FHWA REGION NO.	STATE	PROJECT NO.	YEAR	SHEET NO.	TOTAL SHEETS
7	KANSAS	87N 0064-01	1997	86	130

I. LEAD-IN WIRE

1. **CONDUCTOR:** POWER LEAD-IN WIRE FOR INTERSECTION SIGNALIZATION SHALL BE NO. 6 AMERICAN WIRE GAUGE SINGLE CONDUCTOR CABLE FOR OPERATION ON A 600 VOLT MAXIMUM, AND SUITABLE FOR USE AT CONDUCTOR TEMPERATURES NOT EXCEEDING 165 DEGREES FAHRENHEIT. MATERIAL, CONSTRUCTION, AND TESTS SHALL BE IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF THE LATEST EDITION OF THE INSULATED POWER CABLE ENGINEERS' ASSOCIATION STANDARD S-66-524 "CROSS-LINKED-THERMOSETTING-POLYETHYLENE-INSULATED WIRE AND CABLE FOR THE TRANSMISSION AND DISTRIBUTION OF ELECTRICAL ENERGY".

2. **COPPER WIRE:** CONDUCTORS SHALL BE STRANDED, ANNEALED COATED COPPER. COPPER WIRE, BEFORE INSULATING OR STRANDING, SHALL MEET THE REQUIREMENTS OF THE LATEST EDITION OF THE AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARD B33 "SPECIFICATION FOR TINNED SOFT OR ANNEALED COPPER WIRE FOR ELECTRICAL PURPOSES" (FOR COATED WIRE). STRANDING SHALL BE CLASS B, IN ACCORDANCE WITH THE LATEST EDITION OF ASTM B8 "SPECIFICATION FOR CONCENTRIC-LAY-STRANDED COPPER CONDUCTORS, HARD, MEDIUM-HARD, OR SOFT".

3. **INSULATION:** INSULATION SHALL CONSIST OF CROSS-LINKED THERMOSETTING POLYETHYLENE, MEETING THE REQUIREMENTS OF COLUMN A OF THE INSULATED POWER CABLE ENGINEERS' ASSOCIATION AND LISTED BY UNDERWRITERS' LABORATORY AS TYPE U.S.E. RHW-165 DEGREES FAHRENHEIT.

J. **LIGHTING SECONDARY CABLE:** SEE XII.C "LUMINAIRES AND LAMPS".

VII. TRAFFIC SIGNAL HEADS

A. GENERAL

1. SIGNAL HEAD MOUNTING

a. **INSTALLATION:** SIGNAL HEADS SHALL NOT BE INSTALLED AT ANY INTERSECTION UNTIL ALL OTHER SIGNAL EQUIPMENT, INCLUDING THE CONTROLLER, IS IN PLACE AND READY FOR OPERATION AT THAT INTERSECTION, EXCEPT THAT THE SIGNAL HEADS MAY BE MOUNTED IF THE FACES ARE NOT DIRECTED TOWARD TRAFFIC OR IF THE FACES ARE COMPLETELY COVERED. IN NO CASE SHALL THE HEADS BE INSTALLED MORE THAN 10 DAYS PRIOR TO THE SIGNAL TURN-ON. THE ENGINEER SHALL DIRECT THE FINAL POSITIONING OF THE SIGNAL HEADS FOR OPTIMUM VISIBILITY. VERTICAL BRACKET AND PEDESTAL MOUNTED TRAFFIC SIGNAL HEADS SHALL BE INSTALLED AT A HEIGHT OF 10 FEET FROM THE BASE OF POLE TO THE BOTTOM OF SIGNAL HEAD UNLESS OTHERWISE SPECIFIED IN THE PLANS. MAST ARM MOUNTED SIGNAL HEADS SHALL BE INSTALLED AT A HEIGHT OF 15 TO 19 FEET FROM THE PAVEMENT TO THE BOTTOM OF SIGNAL HEAD.

b. **BRACKET MOUNTING:** BRACKET-MOUNTED SIGNAL HEADS, AS SHOWN ON THE PLAN, SHALL BE SUPPORTED BY MOUNTING BRACKETS CONSISTING OF WATERTIGHT ASSEMBLIES OF 1-1/2 INCH DURABLE POLYCARBONATE. MOUNTING BRACKETS SHALL BE YELLOW. THE DIMENSIONS OF MOUNTING BRACKETS SHALL BE AS REQUIRED TO PROVIDE PROPER SIGNAL HEAD ALIGNMENT. EACH BRACKET SHALL HAVE 72 TOOTH SERRATIONS TO ASSURE A POSITIVE LOCK WITH THE SIGNAL HEAD AND ALLOW POSITIONING OF THE TRAFFIC SIGNAL HEADS IN INCREMENTS OF 5 DEGREES. ALL MEMBERS SHALL BE EITHER PLUMB OR LEVEL, SYMMETRICALLY ARRANGED, AND SECURELY ASSEMBLED. MOUNTING BRACKETS SHALL BE ATTACHED TO THE POLE WITH A STAINLESS STEEL BANDING. CONSTRUCTION SHALL BE SUCH THAT ALL CONDUCTORS ARE CONCEALED WITHIN THE ASSEMBLY.

c. **MAST-ARM MOUNTING:** MAST-ARM SIGNAL HEAD ASSEMBLIES SHALL BE RIGID MOUNTED. THE ASSEMBLY SHALL CONSIST OF BOTH TOP AND BOTTOM BRACKETS AND BE EASILY AND COMPLETELY ADJUSTABLE IN BOTH HORIZONTAL AND VERTICAL PLANES. THE TOP AND BOTTOM BRACKETS SHALL HAVE 72 TOOTH SERRATIONS CAST INTO THE ARM TO ASSURE A POSITIVE LOCK WITH THE SIGNAL HOUSING. THE MAST ARM SIGNAL BRACKET SHALL BE CONSTRUCTED OF A HIGH STRENGTH ALUMINUM. IT SHALL HAVE A MINIMUM OPENING OF 1-1/2 INCHES TO COMPLETELY ENCLOSE THE SIGNAL WIRING. THE BRACKET SHALL ACCOMMODATE THE NUMBER AND SIZE OF SIGNAL HEADS AS SHOWN ON THE PLAN. IT SHALL BE ATTACHED TO THE SIZE AND SHAPE OF THE MAST ARM SUPPLIED BY MEANS OF STAINLESS STEEL BANDS.

2. **BACKPLATES:** WHERE SHOWN ON THE PLAN, 5 INCH BACKPLATES SHALL BE FURNISHED AND ATTACHED TO THE SIGNAL FACES TO PROVIDE A DARK BACKGROUND FOR SIGNAL INDICATIONS. BACKPLATES SHALL BE CONSTRUCTED OF DURABLE PLASTIC ABLE TO WITHSTAND A 100 MILES PER HOUR WIND.

B. VEHICLE AND PEDESTRIAN TRAFFIC SIGNAL HEADS

1. **ASSEMBLY:** EACH SIGNAL HEAD SHALL BE A WEATHERTIGHT ASSEMBLY OF ONE OR MORE SIGNAL FACES OF THE EXPANSIBLE, ADJUSTABLE, INCANDESCENT TYPE, TOGETHER WITH ALL BRACKETS AND FITTINGS NECESSARY FOR PROPER MOUNTING WITH THE TYPE OF SIGNAL SUPPORT DESIGNATED ON THE PLAN. EACH SIGNAL FACE SHALL CONSIST OF ONE OR MORE SIGNAL SECTIONS, RIGIDLY AND SECURELY FASTENED TOGETHER, POSITIVELY POSITIONED TO CONTROL THE MOVEMENT OF ONE DIRECTION OF TRAFFIC. EACH SIGNAL SECTION SHALL BE A SELF-CONTAINED ASSEMBLY CONSISTING OF AN OPTICAL UNIT WITH HOUSING, HOUSING DOOR, AND VISOR, TIE RODS SHALL NOT BE USED TO FASTEN SIGNAL SECTIONS TOGETHER TO FORM A SIGNAL FACE. ALL SIGNAL HEADS ON A PROJECT SHALL BE THE PRODUCT OF ONE MANUFACTURER, EXCEPT FOR PROGRAMMED HEADS. TERMINAL BLOCKS OF SUITABLE SIZE SHALL BE PLACED IN THE BOTTOM SECTION OF THE SIGNAL HEAD, EXCEPT IN THE CASE OF MAST ARM SUSPENDED SIGNAL HEADS, WHEREIN THE TERMINAL BLOCK SHALL BE PLACED IN THE TOP SECTION.

2. **HOUSING:** THE HOUSING FOR EACH SIGNAL SECTION SHALL BE MADE OF A DURABLE POLYCARBONATE. IT SHALL BE CLEAN, SMOOTH, AND FREE FROM FLAWS, CRACKS, BLOWHOLES, AND OTHER IMPERFECTIONS. THE HOUSING SHALL BE YELLOW WITH BLACK DOORS. IT SHALL BE DESIGNED AS A SELF-CONTAINED UNIT FOR SEPARATE MOUNTING OR INCLUSION IN A SIGNAL FACE CONTAINING TWO OR MORE SIGNAL SECTIONS RIGIDLY AND SECURELY FASTENED TOGETHER. IT SHALL BE EQUIPPED WITH ROUND OPENINGS IN THE TOP AND BOTTOM AND SHALL HAVE 72 TOOTH SERRATIONS TO ASSURE A POSITIVE LOCK BETWEEN SIGNAL HEADS AND BRACKETS AND ALLOW POSITIONING OF THE TRAFFIC SIGNAL HEADS IN INCREMENTS OF 5 DEGREES. THE DOORS SHALL BE SUITABLY HINGED AND HELD SECURELY TO THE BODY OF THE HOUSING BY SIMPLE STAINLESS STEEL LOCKING DEVICES. ALL OTHER DOOR PARTS SUCH AS HINGE PINS, LENS CLIPS, SCREWS, ETC. SHALL ALSO BE OF STAINLESS STEEL MATERIAL. A NEOPRENE OR SILICON GASKET SHALL BE USED BETWEEN THE LENS AND REFLECTORS TO EXCLUDE DUST AND MOISTURE.

3. **VISORS:** THE VISORS FOR EACH SIGNAL SECTION SHALL BE A DURABLE POLYCARBONATE NOT LESS THAN 0.05 INCH (NO. 18 U.S. GAUGE) IN THICKNESS. IT SHALL BE DESIGNED TO FIT TIGHTLY AGAINST THE DOOR BY MEANS OF FOUR FASTENING SCREWS AND SHALL NOT PERMIT ANY PERCEPTIBLE FILTRATION OF LIGHT BETWEEN IT AND THE HOUSING DOOR. VISORS SHALL BE AT LEAST 9-1/2 INCHES LONG FOR ALL 12 INCH DIAMETER SIGNALS, SHALL ANGLE SLIGHTLY DOWNWARD, AND SHALL BE OF THE TUNNEL TYPE; PEDESTRIAN HEAD VISORS MAY BE OF THE EGGCRATE TYPE WITH A DEPTH OF 1-1/2 INCHES AND A THICKNESS OF 0.03 INCH. THE OPTICAL UNIT AND VISOR SHALL BE DESIGNED AS A WHOLE SO AS TO ELIMINATE OUTSIDE RAYS ENTERING THE UNIT FROM ABOVE THE HORIZONTAL. ALL VISORS SHALL BE BLACK.

4. **LENSES:** LENSES SHALL MEET THE REQUIREMENTS OF THE LATEST EDITION OF THE EQUIPMENT AND MATERIALS STANDARDS OF THE INSTITUTE OF TRANSPORTATION ENGINEERS-VEHICLE TRAFFIC CONTROL SIGNAL HEADS. LENSES SHALL BE GLASS UNLESS OTHERWISE STATED IN THE PLANS. LETTERING SHALL NOT APPEAR ON LENSES. NOMINAL 12 INCH DIAMETER SIGNAL LENSES SHALL BE FURNISHED FOR VEHICLE SIGNALS.

5. **ARROW LENSES:** ARROW LENSES SHALL CONSIST OF AN ARROW INDICATION DESIGNED TO MEET THE LATEST EDITION OF THE INSTITUTE OF TRANSPORTATION ENGINEERS' SPECIFICATION 9.00 "VEHICLE TRAFFIC CONTROL SIGNAL HEADS" FOR A 12 INCH LENS. DULL OR DARK GRAY ENAMEL SHALL BE APPLIED TO THE CONVEX SURFACES OF THE LENS IN SUCH A MANNER THAT WHEN IN USE THE ARROW WILL BE THE ILLUMINATED PORTION OF THE LENS. THE ENAMEL SHALL BE OF A THICKNESS SUFFICIENT TO TOTALLY HIDE THE LIGHT FROM A 150 WATT LAMP PLACED BEHIND IT AND SHALL BE BAKED OR FIRED INTO THE GLASS OR PERMANENTLY BONDED ONTO THE POLYCARBONATE RESIN. THE ENAMEL SHALL BE HARD AND DURABLE AND SHALL NOT PEEL OR FLAKE. AN ARROW SHIELD MAY BE SUBSTITUTED.

6. **PEDESTRIAN LENSES:** PEDESTRIAN SYMBOL LENSES SHALL BE RECTANGULAR WITH A SIDE DIMENSION OF 12 INCHES IF TWO PIECES OR WITH DIMENSIONS OF 18-1/2 INCHES WIDE BY 18-3/4 INCHES HIGH IF ONE PIECE. THEY SHALL BE OF A MOLDED PRISMATIC GLASS OR POLYCARBONATE NOT LESS THAN THE AREA OF THE DON'T WALK OR WALK SYMBOL. THE PEDESTRIAN SYMBOLS SHALL BE 9 INCHES HIGH. THE DON'T WALK SYMBOL SHALL BE IN PORTLAND ORANGE, AND THE WALK SYMBOL IN LUNAR WHITE. THE INDICATIONS SHALL BE FORMED ON THE LENSES IN THE SAME MANNER AS SPECIFIED FOR ARROWS. THE DON'T WALK AND WALK SYMBOLS SHALL BE LEGIBLE TO ANYONE WITH NORMAL VISION AT ALL DISTANCES FROM 10 FEET TO THE FULL WIDTH OF THE AREA TO BE CROSSED.

7. **REFLECTORS:** REFLECTORS SHALL BE MOUNTED IN THE HOUSING. A REFLECTOR MOUNTING IS TO BE PROVIDED ON NONCORROSIVE MATERIAL, SO ARRANGED THAT THE REFLECTOR CAN BE EASILY REMOVED OR SWUNG OUT OF THE HOUSING IN ORDER TO MAINTAIN ANY NECESSARY WIRING. THE METHOD OF MOUNTING AND FASTENING SHALL BE SUFFICIENTLY RIGID TO SECURE PROPER ALIGNMENT BETWEEN THE LENS AND REFLECTOR WHEN THE DOOR IS CLOSED. ALUMINUM REFLECTORS SHALL BE PROVIDED MEETING THE REQUIREMENTS OF THE LATEST EDITION OF THE EQUIPMENT AND MATERIALS STANDARDS OF THE INSTITUTE OF TRANSPORTATION ENGINEERS-VEHICLE TRAFFIC CONTROL SIGNAL HEADS. METALIZED POLYCARBONATE REFLECTORS MAY BE USED AS AN ACCEPTABLE ALTERNATE.

8. **LAMP SOCKET:** THE LAMP SOCKET SHALL BE MADE OF MOLDED PHENOLIC. IT SHALL BE SO MANUFACTURED THAT IT WILL BE IMPOSSIBLE FOR THE LAMP TO LOOSEN DUE TO VIBRATION. THE LAMP SOCKET SHALL BE OF THE FIXED FOCUS TYPE AND IT SHALL BE POSSIBLE TO ROTATE THE LAMP SOCKET ABOUT ITS AXIS IN ORDER TO POSITION THE OPENING OF THE LAMP FILAMENT. IT SHALL BE POSSIBLE TO ROTATE THE LAMP AND SOCKET WITHOUT THE USE OF TOOLS. TWELVE INCH DIAMETER SIGNALS SHALL ACCOMMODATE TRAFFIC SIGNAL LAMPS WITH A 3 INCH FOCAL LENGTH.

9. **WIRING:** WIRING FOR EACH LAMP RECEPTACLE SHALL BE PROVIDED BY COLOR CODED NO. 18 GAUGE LEAD WIRES WITH POLYVINYL CHLORIDE INSULATION AND A NYLON JACKET. WIRES SHALL BE OF SUFFICIENT LENGTH TO EXTEND TO THE TERMINAL BLOCK WITH THE REFLECTOR FULLY OPEN WITHOUT SPLICING.

10. **LAMPS:** ALL TRAFFIC SIGNAL LAMPS SHALL MEET THE REQUIREMENTS OF THE LATEST EDITION OF THE EQUIPMENT AND MATERIALS STANDARDS OF THE INSTITUTE OF TRANSPORTATION ENGINEERS-TRAFFIC SIGNAL LAMPS. A NOMINAL 150 WATT, 120 VOLT, A21 CLEAR TRAFFIC SIGNAL LAMP SHALL BE USED IN ALL 12 INCH VEHICLE TRAFFIC SIGNAL INDICATIONS. A NOMINAL 116 WATT, 120 VOLT, A21 CLEAR TRAFFIC SIGNAL LAMP SHALL BE USED IN ALL 12 INCH PEDESTRIAN SIGNAL INDICATIONS.

C. **FIBER-OPTIC DUAL INDICATION TURN ARROW SIGNAL:** WHEN SPECIFIED IN THE PLANS, THE SIGNAL SHALL DISPLAY ALTERNATE LEGENDS CONSISTING OF A GREEN OR YELLOW DIRECTIONAL ARROW. THE SIGNAL SHALL BE THE APPROPRIATE MODEL FOR THE DIRECTION AND TYPE OF MOUNTING, AS INDICATED IN THE PLANS. THE LEGEND SHALL BE CLEARLY LEGIBLE UNDER ANY LIGHTING CONDITIONS WITHOUT THE USE OF A VISOR AND SHALL BE VISIBLE AT FULL INTENSITY ANYWHERE WITHIN A 20 DEGREE CONE CENTERED ABOUT THE OPTICAL AXIS.

THE SIGNAL SHALL CONSIST OF YELLOW POLYCARBONATE HOUSING AND BLACK POLYCARBONATE DOOR AND VISOR WITH 12 INCH SIGNAL FACE, CONSISTENT WITH THE VEHICULAR SIGNAL HEAD SPECIFICATIONS IN SUBSECTION VIII-B-2. IT SHALL HAVE 19 INDIVIDUAL LENSES OF 5/8 INCH DIAMETER TO FORM THE LEGEND. THE SAME LENSES SHALL BE USED TO DISPLAY EITHER MESSAGE WITH THE FIBER-OPTIC MODULE HAVING INDIVIDUAL OUTPUT LENSES ATTACHED. GREEN AND YELLOW COLOR FILTERS FOR LEGEND COLORS SHALL BE PROVIDED WITH TWO LIGHT SOURCES WITH SEPARATE TRANSFORMERS FOR EACH LAMP. THE TRANSFORMERS SHALL REDUCE THE INCOMING 120 VOLTS AC TO 10.8 VOLTS AC, AND SHALL HAVE CLASS A INSULATION AND BE RATED AT 48.5 VOLT-AMPS. EACH LIGHT SOURCE SHALL BE ONE TYPE EPT 10.5 TO 10.8 VOLT AC LAMP WITH THE AVERAGE LAMP LIFE TO BE A MINIMUM 8,000 HOURS. LAMPS SHALL BE MOUNTED HORIZONTALLY.

PROVISIONS SHALL BE MADE TO HELP BALANCE THE INTENSITY BETWEEN THE COLORS BY SUPPLYING APPROXIMATELY 50% MORE LIGHT TO THE LENSES WHEN THE GREEN ARROW IS BEING DISPLAYED THAN TO THE YELLOW ARROW DISPLAY.

ALL PARTS OF THE FIBER-OPTIC UNIT SHALL BE MOUNTED ON A 12 INCH DIAMETER ALUMINUM FRONT PANEL TO REPLACE THE LENS IN THE CASE AND SHALL BE MOUNTED ON THE DOOR OF THE SIGNAL HEAD.

FIBER-OPTICS SHALL BE GLASS FIBER BUNDLES ASSEMBLED ON A FLAT BLACK MATRIX PANEL AND THEIR ENDS SHALL BE OPTICALLY POLISHED. INDIVIDUAL FIBER-OPTIC BUNDLES SHALL NOT BE JACKETED OR ENCASED. THE MATRIX PANEL SHALL HAVE A FLAT BLACK NONREFLECTIVE FINISH. FIBER-OPTICS SHALL HAVE SUITABLE PROTECTION PROVIDED SO AS TO ELIMINATE THE POSSIBILITY OF DAMAGE DURING RELAMPING.

ELECTRICAL CONNECTIONS SHALL BE MADE BY A BARRIER TYPE TERMINAL STRIP. ALL COMPONENTS SHALL BE READILY ACCESSIBLE WHEN THE DOOR IS OPEN. ALL SCREWS, WASHERS, NUTS AND BOLTS SHALL BE CORROSION RESISTANT.

D. **RED L.E.D. SIGNAL HEADS:** WHEN SPECIFIED IN THE PLANS, THE RED LENS IN EACH SIGNAL HEAD SHALL BE A SELF-CONTAINED, SEALED UNIT DESIGNED TO FIT A REGULAR 12-INCH TRAFFIC SIGNAL HOUSING. IT SHALL INCORPORATE A MINIMUM OF 186 HIGH RELIABILITY, HIGH INTENSITY LED INDICATORS. THE LENS SHALL PROVIDE A LIGHT BEAM SPREAD OF 30 DEGREES ON ALL SIDES OF ITS CENTER AXIS WHICH SHALL BE DESIGNED TO PROVIDE A 5 TO 7 DEGREE DOWNWARD ANGLE.

THE LENS SHALL BE MADE OF UV STABILIZED PLASTIC. THE REAR COVER SHALL BE OF NON FLAMMABLE MATERIAL AND THE ENTIRE UNIT SHALL BE TOTALLY SEALED TO PRECLUDE THE ENTRANCE OF WATER, DUST OR OTHER CONTAMINANTS.

THE SELF-CONTAINED, REGULATED POWER SUPPLY SHALL ALLOW THE UNIT TO OPERATE OVER AN INPUT VOLTAGE RANGE BETWEEN 89 AND 135 VOLTS AC AND SHALL BE CONFIGURED IN AT LEAST 3 PARALLEL CIRCUITS FOR RELIABILITY. LIGHT OUTPUT SHALL BE COMPARABLE TO THAT PROVIDED BY A STANDARD, 12 INCH TRAFFIC SIGNAL LENS ILLUMINATED BY A 150 WATT INCANDESCENT LAMP. THE RED WAVE LENGTH SHALL BE 630 TO 660 NM.

THE MANUFACTURER SHALL WARRANT THE UNIT AGAINST DEFECTS IN WORKMANSHIP AND MATERIALS FOR A PERIOD OF AT LEAST FIVE YEARS AFTER DATE OF SHIPMENT. THIS WARRANTY SHALL BE ASSIGNED TO THE MAINTAINING AGENCY.

E. PROGRAMMED VISIBILITY TRAFFIC SIGNAL HEADS

1. **GENERAL:** PROGRAMMED VISIBILITY TRAFFIC SIGNAL HEADS AND THE INSTALLATION THEREOF SHALL CONFORM TO THE PROVISIONS ABOVE, EXCEPT THE PROVISIONS ON OPTICAL UNITS AND VISORS SHALL NOT APPLY. THE PROGRAMMED VISIBILITY TRAFFIC SIGNAL HEADS SHALL BE CONSTRUCTED OF DIE CAST ALUMINUM.

2. **VISIBILITY:** THE VISIBILITY OF THE SIGNAL INDICATION SHALL BE ADJUSTABLE WITHIN THE SIGNAL HEAD TO FIT THE LANE OR LANES IN WHICH TRAFFIC IS TO BE CONTROLLED. DURING DAYLIGHT, THE SIGNAL INDICATIONS SHALL BE VISIBLE ONLY IN THOSE AREAS OR LANES DESIGNATED. DURING DUSK OR DARKNESS, A FAINT GLOW VISIBLE TO THE SIDE WILL BE PERMISSIBLE. EXTERNAL ILLUMINATION SHALL NOT CAUSE A SIGNAL INDICATION, NOR SHALL A SIGNAL INDICATION IN ONE SIGNAL SECTION CAUSE A SIGNAL INDICATION IN ANOTHER SIGNAL SECTION. EACH SECTION OF A SIGNAL FACE SHALL PROVIDE A NOMINAL 12 INCH DIAMETER ROUND INDICATION OR ARROW INDICATION MEETING THE INSTITUTE OF TRANSPORTATION ENGINEERS' DIMENSIONS AS REQUIRED.

3. **VISOR:** EACH SECTION SHALL BE PROVIDED WITH A SHEET ALUMINUM SUN VISOR.

4. **PROGRAMMING:** THE INDICATION OF EACH SIGNAL HEAD, WHEN NOT PROGRAMMED, SHALL BE VISIBLE FROM ANYWHERE WITHIN 15 DEGREES OF THE OPTICAL AXIS. THE SIGNAL HEAD SHALL BE ABLE TO BE PRESET AT ANGLES BETWEEN 10 DEGREES ABOVE AND 10 DEGREES BELOW THE HORIZONTAL, AND SHALL BE PRESET AT 4 DEGREES (POST TOP) OR 8 DEGREES (OVERHEAD) BELOW THE HORIZONTAL.

5. **COLOR SCHEME:** PROGRAMMED SIGNAL HEADS SHALL HAVE THE STATED COLOR SCHEME.

6. **CANDLEPOWER:** THE SIGNAL SECTION WITH THE YELLOW INDICATION, PRIOR TO PROGRAMMING, WHEN DIRECTED DOWNWARD 5 DEGREES FROM THE HORIZONTAL, SHALL PROVIDE A MINIMUM CANDLEPOWER OF 2500 CANDELAS IN THE DIRECTION OF THE AXIS AND A MAXIMUM CANDLEPOWER OF 100 CANDELAS AT 15 DEGREES HORIZONTALLY IN EACH DIRECTION FROM THE AXIS. SAID SIGNAL HEAD WITH YELLOW INDICATION SHALL BE PROGRAMMED SO THAT A MINIMUM CANDLEPOWER OF 2500 CANDELAS CAN BE DIRECTED ALONG THE OPTICAL AXIS AND A CANDLEPOWER OF LESS THAN 100 CANDELAS DIRECTED AT 1/2 DEGREE HORIZONTAL FROM THE AXIS AND NO MEASURABLE LIGHT IS DIRECTED FROM 1 TO 15 DEGREES HORIZONTAL FROM THE AXIS. UNDER THE SAME CONDITIONS, THE CANDLEPOWER OF THE RED INDICATION SHALL BE AT LEAST 19 PERCENT OF THE YELLOW INDICATION, AND THE CANDLEPOWER OF THE GREEN INDICATION SHALL BE AT LEAST 38 PERCENT OF THE YELLOW INDICATION.

7. **LAMPS:** ALL TRAFFIC SIGNAL LAMPS SHALL MEET THE REQUIREMENTS OF THE LATEST EDITION OF THE EQUIPMENT AND MATERIALS STANDARDS OF THE INSTITUTE OF TRANSPORTATION ENGINEERS-TRAFFIC SIGNAL LAMPS. A NOMINAL 150 WATT, 120 VOLT, A21 CLEAR TRAFFIC SIGNAL LAMP SHALL BE USED IN ALL 12 INCH VEHICLE TRAFFIC SIGNAL INDICATIONS.

8. **DIMMING DEVICES:** DIMMING DEVICES SHALL BE PROVIDED TO GRADUALLY REDUCE THE CANDLEPOWER AS A FUNCTION OF THE INDIVIDUAL BACKGROUND ILLUMINATION OF EACH SIGNAL HEAD FOR NIGHTTIME OPERATION TO APPROXIMATELY 15 PERCENT OF THAT FOR DAYTIME OPERATION.

VIII. TRAFFIC SIGNAL POLES AND PEDESTALS

A. GENERAL

1. **LOAD:** ALL TRAFFIC SIGNAL POLES SHALL CONFORM TO THE LATEST EDITION OF THE AMERICAN ASSOCIATION FOR STATE HIGHWAY AND TRANSPORTATION OFFICIALS' "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS" HANDBOOK WITH A WIND LOAD OF 80 MILES PER HOUR AND A 30 PERCENT GUST FACTOR. THE POLES SHALL ALSO ACCOMMODATE WIND LOADINGS WHICH MAY CAUSE DEFLECTIONS OF THE MAST ARM IN THE VERTICAL PLANE. THESE DEFLECTIONS SHALL NOT BE SUCH THAT THERE IS LESS THAN A 15 FOOT CLEARANCE BETWEEN THE ROADWAY AND THE LOWEST POINT OF THE SIGNAL ASSEMBLY.

2. **SHOP DRAWINGS:** ALL TRAFFIC SIGNAL POLES SHALL BE DETAILED ON SHOP DRAWINGS BY THE MANUFACTURER INDICATING POLE AND ARM DIMENSIONS AND ATTACHMENT METHOD ALONG WITH SIGNAL WEIGHT, PROJECTED AREAS, AND TYPE OF MOUNTING THAT IT IS DESIGNED TO ACCOMMODATE. ALL NEW TRAFFIC SIGNAL POLES OR POLES NOT PREVIOUSLY APPROVED WILL REQUIRE SUBMISSION OF DESIGN CALCULATIONS ALONG WITH THE SHOP DRAWINGS.

3. **SHAFT:** THE SHAFT SHALL INCLUDE HIGH STRENGTH ANCHOR BOLTS, WASHERS, AND NUTS, CONFORMING TO SECTION 1613, TYPE II OF THE LATEST EDITION OF THE STANDARD SPECIFICATIONS. ANCHOR BOLT WASHERS CONFORMING TO THE REQUIREMENTS OF THE LATEST EDITION OF THE AMERICAN SOCIETY FOR TESTING AND MATERIALS, SPECIFICATION F436 WILL ALSO BE ACCEPTABLE. IT ALSO SHALL INCLUDE COVER LEAVES, A HANDHOLE AND COVER, CAST POLE TOP, A J-HOOK WIRE SUPPORT, AND A SUITABLE DEVICE FOR ATTACHING THE MAST ARM TO THE SHAFT. THE SHAFT SHALL INCLUDE 1 INCH RUBBER GROMMETS AT ALL OUTLETS FOR SIGNAL WIRING.

4. **COMBINATION POLES:** WHERE A COMBINATION LIGHTING/SIGNAL POLE IS SPECIFIED ON THE PLAN, THE ABOVE APPLIES WITH THE LUMINAIRE ARM TO BE MOUNTED IN THE SAME VERTICAL PLANE AS THE SIGNAL ARM.

5. **ARMS:** ALL SIGNAL POLE ARMS SHALL INCLUDE 1 INCH RUBBER GROMMETS AT OUTLETS FOR SIGNAL WIRING AND REMOVABLE END CAPS.

6. **FOUNDATIONS:** THE TOP 6 INCHES OF POLE AND PEDESTAL BASES SHALL BE FORMED INTO A SQUARE AND SHALL BE LEVEL WITH THE TOP OF ADJACENT SIDEWALK OR APPROXIMATELY 2 INCHES ABOVE FINISHED GROUND LINE.

BUREAU OF TRAFFIC ENGINEERING
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KANSAS DEPARTMENT OF TRANSPORTATION
BUREAU OF TRAFFIC ENGINEERING

TRAFFIC SIGNAL SPECIFICATIONS

TE120D 03/17/95

FHWA APPROVAL			04/06/95	APP'D			
DESIGNED	G.J.M.	DETAILED	G.J.M.	QUANTITIES			
DESIGN CK.	L.G.V.	DETAIL CK.	L.G.V.	QUAN. CK.		DATE	