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COMPONENT FAILURE-RATE DATA WITH POTENTIAL APPLICABILITY TO A NUCLEAR FUEL REPROCESSING PLANT

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PREPARED FOR THE U. S. DEPARTMENT OF ENERGY UNDER CONTRACT DE-AC09-76SR00001

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ABSTRACT

Approximately 1,223 pieces of component failure-rate data, under 136 subject categories, have been compiled from published literature and computer searches of a number of data bases. Component selections were based on potential applicability to facilities for reprocessing spent nuclear fuels. The data will be useful in quantifying fault trees for probabilistic safety analyses and risk assessments.

COMPONENT FAILURE-RATE DATA WITH POTENTIAL APPLICABILITY TO A NUCLEAR FUEL REPROCESSING PLANT

INTRODUCTION

The Savannah River Laboratory is developing methodology that can be used to assess the risk of operating a plant to reprocess spent nuclear fuel. This methodology is a modified probabilistic analysis and has been applied successfully to analyses of existing and planned Savannah River Plant facilities.

The fault-tree method is a particularly useful tool for probabilistic risk assessment when failure rate data are available as input. When available, actual system failure rates can be employed, but if not, system failure rates must be calculated from fault-tree logic and failure rate data for the components of the system.

This report presents a compilation of potentially useful component failure rate data gleaned from published literature and accessible data bases.

DISCUSSION

The search for component failure-rate data was accomplished both by manual searches and by computer-aided searches. In the former case, reliability and safety analysis journals and publications were examined for the period 1970-1980. Additionally, numerous non-journal publications were searched. The computer search involved the use of the RECON System of the Oak Ridge National Laboratory to search both the Energy Data Base (EDB) and the Nuclear Science Abstracts (NSA) Data Base and the use of the DIALOG information retrieval system of Lockheed to search the COMPENDEX, INSPEC, ISMEC, and SCISEARCH data bases.

Description of Data

The Component Description column of Table II is arranged alphabetically and follows the Component Failure-Rate Categories of Table I, which in turn can be employed as an index to Table II.

The Failure Rate column of Table II contains those failure rate values which are variously described in the literature from which they are taken, as the "median," "average," "mean," or "recommended" failure rates. Computer terminology is employed; thus, a failure rate of $2.5 \times 10^{-6}/\text{hr}$ is listed as 2.5 E-06/hr. In some instances, the range or spread of failure rates is also available, and this is presented as the HIGH VALUE and LOW VALUE columns. While most failure rates are given in units of hr^{-1} , some data is presented in terms of demand^{-1} and cycle^{-1} ; these are represented in the table by "DM" and "CY", respectively. The units for FAILURE RATE also apply to the HIGH VALUE and LOW VALUE columns.

Finally, the column labeled REF gives the applicable reference number to be employed with the references listed at the end of Table II.

TABLE I

Component Failure-Rate Categories

Accumulators	Fans
Actuators	Filters
Air Pressure Gages	Fire Protection Systems
Air Supplies	Fission Chambers
Alarms	Flame Failure Detectors
Alternators	Flow Measurements
Analyzers	Fulcrums
Annunciator Modules	Fuses
Baffles	Gaskets
Batteries	Gauges
Battery Chargers	Gears
Battery Power Supplies	Geiger-Muller Detectors
Bearings	Generators
Bellows	Gongs
Bells	
Belts, Drive	Hangers and Supports
Blowers	Heaters
Bolts	Heat Exchangers
Brakes	HEPA Filters
Bus Bars	Horns
Buzzers	Hoses
Cables	
Capacitors	Impulse Lines
Circuits	Indicators
Circuit Boards	Inductors
Circuit Breakers	Instrumentation
Clutches	Inverters
Coils	Ion Chambers
Compressors	
Computation Modules	Joints
Connectors, Electrical	
Connectors, Pneumatic	Klaxons
Contactors	
Controllers	Lamps
Couplings	Level Measurements
Covers	Lines, Overhead Power
Cylinders	
	Meters
Diaphragms	Motors
Diesel Generators	Motor Starters
Diodes	Mounts
Ducts	
	Nozzle and Flapper Assemblies
Elbows, Flanges, and Expansion Joints	Nuts
Emergency Lights	

TABLE I (Continued)

Component Failure-Rate Categories

Orifices

Photoelectric Cells

Pins

Pipes

Pivots

Power Supplies

Power Transmittal Mechanisms

Pressure Measurements

Pressure Regulators

Pressure Transducers

Pumps

Pyrometers

Rack and Pinion Assemblies

Recorders

Rectifiers

Regulators

Relays

Resistors

Restrictors

Scintillation Detectors

Screws

Seals

Sensor/Detectors

Servomotors

Shafts

Sirens

Solenoids

Solid-State Devices

Springs

Sprinkler Heads

Steam Supply System Components

Strain Gages

Switches

Switch Gear

Synchros

Tachometers

Tanks

Temperature Measurements

Temperature Trip Amplifiers

Terminal Boards

Thermistors

Thermocouples

Thermowells

Timers

Transducers

Transformers

Transistors

Tubes, Electronic

Valves

Valve Actuators

Valve Operators

Ventilators

Vessels

Vibrators

Welds

Wiring

TABLE II.

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
ACCUMULATOR, LIQUID, PRESSURIZED	1.37E-C6/HR			14
ACCUMULATOR, LIQUID, UNPRESSURIZED	6.3 E-C7/HR			14
ACCUMULATOR, UNSPECIFIED	7.2 E-C6/HR	1.93E-05	4.0 E-C7	12
ACTUATOR, LINEAR	1.04E-C6/HR			14
ACTUATORS, UNSPECIFIED	1.44E-05/HR			20
AIR PRESSURE GAGE	5.1 E-C6/HR	1.37E-C5	3.5 E-C7	12
AIR SUPPLY	2.61E-06/HR			20
ALARMS, ALL TYPES	5.5 E-C6/HR			C2
ALARMS, INDICATORS	6.06E-C6/HR	5.0 E-C5	2.0 E-C7	C8
ALARMS, ISOLATING	2.5 E-C5/HR	5.0 E-05	1.5 E-C5	C8
ALARMS, RELAY	1.0 E-C6/HR	1.5 E-06	2.0 E-C7	C8
ALARMS, SOLID STATE (VISUAL)	1.2CE-C5/HR	3.5 E-C5	8.0 E-C6	C8
ALTERNATORS, ALTERNATING CURRENT	4.5 E-C6/HR	7.0 E-06	3.0 E-C6	C8
ALTERNATORS, ALTERNATING CURRENT	9.0 E-C6/HR			14
ALTERNATORS, UNSPECIFIED	7.0 E-C6/HR			15
ANALYZERS, CO2	7.0 E-C7/HR	2.94E-06	3.3 E-C8	12
ANALYZERS, ELECTRICAL CONDUCTIVITY (FOR LIQUIDS)	1.20E-03/HR			C1
ANALYZERS, ELECTRICAL CONDUCTIVITY (FOR WATER IN SOLIDS)	1.91E-03/HR			C1
ANALYZERS, GAS-LIQUID CHROMATOGRAPH	1.62E-03/HR			C1
ANALYZERS, HYDROGEN	3.45E-C3/HR			C1
ANALYZERS, INFRARED (LIQUID)	1.13E-04/HR			C1
ANALYZERS, OXYGEN	1.6CE-C4/HR			C1
ANALYZERS, PH	2.85E-C4/HR			C1
ANALYZERS, WATER HARDNESS	6.45E-04/HR			C1
ANALYZERS, WATER (IN GASES)	6.71E-04/HR			C1
ANNUNCIATOR MODULES, SOLID STATE	1.24E-C3/HR			C1
BAFFLES	9.13E-C4/HR			C1
BATTERIES, LEAD ACID	7.0 E-C6/HR			14
BATTERIES, MERCURY	1.0 E-06/HR	1.3 E-06	1.2 E-C7	12
BATTERIES, NICKEL CADMIUM	4.4 E-C7/HR			20
BATTERIES, PRIMARY, DRY CELL	7.4 E-C7/HR			20
BATTERIES, RECHARGEABLE	2.5 E-C7/HR			20
BATTERIES, RECHARGEABLE	2.7 E-C5/HR	3.1 E-C5		C8
BATTERIES, SECONDARY (STORAGE)	1.4 E-C6/HR	1.43E-05	5.0 E-C7	12
BATTERIES, SECONDARY (STORAGE), LEAD ACID	1.5CE-C6/HR			20
BATTERIES, SECONDARY (STORAGE), LEAD ACID (JELLY ELECTROLYTE)	2.9CE-C6/HR	1.26E-C5	3.0 E-C8	C8
BATTERIES, SECONDARY (STORAGE), NICKEL CADMIUM	1.60E-06/HR	3.20E-06	7.0 E-C8	C8
BATTERIES, UNSPECIFIED	4.24E-C6/HR	1.26E-05	3.0 E-C8	C8
BATTERIES, WET CELL, MULTIPLE CELL, PREFABRICATED	3.6CE-C6/HR	5.97E-06	1.1 E-C7	C8
BATTERIES, WET CELL, MULTIPLE CELL, RESERVE	1.0 E-C6/HR			C3
BATTERIES, WET CELL, SINGLE CELL, PREACTIVATED	3.3 E-C7/HR			14
	1.4 E-C7/HR			14
	2.02E-C6/HR			14

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
BATTERY CHARGERS	1.23E-C5/HR	1.73E-04	1.4 E-C7	C8
BATTERY CHARGERS, SHUNT WOUND	8.0 E-05/HR	1.5 E-04	5.0 E-C5	C8
BATTERY CHARGERS, CHARGING UNIT (MULTIPLE CELL, PREACTIVATED	3.49E-C6/HR			14
BATTERY CHARGERS, DIVERTER PCLE	1.22E-04/HR	1.73E-04	5.0 E-05	C8
BATTERY CHARGERS, FERRO RESONANT	2.52E-C6/HR	3.0 E-05	1.0 E-C6	08
BATTERY CHARGERS, MAGNETIC AMPLIFIERS	1.36E-C6/HR	2.89E-C6	1.7 E-C7	C8
BATTERY CHARGERS, MOTOR GENERATOR	9.90E-05/HR	1.73E-04	9.0 E-C6	C8
BATTERY CHARGERS, RECTIFIERS, STATIONARY	1.49E-C6/HR	3.0 E-05	1.4 E-C7	C8
BATTERY CHARGERS, SCR	9.6 E-07/HR	1.8 E-06	1.4 E-C7	C8
BATTERY POWER SUPPLIES, FAILURE TO PROVIDE PROPER CULPLT	3.0 E-06/HR			C6
BEARINGS, BALL	1.40E-C5/HR			20
BEARINGS, BALL	1.15E-C6/HR			20
BEARINGS, BALL, HEAVY DUTY	2.0 E-05/HR			03
BEARINGS, BALL, HEAVY DUTY	1.8 E-C6/HR	3.53E-06	7.2 E-C8	12
BEARINGS, BALL, LIGHT DUTY	1.0 E-05/HR			C3
BEARINGS, BALL, LIGHT DUTY	8.8 E-C7/HR	1.72E-06	3.5 E-C8	12
BEARINGS, GENERAL	4.07E-C6/HR			20
BEARINGS, GENERAL	1.38E-06/HR			20
BEARINGS, ROLLER	5.0 E-C6/HR			C3
BEARINGS, ROLLER	5.0 E-07/HR	1.0 E-06	2.0 E-C8	12
BEARINGS, ROLLER	2.8 E-C7/HR			20
BEARINGS, SLEEVE	5.0 E-C6/HR			C3
BEARINGS, SLEEVE	5.0 E-07/HR	1.0 E-06	2.0 E-C8	12
BELLOWS, EXPANSION	5.0 E-06/HR			15
BELLOWS, EXPANSION	2.24E-06/HR	4.38E-C6	4.0 E-C8	12
BELLS	4.5 E-06/HR	5.0 E-06	1.0 E-C6	C8
BELTS, DRIVE	4.0 E-05/HR			C3
BELTS, DRIVE	3.88E-06/HR	1.50E-05	1.42E-C7	12
BLOWERS	2.24E-06/HR	4.38E-06	4.0 E-C8	12
BLOWERS, AXIAL, SINGLE STAGE	3.26E-C6/HR			14
BLOWERS, AXIAL, TWO OR MORE STAGES	2.67E-05/HR			14
BLOWERS, CENTRIFUGAL, MULTISTAGE	1.07E-05/HR			14
BLOWERS, CENTRIFUGAL, SINGLE STAGE	8.30E-C6/HR			14
BLOWERS, POSITIVE DISPLACEMENT	2.05E-04/HR			14
BLOWERS, ROTARY VANE	4.0 E-C6/HR			14
BOLTS	2.0 E-C8/HR			03
BRAKES, GENERAL	4.27E-C6/HR			20
BRAKES, MAGNETIC	1.20E-C5/HR			20
BUS	1.75E-C5/HR	2.3 E-06	5.0 E-C9	C8
BUS, METAL ENCLOSED	1.16E-05/HR	6.0 E-07	5.0 E-C9	08
BUS, OUTDOOR, BUS-BARE	2.63E-C5/HR	2.3 E-06	4.0 E-C8	C8
BUZZERS	3.0 E-C6/HR	3.3 E-05	1.0 E-C6	C8
BUZZERS	6.0 E-C7/HR	1.30E-C6	5.0 E-C8	12

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
CABLES	1.42E-C6/HR	1.5 E-05	3.0 E-C8	C8
CABLES, 33KV TO 275KV(PER KM)	7.5 E-C6/HR			C3
CABLES,ALUMINUM CONDUCTOR(PER 1000FT)	7.07E-C6/HR	1.5 E-05	5.54E-C7	C8
CABLES,ALUMINUM CONDUCTOR,POWER(PER 1000FT)	7.07E-C6/HR	1.5 E-05	5.54E-C7	C8
CABLES,COPPER CONDUCTOR(PER 1000FT)	1.26E-C6/HR	7.0 E-C6	3.0 E-C8	C8
CABLES,COPPER CONDUCTOR,CONTROL(PER 1000FT)	3.46E-C6/HR	6.32E-06	3.2 E-C8	C8
CABLES,COPPER CONDUCTOR,POWER(PER 1000FT)	2.83E-C6/HR	6.32E-06	4.5 E-C8	C8
CABLES,COPPER CONDUCTOR,SUPERVISORY(PER 1000FT)	3.46E-C6/HR	6.0 E-06	3.2 E-C8	C8
CABLES,JOINTS,ALUMINUM CONDUCTOR	2.56E-C6/HR	1.50E-05	5.27E-C8	C8
CABLES,JOINTS,ALUMINUM CONDUCTOR,POWER	5.48E-C6/HR	1.45E-05	5.27E-C8	C8
CABLES,JOINTS,COPPER CONDUCTOR	4.9 E-C6/HR	1.70E-C6	5.27E-C8	C8
CABLES,JOINTS,COPPER CONDUCTOR,CONTROL	4.90E-C6/HR	1.17E-05	5.27E-C8	C8
CABLES,JOINTS,COPPER CONDUCTOR,POWER	4.9 E-C6/HR	1.22E-05	5.27E-C8	C8
CABLES,LESS THAN 1KV(PER KM)	6.0 E-C7/HR			C3
CABLES,PENETRATIONS	3.26E-C6/HR	1.0 E-05	1.0 E-C7	C8
CABLES,PENETRATIONS,INSTRUMENT AND CONTROL APPLICATIONS	3.11E-C6/HR	1.0 E-05	1.0 E-C7	C8
CABLES,PENETRATIONS,POWER APPLICATIONS	3.42E-C6/HR	8.32E-06	2.0 E-C7	C8
CABLES,TERMINATION,ALUMINUM	8.15E-C6/HR	3.5 E-05	2.7 E-C9	C8
CABLES,TERMINATION,ALUMINUM,POWER	8.37E-C6/HR	1.89E-05	2.7 E-C9	C8
CABLES,TERMINATION,COPPER CONDUCTOR	6.12E-C6/HR	3.0 E-05	2.7 E-C9	C8
CABLES,TERMINATION,COPPER CONDUCTOR,CONTROL	6.32E-C6/HR	1.73E-05	2.7 E-C9	C8
CABLES,TERMINATION,COPPER CONDUCTOR,POWER	4.90E-C6/HR	1.22E-05	2.7 E-C9	C8
CABLES,TERMINATION,COPPER CONDUCTOR,SUPERVISORY	6.52E-C6/HR	1.65E-05	2.7 E-C9	C8
CABLES,1 TO 33 KV(PER KM)	4.4 E-C6/HR			C3
CAPACITORS(ELECTROLYTIC),ALUMINUM FOIL	5.0 E-C7/HR			C3
CAPACITORS(ELECTROLYTIC),ALUMINUM FOIL	2.0 E-C6/HR			C4
CAPACITORS(ELECTROLYTIC),TANTALUM FOIL	1.0 E-C6/HR			C3
CAPACITORS(ELECTROLYTIC),TANTALUM PELLET	5.0 E-07/HR			C3
CAPACITORS(ELECTROLYTIC),TANTALUM SOLID	2.0 E-C7/HR			C3
CAPACITORS(FIXED),CERAMIC	1.0 E-C7/HR			C3
CAPACITORS(FIXED),CERAMIC	2.0 E-C8/HR			C4
CAPACITORS(FIXED),METALLIZED PAPER	5.0 E-C7/HR			C3
CAPACITORS(FIXED),MICA	3.0 E-C7/HR			C3
CAPACITORS(FIXED),MICA	5.0 E-C8/HR			C4
CAPACITORS(FIXED),MYLAR	3.5 E-C9/HR			C4
CAPACITORS(FIXED),OIL FILLED	3.0 E-C6/HR			C3
CAPACITORS(FIXED),PAPER	1.0 E-C6/HR			C3
CAPACITORS(FIXED),POLYSTYRENE	1.0 E-C7/HR			C3
CAPACITORS(FIXED),POLYSTYRENE	1.0 E-C8/HR			C4
CAPACITORS(FIXED),QUALITY PAPER	1.1 E-C7/HR			C4
CAPACITORS(FIXED),SYNTHETIC FILM	5.0 E-07/HR			C3
CAPACITORS(VARIABLE),AIR SPACED	1.0 E-C6/HR			C3
CAPACITORS(VARIABLE),CERAMIC	5.0 E-C7/HR			C3

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
CIRCUIT BOARDS, PRINTED	2.36E-C5/HR			20
CIRCUIT BREAKERS	1.85E-C7/HR	1.25E-C6	2.0 E-C8	C8
CIRCUIT BREAKERS GENERAL (LESS THAN 33KV)	2.0 E-C6/HR			C3
CIRCUIT BREAKERS 415V TO 11KV	1.5 E-C6/HR			03
CIRCUIT BREAKERS (FAILURE TO OPERATE)	1.0 E-C3/DM	3.0 E-C3	3.0 E-C4	C6
CIRCUIT BREAKERS (PREMATURE TRANSFER)	1.0 E-C6/HR	3.0 E-C6	3.0 E-C7	C6
CIRCUIT BREAKERS, INDOOR DESIGN-AC BREAKERS	1.44E-C7/HR	6.5 E-C7	2.0 E-C8	C8
CIRCUIT BREAKERS, INDOOR DESIGN-DC BREAKERS	1.39E-C7/HR	4.0 E-C7	2.0 E-C8	C8
CIRCUIT BREAKERS, INDOOR, METAL CLAD, MAGNETIC	1.25E-C6/HR			14
CIRCUIT BREAKERS, INDOOR, METAL CLAD, MANUAL	1.61E-C6/HR			14
CIRCUIT BREAKERS, INDOOR, METAL CLAD, MOTOR	1.79E-C6/HR			14
CIRCUIT BREAKERS, INDOOR, METAL CLAD, THERMAL	4.5 E-C7/HR			14
CIRCUIT BREAKERS, INDOOR, SEALED, MAGNETIC	3.7 E-C7/HR			14
CIRCUIT BREAKERS, INDOOR, SEALED, MANUAL	4.2 E-C7/HR			14
CIRCUIT BREAKERS, INDOOR, SEALED, MOTOR	3.6 E-C6/HR			14
CIRCUIT BREAKERS, INDOOR, UNENCLOSED, MAGNETIC	2.48E-C6/HR			14
CIRCUIT BREAKERS, INDOOR, UNENCLOSED, MANUAL	4.84E-C6/HR			14
CIRCUIT BREAKERS, LOW VOLTAGE FEWER	3.9 E-C8/HR	4.3 E-C7	1.0 E-C8	C8
CIRCUIT BREAKERS, MAGNETIC	5.0 E-C7/HR			12
CIRCUIT BREAKERS, MOULDED CASE	1.11E-C6/HR			20
CIRCUIT BREAKERS, OUTDOOR DESIGN-AC BREAKERS	3.19E-C7/HR	1.25E-C6	5.7 E-C8	C8
CIRCUIT BREAKERS, OUTDOOR, ENCLOSED, MAGNETIC	1.7 E-C5/HR			14
CIRCUIT BREAKERS, OUTDOOR, ENCLOSED, MANUAL	1.4 E-C6/HR			14
CIRCUIT BREAKERS, POWER SWITCH	2.88E-C6/HR			20
CIRCUIT BREAKERS, SPARK GAP, SURGE PROTECTION	1.2 E-C8/HR			20
CIRCUIT BREAKERS, THERMAL	3.0 E-C7/HR	5.0 E-C7	2.5 E-C7	12
CIRCUIT BREAKERS, THERMAL	1.0 E-C6/HR			12
CIRCUIT BREAKERS, UNDERVOLTAGE	1.87E-C6/HR			20
CIRCUIT BREAKERS, 11KV	2.3 E-C6/HR			C9
CIRCUIT BREAKERS, 132KV	4.0 E-C6/HR			C3
CIRCUIT BREAKERS, 275KV	7.0 E-C6/HR			C3
CIRCUIT BREAKERS, 33KV	3.0 E-C6/HR			C2
CIRCUIT BREAKERS, 400KV	1.0 E-C5/HR			C3
CIRCUITS, MICROELECTRONIC SILICON INTEGRATED	4.0 E-C7/HR			C4
CLUTCH (ELECTRICAL) FAILURE TO OPERATE	3.0 E-C4/DM	1.0 E-C3	1.0 E-C4	C6
CLUTCH (ELECTRICAL) PREMATURE DISENGAGEMENT	1.0 E-C4/HR	1.0 E-C5	1.0 E-C7	C6
CLUTCH (FRICTION)	3.0 E-C6/HR			C3
CLUTCH (MAGNETIC)	6.0 E-C6/HR			03
CLUTCH (MAGNETIC)	6.0 E-C7/HR	9.3 E-C7	4.5 E-C7	12
CLUTCH (MECHANICAL)	4.0 E-C7/HR	1.1 E-C6	6.0 E-C8	12
CLUTCH (MECHANICAL)	5.9 E-C7/HR			16
CLUTCH (MECHANICAL) FAILURE TO OPEN	3.0 E-C7/HR	3.0 E-C6	3.0 E-C8	C6
CLUTCH (MECHANICAL) FAILURE TO OPERATE	3.0 E-C4/DM	1.0 E-C3	1.0 E-C4	C6

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
CLUTCH(SLIP)	3.0 E-C7/HR	9.4 E-C7	7.0 E-C8	12
COILS	5.0 E-08/HR	8.8 E-08	3.3 E-C8	12
COILS, COOLING, CHILLED WATER	1.0CE-C6/HR			20
COMPRESSORS	4.17E-C6/HR	5.0 E-05	2.2 E-C7	C8
COMPRESSORS, AIR(MOBILE)	5.96E-C6/HR			20
COMPRESSORS, AXIAL	1.07E-C6/HR	3.16E-06	2.2 E-C7	C8
COMPRESSORS, CENTRIFUGAL(VCLUTE)	2.75E-C6/HR	4.63E-06	8.43E-C7	C8
COMPRESSORS, POSITIVE DISPLACEMENT	1.56E-C5/HR	2.6 E-05	8.43E-C6	C8
COMPUTATION MODULE, AMPLIFIER	1.34E-C6/HR			14
COMPUTATION MODULE, AVERAGER	2.31E-05/HR			14
COMPUTATION MODULE, DIFFERENTIATOR	8.7 E-C7/HR			14
COMPUTATION MODULE, E-E CONVERTER	1.72E-C6/HR			14
COMPUTATION MODULE, ELECTRONIC-EN-CFF	1.15E-C6/HR			14
COMPUTATION MODULE, ELECTRONIC-OTHER	1.97E-C6/HR			14
COMPUTATION MODULE, ELECTRONIC-FPCPORTIONAL	1.24E-C6/HR			14
COMPUTATION MODULE, FUNCTION GENERATOR	3.83E-C6/HR			14
COMPUTATION MODULE, I-E CONVERTER	4.0 E-C7/HR			14
COMPUTATION MODULE, I-I CONVERTER	3.8 E-C7/HR			14
COMPUTATION MODULE, ION EXCHANGE	1.7 E-C5/HR			14
COMPUTATION MODULE, MULTI-FUNCTION GENERATOR	3.16E-05/HR			14
COMPUTATION MODULE, MV-I CONVERTER	1.34E-06/HR			14
COMPUTATION MODULE, OTHER	6.6 E-C7/HR			14
COMPUTATION MODULE, RESISTANCE CHANGE	8.13E-C6/HR			14
COMPUTATION MODULE, SCINTILLATION	3.7 E-C5/HR			14
COMPUTATION MODULE, SOLID STATE	2.02E-C6/HR			14
COMPUTATION MODULE, SQUARE ROOT	6.1 E-C7/HR			14
COMPUTATION MODULE, SUMMER	1.05E-06/HR			14
COMPUTATION MODULE, UNDEFINED	4.3 E-C7/HR			14
CONNECTORS, CIRCULAR	3.7 E-C7/HR			20
CONNECTORS, COAXIAL	1.94E-07/HR			20
CONNECTORS, EACH PIN, GENERAL	5.0 E-C8/HR			C3
CONNECTORS, EACH PIN, GENERAL	2.0 E-07/HR	4.7 E-07	3.0 E-C8	16
CONNECTORS, ELECTRICAL	2.5 E-C7/HR			C2
CONNECTORS, GENERAL	3.2 E-C8/HR			20
CONNECTORS, PNEUMATIC	1.48E-C6/HR			C2
CONNECTORS, PRINTED CIRCUIT, EACH CONTACT	1.0 E-C7/HR			C3
CONNECTORS, RADIO FREQUENCY	6.2 E-C8/HR			20
CONNECTORS, RECTANGULAR	1.06E-07/HR			20
CONNECTORS, TEST JACK	3.0 E-C9/HR			20
CONNECTORS, VALVE HOLDERS, EACH PIN	1.0 E-07/HR			C3
CONTACTORS	1.26E-C7/HR	6.0 E-C7	1.9 E-C8	C8
CONTACTORS	2.5 E-C7/CY	4.0 E-C7	1.0 E-C7	12
CONTACTORS(GENERAL, LESS THAN 3.3KV)	2.5 E-C6/HR			03

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
CONTROLLER, AMPLIFIER	3.4 E-C6/HR			14
CONTROLLER, BOURDON TUBE	1.16E-05/HR			14
CONTROLLER, ELECTRIC	1.5 E-07/HR	3.0 E-C7	5.0 E-C8	C8
CONTROLLER, ELECTRONIC-ON-CFF	8.0 E-07/HR			14
CONTROLLER, ELECTRONIC-OTHER	2.06E-C6/HR			14
CONTROLLER, ELECTRONIC-PROPORTIONAL	2.55E-C6/HR			14
CONTROLLER, FLOW CONTROLLER FAILS CALLING FOR LESS FLOW	4.6 E-05/HR			13
CONTROLLER, FLOW CONTROLLER FAILS CALLING FOR MORE FLOW	4.6 E-05/HR			13
CONTROLLER, GENERAL PURPOSE PNEUMATIC, ELECTRICAL AND TEMP.	3.3 E-C5/HR			C1
CONTROLLER, INDICATING	4.07E-06/HR	6.42E-06	2.25E-C6	C8
CONTROLLER, LEVEL	4.01E-C6/HR	1.18E-C5	1.67E-C6	C8
CONTROLLER, MV-1 CONVERTER	3.7CE-C5/HR			14
CONTROLLER, OTHER	5.19E-C6/HR			14
CONTROLLER, PNEUMATIC	4.3 E-05/HR			C1
CONTROLLER, PNEUMATIC ON-OFF	9.7 E-C7/HR			14
CONTROLLER, PNEUMATIC-OTHER	6.2 E-C7/HR			14
CONTROLLER, PNEUMATIC-PROPORTIONAL	2.9 E-C7/HR			14
CONTROLLER, SETTING	1.6 E-05/HR			C1
COUPLINGS (FLEXIBLE)	6.88E-C7/HR	1.35E-C6	2.7 E-C8	12
COUPLINGS (MECHANICAL)	5.0 E-C6/HR			C3
COUPLINGS (MECHANICAL)	5.34E-06/HR			20
COUPLINGS (RIGID)	2.5 E-C8/HR	4.9 E-C8	1.0 E-C9	12
COVERS, DUST	6.0 E-C9/HR	1.0 E-C8	2.0 E-C9	12
COVERS, PROTECTIVE	3.8 E-C8/HR	6.1 E-C8	1.5 E-C8	12
CYLINDERS	7.0 E-C9/HR	8.1 E-C7	5.0 E-C9	12
CYLINDERS, HYDRAULIC	8.0 E-C9/HR	1.2 E-07	5.0 E-C9	12
CYLINDERS, PNEUMATIC	4.0 E-C9/HR	1.3 E-C8	2.0 E-C9	12
DIAPHRAGMS, METAL	5.0 E-C6/HR			15
DIAPHRAGMS, RUBBER	8.0 E-C6/HR			15
DIAPHRAGMS, RUPTURE, 10 INCH TO 16 INCH DIA.	6.49E-C6/HR			14
DIESEL EMER. POWER SYSTEM (G.E.)	4.93E-05/HR			14
DIESEL ENGINE, FAILS TO RUN	3.0 E-C4/HR	3.0 E-03	3.0 E-C5	C6
DIESEL ENGINE, FOUR STROKE, RECIPROCATING, V-BLOCK	6.8 E-C3/HR			14
DIESEL ENGINE, TWO STROKE RECIPROCATING, IN-LINE BLOCK	2.22E-04/HR			14
DIESEL ENGINE, TWO STROKE RECIPROCATING, V-BLOCK	3.33E-C4/HR			14
DIESEL GENERATORS, FAILS TO RUN AFTER START	3.0 E-C3/HR	3.0 E-C2	3.0 E-C4	C6
DIESEL GENERATORS, FAILS TO START	3.0 E-02/OM	1.0 E-C1	1.0 E-C2	C6
DIODES, GERMANIUM, GOLD-BONDED	2.0 E-C7/HR			C3
DIODES, GERMANIUM, JUNCTION	2.0 E-C7/HR			C3
DIODES, GERMANIUM, POINT CONTACT	5.0 E-C7/HR			C3
DIODES, SEMI-CONDUCTOR	1.0 E-C6/HR			C4
DIODES, SILICON, HIGH POWER	5.0 E-07/HR			C3
DIODES, SILICON, LOW POWER	2.0 E-C8/HR			C3

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
DIODES, SILICON, ZENER	1.0 E-07/HR			03
DIODES, SILICON, ZENER	4.0 E-07/HR			C4
DUCTS	1.0 E-06/HR			15
ELBOWS, FLANGES, EXPANSION JOINTS LEAK/RUPTURE	3.0 E-07/HR	1.0 E-05	1.0 E-08	C6
EMERGENCY DIESEL AUX. SYSTEM(WESTINGHOUSE)	2.41E-05/HR			14
EMERGENCY LIGHTS	1.97E-06/HR			20
FANS	3.12E-05/HR	5.0 E-04	1.0 E-06	C8
FANS, AXIAL	2.22E-06/HR	3.68E-06	1.37E-06	C8
FANS, AXIAL	1.85E-06/HR			20
FANS, CENTRIFUGAL	4.12E-06/HR	7.75E-06	1.87E-06	C8
FANS, CENTRIFUGAL	1.10E-06/HR			20
FANS, EXHAUST	2.25E-07/HR	9.0 E-06	2.1 E-07	12
FANS, EXHAUST	9.0 E-05/HR			15
FANS, GENERAL	2.52E-06/HR			20
FILTERS	3.0 E-07/HR	8.0 E-07	4.5 E-08	12
FILTERS, BLOCKAGE	1.0 E-06/HR			15
FILTERS, FLUID	3.0 E-06/HR			20
FILTERS, GAS	1.2 E-06/HR			20
FILTERS, LEAKAGE	1.0 E-06/HR			15
FIRE PROTECTION SYSTEMS, SPECIAL, CO2	5.3 E-07/DM			C7
FIRE PROTECTION SYSTEMS, SPECIAL, DRY CHEMICAL	6.7 E-07/DM			C7
FIRE PROTECTION SYSTEMS, SPECIAL, WATER SPRAY	5.0 E-07/DM			C7
FIRE PROTECTION SYSTEMS, SPRINKLER, DELUGE	3.7 E-07/DM			C7
FIRE PROTECTION SYSTEMS, SPRINKLER, DRY PIPE	1.7 E-07/DM			C7
FIRE PROTECTION SYSTEMS, SPRINKLER, WET PIPE	1.4 E-07/DM			C7
FISSION CHAMBER	3.52E-06/HR			14
FLAME FAILURE DETECTORS	1.93E-04/HR			C1
FLOW MEASUREMENTS (FLUIDS)	1.30E-04/HR			C1
FLOW MEASUREMENTS (FLUIDS), DIFFERENTIAL PRESSURE TRANSDUCER	1.98E-04/HR			C1
FLOW MEASUREMENTS (FLUIDS), FLOW RATE	8.36E-06/HR			20
FLOW MEASUREMENTS (FLUIDS), INDICATING VARIABLE AREA FLOWMETER	3.9 E-05/HR			C1
FLOW MEASUREMENTS (FLUIDS), MAGNETIC FLOWMETER	2.49E-04/HR			C1
FLOW MEASUREMENTS (FLUIDS), TRANSMITTING VAR. AREA FLOWMETER	1.15E-04/HR			C1
FLOW MEASUREMENTS (SOLIDS), BELT SPEED MEASUREMENT AND CONTROL	1.75E-03/HR			C1
FLOW MEASUREMENTS (SOLIDS), LOAD CELL	4.28E-04/HR			C1
FULCRUMS, KNIFE-EDGE (WEAR)	1.0 E-05/HR			C3
FUSES	5.0 E-06/HR			03
FUSES	1.0 E-07/HR			C4
FUSES	5.0 E-07/HR	8.2 E-07	3.0 E-07	12
FUSES (MILITARY APPLICATIONS)	1.0 E-07/HR			12
FUSES (MILITARY APPLICATIONS)	1.36E-07/HR			20
FUSES, FAILS TO OPEN	1.0 E-05/DM	3.0 E-05	3.0 E-06	06
FUSES, OPENS PREMATURELY	1.0 E-06/HR	3.0 E-06	3.0 E-07	C6

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
FUSES, POWER	2.3 E-C8/HR	2.49E-06	6.0 E-C9	C8
FUSES, POWER UP TO 1000 VOLTS	3.0 E-C8/HR	3.0 E-C7	9.0 E-C9	C8
FUSES, POWER 1000-35,500 VOLTS	2.1 E-C8/HR	3.0 E-07	8.0 E-C9	C8
FUSES, POWER 2300-138,000 VOLTS	1.8 E-C8/HR	4.0 E-07	6.0 E-C9	C8
GASKETS	5.0 E-C6/HR			15
GASKETS, CONTAINMENT QUALITY	3.0 E-06/HR	1.0 E-05	1.0 E-C7	C6
GASKETS, D-RING	2.0 E-C8/HR	3.0 E-08	1.0 E-C8	12
GASKETS, D-RING	2.0 E-C7/HR			15
GASKETS, PACKING	3.53E-C6/HR			20
GASKETS, PHENOLIC	5.0 E-C8/HR	7.0 E-08	1.0 E-C8	12
GASKETS, RUBBER	2.0 E-C8/HR	3.0 E-C8	1.1 E-C8	12
GAUGES, PRESSURE	1.0 E-05/HR			C1
GAUGES, STRAIN	2.5 E-C5/HR			C3
GEARS	1.7 E-C7/HR			20
GEARS, HELICAL	1.0 E-06/HR			C3
GEARS, HELICAL	5.0 E-C8/HR	9.8 E-08	2.0 E-C5	12
GEARS, SPUR	1.0 E-05/HR			C3
GEARS, SPUR	2.18E-C6/HR	4.3 E-06	8.7 E-C8	12
GEIGER-MULLER DETECTOR	1.39E-C5/HR			14
GENERATORS	1.84E-C5/HR	2.45E-05	2.0 E-C5	C8
GENERATORS, A.C.	3.33E-C5/HR			14
GENERATORS, A.C. DIESEL DRIVEN	1.25E-04/HR	1.5 E-04	1.0 E-04	C8
GENERATORS, A.C. GENERAL	7.0 E-C6/HR			C3
GENERATORS, A.C. STEAM-TURBINE DRIVEN, 1800 RPM OR LESS	4.38E-C6/HR	8.8 E-06	2.0 E-C7	C8
GENERATORS, A.C. STEAM-TURBINE DRIVEN, 3600 RPM	4.50E-06/HR	9.5 E-06	2.41E-C7	C8
GENERATORS, D.C.	2.56E-C5/HR			14
GENERATORS, D.C. GENERAL	9.0 E-06/HR			C3
GENERATORS, D.C. (MOBILE)	3.68E-C5/HR			20
GENERATORS, D.C., MOTOR DRIVEN	1.14E-C6/HR	3.8 E-C6	2.0 E-C7	C8
GENERATORS, D.C.	9.0 E-C7/HR	6.27E-06	3.0 E-C7	12
GENERATORS, DIESEL	1.29E-06/HR			20
GENERATORS, DIESEL, BATTERY START	8.9 E-05/HR			18
GENERATORS, GAS ENGINE	2.70E-C6/HR			20
GENERATORS, GAS TURBINE DRIVEN	7.0 E-C5/HR	9.2 E-05	1.0 E-C6	C8
GENERATORS, GAS TURBINE, FAILURE TO START	2.3 E-C2/CM			C9
GENERATORS, MOTOR	2.78E-C5/HR			20
GENERATORS, SYNCHROS	8.0 E-C6/HR			C3
GENERATORS, TACHOMETERS	5.0 E-06/HR			C3
GENERATORS, TURBINE	6.26E-C4/HR			20
GENERATORS, VARIABLE FREQUENCY A.C.	4.5 E-C6/HR			14
GUNGS	4.5 E-C6/HR	3.30E-05	1.0 E-C6	C8
HANGERS AND SUPPORTS, CONSTANT SUPPORT SPRING HANGER	8.05E-C6/HR			14
HANGERS AND SUPPORTS, GUIDE HANGERS	2.47E-C6/HR			14

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
HANGERS AND SUPPORTS, HYDRAULIC SUPPORTS	2.91E-05/HR			14
HANGERS AND SUPPORTS, RESTRAINT SUPPORTS	4.0 E-07/HR			14
HANGERS AND SUPPORTS, ROD TYPE HANGER	9.0 E-08/HR			14
HANGERS AND SUPPORTS, VARIABLE SUPPORT SPRING HANGER	8.0 E-08/HR			14
HANGERS AND SUPPORTS, VARIABLE SUPPORT SPRING HANGERS	4.0 E-07/HR			14
HEAT EXCHANGERS	1.50E-05/HR	1.86E-05	2.21E-06	12
HEAT EXCHANGERS, GENERAL	9.0 E-07/HR			20
HEAT EXCHANGERS, HELICAL COIL, HORIZONTAL SHELL AND TUBE	2.07E-06/HR			14
HEAT EXCHANGERS, HELICAL COIL, SHELL AND CONCENTRIC TUBE	2.02E-05/HR			14
HEAT EXCHANGERS, STRAIGHT TUBE, HORIZONTAL SHELL AND TUBE	2.74E-06/HR			14
HEAT EXCHANGERS, STRAIGHT TUBE, RADIATOR TYPE	5.02E-06/HR			14
HEAT EXCHANGERS, STRAIGHT TUBE, VERTICAL SHELL AND TUBE	2.49E-05/HR			14
HEAT EXCHANGERS, U-TUBE, HORIZONTAL SHELL AND TUBE	8.68E-06/HR			14
HEAT EXCHANGERS, U-TUBE, RADIATOR TYPE	4.72E-05/HR			14
HEAT EXCHANGERS, U-TUBE, VERTICAL SHELL AND TUBE	1.32E-05/HR			14
HEATER, IMMERSION, FLANGE TYPE	2.2 E-07/HR	4.2 E-07	7.1 E-08	08
HEATERS	3.56E-06/HR	3.0 E-05	7.1 E-08	08
HEATERS, AIR	3.22E-06/HR	2.0 E-05	6.1 E-07	08
HEATERS, AIR, ELECTRIC BASEBOARD	2.54E-06/HR	1.16E-05	8.7 E-07	08
HEATERS, AIR, ELECTRIC BLAST COIL (DUCT)	2.63E-06/HR	5.83E-06	6.1 E-07	08
HEATERS, AIR, UNIT ELECTRIC	5.0 E-06/HR	2.0 E-05	2.0 E-06	08
HEATERS, ELECTRICAL, ELEMENTS	2.0 E-08/HR	4.0 E-08	1.0 E-08	12
HEATERS, ELECTRICAL, GENERAL	2.29E-06/HR			20
HEATERS, ELECTRICAL, SPACE	1.16E-06/HR			20
HEATERS, HEAT TRACING	9.6 E-07/HR			14
HEATERS, IMMERSION	4.2 E-06/HR	3.0 E-05	7.1 E-08	08
HEATERS, IMMERSION, SCREW PLUG	1.73E-06/HR	4.24E-06	7.1 E-07	08
HEATERS, IMMERSION, "OVER THE SIDE"	1.0 E-05/HR	1.76E-05	5.0 E-06	08
HEATERS, IMMERSION, BOTTOM CLAMPING	1.0 E-05/HR	1.76E-05	5.0 E-06	08
HEATERS, IMMERSION, CIRCULATION	1.41E-06/HR	3.0 E-05	7.07E-06	08
HEATERS, IMMERSION, TUBULAR WITH THREADED FITTINGS	1.0 E-05/HR	1.76E-05	5.0 E-06	08
HEATERS, OTHER	2.53E-06/HR			14
HEATERS, PIPE	1.75E-06/HR	3.07E-06	1.31E-06	08
HEATERS, PIPE, PARALLEL CIRCLIT TAPES	1.75E-06/HR	3.07E-06	1.31E-06	08
HEATERS, PRESSURIZER HEATER	1.92E-05/HR			14
HEPA FILTERS, FUEL FABRICATION FACILITY	1.4 E-08/HR			05
HEPA FILTERS, FUEL REPROCESSING FACILITY	1.30E-08/HR			05
HORNS	7.5 E-07/HR	3.3 E-05	5.0 E-07	08
HOSE, HEAVILY STRESSED	4.0 E-05/HR			15
HOSE, LIGHTLY STRESSED	4.0 E-06/HR			15
IMPULSE LINES	8.8 E-05/HR			01
INDICATORS, BELLOWS	1.87E-05/HR			14
INDICATORS, BOURDON TUBE	1.84E-06/HR			14

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
INDICATORS, D'ARSONVAL GALVANOMETER	1.15E-C6/HR			14
INDICATORS, DIAPHRAM	4.52E-C6/HR			14
INDICATORS, ELECTRONIC-ON-OFF	3.45E-C6/HR			14
INDICATORS, IRON VANE	6.3 E-C7/HR			14
INDICATORS, MECHANICAL	1.82E-C6/HR			14
INDICATORS, MICRO	6.41E-C5/HR			14
INDICATORS, OTHER	5.0 E-C7/HR			14
INDICATORS, SUMMER	1.14E-C4/HR			14
INDICATORS, UNDEFINED	8.0 E-C7/HR			14
INDUCTORS, A.F. COILS	3.0 E-C7/HR			03
INDUCTORS, R.F. COILS	5.0 E-C7/HR			03
INDUCTORS, SATURABLE REACTORS	1.5 E-C6/HR			03
INDUCTORS, SINGLE COILS, GENERAL	3.0 E-C7/HR			03
INDUCTORS, SOLENOIDS	4.0 E-C7/HR			03
INDUCTORS, TUNING COILS	1.5 E-C6/HR			03
INSTRUMENTATION, ELECTRICAL	1.38E-C6/HR	5.77E-06	1.35E-C6	12
INSTRUMENTATION, FAILURE TO OPERATE	1.0 E-C6/HR	1.0 E-C5	1.0 E-C7	06
INSTRUMENTATION, INDICATOR	3.9 E-C6/HR			20
INSTRUMENTATION, PRESSURE GAGE	4.0 E-C6/HR	7.8 E-06	1.35E-C7	12
INSTRUMENTATION, PRESSURE GAGE	1.0 E-C5/HR			15
INSTRUMENTATION, SHIFT IN CALIBRATION	3.0 E-C5/HR	3.0 E-04	3.0 E-C6	06
INSTRUMENTATION, TEMPERATURE, BULB	1.0 E-C6/HR	3.30E-C6	5.0 E-C8	12
INVERTERS, A.C.	2.53E-C5/HR			14
INVERTERS, D.C.	3.76E-C5/HR			14
ION CHAMBERS (AND LEADS)	5.0 E-C6/HR			03
ION CHAMBERS (AND LEADS), COMPENSATED	3.3 E-C6/HR			14
ION CHAMBERS (AND LEADS), UNCOMPENSATED	3.8 E-C6/HR			14
JOINTS, MECHANICAL	2.0 E-C7/HR			03
KLAXONS	1.0 E-C6/HR	3.30E-05	5.0 E-C7	08
LAMPS	8.62E-06/HR	3.5 E-05	3.45E-C6	12
LAMPS, FILAMENT, HIGH WATTAGE	5.0 E-C5/HR			03
LAMPS, FLUORESCENT	1.0 E-C5/HR			03
LAMPS, INCANDESCENT	8.0 E-C6/HR	3.20E-05	5.2 E-C6	12
LAMPS, INCANDESCENT	1.0 E-C6/HR			12
LAMPS, INCANDESCENT	4.48E-C6/HR			20
LAMPS, INDICATOR	5.0 E-C6/HR			01
LAMPS, INDICATOR	5.0 E-C6/HR			03
LAMPS, INDICATOR, NEON	2.0 E-C6/HR			03
LAMPS, LED	2.76E-C7/HR			20
LAMPS, NEON	1.02E-C5/HR	1.88E-05	4.5 E-C6	12
LAMPS, NEON	2.0 E-C7/HR			12
LEVEL MEASUREMENTS (LIQUIDS)	1.94E-C4/HR			01
LEVEL MEASUREMENTS (LIQUIDS), ELECTRICAL CONDUCTIVITY PROBES	2.65E-C4/HR			01
LEVEL MEASUREMENTS (LIQUIDS), FLOAT-TYPE LEVEL TRANSDUCER	1.87E-C4/HR			01
LEVEL MEASUREMENTS (SOLIDS)	7.83E-C4/HR			01
LEVEL MEASUREMENTS, CAPACITANCE-TYPE LEVEL TRANSDUCER	2.5 E-C5/HR			01

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
LEVEL MEASUREMENTS, DIFF. PRESS. TRANSMITTER (CLEAN FLUIDS)	4.45E-05/HR			C1
LEVEL MEASUREMENTS, DIFF. PRESS. TRANSMITTER (DIRTY FLUIDS)	2.18E-04/HR			O1
LEVEL MEASUREMENTS, DIFF. PRESS. TRANSMITTER, (CLEAN FLUIDS)	1.95E-04/HR			C1
LINES (OVERHEAD POWER), 10KV TO 22KV (PER KM)	1.25E-05/HR			C3
LINES (OVERHEAD POWER), 110KV TO 400KV (PER KM)	3.1 E-06/HR			O3
METERS, INDICATING (MOVING CCIL)	3.0E-06 /HR			C1
METERS, INDICATING (MOVING CCIL)	3.0E-06 /HR			C3
METERS, INDICATING (MOVING CCIL)	1.0E-06 /HR			C4
MOTOR STARTERS	2.24E-07/HR	4.5 E-07	1.5 E-07	C8
MOTORS	1.72E-06/HR	8.0 E-06	6.0 E-06	C8
MOTORS, A.C., GENERAL	1.24E-06/HR			20
MOTORS, AC POLYPHASE SQUIRREL CAGE INDUCTION, 201 HP OR GREATER	1.90E-06/HR	7.73E-06	7.07E-07	C6
MOTORS, AC POLYPHASE SQUIRREL CAGE INDUCTION, 200 HP OR LESS	2.57E-06/HR	4.90E-06	2.16E-07	C8
MOTORS, AC POLYPHASE SQUIRREL-CAGE INDUCTION	1.29E-06/HR	4.89E-06	2.1 E-07	C8
MOTORS, AC POLYPHASE SYNCHRONOUS	2.15E-06/HR	8.0 E-06	6.0 E-07	C8
MOTORS, AC POLYPHASE SYNCHRONOUS, 200 HP OR LESS	3.46E-06/HR	5.20E-06	4.0 E-07	C6
MOTORS, AC POLYPHASE SYNCHRONOUS, 201 HP OR LARGER	2.0 E-06/HR	3.46E-06	7.07E-07	C6
MOTORS, AC POLYPHASE WOUND-ROTOR INDUCTION	2.38E-06/HR	8.0 E-06	6.0 E-07	C8
MOTORS, AC SINGLE PHASE INDUCTION	1.50E-06/HR	5.0 E-06	6.0 E-06	C8
MOTORS, AC SINGLE-PHASE SYNCHRONOUS	1.5 E-06/HR	1.8 E-06	1.2 E-06	O8
MOTORS, BLOWER	2.0 E-07/HR	5.5 E-06	5.0 E-06	12
MOTORS, D.C. COMMUTATOR, SINGLE SPEED, 100-299 VDC	1.90E-05/HR			14
MOTORS, D.C. COMMUTATOR, VARIABLE SPEED, 100-299 VDC	7.69E-05/HR			14
MOTORS, DC	1.76E-06/HR	3.0 E-06	1.0 E-06	C8
MOTORS, ELECTRICAL	3.0 E-07/HR	5.8 E-07	1.1 E-07	12
MOTORS, FAILURE TO RUN	1.0 E-05/HR	3.0 E-05	3.0 E-06	C6
MOTORS, FAILURE TO START	3.0 E-04/DM	1.0 E-03	1.0 E-04	C6
MOTORS, FRACTIONAL H.P.	3.3 E-06/HR			20
MOTORS, FULL H.P.	9.13E-07/HR			20
MOTORS, GENERAL	1.0 E-05/HR			C3
MOTORS, HYDRAULIC	4.3 E-06/HR	7.15E-06	1.45E-06	12
MOTORS, INDUCTION (GREATER THAN 200KW)	1.0 E-05/HR			C3
MOTORS, INDUCTION (LESS THAN 200KW)	5.0 E-06/HR			O3
MOTORS, INDUCTION, REPULSION START, POLYPHASE 300-499 VAC	2.39E-06/HR			14
MOTORS, INDUCTION, SQUIRREL CAGE POLYPHASE 2000-2599 VAC	7.93E-06/HR			14
MOTORS, INDUCTION, SQUIRREL CAGE POLYPHASE 3500-4999 VAC	4.01E-06/HR			14
MOTORS, INDUCTION, SQUIRREL CAGE POLYPHASE 6000-6999 VAC	5.37E-06/HR			14
MOTORS, INDUCTION, SQUIRREL CAGE POLYPHASE, UNDEFINED	4.85E-06/HR			14
MOTORS, INDUCTION, SQUIRREL CAGE POLYPHASE 500-699 VAC	8.66E-06/HR			14
MOTORS, INDUCTION, SQUIRREL CAGE POLYPHASE 300-499 VAC	4.27E-06/HR			14
MOTORS, SERVO	2.3 E-07/HR	3.5 E-07	1.1 E-07	12
MOTORS, SMALL, GENERAL	4.0 E-06/HR			C3
MOTORS, STEP	1.38E-06/HR			20

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
MOTORS, STEPPER	5.0 E-06/HR			03
MOTORS, STEPPER	3.7 E-07/HR	7.1 E-07	2.2E-07	12
MOTORS, SYNCHRONOUS	7.0 E-06/HR			02
MOTORS, SYNCHRONOUS 300-495 VAC POLYPHASE	1.56E-06/HR			14
MOUNTS, RESILIENT	8.75E-07/HR	1.6 E-06	2.0 E-07	12
MOUNTS, VIBRATION	9.0 E-06/HR			02
NOZZLE AND FLAPPER ASSEMBLIES, BLOCKAGE	6.0 E-06/HR			15
NOZZLE AND FLAPPER ASSEMBLIES, BREAKAGE	2.0 E-07/HR			15
NUTS (MECHANICAL)	2.0 E-08/HR			03
ORIFICES, FIXED	1.5 E-07/HR	2.11E-06	1.0 E-08	12
ORIFICES, VARIABLE	5.5 E-07/HR	3.71E-06	4.5 E-08	12
PHOTOELECTRIC CELL	1.48E-05/HR			01
PHOTOELECTRIC CELL	1.5 E-05/HR			03
PINS (MECHANICAL)	1.5 E-05/HR			03
PIPES	2.0 E-07/HR			15
PIPES, GREATER THAN 16 INCHES, STRAIGHT SECTION	3.58E-06/HR			14
PIPES, GREATER THAN 3 INCHES (HIGH QUALITY) RUPTURE OF SECTION	1.0 E-10/HR	3.0 E-09	3.03E-12	06
PIPES, LESS THAN 3 INCHES, RUPTURE OF SECTION	1.0 E-09/HR	3.0 E-08	3.0 E-11	06
PIPES, LESS THAN 4 INCHES, STRAIGHT SECTION	7.46E-06/HR			14
PIPES, PIPE JOINTS	5.0 E-07/HR			15
PIPES, PIPELINE, 1 MILE LENGTH	5.4 E-08/HR			19
PIPES, UNIONS AND JUNCTIONS	4.0 E-07/HR			15
PIPES, 4 INCHES TO 6 INCHES, STRAIGHT SECTION	4.44E-05/HR			14
PIPES, 6 INCHES TO 10 INCHES, STRAIGHT SECTIONS	2.02E-05/HR			14
PIVOTS	1.0 E-06/HR			03
POWER SUPPLIES, AMPLIFIER	7.6 E-07/HR			14
POWER SUPPLIES, E-E CONVERTER	1.45E-06/HR			14
POWER SUPPLIES, ELECTRONIC-CA-CFF	5.6 E-07/HR			14
POWER SUPPLIES, ELECTRONIC-CTHEF	2.37E-06/HR			14
POWER SUPPLIES, MOTOR GENERATOR	1.0 E-06/HR	5.4 E-05	4.0 E-07	08
POWER SUPPLIES, OTHER	2.9 E-07/HR			14
POWER SUPPLIES, UNINTERRUPTABLE	3.23E-06/HR	1.0 E-04	4.0 E-07	08
POWER SUPPLIES, UNINTERRUPTABLE, SINGLE PHASE STATIC INVERTERS	3.42E-06/HR	4.0 E-05	1.0 E-06	08
POWER SUPPLIES, UNINTERRUPTABLE, THREE PHASE STATIC INVERTERS	9.82E-06/HR	1.0 E-04	6.34E-07	08
POWER TRANSMITTAL MECHANISMS	1.67E-06/HR			20
PRESSURE MEASUREMENTS	1.61E-04/HR			01
PRESSURE TRANSDUCERS, CURRENT	5.6 E-05/HR			01
PUMPS	1.35E-05/HR	2.4 E-05	2.7 E-06	12
PUMPS, AXIAL, LESS THAN 500 GPM	4.07E-06/HR			14
PUMPS, BOILER FEED	4.22E-07/HR			20
PUMPS, CENTRIFUGAL	1.2 E-05/HR			20
PUMPS, CENTRIFUGAL, GREATER THAN 50,000 GPM	2.16E-05/HR			14
PUMPS, CENTRIFUGAL, LESS THAN 500 GPM	3.35E-05/HR			14

TABLE II

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
PUMPS,CENTRIFUGAL,UNDEFINED	1.43E-C5/HR			14
PUMPS,CENTRIFUGAL,10,000-50,COC GPM	1.16E-C5/HR			14
PUMPS,CENTRIFUGAL,2500-9999 GPM	3.60E-05/HR			14
PUMPS,CENTRIFUGAL,500-2499 GPM	2.70E-C5/HR			14
PUMPS,DIAPHRAGM,LESS THAN 500 GPM	7.0 E-C5/HR			14
PUMPS,DIAPHRAGM,500-2499 GPM	8.62E-C6/HR			14
PUMPS,ELECTRIC DRIVE	1.35E-C5/HR	2.74E-05	2.9 E-C6	12
PUMPS,FAILURE TO RUN	3.0 E-05/HR	3.0 E-04	3.0 E-C6	06
PUMPS,FAILURE TO START	1.0 E-03/DM	3.0 E-03	3.0 E-C4	C6
PUMPS,FIXED DISPLACEMENT	1.46E-C6/HR			20
PUMPS,FUEL	1.76E-04/HR			20
PUMPS,HYDRAULIC	1.68E-C6/HR			20
PUMPS,JET,UNDEFINED	1.85E-C6/HR			14
PUMPS,OTHER,2500-9999 GPM	8.37E-C6/HR			14
PUMPS,RECIPROCATING,LESS THAN 500 GPM	3.41E-04/HR			14
PUMPS,RECIPROCATING,500-2500 GPM	2.17E-05/HR			14
PUMPS,ROTARY,LESS THAN 500 GPM	5.31E-C5/HR			14
PUMPS,ROTARY,2500-9999 GPM	2.82E-C5/HR			14
PUMPS,VACUUM	2.7 E-05/HR			20
PUMPS,VANE TYPE,LESS THAN 500 GPM	7.0 E-C5/HR			14
PYROMETERS,OPTICAL	1.11E-03/HR			C1
PYROMETERS,RADIATION	2.48E-04/HR			C1
RACK AND PINION ASSEMBLIES	2.0 E-C6/HR			C3
RECORDERS	6.81E-C6/HR	1.09E-05	3.18E-C6	C8
RECORDERS,D'ARSONVAL	7.14E-05/HR			14
RECORDERS,GALVANOMETER TYPE	6.45E-C6/HR			14
RECORDERS,RESISTANCE CHANGE	8.8 E-C6/HR			14
RECORDERS,SERVO-DRIVEN FEED BACK	9.45E-C6/HR			14
RECORDERS,STRIP CHART	2.5 E-C5/HR			C1
RECORDERS,STRIP CHART	2.5 E-C5/HR			C3
RECORDERS,THERMOCOUPLE	7.5 E-C6/HR			14
RECORDERS,UNDEFINED	7.97E-C6/HR			14
RECTIFIERS,COPPER OXIDE	5.0 E-C6/HR			03
RECTIFIERS,METAL,SELENIUM	5.0 E-C6/HR			C3
REGULATORS	2.14E-C6/HR	5.54E-06	7.0 E-C7	12
REGULATORS,FLOW AND PRESSURE	2.14E-C6/HR	5.54E-06	7.0 E-C7	12
REGULATORS,PNEUMATIC	2.40E-C6/HR	6.21E-06	7.7 E-C7	12
REGULATORS,THERMOSTAT	4.86E-C6/HR			20
REGULATORS,VOLTAGE	3.0 E-C6/HR			20
RELAYS	8.7 E-C8/HR	1.5 E-06	1.0 E-C8	C8
RELAYS,ARMATURE	3.5 E-07/HR			20
RELAYS,AUXILIARY TRIP	1.02E-C7/HR	1.5 E-06	1.0 E-C8	C8
RELAYS,CARPENTER,POLARIZED,EACH COIL	3.0 E-07/HR			03

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
RELAYS, CARPENTER, POLARIZED, EACH CONTACT PAIR	5.0 E-07/HR			C3
RELAYS, CONTROL AND SEQUENTIALLY PROGRAMMED	6.7 E-08/HR	2.7 E-06	6.0 E-08	C8
RELAYS, CONTROL, GENERAL PURPOSE, GREATER THAN 300 VAC	7.2 E-07/HR			14
RELAYS, CONTROL, GENERAL PURPOSE, GREATER THAN 300 VDC	6.13E-06/HR			14
RELAYS, CONTROL, GENERAL PURPOSE, UNDEFINED	5.0 E-07/HR			14
RELAYS, CONTROL, GENERAL PURPOSE, 100-100 VCC	5.9 E-07/HR			14
RELAYS, CONTROL, GENERAL PURPOSE, 100-199 VAC	4.9 E-06/HR			14
RELAYS, CONTROL, GENERAL PURPOSE, 200-300 VAC	5.8 E-07/HR			14
RELAYS, CONTROL, GENERAL PURPOSE, 200-300 VDC	6.7 E-07/HR			14
RELAYS, CRYSTAL CAN	1.56E-07/HR			20
RELAYS, EACH COIL, GENERAL	3.0 E-07/HR			C3
RELAYS, EACH CONTACT PAIR, GENERAL	2.0 E-07/HR			C3
RELAYS, EVENT SEQ. TIMER OR T-S CONTROL, 100-199 VAC	1.74E-06/HR			14
RELAYS, EVENT SEQ. TIMER OR T-S CONTROL, 100-199 VDC	2.6 E-07/HR			14
RELAYS, EVENT SEQ. TIMER OR T-S CONTROL, 200-300 VCC	3.51E-06/HR			14
RELAYS, FAILURE TO CLOSE	3.0 E-07/HR	1.0 E-06	1.0 E-07	C6
RELAYS, FAILURE TO ENERGIZE	1.0 E-04/DM	3.0 E-04	3.0 E-05	C6
RELAYS, GENERAL	2.5 E-07/CY	4.8 E-07	1.0 E-07	12
RELAYS, GENERAL	1.91E-07/HR			20
RELAYS, GENERAL CONTROL	2.0 E-06/HR			C3
RELAYS, GENERAL HIGH SPEED	5.0 E-06/HR			C3
RELAYS, HEAVY DUTY	5.0 E-06/HR			C3
RELAYS, HEAVY DUTY	5.0 E-07/CY	8.1 E-07	3.0 E-07	12
RELAYS, HERMETICALLY SEALED	5.0 E-07/HR			C3
RELAYS, HERMETICALLY SEALED	4.0 E-08/CY	1.9 E-07	2.0 E-08	12
RELAYS, HIGH SPEED	7.0 E-07/CY	1.13E-06	4.2 E-07	12
RELAYS, LATCHING	2.7 E-08/HR			20
RELAYS, MINIATURE	6.0 E-08/CY	2.5 E-07	3.0 E-08	12
RELAYS, MINIATURE HIGH SPEED	7.0 E-06/HR			C3
RELAYS, MOTOR DRIVEN	2.22E-05/HR			20
RELAYS, NORMALLY CLOSED CONTACT OPEN	1.0 E-07/HR	3.0 E-07	3.0 E-08	C6
RELAYS, P.O. TYPE, GENERAL	2.0 E-06/HR			C3
RELAYS, P.O. TYPE, TROPICALIZED	1.0 E-06/HR			C3
RELAYS, PNEUMATIC	1.94E-05/HR			C1
RELAYS, PNEUMATIC, TIME DELAY, UNDEFINED	1.43E-06/HR			14
RELAYS, PNEUMATIC, TIME DELAY, 100-199 VAC	5.4 E-07/HR			14
RELAYS, PNEUMATIC, TIME DELAY, 100-199 VDC	3.3 E-07/HR			14
RELAYS, POST OFFICE	2.05E-06/HR			C1
RELAYS, POWER	3.0 E-07/CY	4.10E-06	1.5 E-07	12
RELAYS, POWER	1.01E-06/HR			20
RELAYS, PROTECTIVE	5.0 E-06/HR			C3
RELAYS, PROTECTIVE	9.7 E-08/HR	2.5 E-07	2.0 E-08	C8
RELAYS, SHORT ACROSS CONTACTS	1.0 E-08/HR	1.0 E-07	1.0 E-09	C6

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
RELAYS, SOLID STATE, TIME DELAY, 100-199 VAC	2.63E-05/HR			14
RELAYS, SOLID STATE, TIME DELAY, 100-199 VDC	2.77E-06/HR			14
RELAYS, SOLID STATE, TIME DELAY, 50-99 VAC	2.34E-06/HR			14
RELAYS, THERMAL	4.0 E-06/HR			03
RELAYS, THERMAL	1.31E-05/HR			20
RELAYS, TIME DELAY	4.0 E-06/HR			03
RELAYS, TIME DELAY	1.57E-06/HR			20
RESISTORS (FIXED), COMPOSITION, GRADE 2	1.0 E-07/HR			03
RESISTORS (FIXED), FIXED COMPOSITION	5.0 E-09/HR			04
RESISTORS (FIXED), FIXED FILM	1.5 E-06/HR			04
RESISTORS (FIXED), HIGH STABILITY, CARBON	5.0 E-07/HR			03
RESISTORS (FIXED), METAL FILM	1.0 E-07/HR			03
RESISTORS (FIXED), OXIDE FILM	5.0 E-08/HR			03
RESISTORS (FIXED), THERISTOR	1.0 E-06/HR			03
RESISTORS (FIXED), THYRISTOR (SILICON CARBIDE)	1.0 E-06/HR			03
RESISTORS (FIXED), WIREWOUND, GENERAL	5.0 E-07/HR			03
RESISTORS (FIXED), WIREWOUND, PRECISION	1.0 E-06/HR			03
RESISTORS (VARIABLE), CARBON TRACK	2.0 E-06/HR			03
RESISTORS (VARIABLE), GENERAL WIREWOUND	3.0 E-06/HR			03
RESISTORS (VARIABLE), GENERAL WIREWOUND	1.4 E-06/HR			04
RESISTORS (VARIABLE), LEAD SCREW	5.2 E-05/HR			04
RESISTORS (VARIABLE), MINIATURE WIREWOUND	5.0 E-06/HR			03
RESISTORS (VARIABLE), PRECISION WIREWOUND	6.0 E-06/HR			03
RESTRICTORS, FLOW	5.9 E-07/HR	9.83E-07	1.97E-07	12
RESTRICTORS, FLOW	5.0 E-06/HR			15
SCINTILLATION DETECTOR	1.57E-05/HR			14
SCREWS, GRUB	5.0 E-07/HR			03
SEALS, O-RING	2.0 E-07/HR			15
SEALS, ROTATING	7.0 E-07/HR	1.12E-06	2.5 E-07	12
SEALS, ROTATING	7.0 E-06/HR			15
SEALS, SLIDING	3.0 E-07/HR	9.2 E-07	1.1 E-07	12
SEALS, SLIDING	3.0 E-06/HR			15
SENSOR/DETECTOR, SCINTILLATION	1.57E-05/HR			14
SENSOR/DETECTOR, BIMETALLIC	5.92E-06/HR			14
SENSOR/DETECTOR, BOURDON TUBE	4.04E-06/HR			14
SENSOR/DETECTOR, CONDUCTANCE	6.24E-06/HR			14
SENSOR/DETECTOR, FILLED LIQUID OR GAS	6.0 E-06/HR			14
SENSOR/DETECTOR, FISSION CHAMBER	3.52E-06/HR			14
SENSOR/DETECTOR, FLOAT	6.8 E-07/HR			14
SENSOR/DETECTOR, GEIGER-MULLER	1.39E-05/HR			14
SENSOR/DETECTOR, HELIX	9.6 E-07/HR			14
SENSOR/DETECTOR, ION-CHAMBER COMPENSATED	3.3 E-06/HR			14
SENSOR/DETECTOR, ION-CHAMBER UNCOMPENSATED	3.8 E-06/HR			14

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
SENSOR/DETECTOR, MERCURY	4.93E-05/HR			14
SENSOR/DETECTOR, NOZZLE	2.52E-06/HR			14
SENSOR/DETECTOR, PADDLE/TARGET	8.8 E-07/HR			14
SENSOR/DETECTOR, POSITIVE DISPLACEMENT	5.94E-06/HR			14
SENSOR/DETECTOR, PRESSURE	3.5 E-06/HR	6.6 E-06	1.7 E-06	12
SENSOR/DETECTOR, REED	1.69E-06/HR			14
SENSOR/DETECTOR, RESISTANCE CHANGE	1.51E-06/HR			14
SENSOR/DETECTOR, SOLID STATE	2.13E-05/HR			14
SENSOR/DETECTOR, TEMPERATURE	3.3 E-06/HR	6.4 E-06	1.5 E-06	12
SENSOR/DETECTOR, THERMOCOUPLE	1.4CE-06/HR			14
SERVO MOTORS	3.0 E-07/HR	4.0 E-07	2.0 E-07	08
SERVO MOTORS, DC	3.0 E-07/HR	4.0 E-07	2.0 E-07	08
SERVO MOTORS, STEPPER	3.0 E-07/HR	4.0 E-07	2.0 E-07	08
SHAFTS, HEAVILY STRESSED	2.0 E-07/HR			03
SHAFTS, LIGHTLY STRESSED	2.0 E-08/HR			03
SIRENS	3.0 E-07/HR	3.3 E-05	1.0 E-07	08
SOLENOIDS	5.0 E-08/HR	5.5 E-07	3.6 E-08	12
SOLID STATE DEVICES, HIGH POWER APPLICATIONS, FAILS SHORTED	1.0 E-06/HR	3.0 E-05	3.0 E-07	06
SOLID STATE DEVICES, HIGH POWER APPLICATIONS, FAILS TO FUNCT.	3.0 E-06/HR	3.0 E-05	3.0 E-07	06
SOLID STATE DEVICES, LOW POWER APPLICATIONS, FAILS SHORTED	1.0 E-07/HR	1.0 E-06	1.0 E-08	06
SOLID STATE DEVICES, LOW POWER APPLICATIONS, FAILS TO FUNCTION	1.0 E-06/HR	1.0 E-05	1.0 E-07	06
SPRINGS, CALIBRATION	2.22E-06/HR	4.2 E-07	9.0 E-05	12
SPRINGS, CALIBRATION (BREAKAGE)	2.0 E-07/HR			03
SPRINGS, CALIBRATION (CREEP)	2.0 E-06/HR			03
SPRINGS, HAIR	1.0 E-06/HR			03
SPRINGS, HEAVILY STRESSED	1.0 E-06/HR			03
SPRINGS, LIGHTLY STRESSED	2.0 E-07/HR			03
SPRINKLER HEAD	6.15E-07/HR			20
STEAM SUPPLY SYSTEM, AIR PREHEATER	1.1 E-06/HR			21
STEAM SUPPLY SYSTEM, ASH CONVEYOR	1.0 E-05/HR			21
STEAM SUPPLY SYSTEM, BOILER FEED WATER PUMP	9.0 E-07/HR			21
STEAM SUPPLY SYSTEM, COAL FEED ELEVATOR OF CONVEYOR	3.0CE-04/HR			21
STEAM SUPPLY SYSTEM, CONDENSATE COLLECTION AND RETURN	1.0 E-05/HR			21
STEAM SUPPLY SYSTEM, ECONOMIZER	4.0 E-05/HR			21
STEAM SUPPLY SYSTEM, ELECTRIC DRIVE FOR FORCED DRAFT FAN	3.0 E-06/HR			21
STEAM SUPPLY SYSTEM, ELECTRIC DRIVE FOR GRATE	3.0 E-07/HR			21
STEAM SUPPLY SYSTEM, ELECTRIC DRIVE FOR INDUCED DRAFT FAN	2.0 E-06/HR			21
STEAM SUPPLY SYSTEM, ELECTRIC DRIVE FOR OVERFIRE AIR FAN	2.0 E-06/HR			21
STEAM SUPPLY SYSTEM, ELECTRIC DRIVE FOR SPREADER STOKER	3.0 E-07/HR			21
STEAM SUPPLY SYSTEM, FORCED DRAFT FAN	2.0 E-06/HR			21
STEAM SUPPLY SYSTEM, GRATE	1.0 E-04/HR			21
STEAM SUPPLY SYSTEM, INDUCED DRAFT FAN	1.1 E-06/HR			21
STEAM SUPPLY SYSTEM, OVERBUNKER COAL CONVEYOR	6.0 E-05/HR			21

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
STEAM SUPPLY SYSTEM, OVERPIPE AIR FAN	5.7 E-05/HR			21
STEAM SUPPLY SYSTEM, SPREADER STCKER	8.3 E-04/HR			21
STEAM SUPPLY SYSTEM, STEAM DRIVE FOR FORCED CRAFT FAN	2.0 E-08/HR			21
STEAM SUPPLY SYSTEM, STEAM DRIVE FOR INDUCED CRAFT FAN	3.0 E-06/HR			21
STEAM SUPPLY SYSTEM, STEAM DRIVE FOR OVERFIRE AIR FAN	3.0 E-06/HR			21
STEAM SUPPLY SYSTEM, STEAM DRIVE FOR SPREADER STCKER & GRATE	5.0 E-05/HR			21
STEAM SUPPLY SYSTEM, STEAM GENERATING TUBES	3.0 E-07/HR			21
STEAM SUPPLY SYSTEM, SUPERHEATER	4.0 E-07/HR			21
STEAM SUPPLY SYSTEM, UNDERBUNKER TRANSFER CONVEYOR	6.0 E-05/HR			21
STEAM SUPPLY SYSTEM, WATER WALL TUBES	5.7 E-05/HR			21
STRAIN GAUGES	1.2 E-05/HR	2.0 E-05	7.0 E-06	12
SWITCH GEAR	1.27E-07/HR	4.3 E-07	1.0 E-08	08
SWITCH GEAR, AUXILIARY, 100-195 VAC	1.3 E-07/HR			14
SWITCH GEAR, LOW VOLTAGE POWER CIRCUIT BREAKER	3.9 E-08/HR	4.3 E-07	1.0 E-08	08
SWITCH GEAR, METAL ENCLOSED, POWER	1.3 E-07/HR	4.3 E-07	2.0 E-08	08
SWITCH GEAR, PROTECTIVE, GREATER THAN 300 VAC	7.2 E-07/HR			14
SWITCH GEAR, PROTECTIVE, 100-199 VAC	4.1 E-07/HR			14
SWITCH GEAR, PROTECTIVE, 100-199 VDC	8.0 E-08/HR			14
SWITCH GEAR, SWITCHBOARDS	4.0 E-07/HR	2.74E-06	1.5 E-07	08
SWITCHES	1.15E-07/HR	2.80E-05	1.0 E-09	08
SWITCHES, BELLOWS	2.51E-06/HR			14
SWITCHES, BIMETALLIC	2.28E-06/HR			14
SWITCHES, BOURDON TUBE	5.83E-06/HR			14
SWITCHES, CENTRIFUGAL	1.81E-06/HR			20
SWITCHES, COAXIAL	2.92E-07/HR			20
SWITCHES, CONTROL AND INSTRUMENTATION (LOW POWER)	1.71E-07/HR	2.80E-05	2.5 E-08	08
SWITCHES, DIAPHRAM	3.11E-06/HR			14
SWITCHES, DISPLACEMENT	1.34E-06/HR	2.29E-06	5.85E-07	08
SWITCHES, DISPLACEMENT	5.0 E-06/CY	1.0 E-05	1.0 E-06	08
SWITCHES, EACH CONTACT, GENERAL	2.0 E-07/HR			03
SWITCHES, ELECTRICAL, ROTARY	2.0 E-08/HR			04
SWITCHES, ELECTRICAL, SLIDE	1.0 E-07/HR			04
SWITCHES, FILLED LIQUID OR GAS	7.04E-06/HR			14
SWITCHES, FLOAT	7.7 E-07/HR			14
SWITCHES, FLOW	1.28E-04/HR			01
SWITCHES, FLOW	1.84E-06/HR	5.99E-06	3.0 E-07	08
SWITCHES, FLOW	5.0 E-08/CY	1.7 E-07	1.0 E-08	08
SWITCHES, FLOW	4.82E-06/HR			20
SWITCHES, HUMIDITY	1.68E-05/HR			20
SWITCHES, ION CHAMBER, COMPENSATED	1.45E-05/HR			14
SWITCHES, KEY	2.32E-06/HR			20
SWITCHES, LEVEL	5.85E-06/HR	1.0 E-05	2.6 E-06	08
SWITCHES, LEVEL	1.0 E-06/CY	2.0 E-06	2.0 E-08	08

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
SWITCHES, LIMIT	1.67E-C5/HR	2.80E-05	8.10E-C6	C8
SWITCHES, LIMIT, FAILURE TO OPERATE	3.0 E-04/DM	1.0 E-03	1.0 E-C4	C6
SWITCHES, LIQUID LEVEL	5.28E-C6/HR			20
SWITCHES, MANUAL, CONTACTS SHORTED	1.0 E-C8/HR	1.0 E-07	1.0 E-09	C6
SWITCHES, MANUAL, FAILURE TO TRANSFER	1.0 E-05/DM	3.0 E-05	3.0 E-C6	C6
SWITCHES, MECHANICAL	5.56E-C6/HR			14
SWITCHES, MERCURY	6.28E-06/HR			14
SWITCHES, MICRO	5.0 E-C7/HR			C3
SWITCHES, MICRO	2.5 E-C7/CY	5.0 E-07	9.0 E-C8	12
SWITCHES, MICRO	1.56E-06/HR			14
SWITCHES, MV-I CONVERTER	2.67E-05/HR			14
SWITCHES, OTHER	5.7 E-C7/HR			14
SWITCHES, PENDANT HOIST	6.16E-06/HR			20
SWITCHES, POWER	7.7 E-C8/HR	1.62E-C6	1.0 E-C9	C8
SWITCHES, PRESSURE	3.9 E-05/HR			C1
SWITCHES, PRESSURE	1.6 E-C5/HR			C1
SWITCHES, PRESSURE	2.86E-C6/HR	4.64E-06	3.0 E-C8	C8
SWITCHES, PRESSURE	1.0 E-C6/CY	1.5 E-06	1.4 E-C7	C8
SWITCHES, PRESSURE	9.76E-C7/HR			20
SWITCHES, PRESSURE, FAILURE TO OPERATE	1.0 E-04/DM	3.0 E-04	3.0 E-C5	C6
SWITCHES, PUSH BUTTON	5.0 E-07/HR			C3
SWITCHES, PUSH BUTTON	3.78E-C7/HR	6.94E-07	1.52E-C7	C8
SWITCHES, PUSH BUTTON	6.3 E-C8/CY	1.1 E-07	4.3 E-C8	12
SWITCHES, PUSH BUTTON	1.48E-C7/HR			20
SWITCHES, REED	5.6 E-C7/HR			14
SWITCHES, ROTARY	1.75E-C7/CY	6.6 E-07	1.18E-C7	12
SWITCHES, ROTARY	1.70E-C6/HR			20
SWITCHES, ROTARY SELECTOR	8.06E-07/HR	1.24E-06	6.2 E-C7	C8
SWITCHES, ROTARY, WAFER	2.0 E-06/HR			C3
SWITCHES, SENSITIVE	2.71E-C6/HR			20
SWITCHES, SHAFT	2.36E-07/HR			20
SWITCHES, SOLID STATE	6.8 E-C7/HR			14
SWITCHES, SPEED, CENTRIFUGAL	8.7 E-C7/HR	1.5 E-C6	1.55E-C7	C8
SWITCHES, SPEED, CENTRIFUGAL	5.0 E-09/CY	1.0 E-08	1.0 E-C9	C8
SWITCHES, TEMPERATURE	1.34E-C6/HR	1.96E-C6	3.0 E-C7	C8
SWITCHES, TEMPERATURE	7.5 E-07/CY	1.5 E-06	1.0 E-C7	C8
SWITCHES, THERMAL	1.61E-07/CY	2.61E-07	1.14E-C7	12
SWITCHES, THERMAL	3.89E-C7/HR			20
SWITCHES, THERMAL, CONTACTS	1.0 E-06/HR			C3
SWITCHES, THERMAL, HEATER	1.0 E-C6/HR			C3
SWITCHES, THERMISTOR	7.04E-C6/HR			14
SWITCHES, THERMOCOUPLE	2.49E-06/HR			14
SWITCHES, THERMOSTAT	2.81E-C6/HR			20

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
SWITCHES, TOGGLE	1.86E-07/HR	2.86E-07	1.58E-C7	C8
SWITCHES, TOGGLE	6.0 E-C8/CY	1.23E-C7	1.5 E-C8	12
SWITCHES, TOGGLE	2.31E-07/HR			20
SWITCHES, TOGGLE, EACH CONTACT PAIR	2.0 E-C7/HR			C3
SWITCHES, TOGGLE, GENERAL	1.0 E-C6/HR			C3
SWITCHES, TOGGLE, GENERAL	3.0 E-08/HR			C4
SWITCHES, TORQUE, FAILURE TO OPERATE	1.0 E-C4/DM	3.0 E-04	3.0 E-C5	C6
SWITCHES, ULTRA SONIC	5.88E-C6/HR			14
SWITCHES, UNDEFINED	7.2 E-C7/HR			14
SYNCHROS	3.5 E-C7/HR	6.1 E-C7	9.0 E-C8	12
SYNCHROS	8.0 E-C6/HR			15
TACHOMETERS	5.0 E-C6/HR			C1
TACHOMETERS	3.0 E-C7/HR	5.5 E-07	2.5 E-C7	12
TANKS	1.5 E-07/HR	2.7 E-07	8.3 E-C8	12
TANKS, HIGH PRESSURE, SMALL	8.0 E-C8/HR	1.44E-07	4.4 E-C8	12
TANKS, PRESSURE, SMALL	1.8 E-C7/HR	3.24E-C7	1.0 E-C7	12
TANKS, STORAGE	1.62E-06/HR			20
TEMPERATURE MEASUREMENTS (EXCLUDING PYROMETERS)	4.0 E-C5/HR			C1
TEMPERATURE MEASUREMENTS, MERCURY IN STEEL	3.1 E-06/HR			C1
TEMPERATURE MEASUREMENTS, RESISTANCE THERMOMETER	4.7 E-C5/HR			C1
TEMPERATURE MEASUREMENTS, TEMPERATURE TRANSDUCER	1.0 E-C4/HR			C1
TEMPERATURE MEASUREMENTS, TEMPERATURE TRIP AMPLIFIER, TYPE A	2.97E-04/HR			C1
TEMPERATURE MEASUREMENTS, TEMPERATURE TRIP AMPLIFIER, TYPE B	1.94E-04/HR			C1
TEMPERATURE MEASUREMENTS, THERMOCOUPLE	1.0 E-C5/HR			C1
TEMPERATURE MEASUREMENTS, THERMOCOUPLE	5.9 E-C5/HR			C1
TEMPERATURE MEASUREMENTS, VAPOR PRESSURE BULB	4.2 E-C5/HR			C1
TEMPERATURE TRIP AMPLIFIERS, TYPE A	2.97E-04/HR			C1
TEMPERATURE TRIP AMPLIFIERS, TYPE B	1.94E-04/HR			C1
TEMPERATURE TRIP AMPLIFIERS, TYPE C	1.1 E-05/HR			C1
TERMINAL BOARDS, OPEN CONNECTION	1.0 E-07/HR	1.0 E-06	1.0 E-C8	C6
TERMINAL BOARDS, SHORT TO ADJACENT CIRCUIT	1.0 E-C8/HR	1.0 E-07	1.0 E-C9	C6
THERMISTORS	1.5 E-C5/HR	2.8 E-05	1.0 E-C5	12
THERMISTORS	3.0 E-C7/HR			12
THERMOCOUPLES	1.0 E-C5/HR			C1
THERMOCOUPLES	1.0 E-C5/HR			C3
THERMOCOUPLES	1.4 E-06/HR			14
THERMOWELL, 6 INCHES TO 10 INCHES DIA.	2.84E-C5/HR			14
TIMER, ELECTRO-MECHANICAL, TIME TOTALIZING	4.26E-05/HR			20
TOTALIZERS	3.49E-C6/HR	9.75E-06	1.44E-C6	C8
TOTALIZERS	8.0 E-07/DM	1.5 E-C6	2.0 E-C7	C8
TRANSDUCERS, CAPACITANCE TYPE	2.69E-04/HR			C1
TRANSDUCERS, CURRENT PRESSURE	5.6 E-C5/HR			C1
TRANSDUCERS, DIFFERENTIAL PRESSURE	1.97E-04/HR			C1

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
TRANSDUCERS, FLOAT TYPE	2.5 E-05/HR			C1
TRANSDUCERS, FLOW (FAILS GIVING HIGH READING)	2.28E-05/HR			13
TRANSDUCERS, FLOW (FAILS GIVING LOW READING)	1.14E-05/HR			13
TRANSDUCERS, LIGHT	4.7 E-06/HR	6.66E-06	2.70E-06	12
TRANSDUCERS, LIGHT, PHOTOELECTRIC	1.5 E-05/HR			15
TRANSDUCERS, LIQUID LEVEL	2.6 E-06/HR	3.73E-06	1.47E-06	12
TRANSDUCERS, MILLIVOLT-CURRENT	9.69E-04/HR			C1
TRANSDUCERS, MOTIONAL	3.92E-06/HR			20
TRANSDUCERS, POWER	1.68E-06/HR	6.98E-06	6.9 E-07	08
TRANSDUCERS, PRESSURE	3.5 E-05/HR	5.22E-05	2.32E-05	12
TRANSDUCERS, PRESSURE	1.5 E-05/HR			15
TRANSDUCERS, PRESSURE	6.76E-06/HR			20
TRANSDUCERS, RADIOACTIVITY, BETA	1.4 E-05/HR	2.13E-05	6.7 E-06	12
TRANSDUCERS, SPEED	8.7 E-07/HR	1.73E-06	1.55E-07	08
TRANSDUCERS, STRAIN GAGE	1.20E-05/HR	2.0 E-05	7.0 E-06	12
TRANSDUCERS, STRAIN GAGE	2.5 E-05/HR			15
TRANSDUCERS, TEMPERATURE	1.0 E-04/HR			C1
TRANSDUCERS, TEMPERATURE	3.3 E-06/HR	6.4 E-06	1.5 E-06	12
TRANSDUCERS, TEMPERATURE	2.41E-06/HR			20
TRANSDUCERS, THERMISTORS	1.5 E-05/HR	2.8 E-05	1.0 E-05	12
TRANSDUCERS, THERMOCOUPLES	1.0 E-05/HR			15
TRANSFORMERS (ELECTRICAL), LESS THAN 15KV	6.0 E-07/HR			03
TRANSFORMERS (ELECTRICAL), 132KV TO 400KV	7.0 E-06/HR			03
TRANSFORMERS (ELECTRICAL), 15KV TO 33 KV	2.0 E-06/HR			03
TRANSFORMERS (ELECTRICAL), 33KV TO 132KV	4.0 E-06/HR			03
TRANSFORMERS (ELECTRONIC), A.F.	3.0 E-07/HR			C3
TRANSFORMERS (ELECTRONIC), CLASS A, R INSULATION	3.4 E-07/HR			04
TRANSFORMERS (ELECTRONIC), CLASS B, S INSULATION	2.0 E-07/HR			C4
TRANSFORMERS (ELECTRONIC), CLASS C, Q INSULATION	7.0 E-07/HR			C4
TRANSFORMERS (ELECTRONIC), CONTROL AND LOW VOLTAGE	3.0 E-07/HR			03
TRANSFORMERS (ELECTRONIC), EACH WINDING, GENERAL	3.0 E-07/HR			C3
TRANSFORMERS (ELECTRONIC), HIGH VOLTAGE	9.0 E-06/HR			C3
TRANSFORMERS (ELECTRONIC), I.F.	1.0 E-06/HR			C3
TRANSFORMERS (ELECTRONIC), MAINS, ENCAPSULATED	5.0 E-06/HR			C3
TRANSFORMERS (ELECTRONIC), MAINS, OIL FILLED	1.0 E-06/HR			C3
TRANSFORMERS (ELECTRONIC), PULSE	1.5 E-06/HR			C3
TRANSFORMERS (ELECTRONIC), VARIABLE	1.0 E-06/HR			03
TRANSFORMERS, AIR COOLED, NATURAL CIRCULATION 0-255 VAC	8.0 E-08/HR			14
TRANSFORMERS, AUTO	1.51E-06/HR	6.0 E-06	2.0 E-07	C8
TRANSFORMERS, AUTO LIQ. 1 PHASE	1.12E-06/HR	2.67E-06	2.0 E-07	C8
TRANSFORMERS, AUTO LIQ. 1 PHASE OVER 550KV	1.38E-06/HR	2.58E-06	6.98E-07	C8
TRANSFORMERS, AUTO LIQ. 1 PHASE 146-242KV	9.06E-07/HR	1.56E-06	3.25E-07	C8
TRANSFORMERS, AUTO LIQ. 1 PHASE 2-30KV	7.07E-07/HR	1.2 E-06	3.87E-07	C8

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
TRANSFORMERS,AUTO LIQ. 1 PHASE 243-346KV	1.3 E-C6/HR	2.84E-06	6.08E-C7	C8
TRANSFORMERS,AUTO LIQ. 1 PHASE 31-72KV	7.83E-07/HR	1.33E-06	3.11E-C7	C8
TRANSFORMERS,AUTO LIQ. 1 PHASE 347-550KV	5.41E-C7/HR	8.34E-C7	2.42E-C7	C8
TRANSFORMERS,AUTO LIQ. 1 PHASE 73-145KV	8.43E-C7/HR	1.41E-06	2.9 E-C7	C8
TRANSFORMERS,AUTO LIQ. 3 PHASE	2.02E-C6/HR	6.3 E-06	4.95E-C7	C8
TRANSFORMERS,AUTO LIQ. 3 PHASE CVER 550KV	2.67E-C6/HR	3.9 E-06	1.26E-C6	C8
TRANSFORMERS,AUTO LIQ. 3 PHASE 146-242KV	2.42E-C6/HR	3.15E-06	1.19E-C6	C8
TRANSFORMERS,AUTO LIQ. 3 PHASE 2-30	1.47E-06/HR	2.08E-06	4.95E-C7	C8
TRANSFORMERS,AUTO LIQ. 3 PHASE 243-346KV	1.98E-C6/HR	2.65E-06	1.1 E-C6	C8
TRANSFORMERS,AUTO LIQ. 3 PHASE 31-72KV	1.83E-06/HR	2.54E-06	8.70E-C7	C8
TRANSFORMERS,AUTO LIQ. 3 PHASE 347-550KV	2.45E-C6/HR	3.64E-C6	1.17E-C6	C8
TRANSFORMERS,AUTO LIQ. 3 PHASE 73-145KV	1.95E-06/HR	2.84E-06	6.13E-C7	C8
TRANSFORMERS,INSTRUMENT	4.91E-07/HR	1.0 E-05	7.2 E-C8	C8
TRANSFORMERS,INSTRUMENT,CURRENT	4.5 E-C7/HR	1.0 E-05	1.0 E-C7	C8
TRANSFORMERS,INSTRUMENT,CURRENT CVER 10KV	4.86E-07/HR	1.06E-06	1.72E-C7	C8
TRANSFORMERS,INSTRUMENT,CURRENT 0-10KV	3.02E-C7/HR	5.62E-07	1.43E-C7	C8
TRANSFORMERS,INSTRUMENT,PCTENTIAL	5.36E-C7/HR	5.0 E-06	7.2 E-C8	C8
TRANSFORMERS,INSTRUMENT,PCTENTIAL CVER 10KV	8.68E-07/HR	1.32E-06	4.75E-C7	C8
TRANSFORMERS,INSTRUMENT,PCTENTIAL 0-10KV	4.59E-C7/HR	1.02E-C6	3.5 E-C7	C8
TRANSFORMERS,MAIN POWER GENERATOR,LIQ.-3 PHASE 347-550KV	1.35E-C6/HR	2.62E-06	7.84E-07	C8
TRANSFORMERS,MAIN POWER-GENERATOR	7.05E-07/HR	5.0 E-06	5.0 E-C8	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-1 PHASE	6.03E-C7/HR	5.0 E-C6	1.18E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-1 PHASE 146-242KV	5.64E-07/HR	1.07E-06	4.28E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-1 PHASE 2-30KV	3.25E-07/HR	5.73E-07	1.36E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-1 PHASE 243-346KV	3.26E-C7/HR	8.54E-07	1.21E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-1 PHASE 31-72KV	3.93E-07/HR	7.07E-07	2.02E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-1 PHASE 73-145KV	2.85E-C7/HR	6.38E-C7	1.18E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-1 PHASE,CVER 550KV	1.18E-06/HR	1.87E-06	6.13E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-1 PHASE,347-550KV	1.62E-06/HR	2.67E-06	7.43E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-3 PHASE	8.24E-07/HR	3.0 E-C6	5.0 E-C8	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-3 PHASE CVER 550KV	1.45E-06/HR	2.80E-06	6.58E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-3 PHASE 146-242KV	1.46E-06/HR	2.05E-06	6.85E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-3 PHASE 2-30KV	5.42E-07/HR	8.0 E-07	2.83E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-3 PHASE 243-346KV	2.83E-07/HR	5.17E-07	1.52E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-3 PHASE 31-72KV	7.84E-C7/HR	1.09E-C6	4.1 E-C7	C8
TRANSFORMERS,MAIN POWER-GENERATOR,LIQ.-3 PHASE 73-145KV	3.05E-C7/HR	5.48E-07	1.17E-C7	C8
TRANSFORMERS,COPEN CIRCUIT	1.0 E-C6/HR	3.0 E-C6	3.0 E-C7	C6
TRANSFORMERS,POWER	1.04E-C6/HR	2.08E-06	4.6 E-C7	12
TRANSFORMERS,POWER,HIGH VOLTAGE	9.4 E-C7/HR	1.88E-06	4.07E-C7	12
TRANSFORMERS,POWER,LOW VOLTAGE	3.0 E-C7/HR	6.0 E-07	1.3 E-C7	12
TRANSFORMERS,PULSE,LOW VOLTAGE	1.5 E-C7/HR	2.35E-07	6.5 E-C8	12
TRANSFORMERS,RECTIFIER(GREATER THAN 600V)	1.97E-06/HR	5.7 E-06	5.0 E-C7	C8
TRANSFORMERS,RECTIFIER(GREATER THAN 600V) EXCITATION	2.03E-C6/HR	5.7 E-C6	5.0 E-C7	C8

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
TRANSFORMERS, RECTIFIER (GREATER THAN 6CCV) PRECIPITATOR	1.92E-06/HR	5.7 E-06	5.0 E-C7	C8
TRANSFORMERS, SHORT CIRCUIT	1.0 E-C6/HR	3.0 E-C6	3.0 E-C7	C6
TRANSFORMERS, STATION SERVICE	5.43E-07/HR	4.23E-C6	5.0 E-C8	C8
TRANSFORMERS, STATION SERVICE-DRY, 1 PHASE	6.24E-C7/HR	3.12E-06	1.16E-C7	C8
TRANSFORMERS, STATION SERVICE-DRY, 1 PHASE, 0-60CV	2.37E-C7/HR	7.78E-C7	1.16E-C7	C8
TRANSFORMERS, STATION SERVICE-DRY, 1 PHASE, 15KV-40KV	1.20E-06/HR	3.12E-06	3.3 E-C7	C8
TRANSFORMERS, STATION SERVICE-DRY, 1 PHASE, 601V-15KV	4.80E-C7/HR	1.02E-06	1.96E-C7	C8
TRANSFORMERS, STATION SERVICE-DRY, 3 PHASE	5.96E-C7/HR	1.84E-06	1.52E-C7	C8
TRANSFORMERS, STATION SERVICE-DRY, 3 PHASE, C-6CCV	3.2 E-07/HR	9.91E-07	1.52E-C7	C8
TRANSFORMERS, STATION SERVICE-DRY, 3 PHASE, 15KV-40KV	1.44E-C6/HR	1.84E-06	5.33E-C7	C8
TRANSFORMERS, STATION SERVICE-DRY, 3 PHASE, 601V-15KV	4.67E-07/HR	1.14E-06	2.02E-C7	C8
TRANSFORMERS, STATION SERVICE-LIQ., 1 PHASE	3.96E-C7/HR	1.41E-06	5.0 E-C8	C8
TRANSFORMERS, STATION SERVICE-LIQ., 1 PHASE, C-6CCV	2.43E-C7/HR	7.73E-C7	1.2 E-C7	C8
TRANSFORMERS, STATION SERVICE-LIQ., 1 PHASE, 15KV-40KV	6.63E-C7/HR	1.41E-06	2.57E-C7	C8
TRANSFORMERS, STATION SERVICE-LIQ., 1 PHASE, 601V-15KV	2.44E-C7/HR	5.72E-07	9.9 E-C8	C8
TRANSFORMERS, STATION SERVICE-LIQ., 3 PHASE	5.91E-C7/HR	4.23E-C6	5.0 E-C8	C8
TRANSFORMERS, STATION SERVICE-LIQ., 3 PHASE, C-6CCV	2.28E-07/HR	4.48E-C7	7.13E-C8	C8
TRANSFORMERS, STATION SERVICE-LIQ., 3 PHASE, 15KV-40KV	5.0 E-07/HR	1.14E-C6	1.25E-C7	C8
TRANSFORMERS, STATION SERVICE-LIQ., 3 PHASE, 601V-15KV	1.65E-07/HR	3.97E-C7	7.83E-C8	C8
TRANSFORMERS, SUBSTATION	8.95E-07/HR	5.0 E-06	7.8 E-C8	C8
TRANSFORMERS, SUBSTATION LIQ. 1 PHASE	7.12E-C7/HR	5.0 E-06	7.8 E-C8	C8
TRANSFORMERS, SUBSTATION LIQ. 1 PHASE CVER 550KV	1.56E-C6/HR	2.91E-06	6.43E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 1 PHASE 146-242KV	2.32E-C6/HR	3.68E-06	1.24E-C6	C8
TRANSFORMERS, SUBSTATION LIQ. 1 PHASE 2-30KV	5.08E-C7/HR	8.78E-07	2.41E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 1 PHASE 243-346KV	8.86E-07/HR	1.39E-06	1.31E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 1 PHASE 31-72KV	5.44E-C7/HR	9.56E-07	3.0 E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 1 PHASE 347-550KV	9.27E-C7/HR	1.43E-06	1.37E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 1 PHASE 73-145KV	6.32E-C7/HR	1.13E-06	3.14E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 3 PHASE	1.12E-06/HR	4.23E-C6	3.0 E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 3 PHASE CVER 550KV	2.08E-C6/HR	3.32E-06	6.98E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 3 PHASE 146-242KV	2.24E-06/HR	3.26E-06	9.27E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 3 PHASE 2-30KV	6.34E-C7/HR	9.9 E-07	3.9 E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 3 PHASE 243-346KV	1.44E-06/HR	2.44E-06	6.85E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 3 PHASE 31-72KV	8.78E-C7/HR	1.3 E-06	5.17E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 3 PHASE 347-550KV	1.89E-C6/HR	3.03E-06	8.72E-C7	C8
TRANSFORMERS, SUBSTATION LIQ. 3 PHASE 73-145KV	1.23E-06/HR	1.68E-06	6.13E-C7	C8
TRANSFORMERS, TRANSMISSION TIE	8.26E-C7/HR	4.0 E-C6	5.0 E-C8	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-1 PHASE	6.16E-C7/HR	2.67E-06	5.0 E-C8	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-1 PHASE CVER 550KV	1.15E-C6/HR	2.19E-06	4.45E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-1 PHASE 146-242KV	6.68E-C7/HR	1.28E-06	2.78E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-1 PHASE 2-30KV	1.73E-07/HR	6.32E-07	8.9 E-C8	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-1 PHASE 243-346KV	5.25E-C7/HR	1.10E-06	2.47E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-1 PHASE 31-72KV	4.58E-C7/HR	1.0 E-06	1.73E-C7	C8

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
TRANSFORMERS, TRANSMISSION TIE LIQ.-1 PHASE 347-55KV	3.3 E-C7/HR	6.46E-07	7.5 E-C8	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-1 PHASE 73-145KV	6.21E-C7/HR	1.19E-06	2.36E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-3 PHASE	1.11E-06/HR	4.0 E-06	2.0 E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-3 PHASE CVER 550KV	1.92E-C6/HR	2.83E-C6	7.71E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-3 PHASE 146-242KV	1.32E-06/HR	1.84E-06	5.43E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-3 PHASE 2-30KV	4.9 E-07/HR	8.94E-07	2.0 E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-3 PHASE 243-346KV	1.28E-06/HR	1.94E-06	5.72E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-3 PHASE 31-72KV	7.48E-C7/HR	1.2 E-06	3.46E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-3 PHASE 347-550KV	1.57E-06/HR	2.18E-06	5.05E-C7	C8
TRANSFORMERS, TRANSMISSION TIE LIQ.-3 PHASE 73-145KV	1.03E-C6/HR	1.42E-06	4.57E-C7	C8
TRANSFORMERS, VARIABLE	1.0 E-07/HR	3.1 E-07	3.5 E-C8	12
TRANSFORMERS, VARIABLE, A.F.	2.0 E-C8/HR	4.0 E-08	1.0 E-C8	12
TRANSFORMERS, VARIABLE, I.F.	1.0 E-C7/HR	3.1 E-07	3.5 E-C8	12
TRANSISTORS, GERMANIUM, HIGH POWER	1.0 E-06/HR			03
TRANSISTORS, GERMANIUM, LOW POWER	1.0 E-C7/HR			03
TRANSISTORS, SILICON, HIGH POWER	5.0 E-C7/HR			03
TRANSISTORS, SILICON, LOW POWER	5.0 E-C8/HR			03
TRANSISTORS, SILICON, NPN	3.1 E-07/HR			04
TRANSMITTERS, BELLGWS	5.95E-06/HR			14
TRANSMITTERS, BOURDON TUBE	1.32E-06/HR			14
TRANSMITTERS, CONDUCTANCE	6.06E-C6/HR			14
TRANSMITTERS, D'ARSONVAL GALVANOMETER(MV)	6.76E-06/HR			14
TRANSMITTERS, DIAPHRAM	2.24E-C6/HR			14
TRANSMITTERS, DIFFERENTIAL PRESSURE, PNEUMATIC	8.7 E-C5/HR			C1
TRANSMITTERS, FLOW	5.95E-C6/HR	1.13E-05	2.55E-C6	08
TRANSMITTERS, FLOW TRANSMITTER, FAILS GIVING HIGH READING	4.5 E-05/HR			13
TRANSMITTERS, FLOW TRANSMITTER, FAILS GIVING LOW READING	5.7 E-05/HR			13
TRANSMITTERS, LEVEL	5.13E-C6/HR	1.09E-05	2.8 E-C6	C8
TRANSMITTERS, MANOMETER	3.62E-C6/HR			14
TRANSMITTERS, ORIFICE	3.39E-C6/HR			14
TRANSMITTERS, OTHER	1.47E-C6/HR			14
TRANSMITTERS, PIEZOELECTRIC	1.49E-C5/HR			14
TRANSMITTERS, POSITIVE DISPLACEMENT	1.31E-C6/HR			14
TRANSMITTERS, POTENTIOMETRIC	1.81E-C5/HR			14
TRANSMITTERS, PRESSURE	3.01E-C6/HR	5.74E-06	6.8 E-C7	C8
TRANSMITTERS, RESISTANCE CHANGE	1.19E-06/HR			14
TRANSMITTERS, STRAIN GAGE/RESISTANCE	4.24E-C6/HR			14
TRANSMITTERS, TEMPERATURE	8.9 E-07/HR	7.68E-06	4.26E-C7	C8
TRANSMITTERS, UNDEFINED	1.56E-C6/HR			14
TRANSMITTERS, VARIABLE AREA FLOWMETER, PNEUMATIC	7.8 E-C5/HR			C1
TUBES, ELECTRONIC, DIODES	1.2 E-05/HR			03
TUBES, ELECTRONIC, DOUBLE DIODES	1.6 E-05/HR			03
TUBES, ELECTRONIC, DOUBLE TRIODES	2.8 E-05/HR			03

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
TUBES, ELECTRONIC, EACH ADJACENT ELECTRODE PAIR, S/C FALLT	1.0 E-06/HR			03
TUBES, ELECTRONIC, EACH ELECTRODE, O/C FALLT	1.0 E-06/HR			03
TUBES, ELECTRONIC, LOSS OF EMISSION, DIODES	5.0 E-06/HR			03
TUBES, ELECTRONIC, OTHERS	1.0 E-05/HR			03
TUBES, ELECTRONIC, PENTODES	2.3 E-05/HR			03
TUBES, ELECTRONIC, RECTIFIERS	2.0 E-05/HR			03
TUBES, ELECTRONIC, STABILIZERS, DIODE	1.3 E-05/HR			03
TUBES, ELECTRONIC, STABILIZERS, TRIODE	1.6 E-05/HR			03
TUBES, ELECTRONIC, TETRODES	2.1 E-05/HR			03
TUBES, ELECTRONIC, THERMAL RELAY, CONTINUOUS	1.5 E-05/HR			02
TUBES, ELECTRONIC, THERMAL RELAY, INTERMITTENT	2.0 E-06/HR			03
TUBES, ELECTRONIC, THYRATRONS	5.0 E-05/HR			03
TUBES, ELECTRONIC, TRIODES	1.9 E-05/HR			03
VALVE ACTUATORS, DIAPHRAGM (SPRING OPPOSED)	3.1 E-07/HR	2.5 E-06	7.0 E-08	08
VALVE ACTUATORS, DIAPHRAGM (SPRING OPPOSED)	1.37E-06/CY	4.93E-06	2.8 E-07	08
VALVE ACTUATORS, DIAPHRAGM, OPEN CLOSED SERVICE	3.6 E-07/HR	1.78E-06	1.0 E-07	08
VALVE ACTUATORS, DIAPHRAGM, OPEN CLOSED SERVICE	1.19E-06/CY	3.76E-06	2.8 E-07	08
VALVE ACTUATORS, DIAPHRAGM, THROTTLING SERVICE	2.7 E-07/HR	1.59E-06	7.0 E-08	08
VALVE ACTUATORS, DIAPHRAGM, THROTTLING SERVICE	1.58E-06/CY	4.93E-06	3.2 E-07	08
VALVE ACTUATORS, DOUBLE ACTING PISTONS	1.72E-06/HR	1.28E-05	3.4 E-07	08
VALVE ACTUATORS, DOUBLE ACTING PISTONS	5.23E-06/CY	4.83E-05	6.3 E-07	08
VALVE ACTUATORS, DOUBLE ACTING PISTONS, OPEN CLOSED SERVICE	1.09E-06/HR	5.44E-06	3.4 E-07	08
VALVE ACTUATORS, DOUBLE ACTING PISTONS, OPEN CLOSED SERVICE	2.92E-06/CY	1.71E-05	6.3 E-07	08
VALVE ACTUATORS, DOUBLE ACTING PISTONS, THROTTLING SERVICE	2.71E-06/HR	2.75E-05	7.2 E-07	08
VALVE ACTUATORS, DOUBLE ACTING PISTONS, THROTTLING SERVICE	9.36E-06/CY	4.83E-05	2.97E-06	08
VALVE ACTUATORS, INSTRUMENTS	2.8 E-07/HR	3.87E-06	3.0 E-08	08
VALVE ACTUATORS, INSTRUMENTS	1.73E-06/CY	1.58E-05	1.0 E-07	08
VALVE ACTUATORS, INSTRUMENTS, COMBINED TRANSDUCER POSITIONER	2.8 E-07/HR	3.87E-06	3.0 E-08	08
VALVE ACTUATORS, INSTRUMENTS, COMBINED TRANSDUCER POSITIONER	1.73E-06/CY	1.58E-05	1.0 E-07	08
VALVE ACTUATORS, INSTRUMENTS, ELECTRO-PNEUMATIC TRANSDUCERS	2.8 E-07/HR	3.87E-06	3.0 E-08	08
VALVE ACTUATORS, INSTRUMENTS, ELECTRO-PNEUMATIC TRANSDUCERS	1.73E-06/CY	1.58E-05	1.0 E-07	08
VALVE ACTUATORS, INSTRUMENTS, PNEUMATIC POSITIONER	2.8 E-07/HR	3.87E-06	3.0 E-08	08
VALVE ACTUATORS, INSTRUMENTS, PNEUMATIC POSITIONER	1.73E-06/CY	1.58E-05	1.0 E-07	08
VALVE ACTUATORS, PNEUMATIC	6.5 E-07/HR	7.07E-06	3.0 E-08	08
VALVE ACTUATORS, PNEUMATIC	2.79E-06/CY	6.32E-05	1.0 E-07	08
VALVE ACTUATORS, SINGLE ACTING PISTON, OPEN CLOSED SERVICE	7.5 E-07/HR	2.3 E-06	2.5 E-07	08
VALVE ACTUATORS, SINGLE ACTING PISTON, OPEN CLOSED SERVICE	4.16E-06/CY	2.24E-05	7.1 E-07	08
VALVE ACTUATORS, SINGLE ACTING PISTON, THROTTLING SERVICE	2.0 E-06/HR	7.07E-06	4.5 E-07	08
VALVE ACTUATORS, SINGLE ACTING PISTON, THROTTLING SERVICE	7.07E-06/CY	6.32E-05	1.41E-06	08
VALVE ACTUATORS, SINGLE ACTING (SPRING OPPOSED) PISTON	1.23E-06/HR	7.07E-06	2.5 E-07	08
VALVE ACTUATORS, SINGLE ACTING (SPRING OPPOSED) PISTON	5.42E-06/CY	6.32E-05	7.1 E-07	08
VALVE OPERATORS	6.6 E-07/HR	2.24E-06	1.0 E-07	08
VALVE OPERATORS, DIRECT ACTING SCLENOID	7.0 E-07/HR	1.2 E-06	1.4 E-07	08

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
VALVE OPERATORS, DIRECT ACTING SLENOID	1.55E-05/CY	2.71E-05	7.0 E-C7	08
VALVE OPERATORS, ELECTRIC MOTOR-AC DIRECT ACTING	5.10E-06/HR			14
VALVE OPERATORS, ELECTRIC MOTOR-AC DOUBLE ACTING	3.06E-06/HR			14
VALVE OPERATORS, ELECTRIC MOTOR-AC GEARED	1.57E-05/HR			14
VALVE OPERATORS, ELECTRIC MOTOR-AC REVERSE ACTING	1.01E-06/HR			14
VALVE OPERATORS, ELECTRIC MOTOR-DC GEARED	3.11E-05/HR			14
VALVE OPERATORS, HYDRAULIC, DIRECT ACTING	3.70E-05/HR			14
VALVE OPERATORS, HYDRAULIC, GEARED	1.58E-05/HR			14
VALVE OPERATORS, HYDRAULIC, PILCT ACTIVATED	4.04E-06/HR			14
VALVE OPERATORS, LATCH CLOSED SLENOID	4.0 E-C7/HR	1.27E-06	1.4 E-C7	08
VALVE OPERATORS, LATCH CLOSED SLENOID	3.46E-06/CY	1.41E-05	7.1 E-C7	08
VALVE OPERATORS, LATCH OPEN SLENOID	4.0 E-C7/HR	1.27E-06	1.40E-C7	08
VALVE OPERATORS, LATCH OPEN SLENOID	3.46E-06/CY	1.41E-05	7.1 E-C7	08
VALVE OPERATORS, MECH., DIRECT ACTING	2.35E-05/HR			14
VALVE OPERATORS, MOTOR DRIVEN	6.2 E-07/HR	2.24E-06	1.0 E-C7	08
VALVE OPERATORS, MOTOR DRIVEN	1.0 E-C5/CY	5.0 E-05	5.0 E-C6	08
VALVE OPERATORS, NORMALLY CLOSED SOLENOID	1.32E-06/HR	3.84E-06	4.5 E-C7	08
VALVE OPERATORS, NORMALLY CLOSED SOLENOID	4.64E-06/CY	1.71E-05	1.26E-06	08
VALVE OPERATORS, NORMALLY OPEN SOLENOID	1.04E-06/HR	3.04E-06	3.7 E-C7	08
VALVE OPERATORS, NORMALLY OPEN SOLENOID	3.68E-06/CY	1.36E-05	9.3 E-C7	08
VALVE OPERATORS, PNEUMATIC/DIAPHRAGM/CYLINDER, DIRECT ACTING	6.10E-06/HR			14
VALVE OPERATORS, PNEUMATIC/DIAPHRAGM/CYLINDER, DOUBLE ACTING	1.10E-06/HR			14
VALVE OPERATORS, PNEUMATIC/DIAPHRAGM/CYLINDER, PILCT ACTIVATED	5.54E-06/HR			14
VALVE OPERATORS, PNEUMATIC/DIAPHRAGM/CYLINDER, PROPORTIONAL	7.42E-06/HR			14
VALVE OPERATORS, PNEUMATIC/DIAPHRAGM/CYLINDER, REVERSE ACTING	7.08E-06/HR			14
VALVE OPERATORS, PNEUMATIC/DIAPHRAGM/CYLINDER, UNDEFINED	1.26E-04/HR			14
VALVE OPERATORS, SLENOID-AC DOUBLE ACTING	2.21E-06/HR			14
VALVE OPERATORS, SLENOID-AC PILCT ACTIVATED	5.0 E-08/HR			14
VALVE OPERATORS, SLENOID-DC DIRECT ACTING	8.26E-06/HR			14
VALVE OPERATORS, SLENOID-DC UNDEFINED	6.59E-06/HR			14
VALVE, AIR-FLUID OPERATED, FAILS TO OPERATE	3.0 E-04/DM	1.0 E-03	1.0 E-C4	06
VALVE, AIR-FLUID OPERATED, FAILS TO REMAIN OPEN	1.0 E-04/DM	3.0 E-C4	3.0 E-C5	06
VALVE, AIR-FLUID OPERATED, LEAK OR RUPTURE	1.0 E-C8/HR	1.0 E-07	1.0 E-C9	06
VALVE, AIR-FLUID OPERATED, PLUGGED	1.0 E-04/DM	3.0 E-04	3.0 E-C5	06
VALVE, ANGLE, ELECTRIC MOTOR/SERVO, 4 TO 11.99 IN.	9.95E-06/HR			14
VALVE, ANGLE, MECH., 1/2 TO 1.99 IN.	4.18E-06/HR			14
VALVE, ANGLE, MECH., 2 TO 3.99 IN.	2.96E-05/HR			14
VALVE, ANGLE, MECH., 4 TO 11.99 IN.	6.34E-06/HR			14
VALVE, BALL	6.47E-07/HR			20
VALVE, BALL	4.6 E-C6/HR	7.7 E-06	1.11E-C6	12
VALVE, BALL, ELECTRIC MOTOR/SERVO, 2 TO 3.99 IN.	2.32E-06/HR			14
VALVE, BALL, ELECTRIC MOTOR/SERVO, 4 TO 11.99 IN.	2.0 E-05/HR			14
VALVE, BALL, MANUAL 2 TO 3.99 IN.	2.57E-06/HR			14

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
VALVE,BALL,MECH.1/2 TO 1.99 IN.	1.77E-C6/HR			14
VALVE,BALL,PNEUMATIC/DIAPHRAGM/CYLINDER 4 TO 11.99 IN.	6.4 E-C6/HR			14
VALVE,BUTTERFLY	1.32E-C6/HR			20
VALVE,BUTTERFLY	3.4 E-C6/HR	5.33E-06	1.33E-C6	12
VALVE,BUTTERFLY,ELECTRIC MOTOR/SERVO 12 TO 19.99 IN.	6.2 E-C7/HR			14
VALVE,BUTTERFLY,ELECTRIC MOTOR/SERVO 20 TO 39.99 IN.	7.25E-06/HR			14
VALVE,BUTTERFLY,ELECTRIC MOTOR/SERVO 4 TO 11.99 IN.	2.67E-C6/HR			14
VALVE,BUTTERFLY,ELECTRIC MOTOR/SERVO 40 TO 59.99 IN.	8.47E-C6/HR			14
VALVE,BUTTERFLY,MANUAL 12 TO 19.99 IN.	1.67E-06/HR			14
VALVE,BUTTERFLY,MANUAL 20 TO 39.99 IN.	2.99E-C6/HR			14
VALVE,BUTTERFLY,MANUAL 4 TO 11.99 IN.	4.3 E-C7/HR			14
VALVE,BUTTERFLY,PNEUMATIC/DIAPHRAGM/CYLINDER 12 TO 19.99 IN.	5.04E-C6/HR			14
VALVE,BUTTERFLY,PNEUMATIC/DIAPHRAGM/CYLINDER 2 TO 3.99 IN.	4.05E-C6/HR			14
VALVE,BUTTERFLY,PNEUMATIC/DIAPHRAGM/CYLINDER 20 TO 39.99 IN.	1.06E-05/HR			14
VALVE,BUTTERFLY,PNEUMATIC/DIAPHRAGM/CYLINDER 4 TO 11.99 IN.	1.57E-06/HR			14
VALVE,BUTTERFLY,PNEUMATIC/DIAPHRAGM/CYLINDER 40 TO 59.99 IN.	3.51E-C6/HR			14
VALVE,CHECK	5.0 E-06/HR	8.10E-06	2.02E-C6	12
VALVE,CHECK	3.18E-06/HR			20
VALVE,CHECK, 4 TO 11.99 IN.	2.21E-06/HR			14
VALVE,CHECK,ELECTRIC MOTOR/SERVO 12 TO 19.99 IN.	5.88E-05/HR			14
VALVE,CHECK,FAILS TO OPEN	1.0 E-04/DM	3.0 E-C4	3.0 E-C5	C6
VALVE,CHECK,LEAK-RUPTURE	1.0 E-08/HR	1.0 E-07	1.0 E-C5	C6
VALVE,CHECK,MANUAL 12 TO 19.99	6.4 E-07/HR			14
VALVE,CHECK,MANUAL 2 TO 3.99	5.8 E-C7/HR			14
VALVE,CHECK,MANUAL 4 TO 11.99	1.37E-06/HR			14
VALVE,CHECK,MECH. 12 TO 19.99 IN.	1.21E-05/HR			14
VALVE,CHECK,MECH. 2 TO 3.99 IN.	1.31E-06/HR			14
VALVE,CHECK,MECH. 20 TO 39.99 IN.	1.08E-05/HR			14
VALVE,CHECK,MECH. 4 TO 11.99 IN.	2.34E-C6/HR			14
VALVE,CHECK,MECH.1/2 TO 1.99 IN.	1.23E-06/HR			14
VALVE,CHECK,OTHER,1/2 TO 1.99 IN.	4.68E-C6/HR			14
VALVE,CHECK,OTHER,12 TO 19.99 IN.	1.54E-05/HR			14
VALVE,CHECK,OTHER,2 TO 3.99 IN.	1.81E-C6/HR			14
VALVE,CHECK,OTHER,4 TO 11.99 IN.	1.27E-C6/HR			14
VALVE,CHECK,PNEUMATIC/DIAPHRAGM/CYLINDER 12 TO 19.99 IN.	1.04E-05/HR			14
VALVE,CHECK,PNEUMATIC/DIAPHRAGM/CYLINDER 20 TO 39.99 IN.	9.57E-C6/HR			14
VALVE,CHECK,PNEUMATIC/DIAPHRAGM/CYLINDER 4 TO 11.99 IN.	7.6 E-06/HR			14
VALVE,CHECK,REVERSE LEAK	3.0 E-C7/HR	1.0 E-06	1.0 E-C7	C6
VALVE,CHECK,1/2 TO 1.99 IN.	4.25E-06/HR			14
VALVE,CHECK,12 TO 19.99 IN.	3.62E-06/HR			14
VALVE,CHECK,2 TO 3.99 IN.	2.42E-06/HR			14
VALVE,CONTROL	8.5 E-C6/HR	1.98E-05	1.68E-C6	12
VALVE,CONTROL,PNEUMATIC	2.8 E-C5/HR			C1

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
VALVE, CONTROL, PNEUMATIC	6.8 E-C5/HR			C1
VALVE, DIAPHRAGM	2.62E-06/HR			20
VALVE, DIAPHRAGM, ELECTRIC MOTOR/SERVO, UNDEFINED	4.39E-06/HR			14
VALVE, DIAPHRAGM, ELECTRIC MOTOR/SERVO, 2 TO 3.99 IN.	8.5CE-C6/HR			14
VALVE, DIAPHRAGM, MANUAL, 4 TO 11.99 IN.	1.07E-C6/HR			14
VALVE, DIAPHRAGM, MANUAL, 1/2 TO 1.99 IN.	2.63E-06/HR			14
VALVE, DIAPHRAGM, MANUAL, 2 TO 3.99 IN.	2.47E-C6/HR			14
VALVE, DIAPHRAGM, PNEUMATIC/DIAPHRAGM/CYLINDER, 1/2 TO 1.99 IN.	7.0 E-C6/HR			14
VALVE, DIAPHRAGM, PNEUMATIC/DIAPHRAGM/CYLINDER, 2 TO 3.99 IN.	8.44E-06/HR			14
VALVE, DIAPHRAGM, PNEUMATIC/DIAPHRAGM/CYLINDER, 4 TO 11.99 IN.	2.10E-C5/HR			14
VALVE, DIAPHRAGM, SOLENOID, 1/2 TO 1.99 IN.	1.28E-05/HR			14
VALVE, DIAPHRAGM, UNDEFINED	5.28E-C6/HR			14
VALVE, FRC VALVE FAILS TOWARD THE CLOSED POSITION	2.28E-05/HR			13
VALVE, FRC VALVE FAILS TOWARD THE OPEN POSITION	1.14E-05/HR			13
VALVE, GATE	1.34E-C6/HR			20
VALVE, GATE, ELECTRIC MOTOR/SERVO, 12 TO 19.99 IN.	3.46E-06/HR			14
VALVE, GATE, ELECTRIC MOTOR/SERVO, 2 TO 3.99 IN.	6.19E-C6/HR			14
VALVE, GATE, ELECTRIC MOTOR/SERVO, 20 TO 39.99 IN.	4.45E-06/HR			14
VALVE, GATE, ELECTRIC MOTOR/SERVO, 4 TO 11.99 IN.	3.45E-06/HR			14
VALVE, GATE, MANUAL, UNDEFINED	6.0 E-C7/HR			14
VALVE, GATE, MANUAL, 1/2 TO 1.99 IN.	6.2 E-C7/HR			14
VALVE, GATE, MANUAL, 12 TO 19.99 IN.	2.54E-06/HR			14
VALVE, GATE, MANUAL, 2 TO 3.99 IN.	8.4 E-C7/HR			14
VALVE, GATE, MANUAL, 4 TO 11.99 IN.	3.7 E-C7/HR			14
VALVE, GATE, PNEUMATIC/DIAPHRAGM/CYLINDER, 1/2 TO 1.99 IN.	1.55E-C6/HR			14
VALVE, GATE, PNEUMATIC/DIAPHRAGM/CYLINDER, 2 TO 3.99 IN.	4.23E-C6/HR			14
VALVE, GATE, PNEUMATIC/DIAPHRAGM/CYLINDER, 20 TO 39.99 IN.	3.04E-05/HR			14
VALVE, GATE, PNEUMATIC/DIAPHRAGM/CYLINDER, 4 TO 11.99 IN.	2.78E-C6/HR			14
VALVE, GATE, SOLENOID, 4 TO 11.99 IN.	3.40E-05/HR			14
VALVE, GLOBE	1.73E-C7/HR			20
VALVE, GLOBE, ELECTRIC MOTOR/SERVO, 1/2 TO 1.99 IN.	5.2CE-C6/HR			14
VALVE, GLOBE, ELECTRIC MOTOR/SERVO, 12 TO 19.99 IN.	6.07E-06/HR			14
VALVE, GLOBE, ELECTRIC MOTOR/SERVO, 2 TO 3.99 IN.	4.1CE-06/HR			14
VALVE, GLOBE, ELECTRIC MOTOR/SERVO, 4 TO 11.99 IN.	6.92E-C6/HR			14
VALVE, GLOBE, HYDRAULIC, 2 TO 3.99 IN.	6.94E-C6/HR			14
VALVE, GLOBE, HYDRAULIC, 20 TO 39.99 IN.	1.05E-C5/HR			14
VALVE, GLOBE, MANUAL, 1/2 TO 1.99 IN.	6.0 E-C7/HR			14
VALVE, GLOBE, MANUAL, 2 TO 3.99 IN.	5.9 E-C7/HR			14
VALVE, GLOBE, MANUAL, 4 TO 11.99 IN.	8.0 E-C7/HR			14
VALVE, GLOBE, MECH., 1/2 TO 1.99 IN.	1.17E-05/HR			14
VALVE, GLOBE, MECH., 12 TO 19.99 IN.	1.38E-C5/HR			14
VALVE, GLOBE, MECH., 2 TO 3.99 IN.	4.01E-C6/HR			14
VALVE, GLOBE, MECH., 4 TO 11.99 IN.	1.03E-05/HR			14

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
VALVE, GLOBE, PNEUMATIC/DIAPHRAGM/CYLINDER, 1/2 TO 1.99 IN.	4.14E-C6/HR			14
VALVE, GLOBE, PNEUMATIC/DIAPHRAGM/CYLINDER, 1/2 TO 1.99 IN.	2.92E-05/HR			14
VALVE, GLOBE, PNEUMATIC/DIAPHRAGM/CYLINDER, 2 TO 3.99 IN.	7.95E-C6/HR			14
VALVE, GLOBE, PNEUMATIC/DIAPHRAGM/CYLINDER, 20 TO 39.99 IN.	4.69E-C6/HR			14
VALVE, GLOBE, PNEUMATIC/DIAPHRAGM/CYLINDER, 4 TO 11.99 IN.	1.46E-05/HR			14
VALVE, GLOBE, SOLENOID, 2 TO 3.99 IN.	2.85E-C6/HR			14
VALVE, GLOBE, SOLENOID, 4 TO 11.99 IN.	4.52E-05/HR			14
VALVE, GLOBE, 2 TO 3.99 IN.	7.65E-C6/HR			14
VALVE, HAND	1.5 E-C5/HR			01
VALVE, MANUAL, FAILS TO REMAIN OPEN (PLUGGED)	1.0 E-04/CM	3.0 E-04	3.0 E-05	06
VALVE, MOTOR OPERATED, FAILS TO OPERATE	1.0 E-03/CM	3.0 E-03	3.0 E-04	06
VALVE, MOTOR OPERATED, FAILS TO REMAIN OPEN	1.0 E-04/CM	3.0 E-04	3.0 E-05	06
VALVE, MOTOR OPERATED, LEAK OR RUPTURE	1.0 E-08/HR	1.0 E-07	1.0 E-09	06
VALVE, MOTOR OPERATED, PLUGGED	3.0 E-05/CM	3.0 E-04	3.0 E-05	06
VALVE, NEEDLE	1.36E-C6/HR			20
VALVE, NEEDLE, ELECTRIC MOTOR/SERVO, 4 TO 11.99 IN.	4.59E-C6/HR			14
VALVE, NEEDLE, HYDRAULIC, 1/2 TO 1.99 IN.	1.26E-05/HR			14
VALVE, NEEDLE, HYDRAULIC, 4 TO 11.99 IN.	1.10E-05/HR			14
VALVE, NEEDLE, MANUAL, LESS THAN 1/2 IN.	6.49E-C6/HR			14
VALVE, NEEDLE, MANUAL, 1/2 TO 1.99 IN.	2.2 E-C7/HR			14
VALVE, NEEDLE, MANUAL, 4 TO 11.99 IN.	1.61E-C6/HR			14
VALVE, OIL	2.41E-C6/HR			20
VALVE, PLUG	3.27E-C6/HR			20
VALVE, PLUG, MECH., 1/2 TO 1.99 IN.	1.67E-C6/HR			14
VALVE, PLUG, MECH., 2 TO 3.99 IN.	2.74E-C5/HR			14
VALVE, PLUG, MECH., 4 TO 11.99 IN.	3.52E-C6/HR			14
VALVE, PLUG, PNEUMATIC/DIAPHRAGM/CYLINDER, 2 TO 3.99 IN.	7.8 E-C7/HR			14
VALVE, PLUG, PNEUMATIC/DIAPHRAGM/CYLINDER, 4 TO 11.99 IN.	1.18E-C5/HR			14
VALVE, PLUG, SOLENOID, LESS THAN 1/2 IN.	3.19E-C6/HR			14
VALVE, PNEUMATIC	6.08E-C7/HR			20
VALVE, POSITIONER	5.0 E-05/HR			01
VALVE, PRESSURE RELIEF	2.5 E-C6/HR			01
VALVE, RELIEF	5.7 E-C6/HR	1.41E-05	3.27E-C6	12
VALVE, RELIEF	1.59E-06/HR			20
VALVE, RELIEF, BLOCKAGE	5.0 E-07/HR			15
VALVE, RELIEF, FAILS TO OPEN	1.0 E-05/CM	3.0 E-05	3.0 E-C6	06
VALVE, RELIEF, LEAKAGE	2.0 E-06/HR			15
VALVE, RELIEF, PREMATURE OPEN	1.0 E-C5/HR	3.0 E-C5	3.0 E-C6	06
VALVE, SELECTOR	1.6 E-05/HR	1.97E-05	3.70E-C6	12
VALVE, SELF OPERATED	1.22E-06/HR	5.48E-06	7.0 E-C6	08
VALVE, SELF OPERATED	2.77E-C6/CM	1.73E-05	5.0 E-C7	08
VALVE, SELF OPERATED, DOWNSTREAM	6.3 E-C7/HR	1.73E-06	7.0 E-C8	08
VALVE, SELF OPERATED, DOWNSTREAM	1.4 E-06/CM	5.48E-C6	5.0 E-C7	08

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
VALVE, SELF OPERATED, EXTERNAL	6.3 E-C7/HR	1.73E-06	7.0 E-C8	C8
VALVE, SELF OPERATED, EXTERNAL	1.40E-06/CY	5.48E-06	5.0 E-C7	C8
VALVE, SELF OPERATED, EXTERNAL FLUID	2.0 E-C6/HR	5.48E-06	7.0 E-C8	C8
VALVE, SELF OPERATED, EXTERNAL FLUID	5.48E-06/CY	1.73E-05	5.0 E-C7	C8
VALVE, SELF OPERATED, FLUID HEAD	6.3 E-C7/HR	1.73E-06	7.0 E-C8	C8
VALVE, SELF OPERATED, FLUID HEAD	1.4 E-C6/CY	5.48E-06	5.0 E-C7	C8
VALVE, SELF OPERATED, GRAVITY	6.3 E-C7/HR	1.73E-06	7.0 E-C8	C8
VALVE, SELF OPERATED, GRAVITY	1.40E-06/CY	5.48E-06	5.0 E-C7	C8
VALVE, SELF OPERATED, PROCESS FLUID	6.3 E-C7/HR	1.73E-06	7.0 E-C8	C8
VALVE, SELF OPERATED, PROCESS FLUID	1.4 E-C6/CY	5.48E-06	5.0 E-C7	C8
VALVE, SELF OPERATED, UPSTREAM	6.3 E-C7/HR	1.73E-06	7.0 E-C8	C8
VALVE, SELF OPERATED, UPSTREAM	1.4 E-C6/CY	5.48E-06	5.0 E-C7	C8
VALVE, SHUTOFF	6.5 E-C6/HR	1.02E-05	1.98E-06	12
VALVE, SOLENOID	3.0 E-C5/HR			01
VALVE, SOLENOID	4.8 E-C5/HR			C1
VALVE, SOLENOID	1.1 E-C5/HR	1.97E-05	2.27E-06	12
VALVE, SOLENOID	1.64E-06/HR			20
VALVE, SOLENOID OPERATED, FAILS TO OPERATE	1.0 E-C3/DM	3.0 E-03	3.0 E-C4	06
VALVE, SOLENOID OPERATED, PLUGGED	1.0 E-C4/DM	3.0 E-04	3.0 E-C5	06
VALVE, TEMPERATURE REGULATOR, FILLED SYSTEM THERMAL, BLUE	2.0 E-C6/HR	5.48E-06	7.0 E-C8	08
VALVE, TEMPERATURE REGULATOR, FILLED SYSTEM, THERMAL, BLUE	5.48E-06/CY	1.73E-05	5.0 E-C7	08
VALVE, TEST, FLOWMETERS, ORIFICES, RUPTURE	1.0 E-C8/HR	1.0 E-08	1.0 E-C9	06
VALVE, VACUUM, FAILS TO OPERATE	3.0 E-C5/DM	1.0 E-04	1.0 E-C5	C6
VALVE, VACUUM, RUPTURES	1.0 E-C8/MP	1.0 E-07	1.0 E-09	C6
VALVE, WATER	1.90E-06/HR			20
VALVE, 3-WAY	4.6 E-C6/HR	7.41E-06	1.87E-C6	12
VALVE, 4-WAY	4.6 E-C6/HR	7.22E-06	1.81E-C6	12
VENTILATORS	2.05E-06/HR	6.78E-06	5.9 E-C7	08
VENTILATORS, POWER, ROOF	3.35E-C6/HR	6.78E-06	2.38E-C6	08
VENTILATORS, PROPELLER FANS	1.24E-C6/HR	5.92E-06	5.9 E-C7	08
VESSELS, PRESSURE	2.37E-C7/HR			20
VESSELS, PRESSURE, GENERAL	3.0 E-C6/HR			15
VESSELS, PRESSURE, HIGH STANDARD	3.0 E-C7/HR			15
VESSELS, STEEL, PRESSURE, CATASTROPHIC FAILURE	8.0 E-C9/HR			11
VESSELS, STEEL, PRESSURE, POTENTIALLY DANGEROUS FAILURE	1.4 E-C7/HR			11
VIBRATORS, ELECTRONIC	5.0 E-C6/HR			03
VIBRATORS, ELECTRONIC	5.0 E-C7/HR	8.0 E-C7	4.0 E-C7	12
WELDS, CONNECTING WELD, 6 INCH TO 10 INCH PIPE	2.8 E-C5/HR			14
WELDS, INTERNAL WELDS, PRIMARY CONTAINMENT PENETRATIONS	1.6 E-C7/HR			14
WELDS, LEAK	3.0 E-C9/HR	1.0 E-C7	1.0 E-10	06
WIRING, CRIMPED AND WELDED JOINTS	5.0 E-C9/HR			C3
WIRING, ELECTRICAL CONDUCTORS, CONTROL CABLE, NEOPRENE	6.6 E-C6/HR			14
WIRING, ELECTRICAL CONDUCTORS, POWER CABLE, ALUMINUM	3.9 E-C6/HR			14

TABLE II, Contd

Component Failure-Rate Data

COMPONENT DESCRIPTION	FAILURE RATE	HIGH VALUE	LOW VALUE	REF.
WIRING, ELECTRICAL CONDUCTORS, POWER CABLE, NEOPRENE	3.02E-05/HR			14
WIRING, OPEN CIRCUIT	3.0 E-06/HR	1.0 E-05	1.0 E-06	06
WIRING, SHORT TO GROUND	3.0 E-07/HR	3.0 E-06	3.0 E-08	06
WIRING, SHORT TO POWER	1.0 E-08/HR	1.0 E-07	1.0 E-09	06
WIRING, SOLDERED JOINTS	4.0 E-09/HR	5.0 E-09	2.0 E-10	12
WIRING, SOLDERED JOINTS, AUTC	1.0 E-09/HR			03
WIRING, SOLDERED JOINTS, HANC	5.0 E-08/HR			03
WIRING, TERMINALS	5.0 E-07/HR			02
WIRING, TERMINALS	5.0 E-08/HR	2.7 E-07	4.1 E-08	12
WIRING, WIRES	1.5 E-08/HR	1.2 E-07	8.0 E-09	12
WIRING, WIRES	1.0 E-07/HR			15
WIRING, WRAPPED JOINTS	1.0 E-10/HR			03

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