

GENERIC REQUIREMENTS  
FOR  
UNINTERRUPTIBLE  
POWER SYSTEMS  
(UPS)

TABLE OF CONTENTS

1. Introduction . . . . .	1-1
1.1 Purpose and Scope . . . . .	1-1
1.2 Organization . . . . .	1-1
1.3 Reason for Reissue From Technical Advisory . . . . .	1-2
1.4 Levels of System Characteristics . . . . .	1-3
2. GENERAL INFORMATION . . . . .	2-1
2.1 General System Description . . . . .	2-1
2.2 Purpose and Scope . . . . .	2-1
2.2.1 Rectifiers/Chargers . . . . .	2-1
2.2.2 Inverters . . . . .	2-1
2.2.3 Switching . . . . .	2-1
2.2.4 Battery . . . . .	2-2
2.2.5 Distribution and Grounding . . . . .	2-2
2.2.6 Status, Alarm, and Control . . . . .	2-2
2.2.7 Data Acquisition . . . . .	2-2
2.2.8 History Reporting . . . . .	2-2
2.2.9 Local and Remote Reporting . . . . .	2-2
2.3 Control, Status, Interfaces, Operating Environment, and History . . . . .	2-2
2.3.1 Control, Status, and History . . . . .	2-2
2.3.2 Interface - Local and Remote . . . . .	2-3
2.3.3 Operating Environment . . . . .	2-3
3. GENERAL REQUIREMENTS . . . . .	3-1
3.1 General Design Requirements . . . . .	3-1
3.1.1 *Fail-Safe Design . . . . .	3-1
3.1.2 Architecture . . . . .	3-1
3.1.2.1 *Modularity . . . . .	3-1
3.1.2.2 *Capacity . . . . .	3-1
3.2 Engineering, Installation, and Maintenance . . . . .	3-1
3.2.1 *Code Compliance . . . . .	3-1
3.2.2 *Fire Resistance . . . . .	3-1
3.2.3 *Environmental Requirements . . . . .	3-1
3.2.4 *Electromagnetic Interference (EMI) . . . . .	3-2
3.2.5 *Ground System . . . . .	3-2
3.2.6 *Electrostatic Discharge (ESD) . . . . .	3-2
3.2.7 *Electrical Isolation . . . . .	3-2
3.2.8 *Frame Current . . . . .	3-2
3.2.9 *Shipping Temperature and Humidity . . . . .	3-3
3.2.10 *Packaging Design Considerations . . . . .	3-3
3.2.11 *Acoustical Noise . . . . .	3-3
3.2.12 *Protection and Hazards . . . . .	3-3
3.2.13 *Toxic Materials . . . . .	3-3

3.2.14	*Marking of Components . . . . .	3-3
3.2.15	*Replacement Parts . . . . .	3-3
3.2.16	*Nameplate . . . . .	3-4
4.	FUNCTIONAL REQUIREMENTS . . . . .	4-1
4.1	General . . . . .	4-1
4.2	Uninterruptible Power System . . . . .	4-1
4.2.1	Definition . . . . .	4-1
4.2.2	Architecture . . . . .	4-1
4.3	Functional Requirements . . . . .	4-1
4.3.1	AC Input . . . . .	4-1
4.3.1.1	General . . . . .	4-1
4.3.1.2	*Frequency . . . . .	4-1
4.3.1.3	*Voltage Limits . . . . .	4-2
4.3.1.4	*Phase . . . . .	4-3
4.3.1.5	*Voltage Unbalance (Three-Phase) . . . . .	4-3
4.3.1.6	*Source Impedance . . . . .	4-3
4.3.1.7	*Total Harmonic Distortion . . . . .	4-3
4.3.1.8	*Displacement Power Factor . . . . .	4-4
4.3.1.9	*Crest Factor . . . . .	4-4
	4.3.1.9.1 Definition . . . . .	4-4
	4.3.1.9.2 *Requirement . . . . .	4-4
4.3.2	AC Input - Equipment . . . . .	4-4
4.3.2.1	General . . . . .	4-4
4.3.2.2	*Voltage Source . . . . .	4-4
4.3.2.3	*Voltage Surges . . . . .	4-4
4.3.2.4	*AC Grounding . . . . .	4-4
4.3.2.5	*Surge Withstand Capability . . . . .	4-4
4.3.2.6	*Frequency . . . . .	4-6
4.3.2.7	*Total Harmonic Distortion . . . . .	4-6
4.3.2.8	*Isolation . . . . .	4-6
4.3.2.9	*AC Voltage Phase Shift . . . . .	4-6
4.3.2.10	*Phase Sequence . . . . .	4-6
4.3.2.11	*Overcurrent Protection . . . . .	4-6
4.3.2.12	*Inrush Current . . . . .	4-6
4.3.2.13	*Current Walk-In . . . . .	4-6
4.3.2.14	*Low AC Voltage Protection . . . . .	4-7
4.3.2.15	*Phase . . . . .	4-7
4.3.2.16	*Phase Failure . . . . .	4-8
	4.3.2.16.1 Definition . . . . .	4-8
	4.3.2.16.2 Requirement . . . . .	4-8
4.3.2.17	*Power Interruption . . . . .	4-8
4.3.2.18	*Telephone Influence Factor (TIF) . . . . .	4-8
4.3.3	DC Voltage Source . . . . .	4-8
4.3.3.1	General . . . . .	4-8
4.3.3.2	*Voltage Regulation Point . . . . .	4-8
4.3.3.3	Battery . . . . .	4-9
	4.3.3.3.1 *Float Voltage . . . . .	4-9
	4.3.3.3.2 *Regulation . . . . .	4-9
	4.3.3.3.3 *Emergency Limits . . . . .	4-9
	4.3.3.3.4 *Reserve Time . . . . .	4-10
	4.3.3.3.5 *Recharge Time . . . . .	4-10
	4.3.3.3.6 *Low Voltage Disconnect . . . . .	4-10

	4.3.3.3.7	*Noise Voltage - Telecommunication Source . . . . .	4-10
	4.3.3.3.8	*Battery Grounding . . . . .	4-11
4.3.3.4		Rectifier/Charger Output . . . . .	4-11
	4.3.3.4.1	General . . . . .	4-11
	4.3.3.4.2	*Technology . . . . .	4-11
	4.3.3.4.3	*Output Voltage . . . . .	4-11
	4.3.3.4.4	*Regulation Limits . . . . .	4-12
	4.3.3.4.5	*Float Voltage Adjustment . . . . .	4-13
	4.3.3.4.6	*Voltage/Temperature Coefficient . . . . .	4-13
	4.3.3.4.7	*Current Walk-In . . . . .	4-13
	4.3.3.4.8	*Current Limit . . . . .	4-13
	4.3.3.4.9	*Warm Up Time . . . . .	4-13
	4.3.3.4.10	*Voltage Drift . . . . .	4-14
	4.3.3.4.11	*Transient Limits . . . . .	4-14
	4.3.3.4.12	*Stability . . . . .	4-14
	4.3.3.4.13	*Dynamic Response . . . . .	4-14
	4.3.3.4.14	*Output Protection and Disconnect . . . . .	4-15
	4.3.3.4.15	*Voice Frequency Output Noise . . . . .	4-15
	4.3.3.4.16	*Ripple and Wideband Output Noise . . . . .	4-15
	4.3.3.4.17	*Discharge of Output Capacitors . . . . .	4-15
4.3.4		AC Load Characteristics . . . . .	4-15
	4.3.4.1	*Displacement Power Factor . . . . .	4-15
	4.3.4.2	*Crest Factor . . . . .	4-15
		4.3.4.2.1 Definition . . . . .	4-15
		4.3.4.2.2 *Requirement . . . . .	4-15
	4.3.4.3	*Total Harmonic Distortion . . . . .	4-16
		4.3.4.3.1 Definition . . . . .	4-16
		4.3.4.3.2 *Requirement . . . . .	4-16
	4.3.4.4	*Telephone Influence Factor (TIF) . . . . .	4-16
4.3.5		AC Output . . . . .	4-16
	4.3.5.1	*Input Voltage For Output Inverter Module . . . . .	4-16
	4.3.5.2	*Phase . . . . .	4-16
	4.3.5.3	*Parallel Operation . . . . .	4-16
	4.3.5.4	*Reverse Current Protection . . . . .	4-16
	4.3.5.5	*Power Rating . . . . .	4-17
	4.3.5.6	*Voltage Limits . . . . .	4-17
	4.3.5.7	Frequency . . . . .	4-17
		4.3.5.7.1 *60 Hertz Systems . . . . .	4-17
		4.3.5.7.2 *415 Hertz Systems . . . . .	4-17
	4.3.5.8	Frequency Synchronization . . . . .	4-17
		4.3.5.8.1 *60 Hertz Systems . . . . .	4-17
		4.3.5.8.2 *415 Hertz Systems . . . . .	4-17
	4.3.5.9	*Slew Rate . . . . .	4-17
	4.3.5.10	*Line-to-Line Voltages (3 $\Phi$ ) . . . . .	4-17
	4.3.5.11	*Voltage Adjustability . . . . .	4-17
	4.3.5.12	*Line Drop Compensation . . . . .	4-18
	4.3.5.13	*Voltage Modulation . . . . .	4-18
	4.3.5.14	*Phase Angle . . . . .	4-18
	4.3.5.15	*Input Protection . . . . .	4-18
	4.3.5.16	*Displacement Power Factor . . . . .	4-18
	4.3.5.17	Total Harmonic Distortion . . . . .	4-18
		4.3.5.17.1 *60 Hertz Systems . . . . .	4-18

	4.3.5.17.2	*415 Hertz Systems	4-18
4.3.5.18	Transient Operation		4-18
	4.3.5.18.1	*60 Hertz Systems	4-18
	4.3.5.18.2	*415 Hertz Systems	4-19
4.3.5.19	*Overcurrent Protection		4-19
4.3.5.20	Overcurrent Surge Capacity		4-19
	4.3.5.20.1	*60 Hertz Systems	4-19
	4.3.5.20.2	*415 Hertz Systems	4-19
4.3.5.21	Inrush Current		4-20
	4.3.5.21.1	*60 Hertz Systems	4-20
	4.3.5.21.2	*415 Hertz Systems	4-20
4.3.6	Transfer		4-20
4.3.6.1	Maintenance		4-20
	4.3.6.1.1	Purpose	4-20
	4.3.6.1.2	*60 Hertz Systems	4-20
	4.3.6.1.3	*415 Hertz Systems	4-20
4.3.6.2	Bypass Switch		4-21
	4.3.6.2.1	*Definition	4-21
	4.3.6.2.2	*60 Hertz System	4-21
	4.3.6.2.3	*415 Hertz Output	4-21
4.3.6.3	Times and Conditions		4-21
	4.3.6.3.1	*Automatic Transfer	4-21
	4.3.6.3.2	*Automatic Retransfer	4-22
	4.3.6.3.3	*Transfer/Retransfer Differential	4-22
	4.3.6.3.4	*Manual	4-22
4.3.6.4	Protection		4-22
	4.3.6.4.1	*Definition	4-22
	4.3.6.4.2	*60 Hertz	4-22
	4.3.6.4.3	*415 Hertz	4-22
4.3.7	Status Indications and Alarms		4-22
	4.3.7.1	*Requirements	4-23
	4.3.7.2	*Visual Alarms	4-23
	4.3.7.3	*Visual Alarm Color Codes	4-23
4.3.8	Control Functions		4-24
	4.3.8.1	*Power Conversion and Inversion Units	4-24
	4.3.8.2	Maintenance Control	4-25
	4.3.8.2.1	*60 Hertz	4-25
	4.3.8.2.2	*415 Hertz	4-25
	4.3.8.3	Bypass Control	4-26
	4.3.8.3.1	*60 Hertz	4-26
	4.3.8.3.2	*415 Hertz	4-26
	4.3.8.4	Alarm Cut-Off	4-26
	4.3.8.5	*Test Jacks	4-26
	4.3.8.6	*Test Points	4-26
	4.3.8.7	*Status Indicator TEST Function	4-26
4.3.9	Data Acquisition and History		4-26
	4.3.9.1	General	4-26
	4.3.9.2	Software and Firmware Requirements	4-27
	4.3.9.2.1	*Modularity	4-27
	4.3.9.2.2	*Security	4-27
	4.3.9.2.3	*Failure Detection	4-27
	4.3.9.3	Data Acquisition Gathering Points	4-27
	4.3.9.3.1	*General Requirements	4-27

4.3.9.3.2	*Configuration	4-27
4.3.9.3.3	*Sense Point Identification	4-27
4.3.9.3.4	*Input Ranges	4-28
4.3.9.4	Date and Time Recording and Data Retention	4-28
4.3.9.4.1	Date and Time Recording	4-28
4.3.9.4.2	Data Retention	4-28
4.3.9.5	*Local Status Indicator	4-28
4.3.9.6	*Measurement Accuracy	4-28
4.3.9.7	Memory Retention	4-29
4.3.9.8	Input/Output Functions	4-29
4.3.9.8.1	*Application:	4-29
4.3.9.8.2	*Local Access Devices	4-29
4.3.9.9	Communications Port Requirements	4-30
4.3.9.9.1	*Application	4-30
4.3.9.9.2	*Local Access	4-30
4.3.9.9.3	*Remote Access Provisions	4-30
4.3.9.10	Dial-Out Notification Provisions	4-31
4.3.9.11	User Input	4-31
4.3.9.11.1	*Application	4-31
4.3.9.11.2	*Requirements	4-31
4.3.9.12	Command Language Requirements	4-31
4.3.9.12.1	*Application	4-31
4.3.9.12.2	*Command Language Structure	4-31
4.3.9.12.3	*Command Language Usage	4-32
4.3.9.12.4	*Multi-Level Commands	4-32
4.3.9.12.5	*Menu-Driven Operation	4-32
4.3.9.13	Data Communications	4-33
4.3.9.13.1	*Application	4-33
4.3.9.13.2	*Requirements	4-33
4.3.10	Interface Requirements for Mechanized Engineering and Inventory Record Systems	4-34
4.3.10.1	*Application	4-34
4.3.10.2	*Hardware Requirements	4-34
4.3.10.3	*Login Procedures	4-34
4.3.10.4	Format: SDUMP and FDUMP	4-35
4.3.10.5	Access Security	4-35
4.3.10.5.1	*Local Access	4-35
4.3.10.5.2	*Remote Access	4-36
4.3.10.5.3	*Password Requirements	4-36
4.3.10.5.4	Other	4-36
4.3.10.6	Interfaces to Power Conversion Units	4-36
4.3.10.6.1	*Measured UPS Operating Parameters	4-36
4.3.10.6.2	Operating History	4-37
4.3.10.7	Output Parameter and Temperature Calculations	4-37
4.3.11	Interface to Power Room Monitor (MPROM)	4-39
4.3.11.1	*Application	4-39
4.3.11.2	*Requirements	4-39
4.3.11.3	*Data Sampling Points	4-39
4.3.11.4	*Status Monitoring and Alarm	4-40
4.3.11.5	*Operating History	4-40
5.	Physical Design	5-1

5.1	General . . . . .	5-1
5.2	*Mounting Arrangements . . . . .	5-1
5.3	Equipment Dimensions . . . . .	5-1
5.3.1	*General Requirements . . . . .	5-1
5.4	*Growth Capability . . . . .	5-1
5.5	*Shock and Vibration . . . . .	5-1
5.6	*Earthquake . . . . .	5-1
5.7	*Weight . . . . .	5-1
5.8	*Cooling . . . . .	5-1
5.9	*PWB Nesting . . . . .	5-1
5.10	*Materials . . . . .	5-2
5.11	*Handling . . . . .	5-2
5.12	*Paint . . . . .	5-2
5.13	Instruments . . . . .	5-2
5.14	Human Factors . . . . .	5-2
5.15	Components . . . . .	5-2
5.15.1	*Transformers and Magnetic Coils . . . . .	5-2
5.15.2	*Hook-Up Wire . . . . .	5-3
5.15.3	*Power Conductors . . . . .	5-4
5.15.4	*Hardware, Electrical and Mechanical . . . . .	5-4
5.15.5	*Electrical Power Wire Terminations . . . . .	5-5
5.15.6	*Resistors . . . . .	5-5
5.15.7	*Electrolytic Capacitors . . . . .	5-5
5.15.8	*Capacitors Except Electrolytic . . . . .	5-6
5.15.9	*Semiconductors . . . . .	5-6
5.15.10	*Circuit Breakers . . . . .	5-6
5.15.11	*Fuses . . . . .	5-7
5.15.12	*Meters . . . . .	5-7
5.15.13	*Relays . . . . .	5-7
5.15.14	*Switches . . . . .	5-7
5.15.15	*Printed Wire Boards . . . . .	5-8
6.	QUALITY AND RELIABILITY . . . . .	6-1
6.1	Quality Assurance Programs and Processes . . . . .	6-1
6.1.1	Hardware Quality Assurance Plan . . . . .	6-1
6.1.1.1	*Samples . . . . .	6-1
6.1.1.2	*Quality Assurance Documentation . . . . .	6-1
6.1.2	*Software Quality Assurance Plan . . . . .	6-1
6.2	Reliability . . . . .	6-1
6.2.1	*General . . . . .	6-1
6.2.2	*Clock Power . . . . .	6-2
6.2.3	*Power Train . . . . .	6-2
6.2.4	*Power Transfer Switch . . . . .	6-2
6.2.5	Display . . . . .	6-2
6.3	Availability . . . . .	6-2
6.3.1	*General . . . . .	6-2
6.3.2	*Uninterruptible Power System . . . . .	6-2
7.	Documentation and Training . . . . .	7-1
7.1	*Documentation Requirements . . . . .	7-1
7.2	*Training Requirements . . . . .	7-2
8.	Testing Requirements . . . . .	8-1
8.1	Scope . . . . .	8-1
8.1.1	General . . . . .	8-1

8.1.2	Type Tests . . . . .	8-1
8.2	Test Information . . . . .	8-1
8.3	Specific Tests . . . . .	8-2
8.3.1	General Design Requirement Tests . . . . .	8-2
8.3.1.1	<i>Fail-Safe Design</i> . . . . .	8-2
8.3.1.2	<i>Modularity</i> . . . . .	8-2
8.3.1.3	Capacity . . . . .	8-2
8.3.2	Engineering, Installation, and Maintenance . . . . .	8-2
8.3.2.1	<i>Code Compliance</i> . . . . .	8-3
8.3.2.2	<i>Fire Resistance</i> . . . . .	8-3
8.3.2.3	<i>Environmental Requirements</i> . . . . .	8-3
8.3.2.4	<i>Electromagnetic Interference</i> . . . . .	8-3
8.3.2.5	<i>Ground System</i> . . . . .	8-3
8.3.2.6	<i>Electrostatic Discharge</i> . . . . .	8-3
8.3.2.7	Electrical Isolation . . . . .	8-3
8.3.2.8	Frame Current . . . . .	8-4
8.3.2.9	<i>Shipping Temperature and Humidity</i> . . . . .	8-4
8.3.2.10	<i>Packaging Design Considerations</i> . . . . .	8-4
8.3.2.11	<i>Acoustical Noise</i> . . . . .	8-4
8.3.2.12	<i>Protection and Hazards</i> . . . . .	8-4
8.3.2.13	<i>Toxic Materials</i> . . . . .	8-4
8.3.2.14	<i>Marking of Components</i> . . . . .	8-4
8.3.2.15	<i>Replacement Parts</i> . . . . .	8-4
8.3.2.16	Nameplate . . . . .	8-5
8.3.3	Test Instrumentation . . . . .	8-5
8.3.4	Test System . . . . .	8-6
8.3.5	AC Input . . . . .	8-6
8.3.5.1	Frequency . . . . .	8-6
8.3.5.2	Voltage Limits . . . . .	8-6
8.3.5.3	Phase . . . . .	8-6
8.3.5.4	Voltage Unbalance - 3 $\Phi$ . . . . .	8-6
8.3.5.5	Source Impedance . . . . .	8-6
8.3.5.6	Total Harmonic Distortion . . . . .	8-6
8.3.5.7	Displacement Power Factor . . . . .	8-6
8.3.5.8	Crest Factor . . . . .	8-6
8.3.6	AC Input - Equipment . . . . .	8-6
8.3.6.1	General . . . . .	8-6
8.3.6.2	Voltage Source . . . . .	8-7
8.3.6.3	Voltage Surges . . . . .	8-7
8.3.6.4	AC Grounding . . . . .	8-8
8.3.6.5	Surge Withstand Capability . . . . .	8-8
8.3.6.6	Frequency . . . . .	8-8
8.3.6.7	Total Harmonic Distortion . . . . .	8-8
8.3.6.8	Isolation . . . . .	8-8
8.3.6.9	AC Voltage Phase Shift . . . . .	8-8
8.3.6.10	Phase Sequence . . . . .	8-8
8.3.6.11	Overcurrent Protection . . . . .	8-8
8.3.6.12	Inrush Current . . . . .	8-8
8.3.6.13	Current Walk-In . . . . .	8-9
8.3.6.14	Low AC Voltage Protection . . . . .	8-9
8.3.6.15	Phase . . . . .	8-9
8.3.6.16	Phase Failure . . . . .	8-9
8.3.6.17	Power Interruption . . . . .	8-9

	8.3.6.18 Telephone Influence Factor (TIF) . . . . .	8-9
8.3.7	DC Voltage Source . . . . .	8-10
	8.3.7.1 General . . . . .	8-10
	8.3.7.2 Voltage Regulation Point . . . . .	8-10
	8.3.7.3 Battery . . . . .	8-10
	8.3.7.3.1 Float Voltage . . . . .	8-10
	8.3.7.3.2 Regulation . . . . .	8-11
	8.3.7.3.3 Emergency Limits . . . . .	8-11
	8.3.7.3.4 Reserve Time . . . . .	8-11
	8.3.7.3.5 Recharge Time . . . . .	8-11
	8.3.7.3.6 Low Voltage Disconnect . . . . .	8-11
	8.3.7.3.7 Noise Voltage - Telecommunication Source . . . . .	8-11
	8.3.7.3.8 Battery Grounding . . . . .	8-11
8.3.7.4	Rectifier/Charger Output . . . . .	8-12
	8.3.7.4.1 General . . . . .	8-12
	8.3.7.4.2 Technology . . . . .	8-12
	8.3.7.4.3 Output Voltage . . . . .	8-12
	8.3.7.4.4 Regulation Limits . . . . .	8-12
	8.3.7.4.5 Float Voltage Adjustments . . . . .	8-12
	8.3.7.4.6 Voltage Temperature Coefficient . . . . .	8-12
	8.3.7.4.7 Current Walk In . . . . .	8-12
	8.3.7.4.8 Current Limit . . . . .	8-12
	8.3.7.4.9 Warm Up Time . . . . .	8-13
	8.3.7.4.10 Voltage Drift . . . . .	8-13
	8.3.7.4.11 Transient Limits . . . . .	8-13
	8.3.7.4.12 Stability . . . . .	8-13
	8.3.7.4.13 Dynamic Response . . . . .	8-13
	8.3.7.4.14 Output Protection and Disconnect . . . . .	8-13
	8.3.7.4.15 Voice Frequency Output Noise . . . . .	8-13
	8.3.7.4.16 Ripple and Wideband Output Noise . . . . .	8-13
	8.3.7.4.17 Discharge of Output Capacitors . . . . .	8-14
8.3.7.5	AC Load Characteristics . . . . .	8-14
	8.3.7.5.1 Displacement Power Factor . . . . .	8-14
	8.3.7.5.2 Crest Factor . . . . .	8-14
	8.3.7.5.3 Total Harmonic Distortion . . . . .	8-14
	8.3.7.5.4 Telephone Influence Factor (TIF) . . . . .	8-14
8.3.7.6	AC Output . . . . .	8-14
	8.3.7.6.1 Input Voltage For Output Inverter Module . . . . .	8-14
	8.3.7.6.2 Phase . . . . .	8-14
	8.3.7.6.3 Parallel Operation . . . . .	8-14
	8.3.7.6.4 Reverse Current Protection . . . . .	8-14
	8.3.7.6.5 Power Rating . . . . .	8-14
	8.3.7.6.6 Voltage Limits . . . . .	8-15
	8.3.7.6.7 Frequency . . . . .	8-15
	8.3.7.6.8 Frequency Synchronization . . . . .	8-16
	8.3.7.6.9 Slew rate . . . . .	8-16
	8.3.7.6.10 Line-to-Line Voltages (3 $\Phi$ ) . . . . .	8-16
	8.3.7.6.11 Voltage Adjustability . . . . .	8-16
	8.3.7.6.12 Line Drop Compensation . . . . .	8-16
	8.3.7.6.13 Voltage Modulation . . . . .	8-16
	8.3.7.6.14 Phase Angle . . . . .	8-16



	8.3.7.6.15	Input Protection . . . . .	8-16
	8.3.7.6.16	Displacement Power Factor . . . . .	8-16
	8.3.7.6.17	Total Harmonic Distortion . . . . .	8-16
	8.3.7.6.18	Transient Operation . . . . .	8-17
	8.3.7.6.19	Overcurrent Protection . . . . .	8-17
	8.3.7.6.20	Overcurrent Surge Capacity . . . . .	8-17
	8.3.7.6.21	Inrush Current . . . . .	8-17
8.3.7.7	Transfer . . . . .		8-17
	8.3.7.7.1	Maintenance . . . . .	8-17
	8.3.7.7.2	Bypass Switch . . . . .	8-17
8.3.7.8	Times and Conditions . . . . .		8-17
	8.3.7.8.1	Automatic Transfer . . . . .	8-17
	8.3.7.8.2	Automatic Retransfer . . . . .	8-18
	8.3.7.8.3	Transfer/Retransfer Differential . . . . .	8-18
	8.3.7.8.4	Manual . . . . .	8-18
8.3.7.9	Protection . . . . .		8-18
8.3.7.10	Status Indications and Alarms . . . . .		8-18
	8.3.7.10.1	Requirements . . . . .	8-18
	8.3.7.10.2	Visual Alarms . . . . .	8-18
	8.3.7.10.3	Visual Alarm Color Codes . . . . .	8-18
8.3.8	Control Functions . . . . .		8-19
	8.3.8.1	Power Conversion and Inversion Units . . . . .	8-19
	8.3.8.2	Maintenance Control . . . . .	8-19
	8.3.8.3	Bypass Control . . . . .	8-19
	8.3.8.4	Alarm Cut-Off . . . . .	8-19
	8.3.8.5	Test Jacks . . . . .	8-19
	8.3.8.6	Test Points . . . . .	8-19
	8.3.8.7	Status Indicator TEST Function . . . . .	8-19
8.3.9	Data Acquisition and History . . . . .		8-19
8.3.10	Interface Requirements for Mechanized . . . . .		8-20
8.3.11	Interface to Power Room Monitor (MPROM) . . . . .		8-20
8.3.12	Physical Design . . . . .		8-20
8.3.13	Quality And Reliability . . . . .		8-20
	8.3.13.1	Samples . . . . .	8-20
	8.3.13.2	Quality Assurance Documentation . . . . .	8-20
	8.3.13.3	Software Quality Assurance Plan . . . . .	8-20
8.3.14	Reliability . . . . .		8-20
	8.3.14.1	General . . . . .	8-20
	8.3.14.2	Clock Power . . . . .	8-21
	8.3.14.3	Power Train . . . . .	8-21
	8.3.14.4	Power Transfer Switch . . . . .	8-21
8.3.15	Availability . . . . .		8-21
	8.3.15.1	General . . . . .	8-21
	8.3.15.2	Uninterruptible Power System . . . . .	8-21
8.3.16	Documentation and Training . . . . .		8-21
9.	REFERENCES . . . . .		9-1

LIST OF FIGURES

Figure 4-1. Generic UPS with AC Transformation . . . . .	4-2
Figure 4-2. Generic UPS with DC-TO-AC Transformation . . . . .	4-2
Figure 4-3. Simulated Withstand Surge Waveforms . . . . .	4-5
Figure 7-1. Outline for User's Guide . . . . .	7-3
Figure 8-1. Block Diagram of UPS Architecture For Test Purposes . . . . .	8-2
Figure 8-2. Rectifier/Charger Test Circuit . . . . .	8-7
Figure 8-3. Inverter Output Module Test Circuit . . . . .	8-15

LIST OF TABLES

Table 3-1. Insulation Test Voltages . . . . .	3-2
Table 4-1. Range B Utilization Limits . . . . .	4-3
Table 4-2. Source Impedance . . . . .	4-3
Table 4-3. Current Walk-in Requirements . . . . .	4-7
Table 4-4. Telecommunications Battery Noise Levels . . . . .	4-11
Table 4-5. Rectifier/Charger Terminal Voltage . . . . .	4-12
Table 4-6. Rectifier/Charger Regulation Limits . . . . .	4-12
Table 4-7. Output Voltage During Warm Up . . . . .	4-14
Table 4-8. Required Indicators . . . . .	4-24
Table 4-9. Required Monitors and Alarms . . . . .	4-25
Table 4-10. Maximum Measurement Error vs. Measured Parameter . . . . .	4-29
Table 4-11. Configuration of 25-pin EIA Connector . . . . .	4-34
Table 4-12. Summary of Data Gathering Requirements . . . . .	4-38
Table 5-1. Maximum Temperature For Magnetic Components . . . . .	5-3
Table 5-2. Maximum Permissible Current For Hook-Up Wire . . . . .	5-3
Table 5-3. Maximum Operating Voltage and Temperature . . . . .	5-3
Table 5-4. Suggested Torque, Clamping Load, And Current Rating For Screws and Bolts . . . . .	5-4
Table 5-5. Semiconductor Stud Torque Limits . . . . .	5-6
Table 5-6. Switch Contact and Terminal Temperatures . . . . .	5-7
Table 8-1. Instrumentation Characteristics . . . . .	8-5
Table 8-2. 1960 Single Frequency TIF Weighting Values . . . . .	8-10