

SECTION 19

SPECIAL PROVISIONS – TRAFFIC SIGNALS SPECIFICATIONS

19-1 DESCRIPTION: This supplemental specification covers: advanced traffic signal controllers for installation into National Electrical Manufacturers Association (NEMA) TS2 Type 1 traffic signal cabinets; and hardened ethernet switches of the type and quantity shown in the list of bid items. The contractor shall provide controllers with the modules and external wiring harness defined herein. The contractor shall supply OS-9 and Sepac operating system software, drivers and descriptors, initialization software, and the validation suite as required herein. The contractor shall begin supplying controller, cabinet, and/or ethernet switching equipment within 60 days after the city's approval of the evaluation units. (Rev. 11/11)

- A. **COMPLIANCE:** The Model 2070 and Model 2070L controllers shall comply with the working draft "Advanced Transportation Controller (ATC) Standard Specification for the Type 2070 Controller," Version 99.01.09, June 8, 1999. The ATC units supplied shall comply with all future Addenda to above specification, Draft Version 99.01.09, prior to issuance of the corresponding purchase order. The referenced ATC standard specification reflects the requirements of the TEES, November 1999 specification, including all relevant addenda published by the California Department of Transportation. The ATC units shall comply with all Transportation Electrical Equipment Specifications (TEES) latest revision prior to issuance of the corresponding purchase order.

19-2 CONTROLLER SPECIFICATION:

A. **HARDWARE REQUIREMENTS:**

1. The Contractor shall supply fully assembled controllers that are in full compliance with the referenced ATC Specification. The Contractor shall provide evidence that controller units, with a make and model identical to those being provided, have been tested and approved in accordance with the referenced ATC Specification, by Caltrans. When available, the Contractor shall submit all test results to the City of Arlington for review. The Contractor shall notify the City of Arlington of all changes required by Caltrans for the unit to pass and the Contractor shall correct all controller units provided to the City of Arlington if required to do so by the Department of Transportation. All cost for modifications associated with compliance of the referenced ATC specification shall be at the expense of the Contractor. A Quality Control Plan shall be submitted within fifteen (15) days from the Notice to Proceed.
2. The Contractor shall supply one controller unit of the Model 2070 and/or Model 2070L, at the request of the City, for evaluation by the city, within five (5) days after the request is made. Once the evaluation units are approved, the contractor shall furnish production controller units according to the delivery schedule of this contract. It is anticipated that the City's evaluation period will be approximately thirty (30) days.

B. REQUIRED COMPONENTS FOR THE MODEL 2070L (TS 2 TYPE 1):

1. The Contractor shall supply Model 2070L controllers with the following modules:

Model 2070-1B	Ethernet CPU Module
Model 2070-2N	Field I/O Module (C12S) (Installed in A3 Slot)
Model 2070-3B	Front Panel Assembly (8 x 40 Display)
Model 2070-4A	Power Supply Module (10 Amp)
Model 2070-7A	Async Serial Comm Module RS-232(Installed in A2 Slot)

2. Port 1 SDLC is required.

3. All components listed above shall conform to the referenced ATC Specification.

C. CONTROLLER CABINET: The controller units provided to the City of Arlington shall be designed to operate with the City of Arlington's latest NEMA TS2-Type 1 cabinet specifications and signal monitor specifications.

D. SOFTWARE/HARDWARE DIAGNOSTIC: The Contractor shall provide diagnostic software/hardware capable of checking CPU memory for the 2070-1(x) CPU module, 2070-2(x) I/O module, display functions on the 2070-3(x) front panel assembly, communications ports, and real time clock. Software/Hardware diagnostic test shall be capable of producing a printed copy of test results. Test results will indicate pass or fail for each function tested. Each controller shall have the latest version of OS-9 and Sepac version 3.33b installed and operational. (Rev. 11/11)

E. DATA KEY PROGRAMMING EQUIPMENT: The Contractor shall supply one (1) removable data key with each controller unit.

19-3 NEMA TS2 TRAFFIC CONTROL CABINET SPECIFICATION:

A. GENERAL:

1. These specifications set forth the minimum requirements for a TS2 Type 1 traffic control cabinet assembly fabricated for the City of Arlington. The cabinet assembly shall meet, as a minimum, all applicable sections of the NEMA Standards Publication No. TS2-1992. Where differences occur, these specifications shall govern.

2. This controller cabinet will house a 2070 controller. The controller shall meet the TS2-1992 Specification for TS2-Type 1 controllers.

B. CABINET DESIGN AND CONSTRUCTION:

1. Detailed shop drawings of the cabinets showing the dimensions, equipment placements layout, auxiliary panel placement and dimensions, and labeling shall be submitted to the City for review and approval prior to manufacture.

2. The cabinet shall be constructed from type 5052-H32 aluminum with a minimum thickness of 0.125 inches. The top, door, and each side of the cabinet shall each be a single sheet of aluminum. Welding pieces together to form any of these surfaces shall not be permitted.
3. The cabinet shall have a natural aluminum finish free from scratches and weld flash. The welds shall be neatly formed, smooth and continuous. Spot welding of the cabinet exterior seams and sealing of the remainder of the seams with sealant is not acceptable.
4. The top of the cabinet shall incorporate a slope from front to rear to prevent rain accumulation.
5. All hardware, including pins, hinges, and door handles shall be of non-corroding material.
6. Prior to delivery, the surface of the cabinet shall be cleaned to remove oil film, weld black, mill ink marks and to leave the surface clean, bright, smooth, and non-sticky to the touch.

C. SIZE AND MOUNTING:

1. The cabinet size shall be as specified.
2. Size 6 (base mounted) cabinets shall have the following minimum dimensions:

52" H x 44" W x 27" D

3. Size 6 cabinets shall be designed for mounting on a concrete foundation using anchor bolt flanges inside the cabinet adjacent to the side walls. Slotted anchor bolt holes 2" long (front to back) by 1" wide shall be provided for securing the cabinet to the foundation
4. The bolt pattern for cabinet mounting shall be 40-3/4" wide by 18-1/2" deep. (These measurements are center-to-center of the anchor bolt holes.)
5. Size 5 (pole mounted) cabinets shall have the following minimum dimensions:

53" H x 32" W x 23" D

6. Size 5 cabinets shall be designed for pole mounted installation by means of pole plates and 3/4" stainless steel straps.
7. Pole plates and straps shall be provided.

D. CABINET DOOR:

1. The cabinet main door opening shall be at least 80 percent of the front surface of the cabinet. A stiffener plate shall be welded across the inside of the door to prevent flexing.
2. A rain channel shall be incorporated into the design of the door opening to prevent liquids from entering the cabinet enclosure.
3. The main door shall be equipped with a three-point latching mechanism to firmly secure the door at the top, bottom, and center of the cabinet.
4. The main door shall be hinged on the right side of the cabinet as viewed facing the cabinet door opening. The door hinge shall be a one-piece, continuous stainless piano hinge, with a stainless steel pin, running the entire length of the door.
5. The main door shall include a door stop mechanism located along the top of the door capable of holding the door open at approximately 90, 125, and 150 or greater degrees under windy conditions. The door stop shall be designed to minimize the accidental release of the door from any of the stop positions.
6. The handle on the main door shall utilize a shank of 5/8" minimum diameter. The handle shall include a hasp for the attachment of an optional padlock with a shackle diameter of 3/8 inches. The door handle shall rotate counter-clockwise to open. The handles shall not extend beyond the perimeter of the main door at any time. The lock assembly shall be positioned so that the handle shall not cause any interference with the key when opening the cabinet door. The door handle shall be mounted through a brass bushing or other approved method to prevent the handle from becoming frozen to the door.
7. The main door shall be equipped with a Corbin No. 2 lock with weather-proof cover. Two keys shall be supplied.
8. The main door shall close against a weatherproof and dust-tight, closed-cell neoprene gasket seal. The gasket material shall be a minimum of 0.250 inches (0.635 cm) thick by 1.5 inch (3.81 cm) wide. The gasket shall be attached to the cabinet with a permanent adhesive bond. The mating surface of the gasket shall be coated with a silicon lubricant to prevent sticking to the door.

E. POLICE COMPARTMENT:

1. A hinged police compartment door shall be provided on the outside face of the main door to permit access to a switch panel. There shall be no exposed electrical terminals accessible from the police compartment and no dust or liquid shall be able to enter the main cabinet compartment from the police compartment. The size of the police compartment and door shall be as needed to accommodate the required switches, plugs, and/or jacks and to provide for storage of the manual push button switch.

2. The police compartment door shall be provided with a treasury type lock Corbin No. R357SGS with weatherproof cover, or exact equivalent, and one key.
3. The police compartment door shall close against a weatherproof and dust-tight, closed-cell neoprene gasket seal. The gasket material shall be a minimum of 0.250 inches thick by 0.500 inches wide. The gaskets shall be attached to the cabinet with a permanent adhesive bond. The mating surface of the gasket shall be coated with a silicon lubricant to prevent sticking to the door.

F. VENTILATION AND FANS:

1. The lower section of the cabinet door shall be equipped with a louvered air entrance. The air inlet shall be large enough to allow sufficient air flow for the rated fan capacity. Louvers must satisfy the NEMA rod entry test for 3R ventilated enclosures.
2. Two (2) 12" x 16" x 1" non-corrosive, vermin and insect-proof, removable, replaceable air filters shall be secured to the air entrance. The filters shall fit snugly against the inside of the door.
3. The roof of the cabinet shall incorporate a divided exhaust plenum with a vent screen. Perforations in the vent screen shall not exceed 0.125 inches in width.
4. The cabinet shall be provided with two (2) individually thermostatically controlled (adjustable between 80 - 150 degrees Fahrenheit) ventilation fans in the top of the cabinet plenum. The fans shall be a ball bearing, type fan and each shall be capable of drawing a minimum of 100 cubic feet of air per minute.

G. SHELVES:

1. All cabinets shall be supplied with two (2) removable and adjustable shelves manufactured from 5052-H32 aluminum. The shelves shall be a minimum of 10 inches deep.
2. It shall be possible to position the shelves where the shelves are within 24" of the bottom of the cabinet and to within 8 inches of the top of the cabinet.
3. The two shelves shall be installed prior to the cabinet delivery. In order to facilitate future equipment maintenance, the bottom shelf shall be positioned to provide at least 3/4" clearance between the top of the detector racks and cabinet power supply and the lowest point of the top shelf. The controller unit and MMU will be placed on the top shelf when the cabinet is prepared for installation.

H. SHELF/PANEL MOUNTING:

1. One set of vertical "C" channels shall be mounted on each interior wall of the cabinet for the purpose of mounting the cabinet components. The channels shall

accommodate spring mounted nuts or studs and shall provide for shelf height adjustment in increments of not more than 2 inches. All mounting rails shall extend to within 8 inches of the top and bottom of the cabinets.

2. Four side wall channels shall be provided with center-to-center spacing as needed to provide secure support for the back panel and/or any other mounted equipment.

I. BACK PANEL DESIGN:

1. The back panel shall be constructed from 5052-H32 brushed aluminum of 0.090 inches minimum thickness and formed so as to minimize any flexing when plug-in components are installed.
2. The cabinet back panel shall be designed so that it shall not be necessary to remove either shelf to access the rear of the panel. This can be accomplished by:
 - utilizing a panel design that does not extend beyond the lowest required bottom shelf position or any other cabinet obstructions and hinging the main panel at the bottom to permit it to swing down without removing any cabinet components to at least 30 degrees from horizontal, or
 - providing a rear cabinet door to permit access to the back of the panel. If a rear cabinet door is provided, it must meet all the requirements stated in section 3.3 of this specification.
3. The back panel shall be fully wired for the following:
 - Sixteen (16) load switch sockets (8 vehicle phases, 4 overlaps, 4 pedestrian phases. All vehicle phases and overlaps shall be wired for flashing operations)
 - Six (6) flash transfer relay sockets
 - Four (4) wired BIU rack slots
 - One (1) type 16 MMU
 - Terminals for input/output functions
 - Terminals for all field circuit connections (signals, circuits, pedestrian detector inputs, railroad preemption inputs, etc.)
 - Harness with connector for NEMA TS-2 cabinet Power Supply
4. Rack style mounting shall be provided to accommodate the required BIUs. A dual-row, 64-pin female DIN41612 Type B connector shall be provided for each BIU rack position. Card guides shall be provided for both edges of the BIU. Terminal and facilities for BIU mounting shall be an integral part of the main panel. Detector

rack BIU mounting shall be an integral part of the detector rack.

5. All BIU rack connectors shall have pre-wired address pins corresponding to the requirements of the TS2 specification. The address pins shall control the BIU mode of operation. BIUs shall be capable of being interchanged with no additional programming.
6. Wiring for BIU shall be provided. BIUs shall be permanently addressed as 1 through 4, 9, and 10. Terminals for all I/O on BIUs 1 through 4 shall be provided and shall be permanently labeled according to TS-2 function. BIUs 1 through 4 shall be mounted on the back panel. BIUs 9 and 10 shall be mounted in the detector racks. Wiring for BIUs 9 and 10 shall be as specified under section 3.15 of this specification. Terminal blocks for DC signal interfacing shall have a number 6-32 x 7/32 inch screw at a minimum.
7. All pedestrian push button inputs from the field to the controller shall be optoisolated through the BIU and operate at 12 VAC.
8. All load switches shall be supported by a bracket.
9. The use of printed circuit boards to supply load bay sockets shall not be permitted

J. TERMINAL BLOCKS:

1. Load switch outputs shall be routed to terminals on a series of Marathon 1512D or equivalent terminal blocks. These blocks shall be installed on the main panel. All vehicular and pedestrian signal field circuits shall be connected to these terminals. Compression type terminal blocks are not acceptable.
2. Load switches shall be assigned on a per-phase basis in the controller unit. All three load switch outputs shall be assigned to the same controller phase. Any unused load switch outputs shall not be reassigned to different phases.

K. FLASHER/FLASH OPERATION:

1. The cabinet shall be wired for one (1) dual-circuit flasher unit, separate from the controller unit, that shall permit the flashing of field circuits.
2. The flasher socket shall be capable of operating a 25-amp dual-circuit NEMA solid state flasher. The flasher shall be supported by a bracket.
3. Loadbays shall be wired for balanced loading of the flasher circuits to cover the standard eight phase quad configuration as well as its subsets.
4. The coil of the flash transfer relay shall be deenergized for flash operation.
5. Yellow/red flash shall be defined as normal flash mode (yellow on channels 2 & 6,

all other vehicle channels red). Red/red flash shall be defined as emergency flash mode (all vehicle channels flashing red). An override circuit shall be provided that will override yellow flash on channels 2 and 6 and cause the traffic signal to flash red on all channels. This circuit shall be activated by a toggle switch on the technician switch panel. This switch shall be labeled "Yellow Flash Enable". When in the "off" (downward) position, emergency flash shall be the only flashing mode. When in the "on" (upward) position, technician and police flash switches shall cause normal flash (yellow on channels 2 and 6). In all cases an MMU failure will cause emergency flash (red on all channels).

6. One RC network shall be wired in parallel across each flash-transfer relay and all other AC relay coils. The network shall be appropriately configured to neutralize the surge current induced by the collapse of the magnetic field of the relay coil.
7. Flash Relays shall be Mid-TEX (PART NO. 136-62T3A1) or equivalent.

L. CONNECTOR CABLES:

1. All control and Malfunction Management Unit cables shall be of sufficient length to allow the units to be placed on either shelf.
2. Each cabinet shall be provided with enough RS-485 Port 1 communication cables to allow full capabilities of the cabinet. Each communication cable connector shall be a 15-pin metal shell D subminiature type. The cable shall be a shielded cable suitable for RS-485 communications.
3. All connecting cables and wire runs shall be secured by mechanical clamps. Stick-on type clamps are not acceptable.
4. All wiring shall be neat in appearance. All cabinet wiring shall be continuous from its point of origin to its termination point. Butt type connections/splices are not acceptable.
5. All wires routed to the door shall be routed to adequately protect against damage from repetitive opening and closing of the main door.
6. The grounding system in the cabinet shall be divided into three separate circuits (AC Neutral, Earth Ground and Logic Ground). These circuits shall be connected together as outlined in Section 5.4.2.1 of the NEMA TS2 Standard.

M. POWER PANEL:

1. The power panel shall consist of a separate, wholly enclosed module, securely fastened to the lower right side wall of the cabinet. The power panel shall be wired to provide the necessary power to the cabinet, controller, Malfunction Management Unit, cabinet power supply, and auxiliary equipment. It shall be manufactured from 0.090-inch, 5052-H32 aluminum with a removable clear plastic front cover.

2. The power panel shall house the following components:
 - A 50-amp main breaker. This breaker shall supply power to the controller, MMU, signals, cabinet power supply and auxiliary equipment. Breakers shall be thermal magnetic type, U.L. listed for HACK service, with a minimum of 10,000 amp interrupting capacity.
 - A 15-amp auxiliary breaker. This breaker shall supply power to the fans, lights and GFI outlet.
 - An EDCO model ACP-340 surge arrester shall protect the Controller, MMU, and the Cabinet Power Supply.
 - A 50-amp, 125 VAC radio interference line filter.
 - A normally-open, 60-amp, mercury contractor.
 - A neutral bus bar capable of connecting one #6 stranded wire in each position with minimum 15-position - open position.
 - A NEMA type 5-15R GFI convenience outlet

N. CABINET LIGHTS:

1. A fluorescent lighting fixture rated to accommodate a F15T8 lamp operated from a normal power factor UL or ETL listed ballast shall be provided. It shall be mounted on the inside top near the front of the cabinet. This light shall be automatically illuminated when the cabinet door is opened but shall be equipped with an on-off switch mounted on the fixture that shall permit the light to be turned off when the door is in the open position.
2. A secondary 40-watt goose-necked lamp assembly shall illuminate the back panel. The door switch shall also control the 40-watt lamp.

O. CABINET PLANS/DOCUMENT STORAGE:

1. Two sets of complete and accurate cabinet drawings shall be supplied with each cabinet.
2. A sturdy print pouch shall be mounted to the door of the cabinet. The pouch shall be of sufficient size to accommodate one complete set of cabinet prints.

P. DETECTOR RACKS:

1. General:

Two vehicle detector amplifier racks shall be provided in each cabinet. The configuration for each rack shall be as follows:

- One (1) BIU slot
- Sixteen channels of NEMA TS2 type detection (2 and 4 channel detector cards)
- Two (2) Opticom Model M562 2-channel phase selector units

The detector racks shall, as a minimum, meet the requirements of NEMA TS2 Section 534 and all other applicable sections of the NEMA Standards Publication No. TS2-1992.

The detector rack frame shall be constructed of aluminum. The frame material shall be of sufficient thickness to prevent bending or flexing when detector or other cards are inserted or removed.

All vehicle detector card slots shall be capable of accepting 2 channel detector cards.

The second, fourth, sixth and eighth vehicle detector card slots in each rack shall be capable of accepting both 2 and 4-channel detector cards. (Rev. 11/11)

Circuit boards may be used in the construction of the detector rack back plane only.

Two (2) field loop interface panels shall be mounted on the left wall of the cabinet and connected to the card rack, and back panel. Each panel shall be constructed of aluminum, silkscreened, and contain four (4) 16-position double-row terminal blocks, with a minimum 8-32 binder head screws. Provision shall be made to terminate four (4) pedestrian push button inputs per panel, along with the appropriate power connections. Terminals shall also be provided for detector outputs. When logic ground is applied to these terminals, a call shall be placed via the BIU on the proper controller channel.

Terminals shall be provided for termination of wiring for Opticom optical detectors.

2. Connectors and Terminals:

All terminals shall be permanently marked as to rack channel and function. (i.e.: Rack 1, Channel 1, Output)

Q. TECHNICIAN SWITCHES:

1. Technician switch panels shall be provided.
2. A technician switch panel shall be mounted on the inside front door and shall provide the following:
 - a. AUTO/FLASH SWITCH. When placed in the "flash" (up) position, the

vehicular signal heads shall display the programmed flashing red or yellow indications generated by the flasher unit. Pedestrian indications, if any, shall be dark. Power shall not be removed from the controller. Stop time shall not be applied. The MMU shall not be used to accomplish this task.

- b. EQUIPMENT POWER ON/OFF SWITCH. This switch shall control the controller, MMU, and the cabinet power supply AC power. The up position shall be power "on", and the down position is power "off".
 - c. STOP TIME SWITCH. This switch shall apply stop time to the controller. The up position shall be stop time "on" and the down position shall be stop time "off".
 - d. YELLOW FLASH ENABLE. This switch shall enable yellow flash on channels 2 and 6. When in the up "on" position, the signal shall flash yellow on channels 2 and 6 as outlined in "FLASHER/FLASH OPERATION" section of this specification.
3. A second technician switch panel shall be mounted on the inside left wall. Sixteen switches shall be provided and shall be wired as follows:
- a. The *n*th switch down position will provide a constant call on the *n*th vehicle channel.
 - b. The *n*th switch middle position disconnects the *n*th detector channel output from the *n*th BIU input.
 - c. The *n*th switch up position provides normal operation of the *n*th vehicle channel.
4. Four (4) ped call input switches shall be provided. These switches shall operate in the same manner as the vehicle call switches listed above. These switches shall place calls on ped channels A, B, C, & D of detector BIU 1.

R. POLICE COMPARTMENT SWITCHES:

1. The following switches shall be installed in the police compartment such that the normal operating position is in the "down" position.
 - a. EMERGENCY FLASH SWITCH. When placed in the "flash" (up) position, the vehicular signal heads shall display the programmed flashing red or amber indications generated by the flasher unit. Pedestrian indications, if any, shall be dark. Power shall not be removed from the controller. Stop time shall be applied. When this switch is turned to the "off" (down) position, the controller shall initiate the start-up sequence.

- b. SIGNALS ON/OFF SWITCH. When placed in the “up” position shall remove AC power from the loadswitches. All other power shall not be interrupted.
 - c. AUTO/MANUAL SWITCH. When placed in "up" position shall activate manual push button and manual control enable.
 - d. MANUAL PUSH BUTTON JACK. Shall be wired to logic ground and interval advance through the AUTO/MANUAL SWITCH.
 - e. PUSH BUTTON HAND CORD. MINIMUM TEN (10) FEET EXTENDED.
- S. SWITCHES – GENERAL: All door mounted toggle type switches shall be heavy duty and rated 10 amps minimum. Single, double or triple pole switches shall be provided as required. All switches shall be permanently marked as to function and status.
- T. RAILROAD PREEMPT INTERFACE PANEL: If specified, a panel shall be provided for railroad preemption interface terminals. The panel shall be located on the inside left wall of the cabinet. The panel shall include a 120 volt relay for isolation and shall include one test switch.
- U. AUXILIARY DEVICES:
1. Malfunction Management Units:
Each cabinet assembly shall be wired for one Type 16 Malfunction Management Unit (MMU) as defined by the requirements of Section 4 of the NEMA TS2-1992 Standard.

Malfunction Management Units shall be a Type 16 Model MMU-16 (or approved equivalent).
 2. Bus Interface Units:
Buss Interface Units shall conform to Section 8 of the NEMA TS2-1992 Specifications.
 3. Cabinet Power Supply:
The cabinet power supply shall meet the requirements of Section 5.3.5 of the NEMA TS2-1992 Standard.
 4. Load Switches:
Load switches shall comply with section 6.2 of NEMA TS-2 Traffic Controller Assemblies specification 1992.

All load switches shall use Crydom Block type TC2623-4079 or equal. Load switch assemblies containing circuit boards will not be accepted.

5. Vehicle Detector:
Vehicle inductive loop detectors shall comply with section 6.5 of NEMA TS-2 traffic controller assemblies specification 1992, for Type B, 2 and 4 channel rack mount detector unit.

V. **CABINET TESTING:**

1. The cabinet shall be assembled and tested by the manufacturer to ensure proper component integration and operation.
2. Each assembly shall be delivered with a signed document detailing the cabinet tests performed.
3. The supplier or his/her representative shall be available within 48 hours to assist in locating and correcting any operational problems with cabinets during test operations.

W. **CABINET CONFIGURATION:**

Each TS2 Type 1 cabinet shall be provided with the following components:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>QTY</u>
1	Size 6 (Type P) Cabinet, sixteen (16) position back panel and two (2) card racks.	1
2	Type 16 Malfunction Management Unit (MMU)	1
3	Bus Interface Unit (BIU)	4
4	Cabinet Power Supply	1
5	NEMA Load Switch with 3-LEDs on input side	16
6	NEMA 2-Circuit flasher	1
7	Flash Relays, MID-TEX (PART NO. 136-62T3A1)	8
8	Four Circuit Pedestrian Call Isolation Card	2
9	NEMA TS2 Four (4) channel card rack detector amplifier	4

19-4 ETHERNET SWITCH SPECIFICATIONS:

1. Fiber-optic ports for SC
2. 6 TX ports with auto-negotiation 10/100Mbps
3. Auto-negotiation for speed and duplexity on TX ports
4. IGMP Snooping and IP Multi-cast Filtering
5. Port-based VLAN and 802.1Q Tagged VLAN

6. 802.1p Priority Queuing CoS (Class of Services) Support.
7. SNMP/RMON Support
8. True non-blocking architecture; Store-and-forward mechanism
9. Half-duplex Back pressure and IEEE 802.3x Full-duplex flow control
10. Supports 1K MAC addresses (64 bytes)]
11. Front panel port utilization and status LEDs
12. Switch must comply with the following Ethernet Standards:
 - IEEE802.3 10BASE-T, IEEE802.3u 100BASE-TX
 - 100BASE-T 2-pair UTP Cat. 3, 4, 5, Up to 100 m (328 ft)
 - 100Base-FX 10/125um single-mode fiber optic cable, up to 15 km
13. Switch must have the following Switching Methods:
 - Store-and-Forward
14. Switch must have the following Forwarding Rate:
 - 14,880 pps for 10Mbps, 148,800 pps for 100Mbps
15. Switch must meet the following Physical Specifications:
 - AC Input: 100-240VAC, 50-60Hz internal universal power supply
 - Operating Temperature: -25C to +70 C (-13F to +158 F)
 - Humidity: 10%-90% non-condensing
 - Emission Compliance: FCC part 15 class B, CE Mark, VCCI Class B

19-5 CONTROLLER TESTING, QUALITY CONTROL, DOCUMENTATION, AND WARRANTY

A. GENERAL:

1. The Contractor shall comply with electrical, environmental and testing requirements defined in the ATC specification.
2. The Contractor shall, within fifteen (15) days from the request, supply quality control

procedures and test report formats as required by the ATC Specification.

3. The Contractor shall comply with all testing, quality control, and reporting procedures specified in the ATC Specification.

B. DOCUMENTATION: The Contractor shall submit all documentation required by ATC Specification, this specification, and all associated procurement documentation.

C. OPERATIONAL MANUALS:

1. All controller equipment provided under this specification shall be provided with operational manuals, which document the operation and maintenance of the equipment. Additionally, the following documentation shall be provided for the various items furnished.
2. Manuals shall be printed on 8.5 by 11 inch paper. Schematics, layouts, parts lists and plan details may be on 11 by 17 inch sheets, but the sheets must be neatly folded to 8.5 by 11 inch size. D size sheets must be neatly folded and bound to fit in the 8.5 by 11 inch manuals. The manual shall be bound in durable covers and shall suffer no degradation when subjected to normal cabinet temperature testing.
3. Manual Contents: Each manual shall include the following: General Description, General Characteristics, Installation, Adjustments, Theory of Operation, Systems Description with block diagrams, detailed description of Circuit Operations, and Maintenance, Maintenance shall cover Preventive Maintenance, Trouble Analysis, Trouble Shooting Sequence Chart, waveforms, Voltage Measurements, and Alignment Procedures.
4. Technical information in the form of manufactures published data sheets for all mediums and large scale integrated circuits.
5. Part lists including circuit and board designation, part type and class, power rating and component manufacture, and original manufacturer's part number.
6. Electrical Interconnection Drawing
7. Schematic and logical diagram - consisting of assembly drawings and pictorial diagram showing physical locations and identification of each component.
8. Serial and Revision numbers of equipment numbers in manuals.
9. Updated Documentation shall be provided for any and all design changes or modifications to equipment, circuits, or components supplied to the City of Arlington. The City shall be notified in writing of any impending changes.
10. In addition, all documentation shall be supplied on CD-ROM.

D. SUBMITTALS:

1. Submittal data and/or hardware shall be submitted to the City of Arlington for approval prior to fabrication of the controller assembly. The Contractor shall furnish data and/or hardware submittals to the following agency:

Mr. Paul Iwuchukwu, P.E.
Traffic Engineering Manager
Public Works and Transportation Department
City of Arlington
101 West Abram St.
Arlington, Texas 76010

2. All submittals shall be full detailed and shall provide all information to clearly show how the controller unit assembly does or does not conform to the requirements of the specifications. The purpose of the submittal data and/or hardware is to show, in detail, that the Contractor will satisfy the requirements of the specification to avoid non-conformance with those requirements that might otherwise not become apparent until after fabrication. If prepared literature, such as catalog cut sheets, is used to satisfy some or all of the submittal requirements, there shall be no statements on the literature in conflict with the requirements of the specifications. Any such statements shall be crossed out and initialed by the Contractor.
3. Following a review of the submittal data and/or hardware, the City of Arlington, or its agent, will mark the submittal in any of the following ways: "no exception taken", "corrections required", or "rejected". The Contractor may proceed with the fabrication of the controller unit assembly when the submittal is marked "no exception taken". If the submittal is marked "corrections required", the submittal is considered to be fundamentally acceptable, however, questionable issues must be addressed prior to acceptance of the submittal and subsequent equipment fabrication. If the submittal is marked "rejected", the City of Arlington will have the sole right to immediately cancel the purchase order and re-award the contract, or order the Contractor to initiate equipment redesign in accordance with the specifications and resubmit.
4. The controller equipment delivered shall be identical to the evaluation units accepted by the City of Arlington. Any deviations from the approved evaluation units shall be submitted for evaluation and approval before any shipment is accepted for payment. The Contractor shall be responsible for the costs associated with any additional testing that may be required. Deviations from the approved evaluation units after shipment of any parts of the order shall be cause for rejection and non-payment of the remainder of the order. Excessive delays or non-compliance by the Contractor at any point in the approval process may be cause for cancellation and non-payment.

E. WARRANTY:

1. The Model 2070 and Model 2070L Controller Equipment and components shall have

a full warranty due to manufacture defects, including parts and labor for a minimum of five (5) years from the date of final acceptance.

2. The Contractor shall bear all expenses connected with the return of any material that any agency deems necessary to return for adjustment during the warranty period. The City of Arlington, or its agent, reserves the right to withhold payments that may be due, should it be discovered that material does not meet the specifications and/or claims of the Contractor.
3. The City of Arlington will determine the manufacturer's responsibility for any controller unit assembly failure, if failure occurs within the warranty period. The City of Arlington, or its agent, will contact the manufacturer with instructions on the pick-up and delivery of defective controller assembly components.
4. The contractor shall have field engineer or technicians available on request to assure satisfactory initial operation and to consult with the City or their representatives on any special circuitry that may be required in certain applications.
5. The Contractor shall furnish a certified documentation stating that all equipment and operating system and validation software tests are Y2K compliant, and meets all criteria of the "Working Draft Advanced Transportation (ATC) Standard Specification for the Type 2070 Controller", version 99.01.09.

19-6 MEASUREMENT: The model 2070 and model 2070I controller equipment, traffic signal cabinets, and hardened ethernet switches will be measured as each unit furnished, and made fully functional and operational and tested in accordance with the requirements in this specification.

ITEM	QTY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1	ea	Model 2070L (NEMA - 8 TS 1) Traffic Signal Controller per City of Arlington Specifications Make / Model _____ Does your bid meet exact specifications? _____ If not, where does it differ? _____	_____	_____
2	ea	Model 2070L (NEMA - 8 TS 2 Type 2) Traffic Signal Controller per City of Arlington Specifications Make / Model _____ Does your bid meet exact specifications? _____ If not, where does it differ? _____	_____	_____

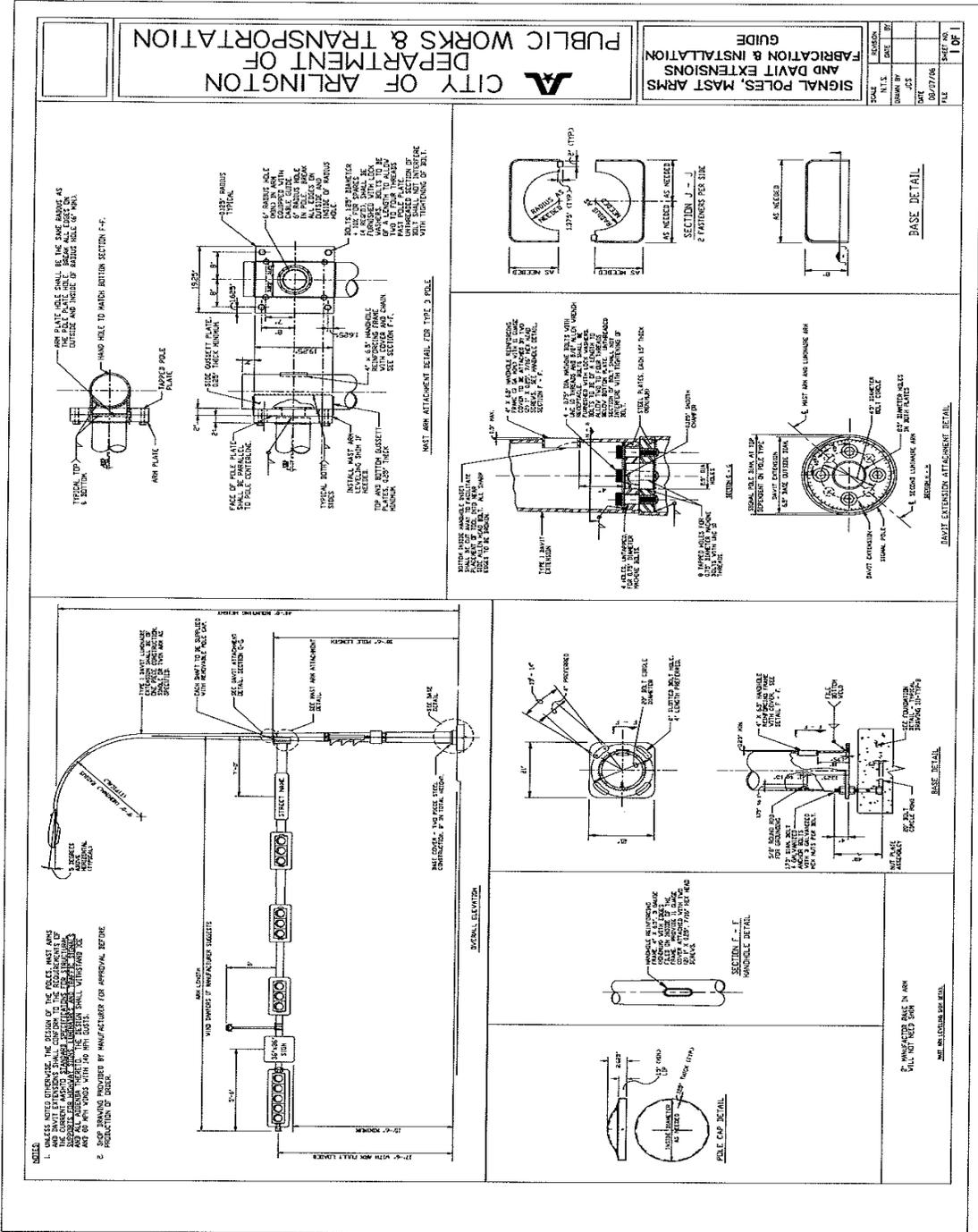
3	ea	Model 2070L (NEMA – 8 TS 2 Type1) Traffic Signal Controller per City of Arlington Specifications	_____	_____
		Make / Model _____		
		Does your bid meet exact specifications? _____		
		If not, where does it differ? _____		
4	ea	NEMA TS2 Type 1 Controller Cabinets (Size 6) per City of Arlington Specifications (without RR Preempt Panel)	_____	_____
		Make / Model _____		
		Does your bid meet exact specifications? _____		
		If not, where does it differ? _____		
5	ea	NEMA TS2 Type 1 Controller Cabinets (Size 6) per City of Arlington Specifications (with RR Preempt Panel)	_____	_____
		Make / Model _____		
		Does your bid meet exact specifications? _____		
		If not, where does it differ? _____		
6	ea	NEMA TS2 Type 1 Controller Cabinets (Size 5 – pole mount, without RR Preempt Panel)	_____	_____
		Make / Model _____		
		Does your bid meet exact specifications? _____		
		If not, where does it differ? _____		
7	ea	Hardened Ethernet Switches per City of Arlington Specifications (68 to be purchased in first year)	_____	_____
		Make / Model _____		
		Does your bid meet exact specifications? _____		
		If not, where does it differ? _____		

VENDOR'S SIGNATURE _____ COMPANY'S NAME _____

19-7 TRAFFIC SIGNAL SUPPORT STRUCTURES LONG MAST ASSEMBLY:

Assembly shall be in accordance to the latest TxDOT's standards (TxDOT's detail sheet number LMA (1) through LMA (4)).

19-8 SIGNAL POLES, MAST ARMS AND DAVIT EXTENSION FABRICATION & INSTALLATION GUIDE: See details as follows or in plans.



END OF SECTION

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