

2.2.9 INSTALLING RECTIFIER UNIT

A. MOUNTING

THE RECTIFIER UNIT HOUSING SHALL BE MOUNTED AT EYE LEVEL HEIGHT AT THE LOCATION SHOWN ON THE PLANS. THE HOUSING DOOR SHALL BE LOCKABLE AND SHALL HAVE A PADLOCK WITH A BRONZE OR BRASS LOCK BODY AND A CORROSION-PROTECTED STEEL SHACKLE.

B. GROUND ROD

THE RECTIFIER UNIT SHALL BE FURNISHED WITH A 3/8" COPPER CLAD, 8 FOOT LONG GROUND ROD AND GROUNDING CONNECTIONS. GROUND WIRE SHALL BE NO. 6 AWG.

C. SCHEMATIC AND WIRING DIAGRAMS

SCHEMATIC AND WIRING DIAGRAMS OF THE RECTIFIER UNIT SHALL BE FURNISHED AND APPROVED BEFORE INSTALLATION.

D. CONTRACTOR REQUIREMENTS

THE CONTRACTOR SHALL INSTALL THE RECTIFIER UNIT, DISCONNECT SWITCH, AND GROUND ROD. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL NECESSARY HARDWARE TO MAKE THE CONDUIT AND WIRING CONNECTIONS WITH THE BRIDGE, DISCONNECT SWITCH, AND GROUND ROD FROM THE RECTIFIER UNIT.

2.3 POWER SERVICE FOR CATHODIC PROTECTION

ALL CONNECTIONS TO AND MODIFICATIONS OF EXISTING AC POWER LINES OR EQUIPMENT SHALL BE AS APPROVED BY PROPER CITY AUTHORITY IN ACCORDANCE WITH THEIR REQUIREMENTS. THE CONTRACTOR SHALL RECEIVE ALL WRITTEN APPROVALS FROM THE CITY BEFORE ANY WORK IS PERFORMED.

3.0 TESTING REQUIREMENTS

3.1 GENERAL

THE INSTALLATION OF A CATHODIC PROTECTION SYSTEM REQUIRES THAT SOME SPECIALIZED TESTS BE PERFORMED. THE ACTIVITY CHART BELOW OUTLINES THE TESTS REQUIRED, THE PHASE OF CONSTRUCTION DURING WHICH THE TESTING NORMALLY TAKES PLACE, THE RESPONSIBILITY FOR THE TEST AND THE APPROVAL REQUIRED BEFORE FURTHER ACTIVITY CAN OCCUR.

A CORRPRO COMPANY CORROSION ENGINEER SHALL BE EMPLOYED BY THE CONTRACTOR TO PERFORM THE STEEL CONTINUITY TEST, DEPTH OF CONCRETE COVER, ANODE STEEL CONTINUITY AND ENERGIZATION TEST AND TO SUBMIT THE SPECIFIED WRITTEN REPORTS AND DOCUMENTATION TO THE ENGINEER FOR APPROVAL. THE CORROSION ENGINEER SHALL BE A PROFESSIONAL ENGINEER REGISTERED IN OHIO BY THE STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS AND SURVEYORS, EXPERIENCED IN INSTALLATION AND TESTING OF CATHODIC PROTECTION SYSTEMS ON HIGHWAY CONCRETE REINFORCED BRIDGE DECKS, AND APPROVED BY THE ENGINEER.

REQUIRED TEST	PHASE	RESPONSIBILITY	APPROVAL
DELAMINATION TEST	(1)	A	D
STEEL CONTINUITY	(2)	B	C AND D
DEPTH OF CONCRETE COVER	(3)	B	C AND D
ANODE/STEEL CONTINUITY	(4)	B	C AND D
INITIAL ENERGIZATION	(5)	B	C AND D

- (1) AFTER SCARIFICATION OF CONCRETE SURFACE
- (2) AFTER DELAMINATED CONCRETE HAS BEEN REMOVED
- (3) AFTER CONCRETE PATCHING AND BEFORE ANODE INSTALLATION
- (4) AFTER ANODE INSTALLATION AND PRIOR TO AND DURING THE OVERLAY POUR
- (5) AFTER CONCRETE OVERLAY HAS CURED

- (A) GENERAL CONTRACTOR
- (B) CATHODIC PROTECTION INSTALLATION SUBCONTRACTOR
- (C) CATHODIC PROTECTION SYSTEM SUPPLIER (PROVIDED BY CONTRACTOR, APPROVED BY ENGINEER)
- (D) ENGINEER

3.3 STEEL CONTINUITY

3.3.1 PURPOSE

THE PURPOSE OF THE STEEL CONTINUITY TEST IS TO ENSURE THAT ALL OF THE EMBEDDED STEEL IS CONTINUOUS. TO BE CATHODICALLY PROTECTED, THE EMBEDDED STEEL MUST BE PART OF THE ELECTRICAL CIRCUIT. SHOULD A PIECE OF EMBEDDED STEEL BE DISCONTINUOUS, THEN IT WILL NOT RECEIVE CATHODIC PROTECTION CURRENT UNLESS IT IS SEPARATELY CONNECTED TO THE SYSTEM NEGATIVE WIRING. IN PRACTICE, IT IS EASIER TO ASSURE THAT ALL OF THE STEEL IS ELECTRICALLY CONTINUOUS AND TO CONNECT THE SYSTEM NEGATIVE WIRING AT A FEW POINTS THAN TO TRY TO CONNECT TO THE ISOLATED STEEL INDIVIDUALLY.

3.3.2 METHOD

TO INSURE PROPER PROTECTION OF THE REINFORCING STEEL BY THE CATHODIC PROTECTION SYSTEM, THE REBAR MUST BE ELECTRICALLY CONTINUOUS OR "SHORTED". A MINIMUM OF FIVE (5) LOCATIONS PER 1,000 SQUARE FEET OF CONCRETE AREA SHOULD BE TESTED FOR ELECTRICAL CONTINUITY. THE CONTINUITY OF THE TOP MAT AS A UNIT, AND THE CONTINUITY BETWEEN THE TWO MATS, AS WELL AS THE CONTINUITY BETWEEN THE TOP MAT AND ALL EMBEDDED STEEL SUCH AS GUTTERS AND EXPANSION JOINTS, SHALL BE TESTED. THE DATA SHALL BE RECORDED INTO THE APPROPRIATE DATA SHEET ALONG WITH THE PROJECT TITLE, DATE, LOCATION AND WEATHER CONDITIONS. THE LOCATION NUMBER FROM THE DATA SHEET SHALL BE INDICATED ON A PLAN DRAWING OF THE STRUCTURE. THE TEST SHALL NOT BE PERFORMED ON WET REBAR.

3.3.3 PROCEDURE

CONTINUITY TESTING SHALL BE CONDUCTED USING A HIGH IMPEDANCE DIGITAL VOLTMETER PLACED ON THE "DC MV" SCALE. THE POSITIVE VOLTMETER LEAD IS ATTACHED TO ONE STEEL CONTACT AND THE COMMON VOLTMETER LEAD IS ATTACHED TO THE OTHER STEEL CONTACT. THE STEEL MUST BE CLEANED TO A BRIGHT METAL CONDITION AT EACH POINT OF CONNECTION PRIOR TO TAKING THE MEASUREMENTS. A MEASUREMENT OF 1.0 MV OR LESS IS AN INDICATION OF DIRECT ELECTRICAL CONTINUITY.

3.3.4 REPAIR

USING (EXOTHERMIC) THERMITE WELDS, ANY REINFORCING STEEL THAT IS FOUND TO BE DISCONTINUOUS MUST BE ELECTRICALLY BONDED AS SHOWN ON THE PLANS TO CONTINUOUS STEEL USING A NO. 10 AWG STRANDED COPPER WIRE WITH HMWPE INSULATION.

IF EXTENSIVE AREAS OF DISCONTINUOUS REBAR ARE FOUND, ALTERNATE REPAIR METHODS MAY BE USED PER THE CORROSION ENGINEER'S RECOMMENDATIONS.

3.4 DEPTH OF COVER SURVEY

3.4.1 PURPOSE

THE DEPTH OF THE REINFORCING STEEL SHALL BE CHECKED TO ENSURE THAT AT LEAST 1/2" OF COVER EXISTS. SHOULD ANY AREA BE FOUND WITH LESS COVER THAN 1/2", THEN PROVISIONS MUST BE TAKEN TO PREVENT THE ANODE FROM TOUCHING THE CONCRETE OR REBAR SURFACE. THE DEPTH OF COVER REQUIREMENT IS TO PREVENT EXCESSIVE CURRENT DISCHARGE FROM THE ANODE AT SHALLOW REBAR LOCATIONS. LACK OF DEPTH OF COVER COULD HAVE A DETRIMENTAL EFFECT ON THE CATHODIC PROTECTION SYSTEM. THE UNIFORMITY OF THE CURRENT DISTRIBUTION COULD BE ADVERSELY AFFECTED IF A FUNCTIONAL SHORT IS DEVELOPED.

3.4.2 METHOD

THE DEPTH OF COVER SURVEY SHALL BE CHECKED WITH A REBAR LOCATOR AND/OR A PACHOMETER. SHOULD AN AREA BE FOUND WITH LESS THAN 1/2" OF CONCRETE COVER, IT SHOULD BE NOTED WITH SPRAY PAINT AND CORRECTIVE ACTIONS TAKEN AS DETAILED IN SECTION 3.4.3

3.4.3 REPAIR

ANY AREAS FOUND TO HAVE "SHALLOW STEEL" MAY BE CORRECTED PRIOR TO ANODE INSTALLATION BY ONE OF THE FOLLOWING WAYS:

1. APPLICATION OF A NON-CONDUCTIVE EPOXY TO THE CONCRETE SURFACE DIRECTLY ABOVE THE STEEL. THE MAXIMUM WIDTH OF THIS APPLICATION IS TWO INCHES.
2. THE ELGARD MESH CAN BE BENT AND FASTENED AROUND THE "SHALLOW STEEL" AREA. THE TECHNIQUE IS DEPENDENT ON THE EXTENT OF THE AREA AND MUST BE APPROVED BY THE CORROSION ENGINEER.
3. A CEMENTITIOUS MATERIAL HAVING A SPECIFIC RESISTIVITY OF LESS THAN 50,000 OHM-CM MAY BE USED TO "BUILD UP" SUFFICIENT CONCRETE COVER.
4. PLASTIC SPACER MESH MAY BE PLACED BETWEEN THE SHALLOW STEEL AND THE ANODE MESH.

3.5 ANODE-STEEL CONTINUITY TESTING

3.5.1 PURPOSE

AFTER THE ANODE HAS BEEN INSTALLED AND PRIOR TO PLACING THE CONCRETE OVERLAY, A CHECK MUST BE MADE TO ENSURE THAT THE ANODE IS DISCONTINUOUS FROM THE STEEL SO THAT THE CATHODIC PROTECTION SYSTEM WILL FUNCTION AS INTENDED.

3.5.2 METHOD

CONTINUITY TESTING SHALL BE CONDUCTED USING A DC VOLTMETER. ONE METER LEAD SHALL BE CONNECTED TO THE ANODE, AND THE OTHER LEAD SHALL BE CONNECTED TO THE STEEL OR A SYSTEM NEGATIVE WIRE WITHIN THE SAME STRUCTURAL COMPONENT. IF CONNECTING TO THE STEEL, THE STEEL MUST BE CLEANED TO A BRIGHT METAL CONDITION AT EACH POINT OF CONNECTION PRIOR TO TAKING THE READINGS. THE CONNECTION TO THE ANODE MAY BE MADE AT ANY CONVENIENT LOCATION. THE RESULTS OF THIS TESTING WILL BE DEPENDENT ON THE SIZE OF THE ZONE AS WELL AS OTHER VARIABLES. THE READINGS MUST BE APPROVED BY THE CORROSION ENGINEER BEFORE PROCEEDING WITH THE CONCRETE PLACEMENT. DURING THE CONCRETE OVERLAY, IF A LARGE VOLTAGE DROP IN MEASUREMENT OCCURS, THEN A SHORT HAS OCCURRED AND REPAIR IS REQUIRED.

3.5.3 REPAIR

SHOULD THE ANODE AND STEEL BE CONTINUOUS, THE LOCATION OF THE SHORT MUST BE FOUND AND CORRECTED BY ONE OF THE TECHNIQUES DESCRIBED IN SECTION 3.4.3. THE REPAIR TECHNIQUE SELECTED SHALL BE APPROVED BY THE CORROSION ENGINEER.

3.6 ENERGIZATION TEST

3.6.1 PURPOSE

ACCEPTANCE TESTING IS PERFORMED TO INSURE THAT THE STEEL IS BEING ADEQUATELY PROTECTED. CATHODIC PROTECTION IS EFFECTIVE WHEN A SUFFICIENT AMOUNT OF CURRENT IS IMPOSED ON THE STEEL REDUCING OR ELIMINATING THE ANODIC REACTION OF THE CONNECTING AREAS OF THE STEEL. TESTING SHALL BE CONDUCTED USING BOTH REFERENCE CELLS INSTALLED IN EACH ZONE TO DETERMINE ADEQUATE PROTECTION LEVELS FOR BOTH THE TOP AND BOTTOM REINFORCING STEEL.

3.6.2 METHOD

THE POTENTIAL OF THE STEEL IS MONITORED USING THE EMBEDDED REFERENCE CELLS. THE CRITERION FOR ADEQUATE PROTECTION SHALL BE A DEPOLARIZATION OF AT LEAST 100 MV AFTER FOUR HOURS OF CATHODIC PROTECTION CURRENT INTERRUPTION. THE MEASUREMENT SHALL BE MADE BY OBSERVING THE STEEL POTENTIAL .01 TO 1.0 SECOND AFTER THE CURRENT IS TURNED OFF, AND MONITORING THE CHANGE IN THE POTENTIAL WITH TIME USING A DC VOLTMETER. IF THE DEPOLARIZATION IS LESS THAN 100 MV, THEN THE CURRENT SETTING OF THE RECTIFIER SHALL BE INCREASED AND THE TEST REPEATED. IF THE DEPOLARIZATION IS GREATER THAN 250 MV, THEN THE CURRENT SETTING SHALL BE REDUCED AND THE TEST REPEATED. THE CORROSION ENGINEER RETAINED BY THE CONTRACTOR SHALL CONDUCT THESE TESTS.

THE RECTIFIER SHALL BE SET TO PROVIDE ACCEPTABLE PROTECTION ON BOTH THE TOP AND BOTTOM LAYERS OF REINFORCING STEEL.

3.6.3 DOCUMENTATION

THE RESULTS OF THE SYSTEM ACTIVATION AND DEPOLARIZATION TESTING SHALL BE SUBMITTED IN A WRITTEN REPORT TO THE ENGINEER FOR APPROVAL OF THE TEST RESULTS, FINDINGS, AND RECOMMENDATIONS.

3.7 THE CATHODIC PROTECTION SYSTEM SUPPLIER SHALL MONITOR AND MAINTAIN THE SYSTEM FOR A PERIOD OF TEN (10) YEARS AFTER ENERGIZATION OF THE SYSTEM. AN ANNUAL REPORT SHALL BE PROVIDED TO THE CITY OF PAINESVILLE.

4.0 BASIS FOR PAYMENT

THE COST FOR ITEM SPECIAL - CATHODIC SYSTEM SHALL INCLUDE:

A. FURNISHING AND INSTALLING THE CATHODIC SYSTEM AS DESCRIBED IN THE PLANS AND NOTES, INCLUDING FURNISHING AND INSTALLING THE ANODE, CONDUIT, JUNCTION BOX SYSTEM, ANODE LEADS, SYSTEM NEGATIVES, EPOXY, EXOTHERMIC WELDS, ATTACHMENT HARDWARE, HEAT SHRINK TUBING, AND TO PERFORM ALL DECK DRILLING AND CLEANING, TROUBLE SHOOTING, CONTINUITY TESTING, COVER TESTING, ACCEPTANCE TESTING, REPORTING AND TO PROVIDE THE SERVICES OF A CORROSION ENGINEER.

B. FURNISHING AND INSTALLING THE RECTIFIER UNIT AND DISCONNECT SWITCH AS SPECIFIED WITH THE AMPERAGE RATING AND NUMBER OF ZONE CIRCUITS AND INCLUDING ALL NECESSARY WIRING, HARDWARE AND CONDUIT IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS IN A PROPERLY FUNCTIONING CONDITION.

C. FURNISHING AND INSTALLING REFERENCE CELLS AS SPECIFIED, INCLUDING HALF CELL SURVEY, EXCAVATION, WELDING, EPOXY, BACKFILLING, TESTING, SPLICING, WIRING TO THE RECTIFIER, DECK DRILLING, ANY NECESSARY JUNCTION BOXES AND CONDUIT AND ATTACHMENT HARDWARE.

PAYMENT SHALL BE MADE AT THE CONTRACT PRICE BID FOR ITEM SPECIAL - CATHODIC SYSTEM LUMP SUM. THIS PRICE AND PAYMENT SHALL BE FULL COMPENSATION FOR ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS NECESSARY TO COMPLETE THE WORK IN CONFORMANCE WITH THESE REQUIREMENTS AND TO THE SATISFACTION OF THE ENGINEER.

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21
25

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 PARTIAL DELAM. NOTE
2	3-9-00	DCF	REVISED BASIS FOR PAYMENT NOTE FOR LUMP SUM PAYMENT
3	3-10-00	DCF	REVISED "SHALLOW DEPTH" FROM 1/2" TO 1/4"
4	3-28-00	DCF	RESIZED TEXT AND SHIFTED NOTES TO ACCOMMODATE TEXT SIZE

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	12 OF 12
DWG. NO.	MEDINA-6