AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
	1		2

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicable)*
0004	4 SEPT 2003		

6. ISSUED BY	CODE	7. ADMINISTERED BY *(If other than Item 6)*	CODE
US ARMY ENGINEER DISTRICT, FORT WORTH ATTN: CESWF-CT (RM 2A19) PO BOX 17300 FORT WORTH, TX 76102-0300			

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*	(X)	9A. AMENDMENT OF SOLICIATION NO.
	☒	DACA63-03-B-0008
		9B. DATED *(SEE ITEM 11)* 11 AUGUST 2003
	☐	10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED *(SEE ITEM 11)*
CODE / FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a)By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (*Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

The Solicitation for Water System Upgrade, Fort Bliss, Texas, is amended as follows:

See Continuation Sheet:

NOTE: The bid opening date and time is "12 September 2003 at 2 p.m. local time", as previous announced.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
15B. CONTRACTOR/OFFEROR *(Signature of person authorized to sign)*	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA *(Signature of Contracting Officer)*	16C. DATE SIGNED

Item 14. Continued.

CHANGES TO BIDDING SCHEDULE

1. Replace the Bidding Schedule, with the accompanying new Bidding Schedule, bearing the notation "ACCOMPANYING AMENDMENT NO. 0004 TO SOLICITATION NO. DACA63-03-B-0008."

CHANGES TO THE SPECIFICATIONS:

2. Replacement Sections: Replace the following section with the accompanying new section of the same number and title, bearing the notation "ACCOMPANYING AMENDMENT NO. 0004 TO SOLICITATION NO. DACA63-03-B-0008:"

13110 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)

CHANGES TO THE DRAWINGS:

3. Reference Sequence No. 022, Drawing C-302: Delete Detail No. 1.

4. Reference Sequence No. 030, Drawing S-502 and Sequence 031 Drawing S-503: Waterstops are shown but not labeled in details 5/S-502 and 6/S-503. Include waterstops in details.

END OF AMENDMENT

Upgrade Water System (Title)
Fort Bliss, Texas (Location)

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE
(To be attached to SF 1442)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
BASE BID: All work required by the plans and specifications for the Upgrade Water System excluding all Option Bid Items.					
0001	WATER LINES IN NON-PAVED AREAS (AREA A)				
0001AA	1-Inch Pipe	50	LF	$_____	$_____
0001AB	2-Inch Pipe	367	LF	$_____	$_____
0001AC	3-Inch Pipe	495	LF	$_____	$_____
0001AD	4-Inch Pipe	891	LF	$_____	$_____
0001AE	6-Inch Pipe	12,600	LF	$_____	$_____
0001AF	8-Inch Pipe	11,000	LF	$_____	$_____
0001AG	10-Inch Pipe	554	LF	$_____	$_____
0001AH	12-Inch Pipe	3,500	LF	$_____	$_____
0001AI	14-Inch Pipe	50	LF	$_____	$_____
0001AJ	16-Inch Pipe	7,700	LF	$_____	$_____
				Total Bid Item No. 1	$_____
0002	WATER LINES IN PAVED AREAS(AREA A)				
0002AA	1-Inch Pipe	50	LF	$_____	$_____
0002AB	2-Inch Pipe	100	LF	$_____	$_____
0002AC	3-Inch Pipe	100	LF	$_____	$_____
0002AD	4-Inch Pipe	100	LF	$_____	$_____
0002AE	6-Inch Pipe	2,400	LF	$_____	$_____
0002AF	8-Inch Pipe	1,600	LF	$_____	$_____
0002AG	12-Inch Pipe	3,400	LF	$_____	$_____
0002AH	14-Inch Pipe	50	LF	$_____	$_____
0002AI	16-Inch Pipe	7,100	LF	$_____	$_____
				Total Bid Item No. 2	$_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
[AM#3] 0003	**DELETED**				
[AM#3] 0004	**DELETED**				
0005	FIRE HYDRANTS (AREA A)	150	EA	$_____	$_____
[AM#3] 0006	PIPE BOLLARDS (AREA A)	**600**	EA	$_____	$_____
0007	GATE VALVES (AREA A)				
0007AA	2-Inch	5	EA	$_____	$_____
0007AB	4-Inch	6	EA	$_____	$_____
0007AC	6-Inch	220	EA	$_____	$_____
0007AD	8-Inch	44	EA	$_____	$_____
0007AE	10-Inch	12	EA	$_____	$_____
0007AF	12-Inch	13	EA	$_____	$_____
0007AG	14-Inch	3	EA	$_____	$_____
0007AH	16-Inch	35	EA	$_____	$_____

Total Bid Item No. 7 $_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0008	REDUCERS (AREA A)				
0008AA	1 or 1-1/2 X 2	2	EA	$_____	$_____
0008AB	2 X 4	3	EA	$_____	$_____
0008AC	3 X 4	1	EA	$_____	$_____
0008AD	4 X 6	3	EA	$_____	$_____
0008AE	4 X 8	2	EA	$_____	$_____
0008AF	4 X 10	1	EA	$_____	$_____
0008AG	4 X 12	1	EA	$_____	$_____
0008AH	4 X 14	1	EA	$_____	$_____
0008AI	4 X 16	1	EA	$_____	$_____
0008AJ	6 X 8	3	EA	$_____	$_____
0008AK	6 X 10	3	EA	$_____	$_____
0008AL	6 X 12	2	EA	$_____	$_____
0008AM	6 X 14	1	EA	$_____	$_____
0008AN	6 X 16	1	EA	$_____	$_____
0008AP	8 X 10	1	EA	$_____	$_____
0008AQ	8 X 12	4	EA	$_____	$_____
0008AR	8 X 14	1	EA	$_____	$_____
0008AS	8 X 16	2	EA	$_____	$_____
0008AT	10 X 12	1	EA	$_____	$_____
0008AU	10 X 14	1	EA	$_____	$_____
0008AV	10 X 16	1	EA	$_____	$_____
0008AW	12 X 14	1	EA	$_____	$_____
0008AX	12 X 16	4	EA	$_____	$_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0008AY	14 X 16	2	EA	$_____	$_____
			Total Bid Item No. 8		$_____
0009	TEES (AREA A)				
0009AA	4-Inch	2	EA	$_____	$_____
0009AB	6-Inch	26	EA	$_____	$_____
0009AC	8-Inch	15	EA	$_____	$_____
0009AD	10-Inch	2	EA	$_____	$_____
0009AE	12-Inch	11	EA	$_____	$_____
0009AF	14-Inch	1	EA	$_____	$_____
0009AG	16-Inch	19	EA	$_____	$_____
			Total Bid Item No. 9		$_____
0010	90 DEGREE BENDS (AREA A)				
0010AA	4-Inch	3	EA	$_____	$_____
0010AB	6-Inch	12	EA	$_____	$_____
0010AC	8-Inch	19	EA	$_____	$_____
0010AD	10-Inch	5	EA	$_____	$_____
0010AE	12-Inch	8	EA	$_____	$_____
0010AF	16-Inch	7	EA	$_____	$_____
			Total Bid Item No. 10		$_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0011	45 DEGREE BENDS (AREA A)				
0011AA	4-Inch	8	EA	$_____	$_____
0011AB	6-Inch	12	EA	$_____	$_____
0011AC	8-Inch	16	EA	$_____	$_____
0011AD	10-Inch	7	EA	$_____	$_____
0011AE	12-Inch	11	EA	$_____	$_____
0011AF	16-Inch	18	EA	$_____	$_____
			Total Bid Item No. 11		$_____
0012	22-1/2 DEGREE BENDS (AREA A)				
0012AA	4-Inch	2	EA	$_____	$_____
0012AB	6-Inch	6	EA	$_____	$_____
0012AC	8-Inch	10	EA	$_____	$_____
0012AD	10-Inch	1	EA	$_____	$_____
0012AE	12-Inch	5	EA	$_____	$_____
0012AF	16-Inch	7	EA	$_____	$_____
			Total Bid Item No. 12		$_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0013	11-1/4 DEGREE BENDS (AREA A)				
0013AA	4-Inch	1	EA	$_____	$_____
0013AB	6-Inch	1	EA	$_____	$_____
0013AC	8-Inch	1	EA	$_____	$_____
0013AD	10-Inch	1	EA	$_____	$_____
0013AE	12-Inch	3	EA	$_____	$_____
0013AF	16-Inch	3	EA	$_____	$_____
			Total Bid Item No. 13		$_____
0014	SOLID SLEEVES (AREA A)				
0014AA	4-Inch	2	EA	$_____	$_____
0014AB	6-Inch	6	EA	$_____	$_____
0014AC	8-Inch	20	EA	$_____	$_____
0014AD	10-Inch	1	EA	$_____	$_____
0014AE	12-Inch	8	EA	$_____	$_____
0014AF	14-Inch	1	EA	$_____	$_____
0014AG	16-Inch	4	EA	$_____	$_____
			Total Bid Item No. 14		$_____
0015	TAPPING SLEEVE AND VALVE WITH VALVE BOX (AREA A)				
0015AA	4 X 4	1	EA	$_____	$_____
0015AB	6 X 6	5	EA	$_____	$_____
0015AC	6 X 8	12	EA	$_____	$_____
0015AD	6 X 10	10	EA	$_____	$_____
0015AE	6 X 12	20	EA	$_____	$_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0015AF	6 X 14	10	EA	$_____	$_____
0015AG	6 X 16	5	EA	$_____	$_____
0015AH	8 X 8	20	EA	$_____	$_____
0015AI	8 X 10	15	EA	$_____	$_____
0015AJ	8 X 12	26	EA	$_____	$_____
0015AK	8 X 14	1	EA	$_____	$_____
0015AL	8 X 16	5	EA	$_____	$_____
0015AM	10 X 10	9	EA	$_____	$_____
0015AN	12 X 12	10	EA	$_____	$_____
0015AO	12 X 14	1	EA	$_____	$_____
0015AP	12 X 15	10	EA	$_____	$_____
			Total Bid Item No. 15		$_____
0016	CUT AND CAP (AREA A)				
0016AA	4-Inch	2	EA	$_____	$_____
0016AB	6-Inch	18	EA	$_____	$_____
0016AC	8-Inch	12	EA	$_____	$_____
0016AD	10-Inch	15	EA	$_____	$_____
0016AE	12-Inch	12	EA	$_____	$_____
0016AF	14-Inch	3	EA	$_____	$_____
0016AG	16-Inch	8	EA	$_____	$_____
			Total Bid Item No. 16		$_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0017	REMOVE EXISTING PIPING (NOT ASBESTOS CEMENT) IN NON-PAVED AREAS (AREA A)				
0017AA	4-Inch	200	LF	$_____	$_____
0017AB	6-Inch	3,000	LF	$_____	$_____
0017AC	8-Inch	4,000	LF	$_____	$_____
0017AD	10-Inch	300	LF	$_____	$_____
0017AE	12-Inch	300	LF	$_____	$_____
0017AF	14-Inch	3,000	LF	$_____	$_____
0017AG	16-Inch	300	LF	$_____	$_____
				Total Bid Item No. 17	$_____
0018	REMOVE EXISTING PIPING (NOT ASBESTOS CEMENT) IN PAVED AREAS (AREA A)				
0018AA	4-Inch	176	LF	$_____	$_____
0018AB	6-Inch	1,732	LF	$_____	$_____
0018AC	8-Inch	2,000	LF	$_____	$_____
0018AD	10-Inch	200	LF	$_____	$_____
0018AE	12-Inch	200	LF	$_____	$_____
0018AF	14-Inch	4,000	LF	$_____	$_____
0018AG	16-Inch	4,000	LF	$_____	$_____
				Total Bid Item No. 18	$_____
0019	REMOVE EXISTING ASBESTOS CEMENT PIPING IN NON-PAVED AREAS (AREA A)				
0019AA	4-Inch	400	LF	$_____	$_____
0019AB	6-Inch	4,000	LF	$_____	$_____
0019AC	8-Inch	4,000	LF	$_____	$_____
0019AD	10-Inch	1,500	LF	$_____	$_____
0019AE	12-Inch	400	LF	$_____	$_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0019AF	14-Inch	200	LF	$_____	$_____
0019AG	16-Inch	100	LF	$_____	$_____
			Total Bid Item No. 19		$_____
0020	REMOVE EXISTING ASBESTOS CEMENT PIPING IN PAVED AREAS (AREA A)				
0020AA	4-Inch	100	LF	$_____	$_____
0020AB	6-Inch	500	LF	$_____	$_____
0020AC	8-Inch	500	LF	$_____	$_____
0020AD	10-Inch	500	LF	$_____	$_____
0020AE	12-Inch	100	LF	$_____	$_____
0020AF	14-Inch	100	LF	$_____	$_____
0020AG	16-Inch	100	LF	$_____	$_____
			Total Bid Item No. 20		$_____
[AM#3] 0021	FLOWABLE BACKFILL (AREA A)	**9,000**	SY	$_____	$_____
0022	AGGREGATE SURFACE COURSE (AREA A)	2,000	SY	$_____	$_____
0023	CONCRETE WALK REPLACEMENT (AREA A)	5,000	SF	$_____	$_____
0024	CONCRETE PAVEMENT REPLACEMENT (AREA A)	300	SY	$_____	$_____
[AM#3] 0025	ASPHALT PAVEMENT REPLACEMENT (AREA A)	**7,400**	SY	$_____	$_____
[AM#3] 0026	CURB AND GUTTER REPLACEMENT (AREA A)	**6,200**	LF	$_____	$_____
0027	CONCRETE ENCASE WATER LINE (AREA A)	180	LF	$_____	$_____
0028	2-INCH BLOW-OFF (AREA A)	12	EA	$_____	$_____
0029	2-INCH METER IN METER BOX (AREA A)	5	EA	$_____	$_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0030	1-INCH METER IN METER BOX (AREA A)	10	EA	$_____	$_____
0031	1-INCH MANUAL AIR RELEASE VALVE (AREA A)	20	EA	$_____	$_____
[AM#3] **0032**	**MOUNT FRANKLIN RED LANDSCAPE ROCK W/ WOVEN WEED BARRIER UNDERLAYMENT (AREA A)**	**1,000**	**TON**	**$_____**	**$_____**
0033	COUPLINGS FOR TIE-INS (AREA A)				
0033AA	1-Inch	10	EA	$_____	$_____
0033AB	2-Inch	5	EA	$_____	$_____
0033AC	3-Inch	2	EA	$_____	$_____
			Total Bid Item No. 33		$_____
[AM#3] 0034	TRENCH ROCK EXCAVATION **(AREA A)**	**500**	CY	$_____	$_____
[AM#3] **0035**	**DUCTILE IRON PIPE ABOVE GROUND (AREA A)**	**1,200**	**LF**	**$_____**	**$_____**
(Am#3)0036	**ALL WORK FOR AREAS B THRU G**				
0036AA	**AREA B - BUILDING 1318 PUMP REPLACEMENTS/RESERVOIR DEMOLITION AND REPLACEMENT**	**JOB**	**SUM**	*******	**$_____**
0036AB	**AREA C - BUILDING 11172 AND 11173 RESERVOIR DEMOLITION AND REPLACEMENT**	**JOB**	**SUM**	*******	**$_____**
0036AC	**AREA D - BUILDING 4317 RESERVOIR DEMOLITION AND REPLACEMENT**	**JOB**	**SUM**	*******	**$_____**
0036AD	**AREA E - HUECO WELL TANK PAINTING/ENGINE REPLACEMENT**	**JOB**	**SUM**	*******	**$_____**
0036AE	**AREA F - BUILDING 3695 PUMP AND ENGINE DRIVE REPLACEMENTS AND MANIFOLD IMPROVEMENTS**	**JOB**	**SUM**	*******	**$_____**

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0036AF	**AREA G - ELECTRICAL SCADA AND INSTRUMENTATION**	**JOB**	**SUM**	*******	**$_____**
0036AG	**DELETED (Am#4)**				
				TOTAL BID ITEM 0036	**$_____**
0037	Warranty Work (All Contract Work) The monetary value of this bid item shall equal at least 1 per cent of the total of all bid items preceding it. A value less than 1 per cent will result in a determination of non-responsive bid. See Contract Specification Section 01770 CONTRACT CLOSEOUT, paragraph "Contractor's Response to Construction Warranty Service Requirements."	JOB	SUM	***	$_____
0038	Operation & Maintenance Manuals	JOB	SUM	***	$ 25,000.00
0039	Final As-Built Drawings	JOB	SUM	***	$ 25,000.00

TOTAL BASE BID $_____

0040 OPTION NO. 1: Additional cost for all work required by the plans and specifications for: Area H - Building 4318 Pump Replacement.

TOTAL OPTION NO. 1 $_____

0041 OPTION NO. 2: Additional cost for all work required by the plans and specifications for: Area I - McGregor Range Camp Water Line Improvements.

TOTAL OPTION NO. 2 $_____

0042 OPTION NO. 3: Additional cost for all work required by the plans and specifications for: Area J - Dona Ana Range Camp Water Storage and Water Line Improvements.

TOTAL OPTION NO. 3 $_____

0043 OPTION NO. 4: Additional cost for all work required by the plans and specifications for: Area K - Oro Grande Range Camp Water Storage and Water Line Improvements.

TOTAL OPTION NO. 4 $_____

0044 OPTION NO. 5: Additional cost for all work required by the plans and specifications for: Area L - Pump Capacity, Tobin Well Building 3695.

TOTAL OPTION NO. 5 $_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0045	OPTION NO. 6: Additional cost for all work required by the plans and specifications for: Area M - Pump Capacity, Main Cantonment Building 1318.				

TOTAL OPTION NO. 6 $_____

TOTAL BASE BID + OPTIONS 1 - 6: $_____

Solicitation No. DACA63-03-B-0008

BIDDING SCHEDULE(cont)

NOTES:

1. ARITHMETIC DISCREPANCIES (EFARS 14.407-2)

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by bidders:

(1) Obviously misplaced decimal points will be corrected;

(2) In case of discrepancy between unit price and extended price, the unit price will govern;

(3) Apparent errors in extension of unit prices will be corrected; and

(4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purpose of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

2. If a modification to a bid based on unit prices is submitted, which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the bid schedule must be stated. If it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the bid schedule.

3. Bidders must bid on all items.

4. Costs attributable to Division 01 - General Requirements are assumed to be prorated among bid items listed.

5. Responders are advised that this requirement may be delayed, cancelled or revised at any time during the solicitation, selection, evaluation, negotiation and/or final award process based on decisions related to DOD changes in force structure and disposition of the Armed Forces.

6. For the purpose of this solicitation, the word "item" shall be considered to mean "schedule" as used in Provision 52.214-0019, CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION, in Section 00100 INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS.

BIDDING SCHEDULE(cont)

NOTES (cont)

(Am#2) 7. Payment items for the work of this Contract for which contract Unit Price payments will be made are listed in the BIDDING SCHEDULE and described below. The unit price and payment made for each item listed shall constitute full compensation for all direct and indirect costs, including all labor, materials, equipment, tools, incidentals, and markups necessary to complete the work.

8. EXERCISE OF OPTIONS (SWDR 715-1-1 (16 January 1996))

The Government reserves the right to exercise the option(s) by written notice to the Contractor either singularly or in any combination for up to 90 calendar days after award of the Base Bid without an increase in the Offeror's Bid Price. Completion of added items shall continue at the same schedule as the Base Bid unless otherwise noted in Section 01000 CONSTRUCTION SCHEDULE, paragraph 1 entitled SCHEDULE.

9. ABBREVIATIONS

For the purpose of this solicitation, the units of measure are represented as follows:

a. EA (each)
b. SY (square yards)
c. SF (square feet)
d. LS (lump sum)
e. LF (length in linear feet)

END OF BIDDING SCHEDULE

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13110

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)

11/98

-- End of Section Table of Contents --

SECTION 13110

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)
11/98
AMMENDMENT NO. 0002 & 0003

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 418	(2001) Cast and Wrought Galvanic Zinc Anodes
ASTM B 843	(1993; R 1998) Magnesium Alloy Anodes for Cathodic Protection
ASTM D 1248	(2002) Polyethylene Plastics Extrusion Materials for Wire and Cable

NACE INTERNATIONAL (NACE)

NACE RP0169	(1996) Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE RP0177	(2000) Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems
NACE RP0188	(1999) Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE RP0190	(1995) External Protective Coatings for Joints, Fittings, and Valves on Metallic Underground or Submerged Pipelines and Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA TC 2	(1998) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA WC 5	(1992; Rev 2 1996) Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(1996; Rev thru Nov 2001) Metallic Outlet Boxes
UL 6	(2000) Rigid Metal Conduit

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G

Six copies of detail drawings consisting of a complete list of equipment and material including manufacturer's descriptive and technical literature, catalog cuts, results of system design calculations including soil-resistivity, installation instructions and certified test data stating the maximum recommended anode current output density and the rate of gaseous production if any at that current density. Detail drawings shall contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function properly as a unit.

Contractor's Modifications; G

Six copies of detail drawings showing proposed changes in location, scope of performance indicating any variations from, additions to, or clarifications of contract drawings. The drawings shall show proposed changes in anode arrangement, anode size and number, anode materials and layout details, conduit size, wire size, mounting details, wiring diagram, method for electrically-isolating each pipe, and any other pertinent information to proper installation and performance of the system.

SD-03 Product Data

Equipment; G

Within 30 days after receipt of notice to proceed, an itemized list of equipment and materials including item number, quantity, and manufacturer of each item. The list shall be accompanied by a description of procedures for each type of testing and adjustments, including testing of coating for thickness and holidays. Installation of materials and equipment shall not commence until this submittal is approved.

Spare Parts; G

Spare parts data for each different item of material and equipment specified, after approval of detail drawings and not later than six (6) months prior to the date of beneficial occupancy. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and source of supply. One (1) spare anode of each type shall be furnished.

SD-06 Test Reports

Tests and Measurements; G

Test reports in booklet form tabulating all field tests and measurements performed, upon completion and testing of the installed system and including close interval potential survey, **[AM#3]** _____ interference tests, final system test verifying protection, insulated joint and bond tests, and holiday coating test. A certified test report showing that the connecting method has passed a 120-day laboratory test without failure at the place of connection, wherein the anode is subjected to maximum recommended current output while immersed in a three percent sodium chloride solution.

Contractor's Modifications; G

Final report regarding Contractor's modifications. The report shall include pipe-to-soil measurements throughout the affected area, indicating that the modifications improved the overall conditions, and current measurements for anodes. The following special materials and information are required: taping materials and conductors; zinc grounding cell, installation and testing procedures, and equipment; coating material; system design calculations for anode number, life, and parameters to achieve protective potential; backfill shield material and installation details showing waterproofing; bonding and waterproofing details; insulated resistance wire; exothermic weld equipment and material.

SD-07 Certificates

Cathodic Protection System; G

Proof that the materials and equipment furnished under this section conform to the specified requirements contained in the referenced standards or publications. The label or listing by the specified agency will be acceptable evidence of such compliance.

Services of "Corrosion Expert"; G

Evidence of qualifications of the "corrosion expert."

a. The "corrosion expert's" name and qualifications shall be certified in writing to the Contracting Officer prior to the start of construction.

b. Certification shall be submitted giving the name of the firm, the number of years of experience, and a list of not less than five (5) of the firm's installations three (3) or more years

old that have been tested and found satisfactory.

SD-10 Operation and Maintenance Data

Cathodic Protection System; G

Before final acceptance of the cathodic protection system, six copies of operating manuals outlining the step-by-step procedures required for system startup, operation, adjustment of current flow, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of maintenance manual, listing routine maintenance procedures, recommendation for maintenance testing, possible breakdowns and repairs, and troubleshooting guides. The manuals shall include single-line diagrams for the system as installed; instructions in making pipe-to-reference cell and tank-to-reference cell potential measurements and frequency of monitoring; instructions for dielectric connections, interference and sacrificial anode bonds; instructions shall include precautions to ensure safe conditions during repair of pipe or other metallic systems. The instructions shall be neatly bound between permanent covers and titled "Operating and Maintenance Instructions." These instructions shall be submitted for the Contracting Officer's approval. The instructions shall include the following:

a. As-built drawings, to scale of the entire system, showing the locations of the piping, location of all anodes and test stations, locations of all insulating joints, and structure-to-reference cell potentials as measured during the tests required by Paragraph: TESTS AND MEASUREMENTS, of this section.

b. Recommendations for maintenance testing, including instructions in making pipe-to-reference cell potential measurements and frequency of testing.

c. All maintenance and operating instructions and nameplate data shall be in English.

d. Instructions shall include precautions to insure safe conditions during repair of pipe system.

Training Course; G

The proposed Training Course Curriculum (including topics and dates of discussion) indicating that all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations, including testing procedures included in the maintenance instructions, are to be covered.

1.3 GENERAL REQUIREMENTS

The Contractor shall furnish and install a complete, operating, sacrificial anode cathodic protection system in complete compliance with NFPA 70, with all applicable Federal, State, and local regulations and with minimum requirements of this contract. The services required include planning,

installation, adjusting and testing of a cathodic protection system, using sacrificial anodes for cathodic protection of the encasement pipes. The cathodic protection system shall include anodes, cables, connectors, corrosion protection test stations, and any other equipment required for a complete operating system providing the NACE criteria of protection as specified. Insulators are required whenever needed to insulate the pipes from any other structure. Any pipe crossing the encasement pipe shall have a test station. The cathodic protection shall be provided on encasement pipes.

1.3.1 Services of "Corrosion Expert"

The Contractor shall obtain the services of a "corrosion expert" to supervise, inspect, and test the installation and performance of the cathodic protection system. "Corrosion expert" refers to a person, who by thorough knowledge of the physical sciences and the principles of engineering and mathematics, acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control of buried or submerged metallic surfaces. Such a person must be accredited or certified by the National Association of Corrosion Engineers (NACE) as a NACE Accredited Corrosion Specialist or a NACE certified Cathodic Protection (CP) Specialist or be a registered professional engineer who has certification or licensing that includes education and experience in corrosion control of buried or submerged metallic piping and tank systems, if such certification or licensing includes 5 years experience in corrosion control on underground metallic surfaces of the type under this contract. The "corrosion expert" shall make at least 3 visits to the project site. The first of these visits shall include obtaining soil resistivity data, acknowledging the type of pipeline coatings to be used and reporting to the Contractor the type of cathodic protection required. Once the submittals are approved and the materials delivered, the "corrosion expert" shall revisit the site the ensure the Contractor understands installation practices and laying out the components. The third visit shall involve testing the installed cathodic protection systems and training applicable personnel on proper maintenance techniques. The "corrosion expert" shall supervise installation and testing of all cathodic protection.

1.3.2 Contractor's Modifications

The specified system is based on a complete system with magnesium sacrificial anodes. The Contractor may modify the cathodic protection system after review of the project, site verification, and analysis, if the proposed modifications include the anodes specified and will provide better overall system performance. The modifications shall be fully described, shall be approved by the Contracting Officer's representative, and shall meet the following criteria. The proposed system shall achieve a minimum pipe-to-soil "instant off" potential of minus 850 millivolts with reference to a saturated copper-copper sulfate reference cell on the underground components of the piping or other metallic surface. The Contractor shall take resistivity measurements of the soil in the vicinity of the pipes and ground bed sites. Based upon the measurements taken, the current and voltage shall be required to produce a minimum of minus 850 millivolts "instant off" potential between the structure being tested and the reference cell. This potential shall be obtained over 95 percent of the metallic area. The anode system shall be designed for a life of twenty-five (25) years of continuous operation.

1.3.3 Isolators

Isolators are required to insulate the indicated pipes from any other structure. Isolators shall be provided with lightning protection and a test station as shown.

1.3.4 Anode and Bond Wires

Provide magnesium anodes in the quantity and sizes necessary to achieve full protection over a 30-year life span. A minimum of 2 test stations per encasement shall be used for these anodes. For each cathodic system, the metallic components and structures to be protected shall be made electrically continuous. This shall be accomplished by installing bond wires between the various structures. Bonding of existing buried structures may also be required to preclude detrimental stray current effects and safety hazards. Provisions shall be included to return stray current to its source without damaging structures intercepting the stray current. The electrical isolation of underground facilities in accordance with acceptable industry practice shall be included under this section. All tests shall be witnessed by the Contracting Officer.

1.3.5 Surge Protection

Approved zinc grounding cells or sealed weatherproof lightning arrestor devices shall be installed across insulated flanges or fittings installed in underground piping as indicated on the drawings. The arrestor shall be gapless, self-healing, solid state type. Zinc anode composition shall conform to ASTM B 418, Type II. Lead wires shall be number 6 AWG copper with high molecular weight polyethylene (HMWPE) insulation. The zinc grounding cells shall not be prepackaged in backfill but shall be installed as detailed on the drawings. Lightning arrestors or zinc grounding cells are not required for insulated flanges on metallic components used on nonmetallic piping systems.

1.3.6 Summary of Services Required

The scope of services shall include, but shall not be limited to, the following:

a. Close-interval potential surveys.

b. Cathodic Protection Systems.

c. System testing.

[AM#3] d. (_____.).

e. Interference testing.

f. Training.

g. Operating and maintenance manual.

h. Insulator testing and bonding testing.

i. Coating and holiday testing shall be submitted within 45 days of notice to proceed.

1.3.7 Nonmetallic Pipe System

In the event pipe other than metallic pipe is approved and used in lieu of metallic pipe, all metallic components of this pipe system shall be protected with cathodic protection. Detailed drawings of cathodic protection for each component shall be submitted to the Contracting Officer for approval within 45 days after date of receipt of notice to proceed, and before commencement of any work.

1.3.7.1 Coatings

Coatings for metallic components shall be as required for metallic fittings. Protective covering (coating and taping) shall be completed and tested on each metallic component (such as valves, hydrants and fillings). This covering shall be as required for underground metallic pipe. Each test shall be witnessed by the Contracting Officer. Coatings shall be selected, applied, and inspected in accordance with NACE RP0190 and as specified in these specifications. The use of nonmetallic pipe does not change other requirements of the specifications. Any deviations due to the use of nonmetallic pipe shall be submitted for approval.

1.3.7.2 Tracer Wire

When a nonmetallic pipe line is used to extend or add to an existing metallic line, an insulated No. 8 AWG copper wire shall be thermit-welded to the existing metallic line and run the length of the new nonmetallic line. This wire shall be used as a locator tracer wire and to maintain continuity to any future extensions of the pipe line.

1.3.8 Tests of Components

A minimum of four (4) tests shall be made at each metallic component in the piping system. Two (2) measurements shall be made directly over the anodes and the other two (2) tests shall be over the outer edge of the component, but at the farthest point from the anodes. Structure and pipes shall be shown with the cathodic protection equipment. All components of the cathodic protection system shall be shown on drawings, showing their relationship to the protected structure or component. A narrative shall describe how the cathodic protection system will work and provide testing at each component. Components requiring cathodic protection shall include but not be limited to the following:

a. **[AM#3]** (_____.).

b. PIV.**[AM#4]**

c. Shutoff valves.**[AM#4]**

d. Metallic pipe extended from aboveground locations.**[AM#4]**

e. **[AM#2]** (_____.)

f. Any metallic pipe component or section.**[AM#4]**

g. **[AM#2]** (_____.)

h. **[AM#2]** (_____.)

1.3.9 Drawings

Detailed drawings shall be provided showing location of anodes, insulated

fittings, test stations, permanent reference cells, and bonding. Locations shall be referenced to two (2) permanent facilities or mark points.

1.3.10 Electrical Potential Measurements

All potential tests shall be made at a minimum of 10 foot intervals witnessed by the Contracting Officer. Submittals shall identify test locations on separate drawing, showing all metal to be protected and all cathodic protection equipment. Test points equipment and protected metal shall be easily distinguished and identified.

1.3.11 Achievement of Criteria for Protection

All conductors, unless otherwise shown, shall be routed to or through the test stations. Each system provided shall achieve a minimum pipe-to-soil "instant off" potential of minus 850 millivolt potentials with reference to a saturated copper-copper-sulfate reference cell on all underground components of the piping. Based upon the measurements taken, the current and voltage of the anodes should be adjusted as required to produce a minimum of minus 850 millivolts "instant off" potential between the structure being tested and the reference cell. This potential should be obtained over 95 percent of the metallic area. This must be achieved without the "instant off" potential exceeding 1150 millivolts. Testing will be witnessed by the Contracting Officer. Additional anodes shall be provided by the Contractor if required to achieve the minus 850 millivolts "instant off". Although acceptance criteria of the cathodic protection systems are defined in NACE RP0169, for this project the "instant off" potential of minus 850 millivolts is the only acceptable criteria.

1.3.12 Metallic Components and Typicals

a. Metallic components: As a minimum, each metallic component shall be protected with two (2) magnesium anodes. This number of anodes is required to achieve minus 850 millivolts "instant off" potential on the metallic area and at the same time not provide overvoltage above 1150 millivolts "instant off." As a minimum, the magnesium anode unpackaged weight shall be 9 pounds. The magnesium anodes shall be located on each side of the metallic component and routed through a test station.

a. Metallic Pipe Component or Section: Each section of metallic pipe shall be protected with at least 2 magnesium anodes. The magnesium anodes shall have an unpackaged weight of at least 9 pounds.

b. Connectors or Change-of-Direction Devices: Each change-of-direction device shall be protected with 2 magnesium anodes. The magnesium anode shall have an unpackaged weight of 9 pounds.

1.3.13 Metallic Component Coating

Coatings for metallic components shall be as required for metallic fittings as indicated. This will include fire hydrants, T's, elbows, valves, etc. Coatings shall be selected, applied, and inspected in accordance with NACE RP0190 and as specified in these specifications.

PART 2 PRODUCTS

2.1 MAGNESIUM ANODES

A minimum of 2 anodes shall be installed on the encasement.

2.1.1 Anode Composition

Anodes shall be of high-potential magnesium alloy, made of primary magnesium obtained from sea water or brine, and not made from scrap metal. Magnesium anodes shall conform to ASTM B 843 and to the following analysis (in percents) otherwise indicated:

Aluminum, max.	0.010
Manganese, max.	0.50 to 1.30
Zinc	0.05
Silicon, max.	0.05
Copper, max.	0.02
Nickel, max.	0.001
Iron, Max.	0.03
Other impurities, max.	0.05 each or 0.3 max. total
Magnesium	Remainder

The Contractor shall furnish spectrographic analysis on samples from each heat or batch of anodes used on this project.

2.1.2 Dimensions and Weights

Dimensions and weights of anodes shall be approximately as follows:

TYPICAL MAGNESIUM ANODE SIZE

(Cross sections may be round, square, or D shaped)

NOMINAL WT. LBS.	APPROX. SIZE (IN)	NOMINAL GROSS WT lb PACKAGED IN BACKFILL	NOMINAL PACKAGE DIMENSIONS (IN)
3	3 X 3 X 5	8	5-1/4 X 5-1/4 X 8
5	3 X 3 X 8	13	5-1/4 X 5-1/4 X 11-1/4
9	3 X 3 X 14	27	5-1/4 X 20
12	4 X 4 X 12	32	7-1/2 X 18
17	4 X 4 X 17	45	7-1/2 X 24
32	5 X 5 X 20-1/2	68	8-1/2 X 28
50	7 X 7 X 16	100	10 X 24

2.1.3 Packaged Anodes

Anodes shall be provided in packaged form with the anode surrounded by specially-prepared quick-wetting backfill and contained in a water permeable cloth or paper sack. Anodes shall be centered by means of spacers in the backfill material. The backfill material shall have the following composition, unless otherwise indicated:

Material	Approximate Percent by Weight
Gypsum	75
Bentonite	20
Sodium Sulphate	5
Total	100

2.1.4 Zinc Anodes

Zinc anodes shall conform to ASTM B 418, Type II.

2.1.5 Connecting Wire

2.1.5.1 Wire Requirements

Wire shall be No. 10 AWG solid copper wire, not less than 10 feet long, unspliced, complying with NFPA 70, Type RHH insulation. Connecting wires for magnesium anodes shall be factory installed with the place or emergence from the anode in a cavity sealed flush with a dielectric sealing compound. Connecting wires for zinc anodes shall be factory installed with the place of connection to the protruding steel core completely sealed with a dielectric material.

2.1.5.2 Anode Header Cable

Cable for anode header and distribution shall be No. 6 AWG stranded copper wire with type CP high molecular weight polyethylene, 7/64 inch thick insulation, 600-volt rating, in accordance with NEMA WC 5.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Electrical Wire

Wire shall be No. 10 AWG stranded copper wire with NFPA 70, Type RHW-USE insulation. Polyethylene insulation shall comply with the requirements of ASTM D 1248 and shall be of the following types, classes, and grades:

High-molecular weight polyethylene shall be Type I, Class C, Grade E5.

High-density polyethylene shall be Type III, Class C, Grade E3.

2.2.1.1 Wire Splicing

Connecting wire splicing shall be made with copper compression connectors or exothermic welds, following instructions of the manufacturer. Single split-bolt connections shall not be used. Sheaths for encapsulating electrical wire splices to be buried underground shall fit the insulated wires entering the spliced joints and epoxy potting compound shall be as specified below.

2.2.1.2 Test Wires

Test wires shall be AWG No. 12 stranded copper wire with NFPA 70, Type TW or RHW or polyethylene insulation.

2.2.1.3 Resistance Wire

Resistance wire shall be AWG No. 16 or No. 22 nickel-chromium wire.

2.2.2 Conduit

Rigid galvanized steel conduit and accessories shall conform to UL 6. Non metallic conduit shall conform to NEMA TC 2.

2.2.3 Test Boxes and Junctions Boxes

Boxes shall be outdoor type conforming to UL 514A.

2.2.4 Joint, Patch, Seal, and Repair Coating

Sealing and dielectric compound shall be a black, rubber based compound that is soft, permanently pliable, tacky, moldable, and unbacked. Compound shall be applied as recommended by the manufacturer, but not less than 1/2-inch thick. Coating compound shall be hot-applied coal-tar enamel. Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

2.2.5 Backfill Shields

Shields shall consist of approved pipeline wrapping or fiberglass-reinforced, coal-tar impregnated tape, or plastic weld caps, specifically made for the purpose and installed in accordance with the manufacturer's recommendations. When joint bonds are required, due to the use of mechanical joints, the entire joint shall be protected by the use of a kraft paper joint cover. The joint cover shall be filled with poured-in, hot coat-tar enamel.

2.2.6 Epoxy Potting Compound

Compound for encapsulating electrical wire splices to be buried underground shall be a two package system made for the purpose.

2.2.7 Test Stations

Stations shall be of the flush-curb-box type and shall be the standard product of a recognized manufacturer. Test stations shall be complete with an insulated terminal block having the required number of terminals. The test station shall be provided with a lockable over and shall have an embossed legend, "C.P. Test." A minimum of one (1) test station shall be provided each component of the encasement. A minimum of six (6) terminals shall be provided in each test station. A minimum of two (2) leads are required to the metallic pipe from each test station. Other conductors shall be provided for each anode, other foreign pipe, and reference cells as required.

2.2.8 Joint and Continuity Bonds

Bonds shall be provided across all joints in the metallic encasement lines, across any electrically discontinuous connections and all other pipes and structures with other than welded or threaded joints that are included in this cathodic protection system. Unless otherwise specified in the specifications, bonds between structures and across joints in pipe with other than welded or threaded joints shall be No. 8 AWG stranded copper cable with polyethylene insulation. Bonds between structures shall contain sufficient slack for any anticipated movement between structures. Bonds across pipe joints shall contain a minimum of 4 inches of slack to allow for pipe movement and soil stress. Bonds shall be attached by exothermic welding. Exothermic weld areas shall be insulated with coating compound and approved, and witnessed by the Contracting Officer. Continuity bonds shall be installed as necessary to reduce stray current interference. Additional joint bondings shall be accomplished by the Contractor where the necessity is discovered during construction or testing or where the Contracting Officer's representative directs that such bonding be done. Joint bonding shall include all associated excavation and backfilling. There shall be a minimum of two (2) continuity bonds between each structure and other than welded or threaded joints. The Contractor shall test for electrical continuity across all joints with other than welded or threaded

joints and across all metallic portions or components. The Contractor shall provide bonding as required and as specified above until electrical continuity is achieved. Bonding test data shall be submitted for approval.

2.2.9 Resistance Bonds

Resistance bonds should be adjusted as outlined in this specification. Alternate methods may be used if they are approved by the Contracting Officer.

2.2.10 Stray Current Measurements

Stray current measurements should be performed at each test station. Stray currents resulting from lightning or overhead alternating current (AC) power transmission systems shall be mitigated in accordance with NACE RP0177.

2.2.11 Resistance Wire

Wire shall be No. 16 or No. 22 nickel-chromium wire with TW insulation.

2.2.12 Electrical Connections

Electrical connections shall be done as follows:

a. Exothermic welds shall be "Cadweld"," Bundy", "Thermoweld" or an approved equal. Use of this material shall be in strict accordance with the manufacturer's recommendations.

b. Electrical-shielded arc welds shall be approved for use on steel pipe by shop drawing submittal action.

c. Brazing shall be as specified in Paragraph: Lead Wire Connections.

2.2.13 Electrical Tape

Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

2.2.14 Permanent Reference Electrodes

Permanent reference electrodes shall be Cu-CuS04 electrodes suitable for direct burial. Electrodes shall be guaranteed by the supplier for 15 years' service in the environment in which they shall be placed. Electrodes shall be installed directly beneath pipe, or metallic component.

2.2.15 **[AM#3] DELETED**

PART 3 EXECUTION

3.1 CRITERIA OF PROTECTION

Acceptance criteria for determining the adequacy of protection on a buried underground metallic component shall be in accordance with NACE RP0169 and as specified below.

3.1.1 Iron and Steel

The following method (a) shall be used for testing cathodic protection

voltages. If more than one method is required, method (b) shall be used.

a. A negative voltage of at least minus 850 millivolts as measured between the underground component and a saturated copper-copper sulphate reference electrode connecting the earth (electrolyte) directly over the underground component. Determination of this voltage shall be made with the cathodic protection system in operation. Voltage drops shall be considered for valid interpretation of this voltage measurement. A minimum of minus 850 millivolts "instant off" potential between the underground component being tested and the reference cell shall be achieved over 95 percent of the area of the structure. Adequate number of measurements shall be obtained over the entire structure, pipe, tank, or other metallic component to verify and record achievement of minus 850 millivolts "instant off." This potential shall be obtained over 95 percent of the total metallic area without the "instant off" potential exceeding 1200 millivolts.

b. A minimum polarization voltage shift of 100 millivolts as measured between the underground component and a saturated copper-copper sulphate reference electrode contacting the earth directly over the underground component. This polarization voltage shift shall be determined by interrupting the protective current and measuring the polarization decay. When the protective current is interrupted, an immediate voltage shift will occur. The voltage reading, after the immediate shift, shall be used as the base reading from which to measure polarization decay. Measurements achieving 100 millivolts decay shall be made over 95 percent of the metallic surface being protected.

c. For any metallic component, a minimum of four (4) measurements shall be made using subparagraph (a), above, and achieving the "instant off" potential of minus 850 millivolts. Two (2) measurements shall be made over the anodes and two (2) measurements shall be made at different locations near the component and farthest away from the anode.

3.1.2 **[AM#2] DELETED**

3.1.3 **[AM#2] DELETED**

3.2 ANODE STORAGE AND INSTALLATION

3.2.1 Anode Storage

Storage area for magnesium anodes will be designated by the Contracting Officer. If anodes are not stored in a building, tarps or similar protection should be used to protect anodes from inclement weather. Packaged anodes, damaged as a result of improper handling or being exposed to rain, shall be resacked by the Contractor and the required backfill added.

3.2.2 Anode Installation

Unless otherwise authorized, installation shall not proceed without the presence of the Contracting Officer. Anodes of the size specified shall be installed to the depth indicated and at the locations shown. Locations may be changed to clear obstructions with the approval of the Contracting Officer. Anodes shall be installed in sufficient number and of the required type, size, and spacing to obtain a uniform current distribution over the surface of the structure. The anode system shall e designed for a life of 25 years of continuous operation. Anodes shall be installed as indicated in a dry condition after any plastic or waterproof protective

covering has been completely removed from the water permeable, permanent container housing the anode metal. The anode connecting wire shall not be used for lowering the anode into the hole. The annular space around the anode shall be backfilled with fine earth in 6 inch layers and each layer shall be hand tamped. Care must be exercised not to strike the anode or connecting wire with the tamper. Approximately 5 gallonsof water shall be applied to each filled hole after anode backfilling and tamping has been completed to a point about 6inches above the anode. After the water has been absorbed by the earth, backfilling shall be completed to the ground surface level.

3.2.2.1 Single Anodes

Single anodes shall be connected through a test station to the pipeline, allowing adequate slack in the connecting wire to compensate for movement during backfill operation.

3.2.2.2 Groups of Anodes

Groups of anodes, in quantity and location shown, shall be connected to an anode header cable. The anode header cable shall make contact with the structure to be protected only through a test station. Anode lead connection to the anode header cable shall be made by an approved crimp connector or exothermic weld and splice mold kit with appropriate potting compound.

3.2.2.3 Welding Methods

Connections to ferrous pipe shall be made by exothermic weld methods manufactured for the type of pipe supplied. Electric arc welded connections and other types of welded connections to ferrous pipe and structures shall be approved before use.

3.2.3 Anode Placement - General

Packaged anodes shall be installed completely dry, and shall be lowered into holes by rope sling or by grasping the cloth gather. The anode lead wire shall not be used in lowering the anodes. The hole shall be backfilled with fine soil in 6inch layers and each layer shall be hand-tamped around the anode. Care must be exercised not to strike the anode or lead wire with the tamper. If immediate testing is to be performed, water shall be added only after backfilling and tamping has been completed to a point 6 inches above the anode. Approximately 2 gallons of water may be poured into the hole. After the water has been absorbed by the soil, backfilling and tamping may be completed to the top of the hole. Anodes shall be installed as specified or shown. In the event a rock strata is encountered prior to achieving specified augered-hole depth, anodes may be installed horizontally to a depth at least as deep as the bottom of the pipe, with the approval of the Contracting Officer.

3.2.4 Underground Pipeline

Anodes shall be installed at a minimum of 8 feet and a maximum of 10 feet from the line to be protected.

3.2.5 Installation Details

Details shall conform to the requirements of this specification. Details shown on the drawings are indicative of the general type of material required, and are not intended to restrict selection to material of any particular manufacturer.

3.2.6 Lead Wire Connections

3.2.6.1 Underground Pipeline (Metallic)

To facilitate periodic electrical measurements during the life of the sacrificial anode system and to reduce the output current of the anodes, if required, all anode lead wires shall be connected to a test station and buried a minimum of 24 inches in depth. The cable shall be No. 10 AWG, stranded copper, polyethylene or RHW-USE insulated cable. The cable shall make contact with the structure only through a test station. Resistance wire shall be installed between the cable and the pipe cable, in the test station, to reduce the current output, if required. Anode connections, except in the test station, shall be made with exothermic welding process, and shall be insulated by means of at least three (3) layers of electrical tape; and all lead wire connections shall be installed in a moistureproof splice mold kit and filled with epoxy resin. Lead wire-to-structure connections shall be accomplished by an exothermic welding process. All welds shall be in accordance with the manufacturer's recommendations. A backfill shield filled with a pipeline mastic sealant or material compatible with the coating shall be placed over the weld connection and shall be of such diameter as to cover the exposed metal adequately.

3.2.6.2 Resistance Wire Splices

Resistance wire connections shall be accomplished with silver solder and the solder joints wrapped with a minimum of three (3) layers of pressure-sensitive tape. Lead wire connections shall be installed in a moistureproof splice mold kit and filled with epoxy resin.

3.2.7 Location of Test Stations

Test stations shall be curb box mounted. Buried insulating joints shall be provided with test wire connections brought to a test station. Unless otherwise shown, other test stations shall be located as follows:

a. At 1,000-foot intervals or less.

b. Where the pipe or conduit crosses any other metal pipe.

c. **[AM#3] DELETED**.

d. Where both sides of an insulating joint are not accessible above ground for testing purposes.

3.2.8 Underground Pipe Joint Bonds

Underground pipe having other than welded or threaded coupling joints shall be made electrically continuous by means of a bonding connection installed across the joint.

3.3 ELECTRICAL ISOLATION OF STRUCTURES

3.3.1 Isolation Joints and Fittings

Isolating fittings, including main line isolating flanges and couplings, shall be installed aboveground, or within manholes, wherever possible. Where isolating joints must be covered with soil, they shall be fitted with a paper joint cover specifically manufactured for covering the particular joint, and the space within the cover filled with hot coal-tar enamel. Isolating fittings in lines entering buildings shall be located at least 12 inches above grade of floor level, when possible. Isolating joints shall be provided with grounding cells to protect against over-voltage surges or approved surge protection devices. The cells shall provide a low resistance across isolating joint without excessive loss of cathodic current.

3.3.2 **[AM#2] DELETED**

3.4 TRENCHING AND BACKFILLING

Trenching and backfilling shall be in accordance with Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEMS.

3.5 TESTS AND MEASUREMENTS

3.5.1 Baseline Potentials

Each test and measurement will be witnessed by the Contracting Officer. The Contractor shall notify the Contracting Officer a minimum of five (5) working days prior to each test. After backfill of the pipe, the static potential-to-soil of the pipe shall be measured. The locations of these measurements shall be identical to the locations specified for pipe-to-reference electrode potential measurements. The initial measurements shall be recorded.

3.5.2 Isolation Testing

Before the anode system is connected to the pipe, an isolation test shall be made at each isolating joint or fitting. This test shall demonstrate that no metallic contact, or short circuit exists between the two isolated sections of the pipe. Any isolating fittings installed and found to be defective shall be reported to the Contracting Officer.

3.5.2.1 Insulation Checker

A Model 601 insulation checker, as manufactured by "Gas Electronics", or an approved equal, using the continuity check circuit, shall be used for isolating joint (flange) electrical testing. Testing shall conform to the manufacturer's operating instructions. Test shall be witnessed by the Contracting Officer. An isolating joint that is good will read full scale on the meter. If an isolating joint is shorted, the meter pointer will be deflected or near zero on the meter scale. Location of the fault shall be determined from the instructions, and the joint shall be repaired. If an isolating joint is located inside a vault, the pipe shall be sleeved with insulator when entering and leaving the vault.

3.5.2.2 Cathodic Protection Meter

A Model B3A2 cathodic protection meter, as manufactured by "M.C. Miller", or an approved equal, using the continuity check circuit, shall be used for isolating joint (flange) electrical testing. This test shall be performed in addition to the Model 601 insulation checker. Continuity is checked across the isolation joint after the test lead wire is shorted together and

the meter adjusted to scale. A full-scale deflection indicates the system is shorted at some location. The Model 601 verifies that the particular insulation under test is good and the Model B3A2 verifies that the system is isolated. If the system is shorted, further testing shall be performed to isolate the location of the short.

3.5.3 Anode Output

As the anodes or groups of anodes are connected to the pipe, current output shall be measured with an approved clamp-on milliammeter, calibrated shunt with a suitable millivoltmeter or multimeter, or a low resistance ammeter. (Of the three methods, the low-resistance ammeter is the least desirable and most inaccurate. The clamp-on milliammeter is the most accurate.) The valves obtained and the date, time, and location shall be recorded.

3.5.4 Reference Electrode Potential Measurements

Upon completion of the installation and with the entire cathodic protection system in operation, electrode potential measurements shall be made using a copper-copper sulphate reference electrode and a potentiometer-voltmeter, or a direct-current voltmeter having an internal resistance (sensitivity) of not less than 10 megohms per volt and a full scale of 10 volts. The locations of these measurements shall be identical to the locations used for baseline potentials. The values obtained and the date, time, and locations of measurements shall be recorded. No less than eight (8) measurements shall be made over any length of line or component. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line.

3.5.5 Location of Measurements

3.5.5.1 Piping or Conduit

For coated piping or conduit, measurements shall be taken from the reference electrode located in contact with the earth, directly over the pipe. Connection to the pipe shall be made at service risers, valves, test leads, or by other means suitable for test purposes. Pipe-to-soil potential measurements shall be made at intervals not exceeding 5 feet. The Contractor may use a continuous pipe-to-soil potential profile in lieu of 5 foot interval pipe-to-soil potential measurements. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line adjacent to the riser. Potentials shall be plotted versus distance to an approved scale. Locations where potentials do not meet or exceed the criteria shall be identified and reported to the Contracting Officer's representative.

3.5.5.2 **[AM#2] DELETED**

3.5.5.3 **[AM#3] DELETED**

3.5.5.4 Interference Testing

Before final acceptance of the installation, interference tests shall be made with respect to any foreign pipes in cooperation with the owner of the foreign pipes. A full report of the tests giving all details shall be made. Stray current measurements shall be performed at all isolating locations and at locations where the new pipeline crosses foreign metallic pipes. The method of measurements and locations of measurements shall be submitted for approval. As a minimum, stray current measurements shall be

performed at the following locations:

a. Connection point of new pipeline to existing pipeline.

b. Crossing points of new pipeline with existing lines.

Results of stray current measurements shall also be submitted for approval.

3.5.5.5 Holiday Test

Any damage to the protective covering during transit and handling shall be repaired before installation. After field-coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current in accordance with NACE RP0188 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. Holidays in the protective covering shall be repaired upon detection. Occasional checks of holiday detector potential will be made by the Contracting Officer to determine suitability of the detector. Labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor. The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

3.5.5.6 Recording Measurements

All pipe-to-soil potential measurements, including initial potentials where required, shall be recorded. The Contractor shall locate, correct and report to the Contracting Officer any short circuits to foreign pipes encountered during checkout of the installed cathodic protection system. Pipe-to-soil potential measurements shall be taken on as many pipes as necessary to determine the extent of protection or to locate short-circuits.

3.6 TRAINING COURSE

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations, including testing procedures included in the maintenance instructions. At least 14 days prior to date of proposed conduction of the training course, the training course curriculum shall be submitted for approval, along with the proposed training date. Training shall consist of demonstration of test equipment, providing forms for test data and the tolerances which indicate that the system works.

3.7 CLEANUP

The Contractor shall be responsible for cleanup of the construction site. All paper bags, wire clippings, etc., shall be disposed of as directed. Paper bags, wire clippings and other waste shall not be put in bell holes or anodes excavation.

3.8 MISCELLANEOUS INSTALLATION AND TESTING

3.8.1 Coatings

All aboveground pipeline shall be coated as indicated or as approved. The

coating shall have a minimum thickness of 7 mil. The pipeline coating shall be in accordance with all applicable Federal, State, and local regulations.

3.8.2 Excavation

In the event rock is encountered in providing the required depth for anodes, the Contractor shall determine an alternate approved location and, if the depth is still not provided, an alternate plan shall be submitted to the Contracting Officer. Alternate techniques and depths must be approved prior to implementation.

3.9 SPARE PARTS

After approval of shop drawings, and not later than three (3) months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and source of supply. In addition, the Contractor shall supply information for material and equipment replacement for all other components of the complete system, including anodes, cables, splice kits and connectors, corrosion test stations, and any other components not listed above.

3.10 **[AM#2] DELETED**

3.11 SYSTEM TESTING

The Contractor shall submit a report including potential measurements taken at adequately-close intervals to establish that minus 850 millivolts potential, "instant-off" potential, is provided, and that the cathodic protection is not providing interference to other foreign pipes causing damage to paint or pipes. The report shall provide a narrative describing how the criteria of protection is achieved without damaging other pipe or structures in the area.

3.12 **[AM#2] DELETED**

-- End of Section --