SIN: 0000040R1 Inspector(s): LJAYNe Spein Rock Comment Number no yes Soot Past Seals (SPINS, SPPOR, SPSOR)? 1. no yes II. Foreign Material (FMIJ)? 🧹 yes III. Seal Damage (PCUT, PDIS, PDMG, SCUT, no SDIS, SDMG)? IV. Heat Affected Seals or Retainer (PORE, HAPOR no yes SORE, HASOR, HTAFF)? no yes V. Rust (SSCOR, PITCO)? VI. Metal Damage (SSMET, DAMML)? yes If yes, describe below: Primary Seal Aft side Missing material and a nick @ 3370 Secondary Seril Aft side nick @ 359° - NICK 337° PRIMARY 1: .01 D: ,02 W= .01 MISSING MATERIAL L. ,07 W-,01 SECONDARY 359° D=? NICK L=,010 02 D= .005 W= .010 AFT SIDE

Detailed Igniter Gasket - Evaluation Checkoff Worksheet

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ition System Sealing Surface Condition - Evaluation Checkoff Worksheet

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Detailed Igniter Gasket – Evaluation Checkoff Worksheet

Motor No.: QM-8	Date:	5/22/09	
Gasket: Q Inner (IGI) Quter (IGN) S&A P/N: 1051926-01 S/N: 000054		+	
Inspector(s): Rocky Ash, Wayne Spercy			
			Comment Number
A DESCRIPTION OF THE CONTROL OF THE	yes	no	Number
I. Soot Past Seals (SPINS, SPPOR, SPSOR)? II. Foreign Material (FMIJ)?	yes	V no	
III. Seal Damage (PCUT, PDIS, PDMG, SCUT,	yes	no	
SDIS, SDMG)?		/	
IV. Heat Affected Seals or Retainer (PORE, HAPOR	yes	no	
SORE, HASOR, HTAFF)?			
V. Rust (SSCOR, PITCO)?	yes yes	no no	
VI. Metal Damage (SSMET, DAMML)?	_ yes	no	

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Ignition	System	Stat-O-Seals -	Evaluation	Checkoff	Worksheet
·					

Motor No.: QM-8	Date: 5-5-89	
Joint: Adapter/Chamber (IGI) Case End: STAT	4	
P/N 1475374-01 Lot Number _ ECL 0010		
Inspector(s): K. Baken		
Bolt Stat-O-Seal Observations:		Comment
A. Eroded Stat-O-Seais (SORE)?	Yes 🗸 No	Number
B. Heat Affected Stat-O-Seals (HASOR)?	Yes No	
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Yes No	1
If any of the above conditions exist, describe below:		
1. Typical disassemby damage was e	seen on All sta	it-0-55=15
		•

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Nozzle Joint Condition – Evaluation Checkoff Worksheet	
inspector(s): K. Baker, J. Curry, L. Nelsen	<u></u>
Motor No.: QM-8 Date: 2-6-87	
Joint: Throat/Fwd Exit Cone (4) Fwd End Ring/Nose Inlet (2) Fixed Housing/Aft End Ring (5) Nose Inlet/Throat (3) Fwit Exit Cone/Aft Exit Cone (1)	
	omment umber
Case Field Joint Observations: Nu A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes No SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? B. Sooted Grease (HAGRE)? Yes No C. Discolored Grease (DIGBE)? Yes No	Imber

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MORTON	THIOKOL	INC.
	THOREE	

Space Operations

Space Operation					
			valuation Checkoff \		
Inspector(s): RO Motor No.: (3)	<u>cky Ash, Zu</u> M-X	Mt Eden, Wo	yne Sperry- +	Date: 2.3	
Joint:		ne/Aft Exit Cone	☐ Fwd	End Ring/Nose	The second se
	Throat/Fwd I			d Housing/AFt E	
	Nose Inlet/T	hroat			
PRIMARY O-RING	G Pa	irt No.:	50.03 Se	erial No.:	<u>p1000</u>
A. Erosion?				Y	es 📈 No
B. Heat Affect	t?			Y	es 📈 No
•	Disassembly Dan			Y	es No
					es <u> </u>
			ble dimensions belo)w:	
Condition	Degree	Maximum	Circumferential	CEVAR	Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)
		<u> </u>			
<u> </u>		······			·
SECONDARY O- (If Applicable)	RING Pa	irt No.: 1075	5150-04 S	erial No.:	CCC0.28
A. Erosion?				v	es 🗸 No
B. Heat Affect	17				
C. Assembly/I	Disassembly Dan	nage?			es 📈 No
D. Other? De	scribe:			Y	es No
•		•••	ble dimensions belo) W:	-
Condition	Degree	Maximum	Circumferential		Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)
		- <u></u>	•		
·					
•			<u> </u>		
					<u></u>
		······			
			<u></u>		
Notes / Comments					
	-				

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Nozzle Joint Condition - Evaluation Checko	off Worksheet
Inspector(s): LOWELL NELSEN, K. Baker	12427/80
Motor No.: Q M - X	Date: Z/15/89 Fwd End Ring/Nose Inlet (2) Nose Inlet/Throat (3)
Case Field Joint Observations: A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR	Comment Number Yes No <u>1</u>
SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? B. Sooted Grease (HAGRE)? C. Discolored Grease (DIGRE)?	Yes No 1 Yes No Yes No Yes No Yes No
 D. Leak Check Port Obstructed (LPOBS)? E. Vent Port Obstructed (VPOBS)? F. Foreign material in the sealing area during motor operation 	Yes No Yes No Yes No Yes No
 (FMIJ)? G. Rust on sealing surfaces (SSCOR)? H. Rust on metal parts (PITCO)? I. Heat affected metal (HTAFF)? J. Damaged metal sealing surface (SSMET)? 	Yes ✓ No ✓ Yes No 2. Yes ✓ No Yes ✓ No
If any of the above conditions exist, record applicable dimensions dition using a comment letter, an "F" if the condition is observed an "A" if the condition is observed on the aft end of the joint and completely describe the observation and its location:	d on the forward end of the joint or d any other information needed to
1. Very small pressure path thro at 355 degrees then Flow to 350 degrees to Allow P Primary O-Ring groove. R Uary good	ugh RTV, started
to 355 degrees then flow	ressure to reach
primary O-Ring groove. R	TV Backfill looked
0 J 0 J	
2. metal discoloration of	bearing flange
at 110 degrees to 150 de	grees And
from 240 degrees to 280	degrees.

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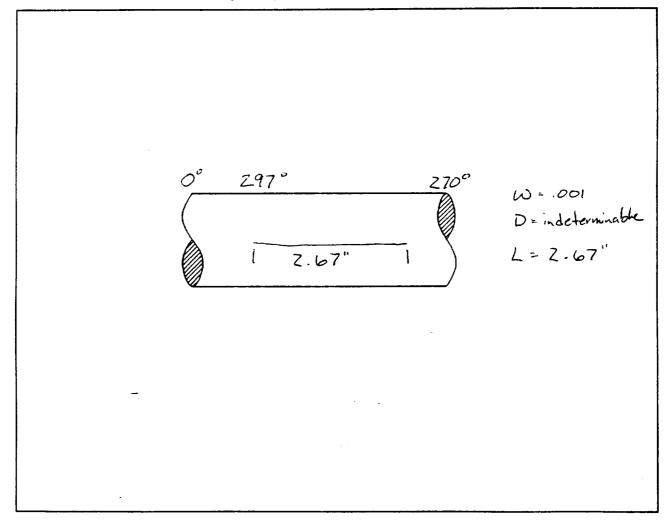
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MORTON THIOKOL INC. Space Operations

Detailed Nozzie	Joint O-ring	(Post-Removal) - Ev	aluation Checkoff W	orksheet (V	Vasatci	n A-2 Bidg)
Inspector(s): Way	ne Sperny	, Rocky Ash	D. GARY N	ELSON		
Motor No.: QM	-8			Date: 2 - /		
Joint:		Cone/Aft Exit Cone	•	End Ring/No		
		d Exit Cone	🗌 Fixed	Housing/AF	it End I	Ring
	Nose Inlet	/Throat				
PRIMARY O-RIN	G	Part No.: 1075150	<u>-07</u> Sei	ial No.: <u>00</u>	2000	/4
A. Erosion?					Yes	No
B. Heat Affec	t?				Yes	No
C. Assembly/	Disassembly D	amage?			Yes	No
D. Other? De	scribe:		·	$\underline{\vee}$	Yes	No
If any of the above	conditions e	xist, record applicat	le dimensions belov	Y:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
D	<u>297°</u>	indeterminable	.001			2.67"
			·			
						
<u></u>						
	<u></u>					
<u> </u>						
······						
SECONDARY O- (If Applicable)	RING	Part No.: 1075150	<u>) - 08</u> Sei	ial No.:	∞	20
A. Erosion?					Yes	No No
B. Heat Affect	17				Yes	No
C. Assembly/	Disassembly D	amage?			Yes	No
D. Other? De	scribe:				Yes	- V No
		kist, record applicab		<i>r</i> :		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
. <u> </u>						
	<u></u>		······			
·						
		·······	······			
		<u> </u>	· <u>····</u> ····			
				·		
Notes / Comments						
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Morton Thiokol Inc.	5
Space Operations	-
	Joint: <u>Fwd End Ring / Nose</u> Secondary Capture Feature Wiper
Serial Number: <u>0000014</u>	
Description: <u>See Below</u>	

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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	pector(s): LOWELL NELSEN, Kelly Bake- tor No.: QM-8			2115/89	
Joi	nt: D Throat/Fwd Exit Cone (4) Fixed Housing/Aft End Ring (5) Fwd Exit Cone/Aft Exit Cone (1)			ng/Nose Inlet (hroat (3)	2)
Ca	se Field Joint Observations:				Commen Number
Α.	Soot in Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	<u></u>	Yes	No	<u> </u>
в.	Sooted Grease (HAGRE)?		Yes	<u> </u>	
C.	Discolored Grease (DIGRE)?		Yes	No	
D.	Leak Check Port Obstructed (LPOBS)?		Yes	No	
Ε.	Vent Port Obstructed (VPOBS)?		Yes	No	
F.	Foreign material in the sealing area during motor operation (FMIJ)?		Yes	<u> </u>	
G.	Rust on sealing surfaces (SSCOR)?		Yes	No	
н.	Rust on metal parts (PITCO)?	<u></u>	Yes	No	<u> </u>
۱.	Heat affected metal (HTAFF)?		Yes	No	
J.	Damaged metal sealing surface (SSMET)?	<u></u>	Yes	<u> </u>	

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an "A" if the condition is observed on the aft end of the joint and any other information needed to completely describe the observation and its location:

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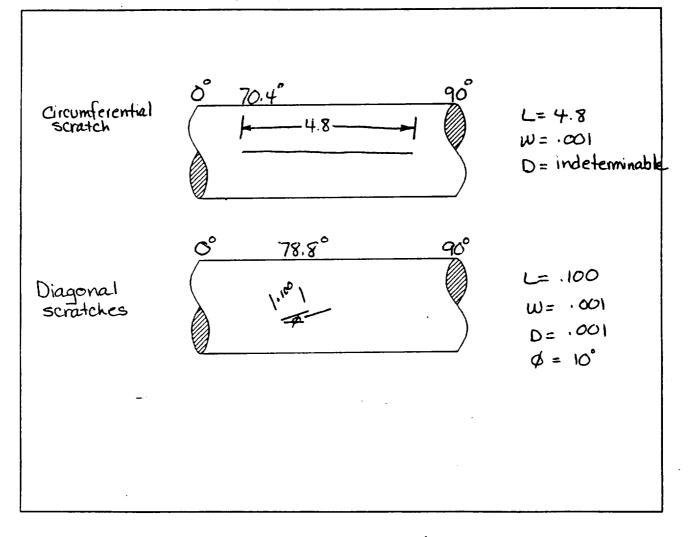
MORTON THIOKOL INC. Space Operations

Detailed Nozzle Joint O-ring (Post-Removal) - Evaluation Checkoff Worksheet (Wasatch A-2 Bidg)							
Inspector(s): Rocky Ash, Wayne Sperry, Scott Eden, D. GARY NELSON							
Motor No.: QY	1-8			Date: 2-17-80			
Joint:		e/Aft Exit Cone		End Ring/Nose inic			
	Throat/Fwd E		🛄 Fixe	d Housing/AFt End	Ring		
Nose Inlet/Throat							
PRIMARY O-RIN	NG Pa	rt No.: 107515	<u>50-10</u> s	erial No.:	219		
A. Erosion?				Yes	No		
B. Heat Affe	ct?			Yes	V No		
C. Assembly	/Disassembly Dam	nage?		Yes	V No		
D. Other? D	escribe:			Yes	No		
If any of the above	ve conditions exis	t, record applicat	ole dimensions beig	ow:			
Condition	Degree	Maximum	Circumferential		Distance		
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)		
D	<u>70.4</u> °	indeterminable			4.8		
D	78.8°	.001					
	<u> </u>						
SECONDARY O- (If Applicable)	-RING Par	rt No.: _10751	50-09 s	erial No.:	2018		
A. Erosion?				Yee	/ 11-		
A. Erosion? B. Heat Affec	: †?			Yes	No No		
B. Heat Affec		8087		Yes	V No		
B. Heat Affec C. Assembly/	Disassembly Dam	•		Yes Yes	_√_ No _√_ No		
B. Heat Affec C. Assembly/ D. Other? D	Disassembly Dam escribe:	-		Yes Yes Yes	V No		
 B. Heat Affect C. Assembly/ D. Other? Do If any of the above 	Disassembly Dam escribe: e conditions exist	, record applicab	ie dimensions belo	Yes Yes Yes	No No No		
 B. Heat Affect C. Assembly/ D. Other? Do If any of the above Condition 	/Disassembly Dam escribe: re conditions exist Degree	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance		
 B. Heat Affect C. Assembly/ D. Other? Do If any of the above 	Disassembly Dam escribe: ce conditions exist Degree Location	, record applicab	ie dimensions belo	Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D)	/Disassembly Dam escribe: re conditions exist Degree	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D)	Disassembly Dam escribe: ce conditions exist Degree Location	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D)	Disassembly Dam escribe: ce conditions exist Degree Location	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D)	Disassembly Dam escribe: ce conditions exist Degree Location	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D)	Disassembly Dam escribe: ce conditions exist Degree Location	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D)	Disassembly Dam escribe: ce conditions exist Degree Location	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D)	Disassembly Dam escribe: ce conditions exist Degree Location	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D)	Disassembly Dam escribe: conditions exist Degree Location 219.7°	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D) 	Disassembly Dam escribe: conditions exist Degree Location 219.7°	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D) 	Disassembly Dam escribe: conditions exist Degree Location 219.7°	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D) 	Disassembly Dam escribe: conditions exist Degree Location 219.7°	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D) 	Disassembly Dam escribe: conditions exist Degree Location 219.7°	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D) 	Disassembly Dam escribe: conditions exist Degree Location 219.7°	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No ✓ No Distance (Length)		
B. Heat Affect C. Assembly/ D. Other? D. If any of the abov Condition (A, B, C or D) 	Disassembly Dam escribe: conditions exist Degree Location 219.7°	, record applicab Maximum	ie dimensions belo Circumferential	Yes Yes Yes Yes	✓ No ✓ No Distance (Length)		

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Morton Thiokol Inc.	
Space Operations	
Date: <u>2-17-89</u> Motor No.: <u>QM-8</u> □ Left (A) □ Right (B)	<u>1</u>

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



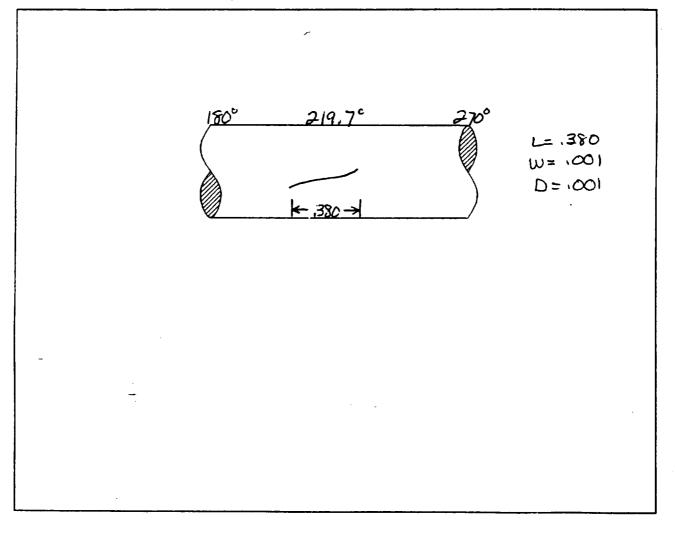
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Morton Thiokol Inc.					<u>ح</u>
Space Operations					
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O-BI	NG OBSERVATIO	N CLARIFICATIO			
Date: 2-17-89		-		Sperce Scott F.	den.
Motor No.: DM-8		D. GARY NEI	Sou	Sperry, Scott E	
Left (A) Right (B)		· Inlet/Th			
O-ring Location: Primary	Secondary			Viper	
Part Number: 1075150-0		•		•	
Serial Number:					
Depth:					
Description: <u>See Be</u>	elow				
			-		_
					_
					_

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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Nozzle Joint Condition – Evaluation C	meckon no.			
Inspector(s): KELLY BAKER, LOWELL NELS	EN			
Motor No.: QM-8	Da	ate: 2/14/	89	
Joint: X Throat/Fwd Exit Cone (4)	🗌 Fwd En	d Ring/Nose	Inlet (2))
Fixed Housing/Aft End Ring (5)	🗌 Nose ir	niet/Throat (3))	
Fwd Exit Cone/Aft Exit Cone (1)				
Case Field Joint Observations:				Commen
	\checkmark	Yes	Ma	Number /
A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR		Yes	No	
SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?				
B. Sooled Grease (HAGRE)?	, 	Yes V	No	<u> </u>
C. Discolored Grease (DIGRE)?		Yes	No	
D. Leak Check Port Obstructed (LPOBS)?	<u> </u>	Yes V	No	
E. Vent Port Obstructed (VPOBS)?		Yes _V	, No	
F. Foreign material in the sealing area during motor operat	ion	Yes V	No	
(FMIJ)?				
G. Rust on sealing surfaces (SSCOR)?		Yes 🗸	No	
H. Rust on metal parts (PITCO)?		Yes 🗸	No	
1. Heat affected metal (HTAFF)?		Yes V	No	
		Yes 🗸	No	
J. Damaged metal sealing surface (SSMET) ?				
dition using a comment letter, an "F" if the condition is ob- an "A" if the condition is observed on the aft end of the jo	served on the	e forward end	or the	ved con- joint or ded to
dition using a comment letter, an "F" if the condition is ob- an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT	served on the	e forward end other informati	ion nee	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a	served on the int and any o ひしついつ	a forward and other information	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a	served on the int and any o ひしついつ	a forward and other information	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring.	served on the int and any o ひしついつ	a forward and other information	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a	served on the int and any o ひしついつ	a forward and other information	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring. Soot d the primary O-ring. drawing worksheet.	served on the int and any o V bond RTV Vo RTV Vo Lid No See	e forward end other information alliNC bid to bid to observ	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring. Soot d the primary O-ring. drawing worksheet.	served on the int and any o V bond RTV Vo RTV Vo Lid No See	e forward end other information alliNC bid to bid to observ	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring. Soot d the primary O-ring. drawing worksheet.	served on the int and any o V bond RTV Vo RTV Vo Lid No See	e forward end other information alliNC bid to bid to observ	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring. Soot d the primary O-ring. drawing worksheet.	served on the int and any o V bond RTV Vo RTV Vo Lid No See	e forward end other information alliNC bid to bid to observ	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring. Soot d the primary O-ring. drawing worksheet.	served on the int and any o V bond RTV vo lid No See	e forward end other information allinc bid to bt rea Observ	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring. Soot d the primary O-ring. drawing worksheet.	served on the int and any o V bond RTV Vo RTV Vo Lid No See	e forward end other information allinc bid to bt rea Observ	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring. Soot d the primary O-ring. drawing worksheet.	served on the int and any o V bond RTV vo lid No See	e forward end other information allinc bid to bt rea Observ	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring. Soot d the primary O-ring. drawing worksheet.	served on the int and any o V bond RTV vo lid No See	e forward end other information allinc bid to bt rea Observ	ion nee at	ded to
an "A" if the condition is observed on the aft end of the join completely describe the observation and its location: 1. Grease penetrated the RT 205° which created a l Primary O-ring. Soot d the primary O-ring. Soot d the primary O-ring. drawing worksheet.	served on the int and any o V bond RTV vo lid No See	e forward end other information allinc bid to bt rea Observ	ion nee at	ded to

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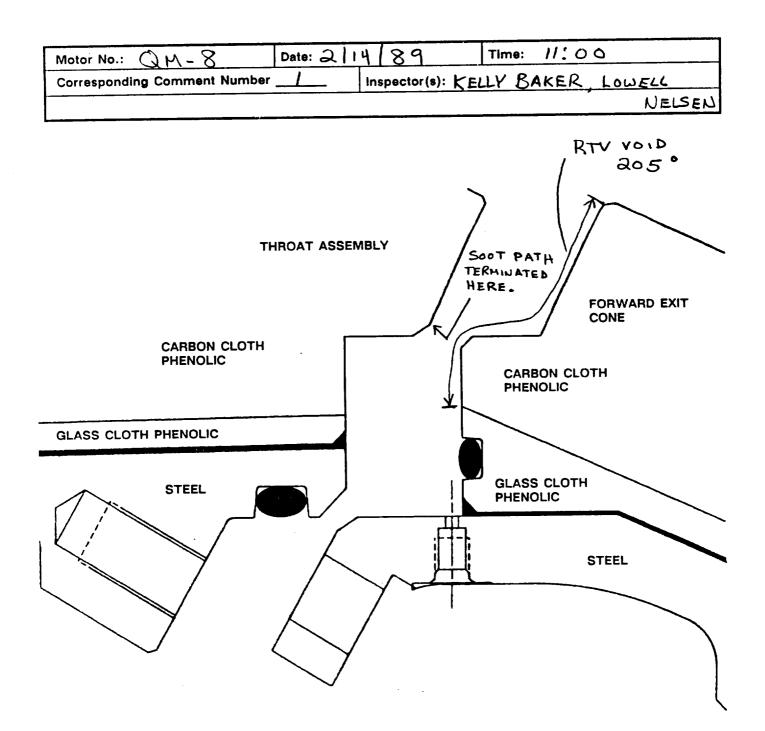
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Observation Drawing Worksheet – Throat/Forward Exit Cone Joint

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MORTON THIOKOL INC.

Space Operations

			valuation Checkoff V			A-2 Bidg)
Inspector(s): S	COTT EDEN,	WAYNE SP	EARY, D. GAL	Nerson)	
Motor No.: Q/	И-8			Date: 2-	<u>15-8</u>	
Joint:	Fwd Exit Con			End Ring/No		
	E Throat/Fwd E			Housing/AF	t End	Ring
· · · · · · · · · · · · · · · · · · ·	Nose Inlet/Th					
PRIMARY O-RIN	G Pai	rt No.: <u>1075</u>	<u>150-01</u> Se	rial No.: <u>C</u>	0000	20
A. Erosion?					Yes	No
B. Heat Affe	: t?				Yes	No
C. Assembly	Disassembly Dam	lage?			Yes	No
D. Other? D	escribe:				Yes	No
If any of the abov	e conditions exist	t, record applica	ble dimensions belo	w:		
Condition	Degree	Maximum	Circumferential			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
		·				
	·	• •		··	_ .	
				- <u></u>		· <u> </u>
·		<u></u>		······	— •	
·····			<u></u> ·			
	<u> </u>		المتكرية مير الكروبا بين مريسي مواقيا مراجلة			······································
SECONDARY O- (If Applicable)	-RING Par	rt No.: <u>///</u> 73	5/50-02 Se	orial No.:	000	020
A. Erosion?					Yes	V No
B. Heat Affect	:t?				Yes	
	Disassembly Dam	age?			Yes	No
	escribe:	-			Yes	1/ No
			ble dimensions below			
Condition	Degree	Maximum	Circumferentiai			Distance
(A, B, C or D)	Location	Depth	Width	CSVAP		(Length)
						(
	<u></u>		····			
			- <u></u>			
						<u></u>
		 ,		<u> </u>		
		······	·····			· · · · · · · · · · · · · · · · · · ·
Notes / Comment	•					
				000		
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	Nozzle Joint Condition – Evaluation Checkoff Worksheet					
Ins	pector(s): KELLY BAKER, LOWELL NELS					
Mo	tor No.: QM - 8	Date: 2/14/89				
Joi		Fwd End Ring/Nose Inlet (2)				
	Fixed Housing/Aft End Ring (5)	Nose Inlet/Throat (3)	r			
	Fwd Exit Cone/Aft Exit Cone (1)					
Ca	se Field Joint Observations:	Comm V Numb				
Α.	Soot in Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	YesNo	-			
в.	Sooted Grease (HAGRE)?	YesNo	-			
c.	Discolored Grease (DIGRE)?	Yes/_No	-			
D.	Leak Check Port Obstructed (LPOBS)?	YesNo	-			
Ε.	Vent Port Obstructed (VPOBS)?	Yes No	-			
F.	Foreign material in the sealing area during motor operation (FMIJ)?	nYesNo	-			
G.	Rust on sealing surfaces (SSCOR)?	YesNo	-			
н.	Rust on metal parts (PITCO)?	YesNo	_			
 1.	Heat affected metal (HTAFF)?	Yes No	-			
J.	Damaged metal sealing surface (SSMET)?	YesNo	-			
dit an	any of the above conditions exist, record applicable dimensi ion using a comment letter, an "F" if the condition is obser "A" if the condition is observed on the aft end of the joint mpletely describe the observation and its location:	erved on the forward end of the joint or				

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MORTON THIOKOL INC.

Space Operations

Detailed Nozzl	Joint U-ring (Pe	ost-Removal) - E	valuation Checkoff W	orksneet (Was	atch A-2 Bidg)
Inspector(s): L	AYNE SPERR	Y, SCOTT	EDEN. D. GAG	LY NELLON	
Motor No.: Q	<u>M-8</u>			Date: 2-15-	
Join		ne/Aft Exit Cone		End Ring/Nose	
	Throat/Fwd		P Fixed	Housing/AFt E	ind Ring
	Nose inlet/T	hroat			
PRIMARY O-RI	NG Pi	art No.: <u>///75</u>	150-05 Sei	rial No.: _ <u>000</u>	20027
A. Erosion?				Y	es 📈 No
B. Heat Affe	ect?			Y	•s
C. Assembly	/Disassembly Dar	nage?		Y	•s 🗸 No
D. Other? I	Describe:			Y	•• 🔽 No
			ble dimensions below	w:	
Condition	Degree	Maximum	Circumferential		Distance
(A, B, C or D)	Location	Depth	Width	CSVAP	(Length)
(, _, _, _ , _ ,				00171	(cangin)
				· · · · · · · · · · · · · · · · · · ·	
	·····				
_		<u> </u>			
SECONDARY O (If Applicable)	-RING Pa	nt No.: 1075	50-06 Se	rial No.: _000	00/9
(ii Applicable)					/
A. Erosion?					/
	ct?			Yo	•• <u>No</u>
A. Erosion? B. Heat Affe		nage?		Yo	•• <u>/</u> No •• <u>/</u> No
A. Erosion? B. Heat Affe C. Assembly	/Disassembly Dan			Yo Yo Yo	No No No No
A. Erosion? B. Heat Affe C. Assembly D. Other? D	/Disassembly Dan Describe:			¥4 ¥4 ¥4 ¥4	No No No No
A. Erosion? B. Heat Affe C. Assembly D. Other? D	//Disassembly Dan Describe: ve conditions exis	it, record applica	ble dimensions belov	¥4 ¥4 ¥4 ¥4	
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition	/Disassembly Dan Describe: ve conditions exis Degree	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? D If any of the abo	//Disassembly Dan Describe: ve conditions exis	it, record applica	ble dimensions belov	¥4 ¥4 ¥4 ¥4	
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition	/Disassembly Dan Describe: ve conditions exis Degree	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition	/Disassembly Dan Describe: ve conditions exis Degree	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition	/Disassembly Dan Describe: ve conditions exis Degree	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition	/Disassembly Dan Describe: ve conditions exis Degree	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition	/Disassembly Dan Describe: ve conditions exis Degree	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition	/Disassembly Dan Describe: ve conditions exis Degree	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition	/Disassembly Dan Describe: ve conditions exis Degree	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition (A, B, C or D)	//Disassembly Dan Describe: ve conditions exis Degree Location	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition	//Disassembly Dan Describe: ve conditions exis Degree Location	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition (A, B, C or D)	//Disassembly Dan Describe: ve conditions exis Degree Location	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition (A, B, C or D)	//Disassembly Dan Describe: ve conditions exis Degree Location	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition (A, B, C or D)	//Disassembly Dan Describe: ve conditions exis Degree Location	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition (A, B, C or D)	//Disassembly Dan Describe: ve conditions exis Degree Location	it, record applica Maximum	ble dimensions belov Circumferential		No No No No No Distance
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition (A, B, C or D)	//Disassembly Dan Describe: ve conditions exis Degree Location	it, record applica Maximum	ble dimensions belov Circumferential	Ya Ya Ya Ya Ya 	No No No No No Distance (Length)
A. Erosion? B. Heat Affe C. Assembly D. Other? E If any of the abo Condition (A, B, C or D)	//Disassembly Dan Describe: ve conditions exis Degree Location	it, record applica Maximum	ble dimensions belov Circumferential	Ya Ya Ya Ya Ya 	No No No No No Distance

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

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SE

:

Motor No.: QM-8	Date: 2-24-89	
Joint: FIXED HOUSING /AFT END RIALE (STAT)		
PIN 1075874-01 Lot Number ECL0010	· · · · · · · · · · · · · · · · · · ·	
Inspector(s): SCOTT EDEN, ROCKY ASH		
Bolt Stat-O-Seal Observations:		Comment
	Yes 🖌 No	Number
A. Eroded Stat-O-Seals (SORE)?	Yes Vo Yes No	
 B. Helt Affected Stat-O-Seals (HASOR)? Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? 	Yes No	
C. Cuts, Assembly/Disassembly Damage (SCU1, SDMG, SDIS)?		
If any of the above conditions exist, describe below:		
All 72 stat-o-seals had extensive disassemb	1 roll downood	
HII 12 STAT-0-SEALS HUL EXICISIVE DISASSEME	ly seal hamage.	

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Case Factory Joint Condition - Evaluation Checkoff Worksheet

	- 1
Inspector(s): Alan Carliste	
Motor No.: QM-8 Date: 4/24/89 Time: 2/1)	
Joint:	
Aft Dome Factory Joint (1817.6, ADS)	
ETA-To-Stiff. Factory Joint (1577.5, FSS) Aft Center Segment Factory Joint (1331.5, ACS)	
Find Segment Factory Joint (691.5, FFS) Forward Center Segment Factory Joint (1011.5, FCS)
Find Dome Factory Joint (531.5. FDS)	
Case field joint observations:	iment iher
A. Soot in Proximity to / Past O-fing Gloove (climite) clock	
SOINT, SPINT, SIPOR, SPPOR SISCR, SPSOR)?	
B. Sooted Grease (HAGRE)?	
C. Discolored Grease (DIGRE)?	
D. Leak Check Port Obstructed (LPCBS)? Yes No	·
E. Foreign material in the sealing area during motor operation	ुल्ल पुः
(FMIJ)? Yes X No	
F. Rust on sealing surfaces (SSCOR)?	
G. Rust on metal parts (PICO)?	
Heat affected metal (HTAFF):	
Damaged metal sealing surface (SSMET)? Yes No	

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:

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spector(s):	Factory Joint Alan Cirliste	- Evaluation Checko	off Worksneet		
	11 d	Date	4/27/85 -	Time: 2KD	
lator No.: <u>()</u> pint:	<u>M-8</u>				
	ctory Joint (1817.5, A	DS) 🗍 Stiffto-S	Stiff. Factory Joint (16	97.5, ASS)	
FTA-to-Stiff.	Factory Joint (1577.5)
Fwd Segmen	t Factory Joint (691.5	, FFS) 🗌 Forward C	enter Segment Factor	y Joint (1011.5.	FCS)
	actory Joint (531.5, Fl				
. Corrosion (On Metal Parts (PITCC)?	yes	<u> </u>	•
I. Sealing Su	rfaca Corrosion (SSC	OR)?	yes	_X_ no	
II. Metal Dam	age (DAMML)?		yes	no no	
V. Sealing Su	rface Metal Damage (SSMET)?	yes	, no	
/. Metal Slive	rs in Pin Holes (MSIP	H)?	yes	, no	
/I. Other?			yes	X no	
Describe					1
f yes, record t	he data below. Desci	ribe the observed co	ondition using the obs	ervation code	
of the correspo	onding condition from	above and the lette	er "C" if the condition	is observed	
on the clevis o	r "T" if the condition	is observed on the	tang (i.e. PITCO-T).	Field joint	
	zones are mapped o				
Comment	Description	Degree	Degree	Zone	1 \$ 21
Number	(Use symbols	Start	Stop	(See zone	.'
Number	from above)	Location	Location	description)	
			(Deg.)		
		(Deg.)	(Deg.)		
		(Deg.)	(Deg.)		_
		(Deg.)	(Deg.)		-
		(Deg.)	(Deg.)		_
		(Deg.)	(Deg.)		
		(Deg.)	(Deg.)		
		(Deg.)	(Deg.)		
		(Ueg.)	(Deg.)		
		(Ueg.)	(Deg.)		
lotes / Comme	nts:	(Ueg.)	(Deg.)		
lotes / Comme		(Ueg.)	(Deg.)		
lotes / Comme	nts:	(Ueg.)	(Deg.)		
lotes / Comme		(Ueg.)	(Deg.)		

See attached sheet(s)

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MORTON THIOKOL INC.

Inspector(s): Rocky ASh Wayne Specry Uan Pullewit Date: 4/25/29 Matior No.: CM -5 Date: 4/25/29 Payony Joint: Forward Segment Factory Joint (531.5) Forward Segment Factory Joint (691.5) Att Segment Factory Joint (1011.5) Att Segment Factory Joint (1817.5) Att Segment Factory Joint (1877.5) Att Segment Factory Joint (1877.5) Att Dome Factory Joint (1817.5) Att Segment Factory Joint (1817.5) Yes No PRIMARY O-RING Part No.: 107/15/20-25 Serial No.: 102002/6/4 A. Erosion? Yes Yes No D. Other? Describe: Yes No No Candition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Wridth CSVAP No SECONDARY O-RING Part No.: 107/51/50-25 Serial No.: 20002/6/5 No If any of the above conditions exist, record applicable dimensions below: Yes No No SECONDARY O-RING Part No.: 107/51/50-25 Serial No.: 20002/6/5 A. Erosion? Yes No Yes No B.						1 (1/450	atch A-2 Bidg)
Motor No.: (MAP2 0 Date: 4/25/89 Festory Joint: □ Forward Dome Factory Joint (531.5) □ Forward Center Segment Factory Joint (1331.5) □ Att Segment Factory Joint (1331.5) □ Att Segment Factory Joint (1817.6) □ Att Segment Factory Joint (1837.5) □ Att Segment Factory Joint (1587.5) □ Att Dome Factory Joint (1817.6) □ Att Segment Factory Joint (1817.6) □ Att Segment Factory Joint (1837.5) □ Att Dome Factory Joint (1817.6) □ Pert No.: □ UT(550-25) Serial No.: ○ ○ Q20/24/ ■ Heat Affect?	Inspector(s): R	ocky Ash	Wayne 5	perry, Da	n Pullem		
✓ Forward Dome Factory Joint (531.5) □ Forward Segment Factory Joint (1331.5) □ Forward Center Segment Factory Joint (1331.5) □ Aft Segment Factory Joint (1331.5) □ Aft Dome Factory Joint (1817.5) □ Aft Segment Factory Joint (1637.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1637.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1637.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1637.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1637.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1637.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1637.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1837.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1817.5) □ Aft Segment Factory Joint (1817.5) □ Yes ✓ No □ Aft Segment Factory Joint (1817.5) □ Yes ✓ No □ Aft Segment Factory Joint (1817.5) □ Yes ✓ No □ Aft Segment Factory Joint (1817.5) □ Yes ✓ No SECONDARY O-RIN	Motor No.: (-)	M-3		· <u> </u>		25/8	9
□ Groward Center Segment Factory Joint (1011.5) □ Aft Center Segment Factory Joint (131.5) □ Att Segment Factory Joint (1877.5) □ Aft Center Segment Factory Joint (1877.5) □ Att Segment Factory Joint (1877.5) □ Aft Segment Factory Joint (1877.5) □ Att Segment Factory Joint (1877.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment Factory Joint (1877.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment Factory Joint (1877.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment Factory Joint (1877.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment Factory Joint (1897.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment Factory Joint (1897.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment/Sectory Joint (1897.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment/Sectory Joint (1897.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment/Sectory Joint (1897.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment/Sectory Joint (1897.5) □ Aft Segment Factory Joint (1897.5) □ Att Segment/Sectory Joint (1897.5) □ Aft Segment Factory Joint (1897.5) □ Att Sectory Joint (1897.5) □ Aft Sectory Joint (1897.5) □ Att Sectory Joint (1897.5) □ Aft Sectory Joint (1897.5) Sectory O-AftNG □ Aft Sectory Joint (18				_	.1	/	
☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Dome Factory Joint (1517.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1577.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (157.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Joint (157.5) ☐ Aft Segment Factory Joint (1597.5) ☐ Aft Segment Factory Decilor ☐ Aft Segment Factory Joint (1597.5) SECONDARY O-RiNQ Part No.: _]_J75150-25 <td>1</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	1						
☐ Aft Dome Factory Joint (1817.6) PRIMARY O-RING Part No.: 107515025 Serial No.: 100002/64 A. Erosion? Yes √ No B. Heat Affect? Yes √ No C. Assembly/Diassembly Damage? Yes √ No If any of the above conditions exist, record applicable dimensions below: Condition Distance (A, B, C or D) Location Depth Width CSVAP SECONDARY O-RING Part No.: 1075150-25 Serial No.: 20002/65 A. Erosion? SECONDARY O-RING Part No.: 1075150-25 Serial No.: 20002/65 A. Erosion? SECONDARY O-RING Part No.: 1075150-25 Serial No.: 20002/65 A. Erosion? SECONDARY O-RING Part No.: 1075150-25 Serial No.: 20002/65 A. Erosion? Secondary Yes √ No C. Assembly/Disasembly Damage? Yes √ No O. Other? Describe: Yes √ No If any of the above conditions exist, record applicable dimensions below: Condition Distance (A, B, C or D) Location Depth Width CSVAP (Length) Secondition Degree Maximu	• <u> </u>						•
PRIMARY O-RING Part No.: 107(150-25) Serial No.: 00002(e4) A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Condition Distance CA. B. C or D) Location Depth Width CSVAP (Length) SECONDARY O-RING Part No.: 1075150-25 Serial No.: 0000265 A. Erosion? No S. Heat Affect? Yes No No No If any of the above conditions exist, record applicable dimensions below: Conduct Series No SECONDARY O-RING Part No.: 1075150-25 Serial No.: 0000265 No SECONDARY O-RING Part No.: 1075150-25 Serial No.: 0000265 No G. Other? Describe: Yes No No If any of the above conditions exist, record applicable dimensions below: Yes No Candition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width			•	🔄 Aft Segme	ant Factory Jo	int (169	7.5)
A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Candition Degree Maximum Circumferential Distance (A. B. C or D) Location Depth Width CSVAP (Length) SECONDARY O-RING Part No.: 10/751/50-25 Serial No.: 0000/26/5 A. Erosion? Yes No Yes No B. Heat Affect? Yes No Yes No C. Assembly/Disassembly Damage? Yes No Yes No SECONDARY O-RING Part No.: 10/751/50-25 Serial No.: 0000/26/5 A. Fersion? Yes No Yes No Yes No If any of the above conditions exist, record applicable dimensions below: Condition Distance No If any of the above conditions exist, record applicable dimensions below: Condition Distance No If any of the above conditions exist, reco	Aft Dome Facto	bry Joint (1817.6	5)				
A. Erosion?	PRIMARY O-RIN	G P	art No.: 1075	50-25	Serial No.: _(1000	264
B. Heat Affect? Yes ✓ No C. Assembly/Disassembly Damage? Yes ✓ No If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential Distance (A. B. C or D) Location Depth Width CSVAP (Length)	A. Erosion?					Yes	
C. Assembly/Disassembly Damage? Yes ✓ No If any of the above conditions exist, record applicable dimensions below: Ves ✓ No Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)	B. Heat Affec	:t?				Yes	
D. Other? Describe:	C. Assembly/	Disassembly Dar	mage?			Yes	
If any of the above conditions exist, record applicable dimensions below: Distance Condition Degree Maximum Circumferential Distance (A. B. C or D) Location Depth Width CSVAP (Length)	D. Other? De	escribe:				Yes	<u>,</u>
Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)					low:	•	
(A. B, C or D) Location Depth Width CSVAP (Length)							Distance
SECONDARY O-RING Part No.: 1075/50-25 Serial No.: 0000265 A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No If any of the above conditions exist, record applicable dimensions below: Condition Degree (A, B, C or D) Location Depth Width CSVAP (Length) Stance Stance Stance Stance (A, B, C or D) Location Depth Width CSVAP (Length) Section Stance Stance Stance Stance Stance Mother Stance Stance Stance Stance Stance (A, B, C or D) Location Depth Width CSVAP Stance Stance Stance Stance Stance Stance Stance	(A, B, C or D)	Location	Depth	Width	CSVAP		
A. Erosion?					•••••		(241911)
A. Erosion?				· · · · · · · · · · · · · · · · · · ·			
A. Erosion?				·····			
A. Erosion?							
A. Erosion?	······			······			
A. Erosion?	· · ·						
A. Erosion?	······································		•				
A. Erosion?							
A. Erosion? Yes No B. Heat Affect? Yes No C. Assembly/Disassembly Damage? Yes No D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length) 	SECONDARY O-	RING Pa	nt No.: 10751	50-25	Serial No.:	0000	265
C. Assembly/Disassembly Damage?	A. Erosion?		·				
D. Other? Describe: Yes No If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)	B. Heat Affec	t?				Yes	V No
If any of the above conditions exist, record applicable dimensions below: Distance Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)	C. Assembly/I	Disassembly Dan	nage?			Yes	No
Condition Degree Maximum Circumferential Distance (A, B, C or D) Location Depth Width CSVAP (Length)	D. Other? De	scribe:				Yes	No
(A, B, C or D) Location Depth Width CSVAP (Length)	If any of the above	conditions exis	it, record applicat	ble dimensions bei	low:		
(A, B, C or D) Location Depth Width CSVAP (Length)	Condition	Degree	Maximum	Circumferential			Distance
Image: Story in the second	(A, B, C or D)	Location	Depth	Width	CSVAP		
	<u>_</u>						
							
				· · · ·			
	Notes / Comments						
	Notes / Comments					 	
	Notes / Comments					 	
	Notes / Comments						
SEC PAGE PAGE	Notes / Comments						
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se F	actory	Joint	Condition	-	Evaluation	Checkoff	Worksheet
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Inspectorisi: Alan Carlisle	
Motor No.: 24-8 Date: 4/24/89	Time: 2330
Joint: Aft Dome Factory Joint (1817.5, ADS) StiffTo-Stiff. ETA-To-Stiff. Factory Joint (1577.5, FSS) Aft Center Seg Find Segment Factory Joint (691.5, FFS) Forward Center Fwd Dome Factory Joint (531.5, FDS)	Factory Joint (1697.5, ASS) ment Factory Joint (1331.5, ACS) r Segment 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 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)? 	Yes No Yes No
If any of the above conditions exist, record applicable dimens dition using a comment number, a "T" if the condition is ob tion is observed on the clevis and any other information need	served on the tang or a "C" if the condi-
	•

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	Factory Joint	t - Evaluation Check	off Worksheet			
Inspector(s):	Alan Carliste					
Motor No.: Q	M-8	Uni	e: 4/24/89	Time: 2350	5	
Joint:	<u></u>					
	actory Joint (1817.6, A	,	-	nt (1697.5, ASS)		
	. Factory Joint (1577.					
V -	nt Factory Joint (691.5		Center Segment i	Factory Joint (101	1.5. FCS)	
	Factory Joint (531.5, F	DS)				
I. Corrosion	On Metal Parts (PITC)	0)?		yes <u>X</u> n	•	
II. Sealing Su	urfaca Corrosion (SSC	OR)?	<u></u>	yes <u>X</u> n	•	
III. Metal Darr	nage (DAMML)?			yes <u> </u>	0	
IV. Sealing Su	urface Metal Damage	(SSMET)?		yes <u>X</u> n	0	
V. Metal Slive	ers In Pin Holes (MSIF	PH)?		yes <u>X</u> n	•	
VI. Other?				yes <u>X</u> n		
Describ	e:					
If yes, record	the data below. Desc	ribe the observed co	ondition using the	e observation cod	e	
of the corresp	onding condition from	above and the lette	er "C" if the con	dition is observed		-1,3-1,5-1 1
on the clevis o	or "T" if the condition	is observed on the	tang (i.e. PITCO	-T). Field joint		
tang and clevi	s zones are mapped o	out on the second pa	age of this form.			
Comment	Description	Degree	Degree	Zone		h bi
Number	(Use symbols	Start	Stop	(See zor	ne	
	from above)	Location	Location	descriptio	on)	-
		(Deg.)	(Deg.)	n an Anna Anna Anna Anna Anna Anna Anna		
		(3.7	(3-)		-	•••
				·····		i.
			<u></u>			
·						
	· · · · · · · · · · · · · · · · · · ·					
Notes / Comme	ents:					

See attached sheet(s)

REV. _____

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MORTON THIOKOL INC.

Detailed Case Factor	ry John O-ring (Post-Removal) -				
Inspector(s): ()ay	K. SDUM	Rocky Hsh	ijan Pulleyn	_		
Motor No .: QM-	8	[1	Date: 2	1-25-89	·
Factory Joint:						(801 6)
Forward Dome F	actory Joint (531	1.5)	Forward Se			
Forward Center S	Segment Factory	Joint (1011.5)	—		Factory Join	
Aft Segment Fac	tory Joint (1577	.5)	Aft Segmer	nt Factory	/ Joint (1697	.5)
Aft Dome Factor						
PRIMARY O-RING		t No.: 1475150	-25 S	erial No.:	00002	47
	•				Yes	No
A. Erosion?	•				Yes	No
B. Heat Affect		3097			Yes	V No
	isassembly Dam				Yes	V No
D. Other? De If any of the above	scribe:		ble dimensions be	low:		
		Maximum	Circumferential			Distánce
Condition	Degree		Width	CS		(Length)
(A, B, C or D)	Location	Depth	TT I G LI I			
		·				
			•		·	
			•		<u> </u>	
				Corlel No	.0000	2110
SECONDARY O-	RING Pa	rt No.: [U75]	50-25	Serial No	.: <u>0000</u> 2	
A. Erosion?	•	nt No.: <u>[U75]</u>	50-25	Serial No	Yes	No
A. Erosion? B. Heat Affec	:t?		50-25	Serial No -	Yes Yes	No No
A. Erosion? B. Heat Affec C. Assembly/	t? Disassembly Dar	nage?	50-25	Serial No - -	Yes Yes Yes	No No No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De	t? Disassembly Dar escribe:	nage?	· ·	-	Yes Yes	No No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov	t? Disassembly Dar escribe: e conditions exis	nage? st, record applic	able dimensions be	- - - 2 810w:	Yes Yes Yes	No No No No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov	t? Disassembly Dar escribe:	nage? st, record applic	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov	t? Disassembly Dar escribe: e conditions exis	nage? st, record applic	able dimensions be	- - - 9low:	Yes Yes Yes	No No No No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	et? Disassembly Dar escribe: e conditions exis Degree	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	et? Disassembly Dar escribe: e conditions exis Degree	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	et? Disassembly Dar escribe: e conditions exis Degree	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	et? Disassembly Dar escribe: e conditions exis Degree	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	et? Disassembly Dar escribe: e conditions exis Degree	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	et? Disassembly Dar escribe: e conditions exis Degree	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	et? Disassembly Dar escribe: e conditions exis Degree	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	et? Disassembly Dar escribe: e conditions exis Degree	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do If any of the abov Condition (A, B, C or D)	et? Disassembly Dar escribe: e conditions exis Degree Location 	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	et? Disassembly Dar escribe: e conditions exis Degree Location 	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do If any of the abov Condition (A, B, C or D)	et? Disassembly Dar escribe: e conditions exis Degree Location 	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do If any of the abov Condition (A, B, C or D)	et? Disassembly Dar escribe: e conditions exis Degree Location 	nage? st, record applic Maximum	able dimensions be Circumferential	- - - 9low:	Yes Yes Yes Yes	No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do If any of the abov Condition (A, B, C or D)	et? Disassembly Dar escribe: e conditions exis Degree Location 	nage? st, record applic Maximum	able dimensions be Circumferential	elow:	Yes Yes Yes Yes	No No No No Distance (Length)
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do If any of the above Condition (A, B, C or D) Notes / Comment	et? Disassembly Dar escribe: e conditions exis Degree Location 	nage? st, record applic Maximum	able dimensions be Circumferential	elow:	Yes Yes Yes Yes	Vol. IV
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do If any of the abov Condition (A, B, C or D)	et? Disassembly Dar escribe: e conditions exis Degree Location 	nage? st, record applic Maximum	able dimensions be Circumferential	alow:	Yes Yes Yes Yes Yes	No No No Distance (Length)

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Case Factory Joint Condition - Evaluation Checkoff Worksheet Ign Lachisle Inspector(s): Time: // 5/9/89 Date: Motor No.: Ú. 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) Find Segment Factory Joint (691.5, FFS) X Forward Center Segment Factory Joint (1011.5, FCS) 🗍 Fwd Dome Factory Joint (531.5, FDS) Comment Number Case field joint observations: No A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes SOINT, SPINT, SIPOR. SPPOR SISCR, SPSOR)? No Yes B. Sooted Grease (HAGRE)? No Yes C. Discolored Grease (DIGRE)? No Yes D. Leak Check Port Obstructed (LPOBS)? No Foreign material in the sealing area during motor operation Yes Ε. (FMIJ)? No Yes Rust on sealing surfaces (SSCOR)? F. No Yes G. Rust on metal parts (PITCO)? No Yes Heat affected metal (HTAFF)? ч. No Yes Damaged metal sealing surface (SSMET)? ۰.

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:

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	Factory Joint	 Evaluation Checko 	ff Worksheet		1 ·
Inspector(s):	Van Carliste				
Motor No.:	11-8	Date	5/9/89		
Joint:					
Aft Dome Eac	tory Joint (1817.6, Al	DS) 🗍 Stiffto-S	tiff. Factory Join	t (1697.5, ASS)	
ETA-to-Stiff.	Factory Joint (1577.5	, FSS) 🗌 Aft Center	Segment Factor	y Joint (1331.5, ACS)	ļ
			enter Segment F	actory Joint (1011.5. FCS)	
Fwd Dome Fa	ctory Joint (531.5, FC	DS)			4
I. Corrosion C	on Metal Parts (PITCC)?		yes <u>X</u> no	
II. Sealing Sur	faca Corrosion (SSCC)?		yes no	
III. Metal Dama	ige (DAMML)?			yes <u> </u>	
IV. Sealing Sur	face Metal Damage (SSMET)?		yes <u>X</u> no	
	rs in Pin Holes (MSIP			yes <u>X</u> no	
VI. Other?				yes no	1.1
Describe					
If ves, record the	ne data below. Descr	ibe the observed co	ndition using the	observation code	fax
of the correspo	nding condition from	above and the lette	r "C" if the cond	lition is observed	
on the clevis of	"T" if the condition	is observed on the	tang (i.e. PITCO-	-T). Field joint	
tens and slovis	zones are mapped o	ut on the second pa	ge of this form.		
tang and clevis	20mes and mapped o			Zone	1.2.1
Comment	Description	Degree	Degree	•	
Number	(Use symbols	Start	Stop	(See zone	
	from above)	Location	Location	description)	
		(Deg.)	(Deg.)		ingentaria. Na I
					·
				— . — — — — — — — — — — — — — — — — — —	
		· .		·	
					1
Notes / Comme	nts:				
					الـــــ

See attached sheet(s)

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] Aft Segment Fa	r Segment Factor actory Joint (157	ry Joint (1011.5) 7.5)	Aft Center So Aft Segment	-	•	• •	
] Aft Dome Facto RIMARY O-RIN	ory Joint (1817.6) art No.: 10751	EA-75 Se	ial No.:	200	na 3	4
A. Erosion? B. Heat Affec C. Assembly/	ct? /Disassembly Dan				Yes Yes Yes Yes	No No No No No	
			ble dimensions below	v:	T G S	<u></u> NO	
Condition A, B, C or D)	Degree Location	Maximum Depth	Circumferential Width	CSVAP		Distance (Length)	
······································							
· · · · · · · · · · · · · · · · · · ·	·						
		·			·		
· · ·					·	······································	
	-RING Pa	art No.:	5150-25 Se			2,250	
A. Erosion? B. Heat Affec	ct?		<u>5150-25</u> se	rial No.:	Yes Yes	No No	
B. Heat Affec	ct? Disassembly Dan		<u>5150-25</u> se	rial No.:	Yes	No	- -
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De	ct? Disassembly Dan escribe:	nage?	5150-25 Se ble dimensions below Circumferential	 	Yes Yes Yes	No No No No	
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do any of the abov Condition	ct? Disassembly Dan escribe: e conditions exis	nagë? st, record applica	ble dimensions belov	 	Yes Yes Yes	No No No	_
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do any of the abov Condition	ct? /Disassembly Dan escribe: /e conditions exis Degree	nage? st, record applica Maximum	ble dimensions belov Circumferential	 v:	Yes Yes Yes	✓ No ✓ No ✓ No ✓ No ✓ No ✓ No	
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do any of the abov Condition A, B, C or D)	ct? /Disassembly Dan escribe: /e conditions exis Degree	nage? st, record applica Maximum	ble dimensions belov Circumferential	 v:	Yes Yes Yes	✓ No ✓ No ✓ No ✓ No ✓ No ✓ No	_
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do any of the abov Condition A, B, C or D)	ct? /Disassembly Dan escribe: /e conditions exis Degree	nage? st, record applica Maximum	ble dimensions belov Circumferential	 v:	Yes Yes Yes	✓ No ✓ No ✓ No ✓ No ✓ No ✓ No	
A. Erosion? B. Heat Affec C. Assembly/ D. Other? Do any of the abov Condition A, B, C or D)	ct? /Disassembly Dan escribe: /e conditions exis Degree	nage? st, record applica Maximum	ble dimensions belov Circumferential	 v:	Yes Yes Yes	✓ No ✓ No ✓ No ✓ No ✓ No ✓ No	

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ictory Joint Condition - Evaluation Checkoff Worksheet

Case Factory			
Inspector(s): Alin (4114)?	Date: 4/14/84	Time: //30	
Motor No.: 0M-8	Uale: -///8/		
Joint: Aft Dome Factory Joint (1817.6. ETA-To-Stiff. Factory Joint (15 Fwd Segment Factory Joint (69 Fwd Dome Factory Joint (531.5	77.3, FSS)X Aft Center Segme 1.3, FFS) CForward Center Se	ctory Joint (1697.5, ASS) Int Factory Joint (1331.5, AC egment Factory Joint (1011.5	S) 5. FCS)
Fwd Dome Factory Joint (031.0			Comment
Case field joint observations: A. Soot in Proximity to / Past O-	ring Groove (SPINS, SICOR	Yes 🔀 No	Number
SOINT, SPINT, SIPOR, SPPOR	SISCH, SPSCH)?	Yes X No	
B. Sooted Grease (HAGRE)?		Yes X No	
C. Discolored Grease (DIGRE)?	(1 POBS)?	Yes X No	
D. Leak Check Port Obstructed E. Foreign material in the sealin	g area during motor operation	Yes No	
'(FMIJ)?	COB)?	Yes <u>V</u> No	
F. Rust on sealing surfaces (SS	7	Yes No	2
G. Rust on metal parts (PITCO)? 4. Heat affected metal (HTAFF)	?	Yes X No	
Heat affected metal (motif)	CE (SSMET)?	Yes X No	
If any of the above conditions ex dition using a comment number tion is observed on the clevis ar D = C; $McHallic$ forelying Q^{0} Z = C = Light conteston in $G = T = Light$ whose de	nd any other information neede naterial between forward Wal	d to describe the observation Il of groove and Phinary (n:
			•
1			

DOC			
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SEC		Page	A-57

	Factory Joint	- Evaluation Che	ckoff Worksheet		-1 .
Inspector(s): A.	an Carliste				
Motor No.: QA	14	<u>ט</u>	nie: 4/14/55	Kher 1130	
ETA-to-Stiff.	tory Joint (1817.6, A Factory Joint (1577.5 Factory Joint (691.5 Inctory Joint (531.5, Fi	5, FSS) 🖾 Aft Car , FFS) 🔲 Forwar	o-Stiff. Factory Joi iter Segment Facto d Center Segment	int (1697.5, ASS) bry Joint (1331.5, ACS) Factory Joint (1011.5, FCS)
I. Corrosion C	On Metal Parts (PITCC) ?	_ <u>X</u> _	yes no	
II. Sealing Sur	face Corrosion (SSC	OR)?		yes <u>X</u> no	
	ige (DAMML)?			yes <u>X</u> no	
	face Metal Damage (·	yes <u> </u>	
V. Metal Slive	rs in Pin Holes (MSIP	H)?		ves X no	
VI. Other? Describe				yes <u>X</u> no	
of the correspo on the clevis or	e data below. Descinding condition from "T" if the condition zones are mapped o	above and the lis observed on t	atter "C" if the cor he tang (i.e. PITCC	ndition is observed D-T). Field joint	್ಷ-೧೯೪
Comment	Description	Degree	Degree	Zone	
Number	(Use symbols	Start	Stop	(See zone	
	from above)	Location	Location	description)	
	1-C	(Deg.) ()	(Deg.) <u>36 D</u>		
	<u> </u>	0	360	<u> </u>	
	<u></u>				
	<u>_,</u> ,,,				
Notes / Commer	nt s:				

See attached sheet(s)

REV. ____

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	10.05	
		A-58

	cky Ash 1	Deyne Spe	rry Dan P	ulley1	8/89	
] Aft Segment Fa	Factory Joint (53 Segment Factor	y Joint (1011.5) 7.5)	☐ Forward Seg ☑ Aft Center S ☐ Aft Segment	ment Factor egment Fact	y Joint ory Joi	nt (1331.5)
RIMARY O-RING A. Erosion? B. Heat Affec C. Assembly/ D. Other? De	G Pa t? Disassembly Dan escribe:	nt No.: <u>)75</u>]	· · · · · · · · · · · · · · · · · · ·	rial No.:	Yes Yes Yes Yes	$ \begin{array}{c} $
f any of the above Condition (A, B, C or D)	 conditions exis Degree Location 	Maximum Depth	ble dimensions belo Circumferential Width	CSVAP		Distance (Length)
						241
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De	t? Disassembly Dar ascribe:			erial No.:	Yes Yes Yes Yes Yes	241 V No V No V No V No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De If any of the abov Condition	t? Disassembly Dar ascribe:	nage?			Yes Yes Yes	No No No
B. Heat Affec C. Assembly/ D. Other? De If any of the abov	t? Disassembly Dar escribe: e conditions exis Degree	nage? st, record applic: Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? De f any of the abov Condition	t? Disassembly Dar ascribe: conditions exis Degree Location 	nage? st, record applic: Maximum	able dimensions belo Circumferential		Yes Yes Yes	No No No No Distance

Case Factory Joint Condition - Evaluation Checkoff Worksheet inspector(s): Lip KOWSP Motor No .: Date: Time: /330 Joint: Aft Dome Factory Joint (1817.6, ADS) Stiff.-To-Stiff. Factory Joint (1697.5, ASS) X 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) Find Dome Factory Joint (531.5, FDS) Case field joint observations: Comment Number A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? 8. Sooted Grease (HAGRE)? Yes No C. Discolored Grease (DIGRE)? Yes No Leak Check Port Obstructed (LPOBS)? D. Yes No Ε. Foreign material in the sealing area during motor operation No Yes (FMIJ)? F. Rust on sealing surfaces (SSCOR)? Yes No G. Rust on metal parts (PITCO)? Yes No 12 Ч. Heat affected metal (HTAFF)? Yes No Damaged metal sealing surface (SSMET)? Yes No

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:

1) Intermittent and sporty light to medium corrosion on outer clevis log.

-) Light wrookin in clevi's bottom at 101-107.0

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17

	Factory Joint	- Evaluation Checkol]
Inspector(s):	Han Carlisle;		1 .	
Motor No.:	M-8	Unte:	3/2/89	
Joint:	, , , , , , , , , , , , , , , , , , ,			07 5 ASS)
🗌 Aft Dome Fac	tory Joint (1817.6, A	ADS) U Stiffto-S	liff. Factory Joint (16)	of (1331.5, ACS)
ETA-to-Stiff.	Factory Joint (1577.	5, FSS) 🗌 Aft Center	Segment Factory Son	v Joint (1011.5, FCS)
			enter Segment ractor	y Joint (1011.5. FCS)
	actory Joint (531.5, F		· · · · · · · · · · · · · · · · · · ·	no
I. Corrosion (On Metal Parts (PITC	0)?	yes	10 no
II. Sealing Su	rfaca Corrosion (SSC	OR)?	yes	
III. Metal Dam	age (DAMML)?		yes	no
IV. Sealing Su	rface Metal Damage	(SSMET)?	yes	
	rs In Pin Holes (MSI		yes	
VI. Other?			yes	X no
Describ	e:			
If ves, record t	he data below. Des	cribe the observed co	indition using the obs	ervation code
of the correspo	onding condition from	m above and the lette	r "C" if the condition	is observed
on the clevis of	r "T" if the conditio	n is observed on the	tang (i.e. PITCO-T).	Field joint
tang and clavis	zones are mapped	out on the second pa	ge of this form.	
		Degree	Degree	Zone
Comment	Description		Stop	(See zone
Number	(Use symbols	Start	-	description)
	from above)	Location	Location	description
		(Deg.)	(Deg.)	11
)	PITO-C_	Interniter and	pty	_///
7	$D_1 f(0) = c$	101	107	H
	<u>PIICO</u>	KE 241 38	ZIA	F
	MMM-C	<u> </u>		F
3	DAMML-C	38,316		<u> </u>
			-	
Notes / Comm				
Notes / Commo	ents: HEAT AND Spotty, 1	isht to medium		
1) Lige	and this			
2) Light (1 DI UNC			
3) Scrutches	5			

See attached sheet(s)

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REV. ____

MORTON THIOKOL INC.

Inspector(s): I Jayle. Sperry, Rock, Ad., D. GARY NELSON Motor No.: OM-8 Factory Joint: Date: 3/6/89 Forward Dome Factory Joint (531.5) Forward Segment Factory Joint	
Motor No.: Date: 3/6/89 Factory Joint: Forward Dome Factory Joint (531.5) Forward Segment Factory Joint	
Forward Dome Factory Joint (531.5) Forward Segment Factory Joint	
	(691.5)
🔲 Forward Center Segment Factory Joint (1011.5) 👘 🗌 Aft Center Segment Factory Joint	int (1331.5)
🖂 Aft Segment Factory Joint (1577.5) 🛛 🗌 Aft Segment Factory Joint (169	7.5)
Aft Dome Factory Joint (1817.6)	
PRIMARY O-RING Part No.: 1475150 - 25 Serial No.: 00002	, RO
· · · · · · · · · · · · · · · · · · ·	V No
If any of the above conditions exist, record applicable dimensions below:	
Condition Degree Maximum Circumferential	Distance
(A, B, C or D) Location Depth Width CSVAP	(Length)
	······
	<u></u>
	· · · · · · · · · · · · · · · · · · ·
	· · ·
······································	
SECONDARY O-RING Part No.: 1075150-25 Serial No.: 2000	28.3
A. Erosion?	28.3 No
A. Erosion?YesYes	
A. Erosion?	No No
A. Erosion?YesYes	No No
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes	No No No
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes	No No No
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes	No No No No No
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum	No No No No Distance
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum	No No No No Distance
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum	No No No No Distance
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum	No No No No Distance
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum	No No No No Distance
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum	No No No No Distance
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum	No No No No Distance
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum	No No No No Distance
A. Erosion?Yes B. Heat Affect?Yes C. Assembly/Disassembly Damage?Yes D. Other? Describe:Yes If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential (A, B, C or D) Location Depth Width CSVAP 	No No No No Distance
A. Erosion?Yes B. Heat Affect?Yes C. Assembly/Disassembly Damage?Yes D. Other? Describe:Yes If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential (A, B, C or D) Location Depth Width CSVAP 	No No No No Distance
A. Erosion?Yes B. Heat Affect?Yes C. Assembly/Disassembly Damage?Yes D. Other? Describe:Yes If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential (A, B, C or D) Location Depth Width CSVAP 	No No No No Distance
A. Erosion?Yes B. Heat Affect?Yes C. Assembly/Disassembly Damage?Yes D. Other? Describe:Yes If any of the above conditions exist, record applicable dimensions below: Condition Degree Maximum Circumferential (A, B, C or D) Location Depth Width CSVAP 	No No No No Distance
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum Circumferential (A, B, C or D) Location Depth Width CSVAP	No No No No Distance
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum Circumferential (A, B, C or D) Location Depth Width CSVAP	No No No No Distance (Length)
A. Erosion? Yes B. Heat Affect? Yes C. Assembly/Disassembly Damage? Yes D. Other? Describe: Yes If any of the above conditions exist, record applicable dimensions below: Yes Condition Degree Maximum (A, B, C or D) Location Depth Width CSVAP	No No No No Distance (Length)

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Inscector(s): Aim (artistic) Inversion Time: 1600 Motor No.: QM-S Date: 35,69 Itime: 1600 Joint: QM-S Date: 75,69 Itime: 1697.5, ASS) Aft Dome Factory Joint (1817.5, ADS) StiffTo-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)	Saca Factory Jo	int Condition - Evaluation Che	eckoff Worksheet	
Insector(s): Prime (ACO) Motor No.: QM-S Date: 35/87 Time: (ACO) Joint: At Dome Factory Joint (1817.5, ADS) StiffTo-Stiff. Factory Joint (1331.5, ACS) ETA-To-Stiff. Factory Joint (1577.5, FSS) Aft Center Segment Factory Joint (1331.5, ACS) Fwd Segment Factory Joint (501.5, FFS) Forward Center Segment Factory Joint (1011.5, FCS) Fwd Dome Factory Joint (531.5, FDS) Forward Center Segment Factory Joint (1011.5, FCS) Case field joint observations: No A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes SolNT, SPINT, SIPOR, SPOR SISOR, SPSOR)? Yes B. Sooted Grease (HAGRE)? Yes C. Discolored Grease (DIGRE)? Yes D. Leak Check Port Obstructed (LPOBS)? Yes E. Foreign material in the sealing area during motor operation Yes M. Heat affected metal (HTAFF)? Yes No Damaged metal sealing surfaces (SSCOR)? Yes No Meta affected metal (HTAFF)? Yes No Damaged metal sealing surface (SSMET)? Yes No If any of the above conditions exist, record applicaule dimensions below. Describe the observed condition using a comment number, a "T" if the condition is obs	Ali Controlle			
Joint: Aft Dome Factory Joint (1817.5, ADS) Sliff, -To-Sliff, Factory Joint (1697.5, ASS) Aft Dome 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) Forward Center Segment Factory Joint (1011.5, FCS) Case field joint observations: No A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? Yes B. Sooted Grease (HAGRE)? Yes C. Discolored Grease (DIGRE)? Yes D. Leak Check Port Obstructed (LPOBS)? Yes F. Rust on seeling surfaces (SSCOR)? Yes M. Heat affected metal (HTAFF)? Yes Damaged metal sealing surface (SSMET)? Yes If any of the above conditions exist, record applicatle dimensions below. Describe the observed condition is observed on the clevis and any other information needed to describe the observation: I) FM IJ-C : Fiber ON bard botween O-ring Grooves Yes Q) //adt Corrosiun dawnSthCam of Secondary Groove at 152, 32, 36, 43, 84, 54, 54, 54, 54, 54, 54, 54, 54, 54, 5	This cector (s).	7 / //	Time:	0
Case field joint observations: X. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes X. No A. Soot in Proximity to / Past O-ring Groove (SPINS, SICOR Yes X. No SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? Yes No Yes No B. Sooted Grease (HAGRE)? Yes No Yes No C. Discolored Grease (DIGRE)? Yes No Yes No D. Leak Check Port Obstructed (LPOBS)? Yes No Yes No E. Foreign material in the sealing area during motor operation (FMIJ)? Yes No Yes No G. Rust on metal parts (PITCO)? Yes Yes No Yes No H. Heat affected metal (HTAFF)? Yes No Yes No Yes No Yes No If any of the above conditions exist, record applicable dimensions below. Describe the observed 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: I) FM D-C : Fiber On land between O-ring Grooves 2) //Ght Orrosibn dawnstheam of Secondery Groove at 15:10, 32, 36, 45, 64, 52, 36, 45, 64,	Joint: Aft Dome Factory Joint (1817.6,) ETA-To-Stiff. Factory Joint (1577) Fwd Segment Factory Joint (691. Fwd Dome Factory Joint (531.5,	7.5, FSS) Aft Center Segme 5, FFS) Forward Center Se	at Eactory Joint Light of	Comment
SOINT. SPINT. SIPOR. SPPOR SISOR. SPOR SISOR, SPOR SPOR SPOR SPOR SPOR SPOR SPOR SPOR	Case field joint observations:	A GOOVE (SPINS, SICOR	Yes X	
If any of the above conditions exist, record applicable dimensions below. Describe the observed con- dition using a comment number, a "T" if the condition is observed on the tang or a "C" if the condi- tion is observed on the clevis and any other information needed to describe the observation: 1) FMD-C: Fiber on land between Oring Grooves 2) Light corrosion downstream of Secondary Groove at 1521, 32, 36-45, 84, 2) Light corrosion downstream of Secondary Groove at 1521, 32, 36-45, 84,	 SOINT, SPINT, SIPOR, SPPOR S B. Scoted Grease (HAGRE)? C. Discolored Grease (DIGRE)? D. Leak Check Port Obstructed (L E. Foreign material in the sealing (FMIJ)? F. Bust on sealing surfaces (SSC I.G. Bust on metal parts (PITCO)? 	POBS)? area during motor operation OR)?	Yes Yes X Yes X Yes Yes Yes Yes Yes	No
	dition using a comment number. tion is observed on the clevis and 1) FM D-C: Fiber on lan 2) / j'att corrosien downst	any other information neede	ed to describe the observ	

VOL IV

	Factory Joint	- Evaluation Checkol	f Worksheet	
	Ale Lalido	Dave Rowsel	1	
Inspector(s):		Unte:	3/2/89	
	U-8		<i>,</i>	
Joint:	and Joint (1817 6. AE	s) Stiffto-S	liff. Factory Joint (1697	7.5, ASS)
	tory Joint (1817.6, Al	ESSI Aft Center	Segment Factory Join	t (1331.5, ACS)
	Eactory Joint (691.5.	FFS) Forward C	enter Segment Factory	Joint (1011.5. FCS)
Fwd Segment	ctory Joint (531.5, Ft	DS)		
			X yes	no
	n Metal Parts (PITCC		yes	<u>X</u> no
	faca Corrosion (SSCC		X yes	no
	ige (DAMML)?	00115713	yes	X no
	face Metal Damage (yes	x no
V. Metal Slive	rs In Pin Holes (MSIP	H)?	yes	T no
VI. Other?			,	
Describe	a:		the obse	nyation code
If yes, record th	he data below. Desc	ribe the observed co	ndition using the obse	ic observed
	adian condition from	above and the lette		
an the clevis o	r "T" if the condition	is observed on the	tang (i.e. ritee t).	Field joint
tang and clevis	zones are mapped o	out on the second pa	age of this form.	
lang and cievis			Degree	Zone
Comment	Description	Degree	-	(See zone
Number	(Use symbols	Start	Stop	
	from above)	Location	Location	description)
		(Deg.)	(Deg.)	
,	Orio C	7N/	137	<u>M</u>
	PILO-C			6
2	PITCO-C	1)-21.32.56-2	15,84,147-175	<u> </u>
3	NAMMI-C	358	358	
			·······	
Notes / Comm	ents:	- TOT I AVIS	between inste d allere	e locations.
Notes , cont	T modium COIRS,	icn on ource cloves	DOWERT HURE COULD	
1) Low Mark	the high contasion (juvn STICIMOT SECON		
E) ZATAMITA	11 2 19 11			
3) Scratch				

See attached sheet(s)

VCL IV TWR-17591 DOC NO.

		, Wayne	Spercy			
	2M-8'		V	Date:	3-6-	89
Factory Joint:					anton, faini	
Forward Dome				d Segment F		
Forward Cente		•	· · · · · ·	nter Segment	•	• •
Aft Segment F	-		LY Aft Se	gment Factor	y Joint (169	97.5)
Aft Dome Fact	ary Joint (1817.6	5)				
PRIMARY O-RIN	IG P	art No.:7	5150-25	Serial No.	: <u>C</u> OC	2292
A. Erosion?				•.	Yes	V No
B. Heat Affe	c+2				Yes	V No
	/Disassembly Da	maga?		-	Yes	No
•	escribe:			-	Yes	No No
					103	
If any of the above Condition			circumferen			Distance
	Degree	Maximum			/ A D	Distance
(A, B, C or D)	Location	Depth	Width	CSV	/AP	(Length)
	· <u>·····</u> ······		· <u></u>			
		<u> </u>	·	<u> </u>	<u> </u>	
		·····				
<u></u> _			<u></u>			·····
· · ·			•	<u></u>	······································	
				فالتقارب والمتعالية والمتعاد	·······	
	•		•		-	
	-RING Pi	art No.: 107	5150-25	Serial No.	:	0276
A. Erosion? B. Heat Affec C. Assembly/	ct? /Disassembly Dar	mage?		Serial No. 	Yes Yes Yes	No No No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D	ct? /Disassembly Dar escribe:	mage?			Yes Yes	№ №
A. Erosion? B. Heat Affed C. Assembly/ D. Other? D If any of the abov	ct? /Disassembly Dar escribe:	mage? st, record applic	able dimensions		Yes Yes Yes	No No No
B. Heat Affed C. Assembly D. Other? D If any of the abov	ct? /Disassembly Dar escribe: re conditions exis	mage? st, record applic	able dimensions		Yes Yes Yes Yes	No No No No No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dar escribe: re conditions exis Degree	mage? st, record applic Maximum	able dimensions Circumferent	- tial	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dar escribe: re conditions exis Degree	mage? st, record applic Maximum	able dimensions Circumferent	- tial	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dar escribe: re conditions exis Degree	mage? st, record applic Maximum	able dimensions Circumferent	- tial	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dar escribe: re conditions exis Degree	mage? st, record applic Maximum	able dimensions Circumferent	- tial	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dar escribe: re conditions exis Degree	mage? st, record applic Maximum	able dimensions Circumferent	- tial	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dar escribe: re conditions exis Degree	mage? st, record applic Maximum	able dimensions Circumferent	- tial	Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dar escribe: re conditions exis Degree	mage? st, record applic Maximum	able dimensions Circumferent		Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dar escribe: re conditions exis Degree	mage? st, record applic Maximum	able dimensions Circumferent		Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition (A, B, C or D)	ct? /Disassembly Dar escribe: /e conditions exis Degree Location 	mage? st, record applic Maximum	able dimensions Circumferent		Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition (A, B, C or D)	ct? /Disassembly Dar escribe: /e conditions exis Degree Location 	mage? st, record applic Maximum	able dimensions Circumferent		Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition (A, B, C or D)	ct? /Disassembly Dar escribe: /e conditions exis Degree Location 	mage? st, record applic Maximum	able dimensions Circumferent		Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition (A, B, C or D)	ct? /Disassembly Dar escribe: /e conditions exis Degree Location 	mage? st, record applic Maximum	able dimensions Circumferent		Yes Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dar escribe: /e conditions exis Degree Location 	mage? st, record applic Maximum	able dimensions Circumferent		Yes Yes Yes Yes Yes	No No No No Distance

÷.

Motor No.: ()M-8 Date: 3/2/89 Joint:		Times	1225	
	·	Time: (<u>1550</u>	·
Aft Dame 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 Fwd Dome Factory Joint (531.5, FDS)	ent Factory	Joint (133	1.5. AC	
Case field joint observations:			· • • • • • • •	Comment
A. Scot in Proximity to / Past O-ring Groove (SPINS, SICOR SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	Ye	s _X	_ No	Number
B. Sooted Grease (HAGRE)?	Ye	s <u>X</u>	No	
C. Discolored Grease (DIGRE)?	Ye	s ک	No	
D. Leak Check Port Obstructed (LPOBS)?	Ye	s 📈	No	
E. Foreign material in the sealing area during motor operation (FMIJ)?	Ye	s 🙏	No	
Rust on sealing surfaces (SSCOR)?	Ye	s 🗡	No	
G. Rust on metal parts (PITCO)?	X Ye	s	No	
H. Heat affected metal (HTAFF)?	Ye	s 👗	No	
. Damaged metal sealing surface (SSMET)?	Ye	s 🔟	No	
EF - Intermitten medium corroston on artside		-	J	
		·		
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		t - Evaluation Checko	ff Worksheet	
inspector(s):	Man Carliste	Davie Rowsell		
Motor No.:		Date	3/2/89	-
Joint:				
Aft Dome Fa	ctory Joint (1817.5,	ADS) 🗌 Stiffto-S	tiff. Factory Joint (16	97.5, ASS)
ETA-to-Stiff.	Factory Joint (1577	.5, FSS) 🗌 Aft Center	Segment Factory Joi	nt (1331.5, ACS)
🔲 Fwd Segmen	t Factory Joint (691.	5, FFS) 🗌 Forward C	enter Segment Factor	y Joint (1011.5, FCS)
Fwd Dome F	actory Joint (531.5,	FDS)		······
I. Corrosion	On Metal Parts (PITC	0)?	<u>X</u> yes	no
II. Sealing Su	rfaca Corrosion (SS	COR)?	yes	no
III. Metal Dam	age (DAMML)?		X yes	no
IV. Sealing Su	rface Metal Damage	(SSMET)?	yes	_X_ no
V. Metal Slive	ers In Pin Holes (MS	PH)?	yes	no
VI. Other?			yes	_X no
Describ	e:			
If yes, record t	he data below. Des	cribe the observed co	ndition using the obs	ervation code
		m above and the lette		
		n is observed on the		
		out on the second pa		
any and clevis				_
Comment	Description	Degree	Degree	Zone
Number	(Use symbols	Start	Stop	(See zone
	from above)	Location	Location	description)
		(Deg.)	(Deg.)	
,	PITCO-#C	Intermitten en itt	er Circumference	M
7.	DAMML-C		34 36 38 40 44 304	F
		206 :08-3,6 34		
2	CAMAL-T	247	246	AB
	CT YML			- to by the second
		· · ·		
Notes / Comme	ents:			
1) medium (1)	ntsion			
2) Scratches	;			
3) Cother 1	O. TS Jown Steam of	-Caling Surface To C	hamer corner	
D) XIUNU 1				
L		·····		
Cog attached				

See attached sheet(s)

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Factory Joint: Forward Dome Forward Cente	r Segment Facto actory Joint (157	ry Joint (1011.5) 7.5)	Aft Cent	Segment Facto er Segment Facto nent Factory Jo	ctory Jo	(691.5) int (1331.5)
D. Other? D	ct? /Disassembly Dar escribe:	mage?		Serial No.:	Ves Yes Yes Yes Yes	107 ↓ No ↓ No ↓ No ↓ No ↓ No
If any of the above Condition (A, B, C or D)	Degree Location	st, record applic: Maximum Depth	able dimensions Circumferenti: Width			Distánce (Length)
A. Erosion?		art No.:7	5150-25	Serial No.:	Yes	291
 B. Heat Affect C. Assembly D. Other? D If any of the above 	ct? Disassembly Dan escribe: re conditions exis	nage? st, record applica	able dimensions t	 Delow:		No No No No
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition (A, B, C or D)	ct? Disassembly Dan escribe: re conditions exis	nage? st, record applica		 Delow:	Yes Yes Yes	No No No
A. Erosion? B. Heat Affed C. Assembly/ D. Other? D If any of the abov Condition	ct? /Disassembly Dan escribe: /e conditions exis Degree	nage? st, record applica Maximum	able dimensions t Circumferentia	 Delow:	Yes Yes Yes	No No No No Distance
A. Erosion? B. Heat Affec C. Assembly/ D. Other? D If any of the abov Condition (A, B, C or D)	ct? Disassembly Dan escribe: re conditions exis Degree Location 	nage? st, record applica Maximum	able dimensions t Circumferentia	 Delow:	Yes Yes Yes	No No No No Distance

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Detailed Port Plug O-ring (Post-Removal) – Evaluation (Checkof			
Motor No.: QM - 8	Date:	3-1	<u>3-89</u>	······································
Joint: 🛛 S&A to Adapter (S&A) 🗌 Adapter to Case (IGN)	Ada	pter to	Chamber	(IGI)
Plug: 🛛 Leak Check(LEAK) Degree 126				
Inspector(s): Scott Eden, Rocky Ash, GAR	24 1	JEL	SON	
PRIMARY O-RING				Comment
Part No.: Lot No.:				Number
A. Erosion (PORE)?	Ye	s _	No	
B. Heat Affect (HAPOR)?	Ye	s	No	
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?	Ye	s	No	
If any of the above conditions exist, record below:				
SECONDARY O-RING (or Shoulder)				<u></u>
Part No.: 1050228-25 Lot No.: ECLOOI3			/	Commen Number
A. Erosion (SORE)?	Ye	s	NO	
B. Heat Affect (HASOR)?	Xe	_	No	
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Ye		No	\overline{I}
If any of the above conditions exist, record below:				L
1. O-ring had O.D. Circumferentic	al i	MP	ressid) N
U		•		
CLOSURE SCREW O-RING				Comment
Part No.: Lot No.:				Number
A. Erosion (CORE)?	Ye	s	No	
B. Heat Affect (HACOR)?	Ye	S	No	
C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?	Ye		No	
If any of the above conditions exist, record below:				
			•	

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Detailed Port Plug O-ring (Post-Removal) – Evaluation	Checkoff	Worksheet	~~~~	
	Date:	3-13-	89	
Motor No.: QM - 8 Motor No.: QM - 8 M S&A to Adapter (S&A) Adapter to Case (IGN)	🗌 Adap	ter to Chan	nber	(IGI)
Joint: Abar to heart (, , , , , , , , , , , , , , , , , ,				
Plug: A Leak Oncon La (A O)	/ NEI	SON		
				Comment
PRIMARY O-RING				Number
	Yes		No	
A. Erosion (PORE)?	Yes		No	
B. Heat Affect (HAPOR)? C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?	Yes		No	
If any of the above conditions exist, record below:				
If any of the above conditions exist, recent				
E Source (or Shoulder)				Comment
SECONDARY O-RING (or Shoulder) Part No.: 10.50.228-25 Lot No.:				Number
	Ye	s	No	
	Ye	s	No	<u> </u>
SCUT, SDMG, SDIS)?	Ye	s	No	<u> </u>
C. Cuts, Assembly/Disassembly Damags (Coort, Comparing) If any of the above conditions exist, record below:				
If any of the above conditions called to the form				
1. See o-ring observation form.				
0				
				Commen
CLOSURE SCREW O-RING				Number
Part No.: Lot No.:	- Y	es	No	
A. Erosion (CORE)?	Y	es	No	
B. Heat Affect (HACOR)?		es	No	
C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?	·		-	
If any of the above conditions exist, record below:				

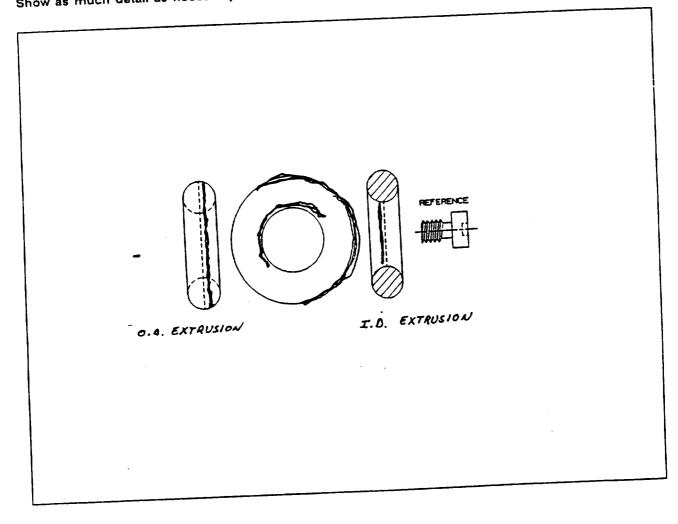
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O-RING OBSERVATION	CLARIFICATION	FORM
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Date 3-13-89 Inspector(s) Scott Eden, Rocky Ash, GARY Nelson
Part Number: 10.50228-25
Serial or Lot Number: Description: <u>See below</u> .
Note: Very, light Coat of Was installed
Positioned on thread side

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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Detailed Port Plug O-ring (Post-Removal) - Evaluation	Checkoff Worksheet	
Motor No.: QM - 8	Date: 3-13-89	
Adapter to Case (IGN)	Adapter to Chamber	(IGI)
Solitic STIC of 18	° and 198°	
Plug: LA Leak Check(LLPhi)	ARY NELSON	
inspector(c) SCOTT ENER , NOLLAY		Comment
PRIMARY O-RING Part No.: 1050228-18 Lot No.:	,	Number
	Yes/_No	
	Yes Vo	
POINT PDMG PDIS)?	Yes Vo	
C. Cuts, Assembly/Disassembly Damage (FCOT, Fornd, Ford).		
If any of the above conditions exist, received and	th STI PIL	ISS.
NOTE: This observation is for bo	TH 07- 11-	0-)
primary seals.		
SECONDARY O-RING (or Shoulder)		Comment
Part No.: 10.50 228-38 Lot No.:	,	Number
A. Erosion (SORE)?	Yes V No	
B. Heat Affect (HASOR)?	Yes V No	
C. Cuts, Assembly/Disassembly Damaga (SCUT, SDMG, SDIS)?	Yes Vo	
If any of the above conditions exist, record below:		
	r bath SII	-
NOTE: This observation is for	r Dotn JI.	L
June Jacob Souls		
plugs, secondary seals	•	
		Comment
CLOSURE SCREW O-RING		Number
	YesNo	
	-Yes No	
B. Heat Affect (HACOR)?C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?	Yes No	
If any of the above conditions exist, record below:		
		•
	•	· ·
· · · · · · · · · · · · · · · · · · ·		

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Case Joint Plug and Plug Hole – Evaluation Checkoff Worksheet						
Motor No.: QM-8	Date: 2-6-89					
Inspector(s): K. Bak						
	e-to-Case Joint (1171.5, CTR)					
	ee Location: _/35					
P/N: 1476425-03 Lot Number:	_ECL0001					
 Plug, plug hole observations: I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? II. Foreign Material (FMIJ)? III. HACOR HACOR HACOR)? 	Commen Number YesNo YesNo					
 III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? 	YesNo					
 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 Yes No					
If any of the above conditions exist, describe below:						

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	I CHeckon IV	UIKSIIOO	
Detailed Port Plug O-ring (Post-Removal) - Evaluation	Date: 6	FEB 87	
Plug: Vent Port(VENT) Leak Check(LEAK) Degree	135		
nspector(s): Scatt Eden, Rocky Ash, Garry K	lelson		
DIMARY O PING			Comment
Part No.: 11350228 - 44 Lot No.: ECL 0004	Yes	V NO	Number
A. Erosion (PORE)?		- No	
B. Heai Affect (HAPOR)?	Yes Yes	<u> </u>	1.
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?	100		
If any of the above conditions exist, record below:			
1. Extrusion Damage Expected	>)		
SEE ATTACHED CLARIFICATION SHEET			
SECONDARY O-RING (or Shoulder)			Comment Number
Part No.: 105022.8 - 15 Lot No.: 2020053	- Yes	No	
A. Erosion (SORE)?	Yes	No	
Heat Affect (HASOR)?	Yes	No	
Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?			
If any of the above conditions exist, record below:			
If any of the above conditions exist, record below:			
If any of the above conditions exist, record below:			
If any of the above conditions exist, record below:			
If any of the above conditions exist, record below:			
If any of the above conditions exist, record below:			
If any of the above conditions exist, record below:	ŗ		
If any of the above conditions exist, record below:	,		Commen
If any of the above conditions exist, record below:	1		Commer Number
If any of the above conditions exist, record below: CLOSURE SCREW O-RING Part No.: 1050228-25 Lot No.: ECLOCIS	Yes	No	
If any of the above conditions exist, record below: CLOSURE SCREW O-RING Part No.: <u>1050228 - 25</u> Lot No.: <u>ECLOCI5</u> A. Erosion (CORE)?	Yes Yes		
If any of the above conditions exist, record below: CLOSURE SCREW O-RING Part No.: <u>JUSO22& - 25</u> Lot No.: <u>ECLCC/5</u> A. Erosion (CORE)? R. Heat Affect (HACOR)?		L No	
If any of the above conditions exist, record below: CLOSURE SCREW O-RING Part No.: <u>IVSO22&-25</u> Lot No.: <u>ECLCC/5</u> A. Erosion (CORE)? B. Heat Affect (HACOR)? C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?	Yes Yes	No No	Number
If any of the above conditions exist, record below: CLOSURE SCREW O-RING Part No.: <u>USO22K-25</u> Lot No.: <u>ECLCC/5</u> A. Erosion (CORE)? B. Heat Affect (HACOR)? C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?	Yes Yes	No No	Number
If any of the above conditions exist, record below: CLOSURE SCREW O-RING Part No.: <u>IUSO22& - 25</u> Lot No.: <u>ECL cc:/5</u> 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: <i>D-RING WAS POSITION(C) DM</i>	Yes Yes	No No	Number
If any of the above conditions exist, record below: CLOSURE SCREW O-RING Part No.: <u>IUSO22& - 25</u> Lot No.: <u>ECLCC15</u> A. Erosion (CORE)? B. Heat Affect (HACOR)? C. Cuts. Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?	Yes Yes	No No	Number
If any of the above conditions exist, record below: CLOSURE SCREW O-RING Part No.: <u>105022&-25</u> Lot No.: <u>ECL cc:/5</u> 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 POSITION(ED DM	Yes Yes	No No	
If any of the above conditions exist, record below: CLOSURE SCREW O-RING Part No.: <u>IUSO22& - 25</u> Lot No.: <u>ECL cc:/5</u> 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: <i>D-RING WAS POSITION(C) DM</i>	Yes Yes	No No	Number

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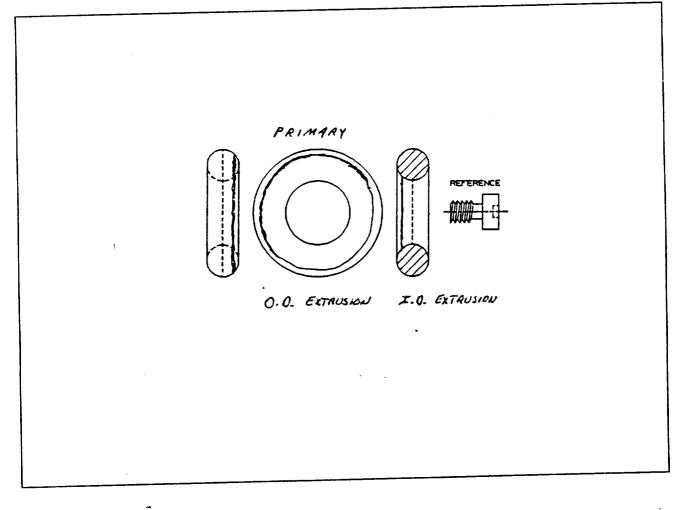
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Morton Thiokol Inc. Space Operations	
O-RING OBSERVATION CLARIFICATION FORM	
Date <u>6 FLB 87</u> Inspector(s) <u>Scott Eden</u> , <u>Rocky Ash</u> , <u>Gary Nelson</u> Motor No. <u>QM1-E</u> Joint (Or Plug and Degree): <u>1.3.5° FWD FIELD</u> O-Ring Location: <u>MPrimary</u> <u>Secondary</u> <u>Capture Feature</u> <u>Wiper</u> <u>Closure</u> Part Number: <u>1050728-44</u> Serial or Lot Number: <u>ECL broy</u> Description: <u></u> <u>Typical</u> <u>C.D.</u> <u>7 1.D- Extrusion</u> <u>Jamoge</u> <u>Acceptable</u>	

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Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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Case Joint Plug and Plug Hole - Evaluation C	Checkoff Worksheet
Motor No.: Qm-8	Date: 2-6-89
Inspector(s): K. Baker	
	r Fleid Joint (1171.5, CTR) e-to-Case Joint (1875.2, NOZ)
Plug: 🛛 Vent Port (VENT) 🗌 Leak Check (LEAK) Degre	ee Location: _/35
P/N: 1476425-03 Lot Number:	ECL 0004
Plug, plug hole observations:	Comment Number
I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?	YesNo
II. Foreign Material (FMIJ)?	YesNo
III. Heat Affected Plug (HAPOR, HASOR, HACOR)?	Yes No Yes No
IV. Rust on sealing surfaces (SSCOR)?	Yes No
V. Rust on metal parts (PITCO)?	Yes No
VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)?	Yes / No
/iii. Plug hole damage, deformed threads (DBHOL)?	YesNo

If any of the above conditions exist, describe below:

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Detailed Port Plug O-ring (Post-Removal) - Evaluation	Checkoff Worksheet	<u> </u>
Motor No.: QIM-8	Date: 6 FEB 87	
	35 "	
Inspector(s): Scott Eden, Rocky Ash, Gary He	lsou	
PRIMARY O-RING Part No.: <u>1150228-44</u> Lot No.: <u>ECL CCO9</u> A. Erosion (PORE)? B. Heai Affect (HAPOR)? C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)? If any of the above conditions exist, record below: 1. I.D. and O.D. Circumferential impression	Yes No Yes VNo Yes VNo	Comment Number
SECONDARY O-RING (or Shoulder) Part No.: <u>1050228-15</u> Lot No.: <u>ECL0053</u> A. Erosion (SORE)? Heat Affect (HASOR)? Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? If any of the above conditions exist, record below:	YesNo YesNo YesNo	Comment Number
CLOSURE SCREW O-RING Part No.: 1050778-25 Lot No.: ECL 000/5 A. Erosion (CORE)? - B. Heat Affect (HACOR)? - C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)? - If any of the above conditions exist, record below: -	Yes No Yes No Yes No	Comment Number

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Case Joint Plug and Plug Hole – Evaluation C	heckoff Worksheet
Motor No.: QM-8	Date: 2-6-89
Inspector(s): K. Baken	
Joint:	
	r Field Joint (1171.5, CTR)
	e-to-Case Joint (1875.2, NOZ)
Plug: Vent Port (VENT) Leak Check (LEAK) Degre	ee Location: <u>/35</u>
P/N: <u>1476425-03</u> Lot Number:	ECLODO1
Plug, plug hole observations:	Comment Number
I. Scot Past Seals (SPINS, SICOR, SOINT,	YesNo
SPINT, SIPOR, SPPOR SISOR, SPSOR)?	
II. Foreign Material (FMIJ)?	YesNo
III. Heat Affected Plug (HAPOR, HASOR, HACOR)?	Yes Vo Yes No Yes No Yes No Yes No Yes No Yes No Yes No
IV. Rust on sealing surfaces (SSCOR)?	YesNo YesNo
V. Rust on metal parts (PITCO)? VI. Damaged metal sealing surface (SSMET)?	
VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)?	Yes No d
/ill. Plug hole damage, deformed threads (DBHOL)?	YesNo
If any of the above conditions exist, describe below:	
1. Damage to 1476425-01 during	installation, looks
1. Damage to 1476425-01 during like installation tool slipped during torquing operations.	aut of grouve
during torquing operations.	
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Detailed Port Plug O-ring (Post-Removal) - Evaluation	Checkoff Worksheet	
Motor No.: Qull-8	Date: 6 FCB 89	
Joint: FWD CTR AFT NOZ	200	
	35°	
Inspector(s): Scott Eden, Rocky Ash, Gary N	elson	
PRIMARY O-RING Part No.: <u>(USO228-44</u> Lot No.: <u>ECL CCO4</u> 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 DamaGE SEE ATTACHED SHEET		Comment Number
SECONDARY O-RING (or Shoulder) Part No.: <u>1050228-15</u> Lot No.: <u>ECLOOY7</u> A. Erosion (SORE)? Heat Affect (HASOR)? Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? If any of the above conditions exist, record below:		Comment Number
CLOSURE SCREW O-RING Part No.: <u>1050228-25</u> Lot No.: <u>ECL 0015</u> A. Erosion (CORE)? B. Heat Affect (HACOR)? C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)? If any of the above conditions exist, record below: MOTE: O-RING WIS POSITIONED ON PLUG GROOVE,	Yes No Yes No Yes No SIDE DF D-RING	Commen Number

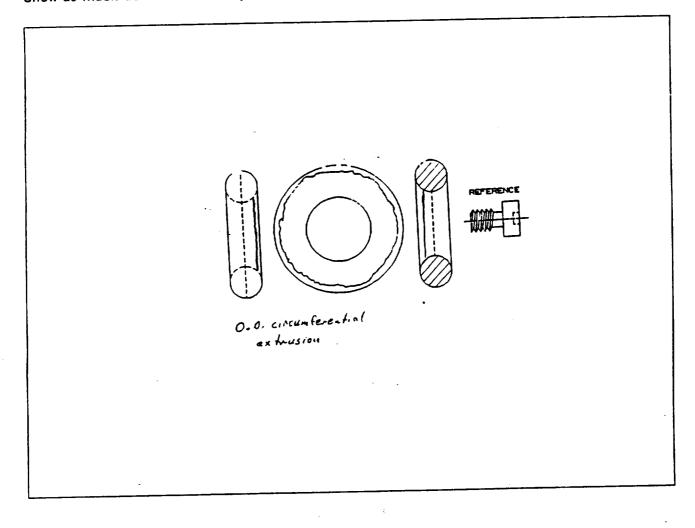
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O-RING OBSERVATION CLARIFICATION FORM

Date 6763 89	Inspector(s) Scott Eden, Rocky Ash, Gary M	elsor
Motor No. <u>Oru-8</u> Joint (Or Plug and Degree): O-Ring Location: Primar	135° <u>AFT FIEUD</u> Iny □ Secondary □ Capture Feature □ Wiper □ Closure - <u>44</u> L 0004	
Part Number: <u>1036228</u> - Serial or Lot Number: <u>ECC</u> Description:	$\frac{-44}{0004}$	
	Expected Extrusion Damage	

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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Case Joint Plug and Plug Hole – Evaluation Checkoff Worksheet				
Motor No.: QM-9	Date: 13 FLB 89			
Inspector(s): DAVID ROWSELL				
Joint:				
	er Field Joint (1171.5, CTR)			
Aft Field Joint (1491.5, AFT)	le-to-Case Joint (1875.2, NOZ)			
Plug: X Vent Port (VENT) Leak Check (LEAK) Deg	ree Location: <u>43. 2.°</u>			
P/N: <u>1076425-03</u> Lot Number:	<u>ECL 0001</u>			
Plug, plug hole observations:	Comment Number			
I. Soot Past Seals (SPINS, SICOR, SOINT,	YesNo			
SPINT, SIPOR, SPPOR SISOR, SPSOR)?				
II. Foreign Material (FMIJ)?	YesNo			
III. Heat Affected Plug (HAPOR, HASOR, HACOR)?	YesNo			
IV. Rust on sealing surfaces (SSCOR)?	YesNo			
V. Rust on metal parts (PITCO)?	YesNo			
VI. Damaged metal sealing surface (SSMET)?	Yes Yo			
VII. Damaged metal other than sealing surface (DAMML)?	Yes No			
/ill. Plug hole damage, deformed threads (DBHOL)?	YesNo			

Case Joint Plug and Plug Hole - Evaluation Checkoff Worksheet

If any of the above conditions exist, describe below:

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Detailed Port Plug O-ring (Post-Removal) - Evaluation	Checkoff Worksheet	
Motor No.: DIM-8	Date: 17 FEB 89	
Plug: 1 Vent Port(VENT) Leak Check(LEAK) Degree 4.5	3.2	
Inspector(s): Scott Eden Rocky Ash Gary	Klelson	
PRIMARY O-RING Part No.: IUSC728-44 Lot No.: ECL COO3 A. Erosion (PORE)? B. Heai Affect (HAPOR)? C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)? if any of the above conditions exist, record below:	Yes <u>No</u> Yes <u>No</u>	comment lumber
1. TYPICAL O.D. & I.D. URCUMFERENTIAL	EXTRUSION (EXPECT	(67
SECONDARY O-RING (or Shoulder)	C	Comment
Part No.: <u>1050228-15</u> Lot No.: <u>ECLOOS6</u> A. Erosion (SORE)? Heat Affect (HASOR)? Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? If any of the above conditions exist, record below: L. Nete. Radia/ FLOW MARK FOUND (MARK	YesNo YesNo YesNo	lumber
Radial Flow MARK NOT OPEN. SCE ATTACHED CLARIFICATION	CN SHEET	
CLOSURE SCREW O-RING Part No.: <u>1050728-25</u> Lot No.: <u>CCC014</u> A. Erosion (CORE)? B. Heat Affect (HACOR)? C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)? If any of the above conditions exist, record below:	•	Comment Number

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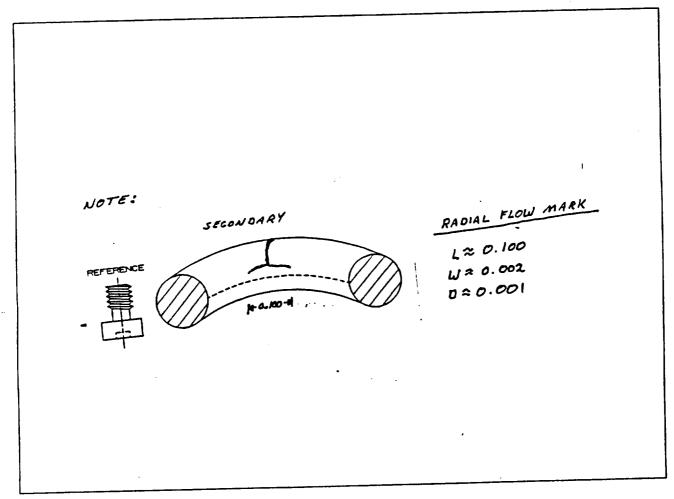
Morto					
Space	0	pe	rat	ioı	ns

O-RING OBSERVATION	CLARIFICATION FORM
--------------------	--------------------

Date 17FCB 8-9 Inspector(s) Scott Eden, Rocky Ash, Gany Nelson Motor No. 11-8
Motor No. <u>(1/11-20)</u> Joint (Qr Plug`and Degree): <u>43.2</u> <u>Noz2LE 70</u> CASE O-Ring Location: Primary Secondary Capture Feature Wiper Closure
O-Ring Location: Primary A Secondary Capture Feature Wiper Closure
Part Number: 1030778 -1-3
Serial or tot Number: ECC 0056
Description:
RADIAL FLOW MARK ON SCIENDARY O'RING,

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.

ANT VENT PORT PLUG



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Nozzie Joint Plug and Plug Hole – Evaluatio			<u> </u>
Inspector(s): KELLY BAKER, LOWCIL NEISER Motor No.: GMI-8		5 FEB 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 Inlet/Throat (3)	(2)
Degree Location: 262,3° P/N: 1050159-02	BIN:	ECLOCOL	•
0-ring: P/N: 1050228-25	L/N:	E.CL 0012	•
Plug, plug hole observations: I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)?		Yes No	
 II. Foreign Material (FMIJ)? III. Heat Affected Plug (HAPOR, HASOR, HACOR)? IV. Rust on sealing surfaces (SSCOR)? V. Rust on metal parts (PITCO)? 		_ Yes _ No _ Yes _ No _ Yes _ No _ Yes _ No	
VI. Damaged metal sealing surface (SSMET)? VII. Damaged metal other than sealing surface (DAMML)? VIII. Plug hole damage, deformed threads (DBHOL)?		Yes No Yes No Yes No	
If any of the above conditions exist, describe below:			
		:	
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		• • •	
	<u> </u>		

le Joint Plug and Plug Hole - Evaluation Checkoff Workshe

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Detailed Port Plug C	0-ring (Post-Removal) - Evaluatio	n Checkoff Worksheet	
Motor No.: W/1-8		Date: 612B 8	7
Joint: _ Throat/Fwd		wd End Ring/Nose Inl	at (2)
	ng/Aft End Ring (5)	Nose Inlet/Throat (3)	
	ne/Aft Exit Cone (1)		
ridgi ya	O(1)	Nelson	
Inspector(s): Scott Eden	, Racky Ash, Gary	NEISON	
PRIMARY O-RING			Comment Number
	Lot No.:	Yes	No
A. Erosion (PORE)?		Yes	No
B. Heat Affect (HAPOR)?			No No
C. Cuts, Assembly/Disassembly i	Damage (PCUT, PDMG, PDIS)?	Yes	
If any of the above conditions exist	st, record below:		
SECONDARY O-RING (or Shou	lder)		Comment
Part No.: 1050228-25	Lot No.: ECL OUIZ	-	Number
A. Erosion (SORE)?		Yes	No
B. Heat Affect (HASOR)?		Yes	No
	Damage (SCUT, SDMG, SDIS)?	VYes	No <u>/-</u>
If any of the above conditions exi			
1. I.D. CUT ON	O-RING (SDIS)		
1. 1.01	' (SDIS)		
SCE ATTACHED	CLARIFICATION SHO	ee T	
1			
CLOSURE SCREW O-RING			Comment
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 ex			
I if any of the above conditions ex			
·			

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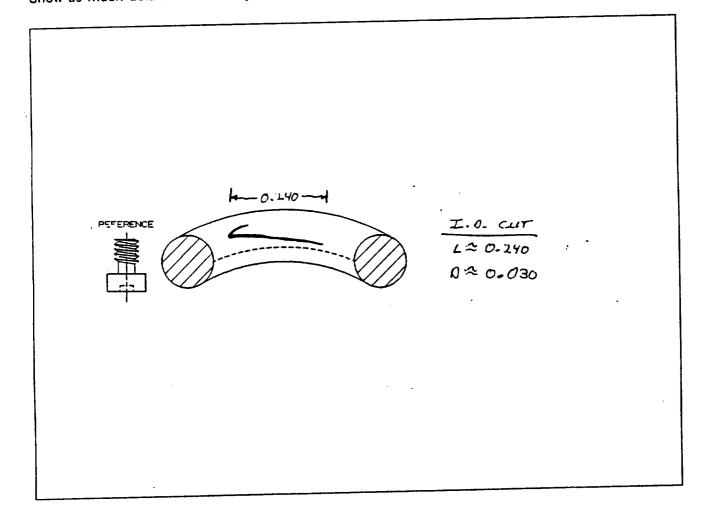
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SHARP

O-RING OBSERVATION CLARIFICATION FORM

Date 6FEB 89	Inspector(s)	Scott Eden	, Rocky Ash	Gary Melson
Motor No. Qui-8	767.30	+/1)		
O-Ring Location: Prima Part Number: 1050228-1	ry XSecond 25	lary 🔲 Capture F	eature 🛄 Wiper	Closure
Serial or Lot Number: Description:	0012			
) (SCE	BELOW)		
		Der in a MAD	DN THE THE LAST THRE	AD OF PLUG

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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		Nozzie Joint Plug and	i Plug Hole - Evaluatio	n Checkof	f Workshee	ot	
Motor No.: Date: $2 - /5 - 8^{\circ}$ Joint: Throat/Fwd Exit Cone (4) String Fwd End Ring/Nose Inlet (2) Fixed Housing/Aft End Ring (5) Nose Inlet/Throat (3) Degree Location: $262 \cdot 2^{\circ}$ P/N: $(L \leq p)/5^{\circ} - p2$ S/N: EcL cont O-ring: P/N: $(L \leq p)/5^{\circ} - p2$ S/N: EcL cont O-ring: P/N: $(U \leq p22^{\circ} - 2^{\circ})$ L/N: EcL cont Plug, plug hole observations: Image: Common Number No No 1. Soot Past Seals (SPINS, SICOR, SOINT, SPINT, SIPOR, SPOR SISOR, SPSOR)? Yes No No II. Foreign Material (FMLJ)? Yes No No No IV. Rust on sealing surfaces (SSCOR)? Yes No No No V. Rust on metal parts (PITCO)? Yes No No No VII. Damaged metal sealing surface (SMET)? Yes No No VIII. Damaged metal other than sealing surface (DAMML)? Yes No No VIII. Damaged metal other than sealing surface (DBHOL)? Yes No No	Inspector(s): kel	ly Baker L	owell Nelson				
Joint.		,,		Date: 2	- 15 - 8	7	
Degree Location: $2g_2 + 3$ PMR : $DD_2 + 3$ DRM O-ring: P/N : $[U 5p_2 28 - 25]$ L/N : $ECL 0006$ Plug, plug hole observations: No No No I. Soot Past Seals (SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? Yes No II. Foreign Material (FMIJ)? Yes No No III. Heat Affected Plug (HAPOR, HASOR, HACOR)? Yes No No IV. Rust on sealing surfaces (SSCOR)? Yes No No V. Rust on metal parts (PITCO)? Yes No No VI. Damaged metal sealing surface (SMET)? Yes No VII. Damaged metal sealing surface (DBHOL)? Yes No VIII. Plug hole damage, deformed threads (DBHOL)? Yes No If any of the above conditions exist, describe below: $Brantaraj$ Tor free $Brantaraj$ Tor free Mes $3G - 16J$	Joint:	Fixed Housing/Af	t End Ring (5)		-		2)
Plug, plug hole observations: Comm Number 1. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? Yes No II. Foreign Material (FMIJ)? Yes No No III. Heat Affected Plug (HAPOR, HASOR, HACOR)? Yes No No IV. Rust on sealing surfaces (SSCOR)? Yes No No V. Rust on metal parts (PITCO)? Yes No No VI. Damaged metal sealing surface (SSMET)? Yes No No VII. Damaged metal other than sealing surface (DAMML)? Yes No No VIII. Plug hole damage, deformed threads (DBHOL)? Yes No No If any of the above conditions exist, describe below: Brankang Jacompton 23 Gain - 163	Degree Location:	262.25 P/N	: 1450159-02	S/N:	ECL 000	>1	
Plug, plug nole observations: Number I. Soot Past Seals (SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? Yes No II. Foreign Material (FMIJ)? Yes No No III. Heat Affected Plug (HAPOR, HASOR, HACOR)? Yes No No IV. Rust on sealing surfaces (SSCOR)? Yes No No V. Rust on metal parts (PITCO)? Yes No No VII. Damaged metal sealing surface (SSMET)? Yes No No VIII. Damaged metal other than sealing surface (DAMML)? Yes No No VIII. Damaged metal other than sealing surface (DBHOL)? Yes No No VIII. Plug hole damage, deformed threads (DBHOL)? Yes No No If any of the above conditions exist, describe below: Breatarey Tor yee 36 in - 163	O-ring:	P/N: <u>{</u> //	150228-25	L/N:	ECL 00	06	
I. Soot Past Seals(SPINS, SICOR, SOINT, SPINT, SIPOR, SPPOR SISOR, SPSOR)? Yes No 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 VI. 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 If any of the above conditions exist, describe below: Brankang Jor Jue Jer Jue	Plug, plug hole of	servations:					Comment Number
If any of the above conditions exist, describe below: Breakang for que was 36 in - 163							
If any of the above conditions exist, describe below: Breakang for que was 36 in - 163	III. Heat Affected	Plug (HAPOR, HASC			Yes	No No	
If any of the above conditions exist, describe below: Breakang for que was 36 in - 163	V. Rust on meta	i parts (PITCO)?			Yes _	No	
Brankang torque was 36 in-163	VII. Damaged me	tal other than sealing	surface (DAMML)?				
	If any of the abov	e conditions exist, de	scribe below:				
	Breakaway t	orque was	36 in - 163				
		-					
			· .				
			······				

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Detailed Port Plug	g O-ring (Po	st-Removal)	- Evaluation (Checkoff Work	sheet	
Motor No .: QUU-8				Date: 17 F	<u>EB 89</u>	
	vd Exit Cone	(4)		End Ring/No		
	using/Aft End	f Ring (5)	🗌 Nos	e inlet/Throat	(3)	
🗌 Fwd Exit	Cone/Aft Exit	t Cone (1)				
	Degree	265.30				
Plug: Leak Check(LEAK) Inspector(s): Scott Colen	Racky		My Nelso	2-7		
and the second	+ <u>LOC-9</u>	7007 , Cre	1			Comment
PRIMARY O-RING Part No.:	Lot No.:		_			Number
A. Erosion (PORE)?				Yes	No	
				Yes _	No	
	v Damage (P	CUT. PDMG.	PDIS)?	Yes	No	
C. Cuts, Assembly/Disassembly If any of the above conditions of			· <u> </u>			
If any of the above conditions (
_						
SECONDARY O-RING (or Sh	oulder)	EALOCO	1.			Comment Number
Part No.: 1050228-25	_ Lot No.:	ECLOOO	\$? 	Yes	∕ No	NULLDEI
A. Erosion (SORE)?			_			
B. Heat Affect (HASOR)?				Yes _		
C. Cuts, Assembly/Disassemb			SUIS)7 _	Yes _	NO	
If any of the above conditions	exist _: record	below:		Side AF	DIV. 6	PONIC
If any of the above conditions NCTE! O-RING WAS	PRIFICH	ED ON	TAREAD	SIDE OF	1200 9	NUOLE.
1						
						Comment
CLOSURE SCREW O-RING						
	_ 1_01 NO	<u> </u>		Yes	No	
			-			
		CONT COMO				
If any of the above conditions	exist, record	Delow:				
1						
Part No.: A. Erosion (CORE)? B. Heat Affect (HACOR)?			 , CDIS)?	Yes Yes Yes	No No No	Number

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	Nozzle Joint	Plug and F	Plug Hole - Evaluatio	on Checkol	f Workshi	991 	
Inspector(s): K.	Baker.	L. Ne	elsen				
Motor No.: QM	1-8			Date: 2	-15-8	89	
Joint:		using/Aft E	ne (4) End Ring (5) Exit Cone (1)		End Ring/ Inlet/Thro	Nose Iniet (pat (3)	(2)
Degree Location:	265	P/N:	1450159-02	S/N:	ELL DO	<u>001</u>	
O-ring:	P/N:	145	0228-25	L/N:	ECL DI	x 1	
Plug, plug hole of	oservations:						Comment Number
I. Soot Past Sea SPINT, SIPOR					_ Yes	No	
II. Foreign Mater					_ Yes Yes	No No	
III. Heat Affected			, HACOH)?		Yes	No No	
V. Rust on meta					Yes	No No	
VI. Damaged me					_ Yes	No No	<u> </u>
VII. Damaged me VIII. Plug hole dar					_ Yes Yes	No	
If any of the abov							
Brinkowy							
			· .				
-							

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Detailed Port Plug O-ring (Post-Removal) - E	valuation Checkoff Worksheet	
Motor No.: GM-8	Date: 17 FCB 87	
Joint: Throat/Fwd Exit Cone (4)	Fwd End Ring/Nose Inlet (2)
Fixed Housing/Aft End Ring (5)	∰ Nose Inlet/Throat (3)	
Fwd Exit Cone/Aft Exit Cone (1)	-	
Plug: Deak Check(LEAK) Degree 265°		
	Nelson	
		Comment
PRIMARY O-RING		Number
	Yes No	
	Yes No	
B. Heat Affect (HAPOR)?C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PD		
If any of the above conditions exist, record below:		
SECONDARY O-RING (or Shoulder)		Comment
Part No.: 1050228-25 Lot No.: ECLOOI3	Yes No	Number
A. Erosion (SORE)?		
B. Heat Affect (HASOR)?	Yes No	<u> </u>
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SD	DIS)? <u> </u>	1.
If any of the above conditions exist, record below:		
1. I.D. CIRCUM FERENTIAL SC	$\mathcal{R}(\mathcal{H}) \subset \mathcal{H} \setminus \{SD, S\}$	
	$(\mathbf{O}\mathbf{P}(\mathbf{S}))$	
SEE ATTACHED CLARIFICATIO	N SHEET-	
	,	
OLOCUPE SOREW O PING		Comment
CLOSURE SCREW O-RING		Number
	 Yes No	
A. Erosion (CORE)?	Yes No	
B. Heat Affect (HACOR)?		
C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, Cl	DIS)? Yes No	<u> </u>
If any of the above conditions exist, record below:		
	·····	

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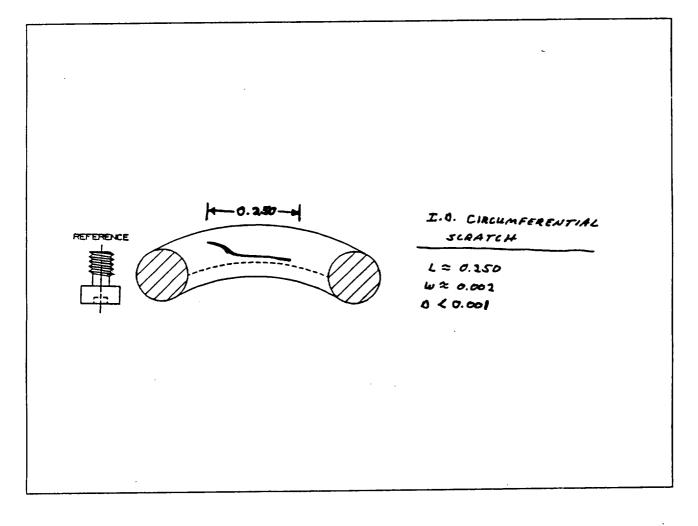
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O-RING OBSERVATION CLARIFICATION FORM

Date 17FCB 87	Inspector(s) <u>Scaff</u>	Eden, Rock	Ly Ash, Gruny,	Nelson
Motor No. Cont-8		<u></u>	·	
Joint (Or Plug and Degree): 265° JOINT #(3)		
O-Ring Location: Prim	iary 🖾 Secondary 🔲 Ca	iptureFeature 🔲	Wiper 🔲 Closure	
Part Number: 1050228	5-25-			
Serial or Lot Number: <u>FC</u>	10013			
Description:				
1. D.	CIRCULATER REACTIAL	SCRATCH	(SEE BELOW)	_

POSITIONED ON THREAD SIDE OF NOTC : C-RING 1145 PLUG GROOVE

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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	Nozzie Joint Plu	ug and P	Plug Hole - Evaluatio	n Checkof	f Worksh	1991 	
Inspector(s): K	Baken.	L. A	Jelsen			Muterana 1	
Motor No.: QW	1-8			Date: 2	-15-	89	
Joint:	Throat/Fwd	ing/Aft E	ind Ring (5)		End Ring Inlet/Thr	/Nose inlet (roat (3)	2)
Degree Location:	268.75	P/N:	1450159-02	S/N:	ECL O	002	
O-ring:	P/N:	145	0228-25	L/N:	ECL	0013	
Plug, plug hole ol	bservations: als(SPINS, SICC	R, SOIN	т.		_ Yes	No	Comment Number
SPINT, SIPOF II. Foreign Mate III. Heat Affected	R, SPPOR SISOF rial (FMIJ)? 1 Plug (HAPOR,	R, SPSOF HASOR,	?(?		_ Yes _ Yes Yes	No No No No	
V. Rust on meta VI. Damaged me VII. Damaged me		? ace (SSN ealing s	urface (DAMML)?		_ Yes _ Yes _ Yes _ Yes		
VIII. Plug hole day If any of the above				**************************************			
Break two j	torque	was	35 in-1p2				
			· .				

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Detailed Port Plug O-ring (Post-Removal) - Evaluat	ion Checkof	f Worl	ksheet	•
Motor No.: GHI-8	Date:	15 H	FEB 89	
Joint: X Throat/Fwd Exit Cone (4)	Fwd End R	-		
Fixed Housing/Aft End Ring (5)] Nose Inlet/	Throat	t (3)	
Fwd Exit Cone/Aft Exit Cone (1)				
Plug: A Leak Check(LEAK) Degree 268.75			······	
	y Nelse	20		
Inspector(s): Scatt Eden, Wayne Sperry , Gan	y NEISE			
PRIMARY O-RING				Commen Number
Part No.: Lot No.:	 Ye		No	NUMBER
A. Erosion (PORE)?		-		
B. Heat Affect (HAPOR)?	Ye	-	No	
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?	Ye	s -	No	
If any of the above conditions exist, record below:				
·				
· ·				
SECONDARY O-RING (or Shoulder)				Comme
	— Ye		∕∕ No	Number
A. Erosion (SORE)?		-		
B. Heat Affect (HASOR)?	Ye	•	No	
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)?	Ye	es .	No	<u> </u>
If any of the above conditions exist, record below:				
NOIC ORING WAS PESITIONED ON THREAD	SIDE O	r Pl	US GRO	OVE.
Marc: Examine Long Pestition CD End Think 15	5, 6 6,			
	ł			
	'			
CLOSURE SCREW O-RING				Comme
Part No.: Lot No.:				Number
	Y	95	No	
	Y		No	
B. Heat Affect (HACOR)?				
C. Cuts, Assembly/Disassembly Damage (CCUT, CDMG, CDIS)?	¥	35	No	
If any of the above conditions exist, record below:				
				•

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Space Operations

Table D-II Detailed Port Plug O-ring or Small O-ring (A-2) - Evaluation	Chackoff	Markahaat	
Inspector(s): SCOTT EDEN, ROCKY ASN	CHECKOII	TV UIKSIIUUL	
	ale: 14	June '8	•9
	facto		/
Plug: Vent Port Leak Check Transducer		ial Bolt Plug	
Special Bolt Degree		ECL0022	
PRIMARY O-RING N/A:			Comment
Part No.: Lot No.:	Yes	No	Number
B. Heat Affect (HAPOR)?	- '83 Yeş	No	
C. Cuts. Assembly/Disassembly Damage (PCUT, PDMG, PDIS)?	_ Yes	No	
If any of the above conditions exist, record below:		No	
SECONDARY O-RING (or Shoulder) N/A:			Comment
Part No.: 1050228-15 Lot No.: ECL0037		1	Number
A. Erosion (SORE)?	Yes	No	
 B. Heat Affect (HASOR)? C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? 	_ Yes	No	<u> </u>
C. Cuts. Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? \checkmark If any of the above conditions exist, record below:	_ Yes	No	
1) I.O. cincumferential cut			
120.690	- 0- 690	#	
0 2 0.030 REFERENCE		+	
		$ \rightarrow $	`
NOTE: 0-ring positioned on thread side		///	λ
Chisel gouge on plug head O.D.			1
Sharp lest thread		-	
CLOSURE SCREW O-RING N/A:		<u> </u>	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:			

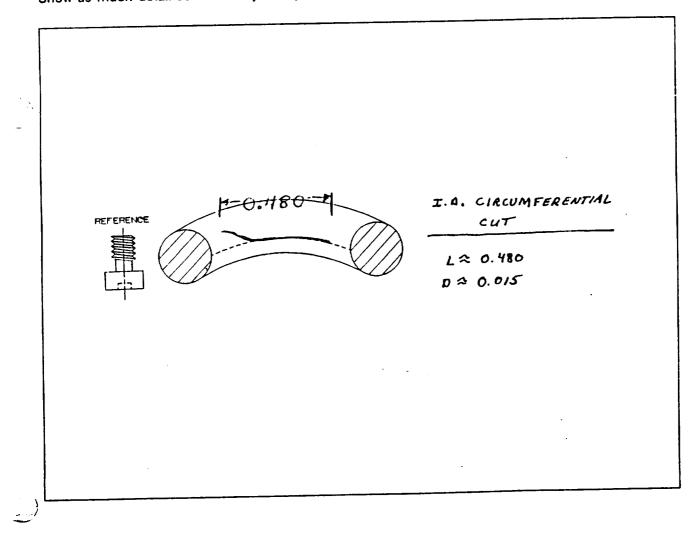
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O-RING OBSERVATION CLARIFICATION FORM

Inspector(s) Scott Eden, Rocky Ash Date 4-25-89 Motor No. OM Joint (Or Plug and Degree): O° FWD FACTORY JOHNT O-Ring Location: Primary Secondary Capture Feature Wiper Closure Part Number 105022-15 Serial or Lot Number: FCL003 Description: See below

thread Si Positioned 01 NOTE: 0.D ouge Plug <u>01</u>

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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Space Operations

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: Left (A) Right (B) Joint: Center - forward cy//cy/ seg facto	ry
Plug: Vent Port 🗹 Leak Check Transducer 🗌 Special Bolt Plug	/
Special Bolt Degree /U100269-01 ECL0022	_
	omment
	umber
A. Eroslon (PORE)? Yes No	
B. Heat Allect (HAPOR)?YesNo	
C. Cuts, Assembly/Disassembly Damage (PCUT, PDMG, PDIS)? Yes No	
If any of the above conditions exist, record below:	
SECONDARY O-RING (or Shoulder) N/A:	omment
	umber
A. Erosion (SORE)?	
B. Heat Affect (HASOR)?	
C. Cuts, Assembly/Disassembly Damage (SCUT, SDMG, SDIS)? 🖌 Yes No	
If any of the above conditions exist, record below:	
1) I.O. circumferential cut	
1) 2.0. circumterential cut	
L 2 0.810 REFERENCE	
D = 0.030	
NOTE: Sharp last thread Ding in last thread	
0-rity positioned on last thread ,	
<u>Chisel gauge on 0.0. of plug head</u> CLOSURE SCREW O-RING N/A:	
	omment umber
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:	

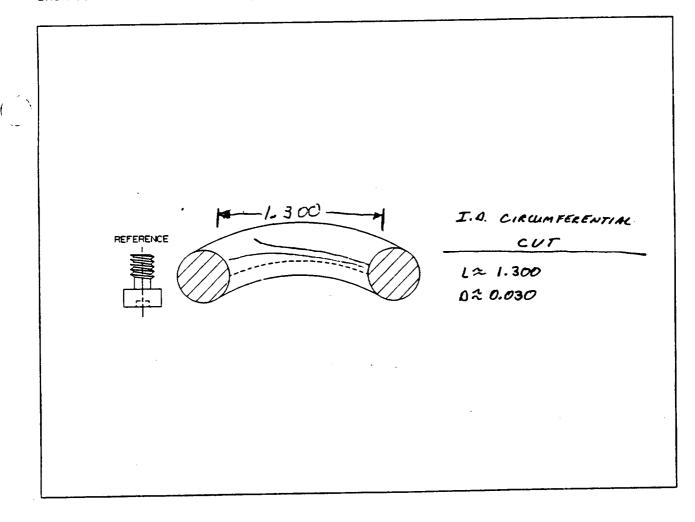
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O-RING OBSERVATION CLARIFICATION FORM

Date 4-20-89	Inspector(s) Scott Eden, R	Bocky Ash
Motor No. <u>QM</u> - Joint (Or Plug) and De	gree): <u>O°, CTR AFT</u> FACTORY JC Primary Secondary Capture Feature	
O-Ring Location:	Primary 🖾 Secondary 🗌 Capture Feature 📋	Wiper [] Closure
Serial or Lot Number:	<u>ECL0037</u>	
Description: <u>See</u>	below.	
Note: 0-	ring positioned on la	st thread, cut
<u> </u>	opened on last the	

IS OPE	yve a	ON	971		<u>race</u>	T	
 Plug	and	0-01	Na	had	<u>li++</u>	<u>le +</u> (N_0
 area	(P	Chise	000	NOR	ON	top_	0.D.
 - gria				Ů			
UOT_	PIU	•					

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.



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Morton Thiokol Inc.

Space Operations

O-RING OBSERVATION CLARIFICATION FORM

Part Number:	QM-8	Depth Scott Eden, Roy GARY Nelson Cgment factory jc dary □ Capture Feature □ Wip ion Ption	<i>,</i>
Description:			
	ETICTIE	(<u>B</u>)	
PART #	ET /STIF 10.50228-15	STIF/STIF 1050228-15	STIF/AFT DOME 1050228-15
L07. #	ECLOOY	ECLO041	F(L003)

Sketch observation below or attach worksheets and list below. Indicate orientation and dimensions. Show as much detail as necessary to explain the observation.

A: (See Below) Oring was positioned on last full thread still holding cut area B: (see Below) Rolled last partial thread. C: (see Below) Rolled last thread Polyculfide. underside (Very slip Note: All three plugs have chied youpe on plug head, all three O-rings were on Plug A had no apparent grease. Plugs Bic had very light, thread side. |-0.920 EFERENCE I.O. CIRCUMFERENTIAL CHT L x 0.720 0 2 0.040 Ø I.O. CIRCUMFERENTIAL CUT REFERENCE L = 0.490 0 = 0.020 I.D. CIRCUMFERENTIAL C47 REFERENCE 1~1.130 0 ~ 0.020

REV.

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