1) CIL ITEM : B400-19
2) FMEA CODE : B400
3) COMPONENT : HPOTP
4) PART NUMBER : RS007701
5) SYSTEM/SUBSYSTEM : PUMPS/BXXX
6) FAILURE MODE : LOSS OF COOLANT TO TURBINE SEALS

7) PREPARED : SSME RELIABILITY
8) APPROVED :
9) DATE : 06-01-95
10) REVISION/CHANGE : -002/0
11) EFFECTIVITY : -761
12) HAZARD REFERENCE : SEE LISTINGS BELOW
13) CCBD # : ME3-01-3375

PHASE	FAILURE DESCRIPTION/EFFECT	CRITICALITY
S	OVERHEATING OF SEAL RINGS AND MATING SURFACES, RESULTING IN EXCESSIVE HOT-GAS LEAKAGE AND/OR SEAL STRUCTURAL AND METALLURGICAL DETERIORATION. HOT-GAS LEAKAGE CAUSES EXCESSIVE SECONDARY TURBINE DRAIN CAVITY PRESSURE, WHICH RESULTS IN A REDLINE SHUTDOWN. MISSION SCRUB IF DETECTED BY REDLINE. LOSS OF VEHICLE DUE TO HPOTP 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 ITEM IS DETECTABLE DURING FLIGHT. C: PASS. LOSS OF REDUNDANT HARDWARE ITEMS COULD NOT RESULT FROM A SINGLE CREDIBLE EVENT.	1R HAZARD REF: ME-C1S,M
M	OVERHEATING OF SEAL RINGS AND MATING SURFACES, RESULTING IN EXCESSIVE HOT-GAS LEAKAGE AND/OR SEAL STRUCTURAL AND METALLURGICAL DETERIORATION. HOT-GAS LEAKAGE CAUSES EXCESSIVE SECONDARY TURBINE DRAIN CAVITY PRESSURE, WHICH IS SENSED AND RESULTS IN A REDLINE SHUTDOWN. MISSION ABORT IF DETECTED BY REDLINE. LOSS OF VEHICLE DUE TO HPOTP 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 ITEM IS DETECTABLE DURING FLIGHT. C: PASS. LOSS OF REDUNDANT HARDWARE ITEMS COULD NOT RESULT FROM A SINGLE CREDIBLE EVENT.	1R HAZARD REF: ME-C1S,M

CIL ITEM: B400-19	DESIGN	DOCUMENT REF.
	FAILURE CAUSE A: BLOCKAGE OF COOLANT CIRCUITS	
	THE TURBINE SEAL ASSEMBLY IS COOLED BY A HYDROGEN-STEAM MIXTURE SUPPLIED BY THE TURBINE HOUSING (1). HYDROGEN GAS IS METERED INTO THE BELLOWS CAVITY BY EIGHT ORIFICE PLUGS (2) AT THE PREBURNER INTERFACE. THE HYDROGEN IS MIXED WITH HOT-GAS ACQUIRED THROUGH EIGHT ORIFICE HOLES IN THE TURBINE HOUSING. COOLANT IS FED TO A MANIFOLD AT THE TURBINE DISCHARGE STRUT INTERFACE (3), WHERE ONE STRUT, WITH AN INTERNAL COOLANT TRANSFER TUBE (4), IS UTILIZED TO INTERNALLY TRANSFER COOLANT ACROSS TO THE MAIN HOUSING (5). THE TUBE IS FLUSH WITH THE STRUT HEIGHT AND UTILIZES THE COMPRESSIVE LOADS BETWEEN THE TURBINE HOUSING, SECOND-STAGE NOZZLE FLANGE, TURBINE DISCHARGE STRUT, AND MAIN HOUSING INTERFACES TO PROVIDE A METAL-TO-METAL SEAL FOR LEAKAGE PROTECTION. A SINGLE PASSAGE IN THE MAIN HOUSING TRANSFERS THE COOLANT TO THE SHAFT COOLANT HEAT SHIELD (6), WHICH DIRECTS THE FLOW TO THE INLET OF THE TURBINE SEALS. THE INTERNAL HOUSING PASSAGES ARE FORMED BY INTERSECTING DRILL PATHS THAT ARE SEALED AT THE HOUSING SURFACE BY PLUG WELDS. THE COOLANT SHIELD MANIFOLDS AND DIRECTS THE FLOW RADIALLY INWARDS AND IS DISCHARGED JUST UPSTREAM OF THE TURBINE SEAL INLET VIA 9 ORIFICE HOLES (6). THE SHIELD IS FORMED TO PROVIDE A SPRING LOAD AGAINST THE MAIN HOUSING, REDUCING BYPASS LEAKAGE POTENTIALS (6). THE TURBINE HOUSING AND DISCHARGE STRUT ARE MANUFACTURED UTILIZING INCOLOY 903. INCOLOY 903 IS AN IRON BASED ALLOY WHICH WAS SELECTED FOR ITS STRENGTH, RESISTANCE TO HYDROGEN ENVIRONMENT EMBRITTLEMENT, CORROSION RESISTANCE AND STRESS CORROSION CRACKING (7). THE ALLOY IS SOLUTION TREATED AND AGE-HARDENED (1) (3). THE ORIFICE PLUGS ARE MANUFACTURED UTILIZING A-286 CRES, WHICH WAS SELECTED FOR ITS TENSILE STRENGTH, DUCTILITY, AND RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING (7). THE ALLOY IS SOLUTION HEAT TREATED AND AGE-HARDENED (2). THE COOLANT TRANSFER TUBE IS MANUFACTURED UTILIZING ANNEALED 321 CRES, WHICH WAS SELECTED FOR ITS STRENGTH, DUCTILITY, AND RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING. BOTH A-286 AND 321 CRES ARE NOT SIGNIFICANTLY AFFECTED IN A HYDROGEN ENVIRONMENT (7). THE MAIN HOUSING IS MANUFACTURED UTILIZING FORGED INCONEL 718, WHICH WAS SELECTED FOR ITS TENSILE STRENGTH AND RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING (7). THE ALLOY IS SOLUTION HEAT TREATED AND AGE-HARDENED (4). ALTHOUGH INCONEL 718 IS SUSCEPTIBLE TO HYDROGEN ENVIRONMENT EMBRITTLEMENT, PROTECTION OF THE INTERNAL PASSAGES ARE NOT POSSIBLE DUE TO THE GEOMETRY CONSTRAINTS. THE COOLANT SHIELD IS MANUFACTURED UTILIZING ANNEALED HAYNES 188, WHICH WAS SELECTED FOR ITS STRENGTH AT ELEVATED TEMPERATURES AND RESISTANCE TO CORROSION AND DEGRADATION IN HIGH PRESSURE GASEOUS HYDROGEN (7). CLEANLINESS REQUIREMENTS DURING HANDLING AND ASSEMBLY (8), AND AT THE VEHICLE PROPELLANT CLEANLINESS (9) LEVEL, WILL PRECLUDE BLOCKAGE OF THE COOLANT PASSAGES. ENGINE DRYING AND PURGING WILL PRECLUDE THE FORMATION OF ICE CONTAMINATION. THE TURBINE HOUSING (10) AND THE MAIN HOUSING (11) HAVE COMPLETED DESIGN VERIFICATION TESTING FOR PROOF PRESSURE-STRESS DISTRIBUTION.	(1) RS007746 (2) RS007783 (3) RS007779 (4) RS007897 (5) RS007729 (6) RS007881 (7) RSS-8578-11 (8) RL10001 (9) ICD 13M15000 (10) RSS-403-60A (11) RSS-403-58

CIL ITEM: B400-19	DESIGN	DOCUMENT REF.
	FAILURE CAUSE B: CRACKED TURBINE HEAT SHIELD	
	THE TURBINE HEAT SHIELD PROVIDES A CONTROLLED DISTRIBUTION OF MIXED COOLANT INTO THE HOT-GAS ENVIRONMENT UPSTREAM OF THE TURBINE SEALS. THE SHIELD IS MANUFACTURED UTILIZING ANNEALED HAYNES 188 AND HAS A SPRING LOADED OUTER DIAMETER RIM THAT ACTS AS A MANIFOLD FOR THE COOLANT SUPPLIED THROUGH THE MAIN PUMP HOUSING (1). THE COOLANT FLOWS RADIALLY INWARDS VIA NINE EQUALLY SPACED CHANNELS OF THE SHIELD. A MANIFOLD, FORMED AROUND THE INNER DIAMETER, COLLECTS THE FLOW AND DISCHARGES IT THROUGH NINE HOLES UPSTREAM OF THE SEAL INLET. HAYNES 188 WAS SELECTED FOR ITS STRENGTH AT ELEVATED TEMPERATURES, AND RESISTANCE TO CORROSION AND DEGRADATION IN HIGH PRESSURE GASEOUS HYDROGEN (2). UNRESTRICTED THERMAL MOVEMENT IS PROVIDED BY RADIALLY SLOTTING THE BOLT HOLES. THE CORRESPONDING BOLTS, WHICH ATTACH THE SHIELD AND TURBINE SEAL ASSEMBLY TO THE MAIN PUMP HOUSING, HAVE SHOULDERS THAT FIT INTO THE SLOTS AND PREVENT BOLT HEAD LOADING ON THE SHIELD (3). THE SHIELD IS NOT TRACKED BY SERIALIZATION.	(1) RS007881 (2) RSS-8578-11 (3) RS007889
	FAILURE CAUSE C: FAILURE OF TURBINE SEAL HOUSING STATIC SEAL ALLOWING COOLANT BYPASS	
	THE TURBINE SEAL HOUSING STATIC SEAL (1) PREVENTS BYPASS LEAKAGE OF MIXED COOLANT FROM THE HEAT SHIELD MANIFOLD, USED TO THERMALLY PRECONDITION THE TURBINE SEAL HOT-GAS. THE SEAL IS SECURED IN A RELIEF CAVITY BETWEEN THE TURBINE SEAL HOUSING AND THE MAIN PUMP HOUSING, AND HAS A "W" CONFIGURATION CROSS-SECTION (1). THE SEAL IS SYMMETRIC AND INSENSITIVE TO ORIENTATION DURING INSTALLATION. SEALING IS PROVIDED BY THE COMPRESSION OF THE SEAL LIPS AND ENHANCED BY PRESSURE LOADING DURING OPERATION. THE SEAL IS MANUFACTURED UTILIZING A-286 CRES, WHICH WAS SELECTED FOR ITS STRENGTH, DUCTILITY, AND HIGH ELASTIC MODULUS (2). THE ALLOY IS RESISTANT TO CORROSION AND STRESS CORROSION CRACKING (2). HYDROGEN ENVIRONMENT, AT ANY TEMPERATURE, DOES NOT HAVE A SIGNIFICANT EFFECT ON THE PROPERTIES OF THIS ALLOY (2). THE SEAL IS AGE HARDENED AND SILVER PLATED FOR LUBRICITY, FRICTIONAL WEAR RESISTANCE, AND ANTI-GALLING CHARACTERISTICS (1). THE SEALING SURFACES ARE GROUND TO ACHIEVE A MICROFINISH SURFACE (1). THE PILOTING DIMENSIONS BETWEEN THE TURBINE SEAL HOUSING AND THE MAIN PUMP HOUSING LIMIT THE AMOUNT OF BYPASS LEAKAGE. THE SEAL IS ASSESSED TO HAVE INFINITE LIFE (3) AND IS NOT TRACKED BY SERIALIZATION.	(1) RES1138 (2) RSS-8578-11 (3) RL00532, CP320R00038
	ALL CAUSES:	
	THE HIGH CYCLE AND LOW CYCLE FATIGUE LIFE OF THE MAIN PUMP HOUSING, DISCHARGE STRUT, TURBINE HEAT SHIELD, AND TURBINE HOUSING SEAL MEET CEI REQUIREMENTS (1). THE TURBINE HOUSING HIGH CYCLE FATIGUE LIFE MEETS CEI REQUIREMENTS (1), BUT IS LOW CYCLE FATIGUE LIFE LIMITED BY MAJOR WAIVER (7). THE MINIMUM FACTORS OF SAFETY FOR THESE PARTS MEET CEI REQUIREMENTS (2). THE HARDWARE PARENT MATERIALS WERE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH SINCE THEY ARE NOT FRACTURE CRITICAL PARTS, EXCEPT FOR THE TURBINE INLET SUPPORT STRUT WHICH WAS CLEARED BY CRITICAL INITIAL FLAW SIZE DETECTABILITY. THE MAIN PUMP HOUSING, AND TURBINE INLET HOUSING WERE CLEARED BY RISK ASSESSMENT (3). THE FMEA/CIL WELDS ARE CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH BY THE WELD ASSESSMENT (4). TABLE B400 LISTS ALL FMEA/CIL WELDS AND IDENTIFIES THOSE WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTABLE AND THOSE WELDS IN WHICH THE ROOT SIDE IS NOT ACCESSIBLE FOR INSPECTION. THOSE WELDS IN WHICH THE CRITICAL INITIAL FLAW SIZE IS NOT DETECTABLE ARE ACCEPTABLE FOR FLIGHT BY RISK ASSESSMENT (4). THE CONTROLLER SOFTWARE IS CONFIGURED TO DETECT AND RESPOND TO THE FAILURES IDENTIFIED AND COMMAND A SAFE ENGINE STATE (5). REUSE OF PARTS DURING OVERHAUL IS CONTROLLED BY THE REQUIREMENTS OF THE OVERHAUL SPECIFICATION (6).	(1) RL00532, CP320R00038 (2) RSS-8546-16, CP320R00038 (3) NASA TASK 117 (4) RSS-8756 (5) CP406R0008 3.2.3.5.2 (6) RL00874 (7) DAR 2141

CIL ITEM: 8400-19		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
FAILURE CAUSE A:	RS007729 - MAIN HOUSING RS007736 - FLANGE RS007746 - TURBINE SUPPORT RS007779 - STRUT ASSEMBLY RS007966 - TURBINE SEAL		RS007729 RS007736 RS007746 RS007779 RS007966
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING AND SPECIFICATION REQUIREMENTS.	RS007746 RBD170-153 RBD170-197 RBD170-186
	WELD INTEGRITY	ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS. INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, RADIOGRAPHIC, ULTRASONIC, AND FILLER MATERIAL, AS APPLICABLE.	RL10011 RA0607-004 RA0115-116 RA0115-006 RA1115-001 RA0115-127
	ASSEMBLY INTEGRITY	HOUSING SEAL DRAIN SYSTEM, COOLANT JETS, INSTRUMENTATION, BLEED AND FLOW PASSAGES ARE VERIFIED FREE OF CONTAMINATION PER SPECIFICATION REQUIREMENTS.	RL00814
		OXIDIZER SYSTEM IS PURGED PER SPECIFICATION REQUIREMENTS.	OMRSD S00F80.300 OMRSD S00FM0.250 OMRSD V41C80.080 OMRSD V41C80.081
		MAIN HOUSING WELDS 22 & 24 ARE MASS SPECTROMETER LEAK CHECKED PER SPECIFICATION REQUIREMENTS.	RA0115-116
	HEAT TREAT	MAIN HOUSING HEAT TREAT IS VERIFIED BY SPECIFICATION REQUIREMENTS.	RA0611-020
FAILURE CAUSE B:	RS007881 - SHIELD		RS007881
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS007881
	HEAT TREAT	SHIELD ANNEALING IS VERIFIED PER DRAWING REQUIREMENTS.	RS007881

CIL ITEM: B400-19	INSPECTION AND TEST		
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
	SURFACE FINISH	SURFACE FINISH IS INSPECTED PER DRAWING REQUIREMENTS.	RS007881 RS007729
		COPPER PLATING AS REQUIRED IS VERIFIED PER DRAWING REQUIREMENTS.	RS007881
	ASSEMBLY INTEGRITY	SHIELD SEALING SURFACE ORIENTATION IS VERIFIED PER DRAWING REQUIREMENTS.	RS007701
FAILURE CAUSE C:	RS007966 - TURBINE SEAL ASSEMBLY		RS007966
	RES1138 - SEAL		RES1138
	RS007729 - MAIN HOUSING		RS007729
	RB007736 - FLANGE		RS007736
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION AND DRAWING REQUIREMENTS.	RB0170-166 RB0170-153 RES1138
		TURBINE SEAL ASSEMBLY IS PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-116
		FLANGE IS ULTRASONIC AND PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-012 RA0115-116
		SEAL IS PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-116
	HEAT TREAT	HEAT TREAT IS VERIFIED PER DRAWING AND SPECIFICATION REQUIREMENTS.	RES1138 RA0611-020 RB0170-153
	ASSEMBLY INTEGRITY	MAIN HOUSING WELDS 22 & 24 ARE MASS SPECTROMETER LEAK CHECKED PER SPECIFICATION REQUIREMENTS.	RA0115-116

CIL ITEM: 0400-19		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
	SURFACE FINISHES	SEALING SURFACE FINISHES ARE INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS.	RL00814 RS007966 RS007729 RES4138
ALL CAUSES:	RS007701 - HPOTP		RS007701
	CLEANLINESS OF COMPONENTS	COMPONENTS ARE VERIFIED CLEANED TO PROPELLANT SERVICE PER SPECIFICATION REQUIREMENTS.	RS007701
	ASSEMBLY INTEGRITY	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.	RL00874 RA0115-116
		OPERATION/PERFORMANCE IS VERIFIED BY ENGINE HOT-FIRE TESTING AND 2ND E & H INSPECTIONS.	RL00050-04 RL00056-06 RL00056-07 RL00461
		THE PRIMARY AND SECONDARY TURBINE SEALS ARE LEAK TESTED AT ASSEMBLY AND AFTER HOT FIRE PER SPECIFICATION REQUIREMENTS.	RL00814 RL00461
		TORQUE CHECKS ARE PERFORMED PRIOR TO EACH FLIGHT.	OMRSD V41BS0.040
		DATA FROM PREVIOUS FLIGHT OR HOT-FIRE IS REVIEWED FOR PROPER TURBOPUMP OPERATION/PERFORMANCE. (LAST TEST)	MSFC PLN 1228
FAILURE HISTORY:	COMPREHENSIVE FAILURE HISTORY DATA IS MAINTAINED IN THE PROBLEM REPORTING DATABASE (PRAMS/PRACA). REFERENCE: NASA LETTER SA21/88/308 AND ROCKETDYNE LETTER 88RCD9761.		

OPERATIONAL USE: NOT APPLICABLE.

TABLE B400. HIGH PRESSURE OXIDIZER TURBOPUMP
FMEA/CIL WELD JOINTS

COMPONENT	BASIC PART NO.	WELD NO.	WELD TYPE	CLASS	ROOT SIDE NOT ACCESS	CRITICAL INITIAL FLAW SIZE NOT DETECTABLE HCF	LCF	COMMENTS
MAIN HOUSING	RS007729	1,2	EBW	1	X	X		
MAIN HOUSING	RS007729	3	EBW	1		X		
MAIN HOUSING	RS007729	9,10	GTAW	II	X	X	X	
MAIN HOUSING	RS007729	11,12	GTAW	I		X		
MAIN HOUSING	RS007729	13	EBW	1	X	X		
MAIN HOUSING	RS007729	14-17,46	GTAW	II	X			
MAIN HOUSING	RS007729	18,19	GTAW	II	X	X	X	
MAIN HOUSING	RS007729	21,23	GTAW	II	X			
MAIN HOUSING	RS007729	22,24	GTAW	II	X			
MAIN HOUSING	RS007729	44,55-59	GTAW	I	X			
MAIN HOUSING	RS007729	45	GTAW	I	X			
MAIN HOUSING	RS007729	48	GTAW	I	X	X	X	
MAIN HOUSING	RS007729	49	GTAW	I	X			
MAIN HOUSING	RS007729	50	GTAW	I				
MAIN HOUSING	RS007729	51,52	GTAW	I	X			
MAIN HOUSING	RS007729	54	GTAW	I	X			
MAIN HOUSING	RS007729	55,56	GTAW	I	X			
MAIN HOUSING	RS007729	61	GTAW	I				
MAIN HOUSING	RS007729	62	GTAW	I	X			
MAIN HOUSING	RS007729	63	GTAW	I				
MAIN HOUSING	RS007729	64	GTAW	I	X	X		
MAIN HOUSING	RS007729	65	GTAW	1	X			
MAIN HOUSING	RS007729	66-70	GTAW	II	X			
INLET HOUSING	RS007732	4	GTAW	I		X		
INLET HOUSING	RS007732	8,9	GTAW	I		X		
VOLUTE	RS007732	10,15	GTAW	I	X	X		
VOLUTE	RS007732	20,21	GTAW	I				
VOLUTE	RS007732	22,23	GTAW	1				
VOLUTE	RS007732	24,27	GTAW	I		X	X	
VOLUTE	RS007732	25,26	GTAW	I				
FLANGE	RS007736	1,2	GTAW	II	X			
FLANGE	RS007736	3,26	GTAW	II	X			

TABLE B400. HIGH PRESSURE OXIDIZER TURBOPUMP
FMEA/CIL WELD JOINTS

COMPONENT	BASIC PART NO.	WELD NO.	WELD TYPE	CLASS	ROOT SIDE NOT ACCESS	CRITICAL INITIAL FLAW SIZE NOT DETECTABLE HCF	LCF	COMMENTS
FLANGE	R0007736	6,7	GTAW	II	X			
FLANGE	R0007736	9-12,17	GTAW	II	X			
FLANGE	R0007736	13-16	GTAW	II	X			
FLANGE	R0007736	18,20	GTAW	I	X			
FLANGE	R0007736	19,21	GTAW	II	X			
FLANGE	R0007736	22	EBW	I	X			
FLANGE	R0007736	23	GTAW	II				
FLANGE	R0007736	24	GTAW	II	X			
FLANGE	R0007736	26	GTAW	II	X			
BELLOWS	R0007740	1,2,5,9	GTAW	I		X		
BELLOWS	R0007740	3,4	EBW	I				
HOUSING	R0007746	1,2	GTAW	I	X	X	X	
HOUSING	R0007746	3	GTAW	I	X			
HOUSING	R0007746	4	GTAW	II	X			
HOUSING	R0007746	5	GTAW	II	X	X		
HOUSING	R0007746	6-17	GTAW	II	X	X		
HOUSING	R0007746	18-29	GTAW	II	X	X	X	
HOUSING	R0007746	30-41	GTAW	II		X	X	
BELLOWS	R0007748	1	EBW	I				
BELLOWS	R0007749	2	GTAW	I	X			
BELLOWS	R0007749	1-4	GTAW	I				
BELLOWS	R0007749	5,6	EBW	I				
BELLOWS	R0007749	11	EBW	I				
BELLOWS	R0007749	12	EBW	I				
BELLOWS	R0007751	3	EBW	I	X			
BELLOWS	R0007751	4	EBW	I	X	X	X	
BELLOWS	R0007751	8	GTAW	I	X	X		
SECOND STAGE NOZZLE	R0007752	1,2	EBW	I	X			
SECOND STAGE NOZZLE	R0007752	1	GTAW	I	X	X	X	
JET RING	R0007757	1	GTAW	I	X	X	X	
FAIRING	R0007774	1-12	GTAW	I		X		
FAIRING	R0007774	13-24	GTAW	I		X		

TABLE B400. HIGH PRESSURE OXIDIZER TURBOPUMP
PREA/CIL WELD JOINTS

COMPONENT	BASIC PART NO.	WELD NO.	WELD TYPE	CLASS	ROOT SIDE NOT ACCESS	CRITICAL INITIAL FLAW SIZE NOT DETECTABLE REF	LCF	COMMENTS
FAIRING	RS007774	25-36	BTAW	I		X		
FAIRING	RS007774	74	BTAW	I				
FAIRING	RS007774	75,76	BTAW	II	X			
STRUT	RS007779	23-44, 143-164	BTAW	II	X			
STRUT	RS007779	45-66, 165-186	BTAW	II	X			
STRUT	RS007779	67	BTAW	II	X			
STRUT	RS007779	69,70	EBW	II	X			
STRUT	RS007779	71	EBW	II				
STRUT	RS007779	72	EBW	II				
STRUT	RS007779	73-94	EBW	II				
STRUT	RS007779	95,96	EBW	II	X			
SHIELD	RS007781	1,11	BTAW	II				
SHIELD	RS007781	2,3,4	BTAW	II				
SEAL	RS008848	1 PLC	BTAW	I				
SEAL	RS008857	1 PLC	BTAW	I		X	X	

FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

CIL ITEMS: B400-XX		HPOTP	P/N RS007791
BASE LINE RATIONALE	VARIANCE	CHANGE RATIONALE	VARIANT DASH NUMBER
1. B400-02, B400-03 SECOND STAGE NOZZLE CASTING IS HOT ISOSTATIC PRESSED PER DRAWING REQUIREMENTS. (ECP 1A-2949)	SECOND STAGE NOZZLE CASTINGS HAVE NOT BEEN HOT ISOSTATIC PRESSED	HOT ISOSTATIC PRESS INCREASES STRUCTURAL INTEGRITY BY REDUCING CASTING MICROPOROSITY. USE AS IS RATIONALE: 1. LIFE LIMIT ON NON HOT ISOSTATIC PRESSED 2ND STAGE NOZZLES REDUCES PROBABILITY OF LOW CYCLE FATIGUE CRACKING RESULTING FROM EXCESSIVE MICROPOROSITY. (DAR 2147) 2. A PENETRANT INSPECTION INTERVAL HAS BEEN IMPOSED ON NON HOT ISOSTATIC PRESSED 2ND STAGE NOZZLES TO VERIFY NO CRACKING IN EXCESS OF ALLOWABLE LIMITS. (DAR 2147)	-121, -131, -141, -151, -161, -171, -181, -191, -201, -211, -221, -231, -241, -251, -261, -271, -291, -301, -311, -331, -351, -371, -401
2. B400-13, B400-22 PROCESSED AND INSPECTED PER SPECIFICATION REQUIREMENTS (RL00916). (ECP 909)	BEARINGS ARE PROCESSED AND INSPECTED PER SPECIFICATION REQUIREMENTS (RL00558).	LONG TERM FATIGUE LIFE OF BEARING IS ENHANCED BY REDUCING THE ALLOWABLE SIZE AND QUANTITY OF ALLOWABLE DEFECTS. USE AS IS RATIONALE: 1. WEAR LIFE LIMIT ON BEARINGS PREVENTS WEAR FROM EXCEEDING ALLOWABLE LIMITS. (DAR 2054, DAR 2082) 2. CONTINUED USE WITH ALLOWABLE DISCREPANCIES IS CONTROLLED PER THE MAINTENANCE CONTROL DOCUMENT REQUIREMENTS (RSS-8795).	-121, -131, -141, -151, -161, -171, -181, -191, -201, -211, -221, -231, -241, -251, -261, -271, -291, -301, -311, -331, -351, -371, -401, -411 -421, -431, -441, -451, -461

FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

CIL ITEMS: 8400-RK		HPOTP	P/N RS007701
BASE LINE RATIONALE	VARIANCE	CHANGE RATIONALE	VARIANT DASH NUMBER
3. 8400-21 HOUSING DETAILS ARE ULTRASONIC INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS. (ECP 680)	HOUSING DETAILS HAVE NOT BEEN ULTRASONIC INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS.	THE ADDED NDI PROVIDES ADDED CONFIDENCE THAT THE CRITICAL FLAW SIZE IS DETECTED IN THE PARENT MATERIAL OF THE HOUSING DETAILS. USE AS IS RATIONALE: 1. HOUSING DETAILS ARE ACCEPTABLE WITHOUT ULTRASONIC INSPECTION DUE TO A PENETRANT INSPECTION OF THE HOUSING DETAILS. THE PENETRANT INSPECTION IS ADEQUATE TO DETECT CRITICAL INITIAL FLAWS WHICH ARE THROUGH CRACKS.	-121, -131, -141, -151, -161, -171, -181, -191, -201, -211, -221, -231, -241, -251, -261, -271, -291, -301, -311, -331, -351, -371, -401, -411 -421, -431, -441, -451, -461, -471, -481, -491, -501
4. 8400-21 FITTING MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS (INCONEL 718, #80170-153).	RS007729-059 TEE-FITTING IS MANUFACTURED FROM AIR MELT 321 CRES BAR (QQ-S-763 CL321 COND A).	INCONEL 718 MATERIAL DOES NOT EXHIBIT INCLUSION STRINGERS WHICH ARE SUSCEPTABLE TO CHEMICAL ATTACK AND MAY RESULT IN LEAKAGE. USE AS IS RATIONALE: 1. FITTINGS ARE LEAK CHECKED FOLLOWING PROOF PRESSURE TEST PER RL00587. 2. LOADS INDUCED BY FABRICATION (WELDING AND PROOF PRESSURE TESTING) ARE HIGHER THAN OPERATIONAL LOADS AND SUFFICIENT TO SCREEN -059 FITTINGS FOR LEAKAGE.	-171, -181