

**From:** spo  
**Sent:** Thursday, March 08, 2012 4:02 PM  
**To:** spo  
**Subject:** SPO Alert - Focus Group Notice for Traffic Cabinets & Controllers Re-Bid  
**Attachments:** T06-59-00108 Solicitation-Contract Part 1.pdf

### **SPO Alert**

**Date:** March 8, 2012

**To:** State Agency Chief Procurement Officers, Cooperative Program membership

**From:** SPO on behalf of the Arizona Department of Transportation

**Re:** Rebid of Contract Set T0659-0108 Statewide Traffic Cabinets and Controllers, Including Spare Parts (for Intelligent Transportation Systems)

**ADOT Procurement will be holding a focus group to rebid the Statewide Traffic Cabinets and Controllers, Including Spare Parts (for Intelligent Transportation Systems) Contract T0659-0108.**

**Please bring any requirements you would like to discuss at this meeting.**

- **Date:** Thursday, March 29, 2012
- **Time:** 2:00 – 3:30 P.M.
- **Location:** ADOT Procurement Conference Room  
1739 W. Jackson, Modular A  
Phoenix, AZ 85007

**Attached are the current specifications for your review.**

**R.S.V.P. to Suzanne Alberts at [SAAlberts@azdot.gov](mailto:SAAlberts@azdot.gov) by Monday, March 26, 2012.**

**Suzanne Alberts**  
**Senior Procurement Specialist**  
**ADOT Procurement Group - Professional Services**  
**[SAAlberts@azdot.gov](mailto:SAAlberts@azdot.gov)**  
**Phone: 602-712-7816 Fax: 602-712-3151**

**SOLICITATION AMENDMENT NO. TWO (2)**  
**SOLICITATION NO. T06-59-00108**



ARIZONA DEPARTMENT OF TRANSPORTATION  
Procurement Group  
1739 West Jackson Street, Suite A, MD 100P  
Phoenix, Arizona 85007-3276  
Phone: (602) 712-7211



Description: Traffic Signal Controllers and Cabinets, including Spare Parts  
Due Date: May 31, 2006 at 3:00 P.M. MST

Pursuant to Section Four Uniform Instructions to Offerors, paragraphs 2.6 and 3.7 Solicitation Amendments, this solicitation is hereby amended as follows:

1. The closing date for the above referenced solicitation has been extended from **May 23, 2006, at 3:00 p.m., MST to May 31, 2006 at 3:00 p.m., MST.**

**ALL OTHER PROVISIONS OF THE SOLICITATION SHALL REMAIN IN THEIR ENTIRETY.**

Offeror hereby acknowledges receipt and understanding of the above amendment.	The above referenced Solicitation Amendment is hereby executed this 19 <sup>th</sup> Day of May 2006, in Phoenix, Arizona.
Signature _____ Date _____	
_____	
Typed Name and Title	
_____	
Company Name	
_____	
Address	
_____	
City _____ State _____ Zip _____	Terri Johnson Contract Officer

**SOLICITATION AMENDMENT NO. ONE (1)  
SOLICITATION NO. T06-59-00108**



ARIZONA DEPARTMENT OF TRANSPORTATION  
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Description: Traffic Signal Controllers and Cabinets, including Spare Parts  
Due Date: May 23, 2006 at 3:00 P.M. MST

Pursuant to Section Four Uniform Instructions to Offerors, paragraphs 2.6 and 3.7 Solicitation Amendments, this solicitation amendment is a result of the stated Pre-Bid Conference, held May 10, 2006, as stated on the front of the above referenced solicitation.

**Complete Price Sheets are attached**

1. Page 1 - 6<sup>th</sup> paragraph, the first sentence is revised to read:

**"All non-stock individual units or items shall be delivered as soon as possible, however the maximum time to delivery is to be no more than 60 days."**

2. Page 5 - 2<sup>nd</sup> paragraph, in the first sentence the word **"compatible"** is to be eliminated.

3. Page 18 - 3<sup>rd</sup> paragraph, It is acceptable and encouraged that two additional NEMA cabinet configurations be offered in addition to the 13 configuration listed. Those additional configurations are:

- "14. Type IV NEMA TS 2 Type 1 - 8 Phase (12 Position)**
- 15. Type V NEMA TS 2 Type 1 - 8 Phase (12 Position)"**

The Department does not anticipate using this configurations, however it is reported that these configuration may be needed for City of Mesa as well as some other cities.

4. Page 18 - 4<sup>th</sup> paragraph, 3<sup>rd</sup> sentence is revised to read:

**"The TS 2 Type 1 8-phase shall be offered in a 12 and 16 load switch configuration too."**

5. Page 30 - Add the following main panel configuration after the **"TS 2 Type 1 - 8 Phase (TS 2 Type 1 Configuration 4 per Table 5-2)"**:

**TS 2 Type 1 - 8 Phase (TS 2 Type 1 Configuration 3 per Table 5-2)**

- 12 Load Switch Positions (8 phases & 4 ped)
- 6 Flash Relay Positions
- 1 2-Circuit Flasher Position
- MMU Type 16
- 3 BIUs for Detector Rack & 2 for Main Panel

6. Page 41 after subsection 1.6.3(c) insert the following new subsection entitled **"1.6.3(d) GPS Clock"** with the following specification:

**"1.6.3(d) GPS Clock**

**SOLICITATION AMENDMENT NO. ONE (1)**  
**SOLICITATION NO. T06-59-00108**



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Description: Traffic Signal Controllers and Cabinets, including Spare Parts  
Due Date: May 23, 2006 at 3:00 P.M. MST

**General:**

The GPS clock assembly shall consist of a programmable GPS interface device, GPS receiver, receiver to interface device harness and power-output harness. The assembly shall be designed to reset the clock time for 170, 2070 or NEMA type of traffic signal controllers using a time reference signal from GPS at least once a day. The interval for the controller clock resetting shall be programmable.

The supplier of the GPS clock shall provide detailed instructions on how the interface device is to reset the clock and how it is to be programmed to do so. These instructions shall include setup and maintenance information and a trouble shooting and error message guide. Part list, circuit diagrams and available service information shall also be included.

As a minimum each device shall come with a one year complete replacement warranty that assures the device shall function as herein specified and be free of any defect in design, material and workmanship. The manufacturer agrees to repair or replace within this time period any device found to be defective free-of-charge.

**Physical Requirements:**

The programmable GPS interface device shall be contained in a fully enclosed metal or plastic case and be suitable for wall mounting or setting on a shelf inside a traffic signal cabinet. As a minimum this device shall have a removable front/back cover, a liquid crystal display (LCD), programming-status switch(es), power-output port, and antenna input port. It can also have additional input/output port (e.g. RS-232) at the option of the manufacturer.

The receiver shall be a low profile (less than 2.5 inches high) fully enclosed rain-tight GPS antenna unit that shall be suitable for mounting on the exterior of a traffic signal cabinet via a single hole. The GPS antenna case shall be made of a long life exterior grade UV resistant plastic. The bottom of the receiver unit shall have a threaded opening with a short antenna connection cable. Attached to the bottom of the receiver unit shall be a short (2 inch minimum) threaded conduit, hub, or nipple mount. The antenna connect cable shall be long enough to project beyond the end of the mount. The receiver to interface device harness shall connect to the antenna connection cable via a quick disconnect pin type of connection. The threaded mount shall include a suitable gasket and locknut so a rain-tight and secure connection between the receiver unit and the traffic signal cabinet can be achieved.

The interface device to receiver and power harnesses shall be at least 4 feet long. The type of connectors provided shall be appropriate for their intended use; however as a minimum all connections shall be pre-wired threaded pin and sleeve type of connectors. Pre-wired means that all the harnesses shall be ready configured for a NEMA type controller unless specified otherwise.

The terminal block for the power supply and the low voltage output shall be a screw clamp type.

The main circuit board shall be screwed with screws so it is removable.

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**Electrical Requirements:**

The interface device shall have an internal power supply. The power supply shall be configured so it can be plugged into a standard 115 volt AC outlet inside the controller cabinet via a three prong outlet (hot, neutral & bond). The power leads shall be internally fused with a 4 amp slow blow type of fuse.

The power supply shall be rated so it operates at 115 input voltage AC (+/- 20 volts) with a 12 output voltage DC (+/- 2 volt). All components shall be rated to operate within these parameters at a temperature range of between -30 degrees C to + 74 degrees C.

If the interface device's case is metal it shall be bonded.

The interface device shall have a single pole double throw relay that enables it to reset the controller clock when logic ground is applied via a selected pin in the NEMA D connector board. The rating of this relay should be at least 15 amps at 120 volts AC.

**Functional Requirements:**

The GPS interface device shall be designed to receive a time reference signal from GPS satellites via a time and interval to be programmed. Typically this will be set at a specified time and then be executed once the receiver locks on the required number of satellites. This time reference "pulse" is then processed and then made available to the traffic signal controller via a hard wire interface. For NEMA controller this shall be accomplished per a direct connection to the "D" plug panel that is pre-wired and attached to the power-output harness.

It is preferred that all programming of the time interval updates be accomplished internal to the interface device via a series of rotary or in-line switches and/or jumpers that are mounted and noted on the circuit board. Other programming arrangements are available, but will be subject to evaluation and test prior to acceptance.

All programmed settings shall be easy to view either with markings on the circuit board and/or thru the LCD screen. This shall include: time zone selected, day or days of the week the clock will reset, and daylight saving times switch status.

The device shall have a power failure routine that enables the device to restore itself automatically to normal function after short or long interruptions. This includes maintaining the programmed settings and then also checking in on the last time it received a time reference and performing this function if necessary to catch up.

The device shall have a selectable time zone setting. Arizona is at Mountain Standard Time in the summer and Pacific Standard Time in the winter. It shall also have an automatic daylight savings time routine. However, it is important to note that Arizona does not use daylight savings time, so the daylight savings time feature must be able to be turned off.

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The day or days of the week the device shall reset the controller clock shall be programmable. At a minimum the device shall have eight settings, 7 for each day of the week and then an every day of the week setting."

7. Page 55 under Subsection "8. **DELIVERY**" – The first sentence is eliminated and replaced with the following sentence: "**All assembled units, individual units or items shall be delivered as soon as possible; however the maximum time to delivery is to be no more than 60 days.**"

8. Page 55 under Subsection "12. **TRAINING**" – This entire section is eliminated and replaced with the following:

The training for this IFB is divided into the following types:

- (1) Product Feature Training
- (2) Traffic Signal Operations Training

The first type of training will be considered incidental to the contract supply items. This type of training will typically only involve a one or two hour session that is fully related to a product that is being purchased. The training session will be done at a Department facility. The objective of this training is to familiarize the Department with the product and to demonstrate certain commonly used features. This training is to occur as a part of the required quarterly service visits and can be conducted by the Suppliers Customer Service Representative visiting. The Supplier is responsible for developing the content of these types of training sessions.

The second type of training shall be more in-depth and detailed and will be between 4 to 6 hours in length. This type of training will be measured and paid for by the following items:

- Training Item #1 for 1 to 5 people by each session delivered
- Training Item #2 for 6 to 15 people by each session delivered

The price for training items 1 and 2 will be by the lump sum for each individual session conducted. This price shall include the development course content, presentation materials, manuals, presentation at a Department facility, travel, lodging and all other incidentals that are necessary to put the session in Arizona. The Department will furnish the room for the training session. If applicable the supplier can offer a discount on those additional sessions that done on consecutive days within the same week.

Training sessions are to be held within 45 days of being requested by the Department unless approved otherwise. It is anticipated that most training sessions will be held at the Department's Traffic Supply Center in Phoenix. However, training session in either Prescott, Flagstaff, or Tucson may be needed...

The in-depth training sessions (per training item #2) may be requested to cover the following topics:

- Introduction to the Controller Cabinet and Related Components
- NEMA TS 1, NEMA TS 2 Type 2 & NEMA TS 2 Type 1
- Model 170E Training
- Advance Controller program Training
- Advance CMU/MMU Training
- Advance Loop Detectors

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Advance Cabinet Trouble Shooting

Each of the classes shall be geared to the appropriate standard that the agency uses (the Department uses NEMA TS 1 cabinets and controllers all over the state, except in the Phoenix area where they also use NEMA Controllers in a modified Caltrans 332 cabinet ("345 cabinet"). The Department is now investigating changing to the NEMA TS 2 Type 2 standard. This listing of class subjects will be modified and/or added to if requested by the Department.

All in-depth training session shall fully demonstrate how the items being purchased through this contract are used and maintained. Training session should be supported with required information and users manuals, programming, including trouble shooting guides and maintenance cycle requirements. All training sessions shall incorporate the contents of related manuals and instruction sheets, as well as referenced traffic control standards and practices (NEMA, Caltrans, etc.).

The training sessions herein specified shall be repeated each year if requested by the Department.

Classes shall be structured in one hour intervals with 10 to 15 minute breaks between each interval. The length and structure of the classes shall be modified if requested by the Department; however the length of the classes is not to exceed the requirements stated herein.

9. **Price Sheet Modifications (Attachment Four):**

**All bidders are encouraged to offer the following additional Subcategory 1b Pre-Wired Cabinet and Subcategory 1c Pre-wired with Plug-In, Rack and Shelf Components configurations (Note: The original Price Sheet will not be modified to include these new items, instead bidder should develop their own Price Sheets that are similar to the original and submit them):**

**Additional Type IV Cabinet Configurations:** The TS 2 Type 1 with a 12 position main panel is the same as items 1b.11a and 1b.11b except it has less load switch sockets (12 vs. 16).

The new subcategory 1b items for this configuration are to be called "**1b.11aX**" for single door Type IV and "**1b.11bX**" for double door Type IV. The sub-items to these main items shall be itemized as "**1b.11.1X**" thru "**1b.12X**".

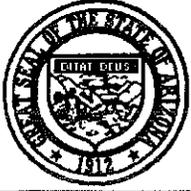
The new subcategory 1c items for this configuration are to be called "**1c.6aX**" for the single door and "**1c.6bX**" for the two door version.

**Additional Type V Cabinet Configurations:** The TS 2 Type 1 with a 12 position main panel is the same as items 1b.17 except it has less load switch sockets (12 vs. 16).

The new subcategory 1b items for this configuration are to be called "**1b.17X**". The sub-items to these main items shall be itemized as "**1b.17.1X**" thru "**1b.18X**".

The new subcategory 1c items for this configuration are to be called "**1c.9X**".

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Due Date: May 23, 2006 at 3:00 P.M. MST

**Training (add the following bid items):**

Training Item #1 for 1 to 5 people by each session delivered

Lump Sum Price per Session:

% Discount to the lump sum price for consecutive class given in the same week or on the same trip:

Training Item #2 for 6 to 15 people by each session delivered

Lump Sum Price per Session:

% Discount to the lump sum price for consecutive class given in the same week or on the same trip:

**ALL OTHER PROVISIONS OF THE SOLICITATION SHALL REMAIN IN THEIR ENTIRETY.**

Offeror hereby acknowledges receipt and understanding of the above amendment.	The above referenced Solicitation Amendment is hereby executed this 17th Day of May 2006, in Phoenix, Arizona.
Signature _____ Date _____	_____ Terri Johnson Contract Officer
_____ Typed Name and Title	
_____ Company Name	
_____ Address	
City _____ State _____ Zip _____	



# STATE OF ARIZONA



IFB-PG-0001 R: 7/18/00

## ARIZONA DEPARTMENT OF TRANSPORTATION PROCUREMENT GROUP

### NOTICE OF INVITATION FOR BID T06-59-00108

**BID DUE DATE:** May 23, 2006 AT 3:00 P.M. MST

**DESCRIPTION:** Traffic Signal Controllers and Cabinets, including Spare Parts

**PRE-BID CONFERENCE:** There WILL be a pre-bid conference for this solicitation on May 10, 2006 at 1739 W Jackson, Suite A, Phx AZ 85007 at 1:00 p.m. MST

**Bid Opening and Submittal Location:** Arizona Department of Transportation  
Procurement Group  
1739 West Jackson, Suite A, Mail Drop 100P  
Phoenix, Arizona 85007

In accordance with A.R.S. §41-2533, Invitation For Bid for the materials or services specified will be received by the Arizona Department of Transportation Procurement Group at the above specified location until the time and date cited. Bids received by the correct time and date will be opened and the name of each bidder and the amount of the bid will be publicly read.

Bids must be in the actual possession of the Arizona Department of Transportation Procurement Group on or prior to the time and date, and at the location indicated above. Late bids will not be considered.

Bids must be submitted in a sealed envelope with the solicitation number and the bidder's name and address clearly indicated on the envelope. Additional instructions for preparing a bid are provided in the Uniform and Special Instructions to Offerors as contained within this solicitation.

**BIDDERS ARE STRONGLY ENCOURAGED TO CAREFULLY READ THE ENTIRE SOLICITATION.**

**Designated Agency:** Arizona Department of Transportation  
**Type of Contract:** Firm Fixed Price  
**Term of Contract:** One year with option to renew up to 48 months

**PHONE:** (602) 712-8364

**DATE:** April 25, 2006

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Terri Johnson  
Contract Officer

"An Equal Employment Opportunity Agency"

The Arizona Department of Transportation is committed to the principles of Equal Employment Opportunity. To ensure dissemination and of the Equal Opportunity program throughout all levels of the department, the ADOT Civil Rights Deputy Administrator serves as the Equal Opportunity Administrator for the Arizona Department of Transportation.

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ARIZONA DEPARTMENT OF TRANSPORTATION  
Procurement Group  
1739 West Jackson Street, Suite A, 100P  
Phoenix, Arizona 85007  
Phone: (602) 712-7211

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# SECTION 1 SPECIFICATIONS

ARIZONA DEPARTMENT OF TRANSPORTATION  
Procurement Group  
1739 West Jackson, Suite A, 100P  
Phoenix, Arizona 85007  
Phone: (602) 712-7211

**SOLICITATION NO. T06-59-00108**

## 1. PURPOSE

The Arizona Department of Transportation (the Department) and its political subdivisions (other user agencies) desire offers to be submitted to supply traffic signal cabinets, traffic signal controllers, related equipment and accessories. The traffic control cabinets and related equipment are to come either as unit assemblies or as individual items. The purpose of this Invitation for Bid (IFB) is to provide the Department and others with the means for the procurement of traffic signal control equipment that will be used throughout the state for new construction and maintenance.

Companies making offers shall have experience and knowledge in representing, selling and distributing traffic signal controllers, cabinets and equipment of the type herein specified. Additionally, these companies shall have Phoenix or Tucson Area, Arizona-based representation and distribution (supply house) that can offer timely and useful customer service. They shall also maintain a reasonable inventory and/or readily available source of related traffic controller equipment and accessories.

Bidders are not required to offer all items as herein specified. The unavailability of a particular cabinet, controller or related device or item will not necessarily be used as a reason to reject a bid and/or that portion of that bid. Given the diversity of the items needed, a multiple award is possible. However, the Department does reserve the right to award based on which bids offer the Department the most advantageous source of supply to meet its overall needs that is reasonably and logically structured and is economical.

All offers shall be in the form of an inclusive catalog (or **Offer Catalog**) that is bound and/or in a 3 ring binder that gives complete information and pricing on all items, sub-items and options that are offered per this IFB. The **Offer Catalog** shall be cross-referenced to the **Price Sheet**. The **Offer Catalog** content shall be such that it allows the Department a ready reference on the individual item's technical data, functional data and available options (as applicable) as well as related pricing. Including the structure of the **Price Sheet** as a part of the **Offer Catalog** is acceptable. The catalog shall also identify whether an item is a stock item and/or indicate delivery lead times for non-stock items and assembled units (e.g. cabinet items). The catalog shall identify what is included with each item for the price offered. This is especially important for those items that are to be offered as separate spare parts or replacement items.

It is important to note that the **Price Sheet** has rows for spare parts and replacement items. In these rows the item description states "**Spare parts (provide list)**" and then includes "**by offer**" in the "**Purch Unit**" row. What this means is that the offeror shall provide a detailed list (description and/or drawing, part number and pricing) of all the individual components that make up the main item which is on the **Price Sheet**. Given the potential number of spare part or replacement items it has been determined that it is not practical to list them all per the Price Sheets (attached). However, this is not true in all cases. There are some spare part and replacement items that have been deemed "**critical**" and are individually listed on the **Price Sheet**. Critical shall mean that these items are often used and that it is important to define the attributes of those items in this specification to be consistent and interchangeable with what has been used. The intent of these spare part items is to give the Department the ability to purchase these items to repair and recycle damaged equipment (for example: replace a door latch or hinge).

The maximum delivered time for **non-stock** individual units or items shall be 21 days. The maximum lead time for any controller cabinet assembled unit shall be **not more than 60 days**. Pricing should also include information and terms on shipping costs. All base pricing shall include free on board (FOB) shipping delivered to the Department's Traffic Supply Center at 2104 South 22<sup>nd</sup> Avenue in Phoenix. A schedule for shipping costs to other locations in the state should be included if applicable.

# SECTION 1 SPECIFICATIONS

ARIZONA DEPARTMENT OF TRANSPORTATION  
Procurement Group  
1739 West Jackson, Suite A, 100P  
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Phone: (602) 712-7211

**SOLICITATION NO. T06-59-00108**

## 1.2 APPLICABLE STANDARDS

In addition to the requirements described in this IFB, all items shall also relate and conform to the applicable requirements of the following standards:

- The Federal Highway Administration's (FHWA) **2003 Edition of the Manual on Uniform Traffic Control Devices (MUTCD)**. Paper copies of the MUTCD can be ordered directly from American Traffic Safety Service Association (ATSSA), Institute for Transportation Engineers (ITE), or American Association of State Transportation and Highway Officials (AASHTO). The MUTCD can also be downloaded per the FHWA's MUTCD home page [www.mutcd.fhwa.dot.gov](http://www.mutcd.fhwa.dot.gov).
- The Department's **Arizona Department of Transportation, Standard Specifications for Road and Bridge Construction, 2000 Edition**, applicable **Stored Specifications**, **Arizona Supplement to the Manual on Uniform Traffic Control Devices (MUTCD) (2003 Edition)**, and **Traffic Signals and Lighting Standard Drawings 2004 Book** with all applicable updates. Paper copies of applicable Department standards can be obtained by contacting the Department's Engineering Records, at (602) 712-8216 or from the Department's website under the Traffic Engineering Group. The link for this website is: [www.dot.state.az.us/highways/traffic/SLStds.asp](http://www.dot.state.az.us/highways/traffic/SLStds.asp).

The specific sections of the **Arizona Department of Transportation, Standard Specifications for Road and Bridge Construction, 2000 Edition** that apply to this specification are Sections: **730 General Requirements For Traffic Signal and Highway Lighting Systems**, **734 Traffic Controller Assembly**, and **735 Detectors**. The drawings of the **Traffic Signals and Lighting Standard Drawings 2004 Book** that apply to this specification are: **T.S. 3-6 Type III Cabinet**, **T.S. 3-9 Type IV Cabinet** and **T.S. Type V Cabinet**.

- The National Electrical Manufacturers Association's (NEMA) Standards Publication Number (No.) **TS 1 1989 Traffic Control Systems**, previous version of **TS 2 Traffic Controller Assemblies** and **TS 2 2003 Traffic Controller Assemblies with NTCIP Requirements**. NEMA standards can be purchased from NEMA directly. Their website address is [www.nema.org](http://www.nema.org).
- The Model 2070 and the Advanced Transportation Controller (ATC) shall conform to the latest version of the Joint American Association of State Highway and Transportation Officials (AASHTO), Institute of Transportation Engineers (ITE) and NEMA committee on the ATC Standard Specification. The latest version of the ATC ITS Cabinet Standard and ATC Controller Standards for the Type 2070 Controller are thought to be available at: <http://www.ite.org/standards/index.asp>. This link also contains additional information about the ATC process and the efforts regarding what has been done and is still pending on the development of this standard. According to the ITE website the latest versions of the 2070 are: **"ATC ITS Cabinet Standard v01.02.15"** and **"ATC Controller Standards for the Type 2070 Controller v01.05."**
- The Model 170 Controller Unit specification referenced herein is based on what is utilized by the City of Scottsdale and California Department of Transportation (Caltrans). It should be noted that the City of Scottsdale does not maintain a complete technical specification on the various versions of the Model 170 they use. Additionally, Scottsdale has used a Model 170 like cabinet; it is very similar to the Caltrans standard; however it has been reconfigured to

# SECTION 1 SPECIFICATIONS

ARIZONA DEPARTMENT OF TRANSPORTATION  
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Phoenix, Arizona 85007  
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**SOLICITATION NO. T06-59-00108**

be placed in a different size cabinet with only a front door. The City of Scottsdale maintains a qualified product list for their version of the Model 170 Controller Unit which they term 170ATC/HC11. The latest Caltrans specification is entitled: "**Traffic Signal Control Equipment Specifications, January 1989**" applicable addendum, and the Transportation Electrical Equipment Specifications (TEES), dated August 16, 2002, plus Errata 1 dated October 27, 2003 and Errata 2 dated June 8, 2004 and applicable addendum. Caltrans specification can be purchased from Publications at (919) 445-3520 or from their website which is <http://caltrans-opac.ca.gov/publicat.htm>. Caltrans also maintains a Qualified Products List for Controller Assemblies for the Model 170/2070 Traffic Controller which has been utilized for the brand name or equal listing contained herein [January 2006 (A) version].

- The National Fire Protection Association's (NFPA) **2005 National Electric Code (NEC)**. Paper copies of the NEC can be purchased directly from the NFPA by phone at (800) 344-3555 or at their website [www.nfpacatalog.org](http://www.nfpacatalog.org).

The reference of these standards is not intended to mean that everything involved in this IFB must meet all of the requirements contained in these standards. Rather they have three basic meanings. The first meaning is to establish the basic context of this specification which is to set requirements for traffic signal cabinets, controllers and other related items that conform to these standards as they are used in the State of the Arizona, not only by the Department, but all of the jurisdictions within the state that are responsible for traffic signal control. Secondly, it means that any item which includes a direct reference to these standards shall meet those standards unless specifically stated otherwise, allowed and/or needed per the particular application. The third meaning relates to implied reference; specifically, if the content of the statement herein implies that a referenced standard does apply, then it will normally apply unless stated otherwise.

If there are any questions and/or non-material conflicts with regards to the context, direct reference and/or implied requirements, bidders are encouraged to submit statements and/or information along with their offers that clarify how the requirements apply or do not apply to their offer. "**Non-material**" means that the conflict does not lessen the capability or quality of the product in a manner that decreases its value or changes the requirement stated in the specification in a manner that would provide an advantage to a bidder in being able to offer a lower price or lesser unit or item. An issue that changes the material requirement and/or intent of the specification must be submitted as an exception or as an alternative bid. All clarifications, exceptions and alternative bids shall be clearly marked as such. All bidders are cautioned to carefully read all instructions regarding the submission of exceptions and alternatives.

If the referenced standards are changed and/or modified in any way during the course of this contract, it is the responsibility of the supplier and manufacturer to carefully study these changes to determine if such changes or modifications might impact the equipment being supplied or how it might be operated in the field. The supplier shall inform the Department if any changes. The Department shall have the right to continue to order and receive the older version of the specified equipment for the life of this contract, unless justified otherwise.

## **1.3 BRAND NAME OR EQUAL SPECIFICATION**

In **Section 3.0 Special Terms and Conditions** contains a tabular listing of traffic control brand name products which are believed to be capable of conforming to requirements stated herein. This listing is cross-referenced to the **Price Sheet**. There are also brand name products listed within the body of this specification. The listings inside this specification are typically for minor components (locks, fuses, contactors, power conditioning devices, etc.) that make up the basic traffic control cabinet assembly. However, there are instances when a manufacturer may be mentioned. The **Section 3.0** listing is typically for the major products such as cabinets, controllers, conflict monitor units, malfunction management units,

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loop units, load switches, flash relays as well as other auxiliary devices. However, there are instances when minor components are also listed. As already stated, the listing of the minor components is to help assure that the Department has access to those components that are needed to maintain and/or expand existing traffic control assemblies that require spare parts or replacement items that conform to those brands listed.

The brand name listings are not intended to restrict competition. All potential suppliers and/or manufacturers who have products which they know are the same or similar and conform to the requirements of the specifications are encouraged to submit offers for all or some of the items. Such offers should be reinforced with sufficient general and technical information to allow the Department to evaluate the products in context of the brand name listing. A point by point (or feature to feature) comparison of the major functional characteristics of the offered alternative product to the listed product is recommended.

The evaluation of products that are not on the list and are offered as an equal may require one or two basic steps. The first step, which will happen as a part of the bid evaluation, will simply be a review of the available information that has been submitted with the offer. Based on the findings of this evaluation, the Department may (1) accept the product, (2) reject the product, or (3) accept the product conditionally pending further review and/or testing. If the product is accepted conditionally, then the evaluation will move to the second step, i.e. further review and/or testing. The second step may happen before or after a contract is awarded depending on what actions are required to make a determination (accept or reject), and the time available to complete such actions. It should be noted that this process stated is intended to apply to major components and not minor components of a cabinet assembly.

The focus of the evaluation of non-listed offered units and/or items will be to determine if they are equal or better than the brand name products listed and how they compare in terms of compatibility with the controller and cabinet standards and practices used by the Department and other jurisdictions in Arizona. If deemed necessary, the second step of this evaluation may require the supplier to submit samples for testing, field demonstrations and/or trials. Length of this step cannot be defined and will be handled on a case-by-case basis. The outcome depends on the availability of resources, the complexity of the products submitted, and the particular needs related to the application for which it is used. It should be noted that an acceptable finding per this evaluation process does not guarantee an award or purchases.

The Department and other users of this contract shall have the right to utilize whatever traffic signal units and items which they determine to be most compatible and suitable for the application under consideration. Some units and items are interchangeable; but many are not, or are marginal in their ability to be mixed and matched. Even if the unit or item is equal and is fully interchangeable, the Department and other users still reserve the right to stay with a particular product and/or configurations of products to maintain consistent applications at specific locations and/or entire areas and/or routes. This practice is not intended to restrict competition; but rather to help ensure a reasonable level of standardization in terms of traffic signal operations, traffic signal system compatibility (if applicable) and maintenance.

It is important to note that the Department has a wide variety of traffic signal control situations throughout the state. Many of these situations involve both the Department and the local jurisdiction (e.g. city). In many cases projects will involve the Department providing the initial construction and equipment with the local jurisdiction taking over the continuing operations and maintenance of the traffic signal. In these cases, the traffic signal equipment is to be configured to the standards of the local jurisdiction as herein provided. All suppliers should have first-hand knowledge (e.g. local representation) of the applicable local standards in order to anticipate what is needed and to structure their offers accordingly.

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## 1.4 SCOPE

To account for the possible diversity of use, this specification involves six basic types of traffic signal controller standard configurations as follows:

**NEMA TS 1**  
**NEMA TS 2 Type 1**  
**NEMA TS 2 Type 2**  
**Model 170**  
**Model 2070**  
**Advance Transportation Controller (ATC)**

The NEMA and Model 170 controller configurations (references to 170 shall be regarded to mean the same as 170E), including the corresponding cabinets, shall include as applicable a full and complete complement of compatible software, firmware, hardware, communication protocols, terminals, components, and other related items which enable each controller standard to be utilized safely and effectively to its fullest extent in the context of the requirements that are typical for signalized intersection configurations in the State of Arizona. The Model 2070 and the ATC shall meet the same basic requirement. The 2070 is, at the very least, to be compatible and utilized as an upgrade to the Model 170 type controller cabinet configurations herein specified. Bidder shall offer the ATC based on what is available, compatible to 170, NEMA TS 1, TS 2 Type 1 or TS 2 Type 2. It is acceptable and desirable for controllers and their corresponding cabinets to be available in numerous configurations that account for as many traffic control applications as possible.

It is important to note that the Department has primarily used the NEMA TS 1-1989 configuration; however adopting NEMA TS 2 Type 2 is under serious consideration. There are many cities that use NEMA TS 2 Type 1 (Cities of Tempe, Phoenix, Mesa and many others). At least two cities, Scottsdale and Avondale are known to use a version of the Model 170 standard. The inclusion of the new Model 2070 and ATC controller standard is not meant to indicate a change to this standard by any jurisdiction in Arizona. Rather it is to provide access to this new technology within the scope of the existing standards already in use. Bidders can offer these new technologies as options within the basic framework of the items included in this IFB.

Additionally, all of these items are to be consistent with the basic physical (except as allowed for per the referenced standard) and functional standards as defined in **MUTCD Part 4 Highway Traffic Signals, NEMA TS 1 Section 14 "Definitions and Physical and Functional Standards for Advanced Two-Phase Through Eight-Phase Solid-State Traffic Signal Controller Units of the Vehicle-Actuated Type," "NEMA TS 2 Sub-Section 3.5 Actuated Control"** as well as other applicable sections of this NEMA standard and those requirements presented herein.

It should be noted that this IFB includes items for a 12 phase controller, but not a corresponding cabinet. The Department does not anticipate installing any additional 12-phase cabinets. However, there may be a need to replace 12 phase controllers at existing intersections. The supplier may offer a 12 phase pre-wired cabinet as an optional item for this IFB. If so, this cabinet shall be in a Type V or Model 170 type cabinet in the TS 1, TS 2 Type 1, TS 2 Type 2 or Model 170 cabinet configuration that has a main panel with 24 load switch positions. It is anticipated that the conflict monitor unit (CMU) and malfunction management unit (MMU) would need to be customized to handle this number of channels.

The 12 phase controller configuration is needed to provide for five to six legged intersections that may have a heavy rail crossing. To handle this application the 8 phase operations requirements stated in TS 1 and TS 2 needs to be expanded to include, as a minimum, 12 phase dual-ring operations with an additional group of four phases with a barrier and two more overlaps (total of six overlaps) and two more pedestrian movements

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(total of six pedestrians). All such 12 phase controllers (as well as the other controllers) shall be capable of multiple pre-emption routines that include programs for light rail, heavy rail, bus transit, and emergency vehicle applications. The heavy rail pre-emption routine shall allow for cycling of non-conflicting phases and the activation of special signs. Additionally, all controllers and cabinets shall be compatible with all traffic signal devices (incandescent, LEDs, and count-down pedestrian units) and detection devices (inductive loops and video) that are in common use in Arizona and other states.

## **1.5 ITEM CATEGORIES AND SUBCATEGORIES**

This procurement has been divided into three main categories. Due to the large number of proposed contract units and items, the main categories of units and items are listed here. The categories and subcategories are as follows:

### **Category 1- TRAFFIC CONTROL CABINETS**

**Subcategory 1a - Bare Cabinets**

**Subcategory 1b - Pre-Wired Cabinets**

**Subcategory 1c - Pre-Wired Cabinets with Plug-In, Rack and Shelf Components**

### **Category 2 – TRAFFIC CONTROL CABINET COMPONENTS**

**Subcategory 2a – NEMA Types**

**Subcategory 2b – Model 170 Types**

### **Category 3 – TRAFFIC SIGNAL CONTROLLERS**

**Subcategory 3a – NEMA Types**

**Subcategory 3b – Model 170**

**Subcategory 3c – Model 2070 and /or ATC**

The **Price Sheet** item number referencing system is based on these categories and subcategories. Given the number of different controller configurations defined within this specification, the **Price Sheet** is extensive. The **Price Sheet** includes, as applicable and as shown for the item or sub-item, a column for each of the following attributes: item number (**Item No.**), item description (**Item**), options to the base item [**Options (Add / Deduct)**], pricing columns [**Base Price** and additions or subtractions ( - or + ) for ordered options (**Amt Add / Deduct**)], purchase units [**Purch Unit** - each (**ea**), pair (**pr**), **kit**, **set of 4**, **box** and **by offer**], quantity (**Qty**), **Extended Price**, **Offered Item Brand / Model / Part Number** and offer catalog reference (**Offer Cat. Ref**). All offerors shall fill out all of this information as a part of their offer. The information filled out on the **Price Sheet** and referenced to the attached **Offer Catalog** shall be clear and give the Department all the details of what is being offered and the associated price. Incomplete and/or confusing information could lead to an adverse finding regarding that part of the offer or the entire offer by the Department.

If items or sub items are not available or do not apply, offerors shall indicate on the price sheet by stating "**Not Available**" (NA), "**No Bid**", or some other appropriate response. If the structure of the **Price Sheet** does not accommodate the nature of what is being offered, then the offer can attach an additional sheet that clarifies what is being offered. It should be noted that in many places the **Price Sheet** has a row that allows offerors to "**add: other options (provide list)**." This row is intended to allow for other options not specifically listed on the **Price Sheet** or variations of those listed to be offered by offerors. If this is done then the offeror shall reference that this has been done by noting this on the **Price Sheet** (e.g. "**additional**

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**options, see offer Cat.**” or similar). As already stated in the first part of this IFB, spare parts and replacement items are to be handled in a similar manner.

In **Section 3.0 Special Terms and Conditions**, the tabulated detailed listing of the brand name products helps to define and illustrate the requirements of these specifications. This listing is also cross referenced to the item and sub items presented on the **Price Sheet** by way of the **Item No.**. This is done because these tables also contain a detailed item description which summarizes the basic requirements, which in turn complements the brand name listings for each item. As applicable, the description and brand name listing also details all of the components (type and number) that then make up item. Hence, the **Section 3.0** listing shall not only be regarded as an extension of the specifications, but the **Price Sheet** as well.

The **Offer Catalog** should reflect this basic category and subcategory structure. The **Offer Catalog** is to give specific information on what is included with each item and what the price is. The **Offer Catalog** should have some form of page number system that can then be referenced per the Offer Catalog Reference column on the **Price Sheet**.

All suppliers are to note on the **Price Sheet** the exact product and manufacturer they are offering for the units and items and related sub-items as applicable to their offer. All information on the offered product shall be contained in the **Offer Catalog**. Pricing shall be filled out as appropriate and applicable. If the product being offered is the “**brand name product**” then this shall be indicated. If the offer involves an “**equal or better product**”, then the supplier shall fill in the manufacturer, product, model and/or part number. If the supplier has a need to clarify an offer on the “**brand name product**” or “**equal or better product**”, this shall be noted on the price sheet per the Offer Catalog Reference column.

It is acceptable to include attachments to the **Price Sheet** for clarifications. If a clarification is necessary, it is appropriate to note this on the **Price Sheet** in some fashion. Such attachments can or should be included in the **Offer Catalog**. All **Offer Catalogs** shall include both general and technical information on the products being offered, even if they are a brand name listed product or being offered as an equal or better product. The offer should include cross reference between the **Price Sheet** and the **Offer Catalog**.

It should be noted that throughout this specification there are items that are identified as a “**spare part or replacement item.**” The intent of these items is to give the Department the ability to repair and replace components of unit assemblies (e.g. cabinets) either on an as needed basis and/or as an item that is stocked in the Department’s Supply Center. Bidders shall structure their offers accordingly by offering these items individually (one spare part or replacement item) and in bulk (box of spare part and replacement items). Thus, each pricing and box pricing will be needed as appropriate and applicable. Details on the spare part and replacement items shall be included in the **Offer Catalog**.

## **1.6 REQUIREMENTS:**

### **1.6.1 General – Quality and Quality Control**

The intent of this IFB is to provide for a supply contract that allows for the Department and others to purchase fully assembled traffic control cabinet units and/or individual component items separately (e.g. spare part and replacement items), as well as allowing the ability to add components and/or features to assembled traffic control cabinet or controller units to account for special needs that may arise per construction, maintenance and operations activities.

At the supplier’s option, additional features and alternatives may be offered. All offers of options and alternatives should be clearly identified as to what is being offered and what is included per the price. Offers

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that do not document the appropriate details of options or alternatives may be rejected. It is acceptable for these additional features and/or alternatives to be worked into the structure of the **Offer Catalog** per the appropriate category or subcategory.

All cabinets, controllers units, component items, device items, and all related sub-items shall be manufactured and packaged in such a manner that they are capable of withstanding normal shipping, and handling, without damage. If this requirement is not met then the supplier agrees to warranty this by replacing any such damaged units, items or sub-items without additional cost.

All units, items and sub-items shall be manufactured in such a manner that they are consistent in design and function from order to order. Units, items, sub-items or parts that have been determined not to match the original approved design, or which are found to be defective and/or improperly fabricated, shall be immediately replaced by the supplier at the supplier's expense.

Spare part or replacement items shall be fully functional, interchangeable and of the same quality as those used in the assembly items.

If at anytime during the course of the contract the Department makes the supplier aware of any problem with the furnished products, the supplier shall take immediate action to investigate the cause and to develop a solution. This includes attending meetings, visiting the signal shop and/or inspecting the issue in the field. Non-response or an untimely response can be the grounds for contract suspension or cancellation. The supplier shall coordinate with the **Procurement Contract Officer** on all problems and solutions relating to this contract.

All products purchased shall be covered by a quality control (QC) plan that provides reasonable assurance that the materials and components used to make them conform to the needed requirements and that the devices function properly. The quality control plan shall include systematic tests and/or inspections that are documented, recorded, and retained for future reference. Test certificates should be submitted with all critical types of control equipment (controllers, conflict monitors, etc.). Additionally, the QC program shall confirm, as applicable and reasonable, that products that are purchased per this contract have a permanent marking that identifies information of importance about the device or component [e.g. manufacturer, model number, and the date (month and year) that the device was made].

No unit, item, sub-item and/or part thereof shall be provided where the date of manufacture is older than what is regarded as reasonable (e.g. 3 years or less) and is common to the traffic control industry. This requirement only applies to the manufacturer at the time the device is made. It does not apply to items that are held in inventory as spare parts or replacement items.

The design life of all cabinet units, controller, related components, items and parts, as operating in their application, shall be 10 years or longer

All traffic control device designs, as applicable, shall be such they have the ability to compensate for temperature extremes to prevent abnormal operations, failure or accelerated deterioration which is not consistent with their design life. The ability of designs and production models to work under these conditions shall be verified per a testing program that simulates these conditions. This testing program shall be conducted at regular intervals and as appropriate (e.g. on product changes and modifications) to ensure this requirement is being met continuously.

Each component shall be properly rated and clearly identifiable as to its ratings and model and/or part number.

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Controllers, CMU, MMU, loop detector units, power supplies, and other related devices shall be designed to be modular whenever possible and to utilize plug-connections where feasible to help facilitate testing and repair. The Department has an electronic shop or lab that has the ability to test and repair almost all types and models of these types of devices. Therefore, the ability of a device to be readily accessible and economically repairable is an important aspect to the Department and will be a factor in the types of devices utilized. The Department reserves the right to utilize a device based on this criteria alone.

All traffic control plug-in and rack mount items, or components thereof, shall be designed and manufactured in such a manner to assure their ability to fit and smoothly plug in or slide into the needed position and make a snug and reliable connection that will not disengage when subjected to impacts and vibrations common to a roadside environment. Supplemental screw locks, catches, lock nuts and/or lock washers shall be used as necessary to ensure a reliable and durable connection. Devices shall be easily removed in the same manner, even after years of use. Pull out handles, tabs and/or lever tabs should be provided as appropriate (e.g. detector units, conflict monitor program cards, other rack mounted items) to aid in this function.

All knobs, switches, key pad buttons, indicators and displays shall be designed in a manner that is consistent with good human engineering practice and is applicable to their function and the environment in which they are to be operated. This means they are of sufficient size and placement to be able to be operated without conflict with other controls by an operator wearing gloves. The exception to this rule pertains to **dual-in-line package** or **dual-in-place** (DIP) slide switches or similar which are typically used with detector units, CMUs or MMUs whose settings are typically not adjusted or set in the field. It is acceptable for switches of this type to be operated with a small screw driver or similar tool. However, it is almost always acceptable for different types of display and/or switching technologies to be used that enables more information to be gained or which eases feature/function programming without having to interrupt the function performed by the device (e.g. use of LCDs on loop detector units with a menu driven program, functioning without having to pull the card out to reprogram it).

Traffic device indicators and displays need to be bright and offer enough contrast and be of sufficient size to be readily readable in both daytime and nighttime visibility conditions.

### 1.6.2 CATEGORY 1 – Traffic Control Cabinets

A traffic control cabinet unit shall consist of a metal enclosure which is specifically designed and configured to provide a suitable housing for a complete assemblage of electrical, electronic, and communication equipment and components for controlling the operation and timing of traffic control signals. Additionally, these traffic control cabinets may sometimes provide for the control of other roadway features such as street lighting, internally illuminated signs, and other related equipment.

The cabinets shall be configured to meet the applicable and referenced standards (e.g. NEMA, Model 170 or Department T.S. Drawing).

All cabinets should be provided with a shipping sheet and sales order requirements check list or equivalent paper work. This information can be placed in the "zip lock" clear plastic envelope (or bag) which is attached to the inside back of the front door, stuffed into the cabinet plan pocket, or taped to a shelf. The information shall provide the Department with readily understandable data about the cabinet supplied (e.g. parts, options and applicable circuit diagrams or prints on the cabinet and components). The shipping sheet shall reference the cabinet serial number, type of cabinet, and date made, and shall give a listing of the parts and quantities of the parts shipped with the cabinet as applicable. If applicable, key components (e.g. controller, conflict monitor unit (CMU), malfunction management unit (MMU), power supply, bus interface unit (BIU),

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etc.) should also have their serial numbers referenced on the shipping sheet. This is especially important if those items are shipped separately.

The default mounting configuration of the cabinets shall be for a flat slab concrete foundation (pad mounted). Separate elevator base and pole mounted (pedestal or side) options should be offered as sub-items to the appropriate cabinet item. A set of anchor bolts with nuts and washers for cabinet concrete slab foundations, and bolts, nuts and washers for cabinet to elevator bases shall be offered as options per the price sheet. The mounting frame of all cabinets and elevator bases shall be such that the anchor bolt attachments shall be on the inside of the cabinet unless specifically called for in the referenced standard. The bolt holes shall be oversized and/or slotted to allow for adjustments. The portion of the cabinet and elevator base around bolt holes should be reinforced and/or braced.

Cabinets that are suitable for mounting to the side of poles shall be configured so this can be accomplished with an upper and lower bracket that is bolted and/or welded to the cabinet in a manner that is capable of supporting the cabinet in a secure and durable fashion. Additionally, knock-outs and/or holes on the floor and/or back panel of the cabinet for field wiring conduits and/or raceways shall be provided. The floors of pole side mounted cabinets shall be made of the same material as the body of the cabinet.

The NEMA or Model 170 type controller cabinets are to be available in three basic configurations with the ability to select options. The three basic configurations are:

**Subcategory 1a - Bare Cabinet**

**Subcategory 1b - Pre-Wired Cabinet**

**Subcategory 1c - Pre-Wired Cabinet with Plug-In, Rack and Shelf Components**

The definition of each configuration is detailed herein. It should be noted that variations, options and additions are allowable based on the controller standard for which the cabinet is to be configured, i.e. NEMA TS 1, NEMA TS 2 Type 1, NEMA TS 2 Type 2 and Model 170. Variations, options and additions will depend on what is available for that type; however, they should include variations that help make the cabinets more applicable to a variety of different traffic control configurations (e.g. pre-emption, telemetry, etc) and also to allow access to spare parts needed for maintenance and repair. Details of available cabinet options and spare parts and replacement items shall be included in the **Offer Catalog** which is to be submitted with all offers.

All cabinets shall be subjected to a rigorous quality control inspection and check that ensures that all items have been properly welded, sealed, circuited, connected and securely attached as applicable to the required configuration, and that all required safety features are properly installed or ready to be installed. Additionally, all cabinets shall be arranged and packed in a manner that helps ensure that they are not damaged when handled, shipped and stored. This same requirement applies to any components which are shipped separately and/or inside the cabinet and for separate spare parts and replacement items.

The following three subsections state the general requirements for the three basic configurations of cabinet by the referenced standard. The specific standard for the cabinet unit item shall be per the item description detailed on the **Price Sheet** and the corresponding Brand Name or equal listing in **Section 3.0**.

## **1.6.2(a) SUBCATEGORY 1a - Bare Cabinet**

### **1.6.2(a)(1) General**

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A **Bare Cabinet** shall always include a welded, completely assembled, rainproof sealed, metal enclosure that includes the following as applicable to the referenced cabinet standard: body, door(s), lock(s), door handle(s), three point locking mechanism (top, middle and bottom), police panel, set of keys, internal police panel dead front (or test switch shield panel), one internal paperwork pocket shelf (for plans, schematics, and manuals), roof, screened roof vent, louvered door vent, hinges, door stop(s), gaskets, weatherproofing, air filter, air filter holder, door switch mounting bracket(s), mounting channels/frame, shelf (or shelves) and hoisting plates and all other incidentals that are necessary and applicable to provide a finished bare traffic signal control cabinet to the style and type as herein specified.

The cabinet shall have a sticker on the inside of the front door (in the upper corner on the door latch side) which identifies as a minimum: the supplier, manufacturer, serial number, print/drawing number, and date of assembly.

A separate locking police door or compartment with a police door shall be provided for all cabinets.

Door hinge pins shall be stainless steel. Front doors shall be hinged on the right side of the cabinet as viewed from the outside, facing the cabinet door opening. Rear doors are to be hinged from the left. Hinge pins shall be secured in a tamperproof manner.

The cabinet rooftops shall be pitched so that they readily shed rainwater. The cabinet enclosure shall have, as a minimum, a weather resistant or weather proof rating. All exterior seams shall be either welded or sealed with an appropriate silicone caulk or sealant on the interior of the cabinet that achieves an appropriate NEMA Type rating for enclosures.

Bolt and rivet holes that penetrate to the outside of the cabinet, shall also be sealed in a suitable manner. Doors and the door handles shall be fully gasketed with an appropriate material.

All doors shall have a neoprene or neoprene equivalent type gasket around the entire perimeter of each door [main, second (if applicable), and police panel]. The gasket shall be non-stick type or treated with a silicone lubricant to prevent sticking. The gasket shall be attached to the door with a permanent adhesive. Door gasket material shall be offered as a separate spare part or replacement item.

Additionally, the top of the metal door frame shall have a drip channel that is internal. This drip channel shall be continuously metal (e.g. welded) so that it will redirect any water that drips down from the front face of the cabinet to the sides. Rear doors, if applicable, shall have a similar treatment. The drip channel shall be an integral part of the door frame. The drip guard shall extend around the top and sides of the door frame if called for in the referenced standard or it can be offered as an option to the cabinet item. All doors shall be easy to close and open and shall nest tightly with their gaskets to form a weatherproof and dust-tight seal between the frame and door.

All cabinet main and rear doors shall use a three point locking device with heavy gauge cam. The latch and locking arms shall engage the door frame at the bottom, middle and top so that a secure and durable seal is achieved. The door handle shall rotate inward to the middle of the door to disengage the locking mechanism. The door handle shall have a hasp or latch that enables the cabinet to be padlocked. The cam, locking arms and handle shall be offered as a separate spare part or replacement item.

All keys and locks shall be made of brass or stainless steel. Locks shall have four mounting holes. A key for each type of lock (main door and police panel lock) shall be supplied with each cabinet.

The cabinet locks and keys shall be of the types that are in common use for traffic signal cabinets in Arizona. The police lock and key shall be able to be operated with a police key, Corbin Type Blank No.

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04266 or equivalent. The main door lock (or back door if applicable) shall have a Corbin No. 15481RS lock or equivalent that can operate with a traffic industry conventional Corbin No. 1R6380 Number 2 key or equivalent. Locks with keys shall be offered as a separate spare part or replacement item.

Keys should be placed in an envelope and placed in either the optional "zip lock" plastic bag on the inside of the cabinet's front door or taped to a shelf top. All locks shall be self locking (e.g. require the key to be engaged and turned to open; once closed the latch shall lock). The key shall only be removable in the locked position. Key holes shutters shall be utilized as necessary to prevent intrusion of water and dust in key holes.

All cabinets shall be provided with a lift stop-and-catch door stop that is mounted at the bottom. The front door stop or catch, as a minimum, shall have stop-and-catch positions that are capable of holding the door open for at least two positions (e.g. 90 and 180 degrees +/- 15 degrees) for the small cabinets, and three positions (including 125 degrees) for the larger cabinets. The door stop shall be easy to disengage so the door can be re-positioned or closed. The stop shall be designed so it can keep the door open and secure even under windy conditions. The door catch arm and brackets shall be offered as spare parts or replacement items.

All cabinets are to have a door vent (supply) and roof (exhaust) ventilation system. The door vent shall be filtered. The roof vent shall be screened. Filters shall be offered as a separate spare part or replacement item.

A welded or bolted-on angle bracket shall be provided in the upper right hand corner of the cabinet door frame to allow for up to two door open/close plunger switches (e.g. door alarm and cabinet light). The door switch bracket shall be offered as a spare part or replacement item.

All shelves and racks shall be capable of supporting controllers and other components without falling apart, bending, sagging or misalignment. Shelves and racks shall be bolted or screwed so they are securely placed in the cabinet so they will not fall or misalign, even if the cabinet is handled roughly or vibrated. Additionally, the shelving and rack system shall be designed to ensure a free flow of air on all sides and through the cabinet.

All cabinets shall have an equipment ground or bonding lug welded to the inside of the cabinet at an appropriate and accessible spot (close to equipment grounding bus bar). The lug shall be sized to accept up to a # 6 AWG solid or stranded copper conductor. The bonding lug's purpose is to assure that the entire metal enclosure provides a low impedance electrical return path in order to effectively operate the overcurrent protection circuit breaker(s) or fuse(s) (within the cabinet itself and/or the service panel) in the case of unintended contact of line AC to the cabinet enclosure.

The default order finish of the outside of cabinets and elevator bases shall be unpainted aluminum. The outside of the cabinet can, at the manufacturer's option, be treated with a colorless or near colorless (clear) conversion coating that is suitable for long term outdoor exposure without discoloring and/or delaminating. If so treated the coating shall form an oxidation resistant barrier film that is suitable for this type of application and is known to be successful in a desert environment like Arizona's.

Painting or powder coating of cabinets and elevator bases, to a color to be specified at the time of order, shall be offered as an available cabinet option. Painting shall be done in a manner that assures proper surface preparation (e.g. degreased, sanded, cleaned and primed), even and neat coverage, and a finish which, for a minimum of 5 years, will not peel, chalk, flake or degrade in any visible way that is directly attributable to workmanship or the powder coat paint.

Care shall be taken in the assembly; handling and packaging of all cabinets, elevator bases and related

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components. All cabinets, elevator bases and internal components are to arrive at their delivered location in excellent condition. This means they are free of scratches, dents, bends, welding blowholes or any other irregularities. All sharp edges, inside and out shall be filed or ground smooth. Cabinets shall be securely mounted (bolted) on wood pallets for delivery to the Department.

## **1.6.2(a)(2) NEMA Types**

The three NEMA type cabinets shall meet the basic configurations requirements of Department Standard Drawing Numbers **T.S. 3-6 Type III Control Cabinet**, **T.S. 3-9 Type IV Control Cabinet**, and **T.S. 3-10 Type V Control Cabinet**. Exceptions to these drawings shall be: all anchor bolt slots are to be on the inside of the cabinet, the door hinges are to be the continuous type, the cabinets are to be un-painted (unless ordered otherwise), the cabinets are to be aluminum, anchor bolts are not to be furnished unless ordered, and the shelves are to be made of aluminum. Other differences from the drawings are noted herein.

Both the Type IV and Type V cabinets shall be 44 inches wide, +/- ½ inch. (The current Standard Drawing T.S. 3-10 shows the Type V cabinet to be 38-1/2 inches wide.)

The Type III cabinet shall be offered in a suitable configuration for pole mounting, see Standard Drawing **T.S. 3-7 and 3-8 Pole Mount for Type III Control Cabinet**. Variations from the requirements shown on these drawings are allowable. In addition to being pre-assembled in the cabinet, the mounting brackets and necessary hardware shall be offered as a separate item.

The Type IV cabinet shall also be available in a dual or back door configuration. At the manufacturer's option the door catch for the back door can be different that the front door catch. The catch shall have at least three open positions.

An 18 inch high elevator base for the type III and IV cabinet shall also be offered. The elevator base for the Type IV is to meet the requirements stated on Department Standard Drawing Number **T.S. 3-14 Elevator Base for Type IV Control Cabinet**. There is no standard drawing for the Type III cabinet elevator base. However, the elevator base for this cabinet size shall conform to the same requirements as T.S. 3-14 except the dimensions for the bolt hole locations shall be changed to match those of the bottom of the Type III cabinet presented per T.S. 3-6.

Other allowable variations from the cabinet T.S. Standard Drawings are: the number, size and location of supply air vents and the configuration of the exhaust vent can be different from what is shown, the air filter dimensions can vary accordingly, the police panel door can be recessed or project slightly from the plane of the front door, the location of the main door lock can be different, the door handle configuration can be different, the Type III cabinet is to also come with a bolt holes in each corner (in addition to the slotted anchor bolt holes for pad mounting) to allow for its attachment to an elevator base or removable floor. The lighting contactor for the Type V cabinet shall be as specified herein.

The cabinet shells are to be fabricated from a minimum 0.125 inch thick type 5052-H32 mill finished or equivalent sheet aluminum that is left unpainted (e.g. natural aluminum finish) unless specifically ordered otherwise. The elevator base shall be made of a thicker aluminum. See drawing T.S, 3-14 for more information.

The cabinets shall have slotted adjustable shelf, panel and component mounting "C-channels" (minimum of 2 per side for Type III and 3 per side for both the Type IV and V). Additional C-channels can be added at the option of the manufacturer. The channels shall extend from the near the bottom to the top of the cabinets. The channel shall extend all the way to the top and bottom if the cabinet has a back door. The locations and

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length of the C-channels shall be adjusted if requested by the Department. The C-channels shall be designed to accept screw lock wing nuts or studs (spring or non-spring strut wings) that are able to hold shelves, panels, cable ties, bus bars, terminal blocks and other components in a secure and an easily adjustable manner.

The channels (and slotted rails-struts, if applicable) shall be continuous pieces of metal without a splice. They shall be welded at regular intervals (top, bottom and two or three times in-between) so they are attached to the side and/or back panels of the cabinet body (act as stiffeners as well). The adjustable shelf mounting channels shall be positioned so each shelf can be bolted or screwed to a channel on or near each corner (four places).

Shelves shall span the entire width of the cabinet. The configuration and setting of the shelving shall be that it enables all makes and types of common use shelf-mounted control devices to be placed on them without conflict. The shelves shall have bent front and side edges (the back of the shelf can also have this feature at the option of the manufacturer) that provides the shelf additional structural strength and a means to attaching it to the mounting channels. The shelf shall also have round and/or slotted holes spaced at regular intervals across the flat and bent edge portions of the shelf to provide a means to secure equipment and/or cabling to the shelf. The holes shall be configured in such a manner that they are readily useable for securing shelf mounted equipment (including detector racks). The number, location and size of the holes shall be adjusted as requested by the Department.

Each cabinet shall be supplied with a set of hoisting plates. Hoisting plates for painted cabinets shall be painted the same color as the cabinet. The plates shall be bolted at the top of each side of the cabinet. The hoisting plate shall of sufficient strength to support the full weight of the cabinet when suspended without sagging or bending. The hoisting plate shall be positioned so the cabinet weight is evenly distributed and the cabinet will remain level and balanced when suspended either with or without plug-in, rack and shelf mounted components. The hoisting plate shall be able to be rotated 90 to 180 degrees or drop down and out of the way when not in use. The hoisting device shall not be attached to the horizontal or flat portion of the roof of the cabinet. If so ordered, hoisting plates can be omitted. The cost of the plates shall be deducted from the price of the cabinets so configured.

A separate main door compartment with a police door shall be provided for all cabinets. This police door shall provide access to switches that shall be configured per the requirements presented herein. Toggle switch mounting holes shall be provided in the switch panel for the bare cabinet configuration. A minimum of three holes shall be provided. Additional holes can be provided at the option of the manufacturer.

The cabinets shall also include a bolt-on or screw-on three (front, top and bottom) or five sided (front, top, bottom and both ends) dead-front panel on the inside of the cabinet door behind the police panel. This dead-front shall have sufficient room to allow for all of the wiring and cabling for the police panel switches as well as the inside cabinet switches, fuses (if used) and a ground fault circuit interrupter circuit (GFCI) duplex outlet as applicable. This panel shall be made of the same or similar material as the metal walls of the cabinet. Standard sized panels that have pre-set knock outs and/or holes for mounting components are acceptable.

The door of the Type IV and Type V cabinets shall include a reinforcing panel at or near the middle of the door. A reinforcing channel panel for the Type III cabinet is optional. This reinforcing panel shall be made of the same material as the cabinet. The panel can be spot welded at regular intervals to the door and should extend around 2/3rds the width of the door. The door locking mechanism can be mounted on this panel or on its separate metal platform. Holes can be provided in this panel for mounting.

The cabinet schematic holders (or pocket) on the inside of the door shall be fabricated from the same materials as the outside shell of the cabinet. The pocket size as a minimum shall be 12 inches wide by 3

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inches deep by 8 inches in height. The pocket shall be on an open area on the inside of the front door. The pocket shall not conflict with any internal components and shall be readily accessible. This metal pocket can be omitted if specified at the time of order, the cost of which shall be deducted for the price of the cabinet.

**Optional Item:** A large size heavy clear plastic "zip-lock" bag to hold cabinet paper work and spare parts can be provided on the inside of the door near the center at the manufacturers option or as requested by the Department. This shall be a **no** cost option. The opening of the bag shall be placed vertical to the bottom of the cabinet and facing the hinge side of the cabinet. The bag shall be bolted or screwed to the door reinforcing panel at three locations (ends and in the middle). The bolt or screws are to include washers to prevent the bag attachments from pulling out. The minimize size of the plastic bag is to be 11 inches by 18 inches.

As applicable to the order item, rear doors shall match the design, style and dimensions of the front doors except they are not required to have a second police panel, a schematic pocket or plastic bag. Additionally, above the rear door there shall be a continuously-welded, 1 to 2 inch external drip guard. This drip guard will be at an angle and of sufficient projection to ensure that water running off the roof of the cabinet does not drip directly between the door and the door frame.

The Type III cabinet shall come with one shelf. The Type IV and V cabinets shall come with two shelves. Additional shelves shall be offered as a cabinet option, spare part or replacement item. A pull out under-shelf drawer shall be offered as an option. The drawer shall be made of metal and have a hinged top cover that can be opened once the draw is pulled out.

The cabinets shall have an angled panel at the top of the cabinet that is suitable for mounting the cabinet fans and light on and is also the exhaust outlet for cabinet ventilation. See Standard Drawing T.S. 3-9 for "**Screened Ventilation Detail**" for a general schematic as to what is to be provided. Pre-cut square or round knock outs shall be provided for the exhaust fans (at least one for the III and two for the IV and V). The exhaust vent for the cabinet shall be grilled, baffled and screened as necessary to minimize dust, small animal or insect intrusion.

The welded or bolted-on angle bracket that is provided in the upper right hand corner of the cabinet door frame shall allow for a minimum of two refrigerator type (plunger) door switches for the cabinet light and door-open alarm. This same bracket shall be provided for the rear door of a two door cabinet as well. The rear door shall typically only be switched for the door-open alarm.

The re-useable and removable air filters for the door intake vent shall be a commercial grade stainless steel grease baffle type that is washable and re-useable. A high quality fiberglass corrugated fabric filter, which is rated for filtering of outdoor air in an intake arrangement, can also be used if found to be acceptable by the Department. The filter shall be retained on the door with a piece of angle at the bottom and a full length spring or similar angle bracket at the top. The angle bracket is to be secured at both ends with wing nuts or similar. The spring is to be secured with hooks or other suitable arrangement. The filter shall be held firmly and securely to the door and over the inside portion of the intake louvers to ensure that all air be drawn into the cabinet is filtered. The filter holder shall be easy to operate so that the filter can be removed and replaced in the matter of minutes. The direction of air flow shall be marked on the filter.

The number of louvers and the size and depth of the filter shall be properly matched to the air flow requirements of the fan assembly and also to the amount of air flow that is needed to maintain the inside of the cabinet within temperature tolerances as called for per the applicable and referenced NEMA standard as applied to the hot Arizona desert environment.

As an option, the following "bare" component mounting panels should be offered as additions to the Type III and Type IV/V bare cabinet configurations or as a separate part. Bare panel means that these panels shall

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have no components (e.g. terminal blocks, circuit boards, cabling, etc.) on them. The panels supplied shall only be the aluminum plates that are typically used to mount components as described. The panels are to be:

- (a) main power supply panel,
- (b) lighting control panel,
- (c) detection panel,
- (d) pre-emption/telemetry panel,
- (e) full size TS 1 "D" panel, and
- (f) police dead front panel (or test switch panel).

The exact configuration of the bare panels shall be per what is specified at the time of order. However, as a minimum, the panels should have the following aspects: (1) they are to be made of aluminum that is similar or same type and thickness of that used to make the cabinet; (2) they are to have numerous slotted holes to facilitate panel and equipment mounting and location adjustments (of the panel and equipment to be mounted on it) and include knock-outs, drilled and tapped holes as what is normally provided; (3) they shall come pre-mounted in the cabinets unless ordered otherwise as a spare part or replacement item; (4) all panels shall be secured at a minimum of two locations, except the detector panel and possibly the D panel which shall be at four locations; (5) mounting holes are to located and threaded if this is what is typically done when they are used in pre-wired cabinets; and (6) the general size or mounting areas available for each panel should be approximately: 160 square inches for the power supply panel, 40 square inches for the light control panel, 240 square inches for the detector panel and 60 square inches for the small pre-emption/telemetry panel and at least three times this for the larger D panel. Exceptions to these space requirements are allowable if the manufacturer normally does the panel differently and/or the Department's needs are different. Panel sizing and dimensions should be adjusted if requested by the Department. Also, the manufacturer can offer different features and/or panels as available (e.g. electrical shock protection shields for power panel).

The police dead-front or test switch panel is to have at least three sides (front, top and bottom). It is acceptable for this panel to be furnished as a two panel set.

The lighting control and the power panel shall come with a thick clear plastic electrical shock shield (including mounting hardware) that that allows a clear space between the panel and the electrical components that it is shielding. For the light control panel this is approximately 4 inches (to allow room for the contactor). The shock shield shall be made of a clear non-conducting plastic material which is suitable for this use. It shall be secured with metal pedestal screw (at each corner of the panel) or some other similar arrangement which results in the same function.

## **1.6.2(a)(3) Model 170 Type**

The Model 170 Type cabinets are to be configured to the requirements of Caltrans Cabinet Housing Detail Drawing TSCES-5 (332 and 336). One additional "non-Caltrans standard (but similar)" cabinet shall also be offered; this cabinet shall be termed the "330."

The 332 shall be offered in housing types 1B (crown exhaust). **Note:** The Department's standard Model 345 cabinet is the same in the bare cabinet configurations as the Caltrans 332. The 336 (or 336A) is to be offered per the type 2 housing (small cabinet with 1B roof crown exhaust). The 330 shall be similar to the 336 with a type 1A housing roof with the following exceptions: it shall have a single door; the police panel is to be in the door; and the basic dimensions are to be 51 inches high by 22 inches wide by 18 inches deep +/-.

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The cabinet bare cages, cabinet housing 2 to "M" base adaptor, elevator base, and pole pedestal adaptors shall also conform to these requirements and are to be offered as options and separate parts to these cabinet items as applicable. The elevator base shall be for the 330 and the 336 cabinets, it shall have a gasketed side access panel. The cages shall come installed inside the cabinets, unless ordered otherwise. The cages shall include the controller unit supports.

## **1.6.2(b) SUBCATEGORY 1b - Pre-Wired Cabinet**

### **1.6.2(b)(1) General**

A **Pre-Wired Cabinet** means, in addition to conforming to the requirements already stated herein under **Bare Cabinets**, that the cabinet enclosure shall also include, in a modular design configuration, the complete cabinet ventilation assembly (fans, thermostat and fan control), cabinet lighting assembly (lamp, fixture and door switch), convenience outlet(s), power panel, signal control panels, detector rack, wires, cables and all other items that need to be pre-wired and installed per the applicable cabinet standard so the cabinet is ready for installation of plug-in, shelf-mounted, and/or rack-mounted control equipment.

The same physical configuration options offered per the **Bare Cabinet** subcategory items shall be offered, as applicable, to the **Pre-Wired Cabinet** subcategory items.

All pre-wired TS 1 and TS 2 control cabinets shall come, as a minimum, with a mounted and pre-wired radio interference suppressor, surge protector, inductive suppressors and other related devices and wiring that is designed to provide a properly conditioned, shielded, grounded, reduced internal interference and/or protected electrical environment for the traffic signal control equipment.

The Model 170 cabinets shall come with a fully installed Power Distribution Assembly (PDA), 24 VDC power supply (if not included with PDA), shelf drawer, input file unit(s), output file unit(s), input panels, harnesses, C1 connector assembly, police panel switches, monitor unit, all terminal panels, related hardware and mounts as herein specified and as applicable to the referenced standard.

On the inside of all pre-wired cabinets a permanent sticker shall state the following: "*Warning: Do not operate controller without conflict monitor (or malfunction management unit) as conflicting signals will not be detected!*" along with any other warning that the supplier or manufacturer believes is appropriate (e.g. "*Danger 120 volts A.C.*"). The exact wording on these warning labels can vary; however, the content shall be the same. There shall also be another sticker which identifies as a minimum: the supplier, manufacturer, serial number, print/drawing number, and date of assembly. Additional information should include the applicable contract number, initials of assembly technician, test date, quality control inspector and inspection date.

As applicable and possible within the referenced standard, the internal configuration of cabinets shall be designed in a manner that maximizes function and access, but minimizes conflict and the likelihood of touch hazards with dangerous voltages. Ample use of conspicuous warning and voltage labels to assure that personnel have the opportunity to be aware of all dangerous voltages in cabinet assemblies shall be done. Additionally, whenever possible and allowable per design and function, all internal cabinet connections, bus bars, panels, terminal blocks, fuse holders, breaker mounts, and similar 120 volt alternating current (AC) and higher voltage shall be positioned and/or shielded with non-conducting insulating material to prevent inadvertent shorts and personnel contact. Non-contact, shock or protective shields should typically be made of a clear material that allows the device, bus bar and/or terminal block to be clearly visible under it. The protective shields shall be easily removable (pivot to one side) and replaceable.

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As applicable and possible within the referenced standard, panels and components shall be designed and placed so they are easily accessible for not only gloved hands, but also to allow easy access to the component items that are on them and the tools that are necessary to maintain and/or make connections to those items. This type of equipment shall be made in such a way and positioned so there is sufficient room to allow those plug-ins and rack mounted components to be inserted and removed with minimal effort and without conflict. All rack guides shall be securely placed so they enable the device to be properly installed and removed.

All pre-wired cabinets shall be subjected to a rigorous quality control inspection, check and testing to ensure that all wires, connections, sockets, racks and switches have been properly constructed and match the design for the cabinet specified. The supplier will be required by the Department to repair and/or replace cabinets that are found to be defective. Such repairs or replacements will be done without cost to the Department and shall be done in a timely manner. If the number of errors are found to be high and/or persistent, and effective action is not taken by the supplier to correct such errors in a timely manner, the Department reserves the right to suspend use and/or cancel the contract.

## **1.6.2(b)(2) NEMA Types**

### **A. General**

The three NEMA type cabinets shall meet the basic configurations requirements of Department Standard Drawing Numbers: **T.S.3-6 Type III Control Cabinet**, **T.S. 3-9 Type IV Control Cabinet**, and **T.S. 3-10 Type V Control Cabinet** that have already been referenced and defined in the bare cabinet subcategory. These three cabinets shall be offered in the following basic pre-wired NEMA-standard fully and completely fabricated configurations:

1. Type III NEMA TS 1 - 4 Phase (8 Position)
2. Type III NEMA TS 2 Type 2 - 4 Phase (8 Position)
3. Type III NEMA TS 2 Type 1 - 4 Phase (8 Position)
4. Type IV NEMA TS 1 - 8 Phase (12 Position)
5. Type IV NEMA TS 1 - 8 Phase "Plus" (16 Position)
6. Type IV NEMA TS 2 Type 2 - 8 Phase (12 Position)
7. Type IV NEMA TS 2 Type 2 - 8 Phase "Plus" (16 Position)
8. Type IV NEMA TS 2 Type 1 - 8 Phase (16 Position)
9. Type V NEMA TS 1 - 8 Phase (12 Position)
10. Type V NEMA TS 1 - 8 Phase "Plus" (16 Position)
11. Type V NEMA TS 2 Type 2 - 8 Phase (12 Position)
12. Type V NEMA TS 2 Type 2 - 8 Phase "Plus" (16 Position)
13. Type V NEMA TS 2 Type 1 - 8 Phase (16 Position)

The number of phases means that the cabinet shall be pre-wired, socketed, terminal-blocked, paneled and racked to support the number of vehicle phases indicated, plus all the other applicable features and functions (pedestrian phases, overlaps, etc.) as specified per the referenced NEMA standard and as stated herein. Both the TS 1 and TS 2 4-phase cabinets shall have 8 load switch positions. The "Plus" on the TS 1 and the TS 2 Type 2 8 phase cabinets means the cabinet shall be equipped with a 16 load switch position main panel, instead of the 12 position for the plain TS 1 or TS 2 Type 2 8-phase. The TS 2 Type 1 8-phase shall always have 16 load switch positions. As an additional option to the configurations listed here, on the Price Sheet and in Section 3.0 the supplier can offer a 12-phase Type V cabinet.

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All of the cabinets shall include a police panel assembly (internal on the inside of the main door and external within the outside portion of the main door), main power panel, main back panel (for load switches, flash relay, contactors, etc.), detector panel, a minimum five position detector rack, test switch panel (police panel dead-front), and all related switches as herein specified. Other panels (telemetry, railroad pre-emption) shall be offered as options to the cabinet items as appropriate and applicable.

All cabinets shall come with the option to be pre-wired and configured with a number of additional panels that will enhance the function of the cabinet. The types of panels to be offered include: telemetry (phone), telemetry (fiber optic), pre-emption, coordination and/or video detection. Specifically, the TS 1 and TS 2 Type 2 cabinets shall come with the option to add a pre-wired "D" panel with cable and connector. The "D" panel shall cover a variety of functions (pre-emption, interconnect) not available per the standard TS 1 A, B and C input and output. All panels and related connectors, cables, line protection devices (surge suppressor) and relays shall be offered as spare parts or replacement items.

All cabinets shall be wired so that all load switch channels can be monitored by the CMU or MMU separately. This includes load switches that handle pedestrian movements. For example a 16 load switch cabinet shall be wired to support a 16 channel CMU or MMU. The CMU or MMU will monitor the 8 phases, 4 overlaps and 4 pedestrians with a dedicated channel. It is not acceptable to monitor a vehicle phase and a pedestrian phase, on the same channel.

Cabinets shall be able to be ordered with an additional detector rack with a corresponding additional detector panel or an enlarged detector panel to support the additional channels.

The TS 1 and the TS 2 Type 2 cabinets shall include a fully installed lighting control system which consists of a photo cell basket guard, photo-electric cell, photo-electric cell socket, contactor, fuse holder, fuses, related wiring, clear plastic shock shield, connectors and terminal blocks. The lighting control system shall be offered as an option to the TS 2 Type 1 cabinets. The pre-assembled lighting control panel (contactor, fuse holder, terminal block and protective shield) and each individual component shall be offered as a spare part or replacement item.

The TS 1 and TS 2 Type 2 cabinets shall also include an external skip-logic 22-pin edge connector that is mounted vertically on the left side (looking in from the front door). The connector shall be suitable for a plug-in "AND" or "OR" gate circuit board cards. Two "OR" cards shall be provide with every cabinet so provided. The plug-in gate cards shall be offered as separate spare parts or replacement items.

The double door version of the Type IV cabinets shall include an additional pre-wired door open alarm switch and a clear plastic removable protective shield over the middle portion of the back of the main back panel. The shield can be secured (at least at four locations) to the back of the back shelf and component mounting channels. This protective shield shall be labeled with a red colored warning label that states as a minimum "*Warning: 120 volts AC*". The exact configuration of the protective shield and the content of the warning label shall be as determined by the cabinet manufacturer. The location and size of the protective shield is to be adjusted if requested by the Department.

An engraved, laminated plastic, or permanently printed metallic legend plate or similar type labeling shall be provided inside the cabinet for each panel, socket, control device, connector cable, connector, switch, circuit breaker, bus bar, rack slot, connector plug, and fuse mounted in the cabinet. Each control device shall be labeled to identify the type of device and its connector number or other reference identifying its use, function and/or position on cabinet prints. Each fuse and/or breaker shall be labeled to identify its rating and circuit function. The size, font and numerals, and letters used on such labels shall be big enough so it is readily readable to a middle-aged guy named Danny without requiring the use of a magnifying glass or reading

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glasses.

All panels shall be mounted on C-channels and be attached with adjustable screw lock wing nuts or studs (spring or non-spring strut wings). All panels shall have slotted and additional holes to readily allow position adjustment and the additional of other items to that panel. The mounting hole arrangements and sizing shall be adjusted as request by the Department.

The default position for the top shelf for the cabinets should be approximately 11 inches from the inside of the roof. The bottom shelf for the type IV and V cabinets are to be mounted about 10 inches below the top shelf. These shelf location requirements shall be adjusted if requested otherwise by the Department.

Unused holes on the police panel and the back panel shall be capped or plugged with a non-conducting removable cap or plug.

If standard sized and pre-set panels are used, only those knock outs that are being utilized shall be removed. All other knock outs are to be in place and/or plugged.

## **B. Cabinet Conductor-Wiring-Cabling Standard**

All conductors, wires and connections shall conform to the applicable requirements of the referenced NEMA TS standard.

The conductors, wiring and cabling in a control cabinet can be divided into two classes: (a) control related and (b) electrical service, auxiliary circuit and lighting control related. Control related is all wiring and cabling that is related to traffic control input or output functions. This wiring is any that is directly attached to a controller, loop detector rack, main panel (not related to the main electrical feed to that panel), loop detector panel, conflict monitor, GPS clock, telemetry panel and any other related traffic signal control. All of the wiring related to the main electrical feed, auxiliary circuit (for cabinet outlet, light and ventilation) and any street lighting control shall be classified as electrical service and lighting related.

The control related wiring for Department TS 1 standard cabinets shall conform to the applicable requirements of **NEMA TS 1 Section 10 Terminals and Facilities**. Control wiring for TS 1 cabinets shall be Number 22 AWG or larger. The control related wiring for **NEMA TS 2 Type 1** and **Type 2** cabinets shall conform to the applicable requirements of **Section 5 Terminals and Facilities** of that standard.

The electrical service, auxiliary circuit and lighting control related wiring should, if and as possible, conform to the applicable requirements of the **National Electric Code (NEC)**, and be sized, insulated and color coded accordingly unless specifically stated otherwise in the referenced standard.

All cabinet wiring and cabling shall be neatly arranged and made tight by the use of wiring harnesses, cable sheaths, cable wraps, and/or raceways. "Neatly arranged" means that all such wires, cables or harnesses shall be routed in a logical fashion so they are easy to follow/trace between all terminations and/or internal equipment. Additionally, all connections shall include enough of a loop (of wire slack or length) to ensure that the connections and connectors are not stressed, under tension or bent at the connectors. All wires in a harness shall be laced or bound together with ties or with a suitable harness fabric that is appropriate for this use. Harnesses shall be routed to minimize crosstalk, electrical interference and physical intrusiveness of cabinet space or access to panels, shelves, racks or control units.

For the TS 1 and TS 2 Type 2 cabinets the controller cables (e.g. A, B and C cables and D cable if applicable) and the CMU for TS 1 and MMU for TS 2 Type 2 cables shall have sufficient length so the cables, when connected to these components, will loop down and around, in a manner that allows the units

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to sit flat on any shelf in the cabinet. Additionally the cable length shall be such that the units can be easily moved to either side of the cabinet. However, the length and shape of the cables shall be that it does not contact the bottom or sides of the cabinet or hang up on any component. This same requirement applies to the MMU and the buses interface unit (BIU) cables in the TS 2 Type 1 cabinets.

Routing wiring and cables snugly and securely against the cabinet side walls and behind the back panel on the back wall shall be maximized. If cables or wires do cross in front of the back panel they shall normally be secured behind and to the underside of leading edge of shelves. Runs like this typically should only be done to service a shelf mounted component. Runs like this shall be configured in such a manner they do not preclude the ability to remove or adjust shelves. Nevertheless, routing of wire and cables in this manner shall be kept to a minimum. Routing of wires and/or cables that are exposed in front of the leading edge of shelves, on the top surface of shelves, on the floor of the cabinet is not allowable. Routing of wires and cables on the underside of the roof is allowable only if such runs are there to specifically service components mounted there (fan, light, photoelectric cell, GPS antenna). The intent of these requirements is to ensure that cabinet wiring, cabling and harnesses are placed so they are out of the way and do not interfere with needed access.

Wiring and cabling shall be routed to minimize contact with metal edges. If the wiring and cabling has to go over a corner and/or through a hole in a panel the edges should be rounded and/or treated in some fashion (e.g. chase nipple, or suitable plastic or rubber insert) to minimize the likelihood of the edge cut of the cable or wire. Particular care shall be taken during fabrication to prevent any damage to wires and cables. Wiring and cabling shall be arranged so that any removable assembly may be removed without too much disruption of other cables, wires or other components not associated with that assembly. Wiring and cabling which transitions from fixed to movable parts of the cabinet (e.g. doors and hinged panels) shall contain enough slack to prevent excessive tension in the cables, wires and/or connections when the movable portion of the cabinet is opened or extended. At the same time, care must be taken to prevent slack cable from becoming pinched when the movable portion is in the closed or nested position. Slack portions of cables and wires, that may be needed to be moved and/or freed, shall be secured in a neat and orderly manner that is readily accessible so the slack can be made free, utilized and then re-secured without difficulty.

All terminal blocks shall be permanently labeled with reference call outs that correspond with the cabinet circuit prints. Additionally, cables are to be labeled with similar references at their end near the connector. Cables that have connectors at both ends shall be labeled at both ends.

All unused pin assignments shall be wired to a terminal to facilitate future use. Tie points shall be required for all controller unit and auxiliary control equipment circuits.

All runs of wiring shall be continuous without a splice between any terminal and/or connector.

As appropriate, all wiring terminated at screw secured terminal blocks shall be connected to a spade or ring connector so that it develops its entire rated capacity (except unless allowed otherwise by the referenced standard). All ring and spade connections shall be made and connected in a manner that is consistent with the connector manufacturer's recommendations. Crimp style connectors shall be applied with the proper tool. The tool's handles shall not open until the crimp has been properly set.

**Ring connectors shall only be used when specifically called for, otherwise spade type connectors are to be used.**

All soldered connections shall be done in a manner that is consistent with good practice and the instruction of the soldering iron/element/tip used and the solder manufacturer's recommendations. Liquid or paste flux is to be used as recommended. The solder used shall be what is recommended for this application. All tie points on the back sides of terminal blocks (on main panel) shall be soldered to a lug.

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Each 24 VDC and 120 VAC circuit that serves an inductive device (fan, cabinet light, mercury contractor, relays), shall have an appropriately sized suppressor element to protect the controller and other cabinet electronic devices from excessive voltage spikes and inductive line noise. These inductive noise suppression devices are in addition to the primary line surge protector which located on the main power panel.

## **C. Main Electrical Service Panel (or Power Panel / Primary Feed)**

### **1. General**

Each cabinet shall have an internal main electrical service or main power panel. The basic 120 VAC circuiting or power distribution for the NEMA type cabinets shall conform to TS 1 **Figure 10-4 Cabinet Power Distribution** (page 51) for TS 1 and **Figure 5-4 Cabinet Power Distribution Schematic** (page 172) for TS 2 and as herein specified. Note that these two figures do not include Department or other user specified additional requirements for different sized breakers, fuse protection, police panel controls, dead-front panel controls, and cabinet door interlock switches, e.g. system power shutoff or roadway lighting control. All of these features are specified herein.

The main power panel shall be located in the lower right portion of the right cabinet wall. The bottom edge of the panel, with the bus bars, shall be a minimum of 16 inches from the bottom of the cabinet; all other components shall be higher. All of the components shall be mounted on a removable aluminum panel that meets the applicable requirements as stated in the bare cabinet portion of this specification. The panel shall include all the necessary breakers, wires, lugs, jumpers, connectors, terminal blocks, three bus bars (as per NEMA's required configuration), surge protector, line conditioner/filter and signal load bus mercury contactor as required by the referenced TS and specified herein.

The power panel as a complete assembly and as individual components shall be offered as spare parts or replacement items.

The main disconnecting means shall conform to the NEMA TS 1 and TS 2 requirements; this means that the default order for all cabinets is to be a 30 amp main breaker with a 15 amp auxiliary circuit breaker. At the option of the supplier, the auxiliary circuit for the TS 1 cabinets can be protected by a panel-mounted "Buss" type 15 amp fuse instead of a breaker, in which case the fuse shall be located on the police panel dead-front on the main door.

Additional options are also to be allowed to account for differing jurisdiction requirements. For example: in the past the Department requires a 50 amp main breaker and the City of Tempe requires a 60 amp main breaker with a 20 amp auxiliary breaker. The City of Phoenix requires the use of fuses that are mounted on the main power panel in ceramic fuse holders. Offers should be designed accordingly to account for these differences on the power panel.

The different power panel configurations to be offered, for the type IV and V pre-wired TS 1 and the TS 2 Type 2 cabinets, are to be as follows:

- (a) 40 amp main breaker with 15 amp auxiliary breaker or fuse
- (b) 50 amp main breaker with 15 amp auxiliary breaker or fuse

The different power panel configurations to be offered for the type III pre-wired TS 2 cabinet is to be:

- (a) 30 amp main fuse and 15 amp auxiliary fuse in ceramic holders (Phoenix Standard)

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The different power panel configurations to be offered for the type IV and V pre-wired TS 2 Type 1 cabinets are to be:

- (a) 30 amp main fuse and 15 amp auxiliary fuse in ceramic holders (Phoenix Standard)
- (b) 40 amp main fuse and 15 amp auxiliary fuse in ceramic holders (alt Phoenix Standard)
- (c) 40 amp main breaker and 15 amp auxiliary breaker
- (d) 50 amp main breaker with 15 amp auxiliary breaker
- (e) 60 amp main breaker with 20 amp auxiliary breaker (Tempe Standard)

The default order position will always be the NEMA Standard if not specified at the time of order. All fuses shall be pre-installed.

The breakers be bolt-on type and shall conform to TS 1 and TS 2 requirements. However, the main breaker for the Department's TS 1 cabinets shall have a 10,000 ampere interruption rating, rather than 5,000 as indicated in TS 1 Subsection 10.3.2.2 Disconnection Means.

The panel shall include double-sided terminal block or blocks to provide for the necessary field (120 VAC, AC Neutral and Ground) and internal cabinet connections. The field side connectors shall have the ability to accept up to #8 to #4 AWG stranded wire either directly or per the use of an appropriately sized lug (or terminal jumpers). The neutral and equipment ground bus bars and main feed terminal block shall be on the lower edge of the power panel. As applicable and needed, additional bus bars can be mounted on pedestals on the C channel below the main power panel and jumper connected, as appropriate, to the main bus bars on the power panel.

## **2. Surge Protection or Transient Suppression**

Each controller cabinet main power panel shall include a transient suppression device. As a minimum this device shall conform to the requirements per TS 2 5.4.2.4 AC Service Transient Suppression and as stated herein. The device shall be at the input power point on the load side (between the main breaker, disconnect switches on the police panel and the radio interference suppressor; see TS 1 Figure 10-4 and TS 2 Figure 5-4). The surge protector shall reduce the effects of power line voltage transients and shall have the minimum ratings as follows:

Impulse Breakdown: less than 1,000 volts in less than 0.1 microseconds at 10 kilovolts per second.  
Standby Current: less than 1.0 milliamperere.  
Striking Voltage: 350 volts D.C.

Additionally the protector shall be capable of withstanding 15 pulses of peak current, each of which will rise in 8.0 microseconds to one half the peak voltage at 3 minute intervals. The peak current rating shall be 20,000 amperes.

The supplier can provide a surge protector device that exceeds these requirements. This device shall be an EDCO SPA-300, equal or better. This unit shall be offered as a spare part and replacement item.

## **3. Radio Interference Suppressor (RIS)**

All cabinets shall be equipped with a single radio interference suppressor (RIS) per TS 2 5.4.2.5 and the requirements stated herein. The RIS shall be installed at the input power point to these loads as shown in TS 2 Figure 5-4 (this same requirement applies to the TS 1 cabinets). It shall be designed to minimize interference in both the broadcast and the aircraft frequencies, and shall provide a minimum attenuation of 50 decibels over a frequency range of 200 kilohertz to 75 megahertz as a minimum.

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The RIS shall be located (in circuit) between the main disconnect switches and the mercury contactor / load switch bus, control equipment bus and the flasher bus.

The RIS shall be hermetically sealed in a substantial metal case which shall be filled with a suitable insulating compound. The terminals shall be nickel-plated or brass studs of sufficient external length to provide space to connect on No. 6, 8 or 10 AWG wires, and shall be so mounted that they cannot be turned in the case. Ungrounded terminals shall be properly insulated from each other, and shall maintain a surface leakage distance of not less than 1/4 inch between any exposed current conductor and any other metallic parts. The terminals shall have an insulation factor of 100-200 mega-ohms dependent upon external circuit conditions. The RIS shall not be rated less than 60 amperes.

**Note:** TS 2 states, per 5.4.2.5, that the RIS a current rating equal to, as a minimum, the main disconnect.

The RIS shall be designed for operation on 115 VAC + 10 percent, 60 Hz, single phase circuits, and shall meet the standards of the Radio Manufacturers Association and be UL listed for this intended function. The RIS shall be an EDCO PPC2005 or equal. The RIS used shall be offered as a spare part and replacement item.

#### 4. Signal Load Switch Bus

The signal switch bus shall be controlled by a single pole 120 VAC normally closed mercury contactor (signal bus mercury contactor). The minimum current rating of the signal bus mercury contactor (SBMC) is to be 60 ampere. The two main connectors (in and out) shall be standard copper wire type connector lugs. The control portion is to have two screw type connectors. The contactor shall be UL listed and be on a metal bracket to facilitate panel mounting and removal. **Note:** TS 1 per 10.3.2.3 calls for the current rating of the SBMC to be 80% of the main disconnect with overcurrent protection. TS 2 per 5.4.2.3 calls for the SBMC to have a current rating of at least the main overcurrent protection device.

The contactor shall be covered with a suitable clear plastic or cardboard cover which is easily removable and replaceable. The contactor shall be installed in the correct orientation (up/down) according to its manufacturer's recommendations. The mercury contactor used shall be offered as a spare part and replacement item.

#### 5. Other Provisions

All connectors to the RIS, surge protector and mercury contactor shall be ring types unless specifically requested otherwise by the Department.

The neutral service leg shall be connected to the AC neutral bus. All terminals and wires shall be labeled as to their purpose. Additional notes or labels shall be attached to the panel regarding factors that need to be accounted for when the panel is made ready for field use and/or when it is connected in the field to an electrical service.

Particular attention needs to be given to the connections between the AC neutral bus bar, equipment ground (or bond) bus bar and the logic ground bus bar. Although NEMA TS 1 Figure 10-4 and TS 2 Figure 5-4 show the bus bar interconnected there may be reason to have the jumper between equipment ground bus bar and the AC neutral bus bar disconnected if the AC neutral is connected to a ground bus in an AC service ahead of the main power panel in the controller cabinet.

For the TS 1 cabinets, at the option of the manufacturer, the 12 VAC power supply for the pedestrian pushbutton circuits can be located on the main power panel. The only other acceptable location is on the pedestrian and loop detector panel on the left side of the cabinet. The actual pedestrian isolation cards shall always be on the left side of the cabinet.

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The street lighting control panel, standard for all TS 1 and TS Type 2 cabinets and optional for TS 2 Type 1 cabinets is a totally separate panel from this main panel.

## **D. Cabinet Light Assembly**

Each pre-wired cabinet shall have an 15 to 18-inch long T8 or T12 cool white fluorescent light (or fixture) that is centrally placed to provide evenly distributed light over the entire inside of the cabinet, especially the front panels of the control equipment. Typically this is in the center of the exhaust channel at the top of the cabinet.

The lamp shall have a maximum rating of 15 watts. The ballast shall be a normal power factor type and be UL listed. The light (self contained fixture or ballast, tube sockets and terminal block) shall be offered as a spare part or replacement item.

The light shall be controlled by a "refrigerator" type plunger or push button switch that turns the light on when the door is open and the light off when the door is closed. The switch mounting angle shall be in the upper right hand corner of the front door. This same angle shall also have the door open alarm switch on it.

As an option the cabinet door open light plunger switch can be omitted in favor of a police panel dead-front mounted toggle switch. This is the City of Phoenix standard.

The cabinet light shall be connected to the auxiliary equipment circuit. The light shall also be in-line fused and inductively protected (between the fixture and feed from the auxiliary circuit). The cabinet light used shall be offered as a spare part and replacement item.

## **E. Cabinet Ventilation Assembly**

All cabinets shall be ventilated by means of two 115-120 VAC, 60HZ, tube axial compact type fan. Each fan's free delivery air flow shall be not less than 100 cubic feet per minute. The supply of air shall be achieved through the door vents and exhausted through the roof vent. The door vents shall be protected by an internal filter as described in the bare cabinet requirements portion of this document.

The fan housing shall be less than 5 inches square by 2 inches deep. The entrance to the fan blades shall be protected by a fan grill. The electrical connection to the fan shall be a plug in or spade terminal type that is readily removable so the fan can be easily removed if need be. The fan shall be secured to the cabinet with four bolts.

The fan bearings shall operate freely within the environmental standards specified herein. The fan unit shall not crack, creep, warp, or have bearing failure within a 5 year rated duty cycle. The maximum noise level shall be 40 decibels. The fan unit shall be corrosion resistant.

The fans shall be controlled by an adjustable thermostat which is suitable for warm air ventilation systems like what is encountered in a control cabinet. The fans can be controlled by two separate thermostats at the option of the manufacturer. The thermostat's turn-on setting shall be adjustable from 70 to 160 degrees Fahrenheit (F) at 20 to 25 degree F differential. The turn on temperature shall be selectable with a hand knob or screw driver per the specified range at 10 degree increments. The fan controls shall be snap-action type with heavy duty contacts.

The fan shall run until the cabinet temperature decreases to approximately 20 degrees below the turn-on temperature setting. The air intake shall be per the door louvers and the exhaust through the roof vent.

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The magnetic field of the fan motor shall not affect the performance of the control equipment. The fan control and fan shall be connected to the auxiliary equipment circuit. The fan shall also be in-line fused and inductively protected (between the fixture and feed from the auxiliary circuit). The inductive suppressor which serves the cabinet light can be utilized for the ventilation system too.

The fan, thermostat/fan controller and all related connectors shall be offered as spare parts or replacement items.

## **F. Convenience Outlets**

Each cabinet shall have two 15 amp NEMA 5-15 GFCI protected 115 VAC duplex outlets. One outlet shall be positioned so it is easy to utilize for maintenance (e.g. energize test equipment or tools) and the other shall be positioned so it is available to provide plug in 120 VAC power for auxiliary shelf mounted equipment (e.g. video detection monitor).

The maintenance outlet can be on the backside of the main door on the police panel dead-front or in the lower right hand corner of the cabinet as a part of the main power panel. The second GFCI outlet, unless specified otherwise at the time of order, shall be on the inside of the right wall (as looking into the cabinet from the main door) of the cabinet about 3/4<sup>th</sup> up from the bottom of the cabinet, just above the top shelf. The box should be mounted so it is forward of the shelf. The alternative location of this box is to be on the left wall at about the same location.

The wall mounted outlet shall be fully self contained plastic DIN Rail Utility Box with a GFCI outlet that has an external 3 wire plug in insulated connector (black line, green bond and white neutral connector) that have screw locks. The plastic box should be mounted on a short piece of suitable u-channel steel rail that is specifically made for mounting electrical components. The box shall be secured to the rail with two bolts. The cabinet manufacturer can use a similar GFCI outlet configuration at their option. The outlet should, unless specified otherwise at the time of order, be mounted so it is upside down, bonding plug on top for the TS 1 and TS 2 Type 2 cabinets or on its side (horizontal) for the TS 2 Type 1 cabinets..

The GFCI outlet(s) shall be connected to the auxiliary circuit which is fuse-protected and/or provided with a separate 15 to 20 amp circuit breaker. This same fuse and/or circuit breaker can be used to provide circuit protection for the cabinet fan and light.

## **G. Cabinet Mounted Switches**

Cabinets are to be furnished with the pre-wired, mounted and labeled switches as herein specified.

Switches shall be commercial grade and properly rated (e.g. voltage, amperage) for the circuits they control and/or test. Each switch shall be individually labeled to identify its function and/or circuit. The label and/or switch plate label shall be an engraved laminated plastic legend plate, or permanently printed metallic legend plate, or made of something similar in durability and conspicuity. Lettering shall be a printed font; hand labeling with a marker is not acceptable. Labels shall be mounted so they are neatly arranged and level.

Toggle switches shall have a tear drop metal switch arm which projects about 5/8" +/- 1/8" beyond the round metal threaded barrel. All switches shall be securely attached on either side of the panel as recommended by the switch manufacturer using nuts and lock washers on the threaded switch barrel. The switches shall be shock and vibration resistant, so they do not trigger (or switch on or off) if the cabinet door is subjected to an impact and/or vibration. The mounting hole shall be properly sized for mounting switches. All wire connections shall be screwed or soldered onto the switch connectors. All wiring shall be properly sized and

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rated for the circuit(s) they control. The threaded barrel of the switches shall be long enough to project beyond the thickness of the panel to allow sufficient threads for the mounting nuts.

**Cabinet Police Panel (Inside Door) Dead-Front or Switch Panel Switches:** The following switches shall be mounted on the switch shield dead-front panel which is mounted on the backside of the police panel inside the cabinet:

**Flash / Normal - Switch (AUTO/FLASH)**– In the **AUTO** position this switch shall not affect the normal operations of the controller. In the **FLASH** position the signal bus relay and flash transfer relays shall be de-energized, connecting the outputs of the flasher to the appropriate field leads and interrupting the signal bus supply to the load switches. Refer to TS 2 - 5.5.1 Auto/Flash switch.

**Stop Time / Run / Normal - Switch (STOP TIME)** - A three position toggle switch shall be provided to permit stop timing, run, normal (or automatic) mode of the controller. The three positions shall be labeled "stop time", "run", and "auto" or "normal". The run function shall allow the controller to run during flash selection of the Flash/Normal (or Auto) switch located in the police panel or when the conflict monitor has put the intersection in flash due to a malfunction. If the cabinet is furnished with a manual change switch (plug-in or pre-wired) in the police panel (e.g. Tempe's standard) this switch or similar (Phoenix has a "auto" to "manual" switch) shall be mounted in the in the police panel to account for this additional control feature.

**Detector Call Test Switches – (Optional for TS 2 Type 1 Cabinets)** - These test switches shall only be provided for the TS 1 and TS 2 Type 2 cabinets. A test switch shall be furnished to simulate a vehicle actuation for each of the phases called for in the item description (4 phase and 8 phase). A test switch shall be furnished to simulate a pedestrian actuation for each of the following phases: 1 thru 4 for a 4 phase cabinet; 2, 4, 6, 8 for an 8 phase cabinet. Each switch shall be a small sized momentary contact push button. Each switch shall be labeled to identify its function and phase.

**Power On / Off – Switch (POWER or Signals On / Off)** – If the cabinet comes with a main power panel that is fuse protected instead of a breaker (e.g. Phoenix Standard), the power on / off switch which is normally provided in the police panel shall be provided on the inside of the cabinet instead. The requirements are presented in the following paragraphs.

**Police Panel Switches:** The following switches shall be mounted inside the police panel that is accessible to the police when the panel door is unlocked and opened:

**Power On / Off – Switch (POWER or Signals On / Off)** - This shall be an "On" or "Off" toggle style breaker switch to control the 120 VAC power to the signal controller assembly. It shall be properly sized to match the amperage of the main power panel circuit breaker or fuse and shall be connected after the main breaker or fuse and in series with it. As already mentioned for the City of Phoenix this switch is to be provided on the inside of the cabinet on the police panel dead-front.

**Flash / Normal – Switch (AUTO/FLASH)** – Same switch as required on the inside dead-front panel. To be provided for both TS 1 and TS 2 cabinets.

**Photo / Off / Manual - Switch (PHOTO)** -The lighting contactor shall be controlled by a three position double pole, double throw switch, the "Photo" position shall place the contactor under the control of the photoelectric cell unit. The "Off" position shall disconnect the contactor's coil from the 120 VAC photoelectric control. The "Manual" position shall activate the contactor and turn on the intersection lighting (roadway and/or sign). This switch shall only be provided when the cabinet is equipped with a lighting control panel. This switch shall be provided for all Department TS 1 and TS 2 Type 2 cabinets and is to be offered as an option for TS 2 Type 1 cabinets.

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**Cabinet Door Interlock Switches:** Unless stated otherwise herein, two plunger switches shall be on the upper right hand corner (looking into the cabinet) to provide control for the light (LIGHT) and the other for the cabinet door open alarm (DOOR ALARM). The switch for the light shall turn the light on when the door is opened and off when it is closed. Two door alarm switches shall be provided for the Type IV double door cabinet, one for the front door and one for the back door.

**Other Switches or Switch Features –** Offers shall include information about providing additional and/or different configurations of pre-wired switches. The information shall also include pricing if and as applicable. All options offered shall be consistent and reasonable as they related to what is acceptable traffic signal control practice. These switches shall only be provided if specified at the time of order. Options or additional switches to be included shall be as follows:

**Cabinet Light On / Off Switch (Cabinet Light On/Off) -** This two position toggle switch shall turn the cabinet light on or off. This switch shall be provided instead of the door plunger switch that is normally called for and is the standard for the City of Phoenix. This switch is to be mounted on the police panel dead-front. Refer to TS 2 paragraph 5.4.2.7.3.

**Field Signal Power On / Field Signal Power Off Switch (Field Signals On/Off) -** This two position breaker type toggle switch shall turn the power off to all the load switches. This is the City of Phoenix standard. This switch is to be mounted on the police panel (inside door) dead-front and in the police panel.

**Railroad Pre-emption Test Switch -** This plunger or toggle type switch shall be similar to what has already been specified herein. When activated this switch shall simulate a railroad pre-emption activation so the pre-emption program in the controller can be checked. This switch shall be mounted on the railroad pre-emption panel or in a separate pre-emption test switch box.

Summary of switch standards by jurisdictions:

**Department TS 1 and TS 2 Type 2 Cabinets:** Inside: AUTO/FLASH, STOP TIME, & DETECTOR TEST. Police Panel: POWER, AUTO/FLASH & PHOTO. Door: LIGHT & DOOR ALARM. Extra DOOR ALARM for two door Type IV.

**Tempe TS 2 Cabinet:** Inside: AUTO/FLASH, CONTROL EQ, & PHOTO. Police Panel: POWER, AUTO/FLASH, STOP TIME, & Manual control plug. Door: LIGHT & DOOR ALARM.

**Phoenix TS 2 Cabinets:** Inside: AUTO/FLASH, POWER, Field Signals On/Off, & Cabinet Light On/Off. Police Panel: AUTO/FLASH, Auto/Manual On/Off, Field Signals On/Off, & Manual control plug. Door: DOOR ALARM.

Switches may be offered as a spare parts and replacement items.

## H. Main Panel (or Load Bay or Back Panel)

All the load switches, flasher, and flash transfer relays shall be mounted on a load bay panel that is sized and wired according to the number of vehicle phases indicated on the cabinet item. The load panels shall be configured to properly fit and utilize the space inside each cabinet in a manner that is consistent with previous Department practice. Maximum utilization of the cabinet width shall be done. The vertical extension of the main panel above the horizontal plane of the lower shelf should be avoided if at all possible.

The layout, configuration and capacity of the main panels shall conform to the applicable TS 1 and TS 2

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requirements as specified per the following:

**TS 1 – 4 Phase [TS 1 Type 2 (2 overlaps and 2 peds or all 4 peds) or Type 3 (4 overlaps) Configuration\*]**

8 Load Switch Positions (4 phases & 4 pedestrians\*)  
4 Flash Relay Positions  
1 2-Circuit Flasher Position  
8 Channel Conflict Monitor

**(Note: “\*” – The circuiting and wiring for the load switches designated for the pedestrian phases (4-8) shall be accomplished in a manner that allows the load switch to be readily and easily reconfigured to a vehicle phase and/or overlap individually (by load switch) without having to access the back of the main panel.)**

**TS 2 Type 2 – 4 Phase (TS 2 Type 1 Configuration 2 per Table 5-2\*\*)**

8 Load Switch Positions  
4 Flash Relay Positions  
1 2-Circuit Flasher Position  
MMU Type 16  
1 BIU for Detector Rack

**(Note: “\*\*” – Table 5-2 is presented in TS 2 per subsection 5.3 Interface. Although the table refers to Type 1, it also applies to Type 2 as stated per 5.3.2 Type 2 Controller Interface.)**

**TS 2 Type 1 – 4 Phase (TS 2 Type 1 Configuration 2 per Table 5-2)**

8 Load Switch Positions  
4 Flash Relay Positions  
1 2-Circuit Flasher Position  
MMU Type 16  
1 BIU for Detector Rack  
Minimum of 1 BIU for Main Panel Type 1 Only

**TS 1 – 8 Phase (TS 1 Type 7 Configuration\*)**

12 Load Switch Positions (8 phases & 4 peds\*)  
6 Flash Relay Positions\*  
1 2-Circuit Flasher Position  
12 Channel Conflict Monitor

**(Note: “\*” - The circuiting and wiring for the load switches designated for the pedestrian phases (9-12) shall be accomplished in a manner that allows the load switch to be readily and easily reconfigured to a vehicle phase or overlap individually (by load switch) without having to access the back of the main panel. Two additional flash relay sockets are to be provided over what is normally called for per TS 1.)**

**TS 2 Type 2 – 8 Phase (TS 2 Type 1 Configuration 3 per Table 5-2\*\*)**

# SECTION 1 SPECIFICATIONS

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Procurement Group  
1739 West Jackson, Suite A, 100P  
Phoenix, Arizona 85007  
Phone: (602) 712-7211

## SOLICITATION NO. T06-59-00108

12 Load Switch Positions (8 phases & 4 peds or 4 overlaps or some combination thereof)  
6 Flash Relay Positions  
1 2-Circuit Flasher Position  
MMU Type 16  
1 BIU for Detector Rack

**(Note: “\*\*\*\*” – Table 5-2 is presented in TS 2 per subsection 5.3 Interface. Although the table refers to Type 1, it also applies to Type 2 as stated per 5.3.2 Type 2 Controller Interface.)**

### **TS 1 – 8 Phase “Plus” (TS 1 Type 8 Configuration)**

16 Load Switch Positions (8 phases, 4 overlaps & 4 peds)  
6 Flash Relay Positions  
1 2-Circuit Flasher Position  
16 Channel Conflict Monitor

### **TS 2 Type 2 – 8 Phase “Plus” (TS Type 1 Configuration 4 per Table 5-2\*\*)**

16 Load Switch Positions (8 phases, 4 overlaps & 4 peds)  
6 Flash Relay Positions  
1 2-Circuit Flasher Position  
MMU Type 16  
1 BIU for Detector Rack

**(Note: “\*\*\*\*” – Table 5-2 is presented in TS 2 per subsection 5.3 Interface. Although the table refers to Type 1, it also applies to Type 2 as stated per 5.3.2 Type 2 Controller Interface.)**

### **TS 2 Type 1 – 8 Phase (TS 2 Type 1 Configuration 4 per Table 5-2)**

16 Load Switch Positions (8 phases, 4 overlaps & 4 peds)  
6 Flash Relay Positions  
1 2-Circuit Flasher Position  
MMU Type 16  
3 BIUs for Detector Rack & 2 for Main Panel

The 4-phase configurations shall apply to the Type III cabinet and the 8-phase configurations will apply to the Type IV and V cabinets. The load switches shall be wired in order (phases, overlaps and/or peds) as stated per each cabinet configuration unless specified otherwise by the Department at the time of order. Other features and/or additional sockets can be provided on the back panel if approved by the Department and/or required by the cabinet manufacturer's design. However, it is not allowable for the TS 1 or TS 2 Type 2 cabinet pedestrian isolation relays to be on the main panel. The isolation relays are to be on the loop detector terminal panel or on a separate panel that is mounted on the left side (looking in) of the cabinet. The 12 VAC power supply can be on this panel or with the power panel on the right side of the cabinet.

If the 12-phase cabinet is offered it is to be offered in both a TS 1 and a TS 2 Type 2 configuration per the Type V cabinet. The main panel for the 12 phase cabinet shall have 24 load switch positions, 12 flash relay positions, 2 flasher positions and a 24 channel CMU or MMU. The load switches shall be configured for 12 vehicle phases, 6 overlaps and 6 pedestrian movements. The TS 2 Type 2 will need to have two detector racks with a BIU for each rack. All other components shall be expanded accordingly to support the full capacity for this size of cabinet (cables, test switches, pedestrian push buttons, detector racks and terminals)

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etc.).

The load switch and flasher sockets shall have a metal support shelf or bracket that supports them in place when they are plugged in. Each socket shall be permanently labeled and numbered in sequence.

All the control hardware and wiring shall be mounted and installed so as to permit the main back panel to be released and pulled forward for inspection and/or servicing in less than ten minutes.

For shipping, all cables and end connections should be secured in a fashion that protects them from damage and/or the elements (dust, moisture, etc.).

The load switch outputs (120 VAC), flasher, and the flash transfer relay load base terminals shall be hard wired with a minimum No. 14 copper conductor with a 105 degree Centigrade rated jacket. The 120 VAC load switch, flasher, and flash relay connections shall be soldered to each base terminal.

The field terminal double sided terminal blocks shall be mounted on a panel that projects beyond the main vertical surface of the panel. It is preferred that the terminal blocks for the field terminals be on a plane that is at an angle facing up toward the front cabinet door opening. Enough field terminal blocks shall be provided to fully support the entire output capacity of the main panel.

All terminal blocks for field terminals shall be double sided high barrier type. One side connects to the load switch outputs and the other side (down side) to the field wiring. Each terminal block position shall have two No. 10/32 screw connectors (not less than 3/8 inch in length) and a removable shorting bar. Each terminal shall accommodate at least three No. 12 AWG conductors.

The terminal block shall have a labeling strip on the center of the strip. The labeling shall be keyed or coded to the load switch output channel as detailed per **NEMA TS 2 5.3.6.3 Field Terminal Nomenclature** unless specified otherwise herein. For example, load switch output field terminals shall be labeled "1R" for red circuit, "1Y" for the yellow circuit, "1G" for green circuit and so forth so that all load switch channels are fully accounted for in this manner.

All controller assembly wiring tie points on the front side of the terminal blocks shall be the spade type. Tie points on the back side of terminal blocks shall be soldered. All crimp style connectors shall be applied with the proper tool. The tool's handles shall not be opened until the crimp is completed. Each terminal position shall be permanently labeled on the front and back of the main panel.

For the TS 1 and the TS 2 Type 2 cabinets, each input from the controller (per the A, B and C cables, (D cable if applicable)) and each output from the load switches and flashers shall be programmable on the main panel (per terminal blocks designated for this). The D cable can be programmable from a separate sub panel that is to be mounted on the left side of the cabinet.

Similar programmability for the TS 2 Type 1 cabinets shall be provided as applicable and as required per this standard.

As appropriate, a similar programmable arrangement shall be applicable to the CMU and MMU wiring and terminals. All load switches shall be circuited so they can all be monitored separately with the CMU or MMU per their own channel (refer to **5.3.2.1 Load Switch and Flash Transfer Positions per 5.3.2 Type 2 Controller Interface**).

## **J. Inductive Loop Detector Assembly**

The loop detector assembly shall include the detector rack, wiring, cables, circuit boards with plug-in

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connectors, panels, connectors and terminals necessary to service the inductive loop detection channels provided in the pre-wired cabinets. As a minimum, all pre-wired cabinets shall be equipped with a single 5-position or more detector rack.

The rack shall have the capacity to offer up to 16 channels of inductive loop detection, utilizing eight 2-channel units or four 4-channel units. The racks shall be capable of accepting and functioning with either type of rack mounted loop detection units (2-channel or 4-channel with or without timing).

The TS 1 cabinets shall be provided with a detector loop assembly which is compatible with the Department's detection requirements and practices, as well as to TS 1 requirements. The detector loop rack assembly supplied for the TS 2 cabinets shall meet or exceed the requirements stated for a TS 2 Detector Rack Configuration 2.

**Note:** This is the minimum number of channels. Additional inductive loop channels and/or other functions (pre-emption, video) can be offered if and as available per the requirements of the specific cabinet configuration. The TS 1 racks shall all be pre-wired for a high capacity rack-mounted power supply. TS2 racks shall be powered from the shelf-mounted cabinet power supply. All channels shall be wired and connected so they are ready to be used in the field. Additional detector and/or expanded capacity racks shall be offered as an option, spare part and replacement item.

The 12-phase cabinet, if offered, shall come with enough detector rack space to have at least 24 channels.

The rack shall be secured to the top shelf in the upper left hand corner of the cabinet. The detector terminal panel shall be mounted on the lower left hand corner of the inside side panel of the cabinet.

The back panel of the detector racks shall be removable. Additionally, the connections between the pre-wired cabinet components and the circuit board of the detector rack shall be per a pluggable type connector that allows the detector rack to be removed and replaced without having to disconnect terminals and/or soldered connections.

For the TS 1 cabinets, the connectors for the power supply and the loop detection cards shall be configured and wired as designated by the Department per the requirements which follow.

The power supply PIN numbers and functions on the 22 pin double-sided edge connector shall be:

PIN No.	Function
A	Output Logic Ground
B	Output 1 (+24 VDC)
C	
D	
E	
F	
H	
J	
K	
L	Chassis Ground
M	120VAC-
N	120VAC+
P	
R	
S	

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T	
U	Output 3 (+24 VDC)
V	Output 4 (+24 VDC)
W	
X	
Y	
Z	

The loop detector unit PIN connections on the 22 pin double-sided edge connector for a four channel inductive loop unit shall be as follows:

Function	PIN No.	PIN No.	Function
Channel 1 Green	1	A	Logic Ground
Channel 2 Green	2	B	+24 VDC IN
Channel 3 Green	3	C	
	4	D	Loop 1 Input
	5	E	Loop 1 Input
	6	F	Output 1 (+)
	7	H	Output 1 (-)
	8	J	Loop 2 Input
	9	K	Loop 2 Input
Channel 4 Green	10	L	Chassis Ground
	11	M	
	12	N	
	13	P	Loop 3 Input
	14	R	Loop 3 Input
	15	S	Output 3 (+)
	16	T	Output 3 (-)
	17	U	Loop 4 Input
	18	V	Loop 4 Input
	19	W	Output 2 (+)
	20	X	Output 2 (-)
	21	Y	Output 4 (+)
	22	Z	Output 4 (-)

GREEN inputs for each channel shall be wired from the rack assembly to a separate terminal board and then to each phase GREEN position on the main back panel. The rack spacing shall be a minimum of 2.31 inches wide on all card rack units, including the power supply.

The TS 1 cabinets inductive loop detection channels shall be assigned as follows: (view of rack is from the front left to right):

- Detector Unit #1 - Channel 1 = Phase 1, Channels 2, 3 & 4 = Phase 2
- Detector Unit #2 - Channel 1 = Phase 3, Channels 2, 3 & 4 = Phase 4
- Detector Unit #3 - Channel 1 = Phase 5, Channels 2, 3 & 4 = Phase 6
- Detector Unit #4 - Channel 1 = Phase 7, Channels 2, 3 & 4 = Phase 8

Detector outputs F, S, W, and Y from detector rack shall each have a separate tie point on the field terminal of the cabinet to allow for ease of future changes.

Barrier terminal blocks shall be provided to support all of the output and input circuits for the loop detector

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units. The field terminal panel for loop detectors shall be located in the lower portion of the left side of the controller cabinet not less than nine inches from the base of the cabinet.

The channel and phase assignments may be changed at the request of the Department.

If the detector rack requires a program card, then two program cards shall be included with each rack, either provided per the pre-wired item or ordered separately as a spare part. Additionally, the program cards themselves shall be offered as a spare part and replacement item.

The detector rack, cables and panels shall be offered as a spare parts and replacement items.

## **K. CMU & MMU Wiring**

The cabinets shall be cabled and connected to fully support CMU / MMU functional capabilities as herein specified (see the brand name or equal listing in **Section 3.0** for actual CMU / MMU products) and those required per the applicable TS 1 and/or TS 2 standards. Additional requirements that pre-wired cabinets must meet for CMUs / MMUs, as applicable, are:

- To monitor conflicts of GREEN, YELLOW, and WALK signals for each applicable phase. For the MMU this shall also include the Type 16 mode which includes "DON'T WALK."
- The WALK signal load switch shall be monitored on its own separate channel. This means that the associated vehicle GREEN signal, which can run concurrently, is to be monitored on its own separate channel. Hence the number of load switches provided per each cabinet shall establish the minimum number of channels that are to be monitored by the CMU or MMU for that cabinet. This is the Department's standard; it is done to expedite diagnosis and correction of field problems. All TS 1 and TS 2 cabinets shall come with this capability.
- To monitor the absence of RED voltage. Any unused phases shall have a removable jumper so to permit future implementation of that phase without rewiring the cabinet.
- To monitor voltage +24 VDC source of the controller unit and any auxiliary controller unit.
- To start-delay the controller unit per applicable TS 1 and/or TS 2 standards.
- The conflict monitor cable shall have the cabinet interlock A and B inputs routed to control cabinet terminal points for future use.
- The monitor input for each signal circuit shall be terminated at the field terminal connection so as to monitor both the automatic and flash modes of the controller cabinet.

These statements are not intended to supercede the requirements that are presented in **TS 2 Section 4 Malfunction Management Unit**, except for the requirement that each load switch is to be monitored on its own separate channel.

## **L. External Logic**

All TS 1 and TS 2 Type 2 cabinets shall be furnished with a completely installed external logic 22 pin double sided printed circuit edge connector (44 terminals). The edge connector shall be mounted vertically with the "A" position to the top. The edge connector shall be mounted on the left inside wall of the cabinet midway up the cabinet side wall on a C channel. Two unpopulated 'OR' gate circuit boards shall be provided with each cabinet furnished with the external logic connector.

The external logic connector and "OR Gate" cards are typically used to account for lead-lag left-turn phasing on opposing approaches where the necessary programming functions are not available on a given controller. Specifically, the external logic shall be used to prevent the "yellow trap" that can sometimes occur if the controller is allowed to serve a protective/permissive left-turn phase on a street immediately following the through phase for that street. If, the controller does not have the capability to prevent this, then

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it is necessary to provide this skip logic external control arrangement as specified herein.

The three situations that this type of control is used is for: (1) phase 4 non-skip call to side street, (2) phase 2 non-skip inside clearance on a 4 phase diamond, and (3) phase 2 non-skip inside clearance on a 3-phase diamond. The Department has specifications (pin and wire diagrams) available for inspection on how these types of external control are achieved. The exact application will be determined by the Department. The pre-wired cabinets shall come with the basic ability to provide external logic for the three applications described. The Department will then make the necessary modification to the wiring (via main panel connections) to account for the specific application needs of a given intersection.

The edge connector shall be pre-wired per function and pin assignments as follows (note: the un-used pins are not labeled):

<u>Pin</u>	<u>Function/Assignment and Wire/Connection to be provided</u>
1-A	Phase 1 or 3 Check or CHK (with 9' wire with label on the end)
5-E	+ 24 VDC (wire to pin U and another 9' wire with label on the end)
8-J	Phase 4 VD or Phase 2 VD (wire to pin X and another 9' wire with label on the end)
9-K	Phase 2 Red or Phase 1 Red (with 9' wire with label on the end)
10-L	LG (wire to pin Z with another 9' wire with label on the end)
13-P	Phase 5 or Phase 4 CHK (with 9' wire with label on the end)
17-U	wire to pin E (or 24 VDC)
20-X	wire to pin J (or phase 4 VD or 2 VD)
21-Y	Phase 6 Red or Phase 1 Red (with 9' wire with label on the end)
22 -Z	wire to pin L (or LG)

The seven 9' long wires shall be routed down from the connector to the bottom left corner of the cabinet where they are to be bundled and secured. Each of the ends shall be labeled as to its function and pin assignment.

The external logic connector and "OR gate" cards shall be offered as spare parts and replacement items. Additionally, the pre-wired connector item shall be offered as subtractive option item to the pre-wired cabinet (see **Price Sheet**).

## **M. Pedestrian Isolation Panel and Opto-isolators**

For TS 1 and TS 2 Type 2 cabinets, each pedestrian push button call input to the controller shall be isolated from the controller's logic circuitry by an auxiliary opto-isolator electronic circuit mounted on a separate panel or on the panel that is also used for the inductive loop detector field terminals. The opto-isolator itself will be contained on a double-sided PC board designed to mount directly to four adjacent positions of a standard barrier terminal strip. The component side of the opto-isolator printed circuit card shall be considered the top side. The connector edge that mates to the terminal strip shall have four terminals, spaced to match the terminal strip spacing, and numbered sequentially from left to right as viewed from the top side of the card, oriented with the edge connector up. The bottom side of the PC card may be used for trace routing as necessary, but not for components. If the bottom side traces extend to the connector edge, then the trace circuit functions shall be redundant of circuit functions on the top side for the same terminal position.

The terminal strip shall be the Type 141 with terminals in multiples of 4. The size shall be 1-1/8 inches wide by 1/2 inch deep. The terminal spacing shall be 7/16 inch. The screw size shall be 6-32. The terminal strip and opto-isolator shall be provided and wired by the Manufacturer.

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## **Terminal Strip "A" side (PC Card Component Side):**

The opto-isolator PC board shall be mounted on the "A" side of the terminal strip. The "A" side shall be the left hand terminal row when the strip is oriented vertically or the top terminal row when the strip is mounted horizontally. Terminal No. 1 shall be the top terminal with the strip mounted vertically or the rightmost terminal with the strip mounted horizontally. The connections to the opto-isolator card (top side) and terminal strip shall be as follows for each card installed:

<u>Terminal</u>	<u>Function</u>
1	+12VAC
2	Logic Ground (LG)
3	"Normally Open" dispatch logic output to Controller
4	- 12 VAC (Call from the field / Ped switch for specified phase)

For the TS 1 cabinets, a separate 12 VAC power supply (transformer) external to the controller shall be provided for the pedestrian call opto-isolators. The transformer can be mounted on the same panel with the isolation cards or on the main power panel. For the TS 2 Type 2 cabinets, the shelf-mounted cabinet power supply shall be utilized for the pedestrian 12VAC source.

Four pedestrian detection opto-isolator circuit boards shall be provided with each pre-wired cabinet. The cards, connectors, transformer, and assembled Pedestrian isolation panel (connectors, cards and transformer) shall be offered as spare parts and replacement items (see **Price Sheet**).

## **N. Cabinet Wiring Diagrams**

Each pre-wired cabinet or pre-wired cabinet with plug-ins shall have three sets of wiring diagrams (or cabinet prints) which shall show all circuiting, switches, terminal blocks and control device connections. All devices and circuits shall be labeled in the diagrams with a referencing system that corresponds to the referencing system which is used and labeled in the cabinet itself. Modifications to the drawings submitted shall be made to account for any configurational changes adopted throughout the life of the contract and/or options ordered.

One compact disk (CD) containing the wiring diagrams for the controller cabinet shall be provided. For a purchase of more than one cabinet, two CDs will suffice for the entire number of cabinets. The disks shall be provided in an uncompressed format (e.g. Microstation, AutoCAD, etc.) that is acceptable and/or requested by the Department

Each drawing shall have a title block and a revision table. The title block shall include the name of the manufacturer and the name of the design engineer, checker and draftsman who prepared the drawing. The title block shall also have a drawing number and sheet number. The drawings shall have a unique number identifier that allows the drawings to be matched to the corresponding cabinet. The electronic file name shall be assigned in a similar fashion. The revision table shall include columns for reference numbers, description, date, draftsman and checker.

All drawings shall include a complete legend that gives clear and accurate information on the plan symbols used for: wire gauge size, wire insulation color, component and abbreviations used.

Cabinet drawings shall be configured and contented as follows:

**Main or Back Panel Drawing:** This drawing shall contain a complete detail of all of the terminals, sockets (load switches, flasher, relays), bus bar and wiring harnesses (connectors A, B, C, D if applicable, conflict

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monitor connectors for TS 1 and the BIUs and MMU connectors for TS 2 Type 1) as viewed from the back of the cabinet . Wiring socket and terminal connections and assignments shall be presented in an easy to follow format that is an accurate and complete portrayal of what the assignments and functions are. Connections, terminals, and sockets shall be labeled in drawings as they are labeled in the cabinet.

**Complete Cabinet Drawing:** This drawing shall include a front view of the main or back panel and all other related panels, connectors and/or components that are inside the controller cabinet. This includes the detector rack, detector panel, summary of pin assignments in the detector rack (for units and power supply if TS 1 cabinet), the pedestrian isolation panel (if TS 1), main power panel, light control panel (if applicable), cabinet mounted switch arrangement, ventilation system, cabinet light, convenience outlets, non-skip (if TS 1), monitor program card and all other items of interest.

Variations to this configuration and content are allowable if approved by the Department. Additionally, configuration and content shall be modified and/or changed by the Department upon request.

## **O. Light Control Assembly**

The lighting control assembly shall be standard on all TS 1, TS 2 Type 2 cabinets and optional on the TS 2 Type 1 cabinets.

A 240 VAC intersection lighting control panel assembly shall consist, as a minimum, of a control panel (with a contactor, fuse holder, fuses, terminal block with a "Munson" shock shield), terminal blocks, wiring, manual override toggle switch, socket, photocell and basket guard that is fully installed and ready to be energized in the field. The control panel shall be mounted on upper right hand side of the cabinet wall near the top. The external photoelectric (PE) cell with the basket guard shall be mounted on top of the roof in the right hand rear corner.

The lighting control panel shall have an 8-position two-sided terminal block, a two position fuse holder (appropriately rated UL listed plastic housing with metal inserts), two 30 amp fuses (one time 250 VAC Class K5 Bussmann Buss Non-30, dual-element time-delay 250VAC Class RK5 Bussmann Fusetron FRN-R 30, or equivalent fuse that is UL listed) and 30 amp two pole 600 volt rated lighting contractor (Square D 8910 DPA 32 or equal). The contactor is to be covered by a moveable/removable clear plastic shock shield. The contactor shall be wired according to the manufacturers recommendations. All wiring shall match the nominal amp ratings of the circuit an devices to which it is connected.

The input and output wires from the contactor shall be routed to the four position terminal block that is mounted in the upper right corner of the cabinet.

The photo cell is to be mounted on a General Electric Cat # MB-PECTL or equal 3 prong female screw in lock PE cell socket that has three pre-wired lead-in wires which are colored red, black and white. The socket is to have a threaded end that enables it to be mounted on the roof of the cabinet utilizing a threaded EMT type of conduit mount or bushing. The socket is to have north direction marked on it. On the inside of the cabinet immediately adjacent to the inside portion of the PE cell socket shall be a four position two sided terminal block mounted to C channel. The terminal block shall be utilized to make the connections between the lighting contactor and the PE cell socket.

All connectors on terminal blocks shall be spade or fork types. The connectors for the manual switch, on the side of the lighting contactor, shall be insulated slot types.

The basket guard shall be mounted on the right rear corner of the cabinet roof to protect the PE cell and the outside portion of the socket. The manner of the mounting shall be similar to the **Photo Electric Cell Mounting Details T.S. 15-1**. The basket guard shall be 5" in diameter by 5.2" high with 6" x 6" mounting

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plate with 4 - ¼" in diameter mounting holes. The guard shall be secured to the roof with four round head carriage bolts. The nuts shall be on the inside of the cabinet. The guard shall have a chrome finish. The expanded metal guard should be no more than 1" rectangular or diamond shaped openings. All openings shall be gasketed and/or sealed with a suitable caulk to achieve a watertight seal.

## **P. Other Panels and Features:**

If ordered, the TS 1 or TS 2 Type 2 cabinets shall be equipped with a "D" panel. The "D" panel shall come as a completely wired panel with the necessary cables, connectors, and terminals to support the available non-standard TS 1 or TS 2 Type 2 functions that are available with the brand name traffic signal controller that can be either ordered with the cabinet or separately.

Various brands of emergency pre-emption and video detection systems should be offered. The offer for these items under the pre-wired cabinet items should only include all of the necessary components that make it possible to install the units in the cabinet. The actual functional units shall be offered as separate items.

It should be noted that it is not the Department's policy to provide for emergency vehicle pre-emption unless such features are provided for per the local jurisdiction.

Other pre-wired options shall be offered as available and applicable.

### **1.6.2(b)(3) Model 170 Types**

The Model 170 type cabinets shall meet the basic configuration requirements that have already been referenced and defined in the bare cabinet subcategory. These cabinets shall be offered in the following basic pre-wired Model 170 or near Model 170 (e.g. 330 City of Scottsdale cabinet) standard fully and completely fabricated configurations that are ready to accept a controller and other plug-in and/or rack mounted components.

The 332 cabinet shall come in two pre-wired configurations. The first 332 shall come with a 12 load switch output file configuration. The second shall be configured according to the Department's Drawing Numbers **T.S. 3-15 Traffic Signals & Lighting Model 345 Cabinet Details** and **T.S. 3-16 Traffic Signals & Lighting Model 345 Cabinet Cage Details** which has 18 load switch positions. The 330 cabinet shall come with 14 load switch positions. The 336A cabinet shall come with 12 load switch positions. The other pre-wired components shall be as listed on the attached price sheet descriptions.

### **1.6.2(c) SUBCATEGORY 1c - Pre-Wired Cabinet with Plug-In, Rack and Shelf Components**

A **Pre-Wired Cabinet with Plug-in Components** means that the cabinet shall include all of the items already specified per the **Bare Cabinet** and **Pre-Wired Cabinet** configurations but it shall also include the number of applicable plug-in components as herein specified and called for per the applicable standard.

"With plug-in components" means that the cabinet is to come with the assigned number of load switches, loop monitors, flashers and flash transfer relays that are required to account for the number of vehicle and pedestrian phases indicated on the order item. The TS 1 cabinet shall also come with a conflict monitor unit (CMU). The conflict monitor provided shall match the number of load switches provided (except for the 4 phase cabinet which is to come with a 12-channel monitor) unless specified otherwise at the time of order. The TS 2 Type 1 and Type 2 cabinets shall come with a cabinet power supply, the required number of Bus Interface Units (BIU) and a Type 16 malfunction management unit (MMU). The monitor for the 170 types shall conform to the number of load switch positions unless specified otherwise at the time of order.

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Controllers and related operations software/firmware and applicable controller related options (D panels, modems, telemetry panels, etc.) can be ordered as a part of a cabinet order or separately, with or without the controller.

The number of plug-in components shall be as specified per the **Price Sheet**.

## **1.6.3 Traffic Control Cabinet Components**

### **1.6.3(a) General**

The items specified in this subsection shall be fully compliant with the applicable requirements already specified herein under **Cabinets**. The difference is that these items are intended to allow the Department to purchase units such as CMU, MMU, BIU, load switches, flashers, flash transfer relays, detector racks, detector units, power supplies and other related cabinet items separately from the cabinet items ordered. These items will be used to maintain and/or upgrade existing cabinets. This subsection also contains various items that will enable the Department to make certain modifications to supplied cabinets for applications not covered per the cabinet configuration items.

### **1.6.3(b) NEMA Types**

#### **Conflict Monitor Unit (CMU)**

The CMU shall exceed the requirements of TS 1 – 1989 **10.3.4.4 Conflict Monitor** as well as meet or exceed the applicable requirements of TS 2 **Section 4 Malfunction Management Units**. A listing of the CMUs believed to meet these requirements is contained in **Section 3.0**.

#### **Malfunction Management Unit (MMU)**

The MMU shall exceed the requirements of TS 2 **Section 4 Malfunction Management Unit**. The MMU shall feature an enhanced display, advanced diagnostic functions, and have data logging capability. The front face shall have a RS-232 communications port to enable computer interfacing. The necessary software to enable this shall be included at no additional cost. A listing of the MMUs believed to meet these requirements is contained in **Section 3.0**

#### **TS 1 Inductive Loop Detector Units**

The detector units to be supplied shall be for inductive loop detectors. A brand name listing of detector units and power supply which are believed to conform to the requirements of this specification are contained in **Section 3.0**.

If and as applicable, the front face of the detector loop unit shall be clearly labeled "**Compatible for TS 1 racks only!**" or similar warning label or marking.

In addition to what is specified herein, the inductive loop amplifiers or detector units shall meet or exceed the applicable standards in **TS 1-1998 Section 15 Inductive Loop Detector**, or TS 2, or both, and be compatible to the requirements already stated herein under the pre-wired cabinet portion of this specification.

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Each detector unit shall be a rack mounted card type that plugs into an appropriately configured detector card rack. The units supplied shall be fully compatible, interchangeable, and functional with type and style of TS 1 detector racks which are supplied by Eagle Traffic Control Systems, Econolite Control Products or similar detector racks as typically used for traffic control in the United States. A listing of the TS 1 detector racks are contained in the in **Section 3.0**.

The power supply for the TS 1 detector rack shall also be rack mounted and fully compatible and configured to supply 24 VDC to the detector units per the rack models and brands already mentioned. The power supply shall be a high capacity type and have four separate power supply circuits or channels. Each circuit shall be protected with a replaceable fuse arrangement that is accessible from its front panel.

### **TS 2 Inductive Loop Detector Units**

The detector units to be supplied shall be for inductive loop detectors. A brand name listing of detector units and power supply which are believed to conform to the requirements of this specification are contained in **Section 3.0**.

The front face of the detector loop unit shall be clearly labeled "**TS 2 only!**" or similar warning label or marking to help make sure these units are not used incorrectly, if applicable.

In addition to what is specified herein, the inductive loop detector unit shall meet or exceed to the applicable standard **TS 2-2003 Section 6.5 Inductive Loop Detector Units** and be compatible to the requirements already stated herein under the pre-wired cabinet portion of this specification.

The units supplied shall be fully compatible, interchangeable, and functional with the type and style of TS 2 detector racks (refer to 5.3.4 Detector Rack) which are supplied by Eagle Traffic Control Systems, Econolite Control Products or similar detector racks as typically used for traffic control in the United States. A listing of the TS 2 detector racks are contained in the in **Section 3.0**.

The power supply for the TS 2 detector rack, the rack mounted detector units and detector BIU shall be the shelf mounted cabinet power supply.

### **TS 2 Power Supply Units**

The shelf mounted power supply unit shall be configured to the applicable TS 2 requirements (refer to 5.3.5 Power Supply). A listing of the power supply units known to meet these requirements is contained in **Section 3.0**.

A higher capacity power supply can be offered if available (e.g. at 12 VDC has 5 amps instead of the TS 2 standard of 2 amps).

### **TS 2 Bus Interface Units (BIU)**

The rack mounted bus interface units shall meet or exceed the applicable TS 2 requirements presented in **Section 8 Bus Interface Unit**. The BIU configuration shall be the NEMA BIU Designation "BIU." A listing of BIUs known to meet these requirements is contained in **Section 3.0**.

### **Load Switches**

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All load switches shall meet or exceed the requirements of subsection **6.2 Three-Circuit Solid State Load Switches** of TS 2 and still be downward compatible to the TS 1 and Model 170 requirements. These units shall also be compatible with all LED signal units that are in conformance with the latest ITE specification for LED signals. A listing of load switches that are believed to conform to this requirement are contained in **Section 3.0**.

An enhanced load switch can be offered if available (e.g. front panel LED indication for both input and output, with or without enhanced electrical capacities).

## **Flashers**

All flasher modules shall meet or exceed the requirements of subsection **6.3 Solid State Flashers** of TS 2 and still be downward compatible to the TS 1 and Model 170 requirements. The flasher shall be dual circuit and have a 15 amp RMS rating per circuit (old TS 1 -1998 Type 3). A listing of the flashers that are believed to conform to this requirement are contained in **Section 3.0**.

## **Flash Transfer Relay**

The flash transfer relay shall meet or exceed the requirements of subsection TS 2 6.4 Flash Transfer Relays and still be downward compatible to TS 1 – 1989 (10.3.4.1 Flash Transfer Control) and Model 170 requirements. A listing of the flash transfer relays that are believed to conform to this requirement is contained in **Section 3.0**.

### **1.6.2(c) Model 170 Types**

All of the Model 170 components shall conform to the applicable Caltrans' requirements and approval lists. A listing of the Model 170 components which are believed to conform to these requirements is contained in **Section 3.0**.

The conflict monitor shall be an enhanced version that exceeds the requirements of the Caltrans specification.

### **1.6.4 CATEGORY 3 - Traffic Signal Controllers**

#### **1.6.4(a) General**

The controller units (CU) supplied (NEMA, 170E and 2070) shall be fully functional electronic devices that have all of the necessary firmware/software and input /output capacity to fully support the hardware platform (pre-wired controller cabinet with components) per the applicable standard or parts of a standard (MUTCD, NEMA, 170E, 2070 and ATC) as referenced, as well as those requirements stated herein.

The CU shall consist of basic groupings or modules depending on the applicable standard and the manufacturer's design. The basic modules of the CU are typically the exterior display / keyboard, processor, input /output (I/O) interface, telemetry (optional) and the power supply, either internal or external. The CU can also offer expansion slots or other options on how these modules are provided (e.g. the display and keyboard can be detachable).

The display / keyboard and processor shall contain all of the hardware circuitry, software program and memory required to operate and control all of the CU functions per its related cabinet. It shall also be capable of enabling the I/O interface (including additional or expanded I/O if applicable), telemetry (if

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included), display / keyboard operations, synchronizing instructions, information transfers, executing transfers, receiving real-time clock updates to maintain accurate system time, monitoring circuits, control circuits, start-up / reset / failure routines, as well as supporting all other internal / external components and operations that are necessary for the CU to perform to the specified parameters with or without options.

The CU housing shall be configured so the internal board and panels can be accessed. The internal portion of the controllers shall contain plug-connected module boards that are designed to permit replacement without damage to other in-place boards or components. The connectors used shall be the types that are in common use for electronic devices. Each board shall be easily removable without the use of special tools.

All internal components and boards shall be identified and arranged in functional groupings or modules per the basic arrangement already presented. The CU manual, which is supplied per the requirements included in **Section 3.0**, shall have schematics and/or block diagrams that show the details of how these groupings or modules function. Additional descriptive text, schematics, circuit diagrams, pin assignments and part lists for all the modules shall also be presented in the CU manual as applicable and as necessary to communicate how each module operates.

Boards and components shall be electrically and mechanically interchangeable with other CUs of the same standard type, model, series and/or frame type. Changes and modifications are allowable if approved by the Department, and if the supply of previously used boards and components is maintained as necessary, either directly from the supplier or from a 3<sup>rd</sup> party source.

Standard, optional, and add-on modules shall be configured so that they can be easily plugged into the CU and secured (e.g. D panel and connector for NEMA TS 1, NEMA TS 2 Type 2, telemetry panel, RS-232 for laptop communications, internal modems etc.). These units shall include an appropriately sized front face label that clearly identifies their function.

As a minimum these controllers shall offer the following features:

- Can operate on either pre-timed, semi-actuated or full actuation basis (or mode of operations) with the features which are applicable to that mode of operations that are herein specified directly and/or gained from the referenced standard.
- Function in a manner that is consistent with the traffic control capacity which is detailed in NEMA TS 1 and **NEMA TS 2** subsections **3.4 Pretimed Control, 3.5 Actuated Control, 3.6 Actuated Coordination, 3.7 Preemption, 3.8 Time Base** and the additional features called for per **3.9 Miscellaneous, 3.10 Future, 3.11 Programming** and **3.12 Power Interruption**.
- Selectable phases and sequence of phases from 2 to 8 phases or more with a minimum of four pedestrian phases and four overlaps. A 12-phase variation shall also be offered. The 12-phase shall have, as a minimum, six pedestrian phases and four overlaps.
- Capacity to include numerous detector inputs with a variety of settings including recall for failed detectors.
- Ability to split phase as well as other adaptive traffic controls for vehicle and pedestrians.
- Time-of-day, week and year features.
- Available with multiple industry standard modem and communication protocols.
- Ability to time many timing plans that support the selected mode of operation and the timing parameters that are typically used in that mode of operations
- Ability to time both leading and lagging protected and/or permissive left turn phases.
- Specific software that allows the "yellow trap" to be mitigated or avoided when protective /permissive left turn phases are activated. The controller does not allow a street's normally leading protected/permissive left-turn phase immediately following the through phases for that same street.

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If this routine is not featured, then the controller shall contain a specific warning label that states this and advises an alternative measure (external logic as herein specified).

- Have the ability to time an all red clearance interval.
- Feature many modes of coordination.
- Units shall be fully functional with all commonly available detector technologies.
- Volume density – the units can increase the minimum displayed green interval based on detector actuations received during the red interval.
- Certain default and fail safe settings and/or screen announcements warnings that help prevent errors (e.g. minimum and maximum time for various critical timed intervals).
- The controller shall be capable to handle time collect updates from a variety of different types of auxiliaries (e.g. GPS clock).
- The ability to provide cycling railroad pre-emption phase operations for non-conflicting phases.
- Railroad pre-emption routine shall include the ability to activate a load switch for a special “No Right Turn” and/or “No Left Turn” blank out sign through the standard input/output configuration of the applicable standard (this is allowable to be achieved thru the D connector for TS 1 controller).
- Ability to do emergency vehicle and transit priority preemption routines.
- Ability to generate numerous types of reports and to do status displays and diagnostics.

### **Additional desirable features:**

All other available features that the controller and/or applicable software supplier knows are necessary to provide a complete and functional traffic signal controller assembly that can account for all needed operations and safeguards.

### **1.6.4(b) NEMA Types**

The NEMA type controller units (CU) shall be offered in two basic configurations: “**standard NEMA**” and “**upgraded NEMA.**” Both of these configurations are portrayed by the brand name or equal listing presented in **Section 3.0.** Both CU configurations shall meet or exceed the requirements of **NEMA TS 2 Version 02.06** and be downward compatible to **NEMA TS 1-1998** requirements. Additionally the CU are to be fully compatible and operation with the cabinet CMU / MMU, detector, power supply and main (or rear) panel configurations herein specified and detailed on the **Price Sheet.** A listing of standard NEMA and upgraded NEMA controllers are in **Section 3.0.**

Both CU standard and upgraded NEMA configurations shall be available in all eight TS 2 CU configurations. Additionally, configurations, including those related to the Model 170, Model 170E and Model 2070-ATC should be offered. It is important to note that the Department does have numerous “Model 179 345 cabinet” (modified version the Model 170) installed in the Phoenix area. A number of these cabinets are currently utilizing a modified NEMA controller that has been made compatible with the Model 170 / 179 standard (rack mounted, plug in power supply and C1 connector) so it can utilize all of the inputs and outputs of this type of cabinet.

The Controllers that are suitable for operations in the Department cabinets as herein specified and that are compatible to the **NEMA TS 1-1998** standard shall include (1) an internal power supply, (2) the standard configuration of the TS 1 NEMA input and output pin assignments for the A, B and C connectors, and (3) the availability of an add on “D” connector and telemetry module for additional functions such as preemption, coordination and other nonstandard traffic control functions. Thus, any CU supplied as TS 1 needs to be fully compatible, functional, and interchangeable with the TS 1 controller assemblies that are in use by the Department. Therefore, it is important that if the manufacturer is supplying a controller that is also compatible with the TS 2 Type 2 configuration, that all such features be disabled (e.g. port 1, additional pin assignments) in a manner so that it does not interfere with any of the TS 1 functions and operations. If there

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are TS 2 Type 2 functions that are compatible with the Department's current TS 1 practices, then the supplier shall clearly identify and communicate in writing these features to the Department's signal shop manager and other involved staff to ensure that such features are reviewed and approved before they are supplied. The Department reserves the right to reject all such features.

It is important to note that the Department is seriously considering a change to the NEMA TS 2 Type 2 configuration. A final decision on this change has not been made.

All available protocols and telemetry options shall be offered.

The upgraded NEMA configuration shall exceed NEMA TS 2 and NTCIP requirements. Additionally, the firmware for this CU shall be stored in flash memory that allows upgrading and updating without changing any hardware. Additionally the NTCIP protocol shall be standard to this CU.

#### **1.6.4(c) 170 Type / 170E / 2070**

The 170 type controllers supplied shall be the updated version which are now termed the 170E and 2070 controllers. This controller shall be fully functional and completely compatible to the 170 cabinets herein specified. The 170E controllers to be supplied shall be of equal or better than those currently listed on Caltrans Qualified Products List for Controller Assemblies for the Model 170/2070 Traffic Controller and is listed in **Section 3.0**. Additionally, the option to buy various traffic control software packages for these controllers shall also be offered if applicable and available.

#### **1.6.4(d) ATC Type**

The ATC type controller offered shall conform to the applicable requirements of the latest drafts of the standards being developed for them. The ATC shall meet the widest variety of standards and configurations which includes the 2070, 170, 170E, NEMA TS 1, NEMA TS 2 Type 1 and NEMA TS 2 Type 2.

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**Definition of Terms.** As used in this Solicitation and any resulting Contract, the terms listed below are defined as follows:

- 1.1 "Attachment" means any item the Solicitation requires the Offeror to submit as part of the Offer.
- 1.2 "Contract" means the combination of the Solicitation, including the Uniform and Special Instructions to Offerors, the Uniform and Special Terms and Conditions, and the Specifications and Statement or Scope of Work; the Offer and any Best and Final Offers; and any Solicitation Amendments or Contract Amendments.
- 1.3 "Contract Amendment" means a written document signed by the Procurement Officer that is issued for the purpose of making changes in the Contract.
- 1.4 "Contractor" means any person who has a Contract with the State.
- 1.5 "Days" means calendar days unless otherwise specified.
- 1.6.1 "Exhibit" means any item labeled as an Exhibit in the Solicitation or placed in the Exhibits section of the Solicitation.
- 1.6.2 "Gratuity" means a payment, loan, subscription, advance, deposit of money, services, or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value is received.
- 1.8 "Materials" means all property, including equipment, supplies, printing, insurance and leases of property but does not include land, a permanent interest in land or real property or leasing space.
- 1.9 "Procurement Officer" means the person, or his or her designee, duly authorized by the State to enter into and administer Contracts and make written determinations with respect to the Contract.
- 1.10 "Services" means the furnishing of labor, time or effort by a contractor or subcontractor which does not involve the delivery of a specific end product other than required reports and performance, but does not include employment agreements or collective bargaining agreements.
- 1.11 "Subcontract" means any Contract, express or implied, between the Contractor and another party or between a subcontractor and another party delegating or assigning, in whole or in part, the making or furnishing of any material or any service required for the performance of the Contract.
- 1.12 "State" means the State of Arizona and Department or Agency of the State that executes the Contract.
- 1.13 "State Fiscal Year" means the period beginning with July 1 and ending June 30,

**2. Contract Interpretation**

- 2.1 Arizona Law. The Arizona law applies to this Contract including, where applicable, the Uniform Commercial Code as adopted by the State of Arizona and the Arizona Procurement Code, Arizona Revised Statutes (A.R.S.) Title 41, Chapter 23, and its implementing rules, Arizona Administrative Code (A.A.C.) Title 2, Chapter 7.
- 2.2 Implied Contract Terms. Each provision of law and any terms required by law to be in this Contract are a part of this Contract as if fully stated in it.
- 2.3 Contract Order of Precedence. In the event of a conflict in the provisions of the Contract, as accepted by the State and as they may be amended, the following shall prevail in the order set forth below:
  - 2.3.1 Special Terms and Conditions;
  - 2.3.2 Uniform Terms and Conditions;
  - 2.3.3 Statement or Scope of Work;
  - 2.3.4 Specifications;
  - 2.3.5 Attachments;
  - 2.3.6 Exhibits;
  - 2.3.7 Documents referenced or included in the Solicitation.

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- 2.4 Relationship of Parties. The Contractor under this Contract is an independent Contractor. Neither party to this Contract shall be deemed to be the employee or agent of the other party to the Contract.
- 2.5 Severability. The provisions of this Contract are severable. Any term or condition deemed illegal or invalid shall not affect any other term or condition of the Contract.
- 2.6 No Parole Evidence. This Contract is intended by the parties as a final and complete expression of their agreement. No course of prior dealings between the parties and no usage of the trade shall supplement or explain any terms used in this document and no other understanding either oral or in writing shall be binding.
- 2.7 No Waiver. Either party's failure to insist on strict performance of any term or condition of the Contract shall not be deemed a waiver of that term or condition even if the party accepting or acquiescing in the nonconforming performance knows of the nature of the performance and fails to object to it.
- 3. Contract Administration and Operation**
- 3.1 Records. Under A.R.S. § 35-214 and § 35-215, the Contractor shall retain and shall contractually require each subcontractor to retain all data and other "records" relating to the acquisition and performance of the Contract for a period of five years after the completion of the Contract. All records shall be subject to inspection and audit by the State at reasonable times. Upon request, the Contractor shall produce a legible copy of any or all such records.
- 3.2 Non-Discrimination. The Contractor shall comply with State Executive Order No. 99-4 and all other applicable Federal and State laws, rules and regulations, including the Americans with Disabilities Act.
- 3.3 Audit. Pursuant to ARS § 35-214, at any time during the term of this Contract and five (5) years thereafter, the Contractor's or any subcontractor's books and records shall be subject to audit by the State and, where applicable, the Federal Government, to the extent that the books and records relate to the performance of the Contract or Subcontract.
- 3.4 Facilities Inspection and Materials Testing. The Contractor agrees to permit access to its facilities, subcontractor facilities and the Contractor's processes or services, at reasonable times for inspection of the facilities or materials covered under this Contract. The State shall also have the right to test, at its own cost, the materials to be supplied under this Contract. Neither inspection of the Contractor's facilities nor materials testing shall constitute final acceptance of the materials or services. If the State determines non-compliance of the materials, the Contractor shall be responsible for the payment of all costs incurred by the State for testing and inspection.
- 3.5 Notices. Notices to the Contractor required by this Contract shall be made by the State to the person indicated on the Offer and Acceptance form submitted by the Contractor unless otherwise stated in the Contract. Notices to the State required by the Contract shall be made by the Contractor to the Solicitation Contact Person indicated on the Solicitation cover sheet, unless otherwise stated in the Contract. An authorized Procurement Officer and an authorized Contractor representative may change their respective person to whom notice shall be given by written notice to the other and an amendment to the Contract shall not be necessary.

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3.6 Advertising, Publishing and Promotion of Contract. The Contractor shall not use, advertise or promote information for commercial benefit concerning this Contract without the prior written approval of the Procurement Officer.

3.7 Property of the State. Any materials, including reports, computer programs and other deliverables, created under this Contract are the sole property of the State. The Contractor is not entitled to a patent or copyright on those materials and may not transfer the patent or copyright to anyone else. The Contractor shall not use or release these materials without the prior written consent of the State.

3.8.1 Ownership of Intellectual Property

Any and all intellectual property, including but not limited to copyright, invention, trademark, tradename, service mark, and/or trade secrets created or conceived pursuant to or as a result of this contract and any related subcontract ("Intellectual Property"), shall be work made for hire and the State shall be considered the creator of such Intellectual Property. The agency, department, division, board or commission of the State of Arizona requesting the issuance of this contract shall own (for and on behalf of the State) the entire right, title and interest to the Intellectual Property throughout the world. Contractor shall notify the State, within thirty (30) days, of the creation of any Intellectual Property by it or its subcontractor(s). Contractor, on behalf of itself and any subcontractor (s), agrees to execute any and all document(s) necessary to assure ownership of the Intellectual Property vests in the State and shall take no affirmative actions that might have the effect of vesting all or part of the Intellectual Property in any entity other than the State. The Intellectual Property shall not be disclosed by contractor or its subcontractor(s) to any entity not the State without the express written authorization of the agency, department, division, board or commission of the State of Arizona requesting the issuance of this contract.

**4. Costs and Payments**

4.1 Payments. Payments shall comply with the requirements of A.R.S. Titles 35 and 41, Net 30 days. Upon receipt and acceptance of goods or services, the Contractor shall submit a complete and accurate invoice for payment from the State within thirty (30) days.

4.2 Delivery. Unless stated otherwise in the Contract, all prices shall be F.O.B. Destination and shall include all freight delivery and unloading at the destination.

4.3 Applicable Taxes.

4.3.1 Payment of Taxes. The Contractor shall be responsible for paying all applicable taxes.

4.3.2 State and Local Transaction Privilege Taxes. The State of Arizona is subject to all applicable state and local transaction privilege taxes. Transaction privilege taxes apply to the sale and are the responsibility of the seller to remit. Failure to collect such taxes from the buyer does not relieve the seller from its obligation to remit taxes.

4.3.3 Tax Indemnification. Contractor and all subcontractors shall pay all Federal, state and local taxes applicable to its operation and any persons employed by the Contractor. Contractor shall, and require all subcontractors to hold the State harmless from any responsibility for taxes, damages and interest, if applicable, contributions required under Federal, and/or state and local laws and regulations and any other costs including transaction privilege taxes, unemployment compensation insurance, Social Security and Worker's Compensation.

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- 4.3.4 IRS W9 Form. In order to receive payment the Contractor shall have a current I.R.S. W9 Form on file with the State of Arizona, unless not required by law.
- 4.4 Availability of Funds for the Next State fiscal year. Funds may not presently be available for performance under this Contract beyond the current state fiscal year. No legal liability on the part of the State for any payment may arise under this Contract beyond the current state fiscal year until funds are made available for performance of this Contract.
- 4.5 Availability of Funds for the current State fiscal year. Should the State Legislature enter back into session and reduce the appropriations or for any reason and these goods or services are not funded, the State may take any of the following actions:
- 4.5.1 Accept a decrease in price offered by the contractor;
- 4.5.2 Cancel the Contract
- 4.5.3 Cancel the contract and re-solicit the requirements.

**5. Contract changes**

- 5.1 Amendments. This Contract is issued under the authority of the Procurement Officer who signed this Contract. The Contract may be modified only through a Contract Amendment within the scope of the Contract. Changes to the Contract, including the addition of work or materials, the revision of payment terms, or the substitution of work or materials, directed by a person who is not specifically authorized by the procurement officer in writing or made unilaterally by the Contractor are violations of the Contract and of applicable law. Such changes, including unauthorized written Contract Amendments shall be void and without effect, and the Contractor shall not be entitled to any claim under this Contract based on those changes.
- 5.2 Subcontracts. The Contractor shall not enter into any Subcontract under this Contract for the performance of this contract without the advance written approval of the Procurement Officer. The Contractor shall clearly list any proposed subcontractors and the subcontractor's proposed responsibilities. The Subcontract shall incorporate by reference the terms and conditions of this Contract.
- 5.3 Assignment and Delegation. The Contractor shall not assign any right nor delegate any duty under this Contract without the prior written approval of the Procurement Officer. The State shall not unreasonably withhold approval.

**6. Risk and Liability**

- 6.1. Risk of Loss: The Contractor shall bear all loss of conforming material covered under this Contract until received by authorized personnel at the location designated in the purchase order or Contract. Mere receipt does not constitute final acceptance. The risk of loss for nonconforming materials shall remain with the Contractor regardless of receipt.
- 6.2 Indemnification
- 6.2.1 Contractor/Vendor Indemnification (Not Public Agency) The parties to this contract agree that the State of Arizona, its' departments, agencies, boards and commissions shall be indemnified and held harmless by the contractor for the vicarious liability of the State as a result of entering into this contract. However, the parties further agree that the State of Arizona, its' departments, agencies, boards and commissions shall be responsible for its' own negligence. Each party to this contract is responsible for its' own negligence.

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- 6.2.2 Public Agency Language Only Each party (as 'indemnitor') agrees to indemnify, defend, and hold harmless the other party (as 'indemnitee') from and against any and all claims, losses, liability, costs, or expenses (including reasonable attorney's fees) (hereinafter collectively referred to as 'claims') arising out of bodily injury of any person (including death) or property damage but only to the extent that such claims which result in vicarious/derivative liability to the indemnitee, are caused by the act, omission, negligence, misconduct, or other fault of the indemnitor, its' officers, officials, agents, employees, or volunteers."
- 6.3 Indemnification - Patent and Copyright. The Contractor shall indemnify and hold harmless the State against any liability, including costs and expenses, for infringement of any patent, trademark or copyright arising out of Contract performance or use by the State of materials furnished or work performed under this Contract. The State shall reasonably notify the Contractor of any claim for which it may be liable under this paragraph. If the contractor is insured pursuant to A.R.S. § 41-621 and § 35-154, this section shall not apply.
- 6.4 Force Majeure.
- 6.4.1 Except for payment of sums due, neither party shall be liable to the other nor deemed in default under this Contract if and to the extent that such party's performance of this Contract is prevented by reason of force majeure. The term "*force majeure*" means an occurrence that is beyond the control of the party affected and occurs without its fault or negligence. Without limiting the foregoing, force majeure includes acts of God; acts of the public enemy; war; riots; strikes; mobilization; labor disputes; civil disorders; fire; flood; lockouts; injunctions-intervention-acts; or failures or refusals to act by government authority; and other similar occurrences beyond the control of the party declaring force majeure which such party is unable to prevent by exercising reasonable diligence.
- 6.4.2 Force Majeure shall not include the following occurrences:
- 6.4.2.1 Late delivery of equipment or materials caused by congestion at a manufacturer's plant or elsewhere, or an oversold condition of the market;
- 6.4.2.2 Late performance by a subcontractor unless the delay arises out of a force majeure occurrence in accordance with this force majeure term and condition; or
- 6.4.2.3 Inability of either the Contractor or any subcontractor to acquire or maintain any required insurance, bonds, licenses or permits.
- 6.4.3 If either party is delayed at any time in the progress of the work by force majeure, the delayed party shall notify the other party in writing of such delay, as soon as is practicable and no later than the following working day, of the commencement thereof and shall specify the causes of such delay in such notice. Such notice shall be delivered or mailed certified-return receipt and shall make a specific reference to this article, thereby invoking its provisions. The delayed party shall cause such delay to cease as soon as practicable and shall notify the other party in writing when it has done so. The time of completion shall be extended by Contract Amendment for a period of time equal to the time that results or effects of such delay prevent the delayed party from performing in accordance with this Contract.
- 6.4.4 Any delay or failure in performance by either party hereto shall not constitute default hereunder or give rise to any claim for damages or loss of anticipated profits if, and to the extent that such delay or failure is caused by force majeure.

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6.5 Third Party Antitrust Violations. The Contractor assigns to the State any claim for overcharges resulting from antitrust violations to the extent that those violations concern materials or services supplied by third parties to the Contractor, toward fulfillment of this Contract.

**7. Warranties**

7.1 Liens. The Contractor warrants that the materials supplied under this Contract are free of liens and shall remain free of liens.

7.2 Quality. Unless otherwise modified elsewhere in these terms and conditions, the Contractor warrants that, for one year after acceptance by the State of the materials, they shall be:

7.2.1 Of a quality to pass without objection in the trade under the Contract description;

7.2.2 Fit for the intended purposes for which the materials are used;

7.2.3 Within the variations permitted by the Contract and are of even kind, quantity, and quality within each unit and among all units;

7.2.4 Adequately contained, packaged and marked as the Contract may require; and

7.2.5 Conform to the written promises or affirmations of fact made by the Contractor.

7.3 Fitness. The Contractor warrants that any material supplied to the State shall fully conform to all requirements of the Contract and all representations of the Contractor, and shall be fit for all purposes and uses required by the Contract.

7.4 Inspection/Testing. The warranties set forth in subparagraphs 7.1 through 7.3 of this paragraph are not affected by inspection or testing of or payment for the materials by the State.

7.5 Year 2000.

7.5.1 Notwithstanding any other warranty or disclaimer of warranty in this Contract, the Contractor warrants that all products delivered and all services rendered under this Contract shall comply in all respects to performance and delivery requirements of the specifications and shall not be adversely affected by any date-related data Year 2000 issues. This warranty shall survive the expiration or termination of this Contract. In addition, the defense of *force majeure* shall not apply to the Contractor's failure to perform specification requirements as a result of any date-related data Year 2000 issues.

7.5.2 Additionally, notwithstanding any other warranty or disclaimer of warranty in this Contract, the Contractor warrants that each hardware, software, and firmware product delivered under this Contract shall be able to accurately process date/time data (including but not limited to calculation, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations, to the extent that other information technology utilized by the State in combination with the information technology being acquired under this Contract properly exchanges date-time data with it. If this Contract requires that the information technology products being acquired perform as a system, or that the information technology products being acquired perform as a system in combination with other State information technology, then this warranty shall apply to the acquired products as a system. The remedies available to the State for breach of this warranty shall include, but shall not be limited to, repair and replacement of the information technology products delivered under this Contract. In addition, the

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defense of *force majeure* shall not apply to the failure of the Contractor to perform any specification requirements as a result of any date-related data Year 2000 issues.

7.6 Compliance With Applicable Laws. The materials and services supplied under this Contract shall comply with all applicable Federal, state and local laws, and the Contractor shall maintain all applicable license and permit requirements.

7.7 Survival of Rights and Obligations after Contract Expiration or Termination.

7.71 Contractor's Representations and Warranties. All representations and warranties made by the Contractor under this Contract shall survive the expiration or termination hereof. In addition, the parties hereto acknowledge that pursuant to A.R.S. § 12-510, except as provided in A.R.S. § 12-529, the State is not subject to or barred by any limitations of actions prescribed in A.R.S., Title 12, Chapter 5.

7.7.2 Purchase Orders. The Contractor shall, in accordance with all terms and conditions of the Contract, fully perform and shall be obligated to comply with all purchase orders received by the Contractor prior to the expiration or termination hereof, unless otherwise directed in writing by the Procurement Officer, including, without limitation, all purchase orders received prior to but not fully performed and satisfied at the expiration or termination of this Contract.

**8. State's Contractual Remedies**

8.1 Right to Assurance. If the State in good faith has reason to believe that the Contractor does not intend to, or is unable to perform or continue performing under this Contract, the Procurement Officer may demand in writing that the Contractor give a written assurance of intent to perform. Failure by the Contractor to provide written assurance within the number of Days specified in the demand may, at the State's option, be the basis for terminating the Contract under the Uniform Terms and Conditions or other rights and remedies available by law or provided by the contract.

8.2 Stop Work Order.

8.2.1 The State may, at any time, by written order to the Contractor, require the Contractor to stop all or any part, of the work called for by this Contract for period(s) of days indicated by the State after the order is delivered to the Contractor. The order shall be specifically identified as a stop work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage.

8.2.2 If a stop work order issued under this clause is canceled or the period of the order or any extension expires, the Contractor shall resume work. The Procurement Officer shall make an equitable adjustment in the delivery schedule or Contract price, or both, and the Contract shall be amended in writing accordingly.

8.3 Non-exclusive Remedies. The rights and the remedies of the State under this Contract are not exclusive.

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- 8.4 Nonconforming Tender. Materials or services supplied under this Contract shall fully comply with the Contract. The delivery of materials or services or a portion of the materials or services that do not fully comply constitutes a breach of contract. On delivery of nonconforming materials or services, the State may terminate the Contract for default under applicable termination clauses in the Contract, exercise any of its rights and remedies under the Uniform Commercial Code, or pursue any other right or remedy available to it.
- 8.5 Right of Offset. The State shall be entitled to offset against any sums due the Contractor, any expenses or costs incurred by the State, or damages assessed by the State concerning the Contractor's non-conforming performance or failure to perform the Contract, including expenses, costs and damages described in the Uniform Terms and Conditions.
- 9. Contract Termination**
- 9.1 Cancellation for Conflict of Interest. Pursuant to A.R.S. § 38-511, the State may cancel this Contract within three (3) years after Contract execution without penalty or further obligation if any person significantly involved in initiating, negotiating, securing, drafting or creating the Contract on behalf of the State is or becomes at any time while the Contract or an extension of the Contract is in effect an employee of or a consultant to any other party to this Contract with respect to the subject matter of the Contract. The cancellation shall be effective when the Contractor receives written notice of the cancellation unless the notice specifies a later time. If the Contractor is a political subdivision of the State, it may also cancel this Contract as provided in A.R.S. § 38-511.
- 9.2 Gratuities. The State may, by written notice, terminate this Contract, in whole or in part, if the State determines that employment or a Gratuity was offered or made by the Contractor or a representative of the Contractor to any officer or employee of the State for the purpose of influencing the outcome of the procurement or securing the Contract, an amendment to the Contract, or favorable treatment concerning the Contract, including the making of any determination or decision about contract performance. The State, in addition to any other rights or remedies, shall be entitled to recover exemplary damages in the amount of three times the value of the Gratuity offered by the Contractor.
- 9.3 Suspension or Debarment. The State may, by written notice to the Contractor, immediately terminate this Contract if the State determines that the Contractor has been debarred, suspended or otherwise lawfully prohibited from participating in any public procurement activity, including but not limited to, being disapproved as a subcontractor of any public procurement unit or other governmental body. Submittal of an offer or execution of a contract shall attest that the contractor is not currently suspended or debarred. If the contractor becomes suspended or debarred, the contractor shall immediately notify the State.
- 9.4 Termination for Convenience. The State reserves the right to terminate the Contract, in whole or in part at any time, when in the best interests of the State without penalty or recourse. Upon receipt of the written notice, the Contractor shall stop all work, as directed in the notice, notify all subcontractors of the effective date of the termination and minimize all further costs to the State. In the event of termination under this paragraph, all documents, data and reports prepared by the Contractor under the Contract shall become the property of and be delivered to the State upon demand. The Contractor shall be entitled to receive just and equitable compensation for work in progress, work completed and materials accepted before the effective date of the termination. The cost principles and procedures provided in A.A.C. R2-7-701 shall apply.

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9.5 Termination for Default.

9.5.1 In addition to the rights reserved in the contract, the State may terminate the Contract in whole or in part due to the failure of the Contractor to comply with any term or condition of the Contract, to acquire and maintain all required insurance policies, bonds, licenses and permits, or to make satisfactory progress in performing the Contract. The Procurement Officer shall provide written notice of the termination and the reasons for it to the Contractor.

9.5.2 Upon termination under this paragraph, all goods, materials, documents, data and reports prepared by the Contractor under the Contract shall become the property of and be delivered to the State on demand.

9.5.3 The State may, upon termination of this Contract, procure, on terms and in the manner that it deems appropriate, materials or services to replace those under this Contract. The Contractor shall be liable to the State for any excess costs incurred by the State in procuring materials or services in substitution for those due from the Contractor.

9.6 Continuation of Performance Through Termination. The Contractor shall continue to perform, in accordance with the requirements of the Contract, up to the date of termination, as directed in the termination notice.

10. Contract Claims. All contract claims or controversies under this Contract shall be resolved according to A.R.S. Title 41, Chapter 23, Article 9, and rules adopted thereunder.

11. Arbitration

The parties to this Contract agree to resolve all disputes arising out of or relating to this contract through arbitration, after exhausting applicable administrative review, to the extent required by A.R.S. § 12-1518, except as may be required by other applicable statutes (Title 41).

12. Comments

The State Procurement Office periodically reviews the Uniform Terms and Conditions and welcomes any comments you may have. Please submit your comments to: State Procurement Administrator, State Procurement Office, 100 North 15th Avenue, Suite 104, Phoenix, Arizona 85007.

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**1. TERM OF CONTRACT**

The term of any resultant contract shall commence on the effective day of award and shall continue for a period of twelve (12) months thereafter, unless terminated, cancelled or extended as otherwise provided herein.

**2. CONTRACT EXTENSION**

The Department reserves the right to unilaterally extend the period of any resultant contract for thirty-one (31) days beyond the stated expiration date. In addition, by mutual written contract amendment, any resultant contract may be extended for supplemental periods of up to (48) months.

**3. CHANGES**

The Department reserves the right to revise the delivery and schedule; and to make other changes within the general Scope of Work as may be deemed necessary to best serve the interest of the Department. All changes shall be documented by formal amendments to the contract.

**4. BID EVALUATION**

In accordance with the Arizona Procurement Code A.R.S. §41-2533, Competitive Sealed Bidding, awards shall be made to the lowest responsible and responsive offeror whose offer conforms in all material respects to the requirements and criteria set forth in this Invitation for Bid.

Specific factors that will be considered by the Department include, but are not limited to:

Technical capability of the contractor to accomplish the scope of work required in the Invitation for Bid. This includes performance history on past and current contracts of similar scope and size. References will be utilized for this purpose.

Compliance to the specifications as stated in Section 1 of this solicitation.

**5. NON-EXCLUSIVE CONTRACT**

Any contract resulting from this solicitation shall be awarded with the understanding and agreement that it is for the sole convenience of the Department. The Department reserves the right to obtain like goods or services from another source when necessary. Off-Contract Purchase Authorization may only be approved by the Chief Procurement Officer. Approval shall be at the discretion of the Chief Procurement Officer and shall be conclusive, however, approval shall be granted only after a proper review and when deemed to be appropriate. Off-contract procurement shall be consistent with the Arizona Procurement Code.

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**7. ORDERING PROCESS**

Upon award of a contract the Department's Procurement Group, or any designated department may procure the specific material and/or service awarded by the issuance of a contract purchase order to the appropriate contractor. Each contract purchase order must cite the correct contract number. The award of a contract shall be in accordance with the Arizona Procurement Code and all transactions and procedures required by the Code for public bidding shall be complied with. A contract purchase order for the awarded material and/or service that cites the correct contract number is the only document required for the using agency to order and the contractor to deliver the material and/or service.

Any attempts to represent any material and/or service not specifically awarded as being under contract is a violation of the contract and the Arizona Procurement Code. Any such action is subject to the legal and contractual remedies available to the State inclusive of but not limited to contract cancellation, suspension and/or debarment of the contractor.

The minimum order value will be for \$1,000 of equipment. This minimum order shall achieve free on board shipping delivered to the Department's Traffic Supply Center in Phoenix. Order values less than this minimum value are allowable; however, the supplier will be allowed to charge up to an additional \$75 for shipping and handling. The supplier may waive this fee.

Additional shipping charges for deliveries outside Maricopa or Pima Counties may be applied at invoice price with no mark up.

**8. DELIVERY**

All materials shall be delivered to the locations specified within a maximum of 21 days for individual components and 60 calendar days for traffic control cabinet assemblies that are either pre-wired or are pre-wired and include plug in components. The time requirement will begin upon receipt of an order in writing. If specified by the Department at the time of order, delivery times may be more than the days indicated herein. If the Department requests a delivery time of more than the required days, then the Department shall have the right to specify the exact week of delivery.

The supplier shall acknowledge an order by some mode of communication. This acknowledgement shall include a description of what was ordered and when the Department or user agency can expect delivery.

Each item shall be delivered complete and ready for use and/or signal shop setup and testing. One set of manuals and/or instruction sheets shall be included with all items.

The supplier shall retain title and control of goods until delivered and unloaded. Any damage to the shipment due to the actions or non-actions of the supplier or shipper shall be the responsibility of the supplier.

A late shipment can be grounds for the Department or user agency to reject the shipment, suspend the contract, cancel the contract, or utilize another supplier.

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Each item and/or sub-item shall be packaged in a manner which is appropriate for the handling and shipping methods used. Assembled controller units shall be fully braced and secured to prevent any component from coming loose. Items shall be palletized as necessary. All methods used to secure devices shall be easy to remove and shall not leave marks, dents or other signs of superficial or real damage.

**9. SHIPPING - FOB STATEWIDE**

Prices shall be Free-On-Board (FOB) destination to the any location in Maricopa or Pima Counties. Additional shipping charges can be applied, if applicable, to other locations outside of these two counties.

Special rush orders shall be allowed. The supplier may charge for the additional handling and/or shipping charges at the invoice price with no additional mark up.

**10. DESCRIPTIVE LITERATURE**

All Offerors shall submit two packages of literature regarding all of the items they are offering. The specifications contain detailed requirements regarding what needs to be submitted (the Offer Catalog).

Bidders shall also include a resume about their company and the traffic signal cabinet, controller and related component manufacturer whose equipment they intend to supply. This information should disclose the location of manufacturing facilities, the capabilities of that facility and some history about the facility in terms of its effectiveness in making and shipping high quality and reliable traffic signal cabinets, controllers, and related components that are of the type herein required. The resume should also include disclosure of any major problems and/or failures of these products that have caused significant harm to the user agency and/or public within the last 5 years. "Major" means any problem with the equipment that would indicate a flaw in design (hardware, firmware and/or software), manufacturing process, quality control program and/or any other problem that the Department needs to know about. This disclosure should include information about why the problem and/or failure occurred, and what has been done to correct the problem, not only in terms of correcting the product itself; but what has been done or is being done to prevent similar problems in the future. A contact person and their phone number with the purchaser and owner of the failure shall be given.

This information will be used to help determine if the offered products and the company making the offer comply with the requirements of **Section 1.0**. Product problems and/or failures in themselves will not be used as a reason to reject a bid. Indication that failures and/or problems have not been effectively addressed and corrected can be reason to reject all of or a portion of any offer.

This information will be used to help determine if the offered products comply with the requirements of **Section 1.0** and the brand name or equal products listed in this section.

**FAILURE TO INCLUDE THIS INFORMATION MAY RESULT IN THE OFFER BEING REJECTED.**

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**11. MANUALS**

For every controller unit (CU) ordered at least **two** manuals shall be included, unless directed otherwise by the Department. All other components shall come with at least one set of instructions, data sheet and trouble shooter guide with each item. This includes loop detector units, CMU, MMU, BIU, load switch and flasher units. At the option of the supplier or manufacturer, manuals can be subdivided and/or grouped. For example, it is acceptable that the CU manual be divided into a programming manual and a maintenance manual.

The manuals and instruction sheets shall provide complete and comprehensive information about the products supplied. This includes consideration of all of the following topics as applicable to the device: table of contents (if manual is more than few pages long), glossary of key terms and principles, general descriptions, general characteristics, features, installation, setup procedures, testing procedures, adjustment (e.g. programming, settings), theory of operations, systems description (including flow chart as applicable), detailed description of circuit operations, general maintenance, preventative maintenance (suggestions on routine maintenance schedule), trouble analysis, trouble shooting guide (include a sequence chart and table of the most frequent trouble issues and the corrections and/or repairs), list of precautions related to maintenance and/or troubleshooting, measurable electrical characteristics (wave forms, current, voltage, etc.), parts list, schematics, I/O assignments / functions and any other subjects that are relevant to the device being supplied. It is important to note that this list should not be regarded as complete and inclusive. It is still up to the supplier and the device manufacturer to furnish manuals and instruction sheets that provides the necessary information so devices can be setup, installed, operated, maintained, and repaired correctly and safely.

Manuals and instructions sheets shall, as applicable, also include parts lists, detailed circuit diagrams (which include board references and all input/out assignments), and detailed assembly drawings. Most manuals and instruction sheets can be standard paper size. Schematics and drawings, however, shall be of an appropriate size to ensure that all detail is clearly shown and easily to follow and read. If requested the supplier shall furnish electronic files of all text, schematics, and drawings so users can utilize this information to its fullest extent (including making edits, changes and modifications).

All manuals and instruction sheets shall provide detailed references to the sections and subsections of the standards (e.g. MUTCD, NEMA TS 1, NEMA TS 2, Model 170, ATC, 2070, etc) that they meet and/or exceed. Amendments to manuals and instructions sheets shall be issued as these standards change.

The user's manual shall also include a customer service contact phone number, e-mail address, and/or website. Suppliers shall have a voluntary method for users to register their name, user agency, address, phone number and e-mail address. The suppliers shall utilize this data to keep users up-to-date on all changes, modifications and recalls, if and as applicable. Schematics and drawings shall also be updated as necessary.

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Any changes that affect the user's manual shall be given to the user as applicable and as soon as possible. Information about any recalls on a device or any part of a device shall be given immediately.

The supplier shall revise and develop changes and/or additions to the manual if requested by users. Manuals can be submitted on CD if approved by the Department.

All manuals and instruction sheets shall be dated and include a method of document control numbering and/or revision referencing to help ensure the Department can easily match the device to the applicable manual and/or instruction sheet. It is also helpful for revised manuals and instruction sheets to summarize changes, modifications, and/or additions that were made to generate the revision.

**12. TRAINING**

Training sessions are to be held within 45 days from award. The training sessions shall be held at the Department Traffic Supply Center in Phoenix or at other locations (Prescott, Flagstaff, Tucson, or Yuma) throughout the state if and as needed to support the equipment purchased.

Due to the complexity of this procurement and the varying degrees of agency personnel experience (from entry level technicians to senior technicians) the training classes are to be divided into the following subject areas:

- Introduction to the Controller Cabinet and Related Components
- NEMA TS 1, NEMA TS 2 Type 2 & NEMA TS 2 Type 1
- Model 170E Training
- Advance Controller program Training
- Advance CMU/MMU Training
- Advance Loop Detectors
- Advance Cabinet Trouble Shooting

Each of the classes shall be geared to the appropriate standard that the agency uses (the Department uses NEMA TS 1 cabinets and controllers all over the state, except in the Phoenix area where they also use NEMA Controllers in a modified Caltrans 332 cabinet ("345 cabinet"). The Department is now investigating changing to the NEMA TS 2 Type 2 standard. This listing of class subjects will be modified if requested by the Department.

The session shall fully demonstrate how the items being purchased through this contract are used and maintained. Training session should be supported with required information and users manuals, programming, including trouble shooting guides and maintenance cycle requirements. All training sessions shall incorporate the contents of related manuals and instruction sheets, as well as referenced traffic control standards and practices (NEMA, Caltrans, etc.).

The training sessions herein specified shall be repeated each year if requested by the Department. Up to eight training sessions are to be held in the first year of the contract on each subject listed (2 in each of the 4 traffic regions). The minimum length of the introduction class shall be 4 hours (1 hours on the cabinet, 1 hours on the controller and one hour each on the

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CMU/MMU and loop detectors). The other training classes can be from 2 to 4 hours. Classes shall be structured in one hour intervals with 10 to 15 minute breaks between each interval. The length and structure of the classes shall be modified if requested by the Department.

Software that allows controller displays to be projected on a personal computer (PC) or through a PC to a computer projector shall be offered to the Department at no cost.

**13. QUARTERLY CUSTOMER SERVICE VISITS**

The supplier shall conduct, at a minimum, quarterly service visits to the signal unit shop in Phoenix. Additional visits are to be made as requested by the Traffic Signal Unit Manager based on need and on demand. These additional visits should be made as soon as they can reasonably be accommodated (visits to help with extreme emergencies should be made immediately). As a minimum, these additional on demand visits, once requested, are to be made within 12 hours, Monday thru Thursday noon, and by the next Monday or Tuesday if made in the afternoon on Thursday or on Friday. Extreme emergency visits shall be made within an hour of notification. Visits to the various regional areas shall be done at least once a year or as needed and/or requested. The objectives of the visits are to ensure that both the supplier and the user are meeting the requirements of the specifications, special terms, and conditions and there is a free flow of technical information that helps ensure that all equipment is utilized in a safe and orderly fashion. Routine quarterly visits shall be coordinated in advance with the involved office and field personnel. The contact information for these persons is as follows:

**Traffic Signal Unit Manager:**

Mr. Danny McIntyre  
2104 South 22<sup>nd</sup> Avenue, MD 013R  
Phoenix, Arizona 85009  
(602) 712-6613 Office  
(602) 712-3305 Office Fax  
(602) 316-9592 Mobile  
e-mail: [dmcintyre@azdot.gov](mailto:dmcintyre@azdot.gov)

**Phoenix Region Signals & Lighting:**

Dave Smith  
Phoenix, Arizona  
(602) 712-6607 Office  
(602) 999-5144 Mobile  
e-mail: [dsmith@azdot.gov](mailto:dsmith@azdot.gov)

**Variable Message Signs, Ramp Metering & Freeway Cameras:**

Chuck McClatchey  
Phoenix, Arizona  
(602) 262-2530 Office  
(602) 908-9164 Mobile

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e-mail: [cmccclatchey@azdot.gov](mailto:cmccclatchey@azdot.gov)

**Tucson Region Signals & Lighting:**

Paul Sykes Jr.  
Tucson, Arizona  
(520) 838-2841 Office  
(520) 449-0734 Mobile  
e-mail: [psykes@azdot.gov](mailto:psykes@azdot.gov)

**Western Region Signals & Lighting:**

Jim Wisniewski  
Prescott Valley, Arizona  
(928) 759-2426 Ext 3616 Office  
(928) 713-4510 Mobile  
e-mail: [Jwisniewski@azdot.gov](mailto:Jwisniewski@azdot.gov)

**Northern Region Signals & Lighting:**

Joe Reed  
Flagstaff, Arizona  
(928) 527-6875 Office  
(928) 607-4229 Mobile  
e-mail: [jreed@azdot.gov](mailto:jreed@azdot.gov)

A customer service representative shall be available to answer questions during normal business hours by telephone (cell) and e-mail. Customer visits shall be made by those who are fully trained and technically familiar with the equipment being sold. They shall also have a good working knowledge of electrical theory and traffic signals standards (e.g. NEMA TS 1, NEMA TS 2, 170, 2070, ATC). They shall be able to provide detailed input and consultation to all Department traffic signal personnel on all software and hardware matters.

**14. WARRANTY**

The supplier warrants:

- **All Items** - That all items and sub-items furnished hereunder shall conform to the requirements of this contract and shall be free from defects in design materials and workmanship. Additionally that all items and sub-items shall be properly handled and packaged to arrive at their destination free of damage.
- **Traffic Control Equipment in Storage** - The warranty period on workmanship and materials shall be a minimum of one year for all products being stored in their original containers or on shelves in the indoors with air conditioning or proper air circulation.