



Florida Department of Transportation

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SECRETARY

February 3, 2020

Khoa Nguyen
Director, Office of Technical Services
Federal Highway Administration
3500 Financial Plaza, Suite 400
Tallahassee, Florida 32312

Re: State Specifications Office
Section: **996**
Proposed Specification: **9960400 Intelligent Transportation System Materials.**

Dear Mr. Nguyen:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

The changes are proposed by Derek Vollmer from the Traffic Engineering and Operations Office to move the material articles and subarticle in Section 620, 635, and 641 from Division II to Division III.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to daniel.strickland@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4130.

Sincerely,

Signature on file

Daniel Strickland, P.E.
State Specifications Engineer

DS/ra

Attachment

cc: Florida Transportation Builders' Assoc.
State Construction Engineer

**INTELLIGENT TRANSPORTATION SYSTEM DEVICE MATERIALS
(REV 11-4-20)**

SECTION 996 is expanded by the following new Articles:

996-4 Grounding and Lightning Protection.

996-4.1 General: Surge Protective Devices for traffic control devices, including intelligent transportation system (ITS), shall be listed on the Department’s Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.

996-4.2 Surge Protective Device.

996-4.2.1 Description: Surge Protective Devices (SPDs) protect electronics from lightning, transient voltage surges, and induced current.

996-4.2.2 SPD for 120 Volt or 120/240 Volt Power: The SPD shall include L-N, L-G, and N-G protection and have a maximum surge current rating of 50 kA per phase or greater. The SPD shall meet the requirements of UL 1449, Third Edition and be listed by a NRTL.

The SPD shall have a visual indication system that monitors the weakest link in each mode and shows normal operation or failure status and also provides one set of normally open (NO)/normally closed (NC) Form C contacts for remote alarm monitoring. The enclosure for a SPD shall have a NEMA 4 rating.

996-4.2.3 SPD at Point of Use: The SPD shall comply with the minimum functional requirements shown in Table 996-3. The units shall be rated at 15 or 20 amps load and are configured with receptacles.

The units shall have internal fuse protection and provide common mode (L+N-G) protection.

996-4.2.4 SPD for Low-Voltage Power, Control, Data and Signal Systems: The SPD devices shall comply with the minimum functional requirements shown in Table 996-3 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).

<u>Table 996-3</u>				
<u>SPD Minimum Requirements</u>				
<u>Circuit Description</u>	<u>Clamping Voltage</u>	<u>Data Rate</u>	<u>Surge Capacity</u>	<u>Maximum Let-Through Voltage</u>
<u>12 V_{DC}</u>	<u>15-20 volts</u>	<u>N/A</u>	<u>5kA per mode (8x20 μs)</u>	<u><150 V_{pk}</u>
<u>24 V_{AC}</u>	<u>30-55 volts</u>	<u>N/A</u>	<u>5kA per mode (8x20 μs)</u>	<u><175 V_{pk}</u>
<u>48 V_{DC}</u>	<u>60-85 volts</u>	<u>N/A</u>	<u>5kA per mode (8x20 μs)</u>	<u><200 V_{pk}</u>

<u>Table 996-3</u>				
<u>SPD Minimum Requirements</u>				
<u>Circuit Description</u>	<u>Clamping Voltage</u>	<u>Data Rate</u>	<u>Surge Capacity</u>	<u>Maximum Let-Through Voltage</u>
<u>120 V_{AC} at POU</u>	<u>150-200 volts</u>	<u>N/A</u>	<u>20kA per mode (8x20 μs)</u>	<u><550 Vpk</u>
<u>Coaxial Composite Video</u>	<u>4-8 volts</u>	<u>N/A</u>	<u>10kA per mode (8x20 μs)</u>	<u><65 Vpk (8x20 μs/1.2x50μs; 6kV, 3kA)</u>
<u>RS422/RS485</u>	<u>8-15 volts</u>	<u>Up to 10 Mbps</u>	<u>10kA per mode (8x20 μs)</u>	<u><30 Vpk</u>
<u>T1</u>	<u>13-30 volts</u>	<u>Up to 10 Mbps</u>	<u>10kA per mode (8x20 μs)</u>	<u><30 Vpk</u>
<u>Ethernet Data</u>	<u>7-12 volts</u>	<u>Up to 1 Gbps</u>	<u>1kA per mode (10x1000 μs)</u>	<u><30 Vpk</u>
<u>POE</u>	<u>60-70 volts</u>	<u>Up to 1 Gbps</u>	<u>5kA per mode (8x20 μs)</u>	<u><200Vpk (100kHz 0.5μs; 6kV, 500A)</u>

The SPDs shall meet the requirements of UL 497B or UL 497C, as applicable, and are listed by a NRTL.

996-4.2.5 Mechanical Specifications: The equipment shall be permanently marked with manufacturer name or trademark, part number, and date of manufacture or serial number.

All parts shall be made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal.

996-4.2.6 Environmental Specifications: The SPDs shall operate properly during and after being subjected to the temperature and humidity test described in NEMA TS 2, Section 2.2.7, and the vibration and shock tests described in NEMA TS 2, Sections 2.2.8 and 2.2.9.

996-5 Pull and Splice Boxes.

996-5.1 General: Pull and splice boxes shall be listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.

Manufacturers of concrete pull and splice boxes and covers seeking inclusion on the APL shall meet the requirements of Section 105 and this Section and be listed on the Department's Production Facility Listing.

The box bodies and covers shall be free of flaws such as cracks, sharp, broken, or uneven edges, and voids.

Ensure in-ground boxes have an open bottom design.

996-5.2 Marking: The following information shall be permanently cast or engraved into the top surface of all pull and splice box covers. If used, identification plates shall be UV stable, mechanically fastened, and bonded with adhesive material suitable for outdoor applications

1. Mark application as follows:

FDOT TRAFFIC SIGNAL for signalized intersections

FDOT FIBER OPTIC CABLE for fiber optic cable

FDOT LIGHTING for highway lighting

FDOT TRAFFIC MONITORING for traffic monitoring

FDOT ELECTRICAL for other electrical applications

2. Manufacturer's name or logo

3. FDOT APL approval number

4. TIER rating

The date of manufacture (month/day/year, or date code) shall be permanently located on the top or bottom of the cover. The interior of the box body shall have a permanent marking that includes the manufacturer part/model number and date of manufacture near the top of box in a location that is visible after installation when the cover is removed.

996-5.3 Dimensions:

For signalized intersection and lighting applications, pull boxes with nominal cover dimensions of 13 inches wide by 24 inches long or larger and no less than 12 inches deep shall be provided. The inside opening area shall be a minimum of 240 square inches and no inside dimension shall be less than 12 inches.

For fiber optic cable applications, pull boxes with nominal cover dimensions of 24 inches wide by 36 inches long or larger and no less than 24 inches deep shall be provided.

Rectangular splice boxes with nominal cover dimensions of 30 inches wide by 60 inches long or larger and no less than 36 inches deep shall be provided. Round splice boxes with a nominal cover diameter of 36 inches or larger and no less than 36 inches deep shall be provided.

996-5.4 Fabrication: Box covers shall be constructed of concrete, polymer concrete or other materials meeting the requirements of this Section.

Box covers with lifting slots and a flush-seating lockdown mechanism shall be provided. Penta-head or other non-standard, security type lockdown lag bolts shall be used. Lockdown bolts and lifting slots shall be Type 316, 304, or 302 passivated stainless steel or brass. Lockdown bolt assembly shall be designed to prevent seizing and can be removed without damaging the cover or box body. The lockdown bolt threaded insert/nut assembly shall be field replaceable.

996-5.5 Testing Requirements: Pull and splice boxes shall meet the American National Standards Institute/Society of Cable Telecommunications Engineers (ANSI/SCTE) 77 2017 Specification for Underground Enclosure Integrity for TIER 15 loading with the following additional clarifications and requirements:

1. Apply all environmental tests to the box and its cover.

2. All flexural testing shall be conducted in accordance with an appropriate ASTM standard and clearly stated in the report.

3. Perform repetitions of Cycle 1 in Table X2.1 of ASTM G154 for a minimum duration of 1000 hours for the simulated sunlight exposure test.

4. Use deflection-measuring devices positioned to measure vertical and lateral deflection (wherever maximum deflection occurs) for the vertical sidewall load test.

5. Conduct the lateral sidewall pressure, vertical sidewall load and cover vertical load tests without any removable or permanent wall to wall supporting beams located in the interior or top of the box opening.

When testing pull and splice boxes of various sizes (width x length x depth), the cover impact test, internal equipment protection test, coefficient of friction test, and all environmental tests, can be completed using a single representative box/cover (instead of samples from all box/cover sizes) as long as the test report indicates the following:

1. Materials of construction, compositions, and manufacturing processes are identical for all box and cover sizes submitted for listing on the APL
2. Size (width x length x depth) of the representative box/cover.

996-6 Camera Lowering Device.

996-6.1 General: Camera lowering devices shall be listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.

The lowering device shall provide the electrical connection between the control cabinet and the equipment installed on the lowering device without reducing the function or effectiveness of the equipment. The lowering device system support arm shall be capable of withstanding service tension and shear up to 1 kip minimum.

The lowering device shall include a disconnect unit and power, data, and video cables (as applicable) for connecting equipment, a divided support arm, pole attachment provisions, a rotatable pole-top tenon, and a pole-top junction box.

All external components shall be made of corrosion-resistant materials that are powder-coated, galvanized, or otherwise protected from the environment. All finished castings shall 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. All pulleys used in the lowering device and portable lowering tool shall have sealed, self-lubricated or oil-tight bearings, or sintered bronze bushings.

A minimum of 100 feet of composite power and signal cable prewired to the lowering device at the factory shall be provided. Splices will not be allowed.

Lowering devices shall be designed to withstand the design wind speeds defined in the Department's Structures Manual.

Lowering devices shall be marked with manufacturer name or trademark, model or part number, date of manufacture, and serial number.

996-6.2 Equipment Connection Box: A 1-1/2 inch National Pipe Thread (NPT) pipe connection point for attaching a camera shall be included. The equipment connection box shall have an ingress protection rating of no less than IP55.

996-6.3 Disconnect Unit: The disconnect units shall have a minimum load capacity of 600 pounds with a 4:1 safety factor and be capable of securely holding the lowering device and any installed equipment. Fixed and movable components of the disconnect unit shall have a locking mechanism between them, with at least two mechanical latches for the movable assembly. The fixed unit shall have a heavy-duty cast tracking guide that allows latching in the same position each time. The load shall be transferred from the lowering cable to the mechanical latches when the system is in the latched position. Interface and locking components shall be constructed of stainless steel or aluminum.

996-6.3.1 Disconnect Unit Housing: The disconnect unit housing shall be weather-proof with an ingress protection rating of no less than IP55.

996-6.3.2 Connector Block: Modular, self-aligning and self-adjusting female and male socket contact halves in the connector block shall be provided. Equip the lowering device with enough contacts to permit operation of all required functions of the camera, up to a

maximum of 20 contacts and include at least two spare contacts. 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 (Vp-p) video signals, as well as 120 V_{AC}, 9-24 V_{AC}, and 9-48 V_{DC} power shall be provided. The lowering device connections shall be capable of carrying the signals, voltages, and current required by the devices connected to them under full load conditions.

Only corrosion-resistant stainless steel hardware shall be used. male contacts used for grounding shall mate first and break last. All contacts and connectors shall be self-aligning and self-adjusting mechanical systems. A spring-assisted contact assembly to maintain constant pressure on the contacts when the device is in the latched position shall be provided.

Connector pins made of brass- or gold-plated nickel, or gold-plated copper shall be provided.

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

996-6.4 Lowering Tool: A portable metal-frame lowering tool manufactured of corrosion-resistant materials with winch assembly and a cable with a combined weight less than 35 lbs that is capable of securely supporting itself and the load shall be provided. The lowering tool shall include a quick release cable connector, and a torque limiter that will prevent over-tensioning of the lowering cable and be equipped with gearing that reduces the manual effort required to operate the lifting handle to raise and lower a capacity load. Ensure that the lowering tool can be powered using a 1/2-inch chuck, variable-speed reversible industrial-duty electric drill capable of matching the manufacturer-recommended revolutions per minute. An adapter with a clutch mechanism and torque limiter for use with the drill shall be provided.

The winch assembly shall have a minimum drum size width of 3.75 inches and a positive braking mechanism to secure the cable reel during raising and lowering operations, and to prevent freewheeling. The lowering cable shall wind evenly on the winch drum during operation. Provide a manual winch handle that incorporates a non-shear pin type torque limiter that can be used repeatedly and will not damage the lowering system.

Provide a minimum of one lowering tool and any additional tools required to operate the lowering device.

996-6.5 Lowering Cable: The lowering cable shall be 0.125-inch minimum diameter Type 316 stainless steel aircraft cable (7 strands x 19 gauge) with a minimum breaking strength of 1,760 pounds. Additionally, the lowering cable assembly (as installed with thimble and crimps on one end and a cable clamp inside the latch on the lowering device end), shall have a minimum breaking strength of 1,760 lbs.

All lowering cable accessories, such as connecting links, shall have a minimum workload rating that meets or exceeds that of the lowering cable.

Prefabricated components for the lift unit support system shall prevent the lifting cable from contacting the power or video cables.

996-6.6 Wiring: All wiring must meet NEC requirements.

996-6.7 External-Mount Lowering System Enclosure for Mounting to Existing Structures: The system shall include an upper mounting/junction box, winch assembly and all external conduit and cabling necessary for mounting to existing structures.

A NEMA 4 rated lower lockable pole-mounted cabinet, constructed of corrosion-resistant 5052 sheet aluminum with a minimum thickness of 1/8 inch, to house the winch assembly shall be provided. The cabinet shall allow for unobstructed operation of the winch, access for servicing and provide sufficient clear area for operation of the winch manually and with an electric drill. The outside surface of the cabinet shall have a smooth, uniform natural aluminum finish. All inside and outside edges of the winch cabinet shall be free of burrs, and all welds must be neatly formed, free of cracks, blow holes, and other irregularities. Cabinet hinges shall be vandal-resistant and constructed of 14 gauge stainless steel or 1/8 inch aluminum with stainless steel hinge pins.

The cabinet door shall be double-flanged and include neoprene closed-cell gaskets permanently secured on the interior door surfaces that contact the door opening. The cabinet door shall not sag. Include a pin tumbler lock keyed for use with a No. 2 key and two keys. The cabinet door handle shall include a lock hasp that will accommodate a padlock with a 7/16-inch diameter shackle.

The upper mounting/junction box shall include a maintenance access door with captive attachment hardware. All necessary mounting hardware, conduits, standoffs, and conduit mounts required for a complete and functional system shall be provided.

The external conduit shall be galvanized Schedule 40 with National Pipe Thread Taper (NPT) threads and have a minimum ID of 3 inches at the lower winch cabinet entrance and allow the lowering cable to wind evenly on the winch drum without binding. All conduit couplings and connections between the pole-mounted cabinet and upper mounting/junction box shall be watertight.

**INTELLIGENT TRANSPORTATION SYSTEM DEVICE MATERIALS
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996-4.1 General: Surge Protective Devices for traffic control devices, including intelligent transportation system (ITS), shall be listed on the Department’s Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.

996-4.2 Surge Protective Device.

996-4.2.1 Description: Surge Protective Devices (SPDs) protect electronics from lightning, transient voltage surges, and induced current.

996-4.2.2 SPD for 120 Volt or 120/240 Volt Power: The SPD shall include L-N, L-G, and N-G protection and have a maximum surge current rating of 50 kA per phase or greater. The SPD shall meet the requirements of UL 1449, Third Edition and be listed by a NRTL.

The SPD shall have a visual indication system that monitors the weakest link in each mode and shows normal operation or failure status and also provides one set of normally open (NO)/normally closed (NC) Form C contacts for remote alarm monitoring. The enclosure for a SPD shall have a NEMA 4 rating.

996-4.2.3 SPD at Point of Use: The SPD shall comply with the minimum functional requirements shown in Table 996-3. The units shall be rated at 15 or 20 amps load and are configured with receptacles.

The units shall have internal fuse protection and provide common mode (L+N-G) protection.

996-4.2.4 SPD for Low-Voltage Power, Control, Data and Signal Systems: The SPD devices shall comply with the minimum functional requirements shown in Table 996-3 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 996-3				
SPD Minimum Requirements				
Circuit Description	Clamping Voltage	Data Rate	Surge Capacity	Maximum Let-Through Voltage
12 V _{DC}	15-20 volts	N/A	5kA per mode (8x20 μs)	<150 V _{pk}
24 V _{AC}	30-55 volts	N/A	5kA per mode (8x20 μs)	<175 V _{pk}
48 V _{DC}	60-85 volts	N/A	5kA per mode (8x20 μs)	<200 V _{pk}

Table 996-3				
SPD Minimum Requirements				
Circuit Description	Clamping Voltage	Data Rate	Surge Capacity	Maximum Let-Through Voltage
120 V _{AC} at POU	150-200 volts	N/A	20kA per mode (8x20 μs)	<550 Vpk
Coaxial Composite Video	4-8 volts	N/A	10kA per mode (8x20 μs)	<65 Vpk (8x20 μs/1.2x50μs; 6kV, 3kA)
RS422/RS485	8-15 volts	Up to 10 Mbps	10kA per mode (8x20 μs)	<30 Vpk
T1	13-30 volts	Up to 10 Mbps	10kA per mode (8x20 μs)	<30 Vpk
Ethernet Data	7-12 volts	Up to 1 Gbps	1kA per mode (10x1000 μs)	<30 Vpk
POE	60-70 volts	Up to 1 Gbps	5kA per mode (8x20 μs)	<200Vpk (100kHz 0.5μs; 6kV, 500A)

The SPDs shall meet the requirements of UL 497B or UL 497C, as applicable, and are listed by a NRTL.

996-4.2.5 Mechanical Specifications: The equipment shall be permanently marked with manufacturer name or trademark, part number, and date of manufacture or serial number.

All parts shall be made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal.

996-4.2.6 Environmental Specifications: The SPDs shall operate properly during and after being subjected to the temperature and humidity test described in NEMA TS 2, Section 2.2.7, and the vibration and shock tests described in NEMA TS 2, Sections 2.2.8 and 2.2.9.

996-5 Pull and Splice Boxes.

996-5.1 General: Pull and splice boxes shall be listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.

Manufacturers of concrete pull and splice boxes and covers seeking inclusion on the APL shall meet the requirements of Section 105 and this Section and be listed on the Department's Production Facility Listing.

The box bodies and covers shall be free of flaws such as cracks, sharp, broken, or uneven edges, and voids.

Ensure in-ground boxes have an open bottom design.

996-5.2 Marking: The following information shall be permanently cast or engraved into the top surface of all pull and splice box covers. If used, identification plates shall be UV stable, mechanically fastened, and bonded with adhesive material suitable for outdoor applications.

1. Mark application as follows:

FDOT TRAFFIC SIGNAL for signalized intersections
FDOT FIBER OPTIC CABLE for fiber optic cable
FDOT LIGHTING for highway lighting
FDOT TRAFFIC MONITORING for traffic monitoring
FDOT ELECTRICAL for other electrical applications

2. Manufacturer's name or logo
3. FDOT APL approval number
4. TIER rating

The date of manufacture (month/day/year, or date code) shall be permanently located on the top or bottom of the cover. The interior of the box body shall have a permanent marking that includes the manufacturer part/model number and date of manufacture near the top of box in a location that is visible after installation when the cover is removed.

996-5.3 Dimensions:

For signalized intersection and lighting applications, pull boxes with nominal cover dimensions of 13 inches wide by 24 inches long or larger and no less than 12 inches deep shall be provided. The inside opening area shall be a minimum of 240 square inches and no inside dimension shall be less than 12 inches.

For fiber optic cable applications, pull boxes with nominal cover dimensions of 24 inches wide by 36 inches long or larger and no less than 24 inches deep shall be provided.

Rectangular splice boxes with nominal cover dimensions of 30 inches wide by 60 inches long or larger and no less than 36 inches deep shall be provided. Round splice boxes with a nominal cover diameter of 36 inches or larger and no less than 36 inches deep shall be provided.

996-5.4 Fabrication: Box covers shall be constructed of concrete, polymer concrete or other materials meeting the requirements of this Section.

Box covers with lifting slots and a flush-seating lockdown mechanism shall be provided. Penta-head or other non-standard, security type lockdown lag bolts shall be used. Lockdown bolts and lifting slots shall be Type 316, 304, or 302 passivated stainless steel or brass. Lockdown bolt assembly shall be designed to prevent seizing and can be removed without damaging the cover or box body. The lockdown bolt threaded insert/nut assembly shall be field replaceable.

996-5.5 Testing Requirements: Pull and splice boxes shall meet the American National Standards Institute/Society of Cable Telecommunications Engineers (ANSI/SCTE) 77 2017 Specification for Underground Enclosure Integrity for TIER 15 loading with the following additional clarifications and requirements:

1. Apply all environmental tests to the box and its cover.
2. All flexural testing shall be conducted in accordance with an appropriate ASTM standard and clearly stated in the report.
3. Perform repetitions of Cycle 1 in Table X2.1 of ASTM G154 for a minimum duration of 1000 hours for the simulated sunlight exposure test.
4. Use deflection-measuring devices positioned to measure vertical and lateral deflection (wherever maximum deflection occurs) for the vertical sidewall load test.
5. Conduct the lateral sidewall pressure, vertical sidewall load and cover vertical load tests without any removable or permanent wall to wall supporting beams located in the interior or top of the box opening.

When testing pull and splice boxes of various sizes (width x length x depth), the cover impact test, internal equipment protection test, coefficient of friction test, and all environmental tests, can be completed using a single representative box/cover (instead of samples from all box/cover sizes) as long as the test report indicates the following:

1. Materials of construction, compositions, and manufacturing processes are identical for all box and cover sizes submitted for listing on the APL.
2. Size (width x length x depth) of the representative box/cover.

996-6 Camera Lowering Device.

996-6.1 General: Camera lowering devices shall be listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6.

The lowering device shall provide the electrical connection between the control cabinet and the equipment installed on the lowering device without reducing the function or effectiveness of the equipment. The lowering device system support arm shall be capable of withstanding service tension and shear up to 1 kip minimum.

The lowering device shall include a disconnect unit and power, data, and video cables (as applicable) for connecting equipment, a divided support arm, pole attachment provisions, a rotatable pole-top tenon, and a pole-top junction box.

All external components shall be made of corrosion-resistant materials that are powder-coated, galvanized, or otherwise protected from the environment. All finished castings shall 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. All pulleys used in the lowering device and portable lowering tool shall have sealed, self-lubricated or oil-tight bearings, or sintered bronze bushings.

A minimum of 100 feet of composite power and signal cable prewired to the lowering device at the factory shall be provided. Splices will not be allowed.

Lowering devices shall be designed to withstand the design wind speeds defined in the Department's Structures Manual.

Lowering devices shall be marked with manufacturer name or trademark, model or part number, date of manufacture, and serial number.

996-6.2 Equipment Connection Box: A 1-1/2 inch National Pipe Thread (NPT) pipe connection point for attaching a camera shall be included. The equipment connection box shall have an ingress protection rating of no less than IP55.

996-6.3 Disconnect Unit: The disconnect units shall have a minimum load capacity of 600 pounds with a 4:1 safety factor and be capable of securely holding the lowering device and any installed equipment. Fixed and movable components of the disconnect unit shall have a locking mechanism between them, with at least two mechanical latches for the movable assembly. The fixed unit shall have a heavy-duty cast tracking guide that allows latching in the same position each time. The load shall be transferred from the lowering cable to the mechanical latches when the system is in the latched position. Interface and locking components shall be constructed of stainless steel or aluminum.

996-6.3.1 Disconnect Unit Housing: The disconnect unit housing shall be weather-proof with an ingress protection rating of no less than IP55.

996-6.3.2 Connector Block: Modular, self-aligning and self-adjusting female and male socket contact halves in the connector block shall be provided. Equip the lowering device with enough contacts to permit operation of all required functions of the camera, up to a

maximum of 20 contacts and include at least two spare contacts. 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 (Vp-p) video signals, as well as 120 V_{AC}, 9-24 V_{AC}, and 9-48 V_{DC} power shall be provided. The lowering device connections shall be capable of carrying the signals, voltages, and current required by the devices connected to them under full load conditions.

Only corrosion-resistant stainless steel hardware shall be used. male contacts used for grounding shall mate first and break last. All contacts and connectors shall be self-aligning and self-adjusting mechanical systems. A spring-assisted contact assembly to maintain constant pressure on the contacts when the device is in the latched position shall be provided.

Connector pins made of brass- or gold-plated nickel, or gold-plated copper shall be provided.

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

996-6.4 Lowering Tool: A portable metal-frame lowering tool manufactured of corrosion-resistant materials with winch assembly and a cable with a combined weight less than 35 lbs that is capable of securely supporting itself and the load shall be provided. The lowering tool shall include a quick release cable connector, and a torque limiter that will prevent over-tensioning of the lowering cable and be equipped with gearing that reduces the manual effort required to operate the lifting handle to raise and lower a capacity load. Ensure that the lowering tool can be powered using a 1/2-inch chuck, variable-speed reversible industrial-duty electric drill capable of matching the manufacturer-recommended revolutions per minute. An adapter with a clutch mechanism and torque limiter for use with the drill shall be provided.

The winch assembly shall have a minimum drum size width of 3.75 inches and a positive braking mechanism to secure the cable reel during raising and lowering operations, and to prevent freewheeling. The lowering cable shall wind evenly on the winch drum during operation. Provide a manual winch handle that incorporates a non-shear pin type torque limiter that can be used repeatedly and will not damage the lowering system.

Provide a minimum of one lowering tool and any additional tools required to operate the lowering device.

996-6.5 Lowering Cable: The lowering cable shall be 0.125-inch minimum diameter Type 316 stainless steel aircraft cable (7 strands x 19 gauge) with a minimum breaking strength of 1,760 pounds. Additionally, the lowering cable assembly (as installed with thimble and crimps on one end and a cable clamp inside the latch on the lowering device end), shall have a minimum breaking strength of 1,760 lbs.

All lowering cable accessories, such as connecting links, shall have a minimum workload rating that meets or exceeds that of the lowering cable.

Prefabricated components for the lift unit support system shall prevent the lifting cable from contacting the power or video cables.

996-6.6 Wiring: All wiring must meet NEC requirements.

996-6.7 External-Mount Lowering System Enclosure for Mounting to Existing Structures: The system shall include an upper mounting/junction box, winch assembly and all external conduit and cabling necessary for mounting to existing structures.

A NEMA 4 rated lower lockable pole-mounted cabinet, constructed of corrosion-resistant 5052 sheet aluminum with a minimum thickness of 1/8 inch, to house the winch assembly shall be provided. The cabinet shall allow for unobstructed operation of the winch, access for servicing and provide sufficient clear area for operation of the winch manually and with an electric drill. The outside surface of the cabinet shall have a smooth, uniform natural aluminum finish. All inside and outside edges of the winch cabinet shall be free of burrs, and all welds must be neatly formed, free of cracks, blow holes, and other irregularities. Cabinet hinges shall be vandal-resistant and constructed of 14 gauge stainless steel or 1/8 inch aluminum with stainless steel hinge pins.

The cabinet door shall be double-flanged and include neoprene closed-cell gaskets permanently secured on the interior door surfaces that contact the door opening. The cabinet door shall not sag. Include a pin tumbler lock keyed for use with a No. 2 key and two keys. The cabinet door handle shall include a lock hasp that will accommodate a padlock with a 7/16-inch diameter shackle.

The upper mounting/junction box shall include a maintenance access door with captive attachment hardware. All necessary mounting hardware, conduits, standoffs, and conduit mounts required for a complete and functional system shall be provided.

The external conduit shall be galvanized Schedule 40 with National Pipe Thread Taper (NPT) threads and have a minimum ID of 3 inches at the lower winch cabinet entrance and allow the lowering cable to wind evenly on the winch drum without binding. All conduit couplings and connections between the pole-mounted cabinet and upper mounting/junction box shall be watertight.