1.2 ANODE SYSTEM

THE ANODE SYSTEM SHALL CONSIST OF ELGARD 210 FOR BRIDGE NUMBER LAK-20-1434, CURRENT DISTRIBUTORS AND PLASTIC FASTENERS.

THE SPECIFICATIONS FOR EACH OF THESE COMPONENTS IS GIVEN BELOW:

ELGARD 210 ANODE MESH. THIS ANODE SHALL CONSIST OF A PROPRIETARY PRECIOUS METAL OXIDE CATALYST SINTERED TO A GRADE 1 TITANIUM SUBSTRATE. THE SUBSTRATE SHALL BE EXPANDED TITANIUM MESH. THE DIAMOND PATTERN OF THE MESH SHALL BE A NOMINAL 1.3" X 3" AND SHALL BE IN ROLLS OF 48" WIDE X 250' LONG.

CURRENT DISTRIBUTOR. THE CURRENT DISTRIBUTOR SHALL BE A SOLID GRADE 1 TITANIUM BAR, ½" WIDE BY .035" THICK.

PLASTIC FASTENERS. THE PLASTIC FASTENER SHALL BE ¼" DIAMETER x 1-⅛" LONG WITH A ¾" SQUARE HEAD.

1.3 REFERENCE CELLS

SILVER/SILVER CHLORIDE REFERENCE CELLS SHALL BE USED. THE INSTRUMENT WIRE TO REFERENCE CELL CONNECTIONS SHALL BE FABRICATED AND SEALED IN THE FACTORY. THE REFERENCE CELL LEAD WIRES IN THE DECK SHALL BE NO. 10 AWG STRANDED COPPER CONDUCTORS WITH RHH/RHW/USE OR HMWPE INSULATION, AND BE OF SUFFICIENT LENGTH TO REACH THE JUNCTION BOX WITHOUT SPLICING IN THE DECK.

1.4 ELECTRICAL

1.4.1 CONDUIT AND JUNCTION BOXES

A. CONDUIT SHALL MEET ALL APPLICABLE FEDERAL, STATE AND LOCAL CODES.

B. EXPOSED CONDUIT SHALL BE PVC AND SHALL BE SECURELY MOUNTED TO THE BRIDGE. ATTACHMENT HARDWARE SHALL BE FASTENED TO THE BRIDGE BY RAM SET PINS OR APPROVED EQUAL. THE MAXIMUM SPACING OF SUPPORTS SHALL NOT BE GREATER THAN THAT INDICATED BY ARTICLE 347(B) OF NEC.

C. EXPANSION COUPLINGS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR A TEMPERATURE CHANGE OF 100° F. LENGTHS OF FLEXIBLE CONDUIT MAY BE USED TO ALLOW FOR BRIDGEMOVEMENT.

D. WEEP HOLES SHALL BE PROVIDED AT ALL LOW POINTS IN THE CONDUIT RUN.

E. JUNCTION BOXES SHALL BE PVC OF SUFFICIENT SIZE TO ACCOMMODATE THE WIRING AND SPLICES.

1.4.2 WIRING

A. ANODE LEAD WIRE AND ANODE HEADER WIRES

ALL ANODE LEAD WIRES AND ANODE HEADER WIRES IN THE CONDUIT RUN SHALL BE NO. 10 AWG STRANDED COPPER WITH THHN INSULATION.

B. SYSTEM NEGATIVE WIRES.

ALL SYSTEM NEGATIVE HEADER WIRES IN THE CONDUIT RUN SHALL BE NO. 10 AWG STRANDED COPPER WITH THHN INSULATION. ALL SYSTEM NEGATIVE LEAD WIRES THAT WILL BE ENCASED IN THE CEMENTITIOUS OVERLAY SHALL BE NO. 10 AWG STRANDED COPPER CONDUCTORS WITH HMWPE INSULATION. THE WIRES SHALL BE OF SUFFICIENT LENGTH TO SPAN THE DISTANCE IN WHICH THEY ARE EMBEDDED IN THE CONCRETE WITHOUT SPLICING.

C. REFERENCE CELL LEAD AND GROUND WIRES

REFERENCE CELL LEAD AND GROUND WIRES THAT WILL BE ENCASED IN THE CEMENTITIOUS OVERLAY SHALL BE NO. 10 AWG STRANDED COPPER CONDUCTOR WITH HMWPE INSULATION. THE WIRES SHALL BE OF SUFFICIENT LENGTH TO SPAN THE DISTANCE IN WHICH THEY ARE EMBEDDED IN THE CONCRETE WITHOUT SPLICING.

REFERENCE CELL LEAD WIRES AND GROUND WIRES FROM THE CONCRETE SURFACE SHALL BE SPLICED TO NO. 18 AWG TWISTED PAIR SHIELDED CABLE IN THE JUNCTION BOX AS SHOWN ON THE PLANS. THE LENGTH OF THE CABLE SHALL BE SUFFICIENT TO SPAN THE DISTANCE FROM THE JUNCTION BOX TO THE RECTIFIER WITHOUT SPLICING.

1.4.5 CONNECTIONS

A. GENERAL

NO COPPER TO COPPER SPLICES WILL BE PERMITTED IN THE CONCRETE OVERLAY UNLESS A REDUNDANT SPLICE IS MADE. WIRING MAY BE SPLICED IN A JUNCTION BOX OUTSIDE OF THE CONCRETE OVERLAY. THIS RESTRICTION IS INTENDED TO PROVIDE EASY ACCESS TO THESE CONNECTIONS SHOULD MAINTENANCE BE REQUIRED IN THE FUTURE.

B. REBAR

THE SYSTEM NEGATIVE AND REFERENCE CELL GROUND CONNECTIONS TO THE STEEL REBAR SHALL BE MADE BY THE THERMITE WELD METHOD. AFTER A THERMITE WELL CONNECTION IS MADE, REMOVE SLAG FROM THE WELD AND IMPACT TEST. ALL CONNECTIONS TO REBAR SHALL BE COATED WITH A NON-CONDUCTIVE, NON-SHRINKING EPOXY MORTAR WHICH MEETS ODOT CMS 705.20. NO MECHANICAL CONNECTIONS WILL BE ACCEPTED.

C. WIRE-TO-WIRE

EACH SYSTEM NEGATIVE CONNECTION (LEAD WIRE FROM THE REBAR CONNECTED TO A COMMON HEADER CABLE), AND REFERENCE CELL LEAD AND GROUND CONNECTION MADE IN THE JUNCTION BOX WILL REQUIRE THE USE OF A MECHANICAL CRIMP CONNECTION WITH A SUITABLE INSULATING MATERIAL. THE MECHANICAL CONNECTION SHALL BE AN LLSCO PART NO. CT-8 OR EQUIVALENT. THE INSULATING MATERIAL SHALL BE 3M SCOTCH EZ SEAL 2200, RAYCHEM WCSM HEAT SHRINK, ITCSN CABLE SLEEVES, OR APPROVED EQUAL.

D. WIRE-TO-ANODE

THE SYSTEM POSITIVE CONNECTION, I.E., CURRENT DISTRIBUTOR CONNECTED TO THE ANODE HEADER WIRE, WILL REQUIRE THE USE OF AN INSULATED TITANIUM CONNECTOR AS SHOWN IN THE PLANS. THIS CONNECTION SHALL BE MADE IN THE JUNCTION BOX AND SEALED FROM THE ENVIRONMENT BY A SUITABLE INSULATING MATERIAL. THE INSULATING MATERIAL SHAL BE 3M SCOTCH EZ SEAL 2200, RAYCHEM WCSM HEAT SHRINK, ITCSN CABLE SLEEVES, OR APPROVED EQUAL.

2.0 INSTALLATION REQUIREMENTS

2.1 DECK PREPARATION

2.1.1 REMOVAL OF UNSOUND CONCRETE

THE CATHODIC PROTECTION SYSTEM MUST BE INSTALLED WITHIN A SOUND CONCRETE SURFACE, I.E., ALL DELAMINATIONS MUST BE REPAIRED.

2.1.2 MINIMUM SPACING BETWEEN ANODE AND STEEL

THE CONCRETE COVER BETWEEN THE ANODE AND ANY STEEL BENEATH OR ABOVE THE ANODE SHALL BE A MINIMUM OF 1½". IF AFTER REMOVING THE DETERIORATED AND CONTAMINATED CONCRETE, THE CONCRETE COVER IS FOUND TO BE INSUFFICIENT, THEN ONE OF THE PROCEDURES IN SECTION 3.4 SHALL BE FOLLOWED.

2.1.3 PATCHING

ALL OF THE STEEL REINFORCING SHALL BE PATCHED WITH A SUITABLE CONCRETE MATERIAL PRIOR TO INSTALLATION OF THE ANODE SYSTEM. THE CONCRETE USED FOR THE PATCH AREA SHALL NOT HAVE AN ELECTRICAL RESISTIVITY GREATER THAN 50,000 OHM-CM.

2.2 ANODE SYSTEM

2.2.1 ANODE PLACEMENT, GENERAL

THE REQUIREMENTS OF THIS SECTION SHALL APPLY TO PLACEMENT OF THE ELGARD 210 ANODE SYSTEM.

DUST FROM HOLE DRILLING SHALL BE REMOVED BEFORE OVERLAYING. THE ANODE SHALL BE PLACED AS THE LAST ITEM OF WORK PRIOR TO OVERLAY WORK. CONTACT BETWEEN THE ANODE AND REINFORCING STEEL AND OTHER BRIDGE STEEL SHALL BE PREVENTED. THE CONTRACTOR SHALL DEMONSTRATE TO THE ENGINEER THAT SUCH CONTACT DOES NOT EXIST BEFORE OVERLAY WORK. THE DEMONSTRATION SHALL CONSIST OF SHOWING THAT THERE IS A HIGH RESISTANCE BETWEEN ALL PORTIONS OF THE ANODE AND THE REINFORCING STEEL, GUTTERS AND EXPANSION PLATES. ANY SUCH CONTACT FOUND BEFORE OR AFTER THE OVERLAY WORK SHALL BE LOCATED AND CORRECTED AT THE CONTRACTOR'S EXPENSE. ALL CONDUIT, GUTTERS, EXPANSION PLATES, AND ALL OTHER EMBEDDED OR EXPOSED METAL SHALL BE ELECTRICALLY CONTINUOUS WITH THE REINFORCING STEEL. THIS CONTINUITY SHALL BE DEMONSTRATED BY THE CONTRACTOR AND ALL DISCONTINUITIES SHALL BE ELIMINATED BY THE CONTRACTOR BEFORE PLACEMENT.

2.2.2 ACCESS HOLES

ACCESS HOLES MUST BE LOCATED AS SHOWN ON THE PLANS. THESE HOLES ARE THE THICKNESS OF THE DECK. ALL OF THE CATHODIC PROTECTION SYSTEM ON-DECK WIRING SHALL RUN THROUGH THESE HOLES TO THE JUNCTION BOX. AFTER THE WIRES HAVE BEEN RUN, ALL ACCESS HOLES SHALL BE FILLED AND SEALED WITH SYMONS RESCON 306 HM-HY EPOXY RESIN.

2.2.3 INSTALLING REFERENCE CELLS

THE CONTRACTOR SHALL FURNISH AND INSTALL 2 REFERENCE CELLS IN EACH ZONE. ONE CELL SHALL BE LOCATED IN THE TOP MAT OF REINFORCING STEEL, THE SECOND AT THE LEVEL OF THE BOTTOM LAYER OF REINFORCING STEEL. THE CELL SHALL BE INSTALLED IN AN AREA OF SOUND CONCRETE WHICH HAS HALF CELL READINGS IN THE HIGHEST 10% OF MOST ANODIC READINGS OF ALL THE SOUND CONCRETE AREAS. THE CONTRACTOR SHALL PERFORM THE HALF CELL SURVEY ON A TEN-FOOT GRID IN ACCORDANCE WITH ASTM C876 PRIOR TO LOCATING THE REFERENCE CELL SITE.

THE CONTRACTOR SHALL EXCAVATE A 3 INCH WIDE, 8 INCH LONG AND 2 INCH DEEP SITE AT THE SELECTED CELL LOCATION. THE EXCAVATION SHALL BE FREE OF EXPOSED REINFORCING STEEL.

REFERENCE CELLS SHALL BE PLACED IN THE BOTTOM OF THE EXCAVATION. THE CONTRACTOR SHALL DRILL AN ACCESS HOLE IN OR NEAR THE EXCAVATION THROUGH THE DECK AND INTO A JUNCTION BOX CONDUIT SYSTEM ATTACHED TO THE BOTTOM OF THE DECK. THE REFERENCE CELL LEAD WIRE SHALL BE ROUTED THROUGH THE ACCESS HOLE AND CONDUIT SYSTEM TO THE RECTIFIER. THE CONTRACTOR SHALL ATTACH THE GROUND WIRE SUPPLIED WITH THE REFERENCE CELL TO THE REINFORCING STEEL. THE GROUND WIRE SHALL BE ATTACHED BY AN EXOTHERMIC WELD. THE GROUND WIRE SHALL BE ATTACHED APPROXIMATELY 1 TO 2 FEET FROM THE REFERENCE CELL. THE CONTRACTOR SHALL PERFORM ALL NECESSARY EXCAVATION FOR THE GROUND CONNECTION AND PROVIDE AN ACCESS HOLE TO A JUNCTION BOX AND CONDUIT SYSTEM ATTACHED TO THE BOTTOM OF THE DECK. THE CONTRACTOR SHALL ROUTE THE GROUND WIRE THROUGH THE JUNCTION BOX CONDUIT SYSTEM TO THE RECTIFIER.

THE CONTRACTOR SHALL BACKFILL THE REFERENCE CELL WITH SALT LADEN CONCRETE (15 LB./CU.YD.), AND GROUND WIRE SITES WITH SALT-FREE PATCHING CONCRETE TO THE LEVEL OF THE SURROUNDING ORIGINAL CONCRETE. AFTER THE BACKFILL CONCRETE IS CURED, THE CONTRACTOR SHALL MEASURE THE AC RESISTANCE AND HALF CELL POTENTIAL OF THE CELL AND GROUND WIRE CIRCUIT. RESISTANCE READINGS SHALL NOT BE MORE THAN 10,000 OHMS AND POTENTIAL READINGS SHALL NOT BE ERRATIC. IF UNACCEPTABLE READINGS ARE OBTAINED, THE CONTRACTOR SHALL REPLACE THE REFERENCE CELL WITH A NEW CELL.

THE BOTTOM REFERENCE CELLS SHALL BE INSTALLED PRIOR TO THE VARIABLE DEPTH CONCRETE PATCHING, AND THE TOP REFERENCE CELLS SHALL BE INSTALLED AFTER THE VARIABLE DEPTH CONCRETE PATCHING.

2.2.4 INSTALLING SYSTEM NEGATIVE

EACH SYSTEM NEGATIVE SHALL BE ATTACHED TO THE REINFORCING STEEL BY AN EXOTHERMIC WELD. SYSTEM NEGATIVE WIRE SHALL BE #10 AWG COPPER CONDUCTOR WITH HWMPE INSULATION. ALL CONNECTIONS TO REBAR SHALL BE COATED WITH A NON-CONDUCTIVE, NON-SHRINKING EPOXY, WHICH MEETS ODOT CMS 705.20. THE SYSTEM NEGATIVE WIRES SHALL BE ROUTED FROM THEIR POINT OF CONNECTION ON THE DECK TO THE JUNCTION BOX WITHOUT SPLICES. THERE SHALL BE NO CONTACT BETWEEN SYSTEM NEGATIVE WIRES AND THE ANODE. ANODE AND NEGATIVE WIRES SHALL BE TAGGED USING PERMANENT WIRE MARKERS.

2.2.5 ISOLATING EXPOSED STEEL

THE ANODE SHALL BE PREVENTED FROM CONTACTING ANY EXPOSED STEEL, E.G., SCUPPERS, EXPANSION JOINTS. THE ELGARD ANODE MESH SHALL BE CUT OUT AND FASTENED TO THE DECK AROUND THE "EXPOSED STEEL" AREA WITH ELGARD PLASTIC FASTENERS. THE GAP BETWEEN THE ANODE AND THE EXPOSED STEEL SHALL BE A MINIMUM OF 1-½ INCHES. THE ANODE SHALL BE SECURELY FASTENED SO THAT THE CONSTRUCTION ACTIVITY ASSOCIATED WITH PLACING THE OVERLAY DOES NOT CAUSE THE MESH TO MOVE AND CONTACT THE STEEL. THE EXPOSED STEEL SHALL BE COATED WITH NON-CONDUCTIVE EPOXY.

2.2.6 INSTALLING CURRENT DISTRIBUTOR BARS

THE CURRENT DISTRIBUTOR BARS SHALL BE INSTALLED AS SHOWN ON THE PLANS. THE CURRENT DISTRIBUTORS SHALL BE SUPPLIED BY THE ANODE MESH MANUFACTURER AS SOLID TITANIUM STRIPS HAVING THE FOLLOWING DIMENSIONS: ½" WIDE BY 0.035" THICK. TO OBTAIN THE DESIRED LENGTH, SEVERAL OF THE TITANIUM STRIPS MAY BE WELDED TOGETHER. THIS WELD SHALL BE MADE BY OVERLAPPING THE ENDS APPROXIMATELY THREE INCHES AND MAKING SPOT WELDS EVERY ½ INCH. IF THE RESULTING LENGTH IS LONGER THAN REQUIRED, THE CURRENT DISTRIBUTOR BAR SHALL BE CUT USING TIN SNIPS.

2.2.7 INSTALLING ELGARD ANODE MESH

THE ELGARD ANODE MESH SHALL BE UNROLLED, FASTENED TO THE DECK, AND WELDED TO THE CURRENT DISTRIBUTOR BARS USING THE FOLLOWING PROCEDURE. THE FIRST WIDTH OF MESH SHALL BE INSTALLED AT THE LIMIT OF THE DESIGNATED AREA. ONE END OF THE REEL OF ELGARD ANODE MESH SHALL BE SECURELY FASTENED USING PLASTIC FASTENERS. (THE FASTENERS SHALL BE INSERTED INTO ¼" DIAMETER x 1-½" DEEP HOLES DRILLED IN THE DECK, AS SHOWN ON THE PLANS.) THE MESH SHALL THEN BE UNROLLED, TENSIONED SLIGHTLY AND FASTENED APPROXIMATELY EVERY TEN FEET TO HOLD THE MESH IN PLACE.

EACH SUCCESSIVE WIDTH OF MESH SHALL BE SPACED ACCORDING TO THE PLANS UNTIL THE ENTIRE AREA IS COVERED. AFTER ALL OF THE MESH HAS BEEN INSTALLED, ADDITIONAL FASTENERS SHALL BE INSTALLED SO THAT THE FASTENING PATTERN IS AS SHOWN ON THE PLANS. THE MESH SHALL BE FIELD WELDED TO THE CURRENT DISTRIBUTOR BARS AT EACH POINT OF CONTACT BETWEEN STRAND JUNCTIONS OF THE MESH AND THE DISTRIBUTOR BAR. THE WELDING OF THE MESH TO THE CURRENT DISTRIBUTOR BARS SHALL BE BY AN ELECTRIC WELDING MACHINE, AVAILABLE FROM THE ANODE MESH MANUFACTURER.

2.2.8 CONCRETE OVERLAY

REVIEWED: DWL 3-10-00

| No. | DATE | BY | REVISION |
|---|---|---|---|
| 1 | 3-8-00 | DCF | CONVERT TO DGN. CHANGED LINE WT. ADDED BRIDGE NO CORRECTED FONT FRACTIONS, DEL PART PURPOSE NOTE |
| 2 | 3-10-00 | DCF | DELETED "DELAMINATION TESTING" NOTE |
| 3 | 3-27-00 | DCF | DELETED PORTIONS OF NOTE 2.1J RELATING TO OUTLINING DELAMINATIONS, REMOVED ODOT APPROVALS FROM NOTES |
| 4 | 3-28-00 | DCF | RESIZED TEXT AND SHIFTED NOTES TO ACCOMODATE TEXT SIZE |
| 5 | 3-30-00 | DCF | REVISED NOTE 2.2.3 INSTALLING REFERENCE CELLS |

REFERENCE DRAWINGS

BURGESS & NIPLE, LIMITED
100 WEST ERIE STREET
PAINESVILLE, OHIO 44077

CATHODIC PROTECTION SYSTEM SPECIFICATIONS
FOR
BRIDGE NO. LAK-20-1434
US ROUTE 20 OVER STATE ROUTE 44

| | |
|---|---|
| DESIGNED BY | JAS |
| CHECKED BY | JAS |
| DRAWN BY | LJH |
| DATE | 02-25-00 |
| SCALE | NONE |
| SHEET | 11 OF 12 |
| DWG. NO. | MEDINA-5 |

CLEVELAND • ATLANTA • CHICAGO
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20/25

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