SSME FMEA/CIL
REDUNDANCY SCREEN

Component Group:	**Ducts and Lines**	**Prepared:**	**D. Early**
CIL Item:	**K202-03**	**Approved:**	**T. Nguyen**
Part Number:	**RS007035**	**Approval Date:**	**7/25/00**
Component:	**LPOTP Turbine Drive Duct**	**Change #:**	**1**
FMEA Item:	**K202**	**Directive #:**	**CCBD ME3-01-5638**
Failure Mode:	**Fretting of internal parts.**	**Page:**	**1 of 1**

Phase	Failure / Effect Description	Criticality Hazard Reference
SMC 4.1	Fire from ignition of internal parts. Loss of vehicle. Redundancy Screens: SINGLE POINT FAILURE: N/A	1 ME-C3S, ME-C3M, ME-C3A,C

SSME EA/CIL DESIGN

Component Group:	**Ducts and Lines**	**Prepared:**	**D. Early**
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Design / Document Reference

FAILURE CAUSE: A: Relative motion of: Inlet sleeve/Stabilizer, Outlet sleeve/Stabilizer.

THE STABILIZER (1), AND INLET/OUTLET SLEEVES (1) ARE MANUFACTURED UTILIZING INCONEL 718. ALL MATERIALS USED IN THE DUCT FABRICATION ARE LOX COMPATIBLE (2). INSTALLATION IS CONTROLLED FOR ANGULARITY AND OFFSET (3). CONTACTING ROTATING SURFACES HAVE CLOSE TOLERANCE REQUIREMENTS TO MAINTAIN EVEN LOADING. DURING OPERATION, PRESSURE SEPARATING LOADS APPLIED TO THE BELLOWS MAINTAIN A CONSTANT LOADING FORCE ON THE MOVING PARTS. MOVING PARTS INCORPORATE RADII ON ENDS TO PREVENT NARROW CONTACT POINTS AND LOADING THAT MAY CAUSE HEAT GENERATION. HEAT TREAT DEVELOPS A HARD SURFACE FINISH REDUCING PARTICLE GENERATION AND SURFACE STRAINS. DRY-FILM LUBRICANT IS USED TO REDUCE FRICTION, AND PARTICLE GENERATION. TOLERANCE CONTROLS DECREASE LUBRICANT WEAR, INCREASING LIFE. INTERNAL STABLIZER REDUCE TURBULENCE OVER THE BELLOWS ASSEMBLY AND PROVIDES LAMINAR FLOW WHICH INHIBITS FLOW INDUCED VIBRATIONS. THE FLEX JOINT HAS COMPLETED BENDING MOMENT, FLEXURAL ENDURANCE, VIBRATION, AND SECTIONING DVS TESTING (4). THE VISUAL BELLOWS INSPECTION, HE MASS LEAK, AND ACCESSIBLE BELLOWS WELDS DYE PENETRANT INSPECTION TESTS HAVE BEEN COMPLETED ON ENGINE 2010 (5) AND 2014 (6) FLEX JOINTS. NO ANOMALIES WERE FOUND. THE 2010 DUCT HAD ACCUMULATED 19,903 SECONDS AND 65 STARTS. THE 2014 DUCT HAD ACCUMULATED 15,346 SECONDS AND 53 STARTS.

(1) RS008641, RS008661; (2) RSS-8582, RSS-8575; (3) I.L. 0126-8066; (4) RSS-511-13; (5) CD#2-0152; (6) CD#2-87-0031

SSME FMEA/CIL
INSPECTION AND TEST

Component Group:	**Ducts and Lines**	**Prepared:**	**D. Early**
CIL Item:	**K202-03**	**Approved:**	**T. Nguyen**
Part Number:	**RS007035**	**Approval Date:**	**7/25/00**
Component:	**LPOTP Turbine Drive Duct**	**Change #:**	**1**
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Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Reference
A	SLEEVE/STABILIZER SLEEVE/STABILIZER		RS008661 RS008641
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS008661 RS008641
	HEAT TREAT	HEAT TREAT IS VERIFIED PER SPECIFICATION AND DRAWING REQUIREMENTS.	RA0611-020 RS008661 RS008641
	SURFACE FINISH	DRY FILM LUBRICANT IS VERIFIED PER DRAWING REQUIREMENTS.	RS008661 RS008641
	ASSEMBLY INTEGRITY	INNER RADII ARE INSPECTED PER DRAWING REQUIREMENTS.	RS008661 RS008641
	FLEX JOINT FLEX JOINT		RS008641 RS008661
	ASSEMBLY INTEGRITY	THE FLEX JOINT IS GIMBAL TESTED PER DRAWING REQUIREMENTS.	RS008641 RS008661
		THE FLEX JOINT IS ACCEPTANCE TESTED PER SPECIFICATION REQUIREMENTS. (LAST TEST)	RL00210 RL00211
	DUCT		RS007035
	COMPONENT CLEANLINESS	ASSEMBLY IS VERIFIED CLEAN PER SPECIFICATION REQUIREMENTS.	RA1610-002 RA1610-004

Failure History: Comprehensive failure history data is maintained in the Problem Reporting database (PRAMS/PRACA)
Reference: NASA letter SA21/88/308 and Rocketdyne letter 88RC09761.

Operational Use: Not Applicable.

SSME EA/CIL
WELD JOINTS

Component Group: Ducts and Lines
CIL Item: K202
Part Number: RS007035
Component: LPOTP Turbine Drive Duct
FMEA Item: K202

Prepared: D. Early
Approved: T. Nguyen
Approval Date: 7/25/00
Change #: 1
Directive #: CCBD ME3-01-5638
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Component	Basic Part Number	Weld Number	Weld Type	Class	Root Side Not Access	Critical Initial Flaw Size Not Detectable HCF	LCF	Comments
DUCT	RS007035	1	GTAW	I		X		
DUCT	RS007035	2	GTAW	I				
DUCT	RS007035	3,4	GTAW	I	X			
DUCT	RS007035	5	GTAW	I				
DUCT	RS007035	7-13	GTAW	I				
DUCT	RS007035	14	GTAW	I	X	X		
DUCT	RS007035	15	GTAW	I				
DUCT	RS007035	16	GTAW	I	X			
DUCT	RS007035	17	GTAW	I				
DUCT	RS007035	18,20,21	GTAW	I				
DUCT	RS007035	19	GTAW	I	X	X		
DUCT	RS007035	22	GTAW	I	X			
FLEX JOINT	RS008641	1-4	EBW	I	X			
FLEX JOINT	RS008641	5,6	GTAW	I	X			
FLEX JOINT	RS008641	16 PLCS	GTAW	III	X			
FLEX JOINT	RS008661	1-4	EBW	I	X			
FLEX JOINT	RS008661	4 PLCS	EBW	I	X			
FLEX JOINT	RS008661	5,6	GTAW	I	X			
FLEX JOINT	RS008661	16 PLCS	GTAW	III	X			
BELLOWS	RS008895	1-4	GTAW	I				
BELLOWS	RS008895	5,6	EBW	I				
BELLOWS	RS008896	1-4	GTAW	I				
BELLOWS	RS008896	5,6	EBW	I				