ITEM 01680.803246 M - NEMA TRAFFIC SIGNAL CABINET (TYPE M)  
ITEM 01680.803247 M - NEMA TRAFFIC SIGNAL CABINET (TYPE P38)

DESCRIPTION

Under these items, the Contractor shall furnish and install NEMA Traffic Signal Cabinets as shown in the plans and as directed by the Engineer. The cabinets shall be NEMA 3R rated enclosures which shall house the traffic signal control equipment necessary to operate a signalized intersection. The traffic signal control equipment shall be provided under these contract items and others as noted below in this specification.

NEMA TS2 Type A2 Traffic Signal Controllers, NEMA TS2 Dual Detector Units, and Microcomputer Cabinet Bases shall be provided under other contract items.

MATERIALS

All materials furnished, assembled, fabricated or installed shall be new, corrosion resistant and in strict accordance with NEMA 3R and Underwriters Laboratories (U.L.) specifications. Each of the two cabinet configurations covered by this specification shall be provided complete with all the internal components and mounting hardware necessary to provide for the installation and operation of a traffic signal as noted in the plans and specifications.

General Requirements. The exterior cabinet housing shall be fabricated from 3.175mm minimum thickness aluminum alloy sheet meeting the requirements in ASTM Specification No. 5052-H32. Each of the cabinets shall be provided with a 25.4mm slope toward the rear of the cabinet to prevent the accumulation of water on its top surface.

The external dimensions of the NEMA Traffic Signal Cabinet (Type M) shall be 1257mm high x 762mm wide x 432mm deep.

The external dimensions of the NEMA Traffic Signal Cabinet (Type P38) shall be 1371mm high x 965mm wide x 648mm deep.

The external finish and color of the cabinet varies and shall be as shown in the plans or as ordered by the Engineer.

All internal traffic signal control equipment to be provided under this contract shall be compatible with the NEMA TS1 cabinet configuration. Equipment provided as part of the NEMA Traffic Signal Cabinets shall connect to NEMA TS2 Type A2 Traffic Signal Controllers through the three military style connectors (Connectors A, B and C) located on the front panel of the controller unit. NEMA TS2 Type A2 Traffic Signal Controllers are provided under another contract item.

The Contractor shall submit an interior cabinet layout for each type of cabinet specified for review and approval by the Engineer. Only cabinets with approved layouts will be accepted under this Contract.

Mechanical Requirements

Door and Door Hardware. Each cabinet shall have a hinged main door which permits access to all equipment within the cabinet and visual inspection of all indications and controls. The main door shall be double flanged on all four edges to increase strength around the openings and to keep dirt and liquids from entering the enclosure when the doors are open.
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The cabinet door shall be constructed of 3.175mm thick type 5052-H32 aluminum alloy to provide a strong rigid construction. All welds shall be neatly formed and free of cracks, blowholes and other irregularities, and all inside and outside edges of the cabinet shall be free of burrs.

The door hinges shall be a one-piece, continuous piano hinge, with a stainless steel hinge pin. The hinge shall be located on the right side of the door when viewed from the front. The hinge and pin shall run the entire length of the door. The hinge pin shall be capped at the top and bottom by weld to render it tamper proof.

The doors shall be furnished with a gasket that satisfies the physical properties as found in UL508 table 21.1, including a weather tight seal between the cabinet and door.

The door shall be equipped with a catch mechanism to automatically hold the door open at least 125 degrees.

All doors shall be provided with a main door lock, Corbin No. 15481RS, or equivalent, constructed of stainless steel which shall operate with a traffic industry conventional No. 2 key. The lock shall engage a three-point locking system. The lock cylinder shall be located so as not to interfere with movement of the door handle. Two No. 2 keys shall be provided with each cabinet for use by traffic department personnel.

Police Compartment. A hinged police compartment door shall be provided on the outside face of the main cabinet door of the NEMA traffic signal control cabinets. The door shall permit access to a switch panel, but shall not allow access to exposed electrical terminals or other equipment within the cabinet.

The police compartment door shall have a lock that can be operated with a traffic industry conventional No. 2 key. Two No. 2 keys shall be provided with each cabinet for use by the police department.

The interior volume of the police panel compartment with the door closed shall be 1147 cubic centimeters minimum. Minimum internal dimensions shall be 127.0mm high x 254.0mm wide x 76.2mm deep.

The electrical components to be housed in the police compartment are as indicated elsewhere in this specification.

Shelves. All NEMA traffic signal cabinets shall be supplied with two removable shelves manufactured from 5052-H32 aluminum having a minimum thickness of 3.175mm. The top shelf of the cabinet shall have a rigid pull-out drawer with a lift open top. The pull-out drawer shall be capable of supporting a complete set of cabinet wiring drawings, intersection diagrams, equipment manuals, and a portable computer. The drawer shall have a castered glide to allow for easy pulling out and returning to the closed position.

Cabinet Mounting. The NEMA traffic signal cabinets will be oriented and mounted as shown in the plans or directed by the Engineer. For pole-mounted cabinets, all the hardware and labor necessary to mount the traffic signal cabinet shall be provided under this contract item. For base-mounted cabinets, all the hardware and labor necessary to mount the traffic signal cabinet on a microcomputer cabinet base shall be provided under this contract item. Microcomputer cabinet bases are provided under another contract item.

Ventilation. The NEMA traffic signal cabinets shall be equipped with suitable top and bottom vents. The lower section of the cabinet door shall be provided with a louvered air entrance. Louvers shall satisfy the NEMA rod entry test for 3R ventilated closures. A removable, air filter shall be supplied with each cabinet for the louvered air entrance. The exhaust area shall be screened with a material having a maximum hole diameter of 3.175 mm. Each cabinet will have an active ventilation system that is thermostatically controlled by a fan. Requirements for the ventilation fan are as indicated elsewhere in this specification.
**Conduit Sweeps.** The NEMA traffic signal cabinets shall be provided to accommodate up to two 75mm and two 100mm threaded conduits. The conduit sweeps for the concrete base pads shall be provided under another contract item.

**Electrical Requirements**

**Main Back Panel.** Each cabinet shall have a main back panel constructed of 5052-H32 brushed aluminum of 0.090 inches minimum thickness and formed so as to minimize any flexing when plug-in components are installed.

All back panels shall be hinged at the bottom to allow easy access to all wiring on the rear of the panel. The cabinet back panel conductors shall be arranged to allow the top of the panel to be tilted out through the main cabinet door. Removal or disconnecting of any conductors or equipment mounted on the side walls of the cabinet shall not be necessary.

For NEMA Traffic Signal Cabinets (Type M), the back panel shall be fully wired to accommodate twelve load switch sockets, six flash transfer relay sockets, and one flasher socket.

For NEMA Traffic Signal Cabinets (Type P38), the back panel shall be fully wired to accommodate sixteen load switch sockets, eight flash transfer relay sockets, and one flasher socket.

Reference designations for all load switch and flash transfer relay sockets shall be silk-screen labeled on the front and rear of the back panel. The back panel shall provide means of programming the controller phase outputs to load switch inputs with only the use of a screwdriver. As a minimum, sufficient screw terminals shall be provided for the termination of the input/output functions described in section 5.3.2 of the TS2-1992 standard.

All necessary cables to interface the back panel with the traffic signal controller and other control equipment shall be provided under this item. Cables shall be of sufficient length to allow the controller to be placed on either shelf. Connecting cables shall be sleeved in a braided nylon mesh.

**Terminal Blocks.** Terminal strips located on panels shall be accessible to the extent that it shall not be necessary to remove the electronic equipment from the cabinet to make an inspection or connection.

Terminal blocks shall be two position multiple pole barrier type. Shorting bars shall be provided in each of the positions along with an integral marking strip. Terminal blocks shall be so arranged that they shall not upset the entrance, routing, and connection of incoming field conductors. All terminals shall be suitably identified by legends permanently affixed and attached to the terminal blocks. Not more than three conductors shall be brought to any one terminal screw. No electrically alive parts shall extend beyond the protection afforded by the barriers. All terminal blocks shall be located below the shelves.

Terminals used for field connections shall secure conductors by means of a #10-32 nickel or cadmium plated brass binder head screw. Terminals used for interwiring connections, but not for field connections, shall secure conductors by means of a #6-32 nickel or cadmium plated brass binder head screw.

As a minimum, all connections to and from the electronic equipment shall terminate to an interwiring type block. These blocks will act as intermediate connection points for all electronic equipment inputs and outputs.

Single lamp circuit terminals shall be marked for each controller phase with a subscript denoting the particular
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phase, in consecutive order as follows: R1, A1, G1, DW1, W1, R2, A2, G3, etc.

A minimum of 20% spare terminals shall be provided on all terminal strips.

Cabinet Wiring. All cabinet wiring where connected to terminal strips, flasher, relays, switches, radio interference suppressor, etc., shall be identified by the use of insulated pre-printed sleeving slipped over the wire before attachment of the lug or making the connection. The wire markers shall carry the legend in plain words with sufficient details so that a translating sheet will not be required.

All wires shall be cut to the proper length before assembly. No wires shall be doubled back to take up slack. Wires shall be neatly laced into cables with nylon lacing. Cables shall be secured with nylon cable clamps. The grounded side of the electric service shall be carried throughout the cabinet without a break.

All electrical connections in the cabinet, including relays, flashers, terminal strips, etc., shall have sufficient clearance between each terminal and the cabinet to provide an adequate distance to prevent a leakage path or physical contact under stress. Where these distances cannot be maintained, barriers must be provided.

All equipment grounds shall run directly and independently to the ground bus. The lay of the interconnect cable between the components must be such that when the door is closed, it does not press against the cables or force the cables against the various components inside the cabinets.

Sufficient length of cable harnesses shall be provided to easily reach the electronic equipment placed anywhere on the shelves.

All wiring containing AC line voltage shall be routed and bundled separately and/or shielded from all low voltage circuits. All conductors and live terminals or parts, which could be hazardous to maintenance personnel, shall be covered with suitable insulating material.

All conductors used in the cabinet wiring shall be #22 AWG or larger with a minimum of 19 strands. Conductors shall conform to MIL SPEC #MIL-W-16878D, type B or D. The insulation shall have a minimum thickness of 0.254 mm. All wiring containing line voltage shall be a minimum size of #14 AWG.

Cabinet Grounding. A solid copper ground bus bar shall be permanently affixed to the inside surface of a cabinet wall. The point of contact between the ground bus and cabinet wall shall have less than 1 ohm resistance. The copper ground bus bar shall have a minimum of 20 connector points, each capable of securing at least one #10 conductor. A.C. return and equipment ground wiring shall return to the ground bus bar. Where multiple bus bars are used, they shall be bonded to each other with bare stranded #10 copper wire. When installed, the cabinets shall be grounded in accordance with Sub-section 680-3.12 of the New York State Standard Specifications.

Circuit Breaker(s). The circuit breaker(s) shall be approved and listed by Underwriter’s Laboratories. The operating mechanism shall be enclosed, trip free from operating handles on overload, and trip indicating. Each cabinet shall have, as a minimum, a circuit breaker to protect the lamp, ventilation fan, and duplex outlet.

Circuit breakers should be unaffected by ambient temperature range, relative humidity, applied power, shock, and vibration as specified in NEMA Standards Publication TS2-1992 “Traffic Controller Assemblies”. Breakers shall have a minimum interrupt capacity of 5000 amperes.
Radio Interference (RF) Suppressor. Each cabinet shall be equipped with a radio interference suppressor installed at the circuit breaker. The suppressor shall provide a minimum attenuation of 50 dB over a frequency range of 200 kHz to 74 MHz. The suppressor shall be hermetically sealed in a substantial metal case filled with a suitable insulation compound.

The RF suppressor terminals shall be nickel plated, 10-24 brass studs of sufficient external length to provide space for connection to two #8 AWG conductors and shall be so mounted that the terminals cannot be turned in the case. The suppressors shall be designed for operations on 50 amps, 125 volts, 60 Hertz, single phase operation and shall be U.L. approved.

Power Line Surge Protection. A surge protector shall be provided to reduce the effects of voltage transients on the AC power line. It shall be installed after the circuit breaker and RF suppressor, and have the following characteristics:

- Recurrent Peak: 212 volts
- Energy Rating, Maximum: 20 joules
- Power Dissipation, Average: 15 watts
- Peak Pulse Current (6 microsecond pulse): 2000 amperes
- Standby current for 60 Hz. input: 1 ma.

Duplex Receptacle. Each cabinet shall be supplied with a NEMA Type 5-15R duplex receptacle with integral ground fault interrupting circuits as defined in the National Electrical Code. The receptacle shall be located so that no electrical hazard exists when used by service personnel.

Power Supply. Each cabinet shall be equipped with a power supply that meets the requirements of NEMA Standards Publication TS2-1992 “Traffic Controller Assemblies”. The power supply shall be able to provide regulated DC power, unregulated AC power, and a line frequency reference for the detectors racks, load switches, and other auxiliary equipment.

Power Panel. Each cabinet shall have a power panel to provide the necessary power to the cabinet, controller, conflict monitor, cabinet power supply and other auxiliary equipment. All components of the power panel shall be accessible for ease of replacement without removing any other components or equipment. Adequate space shall be provided for the tightening of all terminals.

Flasher and Flash Transfer Relay. With each cabinet, a dual circuit flasher shall be provided that is of solid state design and conforms to the NEMA Standards Publication TS2-1992 “Traffic Controller Assemblies”. The flasher shall produce between 50 and 60 flashes per minute at equal on and off intervals.

An interchangeable electromechanical flash transfer relay that conforms to the NEMA Standards Publication TS2-1992 “Traffic Controller Assemblies” shall be provided with each cabinet. The flash transfer relay shall energize flasher and transfer signal light circuits from the controller unit to the flasher. All bearings and moving parts used in the flasher relay units shall be approved sealed bearings of such design that lubrication shall not be necessary. Flash transfer relays shall be physically and functionally interchangeable with Midtex #136-4995. When an intersection is operating in the flash mode, the traffic signal controller shall be able to be disconnected without interfering with the flash operation.

Means shall be provided to allow the flashing signal to be altered during the flashing mode of operation to any one of three states: dark, flashing yellow, or flashing red. Utilization of this means shall not required more than the
use of simple tools. Such means shall be provided for every load switch output designated to drive vehicular traffic signals.

**Vehicle Detection.** Vehicle detection shall be provided in each cabinet by rack mounted NEMA TS2 Dual Detector Units provided under another contract item. These detector units shall connect to a detector interface panel that facilitates the connecting of field loops to detector units. The interface panel shall allow for the connection of a minimum of sixteen independent field loops. The interface panel shall also be able to simulate detection for vehicle and pedestrian calls on all traffic signal phases. The detector rack chassis to house the NEMA TS2 Dual Detector Units shall be provided under another contract item.

**Solid State Load Switches.** All load switches shall be solid state and conform to NEMA Standards Publication TS2-1992 “Traffic Controller Assemblies”. Each solid state load switch shall be furnished with three built in indicator lights to show the output of the load switch. Load switches containing discrete components are not acceptable.

**Conflict Monitor.** A 12 channel conflict monitor external to the controller shall be supplied for all solid state load switches. The signal conflict monitor shall incorporate all of the conventions of the “NEMA PLUS” type monitor with a liquid crystal display. The monitor shall be of the EVENT LOGGING type. The conflict monitor shall have menu-driven 8-key data entry system that has both tactile and audible feedback. Dipswitches are not acceptable.

**Flash Switch Panel.** An flash switch panel shall be provided in the interior of the cabinet with, at a minimum, an auto/flash switch and a control equipment power on/off switch.

When the auto/flash switch is placed in the FLASH position, power shall be maintained to the controller and the intersection shall be placed in flash. When the switch is moved from FLASH position to the AUTO position, an external start signal shall be applied to the controller. This external signal will force the controller to initiate the start up sequence when exiting flash. The power supply to the controller shall not be affected and the controller shall continue to operate normally.

When the control equipment power on/off switch is in the ON position, AC power shall be applied to the controller unit, conflict monitor, and Power Supply AC power.

**Police Panel.** The police compartment shall contain an auto/flash switch and a door open/closed momentary switch. Switches shall be heavy duty type toggle type switches rated at 15 amp, at a minimum. All switch functions shall be permanently and clearly labeled.

When the auto/flash switch is placed in the FLASH position, power shall be maintained to the controller and stop time shall be applied. The traffic signal shall be placed in flash operation. When the switch is moved from the FLASH position to the AUTO position, an external start signal shall be applied to the controller. This controller will then initiate the start up sequence when exiting flash.

**Interior Main Door Panel.** The interior of the main cabinet door shall contain a signal on/off and auto/manual switch. Switches shall be heavy duty type toggle type switches rated at 15 amp, at a minimum. All switch functions shall be permanently and clearly labeled.

When the signals on/off switch is in the SIGNALS OFF position, power shall be removed from all signal heads at
the intersection. The conflict monitor shall not have to be reset to resume operation from this position.

The auto/manual switch shall be a toggle type switch with an auxiliary 1829mm hand cord that allows the controller to advance signal phases with a push of a button when the switch is in the MANUAL position. The hand cord shall be hardwired directly to the interior main door panel and have an acceptor for hanging the cord on the interior of the door.

When the signals on/off switch is in the SIGNALS OFF position, power shall be removed from all signal heads at the intersection. The conflict monitor shall not have to be reset to resume operation from this position.

The auto/manual switch shall be a toggle type switch with an auxiliary 1829mm hand cord that allows the controller to advance signal phases with a push of a button when the switch is in the MANUAL position.

**Gooseneck Light.** A 25-watt gooseneck incandescent lamp fixture mounted on a 14-inch flexible arm shall be included. A rotary type switch, used to activate this lamp shall be provided and installed on the rear of the lamp housing. The lamp shall be positioned to provide light to the face of the equipment installed in each cabinet.

**Ventilation Fan.** Each cabinet shall be provided with a thermostatically controlled ventilation fan. The thermostat turn-on point shall be manually adjustable from +33°C to +45°C, with a differential of not more than +6°C between automatic turn-on and turn-off. The thermostat shall be located on the inside of the cabinet not lower than 150mm from the top of the cabinet.

**CONSTRUCTION DETAILS**

The Contractor shall furnish and install the above equipment, including all necessary electrical interface cables and any other accessories required to provide an operational controller unit.

**Testing Requirements.** The NEMA Traffic Signal Cabinets shall be subjected to the levels of testing described in the General Provisions of the Special Specifications.

**Documentation Requirements.** Each cabinet shall be supplied with three (3) copies of the Final Cabinet Wiring Diagram. One (1) copy shall be placed in a clear plastic envelope and left in the pull-out drawer of the cabinet. Two (2) copies shall be delivered to the Engineer.

**METHOD OF MEASUREMENT**

Each NEMA Traffic Signal Cabinet will be measured for payment as each complete unit furnished, installed, tested and approved.

**BASIS OF PAYMENT**

The unit price bid for each NEMA Traffic Signal Cabinets shall include the cost of furnishing all labor, materials, tools and equipment necessary to complete the work in accordance with the Contract Documents.