AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
	1		41

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicable)*
0001	08/30/2012	4200415466	EDM-11697

6. ISSUED BY CODE

NASA DRYDEN FLIGHT RESEARCH CENTER
P.O. BOX 273 M/S D-1442 ZMW
EDWARDS, CA 93523-0273

7. ADMINISTERED BY *(If other than Item 6)* CODE

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*

CODE FACILITY CODE

(X) 9A. AMENDMENT OF SOLICITATION NO. NND12415466E

☒ 9B. DATED *(SEE ITEM 11)* 08/30/2012

☐ 10A. MODIFICATION OF CONTRACT/ORDER NO.

10B. DATED *(SEE ITEM 13)*

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.)*

1. Questions and Answers are incorporated into this contract, Pages 1-6.

2. Remove SF 1442 and replace with the attached revised SF 1442. THE BID DUE DATE IS CHANGED FROM 3:00PM LOCAL TIME ON SEPTEMBER 5, 2012 TO 3:00PM LOCAL TIME ON SEPTEMBER 7, 2012. Period of Performance in Block 11 is changed from 340 days to 430 days.

CONTINUED ON NEXT PAGE

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

3. Clause B.1, LINE ITEM DESCRIPTION (pages 3 and 4), has been deleted and replaced with the attached revised B.1 (pages 3 and 4). Options #1 and #2 have been deleted from the contract. Option #4 has been revised. Option #5 has been added to B.1.

4. Section F, page 8, has been deleted and replaced with the attached revised Section F, page 8. Period of Performance is changed from 340 days to 430 days.

5. Clause J.1, LIST OF ATTACHMENTS (pages 40 and 41) has been deleted and replaced with the attached revised Clause J.1, LIST OF ATTACHMENTS.

6. In the Specifications, Section 01 11 00, SUMMARY OF WORK, pages 1 and 2 have been deleted and replaced with the attached revised Section 01 11 00, SUMMARY OF WORK, pages 1 and 2. Options #1 and #2 have been deleted from the contract. Option #4 has been revised and Option #5 has been added into Section 01 11 00, SUMMARY OF WORK.

7. In the Specifications, Section 01 11 00, SUMMARY OF WORK, page 3 has been deleted and replaced with the attached revised Section 01 11 00, SUMMARY OF WORK, page 3. Period of Performance has been changed from 340 days to 430 days.

8. In the Specifications, SECTION 26 42 15.00 10, CATHODIC PROTECTION SYSTEM (STEEL WATER TANKS), has been incorporated into the contract.

9. Facility Support Center Drawings T-2, C-10, C-11, and C12 have been deleted and replaced with the attached revised drawings T-2, C-10, C-11, and C12.

10. DWK 808-8, DFRC Excavation and Digging Permit, has been incorporated into the contract as Attachment 7.

11. Sketch SK-1 has been incorporated into the contract as Attachment 8.

12. FY11 & FY12 CoF Projects Map has been incorporated into the contract as Attachment 9.

13. DFRC Boring Log (dated 12/17/09), DFRC Soil Borings Map, and Soil Survey of Edwards Air Force Base California (dated July, 1989) has been incorporated into the contract as Attachment 10.

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FY12 REPAIR CENTER-WIDE FIRE MAINS
RFI Responses

RFI # 1: Are there any specific NASA requirements when digging around existing utilities? Or does potholing suffice?

NASA Response: *Reference Specification Section 31 23 00.20 20, 1.5 CRITERIA FOR BIDDING, g. – "Ground penetrating radar and pot-holing shall be required to locate existing utilities. A map of existing utilities will be provided to the Contractor."*

Additionally, a digging permit will be required Specification Section 01 35 14.11 40, 1.17.1 Excavation and Digging for all excavation inside the DFRC lease line. See attached form DWK-808-8. The NASA Facility Project Manager (FPM) shall coordinate the Air Force digging permit for work outside the DFRC lease line.

RFI # 2: Air relief valves, does not appear to be any on drawings yet there are locations that should have them. Should we figure in an allowance for certain amount determined by NASA.

NASA Response: *Provide an allowance for the placement of 20 air relief valves.*

RFI # 3: Will each phase that contains fire alarm work need to be completed with a contractors test, a test with NASA Fire Marshall and a 10% test for the base before the next phase begins?

NASA Response: *Yes.*

RFI # 4: In Bld 4853 does the existing Fire Alarm Control Panel (FACP) to be removed have any fire alarm devices connected to it that will now need to be connected to the 4100 Simplex 4100 FACP that will remain? The FACP to be removed was not installed by Simplex Grinnell and was never connected to the base Fire Alarm System, so do we have accurate information about it?

NASA Response: *The existing Simplex 4100 fire alarm panel is to be upgraded per sheet FA-3. All devices indicated on sheet FA-3 "ITEMS – B4853" shall be connected to this pane, whether new or existing.*

RFI # 5: Drawing FA4, Fire Alarm System Notes #2 indicates "upgrade existing Simplex Fire Alarm Panel located in Bld 4820". I assume this is an error and they mean 4840 as this is the building on the drawings and the rest of the scope of work.

NASA Response: *The work indicated on sheet FA-4 is part of Option #2. Option #2 is being removed from the scope of this project.*

RFI # 6: What type of cathodic protection is required?

NASA Response: *Please the new Specification Section 26 42 15.00 10 CATHODIC PROTECTION SYSTEM (STEEL WATER TANKS)*

RFI # 7: Who will be financially responsible for compaction testing? If the contractor is, then what are location and frequency requirements for compaction testing?

NASA Response: *Reference Specification Section 31 23 00.00 20, 3.12.2 Testing – The Contractor shall be responsible for testing. Please refer to subsections 3.12.2.1, 3.12.2.2 and 3.12.2.3 for location and frequency requirements.*

RFI # 8: Who will be financially responsible for survey services?

NASA Response: *Reference Specification Section 33 11 00, 1.5 GIS Record of Survey Data – The contractor shall be responsible for recording the survey data as specified in this section. Please also see sheet T-2, "ASBUILT GIS SURVEY NOTES".*

RFI # 9: Will the Owner provide an assembly area? And will the Owner provide an assembly area large enough to accommodate a large spoil pile consisting of concrete, dirt, and asphalt.

NASA Response: *An assembly area (or laydown area) will be provided to stockpile materials. An area will be provided to accommodate a large spoil pile, but please refer to Specification Section 31 23 00.00 20, 3.11 DISPOSITION OR SURPLUS MATERIAL. Surplus material will be removed from the site and disposed of in accordance with the requirements of this section prior to the end of the project. Please also reference Specification Section 01 74 19 - CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT for further clarification of requirements.*

RFI #10: Can the contractor stockpile large spoil piles on site and wait for a build up, before transport, as to make export more financially feasible?

NASA Response: *Please see response to RFI #9.*

RFI #11: Please confirm that the contractor can draw from Owners water supply. What are locations and limitations to the use of that water?

NASA Response: *Contractor can draw water from the water filling station located at the Dryden Fuel Station, located directly east of B4852 along Swann Avenue. During testing operations, Contractor can fill new line from existing system fire hydrants if approved by the Contracting Officer. Please note that a Utility Outage would be required in this instance to shut down the site fire pumps.*

RFI #12: Can roads be shut down if vehicular and pedestrian traffic can be safely detoured?

NASA Response: *Contractor can request a road closure, though please note that full traffic control and detour delineation will be required (signage, etc). A road closure is requested through the Utility Outage/Facility Closure Permit process and approval must be obtained prior to the closure (reference Specification Section 01 35 14.11 40 DRYDEN SAFETY REQUIREMENTS, 1.17.3 Utility/Outages Facility Closures).*

RFI #13: Will a formal SWPPP be required for this project?

NASA Response: *Please reference Specification Section 01 35 40.00 20 ENVIRONMENTAL MANAGEMENT PLAN. A contractor provided SWPPP is required as part of the Environmental Management Plan per section 3.1.2 Water Resources.*

RFI #14: What financial responsibilities will the contractor incur if contaminated soil or contaminated products are encountered? Referring to contaminated water plume and the costs associated with disposal to an approved landfill.

NASA Response: *If contaminated soil or products are discovered during performance of the work, the Safety Office (Code SH) and the Contracting Officer shall be immediately notified. Remediation of contaminated soils or products shall be handled on a case by case basis and are not to be considered part of the base bid. For work within the OU6 Plume, please see the Solicitation titled "Guidelines for Excavation Within DFRC GW Plume Boundaries". Vapor monitoring and PPE as indicated in this guideline will be required when excavating within the plume.*

RFI #15: What procedures will subcontractors and suppliers be subjected to before access to base / project site is authorized?

NASA Response: *Please reference Specification Section 01 14 00 WORK RESTRICTIONS, 1.2.1.3 Identification Badges, and Attachment 2 of the Solicitation for access requirements.*

RFI #16: Are all proposed abandoned pipes to be abandoned in place using either a plug or cap.

NASA Response: *Yes.*

RFI #17: Can the owner please provide existing asphalt and concrete thickness where pipeline will be traveling?

NASA Response: *Concrete thickness is denoted on the plans. Asphalt thickness will range from 4-6" throughout the Center.*

RFI #18: Can owner please provide information on concrete treated base, including submittal or standard? And it is expected that we will encounter such a thing?

NASA Response: *Please see attachment 9, FY11 & FY12 CoF Projects Map, for location where FDR & cement treated base will be encountered. The compressive strength of the*

FDR & cement treated base is 650 psi. Please see attachment 8, Sketch SK-1, for the detail of the cement treated base.

RFI #19: Can Owner please provide locations of where specialized base or asphalt exists and what actions the Owner would like the Contractor to take in replacing?

NASA Response: *Please see response to RFI #18 for locations of specialized base. The patching method will need to be such that differential settling will not occur.*

RFI #20: Is all concrete (including work to be done on tarmac) to be replaced to the nearest joint or is concrete to replaced only to the extents of the trench?

NASA Response: *Concrete will be replaced to the extents of the trench.*

RFI #21: What is the governing specification that is to be followed regarding pipeline installation and testing?

NASA Response: *Reference Specification Section 33 11 00 1.1 REFERENCES. 2010 NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances" and 2005 AWWA C605 "Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water" shall be the govern standards for installation and testing. Should there be a conflict between the standards the stricter requirement shall apply.*

RFI #22: How long can we close down access to the southern side of the hanger located on page C-5?

NASA Response: *A set time period has not been established. A Utility Outage/Facility Closure Permit will be required since the hangar door will not be able to be utilized while this work is completed. The contractor shall propose a time frame during this process requiring approval from the government. The time frame shall reflect every effort to minimize the duration of this closure.*

RFI #23: What permits will be required for boring and jacking on page C-1?

NASA Response: *The Facility Project Manager (FPM) will obtain this permit from the Air Force. The contractor will be responsible for providing the necessary information to the FPM.*

RFI #24: Can owner provide additional information on asphalt replacement requirements? Such as, trench inlay , full depth tee cut, full width overlay, etc.

NASA Response: *The information for asphalt and/or concrete replacement are shown on the following details: Detail 1 on sheet C-13, Detail 2 on sheet C-14, Detail 3 on sheet C-14, Detail 1 on sheet C-15, Detail 2 on sheet C-15, Detail 5 on sheet C-17*

RFI #25: Can Contractor spread water from dewatering, testing, and chlorinating operations (chlorine in water to be neutralized) on site?

NASA Response: *Yes, with prior approval from the Contracting Officer.*

RFI #26: Will Owner want any portion of pipe installation to be disinfected?

NASA Response: *Reference Specification Section 33 11 00 3.1.5 Flushing and Disinfection. The fire water main distribution system is a nonpotable system and does not require disinfection. Connections and/or work to the potable water system will require disinfection in accordance with this section.*

RFI #27: Can owner provide picture of point of entry into building 4840 and of the inside of the building where the work will be performed? 50k tank pipe 20'', 12'', 6'' entry on page C-10"

NASA Response: *The work referenced above is part of Option #2. Option #2 is being removed from the scope of this project.*

RFI #28: Can owner provide existing dimensions of the footings for building 4840 that will be jack and bored on page C-10?

NASA Response: *The work referenced above is part of Option #2. Option #2 is being removed from the scope of this project.*

RFI #29: When connecting to a current hydrant or PIV, will contractor be using the existing bollards or will replacement be required?

NASA Response: *If the existing bollards are not disturbed during the connection to the new system, then the existing bollards can be used.*

RFI #30: Is there a soil report available for the project site?

NASA Response: *Limited data is available. Reference data is included in the attachment titled "Soil Report Information.zip"*

RFI #31: What is the average estimated depth of all connection points that are proposed on the plans?

NASA Response: *As-Builts plans with existing fire main utility depths of bury are not available. Assume code required burial depth (4 ft +/- to top of pipe).*

RFI #32: Can native soil be used to backfill around the pipe?

NASA Response: *If native soil meets the requirements of Specification Section 31 23 00.00 20, it can be used as bedding.*

RFI #33: Given the time constraints on dig permits and outages, has any consideration been given to extending the calendar days?

NASA Response: *The period of performance will be extended to 430 days.*

RFI #34: On the plans it says to paint interior of the existing tanks and specs say interior and exterior…please clarify which is to be done

NASA Response: *The interior of tanks NB103 and NB108 shall be relined in accordance with Specification Section 33 11 00 2.4 RELINING EXISTING TANKS. The exterior of tanks NB103 and NB108 shall be sandblasted and painted in accordance with the Notes on sheet C-18.*

RFI #35: Plans show 5 options (re: page T-2). Bid sheets 3&4 only show 4 options. Please advise.

NASA Response: *There are 5 options. Specification Section Section 01 11 00 will be re-issued. The bid sheets will be corrected and re-issued.*

RFI #36: Bid sheet verbiage for #4 option does not match plans T-2. Please advise.

NASA Response: *The bid sheets will be corrected and re-issued.*

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SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)	3. SOLICITATION NO.	4. TYPE OF SOLICITATION	5. DATE ISSUED	PAGE 1 OF 58 PAGES
	NND12415466E	☒ SEALED BID (IFB) ☐ NEGOTIATED (RFP)	August 6, 2012	

IMPORTANT – The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.
	4200415466	**EDM-1697**

7. ISSUED BY CODE	8. ADDRESS OFFER TO (If other than Item 7)
NASA DRYDEN FLIGHT RESEARCH CENTER **P.O. BOX 273 M/S D-1422 ZMW** **EDWARDS, CA 93523-0273**	**SEE BLOCK 7**

9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. *(NO COLLECT CALLS)*			C. EMAIL ADDRESS
		AREA CODE	NUMBER	EXT.	
	Zachary Wright	**(661)**	**276**	**5112**	**Zachary.M.Wright@nasa.gov**

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying no., date):*

REPAIR CENTER-WIDE FIRE MAINS

OFFERS SUBMITTED VIA OTHER MAILING SERVICES SUCH AS UPS, FED EX, ETC., SHOULD BE SENT TO: NASA DRYDEN FLIGHT RESEARCH CENTER, WAREHOUSE #6, BUILDING 4876, LILLY DRIVE, EDWARDS, CA 93524.

THIS PROCUREMENT IS A SERVICE-DISABLED VETERAN-OWNED SMALL BUSINESS SET-ASIDE THAT WILL BE AWARDED COMPETITIVELY.

THE MAGNITUDE OF THIS PROJECT IS BETWEEN $5,000,000.00 AND $10,000,000.00.

PER FAR 52.236-27, AN ORGANIZED SITE VISIT HAS BEEN SCHEDULED FOR **August 21, 2012.**

TECHNICAL QUESTIONS MUST BE SUBMITTED NOT LATER THAN **August 27, 2012.**

VETS-100 REPORTING—IN ACCORDANCE WITH FAR DEVIATION 22.1304(c) FOR ACTIONS OF $25,000 OR MORE, A CONTRACTING OFFICER SHALL NOT ENTER INTO A NEW CONTACT WITH A CONTRACTOR THAT IS SUBJECT OF THE REPORTING REQUIREMENTS FAR 22.1304(b) IF THE CONTRACTOR HAS NOT SUBMITTED THE MOST RECENT REQUIRED REPORT.

11. The Contractor shall begin performance within **10** calendar days and complete it within **430** calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. ***(See Section F, contract clause F-2 and F-3.)***

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? *(If "YES." Indicate within how many calendar days after award in Item 12B.)*	12B. CALENDAR DAYS
☒ YES ☐ NO	10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

- Sealed offers in original and **one (1)** copy to perform the work required are due at the place specified in Item 8 by **3:00PM** *(hour)* local time **September 7, 2012** *(date)*. If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.
- An offer guarantee ☒ is ☐ is not required.
- All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.
- Offers providing less than **60** calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER *(Must be fully completed by offeror)*

14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*	15. TELEPHONE NO. *(Include area code)*
	16. REMITTANCE ADDRESS *(Include only if different than Item 14)*
CODE: FACILITY CODE	

17. The offeror agrees to perform the work at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government within _____ calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.*

AMOUNTS ➢

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation – give number and date of each)

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*	20B. SIGNATURE	20C. OFFER DATE

AWARD *(To be completed by Government)*

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise specified)* ➢	ITEM SEE BLOCK 27	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO ☐ 10 U.S.C. 234(c) ( ) ☐ 41 U.S.C. 253(c) ( )
26. ADMINISTERED BY CODE		27. PAYMENT WILL BE MADE BY
SEE BLOCK 7		**NASA DRYDEN FLIGHT RESEARCH CENTER P.O. BOX 273 M/S D-1422 ZMW EDWARDS, CA 93523-0273**

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration slated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.	☐ 28. AWARD *(Contractor is not required to sign this document.)* Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and you offer, and (b) this contract award. No further contractual document is necessary.
30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN *(Type or print)*	31A. NAME OF CONTRACTING OFFICER *(Type or print)*

30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY	31C. AWARD DATE

STANDARD FORM 1442 BACK (REV. 4-85)

NND12415466E
Amendment 1
Revised 1442

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PART I – THE SCHEDULE

SECTION B - SUPPLIES OR SERVICES AND PRICE/COSTS

B.1 LINE ITEM DESCRIPTION

In accordance with this contract, the Contractor shall furnish all materials, labor, equipment and facilities, except as specified herein to be furnished by the Government, and shall do all that which is necessary or incidental to the satisfactory and timely performance of the project entitled "Repair Center-Wide Fire Mains" at Dryden Flight Research Center (DFRC) on Edwards AFB, CA, dated 07/29/2011. This effort consists of a base bid with five (5) options.

CLIN 0001 Base Bid

Project will be performed in accordance with the specifications and drawings set forth in Section C, Description/Specifications/Work Statement, of the contract **excluding** CLINS 0002-0006.

	QTY	UNIT	TOTAL PRICE
BASE BID PRICE	1EA	LOT	$_____

CLIN 0002 Option Item #1 - THIS OPTION IS DELETED FROM CONTRACT. PRICING IS NO LONGER NEEDED FOR OPTION ITEM #1.

CLIN 0003 Option Item #2 - THIS OPTION IS DELETED FROM CONTRACT. PRICING IS NO LONGER NEEDED FOR OPTION ITEM #2.

CLIN 0004 Option Item #3

All work indicated as OPTION Item No. 3 in the specifications and drawings. Provide all materials, equipment and labor to safely demolish and install new 20" fire water piping shown clouded on contract drawing C-5. Work also includes demolishing and replacing concrete pavement, grading, and earthwork. If option is not exercised then the contractor shall connect new fire water piping to existing fire water piping with 20" DI bends and adapter couplings.

	QTY	UNIT	TOTAL PRICE
Option Item #3 PRICE	1EA	LOT	$_____

CLIN 0005 Option Item #4

All work indicated as OPTION Item No. 4 in the specification and drawings. Provide all materials, equipment and labor to safely demolish and install new 20" to 3" fire water piping & valves shown clouded on contract drawings C-10, C-11, E-2, and FA-3. Work includes demolishing and replacing backflow preventer assemblies, PIVs, fire hydrants, FDC assemblies, meters, and pavement. Work includes tank painting & replacing tank cathodic protection. The work includes grading work and earthwork. Work includes tamper switches, tank monitoring, fire alarm control panel modifications, fire alarm device work, fuel tank work, and power. The work does not include the new 20" main to the west of B4853. If option is not exercised then the contractor shall connect existing 18" and 6" connections from B4853 to the new 20" main located to the west of B4853.

	QTY	UNIT	TOTAL PRICE
Option Item #4 PRICE	1EA	LOT	$_____

CLIN 0006 Option Item #5

All work indicated as OPTION Item No. 5 in the specifications and drawings. Provide all materials, equipment and labor to safely demolish and install new 20" to 3" fire water piping and valves shown clouded on C-10 and C-11. Work also includes demolishing and replacing PIV's, FH's, FDC Assemblies, pavement, grading work, and earthwork. If option is not exercised the the contractor shall connect new fire water piping to existing fire water piping with 20" DI bends and adapter couplings.

	QTY	UNIT	TOTAL PRICE
Option Item #5 PRICE	1EA	LOT	$_____

B.2 1852.216-78 FIRM FIXED PRICE (DEC 1988)

The total firm fixed price of this contract is $_____*_____.

*TO BE COMPLETED AT TIME OF AWARD

[End of Clause]

[END OF SECTION]

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PART I – THE SCHEDULE

SECTION F - DELIVERIES OR PERFORMANCE

F.1 LISTING OF CLAUSES INCORPORATED BY REFERENCE

NOTICE: In accordance with Clause I.1, FAR 52.252-2, titled "Clauses Incorporated by Reference," the following contract clauses pertinent to this section are hereby incorporated by reference:

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE
52.242-14	APR 1984	SUSPENSION OF WORK

II. NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

CLAUSE NUMBER	DATE	TITLE
NONE INCLUDED BY REFERENCE		

F.2 52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than **430 calendar days, following receipt of a Notice To Proceed (NTP).** The time stated for completion shall include final cleanup of the premises.

(End of Clause)

F.3 52.211-12 LIQUIDATED DAMAGES—CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of **$441.45** for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of Clause)
[END OF SECTION]

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PART III – LIST OF DOCUMENTS, EXHIBITS, AND OTHER ATTACHMENTS

SECTION J - LIST OF DOCUMENTS, EXHIBITS, AND OTHER ATTACHMENTS

J.1 LIST OF ATTACHMENTS

The following documents are attached hereto and made a part of this contract:

ATTACHMENT NO.	NO. OF PAGES	TITLE
1	25	General Wage Decision # CA120031, Mod 8 dated 7/13/2012
2	4	Personal Identity Verification of Contractor Personnel Card Issuance Procedures (NOV 2006)
3	271	Specifications for the Repair of Center-Wide Fire Mains Edwards AFB, CA dated 07/29/2011
4	3	Guidelines for Excavation Within DFRC GW Plume Boundaries and Land Use Control Boundary Map
5	3	DFRC Record of Environmental Consideration (D-WK 39-8)
6	37	Facility Support Center Drawings dated 8/18/2011
	T-1	TITLE AND INDEX SHEET
	T-2	LEGEND, ABBREVIATIONS, AND NOTES
	T-3	EXISTING FIRE MAIN LAYOUT
	T-4	NEW FIRE MAIN LAYOUT AND PHASING
	T-5	PROJECT WORK NOTES
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SECTION 01 11 00

SUMMARY OF WORK
01/08

PART 1 GENERAL

1.1 SUMMARY

The work to be performed under this project consists of providing the labor, equipment, and materials to perform FY12 Repair Centerwide Fire Main for the National Aeronautics and Space Administration at the Dryden Flight Research Center (NASA/DFRC), Edwards, California 93523.

a. The site work scope includes: Replacement of existing cast iron, ductile iron, and asbestos cement fire water mains with class 200 PVC fire water mains, and pertinent fixtures. Refurbishment of Fire Water Tanks and related work. See contract drawings and specifications for further information.

b. The electrical scope includes: Installation of electrical connections to new control panels and sensors, and general devices. See contract drawings and specifications for further information.

c. The fire protection scope includes: Installation of tamper switches, tank monitoring, fire alarm control panel modifications, and fire alarm devices. See contract drawings and specifications for further information.

1.1.1 Separate Construction Phases

The contractor shall perform the work in seven (7) distinct and separate phases as outlined on the project drawings. The Contractor shall perform work on one phase at a time. After completion of each phase of construction a final inspection will be performed by the Government prior to work commencing in the next phase. Once the work in one phase is completed and accepted by the Government, the Contractor will be issued a Notice to Proceed for the next phase.

The government reserves the right to change the order of the phasing prior to the start of construction of that phase. The order of these phases is mandatory. The order of phase execution is: 1, 2, 3, 4, 5, 6, 7. No deviations from this phasing sequence will be allowed. The area of each phase is shown in the contract drawings.

1.1.2 Base Bid and Options

The contract is structured as base bid work and five (5) options.

Base Bid - The base bid work includes: Provide all materials, equipment and labor to construct the scope of work for the repair fire water infrastructure project as shown and described in the contract drawings and specifications; located at Nasa Dryden Flight Research Center, Edwards AFB, CA 93523; with the exception of the work described hereafter and included in additive bid options #1 through #4.

Option 1 - **THIS OPTION IS DELETED FROM CONTRACT.**

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Option 2 - **THIS OPTION IS DELETED FROM CONTRACT.**

Option 3 - Option 3 work includes: Provide all materials, equipment and labor to safely demolish and install new 20" fire water piping shown clouded on contract drawing C-5. Work also includes demolishing and replacing concrete pavement, grading, and earthwork. If option is not exercised then the contractor shall connect new fire water piping to existing fire water piping with 20" DI bends and adapter couplings.

Option 4 - Option 4 work includes: Provide all materials, equipment and labor to safely demolish and install new 18" to 3" fire water piping & valves shown clouded on contract drawings C-10, C-11, E-2, and FA-3. Work includes demolishing and replacing backflow preventer assemblies, PIVs, fire hydrants, FDC assemblies, meters, and pavement. Work includes tank painting & replacing tank cathodic protection. The work includes grading work and earthwork. Work includes tamper switches, tank monitoring, fire alarm control panel modifications, fire alarm device work, fuel tank work, and power. The work does not include the new 20" main to the west of B4853. If option is not excercised then the contractor shall connect existing 18" and 6" connections from B4853 to the new 20" main located to the west of B4853."

Option 5 - Option 5 work includes: Provide all materials, equipment and labor to safely demolish and install new 20" to 3" fire water piping and valves shown clouded on C-10 and C-11. Work also includes demolishing and replacing PIV's, FH's, FDC Assemblies, pavement, grading work, and earthwork. If option is not exercised the the contractor shall connect new fire water piping to existing fire water piping with 20" DI bends and adapter couplings.

1.2 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM E 2114	(2008) Standard Terminology for Sustainability Relative to the Performance of Buildings

1.3 DEFINITIONS

Definitions pertaining to sustainable development are as defined in ASTM E 2114 and as specified.

a. "Environmentally preferable products" have a lesser or reduced effect on the environment in comparison to conventional products and services. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product.

b. "Indoor environmental quality" is the physical characteristics of the building interior that impact occupants, including air quality, illumination, acoustics, occupant control, thermal comfort, daylighting, and views.

c. "Operational performance" is the functional behavior of the building as a whole or of the building components.

d. "Sustainability" is the balance of environmental, economic, and societal considerations.

1.4 CONTRACT DRAWINGS

Drawings and documents that accompany this specification are a part thereof, and are listed in section 00 01 15 List of Drawings.

Digital drawings and specifications will be furnished to the Contractor without charge. Reference publications will not be furnished. The Contractor shall immediately check furnished drawings and notify the Government of any discrepancies.

1.5 PHASED CONSTRUCTION SCHEDULE

Within the overall project schedule of 430 days, including the base bid and all options, the Contractor shall commence and complete the work in phases.

1.6 WORK HOURS

All Construction work under this contract shall be performed during normal duty hours, unless otherwise approved by the Contracting Officer. (Normal duty hours are defined in Section 01 14 00 "WORK RESTRICTIONS".) Weekends and Government holidays may be restricted for work.

The Contractor shall allow for a maximum of ten (10) days per year where construction activity is not permitted because NASA facilities are closed.

1.7 REQUIRED OPERATIONAL SYSTEMS AND UTILITIES

The Contractor shall ensure that all existing building fire suppression systems shall not be "out of service" for more than 4 hours in 1 work week without permission by Contracting Officer.

The Contractor shall ensure that when an existing fire hydrant is taken "out of service", the new designated fire hydrant replacement shall be put "in service" within 4 hours.

The Contractor shall provide traffic control to minimize the impact to traffic access during construction. Temporary road closure(s) will be approved by the Contracting Officer prior to the closure.

All outages shall be coordinated in advance according to Secion 01 35 14.11 40 DRYDEN SAFETY REQUIREMENTS.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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CATHODIC PROTECTION SYSTEM (STEEL WATER TANKS)
11/08

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 within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D1248	(2005) Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

NACE INTERNATIONAL (NACE)

NACE SP0388	(2001; R 2007) Impressed Current Cathodic Protection of Internal Submerged Surfaces

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FU 1	(2002; R 2007) Low Voltage Cartridge Fuses
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Conduit

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment
UL 506	(2008; Reprint Mar 2010) Specialty Transformers
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2004; Reprint Apr 2010) Metallic Outlet Boxes

UL 6 (2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel

1.2 SYSTEM DESCRIPTION

Provide and install a complete automaticcathodic protection system, to prevent corrosion on the interior submerged surface of the water tank, and all equipment wiring, and wiring devices, necessary to produce a continuous flow of direct current from electrodes in the electrolyte to the metal tank surfaces. Submit, 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 adjustment, including testing of coating for thickness and holidays. Installation of materials and equipment shall not commence until this submittal is approved. The installation shall meet the criteria and protection outlined in paragraph CRITERIA OF PROTECTION for a 20 year life. Place the cathodic protection system in operable status.

a. The purpose of the system is to adequately and efficiently protect the surfaces of the metal against corrosion where the surfaces are in contact with water; this is in addition to the protective coating on the tank. The contract drawings indicate the location and size of the tank. The design of this system is based on an impressed current system.

b. Use this impressed current system, as described, with anodes as found necessary in calculation and submitted data to meet this specification. Install anodes in sufficient number and of the required type, size and spacing to obtain a uniform current distribution of 3.5 milliamperes per 1 square foot to all submerged surfaces in the tank when filled with water to the over-flow level. The anodes shall be suspended from the roof steel with hangers or supporting cables that are electrically isolated from both the metal roof and the water electrolyte. Place the anodes with the roof door midway between two adjacent anodes and hung clear of contact with such items as ladders, heater pipes, and stay rods.

c. Contractor's Modifications. The Contractor may modify the cathodic protection system after review of the project, site verification and analysis if the proposed modifications include impressed current anodes and rectifiers and will provide equal or better overall system performance. Submit 3 copies of detail drawings, showing proposed changes in location and scope or 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 the proper installation and performance of the system. This modification shall be fully described and submitted for approval to the Contracting Officer. Modifications or additional anodes shall be at no additional cost to the Government and incorporate all requirements of this specification.

d. The proposed system shall achieve a minimum "Instant Off" potential of minus 850 millivolts with reference to a saturated copper-copper sulfate reference cell on the tank components. Take measurements and adjust the current and voltage of the rectifier as required to produce the required "Instant Off" potential between the structure being tested

and the reference cell. This potential shall be obtained over 95 percent of the metallic area without the "Instant Off" potential exceeding 1100 millivolts.

e. Submit final report including measurements throughout the tank area, indicating that the addition of anodes corrected the conditions which made the additional anodes necessary. The following are required: Installation and testing procedures, anode number, life, and parameters to achieve protective potential.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings G
Contractor's Modifications G

SD-03 Product Data

Miscellaneous Materials G
Equipment G
Spare Parts

SD-06 Test Reports
Testing, Adjusting, and Placing in Service
Contractor's Modifications G

SD-07 Certificates

Cathodic Protection System
Testing, Adjusting, and Placing in Service
Services of "Corrosion Expert" G

SD-10 Operation and Maintenance Data

Cathodic Protection System
Training

1.4 QUALITY ASSURANCE

1.4.1 Services of "Corrosion Expert"

Obtain the services of a "corrosion expert" to supervise and inspect the installation and performance of the cathodic protection system. "Corrosion expert" refers to a person, who, by reason of 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 on steel water tanks.

a. 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

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certification or licensing that includes education and experience in corrosion control on steel water tanks, if such certification or licensing includes 5 years experience in corrosion control on steel water tanks of the type under this contract.

b. The "corrosion expert" shall ensure that the cathodic protection system is installed, tested, and placed into service in accordance with the requirements specified; and shall also design, make calculations, and assure quality control as required.

c. Submit evidence of qualifications of the "corrosion expert". Name and qualifications shall be certified in writing to the Contracting Officer prior to the start of construction. Submit the certification giving the name of the firm, the number of years of experience, and a list of not less than five of the firm's installations three or more years old that have been tested and found satisfactory.

1.4.2 Detail Drawings

Submit 3 copies of detail drawings, within 45 days after the date of award of the contract, before commencement of any work and in accordance with SPECIAL CLAUSES, consisting of a complete list of equipment and materials including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Provide on the drawings tank dimensions, anode arrangement for both elevated and sectional views of the tank, anode size and number, anode material, anode-suspension details, conduit size, wire size, rectifier size and location, handhole details, wiring diagram, and any other pertinent information considered necessary for the proper installation and performance of the system. Shop drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. The list of materials and equipment shall include catalog cuts diagrams, and other descriptive data required by the Contracting Officer for the following list of material. Partial lists submitted from time to time will not be allowed.

a. Water resistivity and water analysis.

b. Conductors.

c. Anodes.

d. Coating material in areas where welding and other work is accomplished.

e. Insulated resistance wire.

f. Layout of anodes in tanks, test stations and isolation points, and grounding.

g. Special details.

h. Certified experience data of installing firm.

i. Exothermic weld equipment and material.

j. Test station.

k. Welding method for electrical connections and steel ring

connections.

l. Calculations for: 1) Total current required for system, (2) Life of the anodes, (3) Anode geometry (showing areas of coverage).

Submit all detail drawings at one time, as a single submittal, in order to demonstrate that the items have been properly coordinated and will function properly as a unit. A notation shall be made on each shop drawing submitted as to the item's specific use, either by a particular type number referenced on the drawings or in the specifications, or by a description of its specific location.

1.5 EXTRA MATERIALS

Submit spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 1 month 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 spare anode of each type shall be furnished

PART 2 PRODUCTS

2.1 IMPRESSED CURRENT ANODES

2.1.1 High Silicon Cast Iron Anodes

Cast iron anodes shall be of the size indicated and shall conform to the following requirements:

2.1.1.1 Chemical Composition (Nominal)

	Percent by Weight	
Element	Grade 1	Grade 2
Silicon	14.20-14.75	14.20-14.75
Manganese	1.50 max.	1.50 max.
Carbon	0.70-1.10	0.75-1.15
Chromium	-------	3.25-5.00
Iron	Balance	Balance

2.1.1.2 Electrical Resistivity

Electrical Resistivity shall be 72 microhm-centimeter at 20 degrees F (maximum).

2.1.1.3 Physical Properties (Nominal)

Tensile strength	15,000 psi
Compressive strength	100,000 psi
Brinell hardness	520
Density	7.0 grams per cubic centimeter
Melting point	2300 degrees F
Coefficient of expansion from 32 to 212 degrees F	0.00000733 centimeter per degree F

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2.1.2 Mixed Metal Oxide Anodes

Mixed metal oxide anodes shall be of the size indicated and shall conform to the following requirements.

2.1.2.1 Conductive Material

The electrically conductive coating shall contain a mixture consisting primarily of iridium, tantalum, and titanium oxides. The average composition is generally a 50/50 atomic percent mixture of iridium and titanium oxides, with a small amount of tantalum. The resistivity, as tested by the manufacturer, shall be no more than 0.002 ohm-centimeter, and the bond strength shall be greater than 7.25 ksi to guarantee the current capacity life and the quality of the conductive ceramic coating. The adhesion or bond strength shall be determined by epoxy bonding a 0.1 inch diameter stud to the ceramic coating and measuring the load to failure (about 10.15 ksi) of either the epoxy or the interface between the coating and the substrate. The anode must be inert and the electrically conductive ceramic coating dimensionally stable. The ceramic coated anode shall be capable of sustaining a current density of 100 ampere per 10.764 square feet in an oxygen generating electrolyte at 150 degrees F for 20 years, to ensure the current capacity life. An accelerated current capacity life test shall be performed by the manufacturer on every lot of anode wire used to construct the anode as described. The mixed metal oxide coating shall be applied to the wire anode by a firm that is regularly engaged in and has a minimum 5 years experience in manufacturing and applying mixed metal oxide coating to titanium anode substrates. The mixed metal oxide shall be sintered to the titanium surface to remain tightly bound to the surface when bent 180 degrees onto itself.

2.1.2.2 Anode Life Test

The anode wire material shall sustain current densities of 100 ampere per 10.764 square feet in an oxygen generating electrolyte for 20 years. The manufacturer shall certify that a representative sample taken from the same lot used to construct the anode, has been tested and meets the following criteria. The test cell sustains a current density of 10,000 ampere per 10.764 square feet in a 15 weight percent sulfuric acid electrolyte at 150 degrees F without an increase in anode to cathode potential of more than 1 volt. The cell containing the anode shall be powered with a constant current power supply for the 30 day test period. The representative sample shall be 5 inch in length taken from the lot of wire that is to be used for the anode.

2.1.2.3 Anode Connecting Cables

The connection between the anode rod or ribbon and the lead wire shall be made with a solid crimp couple with solder. The connection shall be sealed in cast epoxy.

2.1.3 Precious Metal Anodes

2.1.3.1 Selection Requirements

Precious metal anodes shall be solid in form. Selection of the configuration should be left to the designer of the system. Long, continuous wire form lengths of precious metal anodes may have an attenuating effect. This can be overcome by using parallel feeder cable

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connected to segmented lengths of precious metal anodes at intervals. Such assemblies shall be factory assembled with factory sealed and tested electrical connections to the anode.

2.1.3.2 Anode Life Test

The anode wire material shall sustain current densities of 100 ampere per 10.764 square feet in an oxygen generating electrolyte for 20 years. The manufacturer shall certify that a representative sample taken from the same lot used to construct the anode, has been tested and meets the following criteria. The test cell sustains a current density of 10,000 ampere per 10.764 square feet in a 15 weight percent sulfuric acid electrolyte at 150 degrees F without an increase in anode to cathode potential of more than 1 volt. The cell containing the anode shall be powered with a constant current power supply for the 30 day test period. The representative sample shall be 5 inch in length taken from the lot of wire that is to be used for the anode.

2.1.4 Anode Connecting Cables

Anodes, except for mixed metal oxide and precious metal wire anodes, shall have connecting cables installed at the factory. Submit 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 was subjected to maximum recommended current output while immersed in a 3 percent sodium chloride solution. Aluminum anodes connected together by a threaded system shall have water-tight seals and be electrically continuous.

2.2 RECTIFIERS AND ASSOCIATED EQUIPMENT

2.2.1 Rectifier Unit

Rectifier unit shall consist of a transformer, rectifying elements, transformer tap adjuster, terminal block, one dc output voltmeter, one dc output ammeter, one toggle switch for each meter, fuse holders with fuses for each dc circuit, variable resistors, an ac power-supply circuit breaker, lightning arresters for both input and output; all wired and assembled in a weatherproof cabinet. The overall efficiency of the rectifier shall be not less than 65 percent when operated at nameplate rating and shall be capable of supplying continuous full rated output at an ambient temperature of 112 degrees F in full sunlight with expected life in excess of 10 years.

2.2.1.1 Transformer

Transformer shall conform to UL 506.

2.2.1.2 Rectifying Elements

Rectifying elements shall be silicon diodes connected to provide full-wave rectification.

2.2.1.3 Meters

Meters shall be accurate to within plus or minus 2 percent of full scale at 80 degrees F, and shall possess temperature stability above and below 80 degrees F of at least 1 percent per 10 degrees F. Separate meters shall be 2-1/2 inch nominal size or larger.

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2.2.1.4 Circuit Breaker

A double -pole, flush-mounted, fully magnetic, properly rated nonterminal type circuit breaker shall be installed in the primary circuit of the rectifier supply transformer.

2.2.1.5 Fuses

Cartridge-type fuses conforming to NEMA FU 1 with suitable fuse holders shall be provided in each leg of the dc circuit.

2.2.1.6 Automatic Cathodic Protection Control

Provide a system capable of maintaining a tank-to-water potential criterion of protection within plus or minus 25 millivolts regardless of changes in water chemistry, temperature, or water level in the tank. Provision shall be made for readily changing the range and limits of the criterion. The controller shall be either housed integrally with the rectifier or in a separate weatherproof cabinet with provisions for locking. The automatic controller shall be a completely solid-state design, and shall be capable of automatically maintaining the tank-to-water potential at minus 900 millivolts with respect to a copper-copper sulfate reference electrode within an accuracy of 25 millivolts. The tank-to-water potential measured and maintained by the controller shall be free of "IR" drop error.

2.2.1.7 Tank To Water Potential Meter

The controller shall be equipped with a calibrated voltmeter having an internal impedance exceeding 1 megohm which shall be so connected to read, from the system reference cell, the tank-to-water potential being maintained by the cathodic protection system. This voltage reading shall be free of "IR" drop error.

2.2.2 Cabinet

Construct cabinet of molded fiberglass reinforced polyester, and provided with a full door. The enclosure shall have oil-resistant gasket. The door shall be hinged and have a hasp that will permit the use of a padlock. The cabinet shall be fitted with screened openings of the proper size to provide for adequate cooling. Holes, conduit knockouts, or threaded hubs of sufficient size and number shall be conveniently located.

2.2.2.1 Wiring Diagram

A complete wiring diagram of the power unit showing both the ac supply and the dc connections to anodes shall be on the inside of the cabinet door. All components shall be shown and labeled.

2.2.2.2 Grounding

Grounding provisions shall comply with NFPA 70 and UL 467 including a ground terminal in the cabinet. The grounding conductor from the terminal to the earth grounding system shall be solid or stranded copper not smaller than No. 6 AWG. The earth grounding system shall consist of one or more rods. Ground rods shall be copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Rods shall be driven full length into the earth. Sectional type rods may be used.

2.2.2.3 Resistance to Ground

Measure the resistance to ground using the fall-of-potential method described in IEEE 81. The maximum resistance of driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods shall be provided as required at not less than 6 feet on centers, or if sectional type rods are used, additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

2.2.2.4 Cabinet Paint System

The cabinet and mounting support shall be painted with the manufacturer's standard paint system. The mounting support for the fiberglass cabinet shall be painted with the manufacturer's standard painting system.

2.2.3 Wiring

Wiring shall be installed in accordance with NFPA 70 utilizing type TW or RHW or polyethylene insulation. Fittings for conduit and cable work shall conform to UL 514A. Outlets shall be of the threaded hub type with gasketed covers. Conduit shall be securely fastened at 8 foot intervals or less. Splices shall be made in outlet fittings only. Conductors shall be color coded for identification. Cable for anode header and distribution shall be No. 2 AWG stranded copper wire with type cathodic protection high molecular weight polyethylene.

2.2.4 Oil Immersed Enclosures

Enclosures shall be of 11 gauge steel or heavier, with an accessible drain plug. The oil level shall be clearly marked. The lid shall be hinged and have quick release clamps to secure it in closed position. A stop shall limit the swing of the lid when opened. A compressible, oil resistant, positive sealing gasket shall be provided. The gasket shall return to its original shape upon release of lid pressure. The gasket shall be attached to the tank or lid and joints shall be free of gaps. Base mounting using 4 inch high channels shall be provided. Conduits entering the enclosure shall be internally sealed and shall enter or exit above the oil fill line.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Reference Electrodes

The electrodes shall be copper-copper sulphate type provided with micro-pore diffusion window for water contact and water-tight plug for renewal of copper sulphate crystals and solution. A minimum of four reference electrodes shall be part of this system. Electrodes shall be designed for 15 year life.

2.3.2 Electrical Wire and Associated Materials

2.3.2.1 Anode Connecting Wire

Anode connecting wire shall be No. 8 AWG stranded copper wire with type CP high molecular weight polyethylene insulation, 7/64 inch thick, 600 volt

rating. Cable-to-anode contact resistance shall be 0.003 ohms maximum.

2.3.2.2 Anode Header Cable

Cable for anode header and distribution shall be 8 AWG stranded copper wire with type CP high molecular weight polyethylene, 7/64 inch thick insulation, 600-volt rating. Cable-to-anode contact resistance shall be 0.003 ohms maximum.

2.3.2.3 Reference Electrode Wire

Reference electrode wire shall be stranded copper wire with NFPA 70 type RHW-USE or polyethylene insulation.

2.3.3 Conduit

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

2.3.4 Test Boxes and Junction Boxes

Boxes shall be outdoor type conforming to UL 514A.

2.3.5 Polyethylene Insulation

Polyethylene insulation shall comply with the requirements of ASTM D1248 and of the following types, classes, and grades:

2.3.5.1 High Molecular Weight Polyethylene

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

2.3.5.2 High Density Polyethylene

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

2.3.6 Pressure-Sensitive Vinyl Tape

Tape shall conform to UL 510.

PART 3 EXECUTION

3.1 EXAMINATION

Coordinate and properly relate this work to the work of all trades. The general locations of the structures to receive protection are shown. Visit the premises and after becoming familiar with all details of the work and working conditions, verify existing conditions in the field, determine the exact locations of structures to be protected, and advise the Contracting Officer of any discrepancy before performing any work. Take resistivity measurement of the water and analysis of the water and provide this data with detail drawings of the system for approval.

3.2 CRITERIA OF PROTECTION

Acceptance criteria for determining the adequacy of protection on the internal submerged surfaces of steel water tanks shall be in accordance with NACE SP0388 and as specified below.

3.2.1 Minimum

The criterion of protection is a negative voltage of at least minus 850 millivolts as measured between the tank and a saturated copper-copper-sulphate reference electrode. 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 tank surface being tested and the reference cell shall be achieved over 95 percent of the area of the structure. Obtain adequate number of measurements over the entire tank surface 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 the maximum limit indicated below.

3.2.2 Maximum

In order to mitigate disbonding of the interior coating in the tank, potential between a copper-copper-sulphate reference electrode and the tank at any point shall not be more negative than minus 1.07 volt measured with the electrode located between 1/4 inch and 1/2 inch and away from the steel surface but not touching it.

3.3 ANODES

3.3.1 Anode Installation

Suspend anodes to prevent icing damage to anodes and suspending cables. Anodes shall be suspended from roof plate by means of factory installed connecting wire designed to support the anodes in air (before submergence) without failure of the electrical wire insulation or the electrical conductor. Anodes shall be suspended preventing contact with tank surfaces and shall be hung clear of man-access roof hatches and such items as ladders, heater pipes, and stay rods. Anode hangers shall electrically insulate the anode suspending wire from the tank steel. A handhole having a minimum diameter of 6 inch shall be provided in the tank roof for each anode string to permit replacement or inspection of anodes. Certify that the method chosen has been used successfully for similar applications.

3.3.2 Anode Connections

Anodes shall be electrically connected to the positive dc header cable with compression connectors or split bolts, or the header cable may terminate in a junction box for connection with all anode cables. A minimum of two split bolts shall be used for each connection if split bolts are used. Header cable shall be installed on the underside of the roof with electrically insulating hangers and shall enter the tank near the roof line from an externally mounted junction box. External wiring shall be in conduit. All under-roof electric wire splices shall be made above the high water line and sealed water tight using a minimum of two 1/2-lap layers of butyl rubber tape followed by two 1/2-lap layers of plastic tape.

3.4 RECTIFIERS

3.4.1 Rectifier and Control Installation

Mounting shall be at the same location as the existing rectifiers.

3.4.2 Rectifier Grounding

The grounding system for grounding rectifier cabinets shall have a resistance to earth of not more than 25 ohms as determined by an approved method.

3.5 PERMANENT REFERENCE ELECTRODES

3.5.1 Calibration

Calibrate permanent reference electrodes against a standard electrode before installation. Perform calibration in a test tank containing water with the same composition as the tank to be protected. The permanent electrodes shall measure reference voltage agreeing with that measured by the standard electrode within plus or minus 0.005 volt when the sensing windows of the two electrodes being compared are not more than 1/6 inch apart but not touching.

3.5.2 Installation

Reference electrodes shall be operable under the same icing conditions as the anode system. Installation of permanent reference electrodes shall be made at points in the tank which will monitor minimum and maximum tank-to-water potentials and as otherwise needed for automatic control system. Sensing windows of reference electrodes shall be located between 1/4 inch and 1/2 inch away from the steel surface sensed and shall be fixed in position preventing contact with tank steel.

3.6 TRAINING

Conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 2 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Submit 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. The field instructions shall cover all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations. Notify the Contracting Officer at least 14 days prior to date of proposed starting of the training course.

3.7 TESTING, ADJUSTING, AND PLACING IN SERVICE

Submit test reports in booklet form tabulating all field tests and measurements performed, upon completion and testing of the installed system and including potential survey, final system test verifying protection, and holiday coating test. Each test report shall indicate the final position of controls. Submit 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 3 percent sodium chloride solution.

3.7.1 Electrode Potential Measurements

Upon completion of the installation, fill the tank to maximum working level 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 input impedance of not less than 10 megohms per volt and a full scale of 10 volts.

a. 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.

b. Submit 3 copies of operating manual outlining the step-by-step procedures required for system startup, operation, adjustment of current flow, and shutdown, as well as one electronic copy. 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.

c. Submit3 copies of maintenance manual listing routine maintenance procedures, recommendation for maintenance testing, possible breakdowns and repairs, and troubleshooting guides, as well as one electronic copy. The manuals shall include single line diagrams for the system as installed, instructions in making tank-to-reference cell potential measurements, and describe the frequency of monitoring. The instructions shall include precautions to ensure safe conditions during repair of system.

3.7.1.1 Tank-to-Water Potential Measurements

The following series of tank-to-water potential measurements with a portable reference electrode placed not more than 1/2 inch away from but not touching the tank wall shall be performed:

a. On a vertical line midway between two anode strings beginning at a point 1 foot below water level and continuing at points 3 feet apart until the bottom of the tank is reached.

b. On a second vertical line midway between two anode strings on the opposite side of the tank from the first vertical line beginning at a point 1 foot below water level and continuing at points 3 feet apart until the bottom of the tank is reached.

c. Across the bottom of the tank in a line between the two vertical lines at 3 foot intervals.

d. In at least four places which are closest to anodes.

3.7.1.2 Reference Electrode Calibration

The portable reference electrode used for the test shall be calibrated against the standard electrode specified in paragraph PERMANENT REFERENCE ELECTRODES.

3.7.1.3 Test Measurement Recording

All test measurements and their locations, as well as measurements made with the permanent electrodes simultaneously with the test measurements, shall be recorded.

3.7.2 Adjusting

Final adjustment of the rectifier output current shall be made so that repeated voltage readings taken as specified for testing meet the criteria in paragraph CRITERIA OF PROTECTION.

3.8 PLACING IN SERVICE

After final adjustment, place the cathodic protection system in service and record the condition of the system as left by the Contractor indicating transformer tap settings; voltage readings from reference electrode to tank, readings both horizontal and vertical; automatic control differential setting; ac supply voltage; adjusted dc output voltage; and total protective current.

-- End of Section --