

failures of the controller or its components. Should a defect develop under normal and proper operating conditions during the testing period and prior to acceptance by the State, this malfunction shall be corrected by and at the expense of the Contractor, including all labor, materials and associated costs. Minor failures such as lamp failures or loop detector re-tuning will not be the basis for starting a new test period, provided the failures are repaired immediately and the same failures do not recur during the remainder of the test period. A major malfunction or failure of the controller and its components will result in a new 30 day test period being implemented after the repairs have been made.

2.23. GUARANTEE. All equipment furnished on a project by the Contractor shall be guaranteed against any imperfections in workmanship and materials. The customary manufacturers' warranties shall be assigned to the Maintaining Agency.

2.24. MANUALS. A minimum of 2 manuals shall be provided for each controller and shall include complete nomenclature, wiring diagrams, schematics showing test voltages, functional description of circuits, parts list and cross reference to standard part numbers, appropriate testing procedures, and other pertinent data.

5. MATERIALS.

5.1. DESCRIPTION. These specifications cover the general materials and miscellaneous hardware for the installation of a traffic signal to be constructed in accordance with and at locations indicated in the contract, shown in the Plans or designated by the Engineer.

5.2. MATERIAL REQUIREMENTS.

5.2.1. GENERAL. All materials used in the fabrication or assembly of the items listed below shall be new, shall be of the best quality and workmanship, shall be the best standard product of a manufacturer regularly engaged in the production of this type of equipment and shall be of the manufacturer's latest approved design. Major items of electronic equipment installed under this contract shall be of the same type and consist of products supplied by the same supplier in order to secure uniformity, single responsibility, and most satisfactory service.

5.2.1.1. The traffic signal shall be complete, and the Contractor shall furnish and install all equipment necessary for the satisfactory operation of the signal system whether specifically mentioned or not.

5.2.2. N.E.M.A. TRAFFIC CONTROLLER ASSEMBLY.

5.2.2.1. GENERAL. The N.E.M.A. Traffic Controller Assembly shall meet the requirements of the N.E.M.A. Standards Publication No. TS 2-1992. The N.E.M.A. traffic controller assembly shall be either pole mounted or pad mounted. The specific requirements of each type are listed below.

5.2.2.2. CONTROLLER UNIT. The controller unit shall meet the requirements of a Type 1A per Section 3 of the N.E.M.A. Standards

5.2.2.3. MALFUNCTION MANAGEMENT UNIT. The malfunction management unit shall meet the requirements of Section 4 of the N.E.M.A. Standards.

5.2.2.4. TERMINALS AND FACILITIES. The controller assemblies' terminals and facilities shall, as a minimum, meet the requirements of Section 5 of the N.E.M.A. Standards.

5.2.2.4.1. POLE MOUNTED CONTROLLER ASSEMBLIES. The pole mounted controller assemblies shall, as a minimum, be equipped with wired sockets and bus interface units of the quantities listed for Configuration 2 of Table 5.3.1-1 of the N.E.M.A. Standards.

5.2.2.4.2. PAD MOUNTED CONTROLLER ASSEMBLIES. The pad mounted controller assemblies shall be classified as either Type I or Type II. Type I pad mounted controller assemblies shall be equipped the same as pole mounted controller assemblies. Type II pad mounted controller assemblies shall, as a minimum, be equipped with wired sockets and bus interface units of the quantities listed for Configuration 4 of Table 5.3.1-1 of the N.E.M.A. Standards. If the Plans require more than 16 channels of detection, then additional detector racks of Type 2 configuration shall be added to provide the necessary detector slots.

5.2.2.4.3. AC SERVICE TRANSIENT PROTECTION. The AC service transient protection shall be accomplished by a solid state hybrid filtering surge protector meeting the surge requirements of Section 5.4.2.4 of the N.E.M.A. Standards, except that it shall have a clamp voltage of 250 Volts and be designed to absorb power line noises in the range of 10 kilohertz to 20 megahertz.

5.2.2.4.4. LIGHTING FIXTURE. The light fixture shall be fluorescent, and provided with an appropriate fluorescent lamp.

5.2.2.4.5. LIGHTING FIXTURE SWITCH. The light switch shall be door actuated.

5.2.2.4.6. POLICE COMPARTMENT SWITCHES. The panel behind the police door shall contain 2 switches to accomplish the following functions: (1) change from normal operation to flashing, and vice versa and (2) interrupt power to the signal heads.

5.2.2.5. AUXILIARY DEVICES. The auxiliary plug-in devices shall, as a minimum, meet the requirements of Section 6 of the N.E.M.A. Standards.

5.2.2.5.1. THREE-STATE CIRCUIT BOARD SWITCHES. The load switches shall meet the requirements of Section 6.2 of the N.E.M.A. Standards.

5.2.2.5.2. SOLID STATE FLASHERS. The flashers shall meet the requirements of Section 6.3 of the N.E.M.A. Standards.

5.2.2.5.3. FLASH TRANSFER RELAYS. The flash transfer relays shall meet the requirements of Section 6.4 of the N.E.M.A. Standards.

5.2.2.5.4. INDUCTIVE LOOP DETECTORS. The inductive loop detectors shall, as a minimum, meet the requirements of Section 6.5 of the N.E.M.A. Standards.

5.2.2.6. CABINETS. The cabinets shall meet the requirements of Section 7 of the N.E.M.A. Standards, as modified below.

5.2.2.6.1. HOUSING. The cabinets shall be of unpainted sheet aluminum alloy construction.

5.2.2.6.2. POLE MOUNTED CONTROLLER ASSEMBLIES. The pole mounted controller cabinet shall be size 4 per Table 7.3-1 of the N.E.M.A. Standards. The cabinet shall have a continuously welded bottom of the same material as the rest of the cabinet.

5.2.2.6.3. PAD MOUNTED CONTROLLER ASSEMBLIES. Type I pad mounted controller assembly cabinets shall be size 5 per Table 7.3-1 of the N.E.M.A. Standards. Type II pad mounted controller assembly cabinets shall be size 6 per Table 7.3-1 of the N.E.M.A. Standards.

5.2.2.7. BUS INTERFACE UNIT. The bus interface units shall meet the requirements of Section 8 of the N.E.M.A. Standards.

5.2.3. TYPE 170E TRAFFIC SIGNAL CONTROL SYSTEM

5.2.3.1. GENERAL. The Type 170E traffic signal control system shall, as a minimum, meet the State of California Traffic Signal Control Equipment Specifications (TSCES), dated January 1989, as modified by TSCES Addendum 8, dated November 1993, and Addendum 4 dated July 1991 with the additions or modifications as shown in the following specifications.

5.2.3.2. RESPONSIBLE PARTIES. Any reference to the State, State of California, or Agency shall mean the local agency responsible for maintaining the traffic signal. Any reference to the Contractor shall mean equipment manufacturer or supplier.

5.2.3.3. TESTING MANUALS. Two manuals containing the flow chart, listing, and instructions of the test program shall be furnished to the agency responsible for maintaining the traffic signal when the controller unit is delivered.

5.2.3.4. CABINETS. The pole mounted cabinets shall be Model 336A, and the pad mounted cabinets shall be Model 332B meeting the requirements of Chapter 6 of the TSCES with the following additions or modifications.

5.2.3.4.1. FINISH. The cabinet finish shall be natural aluminum.

5.2.3.4.2. LIFT EYES. The cabinet lift eyes shall be removable so that they can be turned down after installation of the cabinet.

5.2.3.4.3. LIGHT FIXTURES. Cabinets shall be furnished with fluorescent light fixtures, including lamps, over the front and back doors that are controlled by door-activated switches.

5.2.3.4.4. PLAN DRAWER/WORK SURFACE. A drawer shall be provided in the EIA rack between the Controller and the top input file. It shall be mounted on sliding tracks having lockout and quick-disconnect features. The drawer shall be able to extend out 350 mm, and shall be capable of supporting a 18 kg load when fully extended. The drawer shall be provided with a hinged aluminum top covered with a chemical-proof Formica-type plastic sheet that can be lifted to gain access to the interior of the drawer. The interior of the drawer shall have nominal dimensions of 25 mm high, 330 mm deep, and 400 mm wide.

5.2.3.4.5. ADDITIONAL MODEL 336A REQUIREMENTS. The Model 336A cabinets shall be furnished with a continuously welded bottom of the same material as the rest of the cabinet, and all of the hardware necessary to permit mounting to a 300 mm outside diameter pole.

5.2.3.4.6. ADDITIONAL MODEL 332B REQUIREMENTS. The Model 332B cabinets shall be furnished with the power distribution assembly #2 in lieu of the power supply and power distribution #1 assemblies. The cabinets shall be supplied with the circuit breaker option per Section 6.4.3.9 of the TSCES. The cabinet shall be furnished with anchor bolts, nuts and washers.

5.2.3.4.7. ADDITIONAL OUTPUT FILE #1 REQUIREMENTS. The output file #1 supplied with the cabinet shall be modified to provide compatibility with the red monitoring features of the conflict monitor.

5.2.3.5. CONTROLLER. The controller unit shall be a Model 170E per Section 2 of the TSCES Addendum 8, dated November 19, 1993.

3.2.3.7. CONFLICT MONITOR. The conflict monitor shall meet the requirements of a Model 210 per Chapter 4, Section 5 of the TSCES with the following additional monitoring functions: red monitoring; absence of signal on a channel; simultaneous multiple indications on a channel; program card ajar; power interrupt after failure; short or absence of yellow; AC line monitoring; full systems compatibility with Wapiti Microsystems Traffic Systems software.

3.2.3.9. LOAD SWITCH. The load switch shall have modular switches that can be easily replaced with the use of a screwdriver, and meet the requirements of a Model 200 switch pack per Chapter 3 of the TSCES.

3.2.3.11. SURGE PROTECTOR. The surge protector shall be a filtering surge protector that absorbs power line noise and switching transients, and provides lightning protection. It shall consist of three basic sub circuits: primary clamp, secondary clamp, and the filter. It shall be rated for a peak current of 20,000 amps from an 8 by 20 microsecond wave shape. The clamp voltage shall never exceed 280 volts during a peak surge. It shall provide a maximum of 10 amps continuous service current at 120 volts AC and 60 Hertz. It shall have an operating temperature range of -40 to +85 degrees Celsius. The filter shall be designed to absorb power line noises in the range of 10 kilohertz to 20 Megahertz.

3.2.3.13.AC ISOLATOR. When called for in the Plans, the AC isolator shall meet the requirements of a Model 252 two-channel AC isolator per Chapter 5 of the TSCES.

3.2.4. SIGNAL HEADS: All signal heads on a project shall be the product of one manufacturer with the exception of programmed visibility signal heads and one piece pedestrian signal indications. The signal heads shall be in general conformance with the latest edition of the Equipment and Materials Standards of the Institute of Transportation Engineers – Vehicle Traffic Control Signal Heads, and as specified below.

3.2.4.1.1. **ARROW LENSES.** The arrow may be formed of either enamel baked or fired onto the glass lens, or an arrow shield placed behind the lens. The arrow shield shall only allow light through the arrow display, with no extraneous light around the edges.

3				
2				
1				
NO.	DATE		BY	APP'D

TE120BSI				04/28/96	
FHWA APPROVAL		05/18/98		APP'D Linda G. Voss, P.E.	
DESIGNED	J.F.F.	DETAILED	J.F.F.	QUANTITIES	TRACED
DESIGN CK.	D.A.C.	DETAIL CK.	D.A.C.	QUAN. CK.	TRACE CK.

Plotted By : @USERNAME@@
Plot File : @@@@@@@@@@@@@@DGN\$SPEC@@@@@@@@@@@@
Plot Date : @@@@@@SYTIME@@@@@