

Table of Contents

1 Introduction and General Requirements

1.1 Purpose	1-1
1.2 Reasons for GR-974-CORE Reissue(s)	1-2
1.2.1 Reasons for GR-974-CORE, Issue 4	1-2
1.2.2 Reasons for GR-974-CORE, Issue 3	1-2
1.3 Organization	1-3
1.4 How To Use These Generic Requirements	1-4
1.5 Application of This Document	1-6
1.6 Requirements Terminology	1-7
1.7 Requirement Labeling Conventions	1-8
1.7.1 Numbering of Requirement and Related Objects	1-8
1.7.2 Requirement, Conditional Requirement, and Objective Identification	1-9
1.8 Safety Precautions	1-9
1.9 Measurements	1-9
1.10 Laboratory Conditions	1-9
1.11 Test Equipment and Applied Test Stress Levels	1-10
1.12 Test Temperatures and Humidity	1-10

2 General Information

2.1 TLPU Configuration With Current-Limiting Mechanism	2-1
2.2 TLPU Configuration With Fusible Link Mechanism	2-2
2.3 TLPU Configuration With Current-Limiting and Fusible Link Mechanisms	2-3
2.4 Sample Selection and Retest	2-3
2.5 Marking	2-4
2.6 Packaging and Shipping	2-10
2.7 Listing	2-10
2.8 Quality	2-10
2.8.1 Quality Program Analysis	2-10
2.8.2 Product Quality Surveillance	2-10
2.9 Product Change Notices (PCNs)	2-11
2.10 Markings, Packaging, and Shipping	2-11
2.10.1 Identification	2-11
2.10.2 Container and Packaging	2-11
2.10.3 Package Label	2-11
2.10.4 Consumable Materials	2-12

3 Mechanical Requirements

3.1 Materials	3-1
3.2 Assembly of Plug-In Type TLPU	3-2
3.3 Assembly of Non Plug-In or Station-Type TLPU	3-2
3.4 Internal Clearance	3-3
3.5 Fire Retardancy	3-3
3.6 Personnel Safety	3-3
3.7 Nominal Pin Dimensions of the Plug-In Type TLPU	3-3
3.8 Screw-In Station Type TLPU Color Coding	3-5
3.9 Plug-In Type TLPU Color Coding	3-5

3.10 Radioactive Content 3-6
 3.11 Hazardous Contents 3-6
 3.12 Bonding and Grounding 3-6

4 Electrical Requirements

4.1 Fusing Coordination 4-1
 4.2 High-Current Capability and Thermal Operation 4-2
 4.3 Contact Resistance (Plug-In Type TLPUs Only) 4-3
 4.4 Dielectric Strength 4-4
 4.5 Immunity to Electromagnetic Interference (EMI) 4-4
 4.6 Immunity to Electrostatic Discharge (ESD) 4-6
 4.7 Rated Voltage (Not for TLPUs Intended for 5ESS Switching System) 4-6
 4.8 Insulation Resistance 4-7
 4.9 Capacitance 4-7
 4.10 Impulse Reset 4-8
 4.11 Voltage Limiting 4-9
 4.11.1 Low Voltage Limiting 4-9
 4.11.2 Medium Voltage Limiting 4-10
 4.11.3 High Voltage Limiting 4-10
 4.11.4 5ESS Voltage Limiting 4-11
 4.11.5 Data Line Protector Limiting 4-12
 4.11.6 Power Over Ethernet (POE) Devices Voltage Limiting 4-12
 4.12 Impulse Life 4-13
 4.12.1 Multi-Pair Protector Impulse Life 4-14
 4.13 AC Life 4-17
 4.14 End-of-Life Mode 4-18
 4.15 Backup Device Integrity 4-20
 4.16 TLPUs Not Provided With a Backup Device 4-21
 4.16.1 Voltage Limiting 4-21
 4.16.2 Mechanical Stress 4-22
 4.16.3 Thermal Aging 4-22
 4.16.4 Thermal Shock 4-22
 4.16.5 Service Life 4-23
 4.16.6 Over-Pressure Leak Test 4-23
 4.17 Blind Spot Test 4-26

5 Environmental Requirements

5.1 Packaged Shock 5-1
 5.2 Drop Test 5-1
 5.3 Stress-Corrosion Cracking 5-1
 5.3.1 Screw-In Type TLPUs 5-2
 5.4 Salt Fog Tests (TLPUs Intended for an Uncontrolled Environment) 5-3
 5.5 Rain Test (TLPUs Intended for an Uncontrolled Environment) 5-3
 5.6 Fungus Resistance 5-4
 5.6.1 Fungus Resistance Test Procedure 5-4
 5.7 Resistance to Chemicals 5-4
 5.8 Aging (TLPUs Intended for an Uncontrolled Environment) 5-5
 5.9 Environmental Cycling With Impulse Surges (TLPUs Intended for an Uncontrolled Environment) 5-6

5.10 Environmental Cycling With AC Surges (TLPUs Intended for an Uncontrolled Environment)	5-7
5.11 NEBS Compliance	5-7
5.11.1 Transportation and Storage Environment	5-8
5.11.2 Temperature and Humidity Cycling (TLPUs Intended for a Controlled Environment)	5-8
5.11.3 Office and Environmental Vibration Environment	5-9
5.11.4 Airborne Contaminants (TLPUs Intended for a Controlled Environment)	5-9
5.11.5 Airborne Contaminants (TLPUs Intended for an Uncontrolled Environment)	5-10

6 Current-Limiting Capability

6.1 Four-Ohm Non-Resetting Current Limiting	6-4
6.1.1 DC Series Resistance	6-4
6.1.2 Rated Current	6-4
6.1.3 Transition Current	6-5
6.1.4 Impulse Life	6-6
6.1.5 AC Life	6-6
6.1.6 Second-Level AC Power Contact	6-7
6.2 Twenty-Ohm Non-Resetting Current Limiting	6-8
6.2.1 DC Series Resistance	6-8
6.2.2 Rated Current	6-8
6.2.3 Transition Current	6-9
6.2.4 Impulse Life	6-11
6.2.5 Second-Level AC Power Contact	6-11
6.3 Self-Resetting Current Limiting	6-12
6.3.1 DC Series Resistance	6-12
6.3.2 Rated Current	6-13
6.3.3 Transition Current	6-14
6.3.4 Current Reset for T1-Carrier Systems	6-15
6.3.5 Impulse Life	6-16
6.3.6 AC Life	6-17
6.3.7 Second-Level AC Power Contact	6-17
6.4 Fast Current Limiting	6-18
6.4.1 DC Series Resistance	6-18
6.4.2 Rated Current	6-19
6.4.3 AC Current Limiting	6-19
6.4.4 Impulse Current Limiting	6-20
6.4.5 Current Reset	6-20
6.4.6 Impulse Life	6-21
6.4.7 AC Life	6-22
6.4.8 Second-Level AC Power Contact	6-22

7 Application Options

7.1 T1-Carrier Systems Without the Use of Regulators	7-1
7.1.1 Impulse Reset	7-1
7.2 High-Exposure Customer Stations	7-2
7.2.1 High-Current Impulse Life	7-2
7.2.2 High-Current End-of-Life Mode	7-3

- 7.3 High-Speed Digital Networks 7-3
 - 7.3.1 High-Speed Digital Systems Operating Up To 30 MHz 7-4
 - 7.3.1.1 Insertion Loss 7-4
 - 7.3.1.2 Return Loss 7-4
 - 7.3.1.3 Bit Error Rate (BER) Test 7-5
 - 7.3.1.4 Longitudinal Balance 7-5
 - 7.3.2 High-Speed Digital Network Operating Up To 100 MHz 7-6
 - 7.3.2.1 Insertion Loss 7-6
 - 7.3.2.2 Return Loss 7-7
 - 7.3.2.3 Bit Error Rate (BER) Test 7-8
 - 7.3.2.4 Longitudinal Balance 7-8
 - 7.3.3 High-Speed Digital Network Operating Up to 250 MHz (To Achieve
10 Gbps) 7-9
 - 7.3.3.1 Insertion Loss 7-9
 - 7.3.3.2 Return Loss 7-9
 - 7.3.3.3 Bit Error Rate (BER) Test 7-10
 - 7.3.3.4 Longitudinal Balance 7-10
 - 7.3.3.5 Near-End Crosstalk (NEXT) 7-11
 - 7.3.3.6 Far-End Crosstalk (FEXT) 7-11
 - 7.3.4 Transmission Test Methods 7-11
 - 7.3.4.1 Insertion Loss 7-12
 - 7.3.4.2 Return Loss 7-13
 - 7.3.4.3 Longitudinal Balance 7-14
 - 7.3.4.4 Crosstalk 7-16
 - 7.3.4.4.1 Near-End Crosstalk (NEXT) 7-16
 - 7.3.4.4.2 Far-End Crosstalk (FEXT) 7-18
- 7.4 Balanced Voltage-Limiting 7-19
 - 7.4.1 Balanced Voltage-Limiting 7-19
 - 7.4.2 Impulse Reset 7-19

8 Insulation Displacement Connector (IDC) Physical Requirements

- 8.1 IDC Electrical Requirements 8-1
 - 8.1.1 Wire Compatibility 8-1
 - 8.1.2 Wire Termination 8-1
 - 8.1.3 IDC Density 8-1
 - 8.1.4 Wire Pair Identification 8-1
 - 8.1.5 Test Points 8-2
 - 8.1.6 Termination Tool 8-2
- 8.2 IDC Mechanical Requirements 8-2
 - 8.2.1 Materials and Finishes 8-2
 - 8.2.2 Terminated Wire Torsion 8-2
 - 8.2.3 Terminated Wire Bending 8-3
 - 8.2.4 Reuse 8-3
 - 8.2.5 Dimensional Stability 8-3
 - 8.2.6 Durability of IDCs 8-4
- 8.3 IDC Environmental Requirements 8-4
 - 8.3.1 Temperature Cycling 8-4
 - 8.3.2 Temperature Cycling with Humidity/Contact Resistance 8-4
 - 8.3.3 Temperature Cycling with Humidity/Insulation Resistance 8-5
 - 8.3.4 Stress Relaxation 8-5

9 Fused TLPUs

9.1 Rated Current 9-4

9.2 Current Interrupting 9-5

9.3 Impulse Life 9-6

9.4 AC Life 9-8

9.5 Dielectric Strength 9-9

Appendix A: Test Waveform Validation

Appendix B: References

B.1 Telcordia Documents B-1

B.2 Telcordia Document Sets (Family of Requirements [FRs]) B-1

B.3 Non-Telcordia Documents B-2

B.4 Telcordia Reference Notes B-4

 B.4.1 Contact Telcordia B-4

 B.4.2 Order Documents Online From the Telcordia Information SuperStore B-4

 B.4.3 Telcordia Web Sites for Generic Requirements Information B-5

 B.4.4 Telcordia Licensing Agreements B-5

Appendix C: Acronyms

Requirement-Object Index



List of Figures

Figure 2-1	TLPU Configuration With Current-Limiting Mechanism	2-1
Figure 2-2	TLPU Configuration With Voltage-Limiting and Fusible Link Mechanisms	2-2
Figure 2-3	TLPU Configuration With Voltage-Limiting and Fusible Link Mechanisms	2-3
Figure 2-4	Marking for TLPUs	2-9
Figure 3-1	5-Pin Plug-In Protector Unit Base and Pin Dimensions	3-4
Figure 4-1	Multi-Pair Protector Impulse Life Test Circuits	4-16
Figure 4-2	Impulse Life Test Circuit	4-27
Figure 4-3	Accessibility Probe	4-28
Figure 4-4	EMI Test Circuit	4-29
Figure 4-5	Termination Networks for E and H Field Measurements	4-30
Figure 4-6	Rated Voltage Test Circuit	4-31
Figure 4-7	Insulation Resistance Test Circuit	4-32
Figure 4-8	Impulse Reset Test Circuit	4-33
Figure 4-9	One-Mile Cable Loop Simulation for AC Life Test Circuit	4-34
Figure 4-10	0.5-Ampere Continuous AC Life Test Circuit	4-35
Figure 5-1	Environmental Cycling With Relative Humidity at 90% to 96%	5-11
Figure 5-2	Powering TLPUs for Environmental Cycling, Rain Test, and Salt-Fog Test	5-12
Figure 5-3	600-Foot Cable Loop Simulation for AC Life Test Circuit	5-13
Figure 6-1	Simplified Examples of Two-Terminal Current Limiters	6-2
Figure 6-2	Simplified Examples of Three-Terminal Current Limiters	6-3
Figure 6-3	Impulse Life Test Circuit for Current Limiters	6-23
Figure 6-4	AC Life Test Circuit and Second-Level AC Power Contact for Current Limiters	6-24
Figure 6-5	AC-Current-Limiting Test Circuit for Fast Current Limiter	6-25
Figure 6-6	Impulse Current Limiting Test Circuit for Fast Current Limiter	6-26
Figure 6-7	Current Reset Test Circuit	6-27
Figure 7-1	Insertion Loss and Return Loss Setup	7-13
Figure 7-2	Longitudinal Balance Setup	7-15
Figure 7-3	NEXT Circuit	7-17
Figure 7-4	FEXT Circuit	7-18
Figure 7-5	Bit Error Test (BER) Test Circuit	7-20
Figure 7-6	Longitudinal Balance Test Circuit	7-21
Figure 7-7	Impulse Reset Test Circuit With Balanced TLPU	7-22
Figure 8-1	Stress Relaxation Pull Force	8-5
Figure 9-1	Fused TLPUs	9-1
Figure 9-2	Fused TLPU With Fusible Link Types	9-2
Figure 9-3	Fused TLPU Application	9-3
Figure 9-4	Rated Current	9-4
Figure 9-5	Current Interrupting Test	9-5
Figure 9-6	Impulse Life Test Circuit for Fused TLPU	9-7
Figure 9-7	AC Life Test Circuit for Fused TLPU	9-9
Figure A-1	Definition of Voltage Rate of Rise	A-2
Figure A-2	Definition of Double Exponential Impulse Waveform of Duration A/B Seconds	A-3



List of Tables

Table 1-1	TLPUs and Corresponding Requirements	1-6
Table 2-1	Markings for TLPUs	2-5
Table 2-2	Matrix for Coding Model Number	2-6
Table 2-3	Examples of Intended Locations of TLPU and Corresponding Electrical Requirements	2-7
Table 3-1	Insertion and Withdrawal Force Limits	3-2
Table 3-2	Nominal Pin Dimensions of the Plug-In Type TLPU	3-3
Table 3-3	Plug-In Type Color Coding	3-5
Table 3-4	TLPU Housing Color	3-6
Table 4-1	Fusing Coordination	4-1
Table 4-2	Termination Network Values	4-5
Table 4-3	Insulation Resistance	4-7
Table 4-4	Low Voltage-Limiting Parameters	4-9
Table 4-5	Medium Voltage-Limiting Parameters	4-10
Table 4-6	High Voltage-Limiting Parameters	4-10
Table 4-7	Voltage-Limiting Parameters for 5ESS TLPUs	4-11
Table 4-8	Data Line Protector Voltage-Limiting Parameters	4-12
Table 4-9	POE Devices Voltage-Limiting Parameters	4-12
Table 4-10	Impulse Life Requirement	4-13
Table 4-11	Multi-Pair Protector Impulse Life Requirement	4-15
Table 4-12	AC Life Requirement	4-17
Table 4-13	End-of-Life Mode Requirement	4-19
Table 4-14	Blind Spot Voltage and Current Impulses	4-26
Table 6-1	Rated Current for a 4-Ohm Non-Resetting Limiter	6-4
Table 6-2	Transition Current for a 4-Ohm Non-Resetting Limited	6-5
Table 6-3	Rated Current for a 20-Ohm Non-Resetting Limiter	6-8
Table 6-4	Transition Currents for a 20-Ohm Non-Resetting Limiter	6-10
Table 6-5	Transition Currents for a 20-Ohm Non-Resetting Limiter	6-10
Table 6-6	Rated Current for a Self-Resetting Current Limiter	6-13
Table 6-7	Transition Currents for a Self-Resetting Current Limiter	6-14
Table 6-8	Transition Currents for a Self-Resetting Limiter	6-14
Table 7-1	Impulse Reset Test Circuit Parameters for T1-Carriers Without Regulators	7-1
Table 7-2	Impulse Life at High Currents	7-3
Table 7-3	Test Times for the BER Test	7-5
Table 7-4	Test Times for the BER Test	7-8
Table 7-5	Test Times for the BER Test	7-10
Table 7-6	Impulse Reset Circuit Parameters for a Balanced TLPU	7-20
Table 9-1	Impulse Life	9-6
Table 9-2	AC Life	9-8