

CRITICAL ITEMS LIST (CIL)

No. 10-04-02-01/04

SYSTEM:	Space Shuttle RSRM 10	CRITICALITY CATEGORY:	1
SUBSYSTEM:	Lightning Protection, ESD, And Instrumentation 10-04	PART NAME:	Motor Chamber Operational Pressure Transducer (1)
FMEA ITEM NO.:	10-04-02-01 Rev M	PART NO.:	(See Table A-4)
CIL REV NO.:	L	PHASE(S):	Boost, Separation (BT, SP)
DATE:	31 Jul 2000	QUANTITY:	(See Table A-4)
SUPERSEDES PAGE:	510-1ff.	EFFECTIVITY:	(See Table 101-6)
DATED:	30 Jul 1999	HAZARD REF.:	BC-11, BI-01
CIL ANALYST:	D. F. Bartelt		
APPROVED BY:		DATE:	
RELIABILITY ENGINEERING:	<u>K. G. Sanofsky</u>		<u>31 Jul 2000</u>
ENGINEERING:	<u>J. W. Edwards</u>		<u>31 Jul 2000</u>

- 1.0 FAILURE CONDITIONS: Failure during operation (D)
- 2.0 FAILURE MODE: 9.0 Failure of the transducer pressure housing
- 3.0 FAILURE EFFECT: Structural failure would result in Forward Dome burnthrough or loss of capability to separate during the separation phase causing loss of RSRM, SRB, crew and vehicle

4.0 FAILURE CAUSES (FC):

FC NO.	DESCRIPTION	FAILURE CAUSE KEY
9.1	Structural failure of the pressure housing due to shipping, handling, or propagation of flaws	A
9.2	Nonconforming welds for the primary-to-secondary chamber and the flange nut-to-OPT body	B
9.3	Degradation of material due to corrosion, hydrogen embrittlement, stress corrosion cracking, galvanic corrosion, or fatigue	C

5.0 REDUNDANCY SCREENS:

SCREEN A: N/A
SCREEN B: N/A
SCREEN C: N/A

6.0 ITEM DESCRIPTION:

1. Motor Chamber Operational Pressure Transducer (Figures 1, 2, and 3). Materials are listed in Table 1.

TABLE 1. MATERIALS

Drawing No.	Name	Material	Specification	Quantity
1U50188	Transducer, Motional Pickup Pressure	17-4PH CRES		3 ea/Motor

CRITICAL ITEMS LIST (CIL)

No. 10-04-02-01/04

DATE: 31 Jul 2000
SUPERSEDES PAGE: 510-1ff.
DATED: 30 Jul 1999

6.1 CHARACTERISTICS:

1. The Motor Chamber Operational Pressure Transducer provides structural integrity of the RSRM pressure vessel. Pressure Transducer: 0-1000 psia, 1.375 diameter maximum times 3.20 length maximum, 3 required per RSRM, located on Forward Dome at 40, 180, and 270 degrees, attached with special bolt.

7.0 FAILURE HISTORY/RELATED EXPERIENCE:

1. Current data on test failures, flight failures, unexplained failures, and other failures during RSRM ground processing activity can be found in the PRACA database.

8.0 OPERATIONAL USE: N/A

CRITICAL ITEMS LIST (CIL)

No. 10-04-02-01/04

DATE: 31 Jul 2000
SUPERSEDES PAGE: 510-1ff.
DATED: 30 Jul 1999

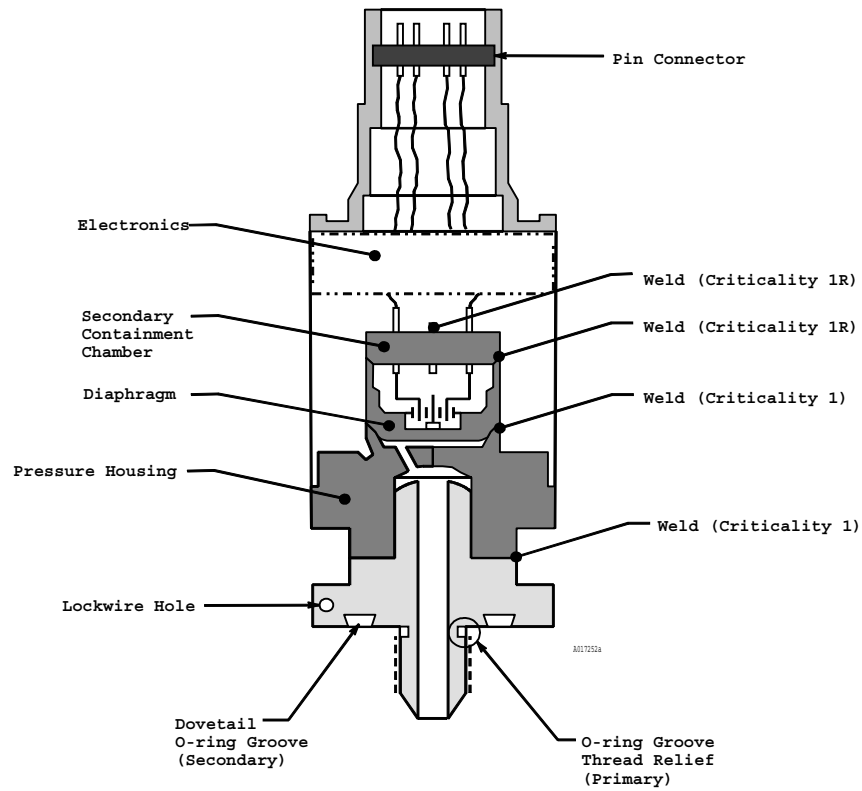


Figure 1. Pressure Transducer Section

CRITICAL ITEMS LIST (CIL)

No. 10-04-02-01/04

DATE: 31 Jul 2000
SUPERSEDES PAGE: 510-1ff.
DATED: 30 Jul 1999

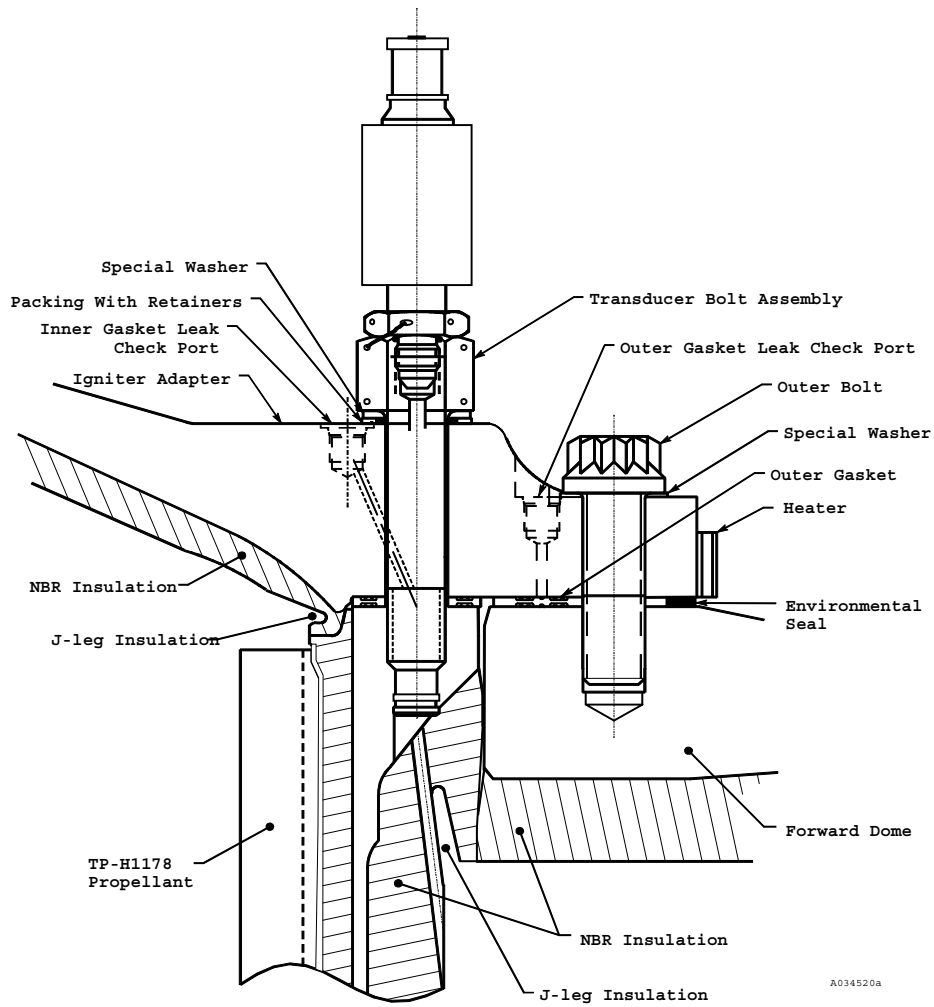


Figure 2. Installed Pressure Transducer and Special Bolt

CRITICAL ITEMS LIST (CIL)

No. 10-04-02-01/04

DATE: 31 Jul 2000
SUPERSEDES PAGE: 510-1ff.
DATED: 30 Jul 1999

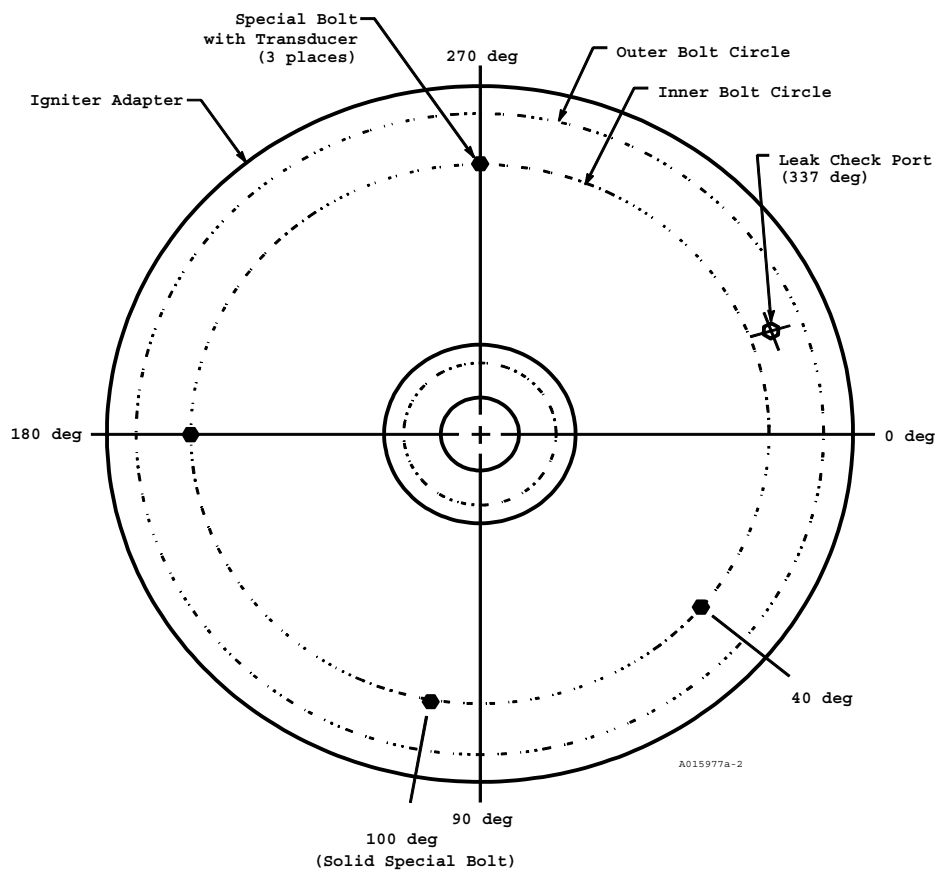


Figure 3. Special Bolt and Leak Check Port Location

CRITICAL ITEMS LIST (CIL)

No. 10-04-02-01/04

DATE: 31 Jul 2000
SUPERSEDES PAGE: 510-1ff.
DATED: 30 Jul 1999

9.0 RATIONALE FOR RETENTION:

9.1 DESIGN:

DCN FAILURE CAUSES

- | | |
|-------|---|
| A,B | 1. Design requirements for the pressure housing are per engineering as follows: <ul style="list-style-type: none"> a. The housing was designed to withstand 200 percent of rated pressure without permanent deformation or physical damage. b. Material: The housing is constructed of heat treated stainless steel. The material is tested for the following: <ul style="list-style-type: none"> 1) Yield strength 2) Tensile strength 3) Fracture toughness 4) Rupture strength 5) Corrosion resistance to oxidizing chemicals and salt water c. The shipping container for the transducer bolt assembly is per engineering. d. After welding, the joints are heat treated. |
| A,B | 2. Qualification testing was performed per engineering as follows: <ul style="list-style-type: none"> a. Transducers, identical to production units (except without diaphragms), were demonstrated to withstand 200 percent of rated pressure for a minimum of 10 seconds without permanent deformation or physical damage. b. These tests demonstrated a safety reliability of 99.8 percent with at least 95 percent confidence (1550 tests on each of five OPTs). |
| A,B | 3. An operational pressure transducer was demonstrated to be capable of sustaining a pressure of 5,000 psi without leakage (both with and without diaphragm intact) per TWR-17795. |
| A,B,C | 4. Transducer certification is per TWR-10405. This report shows similarity to the original Qualification Test Report by Bell & Howell per QTR-10210-21C. |
| A,C | 5. Each New Transducer, Motional Pickup Pressure, is subjected to Radiographic and Dye Penetrant inspection per engineering. |
| A,C | 6. Each Transducer, Motional Pickup Pressure, proposed for reuse is subjected to a Dye penetrant inspection per engineering. |
| B | 7. Electron beam welds and Resistance welds comply with engineering. |
| C | 8. Material for the transducer pressure housing is stainless steel per engineering. |
| C | 9. Use of dissimilar metals is per mil specifications. |
| C | 10. Qualification testing was performed per engineering. Testing associated with degradation of materials included the following: <ul style="list-style-type: none"> a. Storage life. b. Humidity. |
| C | 11. Assurance that the transducer is resistant to hydrogen embrittlement is established |

CRITICAL ITEMS LIST (CIL)

No. 10-04-02-01/04

DATE: 31 Jul 2000
SUPERSEDES PAGE: 510-1ff.
DATED: 30 Jul 1999

by proper heat treatment per engineering.

C

12. Flaw growth analysis per TWR-61739 shows that the design and materials selected have high resistance to stress corrosion cracking and flaw growth.

CRITICAL ITEMS LIST (CIL)

No. 10-04-02-01/04

DATE: 31 Jul 2000
SUPERSEDES PAGE: 510-1ff.
DATED: 30 Jul 1999

9.2 TEST AND INSPECTION:

FAILURE CAUSES and			
<u>DCN</u>	<u>TESTS</u>	<u>(T)</u>	<u>CIL CODES</u>
	1.	For New Transducer, Motional Pickup, Pressure, verify:	
B	(T)	a. Helium leak test	AIK000
A,C	(T)	b. Dye penetrant inspection is acceptable	MKL010
A,C	(T)	c. Radiographic inspection is acceptable	MKL011
A,B		d. Certificate of Conformance is complete and acceptable	AAP024
A,B		e. No shipping or handling damage to the container or transducer	AAP039
A,C	(T)	f. Results of eddy-current are acceptable	RAA051
B		g. Records for welds per approved vendor specifications	AAP111
C		h. OPT pressure housing, diaphragm and fitting end (port) are 17-4PHstainless steel or equivalent material	AAP187
A,B	(T)	i. Each transducer is subject to 150 percent of rated pressure	AAP209
	2.	For Refurbished Transducer, Motional Pickup, Pressure, verify:	
A,B,C	(T)	a. Each transducer is subject to 150 percent of rated pressure	AAP005
C		b. All exterior surfaces of transducer cleaned	AAP013
A,C		c. Defect repairs are acceptable	MKL014
A,C	(T)	d. Dye penetrant inspection is acceptable	MKL015
A,B,C		e. No shipping or handling damage	AAP042
A,C	(T)	f. Results of eddy-current are acceptable	RAA052
A,B		g. Transducer in protective container	AAP266
	3.	KSC verifies:	
A,C		a. Installed transducers are free from damage and contamination per OMRSD File V, Vol I, B47TD0.030	OMD115