

1) CIL ITEM : B400-09
 2) FMEA CODE : B400
 3) COMPONENT : NPOTP
 4) PART NUMBER : AS007701
 5) SYSTEM/SUBSYSTEM : PUMPS/XXXX
 6) FAILURE MODE : LOSS OF INDUCER/IMPELLER HEAD RISE

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) COBD # : M3-01-3275

PHASE	FAILURE DESCRIPTION/EFFECT	CRITICALITY
S	<p>INADEQUATE HEAD RISE RESULTS IN REDUCED ENGINE THRUST. THIS IS SENSED BY THE CONTROLLER, WHICH INCREASES OXIDIZER PREBURNER FLOW. EXCESS TURBINE DISCHARGE TEMPERATURE WILL CAUSE REDLINE SHUTDOWN. MISSION SCRAM IF DETECTED BY REDLINE. LOSS OF VEHICLE DUE TO NPOTP TURBINE OR HEAT EXCHANGER FAILURE MAY RESULT IF NOT DETECTED.</p> <p>REDUNDANCY SCREENS: TURBOPUMP SYSTEM - SENSOR SYSTEM: UNLIKE REDUNDANCY</p> <p>-----</p> <p>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.</p>	<p>1R HAZARD REF: ME-C18,M.</p>
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CIL ITEM: B400-09	DESIGN	DOCUMENT REF.
	<p>FAILURE CAUSE A: INDUCER BLADE DISTORTION/DAMAGE FAILURE CAUSE B: IMPELLER BLADE DISTORTION/DAMAGE</p> <p>THE MAIN IMPELLER IS A DUAL ENTRY BACK-TO-BACK CONFIGURATION WITH AXIAL INDUCERS AT THE TWO IMPELLER INLETS. THE INDUCERS PROVIDE SUFFICIENT HEAD RISE TO THE PROPELLANT PRIOR TO ENTRY INTO THE IMPELLER. THE IMPELLER IS A SHROUDED CENTRIFUGAL DESIGN UTILIZING FOUR FULL AND FOUR PARTIAL BLADES. THE INDUCER AND IMPELLER ARE MANUFACTURED UTILIZING FORGED INCONEL 718 AND IS SOLUTION HEAT TREATED AND AGE-HARDENED (1). INCONEL 718 WAS SELECTED FOR ITS STRENGTH, WHILE RETAINING DUCTILITY AT CRYOGENIC TEMPERATURES (2). THE ALLOY IS RESISTANT TO CORROSION AND STRESS CORROSION CRACKING, AND IS LOK COMPATIBLE (2). SYSTEM CONTAMINATION IS CONTROLLED PER THE VEHICLE CLEANLINESS REQUIREMENTS (3), WHICH MINIMIZES POTENTIAL DAMAGE FROM CONTAMINATION IMPACT. CONTINUED USE WITH ALLOWABLE DISCREPANCIES RESULTING FROM OPERATION IS EVALUATED AND CONTROLLED PER THE REQUIREMENTS OF THE MAINTENANCE CONTROL DOCUMENT (4). PERIODIC IMPELLER INSPECTIONS ARE REQUIRED BY MAJOR WAIVER (5).</p>	<p>(1) RSD07718 (2) R55-B578-11 (3) ICD 13M15000 (4) R55-B793 (5) DAR 19DI</p>
B - 240	<p>FAILURE CAUSE C: EXCESSIVE LEAKAGE THROUGH BALANCE CAVITIES</p> <p>THE ROTOR RESIDUAL AXIAL THRUST FORCES ARE COUNTERACTED AND BALANCED DURING MAINSTAGE BY A BALANCE PISTON DESIGN. THE BALANCE PISTON IS A SELF-COMPENSATING, NON-RUBBING DESIGN WHICH UTILIZES LEAKAGE FLOWS ACROSS OVERLAPPING ORIFICES TO ATTAIN THE DESIRED PRESSURE GRADIENTS IN THE BALANCE CAVITIES. THE LEAKAGE FLOWS, WHICH ARE ROUTED FROM THE MAIN IMPELLER DISCHARGE, ARE CONTROLLED BY THE ORIFICE DIMENSIONS BETWEEN THE MAIN IMPELLER (1) AND THE LEFT AND RIGHT BALANCE PISTON SEALS (2) (3). ASSEMBLY PROCEDURES ESTABLISH PROPER SHIMMING OF THE IMPELLER AND SEAL TO PROVIDE OPTIMUM BALANCE PISTON RESPONSE (4). SHARP EDGE ORIFICE LIPS ARE MACHINED ONTO THE MAIN IMPELLER OUTER SHROUDS. THE MAIN IMPELLER IS MANUFACTURED UTILIZING AN INCONEL 718 FORGING AND IS SOLUTION HEAT TREATED AND AGE-HARDENED (1). THE ALLOY IS RESISTANT TO CORROSION AND STRESS CORROSION CRACKING, AND IS LOK COMPATIBLE (5). INCONEL 718 WAS SELECTED FOR ITS STRENGTH, WHILE RETAINING DUCTILITY AT CRYOGENIC TEMPERATURES (5). THE LEFT AND RIGHT BALANCE PISTON SEALS ARE MACHINED FROM SILVER AND CONTAIN THE STATIONARY SHARP EDGE ORIFICES (2) (3). SILVER WAS SELECTED FOR ITS HIGH IGNITION TEMPERATURE AND THERMAL CONDUCTIVITY CHARACTERISTICS FOR THIS CLOSE TOLERANCE APPLICATION (5). SILVER ALSO EXHIBITS ANTI-GALLING CHARACTERISTICS, WEAR RESISTANCE, AND IS LOK COMPATIBLE (5). THE SEALS ARE SECURED TO THE TURNING VANES, WHICH ARE SECURED TO THE MAIN HOUSING. THE COMPRESSIVE LOAD SUPPLIED BY THE SEAL BOLTS AGAINST THE TURNING VANES, TOGETHER WITH THE INTERFERENCE FIT BETWEEN THE SEAL AND MAIN HOUSING, MINIMIZES BYPASS LEAKAGE POTENTIALS. DAMAGE DUE TO CONTAMINATION IS MINIMIZED BY THE VEHICLE PROPELLANT CLEANLINESS REQUIREMENTS (6). THE CUPWASHERS IN THE BALANCE CAVITIES ARE ANNEALED (7) AND SECURED PER ASSEMBLY PROCEDURES (4) TO ENSURE DEFECT FREE INSTALLATION AND OPERATION. THE SEALS ARE ASSESSED TO HAVE INFINITE LIFE (8) AND ARE NOT TRACKED BY SERIALIZATION.</p>	<p>(1) NS007715 (2) NS007727 (3) RS007773 (4) AL00814 (5) R55-B578-11 (6) ICD 13M15000 (7) RSD07794 (8) RL00532, CP320R00038</p>

CIL ITEM: B400-09		DESIGN	DOCUMENT REF.
ALL CAUSES:			
TIP RUBBING AT THE INDUCER BLADE TIPS OR IMPELLER SHROUDS WITH STATIONARY COMPONENTS IS MINIMIZED BY THE COMPONENT DYNAMIC BALANCE REQUIREMENTS (1), WHICH REDUCE SYNCHRONOUS TIP DEFLECTIONS. THE MAIN IMPELLER HAS COMPLETED DESIGN VERIFICATION TESTING FOR NATURAL FREQUENCY (2) AND STRESS DISTRIBUTION (3). THE ROTATING ASSEMBLY HAS COMPLETED DESIGN VERIFICATION TESTING FOR NATURAL FREQUENCY (4) AND STRUCTURAL DEFLECTION (5). THE HIGH CYCLE AND LOW CYCLE FATIGUE LIFE OF THE MAIN IMPELLER AND BALANCE PISTON BEALS MEET CEI REQUIREMENTS (6). THE MINIMUM FACTORS OF SAFETY FOR THESE PARTS MEET CEI REQUIREMENTS (7). THE LEFT AND RIGHT BALANCE PISTON SEALS PARENT MATERIAL WAS CLEARED FOR FRACTURE MECHANICS/IDE FLAW GROWTH SINCE THEY ARE NOT FRACTURE CRITICAL PARTS, EXCEPT FOR THE MAIN IMPELLER WHICH WAS CLEARED BY CRITICAL INITIAL FLAW SIZE DETECTABILITY (8). THE CONTROLLER SOFTWARE IS CONFIGURED TO DETECT AND RESPOND TO THE FAILURES IDENTIFIED AND COMMAND A SAFE ENGINE STATE (9). RELISE OF PARTS DURING OVERHAUL ARE CONTROLLED BY THE REQUIREMENTS OF THE OVERHAUL SPECIFICATION (10).			(1) RL00816 (2) RSS-403-48 (3) RSS-403-57A (4) RSS-403-49, RSS-403-44N1 (5) RSS-403-50 (6) RL00532, CP320R0003B (7) RSS-8546-16, CP320R0003B (8) NASA TASK 117 (9) CP405R000B 3.2.3:5.2 (10) RL00874
CIL ITEM: B400-09		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
FAILURE CAUSES A,B:	RS007718 - MAIN IMPELLER RS007741 - TURNING VANE RS007743 - TURNING VANE		RS007718 RS007741 RS007743
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RB0170-153 RB0170-051
		FORGINGS ARE ULTRASONIC AND PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-012 RA0115-116
	HEAT TREAT	HEAT TREAT IS VERIFIED PER SPECIFICATION REQUIREMENTS.	RA0611-020
	ASSEMBLY INTEGRITY	MAXIMUM GROWTH IS VERIFIED BY THE IMPELLER HIGH SPEED SPIN PER DRAWING REQUIREMENTS. A PENETRANT INSPECTION IS PERFORMED ON THE IMPELLER AFTER THE SPIN TEST PER DRAWING REQUIREMENTS.	RS007718 RS007718

CIL ITEM: B400-09		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
FAILURE CAUSE C:	RS007718 - MAIN IMPELLER RS007727 - SEAL RING RS007773 - SEAL RING	VANE DIMENSIONS ARE VERIFIED PER SPECIFICATION REQUIREMENTS.	RL00647
		CLEARANCES BETWEEN IMPELLER BLADES AND TURNING VANES ARE INSPECTED PER DRAWING REQUIREMENTS.	RS007718 RS007741 RS007743
			RS007718 RS007727 RS007773
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER SPECIFICATION AND DRAWING REQUIREMENTS.	RB0170-153 RS007727 RS007773
	ASSEMBLY INTEGRITY	SEALS ARE PENETRANT INSPECTED PER SPECIFICATION REQUIREMENTS.	RA0115-116
ALL CAUSES:	ASSEMBLY INTEGRITY	IMPELLER BALANCE STUDS AND RING TIP DIMENSIONS ARE VERIFIED PER DRAWING REQUIREMENTS.	RS007718 RS007727 RS007773
		BALANCE CAVITY CLEARANCES ARE INSPECTED PER DRAWING AND SPECIFICATION REQUIREMENTS.	RS007701 RS007718 RS007727 RS007773 RL00B14
		THE PUMP SUBASSEMBLIES ARE INSPECTED DURING OVERHAUL PER SPECIFICATION REQUIREMENTS. INSPECTIONS INCLUDE: VISUAL, DIMENSIONAL, PENETRANT, AND REPLACEMENT OF USABLE ITEMS AS APPLICABLE, PER OVERHAUL CLASSIFICATION.	RS007701 RL00874 RA0115-116
		OPERATION/PERFORMANCE IS VERIFIED BY ENGINE HOT FIRE TESTING AND 2ND E & H INSPECTIONS.	RL00050-04 RL00056-06 RL00056-07 RL00461

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CEL ITEM: 8400-D9		INSPECTION AND TEST	
POSSIBLE CAUSES	SIGNIFICANT CHARACTERISTICS	INSPECTION(S)/TEST(S)	DOCUMENT REF.
		TORQUE CHECKS ARE PERFORMED PRIOR TO EACH FLIGHT.	OMRSD V41850.040
		HPOTP MICROSHAFT TRAVEL IS PERFORMED PRIOR TO EACH FLIGHT PER SPECIFICATION REQUIREMENTS.	RLO0050-04 OMRSD V41850.045 RLO1034
		DATA FROM PREVIOUS FLIGHT OR HOT FIRE IS REVIEWED FOR PROPER TURBOPUMP OPERATION/PERFORMANCE. (LAST TEST)	NSFC PLM 1228
<p>FAILURE HISTORY: COMPREHENSIVE FAILURE HISTORY DATA IS MAINTAINED IN THE PROBLEM REPORTING DATABASE (PRMS/PRCA). REFERENCE: NASA LETTER SA21/88/308 AND ROCKETDYNE LETTER 88RC09761.</p>			

OPERATIONAL USE: NOT APPLICABLE.

TABLE 8400. 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	FLAN 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 SIDE NOT ACCESS	CRITICAL INITIAL		COMMENTS
						FLAW SIZE NOT DEFECTABLE REF	NOT DEFECTABLE 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"> 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) 	<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"> 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-8793). 	<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"> 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. 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 (02-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"> FITTINGS ARE LEAK CHECKED FOLLOWING PROOF PRESSURE TEST PER RL00387. LOADS INDUCED BY FABRICATION (WELDING AND PROOF PRESSURE TESTING) ARE HIGHER THAN OPERATIONAL LOADS AND SUFFICIENT TO SCREEN -059 FITTINGS FOR LEAKAGE. 	-171, -181

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