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|  | FDOT Traffic Engineering Research Laboratory (TERL)  Uninterruptible Power Supply (UPS) Compliance Matrix | By signing this form, the applicant declares that he/she has read and understands the provisions of Sections 685 and 996 of the FDOT *Standard Specifications for Road and Bridge Construction* and all implemented modifications. The requirements listed on this matrix are derived from Sections 685 and 996, and are the basis for determining a product’s compliance and its acceptability for use on Florida’s roads. |

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| --- | --- | --- | --- |
| Date: | Click here to enter a date. | Applicant’s  Name (print): |  |
| Manufacturer: |  |  |  |
| Item, Model No.: |  | Signature: |  |

|  |  | **\*\* Greyed out rows in table below are for TERL use only \*\*** |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ID No** | **Section** | **Requirement** | **Item Comply? (Yes/No/NA)** | **Comments (Applicant must provide information as indicated)** | **TERL Evaluation Method** |
| The following compliance matrix criteria are for all UPS. | | | | | |
| 1 | 996-1.1 | UPS is permanently marked with manufacturer name or trademark, part number, and date of manufacture or serial number. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): UPS002 (Step 1) |  |  | Init.: |
| 2 | 996-7.2 | UPS is line interactive or online/double-conversion. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 1), UPS003, UPS004 (Steps 1, 2) |  |  | Init.: |
| 3 |  | UPS assembly is designed for installation in a roadside NEMA 3R enclosure to provide battery backup functionality for traffic control systems, including traffic signal and intelligent transportation system (ITS) devices. |  | *Provide a statement of conformance in this field.* | Compliance Matrix Review |
| TERL Test Cases (Steps): UPS001 (Step 2) |  |  | Init.: |
| 4 |  | Loss of utility power, transfer from utility power to battery power, and transfer back to utility power does not interfere with normal operation of connected equipment. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 3), UPS003 |  |  | Init.: |
| 5 |  | In the event of UPS failure or battery depletion, connected equipment is energized automatically upon restoration of utility power. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 4), UPS005 (Step 4) |  |  | Init.: |
| 6 |  | UPS operates in hot standby mode with power transfer being accomplished in 40 milliseconds or less. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 5), UPS003 (Steps 1, 2) |  |  | Init.: |
| 7 |  | Removal and replacement of the UPS does not disrupt the operation of the equipment being protected. |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): UPS007 |  |  | Init.: |
| 8 |  | All harnesses necessary to connect and operate the system are included, including for the battery connections. All connectors are keyed to prevent improper connection.  The battery wiring harness allows 6 feet of separation between the UPS and its battery bank. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): UPS002 (Step 2) |  |  | Init.: |
| 9 | 996-7.2.1 | UPS supports local and remote configuration and management, including access to all user-programmable features as well as alarm monitoring, event logging, and diagnostic utilities. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 6), UPS006 |  |  | Init.: |
| 10 |  | Configuration and management functions are password protected. |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): UPS006 (Steps 1, 7) |  |  | Init.: |
| 11 |  | Alarm function monitoring includes loss of utility power, inverter failure, low battery, voltage, and temperature out of range. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review, and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 7), UPS006 (Steps 8, 9) |  |  | Init.: |
| 12 |  | The UPS includes an event log that indicates the date and time of the following events: AC high, AC low, AC frequency error, AC fail/blackout, and over temperature. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 8), UPS006 (Steps 9, 10) |  |  | Init.: |
| 13 |  | The UPS event log can store a minimum of 60 events. |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): UPS006 (Steps 9, 10) |  |  | Init.: |
| 14 |  | UPS includes a front panel display and controls that allow programming of configurable parameters, features, and functions without the need for another input device. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 9), UPS002 (Step 3) |  |  | Init.: |
| 15 |  | The UPS has visual indications for Power-On, Mode of Operation (utility power or inverter), Battery Status, Alarm Status, Load Levels, and AC Output Voltage. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 10), UPS002 (Step 4) |  |  | Init.: |
| 16 | 996-7.2.2 | UPS includes an Ethernet port (RJ45) for local control using a laptop PC and remote control via a network connection. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 11), UPS002 (Step 5) |  |  | Init.: |
| 17 | 996-7.2.3 | UPS includes batteries, or other technologies recommended by the manufacturer. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 12), UPS002 (Step 6) |  |  | Init.: |
| 18 |  | Batteries are sealed and require no maintenance, cause no corrosion, and be capable of maintaining 80% of original capacity and performance for a minimum of five years. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 13), UPS002 (Step 7) |  |  | Init.: |
| 19 |  | Battery terminals include a protective covering to prevent accidental spark or shorting. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): UPS002 (Step 8) |  |  | Init.: |
| 20 |  | UPS has battery management functions that include active or equalized balancing; monitoring of temperature, voltage, and amperage of charge and discharge; and temperature compensated automatic charging to maximize the life of the batteries. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 14), UPS006 (Steps 2 - 7) |  |  | Init.: |
| 21 | 996-7.2.4 | Frequency is regulated to 60 Hz, plus or minus 0.5 Hz, while the UPS is supplying power. The UPS operates on 85 to 140VAC without requiring assistance from the batteries. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |  |
| TERL Test Cases (Steps): UPS001 (Step 15), UPS004 (Steps 3-5) |  |  | Init.: |
| 22 |  | UPS is listed to the requirements of UL 1778. Upstream back-feed voltage from the UPS is less than 1 VAC. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 16), UPS005 (Step 1) |  |  | Init.: |
| 23 |  | UPS used to provide backup power in an ITS cabinet provides a minimum of 350 watts (at 120VAC) of continuous backup power for a minimum of two hours and UPS assemblies used to provide backup power in a traffic signal controller cabinet provides a minimum 400 watts (at 120VAC) of continuous power for a minimum of 6.5 hours. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 17), UPS005 (Steps 2, 3) |  |  | Init.: |
| The following compliance matrix criterion is for Double-Conversion UPS. | | | | | |
| 24 |  | Double-conversion UPS is capable of simultaneously producing fully regenerated and regulated, conditioned, True Sine Wave power and hot standby AC output, and has a minimum operating efficiency of 90%. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 18), UPS004 (Steps 1, 2) |  |  | Init.: |
| The following compliance matrix criteria are for Traffic Signal UPS Cabinet. | | | | | |
| 25 | 996-7.2.5 | Cabinet is designed to be mounted to the side of a traffic cabinet or base mounted. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): UPS002 (Step 9) |  |  | Init.: |
| 26 |  | Cabinet meets the requirements of Section 676 and includes shelves and rack rails to house all UPS system components including the UPS, batteries, harnesses, switches, surge protective device, power terminal block and a generator hookup with transfer switch. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement. Alternately, provide the Approved Product List (APL) number if the cabinet is APL listed.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 19), UPS002 (Step 10) |  |  | Init.: |
| 27 |  | UPS cabinet allows a maintenance technician to safely insert power for traffic signal operation while the UPS or associated equipment is serviced or replaced. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 20), UPS007 |  |  | Init.: |
| 28 |  | A surge protective device is installed where the supply circuit enters the cabinet in accordance with 620-2.7.1. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 21), UPS002 (Step 11) |  |  | Init.: |
| 29 |  | Cabinet includes a 20 A, 120 volt, 60 Hz GFCI receptacle that is wired to utility power and not regulated by the UPS module. The cabinet includes a main breaker and a breaker for the technician GFCI outlet. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 22), UPS002 (Step 12) |  |  | Init.: |
| 30 | 996-7.2.5.1 | Cabinet includes an automatic transfer switch and generator access panel in accordance with Section 676. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 23), UPS002 (Step 13) |  |  | Init.: |
| 31 |  | Generator access door does not protrude more than 1 inch when closed. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Physical Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 24), UPS002 (Step 14) |  |  | Init.: |
| The following compliance matrix criteria are for all UPS. | | | | | |
| 32 | 996-7.2.6 | All parts are made of corrosion-resistant materials such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal. All fasteners exposed to the elements are Type 304 or 316 passivated stainless steel. |  | *Provide statement of conformance from hardware supplier that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 25) |  |  | Init.: |
| 33 | 996-7.2.7 | UPS assemblies, including batteries, provide continuous power with specified wattage and operate properly during and after being subjected to the environmental testing procedures described in NEMA TS 2-2021, Sections 2.2.7, 2.2.8, and 2.2.9. |  | *Provide a first or third party test report, less than 5 years old, that demonstrates compliance with this requirement. The test report must meet the requirements of FDOT Product Certification Handbook, section 7.2.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): UPS001 (Step 26) |  |  | Init.: |
| 34 | 685-5 | The UPS includes a manufacturer’s warranty covering defects for a minimum of 3 years (5 years for the external batteries in accordance with 685-2.2) from the date of final acceptance in accordance with 5-11 and Section 608. |  | *Provide a statement of conformance in this field.* | Compliance Matrix Review |
| TERL Test Cases (Steps): UPS001 (Step 27) |  |  | Init.: |
| 35 |  | The warranty includes provisions for providing a replacement UPS within 10 calendar days of notification for any UPS found to be defective during the warranty period at no cost to the FDOT or the maintaining agency. |  | *Provide a statement of conformance in this field.* | Compliance Matrix Review |
| TERL Test Cases (Steps): UPS001 (Step 28) |  |  | Init.: |

**Document History for:**

**Uninterruptible Power Supply Compliance Matrix**

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| Rev | Description | Authored and Checked | Reviewed | Approved | Approval Date | Rev More Stringent? |
| 1.0 | New matrix for SSRBC (FA 1-13-15). | D. Bremer | J. Morgan  M. DeWitt  C. Morse | J. Morgan | 08/12/2015 | No |
| 2.0 | Updates for FA 7-2-20 that has less stringent requirements. | W. Geitz | C. Raimer  M. DeWitt | D. Vollmer | 09/30/2020 | No |
| 3.0 | Added warranty information. Corrected CM identifier. | A. Burleson | W. Geitz | M. DeWitt | 02/01/2022 | No |
| 4.0 | Added test cases and steps. Moved from 685 to 996. Updated FA Date 10-24-22. | P. Blaiklock  W. Geitz | D. Bremer | D. Vollmer | 05/09/2023 | No |
| 5.0 | Updated to latest FA dates of 10-24-23 and 12-1-23 for specs 685 and 996, respectively. | W. Geitz | L. Audisio | D. Vollmer | 01/10/2024 | No |