

ORIGINATION FORM

THE INFORMATION BELOW IS TO BE PROVIDED BY THE ORIGINATOR

(The person who receives or originates the issue and needs to forward the issue for action.)

Specification: SECTION 785
Subject: Updates to references and requirements as well as minor grammatical changes.

Origination date: June 28, 2011
Originator: Gene Glotzbach
Office/Phone: Traffic Engineering and Operations, ITS Section
850-410-5600

Problem statement: Project usage and District feedback indicates need to correct and update document, including: correcting inconsistencies in references (some are referred to with title, others are not) and grammar, clarification of requirements and expectations for ground system testing and certification, removing unnecessary cross references, and clarification of requirements for main ground bar attachments.

Proposed solution: Revise and update based on feedback received from District users and industry over the course of past MSP requests and other project usage.

Information source: Traffic Engineering and Operations Office

Recommended Usage Note:

Estimated fiscal impact, if implemented: None

Implementation of these changes, if and when approved, will begin with the Jan 2012 letting.

For State Specifications Office Use Only

Begin date:
File Number:
Scheduled completion date:
Implementation date:
Implementation team member:
Usage Note:

Notes:



Florida Department of Transportation

RICK SCOTT
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

ANANTH PRASAD, P.E.
SECRETARY

M E M O R A N D U M

DATE: July 5, 2011
TO: Specification Review Distribution List
FROM: Rudy Powell, Jr., P.E., State Specifications Engineer
SUBJECT: Proposed Specification: 7850200 ITS – Infrastructure

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change.

The changes are proposed by Gene Glotzbach to clarify and update the requirements and expectations for ground system testing and certifications, removing unnecessary cross references and clarifying the requirements for main ground bar attachments.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or to my attention via e-mail at SP965RP or rudy.powell@dot.state.fl.us. Comments received after **August 2, 2011** may not be considered. Your input is encouraged.

RP/ft
Attachment

INTELLIGENT TRANSPORTATION SYSTEMS - INFRASTRUCTURE.

(REV ~~1-31-11~~~~6-29-11~~) (~~FA 2-24-11~~) (~~7-11~~)

SUBARTICLE 785-2.1 (of the Supplemental Specifications) is deleted and the following substituted:

785-2.1 Description: Furnish and install grounding and Surge Protective Devices (SPDs) for all ITS devices to protect the devices from lightning, transient voltage surges, and induced current. References for this section include, but are not limited to: UL467, Grounding and Bonding Equipment; UL497A, Standard for *Safety of Secondary Protectors for Communications Circuits*; *UL497B, Standard for Safety of Protectors for Data Communications and Fire-Alarm Circuits*; *UL497C, Standard for Safety of Protectors for Coaxial Communications Circuits*; *UL752, Standard of Safety for Bullet-Resisting Equipment*; *UL1008, Standard for Safety for Transfer Switch Equipment*; *UL1449, Surge Protective Devices*; and the NEC. Ensure that lightning protection systems conform to the requirements of NFPA 780, Standard for the Installation of Lightning Protection Systems.

SUBARTICLE 782-2.3.3 (of the Supplemental Specifications) is deleted and the following substituted:

785-2.3.3 Ground Resistance Testing and Certification: Measure the ground resistance with an instrument designed specifically to measure and document earth/ground resistance, soil ~~resistance~~*resistivity*, and current flow. Conduct the test by using the Fall-of-Potential method. Provide the Engineer with written, *certified* test results for each testing location, *signed by all personnel conducting and witnessing the test. Provide the following information on the test results:* ~~Include in the test results the instrument model and date of calibration for the device used in the testing, the local environmental conditions at the time of testing, and a full Fall-of-Potential graph. Certify and sign the test results submitted.~~

- 1. The formal name or ID for the location where the test was performed;*
 - 2. The GPS latitude and longitude for the location where the test was performed;*
 - 3. The date on which the test was performed;*
 - 4. The make and model number, serial number, and last date of calibration (by an independent testing facility within the previous 12 months) for the grounding resistance testing device used;*
 - 5. The names and signatures of personnel conducting, witnessing, and certifying the test;*
 - 6. The local environmental and soil conditions at the time of testing;*
 - 7. A rough sketch of the site grounding system;*
- A full Fall-of-Potential graph, along with the corresponding measured data points; and*
- 8. Page numbering showing the current page number and total page count (e.g., Page 1 of 3).*

SUBARTICLE 782-2.4.4 (of the Supplemental Specifications) is deleted and the following substituted:

785-2.4.4 SPD for Low-Voltage Power, Control, Data and Signal Systems:

Install a specialized SPD on all conductive circuits including, but not limited to, data communication cables, coaxial video cables, and low-voltage power cables. Ensure that these devices comply with the functional requirements shown in Table 785-1 for all available modes (i.e. power L-N, N-G; *L-G*, data and signal center pin-to-shield, L-L, L-G, and shield-G where appropriate).

Table 785-1				
SPD Minimum Requirements				
Circuit Description	Clamping Voltage	Data Rate	Surge Capacity	Maximum Let-Through Voltage
12 VDC	15-20 V	N/A	5kA per mode (8x20 μ s)	<150 Vpk
24 VAC	30-55 V	N/A	5kA per mode (8x20 μ s)	<175 Vpk
48 VDC	60-85 V	N/A	5kA per mode (8x20 μ s)	<200 Vpk
120 VAC at POU	150-200 V	N/A	20kA per mode (8x20 μ s)	<550 Vpk
Coaxial Composite Video	4-8 V	N/A	10kA per mode (8x20 μ s)	<30 Vpk
RS422/RS485	8-15 V	Up to 10 Mbps	10kA per mode (8x20 μ s)	<30 Vpk
T1	13-30 V	Up to 10 Mbps	10kA per mode (8x20 μ s)	<30 Vpk
Ethernet Data	7-12 V	Up to 1 Gbps	1kA per mode (10x1000 μ s)	<30 Vpk

Install a SPD that has an operating voltage matching the characteristics of the circuit. Ensure that these specialized SPDs are UL 497B or UL 497C listed, as applicable.

SUBARTICLE 782-3.2.2 (of the Supplemental Specifications) is deleted and the following substituted:

785-3.2.2 Lowering Device: Use a lowering device as shown in the plans. Use only lowering device equipment and components that meet the requirements of these minimum specifications, and are listed on the Department's Approved Product List (APL). The lowering device must be permanently marked with the APL certification number, manufacturer name, model number, and date of manufacture.

Ensure that the lowering device provides the electrical connections between the control cabinet and the equipment installed on the lowering device without reducing the function or effectiveness of the equipment installed on the lowering device or degrading the overall system in any way. The lowering device system support arm must be capable of withstanding service tension and shear up to 1 kip (kilopound) minimum.

Ensure that the lowering device includes a disconnect unit for electrically connecting the equipment installed on the lowering device's equipment connection box to the power, data, and video *composite* cables (as applicable); a divided support arm, a pole adapter for the assembly's attachment to the rotatable pole-top tenon, and a pole-top junction box, as shown in the plans.

Ensure that all of the lowering device's external components are made of corrosion-resistant materials that are powder-coated, galvanized, or otherwise protected from the environment by industry-accepted coatings that withstand exposure to a corrosive environment. All finished castings must have a smooth finish free from cracks, blow-holes, shrinks, and other flaws. All roller fairlead frames shall be corrosion resistant stainless steel or aluminum.

The lowering device must be provided with a minimum of 100 feet of composite power and signal cable prewired to the lowering device at the factory unless otherwise shown in the plans. *Ensure there are no splices in prewired cable.*

785-3.2.2.1 Equipment Connection Box: Provide an equipment connection box for connecting the CCTV camera or other ITS device to the lowering device. The equipment connection box must include a 1.5 inch National Pipe Thread (NPT) pipe connection point for attaching a camera. Ensure that the equipment connection box has an ingress protection rating of no less than IP55.

785-3.2.2.2 Disconnect Unit: Ensure that the disconnect unit has a minimum load capacity of 600 pounds with a 4:1 safety factor. Ensure that the fixed and movable components of the disconnect unit have a locking mechanism between them. Provide a minimum of two mechanical latches for the movable assembly. Ensure that all load is transferred from the lowering cable to the mechanical latches when the system is in the latched position. Ensure that the fixed unit has a heavy-duty cast tracking guide and a means to allow latching in the same position each time.

Ensure that the disconnect unit is capable of securely holding the lowering device and the equipment installed on the lowering device. Use interface and locking components that are stainless steel or aluminum.

785-3.2.2.2.1 Disconnect Unit Housing: Ensure that the disconnect unit housing is provided with a gasket to seal the interior from dust and moisture. Ensure that the disconnect unit housing has an ingress protection rating of no less than IP55.

785-3.2.2.2.2 Connector Block: Provide modular, self-aligning and self-adjusting female and male socket contact halves in the connector block. Equip the lowering device with enough contacts to permit operation of all required functions of the camera,

up to a maximum of 20 contacts. Provide at least two spare contacts. Provide contact connections between the fixed and movable lowering device components that are capable of passing EIA-232, EIA-422, EIA-485, and Ethernet data signals and 1 volt peak to peak (V_{p-p}) video signals, as well as 120 V_{AC}, 9-24 V_{AC}, and 9-48 V_{DC} power. Ensure that lowering device connections are capable of carrying the signals, voltages, and current required by the device(s) connected to them under full load conditions. Submit documentation showing pin assignment for approval.

Provide corrosion-resistant stainless steel hardware. ~~Apply anti-corrosive lubricant between all dissimilar metals.~~ *Ensure all components, including the connector block and contacts, are lubricated in accordance with the manufacturer's instructions.* Ensure that male contacts used for grounding mate first and break last. Ensure that all contacts and connectors are self-aligning and self-adjusting mechanical systems. Provide a spring-assisted contact assembly to maintain constant pressure on the contacts when the device is in the latched position.

Provide connector pins made of brass- or gold-plated nickel, or gold-plated copper.

Ensure that the current-carrying male and female contacts are a minimum of 0.09 inch in diameter and firmly affixed to the connector block. Ensure mated connectors do not allow water penetration.

SUBARTICLE 785-4.2.9 (of the Supplemental Specifications) is deleted and the following substituted:

785-4.2.9 Electrical Requirements: Ensure that all equipment furnished conforms to applicable UL, NEC, EIA, ASTM, ANSI, and IEEE requirements. ~~Provide surge protection for the main AC power input at the service panel assembly and at the point of use for electronics as required by 785-2.~~ Ensure that the SPD is accessible from the front of any panel used in the cabinet. Connect the SPD for the cabinet's main AC power input on the load side of the cabinet circuit breaker.

Ensure that the wiring in the cabinet conforms to NEC requirements. Use only conductors that are stranded copper. Lase all wiring.

785-4.2.9.1 Service Panel Assembly: Provide a service panel assembly to function as the entry point for AC power to the cabinet and the location for power filtering, transient suppression and equipment grounding. Provide branch circuits, SPDs, and grounding as required for the load served by the cabinet, including ventilation fans, internal lights, electrical receptacles, etc.

785-4.2.9.2 Terminal Blocks: Terminate electrical inputs and outputs on terminal blocks where the voltage and current rating of the terminal block is greater than the voltage and current rating of the wire fastened to it.

Terminate conductors on terminal blocks using insulated terminal lugs large enough to accommodate the conductor to be terminated. When two or more conductors are terminated on field wiring terminal block screws, use a terminal ring lug for termination of those conductors. Number all terminal block circuits and cover the blocks with a clear insulating material to prevent inadvertent contact.

785-4.2.9.3 Ground Bus Bar: Ensure that ground bus bars are fabricated from a copper alloy material compatible with copper wire. Use ground bus bars that have at least two positions where a No. 2 AWG stranded copper wire can be attached.

Mount the ground bus bar on the side of the cabinet wall adjacent to the service panel assembly for the connection of AC neutral wires and chassis ground wires. If more than one ground bus bar is used in a cabinet, use a minimum of a No. 10 AWG copper wire to interconnect them. *Ensure that the equipment rack is connected to the ground bus bar within the cabinet maintaining electrical continuity throughout the cabinet.*

Follow the PANI recommendations of USDA-RUS-1751 for connections to the ground bus bar. Producer (P) or electrical power and sources of stroke current connections shall be on the left end of the bus bar. Absorbing (A) or grounding wires shall be connected immediately right of the P connections. Non-isolated (N) connections such as doors and vents shall be connected to the right of the A connections. Isolated (I) equipment grounds from equipment in the cabinet shall be connected on the right end of the bus bar.

785-4.2.9.4 Power Distribution Assembly: Furnish a power distribution assembly that fits in the EIA 19-inch rack and provides for protection and distribution of 120V_{AC} power unless otherwise shown in the plans.

785-4.2.9.5 Interior Lighting: Unless otherwise shown in the plans, provide the field cabinet with two 20-watt fluorescent lamps and clear shatter-proof shield assemblies which are mounted on the inside front and rear top of the cabinet. Ensure that these lamps are unobstructed and able to cast light on the equipment. Equip the field cabinet with door-actuated switches so that the lamps automatically turn on when either cabinet door is opened and turn off when the doors are closed.

785-4.2.9.6 Generator and Auxiliary Power Connection: Unless otherwise shown in the plans, furnish a cabinet that has provisions for the connection of an external power source, such as a portable generator, through a weatherproof, water-resistant, secure interface. This feature should allow authorized personnel to access, connect, and secure an external power source to the cabinet in order to restore power within 5 minutes of arrival time at the cabinet. Provide the cabinet with either a manual or automatic transfer switch as shown in the plans. Provide a transfer switch rated equal to or higher than the design load of the cabinet's main breaker and the generator input twist-lock connector rating. Ensure that the transfer switch provides a means of switching between normal utility power and auxiliary backup generator power. Ensure that the switching time between sources is no longer than 250 milliseconds. Ensure that the transfer switch meets UL 1008. Ensure that the transfer switch does not allow simultaneous active power from more than one source and does not allow generator backflow into normal utility AC circuits.

785-4.2.9.6.1 Manual Transfer Switch: Ensure the manual transfer switch is a two-position switch. Label the switch positions as "Generator Power" and "Utility Power".

Equip the transfer switch with a "Utility-on" indicator, which will illuminate when normal utility power service is available and the switch is in the "Generator Power" position. The indicator must turn off when the transfer switch is moved to the "Utility Power" position. Ensure that the Utility-on indicator is clearly visible outside the cabinet and that the indicator's on/off state can be visually determined from a distance of 30 feet.

785-4.2.9.6.2 Automatic Transfer Switch: An automatic transfer switch may be used instead of a manual transfer switch to provide for automatic transition from generator power back to normal utility service after utility power is restored. Ensure that the automatic transfer switch has indicators that display the status of connected power sources and indicate which power source is actively energizing the cabinet.

If a relay circuit is used to provide switching, the normally closed circuits must be connected to normal utility power. The relay shall be energized only by the generator, not by the electric utility service. When energized, the relay must break the connection to normal utility power and make connection to the generator power input. Any automatic transfer switch or relay operated switch must include a bypass switch that disables automatic switching and permits manual selection of the power sources connected to the cabinet.

785-4.2.9.6.3 Generator Access Panel: Include a generator connection panel consisting of, at a minimum, the manual transfer switch and three-prong, 30-amp twist-lock connector with recessed male contacts for generator hookup. Locate and label the transfer switch and twist lock connector on a panel easily accessible behind a lockable exterior door. Ensure that this access door is labeled as “Generator Access Door”, equipped with a tamper-resistant hinge, and that the door assembly is weatherproof and dustproof. The access door shall be provided with a #2 lock unless otherwise specified in the plans. The access door must include a weatherproof opening for the generator cable. The generator hookup compartment must be recessed into the cabinet and be deep enough to allow closing and locking of the access door when the generator cable is connected. Limit the generator hookup compartment and access panel’s intrusion into the cabinet interior to no more than 6 inches. Avoid blocking access to any other equipment in the cabinet. Locate this generator panel as close as possible to the main AC circuit breaker. Ensure that the bottom of the access panel is no less than 24 inches above the bottom of the cabinet. Never locate the generator access panel on the main cabinet door or back door.

Connect wiring from the Cabinet AC+ Input Terminal to the transfer switch. Connect the alternate power source’s wiring on the transfer switch to a receptacle that can accept a 120 V_{AC} generator cord. Install a power service wire between the transfer switch and the existing power distribution panel in the cabinet.

SUBARTICLE 785-5.3.4 (of the Supplemental Specifications) is deleted and the following substituted:

785-5.3.4 Grounding Installation: ~~Install a grounding system that meets the requirements in 785-2, in the NEC, and that meets the grounding requirements of the local building code.~~

—————Install all grounds for the equipment shelter on the side of the building that utilities, communication cables, and fiber enter. Install the main ground bar on a suitable wall of the building. Connect all earth grounds to this point, including the grounding system for the surge protection devices (SPDs). Make all connections to SPDs according to the manufacturer’s recommendations.

Ensure that the grounding system is bonded at a single point so that the communication cables, AC power, emergency generator, and equipment frames are connected by the shortest practical route to the grounding system. Protect the lead lengths from each device to the SPD.

Use an exothermic bonding process for all external connections. Ensure that external connections and ground rods remain accessible for inspection, testing, and maintenance during and after construction.

Use compression type connection for all interior connections to bond ground conductors to equipment in the shelter. For connections to bus bars, use mechanical

connections having two bolts on a double-lug connector. After achieving a firm connection to the connectors, apply an anti-oxidant compound.

Ensure that all ground connections to fence components are mechanical bonds. After a firm connection has been achieved, apply an anti-oxidant compound.

For connection of conductors to interior equipment, such as panels and cable trays, use two bolts on a double-lug connector, or clamps appropriate to the size and type of wire and the requirements of the equipment being grounded. Crimp and solder all wires connected to lugs or clamps for reliable electrical contact. Remove all non-conducting surface coatings before each connection is made. Apply an anti-oxidant compound. Install star washers, or another means that accommodates the fasteners used, to achieve reliable electrical connections that will not deteriorate.

Ensure that ground conductors are downward coursing and vertical, and as short and straight as possible. Ensure that the minimum bending radius for interior equipment shelter grounds is 8 inches. Avoid sharp bends and multiple bends in conductors in all cases.

Follow the PANI recommendations of USDA-RUS-1751 for connections to the ground bus bar. Producer (P) or electrical power and sources of stroke current connections shall be on the left end of the bus bar. Absorbing (A) or grounding wires shall be connected immediately right of the P connections. Non-isolated (N) connections such as doors and vents shall be connected to the right of the A connections. Isolated (I) equipment grounds from equipment in the cabinet shall be connected on the right end of the bus bar.

785-5.3.4.1 Interior Grounding: Install a No. 2 AWG solid bare copper wire approximately 1 foot below the ceiling on each wall and mount it using insulated standoffs. Ensure that the wire encircles the equipment room, forming a ring or continuous loop along the upper interior perimeter ground, and includes the wall area above the door. Mechanically connect the cable trays to the upper interior perimeter ground using stranded copper wires with green insulation and bolted terminal connectors at the cable tray ends. Make all points where cable tray sections meet electrically continuous by use of a short jumper wire with terminals attached at each end.

Directly bond all other metallic objects, such as door frames and doors, air conditioners, alarm systems, wall-mounted communication equipment, etc., to the closest interior perimeter ground with the shortest possible stranded copper wire with green insulation. Bond the door to the doorframe using flexible welding cable.

785-5.3.4.2 Exterior Grounding: Install an exterior grounding system consisting of multiple ground rods around the perimeter of the equipment shelter to achieve the resistance to ground required in [Section 785-2.3](#). Space the rods according to 785-2.3.2 and drive them into the ground using the proper tool to prevent rod deformation. Place the rods a minimum of 2 feet from the building foundation in a suitable access point. Ensure that 6 to 10 inches of the ground rod is accessible for inspection, testing, and maintenance during and after construction. Bond the ground rods together using No. 2 AWG solid bare tinned copper wire and an exothermic bonding process. Bury the bonding wires a minimum of 18 inches below grade. Also bond the following items to the shelter's grounding system using No. 2 AWG solid bare tinned copper wire:

1. Metal building parts not grounded by the internal grounding rings, such as downspouts and siding.
2. Ground rods provided by power or telephone utilities for grounding of AC power or surge protection devices, as permitted by local codes.

3. Shelter support skids, bases, or foundations, if applicable.
4. Any metal object larger than 4 square feet.
5. External metal fencing.

785-5.3.4.3 Punch Block SPD Grounding: For all Type 66 punch blocks, install No. 2 AWG solid bare tinned copper wire to ground external line surge protection devices. Install the No. 2 AWG solid bare tinned copper wire in accordance with the SPD manufacturer's recommendations and mechanically connect them to the shelter's interior perimeter ground.

SUBARTICLE 785-6.3 (of the Supplemental Specifications) is deleted and the following substituted:

785-6.3 Surge Protective Devices: Provide a SPD that is warranted by its manufacturer against any failures caused by electrical events, including direct lightning strikes, for a period of not less than 10 years or the SPD device manufacturer's standard warranty period, whichever is greater.

The term "failure" for warranty replacement is defined as follows:

Parallel-connected, power-rated SPD units are considered in failure mode when any of the ~~indicating lamps~~ *visual indicators* shows failure mode when power is applied to the terminals at the unit's rated voltage, or the properly functioning over-current protective device will not reset after tripping.

Series-connected, low-voltage power, data, or signal units are considered in the failure mode when an open circuit condition is created and no data/signal will pass through the SPD device or a signal lead is permanently connected to ground.

In the event that the SPD, including any component of the unit, should fail during the warranty period, the entire SPD shall be replaced by the manufacturer at no cost to the Department. Costs relating to the removal of the SPD, shipping and handling, and the reinstallation of the SPD shall be paid by the Department.