

**SSME FMEA/CIL
REDUNDANCY SCREEN**

Component Group: Fuel Turbopumps
 CIL Item: B200-21
 Component: High Pressure Fuel Turbopump
 Part Number: RS007501
 Failure Mode: Excessive hot-gas leakage into coolant circuit.

Prepared: D. Early
 Approved: T. Nguyen
 Approval Date: 4/21/99
 Change #: 2
 Directive #: CCBD ME3-01-5206
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Phase	Failure / Effect Description	Criticality Hazard Reference
S 4.1	Rise in coolant liner pressure. Excessive rise in coolant liner pressure would result in a premature engine shutdown. Mission scrub if detected by redline. Loss of vehicle due to HPFTP failure may result if not detected. Redundancy Screens: TURBOPUMP SYSTEM - SENSOR SYSTEM: UNLIKE REDUNDANCY. A: Pass - Redundant hardware items are capable of checkout during normal ground turnaround. B: Pass - Loss of a redundant hardware items is detectable during flight. C: Pass - Loss of redundant hardware items could not result from a single credible event.	1R ME-D1S,M
M 4.1	Rise in coolant liner pressure. Excessive rise in coolant liner pressure would result in a premature engine shutdown. Mission abort if detected by redline. Loss of vehicle due to HPFTP failure may result if not detected. Redundancy Screens: TURBOPUMP SYSTEM - SENSOR SYSTEM: UNLIKE REDUNDANCY. A: Pass - Redundant hardware items are capable of checkout during normal ground turnaround B: Pass - Loss of a redundant hardware items is detectable during flight. C: Pass - Loss of redundant hardware items could not result from a single credible event.	1R ME-D1S,M

SSME FMEA/CIL
DESIGN

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FAILURE CAUSE: A: Hot-gas leakage past O.D. of lift-off seal.

THE LIFT-OFF SEAL HOUSING (1) IS MANUFACTURED UTILIZING AN A-286 CRES FORGING (2). THIS MATERIAL WAS SELECTED FOR ITS COMPRESSIVE STRENGTH, RESISTANCE TO HIGH-PRESSURE HYDROGEN DEGRADATION, AND MECHANICAL PROPERTIES AT CRYOGENIC TEMPERATURES. THE MATERIAL IS SOLUTION TREATED AND AGE-HARDENED. THE SECOND-STAGE HUB LABYRINTH SEAL (3) IS MANUFACTURED UTILIZING AN INCONEL 718 FORGING (2). THIS MATERIAL WAS SELECTED FOR ITS CRYOGENIC DUCTILITY, STRENGTH, RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING, AND INSENSITIVITY TO HYDROGEN ENVIRONMENT EMBRITTLEMENT AT OPERATING TEMPERATURES (2). THE MATERIAL IS SOLUTION TREATED AND AGE-HARDENED. A SCALLOPED CHANNEL MACHINED ON THE HUB LABYRINTH SEAL FLANGE FORMS A COOLANT ANNULUS, WHEN INTERFACED WITH THE LIFT-OFF SEAL. COOLANT ENTERS THIS MANIFOLD VIA 4 HOLES DOWNSTREAM OF THE FIRST LABYRINTH STEP AT THE SEAL HUB. THE COOLANT DISCHARGES FROM THIS MANIFOLD VIA 12 HOLES IN THE LIFT-OFF SEAL FLANGE AND ENTERS THE COOLANT LINER BY 12 HOLES IN THE MAIN HOUSING (4). A PRESSURE-ASSISTED STATIC (5) IS PILOTTED IN A GROOVE ON THE TURBINE HUB LABYRINTH SEAL AT THE LIFT-OFF SEAL INTERFACE. THIS SEAL PRECLUDES DIRECT LEAKAGE OF THE HIGH-PRESSURE HYDROGEN UPSTREAM OF THE LABYRINTHS INTO THE COOLANT MANIFOLD. THE SEAL IS MANUFACTURED UTILIZING INCONEL 718 WHICH PROVIDES THE REQUIRED STRENGTH AND DUCTILITY IN THE CRYOGENIC ENVIRONMENT (2). THE SEAL IS GOLD-PLATED TO PROTECT THE BASE MATERIAL FROM HYDROGEN ENVIRONMENT EMBRITTLEMENT AND ALSO IMPROVES THE SEALING CAPABILITY. THE LIFT-OFF SEAL STACK IS ATTACHED TO THE HOUSING UTILIZING 12 A-286 CRES STRETCH BOLTS (6) AND 321 CRES CUPWASHERS (7). A-286 WAS SELECTED FOR ITS RESISTANCE TO HIGH-PRESSURE HYDROGEN DEGRADATION, ITS MECHANICAL PROPERTIES AT CRYOGENIC TEMPERATURES, AND ITS RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING (2). THE MATERIAL IS SOLUTION TREATED AND AGE-HARDENED. 321 CRES WAS SELECTED FOR ITS DUCTILITY AND RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING, AND INSENSITIVITY TO HYDROGEN ENVIRONMENT EMBRITTLEMENT (2). THE MATERIAL IS ANNEALED TO IMPROVE MECHANICAL PROPERTIES, AND THE CUPWASHERS ARE YIELDED PRIOR TO ASSEMBLY TO INCREASE THEIR COMPRESSIVE STRENGTH. STRETCH BOLTS ARE UTILIZED TO ASSURE THE REQUIRED CLAMPING LOAD IS ACHIEVED. THE CUPWASHERS ARE STAKED AT ASSEMBLY TO PREVENT BOLT ROTATION. ASSEMBLY PROCEDURES FOR LOCKING DEVICES ENSURE DEFECT-FREE INSTALLATION (8). THE METAL-TO-METAL CONTACT BETWEEN THE SEAL FLANGES PROVIDES THE SEAL BETWEEN THE EXTERNAL HOT-GAS ENVIRONMENT AT THE OUTSIDE DIAMETER AND THE HYDROGEN COOLANT. THE FLANGES SURFACE FINISH AND FLATNESS REQUIREMENTS ARE TIGHTLY CONTROLLED TO PRECLUDE LEAKAGE. THE HIGH AND LOW CYCLE FATIGUE LIFE OF LIFT-OFF SEAL, HUB LABYRINTH SEAL, STATIC SEAL, BOLTS AND CUPWASHERS MEET CEI REQUIREMENTS (9). THE MINIMUM FACTORS OF SAFETY FOR THESE PARTS MEETS CEI REQUIREMENTS (10). THE LIFT-OFF SEAL ASSEMBLY PARENT MATERIALS WERE CLEARED FOR FRACTURE MECHANICS/IDE FLAW GROWTH SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (11). THE BOLTS, CUPWASHERS, AND STATIC SEAL ARE NON-SERIALIZED PARTS AND ARE NOT TIME HISTORY TRACKED BUT HAVE INFINITE ALLOWABLE LIFE (9). THE CONTROLLER SOFTWARE IS CONFIGURED TO DETECT AND RESPOND PROPERLY TO THE FAILURES IDENTIFIED AND COMMAND A SAFE ENGINE STATE (13). REUSE OF PARTS DURING OVERHAUL IS CONTROLLED BY THE REQUIREMENTS OF THE OVERHAUL SPECIFICATION (14).

(1) RD019230; (2) RSS-8580-10; (3) RS007553; (4) RS007577 RS007568; (5) RE1621; (6) RS007595; (7) RS007523; (8) RL00351; (9) RL00532, CP32DR0003B; (10) RSS-8546-16, CP32DR0003B; (11) NASA TASK 117; (12) RL00528; (13) CP405R0002 PT 1 3.2.3.5.3; (14) RL00528

Component Group: F1al Turbopumps
CIL Item: B200-21
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Design / Document Reference

FAILURE CAUSE: B: Hot-gas ingestion through cracks in the turbine inner ring.

THE TURBINE SECTION OF THE TURBOPUMP MAIN HOUSING (1) IS A WELMENT OF AN ALLOY 718 FORGING (2) AND A HAYNES 188 FORGING MACHINED TO FINISH DIMENSIONS AFTER WELDING. ALLOY 718 AND HAYNES 188 WERE SELECTED FOR THEIR STRENGTH, RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING, AND CRYOGENIC DUCTILITY. ALLOY 718 HOUSING SURFACES AND WELDS EXPOSED TO HIGH-PRESSURE HYDROGEN GAS USE COPPER PLATING AND INCOLOY 88 WELD OVERLAY TO PROVIDE HYDROGEN ENVIRONMENT (HEE) PROTECTION. THE WELDED ASSEMBLY IS SOLUTION ANNEALED AND AGED TO OBTAIN REQUIRED ALLOY 718 MATERIAL PROPERTIES. THE TURBINE SECTION CONSISTS OF THE TURBINE OUTER RING AND THE INNER RING. THE INNER RING IS INTEGRAL TO THE OUTER RING THROUGH 12 STRUTS. THE INNER RING FUNCTION IS TO SUPPORT THE AXIAL AND TORQUE LOADS FROM THE STATIONARY COMPONENTS OF THE TURBINE END OF THE TURBOPUMP, PROVIDE ASSEMBLY PILOTING AND POSITION CONTROL, AND PROVIDE A ROUTE FOR COOLANT FLOW. THE HOUSING AND INNER RING ARE COOLED BY HYDROGEN FLOW FROM THE COOLANT LINER. THE COOLANT LINER PRESSURE IS MEASURED EACH TEST/FLIGHT. THE INNER RING EXPERIENCES THERMALLY INDUCED HYDROGEN ASSISTED LCF CRACKING. INNER RING CRACKING COULD CAUSE HOT GAS INGESTION INTO THE COOLANT CIRCUIT. THE COOLANT LINER PRESSURE MEASUREMENT WOULD SHUT DOWN THE ENGINE. TURBINE INNER RING CRACKS ARE MAPPED AND EVALUATED AT EACH TURBOPUMP OVERHAUL (3). THE CRACK INSPECTION INTERVALS AND CRITERIA ARE CONTROLLED BY MAJOR WAIVER (4) AND SPECIFICATION (3). IN-FIELD THE INSIDE DIAMETER OF THE TURBINE INNER RING BOLT HOLES ARE MAPPED AND EVALUATED AT INTERVALS CONTROLLED BY THE CONDITION SEEN AS PREVIOUS OVERHAUL OR IN-FIELD INSPECTION. THESE INTERVALS AND CRITERIA HAVE BEEN DEVELOPED BASED ON EXTENSIVE HOT FIRE EXPERIENCE TO ASSURE THAT INNER RING CRACKING WILL NOT AFFECT THE FUNCTION OF THE TURBOPUMP. CONTINUED USE WITH ALLOWABLE DISCREPANCIES RESULTING FROM OPERATION IS EVALUATED AND CONTROLLED PER THE REQUIREMENTS OF THE MAINTENANCE CONTROL DOCUMENT. THE CONTROLLER SOFTWARE IS CONFIGURED TO DETECT AND RESPOND PROPERLY TO THE FAILURE IDENTIFIED AND COMMAND A SAFE ENGINE STATE.

(1) RS007577, RS007566; (2) RSS-8580-10; (3) RL00528; (4) DAR 1199, DAR 2906

**SSME FMEA/CIL
INSPECTION AND TEST**

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	LIFT OFF SEAL	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RD019230
	SEAL		RD261-3015
	BOLT		RS007595
	CUPWASHER		RS007523
	HOUSING		RS007577
	LABYRINTH SEAL		RS007553
	MATERIAL INTEGRITY		RD019230
			RD261-3015
			RS007595
			RS007523
			RS007559
			RS007553
			BOLT AND CUPWASHER ARE PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.
HEAT TREAT	BOLT HEAT TREAT IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RB0160-014	
ASSEMBLY INTEGRITY	THE LABYRINTH AND LIFT-OFF SEAL FLANGES SURFACE FINISH AND FLATNESS ARE INSPECTED PER DRAWING REQUIREMENTS	RD019230	
	THE BOLT STRETCH IS VERIFIED PER ASSEMBLY DRAWING REQUIREMENTS.	RS007501	
	BOLT DRY FILM LUBRICATION IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RA0112-003	
	THE CUPWASHER DEFORMATION IS VERIFIED PER DRAWING REQUIREMENTS.	RS007501	
	THE CUPWASHER IS LOAD TESTED PER DRAWING REQUIREMENTS.	RS007523	
	THE LIFT-OFF SEAL STACK IS VERIFIED AS BOTTOMED PER SPECIFICATION REQUIREMENTS.	RL00351	
HPFTP		RS007501	
CLEANLINESS OF COMPONENTS	COMPONENTS ARE VERIFIED CLEANED PER SPECIFICATION REQUIREMENTS.	RL10001	
ASSEMBLY INTEGRITY	OPERATION/PERFORMANCE IS VERIFIED BY ENGINE HOT-FIRE TESTING AND 2ND E & M TESTS ON INSPECTIONS.	RL00050-04 RL00056-06 RL00056-07 RL00481	
	THE PUMP SUBASSEMBLIES ARE INSPECTED DURING OVERHAUL PER SPECIFICATION REQUIREMENTS. INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, AND REPLACEMENT OF USAGE ITEMS AS APPLICABLE. PER OVERHAUL CLASSIFICATION	RL00528 RA0115-116	
	DATA FROM PREVIOUS FLIGHT OR HOT-FIRE IS REVIEWED FOR PROPER TURBOPUMP OPERATION/PERFORMANCE. (LAST TEST)	MSFC PLN 1228	
B	HOUSING		RS007568

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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
B	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING AND SPECIFICATION REQUIREMENTS.	RS007588 RB0170-153 RB0170-154
		FORGING IS PENETRANT AND ULTRASONIC INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-116 RA0115-012
		HOUSING IS PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-116
	WELD INTEGRITY	ALL WELDS ARE INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS. INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, RADIOGRAPHIC, ULTRASONIC, AND FILLER MATERIAL, AS APPLICABLE.	RL10011 RA0607-084 RA0115-116 RA0115-006 RA1115-031 RA0115-127
	HEAT TREAT	HEAT TREAT IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RA0611-020
	SURFACE FINISH	COPPER PLATING AND PLASMA SPRAYING IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RA1109-002 RA0109-018 RA0109-019
	ASSEMBLY INTEGRITY	THE HOUSING PROOF PRESSURE TEST IS PERFORMED PER SPECIFICATION REQUIREMENTS.	RL00143
		IN-FIELD BORESCOPE INSPECTION OF BOLT HOLES, VISUAL AND BORESCOPE INSPECTION OF THE ENTIRE INNER RING AT RECYCLE ARE PERFORMED PER DAR AND SPECIFICATION REQUIREMENTS.	RL00528 DAR 1199 DAR 2909

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Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRAQA).
 Reference: NASA letter SA21/86/308 and Rocketdyne letter 88RCD9761.

Operational Use: Not Applicable.

SSME FMEA/CIL
FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

Component Group: Fuel Turbopumps
 Item Name: High Pressure Fuel Turbopump
 Item Number: B200
 Part Number: RS007501

Prepared: D. Early
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Base Line Rationale	Variance	Change Rationale	Variant Dash Number
1. B200-15 RS007502; CAUSE A, B200-24; RS007605; CAUSE A THE INNER AND OUTER BEARING RACES ARE EDDY CURRENT INSPECTED PER RL00743.	BEARING RACES RECEIVED FROM SUPPLIER SPLIT BALL BEARING INCORPORATED RECEIVED NO GENERAL EDDY CURRENT INSPECTION	GENERAL EDDY CURRENT INSPECTION OF RACES REPLACES TYPE IVC IN PENETRANT INSPECTION IN DETECTING SURFACE FLAWS USE AS IS RATIONALE: 1. RACES SUPPLIED BY SPLIT BALL BEARING INCORPORATED RECEIVED 10X VISUAL AND TYPE IVC PENETRANT INSPECTION INSTEAD OF GENERAL EDDY CURRENT INSPECTION. FLAW DETECTABILITY RELIABILITY LEVELS BETWEEN PENETRANT AND GENERAL EDDY CURRENT INSPECTIONS ARE 0.060 AND 0.057 RESPECTIVELY.	SEE DAR 2745 FOR VARIANT PART SERIAL NUMBERS.
2. B200-13 RS007527, RS007532, CAUSE A & B. B200-26; RS007532; CAUSE B. DIFFUSER HIDDEN SURFACES ARE PENETRANT INSPECTED PER RL00343.	SOME DIFFUSERS MAY NOT RECEIVE THE POST PROOF TEST HIDDEN SURFACE IIP PENETRANT INSPECTION	USE AS IS RATIONALE 1. IMPLEMENTATION OF HIDDEN SURFACE INSPECTION REQUIREMENT IS NOT A RESULT OF AN OBSERVED HARDWARE ANOMALY BUT AS A RESULT OF ROCKETDYNE'S STAND DOWN.	SEE DAR 2751 FOR VARIANT PART SERIAL NUMBERS
3 B200-14 CAUSE A, RS007568 B200-21 CAUSE B, RS007568 B200-26 CAUSE A, RS007568 WELD JOINTS RS007568 TABLE B200 HPFT FMEA/CIL WELD JOINTS RS007568 HOUSING CURRENT CONFIGURATION IS THE ONE (1) PIECE "113" CAP, USING FOUR (4) WELDS AND FOUR (4) WELD NUMBERS	SOME HOUSINGS (POSSIBLY TWO) MAY HAVE BEEN FABRICATED WITH THE TWO (2) PIECE "113" CAPS (THIS HAS AN EXTRA WELD: #13 AND THREE EXTRA WELD NUMBERS 13, 68 & 69)	TO REDUCE CONFUSION ON THE DRAWING AND ON THE MANUFACTURING FLOOR	SEE MCR 2524. SAME -113 DASH NUMBER.
4 B200-02; CAUSE A, RS007524 CAUSE B, RS007524; CAUSE C, RS007524	SOME TURBINE BEARING SUPPORTS (RS007524) ARE FABRICATED USING A WELDMENT OF HAYES 188 SHEET METAL INSTEAD OF THE EDM FORGING.	HIGH CYCLE FATIGUE INDUCED INLET SHEET METAL CRACKS DO OCCUR FROM THE OPERATIONAL ENVIRONMENT EXPERIENCED DURING ENGINE OPERATION. THE CRACKING IS CONTROLLED PER THE REQUIREMENTS OF THE SHEET METAL INSPECTION SPECIFICATION (RL00655) WHICH LIMITS THE CRACKING LENGTH, SPACING, AND SHAPE, TO PRECLUDE SHEET METAL PIECES FROM DISLODGING. THE CRITERIA IS BASED ON CRACK GROWTH RATES AND ENGINE TEST EXPERIENCE. ANY CRACKS, WHICH EXCEED THE SPECIFICATION LIMITS, ARE WELD REPAIRED (RF0001-007). THE TURBINE BEARING SUPPORT WITH WELDED SHEET METAL IS LIFE LIMITED BY MAJOR WAIVER DAR 2709.	RS007524-201 AND SUBS.

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Base Line Rationale	Variance	Change Rationale	Variant Dash Number
5 B200-18 CAUSE A, B200-17 CAUSE A, B200-18 CAUSE A, B200-19 CAUSE A, B200-22; CAUSE A,B,C,E	SOME LIFT-OFF SEAL HOUSING DRAIN LINES ARE FABRICATED USING INTERSECTING LINE DRILLED HOLES THE HOLE THAT INTERSECTS THE OUTSIDE DIAMETER OF THE HOUSING FLANGE HAS A PLUG INSTALLED. THE PLUG IS THEN WELDED AT THE HOUSING OUTSIDE DIAMETER TO FORM A TIGHT GAS SEAL	LOW CYCLE FATIGUE CRACKING HAS BEEN OBSERVED IN THE PLUG WELD. CRACK INITIATION AND PROPAGATION OCCURS AT SHUTDOWN/COOLDOWN ALL UNITS RECEIVE A STANDARD POST FLIGHT INSPECTIONS BY LEAK CHECK. LEAK CHECK POST FLIGHT WILL DETECT A CRACK PRIOR TO REFLIGHT. POST LEAKAGE AT THE DRAIN LINE IS LIMITED TO 10 SCIM. ALL FLIGHT UNITS WILL CONTINUE TO RECEIVE A LEAK CHECK POST FLIGHT FOR THE DRAIN LINE PLUG WELD UNTIL THE ENTIRE FLEET IS RETROFIT WITH THE EDM DRAIN LINE CONFIGURATION	R0019230-071 AND SUBS.

**SSME FMEA/CIL
WELD JOINTS**

Component Group: Fuel Turbopumps
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Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable		Comments
						HCF	LCF	
SHIELD	R0012171	1,24, 28-52	GTAW	II	X			
SHIELD	R0012171	26	GTAW	II				
LIFT-OFF SEAL	R0019230	1, 2	GTAW	II	X			
SHIELD	R0019788	25, 28	GTAW	II				
SHIELD	R0019788	27, 50	GTAW	II	X			
SHIELD	R0019788	51, 52	GTAW	I				
SHIELD	R0019788	53, 55	GTAW	II				
BELLOWS	RS007505	1-4	GTAW	I		X		
BELLOWS	RS007505	5, 6	EBW	I		X		
INLET	RS007512	4	GTAW	I		X		
INLET	RS007512	5-6	GTAW	I				
INLET	RS007512	7-10, 12, 13	GTAW	I				
INLET	RS007512	11	EBW	II				
INLET	RS007512	14, 15	GTAW	I				
INLET	RS007512	16	GTAW	I		X		
BEARING SUPPORT	RS007524	14	EBW	I				
BEARING SUPPORT	RS007524	18	EBW	I	X			
BEARING SUPPORT	RS007524	29, 30	GTAW	I	X	X		
BEARING SUPPORT	RS007524	17	GTAW	I	X			
BEARING SUPPORT	RS007524	119, 121	EBW	I				
BEARING SUPPORT	RS007524	120	GTAW	II	X			
BEARING SUPPORT	RS007524	229-241	GTAW	II	X			
HOUSING	RS007568	75, 223, 228, 230 298	GTAW	I	X	X	X	
HOUSING	RS007568	74	GTAW	I				
HOUSING	RS007568	48	EBW	I	X	X	X	
HOUSING	RS007568	43	GTAW	I	X			
HOUSING	RS007568	51	GTAW	II	X	X		
HOUSING	RS007568	52	GTAW	II	X			
HOUSING	RS007568	53	EBW	I				

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Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable		Comments
						HCF	LCF	
HOUSING	RS007568	56	EBW	II	X			
HOUSING	RS007568	56	GTAW	II	X			
HOUSING	RS007568	57, 324, 325	GTAW	II				
HOUSING	RS007568	58	GTAW	II	X	X	X	
HOUSING	RS007568	59	EBW	I				
HOUSING	RS007568	74, 229, 297	GTAW	I	X	X	X	
HOUSING	RS007568	76, 77	GTAW	I		X		
HOUSING	RS007568	78-89	GTAW	II	X			
HOUSING	RS007568	90-101	GTAW	II	X			
HOUSING	RS007568	102	GTAW	I	X			
HOUSING	RS007568	139	GTAW	II	X			
HOUSING	RS007568	140	GTAW	II	X			
HOUSING	RS007568	150, 154	GTAW	II	X			
HOUSING	RS007568	174-185	GTAW	II	X			
HOUSING	RS007568	191, 192, 195, 196, 245, 455, 456	GTAW	II	X	X		
HOUSING	RS007568	193, 194, 197-202, 204-207	GTAW	II		X		
HOUSING	RS007568	203, 217, 218, 234, 236	GTAW	II	X	X		
HOUSING	RS007568	212, 213	GTAW	II				
HOUSING	RS007568	214, 215	GTAW	II	X			
HOUSING	RS007568	222, 239	GTAW	I		X		
HOUSING	RS007568	224, 225	GTAW	I		X	X	
HOUSING	RS007568	226, 227	GTAW	I		X		
HOUSING	RS007568	231, 232	GTAW	II	X	X		
HOUSING	RS007568	233	GTAW	II	X			
HOUSING	RS007568	237, 238	GTAW	II				
HOUSING	RS007568	246-248	GTAW	II				
HOUSING	RS007568	326-349	GTAW	II	X			
HOUSING	RS007568	374-397	GTAW	II	X			
HOUSING	RS007568	399	GTAW	I	X	X	X	

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						HCF	LCF	
HOUSING	RS007568	401-424	GTAW	II	X			
HOUSING	RS007568	425-448	GTAW	II	X			
HOUSING	RS007568	450 (OPT)	GTAW	II				
HOUSING	RS007568	450 (OPT)	EBW	II	X			
HOUSING	RS007568	454	GTAW	II	X			
HOUSING	RS007568	537 (OPT)	GTAW	II				
ROTOR SEAL	RS007588	1	EBW	I				
SEA.	RS007592	25	EBW	II	X			