

PURPOSE

THE PURPOSE OF THESE NOTES IS TO DESCRIBE THE TOTAL CATHODIC PROTECTION SYSTEM AND TO PROVIDE SPECIFICATIONS FOR THE MATERIALS TO BE FURNISHED, THE METHOD OF INSTALLATION AND THE METHOD OF PAYMENT.

DESCRIPTION

THE CATHODIC PROTECTION SYSTEM (CP) TO BE INSTALLED ON THE BRIDGES WILL PREVENT THE CORROSION OF THE REINFORCING STEEL BY LOWERING ITS POTENTIAL TO A VALUE WHERE RUST-PRODUCING ELECTROCHEMICAL REACTIONS WILL NOT OCCUR.

THE CP SYSTEM DRIVES A CONSTANT LOW VOLTAGE DC CURRENT TO THE STEEL. THE MAXIMUM VOLTAGE WILL BE 18 VDC AND THE MAXIMUM CURRENT INTO ANY ZONE WILL BE LESS THAN 8 AMPS DC. A 120 VAC, 1-PHASE CIRCUIT WILL RUN FROM THE EXISTING LIGHTING POWER LINE TO THE RECTIFIER WHERE IT WILL BE CONVERTED TO DIRECT CURRENT.

THE POSITIVE SIDE OF THE SYSTEM, THE ANODE, WILL BE ATTACHED TO THE SCARIFIED DECK AND OVERLAID WITH CONCRETE. THE CONTRACTOR SHALL SELECT THE TYPE OF ANODE MATERIAL FROM THE FOLLOWING LIST OF ACCEPTABLE PRODUCTS.

ELGARD 210 TITANIUM ANODE MESH SUPPLIED BY CORRPRO COMPANIES, INCORPORATED MEDINA, OHIO

MATERIAL SUPPLY CONTACTS FOR THESE ANODE MATERIALS ARE:

CLEM FIRLOTTE (330) 723-5082 EXT. 407
TONY RIZK (330) 723-5082 EXT. 409

THE CONTRACTOR SHALL USE CONSTRUCTION TECHNIQUES THAT WILL AVOID DIRECT METAL CONTACT BETWEEN THE ANODE AND ANY BRIDGE STEEL AND WILL AVOID LOOSENING THE ANODE ATTACHMENT TO THE DECK DURING APPLICATION OF THE CONCRETE OVERLAY. THE CONTRACTOR SHALL NOT DRIVE HEAVY EQUIPMENT ON THE ANODE. THE CONCRETE OVERLAY SHALL BE DELIVERED TO THE DECK BY PUMPING OR IN LIGHT WEIGHT BUGGY TRUCKS DRIVING ON PLYWOOD AND PLASTIC SHEETING COVERING THE ANODE.

THE CONTRACT WORK SHALL CONSIST OF THE CONTRACTOR FURNISHING AND INSTALLING THE CATHODIC PROTECTION SYSTEM DESCRIBED HEREIN, EMPLOYING A QUALIFIED CORROSION ENGINEER TO PERFORM THE SPECIFIED TESTS AND REPORTS AND TURNING OVER TO THE CITY A FUNCTIONING CP SYSTEM FREE OF SHORTS AND BREAKS AND OPERATING IN A CONSTANT CURRENT MODE WITH THE CORRECT SETTING TO PREVENT REINFORCING STEEL CORROSION.

CATHODIC PROTECTION SPECIFICATIONS

1.0 MATERIAL REQUIREMENTS

1.1 CATHODIC PROTECTION RECTIFIER

1.1.1 DESCRIPTION

THIS SPECIFICATION DEFINES THE REQUIREMENTS FOR THE MANUFACTURE OF CATHODIC PROTECTION RECTIFIERS FOR BRIDGE DECK PROTECTION. THE RECTIFIER SHALL BE THE MANUAL VOLTAGE CONTROL TAP SWITCH TYPE. THE RECTIFIER SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE SCHEMATIC SHOWN ON SHEET NO. 16/25, AND THE FOLLOWING SPECIFICATIONS.

MATERIALS AND EQUIPMENT SHALL BE DESIGNED, MANUFACTURED AND TESTED IN ACCORDANCE WITH THE MINIMUM APPLICABLE REQUIREMENTS OF THE LATEST EDITIONS OF THE FOLLOWING CODES AND STANDARDS REFERENCED.

NATIONAL ELECTRICAL CODE (NEC)
NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)
AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
MILITARY SPECIFICATIONS (MIL SPEC)

THE MATERIAL SHALL BE INSTALLED OUTDOORS AND SUBJECTED TO VARYING CORROSIVE ATMOSPHERES WITH AN AMBIENT TEMPERATURE OF UP TO 50°C AND RELATIVE HUMIDITY UP TO 100%.

EACH RECTIFIER SUPPLIED SHALL INCLUDE TWO SETS OF THE FOLLOWING AS A MINIMUM: A WIRING SCHEMATIC, PARTS LIST, TEST RESULTS AND AN OPERATION AND MAINTENANCE MANUAL. THIS INFORMATION SHALL BE INSERTED IN A CLEAR WATERPROOF PLASTIC FOLDER AND PLACED IN THE RECTIFIER MANUAL HOLDER.

THE RECTIFIER SHALL BE WARRANTED FOR ONE FULL YEAR AFTER INSTALLATION OR 18 MONTHS AFTER DELIVERY (WHICHEVER COMES FIRST) AGAINST DEFECTS IN DESIGN OR WORKMANSHIP.

THE RECTIFIER SHALL BE SUPPLIED BY A COMPANY ESTABLISHED IN AND PRESENTLY INVOLVED IN THE DESIGN AND MANUFACTURE OF CATHODIC PROTECTION RECTIFIERS.

1.1.2 ENCLOSURE

THE ENCLOSURE SHALL BE DESIGNED TO MEET NEMA TYPE 3R REQUIREMENTS AS OUTLINED IN NEMA PUBLICATION NO. 250. IT SHALL BE CONSTRUCTED OF 12 GAUGE MINIMUM THICKNESS MATERIAL AND SHALL PROVIDE FOR ADEQUATE CONVECTION COOLING OF INTERNAL COMPONENTS. THE ENCLOSURE SHALL BE DESIGNED FOR POLE MOUNTING. ANY OPENING DESIGNED FOR COOLING AND OVER 1/4" SHALL BE SCREENED TO PREVENT ENTRY OF NEST BUILDING INSECTS. NEMA 3R ENCLOSURES SHALL HAVE HINGED REMOVABLE FRONT AND SIDE DOORS WITH BOLT ON, ADJUSTABLE, STAINLESS STEEL, HEAVY DUTY LATCHES.

THE ENCLOSURE SHALL HAVE PROVISIONS FOR LOCKING AND PROTECT THE INTERIOR COMPONENTS FROM WEATHER AND VANDALISM. KNOCKOUTS FOR WIRING SHALL BE CONVENIENTLY LOCATED IN THE BOTTOM OF THE ENCLOSURE AND BE OF ADEQUATE NUMBER AND SIZE TO PROVIDE FOR INPUT AND OUTPUT CONNECTIONS. A GROUNDING LUG SHALL BE PROVIDED ON THE OUTSIDE OF THE ENCLOSURE TO ACCOMMODATE A #6 COPPER GROUND WIRE. A PERMANENT MANUAL HOLDER SHALL BE PROVIDED, ATTACHED TO THE INSIDE OF THE CABINET DOOR.

1.1.3 TRANSFORMER

THE TRANSFORMER SHALL BE SPECIFICALLY DESIGNED FOR USE IN A CATHODIC PROTECTION RECTIFIER, HAVE SEPARATE, ISOLATED PRIMARY AND SECONDARY COPPER WIRING AND A GROUNDING COPPER FARADAY SHIELD BETWEEN PRIMARY AND SECONDARY WIRINGS. THE TRANSFORMER SHALL BE DESIGNED TO OPERATE CONTINUOUSLY AT RATED LOAD AND SHALL SUPPLY RATED OUTPUT AT 5% LOW, 10% HIGH LINE VOLTAGE WITHOUT DAMAGE. THE WIRE SIZE OF BOTH WINDINGS IS TO BE BASED ON A MINIMUM OF 750 CIRCULAR MILLS PER AMP. THE TRANSFORMER REGULATION SHALL NOT EXCEED 3% WHEN MEASURED AT 1/4" LOAD AND FULL LOAD. THE TRANSFORMER AND MATERIALS SHALL BE DESIGNED AND MANUFACTURED TO MEET THE REQUIREMENTS OF MIL E 917. THE SECONDARY SHALL HAVE SIX COARSE AND SIX FINE TAPS TO ALLOW ADJUSTMENT OF THE OUTPUT.

ALL TAP LEADS SHALL BE SIZED FOR A MINIMUM OF 500 CIRCULAR MILLS PER AMP. THESE TAPS SHALL BE BROUGHT OUT TO LINK BAR ARRANGEMENTS OR A TERMINAL BLOCK FOR ADJUSTING THE OUTPUT OF THE RECTIFIER AND SHALL BE LOCATED ON THE INSTRUMENT PANEL.

THE TRANSFORMER SHALL BE VACUUM IMPREGNATED OR PREHEATED AND IMMERSED IN CLASS F TRANSFORMER VARNISH UNTIL ALL TAPES, INSULATING MATERIALS, OUTER WRAPPING AND COIL WINDINGS HAVE BEEN COMPLETELY SATURATED AND THEN OVEN BAKED UNTIL DRY. WHEN COMPLETED AND BEFORE INSTALLATION INTO A RECTIFIER, THE TRANSFORMER SHALL BE TESTED AND MUST BE ABLE TO WITHSTAND 2000 VOLTS FOR ONE MINUTE WITHOUT BREAKDOWN BETWEEN THE PRIMARY AND CORE, SECONDARY AND CORE, AND PRIMARY TO SECONDARY.

EACH CIRCUIT SHALL HAVE ITS OWN ISOLATED SECONDARY WINDING OR INDIVIDUAL TRANSFORMER DESIGN PER ABOVE REQUIREMENTS.

1.1.4 PROTECTIVE DEVICES

THE ENTIRE UNIT IS TO BE PROTECTED AGAINST OVERLOAD AND SHORT CIRCUIT BY A THERMAL MAGNETIC TYPE CIRCUIT BREAKER OF THE PROPER VOLTAGE RATING AND SIZED TO HOLD 125% OF THE RATED LOAD CURRENT. IT IS TO BE CONNECTED BETWEEN THE AC SUPPLY AND TRANSFORMER PRIMARY. THE CIRCUIT BREAKER SHALL BE OF THE MANUAL RESET TYPE AND MUST TRIP AT BETWEEN 110% AND 125% OF RATED INPUT CURRENT. THE BREAKER SHALL BE POSITIONED AND LABELLED TO MEET THE REQUIREMENTS OF THE NEC ARTICLE 240 SECTIONS 80 THROUGH 83C.

RECTIFIERS SHALL HAVE A FUSE IN THE POSITIVE OUTPUT AND A QUICK ACTING RECTIFIER FUSE RATED AT 120% OF THE CIRCUIT CAPACITY PLACED IN ONE LEG OF THE AC SECONDARY. THREE SPARE FUSES FOR EACH TYPE AND RATING SHALL BE PROVIDED WITH THE RECTIFIER AND SHALL BE SECURED INSIDE THE RECTIFIER ENCLOSURE.

1.1.5 LIGHTNING AND SURGE PROTECTOR

THE UNIT SHALL BE EQUIPPED WITH PROPERLY SIZED AC AND DC LIGHTNING PROTECTION. EACH CONTROLLED OUTPUT AS WELL AS EVERY INPUT TO THE RECTIFIER SHALL BE PROTECTED AGAINST VOLTAGE SURGES, USING PROPERLY SIZED SURGE SUPPRESSOR. WHEN METAL OXIDE VARISTORS (MOV'S) ARE USED TO PROTECT THE AC INPUT AND DC OUTPUT, THEY SHALL BE RATED AT 500 JOULES AND HAVE A VOLTAGE RATING WHICH PROVIDES ADEQUATE PROTECTION TO THE INTERNAL CIRCUITRY.

1.1.6 PANEL METERS

THE PANEL METER SHALL MONITOR THE OUTPUT OF THE RECTIFIER AS WELL AS THE REFERENCE ELECTRODES USING ENVIRONMENTALLY SEALED SWITCHES TO SELECT THE READING REQUIRED. THE SELECTOR SWITCH SHALL HAVE AN OFF POSITION WHICH REMOVES ALL INPUT SIGNALS FROM THE METER SENSE LEADS. A METER POWER ON/OFF SWITCH SHALL BE SUPPLIED. THE METER IS TO HAVE AN LCD (OR LED) THREE AND ONE HALF DIGIT (MINIMUM) DISPLAY, HAVE AN ACCURACY OF ± 0.05%, OPERATE OVER A TEMPERATURE RANGE OF - 30° C TO + 65° C, AND HAVE A STORAGE TEMPERATURE RANGE OF -30°C TO + 80° C. THE INPUT IMPEDANCE SHALL BE 1000 MEG OHMS MINIMUM.

1.1.7 SHUNTS

A DC SHUNT IS TO BE MOUNTED ON THE TOP SIDE OF THE CONTROL PANEL AND READILY ACCESSIBLE FOR METER ACCURACY CHECKS. ALL SHUNTS SHALL BE PLACED IN THE NEGATIVE CIRCUIT, BE RATED AT 50 M AND 120% OF CIRCUIT CURRENT (MAXIMUM), AND HAVE UNINSULATED RING TONGUE TERMINALS POSITIONED FOR EASY CONNECTION OF TEST EQUIPMENT OR METERS, FASTENED TO THE CALIBRATED TEST POINTS.

1.1.8 CONVENIENCE OUTLET

UNITS SHALL BE EQUIPPED WITH A STANDARD 115 VAC GROUNDING AC OUTLET WITH COVER MOUNTED ON THE PANEL FACE. THE OUTLET SHALL BE FUSED FOR 15 AMPS AND BE ATTACHED TO THE LINE SIDE OF THE CIRCUIT BREAKER.

1.1.9 TERMINALS

AN AC INPUT TERMINAL BLOCK WITH "DEAD FRONT" SHALL BE LOCATED ON THE INSULATED CONTROL PANEL FOR CONNECTION OF THE INPUT AC WIRING. SOLDERLESS, COMPRESSION LUGS, SPACED A MINIMUM OF TWO INCHES APART, SIZED TO ACCOMMODATE UP TO #6 AWG WIRE, SHALL BE PROVIDED FOR THE POSITIVE AND NEGATIVE OUTPUT TERMINALS OF THE RECTIFIER AND BE MOUNTED ON THE CONTROL PANEL. BINDING POSTS, SUITABLE FOR ATTACHING NO. 18 AWG WIRE, SHALL BE PROVIDED FOR EACH ZONE TO ACCOMMODATE TWO REFERENCE ELECTRODES AND TWO STRUCTURE TEST LEADS. TEST JACKS SHALL BE PROVIDED TO ENABLE EXTERNAL MONITORING OF EACH VOLTAGE, CURRENT, OR POTENTIAL READING BEING TAKEN. ALL TERMINALS SHALL BE CLEARLY IDENTIFIED ON THE PANEL.

1.1.10 WIRING

ALL WIRING AND CURRENT CARRYING STUDS WITHIN THE RECTIFIER, EXCEPT FOR METER CIRCUITS, ARE TO BE SIZED FOR NOT LESS THAN 500 CIRCULAR MILLS PER AMP. ALL CURRENT CARRYING BOLTS, TERMINALS AND CONNECTIONS SHALL BE OF COPPER, BRASS OR BRONZE. ELECTRICAL CONNECTIONS MADE THROUGH THE PANEL SHALL BE EITHER SOLDERED TO THE BOLT HEAD OR UTILIZE THE DOUBLE NUT METHOD SO AS NOT TO DEPEND ON THE COMPRESSION STRENGTH OF THE PANEL TO MAINTAIN A TIGHT CONNECTION.

1.1.11 NAMEPLATE

EACH RECTIFIER SHALL BE PROVIDED WITH A STAMPED OR ENGRAVED METAL NAMEPLATE WITH THE FOLLOWING INFORMATION:

NAME OF MANUFACTURER	MODEL CODE
SERIAL NUMBER	AC INPUT AMPS
AC INPUT VOLTS	FREQUENCY
NO. OF PHASES	DC OUTPUT AMPS
DC OUTPUT VOLTS	DC OUTPUT AMPS
MAXIMUM AMBIENT TEMPERATURE DESIGN TO OPERATE IN	

1.1.12 ENCLOSURE FINISH

ALL WELDS SHALL BE SANDED AND ALL SHARP EDGES ROUNDED BEFORE FINISHING. THE ENTIRE ENCLOSURE SHALL BE GALVANIZED ACCORDING TO ASTM SPECIFICATION A123 AND SHALL HAVE A MINIMUM COATING OF 2.6 MILS OR 1.5 OUNCES OF ZINC PER SQUARE FOOT OF SURFACE AREA.

1.1.13 PANEL MATERIAL

THE PANEL SHALL BE CONSTRUCTED OF 1/4 INCH THICK BAKELITE INSULATING MATERIAL.

PANEL MARKING: ALL PANEL FUNCTIONS SHALL BE LEGIBLE AND PERMANENTLY LABELED NEAR THE FUNCTION BEING DESCRIBED USING ENGRAVING TECHNIQUES IN THE PANEL OR BOLT ON ENGRAVED PLATES. STICK ON LABELS ARE NOT ACCEPTABLE.

1.1.14 FILTERS

ALL SINGLE PHASE UNITS SHALL INCLUDE A FILTER. THE OUTPUT RIPPLE OF EACH CIRCUIT OF THE RECTIFIER SHALL NOT EXCEED 10% OF RATED OUTPUT VOLTAGE WHEN MEASURED AT RATED OUTPUT VOLTAGE AND CURRENT. THE FILTER MUST BE REMOVABLE, USING SWITCHES AND/OR LINK BAR.

ARRANGEMENTS, UNLESS THE FILTER IS DISCHARGED COMPLETELY, WHEN CONNECTED TO THE RATED LOAD, IN LESS THAN 15 MILLISECONDS AFTER INTERRUPTION OF THE INPUT POWER TRANSFORMER SPECIFICATIONS (MIL E 917).

1.1.15 TESTING

EACH COMPLETED RECTIFIER SHALL BE FULLY TESTED AT LOW, HIGH AND NOMINAL LINE VOLTAGE. THE AC INPUT VOLTAGE, CURRENT, WATTS, POWER FACTOR, AND THE DC OUTPUT VOLTAGE, CURRENT AND EFFICIENCY SHALL BE RECORDED AT EACH INPUT VOLTAGE. EACH CIRCUIT SHALL BE INDIVIDUALLY TESTED WITH ALL OTHER CIRCUITS ENERGIZED AND LOADED AND TESTED TO SHOW THAT IT (THEY) MEET THE REQUIREMENTS OF THIS SPECIFICATION.

WHEN REQUIRED, TESTING MAY BE WITNESSED BY THE CUSTOMER AT THE MANUFACTURER'S LOCATION. THE MANUFACTURER SHALL CERTIFY COMPLIANCE WITH THE ABOVE TEST PROCEDURE.

1.1.16 DISCONNECT SWITCH

THE RECTIFIER POWER INPUT CIRCUIT SHALL BE FURNISHED WITH A SWITCH AND ENCLOSURE SEPARATE FROM THE RECTIFIER. THE SWITCH SHALL BE A SINGLE-THROW FUSIBLE SAFETY DISCONNECT SWITCH WITH SOLID COPPER NEUTRAL BUS BAR AND SHALL BE UL LISTED. THE CONTRACTOR SHALL DETERMINE THE PROPER SWITCH RATING REQUIRED TO SUPPLY THE MAXIMUM VOLTAGE AND CURRENT OF THE RECTIFIER. THE SWITCH SHALL BE LOCKABLE IN BOTH THE ON AND THE OFF POSITIONS. THE SWITCH ENCLOSURE SHALL BE CLASSIFIED AS A NEMA 3R ENCLOSURE WITH A BAKED ENAMEL FINISH.

1.1.17 ELECTRICAL SERVICE AND POLE

A POLE FOR MOUNTING THE DISCONNECT SWITCH AND RECTIFIER WILL BE INSTALLED AT THE SOUTHEAST CORNER OF THE BRIDGE BY THE CITY OF PAINESVILLE. AFTER THE RECTIFIER AND DISCONNECT SWITCH ARE INSTALLED BY THE CONTRACTOR THE CITY WILL INSPECT AND PROVIDE 120 VOLT SERVICE TO THE DISCONNECT SWITCH.

No.	DATE	BY	REVISION
1	3-8-00	DCF	CONVERT TO DGN, CHANGED LINE WT, ADDED BRIDGE NO HID UNNEEDED NOTES, CORRECTED TEXT FONT SYMBOLS
2	3-8-00	DCF	DELETED ITEM 201 NOTE
3	5-28-00	DCF	RESIZED TEXT AND SHIFTED NOTES TO ACCOMMODATE TEXT SIZE
4	4-28-00	DCF	ADDED NOTE 1.1.17 ELECTRICAL SERVICE AND POLE

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	10 OF 12
DWG. NO.	MEDINA-4



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