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NONELECTRONIC PARTS RELIABILITY DATA

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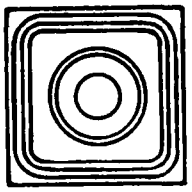

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NONELECTRONIC PARTS RELIABILITY DATA

Prepared by:

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Under Contract to:

Rome Air Development Center
Griffiss AFB, NY 13441

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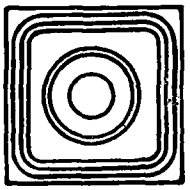

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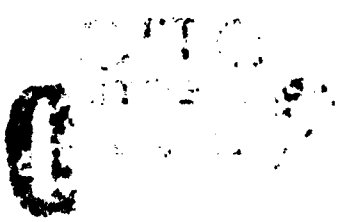

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Failure Modes and Mechanisms
Electromechanical Component
Mechanical Parts

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report, organized in four major sections, presents reliability information based on field operation, dormant state and test data for more than 250 major nonelectronic part types. The four sections are Generic Data, Detailed Data, Application Data, and Failure Modes and Mechanisms. Each device type contains reliability information in relation to the specific operational environments.

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PREFACE

This is the second edition of a series of data publications dealing with nonelectronic reliability at the part level. NPRD-2 updates NPRD-1 by expanding the scope and quality of data.

The data presented in these reliability publications are intended to compliment such documents as MIL-HDBK-217 and MIL-STD-883. The user is cautioned, however, that the data contained herein may not be used in lieu of contractually cited references. It should also be noted that the data contained in this document is failure data, not part replacement data. Only verified failures were used in the calculations of the failure rates.

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TABLE OF CONTENTS

		Page
INTRODUCTION		1
SECTION 1:	NONELECTRONIC GENERIC FAILURE RATES	3
	Definitions of Terms	5
	Index for Generic Failure Rates	10
	Generic Failure Rate Tables	21
SECTION 2:	NONELECTRONIC PARTS DETAILED DATA	117
	Nonelectronic Parts Detailed Data	119
	Index for Detailed Data	121
	Detailed Data Tables	125
SECTION 3:	NONELECTRONIC PARTS DATA FROM COMMERCIAL EQUIPMENT APPLICATIONS	209
	Nonelectronic Parts Data From Commercial Equipment Applications	211
	Index for Commercial Equipment Application Data	213
	Commercial Equipment Application Data Tables	215
SECTION 4:	FAILURE MODES AND MECHANISMS	229
	Operational Failure Modes and Mechanisms	231
	Batteries	231
	Lead-Acid	231
	Nickel-Cadmium	232
	Bearings	233
	Circuit Breakers	234
	Connectors	234
	Coolant Hose	235
	Electron Tubes	236
	Fuses	236

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TABLE OF CONTENTS (Cont'd)

		Page
SECTION 4:	FAILURE MODES AND MECHANISMS (Cont'd)	
	Gaskets and Seals	237
	Gyroscope	238
	IC Sockets	239
	Motors	241
	Printed Circuit Board	241
	Pumps	243
	Hydraulic	243
	Pneumatic	244
	Quick Disconnect Couplings	244
	Relays	245
	Armature	245
	Reed	247
	Solder Connections	248
	Switches	249
	Valves	250
	Dormant Failure Modes and Mechanisms	252
	Bearings	252
	Connectors, General	252
	Clutches	252
	Gyros	252
	Magnetrons	253
	DC Motors	253
	Relays, Latching	253
	Relays, Nonlatching	253
	Seals	253
	Switches, Sensitive	254
	Transformer	254
	Part Failure Mode Distribution	255
APPENDIX:	ADDITIONAL RAC SERVICES	259

INTRODUCTION

This nonelectronic reliability data publication provides failure rate and failure mode information for mechanical, electromechanical, electrical, pneumatic, hydraulic and rotating parts. The data utilized in the development of this publication were collected by the RAC and represent equipment level experience under field conditions in military, industrial and commercial applications.

It has been necessary to accept the assumption that the failures of nonelectronic parts follow the exponential distribution; that is, such parts display a constant failure rate. This assumption is necessary due to the virtual absence of data containing individual times or cycles to failure.

Section 1 of this publication provides summarized generic part level failure rates. Section 2 consists of detailed entries by part type and environmental application in unsummarized form. In Section 3, failure rates for parts unique to or frequently used in computer peripherals, point of sale equipment, and test instruments are tabulated. Section 4 presents the distribution of failure modes for a number of major nonelectronic part families.

NONELECTRONIC PARTS RELIABILITY DATA

SECTION 1

NONELECTRONIC GENERIC FAILURE RATES

Section 1

DEFINITIONS OF TERMS

This section presents summaries of field reliability experience for nonelectronic parts. The summaries are presented in alphabetical order by major family classes and alphabetically by type within each family class.

A careful reading of the description of the presentation format and entry codes employed will aid the user of this publication. The circled numbers shown in the tabulation form below are referenced to the explanatory text which follows.

PART CLASS: (1)

TYPE: (2)

			FAILURE RATE/10^6 HOURS						
ENVIRONMENT	APPLICATION		$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL		NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (10^6)
	MIL.	COML.			LOWER	UPPER			
(3)	(4)		(5)	(6)	(7)		(8)	(9)	(10)

(1) PART CLASS — A major family of parts having or providing the same function.

(2) TYPE: — The identification of the part type.

(3) ENVIRONMENT: — The coded entries are as follows:

DOR - Dormant — The state wherein a component or equipment is connected to a system in the normal operational configuration and experiences below normal and/or periodic operational stresses and environmental stresses. The system may be in a dormant state for prolonged periods (up to five years or more) before being used in a mission.

DEFINITION OF TERMS (Cont'd)

SAT - Satellite	Earth orbital, approaches benign conditions without access for maintenance. Vehicle neither under powered flight nor in atmosphere re-entry.
GRF - Ground Fixed	Conditions less than ideal to include installation in permanent racks with adequate cooling air, maintenance by military personnel and possible installation in unheated buildings.
GRM - Ground Mobile	Conditions more severe than GRF, mostly for vibration and shock. Cooling air supply may also be more limited, and maintenance less uniform.
A - Airborne	The most generalized aircraft conditions.
AI - Airborne Inhabited	General conditions in inhabited areas without environmental extremes.
AIT - Airborne Inhabited Transport	Conditions in inhabited areas of subsonic aircraft such as transport, cargo, heavy bomber, and patrol.
AIF - Airborne Inhabited Fighter	The conditions to be found in the cockpit area of fighters and interceptors.

DEFINITIONS OF TERMS (Cont'd)

AU - Airborne Uninhabited	General conditions typical of such areas as cargo storage areas, wing and tail installations where extreme pressure, temperature and vibration cycling exist; also, may be aggravated by contamination from oil, hydraulic fluid and engine exhaust.
AUT - Airborne Uninhabited Transport	Conditions in uninhabited areas of subsonic aircraft such as transport, cargo, heavy bomber, and patrol.
AUF - Airborne Uninhabited Fighter	Conditions in uninhabited areas of fighters and interceptors.
HEL - Helicopter	Conditions most severe for vibration, temperature and humidity.
SHS - Ship Sheltered	Surface conditions similar to GRF but subject to occasional high shock and vibration.
SHU - Ship Unsheltered	Normal surface shipboard conditions but with repetitive high levels of shock and vibration.
SUB - Submarine	Conditions normal to operation aboard a submerged vessel. Temperature and humidity controlled.

DEFINITIONS OF TERMS (Cont'd)

MIS - Missile Launch	Severe conditions of noise, vibration and other environments related to missile launch, and space vehicle boost into orbit, vehicle re-entry and landing by parachute. Conditions may also apply to installation near main rocket engines during launch operations.

④ **APPLICATION:**

MIL. (Military)	Data resulting from a military or satellite application.
COML. (Commercial)	Data resulting from a commercial or industrial application.
N/A	Not applicable. The nature of the hardware application is unknown.

⑤ $\hat{\lambda}$ — The maximum likelihood estimator when the exponential distribution is assumed.

⑥ **60% UPPER SINGLE-SIDED CONFIDENCE** — The 60% upper single-sided confidence limit estimate of the failure rate, computed from the Chi-square distribution, is provided for those entries for which zero failures have been recorded.

DEFINITION OF TERMS (Cont'd)

⑦ 60% CONFIDENCE INTERVAL, LOWER AND UPPER: The lower and upper limits of the 60% confidence interval about $\hat{\lambda}$ computed from the Chi-square distribution.

⑧ NUMBER OF RECORDS: The number of records merged to provide the failure rate information. The merged records represent only those accepted by a test statistic based on the F-distribution at the 5% level.

⑨ NUMBER FAILED: The total number of failures observed in the merged records.

⑩ OPERATING HOURS ($x10^6$): The total hours at the part level. Derived by multiplying the part population by the equipment hours of operation observed during the period covered by each record. An asterisk (*) in the $\hat{\lambda}$ column indicates that, for this entry, the failure rate information is given in terms of per 10^6 cycles and the total operating hours in the last column should be read as cycles x 10^6.

INDEX FOR GENERIC FAILURE RATES

	Page
Accelerometer	21
Angular	21
General	21
Linear	21
Pendulum	22
Accumulator	22
General	22
Hydraulic	23
Actuator	23
Explosive	23
General	24
Hydraulic	24
Linear	25
Rotary	25
Battery	26
Lead Acid	26
Mercury	26
Nickel Cadmium	26
Non-Rechargeable	27
Rechargeable	27
Bearing	28
Ball	28
Bushing	28
General	29
Needle	29
Roller	30
Spherical	30

INDEX FOR GENERIC FAILURE RATES (Cont'd)

	Page
Bellows	31
Diaphragm Burst	31
Explosive	31
General	31
Brake	32
General	32
Magnetic	32
Brush	33
Electric	33
Circuit Board	33
Plated Through Holes	33
Printed Circuit Board	34
Single Layer	34
Multilayer	34
Terminal	34
Circuit Protection Device	35
Fuse	35
Fuse Holder	35
General	36
Molded Case Circuit Breaker	36
Power Switch, Circuit Breaker	37
Spark Gap, Surge Protection	37
Undervoltage	37
Compressor	38
Air	38
General	38

INDEX FOR GENETIC FAILURE RATES (Cont'd)

	Page
Connection	39
Solder Connection, General	39
Solder, Hand Lap	39
Solder, Wave	39
Wirewrap	39
Connector	40
Circular	40
Coaxial	40
General	41
Phone	41
Pin	42
Power	42
Printed Circuit Board	43
Radio Frequency	43
Rectangular	44
Test Jack	44
Controls and Instruments	45
Air Pressure Gauge	45
Altimeter	45
Ammeter	46
Compass	46
Indicator	47
Magentic Sensing	47
Rate of Flow Instrument	48
Tachometer	48

INDEX FOR GENERIC FAILURE RATES (Cont'd)

	Page
Emergency Light	48
General	48
Fan	49
Axial	49
Centrifugal	49
General	50
Filter	50
Fluid	50
Gas	51
General	51
Gasket and Seal	52
Gasket, Shielding, RFI	52
General	52
O-Ring	53
Packing	53
Generator	54
AC	54
DC	54
Diesel Engine	54
Gas Engine	55
General	55
Hot Gas	55
Motor/Generator	56
Turbine/Generator	56

INDEX FOR GENERIC FAILURE RATES (Cont'd)

	Page
Gyroscope	56
Directional	57
General	57
Rate Integrating	58
Heater	58
Electric, General	58
Electric, Space	59
General	59
Heat Exchanger	60
General	60
Hose	60
Fittings, General	60
Hydraulic	61
Lamp	61
Incandescent	61
LED	62
Neon	62
Manifold	62
General	62
Mechanical Device	63
Clutch	63
Coupling	63
Gear	63

INDEX FOR GENERIC FAILURE RATES (Cont'd)

	Page
Mechanical Device (Cont'd)	
Gear Assembly	64
Gear Shaft	64
Joy Stick Assembly	64
Mechanism, Power Transmittal	65
Speed Drive	65
Spring	66
Miscellaneous	66
Coil, Cooling-Chilled Water	66
Engine	66
RF Cable Assembly	67
Safe & Arm Device	67
Motor	67
Fractional H. P.	67
Full H. P.	68
General, A. C.	68
General, D. C.	69
Induction	69
PM	70
Sensor	70
Solenoid	70
Step	71
Torque	71
Pump	71
Boiler Feed	71
Centrifugal	72
Coolant	72

INDEX FOR GENERIC FAILURE RATES (Cont'd)

	Page
Pump (Cont'd)	
Electric Motor Driven	72
Engine Driven	73
Fixed Displacement	73
Fuel	74
Geroter	74
Hydraulic	75
Hydraulic Motor Driven	75
Impeller	76
Oil	76
Turbine Driven	77
Vacuum	77
Variable Displacement	77
Water	78
Regulator	78
Fuel	78
General	78
Oxygen Demand	79
Pressure	79
Tension	79
Thermostat	80
Voltage	80
Relay	81
Armature	81
Coaxial	81
Crystal Can	82

INDEX FOR GENERIC FAILURE RATES (Cont'd)

	Page
Relay (Cont'd)	
Current Sensitive	82
General	83
High Voltage	83
Latching	84
Motor Driven	84
Power	85
Reed	85
Thermal	86
Time Delay	86
Rotary Joint	87
Microwave	87
Sensor	87
General	87
Shock Absorber	88
General	88
General, Mount	88
Isolator	89
Slip Ring Assembly	89
General	89
Socket	90
Dual-In-Line (Per Pin)	90
High Power Tube	90
Lamp	90
Relay	90

INDEX FOR GENERIC FAILURE RATES (Cont'd)

	Page
Solenoid	91
General	91
Sprinkler Head	91
General	91
Switch	92
Centrifugal	92
Coaxial	92
Dual-In-Line (DIP)	92
Flow	93
General	93
Humidity	93
Inertial	94
Key	94
Liquid Level	94
Pendant-Hoist	95
Pressure	95
Push Button	96
Reed	96
Rotary	97
Sensitive	97
Shaft	98
Snap Slide	98
Stepping	98
Thermal	99
Thermostat	99
Thumb Wheel	100
Toggle	100
Wave Guide	101

INDEX FOR GENERIC FAILURE RATES (Cont'd)

	Page
Synchro	101
Differential	101
General	102
Receiver, Transmitter	102
Resolver	103
Tank	103
Fuel Cell	103
General	104
Oil	104
Pressure Vessel	105
Storage	105
Time-Totalizing Meter	106
Counters	106
Timer, Electro-Mechanical	106
Transducer	106
Fluid Flow	106
General	107
Motional	107
Pressure	108
Tach Generator	108
Temperature	109
Valve	109
Ball	109
Butterfly	109
Check	110
Diaphragm	110

INDEX FOR GENERIC FAILURE RATES (Cont'd)

	Page
Valve (Cont'd)	
Fuel	111
Gate	111
General	112
Globe	112
Hydraulic	113
Needle	113
Oil	114
Plug	114
Pneumatic	114
Relief	115
Servo	115
Solenoid	116
Water	116

GENERIC FAILURE RATE TABLES

PART CLASS: ACCELEROMETER

TYPE: ANGULAR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.177	---	---	3	0	5.182

PART CLASS: ACCELEROMETER

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.419	---	0.389	0.452	6	138	329.240
SAT	X		---	8.179	---	---	2	0	0.112
GRM	X		35.078	---	33.373	36.883	3	303	8.638
AI	X		153.749	---	146.965	160.901	1	367	2.387
AI		X	10.796	---	7.535	15.408	2	8	0.741

PART CLASS: ACCELEROMETER

TYPE: LINEAR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.324	---	---	4	0	2.826
AI	X		525.641	---	476.385	580.671	1	82	0.156

PART CLASS: ACCELEROMETER

TYPE: PENDULUM

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		1.923	---	1.449	2.554	2	12	6.239

PART CLASS: ACCUMULATOR

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.324	---	0.276	0.381	5	33	102.003
SAT	X		---	1.693	---	---	1	0	0.541
GRM	X		29.851	---	12.143	64.524	1	2	0.067
AU	X		0.229	---	0.193	0.272	1	30	131.000
AU		X	193.097	---	181.738	205.280	3	207	1.072
HEL	X		500.000	---	338.580	733.614	1	7	0.014

PART CLASS: ACCUMULATOR

TYPE: HYDRAULIC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.531	---	0.513	0.550	6	605	1,138.442
SAT	X		1.504	---	1.352	1.674	1	71	47.220
GRM	X		55.182	---	53.396	57.038	2	681	12.341
GRM		X	13.739	---	12.638	14.949	1	112	8.152
AU	X		156.365	---	152.606	160.234	2	1232	7.879
HEL	X		80.357	---	70.171	92.180	1	45	0.560

PART CLASS: ACTUATOR

TYPE: EXPLOSIVE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR		X	0.063	---	0.048	0.082	1	13	207.100
GRF	X		218.765	---	156.468	305.193	1	9	0.041

PART CLASS: ACTUATOR

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.434	---	---	1	0	2.110
AUT		X	101.429	---	98.806	104.134	1	1065	10.500

PART CLASS: ACTUATOR

TYPE: HYDRAULIC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.290	---	0.057	0.880	2	1	3.454

PART CLASS: ACTUATOR

TYPE: LINEAR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	N/A	N/A	0.168	---	0.142	0.200	12	29	172.234
GRF	X		14.398	---	13.212	15.705	9	106	7.362
GRM	X		50.459	---	37.464	67.948	1	11	0.218
A	X		174.767	---	170.328	179.342	7	1104	6.317
AUT		X	69.801	---	68.195	71.452	5	1345	19.269
AUF	X		48.132	---	43.446	53.389	1	76	1.579
HEL	X		370.370	---	270.321	506.931	2	10	0.027
HEL		X	159.459	---	147.017	173.109	4	118	0.740
SHS	X		10.707	---	6.622	17.014	1	5	0.467

PART CLASS: ACTUATOR

TYPE: ROTARY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	X		405.405	---	382.536	429.865	1	225	0.555
AUT		X	87.935	---	81.374	95.103	1	129	1.467
SUB	X		---	0.484	---	---	1	0	1.893

PART CLASS: BATTERY

TYPE: LEAD ACID

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	0.440	---	0.298	0.645	2	7	15.917

PART CLASS: BATTERY

TYPE: MERCURY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	0.742	---	0.559	0.986	4	12	16.164

PART CLASS: BATTERY

TYPE: NICKEL CADMIUM

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		0.047/CELL	---	0.027	0.078	2	4	85.862
GRF		X	0.251/CELL	---	0.235	0.268	9	171	681.593

PART CLASS: BATTERY

TYPE: NON-RECHARGEABLE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		333.333	---	66.047	1013.579	1	1	0.003

PART CLASS: BATTERY

TYPE: RECHARGEABLE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.016	---	0.013	0.022	3	12	732.564
GRF	X		1.498	---	1.046	2.138	1	8	5.339
GRM	X		15.748	---	6.406	34.040	2	2	0.127
A	X		348.852	---	342.921	355.955	3	2810	8.055
HEL	X		676.768	---	636.364	720.148	2	201	0.297

PART CLASS: BEARING

TYPE: BALL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.010	---	0.007	0.014	3	9	903.040
SAT	X		---	0.688	---	---	2	0	1.332
GRF	X		1.148	---	1.001	1.319	8	44	38.320
GRF		X	13.975	---	10.356	19.410	1	9	0.644
GRM	X		0.094	---	0.054	0.159	1	4	42.554
A	X		5.133	---	4.787	5.507	2	158	30.784
A		X	1.372	---	0.272	4.171	1	1	0.729
AI	X		4.829	---	3.799	6.148	1	16	3.313
HEL	X		13.398	---	10.963	16.408	2	22	1.642
SHS	X		---	0.053	---	---	2	0	17.156
SUB	X		4.728	---	1.923	10.220	1	2	0.423

PART CLASS: BEARING

TYPE: BUSHING

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	---	0.046	---	---	7	0	19.922
A	X		---	0.609	---	---	1	0	1.503
A		X	---	1.020	---	---	1	0	0.898
HEL	X		21.146	---	20.148	22.202	2	321	15.180

PART CLASS: BEARING

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	4.068	---	3.200	5.180	2	16	3.933
GRF	X		1.378	---	1.084	1.754	1	16	11.614
GRM		X	21.921	---	18.721	25.719	1	34	1.551
A	X		8.260	---	7.828	8.720	1	261	31.598
AUT		X	11.468	---	7.093	18.224	1	5	0.436
AUF	X		3.101	---	1.261	6.702	1	2	0.645
HEL	X		12.591	---	11.735	13.520	1	155	12.310

PART CLASS: BEARING

TYPE: NEEDLE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A		X	---	2.718	---	---	1	0	0.337

PART CLASS: BEARING

TYPE: ROLLER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.280	---	0.195	0.400	1	8	28.562
GRM		X	207.328	---	195.811	219.633	1	232	1.119
A	X		0.863	---	0.641	1.162	1	11	12.745
A		X	---	0.628	---	---	1	0	1.459
AU	X		---	0.037	---	---	1	0	24.570
SHS	X		1.206	---	0.693	2.039	1	4	3.317
HEL	X		24.000	---	15.634	36.457	1	6	0.250

PART CLASS: BEARING

TYPE: SPHERICAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		0.206	---	0.169	0.252	1	22	106.731
A	X		8.260	---	7.828	8.720	1	261	31.598
AUT		X	9.000	---	7.524	10.787	1	27	3.000
HEL	X		53.220	---	49.623	57.119	1	157	2.950

PART CLASS: BELLOWS

TYPE: DIAPHRAGM BURST

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	1.384	---	---	1	0	0.662

PART CLASS: BELLOWS

TYPE: EXPLOSIVE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.014	---	---	1	0	65.600

PART CLASS: BELLOWS

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.068	---	---	1	0	13.520
GRF	X		---	65.429	---	---	1	0	0.014

PART CLASS: BRAKE

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		4.274	---	0.847	12.995	1	1	0.234
A	X		766.250	---	760.349	772.207	1	11,965	15.615
AU	X		213.143	---	209.249	217.123	1	2,131	9.998
AUT		X	11.570	---	7.835	16.976	3	7	0.605
HEL	X		100.000	---	94.333	106.062	1	223	2.230

PART CLASS: BRAKE

TYPE: MAGNETIC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		11.976	---	6.877	20.245	1	4	0.334
HEL	X		241.540	---	227.332	256.780	3	207	0.857

PART CLASS: BRUSH

TYPE: ELECTRIC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	X		4.749	---	4.461	5.058	1	195	41.062
SHS	X		---	0.152	---	---	1	0	6.030

PART CLASS: CIRCUIT BOARD

TYPE: PLATED THROUGH HOLES

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (10^5)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.000251	---	---	1	0	3643.900
DOR		X	---	0.000112	---	---	1	0	8183.538
SAT	X		---	0.000278	---	---	1	0	3298.700
GRM		X	0.000219	---	0.000049	0.000655	1	1	4577.251
AIT	X		0.000110	---	0.000045	0.000233	4	2	18444.416
AIF	X		0.000702	---	0.000474	0.001030	4	7	9974.127

PART CLASS: CIRCUIT BOARD

TYPE: PRINTED CIRCUIT BOARD, SINGLE LAYER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.826	---	0.184	2.479	1	1	1.210
GRF		X	0.163	---	0.036	0.490	10	1	6.119
GRF	X		---	0.017	---	---	1	0	54.700
GRM		X	0.036	---	0.007	0.110	9	1	27.420
A	X		0.004	---	0.001	0.012	1	1	249.000
AIT		X	1.849	---	0.412	5.545	14	1	0.541
AIF	X		5.091	---	1.138	15.306	22	1	0.196
SHS	X		1.682	---	1.203	2.336	1	9	5.350

PART CLASS: CIRCUIT BOARD

TYPE: PRINTED CIRCUIT BOARD, MULTILAYER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.083	---	0.017	0.254	134	1	11.985
GRM	X		0.131	---	0.100	0.181	213	13	99.608

PART CLASS: CIRCUIT BOARD

TYPE: TERMINAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	X		4.946	---	4.612	5.307	1	158	31.948
A		X	---	32.714	---	---	1	0	0.028
AIF	X		---	0.335	---	---	2	0	2.730

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: FUSE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.423	---	---	2	0	2.168
SAT	X		---	0.238	---	---	1	0	3.850
GRF	X		0.136	---	0.122	0.151	1	72	529.168
AIF	X		9.980	---	2.226	29.994	1	1	0.100
HEL		X	200.000	---	114.852	338.090	1	4	0.020
SHS	X		0.124	---	0.080	0.188	1	6	48.577

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: FUSE HOLDER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		0.016	---	0.007	0.035	2	2	124.181
AIF	X		---	9.142	---	---	1	0	0.100
SHS	X		---	0.021	---	---	1	0	44.480

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		44.758	---	25.691	74.969	2	4	8.937
GRF	X		0.683	---	0.608	0.767	19	61	89.359
GRM	X		0.748	---	0.631	0.887	2	30	40.125
A	X		1.967	---	1.858	2.082	1	236	119.998
A		X	---	10.905	---	---	1	0	0.084
HEL		X	28.571	---	11.622	61.759	1	2	0.070
SHS	X		0.268	---	0.053	0.814	2	1	3.737
SUB	X		41.565	---	37.285	46.398	2	68	1.636

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: MOLDED CASE CIRCUIT BREAKER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.107	---	0.932	1.318	14	29	26.186

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: POWER SWITCH, CIRCUIT BREAKER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		2.879	---	1.876	4.373	3	6	2.083

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: SPARK GAP, SURGE PROTECTION

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.012	---	0.002	0.036	2	1	84.790

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: UNDERVOLTAGE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.870	---	1.305	2.669	2	8	4.278

PART CLASS: COMPRESSOR

TYPE: AIR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		5.959	---	4.793	7.424	1	19	3.188
SHS	X		720.694	---	633.177	821.659	1	49	0.067

PART CLASS: COMPRESSOR

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	3.742	---	---	1	0	0.244
AU	X		1992.793	---	1942.226	2044.922	1	1106	0.555

PART CLASS: CONNECTION

TYPE: GENERAL SOLDER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.000151	---	---	1	0	6101.826
GRF	X		0.000644	---	0.000497	0.000835	1	14	21740.000

PART CLASS: CONNECTION

TYPE: HAND LAP, SOLDER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.000190	---	0.000139	0.000259	1	10	52594.180
SAT	X		---	0.000025	---	---	1	0	39610.000

PART CLASS: CONNECTION

TYPE: WAVE, SOLDER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SHS	X		0.000069		0.0000397	0.00012	1	4	57835.239

PART CLASS: CONNECTION

TYPE: WIRE WRAP

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.000355	---	0.000231	0.000538	1	6	16899.888

PART CLASS: CONNECTOR

TYPE: CIRCULAR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.026	---	---	1	0	34.627
SAT	X		---	0.016	---	---	10	0	57.509
GRF	X		0.366	---	0.338	0.395	31	130	355.656
GRM	X		---	16.357	---	---	5	0	0.056
A	X		0.839	---	0.798	0.882	2	308	367.203
AI	X		---	3.664	---	---	15	0	0.250
AU	X		1.248	---	1.181	1.303	3	257	205.916
AUF	X		---	0.920	---	---	5	0	0.996
SHS	X		0.071	---	0.055	0.092	81	14	197.465
SUB	X		---	1.196	---	---	59	0	0.766

PART CLASS: CONNECTOR

TYPE: COAXIAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		0.023	---	0.005	0.070	12	1	43.262
GRF	X		0.187	---	0.164	0.215	31	45	240.318
GRF		X	---	0.019	---	---	5	0	48.700
A	N/A	N/A	0.672	---	0.610	0.740	5	86	128.000
HEL		X	10.000	---	1.981	30.407	1	1	0.100
SHS	X		0.017	---	0.003	0.053	6	1	57.253

PART CLASS: CONNECTOR

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.001	---	0.001	0.002	10	17	11,624.494
SAT	X		---	0.023	---	---	1	0	40.000
GRF	X		0.036	---	0.024	0.053	14	7	195.446
GRF		X	0.689	---	0.154	2.067	1	1	1.451
GRM	X		---	6.596	---	---	3	0	0.139
GRM		X	---	0.271	---	---	1	0	3.380
A		X	0.351	---	0.334	0.369	1	305	868.805
AI	X		0.130	---	0.026	0.394	42	1	7.717
AI		X	---	3.915	---	---	15	0	0.234
AUT		X	---	0.387	---	---	5	0	2.368
HEL	X		10.270	---	8.261	12.794	1	19	1.850
SUB	X		0.051	---	0.041	0.063	64	20	391.136

PART CLASS: CONNECTOR

TYPE: PHONE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SHS	X		---	1.990	---	---	1	0	0.460

PART CLASS: CONNECTOR

TYPE: PIN

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.0003200	---	---	1	0	2798.310
SAT	X		---	0.0004200	---	---	2	0	2208.930
GRF	X		---	0.0010000	---	---	1	0	1514.246
GRM	X		0.011	---	0.007	0.017	1	6	529.200
AIT	X		---	0.0000904	---	---	1	0	10130.000

PART CLASS: CONNECTOR

TYPE: POWER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	0.136	---	---	1	0	6.740
AIF	X		3.194	---	1.299	6.903	4	2	0.626

PART CLASS: CONNECTOR

TYPE: PRINTED CIRCUIT BOARD

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.065	---	---	1	0	14.140
SAT	X		---	0.044	---	---	2	0	20.797
GRF	X		---	0.031	---	---	12	0	3.044
GRM	X		---	0.025	---	---	2	0	36.745
AI	X		0.171	---	0.308	0.512	2	1	5.860
AIF	X		---	0.026	---	---	19	0	34.890
SHS	X		0.011	---	0.005	0.024	2	2	176.678
SUB	X		---	12.053	---	---	4	0	0.076

PART CLASS: CONNECTOR

TYPE: RADIO FREQUENCY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.062	---	0.052	0.074	1	27	434.534

PART CLASS: CONNECTOR

TYPE: RECTANGULAR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		---	0.402	---	---	3	0	2.279
GRF	X		0.097	---	0.060	0.155	12	5	51.315
GRF		X	---	0.007	---	---	1	0	140.018
A	X		1.087	---	0.988	1.200	5	85	78.128
A		X	1.273	---	1.156	1.404	1	85	66.762
AI	X		---	0.554	---	---	19	0	1.653
SUB	X		---	3.084	---	---	16	0	0.297

PART CLASS: CONNECTOR

TYPE: TEST JACK

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.003	---	0.002	0.004	6	14	4515.305
AIF	X		---	0.119	---	---	1	0	7.715
SHS	X		0.011	---	0.008	0.015	1	9	8444.861

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: AIR PRESSURE GAUGE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		2.611	---	2.251	3.035	4	38	14.551
GRM	X		1.020	---	0.796	1.311	2	15	14.699
AI	X		35.185	---	28.300	43.830	1	19	0.540

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: ALTIMETER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
AI	N/A	N/A	130.506	---	121.768	139.967	4	160	1.226
HEL	X		269.608	---	254.226	286.071	3	220	0.816

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: AMMETER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		0.336	---	0.298	0.450	1	21	57.408
GRM		X	26.018	---	21.394	31.708	1	23	0.884
SHS	X		7.491	---	1.484	22.777	2	1	0.133
SUB	X		97.096	---	93.220	101.162	1	448	4.614

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: COMPASS

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
AIT		X	36.090	---	29.812	43.782	3	24	0.665
HEL	X		252.941	---	220.137	291.147	1	43	0.170

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: INDICATOR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		---	0.904	---	---	1	0	1.013
GRF	X		3.907	---	3.585	4.262	4	106	27.130
GRM		X	70.413	---	64.696	76.709	2	109	1.548
AI	X		165.406	---	163.744	167.087	1	7039	42.556
AIT		X	163.747	---	160.608	166.960	8	1935	11.817
HEL	X		166.956	---	162.167	171.912	18	866	5.187

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: MAGNETIC SENSING

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		---	1.825	---	---	2	0	0.502
AIT		X	246.429	---	221.241	274.848	1	69	0.280

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: RATE OF FLOW INSTRUMENT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		8.363	---	7.209	9.720	4	38	4.543

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: TACHOMETER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		10.682	---	9.675	11.808	1	81	7.583
AI	N/A	N/A	23.632	---	18.991	29.396	2	19	0.804
HEL	X		37.500	---	26.821	52.315	2	9	0.240
SUB	X		2.298	---	1.319	3.884	1	4	1.741

PART CLASS: EMERGENCY LIGHT

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.966	---	1.601	2.421	2	21	10.678

PART CLASS: FAN

TYPE: AXIAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.126	---	---	2	0	7.260
GRF	X		---	0.510	---	---	4	0	1.796
GRF		X	1.854	---	1.353	2.538	2	10	5.393
GRM	X		9.615	---	4.908	17.812	3	3	0.312
A	X		211.557	---	199.376	224.604	1	216	1.021
A		X	5.510	---	2.241	11.909	2	2	0.363
AIT		X	---	57.250	---	---	1	0	0.016
AU	X		1296.089	---	1224.091	1373.015	3	232	0.179
HEL	X		100.000	---	19.814	304.074	1	1	0.010
SHS	X		10.926	---	8.788	13.610	1	19	1.739
SUB	X		1.552	---	1.248	1.946	1	18	11.600

PART CLASS: FAN

TYPE: CENTRIFUGAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	1.692	---	---	2	0	0.541
GRF	X		---	0.357	---	---	5	0	2.568
GRM	X		1.220	---	0.960	1.553	2	16	13.114
A	X		89.200	---	85.552	93.031	1	427	4.787
A		X	21.739	---	12.484	36.749	1	4	0.184
SUB	X		8.427	---	4.301	15.610	1	3	0.356

PART CLASS: FAN

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.416	---	---	2	0	2.200
GRF	X		2.518	---	2.289	2.773	6	87	34.557
GRF		X	2.795	---	2.217	3.530	4	17	6.082
GRM	X		6.253	---	5.604	6.986	1	67	10.715
A	X		36.895	---	36.072	37.741	1	1428	38.704
AU	X		74.627	---	46.157	118.592	1	5	0.067
AIT		X	71.634	---	69.208	74.160	2	622	8.683
AIF	X		---	5.234	---	---	1	0	0.175
HEL	X		9.091	---	6.938	11.922	1	13	1.430
SHS	X		13.761	---	12.659	14.973	2	112	8.138
SUB	X		0.456	---	0.282	0.725	2	5	10.953

PART CLASS: FILTER

TYPE: FLUID

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.922	---	---	1	0	0.993
GRF	X		2.997	---	2.566	3.507	3	35	11.679
GRM	X		2.977	---	2.560	3.467	3	37	12.430
GRM		X	64.236	---	57.898	71.359	2	74	1.152
AU	X		22.954	---	20.997	25.118	7	99	4.313
AUT		X	66.496	---	60.967	72.598	3	104	1.564
AUF	X		8.547	---	1.694	25.989	1	1	0.117
HEL	X		49.519	---	42.495	57.813	4	36	0.727

PART CLASS: FILTER

TYPE: GAS

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.201	---	0.813	1.763	1	7	5.827
GRM	X		2.746	---	2.120	3.562	1	14	5.098
AUT		X	2.193	---	0.435	6.668	1	1	0.456
HEL	X		25.974	---	10.566	56.144	2	2	0.077

PART CLASS: FILTER

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.035	---	---	2	0	25.867
SAT	X		---	0.206	---	---	1	0	4.450
GRM		X	66.185	---	58.602	74.865	2	55	0.831
AU		X	---	0.954	---	---	1	0	0.960
AUT		X	54.490	---	49.000	60.673	1	71	1.303
HEL	X		1.265	---	1.024	1.566	1	20	15.810

PART CLASS: GASKET AND SEAL

TYPE: GASKET, SHIELDING, RFI

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.356	---	0.145	0.769	1	2	5.619

PART CLASS: GASKET AND SEAL

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.004	---	---	3	0	221.680
GRF	X		1.338	---	1.052	1.704	3	16	11.959
GRM		X	1.148	---	1.050	1.256	4	99	86.248
A	X		65.788	---	65.251	66.330	3	10,647	161.838
A		X	1.486	---	0.294	4.518	1	1	0.673
AUT		X	122.271	---	113.516	131.803	1	140	1.145
HEL	X		31.594	---	30.046	32.967	3	301	9.527
SHS	X		3.767	---	2.797	5.073	1	11	2.920

PART CLASS: GASKET AND SEAL

TYPE: O-RING

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.078	---	---	1	0	11.699
GRM	X		0.530	---	0.304	0.895	1	4	7.552
A	X		2.387	---	2.081	2.743	1	44	18.431
SHS	X		0.454	---	0.232	0.836	3	3	6.602

PART CLASS: GASKET AND SEAL

TYPE: PACKING

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.002	---	---	1	0	581.360
GRF	X		3.531	---	2.525	4.926	1	9	2.549
GRM	X		0.274	---	0.111	0.591	1	2	7.310
A	X		1.512	---	1.199	1.910	1	17	11.244
HEL	X		5.063	---	4.866	5.270	1	471	93.020

PART CLASS: GENERATOR

TYPE: AC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.806	---	0.598	1.082	2	11	13.641
SHS	X		0.023	---	0.016	0.033	1	8	341.000

PART CLASS: GENERATOR

TYPE: DC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		36.784	---	34.482	39.264	2	183	4.975
AU	X		489.649	---	471.915	508.168	2	544	1.111
HEL	X		205.882	---	139.415	302.076	1	7	0.034

PART CLASS: GENERATOR

TYPE: DIESEL ENGINE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		1.292	---	0.875	1.895	1	7	5.418

PART CLASS: GENERATOR

TYPE: GAS ENGINE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		2.702	---	1.099	5.840	2	2	0.740

PART CLASS: GENERATOR

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	4.925	---	---	1	0	0.186
AU	X		113.353	---	105.532	122.073	4	309	2.726
HEL	X		12.821	---	7.930	20.374	1	5	0.390

PART CLASS: GENERATOR

TYPE: HOT GAS

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.781	---	---	1	0	1.173

PART CLASS: GENERATOR

TYPE: MOTOR/GENERATOR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.210	---	---	3	0	4.353
GRF	X		27.778	---	15.952	46.957	1	4	0.144
GRM	X		166.667	---	67.797	360.259	1	2	0.012
AUF	X		---	2.610	---	---	1	0	0.351

PART CLASS: GENERATOR

TYPE: TURBINE/GENERATOR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		38.052	---	19.422	70.488	1	3	0.078
GRF	X		626.217	---	597.420	656.639	1	338	0.539
GRF		X	11.925	---	10.462	13.616	1	48	4.025
SHS	X		14.409	---	11.661	17.840	1	20	1.388

PART CLASS: GYROSCOPE

TYPE: DIRECTIONAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
AI	X		513.917	---	507.464	520.469	6	4505	8.766
HEL	X		300.000	---	264.296	341.075	3	51	0.170

PART CLASS: GYROSCOPE

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.247	---	0.229	0.267	1	128	518.000
SAT	X		3.503	---	1.425	7.571	3	2	0.571

PART CLASS: GYROSCOPE

TYPE: RATE INTEGRATING

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.409	---	0.368	0.454	15	73	178.654
SAT	X		---	5.295	---	---	1	0	0.173
GRM	X		31.051	---	29.530	32.664	4	298	9.597
AI	X		352.023	---	347.857	356.248	7	5073	14.411
AI		X	4.167	---	1.695	9.006	2	2	0.480
AIF	X		288.156	---	272.286	305.103	1	236	0.819
HEL	X		75.000	---	53.643	104.630	1	9	0.120
SUB	X		70.919	---	68.468	73.474	1	597	8 [illegible]18
MIS	X		541.667	---	451.157	651.686	1	26	C [illegible]8

PART CLASS: HEATER

TYPE: ELECTRIC, GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		0.450	---	0.089	1.369	3	1	2.221
GRF	X		2.286	---	1.313	3.864	3	4	1.750
GRM	X		---	4.468	---	---	1	0	0.205
A		X	---	1.454	---	---	1	0	0.630
AIT		X	17.738	---	15.352	20.532	3	40	2.255
HEL	X		50.000	---	25.520	92.621	1	3	0.060
SUB	X		7.595	---	3.876	14.069	1	3	0.395

PART CLASS: HEATER

TYPE: ELECTRIC, SPACE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.157	---	0.883	1.517	4	13	11.239

PART CLASS: HEATER

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.268	---	---	3	0	3.416

PART CLASS: HEAT EXCHANGER

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.904	---	0.461	1.675	1	3	3.318
GRM	X		3.876	---	2.525	5.888	1	6	1.548
A	X		1.116	---	1.074	1.160	1	505	452.369
AU	X		2.899	---	2.152	3.903	2	11	3.795
AUT		X	5.344	---	3.618	7.840	1	7	1.310
AUF	X		21.898	---	17.058	28.029	3	15	0.685
SHS	X		---	1.667	---	---	1	0	0.549
SUB	X		---	4.447	---	---	1	0	0.206

PART CLASS: HOSE

TYPE: FITTINGS, GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.461	---	0.265	0.780	2	4	8.674
GRM	X		13.035	---	8.827	19.126	2	7	0.537
A	X		19.048	---	10.938	32.199	2	4	0.210
AU	X		1118.928	---	1082.369	1156.945	1	668	0.597
HEL	X		3.898	---	3.311	4.597	2	32	8.210

PART CLASS: HOSE

TYPE: HYDRAULIC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		1.613	---	1.092	1.613	2	7	4.339
GRF	X		---	1.105	---	---	1	0	0.829
GRM	X		0.240	---	0.189	0.305	2	16	66.766
A	X		115.830	---	97.821	137.433	1	30	0.259
HEL	X		32.941	---	30.789	35.267	1	168	5.100

PART CLASS: LAMP

TYPE: INCANDESCENT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	0.006	---	---	1	0	141.538
GRF		X	0.906	---	0.590	1.376	2	6	6.623
GRM	X		10.171	---	4.137	21.985	1	2	0.196
GRM		X	---	0.054	---	---	2	0	16.900
SHS	X		18.624	---	18.029	19.241	1	700	37.586

PART CLASS: LAMP

TYPE: LED

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	0.276	---	0.264	0.289	16	363	1312.882
GRF	X		---	0.480	---	---	1	0	1.910

PART CLASS: LAMP

TYPE: NEON

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SHS	X		0.489	---	0.407	0.588	1	26	53.215

PART CLASS: MANIFOLD

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.613	---	0.249	1.325	3	2	3.263
GRM	X		7.390	---	7.047	7.753	2	332	44.924
A	X		27.568	---	26.469	28.721	1	449	16.287
AU	X		152.318	---	140.278	165.541	1	115	0.755
AUT		X	31.682	---	28.052	35.837	1	55	1.736
HEL	X		75.194	---	68.719	82.364	1	97	1.290

PART CLASS: MECHANICAL DEVICE

TYPE: CLUTCH

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL,	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	0.594	---	0.571	0.619	1	478	804.347
SHS	X		---	1.708	---	---	1	0	0.536

PART CLASS: MECHANICAL DEVICE

TYPE: COUPLING

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL,	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		5.341	---	3.067	9.028	1	4	0.748

PART CLASS: MECHANICAL DEVICE

TYPE: GEAR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL,	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	0.175	---	---	4	0	5.230
GRF		X	0.169	---	0.129	0.218	1	14	83.067
SHS	X		0.073	---	0.016	0.170	2	1	13.641

PART CLASS: MECHANICAL DEVICE

TYPE: GEAR ASSEMBLY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SHS	X		51.503	---	40.515	65.578	3	16	0.310

PART CLASS: MECHANICAL DEVICE

TYPE: GEAR SHAFT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SUB	X		6.730	---	1.333	20.464	1	1	0.148

PART CLASS: MECHANICAL DEVICE

TYPE: JOY STICK ASSEMBLY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SHS	X		14.482	---	5.967	31.064	2	2	0.138

PART CLASS: MECHANICAL DEVICE

TYPE: MECHANISM, POWER TRANSMITTAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.112	---	0.022	0.341	2	1	8.929
SAT	X		---	6.836	---	---	2	0	0.134
GRF	X		1.670	---	1.379	2.024	7	24	14.370
GRF		X	54.054	---	42.480	68.709	2	16	0.296
GRM	X		11.528	---	10.927	12.168	2	263	22.814
GRM		X	41.622	---	39.374	43.864	4	272	6.535
AU	X		10.987	---	10.842	11.135	9	4057	369.258
AUT		X	9.256	---	8.653	9.908	9	169	18.258
AUF	X		1.960	---	1.125	3.313	1	4	2.041
HEL	X		986.655	---	961.652	1012.428	8	1109	1.124
SHS	X		1.776	---	0.352	5.401	1	1	0.563

PART CLASS: MECHANICAL DEVICE

TYPE: SPEED DRIVE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
AUT		X	131.108	---	120.511	142.772	2	110	0.839

PART CLASS: MECHANICAL DEVICE

TYPE: SPRING

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL,	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	5.551	---	---	1	0	0.165
AIF	X		---	1.406	---	---	2	0	0.651

PART CLASS: MISCELLANEOUS

TYPE: COIL, COOLING-CHILLED WATER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL,	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.005	---	0.621	1.597	2	5	4.976

PART CLASS: MISCELLANEOUS

TYPE: ENGINE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL,	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.898	---	0.608	1.318	1	7	7.792
GRF		X	577.397	---	563.952	591.222	1	1313	2.274

PART CLASS: MISCELLANEOUS

TYPE: RF CABLE ASSEMBLY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	0.545	---	---	1	0	1.681

PART CLASS: MISCELLANEOUS

TYPE: SAFE AND ARM DEVICE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.482	---	0.414	0.563	5	36	74.706

PART CLASS: MOTOR

TYPE: FRACTIONAL H.P.

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		3.307	---	2.660	4.120	2	19	5.744
GRF		X	1.498	---	1.396	1.609	1	154	102.788
GRM	X		7.552	---	7.080	8.059	1	184	24.366
AI	X		4.829	---	3.799	6.148	1	16	3.313

PART CLASS: MOTOR

TYPE: FULL H.P.

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.499	---	0.099	1.517	1	1	2.004
GRF	X		0.913	---	0.773	1.080	12	31	33.967
GRM	X		4.238	---	3.468	5.191	2	22	5.190

PART CLASS: MOTOR

TYPE: GENERAL, A.C.

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.235	---	0.883	1.723	2	9	7.288
SHS	X		10.243	---	8.882	11.833	6	41	4.000
SUB	X		2.247	---	0.914	4.820	2	2	0.890

PART CLASS: MOTOR

TYPE: GENERAL, D.C.

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL,	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		0.871	---	0.354	1.884	2	2	2.295
GRM	X		9.132	---	6.665	12.500	1	10	1.095
AU	X		187.387	---	171.807	204.581	1	104	0.555
AUT		X	157.209	---	152.103	162.518	2	676	4.300
HEL	X		190.909	---	155.387	235.027	1	21	0.110
SUB	X		31.384	---	25.679	38.434	2	22	0.701

PART CLASS: MOTOR

TYPE: INDUCTION

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	14.774	---	---	1	0	0.062

PART CLASS: MOTOR

TYPE: PM

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	4.202	---	---	1	0	0.218

PART CLASS: MOTOR

TYPE: SENSOR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		0.792	---	0.322	1.713	1	2	2.524
A		X	8.152	---	4.161	15.101	1	3	0.368
SHS	X		---	0.389	---	---	1	0	2.357
SUB	X		10.487	---	10.112	10.879	1	557	53.114

PART CLASS: MOTOR

TYPE: SOLENOID

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	2.379	---	---	1	0	0.385
SAT	X		*	0.034	---	---	1	0	26.975

PART CLASS: MOTOR

TYPE: STEP

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	1.378	---	0.568	2.956	1	2	1.451

PART CLASS: MOTOR

TYPE: TORQUE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.220	---	---	1	0	4.158
GRM	X		---	4.183	---	---	1	0	0.219
SUB	X		---	0.425	---	---	1	0	2.153

PART CLASS: PUMP

TYPE: BOILER FEED

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.422	---	0.381	0.467	1	78	185.000

PART CLASS: PUMP

TYPE: CENTRIFUGAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		12.013	---	10.176	14.211	5	31	2.580
GRF		X	5.777	---	4.500	7.408	3	15	2.596
SHS	X		298.122	---	282.298	314.980	1	254	0.852

PART CLASS: PUMP

TYPE: COOLANT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	X		657.251	---	648.831	665.803	1	4328	6.585
AUT		X	154.545	---	122.563	195.215	1	17	0.110

PART CLASS: PUMP

TYPE: ELECTRIC MOTOR DRIVEN

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A		X	6.889	---	5.576	8.530	4	20	2.903
AIT		X	387.352	---	354.168	424.080	1	98	0.253
AU	X		354.817	---	341.710	368.516	3	523	1.474
AUT		X	10.000	---	1.981	30.407	1	1	0.100
HEL	X		20.000	---	3.963	60.815	1	1	0.050

PART CLASS: PUMP

TYPE: ENGINE DRIVEN

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A		X	18.519	---	9.452	34.304	1	3	0.162
AIT		X	443.137	---	418.195	469.810	1	226	0.510
AUT		X	231.343	---	195.964	273.660	1	31	0.134
HEL	X		86.667	---	72.185	104.270	1	26	0.300

PART CLASS: PUMP

TYPE: FIXED DISPLACEMENT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.250	---	0.232	0.270	6	135	540.000
GRF	X		1.464	---	0.290	4.452	1	1	0.683

PART CLASS: PUMP

TYPE: FUEL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.057	---	---	3	0	16.140
GRF	X		176.471	---	149.034	209.383	1	30	0.170
GRM	X		6.683	---	5.879	7.608	2	50	7.482
GRM		X	181.001	---	168.088	195.057	1	141	0.779
A	X		71.879	---	70.166	73.642	3	1253	17.432
AU	X		37.539	---	33.783	41.766	1	72	1.918
AUT		X	10.471	---	9.555	11.487	7	94	8.977
AUF	X		130.342	---	116.167	146.457	3	61	0.468
HEL	X		334.821	---	302.005	371.668	1	75	0.224

PART CLASS: PUMP

TYPE: GEROTER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	X		18.286	---	14.384	23.283	2	16	0.875
AUF	X		30.525	---	25.323	36.873	1	25	0.819

PART CLASS: PUMP

TYPE: HYDRAULIC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.178	---	0.155	0.204	15	43	242.136
GRF	X		1.675	---	1.036	2.662	1	5	2.985
GRM	X		42.437	---	41.241	43.675	4	897	21.137
A	X		573.711	---	565.297	582.275	1	3304	5.759
AIT		X	6.289	---	5.295	7.486	4	29	4.611
AUF	X		799.145	---	749.673	852.400	1	187	0.234
HEL	X		395.022	---	377.544	413.448	4	365	0.924

PART CLASS: PUMP

TYPE: HYDRAULIC MOTOR DRIVEN

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	4.219	---	3.452	5.166	4	2	5.215
AUF	X		16.949	---	3.358	51.538	1	1	0.059
SUB	X		34.330	---	29.080	40.610	2	31	0.903

PART CLASS: PUMP

TYPE: IMPELLER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	1.741	---	---	1	0	0.526

PART CLASS: PUMP

TYPE: OIL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM		X	28.241	---	23.108	34.586	1	22	0.779
A	X		59.459	---	50.648	69.941	1	33	0.555
AIT		X	11.687	---	9.610	14.243	1	23	1.968
HEL	X		45.455	---	26.103	76.839	2	4	0.088
SHS	X		78.975	---	71.183	87.732	1	74	0.937

PART CLASS: PUMP

TYPE: TURBINE DRIVEN

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
AU	X		78.189	---	69.391	88.236	1	57	0.729
GRM		X	0.342	---	0.325	0.361	1	265	774.000
AUT		X	66.667	---	53.262	83.601	1	18	0.270

PART CLASS: PUMP

TYPE: VACUUM

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	27.027	---	5.355	82.182	3	1	0.037
A	X		15.464	---	7.893	28.646	1	3	0.194

PART CLASS: PUMP

TYPE: VARIABLE DISPLACEMENT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.200	---	0.162	0.248	2	20	100.000

PART CLASS: PUMP

TYPE: WATER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM		X	0.342	---	0.325	0.361	1	265	774.000
AUT		X	66.667	---	53.262	83.601	1	18	0.270

PART CLASS: REGULATOR

TYPE: FUEL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
AU	X		178.807	---	174.107	183.657	1	1031	5.766
HEL	X		136.213	---	118.118	157.363	2	41	0.301

PART CLASS: REGULATOR

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	N/A	N/A	4.072	---	2.908	5.656	3	9	2.210

PART CLASS: REGULATOR

TYPE: OXYGEN DEMAND

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	X		736.274	---	714.541	758.788	1	818	1.111

PART CLASS: REGULATOR

TYPE: PRESSURE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.906	---	---	2	0	1.011
SAT	X		2.857	---	0.566	8.688	2	1	0.350
GRF	X		2.435	---	2.145	2.768	13	51	20.946
GRM	X		2.525	---	1.811	2.805	3	19	8.437
A	N/A	N/A	83.117	---	81.714	84.549	23	2495	30.018
HEL	X		55.319	---	46.076	66.555	1	26	0.470

PART CLASS: REGULATOR

TYPE: TENSION

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	X		5.221	---	4.381	6.235	1	28	5.363

PART CLASS: REGULATOR

TYPE: THERMOSTAT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		3.484	---	0.690	10.595	1	1	0.287
GRF	X		4.858	---	4.369	5.410	5	71	14.613
GRF		X	17.386	---	14.535	20.838	1	27	1.553
A	X		233.746	---	230.308	237.245	1	3286	14.058
AIT		X	22.562	---	21.248	23.971	3	211	9.352

PART CLASS: REGULATOR

TYPE: VOLTAGE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		2.998	---	2.188	4.103	1	10	3.336

PART CLASS: RELAY

TYPE: ARMATURE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.375	---	0.326	0.432	17	43	114.702
GRF		X	0.015	---	0.003	0.044	2	1	68.807
GRM	X		1.229	---	0.243	3.736	1	1	0.814
GRM		X	---	0.271	---	---	1	0	3.380
AIT	X		0.054	---	0.044	0.066	2	21	392.000
SHS	X		0.915	---	0.843	0.995	2	116	126.716
SUB	X		1.030	---	1.020	1.041	1	6953	6750.051

PART CLASS: RELAY

TYPE: COAXIAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	3.923	---	---	1	0	0.233

PART CLASS: RELAY

TYPE: CRYSTAL CAN

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.021	---	---	1	0	43.469
GRF	X		0.156	---	0.105	0.228	2	7	44.954
GRF		X	0.082	---	0.068	0.100	11	23	279.663
AIT	X		7.407	---	6.256	8.789	2	30	4.050
SHS	X		---	0.920	---	---	1	0	0.996

PART CLASS: RELAY

TYPE: CURRENT SENSITIVE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	---	1.285	---	---	1	0	0.713

PART CLASS: RELAY

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.024	---	0.019	0.030	10	19	799.900
SAT	X		0.013	---	0.007	0.024	9	3	231.331
GRF	X		0.189	---	0.158	0.227	13	27	142.656
GRF		X	1.909	---	1.847	1.974	15	670	350.882
GRM	X		---	1.165	---	---	6	0	0.786
AIT		X	4.106	---	3.724	4.533	9	83	20.212
AIF	X		---	12.189	---	---	1	0	0.075
HEL	X		30.986	---	27.014	35.604	1	44	1.420
SHS	X		0.932	---	0.825	1.054	9	55	59.003
SUB	X		0.353	---	0.341	0.366	5	632	1788.524

PART CLASS: RELAY

TYPE: HIGH VOLTAGE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	0.545	---	---	1	0	1.681
GRF		X	0.551	---	0.109	1.674	3	1	1.816

PART CLASS: RELAY

TYPE: LATCHING

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.081	---	0.016	0.247	1	1	12.333
SAT	X		---	0.066	---	---	7	0	13.897
GRF	X		0.027	---	0.017	0.041	6	6	225.862
GRF		X	0.182	---	0.074	0.393	4	2	11.000
AIT	X		0.043	---	0.008	0.130	1	1	23.400
AIF	X		---	7.328	---	---	3	0	0.125
SUB	X		0.342	---	0.330	0.354	1	601	1759.452

PART CLASS: RELAY

TYPE: MOTOR DRIVEN

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	22.222	---	15.048	32.605	1	7	0.315

PART CLASS: RELAY

TYPE: POWER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.013	---	0.686	1.486	1	7	6.912
GRF		X	1.930	---	1.505	2.480	6	15	7.770
GRM	X		7.009	---	4.566	10.647	2	6	0.856
A	X		9.502	---	8.360	10.818	1	50	5.262
SHS	X		0.198	---	0.101	0.367	4	3	15.139

PART CLASS: RELAY

TYPE: REED

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.194	---	0.152	0.246	4	16	82.675
GRF		X	0.873	---	0.698	1.095	2	18	20.609
SUB		X	1.436	---	1.289	1.602	6	69	48.042
SUB	X		---	0.733	---	---	1	0	1.250

PART CLASS: RELAY

TYPE: THERMAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	2.000	---	---	1	0	0.458
GRF	X		13.089	---	8.096	20.800	1	5	0.382
GRF		X	0.435	---	0.177	0.941	1	2	4.596
AIT	X		25.641	---	5.081	77.968	1	1	0.039
SHS	X		0.746	---	0.304	1.613	1	2	2.680
SUB	X		10.667	---	7.445	15.223	1	8	0.750

PART CLASS: RELAY

TYPE: TIME DELAY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.567	---	1.164	2.110	4	11	7.019
GRF		X	---	1.908	---	---	1	0	0.480
GRM	X		4.246	---	1.727	9.179	1	2	0.471
AIT	X		26.620	---	21.889	32.442	1	23	0.864
SHS	X		1.014	---	0.862	1.196	2	3	4.950
MIS	X		---	1.953	---	---	1	0	0.469

PART CLASS: ROTARY JOINT

TYPE: MICROWAVE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	---	0.401	---	---	1	0	2.282
A	X		393.162	---	343.875	450.280	1	46	0.117

PART CLASS: SENSOR

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.545	---	0.398	0.746	1	10	18.340
GRF	X		2.980	---	2.545	3.496	9	34	11.409
GRF		X	60.606	---	24.654	131.003	1	2	0.033
A	X		88.980	---	82.367	96.203	2	130	1.461
AIT		X	89.252	---	83.786	95.133	2	191	2.140
AU	X		672.367	---	651.597	693.921	1	747	1.111
AUT		X	50.575	---	44.091	58.113	1	44	0.870
HEL	X		76.613	---	66.039	89.047	5	38	0.496

PART CLASS: SHOCK ABSORBER

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	0.552	---	---	1	0	1.658
GRM	X		---	1.141	---	---	1	0	0.803
HEL	X		17.460	---	14.287	21.383	1	22	1.260

PART CLASS: SHOCK ABSORBER

TYPE: GENERAL, MOUNT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.806	---	0.328	1.742	1	2	2.482
A	X		6.309	---	3.623	10.665	1	4	0.634
AUF	X		6.826	---	2.777	14.755	2	2	0.293
HEL	X		131.579	---	102.581	169.017	1	15	0.114

PART CLASS: SHOCK ABSORBER

TYPE: ISOLATOR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.206	---	0.239	3.666	1	1	0.829

PART CLASS SLIP RING ASSEMBLY

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.110	---	---	2	0	8.316
SAT	X		---	2.245	---	---	2	0	0.408
GRF	X		---	2.096	---	---	1	0	0.437
GRM	X		49.879	---	45.712	54.480	1	103	2.065
A	X		---	0.174	---	---	2	0	5.261
SHS	X		---	0.148	---	---	1	0	6.168
SUB	X		39.918	---	34.480	46.299	1	39	0.977

PART CLASS: SOCKET

TYPE: DUAL-IN-LINE (PER PIN)

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	0.00056	---	0.00012	0.0017	1	1	1801.200
SHS	X		---	0.005	---	---	1	0	200.500

PART CLASS: SOCKET

TYPE: HIGH POWER TUBE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	0.477	---	---	1	0	1.921

PART CLASS: SOCKET

TYPE: LAMP

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	0.007	---	---	1	0	124.942
SHS	X		---	0.012	---	---	1	0	76.218

PART CLASS: SOCKET

TYPE: RELAY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SHS	X		---	0.144	---	---	1	0	6.343

PART CLASS: SOLENOID

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.300	---	---	1	0	3.057
SAT	X		0.715	---	0.142	2.174	2	1	1.399
A	X		65.637	---	63.372	67.997	3	599	9.126
AIT		X	18.031	---	13.761	23.646	1	13	0.721
SUB	X		---	25.641	16.703	38.950	1	6	0.234

PART CLASS: SPRINKLER HEAD

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.619	---	0.530	0.724	3	35	56.573

PART CLASS: SWITCH

TYPE: CENTRIFUGAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.808	---	1.178	2.747	2	6	3.317
AIT		X	30.769	---	12.516	66.509	1	2	0.065
AU	X		353.204	---	333.793	373.930	1	237	0.671
HEL	X		73.759	---	60.205	90.108	1	22	0.299

PART CLASS: SWITCH

TYPE: COAXIAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.285	---	0.164	0.482	3	4	14.031
GRF		X	0.431	---	0.175	0.931	2	2	4.645
AIF	X		---	18.283	---	---	1	0	0.050
SUB	X		1.971	---	0.439	5.917	1	1	0.507

PART CLASS: SWITCH

TYPE: Dual-In-Line (DIP)

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		---	1.807	---	---	2	0	0.507

PART CLASS: SWITCH

TYPE: FLOW

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		4.492	---	4.023	5.024	5	66	14.691
SHS	X		---	1.839	----	---	1	0	0.498
SUB	X		2.542	---	1.721	3.718	1	7	2.754

PART CLASS: SWITCH

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.020	---	---	5	0	44.949
SAT	X		0.508	---	0.292	0.858	2	4	7.880
GRF	X		1.986	---	1.633	2.420	9	23	11.581
GRF		X	0.129	---	0.025	0.391	4	1	7.778
AI		X	0.506	---	0.206	1.094	1	2	3.952
AIT		X	107.295	---	104.541	110.135	2	1081	10.075
AIF	X		11.976	---	6.113	21.992	1	3	0.251
HEL	X		178.097	---	169.706	186.975	1	322	1.808
SHS	X		---	0.173	---	---	6	0	5.297
SUB	X		0.506	---	0.206	1.094	1	2	3.952

PART CLASS: SWITCH

TYPE: HUMIDITY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		16.775	---	9.633	28.358	1	4	0.238

PART CLASS: SWITCH

TYPE: INERTIAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.066	---	0.047	0.092	1	9	137.100

PART CLASS: SWITCH

TYPE: KEY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	2.317	---	1.508	3.514	1	6	2.589

PART CLASS: SWITCH

TYPE: LIQUID LEVEL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		5.277	---	3.029	8.839	2	4	0.758
AU	X		285.714	---	116.224	617.586	1	2	0.007
AUT		X	---	18.320	---	---	1	0	0.050
HEL	X		46.512	---	18.920	100.537	1	2	0.043

PART CLASS: SWITCH

TYPE: PENDANT-HOIST

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		6.155	---	3.142	11.402	1	3	0.487

PART CLASS: SWITCH

TYPE: PRESSURE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.083	---	0.048	0.140	2	4	48.300
GRF	X		0.976	---	0.852	1.120	11	45	46.095
GRM	X		6.934	---	6.500	7.402	5	183	26.390
A	N/A	N/A	39.030	---	37.718	40.396	5	631	16.167
HEL	X		95.028	---	86.334	104.716	2	86	0.905
SHS	X		22.556	---	18.021	28.286	1	18	0.798
SUB	X		6.525	---	3.747	11.031	1	4	0.613

PART CLASS: SWITCH

TYPE: PUSH BUTTON

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	1.519	---	---	1	0	0.603
GRF	X		0.144	---	0.101	0.206	28	8	55.533
GRF		X	27.155	---	26.694	27.700	3	21102	777.089
GRM	N/A	N/A	---	0.226	---	---	5	0	4.053
A	N/A	N/A	7.353	---	6.738	8.031	7	103	14.009
HEL	X		---	0.712	---	---	1	0	1.286
SHS	X		0.448	---	0.398	0.506	2	57	127.097
SUB	X		0.078	---	0.053	0.114	3	7	90.228

PART CLASS: SWITCH

TYPE: REED

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.950	---	---	1	0	0.964
SAT	X		---	2.018	---	---	1	0	0.908
GRF		X	---	0.001	---	---	1	0	1200.000
GRM		X	0.123	---	0.050	0.266	1	2	16.252

PART CLASS: SWITCH

TYPE: ROTARY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		0.418	---	0.083	1.272	1	1	2.391
GRF	X		0.691	---	0.610	0.785	15	52	75.242
GRM	X		---	9.347	---	---	8	0	0.098
A	X		16.001	---	15.098	16.966	2	225	14.062
AI	X		37.313	---	21.428	63.076	2	4	0.107
AIT	X		---	0.205	---	---	1	0	4.460
AIT		X	131.579	---	102.581	169.017	2	15	0.114
HEL	X		21.739	---	8.843	46.990	2	2	0.092
SHS	X		1.465	---	1.329	1.616	4	84	57.344
SUB	X		2.406	---	2.685	3.000	17	67	24.955

PART CLASS: SWITCH

TYPE: SENSITIVE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.409	---	---	3	0	2.237
GRF	X		2.707	---	2.379	3.087	11	49	18.098
A	X		14.650	---	13.735	15.634	1	184	12.560
HEL	X		107.500	---	93.558	123.738	1	43	0.400
SHS	X		---	0.347	---	---	2	0	2.636
SUB	X		1.104	---	0.972	1.255	2	51	46.202

PART CLASS: SWITCH

TYPE: SHAFT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF		X	0.236	---	0.053	0.709	1	1	4.229

PART CLASS: SWITCH

TYPE: SNAP SLIDE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM		X	---	0.271	---	---	1	0	3.380
SUB	X		0.216	---	0.170	0.275	1	16	74.050

PART CLASS: SWITCH

TYPE: STEPPING

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.400	---	0.163	0.865	1	2	5.000
SUB	X		21.368	---	13.216	33.956	1	5	0.234

PART CLASS: SWITCH

TYPE: THERMAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.389	---	0.158	0.841	2	2	5.140

PART CLASS: SWITCH

TYPE: THERMOSTAT

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.170	---	---	4	0	5.382
GRF	X		1.784	---	1.452	2.187	7	21	11.769
GRF		X	---	2.462	---	---	4	0	0.372
GRM	X		---	0.862	---	---	1	0	1.063
A	N/A	N/A	6.554	---	5.714	7.531	4	44	6.713
HEL	X		41.284	---	29.528	57.595	2	9	0.218
SHS	X		0.599	---	0.505	0.713	2	29	48.381
SUB	X		1.099	---	0.744	1.612	4	7	6.370

PART CLASS: SWITCH

TYPE: THUMB WHEEL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		---	3.299	---	---	11	0	0.277
AIT		X	15.856	---	8.093	29.372	1	3	0.189

PART CLASS: SWITCH

TYPE: TOGGLE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.907	---	---	1	0	1.010
GRF	X		0.270	---	0.254	0.292	19	163	598.769
GRM	X		0.243	---	0.054	0.720	6	1	4.166
A	X		7.194	---	6.813	7.600	4	255	35.446
AI	X		29.732	---	19.369	45.164	6	6	0.201
HEL	X		18.605	---	12.985	26.552	1	8	0.430
SHS	X		0.553	---	0.495	0.619	16	66	119.306
SUB	X		0.041	---	0.032	0.051	18	18	443.176

PART CLASS: SWITCH

TYPE: WAVE GUIDE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.643	---	0.366	4.926	2	1	.609
GRM	X		3.653	---	2.098	6.175	1	4	1.095

PART CLASS: SYNCHRO

TYPE: DIFFERENTIAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SUB	X		1.313	---	1.124	1.537	2	35	26.658

PART CLASS: SYNCHRO

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	X		4.198	---	3.534	4.997	1	29	6.908
A	X		336.831	---	320.935	353.648	1	321	0.953
A		X	---	2.544	---	---	1	0	0.360
AUT		X	---	10.178	---	---	1	0	0.090
AUF	X		102.857	---	82.175	128.984	1	18	0.175
HEL	X		150.000	---	116.942	192.679	1	15	0.100
SUB	X		0.353	---	0.180	0.653	1	3	8.506

PART CLASS: SYNCHRO

TYPE: RECEIVER, TRANSMITTER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	X		0.649	---	0.129	1.975	1	1	1.540
A		X	7.426	---	2.948	15.663	1	2	0.276

PART CLASS: SYNCHRO

TYPE: RESOLVER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.135	---	0.055	0.291	3	2	14.858
GRF	X		---	2.398	---	---	1	0	0.382
A	X		9.032	---	7.802	10.476	1	39	4.318
A		X	3.378	---	1.940	5.711	2	4	1.184
SHS	X		55.556	---	22.599	120.086	1	2	0.036
SUB	X		1.986	---	1.899	2.066	7	348	175.215

PART CLASS: TANK

TYPE: FUEL CELL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	N/A	N/A	7.745	---	7.019	8.555	3	82	10.588
A	X		152.358	---	149.440	155.345	1	1938	12.720
HEL	X		108.824	---	93.600	126.762	1	37	0.340

PART CLASS: TANK

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
AUT		X	---	6.887	---	---	1	0	0.133
HEL	X		5.000	---	0.991	15.204	1	1	0.200

PART CLASS: TANK

TYPE: OIL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRM	N/A	N/A	4.058	---	2.510	6.449	2	5	1.232
A	X		45.404	---	43.956	46.909	1	701	15.439
AUT		X	14.604	---	12.533	17.051	5	36	2.465
AUF	X		238.636	---	207.318	275.177	1	42	0.176
HEL	X		159.322	---	145.384	174.782	2	94	0.590

PART CLASS: TANK

TYPE: PRESSURE VESSEL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.237	---	0.047	0.722	1	1	4.211
AU	N/A	N/A	53.659	---	43.871	62.974	3	22	0.410
HEL	X		260.000	---	198.427	340.972	1	13	0.050

PART CLASS: TANK

TYPE: STORAGE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.616	---	1.094	2.370	1	7	4.333

PART CLASS: TIME-TOTALIZING METER

TYPE: COUNTERS

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	X		346.985	---	336.434	357.926	1	771	2.222

PART CLASS: TIME-TOTALIZING METER

TYPE: TIMER, ELECTRO-MECHANICAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		42.641	---	35.650	51.108	2	27	0.633
GRM	X		95.238	---	38.741	205.862	1	2	0.021
A	X		10.830	---	7.055	16.452	1	6	0.554
AIT		X	171.756	---	162.067	182.118	1	225	1.310
AU	X		372.746	---	363.152	382.641	1	1075	2.884
HEL	X		332.103	---	302.407	365.115	1	90	0.271

PART CLASS: TRANSDUCER

TYPE: FLUID FLOW

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
AUT	N/A	N/A	194.836	---	176.689	215.800	2	83	0.426

PART CLASS: TRANSDUCER

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
SAT	X		---	0.588	---	---	2	0	1.558
A		X	91.917	---	87.067	97.082	3	257	2.796
HEL	X		100.000	---	87.031	115.105	1	43	0.430

PART CLASS: TRANSDUCER

TYPE: MOTIONAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		3.925	---	2.427	6.237	1	5	1.274
AUF	X		254.237	---	198.207	326.575	1	15	0.059
HEL	X		71.429	---	61.940	82.520	1	41	0.574

PART CLASS: TRANSDUCER

TYPE: PRESSURE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		1.998	---	1.147	3.378	1	4	2.002
GRF	X		6.757	---	1.339	20.546	1	1	0.148
GRM	N/A	N/A	79.055	---	72.247	86.593	2	97	1.227
A	X		151.815	---	146.046	158.200	2	506	3.333
AUT		X	54.106	---	51.611	56.743	3	336	6.210
HEL	X		154.622	---	140.948	169.805	5	92	0.595

PART CLASS: TRANSDUCER

TYPE: TACH GENERATOR

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
A	N/A	N/A	54.331	---	51.173	57.715	5	212	3.902
HEL	X		57.944	---	51.694	65.042	1	62	1.070

PART CLASS: TRANSDUCER

TYPE: TEMPERATURE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		2.413	---	0.981	5.215	1	2	0.829
GRF		X	21.964	---	18.758	25.768	1	34	1.548
A	N/A	N/A	86.938	---	83.977	90.022	4	615	7.074
HEL	X		62.992	---	57.016	69.678	1	80	1.270

PART CLASS: VALVE

TYPE: BALL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.374	---	---	1	0	2.447
GRF	X		0.647	---	0.400	1.029	2	5	7.723
GRM	X		1.441	---	0.891	2.290	2	5	3.469

PART CLASS: VALVE

TYPE: BUTTERFLY

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.316	---	1.052	1.651	5	18	13.675

PART CLASS: VALVE

TYPE: CHECK

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.049	---	0.025	0.092	6	3	6.679
GRF	X		3.180	---	2.735	3.704	8	37	11.636
GRM	X		---	2.385	---	---	1	0	0.384
A	N/A	N/A	27.288	---	26.852	27.288	8	2776	101.729
HEL	X		10.050	---	6.547	15.267	1	6	0.597

PART CLASS: VALVE

TYPE: DIAPHRAGM

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		2.622	---	1.975	3.481	3	12	4.577
GRF		X	---	7.387	---	---	1	0	0.124

PART CLASS: VALVE

TYPE: FUEL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.127	---	---	1	0	7.220
GRF	X		---	8.327	---	---	1	0	0.110
AU	X		42.645	---	38.810	46.910	5	89	2.087
AUT		X	3.056	---	2.487	3.762	7	21	6.872
AUF	X		24.450	---	19.787	30.271	1	20	0.818
HEL	X		40.000	---	16.271	86.462	1	2	0.050

PART CLASS: VALVE

TYPE: GATE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.336	---	0.975	1.829	4	10	7.484
A	X		32.448	---	24.092	43.695	1	11	0.339
HEL	X		71.429	---	44.179	113.510	1	5	0.070

PART CLASS: VALVE

TYPE: GENERAL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		---	0.006	---	---	7	0	148.475
SAT	X		---	0.640	---	---	1	0	1.432
GRF	X		---	0.175	---	---	2	0	5.248
GRF		X	15.121	---	13.463	17.008	2	60	3.968
GRM	X		14.423	---	7.362	26.718	4	3	0.208
A	N/A	N/A	101.086	---	100.154	378.907	8	8353	82.633
HEL	X		98.804	---	93.205	104.793	2	223	2.257

PART CLASS: VALVE

TYPE: GLOBE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		0.173	---	0.034	0.526	2	1	5.784
GRM	X		---	1.104	---	---	1	0	0.829

PART CLASS: VALVE

TYPE: HYDRAULIC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.005	---	0.001	0.015	7	1	208.651
GRF	X		---	9.253	---	---	1	0	0.099
GRM	X		7.302	---	6.320	8.452	2	40	5.478
AU	X		52.144	---	50.163	54.301	13	760	14.575
AUT		X	11.937	---	11.292	12.625	25	245	20.524
AUF	X		17.309	---	14.163	21.198	4	22	1.271

PART CLASS: VALVE

TYPE: NEEDLE

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (x 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.362	---	0.842	2.164	2	5	3.671
GRF		X	---	1.176	---	---	1	0	0.779

PART CLASS: VALVE

TYPE: OIL

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL				
	MIL.	COML.			LOWER	UPPER			
GRF	X		2.412	---	1.571	3.663	1	6	2.488
A	X		32.895	---	20.345	52.274	1	5	0.152

PART CLASS: VALVE

TYPE: PLUG

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL				
	MIL.	COML.			LOWER	UPPER			
GRF	X		3.272	---	2.632	4.076	5	19	5.806

PART CLASS: VALVE

TYPE: PNEUMATIC

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL				
	MIL.	COML.			LOWER	UPPER			
DOR	X		0.019	---	0.004	0.057	4	1	52.908
GRF	X		0.608	---	0.451	0.818	9	11	18.101
A	X		22.242	---	21.455	23.064	16	569	5.482
AIT		X	10.094	---	9.709	10.497	15	490	48.544
AUF	X		31.852	---	27.456	37.022	6	38	1.193

PART CLASS: VALVE

TYPE: RELIEF

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.001	---	0.0003	0.004	8	1	713.891
GRF	X		1.586	---	1.2980	1.943	11	22	13.867
GRM	X		2.517	---	2.1040	3.016	4	27	10.729
GRM		X	0.868	---	0.1720	2.640	1	1	1.152
A	X		26.796	---	26.1000	27.514	3	1056	39.409
AU	X		9.769	---	8.3210	11.491	2	33	3.378
AUT		X	9.207	---	7.3560	11.546	4	18	1.955
AUF	X		78.857	---	70.7970	87.951	3	69	0.875
HEL	X		133.501	---	122.5070	145.623	6	106	0.794

PART CLASS: VALVE

TYPE: SERVO

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS (X 10^6)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.183	---	0.144	0.233	10	16	87.589
A	N/A	N/A	158.187	---	152.118	164.540	3	485	3.066
HEL	X		25.000	---	17.881	34.877	1	9	0.360

PART CLASS: VALVE

TYPE: SOLENOID

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
DOR	X		0.009	---	0.006	0.013	14	7	807.376
GRF	X		1.640	---	1.486	1.812	9	82	50.002
GRM	X		18.519	---	3.669	56.310	1	1	0.054
A	X		28.128	---	26.221	30.196	4	156	5.546
AUT		X	18.990	---	16.468	21.939	4	41	2.159
HEL	X		124.611	---	107.850	144.239	4	40	0.321

PART CLASS: VALVE

TYPE: WATER

ENVIRONMENT	APPLICATION		FAILURE RATE/10^6 HOURS				NUMBER OF RECORDS	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	MIL.	COML.	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER			
GRF	X		1.895	---	1.630	2.208	4	37	19.521

NONELECTRONIC PARTS RELIABILITY DATA

SECTION 2

NONELECTRONIC PARTS DETAILED DATA

Section 2

NONELECTRONIC PARTS DETAILED DATA

The detailed data entries presented in this section are arranged in alphabetical order by major family class and alphabetically by type within each family class. The environmental codes described on page 5 are utilized in this section.

Failure rate estimates are not presented for those entries having zero failures and less than 0.5×10^6 hours. The user of this document who wishes to derive the 60% upper single-sided confidence limit estimate for the zero failure case may do so by dividing the value 0.916 by the operating hours provided for that entry.

INDEX FOR DETAILED DATA

	Page
Actuator	125
Linear	125
Rotary	130
Battery	131
Carbon - Zinc	131
Lead Acid	132
Mercury	133
Nickel Cadmium	134
Bearing	135
Ball	135
Circuit Protection Device	136
Circuit Breaker	136
Molded Case Circuit Breaker	137
Power Switch Circuit Breaker	138
Undervoltage Circuit Breaker	139
Compressor	140
Air	140
Connector	141
Circular	141
Coaxial	148
Power	149
Printed Circuit Board	150
Rectangular	152
Controls and Instruments	157
Compass	157
Indicator	158

PRECEDING PAGE BLANK-NOT FILMED

INDEX FOR DETAILED DATA (Cont'd)

	Page
Emergency Light	161
Stand-By	161
Emergency Power	162
General	162
Fan	163
General	163
Generator	164
General	164
Gyro	166
Rate Integrating	166
Heater	167
Electric	167
Mechanical Device	168
Gear Assembly	168
Power Transmittal	169
Motor	170
Full Horsepower	170
Solenoid	172
Pump	173
Centrifugal	173

INDEX FOR DETAILED DATA (Cont'd)

	Page
Regulator	174
Pressure	174
Thermostatic	176
Relay	177
Armature	177
Crystal Can	178
General Purpose	179
Latching	182
Power	183
Reed	184
Time Delay	185
Socket	186
Pin, DIP	186
Sprinkler Head	187
General	187
Switch	188
Centrifugal	188
Diaphragm	189
Flow	190
Humidity	191
Keyboard	192
Push Button	193
Reed	194
Rotary	195
Sensitive	196
Thermostat	197
Thumbwheel	198
Toggle	200

INDEX FOR DETAILED DATA (Cont'd)

	Page
Time-Totalizing Meter	202
Timer, Electro-Mechanical	202
Valve	203
General	203

DETAILED DATA TABLES

PART CLASS: ACTUATOR

TYPE. Linear

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
DOR		Hydraulic	0.222	---	0.127	0.375	4	18.028
DOR		Hydraulic	40.770	---	23.216	64.239	5	0.123
DOR		Hydraulic	19.027	---	15.908	22.805	27	1.419
DOR		Hydraulic	---	0.030	---	---	0	31.000
DOR		Hydraulic	---	1.230	---	---	0	0.745
DOR		Hydraulic	8.302	---	5.795	11.848	8	0.964
DOR		Hydraulic	---	0.233	---	---	0	3.929
DOR		Hydraulic	0.832	---	0.514	1.322	5	6.012
DOR		Hydraulic	0.066	---	0.055	0.078	29	440.200
DOR		Hydraulic	---	0.727	---	---	0	1.260
DOR		Hydraulic	---	0.339	---	---	0	2.700
DOR		Hydraulic	0.998	---	0.573	1.672	4	4.008
DOR		Hydraulic	---	0.033	---	---	0	27.040
DOR		Pneumatic	---	1.459	---	---	0	0.628
DOR		Pneumatic	0.063	---	0.048	0.082	13	207.100
DOR		Pneumatic	0.256	---	0.179	0.365	8	31.250

PART CLASS: ACTUATOR

TYPE: Linear (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
DOR		Pneumatic	---	1.458	---	---	0	0.628
GRF		Hydraulic	---	---	---	---	0	0.014
GRF		Pneumatic	3.2050*	---	0.635	9.746	1	0.312
GRF		Pneumatic	15.7480*	---	11.866	20.909	12	0.762
GRF		Hydraulic	15.2280*	---	7.773	28.210	3	0.197
GRF		Hydraulic Servo	125.4160	---	110.666	142.845	51	0.446
GRF		Pneumatic, 4 inch dia, 18 inch Stroke,25 PSI	1.206	---	0.497	2.586	2	1.659
GRF		Pneumatic, 4 inch dia, 18 inch Stroke,25 PSI	2.411	---	0.993	5.172	2	0.829
GRF		Pneumatic, 3 inch dia, 36 inch Stroke,125 PSI	9.500	---	4.459	11.500	23	2.421
GRF		Pneumatic, 3 inch dia, 36 inch Stroke,125 PSI	15.745*	---	11.856	20.810	12	0.762
GRM		Pneumatic, Piston Rolling Diaphragm	0.0015	---	0.001	0.002	10	6636.000
GRM		Hydraulic	368.421	---	249.480	540.558	7	0.019

*Actuation (cyc)

PART CLASS: **ACTUATOR**

TYPE: **Linear (continued)**

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRM		Hydraulic	50.459	---	37.464	67.948	11	0.218
GRM		Hydraulic	2.207	---	0.437	6.712	1	0.453
GRM		Hydraulic	826.087	---	664.439	1029.050	19	0.023
A		Electrical	209.009	---	192.560	227.068	116	0.555
A		Electrical	285.714	---	116.224	617.586	2	0.007
A		Hydraulic	5608.696*	---	5190.240	6065.905	129	0.023
A		Hydraulic	149.948	---	139.400	161.417	145	0.967
A		Hydrualic	483.660	---	435.935	537.935	74	0.153
A		Hydraulic	97.087	---	81.993	115.195	30	0.309
A		Hydraulic	319.672	---	276.123	370.774	39	0.122
A		Hydraulic	500.887	---	494.793	507.072	4798	9.579
A		Hydraulic	235.294	---	201.921	274.707	36	0.153
A		Hydraulic	198.485	---	183.790	214.529	131	0.660
A		Hydraulic	164.807	---	159.283	170.556	635	3.853
A		Hydraulic	0.163	---	0.162	0.165	7776	47,561.000

*Actuation (cyc)

PART CLASS: ACTUATOR

TYPE: Linear (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
AIT		Electrical, Passenger Door	21.280	---	---	---	---	---
AUT		Hydraulic Servo	498.335	---	484.298	512.854	898	1.802
AUT		Hydraulic Servo	56.454	---	54.334	58.672	506	8.963
AUT		Hydraulic	80.086	---	76.785	83.774	374	4.670
AUT		Mechanical Spoiler, Slot Control	43.480	---	---	---	---	---
AUT		Mechanical, Aileron/ Rudder	2.000	---	---	---	---	---
AUT		Mechanical Driven	5.503	---	4.991	6.076	83	15.082
AUT		Mechanical Driven	227.829	---	221.926	233.918	1061	4.657
AUT		Electrical	40.291	---	38.131	42.594	249	6.180
AUT		Electrical	86.051	---	82.320	89.980	380	4.416
AUT		Hydraulic	23.445	---	22.780	24.133	886	37.790
AUT		Hydraulic	65.854	---	55.057	78.931	27	0.410
AUT		Pneumatic	227.829	---	221.926	233.918	1061	4.657
AUT		Pneumatic	71.605	---	63.617	80.715	58	0.810

PART CLASS: ACTUATOR

TYPE: Linear (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
AUF		Hydraulic	48.132	---	43.446	53.389	76	1.579
AUF		Hydraulic	0.110	---	0.108	0.113	1346	12,220.000
AUF		Hydraulic	297.297	---	277.698	318.495	165	0.555
HEL		Hydraulic	384.615	---	237.886	611.207	5	0.013
HEL		Hydraulic	357.143	---	220.894	567.550	5	0.014
HEL		Hydraulic	266.124	---	186.124	380.573	8	0.030
HEL		Hydraulic	1120.482	---	1063.746	1180.750	279	0.249
HEL		Hydraulic	146.154	---	133.436	160.253	95	0.650
HEL		Hydraulic	15.217	---	10.305	22.327	7	0.460
HEL		Hydraulic	300.000	---	214.570	418.521	9	0.030
HEL		Hydraulic Servo	103.542	---	93.461	114.853	76	0.734
HEL		Hydraulic Servo	200.000	---	130.287	303.806	6	0.030
SHS		Hydraulic	10.707	---	6.622	17.014	5	0.467

PART CLASS: ACTUATOR

TYPE: Rotary

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
AUT		Electrical	---	---	---	---	0	0.117
SUB		Electrical	---	0.528	---	---	0	1.893

PART CLASS: BATTERY

TYPE: Carbon-Zinc

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS (X 10^6)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
GRF		15 Cell	0.904	---	0.588	1.370	6	6.640
GRF		30 Cell	0.359	---	0.184	0.661	3	8.348

PART CLASS: BATTERY

TYPE: Lead Acid

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		3 Cell	1.162	---	0.259	3.486	1	0.861

PART CLASS: BATTERY

TYPE: Mercury

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE / 10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRF		4 Cell	---	---	---	---	0	0.361
GRF		6 Cell	---	---	---	---	0	0.361
GRF		8 Cell	40.793	---	27.576	59.674	7	0.172
GRF		9 Cell	1.173	---	0.261	3.518	1	0.853

PART CLASS: BATTERY

TYPE: Nickel Cadmium

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
SAT		1 Cell	---	0.0216	---	---	0	42.398
SAT		1 Cell	0.092	---	0.053	0.154	4	43.465
GRF		2 Cell	3.290	---	2.294	4.664	8	2.431
GRF		3 Cell	---	---	---	---	0	0.143
GRF		4 Cell	0.596	---	0.454	0.783	13	21.806
GRF		5 Cell	2.219	---	2.059	2.437	136	61.277
GRF		6 Cell	2.471	---	1.265	4.546	3	1.214
GRF		8 Cell	---	0.0669	---	---	0	13.686
GRF		10 Cell	1.014	---	0.707	1.438	8	7.886
GRF		20 Cell	0.709	---	0.363	1.304	3	4.233
GRF		21 Cell	---	---	---	---	0	0.114

PART CLASS: BEARING

TYPE: Ball

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
AI		4800 RPM, Grease Lube, Fractional HP Motor	4.830	---	3.777	6.126	16	3.313

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: Circuit Breaker

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
GRF	M55629/3	Dustproof, .2A, 240VAC, 60Hz	---	---	---	---	0 0	0.114
GRF	M39019/4	Environmental, 2 Pole Aux. Contacts	---	---	---	---	0	0.029
GRF	M55629/2	Dustproof, 1 Pole, .2A 50VDC	---	---	---	---	0	0.114
GRF		Dustproof, 3 Pole, 20A, 250VAC, 60Hz Triptime 20 sec. at 125% of Load.	---	---	---	---	0	0.029
AI	M524510-10 & M521984-1		---	---	---	---	0	0.017

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: Molded Case Circuit Breaker

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		1 Pole, 15-50A	0.311	---	0.069	0.943	1	3.211
GRF		1 Pole, 15-50A	2.619	---	1.909	3.573	10	3.818
GRF		2 Pole, 15-100A	1.886	---	1.228	2.860	6	3.182
GRF		2 Pole, 15-100A	0.623	---	0.257	1.336	2	3.211
GRF		3 Pole, 15-100A	---	0.840	---	---	0	1.090
GRF		3 Pole, 15-100A	---	0.862	---	---	0	1.063
GRF		3 Pole, 15-100A	1.046	---	0.431	2.243	2	1.913
GRF		3 Pole, 15-100A	1.344	---	0.554	2.883	2	1.488
GRF		3 Pole, 15-100A	---	---	---	---	0	0.425
GRF		3 Pole, 125-400A	2.854	---	0.636	8.562	1	0.350
GRF		3 Pole, 125-400A	1.835	---	0.756	3.935	2	1.090
GRF		3 Pole, 125-400A	0.856	---	0.438	1.575	3	3.504
GRF		3 Pole, 70-225A	---	0.620	---	---	0	1.478
GRF		3 Pole, 15-100A	---	---	---	---	0	0.363

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: Power Switch Circuit Breaker

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		3 Pole, 200-1600A	2.352	---	0.525	7.057	1	0.425
GRF		3 Pole, 200-1600A	2.411	---	0.993	5.172	2	0.829
GRF		3 Pole, 200-1600A	3.617	---	1.852	6.655	3	0.829

PART CLASS: CIRCUIT PROTECTION DEVICE

TYPE: Undervoltage Circuit Breaker

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
GRF		Instant, 208/120 VAC	2.283	---	1.591	3.236	8	3.504
GRF		Time Delay, 208/120 VAC	---	1.178	---	---	0	0.774

PART CLASS: COMPRESSOR

TYPE: Air

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRM		Reciprocal, 150 psi, 300 CFH	1.980	---	1.441	2.696	10	5.059
GRM		Reciprocal, 150 psi, 300 CFH	5.959	---	4.788	7.402	19	3.188
GRM		Reciprocal, 200 psi, 600 CFH	20.250	---	17.087	24.059	30	1.412
SHS		Reciprocal, 125 psi, 3000 CFH, 2 Stage	193.000	---	134.400	273.300	8	0.041
SHS		Reciprocal, 250 psi, 900 CFH, 2 Stage	235.000	---	155.000	304.500	14	0.060
SHS		Reciprocal, 3000 psi, 30 CFH, 6 Stage	721.000	---	632.800	823.700	49	0.068
SHS		Reciprocal, 4500 psi, 13 CFH, 4 Stage	1892.000	---	1736.000	2056.000	107	0.057

PART CLASS: CONNECTOR

TYPE: Circular

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
DOR	MIL-C-26482 UR Series Deutsch		---	0.027	---	---	0	34.627
SAT	MIL-C-26482	Insert D, 4P, 20G, 7.5A	---	---	---	---	0	0.019
SAT	MIL-C-26482	Insert D	---	---	---	---	0	0.010
SAT	MIL-C-26482 UR Series Deutsch	Insert D	---	0.036	---	---	0	25.454
GRF	MIL-C-5015	Insert D	0.166	---	0.137	0.202	24	144.319
GRF	MIL-C-5015	Insert B, 42P	---	---	---	---	0	0.199
GRF	MIL-C-81511	Insert B, 85P, 23G	---	---	---	---	0	0.398
GRF	MIL-C-81511	Insert D	7.559	---	5.835	9.806	14	1.852
GRF	MS3124E12	Insert E, 10P, 20G, Crimp	---	0.083	---	---	0	1.026
GRF	MS3124E20	Insert E, 41P, 20G, Crimp	---	---	---	---	0	0.342
GRF	MS3102A22	Insert A, 19P, 16G, Solder	---	---	---	---	0	0.342
GRM	MIL-C-5015	Insert B, 7P, 8G, 73A	---	---	---	---	0	0.014
GRM	MIL-C-5015	Insert B, 14P, 16G, 22A	---	---	---	---	0	0.014
GRM	MIL-C-26482	Insert D, 5P, 16G, 22A	---	---	---	---	0	0.007
GRM	MIL-C-26482	Insert D, 55P, 20G, 7.5A	---	---	---	---	0	0.007

PART CLASS: CONNECTOR

TYPE: Circular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
GRM	MIL-C-26482	Insert D, 55P, 20G, 7.5A	---	---	---	---	0	0.014
AI	MIL-C-26482	Insert A, 1P, 20G, 7.5A	---	---	---	---	0	0.004
AI	MIL-C-26482	Insert A, 1P, 20G, 7.5A	---	---	---	---	0	0.004
AI	MIL-C-26482	Insert A, 3P, 16G, 22A	---	---	---	---	0	0.004
AI	MIL-C-26482	Insert A, 6P, 16G, 22A	---	---	---	---	0	0.004
AI	MIL-C-26482	Insert A, 15P, 20G, 7.5A	---	---	---	---	0	0.004
AI	MIL-C-26482	Insert A, 16P, 20G, 7.5A	---	---	---	---	0	0.004
AI	MIL-C-26482	Insert A, 16P, 20G, 7.5A	---	---	---	---	0	0.004
AI	MIL-C-26482	Insert A, 30P, 20G, 7.5A	---	---	---	---	0	0.004
AI	MIL-C-26482	Insert B, 32P, 20G, 7.5A	---	---	---	---	0	0.004
AI	MIL-C-81511	Insert B, 30P, 22G	---	---	---	---	0	0.004

PART CLASS: CONNECTOR

TYPE: Circular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
AI	MIL-C-81511	Insert B, 68P, 20G	---	---	---	---	0	0.004
AI	MIL-C-81511	Insert B, 85P, 23G	---	---	---	---	0	0.099
AI	MIL-C-81511	Insert B	---	---	---	---	0	0.099
AI	MIL-C-81511	Insert B, 55P, 22G	---	---	---	---	0	0.004
AI	MIL-C-81511	Insert B, 68P, 22G	---	---	---	---	0	0.004
AU	MIL-C-5015	Insert D	0.961	---	0.890	1.038	133	138.465
AU	MIL-C-5015	Insert D	1.893	---	1.699	1.992	124	67.423
AU	MIL-C-26482	Insert D, 21P, 16G	0.281	---	0.183	0.426	6	21.387
AU	MIL-C-38999	Insert D	0.017	---	0.013	0.022	15	866.817
AU	MIL-C-81511	Insert D	---	---	---	---	0	0.028
AUF	MIL-C-38999	5P, 16G, 13A	---	---	---	---	0	0.096
AUF	MIL-C-38999	Insert B, 13P, 22G, 3A	---	1.231	---	---	0	0.744
AUF	MIL-C-38999	Insert B, 22P, 22G, 3A	---	---	---	---	0	0.060
AUF	MIL-C-38999	Insert B, 37P, 22G, 3A	---	---	---	---	0	0.036
AUF	MIL-C-38999	Insert B, 128P, 22G, 3A	---	---	---	---	0	0.060

PART CLASS: CONNECTOR

TYPE: Circular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
SHS	MIL-C-5015	Insert D	0.691	---	0.397	1.168	4	5.791
SHS	MIL-C-38999	Insert D	0.650	---	0.129	1.976	1	1.539
SHS	MS3106A28	Insert D, 37P, 16G	---	0.920	---	---	0	0.996
SHS	MS3102R22	Insert D, 19P, 18G, Solder, Environmental, Gold Plate Contacts	---	---	---	---	0	0.498
SHS	MS3102R28	Insert D, 37P, 16G, Solder, Gold Plate Contacts	---	0.368	---	---	0	2.490
SUB	MIL-C-5015	Insert B, 3P, 16G, 22A	---	---	---	---	0	0.009
SUB	MIL-C-5015	Insert B, 3P, 16G, 22A	---	---	---	---	0	0.003
SUB	MIL-C-5015	Insert B, 4P, 16G, 22A	---	---	---	---	0	0.009
SUB	MIL-C-5015	Insert B, 4P, 16G, 22A	---	---	---	---	0	0.018
SUB	MIL-C-5015	Insert B, 4P, 16G, 22A	---	---	---	---	0	0.007
SUB	MIL-C-5015	Insert B, 4P, 16G, 22A	---	---	---	---	0	0.003
SUB	MIL-C-5015	Insert B, 5P, 12G, 41A	---	---	---	---	0	0.009
SUB	MIL-C-5015	Insert B, 5P, 12G, 41A	---	---	---	---	0	0.003
SUB	MIL-C-5015	Insert B, 10P, 16G, 22A	---	---	---	---	0	0.009
SUB	MIL-C-5015	Insert B, 10P, 16G, 22A	---	---	---	---	0	0.003
SUB	MIL-C-5015	Insert B, 14P, 16G, 22A	---	---	---	---	0	0.009
SUB	MIL-C-5015	Insert B, 14P, 16G, 22A	---	---	---	---	0	0.016
SUB	MIL-C-5015	Insert B, 14P, 16G, 22A	---	---	---	---	0	0.003
SUB	MIL-C-5015	Insert B, 14P, 16G, 22A	---	---	---	---	0	0.007

PART CLASS: CONNECTOR

TYPE: Circular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
SUB	MIL-C-5015	Insert B, 28P, 16G, 22A	---	---	---	---	0	0.016
SUB	MIL-C-5015	Insert B, 28P, 16G, 22A	---	---	---	---	0	0.007
SUB	MIL-C-5015	Insert B, 37P, 16G, 22A	---	---	---	---	0	0.003
SUB	MIL-C-5015	Insert B, 37P, 16G, 22A	---	---	---	---	0	0.018
SUB	MIL-C-5015	Insert B, 37P, 16G, 22A	---	---	---	---	0	0.016
SUB	MIL-C-5015	Insert B, 37P, 16G, 22A	---	---	---	---	0	0.007
SUB	MIL-C-5015	Insert B, 37P, 16G, 22A	---	---	---	---	0	0.007
SUB	MIL-C-5015	Insert B, 48P, 16G, 22A	---	---	---	---	0	0.003
SUB	MIL-C-5015	Insert B, 48P, 16G, 22A	---	---	---	---	0	0.016
SUB	MIL-C-5015	Insert B, 48P, 16G, 22A	---	---	---	---	0	0.007
SUB	MIL-C-26482	Insert B, 4P, 16G, 22A; 8P, 20G, 7.5A	---	---	---	---	0	0.032
SUB	MIL-C-26482	Insert B, 4P, 16G, 22A; 8P, 20G, 7.5A	---	---	---	---	0	0.032
SUB	MIL-C-26482	Insert B, 6P, 20G, 7.5A	---	---	---	---	0	0.013
SUB	MIL-C-26482	Insert B, 6P, 20G, 7.5A	---	---	---	---	0	0.029

PART CLASS: CONNECTOR

TYPE: Circular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS (x 10^6)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
SUB	MIL-C-26482	Insert B, 32P, 20G, 7.5A	---	---	---	---	0	0.023
SUB	MIL-C-26482	Insert D, 4P, 16G, 22A; 8P, 20G, 7.5A	---	---	---	---	0	0.013
SUB	MIL-C-26482	Insert D, 4P, 16G, 22A; 8P, 20G, 7.5A	---	---	---	---	0	0.041
SUB	MIL-C-26482	Insert D, 4P, 16G, 22A; 8P, 20G, 7.5A	---	---	---	---	0	0.032
SUB	MIL-C-26482	Insert D, 4P, 16G, 22A; 8P, 20G, 7.5A	---	---	---	---	0	0.013
SUB	MIL-C-26482	Insert D, 6P, 20G, 7.5A	---	---	---	---	0	0.032
SUB	MIL-C-26482	Insert D, 6P, 20G, 7.5A	---	---	---	---	0	0.026
SUB	MIL-C-26482	Insert D, 6P, 20G, 7.5A	---	---	---	---	0	0.035
SUB	MIL-C-26482	Insert D, 32P, 20G, 7.5A	---	---	---	---	0	0.010
SUB	MIL-C-26482	Insert D, 32P, 20G, 7.5A	---	---	---	---	0	0.003
SUB	MIL-C-26482	Insert D, 32P, 20G, 7.5A	---	---	---	---	0	0.010

PART CLASS: CONNECTOR

TYPE: Circular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
SUB	MIL-C-26482	Insert D, 32P, 20G, 7.5A	---	---	---	---	0	0.025
SUB	MIL-C-26482	Insert D, 61P, 20G, 7.5A	---	---	---	---	0	0.006
SUB	MIL-C-26482	Insert D, 61P, 20G, 7.5A	---	---	---	---	0	0.009
SUB	MIL-C-26482	Insert D, 61P, 20G, 7.5A	---	---	---	---	0	0.009
SUB	MIL-C-38999	Insert B, 37P, 22 G, 3A	---	---	---	---	0	0.012
SUB	MIL-C-38999	Insert B, 56P, 22G, 3A	---	---	---	---	0	0.054
SUB	MIL-C-38999	Insert B, 100P, 22G, 3A	---	---	---	---	0	0.052

PART CLASS: CONNECTOR

TYPE: Coaxial

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
SAT	MIL-C-39012	Insert C	---	---	---	---	0	0.019
GRF	MIL-C-39012	Insert C	---	---	---	---	0	0.042
GRF	MIL-C-39012	Insert C	---	---	---	---	0	0.042
GRF	MIL-C-39012	Insert C	---	---	---	---	0	0.031
GRF	MIL-C-39012	Insert C	---	---	---	---	0	0.073
GRF	MIL-C-39012	Insert C	---	---	---	---	0	0.146
GRF	MIL-C-39012	Insert C	0.030	---	0.017	0.051	4	133.333
GRF		2 Port	---	1.350	---	---	0	6.785
GRF		3 Port	---	---	---	---	0	0.405
GRF		8 Port	---	0.064	---	---	0	14.351
GRF		Insert C	---	---	---	---	0	0.199

PART CLASS: CONNECTOR

TYPE: Power

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF	MIL-C-3767	Insert D, 3P, 15A, 30°C	---	---	---	---	0	0.032
GRF	MIL-C-3767	Insert D, 10A, 0.1 Stress, 30°C	---	0.136	---	---	0	6.740

PART CLASS: CONNECTOR

TYPE: Printed Circuit Board

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
DOR	MIL-C-55302 /23, /24 AMP 202	75^0 - 125^0C	---	0.0648	---	---	0	14.140
SAT	MIL-C-55302 /23, /24 AMP 202		---	0.0881	---	---	0	10.397
GRF	MIL-C-21097	Insert B, 44P, 5A	---	---	---	---	0	0.022
GRF	MIL-C-21097	Insert B, 44P, 5A	---	---	---	---	0	0.023
GRF	MIL-C-21097	Insert B, 44P, 5A	---	---	---	---	0	0.028
GRF	MIL-C-21097	Insert B, 44P, 5A	---	---	---	---	0	0.013
GRF	MIL-C-21097	Insert B, 50P, 5A	---	---	---	---	0	0.026
GRF	MIL-C-21097	Insert B, 72P	---	---	---	---	0	0.009
GRF	MIL-C-21097	Insert B, 72P	---	---	---	---	0	0.013
GRF	MIL-C-21097	Insert B, 72P	---	---	---	---	0	0.066
GRF	MIL-C-21097	Insert B	---	0.630	---	---	0	1.454
GRF	MIL-C-21097	Insert B, 72P, 5A	---	---	---	---	0	0.016
GRM	MIL-C-21097	Insert B, 80P, 5A, 30^0C	---	0.058	---	---	0	15.714
GRM	MIL-C-21097	Insert B, 80P, 5A, 30^0C	---	0.044	---	---	0	21.031

PART CLASS: CONNECTOR

TYPE: Printed Circuit Board (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
AI	MIL-C-55302	Insert B, 96P, 55°C	---	---	---	---	0	0.090
AI	MIL-C-55302	Insert B, 112P, 45°C	0.173	---	0.034	0.527	1	5.770
AIF	MIL-C-55302	Insert B, 16P, 40°C	---	0.495	---	---	0	1.850
AIF	MIL-C-55302	Insert B, 32P, 40°C	---	0.603	---	---	0	1.520
AIF	MIL-C-55302	Insert B, 41P, 40°C	---	0.565	---	---	0	1.620
AIF	MIL-C-55302	Insert B, 62P, 40°C	---	0.077	---	---	0	11.930
AIF	MIL-C-55302	Insert B, 62P, 40°C	---	0.090	---	---	0	10.200
AIF	MIL-C-55302	Insert B, 64P, 40°C	---	1.735	---	---	0	0.528
AIF	MIL-C-55302	Insert B, 71P, 40°C	---	0.485	---	---	0	1.930
AIF	MIL-C-55302	Insert B, 72P, 40°C	---	0.490	---	---	0	1.870
AIF	MIL-C-55302	Insert B, 77P, 40°C	---	0.391	---	---	0	2.340
SHS	MIL-C-21097	Insert B, 30°C	0.011	---	0.002	0.034	1	88.339
SUB	MIL-C-55302	Insert B, 110P, 26G, 3A, 25°C	---	---	---	---	0	0.018
SUB	MIL-C-55302	Insert B, 110P, 26G, 3A	---	---	---	---	0	0.036
SUB	MIL-C-55302	Insert B, 110P, 26G, 3A	---	---	---	---	0	0.008
SUB	MIL-C-55302	Insert B, 110P, 26G, 3A	---	---	---	---	0	0.014

PART CLASS: CONNECTOR

TYPE: Rectangular

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
SAT	MIL-C-24308	Insert B, 25°C	---	1.105	---	---	0	0.829
GRF	MIL-C-24308	Insert B, 14P, 45°C	---	---	---	---	0	0.298
GRF	MIL-C-24308	Insert B, 14P, 45°C, 0.2 Stress	---	---	---	---	0	0.198
GRF	MIL-C-24308	Insert B, 42P, 45°C	---	---	---	---	0	0.199
GRF	MIL-C-24308	Insert B, 42P, 45°C 0.2 Stress	---	---	---	---	0	0.198
GRF	MIL-C-24748	Insert B, 104P, 20G, 7.5A, 30°C	---	---	---	---	0	0.041
GRM	MIL-C-24308	Insert B, 9P, 20G, 30°C	---	---	---	---	0	0.014
GRM	MIL-C-24308	Insert B, 15P, 20G, 5A, 30°C	---	---	---	---	0	0.028
GRM	MIL-C-24308	Insert B, 15P, 20G, 5A, 30°C	---	---	---	---	0	0.021
GRM	MIL-C-24308	Insert B, 25P, 20G, 5A, 30°C	---	---	---	---	0	0.014
AI	MIL-C-24308	Insert A, 16P, 22G, 3A, 55°C	---	---	---	---	0	0.008
AI	MIL-C-24308	Insert A, 16P, 22G, 5A, 55°C	---	---	---	---	0	0.004

PART CLASS: CONNECTOR

TYPE: Rectangular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
AI	MIL-C-24308	Insert A, 17P, 20G, 5A, 55°C	---	---	---	---	0	0.008
AI	MIL-C-24308	Insert A, 25P, 20G, 5A, 55°C	---	---	---	---	0	0.004
AI	MIL-C-24308	Insert A, 25P, 20G, 5A, 55°C	---	---	---	---	0	0.004
AI	MIL-C-24308	Insert A, 37P, 22G, 5A, 55°C	---	---	---	---	0	0.004
AI	MIL-C-24308	Insert B, 6P, 45°C	---	---	---	---	0	0.050
AI	MIL-C-24308	Insert B, 14P, 45°C	---	---	---	---	0	0.075
AI	MIL-C-24308	Insert B, 14P, 45°C	---	---	---	---	C	0.050
AI	MIL-C-24308	Insert B, 15P, 20G, 5A, 55°C	---	---	---	---	0	0.004
AI	MIL-C-24308	Insert B, 20P, 45°	---	---	---	---	0	0.149
AI	MIL-C-24308	Insert B, 28P, 45°C	---		---	---	0	0.597
AI	MIL-C-24308	Insert B, 42P, 45°C	---	---	---	---	0	0.050
AI	MIL-C-24308	Insert B, 42P, 45°C, 0.2 Stress	---	---	---	---	0	0.050

PART CLASS: CONNECTOR

TYPE: Rectangular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
AI	MIL-C-24308	Insert B, 55P, 45°C	---	---	---	---	0	0.024
AI	MIL-C-24308	Insert B, 55P, 45°C	---	---	---	---	0	0.075
AI	MIL-C-24308	Insert B, 66P, 45°C	---	---	---	---	0	0.050
AI	MIL-C-24308	Insert B, 168P, 45°C	---	---	---	---	0	0.447
AIF	MIL-C-83733	Insert B, 131P, 22G, 5A, 40°C	---	---	---	---	0	0.144
AIF	MIL-C-83733	Insert B, 185P, 22G, 5A, 40°C	---	---	---	---	0	0.048
AIF	MIL-C-83733	Insert B, 185P, 22G, 5A, 40°C	---	0.877	---	---	0	1.044
SUB	MIL-C-24308	Insert B, 9P, 20G, 5A, 25°C	---	---	---	---	0	0.032
SUB	MIL-C-24308	Insert B, 9P, 20G, 5A, 35°C	---	---	---	---	0	0.013
SUB	MIL-C-24308	Insert B, 25P, 20G, 5A, 25°C	---	---	---	---	0	0.014
SUB	MIL-C-24308	Insert B, 25P, 20G, 5A, 25°C	---	---	---	---	0	0.08[illegible]

PART CLASS: CONNECTOR

TYPE: Rectangular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
SUB	MIL-C-24308	Insert B, 25P, 20G, 5A, 25°C	---	---	---	---	0	0.014
SUB	MIL-C-24308	Insert B, 25P, 20G, 5A, 25°C	---	---	---	---	0	0.007
SUB	MIL-C-24308	Insert B, 25P, 20G, 5A, 35°C	---	---	---	---	0	0.032
SUB	MIL-C-24308	Insert B, 37P, 20G, 5A, 35°C	---	---	---	---	0	0.010
SUB	MIL-C-24308	Insert B, 37P, 20G, 5A, 25°C	---	---	---	---	0	0.026
SUB	MIL-C-24308	Insert B, 50P, 20G, 5A, 35°C	---	---	---	---	0	0.003
SUB	MIL-C-24308	Insert B, 50P, 20G, 5A, 35°C	---	---	---	---	0	0.006
SUB	MIL-C-24308	Insert B, 50P, 5 A, 25°C	---	---	---	---	0	0.016
SUB	MIL-C-24308	Insert B, 50P, 20G, 5A, 25°C	---	---	---	---	0	0.009
SUB	MIL-C-24308	Insert B, 78P, 22G, 3A, 25°C	---	---	---	---	0	0.009

PART CLASS: CONNECTOR

TYPE: Rectangular (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
SUB	MIL-C-24308	Insert B, 78P, 22G, 3A, 35°C	---	---	---	---	0	0.003
SUB	MIL-C-24308	Insert B, 104P, 22G, 3A, 25°C	---	---	---	---	0	0.016

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: Compass

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
AI		Magnetic	2388.704	---	2313.486	2466.813	719	0.301
AIT		Magnetic	16.667	---	8.507	30.874	3	0.180
AIT		Magnetic	41.379	---	33.059	51.890	18	0.435
AIT		Bearing Heading Indicator	582.969	---	552.792	615.069	267	0.458

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: Indicator

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Liquid Level	11.905	---	4.843	25.733	2	0.168
GRF		Liquid Quantity - Storage Tank, Float Type	6.718	---	4.541	9.827	7	1.042
GRF		Meter	0.363	---	0.208	0.608	4	11.028
GRM		Temp Gauge	62.016	---	54.406	70.807	48	0.774
GRM		Fuel Quantity	78.811	---	70.240	88.556	61	0.774
AI		Fuel Quantity	35.124	---	27.855	44.367	17	0.484
AI		Vertical Speed	942.197	---	879.700	1009.821	163	0.173
AI		Slip Turn	1346.939	---	1247.601	1455.368	132	0.098
AI		Slip Turn	---	---	---	---	0	0.090
AIT		Fuel Quantity	170.492	---	164.176	177.094	520	3.050
AIT		Fuel Quantity	145.902	---	132.782	160.495	89	0.610
AIT		Fuel Quantity	191.892	---	178.250	206.736	142	0.740
AIT		Temp	24.490	---	20.229	29.709	24	0.980
AIT		Temp	242.574	---	229.463	256.558	245	1.010
AIT		Temp	66.667	---	61.420	72.427	116	1.740

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: Indicator (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
AIT		Vertical Speed	275.000	---	250.130	302.679	88	0.320
AIT		AIM Control System	69.451	---	64.531	74.803	143	2.059
HEL		Vertical Speed	41.958	---	27.333	63.736	6	0.143
HEL		Vertical Speed	27.273	---	13.920	50.521	3	0.110
HEL		Temp	133.816	---	120.611	148.653	74	0.553
HEL		Temp	126.829	---	111.882	144.002	52	0.410
HEL		Fuel Quantity	305.419	---	272.474	342.834	62	0.203
HEL		Fuel Quantity	10.938	---	7.406	16.048	7	0.640
HEL		Fuel Quantity	4666.667	---	3915.458	5573.458	28	0.006
HEL		Fuel Quantity	150.000	---	136.113	165.494	84	0.560
HEL		Fuel Quantity	285.714	---	164.074	482.985	4	0.014
HEL		Engine Torque	75.000	---	56.510	99.581	12	0.160
HEL		Engine Torque	84.416	---	64.424	110.705	13	0.154
HEL		Engine Torque	275.862	---	255.200	298.446	128	0.464
HEL		Engine Torque	666.667	---	576.998	771.680	40	0.060
HEL		Engine Torque	357.143	---	220.894	567.550	5	0.014

PART CLASS: CONTROLS AND INSTRUMENTS

TYPE: Indicator (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
HEL		Slip Turn	187.617	---	171.707	205.209	100	0.533
HEL		Slip Turn	192.001	---	168.441	219.219	48	0.250
HEL		Slip Turn	714.286	---	521.333	977.653	10	0.014
HEL		Altitude	142.857	---	58.112	308.793	2	0.014
HEL		Altitude	362.667	---	336.318	391.389	136	0.375
HEL		Altitude	180.000	---	128.742	251.113	9	0.050

PART CLASS: EMERGENCY LIGHT

TYPE: Stand-By

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Charger, Battery	1.311	---	0.886	1.918	7	5.339
GRF		Lighting Unit, 50 watt Battery, Automatic Recharging	2.622	---	2.022	4.533	14	5.339

PART CLASS: EMERGENCY POWER

TYPE: General

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Stand-By Power System	0.0049	---	0.002	0.011	2	405.050
GRF		6V - Emergency Light - ing Unit	1.4980	---	1.044	2.124	8	5.339

PART CLASS: FAN

TYPE: General

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Exhaust, 130 CFM, 1/25 HP	2.411	---	0.993	5.172	2	0.829
GRF		Exhaust, 9800 CFM, 1 HP, Belt Driven	6.340	---	4.770	8.373	12	1.894
GRF		Exhaust, 980 CFM, 1/6 HP	0.904	---	0.463	1.664	3	3.318
GRF		Centrifugal, 4330 CFM, 2 HP	---	1.104	---	---	0	0.829
GRF		Box, 117 CFM	---	1.148	---	---	0	0.798
GRF		Axial	---	1.004	---	---	0	0.912

PART CLASS: GENERATOR

TYPE: General

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
DOR		Motor Generators, 10 KVA	56.080	---	47.014	66.791	28	0.499
DOR		Gas Turbine	38.050	---	19.482	70.015	3	0.079
DOR		Diesel Engine, 150-440 KW	1.209	---	0.873	1.890	7	5.419
DOR		Diesel Engine, 500-1400 KW	12.802	---	9.640	16.921	12	0.937
DOR		Diesel Engine, 40-140 KW	7.470	---	5.542	10.022	11	1.437
DOR		Diesel Engine, 3000 KW	1385.000	---	1377.000	1399.000	4384	3.165
DOR		Gas Engine, 3-15 KW	6.820	---	2.808	14.619	2	0.293
DOR		Gas Engine, 30-60 KW	---	---	---	---	0	0.447
GRF	HDI-650-60	Gas Turbine, 300 KW	626.200	---	597.900	656.300	338	0.540
GRM		Motor Generator Set, Output - 250V, 400HZ, 3000W; Input - 416V, 400HZ, 3800 RPM	20.350	---	---	---	---	---

PART CLASS: GENERATOR

TYPE: General (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
AUT		AC, Brushless, 8000RPM, Air Cooled	66.600	---	---	---	---	---

PART CLASS: GYRO

TYPE: Rate Integrating

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
AU		Gas Bearing	3.704	---	0.734	11.262	1	0.270

PART CLASS: HEATER

TYPE: Electric

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Coil Heating, Hot water, 120,000 BTU/HR	0.904	---	0.463	1.664	3	3.318
GRF		Space, 1KW, 208 VAC	0.804	---	0.331	1.724	2	2.488
GRF		Space, 30 KW, 480 VAC, 2 Stage	2.363	---	1.461	3.744	5	2.116

PART CLASS: MECHANICAL DEVICE

TYPE: Gear Assembly

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
SHS		Speed Decreaser Recorder	59.224	---	41.279	83.950	8	0.135
SHS		Speed Decreaser Servo	49.380	---	20.346	105.926	2	0.041
GRF		Spur-Drive 130 Teeth Brass Alloy 260, PD-2.0312, PA-20^0	---	0.876	---	---	0	1.046
GRF		Spur-Drive 130 Teeth, Brass Alloy 260, PD-64, PA-20^0	---	0.876	---	---	0	1.046

PART CLASS: MECHANICAL DEVICE

TYPE: Power Transmittal

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Fan Belt	1.378	---	0.962	1.966	8	5.806
GRF		Fan Belt	86.957	---	68.404	110.719	16	0.184
GRF		Couplings	5.340	---	3.067	9.028	4	0.749
GRF		Couplings	---	---	---	---	0	0.109
GRF		Clutch Spring	0.594	---	0.571	0.619	478	804.347
GRF		5 HP Motor Coupling	5.341	---	3.066	8.945	4	0.749
GRM		Sprocket	---	---	---	---	0	0.373
GRM		Magnetic Clutch	11.508	---	10.886	12.083	238	20.682
GRM		Magnetic Clutch	3.289	---	1.888	5.510	4	1.216
AU		Couplings	120.062	---	117.762	122.509	1796	14.959
SHS		Magnetic Clutch	---	1.708	---	---	0	0.536

PART CLASS: MOTOR

TYPE: Full Horse Power

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
DOR		3 HP	0.499	---	0.111	1.497	1	2.004
GRF		2 HP (AC)	5.917	---	2.407	12.790	2	0.338
GRF		2 HP (AC)	2.413	---	0.981	5.215	2	0.829
GRF		2 HP (AC)	11.765	---	4.786	25.430	2	0.170
GRF		2 HP, 110 VAC, NEMA Size 1	---	0.036	---	---	0	25.455
GRF		3 HP (AC)	5.831	---	2.372	12.604	2	0.343
GRF		3 HP (AC)	1.206	---	0.239	3.668	1	0.829
GRF		5 HP (AC)	4.825	---	2.771	8.157	4	0.829
GRF		5 HP, 440 VAC, NEMA Size 1	0.943	---	0.210	2.829	1	1.061
GRF		7.5 HP (AC)	10.101	---	2.001	30.715	1	0.099
GRF		10 HP (AC)	1.206	---	0.239	3.668	1	0.829
GRF		10 HP (AC)	205.882	---	139.415	302.076	7	0.034
GRF		20 HP (AC)	1.206	---	0.239	3.668	1	0.829
GRF		5 to 20 HP, 230/460 VAC	5.943	---	4.582	7.705	14	2.355

PART CLASS: MOTOR

TYPE: Full Horse Power (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRM		1 to 3 HP, 230/460 VDC	3.599	---	2.742	4.728	13	3.612
SHS		2 HP (AC)	2000.000	---	813.569	4323.103	2	0.001

PART CLASS: MOTOR

TYPE: Solenoid

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
DOR	008-939-1 IMC	Rotary	---	---	---	---	0	0.385
SAT	008-939-1 IMC	Rotary	---	0.034	---	---	0	26.975

PART CLASS: PUMP

TYPE: Centrifugal

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		8 GPM, 90 Ft.Hd, 1 HP, 1 in.	19.02	---	13.863	25.939	10	0.526
GRF		20 GPM, 50 Ft Hd, 3 HP, 2 in.	10.605	---	6.087	17.763	4	0.377
GRF		30 GPM, 25 Ft Hd, 1 HP, Sump	9.346	---	6.318	13.672	7	0.749
GRF		170 GPM, 173 Ft Hd, 15 HP	8.439	---	5.705	12.346	7	0.829

PART CLASS REGULATOR

TYPE Pressure

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Temp, Valve, 1/2 in., 150 lb., 3-way, Pneumatic Diaphragm Operated	4.823	---	2.768	8.078	4	0.829
GRF		Temp, Valve, 5/8 in., Refrigeration Expansion	2.411	---	0.993	5.172	2	0.829
GRF		Temp, Valve, 5/8 in., Refrigeration Expansion	2.251	---	1.607	3.127	9	3.998
GRF		Temp, Valve, 5/8 in., Refrigeration Expansion	4.799	---	2.965	7.601	5	1.042
GRF		Temp, Valve, 5/8 in., Refrigeration Expansion	0.941	---	0.387	2.017	2	2.127
GRF		Temp, Valve, 3/4 in., 150 lb, 3-way, Pneumatic, Diaphragm Operated	1.206	---	0.269	3.617	1	0.829
GRF		Valve, 1 in., 150 lb., Self Contained, 5 GPM	3.617	---	2.355	5.486	6	1.659

PART CLASS: REGULATOR

TYPE: Pressure (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRF		Valve, 1 in., 150 lb., Self Contained, 56 GPM	3.332	---	2.379	4.628	9	2.701
GRF		Valve, 2 in., 125 lb., Gas Service, 650 CFH Expansion	2.879	---	1.474	5.298	3	1.042
GRF		Pneumatic, Differential 0.6-12 IWG	1.280	---	0.735	2.146	4	3.122
GRF		Pneumatic, Differential 0.15-3 IWG	1.206	---	0.617	2.218	3	2.488

PART CLASS: REGULATOR

TYPE: Thermostatic

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
GRF		Temp, Pneumatic, Remote Bulb, 0^0 to 100^0F	9.042	---	7.043	11.574	15	1.659
GRF		Temp, Pneumatic, Bi-Metal, Room	7.234	---	4.709	13.503	6	0.829

PART CLASS: RELAY

TYPE: Armature

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF	MIL-R-5757 M5757/9	Hermetic, 2PDT	2.924	---	0.652	4.386	1	0.342
GRF	MS24376	Hermetic, 3PST, 3X Contact Form, High Voltage	2.922	---	1.677	4.894	4	1.369
GRF	MS24143	Hermetic, 3PST, 3X Contact Form, High Voltage	---	0.893	---	---	0	1.026
AIT	MIL-R-39016 M39016/13	Hermetic, 2PDT	0.051	---	0.032	0.081	5	98.000
AIT	MIL-R-39016	Hermetic, 4PDT	0.054	---	0.048	0.069	16	294.000
SHS	MIL-R-5757 M5757/15	Hermetic, 4PDT, 4C Contact Form, Low level	4.016	---	1.655	8.614	2	0.498
SHS	MIL-R-5757 M5757/18	Hermetic, 4PDT, 4C Contact Form, Low level	1.967	---	0.744	3.875	2	1.017

PART CLASS: RELAY

TYPE: Crystal Can

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Non-Latching, DPDT, 10A	0.200	---	0.045	0.608	1	5.000
GRF		Non-Latching, DPDT, 2A	0.500	---	0.203	1.081	2	4.000
GRF		Non-Latching, DPDT	0.050	---	0.026	0.093	3	59.480
AIT	MIL-R-5757 M5757/9	Half size	8.667	---	7.198	10.440	26	3.000
AIT	MIL-R-39016 M39016/6	Half size	3.810	---	2.187	6.381	4	1.050
SHS		Low level, 2PDT, 1A, Max. Coil Voltage 26.5 VDC	---	0.920	---	---	0	0.996

PART CLASS: RELAY

TYPE: General Purpose

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
DOR	MIL-R-39016 432-850 Teledyne	DPDT	---	---	---	---	0	0.193
SAT	MIL-R-39016	DPDT, 125°C	---	---	---	---	0	0.182
SAT	MIL-R-39016 432-850 Teledyne	DPDT	---	---	---	---	0	0.182
GRF	MIL-R-5757		---	---	---	---	0	0.031
GRF	MIL-R-6016	SPST, 50A	---	---	---	---	0	0.041
GRF	MIL-R-6016	4PDT, 10A	---	---	---	---	0	0.010
GRF		DPDT	0.435	---	0.177	0.941	2	4.596
GRF		3PDT	0.109	---	0.022	0.332	1	9.170
GRF		3PDT	0.046	---	0.009	0.140	1	21.740
GRF		6PDT, 10A	---	1.182	---	---	0	0.755
GRF		6PDT, 10A	---	0.303	---	---	0	3.019
GRF	MS25269	6PDT, Hermetic, 5A	---	---	---	---	0	0.057
GRM	MIL-R-39016		---	---	---	---	0	0.353
GRM	MIL-R-39016	ER, DPDT, 125°C, 1A	---	---	---	---	0	0.350

PART CLASS: RELAY

TYPE: General Purpose (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRM	MIL-R-5757	DPDT, 125°C, 2A	---	---	---	---	0	0.007
GRM	MIL-R-5757	DPDT, 2A	---	---	---	---	0	0.035
GRM		SPST	0.211	---	0.047	0.633	1	4.742
AIT	MIL-R-6016	4PDT, 125°C, 10A	---	---	---	---	0	0.004
AIT	MIL-R-5016	4PDT, 125°C, 10A	---	---	---	---	0	0.008
AIT		10A	---	1.741	---	---	0	0.526
AIT	MIL-R-39016	DPDT	0.054	---	0.044	0.066	21	392.000
SHS	MS27401	2PDT, Hermetic	0.287	---	0.006	0.860	1	3.487
SUB	MIL-R-5757	DPDT, 125°C, 2A	---	---	---	---	0	0.018
SUB	MIL-R-5757	6PDT, 125°C, 5A	---	---	---	---	0	0.010
SUB	MIL-R-6016	DPDT, 125°C, 10A	---	---	---	---	0	0.073
SUB	MIL-R-6016	DPDT, 125°C, 10A	---	---	---	---	0	0.029
SUB	MIL-R-6016	DPDT, 125°C, 10A	---	---	---	---	0	0.006
SUB	MIL-R-6016	DPDT, 125°C, 10A	---	---	---	---	0	0.015
SUB		DPDT, 2A	---	---	---	---	0	0.013
SUB	MIL-R-6016	4PDT, 125°C, 10A	---	---	---	---	0	0.044

PART CLASS: RELAY

TYPE: General Purpose (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
SUB	MIL-R-6016	4PDT, 125°C, 10A	---	---	---	---	0	0.009
SUB	MIL-R-6016	4PDT, 125°C, 10A	---	---	---	---	0	0.029
SUB	MIL-R-6016	4PDT, 125°C, 10A	---	---	---	---	0	0.007
SUB	MIL-R-6016	125°C	0.500	---	0.099	1.520	1	2.000
SUB	MIL-R-6016	125°C	---	1.832	---	---	0	0.500

PART CLASS: RELAY

TYPE: Latching

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		10A	0.500	---	0.112	1.500	1	2.000
GRF		10A	---	0.131	---	---	0	7.000
GRF	MIL-R-39016 M39016/9	DPDT, 2C Contact Form, Hermetic, Sensitive	---	1.786	---	---	0	.513
AIT	MS27745	4PDT, DC operated	0.043	---	0.0095	0.128	1	23.400

PART CLASS: RELAY

TYPE: Power

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Heavy Duty Industrial, 115 VAC	2.352	---	1.530	3.940	4	1.701
GRF		Heavy Duty Industrial, 25 VDC	2.411	---	0.993	5.172	2	0.829
GRF		Heavy Duty Industrial, 120 VAC	---	1.077	---	---	0	0.850
GRF	MS24192	3PST, Hermetic, 25A	---	---	---	---	0	0.029
GRF	MS25271	4PDT, Hermetic, 10A, Contact Form 4C	---	---	---	---	0	0.029

PART CLASS: RELAY

TYPE: Reed

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRF		SPST	1.032	---	0.812	1.314	16	15.500
GRF		SPST	2.320	---	1.953	2.761	29	12.500
GRF		DIP, SPST	8.391	---	7.557	9.328	73	8.700
GRF		Dry, 4PST	0.391	---	0.159	0.846	2	5.109
GRM		DPDT, 2A, 125°C	---	---	---	---	0	0.014

PART CLASS: RELAY

TYPE: Time Delay

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
SUB		SPST, Thermal Time	---	1.832	---	---	0	0.500

PART CLASS: SOCKET

TYPE: Pin, DIP

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
GRF	Circuit Assembly Corp.	Formed Phosphor Bronze, Tin Plate	0.00056	---	0.00012	0.0017	1	1801.200
SHS	Augat	Machined Beryllium Copper, Gold Plate	---	0.0046	---	---	0	200.500

PART CLASS: SPRINKLER HEAD

TYPE: General

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRF		Fire Protection 1½ in., 60 GPM	1.206	---	0.617	2.218	3	2.488
GRF		Fire Protection 1 in., 35 GPM	0.603	---	0.134	1.808	1	1.659
GRF		Fire Protection 1/2 in., STD	0.591	---	0.500	0.702	31	52.426

PART CLASS: SWITCH

TYPE: Centrifugal

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Fan Shut-off, Shaft Mtd., 120 VAC	1.808	---	0.926	3.328	3	1.659

PART CLASS: SWITCH

TYPE: Diaphragm

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
GRF		Differential, 0.5 - 1.5 IWG, Air	1.206	---	0.269	3.617	1	0.829
GRF		4 PSI, with Panel Light	9.645	---	6.723	13.672	8	0.829
GRF		Differential, 0-100 IWG, Water	2.411	---	0.993	5.172	2	0.829
GRF		Differential, 0-100 IWG, Water	2.977	---	1.840	4.715	5	1.678
GRF		Differential, 0-100 IWG, Water	3.529	---	1.807	6.493	3	0.850

PART CLASS: SWITCH

TYPE: Flow

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Paddle Type, Air Flow 500 FPM, 120 VAC	3.315	---	2.460	4.449	11	3.318
GRF		Paddle Type, Air Flow 500 FPM, 120 VAC	4.823	---	4.036	5.794	28	5.806
GRF		Paddle Type, Air Flow 500 FPM, 120 VAC	6.832	---	5.425	8.608	17	2.488

PART CLASS: SWITCH

TYPE: Humidity

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRF		Type HT, Wallmounted, Adjustable, 120 VAC	16.775	---	9.629	28.099	4	0.238

PART CLASS: SWITCH

TYPE: Push Button

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF	MIL-S-8805	4PST	0.218	---	0.043	0.662	1	4.590
GRF	MIL-S-8805	4PST	---	0.088	---	---	0	10.400
GRF	MIL-S-22885		---	---	---	---	0	0.218
GRF	MIL-S-22885	SPST, 5A	---	---	---	---	0	0.135
GRF	MIL-S-22885	Illuminated	---	---	---	---	0	0.010
GRF		Push On-Push Off, Snap in mount, 30 or 115VDC at 2A Res., 1A Inductive Actuation = 100,000, Lighted	3.160	---	2.057	4.793	6	1.899
GRF	MS25089	Pushbutton Switch, 2PDT Push-Pull Operation, Dustproof Construction, 125VAC at 10A RES.	---	---	---	---	0	0.028
GRF	MS25089	Pushbutton Switch, 2PDT Momentary Operation, Dustproof Construction, 28VDC at 10A RES.	---	---	---	---	0	0.029
GRM	MIL-S-8805	4PST, 4A	---	---	---	---	0	0.007
GRM	701222 C.P. Clare		---	---	---	---	0	0.298
GRM	701222 Clare Pendar		---	---	---	---	0	0.301
AI		4PDT, 5A, 28VDC	2.28	---	0.508	6.840	1	0.439
SUB	MIL-S-3950	5A	---	---	---	---	0	0.029

PART CLASS: SWITCH

TYPE: Reed

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
DOR	MIL-S-55433 MRR-2 Hamlin	SPST	---	0.950	---	---	0	0.964
SAT	MIL-S-55433 MRR-2 Hamlin	SPST	---	1.009	---	---	0	0.908

PART CLASS: SWITCH

TYPE: Rotary

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
GRF	MIL-S-3786		0.218	---	0.043	0.662	1	4.590
GRF	MIL-S-3786		---	---	---	---	0	0.021
GRF	12L22 Digitran		---	---	---	---	0	0.241
GRF	67-1950 JANCO		---	---	---	---	0	0.069
GRM		1 Deck, 1 Pole, 3 POS	---	---	---	---	0	0.014
GRM		1 Deck, 1 Pole, 4 POS	---	---	---	---	0	0.014
GRM		1 Deck, 2 Pole, 5 POS	---	---	---	---	0	0.007
GRM		1 Deck, 1 Pole, 5 POS	---	---	---	---	0	0.007
GRM		1 Deck, 1 Pole, 7 POS	---	---	---	---	0	0.014
GRM		1 Deck, 1 Pole, 8 POS	---	---	---	---	0	0.028
GRM		5 Deck, 1 Pole, 9 POS	---	---	---	---	0	0.007
GRM		1 Deck, 1 Pole, 11 POS	---	---	---	---	0	0.007
AI	MIL-S-3786 M3786/20-089 M3786/20-093	6 Position & 10 Position, 1/5 A, 28 VDC	---	---	---	---	0	0.017
AIT	MIL-S-3786	4P, 3 POS 6P, 2 POS	---	0.205	---	---	0	4.460

PART CLASS: SWITCH

TYPE: Sensitive

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
DOR	MIL-S-8805 1HM25 Micro Switch	SPDT, 75^0 - 125^0 F	---	---	---	---	0	0.193
GRF		125 VDC, SPDT, 2 oz Operating Force	5.249	---	2.163	11.260	2	0.381
GRF		120 VAC, SPDT	12.812	---	6.560	23.575	3	0.234
GRF		120 VAC, SPDT	4.737	---	3.302	6.768	8	1.689
GRF		120 VAC, SPDT	5.591	---	4.260	7.346	13	0.233
GRF		120 VAC, SPDT	7.857	---	4.856	12.446	5	0.636
GRF		2PDT, Push-Pull Oper., Dustproof, 28VDC at 10A RES.	.264	---	.109	.566	2	7.584

PART CLASS: SWITCH

TYPE: Thermostat

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (X 10^6)
GRF	49-13521	Remote Bulb, 30^0-110^0F, SPDT, 24 VDC	2.411	---	1.384	4.039	4	1.659
GRF	T-302	Bi Metal, 55^0-85^0F, 24 VDC, SPDT	2.411	---	1.993	5.172	2	0.829
GRF	1-28013	Bi Metal, 55^0-85^0F, 24 VDC, SPDT	2.411	---	1.384	4.039	4	1.659
AI	MIL-24236		---	---	---	---	0	0.004

PART CLASS: SWITCH

TYPE: Thumbwheel

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
			$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
					LOWER	UPPER		
GRM	8-L-116 Digitran		---	---	---	---	0	0.014
GRM	8-L-126 Digitran		---	---	---	---	0	0.028
GRM	9-L-34 Digitran		---	---	---	---	0	0.069
GRM	9-L-41 Digitran		---	---	---	---	0	0.007
GRM	9-L-45 Digitran		---	---	---	---	0	0.007
GRM	9-L-46 Digitran		---	---	---	---	0	0.076
GRM	9-L-48 Digitran		---	---	---	---	0	0.021
GRM	9-L-49 Digitran		---	---	---	---	0	0.021
GRM	9-L-51 Digitran		---	---	---	---	0	0.014
GRM	9-L-52 Digitran		---	---	---	---	0	0.007

PART CLASS: SWITCH

TYPE: Thumbwheel (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRM	9-L-53 Digitran		---	---	---	---	0	0.014
AIT		12 and 16 position	15.860	---	8.118	29.175	3	0.189

PART CLASS: SWITCH

TYPE: Toggle

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF	MIL-S-3950	Environmentally Sealed	---	---	---	---	0	0.083
GRF	MIL-S-3950	Environmentally Sealed	---	---	---	---	0	0.042
GRF	MIL-S-3950	Environmentally Sealed	---	---	---	---	0	0.010
GRF	MIL-S-8834	5A	---	---	---	---	0	0.177
GRF	MIL-S-8334		---	0.239	---	---	0	3.840
GRM		SPST, 5A	---	---	---	---	0	0.167
GRM		DPDT, 5A	---	---	---	---	0	0.083
GRM		DPDT, 5A	---	---	---	---	0	0.007
GRM	MIL-S-8834	DPDT, 25A	---	---	---	---	0	0.12
AI	MIL-S-8834 MIS90310-231	SPDT, 4A, 28 VDC	116.000	---	59.535	213.953	3	0.026
AI	MIL-S-8834 MS90311-211	SPDT, 4A, 28 VDC	---	---	---	---	0	0.052
AI	MIL-S-8834 MS90311-231	SPDT, 4A, 28 VDC	---	---	---	---	0	0.017

PART CLASS: SWITCH

TYPE: Toggle

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF	MS35059	2PDT, Momentary Oper., Dustproof Construction, 28VDC at 28A RES.	---	1.339	---	---	0	0.684
GRF	MS35059	2PDT, 2 Position Oper., Dustproof Construction, 28VDC at 20A RES.	---	0.892	---	---	0	1.029
GRF	MS90311	2PDT, 2 Position Oper., Dustproof Construction, 28VDC at 5A RES.	---	0.289	---	---	0	3.165
GRF	MS35059	1PST, Momentary Oper., Dustproof Construction, 28VDC at 8A RES.	---	1.839	---	---	0	0.498

PART CLASS: TIME-TOTALIZING METER

TYPE: Timers, Electro-Mechanical

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRF		Elapsed Time, 1 Phase 120V, 60HZ	42.210	---	30.141	58.630	9	0.213
GRF		Clock	42.850	---	34.190	53.560	18	0.420
GRM		Clock	95.230	---	39.240	204.290	2	0.021
AI		Clock	1338.000	---	1211.136	1482.112	79	0.059
AI		Clock	45.450	---	28.090	72.000	5	0.110
AI		Clock	194.600	---	184.100	205.200	255	1.310
AU		Clock	372.700	---	360.800	385.900	1075	2.884
HEL		Clock	86.360	---	69.610	107.270	19	0.220
SHS		Elasped Time	---	---	---	---	0	0.230

PART CLASS: VALVE

TYPE: General

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRF		Ball - 1 in., 250 lb., SCRD Stainless Steel Body	1.441	---	0.891	2.283	5	3.469
GRF		Butterfly - 3 in., 150 lb., Wafer Type, Steel	3.617	---	1.852	6.655	3	0.829
GRF		Butterfly, 3 in., 150 lb., Wafer Type, Steel	1.206	---	0.269	3.617	1	0.829
GRF		Check - Swing, 2 in., 150 lb., FLGD	2.399	---	1.483	3.800	5	2.084
GRF		Check - Swing, 2 in., 150 lb., FLGD	2.858	---	1.464	5.260	3	1.050
GRF		Check - Swing, 2 in., 200 lb., FLGD	2.873	---	2.051	3.990	9	3.133
GRF		Check - Swing, 1/2 in., 200 lb., SCRD	1.206	---	0.269	3.617	1	0.829
GRF		Check - Swing, 1/2 in., 200 lb., SCRD	5.997	---	3.904	9.905	6	1.001
GRF		Check - Swing, 1 in., 150 lb., SCRD	2.880	---	1.475	5.300	3	1.042

PART CLASS: VALVE

TYPE: General (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRF		Check - Swing, 1 in., 150 lb., SCRD	6.028	---	3.725	9.549	5	0.829
GRF		Diaphragm 1 in., 150 lb., SCRD, Stainless Steel Body	2.411	---	1.008	5.172	2	0.829
GRF		Diaphragm - 150 PSIG, Water	1.205	---	0.497	2.586	2	1.659
GRF		Diaphragm - 20 PSIG, Pneumatic	3.829	---	2.669	5.428	8	2.089
GRF		Diaphragm - 3 way, Water Temp. Control	---	---	---	---	0	0.124
GRF		Fixed Flow Control - 1/2 in., Air	13.632	---	6.980	25.083	3	0.220
GRF		Fixed Flow Control - 1/2 in., Air	---	---	---	---	0	0.321
GRF		Gate - 2 in., 200 lb., SCRD	1.920	---	1.102	3.216	4	2.083
GRF		Gate - 1 in., 200 lb., SCRD Bronze Body	1.206	---	0.497	2.586	2	1.659
GRF		Gate - 1/2 in., 200 lb. SCRD Bronze Body	0.603	---	0.134	1.808	1	1.659

PART CLASS: VALVE

TYPE: General (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Gate - 3 in., 150 lb., FLGD Steel	1.440	---	0.737	2.650	3	2.083
GRF		Globe - 2 in., 175 lb., SCRD	1.206	---	0.269	3.617	1	0.829
GRM		Globe - 1 in., 200 lb., SCRD Bronze Body	---	1.104	---	---	0	0.829
A		Hydraulic - 4 way Spool	463.700	---	414.200	520.500	64	0.138
A		Hydraulic - 3 way Spool	35.211	---	25.669	48.028	10	0.284
AUT		Hydraulic - 3 way Spool	---	---	---	---	0	0.212
AU		Motor Driven - Fuel	47.850	---	38.450	59.450	19	0.397
GRF		Needle - 1/4 in., 3000 PSI, Steel	1.690	---	0.696	2.898	2	1.183
GRF		Needle - 1/2 in., 3000 PSI, Steel	1.206	---	0.617	2.218	3	2.488
GRF		Plug - 1/2 in., 150 lb., SCRD, Steel w/stainless steel plug	1.219	---	0.272	3.657	1	0.820

PART CLASS: VALVE

TYPE: General (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
GRF		Plug - 1/2 in., 150 lb., SCRD, Steel w/stainless steel plug	3.840	---	2.204	6.433	4	1.042
GRF		Plug - 1 in., 150 lb., SCRD, Steel w/stainless steel plug	0.969	---	0.216	2.908	1	1.032
GRF		Plug - 2 in., 300 lb., SCRD, Steel w/stainless steel plug	1.206	---	0.269	3.617	1	0.829
GRF		Plug - 2 in., 300 lb., SCRD, Steel w/stainless steel plug	5.761	---	4.338	7.614	12	2.083
GRF		Relief - 3/4 in., 150 lb., Set 80 PSI, 56 PM	2.411	---	0.993	5.172	2	0.829
GRF		Relief - 3/4 in., 150 lb., Set 80 PSI, 56 PM	1.568	---	0.350	4.705	1	0.638
GRF		Relief - 3/4 in., 150 lb., Set 80 PSI, 56 PM	1.206	---	0.269	3.617	1	0.829
GRF		Relief - 1/2 in., 150 lb., Set 85 PSI, 20 SCFM	1.808	---	0.926	3.328	3	1.659

PART CLASS: VALVE

TYPE: General (continued)

ENV	SPEC NUMBER PART NUMBER MANUFACTURER	CHARACTERISTICS	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS (x 10^6)
GRF		Vent - 3/4 in., Float operated tank vent	---	---	---	---	0	0.321
GRF		Solenoid - 2 in., 380 PSI, 2 way, shuttle	1.608	---	0.331	2.693	4	2.488
GRF		Solenoid - 1/2 in., 4 way, 3 POS. shuttle	0.826	---	0.340	1.772	2	2.421
GRF		Solenoid - 1/2 in., 110V, Refrigerant.	6.816	---	3.490	12.542	3	0.440
GRF		Solenoid - 3/8 in., 150 lb., 110V, Air	9.618	---	4.924	17.697	3	0.312

NONELECTRONIC PART RELIABILITY DATA

SECTION 3

NONELECTRONIC PARTS DATA FROM COMMERCIAL EQUIPMENT APPLICATIONS

Section 3

NONELECTRONIC PARTS DATA FROM COMMERCIAL EQUIPMENT APPLICATIONS

The detailed data presented in this section have been selected and grouped on the basis of direct applicability to electronic data processing, point of sales and test equipments. Data from these areas have proven to be limited and have been grouped in this section in order to improve visibility for the user of the databook. The environmental codes described on page 5 are utilized in this section.

The user should take care to note the terms in which the failure data are given, i.e., hours or cycles, since this is a variable in this section. **An asterisk (*) to the right of the data line is provided to alert the user to note that the column headings are in cycles.**

INDEX FOR COMMERCIAL EQUIPMENT APPLICATION DATA

	Page
Teflon Sleeve Bearing	215
Bearing (Pair)	215
Belt	215
Ceramic Bushing and Spring	216
Spring Clutch	216
Memory Disk	217
LED Display, 7 Segment	217
LED Display, Dot Matrix	218
Fan	220
Vacuum Fan	220
Gear	221
Magnetic Tape Head	221
Motor	221
Relay	222
General Purpose Relay	222
Keyboard Switch	223
Key Push Button Switch	224
Push Button Switch	225
Rocker Switch	225
Toggle Switch	226
Switch	227

PART DESCRIPTION	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
PART: Teflon Sleeve Bearing APPLICATION: Tape Guide, Magnetic Tape Unit APPLICATION CONDITIONS: GRF (45°C Internal) FAILURE MODES: Erratic Movement Worn	14.180	---	12.813	15.862	73	5.148
PART: Bearing (Pair) APPLICATION: Capstan, Magnetic Tape Unit APPLICATION CONDITIONS: GRF (45°C Internal) FAILURE MODES: Noisy, Worn	13.985	---	9.986	19.424	9	0.644
PART: Belt APPLICATION: Capstan Drive, Magnetic Tape Unit APPLICATION CONDITIONS: GRF (45°C Internal) FAILURE MODES: Worn, stretched, broken	41.956	---	35.050	50.385	27	0.644

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PART DESCRIPTION	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($X10^6$)
	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
			LOWER	UPPER		
PART: Belt APPLICATION: Data Entry, Data Preparation Equipment APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	0.456	---	0.419	0.498	106	232.406
PART: Ceramic Bushing and Spring APPLICATION: Tape Guide, Magnetic Tape Unit APPLICATION CONDITIONS (45°C Internal) FAILURE MODES: Worn Bushing, Spring Tension Lost	33.409	---	29.060	38.290	43	1.287
PART: Spring Clutch APPLICATION: Data Entry, Preparation Equipment APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	0.594	---	0.572	0.619	478	804.347

PART DESCRIPTION	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
			LOWER	UPPER		
PART: Memory Disk APPLICATION: ---------- APPLICATION CONDITIONS: DOR FAILURE MODES: ----------	0.148	---	0.033	0.444	1	6.760
PART: LED Display, 7 Segment, 1 Character APPLICATION: Test Instruments APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	0.226	---	0.214	0.238	258	1141.741
PART: LED Display, 7 Segment, 4 Character APPLICATION: Test Instruments APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	0.146	---	0.0325	0.437	1	6.864

PART DESCRIPTION	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
			LOWER	UPPER		
PART: LED Display, 7 Segment, 5 Character APPLICATION: Test Instruments APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	0.114	---	0.077	0.166	7	61.529
PART: LED Display, 7 Segment, 9 Character APPLICATION: Test Instruments APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	---	1.559	---	---	0	0.588
PART: LED Display, Dot Matrix, 1 Character APPLICATION: Test Instruments APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	0.163	---	0.137	0.193	29	178.303

PART DESCRIPTION	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	$\hat{\lambda}$	60% UPPER SINGLE SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
			LOWER	UPPER		
PART: LED Display, Dot Matrix, 3 Character APPLICATION: Test Instruments APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	---	7.190	---	---	0	0.127
PART: LED Display, Dot Matrix, 4 Character APPLICATION: Test Instruments APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	0.962	---	0.214	2.885	1	1.040
PART: LED Display, Dot Matrix, 5 Character APPLICATION: Test Instruments APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	---	0.157	---	---	0	5.829

PART DESCRIPTION	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
			LOWER	UPPER		
PART: LED Display, Dot Matrix, 6 Character APPLICATION: Test Instruments APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	1.095	---	0.891	1.345	21	19.175
PART: Fan APPLICATION: Data Entry, Preparation Equipment APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	0.312	---	0.274	0.356	49	156.952
PART: Vacuum Fan APPLICATION: Magnetic Tape Unit APPLICATION CONDITIONS: GRF (45°C Internal) FAILURE MODES: Bearings Worn, Noisy	12.431	---	8.665	17.662	8	0.644

PART DESCRIPTION	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
			LOWER	UPPER		
PART: Gear APPLICATION: Data Entry, Preparation Equipment APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	0.169	---	0.130	0.218	14	83.067
PART: Magnetic Tape Head APPLICATION: Magnetic Tape Head APPLICATION CONDITIONS: GRF (45°C Internal) FAILURE MODES: Signal Distortion, Head Worn	43.510	---	36.479	52.184	28	0.644
PART: Motor APPLICATION: Data Entry, Preparation Equipment APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	1.499	---	1.401	1.619	154	102.789

PART DESCRIPTION	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
PART: Relay APPLICATION: Data Entry, Preparation Equipment APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	2.693	---	2.591	2.806	488	181.208
PART: General Purpose Relay Silver or Gold Bonded Contacts APPLICATION: Medical Electronics APPLICATION CONDITIONS: GRF FAILURE MODES: Fatigue of Swinger 7 Contact Resistance 9 Contact Bounce Greater than 30 Milliseconds 13	0.00107	---	0.000904	0.00128	29	27000.000*

PART DESCRIPTION	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
PART: General Purpose Relay 10A, 25VDC Contact Res. Initial 0.05 Ω Contact Res. After Life Test 0.10 Ω APPLICATION: Electronic Data Processing APPLICATION CONDITIONS: Test, 10^5 cyc each FAILURE MODES: Mechanical 1 at 18,000 cyc Electrical 10	2.115	---	1.570	2.838	11	5.200*
PART: Keyboard Switch Colorado Instruments Gold Contacts, 10A, 28VDC, 0.2Ω 90GM Force; 0.080 in. Pretravel, 0.020 in. Overtravel APPLICATION: Point-of-sale Equipment APPLICATION CONDITION: Test, 30 cyc per minute FAILURE MODES: Contact Miss 19 Spring Fatigue 7 Broken Actuator 2	0.0622	---	0.0522	0.0744	28	450.000*

PART DESCRIPTION	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($X10^6$)
	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
			LOWER	UPPER		
PART: Keyboard Switch Cherry Electrical Products Gold Alloy Crosspoint Contacts 10A, 24VDC, Operating Life 5 x 10^6 cyc APPLICATION: Intelligent Terminal APPLICATION CONDITIONS: GRF (35°C - 40°C Internal) FAILURE MODES: Contact Miss 4 Burned Contact 3 Broken Return Spring 3 Broken Actuator Stem 1	0.0105	---	0.00777	0.0141	11	1050.000*
PART: Key Push Button Switch Contacts - 3A, 115-200VAC; Resistance 50mΩ at 6VDC & 100mA Life Mechanical - 100,000 cyc Life Electrical - 25,000 cyc APPLICATION: Electronic Data Processing APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	2.317	---	1.508	3.514	6	2.589

PART DESCRIPTION	FAILURE RATE/10^6 HOURS $\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL LOWER	60% CONFIDENCE INTERVAL UPPER	NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
PART: Push Button Switch Contacts - Silver Plate; Contact Resistance Initial 0.015Ω at 2A, 30VDC; After Life Test 0.030Ω APPLICATION: Electronic Data Processing APPLICATION CONDITIONS: Test FAILURE MODES: Contact Resistance 6	3.000	---	1.953	4.550	6	2.000*
PART: Rocker Switch C&K Components - 5101, 5103, 5108 APPLICATION: ---------- APPLICATION CONDITIONS: Test 10^5 cyc each 15 cyc per minute; duty cycle - 1 sec. on, 3 secs. off; resistive load, 20mA, 20VDC FAILURE MODES: ----------	---	0.916	---	---	0	1.000

PART DESCRIPTION	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($X10^6$)
	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
			LOWER	UPPER		
PART: Toggle Switch OAK-12A-2B1-1AO APPLICATION: Electronic Data Processing APPLICATION CONDITIONS: Test 10^5 cycles each at 18 cycles per minute; 20mA, 20VDC, resistive load FAILURE MODES: Actuator Broken 1 Contacts Pitted 1	4.158	---	1.713	8.919	2	0.481*
PART: Toggle Switch Contact Resistance Initial - 0.01Ω at 30VDC; Contact Bounce - 6 milliseconds at 0.1A, 4VDC APPLICATION: Electronic Data Processing APPLICATION CONDITIONS: Test FAILURE MODES: Mechanical 1 @ 20,369 cycles	1.479	---	0.330	4.438	1	0.676*

PART DESCRIPTION	FAILURE RATE/10^6 HOURS				NUMBER FAILED	OPERATING HOURS ($\times 10^6$)
	$\hat{\lambda}$	60% UPPER SINGLE-SIDED CONFIDENCE	60% CONFIDENCE INTERVAL			
			LOWER	UPPER		
PART: Switch APPLICATION: Data Entry, Preparation Equipment APPLICATION CONDITIONS: GRF FAILURE MODES: ----------	27.234	---	26.771	27.779	21096	774.613

NONELECTRONIC PARTS RELIABILITY DATA

SECTION 4

FAILURE MODES AND MECHANISMS

OPERATIONAL FAILURE MODES AND MECHANISMS

The following discussions provide information which serves to identify the major problem areas associated with the failures of certain nonelectronic parts under operational conditions. To a limited extent, guidelines are provided for limiting the failure modes identified.

Batteries

There are two basic types of batteries, primary and secondary. Primary batteries are nonrechargeable, discarded when the energy runs out. Secondary batteries are rechargeable batteries and can be used time and time again. This discussion is limited to specific secondary batteries such as lead-acid and nickel-cadmium.

Lead-Acid Batteries

Lead-acid systems are not new; they have not been used widely in electronic systems because of packing problems, their weight and size, and the danger of acid leakage. The newly developed gelled lead-acid system, however, has overcome most of the drawbacks of its predecessor (except packaging inadequacies), but it is new and not yet in great supply and usage.

Lead-acid batteries have one area which greatly affects their useful life, the recharge cycle. Recharging efficiency is a function of temperature and charge rate. To properly recharge many secondary batteries the charge rate must be tapered with time. Not doing so shortens the life of the battery and can lead to overcharging. In lead-acid batteries, overcharging will cause the generation of gases (H_2 and O_2) within the cell to dangerously high levels. Though almost all lead-acid batteries have venting techniques to allow the gases to escape and thereby reduce cell pressure, the loss of these gases can greatly reduce the life of the cell. Several manufacturers of lead-acid batteries utilize a separate compartment to recombine the gases into water via a catalyst. This is done at the expense of compactness. In the worst case, if the gases are not vented or are vented at too high a pressure, the cells will explode.

Charging, and especially overcharging, also causes the battery cells to generate heat. It should be noted that many rechargers use this condition to increase the tapering of the charge rate and so reduce the possibility of overcharging.

Other reliability considerations lie in the packaging and basic design of lead-acid cells. Examining packaging first, it is incorrect to assume that any battery is hermetically sealed. Corrosion can be found on lead-acid cells that have never been used and have been left in storage. Lead-acid batteries have been known to leak acid either through the case itself or through the terminal seals.

The basic design of the lead-acid battery is also responsible for several problems. The nature of the lead-acid system does not lend itself well to being packaged in a cylindical package. This tends to lower the energy density per cell and also to cause the package failures mentioned previously.

Nickel-Cadmium Batteries

The charging information stated for lead-acid can be applied to the nickel-cadmium. There is also specific information which only applies to the nickel-cadmium.

Memory effect is a reversible failure mode that causes a nickel-cadmium battery to fall below its rated performance because of certain modes of operation. It is caused by repetitive discharge to a shallow depth. A nickel-cadmium battery repeatedly discharged only 25% (75% of charge unused) and then fully recharged will, after 50 or more of such cycles, deliver 25% of its rated capacity when a deep discharge is then attempted. A nickel-cadmium battery exhibiting memory effects can be restored to normal capacity simply by deep discharging it and then fully recharging it. Memory effect is not a problem when the battery is subjected to random depths of discharge or is overcharged for random periods of time. It occurs only when a precise, repetitive pattern of shallow discharge and full recharges is followed. This is not a prevalent problem in all NiCd battery systems but is the product of several design techniques.

Cell polarity reversal is another hazard of the NiCd battery. If a battery (consisting of several cells in series) is discharged to too low a level and one or more of the composing cells is completely depleted of charge, there is the chance that the depleted cell's polarity may reverse. In this instance, the reversal cell would accept a charge from the remaining charged cells, generate internal heat and pressure, and destroy the battery.

Chemical breakdown of the nylon separator is the most frequent failure of nickel-cadmium batteries. Oxygen produced continuously while the cell is in an overcharge mode reacts with the nylon; as a result, a NiCd cell at 50°C has a useful life about half that at 40°C. NiCds for emergency power are almost always run in such a continuous low-rate overcharge mode.

Conclusions

Part level failure problems associated with batteries can be lumped under four basic categories: catastrophic short; catastrophic open circuit; deviations in electrical performance; and mechanical anomalies. The most predominant failure mode is a mechanical anomaly, leakage from a cell seal.

System level failures in charge control or thermal design, while not caused by the battery, may be falsely interpreted as a defect in the battery.

Bearings

The predominate failure modes of bearings are related to their lubrication. Much emphasis has been placed on the study of bearing fatigue life and reliability and the types of lubrication systems used to enhance long life, since bearings are acknowledged as the life-limiting elements of most motors. To reach the longest motor life possible, bearing wear must be reduced to a minimum, usually by the application of lubricants. The selection of lubricants is almost always a compromise, since there are so many significant characteristics to consider. Some of the important application considerations include: operating temperature range,

oxidation and thermal stability properties, type of environment, evaporation rate, and viscosity. Depending on the specific application certain tradeoffs are inevitable, as in the case of silicon, which has an excellent viscosity index rating but poor boundary condition lubrication.

The failure mechanisms of bearings usually result in the reduction of lubrication. These mechanisms include: excessive bearing load, excessive temperature, bearing misalignment, brinnelling (plastic deformation of raceways), fretting corrosion, contamination of raceways (gear wear debris, brush wear debris, corrosion products), evaporation or migration of lubricant, high viscosity (operating temperature lower than anticipated) and spalling or galling.

Circuit Breakers

The function of a circuit breaker is to protect electrical circuitry by acting as a manual switch that can open itself under overload conditions. The major circuit breaker problem is mechanical failure due to the complexity of some activation mechanisms. Contamination caused by the formation of oxides or loose metal particles is also a problem and could result in an open or short condition. Contact corrosion due to external impurities (such as solder resin, body oils, sulfides, or wire lubricants) can also create the same condition. Poor process control can cause deformed, loose, or broken contacts, and termination separation.

Connectors

A device consisting of a plug and a receptacle that provides a disconnect capability between the various components in an electrical circuit is classified under the general heading of connector. The plug or receptacle is the termination of the internal circuit leads. The connection made between the connector and the conductor itself is made by several different methods: crimping, soldering, welding, and the clamping action of mechanical closures. The type of connector depends on the style of the coupling system. Some of the common connector types are radio frequency, cylindrical multipin, rectangular, and printed wiring.

Connector failure problems may be lumped into three basic categories: mechanical parameter deviation, electrical parameter deviation, and mechanical damage. It should be noted that catastrophic opens and shorts are worst-case conditions of certain electrical parameter deviations. These failures may be the result of several different failure mechanisms. The prevelant failure mode for all connectors is an electrical parameter deviation (open condition) generally caused by contamination interfering with normal operation. Corrosion is another failure mechanism resulting in an open circuit: the oxides formed may tend to act as an insulator. Even gold plated contacts have corrosion problems: the base metal may diffuse through the gold and form an oxide on the surface. Mechanical damage is often the result of improper installation techniques. Wear factor is also a major problem. With hard gold you can expect mating and demating cycles of 200 or more. With tin plating or solder coating, the cycles may drop to 50 or more. This can be a problem when using high density connectors. Other common failure modes are creep or relaxation of the materials in the connection and overheating of the termination by the flow of current.

Coolant Hose

A coolant hose failure often results in the shutdown of a whole system which, in many cases, could have been avoided by routine inspection and replacement. Most equipment owners have established maintenance schedules that include the cooling system. By recognizing the signs of coolant hose failures and eliminating their causes, equipment downtime can be reduced.

Coolant hose failures may be attributed to five major failure mechanisms. Excessive heat, one of the more prevalent failure mechanisms, causes hardening or cracking of the hose cover. Hose "overcure" due to excessive internal or external heat will result in the hose becoming stiff and failing. Weathering and cracking can result from pollution in the environment around the hose; ozone especially has an adverse effect. Large irregular cracks in the hose cover without hardening are caused by vibration. To correct vibration problems, use a flex or humped hose or

dampen the vibration source. Coolant deterioration will cause the interior of the hose to crack and flake off and enter the coolant. These particles can clog the cooling system and cause a failure. The final failure mechanism is contamination of the hose. This occurs primarily when oil or grease soaks the hose, causing it to become soft or spongy. An oil-softened hose can collapse under sudden application of vacuum as in sudden acceleration. To correct this problem, eliminate the source of the oil (may be external or internal) and replace the hose.

Electron Tubes

Electron tubes are devices sealed in a gas-tight envelope or "tube" using the motion of electrons through a gas or vacuum for the desired effect. The first class of electron tubes is the vacuum tube, where a vacuum or a near-vacuum is employed. The second class is gas tubes, where the electrons impact atoms of the gas, which then ionize. Many electron tubes have had extensive military use, and failure rates are available in MIL-HDBK-217C.

Four primary modes are associated with electron tubes: deterioration or destruction of the seal, wearout of electron emission surfaces, evolution of gas, and contaminated or damaged emission surfaces resulting in increased electron emission. The failure mechanism most likely to be directly or indirectly responsible for all four failure modes is excessive heat. Both heat from the environment around the tube and heat generated within the tube create this adverse effect. Internal heat rise is due to one of two sources: the current flow from one element of the tube to another element, and power used to raise the electron-emitting cathode to operating temperature.

Fuses

The basic function of a fuse is to protect electrical circuits. When the current flow through the circuit exceeds the rated capacity of the fuse, the circuit is opened by the fuze element. Fuses provide safety against overload conditions which could result in either damage to the electrical system or a fire.

Fuses have two principal failure modes: open, and failure to open. Any premature interruption of the current flow such as a mechanical breaking of the fuse element would be classified as an open. A failure to open is when current flow levels exceed the fuse rating and the fuse element does not open the circuit. Failure to open is most commonly caused by electrically conductive material shorting the fuse terminals together. The principle failure mechanism is contamination including corrosive products. The source of the contaminants is dependent on the type: conductive and nonconductive. The conductive contaminant can come from solder balls or metal flashings and is usually detectable by x-ray screening. However, the nonconductive material, which can cause failure to open as well as open, is difficult to detect. The source of nonconductive contaminants is sometimes the fuse case or body.

Slow blow fuses are treated a little differently. Slow blow fuses are used when a high in-rush of current is desired to initially start a system and after initial start-up, to maintain the system at a lower current level. If the fuse blows too fast the system will not start or energize. If the fuse blows too slow, damage may occur to the system. Therefore, the most prevalent failure mode of slow blow fuses is the delay time.

Gaskets and Seals

Fluid seals are devices used to effect separation of gaseous or liquid environments at points of structural transition and at movable component interfaces. Seals used in applications where the involved surfaces do have relative motion are commonly called gaskets. An example of structural transition seal is the gasket used in the internal combustion engine between three distinctly separate environments, ambient air, cooling fluid, and combustible gases. An example of a seal for a movable component interface is the gland seal around the shaft of a rotary pump, separating the fluid being pumped from the ambient surroundings. This type of seal is commonly known as a dynamic seal and is used to effectively separate the various environments at movable interfaces where there may be reciprocating longitudinal movement as well as rotary motion.

The most common failure mode for fluid sealing devices is leakage, classified into three basic types: (1) permeation, (2) molecular, and (3) viscous flow. Permeation, as the name implies, is a capillary flow directly through the material. This is primarily because of the degree of porosity of the batch material from which the seal was fabricated. Molecular flow is a similar phenomenon, but it occurs at the interface surfaces and is caused by a finite unoccupied space between the two surfaces of the interface. Molecular flow is proportional to the pressure differential between the separated environments. Viscous flow also occurs on the interface surfaces and is encountered when the minimum cross-sectional area of the leakage path becomes large in comparison to the mean free path requirement for gas flow. Viscous flow leakage rate is proportional to the difference between the square of the internal pressure and the square of the external pressure.

In addition to leakage (limited loss of contained fluid), fluid sealing devices fail by rupture because of inadequate back-up rings or excessive pressures and the introduction of corrosion products or other contaminants. Rupture may be caused either by excessive pressure differentials applied to the sealing device or by shearing mechanical forces applied in an unforeseen rotational mode or as an excessive transverse force. Corrosion products and other contaminants may be caused by normally anticipated environmental considerations, or they may be the result of galvanic corrosion and/or contaminants in inadequately filtered fluid.

Gyroscope

A gyroscope is a device developed to detect angular motion with respect to inertial or Newtonian space. Each design is somewhat unique; however, the usual construction is a spinning wheel with one or two degrees of freedom. A gyroscope normally consists of six functional components: wheel, spin bearings, spin motor, gimbel, pickoff and torquer. The primary source of failures are the spin bearings. The normal life of each gyroscope is dependent on the environment it is used in and the conditions it operates under. The prevalent failure mode of gyros using ball bearings is deterioration of the lubricant or running surface due to contamination.

Gas bearings are excellent for continuous operation because of no wear under run conditions. The major failure mechanism occurs during starting and stopping. Grease bearings offer a greater tolerance to contamination and potentially much longer life. Drift instability is also a problem since a very small amount of creep in the gyro float material can cause a drift equivalent to a nautical mile. Material creep is caused by instability due to time and temperature cycling effects.

IC Sockets

There are two basic types of contacts in IC sockets: screw machined, closed-entry sleeves with screw machined or stamped-and-rolled four-leaf contact inserts; or one-piece stamped and formed contacts with single or dual-leaf contacts. Either socket type is available with solder tail on wire-wrapable terminations.

Sockets with stamped contacts come in two configurations. In one, the contacts mate with the broad sides of the leads. In the others, the contact mates with the side and are called side-wipe or face-grip. The merits of these two approaches have been debated at great length.

Zero insertion force connectors have a sliding mechanism that provides effortless insertion and withdrawal of ICs when the sockets are in the open position but locks them securely in place when the mechanism is closed. Zero insertion force sockets are expensive but not compared to a 40 pin IC with a broken lead. Therefore, these sockets are mainly used in "high pin" ICs.

For contact materials, beryllium copper when used for high reliability application is an excellent choice. It retains good spring qualities, although it requires plating because of a tendency to form surface oxides. Phosphor bronze provides excellent spring qualities, adequate conductivity, and generally gives the best combination of economy and reliability. It also usually requires plating with solder lead contacts in order to aid solderability.

Socket bodies are commonly made of thermoplastic materials like glass nylon, glass polyesters and polycarbonates. Thermosets like DAP and phenolics are also used. They provide excellent dimensional stability and heat resistance but are generally more expensive.

One of the major failure modes for sockets is high resistive connections. If the application is in a high contamination area there is the risk of oxidation forming on the contacts or of the accumulation of dust or dirt particles. This condition creates a high resistive connection which may result in a false indication when using sensitive circuitry.

Intermittents are even a larger problem due to problems of location of the intermittents. This is especially difficult in digital systems where there are either high or low logic levels.

The contact must maintain its spring qualities after several removal and insertion cycles. The amount of pressure exerted on the IC lead must be adequate to break through any oxidation which may have formed.

Sufficient caution must be taken during soldering to insure that solder does not enter the barrel of the IC socket, preventing proper installation of the IC.

The following is a listing of failure modes for IC sockets:

1) Increase in contact resistance with repeated insertion because of fatigue and deformation of spring material in contact fingers
2) Damage to contact and pin plating with repeated insertion and exposure of base metal to corrosive atmosphere
3) Corrosion of contact and pin surfaces because of porous plating, plating that is too thin, diffusion of base metal into plating, scratched plating, etc.

4) Insulation resistance failure of plastic socket housing because of water absorption or change of mechanical properties of housing at high temperatures
5) Electrochemical reaction between socket contact and IC pin
6) Poor contact resistance caused by surface films on socket contacts and IC pins

Motors

Motors can be classified into two basic types, ac motors and dc motors. In direct-current motors, speed adjustment is inexpensive and easily obtained; therefore, a wide variety of industrial applications use DC motors. Alternating-current type motors are frequently used in aerospace applications. Overheating causing premature motor failure can be the result of the selection of too small a motor for the given application or of a unit unsatisfactory for the given environment. Therefore, it is important to implement a proper selection and application program for reliable motor operation.

The principal failure modes associated with motors are related to the lubrication of the bearings or the commutation of the brushes. Bearing failure can be caused by various failure mechanisms, of which the most common are: inadequate lubrication due to migration or evaporation or severe operating conditions, brinnelling (plastic deformation of the raceways), fretting corrosion, raceway contamination, and spalling of raceways. Bearings have proven to be the life-limiting items in motors. Most dc motors have the additional failure modes associated with brushes (i.e., fracture, rapid brush wear due to high altitudes, and bearing failures due to contamination from brush wear) and in general are more prone to failure than ac motors.

Printed Circuit Boards

There exists a variety of printed circuit boards commercially available. The choice of interconnection board depends on many different factors. Required packaging density, desired delivery time, cost limitations, usage environment and

size of production run are all factors which can be used to determine the optimal type of interconnection board for a particular application. Circuit board reliability is also an important consideration, and this section includes failure modes and mechanisms for double sided, multilayer, multiwire and wirewrap interconnection boards.

The plated through hole is used in double sided, multilayer and multiwire printed circuit boards to connect component leads to board circuitry. The plated through hole is the largest contributor to circuit board failures for these types of boards. Problems arise because of the differences in thermal expansion of the epoxy glass base material and the copper plating. The epoxy glass and the copper expand and contract at different rates during thermal cycling. This results in axial strains on the plated through hole barrel wall, weakening the mechanical properties of the copper plating and eventually leading to open circuits. In the case where the ductility of the copper plating is already poor, this process is accelerated. Additionally, poor drilling or excessive acid etching during the plated through hole cleaning process can lead to imperfections in the barrel wall. These imperfections will amplify the level of axial strain in the plated through hole and contribute to possible open circuits.

Multilayer boards, as compared to double-sided boards have additional layers of circuitry separated by epoxy glass laminations. This allows for higher packaging density but also creates additional plated through hole problems. Electrical connections to the plated through hole can be made at a number of different layers in the circuit board. This adds to the number of areas which are affected by strains related to thermal cycling. At each layer where a copper run must connect to the plated through hole, a shearing force is applied to the copper run - plated through hole interface, resulting in possible open circuits.

The multiwire type of interconnection board is unique because insulated wire is laid down on the epoxy glass as an alternate to the copper runs used in double-sided and multilayer printed circuit boards. This results in high packaging density because the insulated wires can be crossed on a single level of circuitry. There are several advantages in this type of system but there are also different failure modes

which must be considered. Problem areas are the points of wire crossover and the wire to plated through hole connection. Under extreme environmental conditions, the wire insulation and the wire deform at a point of wire crossover and potentially cause short circuit. The wire to plated through hole can be the source of an open circuit if exposed to vibration and thermal cycling.

One advantage of wirewrap interconnection boards is the absence of plated through holes and the associated problems. However, several failure modes do exist. Insufficient tension in the wire can result in a poor connection between the wire and the wirewrap post. This occurs particularly when applied to a high vibration environment. Additionally, caution must be observed concerning wire insulation cold flow; adjacent wires or contact with a part can result in short circuits due to cold flow. Some materials which exhibit cold flow are teflon, polyvinyl chloride, etc.

Pumps

Hydraulic Pump

Nearly all hydraulic pumps work in rotary fashion. As a pump is rotated, it develops a partial vacuum on the inlet (suction) side, permitting fluid under atmospheric pressure in the reservoir to flow into the pump inlet. Then the pump ejects this fluid, usually at a higher atmospheric pressure. It is worth noting that a pump does not create pressure; it merely moves fluid, causing the flow. Pressure is created by the load on the fluid; if no load exsits, the fluid will have very little pressure. As the load is placed on the fluid, the pressure at the outlet side of the pump increases to a value that is normally indicated as the pump maximum.

Failure modes for hydraulic pumps include:

1) **Bearing or bushing failure**
2) **Incorrect fluid used, causing excessive wear**
3) **Seal deterioration**
4) **Cavitation causing pump internal part failures**

Pneumatic Pumps (Compressors)

An air compressor delivering air to a pneumatic system performs the same job as a hydraulic pump. The main substantive difference between pump and compressor is that the fluid delivered by the compressor-air is compressed and under pressure at the time it is delivered, even if there is no load on the system. The only other substantive difference between the two is that most hydraulic systems are powered by a single pump that is actually part of the system, whereas the hose of the pneumatic systems is often powered by a single compressor, which is almost a "utility" in the plant, like water or electric service.

Failure modes for pneumatic pumps (compressors) include:

1) Bearing or bushing failure
2) Seal deterioration and leakage
3) Foreign material entering pump, causing damage or excessive wear to internal parts
4) Check valve leakage (when valves are integral with the pump)

Quick Disconnect Couplings

The malfunction modes of quick disconnect couplings are:

1) Failure to open or remain open
2) Failure to close or remain closed, including leakage, while uncoupled
3) External leakage while coupled

The possible causes for mode 1 include deformation or failure of the actuation plunger of connectors and binding of the movable engaging clamp ring. The possible causes for mode 2 include binding or cocking of the moving assembly of the connectors and failure or permanent deformation of the plunger return spring. Possible causes for mode 3 include leakage of the sleeve O-ring and leakage at the lip seal.

Relays

A relay is basically a remotely controlled, electrically operated switch which contains two or more contacts arranged so as to control external circuits. This broad definition applies to all relays regardless of type and internal construction. Most relay types, with the exception of simple thermal time delay and reed types, are complex electromechanical devices. Experience with these devices has indicated that, because of imperfections in materials and workmanship, a relay cannot be satisfactorily specified by contact rating alone. Physical considerations force us to recognize such compromising characteristics built into a relay as operate and release time, temperature effects on pickup and dropout voltages, dielectric breakdown, contact resistance, and insulation resistance. These characteristics are not simply design controlled but are directly affected by the materials employed and the care with which the relay is assembled. The factors of design, materials, and workmanship are the ones usually associated with relay failure.

Part level failure problems associated with relays may be lumped under four basic categories:

1) Failure of contacts to make or break
2) Short
3) Electrical parameter deviation
4) Mechanical anomaly

These categories are used for both latching and nonlatching type relays. For this discussion, relays have been grouped into two categories according to their basic internal construction-armature and reed types.

Armature Relays

The relay style most often used in high reliability application (and considered here) is the balanced armature type because of its demonstrated ability to withstand mechanical shock and vibration. In these relays the armature is pivoted at

its center of mass so as to place it in equilibrium with the static and dynamic forces which act upon it during operation. The moving contacts are either mounted on the armature or activated by movement of the armature.

Almost all armature type relays use copper magnet wire in the coil windings. In such copper windings the coil resistance is directly proportional to the temperature of the windings. The ampere-turns required for the coil to actuate the armature is, therefore, proportional to temperature since the coil resistance varies with coil temperature. To maintain the required ampere-turns, the pickup and dropout voltages will vary over the application temperature range.

One of the most crucial and troublesome areas in armature relay reliability is that associated with the contacts. Many of the problem areas result from the users' lack of understanding of the parameters which affect contact performance. As a consequence, contacts are operated under a wide spectrum of load conditions and a multiplicity of performance criteria which, when reviewed singularly or in combination, are inconsistent with the design parameters of the contacts.

There is a wealth of information available on contact theory and the various materials used in obtaining specific contact characteristics. The user of relays in high reliability applications should be thoroughly familiar with the information since reliability is frequently achieved through carefully limiting certain service applications.

Contamination is also a major concern in high reliability relays because it is a prime contributor to relay failures. Contamination is predominantely introduced during the assembly of the relay. The contamination level can be reduced by careful selection of materials which are used for fabrication of the end product. The user should pay particular attention to the materials used for spacers, washers, insulators, and coil insulation, as well as plating requirements, before specifying a particular manufacturer's relay for his applications. These areas are considered critical to the reduction and control of contamination.

The above discussion has served to define a few of the characteristics associated with armature relays. These and other limitations can be described as specification limits for manufacturers and designers. Deviations from the limitations can lead to equipment failure.

Reed Relays

Reed relays are made from one or more reed capsule switches inside a common actuating coil. In those cases where the reed capsule switch is used in conjunction with a coil, it is generally classified as a relay; and in those cases where the reed capsule switch is used in conjunction with permanent magnet actuation, it is classified as a magnetic switch.

A basic magnetic reed switch consists of a pair of low reluctance ferromagnetic, slender flattened reeds, hermetically sealed into a glass tube with a controlled atmosphere, arranged in cantilever fashion so that the ends align and overlap with a small air gap in between. The overlapping ends assure opposite polarity when brought into the influence of a magnetic field. When the magnetic flux density is sufficient, the attraction forces of the opposing magnetic poles overcome the reed stiffness, causing them to flex toward each other and make contact. The restoring force provided by the elasticity of the reeds returns the reeds to their original position when the magnetic field is removed. Reed capsule switches, when used within their rated limits, generally have contact life ratings in the one to one hundred million cycle range, depending on contact voltage and current loads used.

The reed switch is inherently a low current, low voltage device. Its contact areas are small and contact pressures are low because the reeds become magnetically saturated; therefore, additional contact force cannot be developed by increasing the applied magnetic flux. These factors limit the continuous current rating of the switch. The interruption rating of the switch is limited by the gap between fully open contacts and by the restoring force provided by the elasticity of

the reeds. Low contact pressures and small contact gap between fully open contacts limit the reed capsule switch use in severe vibration and shock environments.

The unpredictable random occurrence of contact sticking inherent in these switches is caused by tiny magnetic wear fragments accumulated at, and sometimes binding, the contact gap. Arcing caused by dc loads between the contacts causes metal transfer, resulting in spike and crater formation which sometimes results in contact sticking due to friction between the spike and crater surfaces. For these reasons, application should be limited to those uses where an occasional contact miss is not considered a catastrophic event and those uses where voltage and current loading of the switch contacts minimizes spike and crater formation. Careful handling of the switch is a mandatory requirement. The switch contact members extend beyond each end of the glass capsule and are used as switch terminals. Bending, cutting, or applying excessive heat to the switch leads during soldering and installation changes the switch operating sensitivity. Operating one reed switch adjacent to another or in a stray magnetic field can also change its sensitivity. Magnetic shielding around reed relays is relatively ineffective in reducing the effects of uniform stray magnetic fields. Reed relays are inherently more sensitive to stray magnetic fields by one or two orders of magnitude than any other type of sealed relay in common use today. Stray magnetic fields in the order of 5 to 10 gauss have been known to cause reed relays to malfunction.

In those special applications where usage of reed switch capsules occurs, the above factors should be carefully reviewed and considered with respect to each application prior to usage.

Solder Connections

One of the most prevalent modes of failure for solder connections is the cracking of the connection due to thermal fatigue. In many instances, it is very difficult to distinguish between solder cracking as a result of thermal fatigue and

solder cracking because of poor workmanship (cold solder joints). But there are differences and they become apparent upon very close investigation. Thermal fatigue cracks will predictably occur on sequentially manufactured items and will also propagate with storage time. Solder cracks due to poor workmanship will appear randomly on sequentially produced items. These failures can be reduced by applying and controlling appropriate design criteria. The following list of criteria is provided as a guide to minimize solder connection problems:

1) Use only silicone or polyurethane based conformal coatings; the coatings should be of minimum thickness.
2) Avoid gold-plated boards; use solder-plated or solder-coated boards.
3) Do not use rigid encapsulating systems to secure and/or protect connected parts on printed wiring boards.
4) Resilient spacers, when used, should be of minimum thickness between the solder connected part and printed wiring board.
5) Do not hard mount parts to printed boards with mechanical fasteners unless leads are parallel to the board and of sufficient length as to provide strain relief. Also, do not hard mount parts by using minimum lead length inserted through feed-through holes.
6) Use terminals only when necessary and then only use terminals designed to be used on printed wiring boards.

Switches

The most consistently documented failure modes for switches are opens and shorts. The mechanism most often responsible is contamination both of the particulate and oxide nature. Particulate material in the form of solder balls or loose metal flashings can produce varied conductive paths or shorts and switch lockup due to wedging or jamming. Nonconductive particulate contamination could result in contact interference or opens as well as switch lockup. Corrosion of the contact surface due to the introduction of external sources such as polluted or heavy industrial environment, moisture and salt, body oils, solder resin, and wire lubricants also can cause high contact resistance and opens. Successful deterrents to this corrosion include: using corrosive resistive metals (gold, platinum, and palladium) and their alloys, using hermetically sealed switches, stringent control of the cleanliness of the package.

Switch screening inspections and tests are recommended to discover failures before actual part implementation. MIL-STD-202 has many effective tests ranging from temperature cycling to hermeticity and radiographic inspection.

Valves

Valves are used to control the flow of fluids, either liquids or gases, with respect to amount and direction. Industry employs many varieties of valves, such as gate, glove, poppet, plug, and needle valves, plus specialized varieties like check, metering, and relief valves. A common feature of all these valves is that they contain a solid movable member (gate, disk, poppet face, needle, or plug) that impinges on, or into, an orifice in such a manner as to create a fluid-tight separation between the entry and outflow sections of the valve. The contacting surface of this orifice, i.e., valve seat, is normally of an elastomeric material. Where this is not true, the contacting surface of the movable member is deformable or elastomeric in nature or the seat is of a deformable material and the movable member is hard.

The most prolific problem or failure mode detected and described for the valves is leakage. Deterioration of the contacting surfaces, whether due to wear, damage during installation, chemical attack, misalignment, etc., will result in imperfect sealing resulting in internal leakage. All valves, with the exception of relief and check valves, are actuated by an external mechanical force that is transferred to the movable member by a stem or riser. This actuating mechanism is subject to failure by seizure as the result of corrosion, contamination or failure. The required opening into the valve body for entry of the operating stem is an additional source of leakage, due to inadequate design and/or packing. As the valve body is generally formed from a casting, valves are subject to all of the hydrostatic problems associated with castings such as porosity and fracture from mechanical damage or pressure stress fracture due to inadequate section thickness.

Supports for valves and their associated piping are fabricated from flatbar, channel, or angle configurations. These supports should be installed in such a manner that they do not impose undue stresses on the valve piping. Valve actuating media, such as a handwheel, crank or bar should be unhindered by support

installation, permitting a complete clearance radius. When a system is subjected to stress imposed by high temperature and pressure, the supports and hangers should be designed to "walk" with the system, imposing minimal loading and maintaining support integrity.

Primary consideration in the selection of valves includes knowledge of the physical property of materials from which the valve is manufactured in order to assure compatibility with: (1) applicable fluids, (2) operating temperatures, and (3) pressure limits. The function the valve must perform and its dimensional limitations are also important considerations. Life and wear factors must be taken into account as well as maintainability. The valve should be designed to facilitate replacement of gaskets, seals and seat. The applicable limits that are the result of design considerations should be delineated at the design review that is conducted at time of first approval and should be confirmed by proof testing. Furthermore, these limits should be reflected in resulting specification and design handbooks as application notes in order that the system design does not inadvertently contribute to premature failure of the finished system.

DORMANT FAILURE MODES AND MECHANISMS

Bearings

The primary dormant failure mechanism is inadequate lubrication. Some of the common causes of this problem are: evaporation loss, migration loss, and contamination of the lubricant. To eliminate or minimize these failure modes use an oil or grease with a lower evaporation rate or a sealed motor. Periodic rotation every six months will reduce the problem of migration.

Connectors, General

Improper cleaning of connector sockets or pins prior to plating results in plating flaking on subsequent mating/demating. This results in circuit resistance increases or possible short circuits.

Clutches

Drying out of the clutch fibers lowers the required frictional coefficient and results in slippage. Conversely, if clutch faces are left in compression, the clutch materials tend to equalize out any surface roughness, but this causes interlocking of the fibers from each face and sticking. This problem can be overcome by exercising the clutch at least once each year so that the plate fibers are realigned.

Gyros

Gyro drift is the primary aging concern and is usually caused by molecular metallic interchange of the spin bearing detail parts. This phenomenon is similar to cold welding and results in excessive bearing friction that produces drift. The molecular interchange at points of metallic contact is minimized by maintaining a constant temperature on the gyros. Periodic operation at 6 to 12 month intervals is essential in preventing migration of the lubricant away from the wear path and subsequently prevents metal to metal contact.

Magnetrons

The filaments tend to become gaseous unless the unit is operated periodically. The outgassing is a result of time-oriented liberation of gas molecules that have been absorbed on the walls of the magnetron. When enough gas molecules have been generated, activation of the magnetron imparts high velocities to these molecules; they strike the filament and possibly cause shorting.

DC Motors

Brush-type motors are prone to cold welding of the brushes to the armature. The cold welding is caused by brush pressure and the galvanic coupling of the two materials in contact. Periodic operation of this type of motor is recommended.

Relays, Latching

The use of anodic materials such as tin, copper or silver as contact materials have resulted in cold welding or highly resistive contacts after sustained periods of dormancy/storage. The use of more cathodic materials, such as gold as the contact material, overcomes these problems.

Relays, Nonlatching

The same comments that were used for Relays, Latching also apply here. In addition, if the nonlatching relay is a miniature relay, e.g., TO-5 can package, an additional failure mechanism is possible. Cold welding of the relay armature to the backstop has occurred and was caused by plating incompatibility. If the activating coil voltage is in the low range, this age-oriented cold weld is more readily exposed, e.g., no transfer.

Seals

Inherent porosity tends to let seals dry out and become semi-brittle unless kept wetted. The resultant embrittlement creates leakage paths as a function of

osmosis. Ozone (caused by electric motors or electric welding) concentrations also tend to accelerate seal aging by breaking down the seal fibers. All system containing seals should be activated at least once a year to assure rewetting of seals.

Switches, Sensitive

The same comments that apply to Relays, Latching also apply here except that the consequences may be more severe for switches. The wiping action of the contacts is about 50% less than for relays. Thus, resistive oxides or contaminants are less likely to be scrubbed from the contacts.

Transformer

Coil shorting can be caused by improper removal of cleaning agents that erode the dielectric off the wire windings or by cold flow of the insulation material covering the wire windings.

PART FAILURE MODE DISTRIBUTION

The failure mode information presented in this section is limited to those modes considered to have a significant frequency of occurrence. Failure modes resulting from workmanship, inadequate inspection, screening and misapplication have not been included.

PART FAILURE MODE DISTRIBUTION

PART TYPE	FAILURE MODE	FREQUENCY OF OCCURRENCE IN PERCENT
ACCELEROMETERS		
	BINDING	33
	DRIFT	27
	OPEN	23
	UNSTABLE	17
BATTERIES		
Lithium-Sulfer Dioxide		
	INTERNAL SHORT	21
	INTERNAL OPEN	7
	LARGE STARTUP DELAY	50
	LOW ENERGY CAPACITY	2
	HERMETICITY	20
BEARINGS		
	WEAR	73
	BINDING	20
	SCORED	7
CIRCUIT BREAKERS		
	SHORT	38
	OPEN	38
	UNSTABLE	19
	ARCING	5
CONNECTORS		
	OPEN	36
	MECHANICAL DAMAGE	24
	INTERMITTENT	22
	CONTACT RESISTANCE	9
	SHORT	9
CYLINDERS, ACTIVATING		
	LEAKING	52
	WEAR	18
	STRUCTURAL	13
	MECHANICAL DAMAGE	11
	DRIFT	6
FUSES		
	SLOW OPEN	75
	EXCEEDS AMP RATING	15
	PREMATURE OPEN	10

PART FAILURE MODE DISTRIBUTION (Cont'd)

PART TYPE	FAILURE MODE	FREQUENCY OF OCCURRENCE IN PERCENT
GEAR BOXES		
	LEAKING	40
	MATERIAL FAILURE	35
	BINDING	25
GENERATORS		
	WEAR	44
	CONTAMINATION	17
	DRIFT	16
	BEARING	13
	ELECTRICAL	10
GYROS		
	DRIFT/UNSTABLE	64
	BINDING	16
	OUT OF TOLERANCE	8
	UNBALANCED	6
	BEARING	4
	RATE ERROR	2
MOTORS		
	BRUSH BREAKAGE OR WEAR	32
	CONTAMINATION/LOSS OF LUBRICANT	31
	OPEN/SHORT STATOR	14
	COMMUTATOR FAILURE	12
	OPEN/SHORT ROTOR	11
PUMPS		
	LEAKING	53
	INTERNAL PART FAILURE	20
	IMPROPER OPERATION	13
	WEAR	8
	BEARING FAILURE	6
RELAYS		
	CONTACT RESISTANCE	25
	OPEN	24
	DRIFT	16
	NO TRANSFER	16
	CONTACTS BURNED	7
	MECHANICAL	5
	INTERMITTENT	4
	SHORT	3

PART FAIL[illegible] MODE DISTRIBUTION (Cont'd)

PART TYPE	FAILURE MODE	FREQUENCY OF OCCURRENCE IN PERCENT
SEALS		
	PHYSICAL DAMAGE	54
	LEAKING	39
	DETERIORATION	7
SOLENOIDS		
	SHORT	52
	BINDING	29
	WEAK SPRING	19
SPRINGS		
	FATIGUE	45
	WEAK	28
	WEAR	23
	DISTORTED	4
SWITCHES		
	MECHANICAL	51
	INTERMITTENT	13
	FAILED TO OPERATE	9
	OPEN	9
	SHORT	9
	DRIFT/UNSTABLE	8
	CONTAMINATION	1
SYNCHROS		
	DRIFT	28
	MECHANICAL	22
	OUTPUT ERROR	22
	INTERMITTENT	17
	OPEN	11

NONELECTRONIC PART RELIABILITY DATA

APPENDIX

ADDITIONAL RAC SERVICES

ADDITIONAL RAC SERVICES

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Retrospective Searches are conducted at a flat fee of $125 per search. If no references are identified, a $50 service charge will be made in lieu of the above. For best results, please call or write for assistance in formulating your search question. An extra charge, based on engineering time and costs, will be made for evaluating, extracting or summarizing information from the cited references.

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