

June 01, 1995

CRITICAL ITEMS LIST

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1) CIL ITEM : B400-21  
 2) FMEA CODE : B400  
 3) COMPONENT : NPOTP  
 4) PART NUMBER : RSD07701  
 5) SYSTEM/SUBSYSTEM : PUMPS/BKXX  
 6) FAILURE MODE : STRUCTURAL FAILURE

7) PREPARED : SSWE RELIABILITY  
 8) APPROVED :  
 9) DATE : 06-01-95  
 10) REVISION/CHANGE : -002/0  
 11) EFFECTIVITY : -761  
 12) HAZARD REFERENCE : SFE LISTINGS BELOW  
 13) CCID # : *me3-01-3275*

PHASE	FAILURE DESCRIPTION/EFFECT	CRITICALITY
PSMCD	STRUCTURAL FAILURE OF PREBURNER PUMP OR MAIN PUMP HOUSING, RESULTING IN LOSS OF PUMP OUTPUT AND OVERPRESSURIZATION OF AFT COMPARTMENT. LOSS OF VEHICLE.  REDUNDANCY SCREENS: SINGLE POINT FAILURE: N/A	1 HAZARD REF: NE-C3P,0 NE-C15,M, NE-C1A,C

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CEL ITEM: B400-21	DESIGN	DOCUMENT REF.
FAILURE CAUSE A: WELD, PARENT METAL, OR DRAIN LINE FAILURE		
<p>THE MAIN PUMP HOUSING IS A WELDED ASSEMBLY MANUFACTURED UTILIZING INCONEL 718 (1). TWO ELECTRON BEAM WELDS JOIN TOGETHER THE INLETS TO THE VOLUTE TO FORM THE PUMP SUBASSEMBLY, WHILE A THIRD ELECTRON BEAM WELD ATTACHES THE MAIN FLANGE TO COMPLETE THE ASSEMBLY. ELECTRON BEAM PRODUCES A CLEAN WELD WITH MINIMAL DISTORTION AND A SMALL HEAT AFFECTED ZONE. THE THIRD WELD IS FLUSHED ON BOTH SIDES. THE VOLUTE IS A WELDED SUBASSEMBLY CONSISTING OF A FORGED INCONEL 718 CENTER BODY AND VOLUTE SHELL, AND A CAST OR FORGED INCONEL 718 DISCHARGE FLANGE. THE DIFFUSER VANES IN THE CENTER BODY ARE FORMED BY AN ELECTRICAL DISCHARGE MACHINING (EDM) PROCESS AND ARE SPOT-PRENNED FOR ADDITIONAL FATIGUE RESISTANCE (1). A CHEM MILL OPERATION IS ACCOMPLISHED AFTER EDM TO REMOVE THE RECAST LAYER. THE INLETS ARE INCONEL 718 INVESTMENT CASTINGS DUE TO THE COMPLEXITY OF THE FLOW PASSAGES AND INTERNAL VANE PROFILES. THE INTERNAL VANE PASSAGES ARE FINISHED BY HAND TO REMOVE "CORE METAL" REACTION. THE HAND GRIND OPERATION ALSO SMOOVES AND REMOVES ANY DISCONTINUITIES ON THE CAST SURFACE. THE CASTINGS ARE NOT ISOSTATICALLY PRESSED FOR IMPROVED MECHANICAL PROPERTIES AND DENSIFICATION (1). THE MAIN FLANGE IS MANUFACTURED UTILIZING AN INCONEL 718 FORGING. THE INTERNAL PASSAGES BETWEEN THE PRIMARY TURBINE AND SECONDARY TURBINE SEAL DRAINS ARE SEPARATED BY FLANGE PARENT METAL AND DO NOT REQUIRE THE USE OF WELDS. THE SECONDARY TURBINE SEAL DRAIN CAVITY IS SEPARATED FROM THE PRIMARY OXIDIZER DRAIN CAVITY BY THE USE OF TWO PLUG WELDS. THE PRESSURE DIFFERENTIAL ACROSS THE PLUGS ARE LOW AND LIMITED BY THE SECONDARY TURBINE SEAL CAVITY PRESSURE RECLINE. EACH OF THE DRAIN CAVITIES EXIT THE FLANGE AT TWO LOCATIONS AND ARE COLLECTED BY FITTINGS, ADAPTERS, AND TUBING WHICH ARE WELDED TOGETHER TO FORM SINGLE FLOW PASSAGES FOR EACH OF THE SEAL DRAIN LINES. THE FITTINGS AND ADAPTERS ARE MANUFACTURED UTILIZING INCONEL 718 AND ARE SOLUTION HEAT TREATED AND AGE-HARDENED (1). THE TUBING IS MANUFACTURED UTILIZING ANNEALED 321 CRES, WHICH WAS SELECTED FOR ITS STRENGTH, DUCTILITY, AND RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING. HYDROGEN ENVIRONMENT AT OPERATING TEMPERATURES DOES NOT HAVE A SIGNIFICANT EFFECT ON THE PROPERTIES OF THIS ALLOY (3). THE EXTERNAL SURFACES OF THE MAIN FLANGE EXPOSED TO A HYDROGEN ENVIRONMENT ARE COPPER PLATED FOR ENBRITTELEMENT PROTECTION (1). THE PREBURNER PUMP HOUSING IS INVESTMENT CAST FROM INCONEL 718 AND IS NOT ISOSTATICALLY PRESSED (2). NO WELDS ARE UTILIZED IN THE PREBURNER PUMP HOUSING. THE ALLOY IS SOLUTION HEAT TREATED AND AGE-HARDENED (1) (2). IT EXHIBITS RESISTANCE TO CORROSION AND STRESS CORROSION CRACKING, AND IS LOW COMPATIBLE (3). THE MAIN PUMP AND PREBURNER PUMP HOUSINGS PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/NOE FLAW GROWTH BY RISK ASSESSMENT (4). THE FMEA/CIL WELDS ARE CLEARED FOR FRACTURE MECHANICS/NOE FLAW GROWTH BY THE WELD ASSESSMENT (5). 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 (5). THE HOUSINGS MEET CEL REQUIREMENTS FOR HIGH CYCLE AND LOW CYCLE FATIGUE LIFE (6), EXCEPT THE MAIN HOUSING IS LIFE LIMITED BY MAJOR WAIVER (7). THE MINIMUM FACTORS OF SAFETY FOR THE HOUSINGS MEET CEL REQUIREMENTS (8). THE MAIN PUMP HOUSING (9) AND PREBURNER PUMP HOUSING (10) HAVE COMPLETED DESIGN VERIFICATION TESTING FOR PROOF PRESSURE-STRESS RELATIONSHIP. CONTINUED USE WITH ALLOWABLE DISCREPANCIES RESULTING FROM OPERATION IS EVALUATED AND CONTROLLED PER THE REQUIREMENTS OF THE MAINTENANCE CONTROL DOCUMENT (11). REUSE OF PARTS DURING OVERHAUL IS CONTROLLED BY THE REQUIREMENTS OF THE OVERHAUL SPECIFICATION (12).</p>		<p>(1) RS007729  (2) RS007739  (3) RSS-8578-11  (4) NASA TASK 117  (5) RSS-8756  (6) RL00532,  CP320R0003H  (7) DAR 2044  (8) RSS-8546-16,  CP320R0003B  (9) RSS-405-5B  (10) RSS-503-5BA  (11) RSS-8793  (12) RL00874</p>

CSL ITEM: R40D-21		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
FAILURE CAUSE A:	RS007729 - MAIN HOUSING RS007739 - PRECURSOR VOLUTE		RS007729 RS007739
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RB0170-155 RB0170-154 RB0170-153
	HEAT TREAT	THE VOLUTE AND MAIN HOUSINGS INLET CASTING HOT ISOSTATIC PRESS IS VERIFIED PER SPECIFICATION REQUIREMENTS.  HEAT TREAT IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RL00360  RB0170-155 RA0511-020
	ASSEMBLY INTEGRITY	MAIN HOUSING IS PROOF PRESSURE TESTED PER SPECIFICATION REQUIREMENTS.  VOLUTE IS PROOF PRESSURE TESTED PER SPECIFICATION REQUIREMENTS.  HOUSING DETAILS ARE ULTRASONIC INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS.	RL00387  RL00018  RS007729 RA0115-124 RA0115-012 MEL-STD-2154
		THE MAIN HOUSING FORGING IS ULTRASONIC AND PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-012 RA0115-116
		MAIN HOUSING WELDS 22 & 24 ARE MASS SPECTROMETER LEAK CHECKED PER SPECIFICATION REQUIREMENTS.	RA0115-116
		VOLUTE CASTING IS RADIOGRAPHIC AND PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-006 RA0115-116
		A PENETRANT INSPECTION IS PERFORMED (ON THE VOLUTE AND MAIN HOUSING) AFTER PROOF PRESSURE TESTING PER DRAWING REQUIREMENTS.	RA0115-116 RS007729 RS007729
		A HIDDEN SURFACE BORESCOPE PENETRANT INSPECTION IS PERFORMED PER SPECIFICATION REQUIREMENTS FOR THE VOLUTE AND MAIN HOUSINGS INLET CASTINGS.	RL00314

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CIL ITEM: B400-21		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
	WELD INTEGRITY	<p>ALL WELDS ARE INSPECTED TO DRAWING AND SPECIFICATION REQUIREMENTS PER WELD CLASS. INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, RADIOGRAPHIC, ULTRASONIC, AND FILLER MATERIAL, AS APPLICABLE.</p> <p>PRIMARY TURBINE SEAL DRAIN WELD 4B IS BLENDED AT THE WELD FACE PER DRAWING REQUIREMENTS.</p> <p>AFTER COMPLETION OF WELDING, THE INSIDE DIAMETER AND OUTSIDE DIAMETER OF WELDS 3, 11 AND 12, AND THE CONVEX CURVATURE OF WELD 13 ARE GROUND FLUSH PER DRAWING REQUIREMENTS.</p>	<p>RL10011 RA0607-094 RA0115-116 RA0115-006 RA0115-127 RA1115-001</p> <p>RS007729 ECP 1011</p> <p>RS007729</p>
	ASSEMBLY INTEGRITY	<p>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.</p> <p>OPERATION/PERFORMANCE IS VERIFIED BY ENGINE HOT FIRE TESTING AND 2ND E &amp; M INSPECTIONS.</p> <p>TORQUE CHECKS ARE PERFORMED PRIOR TO EACH FLIGHT FLOW.</p> <p>HPOTP MICROSHAFT TRAVEL MEASUREMENTS ARE PERFORMED PRIOR TO EACH FLIGHT PER SPECIFICATION REQUIREMENTS.</p> <p>AN INTERNAL BOROSCOPE INSPECTION IS PERFORMED EACH FLIGHT FLOW.</p> <p>AN EXTERNAL VISUAL INSPECTION IS PERFORMED EACH FLIGHT FLOW.</p> <p>A HELIUM SIGNATURE LEAK TEST IS PERFORMED PRIOR TO EACH FLIGHT.</p>	<p>RL00B74 RA0115-116</p> <p>RL00050-04 RL00056-06 RL00056-07 RL00461</p> <p>OMRSD V418SD.040</p> <p>RL01034 RL0005-04 OMRSD V418SD.045</p> <p>OMRSD V418LD.065</p> <p>OMRSD V418LD.030</p> <p>OMRSD S00000.950</p>

CIL ITEM: B400-21		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
		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 ROCKEIDYNE LETTER B88C09761.			

OPERATIONAL USE: NOT APPLICABLE.

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

COMPONENT	BASIC PART NO.	WELD NO.	WELD TYPE	CLASS	ROOT SIDE NOT ACCESS	CRITICAL INITIAL		COMMENTS
						FLAW SIZE NOT HCF	DETECTABLE LCF	
MAIN HOUSING	RS007729	1,2	EBW	I	X	X		
MAIN HOUSING	RS007729	3	EBW	I		X		
MAIN HOUSING	RS007729	9,10	GTAW	II	X	X	X	
MAIN HOUSING	RS007729	11,12	GTAW	I		X		
MAIN HOUSING	RS007729	13	EBW	I	X	X		
MAIN HOUSING	RS007729	14-17,16	GTAW	II	X			
MAIN HOUSING	RS007729	18,19	GTAW	II	X	I	X	
MAIN HOUSING	RS007729	21,23	GTAW	II	X			
MAIN HOUSING	RS007729	22,24	GTAW	II	X			
MAIN HOUSING	RS007729	44,53-59	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	I	X			
MAIN HOUSING	RS007729	66-70	GTAW	II	X			
INLET HOUSING	RS007732	4	GTAW	I			I	
INLET HOUSING	RS007732	8,9	GTAW	I			I	
VOLUTE	RS007732	10,15	GTAW	I	X	I		
VOLUTE	RS007732	20,21	GTAW	I				
VOLUTE	RS007732	22,23	GTAW	I				
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			

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TABLE 1400. HIGH PRESSURE OXIDIZER TURBOPUMP  
FREA/CIL WELD JOINTS

COMPONENT	BASIC PART NO.	WELD NO.	WELD TYPE	CLASS	ROOT	CRITICAL INITIAL		COMMENTS
					SIDE NOT ACCESS	FLAW SIZE NOT HCF	DETECTABLE LCF	
FLANGE	RS007736	6,7	GTAW	II	X			
FLANGE	RS007736	9-12,17	GTAW	II	X			
FLANGE	RS007736	13-16	GTAW	II	X			
FLANGE	RS007736	18,20	GTAW	I	X			
FLANGE	RS007736	19,21	GTAW	II	X			
FLANGE	RS007736	22	EBW	I	X			
FLANGE	RS007736	23	GTAW	II				
FLANGE	RS007736	24	GTAW	II	X			
FLANGE	RS007736	26	GTAW	II	X			
BELLOWS	RS007740	1,2,5,9	GTAW	I		X		
BELLOWS	RS007740	3,4	EBW	I				
HOUSING	RS007746	1,2	GTAW	I	X		X	
HOUSING	RS007746	3	GTAW	I	X			
HOUSING	RS007746	4	GTAW	II	X			
HOUSING	RS007746	5	GTAW	II	X		X	
HOUSING	RS007746	6-17	GTAW	II	X		X	
HOUSING	RS007746	18-29	GTAW	II	X		X	
HOUSING	RS007746	30-41	GTAW	II		X		X
BELLOWS	RS007748	1	EBW	I				
BELLOWS	RS007748	2	GTAW	I	X			
BELLOWS	RS007749	1-4	GTAW	I				
BELLOWS	RS007749	5,6	EBW	I				
BELLOWS	RS007749	11	EBW	I				
BELLOWS	RS007749	12	EBW	I				
BELLOWS	RS007751	3	EBW	I	X			
BELLOWS	RS007751	4	EBW	I	X	X		X
BELLOWS	RS007751	8	GTAW	I	X	X		
SECOND STAGE NOZZLE	RS007752	1,2	EBW	I	X			
SECOND STAGE NOZZLE	RS007752	1	GTAW	I	X	X		X
JET RING	RS007757	1	GTAW	I	X	X		X
FAIRING	RS007774	1-12	GTAW	I		X		
FAIRING	RS007774	13-24	GTAW	I		X		

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TABLE B100. HIGH PRESSURE OXIDIZER TURBOPUMP  
FMEAS/CIL WELD JOINTS

COMPONENT	BASIC PART NO.	WELD NO.	WELD TYPE	CLASS	ROOT	CRITICAL INITIAL		COMMENTS
					SIDE NOT ACCESS	FLAW SIZE NOT DEFECTABLE	NOT DEFECTABLE	
						KEF	LCF	
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	EDW	II	X			
STRUT	RS007779	71	EDW	II				
STRUT	RS007779	72	EDW	II				
STRUT	RS007779	73-94	EDW	II				
STRUT	RS007779	95,96	EDW	II	X			
SHIELD	RS007781	1,11	BTAW	II				
SHIELD	RS007781	2,3,4	BTAW	II				
SEAL	RS006848	1 PLC	BTAW	I				
SEAL	RS006857	1 PLC	BTAW	I		X	X	

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FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

CIL ITEMS: B400-XN	HPOIP		P/N RS007791
BASE LINE RATIONALE	VARIANCE	CHANGE RATIONALE	VARIANT DASH NUMBER
<p>1. B400-02, B400-03 SECOND STAGE NOZZLE CASTING IS NOT ISOSTATIC PRESSED PER DRAWING REQUIREMENTS. (ECP 1A-2949)</p>	<p>SECOND STAGE NOZZLE CASTINGS HAVE NOT BEEN HOT ISOSTATIC PRESSED</p>	<p>NOT ISOSTATIC PRESS INCREASES STRUCTURAL INTEGRITY BY REDUCING CASTING MICROPOROSITY.</p> <p>USE AS IS RATIONALE:</p> <ol style="list-style-type: none"> <li>1. LIFE LIMIT ON NON HOT ISOSTATIC PRESSED 2ND STAGE NOZZLES REDUCES PROBABILITY OF LOW CYCLE FATIGUE CRACKING RESULTING FROM EXCESSIVE MICROPOROSITY. (DAR 2147)</li> <li>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)</li> </ol>	<p>-121, -131, -141, -151, -161, -171, -181, -191, -201, -211, -221, -231, -241, -251, -261, -271, -291, -301, -311, -351, -351, -371, -401</p>
<p>2. B400-13, B400-22 PROCESSED AND INSPECTED PER SPECIFICATION REQUIREMENTS (RL00916). (ECP 909)</p>	<p>BEARINGS ARE PROCESSED AND INSPECTED PER SPECIFICATION REQUIREMENTS (RL00558).</p>	<p>LONG TERM FATIGUE LIFE OF BEARING IS EXTENDED BY REDUCING THE ALLOWABLE SIZE AND QUANTITY OF ALLOWABLE DEFECTS.</p> <p>USE AS IS RATIONALE:</p> <ol style="list-style-type: none"> <li>1. WEAR LIFE LIMIT ON BEARINGS PREVENTS WEAR FROM EXCEEDING ALLOWABLE LIMITS. (DAR 2054, DAR 2082)</li> <li>2. CONTINUED USE WITH ALLOWABLE DISCREPANCIES IS CONTROLLED PER THE MAINTENANCE CONTROL DOCUMENT REQUIREMENTS (RSS-8793).</li> </ol>	<p>-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</p>

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FIELD CONFIGURATION VARIANCES FROM CIL RATIONALE

CIL ITEMS: B400-NK		HPOTP	P/W RS007701
BASE LINE RATIONALE	VARIANCE	CHANGE RATIONALE	VARIANT DASH NUMBER
3. B400-21 HOUSING DETAILS ARE ULTRASONIC INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS. (ECP 680)	HOUSING DETAILS HAVE NOT BEEN ULTRASONIC INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS.	<p>THE ADDED NDI PROVIDES ADDED CONFIDENCE THAT THE CRITICAL FLAW SIZE IS DETECTED IN THE PARENT MATERIAL OF THE HOUSING DETAILS.</p> <p>USE AS IS RATIONALE:</p> <ol style="list-style-type: none"> <li>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.</li> </ol>	-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. B400-21 FITTING MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS (INCONEL 718, 880170-153).	RS007729-059 TEE-FITTING IS MANUFACTURED FROM AIR MELT 321 CRES BAR (00-S-763 CL321 COND A).	<p>INCONEL 718 MATERIAL DOES NOT EXHIBIT INCLUSION STRINGERS WHICH ARE SUSCEPTABLE TO CHEMICAL ATTACK AND MAY RESULT IN LEAKAGE.</p> <p>USE AS IS RATIONALE:</p> <ol style="list-style-type: none"> <li>FITTINGS ARE LEAK CHECKED FOLLOWING PROOF PRESSURE TEST PER RL00387.</li> <li>LOADS INDUCED BY FABRICATION (WELDING AND PROOF PRESSURE TESTING) ARE HIGHER THAN OPERATIONAL LOADS AND SUFFICIENT TO SCREEN -059 FITTINGS FOR LEAKAGE.</li> </ol>	-171, -181

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