

Special Specification
6016
ITS Field Equipment Cabinet

1. **Description.** Furnish, install, and test equipment cabinets.
2. **Materials.** Furnish new, corrosion resistant materials. Furnish, assemble, fabricate and install materials as shown on the plans, the requirements of this Item, and with the pertinent requirements of the following:
 - Special Specification, "CCTV Field Equipment,"
 - Special Specification, "Local Control Units,"
 - Special Specification, "Lane Control Signal Head," and
 - Special Specification, "Digital Card Rack Detector Assembly."

Provide cabinets of identical size, shape, and quality for the same type of cabinet. Equip cabinets internally as specified herein. Provide materials that meet NEMA Standards and the requirements of ASTM designation B209 for 5052-H32 aluminum sheet.

- A. Functional Requirements.** House the field equipment inside cabinets as shown on the plans or as directed. Provide cabinets with fully wired equipment panels, terminal blocks, wiring, harnesses, connectors, and attachment hardware for each cabinet.

Provide waterproofed fused and unfused breakaway connectors on the power service conductors. Use a fused breakaway connector for the ungrounded (line) wire. Use an unfused breakaway connector for the grounded (neutral) wire. Install the breakaway connectors prior to the main power panel of the cabinet.

Supply each field cabinet with the following:

- Fan and Thermostat
- Power Distribution Panel
- Adjustable Shelves, as Required
- Cabinet Light
- Surge Protection
- Terminal Blocks
- Conductor Guides
- Interconnect Harnesses with Connectors
- "Door Open" Connection to Equipment Panel
- All Necessary Installation and Mounting Hardware

Furnish additional panels as required by the specific field cabinet type shown on the plans and with the pertinent requirements of the parent special specification.

B. Electrical Requirements.

1. **Primary Input Power Interruption.** Use material that meets the requirements of Section 2.1.4 "Power Interruption" of the NEMA Standard TS 2, latest revision.
2. **Power Service Transients.** Use material that meets the requirements of Section 2.1.6 "Transients, Power Service" of the NEMA Standard TS 2, latest revision.
3. **Power Service Protection.** Use readily accessible and either manually resettable or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.
4. **Uninterruptible Power Supply.** Use uninterruptible power supplies as required in Special Specification, "Uninterruptible Power Supply."
5. **Fail Safe.** Design the material so that the failure of the equipment will not cause the failure of any other unit of equipment.
6. **Power Distribution Panel.** Furnish cabinets with a 115 VAC power distribution panel. Provide the following components on the panel:

- a. **Duplex Service Outlets.** Provide 115 VAC service outlets with integral ground fault interrupt and protected by a circuit breaker. Provide NEMA Type 5-15R duplex receptacles or as required to match connecting electrical equipment as shown in the plans and specifications.

Locate receptacles to minimize electrical hazards to service personnel. Provide at least one outlet for use of service equipment. Other equipment in the cabinet must obtain power from other approved sources.

- b. **Circuit Breakers.** Provide Underwriters Laboratories (UL) listed circuit breakers. Enclose operating mechanisms and mark the switches to indicate whether closed or open. Provide silver alloy contacts and enclose in an arc-quenching chamber.

Provide main circuit breakers as shown on the plans. Provide a single pole 20 A. circuit breaker in each cabinet to protect the lamp, vent, fan, and duplex outlets.

Provide properly rated equipment circuit breakers for the configuration of equipment in each cabinet. Provide circuit breakers capable of operating in accordance with Section 2, "Environmental Standards and Test Procedures" of NEMA TS 2, latest revision. Provide circuit breakers with an interrupt capacity of 5,000 A. and insulation resistance of 100 Megohms at 500 VDC.

Furnish breakers, which are in addition to any auxiliary fuses, with the electronic equipment to protect component parts. Provide an EDCO Model

SHP-300-10S or equivalent 3 terminal lightning arrestor to protect the load side of all circuit breakers. Connect the arrestor into the circuit with No. 8 AWG or larger stranded copper conductors. Connect arrestor to the line filter as recommended by the manufacturer.

- c. **Radio Interference Suppressor.** Equip cabinets with a UL and EIA listed radio interference suppressor on the load side of the circuit breaker. Provide suppressors in series with the incoming AC power line before it is distributed to any equipment in the cabinet. Provide a suppressor with a minimum attenuation of 50 dB. over a frequency range of 200 kilocycles to 75 megacycles. Hermetically seal the suppressor in a substantial metal case, filled with a suitable insulation compound.

Suppressor terminals must be nickel plated brass studs of sufficient external length to provide space for connection of two appropriately sized conductors and must be mounted so that the terminals cannot be turned in the case. Provide suppressors that operate on 120 V, 60 Hz, at the current rating shown on the plans.

- d. **Power Line Surge Protection.** Provide and install power line surge protectors as described below:

- (1) Provide one 3 electrode gas tube type surge protector with the following ratings:
- Impulse breakdown: Less than 1,000 V in less than 0.1 microseconds at 10 kV per microsecond.
 - Standby current: Less than 1 mA.
 - Striking voltage: Limit any voltage greater than 212 VDC.
 - Capable of withstanding 15 pulses of peak current, each of which must rise in 8 microseconds and fall in 20 microseconds to one half the peak voltage, at 3 min. intervals. Peak current rating must be 20,000 A.
- (2) Use both metal oxide varistors and silicon avalanche diodes in surge protectors to protect against transients having a single surge energy level up to 70 joules, voltage transients up to 6 kV, and current transients up to 6 kA. Provide protection for line to neutral, line to ground, and neutral to ground terminals

Provide protectors with the following ratings:

- Recurrent peak voltage 212 V.
- Energy rating minimum 120 joule.
- Power Dissipation - average 0.85 W.
- Peak Current for pulses for less than 6 microseconds 20,000 A.
- Standby current less than 1 mA.

- e. **Power Cable Input Junction Terminals.** Provide power distribution blocks suitable for use as a power feed and junction points for 2 and 3 wire circuits. Provide terminals capable of handling 2 size 1/0 AWG conductors.

Electrically isolate the AC neutral and equipment ground wiring from the line wiring by an insulation resistance of at least 10 megohms when measured at the AC neutral. Color code the AC neutral and equipment grounding wiring as white and green respectively.

- 7. **Wiring.** Identify cabinet wiring where connected to terminal strips, flashers, relays, switches, radio interference suppressors, etc., by the use of preprinted labels of insulated, heat shrinkable, white, polyolefin, sleeving slipped over the wire before attachment of the lug or making the connection.

Print labels using a mechanical device specifically designed for this purpose. Provide labels and a printing device capable of recording and printing at least 15 characters. Print labels using black ink. Provide a legend for labels.

Cut wires to the proper length before assembly. Do not double back wires to take up slack. Cover harnesses to connectors with "Chinese Finger" woven braid. Secure cables with nylon cable clamps. Rack wire runs in conductor guides.

Provide service loops to facilitate removal and replacement of assemblies, panels, and modules. Use insulated parts and wire rated for a minimum of 600 V. Color code harnesses and wiring. Hot-stamp wires every 4 in. indicating the pin number of the connector and terminal number. Do not hot-stamp individual conductors in detector harnesses.

Label harnesses with connectors and pins identified by letters with numbers that correspond to the alphabetic sequence of the pins. Cross-reference each harness to a wiring diagram. Enclose each harness in PVC sheathing, woven braid or braided. Do not use tie wraps, tape, or other cable ties.

Provide sufficient clearance between each terminal and the cabinet to prevent a leakage path or physical contact under stress for electrical connections in the cabinet, including relays, flashers, terminal blocks, etc. Provide barriers for insufficient clearances.

Run equipment grounds directly and independently to the ground bus. Provide sufficient length of cable to reach the electronic equipment on the shelves.

Route and bundle or shield low voltage wiring from AC line voltage wiring. Cover conductors and live terminals or parts with suitable insulating material.

Size AC service lines in accordance with the N.E.C. Use white insulated conductors for AC common. Use green insulated conductors for equipment ground. Use any color different from the foregoing on other conductors. For equipment that requires grounding, use grounding conductors, do not use conduit for grounding. Size the ground conductor in accordance with the N.E.C.

Use No. 22 AWG or larger with a minimum of 19 strands conductors for cabinet wiring. Provide conductors conforming to MIL SPEC MIL-W-168780, Type B or D. Provide insulation with a minimum thickness of 10 mils. Use No. 14 AWG or larger conductors for line voltage wiring. Attach lugs or other approved terminal fittings to wires that attach to binding posts, except when wires are soldered to the post.

Assign the color scheme adopted by Western Electric Telephone standards to all termination points for the 12, 25, or 50 pair cables to insure uniformity within the cabinet.

8. **Terminal Blocks.** Locate terminal blocks on the panels to minimize interference between connecting wires and the cabinet electronic equipment. Locate all terminal blocks below the shelves. Identify terminals by legends permanently marked on the terminal blocks. Bring no more than 3 conductors to any 1 terminal screw. Protect electrically energized components or connectors by a barrier.

Use No. 10-32 nickel or cadmium plated brass binder head screw terminals for field connections. Use No. 5-32 nickel plated brass binder head screw terminals for interwiring connections. Terminate all connections to and from the electronic equipment to an interwiring type block.

9. **Cabinet Internal Grounding.** Provide at least 1 ground bus bar permanently affixed to the cabinet and connected to the grounding electrode for the cabinet internal ground. Use bare stranded No. 6 AWG copper wire between the bus bar and grounding electrode. Provide 20 connector points on each ground bus bar, each capable of securing at least one No. 10 AWG conductor. Use these bus bars for AC neutral and equipment ground wiring.
10. **Transient Suppression.** Provide diodes across the coils for transient suppression in DC relays, solenoids, and holding coils. Provide snubbers in AC contactors.
11. **Communication Interface Panel.** Provide a fully wired communication interface panel as shown on the plans or as directed. Design panels as one integral unit. Provide a 2 conductor, RJ11 phone jack on the panel. Insulate the jack electrically from the panel. Connect phone jack for cabinet pair assignment as shown in Table 1. Connect phone jack for voice pair assignment as shown in Table 2. Connect the phone jack for local limited distance modem assignment as shown in Table 3. Connect phone jack for voice jack assignment as shown in Table 4.

Include the following components on the panel:

- a. **Power Distribution.** Obtain 115 VAC power from the power distribution panel.
- b. **Surge Protection.** Mount surge protection for incoming communication pairs on a distribution panel.

Table 1
Cabinet Pair Assignment

2 Pair to RJ11 Adapter Slot	RJ11 Pin Number	Insulation Color	Input to Surge Protector Terminal Number
1	2	Black	1
2	3	Red	2
3	4	Green	3
4	5	Yellow	4

Table 2
Voice Pair Assignment

2 Pair to RJ11 Adapter Slot	RJ11 Pin Number	Insulation Color	Input to Surge Protector Terminal Number
1	3	Black	5
2	4	Red	6

Table 3
Limited Distance Modem Assignment

Insulation Color	Output from Surge Protector Terminal Number	Modem Connection
Black	1	LCU received data
Red	2	LCU received data
Green	3	LCU transmit data
Yellow	4	LCU transmit data

Table 4
Voice Jack Assignment

Insulation Color	Output from Surge Protector Terminal Number	Modem Connection
Red	5	Voice Jack
Green	6	Voice Jack

C. Mechanical Requirements.

- 1. Size and Construction.** Design cabinets with dimensions shown in Table 5.

Table 5
Minimum Cabinet Internal Dimensions

	Depth (in.)	Width (in.)	Height (in.)
CCTV	15	20	36
ISDN Compressed Video	24	36	44
Surveillance	26	59	75
DMS	24	30	36
Ramp Meter	27	44	55
LCU TY 3	16 ¾	30	47 ¾
LCU TY 5	26	38 ½	75
LCU TY P	26	54	54
Intermediate Amplifier	16	25	51
Detector Amplifier	15	20	36

Determine the suitability of the listed cabinet for the equipment complement shown at each field location on the plans. Furnish and install a larger size cabinet, if required, at no additional cost. Other than size, the selected cabinet must fully meet the requirements of this Item.

Provide four 1 in. diameter holes centered in the bottom for cabinet mounts on a concrete foundation or as shown on the plans. Provide attachment hardware for cabinets mounted on a pole.

- 2. Ventilation.** Do not install openings on the sides or roof of the cabinet. Provide a 16 in. wide by 12 in. high intake vent openings on the lower portion of the cabinet door. Use a filtered intake, a fan, and a screened exhaust for cabinet ventilation.

Provide a thermostatically controlled fan. Provide a thermostat that is adjustable with an adjustment range of 70°F to 110°F. Provide a press-to-test switch to test the operation of the fan. Provide a fan with a capacity of at least 100 cu. ft./min.

Filter the intake with a 16 in. wide by 12 in. high by 1 in. thick air conditioning filter. Securely mount the filter to ensure air enters the cabinet through the filter. Screen the exhaust vent to prevent entry of insects. Use screens with openings no larger than 0.0125 sq. in. Provide total free air openings large enough to prevent excessive back-pressure on the fan.

- 3. Lighting.** Mount a fluorescent light above the door inside the cabinet. Position the light in order to provide illumination to the face of the equipment in the cabinet and not into a technician's eyes. Install 2 momentary, pin type door switches in the cabinet or on the door. Wire 1 switch to turn on the cabinet lights when the door is open and off when the door is closed. Wire the other in parallel to a terminal block to detect a cabinet intrusion condition.

- 4. Exterior Finish.** Smooth the aluminum and leave the exterior in its unpainted natural color.

- 5. Serial Number.** Provide cabinets with a 5 digit serial number unique to the manufacturer. Place a 2 letter manufacturer's code prior to the serial number. Permanently affix the serial number to the upper right hand cabinet sidewall either by a metal plate riveted to the cabinet, by stamping it directly on the cabinet, or by engraving it on a metalized Mylar plate.

- 6. Shelves.** Provide adjustable shelves in each cabinet as shown on the plans to support the appropriate equipment. Provide 2 in. intervals for shelf adjustment. Position shelves from the top of the cabinet in accordance with the actual equipment complement of the particular cabinet.

Provide a minimum of 1 in. between the rear and front edge of the shelf and the back inside wall and door of the cabinet.

- 7. Mounting Hardware.** Furnish cabinets with the appropriate mounting plates, anchor bolts, and any other necessary hardware to mount the cabinet.

8. **Equipment Panels.** Construct panels of 0.125 in. aluminum. Provide a 3 in. horizontal slot in each corner of the panel for a 0.25 in. mounting bolt. Provide clamps or straps to hold cables on the panel. Mount panels in the cabinet on mounting studs. It must not be necessary to remove a panel to replace any mounted equipment. Panels must support the following when the panels are mounted on the studs:
 - Terminal Blocks
 - Load Switches
 - Relays
 - Switches
 - Miscellaneous Equipment - All Necessary Mounting Hardware
9. **Modular Design.** Design the material to be modular for ease of replacement. Mechanically key modules of unlike function in order to prevent insertion into the wrong socket or connector. Identify modules and assemblies with name, model number, serial number and any other pertinent information to facilitate equipment maintenance.
10. **Connectors and Harness.** Make all external connections by means of connectors. Key connectors to preclude improper hookups. Color code or appropriately mark all wires to and from the connectors in accordance with this Item.

D. Surge Protection.

1. **Protector and Cabinet Configuration.** Provide surge protectors for all ungrounded conductor wires entering or leaving an equipment cabinet. Keep the conductor leads and the surge protector leads as short as possible with all conductor bends formed to the maximum possible radius. Locate the protector units 6 in. from the entry or exit point, and as far as possible from any electrical equipment. Connect the protector ground lead directly to the ground bus.

Surge protector utilized for AC power must not dissipate any energy and must not provide any series impedance during standby operation. Unit must return to its non-shunting mode after the passage of any surge and must not allow the shunting of AC power.
2. **Power Line Surge Protector.** Install a power line surge protector in each cabinet between both line conductors and equipment ground.
3. **Signal Head Lamp Wires.** Provide surge protectors for signal lamp interconnect conductors at the equipment cabinet. Surge protector must have the same characteristics as specified for power lines.
4. **Detector Loop Lead-In.** Provide surge protection for each detector lead-in cable. Connect drain wire of the lead-in cable to the cabinet ground bus.
5. **Communication Cable.** Provide lightning arrestor for each pair of connectors for the 6, 12, 18, 25, or 50 pairs.

- 6. Signal Wires.** Provide two-stage surge protection for signal wires entering or leaving the cabinet with the following characteristics:
- Input, output and ground connections;
 - Peak surge handling capability: 4,000 A., 8 X 20 microsecond waveform;
 - Protector life: Must withstand a minimum of fifty 2,000 A., 8 X 20 waveform surges.
 - Response time: Calculated element speed of 1 X 10⁻¹² sec., measured speed of less than 20 nsec.
 - Protector clamp voltage: Specified by the Contractor to be consistent with the equipment being protected and submitted for approval.

E. Environmental Design Requirements. Provide cabinets that meet the functional requirements of this item during and after subsection to any combination of the following requirements:

- Ambient temperature range of -30°F to 165°F.
- Temperature shock not to exceed 30°F per hr., during which the relative humidity shall not exceed 95%.
- Relative humidity range not to exceed 95% over the temperature range of 40°F to 110°F.
- Moisture condensation on all surfaces caused by temperature changes.

F. Vibration. Material used must show no degradation of mechanical structure, soldered components, plug in components or satisfactory operation in accordance with the manufacturer's equipment specifications after being subjected to the vibration test as described in Section 2.2.5 "Vibration Test" of the NEMA standard TS 2, or the latest revision.

3. Construction Methods.

A. General. Utilize the latest available techniques to minimize the number of different parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

Design equipment for ease of maintenance. Component parts must be readily accessible for inspection and maintenance. Tools and test instruments required for maintenance by maintenance personnel must be simple hand held tools, basic meters and oscilloscopes.

B. Fabrication. Fabricate and weld in accordance with Item 441, "Steel Structures". Continuously weld all exterior seams for cabinet and doors. Fill edges to a radius of 0.03125 in. minimum. Smooth exterior welds.

Weld aluminum cabinets using the gas metal arc (MIG) or gas tungsten arc (TIG) process using bare aluminum welding electrodes. Use electrodes conforming to the requirements of the American Welding Society (AWS) A5.10 for ER5356 aluminum alloy bare welding electrodes.

Use qualified procedures, welding machines and operators for welding on aluminum in accordance with the requirements of AWS B3.0, "Welding Procedures, and Performance Qualification" and to the practices recommended in AWS C5.6.

1. **Cabinet.** Construct all cabinets of welded sheet aluminum with a minimum thickness of 0.125 in., unless otherwise shown on the plans. Do not use wood, wood fiber product, or flammable products in the cabinet. Seal cabinet structure to prevent the entry of rain, dust, and dirt. Permanently attach aluminum lifting eyes, ears, or build them into the cabinet to permit lifting the cabinet with a sling. Provide an unused space of 12 in. in height, 15 in. in width, and 14 in. in depth for future expansion.
2. **Door.** Provide sturdy and torsionally rigid cabinet doors that substantially cover the full area of the front of the cabinet. Attach cabinet door by a minimum of 2 heavy duty hinges.

Fabricate the doors and hinges to withstand a 100 lb. per vertical ft. force applied to the outer edge of the door when open without permanent deformation or impairment of the door or cabinet body when the load is removed.

Equip cabinets equal to or greater than 48 in. in width with 2 doors in front and 2 doors in back to provide access to the cabinet. Provide each door with 5 hinges, or a full length stainless steel piano hinge, with stainless steel pins spot welded at the top. Mount the hinges so that it is not possible to remove them from the doors or cabinet without first opening the doors. Place a removable center support in the middle of each set of doors to ensure cabinet rigidity.

Fit the cabinet doors with Number 2 Corbin lock and aluminum or chrome plated handle with a minimum 3/8 in. drive pin and a 3 point latch. Design the lock and latch so that the handle cannot be released until the lock is released. Provide a locking ring for a padlock. Provide 2 keys for each cabinet. Locate the lock clear of the arc of the handle. Keys must be removable in the locked position only. Mount locks with 2 stainless steel machine screws. Provide cabinet doors with a catch mechanism to hold the door open at 2 positions – 90° and 180°.

Fabricate the door and door stop mechanism to withstand a simulated wind load of 5 lb./sq. ft. applied to both inside and outside surfaces without failure, permanent deformation, or compromising of door position.

Provide an auxiliary police door on the cabinet when shown on the plans. Provide a lock on the auxiliary police door. Provide 1 brass key for each police door lock. Provide a gasket around the doors to prevent entry of moisture or dust. Use a non-absorbent gasket material that is resilient to the outdoor environment. Provide a gasket with a minimum thickness of 0.375 in. Locate the gasket in a channel or an "L" bracket on either the cabinet or door.

- C. **Shop Drawings.** Submit details of the cabinet design prior to fabrication. Submit a cabinet layout for each cabinet, including site location plan and detailed panel layouts. Submit drawings for only 1 cabinet for cabinets of identical design and dimension.

- D. Electronic Components.** Provide electronic components in accordance with Special Specification, "Electronic Components."
- E. Mechanical Components.** Provide stainless steel external screws, nuts, and locking washers. Do not use self tapping screws unless approved. Provide corrosion resistant materials and materials resistant to fungus growth and moisture deterioration. Separate dissimilar metals with an inert dielectric material.
- F. Installation.** Install cabinet foundations in accordance with Item 656, "Foundations for Traffic Control Devices."

Install pedestal pole assemblies in accordance with Item 687, "Pedestal Pole Assemblies." Install conduits as shown on the plans and in accordance with Item 618, "Conduit." Place wiring in a neat and orderly manner and grouped together with nylon tie-downs.

Install the cabinet as shown on the plans or as directed. Install a 0.625 in. diameter x 8 ft. long copper clad steel ground rod with the cabinet. Ground the cabinet to the ground rod.

1. **Connection of Lead-In Cable.** Connect the detector lead-in cable to the detector terminal blocks in the following manner:
 - Dress each cable into position in accordance with the approved lead-in cable position on the panel (bundle cables together and broken out by their position on the terminal boards).
 - Place cable as close to the terminal points as possible and left floating.
 - Ground the cable shield after testing and in accordance with the detector manufacturers' specifications.
2. **Connection of Miscellaneous Cables.** Terminate connection of signal wires, sign control wires and any other wires required to complete connections for an operational system on terminal blocks.
4. **Documentation.** Provide cabinet documentation in accordance with Article 4, Special Specification, "Testing, Training, Documentation, Final Acceptance, and Warranty."

Include the connector pin letter or number, the wire number, the terminal number and the function of the wire on the wiring diagram. Place 1 copy of the wiring diagram in the cabinet.
5. **Testing.** Test cabinets in accordance with Article 2, Special Specification, "Testing, Training, Documentation, Final Acceptance, and Warranty."
6. **Measurement.** This Item will be measured by each cabinet furnished, installed, and tested.
7. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement", will be paid for at the unit prices bid for "Equipment Cabinet" of the type specified and installation method specified as applicable. This prices is full compensation for cabinets installation; cables and connectors; documentation, and testing; and for labor, equipment, materials, training, and incidentals.